Applicable Product

- Range-free Multi-controller FA-M3

Model: F3YP14-0N, F3YP18-0N
Name: Positioning Module (with Multi-Channel Pulse Output)

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 or the document model code when purchasing additional copies of this manual.

Document No. : IM 34M6H55-02E
Document Model Code : DOCIM
Important

■ About This Manual

- This Manual should be passed on to the end user.
- Before using the controller, read this manual thoroughly to have a clear understanding of the controller.
- 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.

接地端子。

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

接地端子。

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

交流電流。 Indicates alternating current.

直流電流。 Indicates direct current.
The following symbols are used only in the instruction manual.

⚠️ **WARNING**
Indicates a “Warning”.
Draws attention to information essential to prevent hardware damage, software damage or system failure.

⚠️ **CAUTION**
Indicates a “Caution”
Draws attention to information essential to the understanding of operation and functions.

**TIP**
Indicates a “TIP”
Gives information that complements the present topic.

**SEE ALSO**
Indicates a “SEE ALSO” reference.
Identifies a source to which to refer.

- For the protection and safe use of the product and the system controlled by it, be sure to follow the instructions and precautions on safety stated in this manual whenever handling the product. Take special note that if you handle the product in a manner other than prescribed in these instructions, the protection feature of the product may be damaged or impaired. In such cases, Yokogawa cannot guarantee the quality, performance, function or safety of the product.
- When installing protection and/or safety circuits for this product or the system controlled by it, the user should install them outside this product.
- If component parts or consumables are to be replaced, be sure to use parts specified by the company.
- If you want to use this product in a system which directly affects or threatens human lives and safety — such as nuclear power equipment, devices using radioactivity, railway facilities, aviation facilities and medical equipment, please contact your nearest Yokogawa Electric representative.
- Do not attempt to modify the product.

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General Requirements for Using the FA-M3

- Avoid installing the FA-M3 in the following locations:
  - Where the product 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 product will be exposed to direct mechanical vibration or shock.
  - Where the product 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.

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

- Ground for low impedance:
  - For safety reasons, connect the [FG] grounding terminal to a Japanese Industrial Standards (JIS) Class D Ground*1 (Japanese Industrial Standards (JIS) Class 3 Ground). For compliance to CE Marking, use cables such as twisted cables which can ensure low impedance even at high frequencies for grounding.

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

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

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

- Keep spare parts on hand:
  - Stock up on maintenance parts including spare modules, in advance.
Discharge static electricity before operating the system:
- Because static charge can accumulate in dry conditions, first touch grounded metal to discharge any static electricity before touching the system.

Never use solvents such as paint thinner for cleaning:
- Gently clean the surfaces of the FA-M3 with a soft cloth that has been soaked in water or a neutral detergent and wrung.
- 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 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.
Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC
(This directive is only valid in the EU.)

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

Product Category
With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a “Monitoring and Control instrumentation” product.
Do not dispose in domestic household waste.
When disposing products in the EU, contact your local Yokogawa Europe B. V. office.
Introduction

■ Overview of the Manual

This user’s manual, “Positioning Module with Multi-channel Pulse Output,” explains the specifications and provides information required to operate the positioning modules, F3YP14-0N and F3YP18-0N, with an FA-M3 controller.

■ Other Manuals

Refer to the following manuals.

● For sequence CPU functions:
  - Sequence CPU Modules - Functions (for F3SP21, F3SP25 and F3SP35) (IM 34M6P12-02E)
  - Sequence CPU Modules - Functions (for F3SP28, F3SP38, F3SP53 and F3SP58) (IM 34M6P13-01E)

● For sequence CPU instructions:
  - Sequence CPU Modules - Instructions (IM 34M6P12-03E)

● For commands and responses of the PC Link function:
  - Personal Computer Link Command (IM34M6P41-01E)

● For creating programs using ladders:
  - FA-M3 Programming Tool WideField (IM 34M6Q14-01E)
  - FA-M3 Programming Tool WideField - Application (IM 34M6Q14-02E)

● For the FA-M3 specifications and configurations*1, installation and wiring, test run, maintenance, and module installation limits for the whole system:

  *1: Refer to the relevant product manuals for specifications except for power supply modules, base modules, input/output modules, cables and terminal units.

  - Hardware Manual (IM 34M6C11-01E) version 8 or later
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1. Overview

Models F3YP14-0N and F3YP18-0N are advanced positioning modules (hereinafter referred to as the modules or positioning modules) used to control servo drivers and thereby the speed and position of pulse-driven motors. Driven by commands from the CPU module of the FA-M3 controller, the positioning module generates paths for positioning and outputs positioning command values in the form of pulse trains.

A single module can control different types of motors/drivers. It can control up to 4 (the F3YP14-0N module) or up to 8 (the F3YP18-0N module) pulse-driven motors or servomotors. When in use, the positioning modules are attached to the base module of an FA-M3 controller.

### Features

- Compared to the earlier positioning module, which allows up to 2 controlled axes per slot, this module allows up to 8 controlled axes per slot.
- With a short startup time (0.1 ms maximum), it can come into action quickly and operate in synchronization with peripheral equipment.
- It can output speed reference pulses as fast as 3.998 Mpps for servomotors, or 499.75 kpps for pulse-driven motors.

![Figure 1.1 Operating Principle of Positioning Module (with Multi-channel Pulse Output)](image)

**WARNING**

An external emergency stop circuit should be built in, according to the motor manufacturer’s recommendations, for turning off the power supply and stopping the motor immediately if it operates in an unexpected manner due to machine fault or misoperation.

**CAUTION**

- When controlling a servomotor with the positioning module, choose a position-control servo driver. Speed-control or torque-control servo drivers cannot be used with the positioning module.
- The maximum pulse output rate is 499.75 kpps for pulse-driven motors. If the Maximum Speed Selection parameter is set to 3.998 Mpps for pulse-driven motors, the motor performance cannot be guaranteed.
2 Specifications

2.1 General Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
<th>F3YP14-0N</th>
<th>F3YP18-0N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of controlled axes</td>
<td></td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Number of axes controlled simultaneously</td>
<td></td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Pulse output method</td>
<td>RS-422A compliant differential output</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Either forward/reverse pulse output or direction/travel pulse output selectable for each axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpolation</td>
<td>PTP movement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multi-axis linear interpolation (by CPU module programming)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Command pulse range</td>
<td>-2,147,483,648 to 2,147,483,647 pulses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Command speed</td>
<td>0.1 to 3,998,000 pps (for servomotor)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.1 to 499,750 pps (for pulse-driven motor)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position control</td>
<td>Absolute/relative positioning command</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Target position change during movement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Speed change during movement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceleration/deceleration system</td>
<td>Automatic trapezoidal acceleration/deceleration (starting speed programmable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Automatic S-shape acceleration/deceleration (starting speed fixed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceleration/deceleration time</td>
<td>0 to 32,767 ms (programmable for acceleration and deceleration separately)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Origin position search method</td>
<td>User-definable using a combination of external contact inputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal and automatic origin search operations available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Origin position search speed</td>
<td>User-definable within the command speed range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External contact input</td>
<td>Positive and negative limit inputs, home position input, encoder Z-phase input</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External contact output</td>
<td>Deviation pulse clear signal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data backup</td>
<td>Using flash memory or CPU module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Startup time*</td>
<td>0.09 ms for one axis</td>
<td>0.09 ms for one axis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.25 ms for four axes</td>
<td>0.25 ms for four axes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 ms for eight axes</td>
<td>0.5 ms for eight axes</td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>320 mA</td>
<td>380 mA</td>
<td></td>
</tr>
<tr>
<td>External power supply</td>
<td>5 V DC, 350 mA</td>
<td>5 V DC, 700 mA</td>
<td></td>
</tr>
<tr>
<td>External wiring</td>
<td>One 48-pin connector</td>
<td>Two 48-pin connectors</td>
<td></td>
</tr>
<tr>
<td>External dimensions</td>
<td>28.9 (W) × 100 (H) × 83.2 (D) mm**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>125 g</td>
<td>145 g</td>
<td></td>
</tr>
</tbody>
</table>

* Up to 1 ms delay may be added if another axis is in motion.
** Not including protrusions (see the external dimension diagram for more details).

2.2 Operating Environment

The positioning modules can be used with all models of CPU modules.

2.3 Model and Suffix Codes

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Style Code</th>
<th>Option Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3YP14</td>
<td>-0N</td>
<td>............</td>
<td>.............</td>
<td>4-axis, multi-channel pulse output 3,998,000 pps max. (for servomotor) or 499,750 pps max. (for pulse-driven motor)</td>
</tr>
<tr>
<td>F3YP18</td>
<td>-0N</td>
<td>............</td>
<td>.............</td>
<td>8-axis, multi-channel pulse output 3,998,000 pps max. (for servomotor) or 499,750 pps max. (for pulse-driven motor)</td>
</tr>
</tbody>
</table>
2.4 Components and Functions

RDY indicator: Lit when the internal circuitry is functioning normally.

ERR indicator: Lit when an error occurs. For details, refer to Section 8.2, "Error Codes."

Connector for axes 1 to 4 (48P) Connects to external I/O devices such as servo motors and limit switches.
2.5 External Dimensions

* Diagram shown above is for the F3YP14-0N module
2.6 Terminal Assignments and Connections

Pulse output A: Forward pulse output (in forward/reverse mode), or travel pulse output (in travel pulse/direction mode)
Pulse output B: Reverse pulse output (in forward/reverse mode), or direction output (in travel pulse/direction mode)
Contact input common and the external power supply 5Vin/GND terminals are common to all axes (they are connected through the internal circuitry even between different connectors). Other signals are independent for each axis.

**CAUTION**

Always connect the external power supply (5 V DC) with the correct polarity. The internal circuitry may be damaged otherwise.

For details on the external connection signals, please refer to Chapter 9, "External Interface Signals."

### 2.7 Applicable External Interface Connectors

<table>
<thead>
<tr>
<th>Connection</th>
<th>Applicable Connector</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soldered</td>
<td>FCN-361J048-AU connector, FCN-360C048-B connector cover (Fujitsu Limited)</td>
<td></td>
</tr>
<tr>
<td>Crimp-on</td>
<td>FCN-363J048 housing, FCN-363J-AU contacts, FCN-360C048-B connector cover (Fujitsu Limited)</td>
<td>Purchase the desired connector kit separately.</td>
</tr>
<tr>
<td>Pressure-welded</td>
<td>FCN-367J048-AU/F (Fujitsu Limited)</td>
<td></td>
</tr>
</tbody>
</table>
2.8 Attaching and Detaching Modules

Attaching/Detaching Modules

Figure 2.1 shows how to attach the 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 towards the base module until the yellow button clicks into place.

![Diagram of attaching module](image)

**Figure 2.1 Attaching/Detaching Modules**

**CAUTION**

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

**CAUTION**

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

Detaching Modules

To remove the module from the base module, reverse the above operation: Press the yellow button on the top of the module to unlock it, and tilt the module away from the base module. Then lift the module off the anchor pin at the base.
Attaching Module in Intense Vibration Environments

If the module is used in intense vibration environments, fasten the module with a screw as described in the table below by screwing it into the threaded hole at the top of the module with a Phillips screwdriver.

<table>
<thead>
<tr>
<th>Screws to be used</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4 binder screws, 12-15 mm long</td>
</tr>
<tr>
<td>(or 14-15 mm long for screws with washer)</td>
</tr>
</tbody>
</table>

![Figure 2.2 Fastening the Module with a Screw](image)
3. Function Overview

This chapter explains the major functions of the positioning modules. For details on how to use each function, see Chapter 7. Table 3.1 summarizes the functions discussed in this chapter.

Table 3.1 Major Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positioning operation</td>
<td>Performs normal positioning.</td>
</tr>
<tr>
<td>Jog stepping</td>
<td>Allows a motor to be rotated manually, for example, during position teaching.</td>
</tr>
<tr>
<td>Contact input</td>
<td>Inputs external contact signals such as a limit-switch signal or an origin input signal.</td>
</tr>
<tr>
<td>Z-phase encoder input</td>
<td>Inputs a Z-phase encoder signal during an origin search.</td>
</tr>
<tr>
<td>Normal origin search operation</td>
<td>Searches for the origin using external contact inputs according to commands issued from a program.</td>
</tr>
<tr>
<td>Automatic origin search operation</td>
<td>Automatically searches for the origin using external contact inputs according to the values stored in the entry parameters.</td>
</tr>
<tr>
<td>Deviation pulse clear signal</td>
<td>Outputs a deviation pulse clear signal when an origin position search is completed.</td>
</tr>
<tr>
<td>Linear-interpolated operation</td>
<td>Performs a multi-axial linear-interpolated operation.</td>
</tr>
<tr>
<td>Change in speed during operation</td>
<td>Changes the speed during a positioning operation.</td>
</tr>
<tr>
<td>Change in target position during operation</td>
<td>Changes the target position during a positioning operation.</td>
</tr>
<tr>
<td>Saving of entry parameters</td>
<td>Saves the entry parameters in the flash memory.</td>
</tr>
</tbody>
</table>
3.1 Positioning Operation

To initiate a positioning operation, write the target position, target speed, acceleration time, and deceleration time from the CPU module, set the command code to 0, and change the state of the Execute Command output relay from off to on. When the positioning operation is completed, the End of Positioning input relay turns on. The acceleration/deceleration curve is trapezoidal or of S-shape. The acceleration time and deceleration time can be set independently.

![Figure 3.1 Speed and Acceleration/deceleration Time for Trapezoidal/trigonometric Curves](F030101.VSD)

![Figure 3.2 Comparison Between the Theoretical and Actual Behaviors of a Servomotor in Position Control](F030102.VSD)

![Figure 3.3 Acceleration/Deceleration Times when a Startup Speed Is Given](F030103.VSD)
Figure 3.4 Acceleration/Deceleration Times when Using S-shape Acceleration/Deceleration
3.2 Jog Stepping

To perform jog stepping, first write the target velocity, acceleration time, deceleration time and other required parameters from the CPU module, and then change the state of the Positive-direction Jog Stepping output relay or Negative-direction Jog Stepping output relay from off to on. To stop jog stepping, turn off the corresponding output relay.

During jog stepping, any error in the positive-direction or negative-direction limit value will not be detected (no error occurs). If the operation range of the positioning module is exceeded, however, a pulse overflow error occurs.

The acceleration/deceleration curve can be either trapezoidal or of S-shape, and the acceleration and deceleration times can be set independently.

![Figure 3.5 Jog-stepping Operation (Positive Direction, Trapezoidal Acceleration/deceleration)](F030201.VSD)

![Figure 3.6 Jog-stepping Operation (Positive Direction, S-shape Acceleration/deceleration)](F030202.VSD)
3.3 Contact Inputs

The positioning module has three external contact inputs defined as “Positive-direction limit,” “Negative-direction limit,” and “Origin” for each axis. You can read the state of each contact input using an application program.

You can set the polarity of each contact input separately.

3.4 Z-phase Encoder Input

For improved repeatability in origin searches, you can use a Z-phase encoder input. You can read the state of the encoder input in the same way you read the state of a contact input.

3.5 Origin Search

There are two ways to perform origin search: normal and automatic. In normal origin search, the origin search behavior is arbitrarily defined by an application program; the automatic origin search operation uses entry parameters to define the origin search behavior. In either type of operation, only trapezoidal acceleration or deceleration is available. This section describes the normal origin search operation only.

To start an origin search, write the speed set point, the direction of the origin search, the origin search mode (operation upon detecting external contact inputs), Z-phase edge selection and other required parameters, set the command code to 2 and change the state of the Execute Command output relay from off to on. When the positioning module detects a change in the state of a preset external contact input after the start of the origin-search operation, the module either stops the motor or performs Z-phase detection, depending on the value of the origin search mode.

In Z-phase detection, when the module detects the preset Z-phase pulse count, it immediately stops the motor. The position where the motor stops is defined as the origin (position “0”). At that point, it outputs the deviation pulse clear signal for a period specified in the deviation pulse clear time parameter. If the Z-phase pulse count is set to 0, it does not output the deviation pulse clear signal.

To perform an origin search at two different speeds or to change the operation direction according to the state of an external contact input detected during an origin search, split the origin search process into different phases, varying the parameters for each phase. This strategy allows you to customize your origin-search operation to a desired search pattern.

See the next page for information on the origin search mode.
Details on Origin Search Mode

The origin search mode defines the operation when an edge is detected in each contact input using bit combinations.

One out of four 2-bit combinations can be selected for each rising/falling edge of an external contact input.

Bits 12 to 15 are fixed to 0.

If all bits are 0, the operation shifts to a Z-phase search after the start of the origin search.

<table>
<thead>
<tr>
<th>Bit Combination</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0</td>
<td>Ignore (Stop with error at the rising edge of the limit input in the direction of operation)</td>
</tr>
<tr>
<td>0 1</td>
<td>Shift to Z-phase search</td>
</tr>
<tr>
<td>1 0</td>
<td>Decelerate and stop</td>
</tr>
<tr>
<td>1 1</td>
<td>Stop immediately</td>
</tr>
</tbody>
</table>

![Origin Search Operation Diagram](image)

Figure 3.7 Origin Search Operation
3.6 Automatic Origin Search

There are two ways to perform origin search: normal and automatic. In normal origin search, the origin search behavior is arbitrarily defined by an application program; the automatic origin search operation uses entry parameters to define the origin search behavior. In either type of operation, only trapezoidal acceleration or deceleration is available. This section describes the automatic origin search operation only.

Before initiating the automatic origin search, you must first set the automatic origin search mode and other entry parameters for automatic origin search. To initiate the automatic origin search, set the command code to 8 (Automatic Origin Search command), and change the state of the Execute Command output relay from off to on. A series of origin search movements will be automatically carried out up to Z-phase detection according to the entry parameter settings. In Z-phase detection, when the number of Z-phase pulses as defined in the Automatic Origin Search Z-phase Pulse Count parameter is detected, the axis stops immediately. The stop position is defined as the origin (the value of the origin is defined in the Automatic Origin Search Origin Offset parameter). The deviation pulse clear signal is then output for a period specified in the Automatic Origin Search Deviation Pulse Clear Time parameter. The automatic origin search has two modes: mode 0 and mode 1. Mode 0 uses the origin switch input, whilst mode 1 does not use the origin switch input but uses the positive/negative direction limit switch input instead.

Figure 3.8 illustrates the automatic origin search behaviors initiated at different start positions where the automatic origin search mode is set to 0 (mode 0, using the origin switch), and the automatic origin search direction is set to 0 (negative direction). If the automatic origin search direction is set to 1 (positive direction), exchange the positive direction limit and the negative direction limit as shown in Figure 3.8.

1. At the start of automatic origin search, if the origin switch or the negative direction limit switch is off (not reached), the axis moves at automatic origin search speed 1 in the negative direction. If the origin switch or the negative direction limit switch is on (reached) at the start of automatic origin search, automatic origin search starts with step 3 below.
2. The axis decelerates and stops at the rising edge of the origin or negative direction limit switch.
3. The axis then restarts in the positive direction at automatic origin search speed 2.
4. The axis shifts into the Z-phase detection operation at the falling edge of the origin switch.

