User's Manual

FA-M3 V VITESSE™

Positioning Modules (with Multi-channel Pulse Output)

IM 34M06H55-04E

vigilantplant.®

Applicable Modules:

Model Code	Model Name
F3YP22-0P	Positioning Module (with Multi-channel Pulse Output)
F3YP24-0P	Positioning Module (with Multi-channel Pulse Output)
F3YP28-0P	Positioning Module (with Multi-channel Pulse Output)

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IM 34M06H55-04E
1st Edition

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Applicable Product

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

Model : F3YP22-0P, F3YP24-0P, F3YP28-0P
Name: Positioning Module (with Multi-Channel Pulse Output)

The document number for this manual is given below:

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

Document No. : IM 34M06H55-04E

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.

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

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

- **Alternating current.** Indicates alternating current.

- **Direct current.** Indicates direct current.

The following symbols are used only in the instruction manual.

WARNING

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

CAUTION

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

TIP

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

SEE ALSO

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

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

■ Exemption from Responsibility

- Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa Electric) makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.
- Yokogawa Electric assumes no liability to any party for any loss or damage, direct or indirect, caused by the use or any unpredictable defect of the product.

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- Copying the software for any purposes other than backup is strictly prohibited.
- Store the original media, such as floppy disks, that contain the software in a safe place.
- Reverse engineering, such as decompiling of the software, is strictly prohibited.
- No portion of the software supplied by Yokogawa Electric may be transferred, exchanged, or sublet or leased for use by any third party without prior permission by Yokogawa Electric.

■ General Requirements for Using the FA-M3

● Set the product in a location that fulfills the following requirements:

- Where the product will not be exposed to direct sunlight, and where the operating surrounding air temperature is from 0°C to 55°C (32°F to 131°F).

  There are modules that must be used in an environment where the operating surrounding air temperature is in a range smaller than 0°C to 55°C (32°F to 131°F). Refer to hardware user's manual or the applicable user's manual. In case of attaching such a module, the entire system's operating surrounding air temperature is limited to the module's individual operating surrounding air temperature.
- Where the relative humidity is from 10 to 90%.

  In places where there is a chance of condensation, use a space heater or the like to constantly keep the product warm and prevent condensation.
- For use in Pollution Degree 2 Environment.
- Where there are no corrosive or flammable gases.
- Where the product will not be exposed to mechanical vibration or shock that exceed specifications.
- Where there is no chance the product may be exposed to radioactivity.

● Use the correct types of wire for external wiring:

- USE COPPER CONDUCTORS ONLY.
- Use conductors 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.
  Refer to the hardware user's manual or the applicable user's manual for the appropriate tightening torque.

● Securely lock connecting cables:

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

● Interlock with emergency-stop circuitry using external relays:

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

● Ground for low impedance:

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

  *1 Japanese Industrial Standard (JIS) Class D Ground means grounding resistance of 100 Ω 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 with CE Marking, perform installation and cable routing according to the description on compliance to CE Marking in the “Hardware Manual”.

● We recommend that you stock up on maintenance parts:

- We recommend that you stock up on maintenance parts, including spare modules, in advance.
- Preventive maintenance (replacement of the module) is required for using the module beyond 10 years.

● Discharge static electricity before touching the system:

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

● Wipe off dirt with a soft cloth:

- Gently wipe off dirt on the product’s surfaces with a soft cloth.
- If you soak the cloth in water or a neutral detergent, tightly wring it out before wiping the product.

  Letting water enter the module interior can cause malfunctions.
- Do not use volatile solvents such as benzine or paint thinner or chemicals for cleaning, as they may cause deformity, discoloration, or malfunctioning.

● Avoid storing the FA-M3 controller in places with high temperature or humidity:

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

● Always turn off the power before installing or removing modules:

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

● Do not touch components in the module:

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

● Do not use unused terminals:

- Do not connect wires to unused terminals on a terminal block or in a connector. Doing so may adversely affect the functions of the module.

● Use the following power source:

- Use only power supply module F3PU□□-□□ in FA-M3 Controller for supplying power input for control circuit connection.
- If using this product as a UL-approved product, for the external power supply, use a limited voltage / current circuit power source or a Class 2 power source.

● Refer to the user's manual before connecting wires:

- Refer to the hardware user's manual or the applicable user's manual for the external wiring drawing.
- Refer to "A3.6.5 Connecting Output Devices" in the hardware user's manual before connecting the wiring for the output signal.
- Refer to "A3.5.4 Grounding Procedure" in the hardware user's manual for attaching the grounding wiring.

■ Waste Electrical and Electronic Equipment

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

(This directive is only valid in the EU.)

This product complies with the WEEE Directive (2002/96/EC) marking requirement.

The following marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category

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

Do not dispose in domestic household waste.

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

■ How to Discard Batteries

The following description on DIRECTIVE 2006/66/EC (hereinafter referred to as the EU new directive on batteries) is valid only in the European Union.

Some models of this product contain batteries that cannot be removed by the user. Make sure to dispose of the batteries along with the product.

Do not dispose in domestic household waste.

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

Battery type: Lithium battery

Note: The symbol above means that the battery must be collected separately as specified in Annex II of the EU new directive on batteries.

Introduction

■ Overview of the Manual

This user's manual explains the specifications and operation of the positioning modules (multi-channel pulse output) F3YP22-0P, F3YP24-0P, and F3YP28-0P.

■ Other Manuals

Refer to the latest editions of the following manuals.

