# User's Manual



# Positioning Module

# (with MECHATROLINK-III Interface)

IM 34M06H60-03E

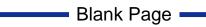


# Applicable Modules:

Model Code Model Name

F3NC97-0N Positioning Module (with MECHATROLINK-III Interface)





# **Applicable Product:**

#### • Range-free Multi-controller FA-M3

- Model code : F3NC97-0N

- Name : Positioning Module (with MECHATROLINK-III 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 34M06H60-03E
- Document Model Code : DOCIM

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# 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.

 $\sim$ 

Alternating current. Indicates alternating current.

\_\_\_

Direct current. Indicates direct current.

# 

Indicates a "Warning".

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

# AUTION

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.

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### 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 emergencystop 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<sup>11</sup> (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 100 $\Omega$  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" (IM34M06C11-01E).

#### • Keep spare parts on hand:

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

- 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.)  $% \label{eq:constraint}$ 

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 F3NC97-0N positioning module (with MECHATROLINK-III Interface), as well as information required for operating the module.

#### 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) (IM34M06P14-01E)
  - Sequence CPU Network Functions User's Manual (for F3SP66-4S, F3SP67-6S) (IM34M06P14-02E)
- 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) (IM34M06P13-01E)
- 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) (IM34M06P12-02E)
- For information on the instructions used with sequence CPUs, refer to:
  - Sequence CPU Instructions User's Manual (IM34M06P12-03E)
- When creating programs using ladder language, refer to:
  - FA-M3 Programming Tool WideField2 User's Manual (IM34M06Q15-01E)
- For information common to all sequence CPU modules on the specifications\*, configuration\*, installation, wiring, trial operation, maintenance and inspection of the FA-M3, or system-wide limitation of module installation, refer to:

Hardware Manual (IM34M06C11-01E)

- \*: For information on the specifications of products other than power supply modules, base modules, I/O modules, cables and terminal block units, refer to their respective user's manuals.
- For information on CPU modules for Windows CE (F3RP42-5P, F3RP44-5P, F3RP45-5P), refer to:
  - Network CPU Module (IM34M06M51-04E)

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# FA-M3 Positioning Module (with MECHATROLINK-III Interface)

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# 1. Overview

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

# What is MECHATROLINK-III Communications?

### Overview

MECHATROLINK-III communications is a high performance, advanced, openarchitecture motion field network standard published by the MECHATROLINK Members Association. It enables distributed control of multiple FA units (servo drives, inverters, I/O modules, etc.) by one FA controller.

With higher communication specification than its predecessors, namely MECHATROLINK-I of 4 Mbps transmission rate and MECHATROLINK-II of 10 Mbps transmission rate, MECHATROLINK-III features higher speed and more functions.

MECHATROLINK-III has the following features:

- Synchronous communication through cyclic transmission
- High speed transmission at 100 Mbps
- Communication cycle time options allow optimization based on the number of connected stations and transmission data size. (This module provides three communication cycle time options: 0.25 ms for 4 axes, 0.5 ms for 8 axes and 1 ms for 15 axes.)
- Reduced wiring at low cost through the use of standard Ethernet cables between external devices.
- Lower FA controller load as transmission control by the proprietary Communication ASIC includes error detection and retransmission within a communication cycle.
- Allows a FA controller acting as master to connect to other FA support tools.

#### Network Connection

MECHATROLINK-III communications allows one C1 master to be connected to a maximum of 62 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-III communications.

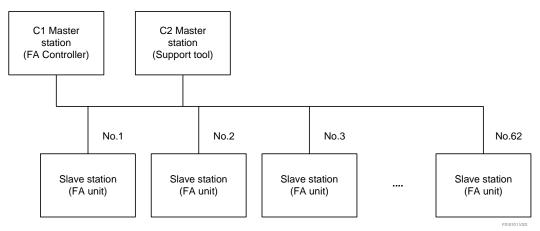


Figure 1.1 Network Connections for MECHATROLINK-III Communications

### Module Features

The positioning module provides the C1 master function of the MECHATROLINK-III communications, transmitting MECHATROLINK-III commands to external devices (slaves) according to the instructions from a CPU module and receiving MECHATROLINK-III responses from external devices.

The module enables:

- (1) Independent axis motion using MECHATROLINK-III commands
- (2) Linear interpolation motion (starting and stopping multiple axes simultaneously)
- (3) Reading target positions, current positions and other statuses of external devices
- (4) Reading and writing parameters of external devices
- (5) External device I/O

The module has the following features:

#### Latest open motion field network

 MECHATROLINK-III is a high-performance, advanced, open-architecture motion field network standard published by the MECHATROLINK Members Association. It adopts proven Ethernet as its physical layer.

#### • Fewer cables, simpler configuration, lower wiring cost

- The module implements position control for up to 15 axes from a single slot. Controllers and motors can be connected using fewer cables terminated with easyto-attach connectors, contributing to lower wiring cost.

#### High-speed, accurate position control through high-speed, highthroughput communication

- High transmission rate of 100 Mbps and short cycle time of 0.25, 0.5, or 1 ms for 4-, 8-, or 15-axis control respectively enable shorter control cycle, faster startup, better control performance, shorter tact time, and higher productivity.
- Up to 8 monitor data (target position, current position, speed, torque, etc.) per axis can be read simultaneously for better monitoring of external device operation.
- Control by transmitted commands enables full exploitation of motor performance (high speed and high resolution) to achieve fast and accurate position control.
- Versatile position control includes linear interpolation motion of up to 15 axes (starting and stopping multiple axes simultaneously), simultaneous linear interpolation motion of any combination of axes, and change of speed or target position during motion.

#### • Flexible system configuration

- Cascade and star network topologies with inter-station distance up to 100 m are supported, enabling optimal system configuration.

#### More compatible external devices upcoming

- In addition to AC servomotors from Yaskawa Electric Corporation, stepping motors, external I/O equipment, and inverters from other manufacturers will be supported in the future.

### Module Operation

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

#### • Independent axis motion using MECHATROLINK-III commands

The procedure for initiating a positioning motion by sending a MECHATROLINK-III command is given below.

- From the CPU module, a program writes the command code (\$35) for the 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-III command is transmitted to the external device (e.g. servo drive) to initiate the desired positioning motion in the external device.
- The Response Received input relay turns on when a response to the transmitted MECHATROLINK-III command is received.
- The Positioning Completed input relay turns on subsequently when the positioning motion completes.

#### Linear interpolation motion (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) and other command parameters for the interpolation motion command such as acceleration time (in ms), deceleration time (in ms), and interpolation axes, as well as the target position (reference unit) and target speed (reference unit/s) of each motion axis 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 devices involved in the linear interpolation motion simultaneously using MECHATROLINK-III commands to initiate the desired positioning motion.
- The Response Received input relay turns on when positioning motion begins.
- The Positioning Completed input relay turns on subsequently when positioning motion completes.

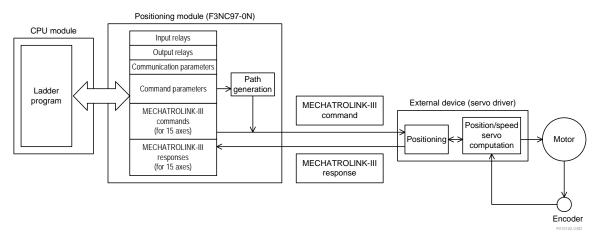


Figure 1.2 Operating Principle of the Positioning Module



Machine fault or misoperation may cause a motor to behave in an unexpected manner. All motors should be wired according to manufacturers' recommendations to allow external power shutdown and emergency stop.

# 2. **Overview of Positioning Functions**

The positioning module (with MECHATROLINK-III Interface) provides positioning by MECHATROLINK-III standard servo profile commands and positioning by interpolation motion commands. The module implements the latter by computing and sending position references required for implementing an interpolation motion.

# 2.1 Positioning by Standard Servo Profile Commands

This section gives an overview of positioning by MECHATROLINK-III standard servo profile commands executable by the module.

For details on the operation of each of these commands, as well as other MECHATROLINK-III standard servo profile commands, refer to the technical documentation published by the MECHATROLINK Members Association (MMA) or user manuals published by Yaskawa Electric Corporation, as listed in the tables below.

Document Name	Document Number	Description
MECHATROLINK-III Overview	MLC07-003	Gives an overview of MECHATROLINK-III.
MECHATROLINK-III Protocol Specifications	MMATDEP020A	Describes the physical layer, data link layer and application layer of MECHATROLINK-III.
MECHATROLINK-III Command Specifications for Standard Servo Profile	MMATDEP021A	Describes the MECHATROLINK-III command specifications for standard servo profile.
MECHATROLINK-III Command Specifications for Standard I/O Profile	MMATDEP022A	Describes the MECHATROLINK-III command specifications for standard I/O profile.

#### Table 2.1 List of MECHATROLINK-III Technical Documents published by the MECHATROLINK Members Association

Note: MECHATROLINK Members Association (MMA) membership is required for accessing technical documentation published by MMA.

#### Table 2.2 List of Manuals for MECHATROLINK- III Compatible Products manufactured by Yaskawa Electric Corporation

Document Name	Document Number	Description
AC Servodrive Σ -V Series USER'S MANUAL: Design and Maintenance (Rotational Motor MECHATROLINK-III Command Option Type)	SIEP S800000 64A	Describes information required for design and maintenance for the $\Sigma$ -V Series SERVOPACK (Rotational Motor MECHATROLINK-III Command Option Type)
AC Servodrive Σ -V Series USER'S MANUAL: Design and Maintenance (Linear Motor MECHATROLINK-III Command Option Type)	SIEP S800000 65A	Describes information required for design and maintenance for the $\Sigma$ -V Series SERVOPACK (Linear Motor MECHATROLINK-III Command Option Type)
AC Servodrive Σ -V Series USER'S MANUAL: MECHATROLINK-III Standard Servo Profile Commands	SIEP S800000 63A	Describes the specifications of standard servo profile commands used in MECHATROLINK-III communication for the $\Sigma$ -V Series SERVOPACK

### Positioning Command (POSING: \$35)

The POSING command is used to execute positioning to a specified position.

Positioning is executed to the target position (P1) at the positioning speed.

To cancel a POSING command execution, set SVCMD\_CTRL.CMD\_CANCEL (the CMD\_CANCEL bit of the Servo Command Control Field) to 1 and re-execute the POSING command; to pause a POSING command execution, set SVCMD\_CTRL.CMD\_PAUSE to 1 and re-execute the POSING command.

Confirm the completion of motion reference output by checking that SVCMD\_IO.DEN = 1, and the completion of positioning by checking that SVCMD\_IO.PSET = 1.

To change the speed during motion or change the target position during motion, change the command value and re-execute the POSING command.

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 motion direction, the motion is decelerated to a stop before positioning to the new position.

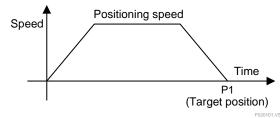


Figure 2.1 Operation Example for Positioning Command (POSING: \$35)

#### ■ Feed Command (FEED: \$36)

The FEED command is used to perform constant speed feed control at a specified feed speed.

To cancel a FEED command execution, set SVCMD\_CTRL.CMD\_CANCEL (the CMD\_CANCEL bit of the Servo Command Control Field) to 1 and re-execute the FEED command; to pause a FEED command execution, set SVCMD\_CTRL.CMD\_PAUSE to 1 and re-execute the FEED command.

Confirm the completion of motion reference output by checking that SVCMD\_IO.DEN = 1, and the completion of positioning by checking that SVCMD\_IO.PSET = 1.

To change the speed and/or direction during motion, change the feed speed setting and re-execute the FEED command. If a direction change is required, the motion is decelerated to a stop before operation is initiated in the reverse direction.

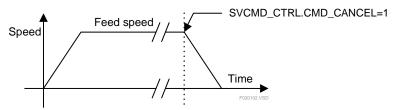


Figure 2.2 Operation Example for Feed Command (FEED : \$36)

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#### External Input Feed Command (EX\_FEED: \$37)

The EX\_FEED command performs positioning in response to the input of the external positioning signal during constant speed feed at the specified feed speed.

When the external positioning signal is input during constant speed feed, the current position counter (P2) is latched, and motion is then decelerated to a stop at position P3 by traveling through the external positioning final travel distance specified by a parameter.

If the travel distance required for deceleration to a stop is longer than the specified external positioning final travel distance, the motion is first decelerated to a stop according to the deceleration pattern, and then a return to the target position is executed before command execution ends.

The external signal used to latch the current position is specified by SVCMD\_CTRL.LT\_SEL.

To cancel an EX\_FEED command execution, set SVCMD\_CTRL.CMD\_CANCEL (the CMD\_CANCEL bit of the Servo Command Control Field) to 1 and re-execute the EX\_FEED command; to pause an EX\_FEED command execution, set SVCMD\_CTRL.CMD\_PAUSE to 1 and re-execute the EX\_FEED command.

Confirm the completion of motion reference output by checking that SVCMD\_IO.DEN = 1, and the completion of positioning by checking that SVCMD\_IO.PSET = 1.

To change the speed and/or direction during motion, change the speed feed setting and re-execute the EX\_FEED command. If a direction change is required, the motion is decelerated to a stop before operation is initiated in the reverse direction.

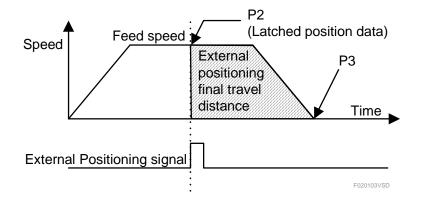


Figure 2.3 Operation Example for External Input Feed Command (EX\_FEED: \$37) (Positioning after Latching)

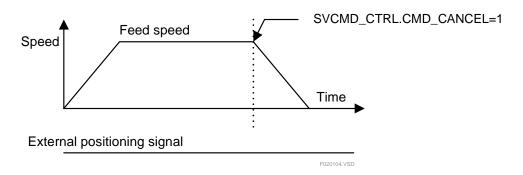


Figure 2.4 Operation Example for External Input Feed Command (EX\_FEED: \$37) (Interrupted Operation)

### External Input Positioning Command (EX\_POSING: \$39)

The EX\_POSING command performs positioning in response to the input of the external positioning signal during positioning to a specified position.

When the external positioning signal is input during positioning to a specified position (P1), the current position counter (P2) is latched, and motion is then decelerated to a stop at position P3 by traveling through the external positioning final travel distance specified by a parameter.

If the travel distance required for deceleration to a stop is longer than the specified external positioning final travel distance, the motion is first decelerated to a stop according to the deceleration pattern, and then a return to the target position is executed before command execution ends.

The external signal used to latch the current position is specified by SVCMD\_CTRL.LT\_SEL.

To cancel an EX\_POSING command execution, set SVCMD\_CTRL.CMD\_CANCEL (the CMD\_CANCEL bit of the Servo Command Control Field) to 1 and re-execute the EX\_POSING command; to pause an EX\_POSING command execution, set SVCMD\_CTRL.CMD\_PAUSE to 1 and re-execute the EX\_POSING command.

Confirm the completion of motion reference output by checking that SVCMD\_IO.DEN = 1, and the completion of positioning by checking that SVCMD\_IO.PSET = 1.

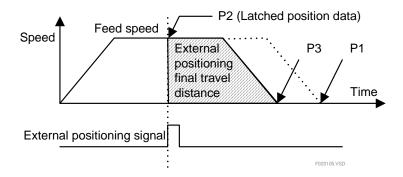
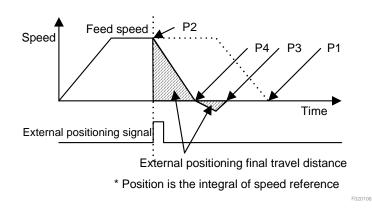
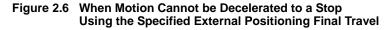


Figure 2.5 Operation Example for External Input Positioning Command (EX\_POSING: \$39) (Positioning after Latching)





IM 34M06H60-03E

## Zero Point Return Command (ZRET: \$3A)

The ZRET command is used to perform a zero point return operation using the zero point limit switch and the position latch signal.

The signal used to latch the position is specified by SVCMD\_CTRL.LT\_SEL.

The zero point return direction and zero point return type is specified by MODE.

To cancel a ZRET command execution, set SVCMD\_CTRL.CMD\_CANCEL (the CMD\_CANCEL bit of the Servo Command Control Field) to 1 and re-execute the ZRET command; to pause a ZRET command execution, set SVCMD\_CTRL.CMD\_PAUSE to 1 and re-execute the ZRET command.

Confirm the completion of motion reference output by checking that  $SVCMD_IO.DEN = 1$ , and the completion of positioning by checking that  $SVCMD_IO.ZPOINT=1$  and  $SVCMD_IO.PSET = 1$ .

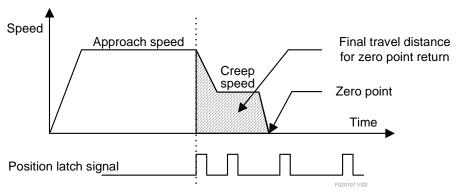


Figure 2.7 Operation Example for Zero Point Return Command (ZRET: \$3A) (When MODE=0)

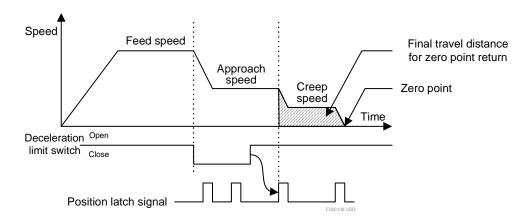


Figure 2.8 Operation Example for Zero Point Return Command (ZRET: \$3A) (When MODE=1)

# 2.2 Positioning by Interpolation Motion Commands

This section describes positioning by interpolation motion commands executable by the module.

### Start Positioning Command (\$0100)

The Start Positioning command executes linear interpolation motion (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 motion 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 motion is in progress, another linear interpolation motion can be executed using a different set of axes, which are at rest. Up to 15 axes can be made to move this way. Concurrent execution of two or more linear interpolation motions with overlapping sets of axes is, however, not allowed.

Target position and speed must be specified for each motion axis (reference axis and interpolation axes). In order that all motion 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 motion, 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 motion, 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.

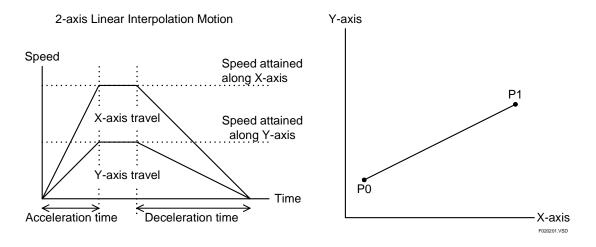


Figure 2.9 Linear Interpolation Motion Initiated by Start Positioning Command (\$0100)

### Change Speed command (\$0400)

The Change Speed command can be executed to change the speeds of moving axes during a linear interpolation motion.

Changing the set of motion axes during linear interpolation motion 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 to a stop according to the deceleration time specified in the Change Speed command.

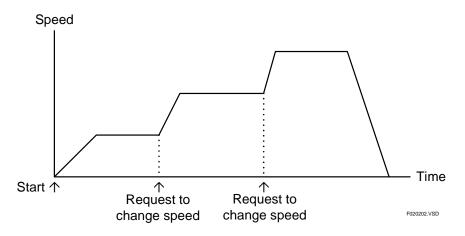


Figure 2.10 Operation Example fof Change Speed Command (\$0400)

### Change Target Position Command (\$0500)

The Change Target Position command is executed to change the target positions of moving axes during a linear interpolation motion.

Changing the set of motion axes during linear interpolation motion 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.

If a Change Target Position command is executed in 'positioning completed' state, a Start Positioning sequence is executed.

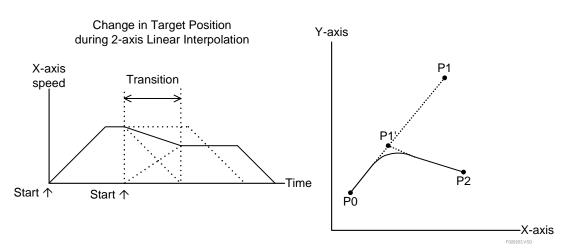


Figure 2.11 Operation Example for Change Target Position Command (\$0500)



# 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
F3NC97	-0N			Controls up to 15 axes with MECHATROLINK-III interface

## Operating Environment

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

Ite	m	Specifications		
Interface		MECHATROLINK-III compliant		
Physical layer		Ethernet		
Transmission rat	е	100 Mbps		
Cycle time / No. o	of stations	0.25 ms for 4 axes, 0.5 ms for 8 axes, or 1.0 ms for 15 axes		
Transmission by	tes	16, 32, 48, or 64 bytes (intermixing allowed)		
Communications	method	Cyclic communication		
Network topology	y	Cascade or star		
Transmission me	dia	Ethernet STP Cat5e (dedicated cable)		
Maximum transm	nission distance	100 m (between stations)		
Minimum distance stations	e between	0.2 m		
Supported profile	es	- Standard servo profile - Standard I/O profile		
	Position	-2,147,483,648 to 2,147,483,647		
	reference	(reference unit)		
Positioning functions	Functions	<ul> <li>Independent axis motion using standard servo profile commands (availability dependent on connected external device and supported standard servo profile commands)</li> <li>Linear interpolation motion (starting and stopping multiple axes simultaneously) and speed/target position change during motion</li> </ul>		
	Others	<ul> <li>Status monitoring of external devices (target position, current position, speed, and torque)</li> <li>Reading and writing parameters of external devices</li> <li>External device I/O using standard I/O profile commands</li> </ul>		
Number of install		8 modules max. (controlling 120 axes max.)		
Current consump	otion	530 mA (at 5 V DC)		
External connection		Two MECHATROLINK-III connectors (industrial mini-connector)		
External dimensions		28.9 (W) × 100 (H) × 83.2 (D) mm *		
Weight		130 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		-20 to 75°C		
Storage ambient		10 to 90% RH (non-condensing)		
		s. see external dimensions drawing)		

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

# 3.2 Compatible External Devices and Cables

# Servo Drives, I/O Equipment

#### • Products from Yaskawa Electric Corporation

#### Table 3.4 Servo Drives, I/O Equipment

Product	Model	Description
AC Servo Drive Σ-V Series MECHATROLINK-III Command Option type SERVOPACK	SGDV-DDDD2DD	
64-point I/O module	JEPMC-MTD2310-E	

## MECHATROLINK-III Communications Cable

#### • Products from Yaskawa Controls Co., Ltd.

#### Table 3.5 MECHATROLINK-III Communications Cable

Product	Model	Description
	JEPMC-W6012-DD-E	No core
	JEPMC-W6013-DD-E	With core
MECHATROLINK-III communications cable	JEPMC-W6014-DD-E	No core;
		no connector on the other
		end

### MECHATROLINK-III Dedicated Hub

#### Products from Yaskawa Electric Corporation

#### Table 3.6 MECHATROLINK-III Dedicated Hub

Product	Model	Description
MECHATROLINK-III compatible hub module	JEPMC-MT2000-E	

# 3.3 Scope of MECHATROLINK-III Support

# 3.3.1 **Profile Types**

The profile types supported by the module and the corresponding data size in bytes are listed in the table below.

Profile Code	Profile	Description	Data Size (bytes)
\$10	Standard servo profile	Profile supported by MECHATROLINK-III compliant standard servo products	32 or 48
\$30	Standard I/O profile	Profile supported by MECHATROLINK-III compliant standard I/O products	16, 32, 48 or 64

Table 3.7 Profile Type and Number of Data Bytes

# 3.3.2 Standard Servo Profile Commands

This section lists the MECHATROLINK-III standard servo profile commands that are executable by the module.

- $\odot:$  Executable by a user using MECHATROLINK-III command parameters of each axis.
- ○: Executable by a user using extended MECHATROLINK-III command parameters.
- $\bigtriangleup$ : Not executable by a user but is executed automatically by the positioning module or external device.
- $\times: \ensuremath{\mathsf{Not}}\xspace$  supported

### Standard Servo Profile Main Commands

Table 3.8	Standard Servo	Profile Main	<b>Command List</b>
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Profile	Command Code	Command	Function	Communi- cation Type	Supported
	\$00	NOP	No operation	A	Ø
	\$01	PRM_RD	Read parameter	A	<b>X</b> *1
	\$02	PRM_WR	Write parameter	А	<b>X</b> *1
	\$03	ID_RD	Read ID	A	0
	\$04	CONFIG	Setup device	A	Ø
	\$05	ALM_RD	Read alarm or warning	А	0
Common	\$06	ALM_CLR	Clear alarm or warning	A	Ø
commands	\$0D	SYNC_SET	Start synchronous communication	А	Ø
	\$0E	CONNECT	Establish connection	A	Δ
	\$0F	DISCONNECT	Release connection	Α	Δ
	\$1B	PPRM_RD	Read stored parameter	А	<b>X</b> *1
	\$1C	PPRM_WR	Write stored parameter	A	<b>X</b> *1
	\$1D	MEM_RD	Read memory	А	0
	\$1E	MEM_WR	Write memory	А	0
	\$20	POS_SET	Set coordinates	А	Ø
	\$21	BRK_ON	Apply brake	А	<b>©</b> *2
	\$22	BRK_OFF	Release brake	А	<b>©</b> *2
	\$23	SENS_ON	Turn sensor ON	А	Ø
	\$24	SENS_OFF	Turn sensor OFF	А	Ø
	\$30	SMON	Servo status monitor	А	Ø
	\$31	SV_ON	Servo ON	А	Ø
	\$32	SV_OFF	Servo OFF	A	Ø
Standard	\$34	INTERPOLATE	Interpolation	S	Δ
servo	\$35	POSING	Positioning	А	Ø
	\$36	FEED	Feed	А	Ø
	\$37	EX_FEED	External input feed	A	Ø
	\$39	EX_POSING	External input positioning	A	Ø
	\$3A	ZRET	Zero point return	А	Ø
	\$3C	VELCTRL	Velocity control	A	Ø
	\$3D	TRQCTRL	Torque control	А	Ø
	\$40	SVPRM_RD	Read servo parameter	A	Ø
	\$41	SVPRM_WR	Write servo parameter	A	Ø

\*1: The standard servo command profile does not use PRM\_RD, PRM\_WR, PPRM\_RD and PPRM\_WR, but uses SVPRM\_RD and SVPRM\_WR instead.

\*2: Brake ON/OFF should be controlled by an external device n tandem with Servo ON/OFF commands.

Table 3.9	Communication	Туре
-----------	---------------	------

Symbol	Communication Type
S	Synchronous communication command
A	Asynchronous communication command

# Standard Servo Profile Subcommands

Table 3.10	Standard Servo Profile Subcommand List
------------	--

Profile	Command Code	Command	Function	Supported
	\$00	NOP	No operation	Δ
	\$01	PRM_RD	Read parameter	<b>X</b> *1
	\$02	PRM_WR	Write parameter	<b>X</b> *1
	\$05	ALM_RD	Read alarm or warning	×
	\$06	ALM_CLR	Clear alarm or warning	×
Standard	\$1B	PPRM_RD	Read stored parameter	<b>X</b> *1
servo	\$1C	PPRM_WR	Write stored parameter	<b>X</b> *1
	\$1D	MEM_RD	Read memory	×
	\$1E	MEM_WR	Write memory	×
	\$30	SMON	Servo status monitor	Δ
	\$40	SVPRM_RD	Read servo parameter	×
	\$41	SVPRM_WR	Write servo parameter	×

\*1: The standard servo command profile does not use PRM\_RD, PRM\_WR, PPRM\_RD and PPRM\_WR, but uses SVPRM\_RD and SVPRM\_WR instead.

# 3.3.3 Standard I/O Profile Commands

This section lists the MECHATROLINK-III standard I/O profile commands that are executable by the module.