If the axis is on the positive direction side of the origin switch at origin search start

![Graph illustrating the automatic origin search behaviors](image-url)
If the axis is right on the origin switch (with the origin switch input on) at origin search start

If the axis is between the origin and the negative limit switch at origin search start

If the axis is right on the negative limit switch at origin search start

Figure 3.8 Automatic Origin Search Behaviors (mode 0, negative direction search)

Figure 3.9 illustrates the automatic origin search behaviors initiated at different start positions where the automatic origin search mode is set to 1 (mode 1, not using the origin switch), and the automatic origin search direction is set to 0 (negative direction). If the automatic origin search direction is set to 1 (positive direction), exchange the positive direction limit and the negative direction limit as shown in Figure 3.9.

1. At the start of automatic origin search, if the negative direction limit switch is off (not reached), the axis moves at automatic origin search speed 1 in the negative direction. If the negative direction limit switch is on (reached) at the start of automatic origin search, automatic origin search starts with step 3 below.
2. The axis decelerates and stops at the rising edge of the negative direction limit switch.
3. The axis then restarts in the positive direction at automatic origin search speed 2.
4. The axis shifts into the Z-phase detection operation at the falling edge of the negative limit switch.
• If the axis is away from the negative limit switch at origin search start

![Diagram showing automatic origin search behaviors in negative direction search]

• If the axis is right on the negative limit switch at origin search start

![Diagram showing automatic origin search behaviors in negative direction search]

Figure 3.9 Automatic Origin Search Behaviors (mode 1, negative direction search)
3.7 Deviation Pulse Clear Signal Output

In an origin search using a servo driver, this outputs a deviation pulse clear signal at the end of the origin search to the servo driver. The deviation pulse clear signal is connected to the input of the servo driver.

The length of the deviation pulse clear signal output is defined in a parameter. When the Z-phase pulse count is set to 0, no deviation pulse clear signal is generated.

![Diagram of Deviation Pulse Clear Signal Output](image)

Figure 3.10 Deviation Pulse Clear Signal Output
3.8 Linear-Interpolated Operation

To perform a linear-interpolated operation, write the target speed, target position, acceleration time, deceleration time and other necessary parameters for each axis from the CPU module, set the command code to "0", and change the state of the Execute Command output relay from off to on for all axes simultaneously. When the positioning operation for each axis is completed, the input relay End-of-Positioning input relay for each axis turns on.

In this operation, set the same acceleration and deceleration times to all axes concerned. Set the startup speed for all axes to 0 and then calculate and set the ratio between the target speeds of the two axes so that it equals the ratio between the travels of the two axes.

Figure 3.11 Multi-axial Linear-interpolated Operation (Example of Biaxial Operation)
3.9 Changing Speed during Operation

To change the speed of an axis currently moving in a positioning or jog stepping operation, write a new target speed and acceleration/deceleration time, set the command code to 6 (Change Speed command), and change the state of the Execute Command output relay from off to on.

The following restrictions apply to changing the speed during positioning or jog stepping. If the Change Speed command issued during acceleration, deceleration or a change in speed is such as to prevent the axis from stopping at the target position, the command is ignored, the Execute Command ACK input relay is not set, and an alarm is raised. The alarm status is automatically cleared when the state of the Execute Command output relay is changed from on to off.

If a Change Speed command is issued during a jog stepping operation, the module waits until all acceleration and deceleration has been completed before executing the command. If a new Change Speed command is issued during the wait, the previous command is discarded and only the new command is executed.

![Figure 3.12 Behavior When the Speed is Changed](image-url)
3.10 Changing Target Position during Positioning

To change the target position during positioning, write a new target position, set the command code to 7 (Change Target Position command), and change the state of the Execute Command output relay from off to on. A new target position issued during positioning may require a reversal of the direction of a moving axis. In this case, the axis immediately decelerates and stops, and then accelerates in the other direction toward the new target position.

If a Change Target Position command is issued in the End-of-Positioning status, the command is executed just as the Start Positioning command.

The following restrictions apply to the change in target position during positioning.

If a Change Target Position command is issued during acceleration/deceleration or a change in speed, the execution of the command is suspended until the start of the constant-speed operation or until the axis stops. During the execution of the Change Target Position command, only the Decelerate-and-Stop and Stop Immediately commands are available. The extended status indicates whether the Change Target Position command is in execution. If an invalid command is issued when the Change Target Position command is being executed, an alarm is raised. The alarm is automatically cleared when the state of the Execute Command output relay is changed from on to off. The Change Target Position command does not allow a change in the target speed, acceleration or deceleration.

Figure 3.13  Behavior When the Target Position is Changed
3.11 Saving Entry Parameters

When all axes are at rest, you can save entry parameters in the flash memory. Entry parameters must be set for all axes with the Set Parameter command before you can save the parameters in the flash memory. You can issue the Save Parameter command for a particular axis. When you do so, however, the entry parameters of all axes are saved in the flash memory.

To save entry parameters in the flash memory, set the command code to 9 (Save Parameter command), and change the state of the Execute Command output relay from off to on.

At power up or system reset, the content of the flash memory is automatically reloaded to the entry parameters.

To initialize the content of the flash memory to the factory defaults, set the command code to 99 (Initialize Flash Memory command), and change the state of the Execute Command output relay from off to on. At this time, the entry parameters will also be initialized to the factory defaults.

---

**CAUTION**

- If the power to the positioning module is cut off during the execution of the Save Parameter command, the content of the entry parameters being saved will be lost.
- As there is a limit to the number of times data can be written to the flash memory (100,000 times max.), you should save entry parameters to the flash memory only when required.
4. Parameters

4.1 Parameters

Of the parameters given Tables 4.2 and 4.3, those listed with two data position numbers are 2 word data. The smaller data position number contains the low-order word, and the larger data position number contains the high-order word.

Data position numbers are three-digit numbers; the leading * symbol represents the value (axis number - 1), ranging from 0 for axis 1 to 7 for axis 8.

Each data position numbers corresponds to a word. Use only READ and WRITE instructions on a word-basis when accessing from a sequence program. Using long-word-based instructions may cause unexpected results. You should also use word-based instructions when accessing from BASIC programs.

- Fixed-point data

Speed-related data whose unit is [(1/65536) pulses/ms] are fixed point data with 1-word for the integer part (16 bits) and 1-word for the fractional part (16 bits). Again, the smaller data position number contains the low-order word, and the larger data position number contains the high-order word.

Bits for the integer part of the binary data designate the values for 1, 2, 4 ... whilst bits for the fractional part designate the values for 1/2, 1/4, 1/8, etc. If the integer and the fractional parts consist of 16 bits each, the least significant bit in the fractional part represents 1/65536, which means that the data is 32-bit (long-word) with a unit of 1/65536. Negative numbers are expressed as complements of 2, like regular binary data.

**Table 4.1**

<table>
<thead>
<tr>
<th>Bit</th>
<th>31(MSB)</th>
<th>30</th>
<th>···</th>
<th>17</th>
<th>16</th>
<th>15</th>
<th>14</th>
<th>···</th>
<th>1</th>
<th>0(LSB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>Sign bit</td>
<td>16364</td>
<td>···</td>
<td>2</td>
<td>1</td>
<td>1/2</td>
<td>1/4</td>
<td>···</td>
<td>1/32768</td>
<td>1/65536</td>
</tr>
</tbody>
</table>

--- Example of fixed point data ---

When setting speed data of 123.45 [pulse/ms] (=123450 [pulses/s]),

\[
123.45 \times 65536 = 8090419.2 \text{ [pulses/ms]}
\]

Thus, we should set 8090419 as long-word data. The high-order word of this data is 123 because

\[
8090419 \div 65536 = 123.
\]

The low-order word is the remainder, i.e., 29491.

- Sample program for converting speed data

Here, we show a sample sequence program for converting speed data in [pulses/s] into setting data for the positioning module with unit [(1/65536) pulses/ms].

Let D0001 (long-word data) be the original data ([pulses/s]).

1) Divide D0001 by 1000 (long-word division) and store the result in D0011. In this case, since the maximum value of D0001 is 3998000 (3.998 Mpps) and it is positive, the maximum value of the result is 3998 and the high-order word (D0012) is always 0. The low-order word of the result of the division (D0011) will become the high-order word (the integer which is 16 bits long) of the value ([(1/65536) pulses/ms]) to be set in the positioning module.
Store the remainder in D0013 (the low-order word) and D0014 (the high-order word). Since the divisor is 1000, the maximum value of the remainder is 999 and the high-order word of the remainder (D0014) is always 0.

\[
\begin{array}{c|c|c|c}
D00014 & \text{Remainder} & 0 & \text{High-order setting data} \\
\hline
0 & & & \\
\end{array}
\]

(2) Multiply the remainder by 65536 and divide it again by 1000. A useful tip: the remainder is in D0013 and D0012 is always 0; thus, if we treat D0012 as a long-word data (high-order word in D0012 and low-order word in D0013), its value is already the result of multiplying the remainder by 65536. Therefore, in order to multiplying the remainder by 65536 and then divide it again by 1000, we only need to divide D0012 by 1000 (long-word division). Store the result of this division into D0021.

D0012 (long word) has a maximum value of \(999 \times 65536\); dividing by 1000 gives 65470 maximum so the high-order word (D0022) is always 0. Thus, D0021 is the low-order word (16-bit fractional part) of the data \([(1/65536)\text{ pulses/ms}]\) to be set in the positioning module and the remainder is discarded.

\[
\begin{array}{c|c|c|c}
D00024 & D00023 & D00022 & D00021 \\
\hline
0 & \text{Remainder} & 0 & \text{Low-order setting data} \\
\end{array}
\]

(3) Combine the contents of D0011 and D0021 into long-word data \([(1/65536)\text{ pulses/ms}]\). To do this, you need to perform long-word division twice and transfer the resulting high-order and low-order words to D0032 and D0031, respectively. D0011-D0014 and D0021-D0024 are work areas.

\[
\begin{array}{c}
\text{MOV } D00011 \text{ D00032} \\
\text{MOV } D00021 \text{ D00031} \\
\end{array}
\]

\[
\begin{array}{c|c|c}
D00032 & D00031 \\
\hline
\text{High-order setting data} & \text{Low-order setting data} \\
\end{array}
\]

- In the case of 123450 [pulse/s]
- In the case of 123450 [pulse/s]

(1) \( D0011 = \frac{123450}{1000} \) (long-word division)

<table>
<thead>
<tr>
<th>D00014</th>
<th>D00013</th>
<th>D00012</th>
<th>D00011</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>450</td>
<td>0</td>
<td>123</td>
</tr>
</tbody>
</table>

\( 29491200 = (450 \times 65536) \)

(2) \( D0021 = \frac{29491200}{1000} \) (long-word division)

<table>
<thead>
<tr>
<th>D00024</th>
<th>D00023</th>
<th>D00022</th>
<th>D00021</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>200</td>
<td>0</td>
<td>29491</td>
</tr>
</tbody>
</table>

From the results, the high-order word of the long-word data (\([(1/65536)\) pulses/ms]) to be set in the positioning module is 123, and the low-order word is 29491.
4.1.1 Entry Parameters

At power up or system reset, the content of the flash memory is automatically reloaded to the entry parameters. To change the settings of the entry parameters, write new parameter settings from the CPU module, and execute the Set Parameter command.

Table 4.2 Entry parameters

<table>
<thead>
<tr>
<th>Data Position</th>
<th>Parameter</th>
<th>Range of values</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;01&quot;</td>
<td>Maximum Speed Selection</td>
<td>0: 499,750 [pps], 1: 3,998,000 [pps]</td>
</tr>
<tr>
<td>&quot;02&quot;</td>
<td>Pulse Output Mode</td>
<td>0: Forward/reverse pulse output, 1: Travel pulse/direction output</td>
</tr>
<tr>
<td>&quot;03&quot;</td>
<td>Direction of Rotation</td>
<td>0: Positive data indicates forward pulse output, 1: Negative data indicates forward pulse output.</td>
</tr>
<tr>
<td>&quot;04&quot;</td>
<td>Contact Input Polarity</td>
<td>0 to 7</td>
</tr>
<tr>
<td>&quot;05&quot;/&quot;06&quot;</td>
<td>Positive-direction Limit</td>
<td>-2147483648 to 2147483647 [pulses]</td>
</tr>
<tr>
<td>&quot;07&quot;/&quot;08&quot;</td>
<td>Negative-direction Limit</td>
<td>-2147483648 to (positive-direction limit value - 1) [pulses]</td>
</tr>
<tr>
<td>&quot;09&quot;/&quot;10&quot;</td>
<td>Speed Limit</td>
<td>1 to 32751616 [((1/65536) pulse/ms] if maximum speed selection is 0</td>
</tr>
<tr>
<td>&quot;11&quot;</td>
<td>Automatic Origin Search Mode</td>
<td>0: Use origin input, 1: Do not use origin input</td>
</tr>
<tr>
<td>&quot;12&quot;</td>
<td>Automatic Origin Search Direction</td>
<td>0: Negative direction, 1: Positive direction</td>
</tr>
<tr>
<td>&quot;13&quot;/&quot;14&quot;</td>
<td>Automatic Origin Search Speed 1</td>
<td>1 to speed limit value</td>
</tr>
<tr>
<td>&quot;15&quot;/&quot;16&quot;</td>
<td>Automatic Origin Search Speed 2</td>
<td>1 to automatic origin search speed 1</td>
</tr>
<tr>
<td>&quot;17&quot;/&quot;18&quot;</td>
<td>Automatic Origin Search Starting Speed</td>
<td>0 to automatic origin search speed 2</td>
</tr>
<tr>
<td>&quot;19&quot;</td>
<td>Automatic Origin Search Acceleration Time</td>
<td>0 to 32767 [ms]</td>
</tr>
<tr>
<td>&quot;20&quot;</td>
<td>Automatic Origin Search deceleration Time</td>
<td>0 to 32767 [ms]</td>
</tr>
<tr>
<td>&quot;21&quot;</td>
<td>Automatic Origin Search Z-phase Edge Selection</td>
<td>0: Rising edge, 1: Falling edge</td>
</tr>
<tr>
<td>&quot;22&quot;</td>
<td>Automatic Origin Search Z-phase Search Count</td>
<td>0 to 32767 [times]</td>
</tr>
<tr>
<td>&quot;23&quot;/&quot;24&quot;</td>
<td>Automatic Origin Search Z-phase Search Range</td>
<td>0 to 2147483647/automatic origin search Z-phase pulse count [pulses]</td>
</tr>
<tr>
<td>&quot;25&quot;</td>
<td>Automatic Origin Search Deviation Pulse Clear Time</td>
<td>0 to 32767 [ms]</td>
</tr>
<tr>
<td>&quot;26&quot;/&quot;27&quot;</td>
<td>Automatic Origin Search Origin Offset Value</td>
<td>-2147483648 to 2147483647 [pulses]</td>
</tr>
</tbody>
</table>

The symbol "" designates the value of (axis number - 1). The values for axis 1 to axis 8 are 0 to 7 respectively.
### 4.1.2 Command Parameters

These are parameters to be set when executing a command. It is necessary to write all the required parameters when executing a command.

<table>
<thead>
<tr>
<th>Data Position</th>
<th>Parameter</th>
<th>Range of values</th>
</tr>
</thead>
<tbody>
<tr>
<td>*41</td>
<td>Command Code</td>
<td>0 to 9, and 99</td>
</tr>
<tr>
<td>*42</td>
<td>Target Position Mode</td>
<td>0: Absolute position, 1: Relative position</td>
</tr>
<tr>
<td>*43/*44</td>
<td>Target Position</td>
<td>Negative-direction limit value to positive-direction limit value [pulses]</td>
</tr>
<tr>
<td>*45</td>
<td>Acceleration/deceleration Mode</td>
<td>0: Trapezoidal curve (with programmable startup speed), 1: S-shape curve</td>
</tr>
<tr>
<td>*46/*47</td>
<td>Target Speed</td>
<td>1 to speed limit [(1/65536) pulses/ms]</td>
</tr>
<tr>
<td>*48</td>
<td>Acceleration Time</td>
<td>0 to 32767 [ms]</td>
</tr>
<tr>
<td>*49</td>
<td>Deceleration Time</td>
<td>0 to 32767 [ms]</td>
</tr>
<tr>
<td>*50/*51</td>
<td>Startup Speed</td>
<td>0 to target speed [(1/65536) pulses/ms] (valid only for trapezoidal acceleration/deceleration)</td>
</tr>
<tr>
<td>*52</td>
<td>Origin Search Mode</td>
<td>0 to 4095</td>
</tr>
<tr>
<td>*53</td>
<td>Origin Search Direction</td>
<td>0: Negative direction, 1: Positive direction</td>
</tr>
<tr>
<td>*54</td>
<td>Z-phase Edge Selection</td>
<td>0: Rising edge, 1: Falling edge</td>
</tr>
<tr>
<td>*55</td>
<td>Z-phase Search Count</td>
<td>0 to 32767 [times]</td>
</tr>
<tr>
<td>*56/*57</td>
<td>Z-phase Search Range</td>
<td>0 to 2147483647/Z-phase search count [pulses]</td>
</tr>
<tr>
<td>*58</td>
<td>Deviation Pulse Clear Time</td>
<td>0 to 32767 [ms]</td>
</tr>
</tbody>
</table>

The symbol "*" designates the value of (axis number - 1). The values for axis 1 to axis 8 are 0 to 7 respectively.
4.2 Required Parameters for Each Command

You must write all the required parameters before executing a command for the positioning module from the CPU module. Table 4.4 shows the required parameters for each command.

The Set Parameter command and the Save Parameter command that respectively updates and saves all the entry parameters are not shown in the table.

<table>
<thead>
<tr>
<th>Data Position Number</th>
<th>Parameter</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Start Positioning</td>
</tr>
<tr>
<td>*41</td>
<td>Command code</td>
<td>◎ ◎ -</td>
</tr>
<tr>
<td>*42</td>
<td>Target position mode</td>
<td>◎ - -</td>
</tr>
<tr>
<td>*43/44</td>
<td>Target position</td>
<td>◎ - -</td>
</tr>
<tr>
<td>*45</td>
<td>Acceleration/deceleration mode</td>
<td>◎ -</td>
</tr>
<tr>
<td>*46/*47</td>
<td>Target speed</td>
<td>◎ ◎ ◎ -</td>
</tr>
<tr>
<td>*48</td>
<td>Acceleration time</td>
<td>◎ ◎ ◎ -</td>
</tr>
<tr>
<td>*49</td>
<td>Deceleration time</td>
<td>◎ ◎ ◎ -</td>
</tr>
<tr>
<td>*50/*51</td>
<td>Starting speed</td>
<td>◎ ◎ ◎</td>
</tr>
<tr>
<td>*52</td>
<td>Origin search mode</td>
<td>◎</td>
</tr>
<tr>
<td>*53</td>
<td>Origin search direction</td>
<td>-</td>
</tr>
<tr>
<td>*54</td>
<td>Z- phase edge selection</td>
<td>-</td>
</tr>
<tr>
<td>*55</td>
<td>Z- phase search count</td>
<td>-</td>
</tr>
<tr>
<td>*56/*57</td>
<td>Z- phase search range</td>
<td>-</td>
</tr>
<tr>
<td>*58</td>
<td>Deviation pulse clear time</td>
<td>-</td>
</tr>
</tbody>
</table>

The symbol ‘*’ designates the value of (axis number - 1). The values for axis 1 to axis 8 are 0 to 7 respectively.