● For F3SP71, F3SP76 functions:

- Sequence CPU Instruction Manual - Functions (for F3SP71-4N/4S, F3SP76-7N/7S) (IM 34M06P15-01E)

● For F3SP66, F3SP67 functions:

- Sequence CPU - Functions (for F3SP66-4S, F3SP67-6S) (IM 34M06P14-01E)
- Sequence CPU - Network Functions (for F3SP66-4S, F3SP67-6S) (IM 34M06P14-02E)

● For F3SP22, F3SP28, F3SP38, F3SP53, F3SP58, F3SP59 functions:

- Sequence CPU Instruction Manual - Functions (for F3SP22-0S, F3SP28-3N/3S, F3SP38-6N/6S, F3SP53-4H/4S, F3SP58-6H/6S, F3SP59-7S) (IM 34M06P13-01E)

● For F3SP21, F3SP25, F3SP35, F3SP05, F3SP08 functions:

- Sequence CPU -Functions (for F3SP21,F3SP25, F3SP35) (IM 34M06P12-02E)

● For sequence CPU instructions:

- Sequence CPU Instruction Manual – Instructions (IM 34M06P12-03E)

● For creating ladder programs:

- FA-M3 Programming Tool WideField3 (Introduction, Trouble Shootings) (IM 34M06Q16-□□E)

● For FA-M3 specifications and configurations common to all CPU modules*1, installation and wiring, test run, maintenance, and module 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 34M06C11-01E)

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FA-M3

Positioning Modules (with Multi-channel Pulse Output)

IM 34M06H55-04E 1st Edition

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1. Overview

Models F3YP22-0P, F3YP24-0P, and F3YP28-0P are advanced positioning modules (hereinafter referred to as the module or positioning module) used to control servo drivers and thereby the speed and position of stepper 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 2 (the F3YP22-0P module), 4 (the F3YP24-0P module), or up to 8 (the F3YP28-0P module) stepper motors or servomotors. When in use, the positioning module is attached to the base module of an FA-M3 controller.

With position command output pulse, the module is suitable for driving servomotors or drivers, as well as stepper motors or drivers in position control applications.

1.1 Features

The module has the following features:

● Most suitable for a multi-axial positioning system

- A single module can control positioning for up to 8 axes. When 16 F3YP28-0P modules are used, a multi-axial positioning system for up to 128 axes can be configured.
- The module supports position control (PTP operation and multi-axis linear interpolation), speed control, and speed control to position control switchover as control modes.
- The positioning module provides two operation modes: "direct operation" and "position data record operation". In direct operation mode, ladder programs are used to set target positions and target speeds. In position data record operation mode, the records of target positions and speeds registered in the positioning module beforehand are used for operations.

● Fast and accurate positioning control

- High-speed positioning command pulse output at 7.996 Mpps max. for servomotors and at 1.999 Mpps max. for stepper motors provides comfortable margin for driving linear, DD, and other high speed, high precision motors.
- Short startup time of a minimum of 40 μs reduces unnecessary time that elapses before positioning starts, and allows a fast start of operation and also synchronization with peripheral devices.
- A trigger start (e.g. by an external trigger, software trigger, or counter coincidence), for which target positions and target speeds are specified beforehand, allows shorter startup time of a minimum of 1 μs, which enables to start operation faster.
- A short control period of 0.125 ms allows outputting positioning commands smoother than before, which enables faster movement on the work. In addition, statuses, such as positioning completed and current values, can be updated faster.

● Support for various applications

- The module has a channel for the pulse counter in which up to 8 Mpps pulses can be input. Thus, the module can detect the position of an external device and start positioning based on the position on an index table or the movement amount on a conveyor, which allows faster and more accurate position control.

1.2 Concept of Position Control

The positioning module generates a position control path according to commands (with specified target positions, speeds, acceleration/deceleration time, etc.) from the CPU module and outputs positioning command values in the form of pulse trains. The number of output pulses determines the angle through which a motor rotates and the frequency of output pulses determines the speed at which a motor rotates.

Based on the pulse trains from the module and feedback pulse trains from an encoder, a servomotor/servo driver adjusts the position and speed and passes a driving current to rotate the motor.

When the module stops pulse outputs, as the difference between the number of pulses output from the module and the number of pulses fed back from the encoder becomes small, the rotation speed decreases, and finally when the difference becomes zero, the motor stops.