- $\odot:$  Executable by a user using MECHATROLINK-III command parameters of each axis.
- ○: Executable by a user using extended MECHATROLINK-III command parameters.
- $\bigtriangleup$ : Not executable by a user but is executed automatically by the positioning module or external devices.
- $\times$ : Not supported

## Standard I/O Profile Commands

#### Table 3.11 List of Standard I/O Profile Commands

Profile	Command Code	Command	Function	Communi- cation Type	Supported
	\$00	NOP	No operation	A	Ø
	\$01	PRM_RD	Read parameter	A	×
	\$02	PRM_WR	Write parameter	A	×
	\$03	ID_RD	Read ID	A	0
	\$04	CONFIG	Setup device	A	Ø
	\$05	ALM_RD	Read alarm or warning	A	0
Common	\$06	ALM_CLR	Clear alarm or warning	A	Ø
commands	\$0D	SYNC_SET	Start synchronous communication	A	×
	\$0E	CONNECT	Establish connection	A	Δ
	\$0F	DISCONNECT	Release connection	A	Δ
	\$1B	PPRM_RD	Read stored parameter	A	×
	\$1C	PPRM_WR	Write stored parameter	Α	×
	\$1D	MEM_RD	Read memory	A	×
	\$1E	MEM_WR	Write memory	A	×
Standard I/O	\$20	DATA_RWA	Data Read/write_a	A	Ø
	\$21	DATA_RWS	Data Read/write_s	S	×

#### Table 3.12 Communication Type

Symbol	Communication Type
S	Synchronous communication command
А	Asynchronous communication command

# 3.4 Components and Their Functions

## Appearance and Construction

The outer appearance of the module is shown in the figure below.

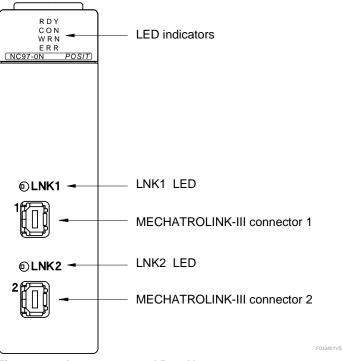


Figure 3.1 Appearance and Part Names

# Component Functions

#### LED Indicators

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

	Table 3.13	LED Indicators
--	------------	----------------

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

### • LNK1 LED, LNK2 LED

The LNK1 and LNK2 LED indicators are lit when an external device is connected to the LNK1 and LNK2 connectors respectively.

#### MECHATROLINK-III Connectors 1 and 2

These connectors are used for connecting MECHATROLINK-III compliant external devices.

The table below shows the pin assignments for the module's MECHATRONLINK IIII connectors used for attaching MECHATROLINK-III compliant external devices.

Pin No.	Signal	Function
1	TXP	Send data (+)
2	TXN	Send data (-)
3	RXP	Receive data (+)
4	-	
5	-	
6	RXN	Receive data (-)
7	-	
8	-	

#### Table 3.14 MECHATROLINK-III Connector Specifications

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

These signal lines are isolated from the internal circuitry by pulse transformers.

# 3.5 External Dimensions

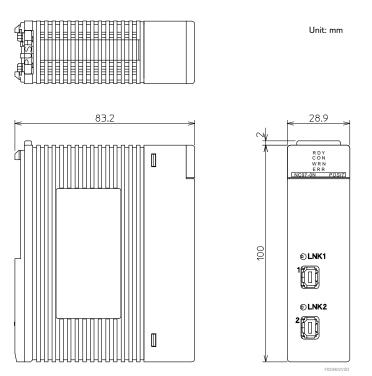


Figure 3.2 External Dimensions Drawing

# 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.

# 

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

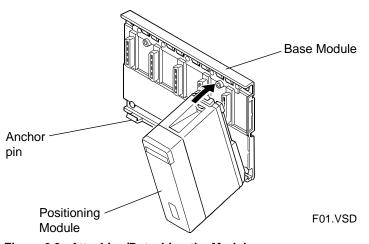


Figure 3.3 Attaching/Detaching the Module

# 

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.

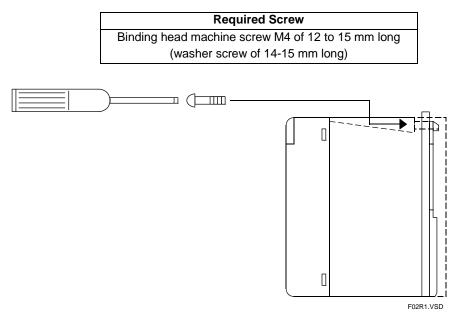


Figure 3.4 Securing Module Using Screws

# 3.7 Connecting to External Devices

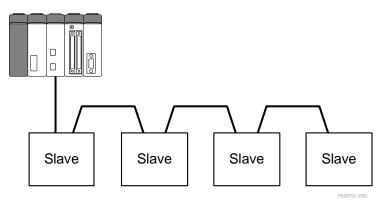
The positioning module uses MECHATROLINK-III dedicated cables for connecting MECHATROLINK-III compliant external devices.

Attach the connector of a MECHATROLINK-III cable to the MECHATROLINK-III connector 1 or MECHATROLINK-III connector 2 of the module.

#### Network Topology

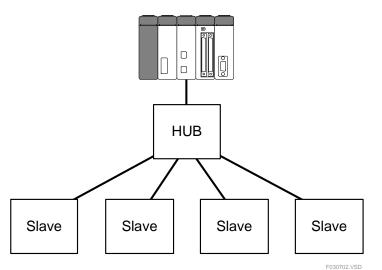
Both cascade and star network configurations are supported.

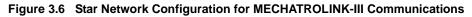
#### Cascade topology





#### Star topology





## 

Machine fault or misoperation may cause a motor to behave in an unexpected manner. All motors should be wired according to manufacturers' recommendations to allow external power shutdown and emergency stop.

#### Precautions on Wiring of MECHATROLINK-III Cable

Observe the following precautions when wiring MECHATROLINK-III communication cables.

#### Cable

Always use a MECHATROLINK-III dedicated cable for connection.

#### Inter-station cable length

All cables between stations must be kept within 0.2 m and 100 m long.

#### • Detaching a MECHATROLINK-III communication cable

Follow the procedure shown in the figure below when detaching a cable connector. Always slide the lock injector of the connector towards the module to release the lock before pulling out the connector.

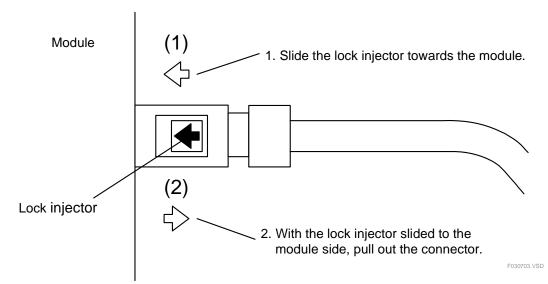


Figure 3.7 How to Detach MECHATROLINK-III Communication Cables

## 

Pulling out a cable connector without first releasing its lock may damage the connector.

# 4. Input/Output Relays, Parameters and Statuses

## 4.1 List of Input/Output Relays

This module provides 32 input relays and 32 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, "DDD" 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 <b>DDD</b> 01	AX1 Response Received	Turns on when a MECHATROLINK-III response for axis 1 is received.	Turning off Y $\square$ $\square$ $\square$ 33 also turns off this relay.
X <b>DDD</b> 02	AX2 Response Received	Turns on when a MECHATROLINK-III response for axis 2 is received.	Turning off $Y\square\square\square34$ also turns off this relay.
X <b>DDD</b> 03	AX3 Response Received	Turns on when a MECHATROLINK-III response for axis 3 is received.	Turning off YDDD35 also turns off this relay.
X <b>DD0</b> 4	AX4 Response Received	Turns on when a MECHATROLINK-III response for axis 4 is received.	Turning off $Y\square\square\square$ 36 also turns off this relay.
X <b>DDD</b> 05	AX5 Response Received	Turns on when a MECHATROLINK-III response for axis 5 is received.	Turning off YDDD37 also turns off this relay.
X <b>DDD</b> 06	AX6 Response Received	Turns on when a MECHATROLINK-III response for axis 6 is received.	Turning off YDDD38 also turns off this relay.
X <b>DDD</b> 07	AX7 Response Received	Turns on when a MECHATROLINK-III response for axis 7 is received.	Turning off Y $\square$ $\square$ $\square$ 39 also turns off this relay.
	AX8 Response Received	Turns on when a MECHATROLINK-III response for axis 8 is received.	Turning off YDDD40 also turns off this relay.
X <b>DDD</b> 09	AX9 Response Received	Turns on when a MECHATROLINK-III response for axis 9 is received.	Turning off $Y\square\square\square41$ also turns off this relay.
X <b>DD1</b> 0	AX10 Response Received	Turns on when a MECHATROLINK-III response for axis 10 is received.	Turning off YDDD42 also turns off this relay.
X <b>DDD</b> 11	AX11 Response Received	Turns on when a MECHATROLINK-III response for axis 11 is received.	Turning off $Y \square \square \square 43$ also turns off this relay.
X <b>DDD</b> 12	AX12 Response Received	Turns on when a MECHATROLINK-III response for axis 12 is received.	Turning off YDDD44 also turns off this relay.
X <b>DDD</b> 13	AX13 Response Received	Turns on when a MECHATROLINK-III response for axis 13 is received.	Turning off Y $\Box$ $\Box$ $\Box$ 45 also turns off this relay.
X <b>DDD</b> 14	AX14 Response Received	Turns on when a MECHATROLINK-III response for axis 14 is received.	Turning off YDDD46 also turns off this relay.
X <b>DDD</b> 15	AX15 Response Received	Turns on when a MECHATROLINK-III response for axis 15 is received.	Turning off $Y\square\square\square47$ also turns off this relay.
X <b>DD</b> 16	Communication Status	Turns on while MECHATROLINK-III communication is in progress; turns off otherwise.	Turning on YDDD48 to initiate communication turns on this relay when communication begins. Turning off YDDD48 also turns off this relay.

Input Relay No.	Signal Name	Description	Relation with Other Relays
	AX1 Positioning Completed	Turns on when axis 1 is in positioning completed state.	
X <b>DDD</b> 18	AX2 Positioning Completed	Turns on when axis 2 is in positioning completed state.	
X <b>DDD</b> 19	AX3 Positioning Completed	Turns on when axis 3 is in positioning completed state.	
X <b>DD</b> 20	AX4 Positioning Completed	Turns on when axis 4 is in positioning completed state.	
X <b>DDD</b> 21	AX5 Positioning Completed	Turns on when axis 5 is in positioning completed state.	
X <b>DDD</b> 22	AX6 Positioning Completed	Turns on when axis 6 is in positioning completed state.	
X <b>DDD</b> 23	AX7 Positioning Completed	Turns on when axis 7 is in positioning completed state.	
X <b>DDD</b> 24	AX8 Positioning Completed	Turns on when axis 8 is in positioning completed state.	
X <b>DDD</b> 25	AX9 Positioning Completed	Turns on when axis 9 is in positioning completed state.	
X <b>DDD</b> 26	AX10 Positioning Completed	Turns on when axis 10 is in positioning completed state.	
X <b>DDD</b> 27	AX11 Positioning Completed	Turns on when axis 11 is in positioning completed state.	
X <b>DDD</b> 28	AX12 Positioning Completed	Turns on when axis 12 is in positioning completed state.	
X <b>DDD</b> 29	AX13 Positioning Completed	Turns on when axis 13 is in positioning completed state.	
X <b>DD</b> 30	AX14 Positioning Completed	Turns on when axis 14 is in positioning completed state.	
X <b>DDD</b> 31	AX15 Positioning Completed	Turns on when axis 15 is in positioning completed state.	
X <b>DDD</b> 32	Error/Warning Detected	Turns on when an error or warning is detected by the module or any axis.	Turning on YDDD64 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, " $\Box\Box\Box$ " denotes the FA-M3 slot number where the module is mounted.

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y <b>DDD</b> 33	AX1 Send Command	Request to send MECHATROLINK-III command for axis 1.	Turn off this relay after verifying that XDDD01 has turned on.
Y <b>DDD</b> 34	AX2 Send Command	Request to send MECHATROLINK-III command for axis 2	Turn off this relay after verifying that $X \square \square \square \square 02$ has turned on.
Y <b>DDD</b> 35	AX3 Send Command	Request to send MECHATROLINK-III command for axis 3	Turn off this relay after verifying that XDDD03 has turned on.
Y <b>DDD</b> 36	AX4 Send Command	Request to send MECHATROLINK-III command for axis 4	Turn off this relay after verifying that $X\Box\Box\Box$ 4 has turned on.
Y <b>DDD</b> 37	AX5 Send Command	Request to send MECHATROLINK-III command for axis 5	Turn off this relay after verifying that $X\Box\Box\Box$ 5 has turned on.
Y <b>DDD</b> 38	AX6 Send Command	Request to send MECHATROLINK-III command for axis 6	Turn off this relay after verifying that XDDD06 has turned on.
Y <b>DDD</b> 39	AX7 Send Command	Request to send MECHATROLINK-III command for axis 7	Turn off this relay after verifying that $X\Box\Box\Box$ 07 has turned on.
Y <b>DD</b> 40	AX8 Send Command	Request to send MECHATROLINK-III command for axis 8	Turn off this relay after verifying that XDDD08 has turned on.
Y <b>DDD</b> 41	AX9 Send Command	Request to send MECHATROLINK-III command for axis 9	Turn off this relay after verifying that $X\square\square\square09$ has turned on.
Y <b>DDD</b> 42	AX10 Send Command	Request to send MECHATROLINK-III command for axis 10	Turn off this relay after verifying that XDDD10 has turned on.
Y <b>DD4</b> 3	AX11 Send Command	Request to send MECHATROLINK-III command for axis 11	Turn off this relay after verifying that XDDD11 has turned on.
Y <b>DDD</b> 44	AX12 Send Command	Request to send MECHATROLINK-III command for axis 12	Turn off this relay after verifying that XDDD12 has turned on.
Y <b>DDD</b> 45	AX13 Send Command	Request to send MECHATROLINK-III command for axis 13	Turn off this relay after verifying that XDDD13 has turned on.
Y <b>DDD</b> 46	AX14 Send Command	Request to send MECHATROLINK-III command for axis 14	Turn off this relay after verifying that XDDD14 has turned on.
Y <b>DDD</b> 47	AX15 Send Command	Request to send MECHATROLINK-III command for axis 15	Turn off this relay after verifying that XDDD15 has turned on.
Y <b>DDD</b> 48	Start/Stop Communication	Request to start or stop MECHATROLINK-III communication	XDDD16 shows the current communication status.

#### Table 4.2 List of Output Relays

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y <b>DDD</b> 49	(system reserved)		
Y <b>DDD</b> 50	(system reserved)		
	(system reserved)		
Y <b>DDD</b> 52	(system reserved)		
Y <b>DDD</b> 53	(system reserved)		
Y <b>DDD</b> 54	(system reserved)		
Y <b>DDD</b> 55	(system reserved)		
Y <b>DDD</b> 56	(system reserved)		
Y <b>DDD</b> 57	(system reserved)		
Y <b>DDD</b> 58	(system reserved)		
Y <b>DDD</b> 59	(system reserved)		
Y <b>DD</b> 60	(system reserved)		
Y <b>DDD</b> 61	(system reserved)		
Y <b>DDD</b> 62	(system reserved)		
Y <b>DDD</b> 63	(system reserved)		
Y <b>DDD</b> 64	Clear Error/warning	Request to clear all errors and warnings	Turn off this relay after verifying that XDDD32 has turned off.



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" (IM34M06Q15-01E).

## 4.1.3 **Operation of Input/Output Relays**

#### Input Relays

#### • Response Received relays (XDDD01 to XDD15)

#### (1) When sending MECHATROLINK-III (standard servo profile) commands

The Response Received relay of an axis turns on when a MECHATROLINK-III response is received for a MECHATROLINK-III command, whose transmission is initiated by a rising edge of the Send Command relay (YDDD33 to YDDD47) of the axis.

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

Turning off the Send Command relay of an axis (YDDD33 to YDDD47) turns off the corresponding Response Received relay.

#### (2) When sending MECHATROLINK-III (standard I/O profile) commands

If the command code (CMD) of the MECHATROLINK-III command parameters of an axis is set to DATA\_RWA (\$20) for the Data Read/Write\_A command and transmission of the command is initiated by a rising edge of the Send Command relay (YDDD33 to YDDD47) of the axis, the Response Received relay of the axis turns on when a MECHATROLINK-III response is received for the transmitted MECHATROLINK-III command.

While the Response Received relay is ON, output data (OUTPUT) is sent and input data (INPUT) is received continually.

Turning off the Send Command relay of an axis (YDDD33 to YDDD47) turns off the corresponding Response Received relay and stops sending of output data (OUTPUT). However, receiving of input data (INPUT) continues until another MECHATROLINK-III command is sent.

#### (3) When executing interpolation motion commands

The Response Received relay of an axis turns on to indicate normal processing of an interpolation motion command, whose execution was initiated by a rising edge in the Send Command relay (YDDD33 to YDDD47) of the axis.

Turning off the Send Command relay of an axis (YDDD33 to YDDD47) turns off the corresponding Response Received relay.

#### • Communication Status relay (XDD16)

The Communication Status relay turns on when MECHATROLINK-III communication initialization, which was initiated by a rising edge in the Start/Stop Communication relay (YDDD48), is successfully completed to indicate that the module is ready to send and receive MECHATROLINK-III commands.

Turning off the Start/Stop Communication relay (YDDD48) to stop MECHATROLINK-III communication also turns off this relay.

If MECHATROLINK-III communication initialization is not successful, this relay does not turn on. If this happens, check the configuration and wiring of external devices, as well as communication parameter values.

#### • Positioning Completed relays (XDDD17 to XDD31)

These relays are valid only for MECHATROLINK-III standard servo profile compliant external devices. These relays are always OFF for MECHATROLINK-III standard I/O profile compliant external devices.

#### (1) When sending MECHATROLINK-III 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 motion, which is initiated by a MECHATROLINK-III command, begins.

The relay turns on or turns off according to the Positioning Completed Status (PSET) bit of SVCMD\_IO of a MECHATROLINK-III response.

#### (2) When executing interpolation motion 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 motion, which is initiated by an interpolation motion command, begins.

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

#### • Error/Warning Detected relay (XDD32)

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 CMD\_STAT of a MECHATROLINK-III response received from an external device indicates an alarm (CMD\_STAT.D\_ALM bit =1), a warning (CMD\_STAT.D\_WAR bit =1), a command error code (CMD\_STAT.CMD\_ALM code  $\neq$ 0) or a communication error code (CMD\_STAT.COMM\_ALM code  $\neq$ 0). It also turns on when the module detects a MECHATROLINK-III communication initialization related error, a MECHATROLINK-III communication related error, or an interpolation motion command execution related error.

To clear all reported errors and warnings, turn on the Clear Error/Warning relay (YDDD64). If an error or warning condition persists even after the Clear Error/Warning relay (YDDD64) is turned on, 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 5.6, "Detecting Errors, Warnings and Communication Alarms".

#### Output Relays

#### • Send Command relays (YDDD33 to YDD47)

#### (1) When sending MECHATROLINK-III (standard servo profile) commands

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

The corresponding Response Received input relay (XDDD1 to XDD15) turns on when a MECHATROLINK-III response to the transmitted MECHATROLINK-III command is received.

Turning off the Send Command output relay thereafter also turns off the corresponding Response Received input relay ( $X\square\square\square01$  to  $X\square\square\square15$ ).

MECHATROLINK-III response data is stored in axis MECHATROLINK-III response parameters, axis statuses and common statuses.

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

#### (2) When sending MECHATROLINK-III (standard I/O profile) commands

Turning on the Send Command relay for an axis after setting the Command Code (CMD) axis MECHATROLINK-III command parameter to the command code (DATA\_RWA: \$20) of the Data Read/Write\_A command transmits the specified MECHATROLINK-III command.

The corresponding Response Received input relay (XDDD1 to XDD15) turns on when a MECHATROLINK-III response to the transmitted MECHATROLINK-III command is received.

To send output data (OUTPUT) and receive input data (INPUT) continually, keep the Send Command output relay ON.

Turning off the Send Command output relay of an axis (YDDD33 to YDDD47) turns off the corresponding Response Received relay and stops sending of output data (OUTPUT). However, receiving of input data (INPUT) continues until another MECHATROLINK-III command is sent.

#### (3) When executing interpolation motion commands

Turning on the Send Command relay for an axis after setting the Command Code (CMD) axis MECHATROLINK-III command parameter to an interpolation motion command code executes the specified interpolation motion command.

The Response Received relay (X $\square$  $\square$  $\square$ 01 to X $\square$  $\square$  $\square$ 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 (XDDD1 to XDD15).

#### • Start/Stop Communication relay (YDD48)

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

The Communication Status relay (XDDD16) turns on when MECHATROLINK-III communication initialization is successfully completed to indicate that the module is ready to send and receive MECHATROLINK-III commands.

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

#### • Clear Error/Warning relay (YDDD64)

Turning on the Clear Error/Warning relay clears warnings and errors on all axes. It also clears all reported MECHATROLINK-III communication initialization related errors, MECHATROLINK-III communication related errors and interpolation motion command execution related errors.

The Error/Warning Detected relay ( $X\square\square\square32$ ) 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 (XDDD32) 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.

	ut of Parameter and Status Areas	
Data Position Number	Description	
0001 to 0008	Module information statuses	
0009 to 0030	(System reserved)	-
0031 to 0100	MECHATROLINK-IIII communication parameters	4-11
0101 to 0150	Axis 1: MECHATROLINK-III command parameters	
0151 to 0160	MECHATROLINK-III response parameters	
0161 to 0200	Statuses	
	Axis 2: MECHATROLINK-III command parameters	
0201 to 0300	MECHATROLINK-III response parameters	
	Statuses	
	Axis 3: MECHATROLINK-III command parameters	
0301 to 0400	MECHATROLINK-III response parameters	
	Statuses	
	Axis 4: MECHATROLINK-III command parameters	
0401 to 0500	MECHATROLINK-III response parameters	
	Statuses	
	Axis 5: MECHATROLINK-III command parameters	
0501 to 0600	MECHATROLINK-III response parameters	
	Statuses	
	Axis 6: MECHATROLINK-III command parameters	
0601 to 0700	MECHATROLINK-III response parameters	
	Statuses	
	Axis 7: MECHATROLINK-III command parameters	
0701 to 0800	MECHATROLINK-III response parameters	
	Statuses	
	Axis 8: MECHATROLINK-III command parameters	4-14
0801 to 0900	MECHATROLINK-III response parameters	4-26
	Statuses	4-28
	Axis 9: MECHATROLINK-III command parameters	
0901 to 1000	MECHATROLINK-III response parameters	
	Statuses	
	Axis 10: MECHATROLINK-III command parameters	
1001 to 1100	MECHATROLINK-III response parameters	
	Statuses	
	Axis 11: MECHATROLINK-III command parameters	
1101 to 1200	MECHATROLINK-III response parameters	
	Statuses	
	Axis 12: MECHATROLINK-III command parameters	
1201 to 1300	MECHATROLINK-III response parameters	
	Statuses	
4004 4 4400	Axis 13: MECHATROLINK-III command parameters	
1301 to 1400	MECHATROLINK-III response parameters	
	Statuses	
	Axis 14: MECHATROLINK-III command parameters	
1401 to 1500	MECHATROLINK-III response parameters	
		_
4504 1 4/00	Axis 15: MECHATROLINK-III command parameters	
1501 to 1600	MECHATROLINK-III response parameters	
4/04 1 0000	Statuses	4.05
1601 to 2000	Common statuses	4-35
2001 to 2750	Extended MECHATROLINK-III command parameters	4-38
3001 to 3750	Extended MECHATROLINK-III response parameters	
3751 & above	(System reserved)	-

#### Table 4.3 Layout of Parameter and Status Areas

#### System of Units

MECHATROLINK-III standard servo profile compliant external devices allow units for position, speed, acceleration/deceleration and torque to be selected using parameters of the external device.

Check the respective user's manuals of external devices connected to the module for the units to be used when writing MECHATROLINK-III command parameter data, as well as reading MECHATROLINK-III response parameter data and axis statuses for each axis from the CPU module.

#### Position

Unit	Remarks
reference unit (default)	Can be defined as ×10 <sup>n</sup> [reference unit].

#### Speed

Unit	Remarks
Reference unit/s (default)	Can be defined as ×10 <sup>n</sup> [reference unit/s].
Reference unit/min	Can be defined as ×10 <sup>n</sup> [reference unit/min].
% of rated speed	Can be defined as ×10 <sup>n</sup> [%].
min <sup>-1</sup> (rpm)	Can be defined as ×10 <sup>n</sup> [min <sup>-1</sup> ].
Max. motor speed/\$4000000	

#### Acceleration/deceleration

Unit	Remarks
Reference unit/s <sup>2</sup> (default)	Can be defined as $\times 10^{n}$ [reference unit/s <sup>2</sup> ].
ms	Can be defined as $\times 10^{n}$ [ms].

#### • Torque

Unit	Remarks
N (N· m)	Can be defined as $\times 10^{n}$ [N].
% of rated torque (default)	Can be defined as $\times 10^{n}$ [%].
Max. torque/\$4000000	

#### Reading and Writing 2-word Data

In Tables 4.6, 4.10 and 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.

The leading " $\Box\Box$ " 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.

# 

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 instruction to read the data twice consecutively and verify that the data read are the same in both instances. If the HRD instruction is used, data concurrency is not assured even if you had verified that the data are the same.

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

For details on how to check that data read twice consecutively by a sequence CPU are the same in both instances, see Section 6.3, "Precautions When Reading 2-word Data."

## 4.2.1 Module Information Statuses

This subsection lists and describes module information statuses.

Do not write any data to Module Information Statuses as it will overwrite and result in loss of module information data.

#### List of Module Information Statuses

Data Position Number	Parameter Name	Data Description	See Also
0001	Module information	"F3"	
0002	Module information	"NC"	
0003	Module information	"97"	
0004	Module information	"0N"	4-10
0005	Module information		4-10
0006	Module information	"	
0007	Module information	"RV"	
0008	Module information	"	
0009 to 0030	(System reserved)	Always 0	-

#### Table 4.4 List of Module Information Statuses

#### Description of Module Information Statuses

#### Module Information

[Data position number] [Data description] 0001 to 0008 Module Model Name: "F3NC970N" Revision: "RVDD"

Returns the model name and revision of the module as module information.

#### **MECHATROLINK-III Communication Parameters** 4.2.2

This subsection lists and describes MECHATROLINK-III communication parameters.

For details on the profile type supported by an external device to be connected and its communication specification (communication cycle, communication data size in bytes, etc.), as well as how to set its station address, read the user's manual of the external device.