◎: Mandatory parameters.
○: Parameters that are mandatory or optional depending on the values of other parameters.
△: Mandatory if the command is to be executed in the End of Positioning Status.
-: Not used (have no effect on the operation of the commands if used).
4.3 Description of Parameters

4.3.1 Entry parameters

At power up, the content of the flash memory is automatically reloaded to the entry parameters. Modify the values of the entry parameters as necessary using the Set Parameter command in an application program. If a parameter value is invalid, the Error Notification input relay is set, and an entry parameter setting error results. When this happens, all commands other than the Set Parameter command are disabled. Execute the Set Parameter command again with valid values. To save the values of the entry parameters in flash memory, use the Save Parameter command.

Table 4.5 Entry Parameters

<table>
<thead>
<tr>
<th>Parameter Type (Data Position Number)</th>
<th>Description</th>
<th>Data Range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Speed Selection (*01)</td>
<td>Sets the maximum speed of output pulses.</td>
<td>0: 499,750 [pps] 1: 3,998,000 [pps] [Default: 0]</td>
<td>Set to 0 for pulse motors or 1 for servomotors. If 1 is selected for pulse motors, the performance is not guaranteed. If the maximum speed of a servomotor used is not more than 499,750 pps, select 0.</td>
</tr>
<tr>
<td>Pulse Output Mode (*02)</td>
<td>Sets the pulse output mode.</td>
<td>0: Forward/reverse pulse output 1: Direction/travel pulse output [Default: 0]</td>
<td></td>
</tr>
<tr>
<td>Direction of Rotation (*03)</td>
<td>Sets the relationship between positive/negative position data from the CPU module and the forward/reverse pulse output.</td>
<td>0: Positive value indicates forward pulse output. 1: Negative value indicates forward pulse output. [Default: 0]</td>
<td>Position and negative data here refers to positioning parameter values set by a program from the CPU module.</td>
</tr>
<tr>
<td>Contact Input Polarity (*04)</td>
<td>Defines the logic of the external contact inputs.</td>
<td>Specified for each contact input as a bit. &quot;0&quot; indicates an &quot;a&quot; contact, and &quot;1&quot; indicates a &quot;b&quot; contact. Bit 0: Negative-direction limit input Bit 1: Positive-direction limit input Bit 2: Origin position input [Default: 0]</td>
<td>An &quot;a&quot; contact input is an input which is true when a signal input exists, and a &quot;b&quot; contact input is an input which is true when no signal input exists. For example, a &quot;b&quot; contact limit input is detected when there is no limit signal and false when there is a limit signal.</td>
</tr>
<tr>
<td>Positive-direction Limit (*05/*06)</td>
<td>Sets the operation limit position in the positive direction as the number of pulses from the origin.</td>
<td>-2147483648 to 2147483647 [pulses] [Default: 2147483647]</td>
<td>If the origin search is not used, the current position at power up is used as the origin. If you start the system after setting a target position beyond this range, an error results and the motor does not start. During an origin search or jog stepping operation, these limit values are disregarded (no error occurs).</td>
</tr>
<tr>
<td>Negative-direction Limit (*07/*08)</td>
<td>Sets the operation limit position in the negative direction as the number of pulses from the origin.</td>
<td>-2147483648 to (positive-direction limit value – 1) [pulses] [Default: -2147483648]</td>
<td></td>
</tr>
<tr>
<td>Speed Limit (*09/*10)</td>
<td>Sets the speed setting range.</td>
<td>1 to 32751616 [(1/65536) pulse/ms] if maximum speed selection is 0 1 to 262012928 [(1/65536) pulse/ms] if maximum speed selection is 1 [Default: 32751616 (= 499750 pps)]</td>
<td>If a command is given with the target speed beyond this value, an error occurs.</td>
</tr>
</tbody>
</table>

The symbol "*" designates the value of (axis number - 1). The values for axis 1 to axis 8 are 0 to 7 respectively.

(Continued on the next page)
<table>
<thead>
<tr>
<th>Parameter Type</th>
<th>Description</th>
<th>Data Range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Origin Search Mode (*11)</td>
<td>Specifies whether the origin input is used for automatic origin search.</td>
<td>0: Origin input is used. 1: Origin input is not used. [Default: 0]</td>
<td>For details, refer to Section 3.5, &quot;Origin Search.&quot;</td>
</tr>
<tr>
<td>Automatic Origin Search Direction (*12)</td>
<td>Sets the direction of movement for speed 1 during automatic origin search.</td>
<td>0: Negative direction 1: Positive direction [Default: 0]</td>
<td></td>
</tr>
<tr>
<td>Automatic Origin Search Speed 1 (*13)</td>
<td>Sets the high search speed for automatic origin search.</td>
<td>1 to speed limit value [Default: 655360 (10000 pps)]</td>
<td></td>
</tr>
<tr>
<td>Automatic Origin Search Speed 2 (*14)</td>
<td>Sets the low search speed for automatic origin search.</td>
<td>1 to automatic origin search speed 1 [Default: 65536 (1000 pps)]</td>
<td></td>
</tr>
<tr>
<td>Automatic Origin Search Starting Speed (*15)</td>
<td>This is the starting speed at the beginning of, and the speed just before stopping at the end of, automatic origin search.</td>
<td>0 to automatic origin search speed 2 [Default: 0]</td>
<td>When the positioning module is used to control a pulse motor, if this speed is set to 0, the motor could resonate and get out of phase in the early stage of acceleration (or in the late stage of deceleration). Thus this speed should be set above the resonance frequency. Also, if this speed is set too high, the motor undergoes mechanical shock and could get out of phase at starting or stopping. When the positioning module is used to control a servomotor, this speed is normally set to 0.</td>
</tr>
<tr>
<td>Automatic Origin Search Acceleration Time (*)</td>
<td>Sets the time it takes to reach search speed 1 from the starting speed during automatic origin search.</td>
<td>0 to 32767 [ms] [Default: 1000]</td>
<td>The acceleration to search speed 2 during automatic origin search is done at the same acceleration rate as for the acceleration to search speed 1.</td>
</tr>
<tr>
<td>Automatic Origin Search Deceleration Time (*)</td>
<td>Sets the time it takes to decelerate from search speed 1 to a halt during automatic origin search.</td>
<td>0 to 32767 [ms] [Default: 1000]</td>
<td>The deceleration from search speed 2 during automatic origin search is done at the same deceleration rate as for the deceleration from search speed 1.</td>
</tr>
<tr>
<td>Automatic Origin Search Z-phase Edge Selection (*21)</td>
<td>Specifies whether to use the rising edge or the falling edge of a Z-phase pulse for Z-phase detection during an automatic origin search.</td>
<td>0: Rising edge 1: Falling edge [Default: 0]</td>
<td></td>
</tr>
<tr>
<td>Automatic Origin Search Z-phase Pulse Count (*)</td>
<td>Specifies how many Z-phase pulses must be detected before an origin can be found during automatic origin search.</td>
<td>0 to 32767 [pulses] [Default: 0]</td>
<td></td>
</tr>
<tr>
<td>Automatic Origin Search Z-phase Search Range (*)</td>
<td>An error occurs if a Z-phase cannot be detected within this pulse count range during automatic origin search.</td>
<td>0 to 2147483647/automatic origin search Z-phase pulse count [pulses] [Default: 2147483647]</td>
<td>This parameter is used to prevent continued operation when no Z-phase can be detected because of a disconnected Z-phase signal line, etc. This value is usually set close to the period of the Z-phase.</td>
</tr>
<tr>
<td>Automatic Origin Search Deviation Pulse clear Time (*)</td>
<td>Sets the length of time to output the deviation pulse clear signal when a Z-phase (origin) is detected in automatic origin search.</td>
<td>0 to 32767 [ms] [Default: 1000]</td>
<td></td>
</tr>
<tr>
<td>Automatic Origin Search Origin Offset (*)</td>
<td>Sets the desired actual origin position when automatic origin search is completed.</td>
<td>-2147483648 to 2147483647 [pulses] [Default: 0]</td>
<td>You can use this value to adjust the position of the origin as detected in automatic origin search if there is a difference (offset) in position between the detected origin and the physical origin.</td>
</tr>
</tbody>
</table>

The symbol "*" designates the value of (axis number - 1). The values for axis 1 to axis 8 are 0 to 7 respectively.
### 4.3.2 Command Parameters

#### Table 4.6 Command Parameters

<table>
<thead>
<tr>
<th>Parameter Type (Data Position Number)</th>
<th>Description</th>
<th>Data Range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command Code (*41)</td>
<td>Sets the command type for command execution using the Execute Command relay.</td>
<td>0: Start Positioning command 1: Decelerate-and-Stop command 2: Normal Origin Search command 3: Set Parameter command 4: Set Current Position command 5: Reset Error command 6: Change Speed command 7: Change Target Position command 8: Automatic Origin Search command 9: Save Parameter command 99: Initialize Flash Memory command</td>
<td></td>
</tr>
<tr>
<td>Target Position Mode (*42)</td>
<td>Sets the type of target position.</td>
<td>0: Absolute position 1: Relative position</td>
<td>In the absolute position mode, a target position is expressed as an absolute coordinate value independent of the current position of the axis. In the relative position mode, a target position is expressed as an offset from the current position of the axis (if the axis is at rest) or the last target position setting of the axis (if the target position has been changed during operation).</td>
</tr>
<tr>
<td>Target Position (*43/*44)</td>
<td>Sets the target position for a positioning operation, or the current position.</td>
<td>Negative-direction limit value to positive-direction limit value [pulses]</td>
<td></td>
</tr>
<tr>
<td>Acceleration /deceleration Mode (*45)</td>
<td>Selects the acceleration/deceleration pattern.</td>
<td>0: Trapezoidal curve (with programmable startup speed) 1: S-shape curve</td>
<td></td>
</tr>
<tr>
<td>Target Speed (*46/*47)</td>
<td>Sets the operation speed in position control, origin position search and jog stepping.</td>
<td>1 to speed limit ([1/65536]) pulses/ms</td>
<td>If the value of the target speed specified is smaller than the startup speed, an error occurs.</td>
</tr>
<tr>
<td>Acceleration Time (*48)</td>
<td>Sets the time to reach the target speed from the startup speed.</td>
<td>0 to 32767 [ms]</td>
<td></td>
</tr>
<tr>
<td>Deceleration Time (*49)</td>
<td>Sets the time to decelerate and stop from the target speed.</td>
<td>0 to 32767 [ms]</td>
<td></td>
</tr>
<tr>
<td>Startup Speed (*50/*51)</td>
<td>This is the starting speed at the beginning of the positioning operation and the speed just before stopping at the end of positioning.</td>
<td>0 to target speed ([1/65536]) pulses/ms</td>
<td>When using a pulse-driven motor and accelerating from zero speed, resonance may occur causing the motor to be out of phase at low speeds during acceleration. (The situation is the same for deceleration). Set to a speed faster than the resonance frequency to avoid this. However, you should take note that too large a setting may cause the motor to be out of phase at startup or stopping due to shock. When using a servomotor, the startup speed is normally set to “0.”</td>
</tr>
</tbody>
</table>

The symbol “*” designates the value of (axis number - 1). The values for axis 1 to axis 8 are 0 to 7 respectively.
### Parameter Type (Data Position Number) | Description | Data Range | Remarks
---|---|---|---
Origin Search Mode (*52) | Defines, using bit patterns, the behavior of the motor when the edges of each contact input is detected during an origin search. | 0 to 4095 | For details, see Section 3.5, “Origin-search Operation.”
Origin Search Direction (*53) | Sets the motor rotation direction during an origin search. | 0: Negative direction 1: Positive direction |
Z-phase Edge Selection (*54) | Defines the Z-phase edge direction for Z-phase detection during an origin search. | 0: Rising edge 1: Falling edge |
Z-phase Search Count (*55) | Sets the number of Z-phase pulses to be counted during origin search before an origin can be established. | 0 to 32767 [times] |
Z-phase Search Range (*56=*57) | An error occurs if a Z-phase cannot be detected even after the search exceeds the Z-phase search range. | 0 to 2147483647/Z-phase search count [pulses] | This parameter is used to prevent continued operation when a Z-phase cannot be detected because of a Z-phase signal disconnection, etc. Usually, this is set to a value close to the period of the Z-phase. |
Deviation Pulse Clear Time (*58) | Sets the output time of the deviation pulse clear signal when the origin search ends after Z-phase detection. | 0 to 32767 [ms] |
4.4 Example for Setting Entry Parameters

The following example shows a minimal set of entry parameters, which must be defined for controlling a motor using the positioning module. The underlined values are to be entered.

- **The motor used**
  
  Rated rotating speed: 3000 rpm  
  Encoder pulse count: 8000 pulses per rotation

---

- **CAUTION**

  Sometimes, you may need to set or change the command pulse/encoder pulse ratio on the servo driver side; under such circumstances, always ensure that the parameters set in the positioning module matches the setting of the servo driver. Always calculate the values of the entry parameters after confirming the setting of the servo driver.

---

- **Mechanism**

  Direct shaft drive using a ball screw  
  Ball screw pitch: 5 mm/rot  
  Operation Range: -500 mm to +1000 mm  
  Maximum speed: 12000 mm/min [200 mm/s]  
  Contact Inputs: Positive/Negative-direction limit input (“b” contact), origin (“a” contact)

---

- **Calculation of entry parameters**

  - **Maximum speed selection (**01**)**
    
    Set to 0 as the motor used is a servomotor rated at below 499,750 pps.

  - **Pulse output mode (**02**)**
    
    Set to 0 to use forward/reverse pulse output.

  - **Rotating direction (**03**)**
    
    Set to 0 so that positive data indicates forward pulse output.

  - **Contact input polarity (**04**)**
    
    Positive-direction limit value (b), Negative-direction limit input (b), Origin (a) $00003$

  - **Positive-direction limit value (**05/**06)**
    
    $1000 \text{ [mm]} \div 5 \text{ [mm/rot]} \times 8000 \text{ [pulses/rot]} = 1600000 \text{ [pulses]}$

  - **Negative-direction limit value (**07/**08)**
    
    $-500 \text{ [mm]} \div 5 \text{ [mm/rot]} \times 8000 \text{ [pulses/rot]} = -800000 \text{ [pulses]}$
– **Speed limit (*09/*10)**

The maximum pulse output speed allowed by the motor is:

\[
3000 \text{ [rpm]} \div 60 [\text{s/min}] \times 8000 [\text{pulse/rot}] = 400000 [\text{pulse/s}].
\]

The maximum pulse output speed allowed by the ball screw is:

\[
200 [\text{mm/s}] \div 5 [\text{mm/rot}] \times 8000 [\text{pulse/rot}] = 320000 [\text{pulse/s}].
\]

Thus, the maximum pulse output speed for this system is 320000 [pulse/s]. Therefore, the speed limit setting is:

\[
320000 [\text{pulse/s}] \div 1000 \times 65536 = 20971520 \text{ [(1/65536) pulses/ms]}
\]

– **Automatic origin search mode (**11**)

Set to 0 to use the origin input.

– **Automatic origin search direction (**12**)

Set to 0 to move the axis in the negative direction to search for the origin.

– **Automatic origin search speed 1 (**13/**14**)

Assume that the origin search speed 1 is 50 [mm/s].

\[
50 [\text{mms}] \div 5 [\text{mm/rot}] \times 8000 [\text{pulse/rot}] = 80000 [\text{pulse/s}]
\]

\[
80000 [\text{pulse/s}] \div 1000 \times 65536 = 5242880 \text{ [(1/65536) pulses/ms]}
\]

– **Automatic origin search speed 2 (**15/**16**)

Suppose that the origin search speed 2 is 2 [mm/s].

\[
2 [\text{mms}] \div 5 [\text{mm/rot}] \times 8000 [\text{pulse/rot}] = 3200 [\text{pulse/s}]
\]

\[
3200 [\text{pulse/s}] \div 1000 \times 65536 = 209715 \text{ [(1/65536) pulses/ms]}
\]

– **Automatic origin search starting speed (**17/**18**)

Set to 0 [(1/65536) pulses/ms] as the motor used is a servomotor.

– **Automatic origin search acceleration time (**19**)

Set to 500 [ms].

– **Automatic origin search deceleration time (**20**)

Set to 500 [ms].

– **Automatic origin search Z-phase edge selection (**21**)

Set to 0 to use the rising edge.

– **Automatic origin search Z-phase pulse count (**22**)

Set to 1 [time] so that the position where the first Z-phase pulse is detected is considered the origin.

– **Automatic origin search Z-phase search range (**23/**24**)

Set to 8000 [pulse] as the encoder outputs 8000 pulses per rotation.

– **Automatic origin search deviation pulse clear time (**25**)

Set to 1000 [ms] to output the deviation pulse clear signal for 1 second.

– **Automatic origin search origin offset (**26/**27**)

Set to 0 [pulse].
5. Status

Status refers to data which the CPU module reads from the positioning module. You can check the state of the positioning module using the status and input relays.

⚠️ CAUTION

When the CPU module reads 2-word 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 period of the positioning module.

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

When reading from a BASIC CPU, concurrency is not assured because the time required to read 2-word data is longer than the data update period of the positioning module.
5.1 List of Status

In Table 5.1, status listed with 2 data position numbers are 2-word data. The smaller number data position number contains the low-order word, and the larger data position number contains the high-order word.

The data position number consists of three digits; the leading ‘*’ is the value of (axis number - 1). Replace ‘*’ with values 0 to 7 for axes 1 to 8 respectively.

Each data position number corresponds to a word. Always use the word-based READ instruction to access from a sequence program; using a long-word-based instruction may cause unexpected results.

Always use word instructions when accessing from a BASIC program.

- **Fixed-decimal point data**

  Speed-related data with unit [(1/65536) pulses/ms] is fixed-point data with 1 word (16 bits) for the integer part and 1 word (16 bits) for the fractional part. The smaller data position number contains the low-order word, and the larger data position number contains the high-order word. For more information on fixed-point data, see the description of fixed point data in Section 4.1, “Parameters.”

- **Speed data conversion program**

  To convert data in [(1/65536) pulses/ms] units into data in [pulses/sec] units, multiply the data by 1000 using a long word operation, ignore the lowest-order word and the highest-order word and use the second and the third words as long word data.