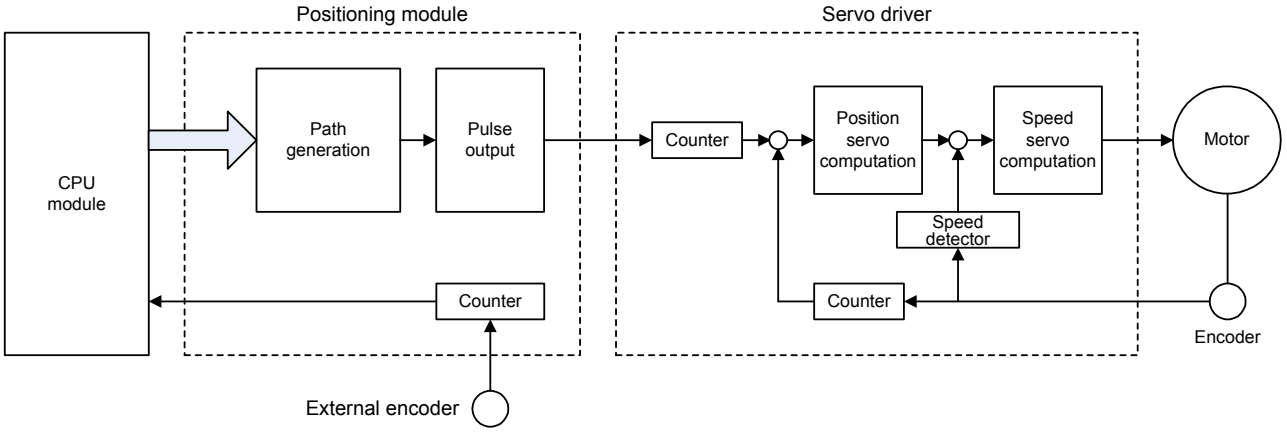

Figure 1.1 Operation Principle

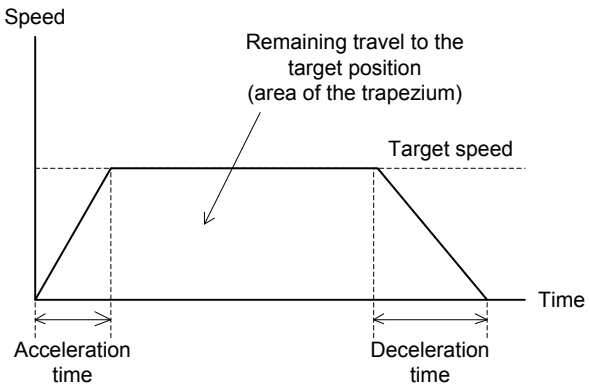

Figure 1.2 Path Generation

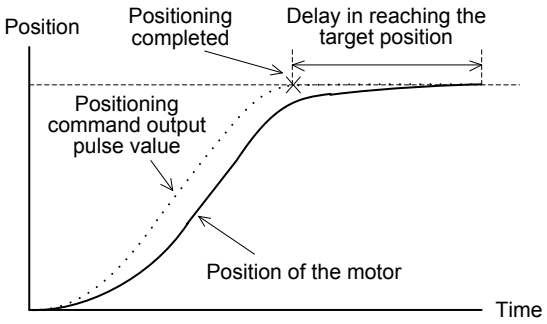

Figure 1.3 Positioning Command Output Pulse and Servomotor Operation

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 rate is 1.998 Mpps for stepper motors. If high speed mode is selected for speed mode selection, the motor performance cannot be guaranteed.

1.3 Counter Functions

The module supports connecting a sensor such as an incremental encoder and has a counter input channel that allows input at up to 8 Mpps, three high-speed contact inputs for the counter, and two high-speed contact outputs for the counter.

General counter functions, such as the counter enable/disable control function, counter coincidence detection function (two channels), counter latch function (two channels), and counter preset function, are available.

A change in counter input states can be used as a trigger condition for a positioning operation. When the counter functions are used in a positioning operation, the module can detect the position of an external device and start positioning based on the position on an index table or the movement amount on a conveyor.

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2. Specifications

2.1 Model and Suffix Codes

Table 2.1 Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Description
F3YP22	-0P	……	……	2-axis control, 7.996 Mpps max. (for servomotor) or 1.999 Mpps max. (for stepper motor) One counter channel for encoder input, 8 Mpps max. Position control/speed control/switching between speed and position control, direct operation/position data record operation
F3YP24	-0P	……	……	4-axis control, 7.996 Mpps max. (for servomotor) or 1.999 Mpps max. (for stepper motor) One counter channel for encoder input, 8 Mpps max. Position control/speed control/switching between speed and position control, direct operation/position data record operation
F3YP28	-0P	……	……	8-axis control, 7.996 Mpps max. (for servomotor) or 1.999 Mpps max. (for stepper motor) One counter channel for encoder input, 8 Mpps max. Position control/speed control/switching between speed and position control, direct operation/position data record operation