#### List of MECHATROLINK-III Communication Parameters

Data Position Number	Data Name	Data Description	See Also
0031	AX1 Device Type	<ul> <li>For standard servo profile compliant external device: High-byte : Profile type code (\$10: standard servo profile)</li> <li>Bit 0 : Subcommand setting (0: Enabled, 1: Disabled)</li> <li>For standard I/O profile compliant external device: High-byte : Profile type code (\$30: standard I/O profile)</li> <li>Bits 3 to 0 : Communication data size in bytes (0: 16, 1: 32, 2: 48, 3: 64)</li> </ul>	
0032	AX1 Station Address	0: unconnected, \$03 to \$EF	
0033	AX2 Device Type		
0034	AX2 Station Address		
0035	AX3 Device Type		
0036	AX3 Station Address		
0037	AX4 Device Type		
0038	AX4 Station Address		
0039	AX5 Device Type		
0040	AX5 Station Address		
0041	AX6 Device Type		4-12
0042	AX6 Station Address		
0043	AX7 Device Type		
0044	AX7 Station Address		
0045	AX8 Device Type		
0046	AX8 Station Address		
0047	AX9 Device Type		
0048	AX9 Station Address		
0049	AX10 Device Type		
0050	AX10 Station Address		
0051	AX11 Device Type		
0052	AX11 Station Address		
0053	AX12 Device Type		
0054	AX12 Station Address		
0055	AX13 Device Type		1
0056	AX13 Station Address		
0057	AX14 Device Type		
0058	AX14 Station Address		
0059	AX15 Device Type		
0060	AX15 Station Address		
0061	(System reserved)	Always 0	-
0062	Communication Cycle	0: 2 ms, 1: 1 ms, 2: 0.5 ms (8 axes max.), 3: 0.25 ms (4 axes max)	4-13
0063 to 0100	(System reserved)	Always 0	-

Table 4.5 List of MECHATROLINK-III Communication Parameters

## Description of MECHATROLINK-III Communication Parameters

#### • Device Type of each axis

[Data Range]	Profile type code (high-byte) \$10: Standard servo profile \$30: Standard I/O profile Detailed setting for profile type (low-byte)						
[Data Position No.]	Axis 1: 0031; Axis 2: 0033; Axis 3: 0035; Axis 4: 0037 Axis 5: 0039; Axis 6: 0041; Axis 7: 0043; Axis 8: 0045 Axis 9: 0047; Axis 10: 0049; Axis 11: 0051; Axis 12: 0053 Axis 13: 0055; Axis 14: 0057; Axis 15: 0059						
Axis 13: 0055; Axis 14: 0057; Axis 15: 0059 The Device Type of each axis (axes 1 to 15) specifies the profile type code of the corresponding external device and detailed information of each profile type.							
- For standard servo	profile compliant external device:						
15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0						
0 0 0 1 0 0 0 0	0 0 0 0 0 X						
	L - Subcommand Setting						
	0: Enabled; 1: Disabled						
	— — — — — — — - Profile type code						

— — — — — Profile type code \$10: Standard servo profile

#### - For standard servo I/O compliant external device:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	1	1	0	0	0	0	0	0	0	0					
							Ι					L	L	L	L	- Communication Data Size
							Ι									0: 16 bytes
							Ι									1: 32 bytes
																2: 48 bytes
							Ι									3: 64 bytes
																-
L	L	L	L	L	L	L	L	_	_	_	_	_		_	_	<ul> <li>Profile type code</li> </ul>
																\$30: Standard I/O profile

#### • Station Address of each axis

[Data Range]	0: Unconnected \$03 to \$EF: Station address
[Data Position No.]	Axis 1: 0032; Axis 2: 0034; Axis 3: 0036; Axis 4: 0038 Axis 5: 0040; Axis 6: 0042; Axis 7: 0044; Axis 8: 0046
	Axis 9: 0048; Axis 10: 0050; Axis 11: 0052; Axis 12: 0054 Axis 13: 0056; Axis 14: 0058; Axis 15: 0060

The Station Address of each axis (axes 1 to 15) specifies the station address of the corresponding external device.

#### • Communication Cycle

[Data Range]	0: 2 ms
	1: 1 ms
	2: 0.5 ms (8 axes max.)
	3: 0.25 ms (4 axes max.)
[Data Position No.]	0062
<u> </u>	

This parameter specifies the communication cycle time.

If communication cycle time is specified as 0.5 ms, no more than eight axes can be connected. If it is specified as 0.25 ms, no more than four axes can be connected.

## 4.2.3 Axis MECHATROLINK-III Command Parameters

This subsection lists and describes MECHATROLINK-III command parameters for each axis.

The MECHATROLINK-III command parameters of an axis depend on the profile type supported by the connected external device.

The content and setting data of each MECHATROLINK-III command parameter depends on the connected external device. For details on individual parameters, see the user's manual of the connected external device.

## ■ List of Axis MECHATROLINK-III Command Parameters

#### • For standard servo profile compliant device:

Data Position Number	Data Name	Data Description	See Also
01	Command Code (CMD)	\$0000 to \$00FF (MECHATROLINK-III commands) \$FFFF (Extended MECHATROLINK-III commands) \$0100 to \$FF00 (Interpolation motion commands)	4-16
	Command Control (CMD_CTRL)	Bit data: Bits 15 to 0	4-16
	Servo Command Control Field (SVCMD_CTRL)	Bit data: Bits 31 to 0	4-17
□□05 / □□06	Servo Command Output Signal (SVCMD_IO)	Bit data: Bits 31 to 0	4-18
	Target Position (TPOS) / Zero Point Return Mode (MODE)	<ul> <li>For target position (TPOS):</li> <li>-2,147,483,648 to 2,147,483,647</li> <li>For Zero Point Return Mode (MODE): Bits 0 to 3 : Zero point return type (0 or 1) Bit 7 : Zero point return direction (0 or 1)</li> </ul>	4-19
009/0010	Target Speed (TSPD)	<ul> <li>For POSING, EX_POSING or ZRET command: 0 to 2,147,483,647</li> <li>For FEED or EX_FEED command: -2,147,483,648 to 2,147,483,647</li> </ul>	4-19
0011 / 0012	Acceleration (ACCR)	-1: Maximum acceleration 1 to 2,147,483,647	4-19
	Deceleration (DECR)	-1: Maximum deceleration 1 to 2,147,483,647	4-20
<b>DD</b> 15 / <b>DD</b> 16	Torque Limit (TLIM)	-1: No torque limit (Maximum torque limit value) 0 to 2,147,483,647	4-20
	Speed Reference (VREF)	-2,147,483,648 to 2,147,483,647	4-20
	Speed Limit (VLIM)	-1: No speed limit (Maximum speed limit value) 0 to 2,147,483,647	4-20
0021/0022	Torque Reference (TQREF)	-2,147,483,648 to 2,147,483,647	4-20
	Speed Feed Forward (VFF)	0: No speed feed forward -2,147,483,648 to 2,147,483,647	4-20
	Torque Feed Forward (TFF)	0: No torque feed forward -2,147,483,648 to 2,147,483,647	4-20

#### Table 4.6 List of Axis MECHATROLINK-III Command Parameters (1/2)

Data Position Number	Data Name	Data Description	See Also
	Coordinates Setting Mode (POS_SET_MOD)	Bits 0 to 3 : Coordinate system selection (0 to \$F) Bit 7 : Reference point enable/disable (0 or 1)	4-21
	Coordinates Set Value (POS_DATA)	-2,147,483,648 to 2,147,483,647	4-21
0031 to 0032	(System reserved)	Always 0	_
	Configuration Mode (CONFIG_MOD)	<ul><li>0: Parameter re-calculation and setup</li><li>1: Batch writing to retentive memory</li><li>2: Initialization to the factory parameter settings</li></ul>	4-21
□□34	Alarm Clear Mode (ALM_CLR_MOD)	0: Clear current alarm / warning state; 1: Clear alarm history	4-21
□□35	Servo Parameter Number (NO)	\$0000 to \$FFFF	4-22
□□36	Servo Parameter Data Size [byte] (SIZE), Servo Parameter Read/Write Mode (MODE)	Low byte: Servo Parameter Data Size [byte] 2, 4 High byte: Servo Parameter Read/Write Mode \$00: Common parameter (RAM area) \$01: Common parameter (Retentive memory area) \$10: Device parameter (RAM area) \$11: Device parameter (Retentive memory area)	4-22
	Servo Parameter Data (PARAMETER)	-2,147,483,648 to 2,147,483,647	4-22
□□39 to □□40	(System reserved)	Always 0	-
	Subcommand Control (SUB_CTRL)	Bit data: Bits 31 to 0	4-23
	Target Position (for interpolation motion commands)	-2,147,483,648 to 2,147,483,647	4-23
	Target Speed (for interpolation motion commands)	1 to 2,147,483,647	4-23
<b>D</b>	Interpolation Axes (for interpolation motion commands)	Bit data: \$0000 to \$7FFF	4-24
	Acceleration Time (for interpolation motion commands)	0 to 32767 [ms]	4-24
	Deceleration Time (for interpolation motion commands)	0 to 32767 [ms]	4-24
	(System reserved)	Always 0	-

Table 4.6 List of Axis MECHATROLINK-III Command Parameters (2/2)

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

#### • For standard I/O profile compliant external device:

#### Table 4.7 List of Axis MECHATROLINK-III Command Parameters

Data Position Number	Data Name	Data Description	See Also
01	Command Code (CMD)	\$0000 to \$00FF : MECHATROLINK-III command \$FFFF : Extended MECHATROLINK-III command	4-16
02	Command Control (CMD_CTRL)	Bit data: Bits 15 to 0	4-16
<b>DD</b> 03 to <b>DD</b> 32	Output Data (OUTPUT)	Bit data: Bits 15 to 0	4-25
□□33	Configuration Mode (CONFIG_MOD)	<ol> <li>D: Parameter re-calculation and setup</li> <li>Batch writing to retentive memory</li> <li>Initialization to the factory parameter settings</li> </ol>	4-21
□□34	Alarm Clear Mode (ALM_CLR_MOD)	0: Clear current alarm / warning state 1: Clear alarm history	4-21
□□35 to □□50	(System reserved)	Always 0	-

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

## Description of Axis MECHATROLINK-III Command Parameters

• Command Code	(CMD)	STD SERVO / STD IO
[Data Range]	\$0000 to \$00FF	: Transmits MECHATROLINK-III command parameter data for an axis.
	\$FFFF	: Transmits extended MECHATROLINK-III command parameter data.
	\$0100 to \$0500	: Executes interpolation motion command (standard servo only) \$0100: Start positioning
		\$0200: Decelerate & stop \$0300: Stop immediately
		\$0400: Change speed
		\$0500: Change target position
Data Position No 1	□□01 (□□ denote	es an axis number from 01 to 15)

**[Data Position No.] □□01 (□□ denotes an axis number from 01 to 15)** Specify the command code for the MECHATROLINK-III command to be transmitted or the interpolation motion command to be executed.

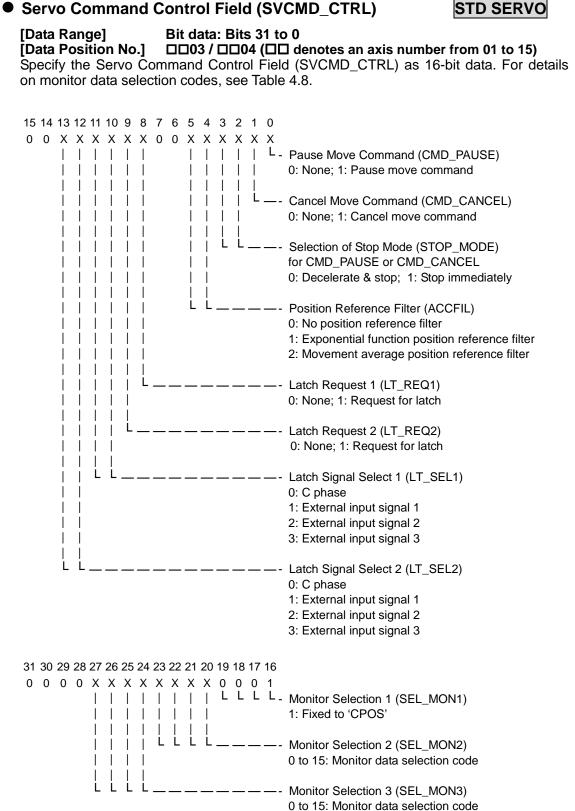
#### • Command Control (CMD\_CTRL)

STD SERVO / STD IO

[Data Range]Bit data: Bits 15 to 0[Data Position No.]□□02 (□□ denotes an axis number from 01 to 15)Specify the Command Control (CMD\_CTRL) as 16-bit 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 X X 0 0 X 0 0 0 L — — - Clear Alarm/Warning (ALM\_CLR) 0: Clear alarm/warning disabled 1: Clear alarm/warning triggered L 1 ĹĹ ---- Command ID (CMD\_ID) 0 to 3

#### STD SERVO



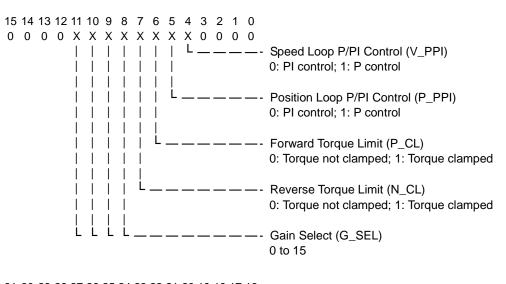
Selection Code	Monitor Name	Contents	Remark
0	APOS	Feedback Position	Current position of the motor
1	CPOS	Command Position	Command position after acceleration/deceleration filter
2	PERR	Position Error	Position error of the control loop
3	LPOS1	Latched Position 1	Motor position 1 latched by the latch signal
4	LPOS2	Latched Position 2	Motor position 2 latched by the latch signal
5	FSPD	Feedback Speed	Current speed of the motor
6	CSPD	Reference Speed	Command speed of the motor
7	TRQ	Torque (Force) Reference	Command torque (force) of the motor
8	ALARM	Detailed Information of the Current Alarm	Current alarm/warning
9	MPOS	Command Position	Input command position of the position control loop
A	-		
В	-		
С	CMN1	Common Monitor 1	Selects the monitor data specified by a parameter of the external device.
D	CMN2	Common Monitor 2	Selects the monitor data specified by a parameter of the external device.
E	OMN1	Optional Monitor 1	Selects the monitor data specified by a parameter.
F	OMN2	Optional Monitor 2	Selects the monitor data specified by a parameter.

 Table 4.8
 List of Monitor Data Selection Codes

#### Servo Command Output Signal (SVCMD\_IO)



[Data Range]Bit data: Bits 31 to 0[Data Position No.]DD05 / DD06 (DD denotes an axis number from 01 to 15)Specify the Servo Command Output Signal as 16-bit data.



 Target Position (TPOS) / Zero Point Return Mode (MODE) STD SERVO

[Data Range]

- For Target Position (TPOS):
   -2,147,483,648 to 2,147,483,647
  - For Zero Point Return Mode (MODE):
    - Bit data: Bits 15 to 0

**[Data Position No.]** DD07 / DD08 (DD denotes an axis number from 01 to 15) For POSING (CMD=\$35) or EX\_POSING (CMD=\$39) command, specify the target position (TPOS).

For ZRET command (CMD=\$3A), specify the zero point return mode (MODE).

- Zero Point Return Mode (MODE)

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 L L L L - Zero Point Return Type (MODE.TYPE) 0: Latch signal; 1: Deceleration LS + Latch signal L - - - - Zero Point Return Direction (MODE.HOME\_DIR) 0: Positive direction; 1: Negative direction

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#### Target Speed (TSPD)

[Data Range]

#### STD SERVO

STD SERVO

- For POSING (\$35), EX\_POSING (\$39) or ZRET (\$3A) command:
  - 0 to 2,147,483,647
- For FEED (\$36) or EX\_FEED (\$37) command,
- -2,147,483,648 to 2,147,483,647

[Data Position No.] DD09 / DD10 (DD denotes an axis number from 01 to 15) Specify the target speed (TSPD).

For FEED (CMD=\$36) or EX\_FEED (CMD=\$37) command, the direction of motion is specified by the sign of the TSPD value.

#### Acceleration (ACCR)

[Data Range] -1: Maximum acceleration 0 to 2,147,483,647

**[Data Position No.]**  $\Box \Box 11 / \Box \Box 12$  ( $\Box \Box$  denotes an axis number from 01 to 15) Specify the acceleration (ACCR).

#### Deceleration (DECR)

[Data Range] -1: Maximum deceleration 0 to 2,147,483,647

**[Data Position No.]**  $\Box \Box \Box \Box 3 / \Box \Box \Box 4$  ( $\Box \Box$  denotes an axis number from 01 to 15) Specify the deceleration (DECR).

#### Torque Limit (TLIM)

[Data Range] -1: No torque limit (Maximum torque limit) 0 to 2,147,483,647

[Data Position No.] DD15 / DD16 (DD denotes an axis number from 01 to 15) Specify the torque limit (TLIM).

#### Speed Reference (VREF)

[Data Range] -2,147,483,648 to 2,147,483,647 [Data Position No.] DD17 / DD18 (DD denotes an axis number from 01 to 15) Specify the torque reference (TQREF) with the sign indicating the direction of rotation.

#### • Speed Limit (VLIM)

[Data Range]-1: No speed limit (Maximum speed limit)<br/>0 to 2,147,483,647[Data Position No.]□□19 / □□20 (□□ denotes an axis number from 01 to 15)

Specify the speed limit (VLIM).

#### • Torque Reference (TQREF)

[Data Range] -2,147,483,648 to 2,147,483,647 [Data Position No.] DD21 / DD22 (DD denotes an axis number from 01 to 15) Specify the torque reference (TQREF) with the sign indicating the direction of output torque.

#### • Speed Feed Forward (VFF)

[Data Range] 0: No speed feed forward

#### -2,147,483,648 to 2,147,483,647

[Data Position No.] Diangle 23 / Diangle 24 (Diangle denotes an axis number from 01 to 15) Specify the speed feed forward (VFF).

#### • Torque Feed Forward (TFF)

[Data Range] 0: No torque feed forward -2,147,483,648 to 2,147,483,647 [Data Position No.] 0025 / 0026 (00 denotes an axis number

## STD SERVO

STD SERVO

STD SERVO

STD SERVO

#### STD SERVO

STD SERVO

#### STD SERVO

#### IM 34M06H60-03E 1st Edition : Jan. 2010-00

#### Coordinates Setting Mode (POS SET MOD) STD SERVO [Data Range] Bit data: Bits 31 to 0 [Data Position No.] $\Box \Box 27 / \Box \Box 28$ ( $\Box \Box$ denotes an axis number from 01 to 15) For POS\_SET command (CMD=\$20), specify whether to enable or disable the reference point (REFE), and select the coordinate system (POS SEL). 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) 0 to 15: Monitor selection code L Reference Point Enable (REFE) 0: Disabled 1: Enabled 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Coordinates Set Value (POS\_DATA) STD SERVO [Data Range] -2,147,483,648 to 2,147,483,647 [Data Position No.] $\Box \Box 29 / \Box \Box 30$ ( $\Box \Box$ denotes an axis number from 01 to 15) For POS\_SET command (CMD=\$20), specify set values for the selected coordinate system (POS DATA). Configuration Mode (CONFIG\_MOD) STD SERVO / STD IO [Data Range] 0: Parameter re-calculation and setup 1: Batch writing to retentive memory 2: Initialization to the factory-set parameter setting values [Data Position No.] $\Box\Box33$ ( $\Box\Box$ denotes an axis number from 01 to 15) For CONFIG command (CMD=\$04), specify the Configuration Mode (CONFIG MODE). Alarm Clear Mode (ALM\_CLR\_MOD) STD SERVO / STD IO [Data Range] 0: Clear current alarm / warning state 1: Clear alarm history

**[Data Position No.]** DD34 (DD denotes an axis number from 01 to 15) For ALM\_CLR command (CMD=\$06), specify the Alarm Clear Mode (ALM\_CLR\_MOD).

#### • Servo Parameter Number (NO)

[Data Range]\$0000 to \$FFFF[Data Position No.]□□35 (□□ denotes an axis number from 01 to 15)For SVPRM\_RD command (CMD=\$40) or SVPRM\_WR command (CMD=\$41), specifythe Servo Parameter Number (NO).

#### Servo Parameter Data Size [byte] (SIZE) Servo Parameter Read/Write Mode (MODE)



STD SERVO

[Data Range] Servo Parameter Data Size [byte] (SIZE) 2, 4 Servo Parameter Read/Write Mode (MODE) \$00: Common parameter (RAM area) \$01: Common parameter (RAM area)

\$01: Common parameter (Retentive memory area)

\$10: Device parameter (RAM area)

\$11: Device parameter (Retentive memory area)

**[Data Position No.]** DD36 (DD denotes an axis number from 01 to 15) For SVPRM\_RD command (CMD=\$40) or SVPRM\_WR command (CMD=\$41), specify the Servo Parameter Data Size [byte] (SIZE) and Servo Parameter Read/Write Mode (MODE).

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Servo Parameter Data Size [byte] (SIZE) 2, 4 LLLL 1 1 Servo Parameter Read/Write Mode (MODE) \$00: Common parameter (RAM area) \$01: Common parameter (Retentive memory area) \$10: Device parameter (RAM area) \$11: Device parameter (Retentive memory area)

Servo Parameter Data (PARAMETER)

#### STD SERVO

[Data Range] -2,147,483,648 to 2,147,483,647 [Data Position No.] DD37 / DD38 (DD denotes an axis number from 01 to 15) For SVPRM\_WR command (CMD=\$41), specify the Servo Parameter Data (PARAMETER).

STD SERVO

#### Subcommand Control (SUB CTRL)

[Data Range] Bit data: Bits 31 to 0 [Data Position No.]  $\Box \Box 41 / \Box \Box 42$  ( $\Box \Box$  denotes an axis number from 01 to 15) Specify the Subcommand Control Field (SUB\_CTRL) as 32-bit data. For details on monitor data selection codes, see Table 4.8. 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 X X X X 0 0 0 0 0 0 0 0 0 0 0 0 0 LL L ------ Monitor Selection 4 (SEL\_MON4) 0 to 15: Monitor data selection code 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 0 to 15: Monitor data selection code L LL L Monitor Selection 6 (SEL\_MON6) 0 to 15: Monitor data selection code

Target Position (for interpolation motion commands)

STD SERVO

[Data Range] -2,147,483,648 to 2,147,483,647 Specify the target position when executing an interpolation motion command.

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

#### Target Speed (for interpolation motion commands)

STD SERVO

1 to 2,147,483,647 [Data Range]

[Data Position No.]  $\Box\Box45 / \Box\Box46 (\Box\Box \text{ denotes an axis number from 01 to 15})$ Specify the target speed when executing an interpolation motion command.

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

STD SERVO

## Interpolation Axes (for interpolation and for a section as a

(for interpolation motion commands)

[Data Range] Bit data: Bits 15 to 0 [Data Position No.] DD47 (DD denotes an axis number from 01 to 15) Specify the set of axes to be moved in tandem with the reference axis during interpolation motion as bit data.

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

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

| | | | L - Axis 1 (0: no; 1: yes) L \_\_\_\_ - Axis 2 (0: no; 1: yes) | | | | L — - Axis 3 (0: no; 1: yes) | | | | <sup>L</sup> — — - Axis 4 (0: no; 1: yes) | | | | L - - - - Axis 5 (0: no; 1: yes) | | | L \_ \_ \_ Axis 6 (0: no; 1: yes) | | | L \_\_\_\_ - \_\_\_ - Axis 7 (0: no; 1: yes) L \_\_\_\_\_ - Axis 8 (0: no; 1: yes) | | | L \_ \_ \_ \_ \_ \_ \_ Axis 9 (0: no; 1: yes) | | L \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ Axis 10 (0: no; 1: yes) L \_\_\_\_ - Axis 11 (0: no; 1: yes) \_\_\_\_\_ Axis 12 (0: no; 1: yes) — — — — — — — - Axis 15 (0: no; 1: yes)

#### Acceleration Time (for interpolation motion commands)

[Data Range] 0 to 32,767[ms]

**[Data Position No.]** Digital **Digital Action and Acti** 

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

#### Deceleration Time

(for interpolation motion commands)

[Data Range]0 to 32,767[ms][Data Position No.]□□49 (□□ denotes an axis number from 01 to 15)Specify the deceleration time for an interpolation motion.

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

STD SERVO

STD SERVO

#### • Output Data (OUTPUT)

#### STD I/O

[Data Range] Bit data: Bits 15 to 0 [Data Position No.] DD3 to DD32 (DD denotes an axis number from 01 to 15) For a DATA\_RWA command (CMD=\$20), specify the Output Data (OUTPUT) to a standard I/O profile compliant external device.

Output data (OUTPUT) is sent continually for an axis while its Send Command relay (YDDD33 to YDDD47) remains ON. Turning OFF the Send Command relay (YDDD33 to YDDD47) of an axis stops transmission of output data (OUTPUT) for the axis.

Data Position No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	O <sub>16</sub>	O <sub>15</sub>	O <sub>14</sub>	O <sub>13</sub>	O <sub>12</sub>	O <sub>11</sub>	O <sub>10</sub>	Ο <sub>9</sub>	O <sub>8</sub>	O <sub>7</sub>	O <sub>6</sub>	O <sub>5</sub>	O <sub>4</sub>	O <sub>3</sub>	02	O <sub>1</sub>
	O <sub>32</sub>	O <sub>31</sub>	O <sub>30</sub>	O <sub>29</sub>	O <sub>28</sub>	O <sub>27</sub>	O <sub>26</sub>	O <sub>25</sub>	O <sub>24</sub>	O <sub>23</sub>	O <sub>22</sub>	O <sub>21</sub>	O <sub>20</sub>	O <sub>19</sub>	O <sub>18</sub>	O <sub>17</sub>
	O <sub>48</sub>	O <sub>47</sub>	O <sub>46</sub>	O <sub>45</sub>	O <sub>44</sub>	O <sub>43</sub>	O <sub>42</sub>	O <sub>41</sub>	O <sub>40</sub>	O <sub>39</sub>	O <sub>38</sub>	O <sub>37</sub>	O <sub>36</sub>	O <sub>35</sub>	O <sub>34</sub>	O <sub>33</sub>
	O <sub>64</sub>	O <sub>63</sub>	O <sub>62</sub>	O <sub>61</sub>	O <sub>60</sub>	O <sub>59</sub>	O <sub>58</sub>	O <sub>57</sub>	O <sub>56</sub>	O <sub>55</sub>	O <sub>54</sub>	O <sub>53</sub>	O <sub>52</sub>	O <sub>51</sub>	O <sub>50</sub>	O <sub>49</sub>
:																

#### Table 4.9 Output Data (OUTPUT) Map

## 4.2.4 Axis MECHATROLINK-III Response Parameters

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

The MECHATROLINK-III response parameters of an axis depend on the profile type supported by the connected external device.

The content and reference data of each MECHATROLINK-III response parameter depends on the connected external device. For details on individual parameters, see the user's manual of the connected external device.

## ■ List of Axis MECHATROLINK-III Response Parameters

#### • For standard servo profile compliant external device:

#### Table 4.10 List of Axis MECHATROLINK-III Response Parameters

Data Position Number	Data Name	Data Description	See Also
<b>DD</b> 51	Servo Parameter Number (NO)	\$0000 to \$FFFF	4-27
<b>D5</b> 2	Servo Parameter Data Size [byte] (SIZE), Servo Parameter Read/Write Mode (MODE)	Low byte: Servo Parameter Data Size [byte] 2, 4 High byte: Servo Parameter Read/Write Mode \$00: Common parameter (RAM area) \$01: Common parameter (Retentive memory area) \$10: Device parameter (RAM area) \$11: Device parameter (Retentive memory area)	4-27
	Servo Parameter Data (PARAMETER)	-2,147,483,648 to 2,147,483,647	4-27
□□55 to □□60	(System reserved)		-
	Note: DD depotes an axis number (01 to 15)		

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

#### • For standard I/O profile compliant external device:

#### Table 4.11 List of Axis MECHATROLINK-III Response Parameters

Data Position Number	Data Name	Data Description	See Also
□□51 to □□60	(System reserved)		-
	Note: $\Box\Box$ denotes an axis number (01 to 15).		