  Let D0001 be long word data in [(1/65536) pulses/ms] units. The operation is as follows.

  \[
  \text{Calculation result} \quad \text{D0001} \times 1000 = \text{D0001} \quad \text{Truncated Portion}
  \]

<table>
<thead>
<tr>
<th>Calculation result</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00014</td>
</tr>
<tr>
<td>Resulting long word [pulses/ms]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5.1 Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Position Number</strong></td>
</tr>
<tr>
<td>&quot;81&quot;/&quot;82*&quot;4</td>
</tr>
<tr>
<td>&quot;83&quot;/&quot;84*&quot;5</td>
</tr>
<tr>
<td>&quot;85&quot;/&quot;86*&quot;6</td>
</tr>
<tr>
<td>&quot;87*&quot;7</td>
</tr>
<tr>
<td>&quot;88*&quot;8</td>
</tr>
<tr>
<td>&quot;89*&quot;9</td>
</tr>
<tr>
<td>&quot;90*&quot;10</td>
</tr>
<tr>
<td>&quot;91*&quot;11</td>
</tr>
<tr>
<td>&quot;92&quot;/&quot;93*&quot;12</td>
</tr>
</tbody>
</table>

The symbol ‘*’ designates the value of (axis number - 1). The values for axis 1 to axis 8 are 0 to 7 respectively.
## 5.2 Description of Statuses

<table>
<thead>
<tr>
<th>Data Position Number</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*81/*82</td>
<td>Target Position Status [pulses]</td>
<td>Reads the operation target position during a positioning operation. The operation target position is determined from the Target Position Mode and Target Position, set at the beginning of the positioning. The Operation Target Position always contains absolute position data, regardless of whether the Target Position Mode is absolute or relative.</td>
</tr>
<tr>
<td>*83/*84</td>
<td>Current Position Status [pulses]</td>
<td>This represents the current position of a motor as output pulse counts of the positioning module. It is thus not the actual motor position when a servomotor is used.</td>
</tr>
<tr>
<td>*85/*86</td>
<td>Current Speed Status [(1/65536) pulses/ms]</td>
<td>Reads the current speed of a motor as output pulse counts of the positioning module. It is thus not the actual speed of the motor when a servomotor is used. Regardless of the direction of the motor’s rotation, the value is zero or positive.</td>
</tr>
<tr>
<td>*87</td>
<td>Contact Input Status</td>
<td>Reads the state of the external contact inputs and the encoder Z-phase input. The state of each contact is stored as 1 bit (0: off; 1: on). If a contact is specified as an “a” contact, it is represented by “1” when the contact input circuit is closed. If a contact is specified as a “b” contact, it is represented by “1” when the contact input circuit is open. bit 0: negative-direction limit input bit 1: positive-direction limit input bit 2: origin input bit 3: encoder Z-phase input</td>
</tr>
<tr>
<td>*88</td>
<td>Error Status</td>
<td>Reads the error code when an error occurs. It has no meaning if the Error Notification input relay is off. For details, refer to Section 8.2, “Error Codes.”</td>
</tr>
<tr>
<td>*89</td>
<td>Alarm Status</td>
<td>Reads the alarm code when an alarm occurs. A value of 0 indicates no alarm. There is no separate alarm notification input relay. For details, refer to Section 8.3, “Alarm Codes.”</td>
</tr>
<tr>
<td>*90</td>
<td>Origin Search Status</td>
<td>Reads the status during or at the end of an origin search. 0: On power-up or at normal end of the origin search 1: Stopped upon detection of an input edge of “Stop immediately” or “Decelerate and Stop”. 2: Stopped by a “Stop immediately” or “Decelerate and Stop” command. 3: Stopped by an error 4: During a Z-phase search 5: Before a Z-phase search</td>
</tr>
<tr>
<td>*91</td>
<td>Extended Status</td>
<td>Reads the state of an axis during positioning or jog stepping as bit data. When an axis is in a particular stage of motion, the corresponding bit is ‘1’. bit 0: Accelerating (at the time of operation start) bit 1: Moving at constant speed bit 2: Decelerating (during a Decelerate &amp; Stop operation) bit 3: Accelerating or decelerating (during a Change Speed operation) bit 4: During a Change Target Position operation</td>
</tr>
<tr>
<td>*92/*93</td>
<td>Number of Flash Memory Write Operations</td>
<td>Reads the total number of flash memory write operations that has been performed. As there is a limit to the number of times data can be saved in the flash memory (100,000 times maximum), save the entry parameters to the flash memory only when required. The performance of the flash memory is not assured after 100,000 writes.</td>
</tr>
</tbody>
</table>

The symbol "*" designates the value of (axis number - 1). The values for axis 1 to axis 8 are 0 to 7 respectively.
6. Input/Output Relays

The positioning module has 32 output relays and 32 input relays for interfacing to the FA-M3 CPU module. For details on each input/output relay, refer to Chapter 7, “Accessing Modules.”

**CAUTION**

For the F3YP14-0N, NEVER set the output relays for axes 5 to 8. Input relays for axes 5 to 8 have no meaning.

### 6.1 Output Relays

Table 6.1 lists the output relays available in this positioning module.

<table>
<thead>
<tr>
<th>Output relay number</th>
<th>Operation when ON</th>
<th>Output relay number</th>
<th>Operation when ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y□□□33</td>
<td>Axis 1, Execute Command</td>
<td>Y□□□49</td>
<td>Axis 1, Positive-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□34</td>
<td>Axis 2, Execute Command</td>
<td>Y□□□50</td>
<td>Axis 2, Positive-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□35</td>
<td>Axis 3, Execute Command</td>
<td>Y□□□51</td>
<td>Axis 3, Positive-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□36</td>
<td>Axis 4, Execute Command</td>
<td>Y□□□52</td>
<td>Axis 4, Positive-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□37</td>
<td>Axis 5, Execute Command</td>
<td>Y□□□53</td>
<td>Axis 5, Positive-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□38</td>
<td>Axis 6, Execute Command</td>
<td>Y□□□54</td>
<td>Axis 6, Positive-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□39</td>
<td>Axis 7, Execute Command</td>
<td>Y□□□55</td>
<td>Axis 7, Positive-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□40</td>
<td>Axis 8, Execute Command</td>
<td>Y□□□56</td>
<td>Axis 8, Positive-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□41</td>
<td>Axis 1, Stop Immediately</td>
<td>Y□□□57</td>
<td>Axis 1, Negative-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□42</td>
<td>Axis 2, Stop Immediately</td>
<td>Y□□□58</td>
<td>Axis 2, Negative-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□43</td>
<td>Axis 3, Stop Immediately</td>
<td>Y□□□59</td>
<td>Axis 3, Negative-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□44</td>
<td>Axis 4, Stop Immediately</td>
<td>Y□□□60</td>
<td>Axis 4, Negative-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□45</td>
<td>Axis 5, Stop Immediately</td>
<td>Y□□□61</td>
<td>Axis 5, Negative-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□46</td>
<td>Axis 6, Stop Immediately</td>
<td>Y□□□62</td>
<td>Axis 6, Negative-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□47</td>
<td>Axis 7, Stop Immediately</td>
<td>Y□□□63</td>
<td>Axis 7, Negative-direction Jog Stepping</td>
</tr>
<tr>
<td>Y□□□48</td>
<td>Axis 8, Stop Immediately</td>
<td>Y□□□64</td>
<td>Axis 8, Negative-direction Jog Stepping</td>
</tr>
</tbody>
</table>

Note: Replace “□□□” with the number of the FA-M3 slot where the positioning module is installed.

- **Execute Command Relay (Y□□□33 to Y□□□40)**

  Turning on one of these relays causes the axis concerned to start operating according to the current command code stored in the command parameter. When the operation defined by the command code has been successfully executed, the Execute Command ACK relay (X□□□01 to X□□□08) turns on. Turning off the Execute Command relay turns off the Execute Command ACK relay (X□□□01 to X□□□08).

- **Stop Immediately Relay (Y□□□41 to Y□□□48)**

  Turning on one of these relays causes the axis concerned to stop immediately without going through deceleration. When the Stop Immediately operation has been successfully executed, the Stop Immediately ACK relay (X□□□09 to X□□□16) turns on. Turning off the Stop Immediately relay turns off the Stop Immediately ACK relay (X□□□09 to X□□□16).

- **Positive-direction Jog Stepping Relay (Y□□□49 to Y□□□56)**

  The axis moves in the positive direction as long as this relay stays on.

- **Negative-direction Jog Stepping Relay (Y□□□57 to Y□□□64)**

  The axis moves in the negative direction as long as this relay stays on.
6.2 Input Relays

Table 6.2 lists the input relays available in this positioning module.

An interrupt signal can be sent to the CPU module by changing the state of an input relay from off to on.

Table 6.2 Input Relays

<table>
<thead>
<tr>
<th>Input relay number</th>
<th>Operation when ON</th>
<th>Input relay number</th>
<th>Operation when ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>X00001</td>
<td>Axis 1, Execute Command ACK</td>
<td>X00017</td>
<td>Axis 1, Error Notification</td>
</tr>
<tr>
<td>X00002</td>
<td>Axis 2, Execute Command ACK</td>
<td>X00018</td>
<td>Axis 2, Error Notification</td>
</tr>
<tr>
<td>X00003</td>
<td>Axis 3, Execute Command ACK</td>
<td>X00019</td>
<td>Axis 3, Error Notification</td>
</tr>
<tr>
<td>X00004</td>
<td>Axis 4, Execute Command ACK</td>
<td>X00020</td>
<td>Axis 4, Error Notification</td>
</tr>
<tr>
<td>X00005</td>
<td>Axis 5, Execute Command ACK</td>
<td>X00021</td>
<td>Axis 5, Error Notification</td>
</tr>
<tr>
<td>X00006</td>
<td>Axis 6, Execute Command ACK</td>
<td>X00022</td>
<td>Axis 6, Error Notification</td>
</tr>
<tr>
<td>X00007</td>
<td>Axis 7, Execute Command ACK</td>
<td>X00023</td>
<td>Axis 7, Error Notification</td>
</tr>
<tr>
<td>X00008</td>
<td>Axis 8, Execute Command ACK</td>
<td>X00024</td>
<td>Axis 8, Error Notification</td>
</tr>
<tr>
<td>X00009</td>
<td>Axis 1, Stop Immediately ACK</td>
<td>X00025</td>
<td>Axis 1, End of Positioning</td>
</tr>
<tr>
<td>X00010</td>
<td>Axis 2, Stop Immediately ACK</td>
<td>X00026</td>
<td>Axis 2, End of Positioning</td>
</tr>
<tr>
<td>X00011</td>
<td>Axis 3, Stop Immediately ACK</td>
<td>X00027</td>
<td>Axis 3, End of Positioning</td>
</tr>
<tr>
<td>X00012</td>
<td>Axis 4, Stop Immediately ACK</td>
<td>X00028</td>
<td>Axis 4, End of Positioning</td>
</tr>
<tr>
<td>X00013</td>
<td>Axis 5, Stop Immediately ACK</td>
<td>X00029</td>
<td>Axis 5, End of Positioning</td>
</tr>
<tr>
<td>X00014</td>
<td>Axis 6, Stop Immediately ACK</td>
<td>X00030</td>
<td>Axis 6, End of Positioning</td>
</tr>
<tr>
<td>X00015</td>
<td>Axis 7, Stop Immediately ACK</td>
<td>X00031</td>
<td>Axis 7, End of Positioning</td>
</tr>
<tr>
<td>X00016</td>
<td>Axis 8, Stop Immediately ACK</td>
<td>X00032</td>
<td>Axis 8, End of Positioning</td>
</tr>
</tbody>
</table>

Note: Replace “□□□□” with the number of the FA-M3 slot where the positioning module is installed.

● **Execute Command ACK Relay (X□□□□01 to X□□□□08)**

This relay turns on if the Execute Command relay (Y□□□□33 to Y□□□□40) is turned on and a command has been successfully executed. It does not turn on if the command has not been successfully executed (due to an error, etc.). It turns off when the Execute Command relay (Y□□□□33 to Y□□□□40) is turned off.

● **Stop Immediately ACK Relay (X□□□□09 to X□□□□16)**

This relay turns on if the Stop Immediately relay (Y□□□□41 to Y□□□□48) is turned on and the stop immediately operation has been successfully executed. It does not turn on if the operation has not been successfully executed (due to an error, etc.). It turns off when the Stop Immediately relay (Y□□□□41 to Y□□□□48) is turned off.

● **Error Notification Relay (X□□□□17 to X□□□□24)**

When an error occurs on a particular axis, the Error Notification relay for that axis turns on. To identify an error, check the error code stored in the Error Status. Executing the Reset Error command resets the error condition and turns off the Error Notification relay. If an error occurs in a Set Parameter command (error code 2 □□□□), re-execute the Set Parameter command with valid parameters; the Reset Error command is not effective for such errors.

● **End of Positioning Relay (X□□□□25 to X□□□□32)**

This relay is on when the axis is in the End of Positioning status (i.e., when the axis is at rest). It is off during a positioning or jog stepping operation (i.e., when the motor is in motion).
7. Accessing Modules

The sample program shown in this chapter assumes that the positioning module is installed in slot 4 (slot #004) of the main unit; it also assumes that when only one axis is used, it is axis 1.

**CAUTION**

On the F3YP14-0N module, NEVER set the output relays for axes 5 to 8; moreover, input relays for axes 5 to 8 have no meaning.

7.1 Accessing from Sequence CPU

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

● Reading/Writing Parameters and Status

Use these instructions on a word basis. Long word instructions cannot be used.

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

  \[
  \text{READ SL n1 D k}
  \]

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

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

  \[
  \text{WRITE S SL n2 k}
  \]

  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

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

  \[
  \text{HRD SL n1 D k}
  \]

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

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

  \[
  \text{HWR S SL n2 k}
  \]

  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
7.1.1 Reading Module Statuses

This section explains how to read the status of the positioning module.

- **Note:**
  The status of the positioning module can be read at any time. Take care when reading long-word data. See Chapter 5, “Status.”

- **Sample Program:**
  In the example below, all of the statuses are read at the same time using a single READ instruction.

**Major devices used**

<table>
<thead>
<tr>
<th>Device Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00081/D00082</td>
<td>Read target position status</td>
</tr>
<tr>
<td>D00083/D00084</td>
<td>Read current position status</td>
</tr>
<tr>
<td>D00085/D00086</td>
<td>Read current speed status</td>
</tr>
<tr>
<td>D00087</td>
<td>Read contact input status</td>
</tr>
<tr>
<td>D00088</td>
<td>Read error status</td>
</tr>
<tr>
<td>D00089</td>
<td>Read alarm status</td>
</tr>
<tr>
<td>D00090</td>
<td>Read origin search status</td>
</tr>
<tr>
<td>D00091</td>
<td>Read extended status</td>
</tr>
<tr>
<td>D00092/D00093</td>
<td>Read the number of flash memory write operations</td>
</tr>
<tr>
<td>D00121/D00122</td>
<td>Current speed [pulses/s]</td>
</tr>
<tr>
<td>I00001 to I00016</td>
<td>Bit data for contact inputs</td>
</tr>
<tr>
<td>I00017 to I00032</td>
<td>Origin search status bit data</td>
</tr>
<tr>
<td>I00033 to I00048</td>
<td>Extension status bit data</td>
</tr>
</tbody>
</table>

**Program for Reading Module Status**

```
0001  MO0033
0002  READ   4   81  D00031  13
0003  MOV   D00037  I0001
0004  MOV   D00032  I0007
0005  MOV   D00031  D00033
0006  D00131 = D00003 * 1000
0007  MOV   D00132  D00121
```

**Figure 7.1 Program for Reading the Module Status**
7.1.2 Set Parameter

The Set Parameter command sets the entry parameters.

- **Conditions for Command Execution:**
  - The axis is in the End-of-Positioning status.
  - No other command is being executed.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored (the Command Execution ACK relay is not set). If the command is issued when the axis is not in the End-of-Positioning status, an alarm code is set in the alarm status. Resetting the Execute Command output relay resets the alarm status. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - An error arising from a Set Parameter command (error code 2) cannot be reset with the Reset Error command. Run the Set Parameter command again with proper data.

- **Procedure:**
  1. Write the parameter values and command code to the positioning module with the WRITE instruction or any other appropriate instruction (set the command code to 3).
  2. Set the Execute Command output relay.
  3. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. If there is an entry parameter error, the Error Notification input relay will be set but the Execute Command ACK input relay will not be set. In this case, reset the Execute Command output relay and return to step 1.
  4. Check that the Execute Command ACK input relay is reset.
Sample Program:

In this example, parameters are preset in the data registers. All entry parameters are written at one go with the WRITE instruction.

**Major devices used**

<table>
<thead>
<tr>
<th>Register</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00001</td>
<td>Maximum speed selection</td>
</tr>
<tr>
<td>D00002</td>
<td>Pulse output mode</td>
</tr>
<tr>
<td>D00003</td>
<td>Direction of rotation</td>
</tr>
<tr>
<td>D00004</td>
<td>Contact input polarity</td>
</tr>
<tr>
<td>D00005/D00006</td>
<td>Positive direction limit</td>
</tr>
<tr>
<td>D00007/D00008</td>
<td>Negative direction limit</td>
</tr>
<tr>
<td>D00009/D00010</td>
<td>Speed limit</td>
</tr>
<tr>
<td>D00011</td>
<td>Automatic origin search mode</td>
</tr>
<tr>
<td>D00012</td>
<td>Automatic origin search direction</td>
</tr>
<tr>
<td>D00013/D00014</td>
<td>Automatic origin search speed 1</td>
</tr>
<tr>
<td>D00015/D00016</td>
<td>Automatic origin search speed 2</td>
</tr>
<tr>
<td>D00017/D00018</td>
<td>Automatic origin search starting speed</td>
</tr>
<tr>
<td>D00019</td>
<td>Automatic origin search acceleration time</td>
</tr>
<tr>
<td>D00020</td>
<td>Automatic origin search deceleration time</td>
</tr>
<tr>
<td>D00021</td>
<td>Automatic origin search Z-phase edge selection</td>
</tr>
<tr>
<td>D00022</td>
<td>Automatic origin search Z-phase search count</td>
</tr>
<tr>
<td>D00023/D00024</td>
<td>Automatic origin search Z-phase search range</td>
</tr>
<tr>
<td>D00025</td>
<td>Automatic origin search deviation pulse clear time</td>
</tr>
<tr>
<td>D00026/D00027</td>
<td>Automatic origin search origin offset value</td>
</tr>
<tr>
<td>Y00433</td>
<td>Execute Command output relay</td>
</tr>
<tr>
<td>X00401</td>
<td>Execute Command ACK input relay</td>
</tr>
<tr>
<td>I00099</td>
<td>Command execution prohibit condition (to be set elsewhere)</td>
</tr>
<tr>
<td>I00101</td>
<td>Request to execute command</td>
</tr>
<tr>
<td>I00102</td>
<td>Request to execute command (rising edge)</td>
</tr>
<tr>
<td>I00103</td>
<td>Waiting for Command ACK</td>
</tr>
<tr>
<td>I00104</td>
<td>Command executing</td>
</tr>
<tr>
<td>I00105</td>
<td>Forced reset of the Set Parameter operation</td>
</tr>
</tbody>
</table>
Figure 7.2  Set Parameter Program
Figure 7.3  Time Chart for the Set Parameter Program
7.1.3 Reset Error

The Reset Error command resets the error status of the positioning module.

- **Conditions for Command Execution:**
  - The axis is in error (other than an entry parameter error).
  - No other command is being executed.