2.2 Operating Environment

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

2.3 General Specifications

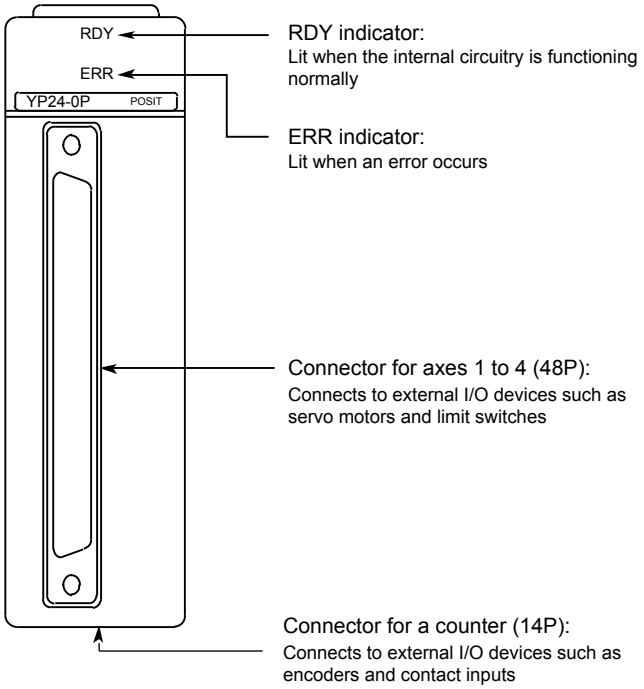
Table 2.2 General Specifications

Item		Specifications		
		F3YP22-0P	F3YP24-0P	F3YP28-0P
Control	Number of controlled axes	2	4	8
	Control method	Open-loop control with positioning command pulse output		
	Pulse output method	RS-422A compliant differential line driver (ISL32172E equivalent) Pulse type selectable for each axis: CW/CCW , travel/direction , and phase A/B		
	Output pulse rates	- Using a servomotor / - Using a stepper motor CW/CCW pulse: 7,996,000 (pulse/s) / 1,999,000 (pulse/s) Travel/direction: 7,996,000 (pulse/s) / 1,999,000 (pulse/s) Phase A/B (x4): 7,996,000 (pulse/s) / 1,999,000 (pulse/s) Phase A/B (x2): 3,998,000 (pulse/s) / 999,500 (pulse/s) Phase A/B (x1): 1,999,000 (pulse/s) / 499,750 (pulse/s)		
	Control period	0.125 ms		
External contact input		4 inputs per axis (origin input, forward and reverse limit inputs, and Z-phase input) (A digital filter can be set for each input. Forward and reverse limit inputs can be used as generic inputs.)		
External contact output		1 output per axis (deviation pulse clear signal)		
Position-ing functions	Control unit	pulse		
	Control mode	Position control (PTP control, multi-axis linear interpolation), speed control, and speed control to position control switchover		
	Operation method	Direct operation, position data record operation (10 data/axis)		
	Command position	Absolute/incremental positioning command -2,147,483,648 to 2,147,483,647 (pulses)		
	Command speed	For servomotor, 1 to 7,996,000 (pulse/s) For stepper motor, 1 to 1,999,000 (pulse/s)		
	Acceleration/ deceleration system	Automatic trapezoidal acceleration/deceleration (startup speed programmable) Automatic S-shape acceleration/deceleration (startup speed fixed)		
	Acceleration/ deceleration time	0 to 32,767 (ms) (configurable for acceleration and deceleration separately)		
	Origin search	Two types of automatic origin search Manual origin search (user-definable using a combination of external contact inputs)		
	Manual control	Jog and manual pulse generator mode		
	Other functions	Target position change during operation, speed change during operation, current position setup, software limit detection, positioning start/stop by an external trigger, software trigger, or counter coincidence		
	Startup time*1	0.04 ms for one axis	0.04 ms for one axis 0.09 ms for four axes	0.04 ms for one axis 0.09 ms for four axes 0.15 ms for eight axes
Counter*3	Number of channels	1 channel		
	Pulse input method	Pulse type selectable: CW/CCW pulse, travel/direction pulse, and phase A/B pulse		
	Input pulse rate	CW/CCW pulse: 2,000,000 (pulse/s) Travel/direction: 2,000,000 (pulse/s) Phase A/B (x4): 8,000,000 (pulse/s) Phase A/B (x2): 4,000,000 (pulse/s) Phase A/B (x1): 2,000,000 (pulse/s)		
	Operation mode	Linear counter, ring counter		
	Counter functions	Counter enable function, counter preset function, counter coincidence detection function, cam-operated switch function, counter latch function, speed measurement function, positioning start/stop by an external trigger or counter coincidence		
	Counter Z-phase input	1 input (latch input, present input, and so on can be assigned)		
	Counter external contact input	3 inputs (latch input, present input, enable input, trigger condition of the positioning function, and so on can be assigned)		
	Counter external contact output	2 outputs (counter coincidence output, cam-operated switch output, and so on can be assigned)		
Data backup		Flash ROM (100,000 times rewritable)		
Current consumption (at 5 V DC)		210 mA	240 mA	280 mA
External power supply (24 V DC)*4 (For pulse output/counter contact output)		70 mA (60 mA/10 mA)	110 mA (100 mA/10 mA)	200 mA (190 mA/10 mA)
External wiring		One 48-pin connector One 14-pin connector	One 48-pin connector One 14-pin connector	Two 48-pin connectors One 14-pin connector
External dimensions		28.9 (W) × 100 (H) × 83.2 (D) mm*2		
Weight		110 g	110 g	175 g
Surrounding air temperature range		Operating : 0 to 55°C		
		Storage : -20°C to 75°C		
Surrounding humidity range		Operating : 10 to 90% RH (non-condensing)		
		Storage : 10 to 90% RH (non-condensing)		
Surrounding atmosphere		Must be free of corrosive gases, flammable gases or heavy dust.		

*1: Up to 0.125 ms delay may be added if another axis is in motion.
*2: Not including protrusions (see the external dimension diagram for more details).
*3: When you need to send a counter status change (e.g., counter coincidence and preset input) to the CPU module by an input relay interrupt, you can use Stop Immediately ACK relays for positioning functions by assigning them to the input relays for counters.
*4: When using the module as a UL approved product, use limited voltage/current circuits or a Class 2 power supply for the external power supply.

2.4 Components and Functions

● F3YP22-0P (with two axes), F3YP24-0P (with four axes)



● F3YP28-0P (with eight axes)

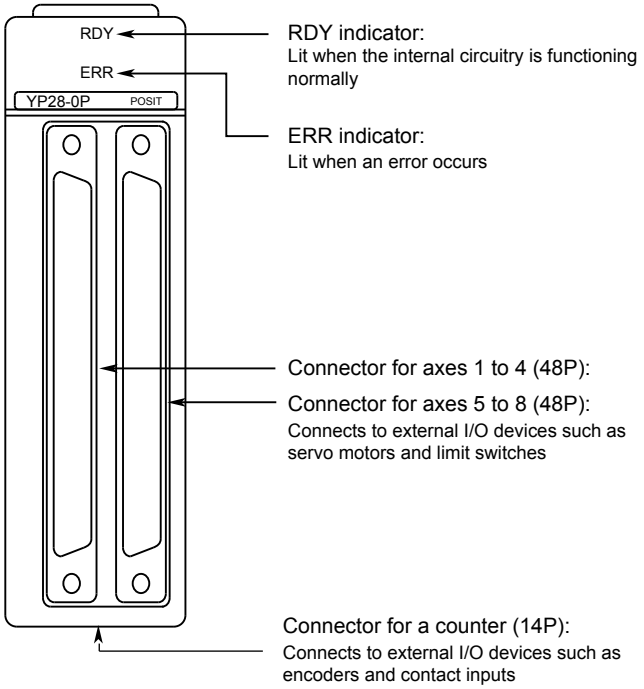
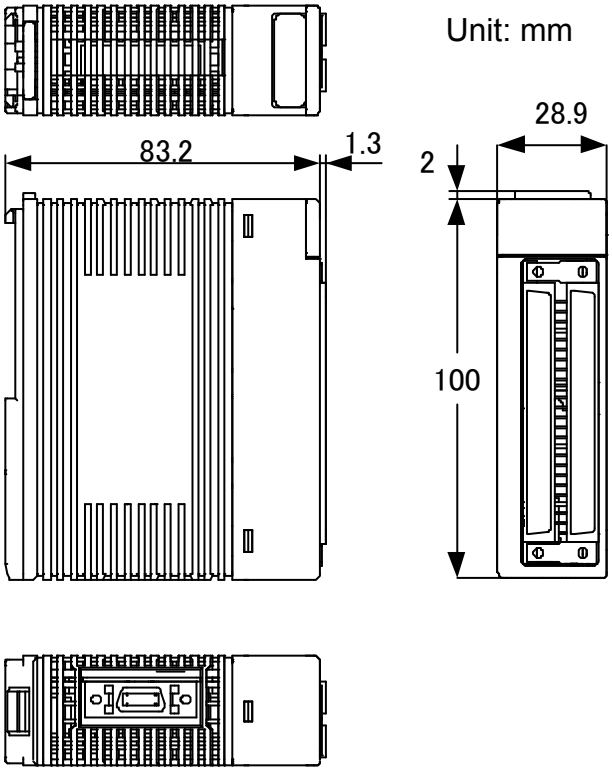


Figure 2.1 Front View of the F3YP22-0P, F3YP24-0P, and F3YP28-0P Modules

2.5 External Dimensions

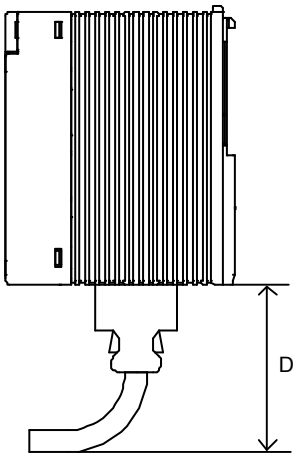


Note: The above diagram is for the F3YP28-0P module.