## Description of Axis MECHATROLINK-III Response Parameters

• Servo Parameter	Number (NO)		STD SERVO							
[Data Position No.] [Data Range] For SVPRM_RD com the Servo Parameter	<b>\$0000 to \$FFFF</b> Imand (CMD=\$40) or	s an axis number from 01 SVPRM_WR command								
<ul> <li>Servo Parameter Servo Parameter</li> </ul>	Data Size [byte] (S Read/Write Mode		STD SERVO							
[Data Position No.] [Data Range] For SVPRM_RD com the Servo Parameter (MODE).	[Data Range] Servo Parameter Data Size [byte] (SIZE) 2, 4 Servo Parameter Read/Write Mode (MODE) \$00: Common parameter (RAM area) \$01: Common parameter (Retentive memory area) \$10: Device parameter (RAM area) \$11: Device parameter (Retentive memory area) For SVPRM_RD command (CMD=\$40) or SVPRM_WR command (CMD=\$41), returns the Servo Parameter Data Size [byte] (SIZE) and Servo Parameter Read/Write Mode									
15 14 13 12 11 10 9 8 X X X X X X X X                 		Servo Parameter Data Size [k 2, 4 Servo Parameter Read/Write (MODE) \$00: Common parameter (RA \$01: Common parameter (RA \$10: Device parameter (RAM \$11: Device parameter (Reter	Mode M area) tentive memory area) area)							
• Servo Parameter	Data (PARAMETE	R)	STD SERVO							

#### • Servo Parameter Data (PARAMETER)

□□53 / □□54 (□□ denotes an axis number from 01 to 15) [Data Position No.] -2,147,483,648 to 2,147,483,647 [Data Range] For SVPRM\_RD command (CMD=\$40) or SVPRM\_WR command (CMD=\$41), returns the Servo Parameter Data (PARAMETER).

## 4.2.5 Axis Statuses

This subsection lists and describes the axis statuses.

The statuses of an axis depend on the profile type supported by the connected external device.

The content and reference data of each status depends on the connected external device. For details on individual statuses, see the user's manual of the connected external device.

#### List of Axis Statuses

#### • For standard servo profile compliant external device:

Data Position Number	Data Name	Data Description	See Also
<b>DD</b> 61	(System reserved)		-
<b>DD</b> 62	Command Status (CMD_STAT)	Bit data: Bits 15 to 0	4-29
	Servo Command Status Field (SVCMD_STAT)	Bit data: Bits 31 to 0	4-30
□□65 / □□66	Servo Command Input Signal (SVCMD_IO)	Bit data: Bits 31 to 0	4-31
	Fixed Monitor 1 (CPRM_SEL_MON1)	Fixed monitor 1 data	4-32
0069/0070	Fixed Monitor 2 (CPRM_SEL_MON2)	Fixed monitor 2 data	4-32
0071/0072	Monitor 1 (MONITOR1)	Monitor 1 data (Fixed to CPOS data)	4-32
	Monitor 2 (MONITOR2)	Monitor 2 data	4-32
	Monitor 3 (MONITOR3)	Monitor 3 data	4-32
	Monitor 4 (MONITOR4)	Monitor 4 data	4-32
	Monitor 5 (MONITOR5)	Monitor 5 data	4-33
	Monitor 6 (MONITOR6)	Monitor 6 data	4-33
	Subcommand Status (SUB_STAT)	Bit data: Bits 15 to 0	4-33
	Remaining Travel Status	-2,147,483,648 to 2,147,483,647	4-33
<b>DD</b> 87	Interpolation Status	Bit data: Bits 15 to 0	4-34
□□88 to ■■00	(System reserved)		-

#### Table 4.12 List of Axis Statuses

Note: □□ denotes an axis number (01 to 15). ■■ denotes the value of □□ + 1.

#### • For standard I/O profile compliant external device:

#### Table 4.13 List of Axis Statuses

Data Position Number	Data Name	Data Description	See Also
<b>DD</b> 61	(System reserved)		-
	Command Status (CMD_STAT)	Bit data: Bits 15 to 0	4-29
□□63 to □□92	Input Data (INPUT)	Bit data: Bits 15 to 0	4-34
□□93 to ■■00	(System reserved)		-

Note: □□ denotes an axis number (01 to 15). ■■ denotes the value of □□ + 1.

#### Description of Axis Statuses

#### Command Status (CMD\_STAT)

[Data Position No.] DIG2 (DI denotes an axis number from 01 to 15) [Data Range] Bit data: Bits 15 to 0 Returns the Command Status (CMD\_STAT). For details on command error codes and communication error codes, see Table 4.14 and Table 4.15 respectively.

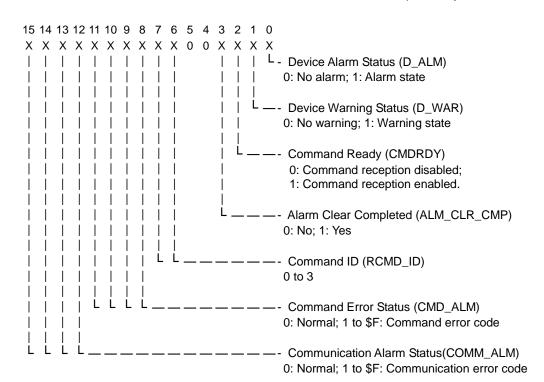


Table 4.14	Command Error Codes	

Code		Description
	0	Normal
	1	Invalid data
	2	
Warning	3	
Varr	4	
>	5	
	6	
	7	
	8	Unsupported command received
	9	Invalid data
	А	Command execution condition
E		error
Alarm	В	Subcommand combination
A	Б	error
	С	Phase error
	D	
	Е	
	F	

Table 4.15	Communication	Error	Codes
	oominamouton		00000

Co	de	Description
	0	Normal
	1	FCS error
	2	Command data not received
Warning	3	Synchronous frame not received
Varr	4	
>	5	
	6	
	7	
	8	FCS error
	9	Command data not received
٤	А	Synchronous frame not received
Alarm	В	Synchronization interval error
	С	WDT error
	D	
	Е	
	F	

#### Servo Command Status Field (SVCMD\_STAT) STD SERVO

[Data Position No.]  $\Box\Box63 / \Box\Box64 (\Box\Box$  denotes an axis number from 01 to 15) [Data Range] Bit data: Bits 31 to 0 Returns the Servo Command Status Field (SVCMD\_STAT). For details on monitor data selection codes, see Table 4.8. 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 0 0 X X X X X X 0 0 X X 0 0 X X L - Pause Move Command Completed (CMD\_PAUSE\_CMP) 0: No; 1: Yes -- Cancel Move Command Completed L (CMD\_CANCEL\_CMP) 0: No; 1: Yes Current Position Reference Filter (ACCFIL) 0: No position reference filter 1: Exponential function position reference filter 2: Movement average position reference filter Latch Completed 1 (LT\_CMP1) 0: No; 1: Yes -- Latch Completed 2 (LT\_CMP2) 0: No; 1: Yes - Position Data Enabled (POS\_RDY) 0: Disabled; 1: Enabled Power ON (PON) 0: Power OFF; Power ON I Motor Energization Ready (M\_RDY) 0: Not ready; 1: Ready Servo ON (SVON) 0: Servo OFF; 1: Servo ON 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 X X X X X X X X X X X 0 0 0 1 Х L L L - Monitor Selection 1 (SEL\_MON1) T 1: Always fixed to 'CPOS' L L L Monitor Selection 2 (SEL\_MON2) 0 to 15: Monitor data selection code L L L Monitor Selection 3 (SEL\_MON3) 0 to 15: Monitor data selection code ------- External Device Vendor Specific Area

STD SERVO

#### Servo Command Input Signal (SVCMD\_IO)

[Data Position No.]DD65 / DD66 (DD denotes an axis number from 01 to 15)[Data Range]Bit data: Bits 31 to 0Returns Servo Command Input Signal (SVCMD\_IO) data.

31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 X X X X X X X X 0 0 0 0 X X X X L - Torque Limit (T\_LIM) 0: Not in torque limited state; I 1: In torque limited state L -- Speed Limit (V\_LIM) 0: Speed limit not detected; 1: Speed limit detected L Speech Match (V\_CMP) 1 0: Speed not matched; 1: Speed matched Zero Speed (ZSPD) 0: Zero speed not detected; 1: Zero speed detected External Device Vendor Specific Area STD SERVO Fixed Monitor 1 (CPRM\_SEL\_MON1) [Data Position No.]  $\Box\Box67 / \Box\Box68 (\Box\Box$  denotes an axis number from 01 to 15) -2,147,483,648 to 2,147,483,647 [Data Range] Returns data of Fixed Monitor 1 (CPRM SEL MON1). Fixed Monitor 2 (CPRM\_SEL\_MON2) STD SERVO □□69 / □□70 (□□ denotes an axis number from 01 to 15) [Data Position No.] [Data Range] -2,147,483,648 to 2,147,483,647 Returns data of Fixed Monitor 2 (CPRM\_SEL\_MON2). STD SERVO [Data Position No.]  $\Box\Box71 / \Box\Box72$  ( $\Box\Box$  denotes an axis number from 01 to 15) [Data Range] -2,147,483,648 to 2,147,483,647 Returns Command Position (CPOS) data. STD SERVO [Data Position No.]  $\Box\Box73 / \Box\Box74 (\Box\Box \text{ denotes an axis number from 01 to 15})$ [Data Range] -2,147,483,648 to 2,147,483,647 Returns data of monitor 2 (MONITOR2). STD SERVO [Data Position No.]  $\Box\Box75 / \Box\Box76 (\Box\Box$  denotes an axis number from 01 to 15) -2,147,483,648 to 2,147,483,647 [Data Range] Returns data of monitor 3 (MONITOR3). STD SERVO [Data Position No.]  $\Box\Box77 / \Box\Box78 (\Box\Box \text{ denotes an axis number from 01 to 15})$ [Data Range] -2,147,483,648 to 2,147,483,647 Returns data of monitor 4 (MONITOR4).

#### Monitor 1 (MONITOR1)

#### Monitor 2 (MONITOR2)

## Monitor 3 (MONITOR3)

## Monitor 4 (MONITOR4)

## STD SERVO

[Data Position No.]DD79 / DD80 (DD denotes an axis number from 01 to 15)[Data Range]-2,147,483,648 to 2,147,483,647Returns data of monitor 5 (MONITOR5).

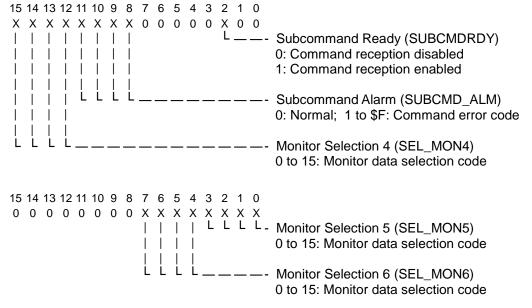
#### Monitor 6 (MONITOR6)

Monitor 5 (MONITOR5)

[Data Position No.]Image Bal / Image Bal

#### • Subcommand Status (SUB\_STAT)

[Data Position No.]III83 / III84 (III denotes an axis number from 01 to 15)[Data Range]Bit data: Bits 31 to 0Returns Subcommand Status (SUB\_STAT).For details on monitor data selectioncodes, see Table 4.8.



#### Remaining Travel Status

#### STD SERVO

Returns the remaining distance to the target position for an interpolation motion.

If a Decelerate & Stop motion was executed during motion, this status returns the remaining distance to the position for deceleration to a stop.

If a change in target position was executed during motion, this status returns the remaining travel distance to the new target position after the target position change completes execution.

STD SERVO

#### Interpolation Status

Interpola	tion St	tatu	IS							STD SERVO
[Data Posi [Data Ran Returns the	ge]	•	Bit	da	tà:	Bi	its	15	otes an axis number from 01 to 0 otion in progress.	to 15)
15 14 13 12	11 10 9	8	76	5	4	3	2	1	0	
0 X 0 0	0 0 0	0	0 0	0	х	х	х	х	X	

0	X       	0	0	0	0	0	0	0	0	0	   	     L	   L	 	L 	<ul> <li>Accelerating (at beginning of motion)</li> <li>Moving at constant speed</li> <li>Decelerating (decelerating to a stop)</li> <li>Changing speed</li> </ul>
	   L						_			_	Ĺ	_	_	_	_	<ul> <li>Changing target position</li> <li>Interpolating (Module is generating path)</li> </ul>

#### Input Data (INPUT)



#### [Data Position No.] □□63 to □□92 (□□ denotes an axis number from 01 to 15) [Data Range] Bit data: Bits 15 to 0

Returns input data (INPUT) from standard I/O profile compliant external devices.

Input data (INPUT) is received continually while the Send Command relay (YDDD33 to  $Y \square \square \square 47$ ) remains ON. Even after ( $Y \square \square \square 33$  to  $Y \square \square \square 47$ ) is turned off, input data (INPUT) continues to be received until another MECHATROLINK-III command is sent.

#### Table 4.16 Input Data (INPUT Map

Data Position Number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	I <sub>16</sub>	I <sub>15</sub>	I <sub>14</sub>	I <sub>13</sub>	$I_{12}$	<b>I</b> <sub>11</sub>	I <sub>10</sub>	<b>I</b> 9	1 <sub>8</sub>	1 <sub>7</sub>	1 <sub>6</sub>	1 <sub>5</sub>	$I_4$	I <sub>3</sub>	I <sub>2</sub>	$I_1$
	I <sub>32</sub>	I <sub>31</sub>	I <sub>30</sub>	1 <sub>29</sub>	1 <sub>28</sub>	1 <sub>27</sub>	1 <sub>26</sub>	1 <sub>25</sub>	$ _{24}$	1 <sub>23</sub>	I <sub>22</sub>	I <sub>21</sub>	I <sub>20</sub>	I <sub>19</sub>	I <sub>18</sub>	I <sub>17</sub>
	1 <sub>48</sub>	I <sub>47</sub>	1 <sub>46</sub>	1 <sub>45</sub>	44	I <sub>43</sub>	I <sub>42</sub>	I <sub>41</sub>	I <sub>40</sub>	I <sub>39</sub>	I <sub>38</sub>	I <sub>37</sub>	I <sub>36</sub>	1 <sub>35</sub>	1 <sub>34</sub>	I <sub>33</sub>
	1 <sub>64</sub>	I <sub>63</sub>	I <sub>62</sub>	I <sub>61</sub>	I <sub>60</sub>	1 <sub>59</sub>	1 <sub>58</sub>	1 <sub>57</sub>	1 <sub>56</sub>	1 <sub>55</sub>	1 <sub>54</sub>	I <sub>53</sub>	1 <sub>52</sub>	I <sub>51</sub>	1 <sub>50</sub>	I <sub>49</sub>
:																



## 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 instruction to read the data twice consecutively and verify that the data read are the same in both instances. If the HRD instruction is used, data concurrency is not assured even if you had verified that the data are the same.

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

For details on how to check that data read twice consecutively by a sequence CPU are the same in both instances, see Section 6.3, "Precautions When Reading 2-word Data."

### 4.2.6 Common Statuses

This subsection lists and describes the common statuses.

#### List of Common Statuses

#### Table 4.17 List of Common Statuses

Data Position Number	Data Name	Data Description	See Also
1601	Alarm Axis Bits	Bit data for module, AX15, AX14,, AX2 and AX1	4-35
1602	Warning Axis Bits	'0' and bit data for AX15, AX14,, AX2 and AX1	4-36
1603	Module Alarm Code	MECHATROLINK-III communication initialization related errors, MECHATROLINK-III communication related errors, interpolation motion command execution related errors, etc.	4-36
1604	Module Detailed Alarm Code	'0' and bit data for AX15, AX14,, AX2 and AX1	4-37
1605 to 2000	(System reserved)		-

#### Description of Common Statuses

#### • Alarm Axis Bits

[Data Position No.] 1601 [Data Range] Bit data: Bits 15 to 0

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

The alarm module bit turns on when a MECHATROLINK-III communication initialization related error, a MECHATROLINK-III communication related error or an interpolation motion command execution related error is detected.

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

For more details, see Section 5.6, "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 \* \* \* \* \* \* \* \* \* \* \* \* \* \* \* \* \* \* | | | L - Axis 1 Т L \_\_\_ - Axis 2 L \_\_\_\_ - Axis 3 L \_\_\_\_ - Axis 4 L \_\_\_\_ - Axis 5 L \_\_\_\_ - Axis 6 L \_\_\_\_\_ - Axis 7 L \_ \_ \_ \_ \_ \_ \_ \_ - Axis 8 Ĺ\_\_\_\_ Axis 9 L \_\_\_\_ - Axis 10 L \_ \_ \_ \_ Axis 11 \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ Axis 12 L \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ Axis 13 L I \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ Axis 14 – — — — — — — — — – Axis 15 \_\_\_\_ - Module

#### • Warning Axis Bits

[Data Position No.] 1602 [Data Range] Bit data: Bits 15 to 0

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

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

For more details, see Section 5.6, "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	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х			
															L	-	Axis	1
														L	_	-	Axis	2
													L	—	_	-	Axis	3
												L	_	_	_	-	Axis	4
											L	_	_	_	_	-	Axis	5
										L	_	_	_	_	_	-	Axis	6
									L	_	_	_	_	_	_	-	Axis	7
								L	_	_	_	_	_	_	_	-	Axis	8
							L	—			—		—	—	_	-	Axis	9
						L	_	_	_	_	_	_	_	_	_	-	Axis	10
					L	_	_	_	_	_	_	_	_	_	_	-	Axis	11
				L	_	_	_	_	_	_	_	_	_	_	_	-	Axis	12
			L	_	_	_	_	_	_	_	_	_	_	_	_	-	Axis	13
		L	_		_	_		_		_	_	_			_	-	Axis	14
	L			_	_	_									_	-	Axis	15

#### Module Alarm Code

[Data Position No.]1603[Data Range]0: No module alarm detected<br/>\$0000 to \$FFFF: Alarm code

Returns the alarm code when a module alarm is detected.

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

The alarm code may indicate a MECHATROLINK-III communication initialization related error, a MECHATROLINK-III communication related error or an interpolation motion command execution related error.

For more details, see Section 5.6, "Detecting Errors, Warnings and Communication Alarms" and Section 7.2.1, "Module Alarms."

#### • Module Detailed Alarm Code

#### [Data Position No.] 1604

[Data Range] Bit data: Bits 15 to 0

Returns bit data that indicates the axes where a module alarm is encountered.

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

For more details, see Section 5.6, "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 X L - Axis 1 L \_\_\_ - Axis 2 L \_\_ \_ - Axis 3 L\_ \_ \_\_ - Axis 4 L - Axis 5 L - Axis 6 L - Axis 7 L - Axis 8 — — — – Axis 9 - — — — - Axis 10 - — — — - Axis 11 L — — — — — - Axis 12 L – <u>— — —</u> – Axis 13 L - — — — - Axis 14 L - — — — — - Axis 15

## 4.2.7 Extended MECHATROLINK-III Command and Response Parameters

This subsection lists and describes extended MECHATROLINK-III command and response parameters.

These parameters are used when a ladder program is used to directly write a MECHATROLINK-III command to be transmitted to an external device.

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

#### List of Extended MECHATROLINK-III Command and Response Parameters

#### Table 4.18 List of Extended MECHATROLINK-II Command and Response Parameters

Data Position Number	Data Name	Data Description	See Also
2001 to 2050	AX1 Extended MECHATROLINK-III command parameters		
2051 to 2100	AX2 Extended MECHATROLINK-III command parameters		
2101 to 2150	AX3 Extended MECHATROLINK-III command parameters		
2151 to 2200	AX4 Extended MECHATROLINK-III command parameters		
2201 to 2250	AX5 Extended MECHATROLINK-III command parameters		
2251 to 2300	AX6 Extended MECHATROLINK-III command parameters		
2301 to 2350	AX7 Extended MECHATROLINK-III command parameters		
2351 to 2400	AX8 Extended MECHATROLINK-III command parameters		4-39
2401 to 2450	AX9 Extended MECHATROLINK-III command parameters		
2451 to 2500	AX10 Extended MECHATROLINK-III command parameters		
2501 to 2550	AX11 Extended MECHATROLINK-III command parameters		
2551 to 2600	AX12 Extended MECHATROLINK-III command parameters		
2601 to 2650	AX13 Extended MECHATROLINK-III command parameters		
2651 to 2700	AX14 Extended MECHATROLINK-III command parameters		
2701 to 2750	AX15 Extended MECHATROLINK-III command parameters		

Data Position Number	Data Name	Data Description	See Also
3001 to 3050	AX1 Extended MECHATROLINK-III response parameters		
3051 to 3100	AX2 Extended MECHATROLINK-III response parameters		
3101 to 3150	AX3 Extended MECHATROLINK-III response parameters		
3151 to 3200	AX4 Extended MECHATROLINK-III response parameters		
3201 to 3250	A X5 Extended MECHATROLINK-III response parameters		
3251 to 3300	AX6 Extended MECHATROLINK-III response parameters		
3301 to 3350	AX7 Extended MECHATROLINK-III response parameters		
3351 to 3400	AX8 Extended MECHATROLINK-III response parameters		4-39
3401 to 3450	AX9 Extended MECHATROLINK-III response parameters		
3451 to 3500	AX10 Extended MECHATROLINK-III response parameters		
3501 to 3550	AX11 Extended MECHATROLINK-III response parameters		
3551 to 3600	AX12 Extended MECHATROLINK-III response parameters		
3601 to 3650	AX13 Extended MECHATROLINK-III response parameters		
3651 to 3700	AX14 Extended MECHATROLINK-III response parameters		
3701 to 3750	AX15 Extended MECHATROLINK-III response parameters		

#### Description of Extended MECHATROLINK-III Command and Response Parameters

#### • Axis Extended MECHATROLINK-III Command Parameters

Specify the parameters for a MECHATROLINK-III command to be transmitted.

The specified extended MECHATROLINK-III command parameter data is transmitted as is if the Command Code (CMD) axis MECHATROLINK-III command parameter is specified as -1.

#### • Axis Extended MECHATROLINK-III Response Parameters

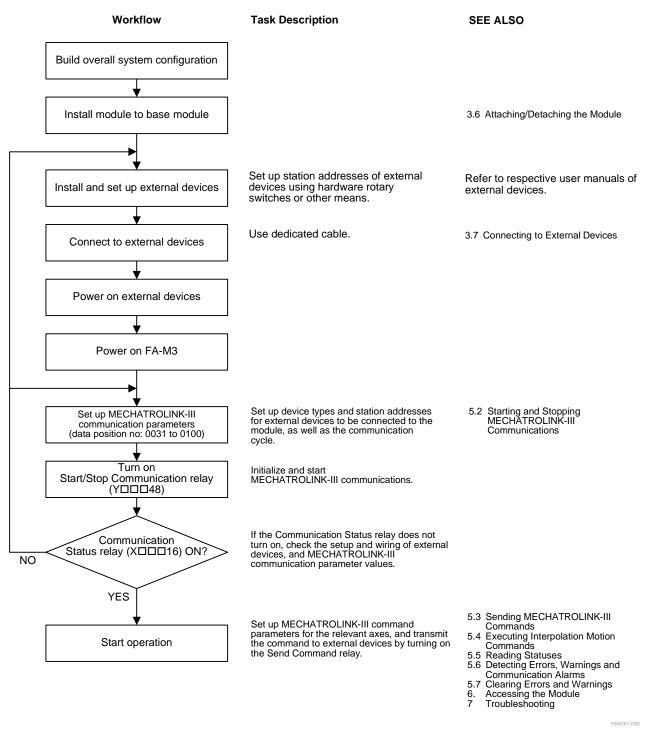
These parameters return the response for a transmitted MECHATROLINK-III command.

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



# Using the Positioning Module Startup Preparation

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



#### Figure 5.1 Startup Preparation Flowchart

## 5.2 Starting and Stopping MECHATROLINK-III Communications

This section describes how to set up the device types and station addresses of external devices corresponding to axes 1 to 15 of the positioning module and the communication cycle in the MECHATROLINK-III communication parameters area, initialize MECHATROLINK-III communications, and begin communications.

The positioning command automatically sends the MECHATROLINK-III commands listed below in sequence to begin communications.

- For standard servo profile compliant external device:

No operation command (NOP: \$00)

Release connection command (DISCONNECT: \$0F)

Establish connection command (CONNECT: \$0E)

Turn sensor ON command (SENS\_ON: \$23)

Servo status monitor command (SMON: \$30)

 For standard I/O profile compliant external device: No operation command (NOP: \$00)
 Release connection command (DISCONNECT: \$0F)

Establish connection command (CONNECT: \$0E)

#### Starting Communications

#### Procedure for Starting Communications

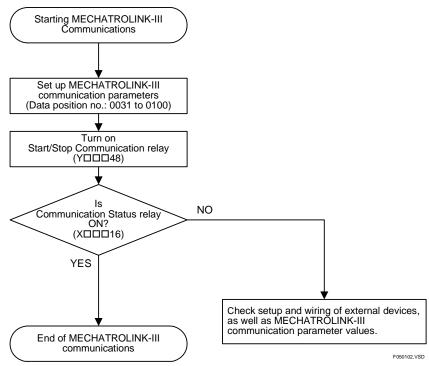


Figure 5.2 Procedure for Starting MECHATROLINK-III Communications

#### • Writing MECHATROLINK-III Communication Parameters

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

Data Position Number	Data Name	Data Description	See Also
0031	AX1 Device Type	<ul> <li>For standard servo profile compliant external device: High-byte : Profile type code (\$10: standard servo profile)</li> <li>Bit 0 : Subcommand setting (0: Enabled, 1: Disabled)</li> <li>For standard I/O profile compliant external device: High-byte : Profile type code (\$30: standard I/O profile)</li> <li>Bits 3 to 0 : Communication data size in bytes (0: 16, 1: 32, 2: 48, 3: 64)</li> </ul>	
0032	AX1 Station Address	0: unconnected, \$03 to \$EF	
0032	AX2 Device Type		
0034	AX2 Station Address		
0035	AX3 Device Type		
0036	AX3 Station Address		
0037	AX4 Device Type		
0038	AX4 Station Address		
0039	AX5 Device Type		
0040	AX5 Station Address		
0041	AX6 Device Type		4-12
0042	AX6 Station Address		- 12
0043	AX7 Device Type		
0044	AX7 Station Address		
0045	AX8 Device Type		
0046	AX8 Station Address		
0047	AX9 Device Type		
0048	AX9 Station Address		
0049	AX10 Device Type		
0050	AX10 Station Address		
0051	AX11 Device Type		
0052	AX11 Station Address		
0053	AX12 Device Type		
0054	AX12 Station Address		
0055	AX13 Device Type		
0056	AX13 Station Address		
0057	AX14 Device Type		
0058	AX14 Station Address		
0059	AX15 Device Type		
0060	AX15 Station Address		
0061	(System reserved)	Always 0	-
0062	Communication Cycle	0: 2 ms, 1: 1 ms, 2: 0.5 ms (8 axes max.), 3: 0.25 ms (4 axes max)	4-13
0063 to 0100	(System reserved)	Always 0	-

#### Table 5.1 MECHATROLINK-III Communication Parameters

IM 34M06H60-03E

#### Start/Stop Communication relay

Turning on the Start/Stop Communication relay (YDDD48) after writing MECHATROLINK-III communication parameter values initializes MECHATROLINK-III communication Status relay (XDD16) turns on when MECHATROLINK-III communication initialization is successfully completed to indicate that the module is ready to send and receive MECHATROLINK-III commands.

Always keep the Start/Stop Communication relay (YDDD48) ON while operating the module. Turning off this relay stops MECHATROLINK-III communications, and turns off the Communication Status (XDD16) relay. It also stops the operation of connected external devices.

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

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y <b>DDD</b> 48	· · ·		XDDD16 shows the current communication status.

Input Relay No.	Signal Name	Description	Relation with Other Relays
X <b>DDD</b> 16	Communication Status	Turns on while MECHATROLINK-III	Turning on YDDD48 to initiate communications turns on this relay when communication begins. Turning off YDDD48 turns off this relay.

Note: In the table, "

#### Communication Parameters Setup Example

#### Procedure

- (1) Specify the device type and station addresses of external devices to be connected in data position numbers 0031 to 0060.
- (2) Specify the communication cycle time in data position number 0062.
- (3) Turn on the Start/Stop Communication relay (YDD48).
- (4) Check that the Communication Status relay (XDDD16) has turned on.