- **Note:**
  - The positioning module ignores all commands other than the Reset Error command and Set Parameter command in an error status (i.e. when the Error Notification input relay is on). Therefore, always execute the Reset Error command when in an error status. If the Reset Error command is issued when the axis is not in an error status, or if any command other than the Reset Error command or Set Parameter command is issued when the axis is in an error status, an alarm code is written to the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.” An entry parameter error (error code 2) of a Set Parameter command cannot be reset using the Reset Error command. For more information, see Section 7.1.2, “Set Parameter.”

- **Procedure:**
  1. Write the command code to the positioning module with the WRITE instruction or any other appropriate instruction (set the command code to 5).
  2. Set the Execute Command output relay.
  3. Check that the Error Notification input relay is reset. Then reset the Execute Command output relay.
  4. Check that the Execute Command ACK input relay is reset.

- **Sample Program:**
  This example assumes that the Reset Error operation is done manually. All output relays of the positioning module are reset during the Reset Error operation. The error code retains its value after the Reset Error command has been completed.

**Major devices used**

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00188</td>
<td>Error code storage device</td>
</tr>
<tr>
<td>Y00433</td>
<td>Execute Command output relay</td>
</tr>
<tr>
<td>X00401</td>
<td>Execute Command ACK input relay</td>
</tr>
<tr>
<td>X00417</td>
<td>Error Notification input relay</td>
</tr>
<tr>
<td>I00111</td>
<td>Request to Reset Error (manual)</td>
</tr>
<tr>
<td>I00112</td>
<td>Request to Reset Error (rising)</td>
</tr>
<tr>
<td>I00113</td>
<td>Request to Reset Error (falling)</td>
</tr>
<tr>
<td>I00114</td>
<td>Command executing</td>
</tr>
</tbody>
</table>
Figure 7.4 Reset Error Program

Figure 7.5 Time Chart for the Reset Error Program
7.1.4 Jog Stepping

When the Positive- (Negative-) direction Jog Stepping output relay is on, the axis moves in the positive (negative) direction.

● Conditions for Command Execution:
- The axis is not in an error state.
- The axis is in the End-of-Positioning status.
- No other command is being executed.

● Note:
- If any of the conditions is not satisfied, the command is ignored. If the command is issued when the axis is in an error state or not in the End-of-Positioning status, an alarm code is written to the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
- During jog stepping, the Stop Immediately command is valid, but the Decelerate-and-Stop command is ignored (the Execute Command ACK input relay is not turned on). If the Decelerate-and-Stop command is issued during jog stepping, an alarm code is written to the alarm status. Terminate jog stepping before executing the Decelerate-and-Stop command.
- During jog stepping, no error occurs even if the axis exceeds the range defined by the positive direction limit value and negative direction limit value.

● Procedure:
1. Write the required parameters of the Jog Stepping command to the positioning module with the WRITE instruction or any other appropriate instruction.
2. Set the Positive-direction (Negative-direction) Jog Stepping output relay to move the axis according to the parameters. The End-of-Positioning input relay is reset.
3. Reset the Positive-direction (Negative-direction) Jog Stepping output relay to decelerate and stop the axis according to the parameters. The End-of-positioning input relay is reset.

● Sample Program:

In this example, jog stepping starts with a Request for Jog Stepping, and ends with the release of the request. The jog stepping mode is reset automatically if any error occurs during jogging. This example shows only the case for positive-direction. Required parameters are preset in the data registers.

### Major devices used

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00245</td>
<td>Acceleration/deceleration mode</td>
</tr>
<tr>
<td>D00246/D00247</td>
<td>Target speed</td>
</tr>
<tr>
<td>D00248</td>
<td>Acceleration time</td>
</tr>
<tr>
<td>D00249</td>
<td>Deceleration time</td>
</tr>
<tr>
<td>D00250/D00251</td>
<td>Startup speed</td>
</tr>
<tr>
<td>D00289</td>
<td>Alarm code storage device</td>
</tr>
<tr>
<td>Y00449</td>
<td>Positive-direction Jog Stepping output relay</td>
</tr>
<tr>
<td>X00417</td>
<td>Error Notification input relay</td>
</tr>
<tr>
<td>X00425</td>
<td>End-of-Positioning input relay</td>
</tr>
<tr>
<td>I00099</td>
<td>Command execution prohibit condition (to be set elsewhere)</td>
</tr>
<tr>
<td>I00121</td>
<td>Positive-direction jog stepping request</td>
</tr>
<tr>
<td>I00122</td>
<td>Positive-direction jog stepping request (rising edge)</td>
</tr>
<tr>
<td>I00123</td>
<td>Positive-direction jog stepping request (falling edge)</td>
</tr>
<tr>
<td>I00124</td>
<td>Executing positive-direction jog stepping</td>
</tr>
</tbody>
</table>
Figure 7.6 Jog Stepping Program
Figure 7.7 Time Chart for the Jog Stepping Program
7.1.5 Origin Search

There are two ways to perform origin search operation: normal and automatic. In the normal origin search operation, the origin search behavior is arbitrarily defined by an application program. The automatic origin search operation uses entry parameters to define the origin search behavior.

This section describes the normal origin search operation. For information on the automatic origin search operation, see Section 7.1.6, "Automatic Origin Search."

There are three external contact inputs related to the normal origin search. The origin search mode specifies the action when each rising and falling edge of these three inputs (six in total) is detected during the origin search using bit patterns (2 bits for each edge, hence 12 bits in total).

In the example below, the search moves in the negative direction with the following behavior: (1) Stops immediately when a rising edge of the negative-direction limit is detected. (2) Decelerates and stops when a rising edge of the origin input is detected. (3) Shifts to a Z-phase search when a falling edge of the origin search is detected. In this case, the origin search mode is set as follows:

```
0 0 0 0 1 1 0 0 0 0 0 0 1 0 0 1
```

("0C09" in hexadecimal)

For details on the origin search mode, see Section 3.5, "Origin Search."

![Diagram of Origin Search Operation]

**Conditions for Command Execution:**

- The axis is not in an error state.
- The axis is in the End-of-Positioning status.
- No other command is being executed.

**Note:**

- If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued when the axis is in an error state or not in the End-of-Positioning status, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
- The origin search ends when a specified external contact input is detected and the axis is stopped. Change the parameters and begin the origin search again if you want to continue the search in another direction or at a different speed.
- In the following cases, an error occurs and the origin search is aborted:
  - The limit input of the origin search direction is set to be ignored but it is detected.
  - After shifting to Z-phase search, the limit switch of the origin search direction is detected. This causes an error regardless of the setting.
  - After shifting to Z-phase search, no Z-phase pulse is detected within the origin search Z-phase search range.
  - If you wish to change the setup values according to the status of an external contact input at the beginning of the origin search, read the state in the Contact Input Status before executing the origin search.
- After shifting to a Z-phase search, even if the external contact input that activates the Stop Immediately or Decelerate and Stop operation is detected, the Z-search operation will continue. (This behavior is different from the origin search in the F3NC11-0N and F3NC12-0N modules)
- During the origin search, no error occurs even if the axis exceeds the range defined by the positive and negative direction limit values.

**Procedure:**

1. Write the parameters and command code required for the normal origin search operation to the positioning module with the WRITE or any other appropriate instruction (set the command code to 2).
2. Set the Execute Command output relay. The Execute Command ACK input relay will be set, and the automatic origin search starts. Operation continues until the specified external contact input is detected. If there is an invalid parameter, the Error Notification Input Relay will be set but not the Execute Command ACK Input Relay.
3. When Z-phase pulses are detected for the specified number of times after shifting to a Z-phase search (if this number is specified as "0," the module skips the Z-phase search), the current position is specified as "Position 0" and the axis stops immediately. After outputting the deviation pulse clear signal for a preset duration, the End of Positioning input relay is set.
4. Confirm the status of the origin search by checking the origin search status. If the origin search status is "0," the origin search has ended following a successful Z-phase search. For details on the origin search status, see Section 5.2, "Description of Statuses".

**Sample Program:**

This program starts the origin search using the Request to Search Origin input and stops the search using a designated external contact input. If any error is detected during the search, the search status is automatically reset. The program also uses some area for non-required parameters because all the parameters are written at once. All required parameters are preset in the data registers.

**Major devices used**

<table>
<thead>
<tr>
<th>Device Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00341</td>
<td>Command code</td>
</tr>
<tr>
<td>D00342 to D00345</td>
<td>Area for non-required parameters</td>
</tr>
<tr>
<td>D00346/D00347</td>
<td>Target speed</td>
</tr>
<tr>
<td>D00348</td>
<td>Acceleration time</td>
</tr>
<tr>
<td>D00349</td>
<td>Deceleration time</td>
</tr>
<tr>
<td>D00350/D00351</td>
<td>Startup speed</td>
</tr>
<tr>
<td>D00352</td>
<td>Origin search mode</td>
</tr>
<tr>
<td>D00353</td>
<td>Origin search direction</td>
</tr>
<tr>
<td>D00354</td>
<td>Z-phase edge selection</td>
</tr>
<tr>
<td>D00355</td>
<td>Z-phase search count</td>
</tr>
<tr>
<td>D00356/D00357</td>
<td>Z-phase search range</td>
</tr>
<tr>
<td>D00358</td>
<td>Deviation pulse clear time</td>
</tr>
<tr>
<td>D00389</td>
<td>Alarm code storage device</td>
</tr>
<tr>
<td>D00390</td>
<td>Origin search status</td>
</tr>
<tr>
<td>Y00433</td>
<td>Execute Command output relay</td>
</tr>
<tr>
<td>X00401</td>
<td>Execute Command ACK input relay</td>
</tr>
<tr>
<td>X00417</td>
<td>Error Notification input relay</td>
</tr>
<tr>
<td>X00425</td>
<td>End of Positioning input relay</td>
</tr>
<tr>
<td>I00099</td>
<td>Command execution prohibit condition (to be set elsewhere)</td>
</tr>
<tr>
<td>I00131</td>
<td>Request to search origin</td>
</tr>
<tr>
<td>I00132</td>
<td>Request to search origin (rising edge)</td>
</tr>
<tr>
<td>I00133</td>
<td>Origin search operating</td>
</tr>
<tr>
<td>I00134</td>
<td>Origin search executing</td>
</tr>
</tbody>
</table>
Figure 7.9 Origin Search Program
Figure 7.10  Time Chart for the Origin Search Program
7.1.6 Automatic Origin Search

There are two ways to perform origin search: normal and automatic. In normal origin search, the search behavior is arbitrarily defined by an application program. The automatic origin search operation uses entry parameters to define the origin search behavior. This section describes the automatic origin search operation. For details on the normal origin search operation, see Section 7.1.5, "Origin Search."

Before initiating an automatic origin search, you must first set the automatic origin search mode and other relevant entry parameters. For details on the automatic origin search operation, see Section 3.6, "Automatic Origin Search."

- **Conditions for Command Execution:**
  - The axis is not in an error state.
  - The axis is in the End-of-Positioning status.
  - No other command is being executed.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued when the axis is in an error state or not in the End-of-Positioning status, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, "Alarm Codes."
  - In the following cases, an error occurs and the origin search is aborted:
    - The limit switch for the direction opposite to the automatic origin search direction is detected when the axis is moving in that direction at automatic origin search speed 2.
    - After shifting into Z-phase detection operation, no Z-phase pulse is detected within the automatic origin search Z-phase search range.
    - During automatic origin search, no error occurs even if the axis exceeds the range defined by the positive and negative direction limit values.

- **Procedure:**
  1. Set the command code in the positioning module to 8 using a WRITE instruction or any other appropriate instruction.
  2. Set the Execute Command output relay. The Execute Command ACK input relay will be set, and the automatic origin search starts. If there is an error in the parameters, the Error Notification input relay is set but the Execute Command ACK input relay is not set.
  3. After shifting to Z-phase search, the axis stops when Z-phase pulses are detected for the specified number of times (no shifting to a Z-phase search if the Z-phase pulse count is set to 0), and that position becomes the origin (the value of the origin is defined in the Automatic Origin Search Origin Offset parameter). The deviation pulse clear signal is then output for a specified period, and then the End of Positioning input relay is set.
  4. Confirm the status of the origin search by checking the origin search status. If the origin search status is "0," the automatic origin search has ended following a successful Z-phase search. For details on the origin search status, see Section 5.2, "Description of Statuses."
Sample Program:

This program starts the automatic origin search operation using the Request to Start Automatic Origin Search and stops the operation using Z-phase detected. The program stops the operation if it detects an error during operation.

Major devices used

<table>
<thead>
<tr>
<th>Device Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00489</td>
<td>Alarm code storage device</td>
</tr>
<tr>
<td>D00490</td>
<td>Origin search status</td>
</tr>
<tr>
<td>Y00433</td>
<td>Execute Command output relay</td>
</tr>
<tr>
<td>X00401</td>
<td>Execute Command ACK input relay</td>
</tr>
<tr>
<td>X00417</td>
<td>Error Notification input relay</td>
</tr>
<tr>
<td>X00425</td>
<td>End of Positioning input relay</td>
</tr>
<tr>
<td>I00099</td>
<td>Command execution prohibit condition (set elsewhere)</td>
</tr>
<tr>
<td>I00136</td>
<td>Request to start automatic origin search</td>
</tr>
<tr>
<td>I00137</td>
<td>Request to start automatic origin search (rising edge)</td>
</tr>
<tr>
<td>I00138</td>
<td>Automatic origin search operating</td>
</tr>
<tr>
<td>I00139</td>
<td>Automatic origin search executing</td>
</tr>
</tbody>
</table>

![Automatic Origin Search Program Diagram](image-url)
Figure 7.12  Time Chart for the Automatic Origin Search Program
7.1.7 Set Current Position

The Set Current Position command changes the current position of an axis in the End of Positioning status.

**Conditions for Command Execution:**

- The axis is not in an error state.
- The axis is in the End-of-Positioning status.
- No other command is being executed.

**Note:**

- If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued when the axis is in an error state or not in the End-of-Positioning status, an alarm code is written to the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
- The new position must fall between the positive-direction limit and the negative-direction limit. An error occurs if a request is made to change the current position beyond the limits of the range.

**Procedure:**

1. Set the Target Position parameter in the positioning module to the new target position value and set the command code to 4 using a WRITE instruction or any appropriate instruction.
2. Set the Execute Command output relay.
3. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. If there is an entry parameter error, the Error Notification input relay will be set but the Execute Command ACK input relay will not be set.
4. Check that the Execute Command ACK input relay is reset.

**Sample Program:**

This is an example to set the current position. All required parameters are preset in the data registers.

**Major devices used**

<table>
<thead>
<tr>
<th>Device Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00541</td>
<td>Command code</td>
</tr>
<tr>
<td>D00542</td>
<td>Area for non-required parameters</td>
</tr>
<tr>
<td>D00543/D00544</td>
<td>Target position (new current position)</td>
</tr>
<tr>
<td>D00589</td>
<td>Alarm code storage device</td>
</tr>
<tr>
<td>Y00433</td>
<td>Execute Command output relay</td>
</tr>
<tr>
<td>X00401</td>
<td>Execute Command ACK input relay</td>
</tr>
<tr>
<td>X00417</td>
<td>Error Notification input relay</td>
</tr>
<tr>
<td>X00425</td>
<td>End of Positioning input relay</td>
</tr>
<tr>
<td>I00099</td>
<td>Command execution prohibit condition (to be set elsewhere)</td>
</tr>
<tr>
<td>I00141</td>
<td>Request to write current position</td>
</tr>
<tr>
<td>I00142</td>
<td>Request to write current position (rising edge)</td>
</tr>
<tr>
<td>I00143</td>
<td>Waiting for Execute Command ACK</td>
</tr>
<tr>
<td>I00144</td>
<td>Command executing</td>
</tr>
</tbody>
</table>
Figure 7.13  Set Current Position Program

Figure 7.14  Time Chart for the Set Current Position Program
7.1.8 Positioning Operation

This command executes a positioning operation towards a preset target position.

- **Conditions for Command Execution:**
  - The axis is not in an error state.
  - The axis is in the End-of-Positioning status.
  - No other command is being executed.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued when the axis is in an error state or not in the End-of-Positioning status, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - If an invalid value is set for a parameter, a parameter error results and the axis does not move.

- **Procedure:**
  1. Write the required parameters and command code to the positioning module using the WRITE instruction or any other appropriate instruction (set the command code to 0).
  2. Set the Execute Command output relay.
  3. The Execute Command ACK will be set and the axis starts positioning. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. If there is an entry parameter error, the Error Notification input relay will be set, but the Execute Command ACK input relay will not be set.
  4. The End of Positioning input relay is set when the output pulse count reaches the target position. In general, when using servomotors, take note that there is some time lag between the stopping of the pulse output and the stopping of the axis after reaching the target position.

- **Sample Program**

This is a sample program for a positioning operation. All required parameters are preset in the data registers.

**Major devices used**

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00641</td>
<td>Command code</td>
</tr>
<tr>
<td>D00642</td>
<td>Target position mode</td>
</tr>
<tr>
<td>D00643/D00644</td>
<td>Target position</td>
</tr>
<tr>
<td>D00645</td>
<td>Acceleration/deceleration mode</td>
</tr>
<tr>
<td>D00646/D00647</td>
<td>Target speed</td>
</tr>
<tr>
<td>D00648</td>
<td>Acceleration time</td>
</tr>
<tr>
<td>D00649</td>
<td>Deceleration time</td>
</tr>
<tr>
<td>D00650/D00651</td>
<td>Startup speed</td>
</tr>
<tr>
<td>D00689</td>
<td>Alarm code storage device</td>
</tr>
<tr>
<td>Y00433</td>
<td>Execute Command output relay</td>
</tr>
<tr>
<td>X00401</td>
<td>Execute Command ACK input relay</td>
</tr>
<tr>
<td>X00417</td>
<td>Error Notification input relay</td>
</tr>
<tr>
<td>X00425</td>
<td>End of Positioning input relay</td>
</tr>
<tr>
<td>I00099</td>
<td>Command execution prohibit condition (to be set elsewhere)</td>
</tr>
<tr>
<td>I00151</td>
<td>Request to start positioning</td>
</tr>
<tr>
<td>I00152</td>
<td>Request to start positioning (rising edge)</td>
</tr>
<tr>
<td>I00153</td>
<td>Waiting for Execute Command ACK</td>
</tr>
<tr>
<td>I00154</td>
<td>Executing positioning operation</td>
</tr>
</tbody>
</table>
Figure 7.15  Positioning Operation Program
Figure 7.16  Time Chart for the Positioning Operation Program
7.1.9 Request to Decelerate and Stop

This Request to Decelerate and Stop command decelerates and stops a moving motor during a positioning operation, origin search, etc. The rate of deceleration is determined from the preset values at startup.

- **Conditions for Command Execution:**
  - The axis is not in an error state.
  - The axis is not in jog stepping mode.
  - No other command is being executed.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued when the axis is in an error state or in jog stepping mode, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - You cannot execute the Decelerate and Stop command during jog stepping; you must first terminate jog stepping.
  - The Decelerate and Stop command is also accepted in the end-of-positioning status. (The Execute Command ACK is set.)

- **Procedure:**
  1. Set the command code in the positioning module to 1 using a WRITE instruction or any other appropriate instruction.
  2. Set the Execute Command output relay.
  3. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. The axis starts decelerating when the Execute Command ACK is set.
  4. The End of Positioning input relay is set when the axis stops.