Figure 2.2 External Dimensions Diagram

2.6 Attachment Dimensions

This module requires space for the wiring of the connector for counters.



	D (mm)
Min. space	100 min

Figure 2.3 Attaching the Connector for Counters

2.7 Applicable External Interface Connectors

● Connectors for external I/O devices

Fujitsu Component Limited

Connection	Applicable Connector	Remarks
Soldered	FCN-361J048-AU connector FCN-360C048-B connector cover	Purchase the desired connector kit separately.
Crimp-on	FCN-363J048 housing FCN-363J-AU contacts FCN-360C048-B connector cover	
Pressure-welded	FCN-367J048-AU/F	

● Connectors for counters

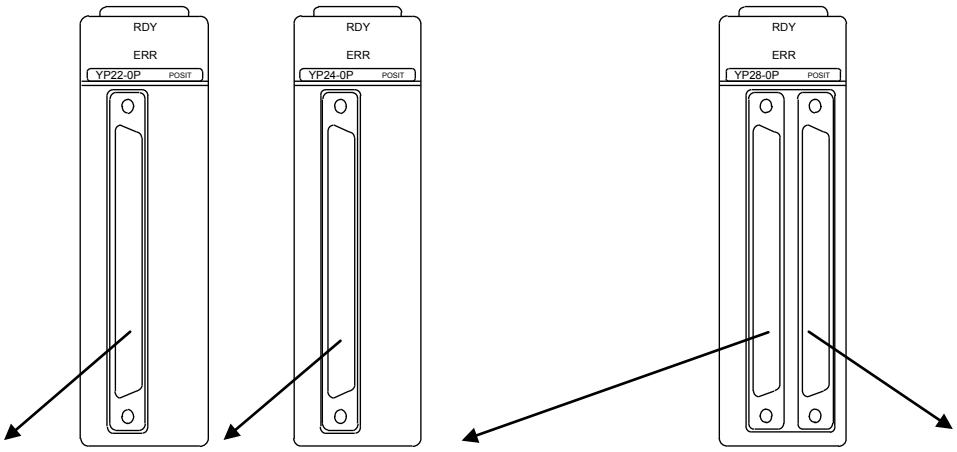
Sumitomo 3M Limited

Connection	Applicable Connector	Remarks
Soldered	10114-3000PE connector 10314-52F0-008 connector cover	Purchase the desired connector kit separately.
Pressure-welded	10114-6000EL connector 10314-52F0-008 connector cover	

2.8 Terminal Assignments and Connections

For details on the external connection signals, refer to Chapter 12, "Connections and Wiring."

● Connectors for external I/O devices



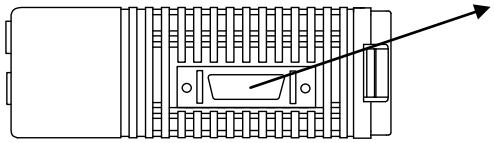
24b	Axis 4 Z-phase input (-)	**24a**	Axis 2 Z-phase input (-)
23b	Axis 4 Z-phase input (+)	**23a**	Axis 2 Z-phase input (+)
22b	Axis 4 pulse output A (+)	**22a**	Axis 2 pulse output A (+)
21b	Axis 4 pulse output A (-)	**21a**	Axis 2 pulse output A (-)
20b	Axis 4 pulse output B (+)	**20a**	Axis 2 pulse output B (+)
19b	Axis 4 pulse output B (-)	**19a**	Axis 2 pulse output B (-)
18b	Axis 4 deviation pulse clear	**18a**	Axis 2 deviation pulse clear
17b	Pulse output GND*2	**17a**	Pulse output GND*2
16b	Axis 3 Z-phase input (-)	**16a**	Axis 1 Z-phase input (-)
15b	Axis 3 Z-phase input (+)	**15a**	Axis 1 Z-phase input (+)
14b	Axis 3 pulse output A (+)	**14a**	Axis 1 pulse output A (+)
13b	Axis 3 pulse output A (-)	**13a**	Axis 1 pulse output A (-)
12b	Axis 3 pulse output B (+)	**12a**	Axis 1 pulse output B (+)
11b	Axis 3 pulse output B (-)	**11a**	Axis 1 pulse output B (-)
10b	Axis 3 deviation pulse clear	**10a**	Axis 1 deviation pulse clear
9b	Deviation pulse clear GND*2	**9a**	Deviation pulse clear GND*2
8b	External power supply 24 Vin*1	**8a**	External power 24 Vin (GND)*1
7b	Axis 4 origin input	**7a**	Axis 2 origin input
6b	Axis 4 forward limit input	**6a**	Axis 2 forward limit input
5b	Axis 4 reverse limit input	**5a**	Axis 2 reverse limit input
4b	Axis 3 origin input	**4a**	Axis 1 origin input
3b	Axis 3 forward limit input	**3a**	Axis 1 forward limit input
2b	Axis 3 reverse limit input	**2a**	Axis 1 reverse limit input
1b	Contact input common*2	**1a**	Contact input common*2