#### • Sample Program

This sample program issues a request to the positioning module installed in slot 3 to initiate communication with three standard servo profile compliant external devices having station addresses \$03, \$04 and \$05, as well as one standard I/O profile compliant device having station address \$06. It verifies whether MECHATROLINK-III communication is successfully initiated by checking whether the Communication Status (XDDD16) relay has turned on.

rt Communication				-	
ation	BMOV	0	D0C031	32	Clear communication parameters
	[	MOV	\$31000	D00031	AX1 device type/ station address
	(	L MOV	\$41000	D00033	AX2 device type/ station address
	(	MOV	\$51000	D00035	AX3 device type/ station address
	(	MOV	\$63000	D00037	AX4 device type/ station address
		MOV	0	D00061	System reserved
		MOV	3	D00062	Communication Cycle =0.25 ms
WRITE	D00031	3	31	32	Write parameters
					Start/Stop Communication ON
		C	SET ]	100101	Verify communication
e	eck for starting of communication	EMOV	BMOV       0         ication       I         MOV       I         MOV       I         MOV       I         MOV       MOV         MOV       MOV	BMOV         0         D0C031           MOV         \$\$1000           MOV         \$100           MOV         \$1000           MOV         \$1000           MOV         \$10000           SET         \$10000           SET         \$100000	BMOV         0         D00031         32           ication         MOV         \$\$1000         D00031           MOV         \$\$1000         D00033           MOV         \$\$1000         D00035           MOV         \$\$51000         D00035           MOV         \$\$51000         D00037           MOV         \$\$63000         D00037           MOV         \$\$1000         D00061           MOV         \$\$1000         D00062           MOV         \$\$1000         D00062           MOV         \$\$1000         \$\$1000           MOV         \$\$1000         \$\$100062           MOV         \$\$100031         \$\$13           SET         Y00348         \$\$1art/stop           Communication

## 5.3 Sending MECHATROLINK-III Commands

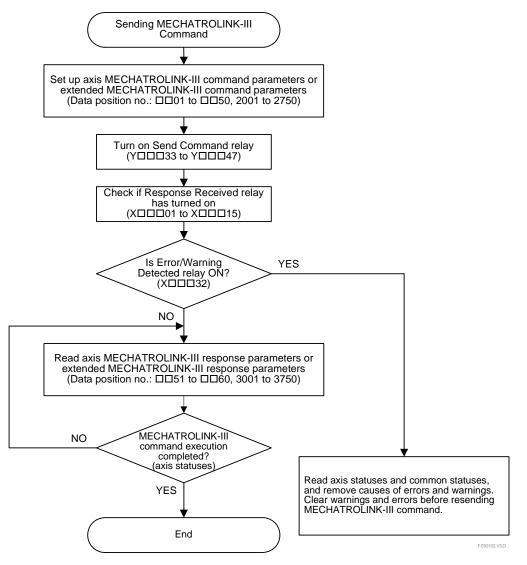
This section describes how to send MECHATROLINK-III commands to external devices corresponding to axes 1 to 15 of the positioning module. It also describes how to receive MECHATROLINK-III responses for transmitted MECHATROLINK-III commands.

The positioning module performs no error and other status checks of the destination external device 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 MECHATROLINK-III response received subsequently.

#### Sending a MECHATROLINK-III Command

• Procedure for sending a MECHATROLINK-III command



#### Figure 5.3 Procedure for Sending a MECHATROLINK-III Command

#### • Acceptance conditions for MECHATROLINK-III commands

- MECHATROLINK-III communication is in progress.
- Send Command relay is OFF.
- Response Received relay is OFF.
- No interpolation motion in progress.

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

#### • Writing MECHATROLINK-III command parameters

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

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

#### Turning on Send Command relay and checking for Response Received relay turning on

Turning on the Send Command relay (YDDD33 to YDDD47) of an axis after writing MECHATROLINK-III command parameter values sends a MECHATROLINK-III command. The Response Received input relay (XDD01 to XDD15) for the axis turns on when a MECHATROLINK-III response to the transmitted MECHATROLINK-III command is received.

Verify that the Response Received relay (XDDD1 to XDD15) has turned on before turning off the Send Command relay (YDD33 to YDD47). Turning off the Send Command relay (YDD47) for an axis also turns off the corresponding Response Received relay (XDD01 to XDD15).

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y <b>DDD</b> 33	AX1 Send Command	Request to send MECHATROLINK-III command for axis 1	Turn off this relay after verifying that $X\square\square\square01$ has turned on.
Y <b>DDD</b> 34	AX2 Send Command	Request to send MECHATROLINK-III command for axis 2	Turn off this relay after verifying that $X\square\square\square02$ has turned on.
Y <b>DDD</b> 35	AX3 Send Command	Request to send MECHATROLINK-III command for axis 3	Turn off this relay after verifying that $X \square \square \square 03$ has turned on.
Y <b>DDD</b> 36	AX4 Send Command	Request to send MECHATROLINK-III command for axis 4	Turn off this relay after verifying that $X\square\square\square04$ has turned on.
Y <b>DDD</b> 37	AX5 Send Command	Request to send MECHATROLINK-III command for axis 5	Turn off this relay after verifying that $X\square\square\square05$ has turned on.
Y <b>DDD</b> 38	AX6 Send Command	Request to send MECHATROLINK-III command for axis 6	Turn off this relay after verifying that $X \square \square \square 06$ has turned on.
Y <b>DDD</b> 39	AX7 Send Command	Request to send MECHATROLINK-III command for axis 7	Turn off this relay after verifying that $X\square\square\square07$ has turned on.
Y <b>DDD</b> 40	AX8 Send Command	Request to send MECHATROLINK-III command for axis 8	Turn off this relay after verifying that $X\square\square\square08$ has turned on.
Y <b>DDD</b> 41	AX9 Send Command	Request to send MECHATROLINK-III command for axis 9	Turn off this relay after verifying that $X\square\square\square09$ has turned on.
Y <b>DDD</b> 42	AX10 Send Command	Request to send MECHATROLINK-III command for axis 10	Turn off this relay after verifying that $X\square\square\square10$ has turned on.
Y <b>DDD</b> 43	AX11 Send Command	Request to send MECHATROLINK-III command for axis 11	Turn off this relay after verifying that $X\square\square\square11$ has turned on.
Y <b>DDD</b> 44	AX12 Send Command	Request to send MECHATROLINK-III command for axis 12	Turn off this relay after verifying that $X\square\square\square12$ has turned on.
Y <b>DDD</b> 45	AX13 Send Command	Request to send MECHATROLINK-III command for axis 13	Turn off this relay after verifying that $X\square\square\square13$ has turned on.
Y <b>DD</b> 46	AX14 Send Command	Request to send MECHATROLINK-III command for axis 14	Turn off this relay after verifying that $X\square\square\square14$ has turned on.
Y <b>DDD</b> 47	AX15 Send Command	Request to send MECHATROLINK-III command for axis 15	Turn off this relay after verifying that $X\square\square\square15$ has turned on.

Table 5.3 Relays for Sending MECHATROLINK-III Commands

To be continued on next page

Input Relay No.	Signal Name	Description	Relation with Other Relays
X <b>DDD</b> 01	AX1 Response Received	Turns on when a MECHATROLINK-III response for axis 1 is received.	Turning off YDDD33 also turns off this relay.
X <b>DDD</b> 02	AX2 Response Received	Turns on when a MECHATROLINK-III response for axis 2 is received.	Turning off YDD34 also turns off this relay.
X <b>DD</b> 03	AX3 Response Received	Turns on when a MECHATROLINK-III response for axis 3 is received.	Turning off YDDD35 also turns off this relay.
X <b>DDD</b> 04	AX4 Response Received	Turns on when a MECHATROLINK-III response for axis 4 is received.	Turning off YDD36 also turns off this relay.
X <b>DDD</b> 05	AX5 Response Received	Turns on when a MECHATROLINK-III response for axis 5 is received.	Turning off YDDD37 also turns off this relay.
X <b>DDD</b> 06	AX6 Response Received	Turns on when a MECHATROLINK-III response for axis 6 is received.	Turning off YDDD38 also turns off this relay.
X <b>DDD</b> 07	AX7 Response Received	Turns on when a MECHATROLINK-III response for axis 7 is received.	Turning off YDDD39 also turns off this relay.
X <b>DD0</b> 8	AX8 Response Received	Turns on when a MECHATROLINK-III response for axis 8 is received.	Turning off YDDD40 also turns off this relay.
X <b>DDD</b> 09	AX9 Response Received	Turns on when a MECHATROLINK-III response for axis 9 is received.	Turning off YDDD41 also turns off this relay.
X <b>DDD</b> 10	AX10 Response Received	Turns on when a MECHATROLINK-III response for axis 10 is received.	Turning off $Y \square \square \square 42$ also turns off this relay.
X <b>DDD</b> 11	AX11 Response Received	Turns on when a MECHATROLINK-III response for axis 11 is received.	Turning off YDDD43 also turns off this relay.
X <b>DDD</b> 12	AX12 Response Received	Turns on when a MECHATROLINK-III response for axis 12 is received.	Turning off YDDD44 also turns off this relay.
X <b>DDD</b> 13	AX13 Response Received	Turns on when a MECHATROLINK-III response for axis 13 is received.	Turning off YDDD45 also turns off this relay.
	AX14 Response Received	Turns on when a MECHATROLINK-III response for axis 14 is received.	Turning off YDDD46 also turns off this relay.
X <b>DDD</b> 15	AX15 Response Received	Turns on when a MECHATROLINK-III response for axis 15 is received.	Turning off YDDD47 also turns off this relay.

Note: In the table, "

#### Reading MECHATROLINK-III response parameters and statuses

The Response Received relay (XDDD01 to XDDD15) for an axis turns ON when a MECHATROLINK-III response is received for a transmitted MECHATROLINK-III command. Axis MECHATROLINK-III response parameters, axis statuses, common statuses or extended MECHATROLINK-III response parameters can then be read using READ instructions in a ladder program.

For details on the response parameters and statuses that are returned for each transmitted MECHATROLINK-III command, see Subsection 5.3.1, "Parameters and Statuses of MECHATROLINK-III Commands".

#### Checking for completion of MECHATROLINK-III command execution

Some MECHATROLINK-III commands such as SV\_ON (\$31), SV\_OFF (\$32), POSING (\$35), FEED (\$36), EX\_FEED (\$37), EX\_POSING (\$39) and ZRET (\$3A) commands continue execution even after the Response Received relay XDDD01 to XDD15) has turned ON.

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

- Positioning Completed relay (XDDD17 to XDD31)
- Error/Warning Detected relay (XDD32)
- Axis statues and common statuses

#### Examples for Sending MECHATROLINK-III Commands

#### Procedure

- (1) Specify the MECHATROLINK-III command code and required parameter values in data position numbers DD01 to DD50. To transmit an extended MECHATROLINK-III command, specify value -1 for the command code (CMD) and specify the data to be transmitted in the extended MECHATROLINK-III command parameters area.
- (2) Turn on the Send Command relay (YDDD33 to YDDD47).
- (3) Verify that the Response Received relay (XDDD01 to XDD15) has turned on.
- (4) Verify that command execution has completed by checking the Positioning Completed relay (X□□□17 to X□□□31), Error/Warning Detected relay (X□□□32), axis statuses and common statuses as required for each command.

#### • Sample Program for Sending Servo ON (SV\_ON: \$31) Command

This sample program issues a SV\_ON (31) command for axes 1 to 3 to the positioning module mounted in slot 3.

After issuing the command, it verifies completion of the command execution by checking that the SVON bit of each corresponding SVCMD\_STAT axis status has turned ON.

00001	*** Samp 100200	le Program for Sending S	V_ON Command ***
and the second			DIFU 100201 Execute
	SV ON		Command
	Send S 100201	SV_ON Command	
	Execute		MOV \$31 D00101 AX1 CMD =SV_ON
	Command		
00005			
00006			L
00007			L 0 000105 AX1 SVCMD_IO
00008			MOV \$31 D00201 AX2 CMD
	21		=SV_ON
00009	-		
00010			L
00011			MOV 0 D00205 AX2 SVCMD_10
00012	-		MOV \$31 D00301 AX3 CMD
00010			=SV_ON
00013			MOV 0 D00302 AX3 CMD_CTRL
00014			Landard
00015			0 D00305 AX3 SVCMD_10
00016			WRITE   D00101   3 101 6 Write AX1
			parameters
00017			WRITE   D00201   3 201 6 Write AX2
00018			
			WRITE   D00301   3 301 6 Write AX3

00019	100201									SET	Y00333	AX1 Send Command
00020	Execute Command										AX1 Send Command	relay ON
00020									-	SET	AX2 Send Command	AX2 Send Command relay ON
00021										SET	Y00335 AX3 Send	AX3 Send Command relay ON
00022										-	Command	
										SET	ID0202 Receiving Response	Receiving Response
00023		_								- SFT	1 mn2n3	Executing Command
00024 00025		k sendir X00301	ng of SV	_ON cor	nmand -						Executing Command	ON
00020	Receiving	AX1	AX2	AX3	-	_				RST	V00333 AX1 Send	AX1 Send Command relay OFF
00026	Response	Response Received	Response Received	Response Received						-	Command	
					1					- RST	AX2 Send Command	AX2 Send Command relay OFF
00027									-	RST	Y00335	AX3 Send Command
											AX3 Send Command	relay OFF
00028					-					RST	ID0202 Receiving	Receiving Response
00029	Chec	k compl	etion of	SV_ON	commar	nd					Response	
00030	100202	100203					READ		163	DOC163	2	
	Receiving Response	Executing Command										AX1 SVCMD_STAT
00031			-			_			MOV	D0C163	100210	Extract AX1 SVCMD_STAT bits
00032							and the second	-				
							READ		263	D0C263	2	Read AX2 SVCMD_STAT
00033								_	MOV	D0C263	100230	Extract AX2
00004												SVCMD_STAT bits
00034			1				READ	1 3	363	D0C363	2	Read AX3 SVCMD_STAT
00035									L MOV	L 000000	1 100050	
							6		MOV	D00363	100250	Extract AX3 SVCMD_STAT bits
00036	-17-	100203	X00301	100223	X00302	100243	X00303	100263	_	RST	100203	Executing Command
0003	Receiving Response	Executing Command	AX1 Response Received	AX1 Servo on (SVON)	AX2 Response Received	AX2 Servo on (SVON)	AX3 Response Received	AX3 Servo on (SVON)			Executing Command	OFF
00037			Received	(30010)	Received	(30010)	Received	(30010)		SET	100204 SV_ON	Execution completed
											Completed	

#### • Sample Program for Sending Servo OFF (SV\_OFF: \$32) Command

This sample program issues a SV\_OFF (32) command for axes 1 to 3 to the positioning module mounted in slot 3.

After issuing the command, it verifies completion of the command execution by checking that the SVON bit of each corresponding SVCMD\_STAT axis status has turned OFF

00001	*** Sample Program for Sending SV_OFF Command ***	
00002	DIFU 100301	
	Execute Execute SV_OFF Command	
00003		
00004	100301	AX1 CMD
	Execute	=SV_OFF
00005	Command	0.7011
00005		AX1 CMD_CTRL
00006		
	MOV \$80:0000 D00103	AX1 SVCMD_CTRL
00007	MOV 0 D00105	AX1 SVCMD_IO
00008		
00000	MOV \$32 D00201	AX2 CMD
		=SV_OFF
00009	MOV 0 D00202	
		AX2 CMD_CTRL
00010		
00010	MOV \$80.0000 D00503	AX2 SVCMD_CTRL
00011		
	MOV 0 D00205	AX2 SVCMD_IO
00012	MOV \$32 D00301	AX3 CMD
		=SV_OFF
00013		
	MOV 0 D00302	AX3 CMD_CTRL
00014	MOV \$80.0000 D00303	AX3 SVCMD_CTRL
00015		
00013		AX3 SVCMD_IO
00016		Mrite AV1 nonomotore
	WRITE   D00101   3 101 6	Write AX1 parameters
0004-		
00017	WRITE   D00201   3 201 6	Write AX2 parameters
00018		
	WRITE D00301 3 301 6	Write AX3 parameters

00019	100301									SET	Y00333	AX1 Send Command
00000	Execute command									1 001	AX1 Send Command	relay ON
00020										SET	AX2 Send Command	AX2 Send Command relay ON
00021										- SET	Y00335 AX3 Send	AX3 Send Command relay ON
00022										SET	Command ID0302 Receiving	Receiving Response
00023										SFT	Response	ON Executing Command
00024	Send		F Comm	and							Executing Command	ON
00025	100302	X00301	X00302	X00303						RST	Y00333	AV1 Cand Command
00000	Receiving Response	AX1 Response	AX2 Response	AX3 Response							AX1 Send Command	AX1 Send Command relay OFF
00026		Received	Received	Received						- RST	AX2 Send	AX2 Send Command relay OFF
00027									-	RST	Command Y00335 AX3 Send	AX3 Send Command
00028										RST	Command 100302	relay OFF Receiving Response
	0			01/ 05							Receiving Response	OFF
00029	Same Sale Sale	k compl	letion of	SV_OF	- comma	and						
00030	100302	100303	-				READ		3 16	3 D00163	Read 2	Read
00031	Receiving Response	Executing Command										AX1 SVCMD_STAT
00001						_			- MOV	D0C163	100310	Extract AX1 SVCMD_STAT bits
00032						-	READ		3  26	3 D0C263	2	Read AX2 SVCMD_STAT
00033	P-11											
00000						-			MOV	D0C263	100330	Extract AX2 SVCMD_STAT bits
00034			10			-	READ		3  36	3 D00363	2	Read AX3 SVCMD_STAT
00035	1								MOV	D00363	100350	Extract AX3
00000	100000	100000	VIDDOOT	100000	V00000	100949	V00000	100020				SVCMD_STAT bits
00036	I00302 Receiving Response	ID0303 Executing Command	X00301 AX1 Response	AX1 Servo on	X00302 AX2 Response	ID0343 AX2 Servo on	X00303 AX3 Response	ID0363 AX3 Servo on		- RST	ID0303 Executing Command	Executing Command OFF
00037			Received	(SVON)	Received	(SVON)	Received	(SVON)		SET	ID0304 SV_OFF	Execution completed
											Completed	

#### • Sample Program for Sending Zero Point Return (ZRET: \$3A) Command

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

After issuing the command, it verifies completion of the command execution by checking that both the corresponding Positioning Completed relay and the ZPOINT bit of the corresponding SVCMD\_IO axis status have turned on.

00001	*** Sample Program for Sending ZRET Command ***	
00002	100400 DIFU 100401	
	Execute Execute	
00003	ZRET Command Command	
00003	100401	
		AX1 CMD
	Execute Command	=ZRET
00005		
		AX1 CMD_CTRL
00006		
		AX1 SVCMD_CTRL
00007	MOV 0 D00105	AX1 SVCMD_IO
		AXT SVCIVID_IU
00008	MOV 1 D00107	Zero Point Return
		Mode (MODE)
00009		
00009	MOV   10000  D00109 -	Target Speed
		(TSPD)
00010		
00010		Acceleration
		(ACCR)
00011	L	
		Deceleration (DECR)
		(DECK)
00012	MOV -1 D00115	Torque Limit
		(TLIM)
100		(12)
00013	WRITE   D00101   3  101   16	Write
		AX1 parameters
00014		
00014		AX1 Send Command
	AX1 Send	relay ON
00015	Command	
		Receiving Response
	Receiving Response	ON
00016		
		Executing Command
	Command	ON
00017		
00018	100402 X00301	AX1 Send Command
	Receiving AX1 AX1 Send	relay OFF
00010	Response Response Command	
00019	R51 100402	Receiving Response
	Receiving	
	Response	

00020 00021	Cheo 100402	<b>ck comp</b> 100403	letion of	ZRET c	ommand	READ	3  165  D00	165   1	Read
00022	Receiving Response	Executing Command							AX1 SVCMD_IO
00022							MOV DOC	165   100410	Extract AX1 SVCMD_IO bits
00023	HV-	100403	X00301	X00317	100425				Executing Command
00024	Receiving Response	Executing Command	AX1 Response Received	AX1 Positioning Completed	Zero Point (ZPOINT)			Executing Command	OFF
								T I00404 ZRET Completed	Execution completed

#### • Sample Program for Sending Set Coordinates (POS\_SET: \$20) Command

This sample program issues a POS\_SET (\$20) command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it verifies completion of the command execution by checking that the corresponding Response Received relay has turned on.

	*** Sample Program for Sending POS_SET Command ***	
00002	D0500	
	Execute Execute	
00003	POS_SET Command	
00004	100501 MOV \$20 D00101	AV1 CMD
	Execute	AX1 CMD =POS_SET
00005	Command	
00005		AX1 CMD_CTRL
00006	MOV \$80°0000 D00103	
		AX1 SVCMD_CTRL
00007		
00001	MOV 0 D00105	AX1 SVCMD_IO
00008	MOV \$80 D00127	Coord. Setting Mode
		(POS_SET_MOD)
00009	L.	
	MOV 30000 D00129	Coordinates Set Value
		(POS_DATA)
00010	WRITE   D00101   3 101 30	Write
		AX1 parameters
00011		AV(1.Courd.Comment
	SET Y00333 AX1 Send	AX1 Send Command relay ON
00012	Command	
00012		Receiving Response
	Receiving Response	ON
00013	SET 100503	Executing Command
	Executing	ON
00014	Check sending of POS_SET command	
00015		AX1 Send Command
	Receiving AX1 AX1 Send	relay OFF
00016	Response Response Command	
00010		Receiving Response
	Receiving Response	OFF
00017	Check completion of POS_SET command 100502 100503 X00301	
00018		Executing Command
	Receiving Response         Executing Command         AX1         Executing Command	OFF
00019	Received SET 100504	Execution completed
	POS_SET	
	Completed	

#### • Sample Program for Sending Feed (FEED: \$36) Command

This sample program issues a FEED (\$36) command for axis 1 to the positioning module mounted in slot 3.

After the command is issued, motion continues until a command cancellation is issued using the CMD\_CANCEL bit.

00001	*** Sample Program for Sending FEED Command ***	
00002		
	FEED Command	
	Send FEED command	
00004	100601 MOV \$36 D00101	AX1 CMD
	Execute Command	=FEED
00005		
	MOV 0 D00102	AX1 CMD_CTRL
00000		
00006	MOV \$8010000 D00103	AX1 SVCMD_CTRL
00007		
		AX1 SVCMD_IO
00008		
00000	MOV 10000 D00109	Target Speed
		(TSPD)
00009	MOV -1 D00111	Acceleration
		(ACCR)
00010	I	
	MOV -1 D00113	Deceleration (DECR)
		(DECK)
00011	MOV -1 D00115	Torque Limit
		(TLIM)
00012	WRITE   D00101   3 101 16	Write
		AX1 parameters
00013		
00010	SET Y00333	AX1 Send Command
	AX1 Send Command	relay ON
00014	SET   100602	Receiving Response
	Receiving	ON
00015	Response	
	SET 100603 Executing	Executing Command ON
0004.0	Check sending of FEED command	
00016	100602 X00301	
	RST Y00333 Receiving AX1 AX1 Send	AX1 Send Command relay OFF
	Response Response Command	
00018	Received RST 100602	Receiving Response
	Receiving Response	OFF
00019	Check completion of FEED command	
00020	100602 100603 X00301 RST 100603	Executing Command
	Receiving Executing AX1 Executing	OFF
00021	Response Response Response Command	
	SET 100604 Feeding	Execution completed
	Started	

#### • Sample Program for Canceling a Feed (FEED: \$36) Command

This sample program cancels FEED command execution of axis 1, which is moving, by reissuing to the positioning module mounted in slot 3 a FEED (\$36) command with the SVCMD\_CTRL.CMD\_CANCEL bit set to 1.

After issuing the command, it verifies completion of positioning by checking that the corresponding Positioning Completed relay has turned on.

00001	*** Sample Program for Canceling FEED Command ***	
00002	Cancel Execute FEED Command	
00004	100701 MOV\$36  D00101	AX1 CMD =FEED
00005	command	AX1 CMD_CTRL
00006		AX1 SVCMD_CTRL
00007		(CMD_CANCEL=1) AX1 SVCMD_IO
00008		Write AX1 parameters
00009	SET Y00333 AX1 Send	AX1 Send Command relay ON
00010	Receiving	Receiving Response ON
00011	Executing	Executing Command ON
00012 00013	Check sending of FEED command D00702 X00301 RST Y00333	AX1 Send Command
00014	Receiving     AX1     AX1 Send       Response     Response     Command       Received	relay OFF
00015	Receiving Response	Receiving Response OFF
00015	100702         100703         X00301         X00317           Receiving         Executing         AX1         AX1         Executing	Executing Command OFF
00017	Response Command Response Positioning Command SET 100704 Received Completed SET 100704 Feeding Canceled	Execution completed

#### • Sample Program for Sending Positioning (POSING: \$35) Command

This sample program issues a POSING (\$35) command for axis 1 to the positioning module mounted in slot 3.

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

00001	*** Sample Program for Sending POSING Command ***	
- Contractor	Execute DIFU ID0801 Execute	
00003		
00004	100801 MOV \$35 D00101 Execute	AX1 CMD =POSING
00005	Command	
		AX1 CMD_CTRL
00006	L MOV \$8010000 D00103	AX1 SVCMD_CTRL
00007		AX1 SVCMD_IO
00008		Tannak Daalillan
	MOV 20000 D00107	Target Position (TPOS)
00009	L MOV 10000 D00109	Target Speed
		(TSPD)
00010		Acceleration (ACCR)
00011		
	MOV -1 D00113	Deceleration (DECR)
00012	L MOV   -1  D00115	Torque Limit
		(TLIM)
00013	WRITE   D00101   3  101  16	Write AX1 parameters
00014		
	SET Y00333 AX1 Send Command	AX1 Send Command relay ON
00015		Receiving Response
0001.0	Receiving Response	ON
00016	SET 100803 Executing	Executing Command ON
00017	Check sending of POSING command Command	
00018	ID0802         X00301         RST         Y00333           Receiving         AX1         AX1 Send	AX1 Send Command
00019	Response Response Command	relay OFF
	RST 100802 Receiving	Receiving Response OFF
00020	Check completion of POSING command 100802 100803 ×00301 ×00317	
00021	Receiving Executing AX1 AX1 Executing	Executing Command OFF
00022	Response Command Response Positioning Command SET 100804	
	Positioning Completed	Execution completed

#### • Sample Program for Canceling a Positioning (POSING: \$35) Command

This sample program cancels POSING command execution of axis 1, which is moving, by reissuing to the positioning module mounted in slot 3 a POSING (\$35) command with the SVCMD\_CTRL.CMD\_CANCEL bit set to 1.

After issuing the command, it verifies completion of positioning by checking that the corresponding Positioning Completed relay has turned on.

00001	*** Sample Program for Canceling POSING Command ***	
00002		
10	Cancel	
	Positioning Command	
00003		
00004	MOV \$35 D00101	AX1 CMD
199		=POSING
00005	Command	
00000		AX1 CMD_CTRL
00006		
24		AX1 SVCMD_CTRL
		(CMD.CANCEL=1)
00007		
	MOV 0 000105	AX1 SVCMD_IO
00008	WRITE   D00101   3 101 6	Write
		AX1 parameters
00009	SET   Y00333 /	AX1 Send Command
	AX1 Send	relay ON
00010	Command	
00010	SET 100902	Receiving Response
	Receiving	ON
00011	Response	
00011		Executing Command
	Command	ON
00012		
00013	100902 X00301	AV1 Cond Command
		AX1 Send Command relay OFF
and a local	Response Response Command	
00014	Received BST 100902	Receiving Response
		OFF
	Check completion of POSINC command Response	
00015		
00010	RST 100903	Executing Command
	Receiving         Executing         AX1         Executing           Response         Command         Response         Command	OFF
00017	Received Completed	
	SET 100904	Execution completed
	Positioning Canceled	

#### Sample Program for Sending Servo Status Monitor (SMON: \$30) Command

This sample program issues a SMON (\$30) command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it verifies completion of the command execution by checking that the corresponding Response Received relay has turned on.