- **Sample Program:**

This sample program performs a request to decelerate and stop. All required parameters are preset in the data registers.

**Major devices used**

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00789</td>
<td>Alarm code storage device</td>
</tr>
<tr>
<td>Y00433</td>
<td>Execute Command output relay</td>
</tr>
<tr>
<td>X00401</td>
<td>Execute Command ACK input relay</td>
</tr>
<tr>
<td>X00425</td>
<td>End of Positioning input relay</td>
</tr>
<tr>
<td>I00099</td>
<td>Command execution prohibit condition (to be set elsewhere)</td>
</tr>
<tr>
<td>I00161</td>
<td>Request to decelerate and stop</td>
</tr>
<tr>
<td>I00162</td>
<td>Request to decelerate and stop (rising edge)</td>
</tr>
<tr>
<td>I00163</td>
<td>Waiting for Execute Command ACK</td>
</tr>
<tr>
<td>I00164</td>
<td>Waiting for decelerate and stop</td>
</tr>
</tbody>
</table>
Figure 7.17 Request to Decelerate and Stop Program

Figure 7.18 Time Chart for the Request to Decelerate and Stop Program
7.1.10 Request to Stop Immediately

The Request to Stop Immediately command stops a moving motor immediately without any deceleration during a positioning operation, origin search, etc.

**Conditions for the Command:**
- The axis is not in an error state.

**Note:**
- If any of the conditions is not satisfied, the command is ignored and the Stop Immediately ACK relay is not set. If the command is issued when the axis is in an error state, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Stop Immediately output relay is reset. For details on alarm codes, see Section 8.3, "Alarm Codes."
- Take care when stopping a motor operating at high speed as the sudden stop may result in a shock to the system.
- The Stop Immediately command is also accepted in the end-of-positioning status. (The Execute Command ACK is set.)

**Procedure:**
1. Set the Stop Immediately output relay.
2. Reset the Stop Immediately output relay after confirming that the Stop Immediately ACK input relay is set. The axis stops immediately when the Stop Immediately ACK input relay is set.
3. The End of Positioning input relay is set when the axis stops.

**Sample Program:**
This sample program performs a request to stop immediately.

**Major devices used**

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00889</td>
<td>Alarm code storing device</td>
</tr>
<tr>
<td>Y00441</td>
<td>Stop Immediately output relay</td>
</tr>
<tr>
<td>X00409</td>
<td>Stop Immediately ACK input relay</td>
</tr>
<tr>
<td>X00425</td>
<td>End of Positioning input relay</td>
</tr>
<tr>
<td>I00171</td>
<td>Request to stop immediately</td>
</tr>
<tr>
<td>I00172</td>
<td>Request to stop immediately (rising edge)</td>
</tr>
<tr>
<td>I00173</td>
<td>Waiting for Stop Immediately ACK</td>
</tr>
<tr>
<td>I00174</td>
<td>Command executing</td>
</tr>
</tbody>
</table>
Figure 7.19  Request to Stop Immediately Program

Figure 7.20  Time Chart for the Request to Stop Immediately Program
7.1.11 Changing Speed during Operation

When the Change Speed command is issued during a positioning operation, the axis immediately starts to accelerate (or decelerate) to the new speed at a rate determined by the new speed and the acceleration (or deceleration) time. When the axis subsequently decelerates and stops from the new target speed to complete the positioning operation, or when the Decelerate-and-Stop command is issued, the deceleration rate is determined by the new speed and the deceleration time.

● Conditions for Command Execution:
  - The axis is not in an error state.
  - The axis is not in the End-of-Positioning status.
  - The axis is not executing an origin search operation.
  - The axis is not accelerating in a positioning operation.
  - The axis is not decelerating in a positioning operation or in a jog stepping operation.
  - The axis is not changing its target speed in a positioning operation.
  - The axis can stop at the target position even after changing to the new speed.
  - The axis is not changing its target position.

● Note:
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set.
    If the command is issued but not all the conditions are satisfied, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
    - If the Change Speed command is issued during a jog stepping operation, the module waits until all acceleration and deceleration has been completed before executing the command. If a new Change Speed command is issued during the wait, the previous command is discarded and only the new command is executed.
    - If a command parameter is invalid, an error occurs and the axis stops immediately.

● Procedure:
  1. Write the required parameters and command code to the positioning module with the WRITE instruction or any other appropriate instruction (set the command code to 6).
  2. Set the Execute Command output relay.
  3. The Execute Command ACK input relay is set, and the Change Speed operation starts. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. If there is an invalid parameter, the Error Notification input relay will be set, but the Execute Command ACK input relay will not be set.
  4. Confirm that the Execute Command ACK input relay is reset.
Sample Program

This program changes speed during operation. All required parameters are preset in the data registers.

Major devices used

<table>
<thead>
<tr>
<th>Device Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D00941</td>
<td>Command code</td>
</tr>
<tr>
<td>D00942 to D00945</td>
<td>Area for non-required parameters</td>
</tr>
<tr>
<td>D00946/D00947</td>
<td>Target speed</td>
</tr>
<tr>
<td>D00948</td>
<td>Acceleration time</td>
</tr>
<tr>
<td>D00949</td>
<td>Deceleration time</td>
</tr>
<tr>
<td>D00989</td>
<td>Alarm code storage device</td>
</tr>
<tr>
<td>Y00433</td>
<td>Execute Command output relay</td>
</tr>
<tr>
<td>X00401</td>
<td>Execute Command ACK input relay</td>
</tr>
<tr>
<td>X00417</td>
<td>Error Notification input relay</td>
</tr>
<tr>
<td>I00099</td>
<td>Command execution prohibit condition (to be set elsewhere)</td>
</tr>
<tr>
<td>I00181</td>
<td>Request to change speed</td>
</tr>
<tr>
<td>I00182</td>
<td>Request to change speed (rising edge)</td>
</tr>
<tr>
<td>I00183</td>
<td>Waiting for Execute Command ACK</td>
</tr>
<tr>
<td>I00184</td>
<td>Command executing</td>
</tr>
</tbody>
</table>

Figure 7.21 Request to Change Speed Program
Figure 7.22  Time Program for the Request to Change Target Speed Program
7.1.12 Changing Target Position during Positioning

When the Change Target Position command is issued during a positioning operation, the module updates the target position and performs positioning to reach the new target position. Changing the target speed, acceleration or deceleration is not allowed during the execution of the change target position command.

● Conditions for Command Execution:
  - The axis is not in an error state.
  - The axis is not in a jog stepping operation.
  - The axis is not in an origin search operation.
  - The axis is not in a change target position operation.

● Note:
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued but not all the conditions are satisfied, an alarm code is written to the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - If the Change Target Position command is issued in the End-of-Positioning status, the command is executed the same way as a Start Positioning command.
  - If the Change Target Position command is issued during acceleration, deceleration or speed change, the execution of the command is suspended until the axis speed becomes constant or the axis stops.
  - When the Change Target Position command is being executed, no command other than the Decelerate-and-Stop command and Stop Immediately command are available.
  - If a command parameter is invalid, an error occurs and the axis stops immediately.

● Procedure:
  1. Write the command parameters to the positioning module with the WRITE instruction or any other appropriate instruction (set the command code to 7).
  2. Set the Execute Command output relay.
  3. The Execute Command ACK input relay is set, and the Change Target Position operation begins. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. If there is an invalid parameter, the Error Notification input relay will be set, but the Execute Command ACK input relay will not be set.
  4. Confirm that the Execute Command ACK input relay is reset.
Sample Program:

This program changes the target position during a positioning operation. All required parameters are preset in the data registers.

**Major devices used**

- **D01041** Command code
- **D01042** Target position mode
- **D01043**/**D01044** Target position
- **D01089** Alarm code storage device
- **Y00433** Execute Command output relay
- **X00401** Execute Command ACK input relay
- **X00417** Error Notification input relay
- **I00099** Command execution prohibit condition (to be set elsewhere)
- **I00191** Request to change target position
- **I00192** Request to change target position (rising edge)
- **I00193** Waiting for Execute Command ACK
- **I00194** Command executing

---

**Figure 7.23 Request to Change Target Position Program**
Figure 7.24  Time Chart for the Request to Change Target Position Program
7.1.13  Saving Entry Parameters

When all axes are at rest, you can save all entry parameters to the flash memory. You can issue the Save Parameter command for any axis but the entry parameters of all axes are saved to the flash memory, regardless.

- **Conditions for Command Execution:**
  - No axis is in an error state.
  - All axes are in the End-of-Positioning state.
  - No other command is being executed for any axis.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued but not all the conditions are satisfied, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - As there is limit to the number of times data can be written to the flash memory (100,000 times max.), you should save the entry parameters to the flash memory only when required.

- **Procedure:**
  1. Set the command code to 9 (Save Parameter command) by writing to the positioning module using a WRITE instruction or any other appropriate instruction.
  2. Set the Execute Command output relay.
  3. The Execute Command ACK input relay is set, and the entry parameters are saved to the flash memory. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set.
  4. Confirm that the Execute Command ACK input relay is reset.

- **Sample Program:**

This program saves the entry parameters to the flash memory. All required parameters are preset in the data registers.

**Major devices used**

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D01189</td>
<td>Alarm code storage device</td>
</tr>
<tr>
<td>Y00433</td>
<td>Execute Command output relay</td>
</tr>
<tr>
<td>X00401</td>
<td>Execute Command ACK input relay</td>
</tr>
<tr>
<td>I00099</td>
<td>Command execution prohibit condition (to be set elsewhere)</td>
</tr>
<tr>
<td>I00201</td>
<td>Request to save entry parameters</td>
</tr>
<tr>
<td>I00202</td>
<td>Request to save entry parameters (rising edge)</td>
</tr>
<tr>
<td>I00203</td>
<td>Waiting for Execute Command ACK</td>
</tr>
<tr>
<td>I00204</td>
<td>Command executing</td>
</tr>
</tbody>
</table>
Figure 7.25  Request to Save Entry Parameters Program

Figure 7.26  Time Chart for the Request to Save Entry Parameters Program
## 7.2 Accessing from a BASIC CPU

You can use the following commands to access the module from a BASIC CPU. For details of each command, see “Basic CPU Modules and YM-BASIC/FA Programming Language” (IM 34M6Q22-01E).

<table>
<thead>
<tr>
<th>Function</th>
<th>Statement Format</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module use declaration</td>
<td>ASSIGN YP18 = SL</td>
<td>Declares use of a module or CPU module.</td>
</tr>
<tr>
<td></td>
<td>SL: Slot number</td>
<td></td>
</tr>
<tr>
<td>Reading parameters and status</td>
<td>ENTER SL, n NOFORMAT; I</td>
<td>Reads the parameter or status of the data position number (n) of the module installed in the slot (SL), and stores it in the variable (I).</td>
</tr>
<tr>
<td></td>
<td>SL: Slot number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n : Data position number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I : Name of the integer/integer array variable for storing the read data</td>
<td></td>
</tr>
<tr>
<td>Writing parameters</td>
<td>OUTPUT SL, n NOFORMAT; I</td>
<td>Overwrites a parameter at the data position number (n) of the module installed in the slot (SL) with the value stored in the variable (I).</td>
</tr>
<tr>
<td></td>
<td>SL: Slot number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n : Data position number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I : Name of the integer/integer array variable for storing the write data</td>
<td></td>
</tr>
<tr>
<td>Reading input relays*1</td>
<td>STATUS SL, n; P</td>
<td>Reads the status of the input relays of the module that is installed in the slot (SL), and stores it in the variable (P).</td>
</tr>
<tr>
<td></td>
<td>SL: Slot number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n : Data position number (101 or 102)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P : Name of the Integer variable for storing the read data</td>
<td></td>
</tr>
<tr>
<td>Writing output relays*2</td>
<td>CONTROL SL, n; P, M</td>
<td>Overwrites the output relays of the module installed in the slot (SL) with the value stored in the variable (P). The mask pattern (M) allows overwriting to only specified output relays.</td>
</tr>
<tr>
<td></td>
<td>SL: Slot number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n : Data position number (101 or 102)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P : Output data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M : Mask pattern</td>
<td></td>
</tr>
</tbody>
</table>

*1: For input relays, data position number 101 is for axes 1 to 4 (X01/G86/G86/G86 to X04/G86/G86/G86), and 102 is for axes 5 to 8 (X05/G86/G86/G86 to X08/G86/G86/G86).

*2: For output relays, data position number 101 is for axes 1 to 4 (Y01/G86/G86/G86 to Y04/G86/G86/G86), and 102 is for axes 5 to 8 (Y05/G86/G86/G86 to Y08/G86/G86/G86).

### How To Handle 2-Word Data

You must convert long-word data to 2-word integer data before writing parameters to the positioning module. When reading 2-word data from the positioning module, you must convert the data to long-word data after reading the data as two integer variables.

LDAT : Long-word integer variable before conversion

IDD, IDU: Integer variable for storing the data after conversion (low-order/high-order)

100 IDD=VAL("$"+RIGHT$(LHEX$(LDAT),4))

110 IDU=VAL("$"+LEFT$(LHEX$(LDAT),4))

ISD, ISU: Integer variable containing the 2 words read (low-order/high-order)

LST : Long-word integer variable after conversion

100 LST=VAL("$"+HEX$(ISU)+HEX$(ISD))
7.2.1 Reading Module Statuses

This section explains how to read the status of the positioning module.

- **Note:**
  - The status of the positioning module can be read at any time. Use the ENTER instruction to read the status.
  - 2-word data status, such as the current position or current speed status, must be read as two separate integer variables. Take care when reading long-word data. See Chapter 5, “Status”.

- **Sample Program:**

  This sample program uses the ENTER instruction to read all the statuses. It then converts 2-word data into long-word data and converts the speed data to [pulses/s].

```plaintext
100 ENTER SL,81 NOFORMAT;I081
110 ENTER SL,82 NOFORMAT;I082
120 ENTER SL,83 NOFORMAT;I083
130 ENTER SL,84 NOFORMAT;I084
140 ENTER SL,85 NOFORMAT;I085
150 ENTER SL,86 NOFORMAT;I086
160 ENTER SL,87 NOFORMAT;I087
170 ENTER SL,88 NOFORMAT;I088
180 ENTER SL,89 NOFORMAT;I089
190 ENTER SL,90 NOFORMAT;I090
200 ENTER SL,91 NOFORMAT;I091
210 ENTER SL,92 NOFORMAT;I092
220 ENTER SL,93 NOFORMAT;I093
230 L081=VAL("$"+HEX$(I082)+HEX$(I081))
240 L083=VAL("$"+HEX$(I084)+HEX$(I083))
250 L085=VAL("$"+HEX$(I086)+HEX$(I085))
260 L092=VAL("$"+HEX$(I093)+HEX$(I092))
270 D085PPS=L085/65.536
```
7.2.2 Set Parameter

The Set Parameter command sets the entry parameters.

- **Conditions for Command Execution:**
  - The axis is in the End-of-Positioning status.
  - No other command is being executed.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued when the axis is not in the End-of-Positioning status, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - An error arising from a Set Parameter command (error code 2) cannot be reset with the Reset Error command. Run the Set Parameter command again with proper data.

- **Procedure:**
  1. Write the parameter values and command code to the positioning module with the OUTPUT instruction.
  2. Set the Execute Command output relay.
  3. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. Note that if there is an entry parameter error, the Execute Command ACK input relay will not be set, but the Error Notification input relay will be set. In this case, reset the Execute Command output relay, and return to step 1.
  4. Check that the Execute Command ACK input relay is reset.

- **Sample Program:**

In this example, parameters are preset in integer variables (I01 to I25, and I41).

```
100 OUTPUT SL,1 NOFORMAT;I01
110 OUTPUT SL,2 NOFORMAT;I02
  :
340 OUTPUT SL,25 NOFORMAT;I25
350 OUTPUT SL,41 NOFORMAT;I41
400 CONTROL SL,101;$0001,$0001
410 LOOP1@
420 STATUS SL,101;P
430 IF BIT(P,0)=0 THEN LOOP1@
440 CONTROL SL,101;$0000,$0001
450 LOOP2@
460 STATUS SL,101;P
470 IF BIT(P,0)=1 THEN LOOP2@
```
7.2.3 Reset Error

The Reset Error command resets the error status of the positioning module.

- **Conditions for Command Execution:**
  - The axis is in error (other than an entry parameter error)
  - No other command is being executed.

- **Note:**
  - The positioning module ignores all commands other than the Reset Error command and Set Parameter command in an error status (i.e. when the Error Notification input relay is set). Therefore, always execute the Reset Error command in an error status. If the Reset Error command is issued when the axis is not in an error status, or any command other than the Reset Error command or Set Parameter command is issued when the axis is in an error status, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.” An entry parameter error (error code 2) arising from a Set Parameter command cannot be reset using the Reset Error command. See Section 7.1.2, “Set Parameter.”

- **Procedure:**
  1. Write the command code to the positioning module with the OUTPUT instruction.
  2. Set the Execute Command output relay.
  3. Check that the Error Notification input relay is reset and reset the Execute Command output relay.
  4. Check that the Execute Command ACK input relay is reset.

- **Sample Program:**

In this example, all output relays of the positioning module are reset during the Reset Error operation. The error code retains its value even after the Reset Error operation. Parameters are preset in an integer variable (I41).

```
100 STATUS SL,102;P
110 IF BIT(P,0)=0 THEN EXIT1@
120 ENTER SL,88 NOFORMAT;IERCODE
130 OUTPUT SL,41 NOFORMAT;I41
140 CONTROL SL,101;$0001,$0101
150 CONTROL SL,102;$0000,$0101
160 LOOP1@
170 STATUS SL,102;P
180 IF BIT(P,0)=1 THEN LOOP1@
190 CONTROL SL,101;$0000,$0001
200 EXIT1@
```
7.2.4 Jog Stepping

When the Positive- (Negative-) direction Jog Stepping output relay is on, the motor moves in the positive (negative) direction.

● Conditions for Command Execution:
- The axis is not in an error state.
- The axis is in the End-of-Positioning status.
- No other command is being executed.

● Note:
- If any of the conditions is not satisfied, the command is ignored. If the command is issued when the axis is in an error state or not in the End-of-Positioning status, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
- During jog stepping, the Stop Immediately command is valid but the Decelerate-and-Stop command is ignored (the Execute Command ACK input relay is not set). If the Decelerate-and-Stop command is issued during jog stepping, an alarm code is set in the alarm status. Terminate jog stepping before executing the Decelerate-and-Stop command.
- During jog stepping, no error occurs even if the axis exceeds the range defined by the positive direct limit value and the negative direction limit value.

● Procedure:
1. Write the required parameters of the Jog Stepping command to the positioning module with the OUTPUT instruction.
2. When the Positive-direction (Negative-direction) Jog Stepping output relay is set, the axis moves according to the parameters and the End-of-Positioning input relay is reset.
3. When the Positive-direction (Negative-direction) Jog Stepping output relay is reset, the axis will decelerate and stop according to the parameters. After that, the End-of-positioning input relay is set.