24b	Axis 8 Z-phase input (-)	**24a**	Axis 6 Z-phase input (-)
23b	Axis 8 Z-phase input (+)	**23a**	Axis 6 Z-phase input (+)
22b	Axis 8 pulse output A (+)	**22a**	Axis 6 pulse output A (+)
21b	Axis 8 pulse output A (-)	**21a**	Axis 6 pulse output A (-)
20b	Axis 8 pulse output B (+)	**20a**	Axis 6 pulse output B (+)
19b	Axis 8 pulse output B (-)	**19a**	Axis 6 pulse output B (-)
18b	Axis 8 deviation pulse clear	**18a**	Axis 6 deviation pulse clear
17b	Pulse output GND*2	**17a**	Pulse output GND*2
16b	Axis 7 Z-phase input (-)	**16a**	Axis 5 Z-phase input (-)
15b	Axis 7 Z-phase input (+)	**15a**	Axis 5 Z-phase input (+)
14b	Axis 7 pulse output A (+)	**14a**	Axis 5 pulse output A (+)
13b	Axis 7 pulse output A (-)	**13a**	Axis 5 pulse output A (-)
12b	Axis 7 pulse output B (+)	**12a**	Axis 5 pulse output B (+)
11b	Axis 7 pulse output B (-)	**11a**	Axis 5 pulse output B (-)
10b	Axis 7 deviation pulse clear	**10a**	Axis 5 deviation pulse clear
9b	Deviation pulse clear GND*2	**9a**	Deviation pulse clear GND*2
8b	External power supply 24 Vin*1	**8a**	External power 24 Vin (GND)*1
7b	Axis 8 origin input	**7a**	Axis 6 origin input
6b	Axis 8 forward limit input	**6a**	Axis 6 forward limit input
5b	Axis 8 reverse limit input	**5a**	Axis 6 reverse limit input
4b	Axis 7 origin input	**4a**	Axis 5 origin input
3b	Axis 7 forward limit input	**3a**	Axis 5 forward limit input
2b	Axis 7 reverse limit input	**2a**	Axis 5 reverse limit input
1b	Contact input common*2	**1a**	Contact input common*2

*1: The external power supply 24 V is common to all axes. Connect one of two connectors or both connectors to the same power supply.
*2: Four contact input commons, four deviation pulse clear GNDs, and four pulse output GNDs are connected, respectively, in the module.
*3: The F3YP22-0P module does not support three and four axes. Never wire the pins for three and four axes on this module.

Figure 2.4 Terminal Assignments and Connections of the Connectors for External I/O Devices

● Connectors for counters



1	Counter input A (+)	**8**	Counter contact output 1
2	Counter input A (-)	**9**	External power supply 24 Vin (GND)
3	Counter input B (+)	**10**	Counter contact output 2
4	Counter input B (-)	**11**	External power supply 24 Vin
5	Counter Z-phase input (+)	**12**	Counter contact input 1
6	Counter Z-phase input (-)	**13**	Counter contact input 2
7	Counter contact input plus common	**14**	Counter contact input 3

Figure 2.5 Terminal Assignments and Connections of the Connector for Counters

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3. Function Overview

This chapter explains the major functions of the positioning module.

3.1 Position Control

3.1.1 Positioning Operation

Positioning operation to a specified target position is performed according to the specified target speed, acceleration time, and deceleration time. You can specify an absolute position or incremental position as the target position.

You can set an automatic trapezoidal or automatic S-shape curve acceleration/deceleration as an acceleration/deceleration curve. For each curve, you can set the acceleration time and deceleration time. When using automatic trapezoidal acceleration/deceleration, you can set a startup speed.

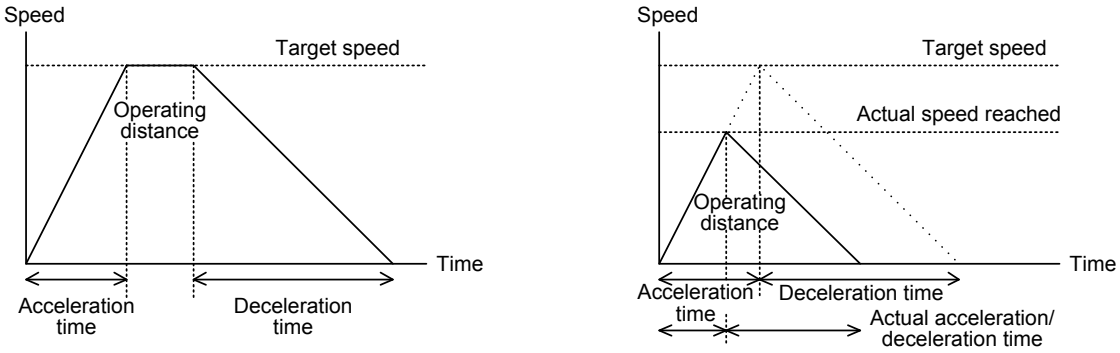


Figure 3.1 Speed and Acceleration/Deceleration Time for Trapezoidal/Trigonometric Curves

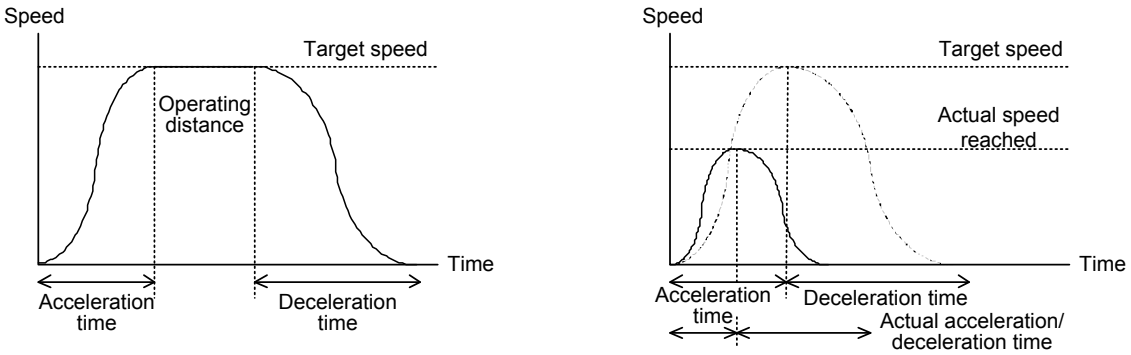


Figure 3.2 Acceleration/Deceleration Times when Using S-shape Acceleration/Deceleration

3.1.2 Position Data Record Operation

You can perform a positioning operation by a Start Positioning command that programmatically creates parameters needed for positioning or by a Start Positioning with Position Data Record command. To use a Start Positioning with Position Data Record command, you must set parameters in records beforehand and specify only a record number to start positioning.