00001	*** Sample Program for Sending SMON Command *** ID1000		
00002	Execute	DIFU ID1001 Execute	
00003	SMON	Command	
00004		/ \$30 D00101	AX1 CMD
	Execute Command		=SMON
00005		0 D00102	AX1 CMD_CTRL
00006			
		/ \$80°0000  D00103	AX1 SVCMD_CTRL
00007	L	(   0  D00105	AX1 SVCMD_IO
00008			
00000	WRITE   D00101	3 101 6	Write AX1 parameters
00009			AX1 Send Command
		AX1 Send Command	relay ON
00010		SET 101002 Receiving	Receiving Response
00011		Response	Executing Command
		Executing Command	ON
00012		Command	
00013	Receiving AX1	RST Y00333 AX1 Send	AX1 Send Command relay OFF
00014	Response Response Received	Command RST 101002	Receiving Response
	- Check completion of SMON command	Receiving Response	OFF
00015		and the second second	
	Receiving Executing AX1	RST 101003 Executing	Executing Command OFF
00017	Response Command Response Received	Command	
and I		SET ID1004 SMON	Execution completed
		Completed	10 - 11 - 11

#### Sample Program for Sending Write Servo Parameter (SVPRM\_WR: \$41) Command

This sample program issues a SVPRM\_WR (\$41) command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it verifies completion of the command execution by checking the response received.

00001	*** Sample Program for Sending SVPRM_WR Command ***           ID1100	
00002	DFU	
	Execute Execute	
00003	SVPRM_WR Command Command	
00004	101101	
		AX1 CMD
	Execute Command	=SVPRM_WR
00005		
		AX1 CMD_CTRL
00006	MOV   \$8010000  D00103	AX1 SVCMD_CTRL
00007		
00007	MOV 0 D00105	AX1 SVCMD_IO
00008		
		Servo Parameter
		Number (NO)
00009		Convo Doromotor Data
		Servo Parameter Data Size (SIZE)
00010	MOV   100000  D00137	Servo Parameter Data
		(PARAMETER)
00011		
00011		Write
		AX1 parameters
00012		
		AX1 Send Command
	Command	relay ON
00013	SET 101102	Receiving Response
	Receiving	ON ON
	Response	
00014	SET   101103	Executing Command
	Executing	ON
00015	Check sending of SVPRM_WR command	
00016	I01102 X00301	
	RS1 Y00333	AX1 Send Command relay OFF
	Response Response Command	Teldy OF T
00017	Received RST 101102	Receiving Response
	Receiving	OFF
00010	Response	
00018	READ 3 151 D00151 4	Read response
00019	Check completion of SVPRM_WR command	
00020		Executing Command
	Receiving Executing AX1 Executing	OFF
20.00.00	Response Command Response Command	
00021	Received SET 101104	Execution completed
	SVPRM_WR	Execution completed
	Completed	

#### Sample Program for Sending Data Read/Write\_A (DATA\_RWA: \$20) Command

This sample program issues a DATA\_RWA (\$20) command for axis 4 to the positioning module mounted in slot 3.

After the command is issued, output data (OUTPUT) is sent continually and input data (INPUT) is received continually while the Send Command relay remains ON.

00001	*** Sample Program for Sending DATA_RWA Command ***	
00002	DIFU 101201	
- Carlore	Execute Execute Command	
00003	DIFD ID1205	
00004		
00005	MOV \$20 D00401	AX4 CMD
	Execute Command	= DATA_RWA
00006		AX4 CMD_CTRL
1.1		
00007	BMOV 0 D0C403 30	Output Data
1.1		(OUTPUT)
00008	WRITE   D00401   3 401 16	Write
		AX4 parameters
00009		
	AX4 Send	AX4 Send Command relay ON
00010	Command	, ,
100.001.00	SET ID1202 Receiving	Receiving Response
00011	Response	ON
00012	101202 X00304	Cat Output Data
	Receiving AX4	Set Output Data (OUTPUT)
00013	Response Response Received	
		Set Output Data (OUTPUT)
00014		, ,
00011	WRITE   D00403   3  403  30	Write Output Data (OUTPUT)
00015		(001101)
00010	READ 3 463 D00463 30	Read Input Data
	Stop DATA_RWA transmission	(INPUT)
00016	101205 101202	
	Rol 100336	AX4 Send Command relay OFF
00018	Response Command	
00010	RST ID1202 Receiving	Receiving Response
	Receiving Response	OFF

#### • Sample Program for Sending Read ID (ID\_RD: \$03) Command

This sample program issues an ID\_RD (03) command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it verifies completion of the command execution by checking the extended MECHATROLINK-III response parameters.

To read the device name, the program writes the following ID\_RD (\$03) MECHATROLINK-III command directly to the extended MECHATROLINK-III command parameter area, and then transmits the extended command.

Duto	1 Byte
Byte	(8 bits)
1	\$03
2	WDT
3	\$00
4	\$00
5	\$80
6	\$00
7	\$0C
8	\$00
9	\$00
10	\$00
11	\$00
12	\$00
13	\$00
14	\$00
15	\$00
16	\$00
17	\$00
18	\$00
19	\$00
20	\$00
21	\$00
22	\$00
23	\$00
24	\$00
25	\$00
26	\$00
27	\$00
28	\$00
29	\$00
30	\$00
31	\$00
32	\$00

#### Table 5.4 Send Data for ID\_RD (\$03) Command

Data Position	Data	Size
Number	1 word (	16 b its)
2001	\$03	0
2002	0	0
2003	\$80	0
2004	\$0C	0
2005	0	0
2006	0	0
2007	0	0
2008	0	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0
2013	0	0
2014	0	0
2015	0	0
2016	0	0

	*** Sample Program for Sending ID_RD Command ***	
00002	101300 DIFU 101301	
00003		
00004	101301 WRITE -1 3 101 1 Execute	AX1 CMD
00005	Command	= -1 Date bytes 1, 2
00006		Date bytes 3, 4
00007	MOV \$8000 D02003	
		Date bytes 5, 6
00008	MOV \$C00 D02004	Date bytes 7, 8
00009	BMOV 0 D02005 12	Date bytes 9 to 32
00010		Write parameters
00011	SET   Y00333	AX1 Send Command
00012	AX1 Send Command SET 101302	relay ON
00013	Receiving Response	Receiving Response ON
	SET 101303 Executing Command	Executing Command ON
00014 00015		AX1 Send Command
00016	Receiving Response         AX1         AX1 Send           Command         Command	relay OFF
00010	RST ID1302 Receiving Response	Receiving Response OFF
00017		Read response
00018	Check completion of ID_RD command	
00019	Receiving     Executing     AX1     Executing       Response     Command     Response     Command	Executing Command OFF
00020		ID_RD Completed ON
	Completed	

#### Sample Program for Sending Read Alarm or Warning (ALM\_RD: \$05) Command

This sample program issues an ALM\_RD (\$05) command for axis 1 to the positioning module mounted in slot 3.

After issuing the command, it verifies completion of the command execution by checking the extended MECHATROLINK-III response parameters.

To read the current alarm/warning state, the program writes the following ALM\_RD (\$05) MECHATROLINK-III command directly to the extended MECHATROLINK-III command parameter area, and then sends the extended command.

Byte	1 Byte
	(8 b its)
1	\$05
2 3	WDT
	\$00
4	\$00
5	\$00
6	\$00
7	\$00
8	\$00
9	\$00
10	\$00
11	\$00
12	\$00
13	\$00
14	\$00
15	\$00
16	\$00
17	\$00
18	\$00
19	\$00
20	\$00
21	\$00
22	\$00
23	\$00
24	\$00
25	\$00
26	\$00
27	\$00
28	\$00
29	\$00
30	\$00
31	\$00
32	\$00

Table 5.5 Send Data for ALM\_RD (\$05) Command

(405) Command	а Г								
Data Position	Data	Size							
Number	1 word (16 b its)								
2001	\$05	0							
2002	0	0							
2003	0	0							
2004	0	0							
2005	0	0							
2006	0	0							
2007	0	0							
2008	0	0							
2009	0	0							
2010	0	0							
2011	0	0							
2012	0	0							
2013	0	0							
2014	0	0							
2015	0	0							
2016	0	0							

00001	*** Sample Program for Sending ALM_RD Command ***			
	2 101400 	[	DIFU I01401 Execute Command	
00004	UD1401	-1  3	101  1	AX1 CMD = -1
00005	5 Command	MOV	\$500 D02001	Date bytes 1, 2
00006		3MOV   0	D02002   15	Date bytes 3 to 32
00007	WRITE   D	002001 3	2001 16	Write parameters
00008	3		SET Y00333	AX1 Send Command
00009		E	AX1 Send Command SET 101402	relay ON Receiving Response
00010			Receiving Response SET ID1403	ON Executing Command
00011			Executing Command	ON
	Receiving AX1 Response Response		RST Y00333 AX1 Send Command	AX1 Send Command relay OFF
00013	Received	Ē	RST ID1402 Receiving Response	Receiving Response OFF
00014	READ	3 3001	And the second s	Read response
00015				
00016	i 101402 101403 X00301 Receiving Executing AX1 Response Command Response	E	RST ID1403 Executing Command	Executing Command OFF
00017			SET ID1404 ALM_RD Completed	ALM_RD Completed ON

# 5.3.1 Parameters and Statuses of MECHATROLINK-III Commands

The following tables list the required command parameters that must be written, as well as the response parameters and statuses that are returned for each MECHATROLINK-III command. The command parameters and returned response parameters and statuses depend on the profile type supported by the connected external device.

In the table, " $\Box\Box$ " denotes an axis number (01 to 15), while " $\blacksquare$ " denotes the value of " $\Box\Box$  + 1".

The MECHATROLINK-III commands that are executable by the positioning module are listed with the following indications:

- ©: Executable by a user using MECHATROLINK-III command parameters of each axis.
- O: Executable by a user using extended MECHATROLINK-III command parameters.
- $\bigtriangleup$  : Not executable by a user but is executed automatically by the positioning module or external device.
- $\times: \ensuremath{\mathsf{Not}}$  supported

#### Standard Servo Profile Commands (1 of 3)

#### Command parameters

Data Position Number	Data Name	© NOP	× PRM_RD	× PRM_WR		© CONFIG	O ALM_RD	ALM_CLR	<pre>     SYNC_SET </pre>	CONNECT		× PPRM_RD	× PPRM_WR	O MEM_RD	O MEM_WR
01	Command Code (CMD)	\$00	\$01	\$02	-1	\$04	-1	\$06	\$0D	\$0E	\$0F	\$1B	\$1C	-1	-1
<b>DD</b> 02	Command Control (CMD_CTRL)	✓				✓		~	✓	~					
	Servo Command Control Field (SVCMD_CTRL)														
	Servo Command Output Signal (SVCMD_IO)														
	Target Position (TPOS) / Zero Point Return Mode (MODE)														
	Target Speed (TSPD)														
	Acceleration (ACCR)														
	Deceleration (DECR)														
	Torque Limit (TLIM)														
	Speed Reference (VREF)														
	Speed Limit (VLIM)														
	Torque Reference (TQREF)														
	Speed Feed Forward (VFF)														
	Torque Feed Forward (TFF)														
	Coordinates Setting Mode (POS_SET_MOD)														
	Coordinates Set Value (POS_DATA)														
<b>DD</b> 31 to <b>DD</b> 32	(System reserved)														
	Configuration Mode (CONFIG_MOD)					✓									
□□34	Alarm Clear Mode (ALM_CLR_MOD)							✓							
□□35	Servo Parameter Number (NO)														
□□36	Servo Parameter Data Size [byte] (SIZE), Servo Parameter Read/Write Mode (MODE)														
	Servo Parameter Data (PARAMETER)														
□□39 to □□40	(System reserved)														
	Subcommand Control (SUB_CTRL)														
	Target Position (for interpolation motion commands)														
	Target Speed (for interpolation motion commands)														
0047	Interpolation Axes (for interpolation motion commands)														
	Acceleration Time (for interpolation motion commands)														
□□49	Deceleration Time (for interpolation motion commands)														
<b>DD</b> 50	(System reserved)														
2001 to 2750	Extended MECHATROLINK-III Command Parameters				~		✓							~	~

#### • Response parameters

Data Position Number	Data Name	ON	× PRM_RD	X PRM_WR		© CONFIG	D ALM_RD	<pre>O ALM_CLR</pre>	<pre>© SYNC_SET</pre>	CONNECT	DISCONNECT	X PPRM_RD	X PPRM_WR	O MEM_RD	D MEM_WR
<b>DD</b> 51	Servo Parameter Number (NO)		~		0		0	•				^		0	$\vdash$
	Servo Parameter Data Size [byte] (SIZE), Servo Parameter Read/Write Mode (MODE)														
<b>DD</b> 53 / <b>DD</b> 54	Servo Parameter Data (PARAMETER)														
□□55 to □□60	(System reserved)														
3001 to 3750	Extended MECHATROLINK-III Response Parameters				~		~							~	~

#### • Statuses

Data Position Number	Data Name	OP	× PRM_RD	× PRM_WR	O ID_RD	© CONFIG	O ALM_RD	ALM_CLR	SYNC_SET	CONNECT	DISCONNECT	X PPRM_RD	× PPRM_WR	O MEM_RD	O MEM_WR
□□61	(System reserved)														
□□62	Command Status (CMD_STAT)	✓			~	<	~	~	~	~				<	$\checkmark$
	Servo Command Status Field (SVCMD_STAT)														
0065 / 0066	Servo Command Input Signal (SVCMD_IO)														
	Fixed Monitor 1 (CPRM_SEL_MON1)														
	Fixed Monitor 2 (CPRM_SEL_MON2)	1													
0071/0072	Monitor 1 (MONITOR1)	1													
	Monitor 2 (MONITOR2)														
0075/0076	Monitor 3 (MONITOR3)														
	Monitor 4 (MONITOR4)														
	Monitor 5 (MONITOR5)														
	Monitor 6 (MONITOR6)														
	Subcommand Status (SUB_STAT)	✓			✓	$\checkmark$	✓	✓	✓	✓				$\checkmark$	$\checkmark$
	Remaining Travel Status														
<b>D0</b> 87	Interpolation Status														
□□88 to ■■00	(System reserved)														
1601 to 2000	Common Statuses	✓			√	<	>	✓	✓	>				$\checkmark$	_ ✓ ]

## Standard Servo Profile Commands (2 of 3)

#### • Command parameters

Data Position Number       Data Name       Image: Solution Solution Number       Image: Solution Solution Number       Image: Solution Solution No       Image: Solution NO NB       Image: Solution NO NB       Image: Solution NO NB       Image: Solution NO NB       Image: Solution NO NB       Image: Solution NO ND       Image: Solution NO ND       Image: Solution ND       Image: Soluticon ND       Image: Solution ND	Ш • ©	
□□01       Command Code (CMD)       \$20       \$21       \$22       \$23       \$24       \$30       \$31       \$32       \$34       \$35       \$36       \$35         □□02       Command Control (CMD_CTRL)       ✓ </td <td>7 \$39 \$ ✓</td> <td>\$3A</td>	7 \$39 \$ ✓	\$3A
□□02       Command Control (CMD_CTRL)       ✓ <t< td=""><td>✓</td><td></td></t<>	✓	
Image: Display 1         Servo Command Control Field (SVCMD_CTRL)         Image: V         Image:		
$\square \square 05 / \square \square 06 Servo Command Output Signal (SVCMD_IO) \lor \lor$	✓	✓
		✓
	✓	✓
Target Position (TPOS) / Zero Point Return Mode (MODE)	~	~
DD09/DD10 Target Speed (TSPD)	✓	✓
□□11 / □□12 Acceleration (ACCR)	✓	✓
DD13/DD14 Deceleration (DECR)	✓	✓
□□15 / □□16 Torque Limit (TLIM)	✓	✓
DD17/DD18 Speed Reference (VREF)		
□□19/□□20 Speed Limit (VLIM)		
□□21 / □□22 Torque Reference (TQREF)		
DD23/DD24 Speed Feed Forward (VFF)		
□□25 / □□26 Torque Feed Forward (TFF)		
□□27 / □□28 Coordinates Setting Mode (POS_SET_MOD) ✓		
□□29 / □□30 Coordinates Set Value (POS_DATA) ✓		
□□31 to □□32 (System reserved)		
□□33 Configuration Mode (CONFIG_MOD)		
□□34 Alarm Clear Mode (ALM_CLR_MOD)	+	
□□35 Servo Parameter Number (NO)		
Servo Parameter Data Size [byte] (SIZE), Servo Parameter Read/Write Mode (MODE)		
DI 37 / DI 38 Servo Parameter Data (PARAMETER)	+ +	
	+ +	
$\Box \Box 41 / \Box \Box 42 $ Subcommand Control (SUB_CTRL) $\checkmark \checkmark \checkmark$	1	✓
□□44 Target Position (for interpolation motion commands)	+ +	
□□45 / □□46 Target Speed (for interpolation motion commands)	+ $+$	
□□47 Interpolation Axes (for interpolation motion commands)	+ +	
□□48 Acceleration Time (for interpolation motion commands)	+	
Deceleration Time (for interpolation motion commands)	+	
□□50 (System reserved)	+	
	+	
2001 to 2750 Extended MECHATROLINK-III Command Parameters		

# • Response parameters

Data Position Number	Data Name	<pre>     POS_SET </pre>	© BRK_ON	BRK_OFF	© SENS_ON	© SENS_OFF	© SMON	© sv_on	© SV_OFF	© POSING	© FEED	© EX_FEED	© EX_POSING	© ZRET
<b>DD</b> 51	Servo Parameter Number (NO)		-			-			-	-	-	-		_
<b>DD</b> 52	Servo Parameter Data Size [byte] (SIZE), Servo Parameter Read/Write Mode (MODE)													
	Servo Parameter Data (PARAMETER)													
□□55 to □□60	(System reserved)													
3001 to 3750	Extended MECHATROLINK-III Response Parameters													

#### • Statuses

Data Position Number	Data Name	<pre>     POS_SET </pre>	BRK_ON	BRK_OFF	© SENS_ON	© SENS_OFF	© SMON	NO_V2 @	© SV_OFF		© POSING	© FEED	© ex_feed		© ZRET
	(System reserved)		٢	e	•	•		•	•		•	•	•		
	Command Status (CMD_STAT)	<b>√</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Servo Command Status Field (SVCMD_STAT)	<ul> <li>✓</li> </ul>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0065/0066	Servo Command Input Signal (SVCMD_IO)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fixed Monitor 1 (CPRM_SEL_MON1)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fixed Monitor 2 (CPRM_SEL_MON2)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0071/0072	Monitor 1 (MONITOR1)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Monitor 2 (MONITOR2)	✓	~	✓	~	~	✓	~	~	~	~	~	~	✓	✓
0075/0076	Monitor 3 (MONITOR3)	✓	>	✓	>	>	✓	>	>	>	>	>	>	~	✓
	Monitor 4 (MONITOR4)	✓	>	~	>	>	✓	>	>	>	>	>	>	~	✓
	Monitor 5 (MONITOR5)	✓	✓	✓	~	✓	✓	✓	~	$\checkmark$	~	~	✓	✓	✓
	Monitor 6 (MONITOR6)	✓	~	✓	~	~	✓	~	~	~	~	~	~	<	✓
	Subcommand Status (SUB_STAT)	✓	~	✓	~	~	✓	~	~	~	~	~	~	~	✓
	Remaining Travel Status	1													
	Interpolation Status														
□□88 to ■■00	(System reserved)														
1601 to 2000	Common Statuses	~	~	~	~	✓	✓	~	~	✓	~	~	~	~	✓

# Standard Servo Profile Commands (3 of 3)

# • Command parameters

	-	1	1	1		1	Т	1	1	1	
Data Position Number	Data Name	VELCTRL	TRQCTRL	SVPRM_RD	SVPRM_WR						
		0	0	0	0						
<b>DD</b> 01	Command Code (CMD)		\$3D								
	Command Control (CMD_CTRL)	✓	✓	✓	~						
	Servo Command Control Field (SVCMD_CTRL)	✓	✓	✓	~						
	Servo Command Output Signal (SVCMD_IO)	✓	✓	✓	✓						
	Target Position (TPOS) / Zero Point Return Mode (MODE)										
	Target Speed (TSPD)										
	Acceleration (ACCR)	$\checkmark$									
	Deceleration (DECR)	✓									
	Torque Limit (TLIM)	✓									
<b>DD</b> 17 / <b>DD</b> 18	Speed Reference (VREF)	✓									
	Speed Limit (VLIM)		✓								
	Torque Reference (TQREF)		✓								
	Speed Feed Forward (VFF)										
	Torque Feed Forward (TFF)	$\checkmark$									
	Coordinates Setting Mode (POS_SET_MOD)										
	Coordinates Set Value (POS_DATA)										
<b>DD</b> 31 to <b>DD</b> 32	(System reserved)										
	Configuration Mode (CONFIG_MOD)										
<b>DD</b> 34	Alarm Clear Mode (ALM CLR MOD)										
	Servo Parameter Number (NO)			✓	✓						
□□36	Servo Parameter Data Size [byte] (SIZE), Servo Parameter Read/Write Mode (MODE)			~	~						
	Servo Parameter Data (PARAMETER)				~						
□□39 to □□40	(System reserved)										
	Subcommand Control (SUB_CTRL)	✓	~								
	Target Position (for interpolation motion commands)	1									
0045/0046	Target Speed (for interpolation motion commands)										
0047	Interpolation Axes (for interpolation motion commands)										
<b>D4</b> 8	Acceleration Time (for interpolation motion commands)										
<b>D</b>	Deceleration Time (for interpolation motion commands)										
<b>DD</b> 50	(System reserved)										
2001 to 2750	Extended MECHATROLINK-III Command Parameters										

# • Response parameters

Data Position Number	Data Name	O VELCTRL	TRACTRL	© SVPRM_RD	© SVPRM_WR					
<b>DD</b> 51	Convo Doromotor Number (NO)		•	<b>•</b>	<b>S</b>					
	Servo Parameter Number (NO)			•	v					 
□□52	Servo Parameter Data Size [byte] (SIZE), Servo Parameter Read/Write Mode (MODE)			~	~					
□□53 / □□54	Servo Parameter Data (PARAMETER)			✓	<					
□□55 to □□60	(System reserved)									
3001 to 3750	Extended MECHATROLINK-III Response Parameters									

#### • Statuses

Data Position Number	Data Name	VELCTRL	TRQCTRL	© SVPRM_RD	© SVPRM_WR					
<b>DD</b> 61	(System reserved)									
□□62	Command Status (CMD_STAT)	$\checkmark$	~	~	✓					
	Servo Command Status Field (SVCMD_STAT)	✓	>	>	✓					
□□65 / □□66	Servo Command Input Signal (SVCMD_IO)	✓	~	~	✓					
	Fixed Monitor 1 (CPRM_SEL_MON1)	✓	~							
0069/0070	Fixed Monitor 2 (CPRM_SEL_MON2)	✓	~							
0071/0072	Monitor 1 (MONITOR1)	✓	~							
	Monitor 2 (MONITOR2)	✓	~							
0075/0076	Monitor 3 (MONITOR3)	✓	✓							
	Monitor 4 (MONITOR4)	✓	✓							
	Monitor 5 (MONITOR5)	✓	✓							
	Monitor 6 (MONITOR6)	✓	✓							
	Subcommand Status (SUB_STAT)	$\checkmark$	~	~	✓					
	Remaining Travel Status									
<b>DD</b> 87	Interpolation Status									
□□88 to ■■00	(System reserved)									
1601 to 2000	Common Statuces		~	~	<ul> <li>✓</li> </ul>					
1601 (0 2000	Common Statuses	<b>v</b>	✓	✓	✓					

# ■ Standard I/O Profile Commands (1 of 2)

#### • Command parameters

Data Position Number	Data Name	NOP	RM_RD	PRN	ID_RD	CO	ALM_RD	ALM_CLR			DISCONNECT		R PPRM_WR	K MEM_RD	K MEM_WR
		0	X	×	0	0	0	0	×		$\triangle$	×	X	×	×
<b>DD</b> 01	Command Code (CMD)	\$00	\$01	\$02	-1	\$04	-1	\$06	\$0D	\$0E	\$0F	\$1B	\$1C	\$1B	\$1C
	Command Control (CMD_CTRL)	$\checkmark$				$\checkmark$		✓		$\checkmark$					
<b>DD</b> 03 to <b>DD</b> 32	Output Data (OUTPUT)														
	Configuration Mode (CONFIG_MOD)					✓									
□□34	Alarm Clear Mode (ALM_CLR_MOD)							<							
□□35 to □□50	(System reserved)														
2001 to 2750	Extended MECHATROLINK-III Command Parameters				~		~								

#### • Response 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	MEM_RD	MEM_WR
		0	×	×	0	0	0	0	×	X	$\triangle$	×	×	×	$\times$
□□51 to □□60	(System reserved)														
3001 to 3750	Extended MECHATROLINK-III Response Parameters				~		~							~	~

### Statuses

Data Position Number	Data Name	NOP	PRM_RD	PRM_WR	D_RD	CONFIG	ALM_RD	ALM_CLR	SYNC_SET	CONNECT	DISCONNECT	PPRM_RD	PPRM_WR	MEM_RD	MEM_WR
		0	X	X	0	0	0	0	×	×	$\Delta$	×	×	×	$\times$
<b>DD</b> 61	(System reserved)														
<b>DD</b> 62	Command Status (CMD_STAT)	✓			✓	✓	✓	✓		✓					
□□63 to □□92	Input Data (INPUT)														
□□93 to ■■00	(System reserved)														
1601 to 2000	Common Statuses	✓			$\checkmark$	~	$\checkmark$	✓		~					

#### • Command parameters

Data Position Number	Data Name	<pre> © DATA_RWA </pre>	X DATA_RWS						
<b>DD</b> 01	Command Code (CMD)	\$20	\$21						
□□02	Command Control (CMD_CTRL)	✓							
<b>DD</b> 03 to <b>DD</b> 32	Output Data (OUTPUT)	✓							
	Configuration Mode (CONFIG_MOD)								
□□34	Alarm Clear Mode (ALM_CLR_MOD)								
□□35 to □□50	(System reserved)								
2001 to 2750	Extended MECHATROLINK-III Command Parameters								

#### • Response parameters

Data Position Number	Data Name	DATA_RWA	DATA_RWS						
		$\odot$	×						
□□51 to □□60	(System reserved)								
3001 to 3750	Extended MECHATROLINK-III Response Parameters								

#### Statuses

Data Position Number	Data Name	<pre>O DATA_RWA</pre>	× DATA_RWS						
<b>DD</b> 61	(System reserved)								
□□62	Command Status (CMD_STAT)	✓							
□□63 to □□92	Input Data (INPUT)	$\checkmark$							
□□93 to ■■00	(System reserved)								
1601 to 2000	Common Statuses	✓							

# 5.3.2 Example of MECHATROLINK-III Command Format Conversion

## MECHATROLINK-III Command

Axis MECHATROLINK-III command parameters or extended MECHATROLINK-III command parameters that are written to the positioning module are converted into a MECHATROLINK-III command as shown below before transmission to an external device. The following example illustrates the conversion for the POSING (\$35) command.