● Sample Program:
This sample program shows the operation of Start Jog Stepping (JOGST@) and End Jog Stepping (JOGEND@) in the positive direction. Required parameters are preset in integer variables (I45 to I51).

```
100 JOGST@
110 OUTPUT SL,45 NOFORMAT;I45
120 OUTPUT SL,46 NOFORMAT;I46
: 170 OUTPUT SL,51 NOFORMAT;I51
180 CONTROL SL,102;$0001,$0001

300 JOGEND@
310 CONTROL SL,102;$0000,$0001
320 LOOP1@
330 STATUS SL,102;P
340 IF BIT(P,8)=0 THEN LOOP1@
```
7.2.5 Origin Search

There are two ways to perform origin search: normal and automatic. In normal origin search, the origin search behavior is arbitrarily defined by an application program; the automatic origin search operation uses entry parameters to define the origin search behavior.

This section describes the normal origin search operation. For details on the automatic origin search operation, see Section 7.1.6, "Using Automatic Origin Search."

There are three external contact inputs related to the normal origin search. The origin search mode uses bit patterns (2 bits for each edge, 12 bits in total) to specify the desired behavior when each rising and falling edge of these three inputs (six in total) is detected during the origin search.

In the example below, the origin search proceeds in the negative direction with the following behavior: (1) Stops immediately when a rising edge of the negative-direction limit is detected. (2) Decelerates and stops when a rising edge of the origin input is detected. (3) Shifts to a Z-phase search when a falling edge of the origin search is detected. In this case, the origin search mode is set as follows:

```
0 0 0 0 1 1 0 0 0 0 1 0 1
```

(“0C09” in hexadecimal)

For the origin search mode, see Section 3.5, “Origin Search.”

![Example of Origin Search Operation](F070127.VSD)
Conditions for Command Execution:
- The axis is not in an error state.
- The axis is in the End-of-Positioning status.
- No other command is being executed.

Note:
- If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued when the axis is in an error state or not in the End-of-Positioning status, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
- The origin search ends when a specified external contact input is detected and the axis is stopped. Change the parameters and begin the origin search again if you wish to continue the search in another direction or at a different speed.
- In the following cases, an error occurs and the origin search is aborted:
  - The limit input of the origin-search direction is set to be ignored but is detected.
  - After shifting to Z-phase search, the limit switch of the origin search direction is detected (this always causes an error regardless of the setting).
  - After shifting to Z-phase search, no Z-phase pulse is detected within the origin search Z-phase search range.
- If you wish to change the setup values according to the state of the external contact input at the beginning of the origin search, read the state with the Contact Input Status before executing the origin search.
- After shifting to Z-phase search, even if the external contact input that sets the Stop Immediately or Decelerate and Stop operation is detected, the Z-search operation will continue. (This is different from an origin search in the F3NC11-0N and F3NC12-0N modules)
- During the origin search, even if the axis exceeds the range defined by the positive and negative direction limit values, no error occurs.

Procedure:
1. Write the entry and command parameters required for the origin search operation to the positioning module with the OUTPUT instruction (set the command code to 2).
2. Set the Execute Command output relay. The Execute Command ACK input relay will be set and the automatic origin search begins. Operation continues until the specified external contact input is detected. If there is an invalid parameter, the Error Notification Input Relay will be set but not the Execute Command ACK Input Relay.
3. When Z-phase pulses are detected for the specified number of times after shifting to Z-phase search (if this number is specified as "0," the module skips the Z-phase search), the current position is specified as “Position 0” and the axis stops immediately. After outputting the deviation pulse clear signal for a preset duration, the End of Positioning input relay is set.
4. Confirm the state of origin search by checking the origin search status. If the origin search status is "0," the origin search has ended following a successful Z-phase search. For details on the origin search status, see Section 5.2, “Description of Statuses”.
Sample Program:

This program starts the origin search using the Request to Search Origin input and stops the search using a designated external contact input. If any error is detected during the search, the search mode is automatically reset. All required parameters are preset in integer variables (I41, and I46 to I58).

```
100 OUTPUT SL,46 NOFORMAT;I46
110 OUTPUT SL,47 NOFORMAT;I47

220 OUTPUT SL,58 NOFORMAT;I58
230 OUTPUT SL,41 NOFORMAT;I41
240 CONTROL SL,101;$0001,$0001
250 LOOP1@
260 STATUS SL,101;$
P270 IF BIT(P,0)=0 THEN LOOP1@
280 CONTROL SL,101;$0000,$0001
290 LOOP2@
300 STATUS SL,102;$
P310 IF BIT(P,8)=0 THEN LOOP2@
320 ENTER SL,90 NOFORMAT;IORGST
```
7.2.6 Automatic Origin Search

There are two ways to perform origin search: normal and automatic. In normal origin search, the origin search behavior is arbitrarily defined by an application program; the automatic origin search operation uses entry parameters to define the origin search behavior.

This section describes the automatic origin search operation. For the normal origin search operation, refer to Section 7.2.5, “Origin Search.”

Before initiating the automatic origin search, you must first set the automatic origin search mode and other relevant entry parameters. For details on automatic origin search behavior, see Section 3.6, “Automatic Origin Search.”

● Conditions for Command Execution:
- The axis is not in an error state.
- The axis is in the End-of-Positioning status.
- No other command is being executed.

● Note:
- If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued when the axis is in an error state or not in the End-of-Positioning status, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
- In the following cases, an error occurs and the origin search is aborted:
  - The limit switch for the direction opposite the automatic origin search direction is detected when the axis is moving in that direction at automatic origin search speed 2.
  - After shifting into Z-phase detection, no Z-phase pulse is detected within the automatic origin search Z-phase search range.
  - During the automatic origin search, no error occurs even if the axis exceeds the range defined by the positive and negative direction limit values.

● Procedure:
1. Set the command code to 8 by writing to the positioning module using an OUTPUT instruction.
2. Set the Execute Command output relay. The Execute Command ACK input relay will be set, and the automatic origin search begins. The operation continues until the automatic origin search completes and the axis stops moving. If there is an invalid parameter, the Error Notification input relay will be set but the Execute Command ACK input relay will not be set.
3. After shifting to Z-phase search, the axis stops when Z-phase pulses are detected for the specified number of times (if the Z-phase pulse count is set to 0, the module skips the Z-phase search) and that position becomes the origin (the value of the origin is defined in the Automatic Origin Search Origin Offset parameter). The deviation pulse clear signal is then output for a specified period and the End of Positioning input relay is set.
4. Confirm the state of the origin search by checking the origin search status. If the origin search status is “0,” the automatic origin search has ended following a successful Z-phase search. For details on the origin search status, see Section 5.2, “Description of Statuses.”
Sample Program:

This program starts the automatic origin search operation using the Request to Start Automatic Origin Search, performs Z-phase detection and stops the operation. The program also stops the operation if it detects an error during the operation. All required parameters are preset in an integer variable (I41).

```
100 OUTPUT SL,41 NOFORMAT;I41
110 CONTROL SL,101;$0001,$0001
120 LOOP1@
130 STATUS SL,101;P
140 IF BIT(P,0)=0 THEN LOOP1@
150 CONTROL SL,101;$0000,$0001
160 LOOP2@
170 STATUS SL,102;P
180 IF BIT(P,8)=0 THEN LOOP2@
190 ENTER SL,90 NOFORMAT;IORGST
```
7.2.7 Set Current Position

The Set Current Position command changes the current position of an axis in the End of Positioning status.

- **Conditions for Command Execution:**
  - The axis is not in an error state.
  - The axis is in the End-of-Positioning status.
  - No other command is being executed.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set.
  - If the command is issued when the axis is in an error state or the axis is not in the End-of-Positioning state, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - The new changed must fall between the positive-direction limit and the negative-direction limit. An error occurs if a request is made to change the current position beyond the limits of the range.

- **Procedure:**
  1. Set the Target Position parameter to the new position and the command code to 4 by issuing OUTPUT instructions to the positioning module.
  2. Set the Execute Command output relay.
  3. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. If there is an invalid parameter, the Error Notification input relay will be set but the Execute Command ACK input relay will not be set.
  4. Check that the Execute Command ACK input relay is reset.

- **Sample Program:**

  This is an example to set the current position. All required parameters are preset in integer variables (I41, I43, and I44).

```
100 OUTPUT SL,43 NOFORMAT;I43
110 OUTPUT SL,44 NOFORMAT;I44
120 OUTPUT SL,41 NOFORMAT;I41
130 CONTROL SL,101;$0001,$0001
140 LOOP1@
150 STATUS SL,101;P
160 IF BIT(P,0)=0 THEN LOOP1@
170 CONTROL SL,101;$0000,$0001
180 LOOP2@
190 STATUS SL,101;P
200 IF BIT(P,0)=1 THEN LOOP2@
```
7.2.8 Positioning Operation

This executes a positioning operation towards a preset target position.

- **Conditions for Command Execution:**
  - The axis is not in an error state.
  - The axis is in the End-of-Positioning status.
  - No other command is being executed.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set.
  - If the command is issued when the axis is in an error state or not in the End-of-Positioning status, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - If there is an invalid parameter, a parameter error results and the axis does not move.

- **Procedure:**
  1. Write the required parameters and command code to the positioning module with the OUTPUT instruction (set the command code to 0).
  2. Set the Execute Command output relay.
  3. The Execute Command ACK will be set and the axis starts positioning. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. If there is an invalid entry parameter, the Error Notification input relay will be set but the Execute Command ACK input relay will not be set.
  4. The End of Positioning input relay is set when the output pulses reach the target position. In general, when using servomotors, take note that there is some time lag between the stopping of the pulse output and the stopping of the axis after reaching the target position.
Sample Program

This is a sample program for a positioning operation. All required parameters are preset in integer variables (I41 to I51).

```
100 OUTPUT SL,42 NOFORMAT;I42
110 OUTPUT SL,43 NOFORMAT;I43
:  
190 OUTPUT SL,51 NOFORMAT;I51
200 OUTPUT SL,41 NOFORMAT;I41
210 CONTROL SL,101; $0001,$0001
220 LOOP1@
230 STATUS SL,101;P
240 IF BIT(P,0)=0 THEN LOOP1@
250 CONTROL SL,101; $0000,$0001
260 LOOP2@
270 STATUS SL,101;P
280 IF BIT(P,0)=1 THEN LOOP2@
290 LOOP3@
300 STATUS SL,102;P
310 IF BIT(P,8)=0 THEN LOOP3@
```
7.2.9  Request to Decelerate and Stop

The Request to Decelerate and Stop command decelerates and stops a moving motor during a positioning operation, origin search, etc. The rate of deceleration is determined from the preset values at startup.

● Conditions for Command Execution:
  - The axis is not in an error state.
  - The axis is not in jog stepping.
  - No other command is being executed.

● Note:
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued when the axis is in an error state or in jog stepping, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - You cannot execute the Decelerate and Stop command during jog stepping. Terminate jog stepping first, if necessary.
  - The Decelerate and Stop command is also accepted in the end-of-positioning status. (The Execute Command ACK is set.)

● Procedure:
  1. Set the command code to 1 by issuing an OUTPUT instruction to the positioning module.
  2. Set the Execute Command output relay.
  3. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. The axis starts decelerating when the Execute Command ACK is set.
  4. The End of Positioning input relay is set when the axis stops.

● Sample Program:
This sample program performs a request to decelerate and stop. All required parameters are preset in an integer variable (I41).

100 OUTPUT SL,41 NOFORMAT;I41
110 CONTROL SL,101;$0001,$0001
120 LOOP1@
130 STATUS SL,101;P
140 IF BIT(P,0)=0 THEN LOOP1@
150 CONTROL SL,101;$0000,$0001
160 LOOP2@
170 STATUS SL,101;P
180 IF BIT(P,0)=1 THEN LOOP2@
190 LOOP3@
200 STATUS SL,102;P
210 IF BIT(P,8)=0 THEN LOOP3@
7.2.10 Request to Stop Immediately

The Request to Stop Immediately command stops an operating motor immediately without deceleration during a positioning operation, origin search, etc.

- **Conditions for Command Execution:**
  - The axis is not in an error state.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored and the Stop Immediately ACK relay is not set. If the command is issued when the axis is in an error state, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Stop Immediately output relay is reset. For details on alarm codes, see Section 8.3, "Alarm Codes."
  - Take care when stopping a motor operating at high speed as the sudden stop may result in a shock to the system.
  - The Stop Immediately command is also accepted in the end-of-positioning status. (The Execute Command ACK is set.)

- **Procedure:**
  1. Set the Stop Immediately output relay.
  2. Reset the Stop Immediately output relay after confirming that the Stop Immediately ACK input relay is set. The axis stops immediately when the Stop Immediately ACK input relay is set.
  3. The End of Positioning input relay is set when the axis stops.

- **Sample Program:**
  This sample program performs a request to stop immediately.

```
100 CONTROL SL,101;$0100,$0100
110 LOOP1@
120 STATUS SL,101;P
130 IF BIT(P,8)=0 THEN LOOP1@
140 CONTROL SL,101;$0000,$0100
150 LOOP2@
160 STATUS SL,101;P
170 IF BIT(P,8)=1 THEN LOOP2@
180 LOOP3@
190 STATUS SL,102;P
200 IF BIT(P,8)=0 THEN LOOP3@
```
7.2.11 Changing Speed during Operation

When the Change Speed command is issued during a positioning operation, the axis immediately starts to accelerate (or decelerate) to the new speed at a rate determined by the new speed and the new acceleration (or deceleration) time. When the axis subsequently decelerates from the new speed and stops to complete the positioning operation, or when a Decelerate-and-Stop command is issued, the deceleration rate is determined by the new speed and the deceleration time.

**Conditions for Command Execution:**
- The axis is not in an error state.
- The axis is not in the End-of-Positioning status.
- The axis is not in an origin search operation.
- The axis is not accelerating during a positioning operation.
- The axis is not decelerating during a positioning operation or in the jog stepping operation.
- The axis is not changing its speed during a positioning operation.
- The axis can reach the target position even after changing to the new speed.
- The axis is not changing its target position.

**Note:**
- If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued but not all the conditions are satisfied, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
- If the Change Speed command is issued during a jog stepping operation, the module waits until all acceleration and deceleration has been completed before executing the command. If a new Change Speed command is issued during the wait, the previous command is discarded and only the new command is executed.
- If there is an invalid command parameter, an error occurs and the axis stops immediately.

**Procedure:**
1. Write the command parameters to the positioning module with the OUTPUT instruction (set the command code to 6).
2. Set the Execute Command output relay.
3. The Execute Command ACK input relay is set and the Change Speed operation begins. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. If there is an invalid parameter, the Error Notification input relay will be set, but the Execute Command ACK input relay will not be set.
4. Confirm that the Execute Command ACK input relay is reset.
Sample Program:

This program changes the speed during operation. All required parameters are preset in integer variables (I41 to I49).

```
100 OUTPUT SL,46 NOFORMAT;I46
110 OUTPUT SL,47 NOFORMAT;I47
120 OUTPUT SL,48 NOFORMAT;I48
130 OUTPUT SL,49 NOFORMAT;I49
140 OUTPUT SL,41 NOFORMAT;I41
150 CONTROL SL,101;$0001,$0001
160 LOOP1@
170 STATUS SL,101;P
180 IF BIT(P,0)=0 THEN LOOP1@
190 CONTROL SL,101;$0000,$0001
200 LOOP2@
210 STATUS SL,101;P
220 IF BIT(P,0)=1 THEN LOOP2@
```
7.2.12 Changing Target Position during Positioning

When the Change Target Position command is issued during a positioning operation, the module updates the target position and performs positioning to reach the new target position. Changing the target speed, acceleration or deceleration is not allowed during the execution of the change target position command.

● Conditions for Command Execution:
  - The axis is not in an error state.
  - The axis is not in a jog stepping operation.
  - The axis is not in an origin search operation.
  - The axis is not in a change target position operation.

● Note:
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued but not all the conditions are satisfied, an alarm code is set in the alarm status. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - If the Change Target Position command is issued in the End-of-Positioning status, the command is executed the same as a Start Positioning command.
  - If the Change Target Position command is issued during acceleration, deceleration or speed change, the execution of the command is suspended until the axis speed becomes constant or the axis stops.
  - When the Change Target Position command is being executed, no commands other than Decelerate-and-Stop and Stop Immediately are available.
  - If there is an invalid command parameter, an error occurs and the axis stops immediately.

● Procedure:
  1. Write the command parameters to the positioning module with the OUTPUT instruction (set the command code to 7).
  2. Set the Execute Command output relay.
  3. The Execute Command ACK input relay is set and the Change Target Position operation begins. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set. If there is an invalid parameter, the Error Notification input relay will be set but the Execute Command ACK input relay will not be set.
  4. Confirm that the Execute Command ACK input relay is reset.
Sample Program:

This program changes the target position during a positioning operation. All required parameters are preset in integer variables (I41, I46 to I49).

```
100 OUTPUT SL,42 NOFORMAT;I42
110 OUTPUT SL,43 NOFORMAT;I43
120 OUTPUT SL,44 NOFORMAT;I44
130 OUTPUT SL,41 NOFORMAT;I41
140 CONTROL SL,101;$0001,$0001
150 LOOP1@
160 STATUS SL,101;P
170 IF BIT(P,0)=0 THEN LOOP1@
180 CONTROL SL,101;$0000,$0001
190 LOOP2@
200 STATUS SL,101;P
210 IF BIT(P,0)=1 THEN LOOP2@
```
7.2.13 Saving Entry Parameters

When all axes are at rest, you can save all entry parameters to the flash memory. You can issue the Save Parameter command for any axis but the entry parameters of all axes are saved to the flash memory, regardless.

- **Conditions for Command Execution:**
  - No axis is in an error state.
  - All axes are in the End-of-Positioning status.
  - No other command is being executed for any axis.

- **Note:**
  - If any of the conditions is not satisfied, the command is ignored and the Command Execution ACK relay is not set. If the command is issued for an axis which is in an error state or not in the End-of-Positioning status, an alarm code is set in the alarm status for the axis. The alarm code is automatically cleared when the Execute Command output relay is reset. For details on alarm codes, see Section 8.3, “Alarm Codes.”
  - As there is limit to the number of times data can be written to the flash memory (100,000 times max.), you should save the entry parameters to the flash memory only when required.

- **Procedure:**
  1. Set the command code to 9 (Save Parameter command) by issuing an OUTPUT instruction to the positioning module.
  2. Set the Execute Command output relay.
  3. The Execute Command ACK input relay is set and the entry parameters are saved to the flash memory. Reset the Execute Command output relay after confirming that the Execute Command ACK input relay is set.
  4. Confirm that the Execute Command ACK input relay is reset.

- **Sample Program:**

  This program saves the entry parameters to the flash memory. All required parameters are preset in integer variables (I41 to I44).

  ```
  100 OUTPUT SL,41 NOFORMAT;I41
  110 CONTROL SL,101;$0001,$0001
  120 LOOP1@
  130 STATUS SL,101;P
  140 IF BIT(P,0)=0 THEN LOOP1@
  150 CONTROL SL,101;$0000,$0001
  160 LOOP2@
  170 STATUS SL,101;P
  180 IF BIT(P,0)=1 THEN LOOP2@
  ```
8. Errors and Troubleshooting

This section describes troubleshooting on the positioning module. However, it assumes that power is supplied to the FA-M3 and the module is installed correctly.