You can register up to ten position data records for each axis.

Table 3.1 Position Data Record

Record No.	Target Position Mode	Target Position (pulses)	Accel/ Decel Mode	Target Speed (pulse/s)	Acceleration Time (ms)	Deceleration Time (ms)	Startup Speed (pulse/s)
1	0	0	1	2,000	100	100	0
2	0	131,072	0	2,000	100	100	0
10	1	100,000	1	5,000	250	250	0

3.1.3 Multi-axis Linear Interpolated Operation

To perform a linear-interpolated operation, set the target position, target speed, acceleration time, and deceleration time, and execute a Start Positioning command (or a Start Positioning with Position Data Record command) simultaneously for all axes to be interpolated.

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

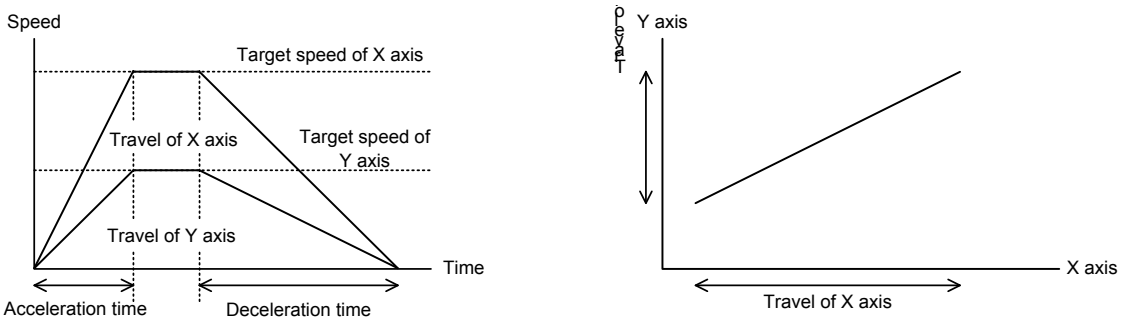


Figure 3.3 Multi-axis Linear Interpolated Operation (Example of Biaxial Operation)

3.1.4 Target Position Change Operation

You can change the target position during a positioning operation. The Change Target Position command cannot change the target speed, acceleration, or deceleration. 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. When the Change Target Position command is being executed, no commands other than Decelerate-and-Stop and Stop Immediately are available. You can use a position data record for target position change operation.

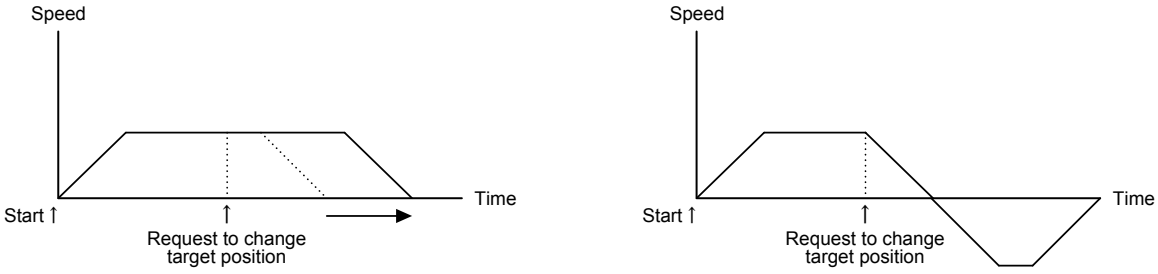


Figure 3.4 Behavior When the Target Position Is Changed

3.1.5 Positioning Operation with Resetting Current Position

You can perform positioning operation after setting the current position to "0".

By executing a single command, you can execute a Set Current Position command to write "0" for the current position and then execute a Start Positioning command.

This operation is useful for control that repeats an operation in a single direction because it can avoid an overflow error that occurs if the operating range (32 bit) of the positioning module is exceeded.

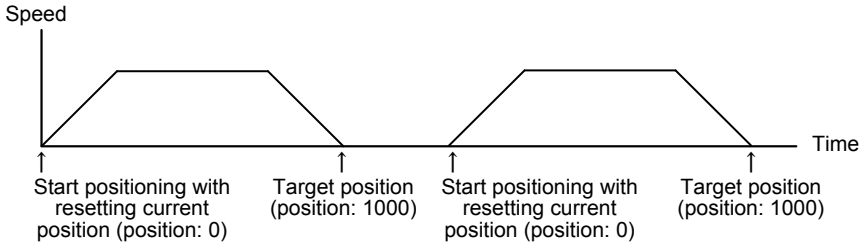


Figure 3.5 Positioning Operation with Resetting Current Position

3.1.6 Target Position Change with Resetting Current Position

You can perform a positioning operation with Resetting Current Position during a positioning operation.

This operation changes the current position so that the current target position becomes "0", and then performs a positioning operation toward the new target position.

The target position can be set only to a positive value during a forward operation or a negative value during a reverse operation. (Note that the operation direction cannot be changed in a target position change operation.)