#### Conversion of axis MECHATROLINK-III command parameter data to a MECHATROLINK-III command

#### Table 5.6 Axis MECHATROLINK-III Command Parameters

Data Position			Long W	ord Data	
Number	Data Name		word bits)	0	-word bits)
<b>DD</b> 01	Command Code (CMD)	00	\$35		
<b>DD</b> 02	Command Control (CMD_CTRL)	A1	A2		
	Servo Command Control Field (SVCMD_CTRL)	B1	B2	B3	B4
	Servo Command Output Signal (SVCMD_IO)	C1	C2	C3	C4
	Target Position (TPOS) / Zero Point Return Mode (MODE)	D1	D2	D3	D4
	Target Speed (TSPD)	E1	E2	E3	E4
0011/0012	Acceleration (ACCR)	F1	F2	F3	F4
	Deceleration (DECR)	G1	G2	G3	G4
0015/0016	Torque Limit (TLIM)	H1	H2	H3	H4

#### Table 5.7 MECHATROLINK-III Command

Byte	Command	Byte Data
-		(8 bits)
1	CMD	\$35
2	WDT	WDT
3	CMD_CTRL	A2
4		A1
5		B2
6	SVCMD_CTRL	B1
7	SVCIND_CTILE	B4
8		B3
9		C2
10	SVCMD IO	C1
11		
12		C3
13		D2
14	TPOS	D1
15	105	D4
16		D3
17		E2
18	TSPD	E1
19	1500	E4
20		E3
21		F2
22	ACCR	F1
23	ACCR	F4
24		F3
25		G2
26	DECB	G1
27	- DECR	G4
28		G3
29		H2
30		H1
31	- TLIM	H4
32		H3

# • Conversion of extended MECHATROLINK-III command parameter data to a MECHATROLINK-III command

# Table 5.8 Extended MECHATROLINK-III Command Parameters

Data Position Number	Word Data (16 bits)		
2001	A1	A2	
2002	B1	B2	
2003	C1	C2	
2004	D1	D2	
2005	E1	E2	
2006	F1	F2	
2007	G1	G2	
2008	H1	H2	
2009	l1	12	
2010	J1	J2	
2011	K1	K2	
2012	L1	L2	
2013	M1	M2	
2014	N1	N2	
2015	01	O2	
2016	P1	P2	

#### **MECHATROLINK-III Command**

Byte	Byte Data
,	(8 bits)
1	A1
2	WDT
2 3 4	B1
	B2
5	C1 C2 D1
6	C2
7	D1
8	D2
9	D2 E1
10	E2 F1
11	F1
12	F2
13	G1
14	G2
15	H1
16	H2
17	l1
18	12
19	J1
20	J2
21	K1
22	K2
23	L1
24	L2
25	K1 K2 L1 L2 M1
26	M2
27	N1
28	N2
29	O1
30	O2
31	P1
32	P2
	•

# MECHATROLINK-III Response

MECHATROLINK-III response data received from an external device can be read from axis statuses or extended MECHATROLINK-III response parameters as shown below. The following example illustrates the case for the POSING (\$35) command.

#### Conversion of MECHATROLINK-III response to axis statuses and axis MECHATROLINK-III response parameter data

Byte No. Command		Byte Data (8 bits)
1	RCMD	\$35
2		RWDT
3		A1
4	CMD_STAT	A2
5		B1
6	SVOND STAT	B2
7	SVCIND_STAT	B3
8		B4
9		C1
10	SVCMD IO	C2
11		C3
12		C4
13		D1
14	Command RCMD RWDT CMD_STAT SVCMD_STAT SVCMD_IO CPRM_SEL_MON1 CPRM_SEL_MON2 MONITOR1 MONITOR2 MONITOR3	D2
15	CPRIVI_SEL_IVIONT	D3
16		D4
17		E1
18		E2
19	CPRIM_SEL_MOINZ	E3
20		E4
21		F1
22	MONITOD1	F2
23		F3
24		F4
25		G1
26		G2
27		G3
28		G4
29		H1
30		H2
31	31	H3
32		H4

Table 5.9 MECHATROLINK-III Response

#### Table 5.10 Axis Statuses

Data Position	Data Name	Long Word Data			
Number	Data Name	Low-word (16 bits)		High-word (16 bits)	
<b>DD</b> 61	(System reserved)	(	)		
<b>DD</b> 62	Command Status (CMD_STAT)	A2	A1		
	Servo Command Status Field (SVCMD_STAT)	B2	B1	B4	B3
□□65 / □□66	Servo Command Input Signal (SVCMD_IO)	C2	C1	C4	C3
	Fixed Monitor 1 (CPRM_SEL_MON1)	D2	D1	D4	D3
	Fixed Monitor 2 (CPRM_SEL_MON2)	E2	E1	E4	E3
0071/0072	Monitor 1 (MONITOR1)	F2	F1	F4	F3
	Monitor 2 (MONITOR2)	G2	G1	G4	G3
0075/0076	Monitor 3 (MONITOR3)	H2	H1	H4	H3

# Conversion of MECHATROLINK-III response to extended MECHATROLINK-III response parameter data

Byte No.	Byte Data
-	(8 bits)
1	A1
2	RWDT
3	B1
4	B2
5	C1
6	C2 D1
7	D1
8	D2
9	E1
10	E2
11	F1
12	F2
13	G1
14	G1 G2
15	H1
16	H1 H2 I1
17	l1
18	12
19	J1
20	J2
21	K1
22	K2
23	L1
24	K1 K2 L1 L2
25	M1
26	M2
27	N1
28	N2
29	N2 01
30	02
31	P1
32	P2

#### Table 5.11 MECHATROLINK-III Response Extended MECHATROLINK-III Response Parameters

Data Position Number	Word Data (16 bits)	
2001	A1	RWDT
2002	B1	B2
2003	C1	C2
2004	D1	D2
2005	E1	E2
2006	F1	F2
2007	G1	G2
2008	H1	H2
2009	l1	12
2010	J1	J2
2011	K1	K2
2012	L1	L2
2013	M1	M2
2014	N1	N2
2015	01	02
2016	P1	P2

# 5.4 Executing Interpolation Motion Commands

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

Only interpolation motion commands can be executed during interpolation motion. Other MECHATROLINK-III commands cannot be transmitted during interpolation motion. Therefore, always verify that an interpolation motion initiated by an interpolation motion command has stopped by checking that the Positioning Completed input relay has turned on before sending the next MECHATROLINK-III command.

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

# Executing Interpolation Motion Command



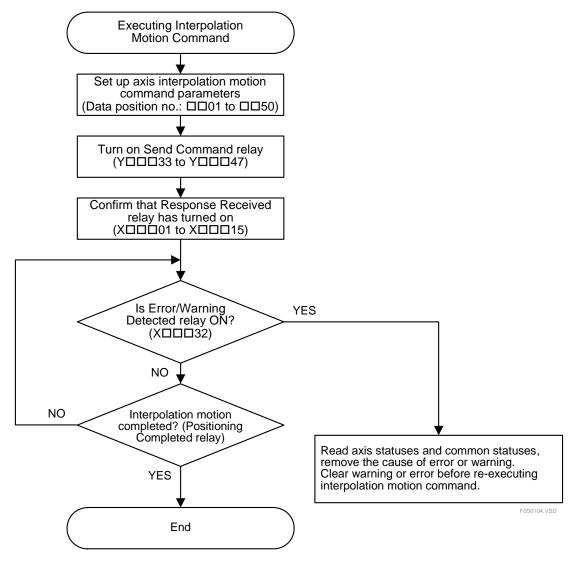


Figure 5.4 Procedure for Executing Interpolation Motion Command

#### Acceptance conditions for interpolation motion commands

- MECHATROLINK-III 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 motion command is the Start Positioning command (\$0100).

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

#### Writing parameters for interpolation motion commands

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

For details on the required parameters of each interpolation motion command, see Subsection 5.4.1, "Parameters and Statuses of Interpolation Motion Commands".

#### Turning on Send Command relay and checking for Response Received relay turning on

Turning on the Send Command relay of an axis ( $Y\square\square\square33$  to  $Y\square\square47$ ) after writing interpolation motion command parameter values executes the interpolation motion command. The Response Received relay ( $X\square\square01$  to  $X\square\square15$ ) of the axis turns on if the executed command is processed normally.

Verify that the Response Received relay has turned on before turning off the Send Command relay. Turning off the Send Command relay ( $Y\square\square\square33$  to  $Y\square\square47$ ) for an axis also turns off the corresponding Response Received relay ( $X\square\square01$  to  $X\square\square15$ ).

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y <b>DDD</b> 33	AX1 Send Command	Request to send MECHATROLINK-III command for axis 1.	Turn off this relay after verifying that $X\square\square\square01$ has turned on.
Y <b>DDD</b> 34	AX2 Send Command	Request to send MECHATROLINK-III command for axis 2	Turn off this relay after verifying that $X\square\square\square02$ has turned on.
Y <b>DDD</b> 35	AX3 Send Command	Request to send MECHATROLINK-III command for axis 3	Turn off this relay after verifying that $X\square\square\square03$ has turned on.
Y <b>DDD</b> 36	AX4 Send Command	Request to send MECHATROLINK-III command for axis 4	Turn off this relay after verifying that $X\square\square\square04$ has turned on.
Y <b>DDD</b> 37	AX5 Send Command	Request to send MECHATROLINK-III command for axis 5	Turn off this relay after verifying that $X\square\square\square05$ has turned on.
Y <b>DDD</b> 38	AX6 Send Command	Request to send MECHATROLINK-III command for axis 6	Turn off this relay after verifying that $X\square\square\square06$ has turned on.
Y <b>DDD</b> 39	AX7 Send Command	Request to send MECHATROLINK-III command for axis 7	Turn off this relay after verifying that $X\square\square\square07$ has turned on.
Y <b>DDD</b> 40	AX8 Send Command	Request to send MECHATROLINK-III command for axis 8	Turn off this relay after verifying that $X\square\square\square08$ has turned on.
Y <b>DDD</b> 41	AX9 Send Command	Request to send MECHATROLINK-III command for axis 9	Turn off this relay after verifying that $X\square\square\square09$ has turned on.
Y <b>DDD</b> 42	AX10 Send Command	Request to send MECHATROLINK-III command for axis 10	Turn off this relay after verifying that $X\square\square\square10$ has turned on.
Y <b>DDD</b> 43	AX11 Send Command	Request to send MECHATROLINK-III command for axis 11	Turn off this relay after verifying that XDDD11 has turned on.
Y <b>DDD</b> 44	AX12 Send Command	Request to send MECHATROLINK-III command for axis 12	Turn off this relay after verifying that $X\square\square\square12$ has turned on.
Y <b>DDD</b> 45	AX13 Send Command	Request to send MECHATROLINK-III command for axis 13	Turn off this relay after verifying that $X\square\square\square13$ has turned on.
Y <b>DDD</b> 46	AX14 Send Command	Request to send MECHATROLINK-III command for axis 14	Turn off this relay after verifying that $X\square\square\square14$ has turned on.
Y <b>DDD</b> 47	AX15 Send Command	Request to send MECHATROLINK-III command for axis 15	Turn off this relay after verifying that XDDD15 has turned on.
	To be con	tinued on the next nade	

Table 5 12	<b>Relays for Sending</b>	Internolation	Motion Commands
	Relays for benaning	merpolation	motion communus

To be continued on the next page

Input Relay No.	Signal Name	Description	Relation with Other Relays
X <b>DDD</b> 01	AX1 Response Received	Turns on when a MECHATROLINK-III response for axis 1 is received.	Turning off YDD33 also turns off this relay.
X <b>DDD</b> 02	AX2 Response Received	Turns on when a MECHATROLINK-III response for axis 2 is received.	Turning off YDD34 also turns off this relay.
X <b>DDD</b> 03	AX3 Response Received	Turns on when a MECHATROLINK-III response for axis 3 is received.	Turning off YDD35 also turns off this relay.
X <b>DDD</b> 04	AX4 Response Received	Turns on when a MECHATROLINK-III response for axis 4 is received.	Turning off YDD36 also turns off this relay.
X <b>DDD</b> 05	AX5 Response Received	Turns on when a MECHATROLINK-III response for axis 5 is received.	Turning off YDD37 also turns off this relay.
X <b>DDD</b> 06	AX6 Response Received	Turns on when a MECHATROLINK-III response for axis 6 is received.	Turning off YDD38 also turns off this relay.
X <b>DDD</b> 07	AX7 Response Received	Turns on when a MECHATROLINK-III response for axis 7 is received.	Turning off YDD39 also turns off this relay.
	AX8 Response Received	Turns on when a MECHATROLINK-III response for axis 8 is received.	Turning off YDDD40 also turns off this relay.
X <b>DDD</b> 09	AX9 Response Received	Turns on when a MECHATROLINK-III response for axis 9 is received.	Turning off YDDD41 also turns off this relay.
X <b>DDD</b> 10	AX10 Response Received	Turns on when a MECHATROLINK-III response for axis 10 is received.	Turning off $Y \square \square \square 42$ also turns off this relay.
X <b>DDD</b> 11	AX11 Response Received	Turns on when a MECHATROLINK-III response for axis 11 is received.	Turning off YDDD43 also turns off this relay.
X <b>DDD</b> 12	AX12 Response Received	Turns on when a MECHATROLINK-III response for axis 12 is received.	Turning off YDDD44 also turns off this relay.
X <b>DDD</b> 13	AX13 Response Received	Turns on when a MECHATROLINK-III response for axis 13 is received.	Turning off Y $\Box$ $\Box$ 45 also turns off this relay.
X <b>DDD</b> 14	AX14 Response Received	Turns on when a MECHATROLINK-III response for axis 14 is received.	Turning off YDDD46 also turns off this relay.
X <b>DDD</b> 15	AX15 Response Received	Turns on when a MECHATROLINK-III response for axis 15 is received.	Turning off YDDD47 also turns off this relay.

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

#### Reading statuses

After verifying that the Response Received relay ( $X\square\square\square01$  to  $X\square\square\square15$ ) for the axis has turned on, indicating that the executed interpolation motion command has been processed normally, read the axis statuses and common statuses using READ instructions in a ladder program.

For details on the statuses that can be read for each executed interpolation motion command, see Subsection 5.4.1, "Parameters and Statuses of Interpolation Motion Commands".

#### • Checking completion of interpolation motion command execution

Interpolation motion 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 motion commands by reading the following relays and statuses in a ladder program and checking the values of the relevant status bits.

Positioning Completed relay (XDDD17 to XDDD31) Error/Warning Detected relay (XDDD32) Axis statuses and common statuses

# Example for Executing Interpolation Motion Command

#### Procedure

- (1) Specify the command code and required parameter values of the interpolation motion command in data position numbers □□01 to □□50.
- (2) Turn on the Send Command relay (Y $\square$  $\square$  $\square$ 33 to Y $\square$  $\square$  $\square$ 47).
- (3) Verify that the Response Received relay ( $X\square\square\square01$  to  $X\square\square\square15$ ) has turned on.
- (4) Verify that positioning has completed by checking the Positioning Completed relay, Error/Warning Detected relay (X□□□32), axis statuses and common statuses.

#### • 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.

0002	*** Sample Program for Executing Start Po	DIFU 102001	
Ī	Execute	Execute	
and and a second	Positioning	Command	
0003	Execute Start Positioning command	a design of the second	
0004			AX1 CMD
	Execute		Start Positioning
0005	Command		
			AX1 CMD_CTRL
0006		MOV   \$0010000 D00100 /	
			AX1 SVCMD_CTF
0007		MOV 0 D00105 /	AX1 SVCMD_IO
0008		A second s	
		MOV 400000 D00143 /	AX1 Target Positic
			(for interpolation)
0009			
		MOV   10000  D00145 /	AX1 Target Speed
			(for interpolation)
0010		MOV 6 D00147 I	Interpolation Axes
			(for interpolation)
0011		Same and States	
			Acceleration Time
			(for interpolation)
0012			
			Deceleration Time (for interpolation)
0013		MOV 0 D00202	AX2 CMD_CTRL
	Execute		AVE CIMP_CITCE
0014	Command	A second s	
0014		MOV \$8010000 D00203 /	AX2 SVCMD_CTF
0015			
1			AX2 SVCMD_IO
0016		MOV   50000  D00243 /	AX2 Target Positio
			(for interpolation)
0017			
0017			AX2 Target Speed
			(for interpolation)

00018	Į02001		1.000		
	Execute		MOV	0  D00302	AX3 CMD_CTRL
	Command				
00019			MOV S	8010000 D00303	AX3 SVCMD_CTRL
					_
00020	1	L			AX3 SVCMD_IO
1			MOV	0  D00305	
00021			MOV	60000 D00343	AX3 Target Position
1.5					(for interpolation)
00022	-	L. L.	MOUT	15000 D00345	AV2 Torget Speed
10			MOV	10000 000345	AX3 Target Speed (for interpolation)
00023	102001				
00023		WRITE D00101	3	101 49	Write
	Execute Command				AX1 parameters
00024		WRITE   D00202	3	202 45	Write
	i i		9	202 40	AX2 parameters
00025					
00020			3	302 45	Write
· ····					AX3 parameters
00026				SET   Y00333	AX1 Send Command
				AX1 Send	relay ON
00027			_	Command	
1				SET ID2002 Receiving	Receiving Response
				Response	
00028				SET   102003	Executing Command
				Executing Command	ON
00029	Chec	k execution of Start Positioning command		Command	
00030	102002	X00301		BST   Y00333	AX1 Send Command
	Receiving	AX1		AX1 Send	relay OFF
00031	Response	Response Received		Command	
				RST ID2002 Receiving	Receiving Response
z.l	Cher	k completion of Start Positioning command		Response	
00032	ID2002				
00000				RST ID2003	Executing Command
	Receiving Response	Command Response Positioning Positioning Positioning		Executing Command	OFF
00034		Received Completed Completed	T	SET   102004	Execution completed
			-	Positioning	
				Completed	

#### • Sample Program for Executing Decelerate & Stop Command

This sample program issues a Decelerate & Stop command (\$0200) against axis 1 to the positioning module mounted in slot 3 to decelerate and stop axes 1, 2 and 3 during interpolation motion with axis 1 as reference axis and axes 2 and 3 as interpolation axes.

00001	*** Sample Program for Executing Decelerate & Stop Command ***	
00002	102100 DIFU 102101	
	Execute Execute Command	
00003	Execute Decelerate & Stop command	
00004	102101	
		AX1 CMD =Decelerate & Stop
	Command	
00005	WRITE   D00101   3 101 1	Write
		AX1 parameters
00006		
00000	SET Y00333	AX1 Send Command
	AX1 Send Command	relay ON
00007		
	SET 102102	Receiving Response
	Receiving Response	ON
00008		Executing Command
	Executing	ON
	Check execution of Decelerate & Stop command	
00009	and a strategy of a strategy of the strategy o	
00010	RST Y00333	AX1 Send Command
	Receiving AX1 AX1 Send	relay OFF
00011	Response Response Command	
	RST 102102	Receiving Response
	Receiving Response	OFF
00012	Check completion of Decelerate & Stop command	
00013	102102 102103 X00301 X00317 X00318 X00319 RST 102103	Executing Command
	Receiving Executing AX1 AX1 AX2 AX3 Executing	OFF
00014	Response Command Response Positioning Positioning Positioning Command	
00014	Received Completed Completed Completed SET 102104	Execution completed
	Decel. & Sto	
	Completed	

#### • Sample Program for Executing Stop Immediately Command

This sample program issues a Stop Immediately command (\$0300) against axis 1 to the positioning module mounted in slot 3 to stop the motion of axes 1, 2 and 3 immediately during interpolation motion with axis 1 as reference axis and axes 2 and 3 as interpolation axes.

		ple Program for Executing Stop Immediately Command ***	
00002	102200		102201
	Execute		kecute
	Stop Immedi		ommand
00003		cute Stop Immediately command	
00004	102201	MOV \$300	D00101 AX1 CMD
	Execute		=Stop Immediately
	Command		
00005		WRITE   D00101   3 101	1 14/-14-
			Write
			AX1 parameters
00006		SET	Y00333 AX1 Send Command
			K1 Send relay ON
00007			and the second
		SET	102202 Receiving Response eceiving ON
			esponse
00008			
	3	SET	102203 Executing Command
			cecuting ON
00009	Chec	ck execution of Stop Immediately command	initiana initian
00010	102202	X00301	
	Receiving		Y00333 AX1 Send Command X1 Send relay OFF
	Response		X1 Send relay OFF
00011	litooponoo	Received	Conception of the second se
		RST	102202 Receiving Response
		D	eceiving OFF esponse
00012	Chec	ck completion of Decelerate & Stop command	25ponse
00013	102202	102203 X00301 X00317 X00318 X00319	Sector Sector
			102203 Executing Command
	Receiving Response		vecuting OFF
00014	Response	Received Completed Completed	and the second se
00011		SET	102204 Execution completed
			op
			mediately ompleted
		U.	mpiereu

#### • 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 during interpolation motion with axis 1 as reference axis and axes 2 and 3 as interpolation axes.

00001	*** Sample Program for Executing Change Speed Command ***	
00002	DFU 102301	
	Execute Execute	
00003	Change Speed Command Command	
00004	102301	
		AX1 CMD
	Execute Command	= Change Speed
00005	L.	
		AX1 Target Speed
		(for interpolation)
00006	MOV 250 D00148	Acceleration Time
		(for interpolation)
		(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
00007	MOV 250 D00149	Deceleration Time
		(for interpolation)
00008		· · · /
00000	MOV   10000 D00245	AX2 Target Speed
		(for interpolation)
00009	L	
	MOV 7500 D00345	AX3 Target Speed
		(for interpolation)
00010		
		Write AX1 parameters
		ANT parameters
00011	WRITE   D00245   3 245 2	Write
		AX2 parameters
00012	WRITE   D00345   3  345  2	Write
		AX3 parameters
00013		
00010		AX1 Send Command
	AX1 Send Command	relay ON
00014		
		Receiving Response
	Receiving Response	ON
00015	the second se	Executing Command
		ON Command
0001.0	Command	
00016	T02302 X00301	
00011	RST Y00333	AX1 Send Command
	Receiving     AX1     AX1 Send       Response     Response     Command	relay OFF
00018	Received	
		Receiving Response
	Response	OFF
00019	Check completion of Change Speed command	
00020	102302 102303 X00301 X00317 X00318 X00319 RST 102303	Executing Command
	Receiving Executing AX1 AX1 AX2 AX3 Executing	OFF
00021	Response Command Response Positioning Positioning Positioning Command Completed Completed	
00021		Execution completed
	Positioning	
	Completed	

#### • 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 during interpolation motion with axis 1 as reference axis and axes 2 and 3 as interpolation axes.

00001	*** Sample Program for Executing Change Target Position Command ***	
00002	1 DIFU 102401	
	Target Position Command	
00003	ID2401	
00004	MOV \$500 D00101	AX1 CMD
	Execute Command	= Change Target
00005		Position AX1 Target Position
		(for interpolation)
00006		
00000	MOV 0000 D00145	AX1 Target Speed
		(for interpolation)
00007	MOV 500 D00148	Acceleration Time
		(for interpolation)
00008		
	MOV 500 D00149	Deceleration Time
		(for interpolation)
00009	MOV 50000 D00243	AX2 Target Position
		(for interpolation)
00010		
	MOV 20000 D00245	AX2 Target Speed (for interpolation)
00011		
00011	MOV 60000 D00343	AX3 Target Position
		(for interpolation)
00012	MOV 5000 D00345	AX3 Target Speed
		(for interpolation)
00013		
00010	WRITE   D00101   3 101 49	Write
		AX1 parameters
00014	WRITE   D00243   3 243 4	Write
		AX2 parameters
00015		
	WRITE D00343 3 343 4	Write AX3 parameters
00016	SET Y00333	AX1 Send Command
	AX1 Send Command	relay ON
00017		Receiving Response
	Receiving	ON
00018	Response	
00010	SET   102403	Executing Command
	Executing Command	ON

00020 102402 Receiving Response 00021	X00301 AX1 Response Received		Position command	RST	AX1 Send Command	AX1 Send Command relay OFF Receiving Response OFF
00023 ID2402 Receiving	Executing AX1 AX Command Response Po	200317 X00318 X1 AX2 ositioning Positioning ompleted Completed	X00319 AX3 Positioning Completed	SET	Executing Command	Executing Command OFF Execution completed

# 5.4.1 Parameters and Statuses of Interpolation Motion Commands

The following tables list the required command parameters that must be written, as well as the statuses that are returned for each interpolation motion command.

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

In the table, "□□" denotes an axis number (01 to 15), while "■■" denotes the value of "□□ + 1".

The parameters for each command are listed with the following indications:

- $\odot:$  This parameter must be wirtten for the reference axis, as well as each interpolation axis.
- $\bigcirc$ : This parameter must be written only for the reference axis.
- $\bigtriangleup$ : This parameter must be written only if the command is executed in Positioning Completed state.

#### Change Target Position Change Speed Decelerate 8 Stop Immediately Positioning Start Stop **Data Position** Data Name Number Command Code (CMD) \$0100 \$0200 \$0300 \$0400 \$0500 Command Control (CMD\_CTRL) 0 $\Pi \Pi 02$ Δ Servo Command Control Field (SVCMD\_CTRL) 0 Δ Servo Command Output Signal (SVCMD\_IO) 0 Δ Target Position (TPOS) / Zero Point Return Mode (MODE) Target Speed (TSPD) Acceleration (ACCR) Deceleration (DECR) Torque Limit (TLIM) Speed Reference (VREF) Speed Limit (VLIM) Torque Reference (TQREF) Speed Feed Forward (VFF) Torque Feed Forward (TFF) Coordinates Setting Mode (POS\_SET\_MOD) Coordinates Set Value (POS\_DATA) (System reserved) **DD**31 to **DD**32 Configuration Mode (CONFIG\_MOD) Alarm Clear Mode (ALM\_CLR\_MOD) Servo Parameter Number (NO) Servo Parameter Data Size [byte] (SIZE) Servo Parameter Read/Write Mode (MODE) Servo Parameter Data (PARAMETER) □□39 to □□40 (System reserved) Subcommand Control (SUB\_CTRL) 0 Δ Target Position (for interpolation motion commands) 0 0 0 0 Target Speed (for interpolation motion commands) 0 Ο Interpolation Axes (for interpolation motion commands) Δ Acceleration Time (for interpolation motion commands) Ο Ο Ο 0 Deceleration Time (for interpolation motion commands) Ο Ο (System reserved) Extended MECHATROLINK-III Command 2001 to 2750 Parameters

#### Command parameters

#### • Statuses

Data Position Number	Data Name	Start Positioning	Decelerate & Stop	Stop Immediately	Change Speed	Change Target Position
<b>DD</b> 61	(System reserved)					
	Command Status (CMD_STAT)	0	0	0	0	0
	Servo Command Status Field (SVCMD_STAT)	0	0	0	0	0
□□65 / □□66	Servo Command Input Signal (SVCMD_IO)	0	0	0	0	0
	Fixed Monitor 1 (CPRM_SEL_MON1)	0	0	0	0	0
0069/0070	Fixed Monitor 2 (CPRM_SEL_MON2)	0	0	0	0	0
0071/0072	Monitor 1 (MONITOR1)	0	0	0	0	0
	Monitor 2 (MONITOR2)	0	0	0	0	0
<b>DD</b> 75 / <b>DD</b> 76	Monitor 3 (MONITOR3)	0	0	0	0	0
	Monitor 4 (MONITOR4)	0	0	0	0	0
	Monitor 5 (MONITOR5)	0	0	0	0	0
	Monitor 6 (MONITOR6)	0	0	0	0	0
	Subcommand Status (SUB_STAT)	0	0	0	0	0
	Remaining Travel Status	0	0	0	0	0
<b>D1</b> 87	Interpolation Status	0	0	0	0	0
□□88 to ■■00	(System reserved)					
1601 to 2000	Common Statuses	0	0	0	0	0

# 5.5 Reading Statuses

The positioning module allows statuses of external devices corresponding to axes 1 to 15 to be read from input relays, axis statuses and common statuses. Status data is updated at each communication cycle.

The statuses that are updated depend on the transmitted MECHATROLINK-III commands.

For details on the statuses that are updated for each MECHATROLINK-III command, see Subsection 5.3.1, "Parameters and Statuses of MECHATROLINK-III Commands" and Subsection 5.4.1, "Parameters and Statuses of Interpolation Motion Commands".