8.1 Troubleshooting Flow

When jogging, leave the values of all entry parameters at their factory defaults, set the high-order word for the target speed command parameter in data position *47 (is the value of (axis number -1)) to 10, and set all the remaining command parameters to 0. Disconnect the external wiring except the external 5V power supply and keep the Jog Stepping relay on. At this time, a 10kpps pulse will be generated.

You can check the contact input status (data position number *87) for the state of the contact input.

Replace the module after checking the external connections (especially the external power supply 5 V) (see Section 2.6, "Terminal Assignments and Connections.")
8.2 Error Codes

When an error occurs in any axis in the positioning module, the Error LED at the front of the module lights up to indicate that an error has occurred. The Error Notification input relay related to the axis is set. The error code status is also set. When the Error LED lights up, axes other than the one in error can still operate. The table below lists the errors detectable in the positioning module. If an error occurs, check the error code, remove the cause of the error, and issue the Reset Error command.

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description of Error</th>
<th>Cause of Error</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Positive-direction limit error</td>
<td>An attempt is made to output a positive-direction pulse when the Positive-direction Limit input is on. Or the Positive-direction Limit input is turned on during the output of a positive-direction pulse.</td>
<td>Check the Limit Input contact input polarity setting (data position number *04). Or, verify the position of the limit switch and the operation direction. You can check the contact input status (data position number *87) for the limit input status.</td>
</tr>
<tr>
<td>12</td>
<td>Negative-direction limit error</td>
<td>An attempt is made to output a negative-direction pulse when the Negative-direction Limit input is on. Or the Negative-direction Limit input is turned on during the output of a negative-direction pulse.</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Pulse overflow error</td>
<td>An attempt is made during jog stepping to position the axis beyond the operating range (-2147483648 to 2147483647 pulses) of the positioning module.</td>
<td>Always position an axis within the operating range of the positioning module. To move the axis further in the same direction, stop the axis and change the current position with the Set Current Position command.</td>
</tr>
<tr>
<td>41</td>
<td>Origin-search error</td>
<td>During normal origin search, Z-phase is not detected within the Z-phase search range (data position number *56/ *57) after starting Z-phase search. During automatic origin search, Z-phase is not detected within the automatic origin search Z-phase search range (data position number *23/ *24) after starting Z-phase search.</td>
<td>Set the Z-phase search range larger than the Z-phase output period value. If the error persists, check the Z-phase input. You can check the contact input status (data position number *87) for the Z-phase input.</td>
</tr>
<tr>
<td>99</td>
<td>Flash memory error</td>
<td>The entry parameters saved in the flash memory are lost. This may be caused by writing to the flash memory more than the maximum allowable times or losing the power to the positioning module during a save entry parameter operation.</td>
<td>Reset the error, set the entry parameters again, and save them in the flash memory. When this error occurs, the entry parameters are reverted to their default values, but the content of the flash memory is not automatically restored. If this error occurs frequently, replace the positioning module. You can check the total number of flash memory write operations already performed so far by checking the operation status (data position number *92/93).</td>
</tr>
</tbody>
</table>

Continued to the next page
<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description of Error</th>
<th>Cause of Error</th>
<th>Trouble-shooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Maximum speed selection setting error</td>
<td>Maximum speed selection setting is beyond the setting range (0 and 1).</td>
<td>Set a value within the setting range.</td>
</tr>
<tr>
<td>2002</td>
<td>Pulse output mode setting error</td>
<td>Pulse output mode setting is beyond the setting range (0 and 1).</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>Rotating direction setting error</td>
<td>Rotating direction setting is beyond the setting range (0 and 1).</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>Contact input polarity setting error</td>
<td>The contact input polarity is beyond the setting range (0 to 7).</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>Positive-direction limit value setting error</td>
<td>Positive-direction limit value is beyond the setting range (–2147483648 to 2147483647).</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Negative-direction limit value setting error</td>
<td>Negative-direction limit value is beyond the setting range (–2147483648 to (Positive-direction Limit Value - 1)).</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Speed limit setting error</td>
<td>Speed limit setting is beyond the setting range (1 to 32751616, or 1 to 262012928).</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Automatic origin search mode setting error</td>
<td>Automatic origin search mode setting is beyond the setting range (0 and 1).</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Automatic origin search direction setting error</td>
<td>Automatic origin search direction setting is beyond the setting range (0 and 1).</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>Automatic origin search speed 1 setting error</td>
<td>Automatic origin search speed 1 setting is beyond the setting range (1 to Speed Limit).</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Automatic origin search speed 2 setting error</td>
<td>Automatic origin search speed 2 setting is beyond the setting range (1 to Automatic Origin Search Speed 1).</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>Automatic origin search starting speed setting error</td>
<td>Automatic origin search starting speed setting is beyond the setting range (0 to Automatic Origin Search Speed 2).</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>Automatic origin search acceleration time setting error</td>
<td>Automatic origin search acceleration time setting is beyond the setting range (0 to 32767).</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>Automatic origin search deceleration time setting error</td>
<td>Automatic origin search deceleration time setting is beyond the setting range (0 to 32767).</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>Automatic origin search Z-phase edge selection setting error</td>
<td>Automatic origin search Z-phase edge selection setting is beyond the setting range (0 and 1).</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>Automatic origin search Z-phase search count setting error</td>
<td>Automatic origin search Z-phase pulse count setting is beyond the setting range (0 to 32767).</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>Automatic origin search Z-phase search range setting error</td>
<td>Automatic origin search Z-phase search range setting is beyond the setting range (0 to 2147483647/Automatic Origin Search Z-phase Pulse Count).</td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>Automatic origin search deviation pulse clear time setting error</td>
<td>Automatic origin search deviation pulse clear time setting is beyond the setting range (0 to 32767).</td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td>Automatic origin search origin offset setting error</td>
<td>Automatic origin search origin offset setting is beyond the setting range (0 to 32767).</td>
<td></td>
</tr>
<tr>
<td>1041</td>
<td>Command code setting error</td>
<td>Command code is beyond the setting range (0 to 9, and 99).</td>
<td></td>
</tr>
<tr>
<td>1042</td>
<td>Target position mode setting error</td>
<td>Target position mode is beyond the setting range (0 and 1).</td>
<td></td>
</tr>
<tr>
<td>1043</td>
<td>Target position setting error</td>
<td>Target position setting is beyond the setting range (Negative-direction Limit Value to Positive-direction Limit Value).</td>
<td></td>
</tr>
<tr>
<td>1045</td>
<td>Acceleration/deceleration mode setting error</td>
<td>Acceleration/deceleration mode setting is beyond the setting range (0 and 1).</td>
<td></td>
</tr>
<tr>
<td>1046</td>
<td>Target speed setting error</td>
<td>Target speed setting is beyond the setting range (1 to Speed Limit).</td>
<td></td>
</tr>
<tr>
<td>1048</td>
<td>Acceleration time setting error</td>
<td>Acceleration time setting is beyond the setting range (0 to 32767).</td>
<td></td>
</tr>
<tr>
<td>1049</td>
<td>Deceleration time setting error</td>
<td>Deceleration time setting is beyond the setting range (0 to 32767).</td>
<td></td>
</tr>
<tr>
<td>1050</td>
<td>Startup speed setting error</td>
<td>Startup speed setting is beyond the setting range (0 to target speed).</td>
<td></td>
</tr>
<tr>
<td>1052</td>
<td>Origin search mode setting error</td>
<td>Origin search mode setting is beyond the setting range (0 to 4095).</td>
<td></td>
</tr>
<tr>
<td>1053</td>
<td>Origin search direction setting error</td>
<td>Origin search direction setting is beyond the setting range (0 and 1).</td>
<td></td>
</tr>
<tr>
<td>1054</td>
<td>Z-phase edge selection setting error</td>
<td>Z-phase edge selection setting is beyond the setting range (0 and 1).</td>
<td></td>
</tr>
<tr>
<td>1055</td>
<td>Z-phase search count setting error</td>
<td>Z-phase search count setting is beyond the setting range (0 to 32767).</td>
<td></td>
</tr>
<tr>
<td>1056</td>
<td>Z-phase search range setting error</td>
<td>Z-phase search range setting is beyond the setting range (0 to 2147483647/Z-phase search count).</td>
<td></td>
</tr>
<tr>
<td>1058</td>
<td>Deviation pulse clear time setting error</td>
<td>Deviation pulse clear time setting is beyond the setting range (0 to 32767).</td>
<td></td>
</tr>
</tbody>
</table>
8.3 Alarm Codes

When the positioning module issues an alarm for any axis, it writes an alarm code in the Alarm Status for the axis. An alarm is issued when an executed command does not meet the conditions for proper execution. Resetting the Execute Command relay or other output relay related to the invalid command clears the Alarm Status.

The following table lists the types of alarm detectable by the positioning module.

<table>
<thead>
<tr>
<th>Alarm Code</th>
<th>Type of Alarm</th>
<th>Cause of Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>Start Positioning Command Failed alarm</td>
<td>Start Positioning Command is executed in an error state.</td>
</tr>
<tr>
<td>1002</td>
<td>Start Positioning Command Failed alarm</td>
<td>Start Positioning Command is executed when the axis is not in an End of Positioning state.</td>
</tr>
<tr>
<td>1101</td>
<td>Decelerate-and-Stop Command Failed alarm</td>
<td>Decelerate-and-Stop Command is executed in an error state.</td>
</tr>
<tr>
<td>1103</td>
<td>Decelerate-and-Stop Command Failed alarm</td>
<td>Decelerate-and-Stop Command is executed during a jog stepping operation.</td>
</tr>
<tr>
<td>1201</td>
<td>Origin Search Command Failed alarm</td>
<td>Normal Origin Search Command is executed in an error state.</td>
</tr>
<tr>
<td>1202</td>
<td>Origin Search Command Failed alarm</td>
<td>Normal Origin Search Command is executed when the axis is not in an End of Positioning state.</td>
</tr>
<tr>
<td>1302</td>
<td>Set Parameter Command Failed alarm</td>
<td>Set Parameter Command is executed when the axis is not in an End of Positioning state.</td>
</tr>
<tr>
<td>1401</td>
<td>Set Current Position Command Failed alarm</td>
<td>Set Current Position Command is executed in an error state.</td>
</tr>
<tr>
<td>1402</td>
<td>Set Current Position Command Failed alarm</td>
<td>Set Current Position Command is executed when the axis is not in an End of Positioning state.</td>
</tr>
<tr>
<td>1501</td>
<td>Reset Error Command Failed alarm</td>
<td>Reset Error Command is executed when no error exists or when a parameter setting error exists.</td>
</tr>
<tr>
<td>1601</td>
<td>Change Speed Command Failed alarm</td>
<td>Change Speed Command is executed in an error state.</td>
</tr>
<tr>
<td>1602</td>
<td>Change Speed Command Failed alarm</td>
<td>Change Speed Command is executed when the axis is in the End of Positioning status.</td>
</tr>
<tr>
<td>1604</td>
<td>Change Speed Command Failed alarm</td>
<td>Change Speed Command is executed during an origin search.</td>
</tr>
<tr>
<td>1605</td>
<td>Change Speed Command Failed alarm</td>
<td>Change Speed Command is executed when the axis is accelerating (not including jog stepping), decelerating, or already changing its speed (not including jog stepping).</td>
</tr>
<tr>
<td>1606</td>
<td>Change Speed Command Failed alarm</td>
<td>Executing the Change Speed Command will prevent the axis from stopping at the target position.</td>
</tr>
<tr>
<td>1607</td>
<td>Change Speed Command Failed alarm</td>
<td>Change Speed Command is executed when the axis is changing its target position.</td>
</tr>
<tr>
<td>1701</td>
<td>Change Target Position Command Failed alarm</td>
<td>Change Target Position Command is executed in an error state.</td>
</tr>
<tr>
<td>1703</td>
<td>Change Target Position Command Failed alarm</td>
<td>Change Target Position Command is executed during jog stepping.</td>
</tr>
<tr>
<td>1704</td>
<td>Change Target Position Command Failed alarm</td>
<td>Change Target Position Command is executed during origin search.</td>
</tr>
<tr>
<td>1707</td>
<td>Change Target Position Command Failed alarm</td>
<td>Change Target Position Command is executed when the axis is already changing its target position.</td>
</tr>
<tr>
<td>1801</td>
<td>Automatic Origin Search Command Failed alarm</td>
<td>Automatic Origin Search Command is executed in an error state.</td>
</tr>
<tr>
<td>1802</td>
<td>Automatic Origin Search Command Failed alarm</td>
<td>Automatic Origin Search Command is executed when the axis is not in an End of Positioning state.</td>
</tr>
<tr>
<td>1901</td>
<td>Save Parameter Command Failed alarm</td>
<td>Save Parameter Command is executed in an error state.</td>
</tr>
<tr>
<td>1902</td>
<td>Save Parameter Command Failed alarm</td>
<td>Save Parameter Command is executed when the axis is not in an End of Positioning state.</td>
</tr>
<tr>
<td>2001</td>
<td>Jog Stepping Command Failed alarm</td>
<td>Jog Stepping Command is executed in an error state.</td>
</tr>
<tr>
<td>2002</td>
<td>Jog Stepping Command Failed alarm</td>
<td>Jog Stepping Command is executed when the axis is not in an End of Positioning state.</td>
</tr>
<tr>
<td>2101</td>
<td>Stop Immediately Command Failed alarm</td>
<td>Stop Immediately Command is executed in an error state.</td>
</tr>
</tbody>
</table>
9. External Interface Signals

9.1 Pulse Output

The positioning modules output positioning command pulses as RS422A compliant differential signals. An external power supply (5 V DC ±5%, 350 mA for the F3YP14-0N; or 5 V DC ±5%, 700 mA for the F3YP18-0N, is required for positioning command pulse output.

<table>
<thead>
<tr>
<th>Table 9.1 Signal Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>Insulation method</td>
</tr>
<tr>
<td>Electrical specification</td>
</tr>
<tr>
<td>Maximum speed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 9.2 Signal Polarity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal</strong></td>
</tr>
<tr>
<td><code>+</code> signal</td>
</tr>
<tr>
<td><code>-</code> signal</td>
</tr>
</tbody>
</table>

![Figure 9.1 Connecting the Pulse Outputs (line driver)](F090101.VSD)

**CAUTION**

- Make sure that the polarity of the `+` signal and `-` signal during signal off matches the specification of the target driver. When connected with reverse polarities, the driver may not operate.
- Always check the polarity of the external power supply (5V DC). Connecting with reverse polarities may damage the internal circuitry of the positioning module.
9.2 External Contact Input

These are 24 V DC inputs with a common terminal. The polarity of the common may be either positive or negative. It is insulated from the internal circuitry by a photocoupler.

Table 9.3 Signal Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation method</td>
<td>Photocoupler-isolated</td>
</tr>
<tr>
<td>Input impedance</td>
<td>Approx. 7.4 kΩ</td>
</tr>
<tr>
<td>Rated input voltage (operating voltage range)</td>
<td>24 V DC (20.4 to 26.4 V DC)</td>
</tr>
<tr>
<td>Rated input current</td>
<td>3.1 mA</td>
</tr>
<tr>
<td>On voltage/current (for “a” contact)</td>
<td>19.2 V DC min./2.4 mA min.</td>
</tr>
<tr>
<td>Off voltage/current (for “a” contact)</td>
<td>5.8 V DC max./ 0.9 mA max.</td>
</tr>
<tr>
<td>Common method</td>
<td>Shared common</td>
</tr>
<tr>
<td>Response time</td>
<td>3 ms max.</td>
</tr>
</tbody>
</table>

Table 9.2 Signal Polarity
9.3 Encoder Z-phase Input

This is the encoder Z-phase input. It is used only during an origin search. You may also connect a RS422A compliant differential signal.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation method</td>
<td>Photocoupler-isolated</td>
</tr>
<tr>
<td>Input impedance</td>
<td>240 Ω</td>
</tr>
<tr>
<td>Rated input voltage</td>
<td>5 V DC</td>
</tr>
<tr>
<td>(operating voltage range)</td>
<td>(4.25 to 5.5 V DC)</td>
</tr>
<tr>
<td>Rated input current</td>
<td>15.3 mA</td>
</tr>
<tr>
<td>On voltage/current</td>
<td>3.5 V DC min./9 mA min.</td>
</tr>
<tr>
<td>(for “a” contact)</td>
<td></td>
</tr>
<tr>
<td>Off voltage/current</td>
<td>1.5 V DC max./ 2 mA max.</td>
</tr>
<tr>
<td>(for “a” contact)</td>
<td></td>
</tr>
<tr>
<td>Common method</td>
<td>No internal common connection</td>
</tr>
<tr>
<td>Response time</td>
<td>1 ms max.</td>
</tr>
</tbody>
</table>

Figure 9.3 Connecting the Encoder Z-phase Input
9.4 Deviation Pulse Clear Signal Output

When using a servomotor/driver, this signal output is used to clear the deviation pulse count of the servo driver when the origin search ends. It is insulated from the internal circuitry by a photocoupler.

Table 9.5 Signal Specifications

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<th>Specifications</th>
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</thead>
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<td>Photocoupler-isolated</td>
</tr>
<tr>
<td>Rated load voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>Maximum load current</td>
<td>100 mA/point</td>
</tr>
<tr>
<td>Off leakage current</td>
<td>0.1 mA max.</td>
</tr>
<tr>
<td>On residual voltage</td>
<td>1.5 V DC max.</td>
</tr>
<tr>
<td>Common method</td>
<td>No internal common connection</td>
</tr>
</tbody>
</table>
10. Examples of Connections to Drivers

This chapter presents examples of connections of the module to motor or drivers. Note that the figures indicate canonical connections. Other signals may also have to be connected depending on your application.

⚠️ **CAUTION**

- Make sure that the polarity of the ‘+’ and ‘-’ signals during signal off matches the specification of the target driver. When connected with reverse polarities, the driver may not operate.

- Always check the polarity of the external power supply (5 V DC). Connecting with reverse polarities may damage the internal circuitry of the positioning module.

- Use shielded cables to connect signal lines and connect the shield to the FG terminal of the driver.
10.1 Example of Connection to Oriental Motor Driver

Figure 10.1 Example Connection to Oriental Motor Driver

**CAUTION**
- Always check the polarity of the external power supply (5 V DC). Connected with reverse polarities may damage the internal circuitry of the positioning module.
10.2 Example of Connection to YASUKAWA Electric Σll-Series Driver

Figure 10.2 Example Connection to YASKAWA Electric Σ ll Series Driver

CAUTION

- Always check the polarity of the external power supply (5 V DC). Connecting with reverse polarities may damage the internal circuitry of the positioning module.
10.3 Example of Connection to Sanyo Denki PZ Series Driver

- Always check the polarity of the external power supply (5 V DC). Connecting with reverse polarities may damage the internal circuitry of the positioning module.

---

**CAUTION**
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<td>5-2,5-3,7-2</td>
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<tr>
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<td>5-2,5-3,7-2</td>
</tr>
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<td>3-14,4-9,5-3,7-34,7-55,8-2</td>
<td>4-1,5-2</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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