After the module receives a response from a standard servo profile compliant external device for a transmitted MECHATROLINK-III command (but not an extended MECHATROLINK-III command) for which status data is not updated, it automatically sends a Servo Status Monitor (SMON :\$30) command. In this way, status data is updated automatically.

## How to Read Status

#### • Reading statuses

Input relays can be read as input relays in 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.

Input Relay No.	Signal Name	Description	Relation with Other Relays
X <b>DDD</b> 01	AX1 Response Received	Turns on when a MECHATROLINK-III response for axis 1 is received.	Turning off Y $\square$ $\square$ $\square$ 33 also turns off this relay.
X <b>□□0</b> 2	AX2 Response Received	Turns on when a MECHATROLINK-III response for axis 2 is received.	Turning off YDDD34 also turns off this relay.
X <b>DDD</b> 03	AX3 Response Received	Turns on when a MECHATROLINK-III response for axis 3 is received.	Turning off Y $\Box$ $\Box$ $\Box$ 35 also turns off this relay.
X <b>DDD</b> 04	AX4 Response Received	Turns on when a MECHATROLINK-III response for axis 4 is received.	Turning off $Y \square \square \square$ 36 also turns off this relay.
X <b>DDD</b> 05	AX5 Response Received	Turns on when a MECHATROLINK-III response for axis 5 is received.	Turning off Y $\square$
X <b>DDD</b> 06	AX6 Response Received	Turns on when a MECHATROLINK-III response for axis 6 is received.	Turning off Y $\square$ $\square$ $\square$ 38 also turns off this relay.
X <b>DDD</b> 07	AX7 Response Received	Turns on when a MECHATROLINK-III response for axis 7 is received.	Turning off YDDD39 also turns off this relay.
X <b>DD</b> 08	AX8 Response Received	Turns on when a MECHATROLINK-III response for axis 8 is received.	Turning off $Y\square\square\square40$ also turns off this relay.
X <b>□□□</b> 09	AX9 Response Received	Turns on when a MECHATROLINK-III response for axis 9 is received.	Turning off YDDD41 also turns off this relay.
X <b>DDD</b> 10	AX10 Response Received	Turns on when a MECHATROLINK-III response for axis 10 is received.	Turning off YDDD42 also turns off this relay.
X <b>DDD</b> 11	AX11 Response Received	Turns on when a MECHATROLINK-III response for axis 11 is received.	Turning off $Y \square \square \square 43$ also turns off this relay.
X <b>DDD</b> 12	AX12 Response Received	Turns on when a MECHATROLINK-III response for axis 12 is received.	Turning off YDDD44 also turns off this relay.
X <b>DDD</b> 13	AX13 Response Received	Turns on when a MECHATROLINK-III response for axis 13 is received.	Turning off YDDD45 also turns off this relay.
X <b>DDD</b> 14	AX14 Response Received	Turns on when a MECHATROLINK-III response for axis 14 is received.	Turning off YDDD46 also turns off this relay.
X <b>DDD</b> 15	AX15 Response Received	Turns on when a MECHATROLINK-III response for axis 15 is received.	Turning off Y $\Box$ $\Box$ $\Box$ 47 also turns off this relay.
X <b>DDD</b> 16	Communication Status	Turns on while MECHATROLINK-III communication is in progress; turns off otherwise.	Turning on YDDD48 to initiate communication turns on this relay when communication begins. Turning off YDDD48 also turns off this relay.

#### Table 5.13 List of Input Relays

#### To be continued on the next page

Input Relay No.	Signal Name	Description	Relation with Other Relays
X <b>DDD</b> 17	AX1 Positioning Completed	Turns on when axis 1 is in positioning completed state.	
X <b>DDD</b> 18	AX2 Positioning Completed	Turns on when axis 2 is in positioning completed state.	
X <b>DDD</b> 19	AX3 Positioning Completed	Turns on when axis 3 is in positioning completed state.	
X <b>DDD</b> 20	AX4 Positioning Completed	Turns on when axis 4 is in positioning completed state.	
X <b>DDD</b> 21	AX5 Positioning Completed	Turns on when axis 5 is in positioning completed state.	
X <b>DDD</b> 22	AX6 Positioning Completed	Turns on when axis 6 is in positioning completed state.	
X <b>DDD</b> 23	AX7 Positioning Completed	Turns on when axis 7 is in positioning completed state.	
X <b>DDD</b> 24	AX8 Positioning Completed	Turns on when axis 8 is in positioning completed state.	
X <b>DDD</b> 25	AX9 Positioning Completed	Turns on when axis 9 is in positioning completed state.	
X <b>DDD</b> 26	AX10 Positioning Completed	Turns on when axis 10 is in positioning completed state.	
X <b>DDD</b> 27	AX11 Positioning Completed	Turns on when axis 11 is in positioning completed state.	
X <b>DDD</b> 28	AX12 Positioning Completed	Turns on when axis 12 is in positioning completed state.	
X <b>DDD</b> 29	AX13 Positioning Completed	Turns on when axis 13 is in positioning completed state.	
X <b>DD</b> 30	AX14 Positioning Completed	Turns on when axis 14 is in positioning completed state.	
X <b>DDD</b> 31	AX15 Positioning Completed	Turns on when axis 15 is in positioning completed state.	
X <b>DDD</b> 32	Error/Warning Detected	Turns on when an error or warning is detected by the module or any axis.	Turning on YDDD64 to clear all errors and warnings turns off this relay if errors and warnings are successfully cleared.

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

#### Axis statuses

Table 5.14 and Table 5.15 list the axis statuses. The axis statuses depend on the profile type supported by the connected external device. For details of axis statuses, see Subsection 4.2.5, "Axis Statuses".

Table 5.14	List of Axis	Statuses (for	standard s	servo profile	compliant	external devices)
------------	--------------	---------------	------------	---------------	-----------	-------------------

Data Position Number	Data Name	Data Description	See Also
□□61	(System reserved)		-
<b>DD</b> 62	Command Status (CMD_STAT)	Bit data: Bits 15 to 0	4-29
□□63 / □□64	Servo Command Status Field (SVCMD_STAT)	Bit data: Bits 31 to 0	4-30
0065 / 0066	Servo Command Input Signal (SVCMD_IO)	Bit data: Bits 31 to 0	4-31
	Fixed Monitor 1 (CPRM_SEL_MON1)	Fixed monitor 1 data	4-32
0069/0070	Fixed Monitor 2 (CPRM_SEL_MON2)	Fixed monitor 2 data	4-32
0071/0072	Monitor 1 (MONITOR1)	Monitor 1 data (Fixed to CPOS data)	4-32
	Monitor 2 (MONITOR2)	Monitor 2 data	4-32
0075/0076	Monitor 3 (MONITOR3)	Monitor 3 data	4-32
<b>DD</b> 77 / <b>DD</b> 78	Monitor 4 (MONITOR4)	Monitor 4 data	4-32
	Monitor 5 (MONITOR5)	Monitor 5 data	4-33
	Monitor 6 (MONITOR6)	Monitor 6 data	4-33
	Subcommand Status (SUB_STAT)	Bit data: Bits 15 to 0	4-33
	Remaining Travel Status	-2,147,483,648 to 2,147,483,647	4-33
<b>DD</b> 87	Interpolation Status	Bit data: Bits 15 to 0	4-34
□ <b>□</b> 88 to <b>■■</b> 00	(System reserved)		_

Note: □□ denotes an axis number (01 to 15). ■■ denotes the value of □□+1.

#### Table 5.15 List of Axis Statuses (for standard I/O profile compliant external devices)

Data Position Number	Data Name	Data Description	See Also
<b>DD</b> 61	(System reserved)		-
	Command Status (CMD_STAT)	Bit data: Bits 15 to 0	4-29
□□63 to □□92	Input Data (INPUT)	Bit data: Bits 15 to 0	4-34
□□93 to ■■00	(System reserved)		-

Note: □□ denotes an axis number (01 to 15). ■■ denotes the value of □□+1.

#### • Common statuses

Table 5.16 lists the common statuses. For details of common statuses, see Subsection 4.2.6, "Common Statuses".

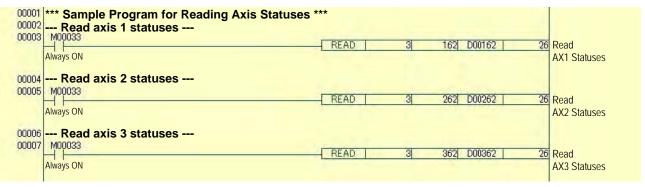
Data Position Number	Data Name	Data Description	See Also
1601	Alarm Axis Bits	Bit data for module, AX15, AX14,, AX2 and AX1	4-35
1602	Warning Axis Bits	'0' and bit data for AX15, AX14,, AX2 and AX1	4-36
1603	Module Alarm Code	MECHATROLINK-III communication initialization related errors, MECHATROLINK-III communication related errors, interpolation motion command execution related errors, etc.	4-36
1604	Module Detailed Alarm Code	'0' and bit data for AX15, AX14,, AX2 and AX1	4-37
1605 to 2000	(System reserved)		-

#### Table 5.16 List of Common Statuses

# 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.





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 had verified that the data are the same.

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

For details on how to check that data read twice consecutively by a sequence CPU are the same in both instances, see Section 6.3, "Precautions When Reading 2-word Data."

# 5.6 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 devices and reported to the module via MECHATROLINK-III communications. The Error/Warning Detected relay turns on for both types of errors and warnings.

Error and warnings detected by external devices may be caused by communication errors during MECHATROLINK-III communication (communication error, watchdog data error, transmission cycle error and synchronous command error), command errors and external device faults. These errors are reported to the positioning module via CMD\_STAT (specifically, its D\_ALM bit, D\_WAR bit, CMD\_ALM code and COMM\_ALM code) of the MECHATROLINK-III response returned from the external device.

## MECHATROLINK-III Communication Initialization Related Errors

#### Communication parameter error

A communication parameter error is generated when starting MECHATROLINK-III communication if a specified MECHATROLINK-III communication parameter value is out of the valid data range.

#### Disconnected external device

A disconnected external device error is generated if an external device defined in MECHATROLINK-III communication parameters is not connected or powered off.

#### Station address error

A station address setup error is generated if two or more connected external devices have the same station address.

## MECHATROLINK-III Communication Related Errors

#### • Communication error

In MECHATROLINK-III communications, data exchange with external devices is carried out at each communication cycle.

A communication error is generated if the data receive status for received data read from an external device is not normal for two or more consecutive cycles.

#### Watchdog data error

In MECHATROLINK-III 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 establish synchronous communication, as well as detect any synchronization lag.

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

#### • Command timeout error

A command timeout error is generated if no MECHATROLINK-III response for a MECHATROLINK-III command is received within ten seconds after command transmission. It is assumed that a command processing error is detected by the external device.

# Interpolation Motion Command Execution Related Errors

#### • Parameter setup error

A parameter setup error is generated when an invalid parameter value is specified for an interpolation motion 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 motion, the motion is decelerated to a stop.

#### • Motion axis error

A motion axis error is generated if an interpolation motion is executed against 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-III 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 External Devices

For details on errors and warnings that may be reported by a connected external device, see its user's manual.

## 5-59

# Checking for Errors and Warnings

#### Error/Warning Detected relay

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

Table 5.17	Relays for Checking Errors or Warnings
------------	--

Input Relay No.	Signal Name	Description	Relation with Other Relays
X <b>DDD</b> 32		the module or any axis.	Turning on YDDD64 to clear all errors and warnings also turns off this relay.

Note: In the table, "

#### • Errors and Warnings detected by the module

When the positioning module detects a warning or an error, 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.

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

Data Position Number	Data Name	Data Description	See Also
1601	Alarm Axis Bits	Bit data for module, AX15, AX14,, AX2 and AX1	4-35
1602	Warning Axis Bits	'0' and bit data for AX15, AX14,, AX2 and AX1	4-36
1603	Module Alarm Code	MECHATROLINK-III communication initialization related errors, MECHATROLINK-III communication related errors, interpolation motion command execution related errors, etc.	4-36
1604	Module Detailed Alarm Code	'0' and bit data for AX15, AX14,, AX2 and AX1	4-37

#### Table 5.18 List of Statuses for Checking (Module) Errors or Warnings

#### • Errors and Warnings detected by external devices

When an error or warning is detected by an external device, the corresponding bit of the Alarm Axis Bits or Warning Axis Bits of common statuses turns on.

When an error or warning is detected by an external device, read the error/warning code using the ALM\_RD (\$05) command. By pre-setting SEL\_MON2 or SEL\_MON3 of SVCMD\_CTRL to 8 (for ALARM monitor), the warning/alarm code will be stored in MONITOR2 or MONITOR3 of axis statuses respectively.

#### Table 5.18 List of Statuses for Checking (External Device) Errors or Warnings

Data Position Number	Data Name	Data Description	See Also
1601	Alarm Axis Bits	Bit data for module, AX15, AX14,, AX2 and AX1	4-35
1602	Warning Axis Bits	'0' and bit data for AX15, AX14,, AX2 and AX1	4-36

Data Position Number	Data Name	Data Description	See Also
	Command Status (CMD_STAT)	Bit data: Bits 15 to 0	4-29

# Example of Checking for Errors and Warnings

#### • Sample Program

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

It is assumed that SEL\_MON3 of SVCMD\_CTRL of each axis is set to 8 (for ALARM monitor) beforehand so that any warning/alarm codes are stored in the respective MONITOR3 axis statuses.

00001		le Progra	am for Ch	ecking I	Errors and V	and the second second					
	Error/Warning					READ	3	1601	D01601	1	Alarm Axis Bits
	Detected										
00003						READ	3	1602	D01602	1	Warning Axis Bits
						THERE	<u> </u>	1002	201002		
00004											
00004	1							MOV	D01601	103001	Extract
										AX1 Alarm Bit	Alarm Axis Bits
00005								MOV	D01602	103017	- Future at
								INOV	D01002	AX1	Extract Warning Axis Bits
03004	Read	code for	module e	rror/war	ning					Warning Bi	
00006		103016	inouule e	1101/Wal	iiiig						
00007	HF-		_			READ	3	1603	D01603	1	Read
	Error/Warning Detected	Module Alarm									Module Alarm Code
00008						DEAD		1004	DOI204	1	
		-				READ	3	1004	D01604	-	Read Module Detailed Alarm Code
	Read	ode for	orror/wai	ning def	tected on a	vie 1					
00009	Ter State State	103001	en or/wai	ning dei		(13 T					
00010	H		_			READ	3	175	D00175	1	2 Read AX1 Monitor 3
	Error/Warning Detected	AX1 Alarm Bit									for AX1 error/warning code
00011	Dottottou	103017									coue
		AX1									
		Warning Bit									
00012	Read	code for	error/wai	ning det	tected on a	(is 2					
00010	HH					READ	3	275	D00275	1	Read AX2 Monitor 3
	Error/Warning Detected	AX2 Alarm Bit									for AX2 error/warning
00014		103018									code
		AX2									
		Warning Bit									
00015		code for 103003	error/wai	ning det	tected on a	(is 3					
00010			-			READ	3	375	D00375	1	2 Read AX3 Monitor 3
	Error/Warning Detected	AX2 Alarm Bit									for AX3 error/warning
00017		I03019									code
	L										
		AX2 Warning Bit									

# 5.7 Clearing Errors and Warnings

This section describes how to clear MECHATROLINK-III communication initialization related errors, MECHATROLINK-III communication related errors, and interpolation motion command execution related errors detected by the module, as well as errors and warnings reported by external devices.

Errors and warnings reported by external devices can be cleared only while MECHATROLINK-III communication is in progress.

The positioning module clears errors and warnings by automatically sending the following sequence of MECHATROLINK-III commands.

- For standard servo profile compliant external device:

Clear alarm or warning command (ALM\_CLR: 06)

Start synchronous communication command (SYNC\_SET: \$0D)

- For standard I/O profile compliant external device: Clear alarm or warning command (ALM\_CLR: \$06)

# Procedure for Clearing Errors and Warnings



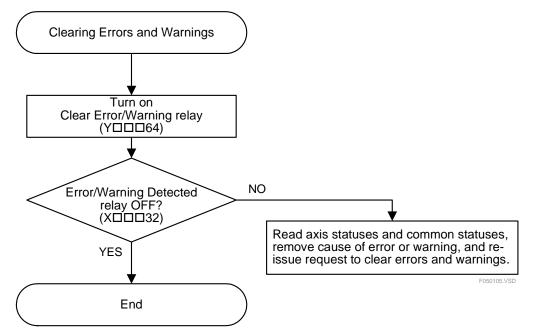


Figure 5.5 Procedure for Clearing Errors and Warnings

#### • Turning on the Clear 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.

Verify 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.

Output Relay No.	Signal Name	Description	Relation with Other Relays
Y <b>DDD</b> 64	Clear Error/warning	Request to clear all errors and warnings	Turn off this relay after verifying that XDDD32 has turned off.

Input Relay No.	Signal Name	Description	Relation with Other Relays
X <b>DDD</b> 32		lurns on when an error or warning is detected by the module or any axis	Turning on YDDD64 to clear all errors and warnings turns off this relay if errors and warnings are successfully cleared.

Note: In the table, "DDD" 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.

00002	*** Sample Program for Clearin 103100 Execute Clear Error/Warning	g Errors and Warnings *** DI-U ID3101 Execute Command	
	Clear errors and warnings		
00004	103101 X00332		
			Clear Error/Warning
	Execute Error/Warning		ON
	Command Detected	Error/Warning	
00005	X00332	RST Y00364	Clear Error/Warning
	Error/	Clear	OFF
	Warning	/Error/Warning	
00006	Detected		Everytion completed
		SET 103102 Error/Warning	Execution completed
		Cleared	

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" (IM34M06P12-03E).

#### 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		
Olympian of alaty where the medule is installed						

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
<u>.</u>				

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)

<u>.</u>	finat day	ing for star	ملاتين مطلبهم	data	
	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 ( $X\square\square\square01$  to  $X\square\square32$ ) 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 34M06Q22-01E).

Function	Statement Format	Description
Declare use of	ASSIGN NC93=SL	Declares use of a module or CPU module.
module	SL : slot number	
Read	ENTER SL, n NOFORMAT; I	Reads the parameter or status at a data
parameter or	SL : slot number	position number (n) of the module
status	n : data position number	installed in a slot (SL), and stores it in a
	I : Name of integer or integer	variable (I).
	array variable for storing read	
Write	data	Our munited the new standt a data
	OUTPUT SL, n NOFORMAT; I SL : slot number	Overwrites the parameter at a data
parameter	n : data position number	position number (n) of the module installed in a slot (SL) with the value
	I : Name of integer or integer	stored in a variable (I).
	array variable storing write data	
Read input	STATUS SL,n;P	Reads the status of input relays of a
relays *1	SL : slot number	module that is installed in a slot (SL), and
	n : data position no. (101 or 102)	stores it in a variable (P).
	P : Name of integer variable for	
	storing read data	
Write output	CONTROL SL,n;P,M	Overwrites output relays of a module
relays *2	SL : slot number	installed in a slot (SL) with a value stored
	n : data position no. (101 or 102)	in a variable (P). The mask pattern (M)
	P : output data	allows writing only to selected output
Destau	M : mask pattern	relays.
Declare	ON INT SL,nn GOSUB {label}	Declares branch destination for handling
interrupt	ON INT SL,nn CALL {subprogram} ON INT SL,nn GOTO {label}	interrupt request from the CPU module.
	SL : slot number	
	nn : input relay no.	
Clear interrupt	OFF INT SL,nn	Clears an ON INT statement.
declaration	SL : slot number	
	nn : input relay no.	

\*1: 101 and 102 refer to input relays having data position numbers (XDDD01 to XDDD16) and (XDDD17 to XDDD32) respectively.

\*2: 101 and 102 refer to output relays having data position numbers (YDDD33 to YDDD48) and (YDDD49 to YDDD64) 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 word/high word 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 word/high word order)
- LST : long-word integer variable after conversion

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

# 6.3 Precautions When Reading 2-word Data

When the CPU module reads 2-word status data (such as MONITOR1) 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 instruction to read the data twice consecutively and verify that the data read are the same in both instances. If the HRD instruction is used, data concurrency is not assured even if you had verified that the data are the same.

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

## • Sample Program

This sample program reads MONITOR1 of axis statuses for axis 1 from the positioning module installed in slot 3.

00001 00002	*** Samp M00033	ole Program for Reading MONITOR1 ***	READ	3	171 D00001	2	First read
	Always ON						Tilstread
00003			READ	3	171 D00003	2	Second read
00004	ų	L D00001	READ	3	171 D00001	2	Secure data concurrency



# 7. 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.

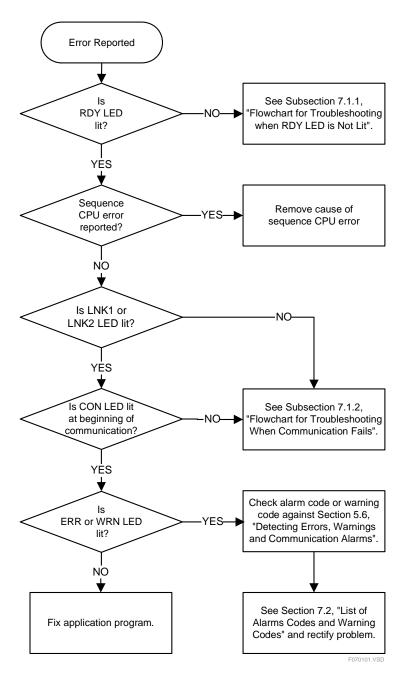


Figure 7.1 Troubleshooting Flowchart

# 7.1.1 Flowchart for Troubleshooting When RDY LED is Not Lit

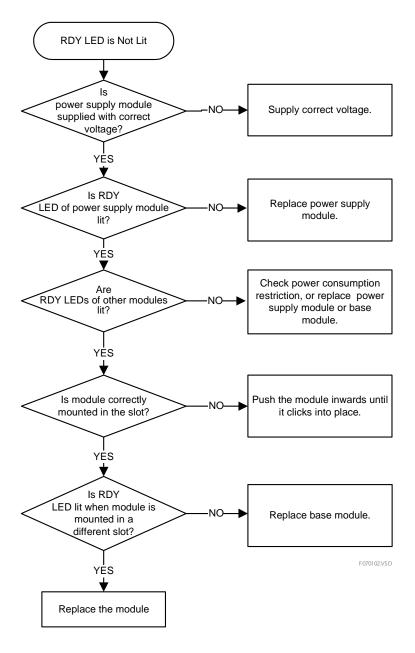


Figure 7.2 Flowchart for Troubleshooting When RDY LED is Not Lit

# 7.1.2 Flowchart for Troubleshooting When Communication Fails

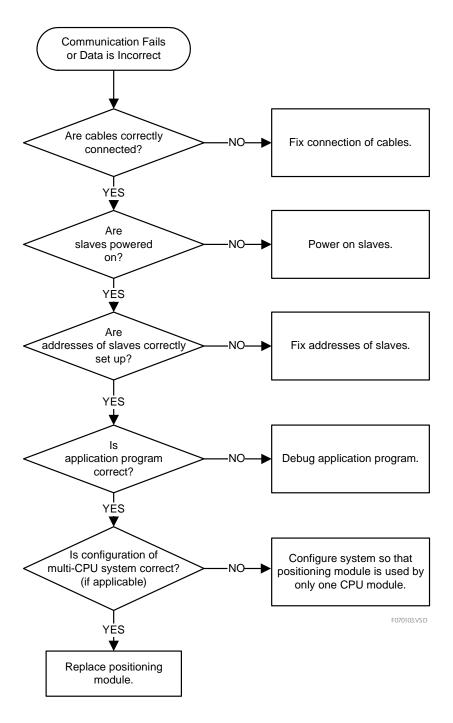


Figure 7.3 Flowchart for Troubleshooting When Communication Fails

# 7.2 List of Alarm Codes and Warning Codes

# 7.2.1 Module Alarms

The table below lists codes for alarms and warnings that may be detected by the positioning module.

Alarm Code (Hex.)	Alarm Name	Possible Causes and Description	Troubleshooting
\$80E0	Access driver error	An error was reported by the access driver for MECHATROLINK-III communication.	Check the connection with the external device and its status. (This error normally should not happen.)
\$80E1	Disconnected external device	An external device specified in the MECHATROLINK-III communication parameter area is not connected or powered off.	Check the connection of the external device. If no external device is connected, specify it as such in the MECHATROLINK-III communication parameter area.
\$80E4	Station address error	The connected external device has the same station address as another external device.	Check the station addresses of connected external devices.
\$80E5	Watchdog data error	MECHATROLINK-III synchronization error - WDT data mismatch	Update WDT data at each communication cycle. (This error normally should not happen.)
\$80E6	Communication error	MECHATROLINK-III communication error was detected for two consecutive cycles. - Bad contact of cables or connector - Operation error due to noise	<ul> <li>Check connector wiring.</li> <li>Check communication parameter values.</li> <li>Adopt measures against noise.</li> </ul>
\$8095	Command timeout error	MECHATROLINK-III command timeout error - No response was received within the timeout interval (about 10 seconds) after a command was transmitted.	<ul> <li>Check status of external device.</li> <li>Make sure no unsupported command is sent.</li> </ul>
\$8101	Parameter setup error	A parameter value specified for an interpolation motion command is out of range.	- Correct invalid parameter value.
\$8102	Motion axis error	An interpolation motion 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 executing the Starting Positioning command. Wait for target position change to complete before executing a Change Speed command or Change Target Position command.
\$8201	Communication parameter error	MECHATROLINK-III communication parameter setup error	Check MECHATROLINK-III communication parameter settings.

#### Table 7.1 List of Module Alarm Codes

# 7.2.2 External Device Communication Alarms and Warnings

The table below lists the codes of common communication related alarms and warnings, which may be detected by external devices.

For details of other alarm codes and warning codes, see the respective user's manuals of the external devices.

Alarm Code (Hex.)	Alarm Name	Possible Causes and Description	Troubleshooting
\$0E50	MECHATROLINK synchronization error	MECHATROLINK-III synchronization error - WDT data mismatch	Update WDT data at each communication cycle. (This error normally should not happen.)
\$0E60	MECHATROLINK communication error	MECHATROLINK-III communication error was detected for two consecutive cycles. - Bad contact of cables or connector - Operation error due to noise	<ul> <li>Check connector wiring.</li> <li>Adopt measures against noise.</li> </ul>

 Table 7.2
 List of MECHATROLINK-III Communication Related Alarm Codes

Table 7.3	List of MECHATROLINK-III Communication Related Warning Codes
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Warning Code (Hex.)	Warning Name	Possible Causes and Description	Troubleshooting
\$094□	Data setup warning	Value specified for MECHATROLINK-III communication is out of range.	Fix specified value.
\$095□	command warning	<ul> <li>Some acceptance condition of a transmitted command is not satisfied.</li> <li>Transmitted command is not supported.</li> </ul>	<ul> <li>Ensure that all acceptance conditions for a transmitted command are satisfied.</li> <li>For details on the acceptance conditions, see the description of each command.</li> <li>Make sure that no unsupported command is sent.</li> </ul>
\$0960	MECHATROLINK communication warning	MECHATROLINK-III communication error was detected for one cycle. - Bad cable or connector contact - Operation error due to noise	<ul> <li>Check connector wiring.</li> <li>Adopt measures against noise.</li> </ul>

Note: 
denotes a detailed code (\$0 to \$0F), detailing the cause of a warning.



When the positioning module is notified of an alarm or warning that has been detected by an external machine, it performs no error handling such as issuing a Decelerate & Stop, Stop Immediately or Servo Off command. Such error handling should be implemented by a user application program as required.



# FA-M3 Positioning Module (with MECHATROLINK-III Interface)

#### IM 34M06H60-03E 1st Edition

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