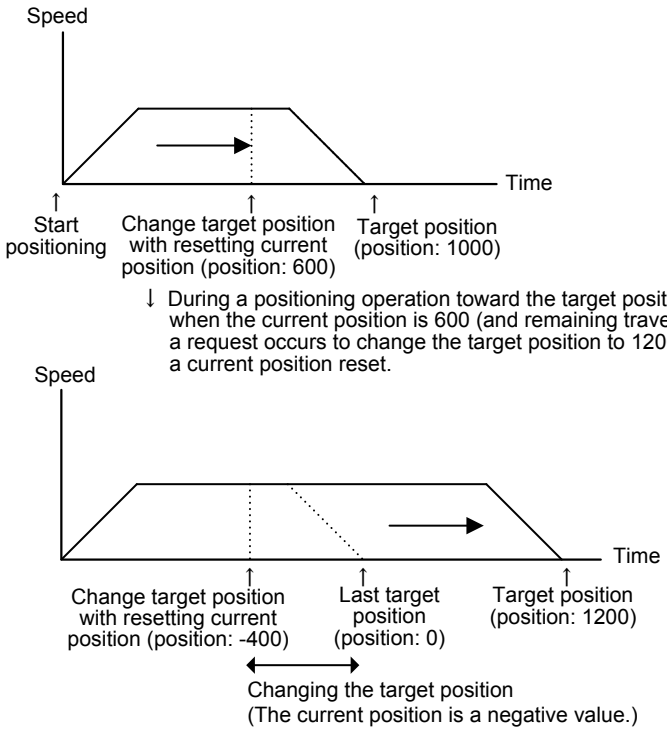


Figure 3.6 Target Position Change Operation with Resetting Current Position

3.2 Speed Control

3.2.1 Speed Control Operation

This operation moves an axis continuously in a single direction according to the specified target speed, acceleration time, and deceleration time.

You can set an automatic trapezoidal or automatic S-shape acceleration/deceleration as an acceleration/deceleration curve. For each curve, you can set the acceleration time and deceleration time. When using automatic trapezoidal acceleration/deceleration, you can set a startup speed. You can request to change the speed during a speed control operation.

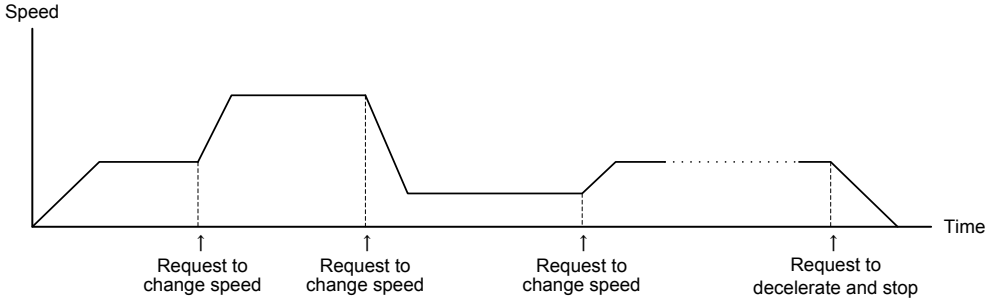


Figure 3.7 Behavior When Speed Control Starts and Speed Changes Are Requested

3.2.2 Speed Control to Position Control Switchover

During a speed control operation, you can specify a target position (travel distance) so that the operation can stop at the target position.

When speed control is switched to position control, the current position is set to "0".

Switchover to position control can be set to be performed not only when a command request occurs from the CPU module but also when an edge input occurs for the encoder Z-phase.

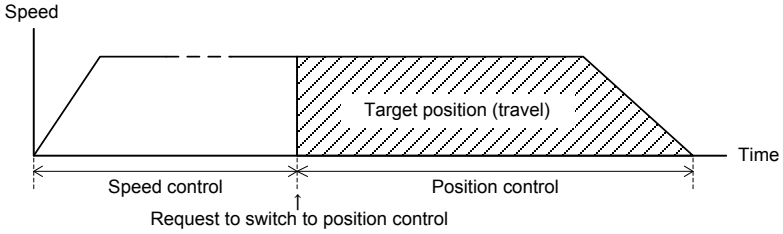


Figure 3.8 Speed Control to Position Control Switchover (without Z-phase counts)

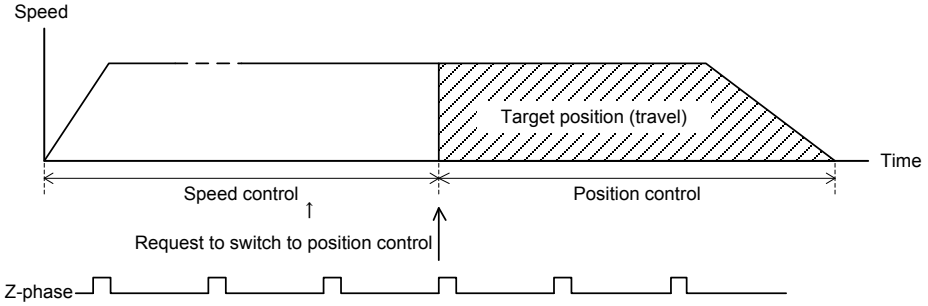


Figure 3.9 Speed Control to Position Control Switchover (with Z-phase counts, two rising edges)

3.3 Origin Search

There are two ways to perform origin search: automatic and manual. In automatic origin search, the origin search behavior is defined by registered parameters. In manual origin search, the origin search behavior is arbitrarily defined by an application program.

3.3.1 Automatic Origin Search

Before initiating automatic origin search, you must first set the AOS Mode and other registered parameters for automatic origin search.

In automatic origin search, a series of origin search movements will be automatically carried out up to Z-phase detection according to the settings of the registered parameter.

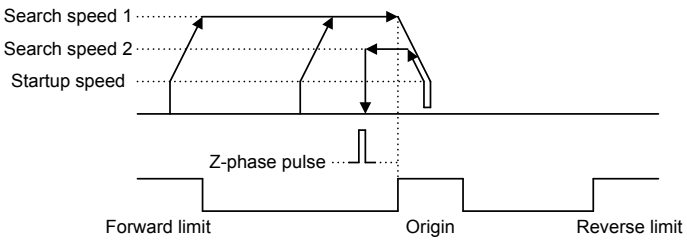
In Z-phase detection, when the number of Z-phase pulses defined in the AOS Z-phase Search Count parameter is detected, the axis stops immediately. The stop position is defined as the origin (the value of the origin is defined in the AOS Offset parameter). A deviation pulse clear signal is then output for a period specified in the AOS 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 forward/reverse limit switch input instead.

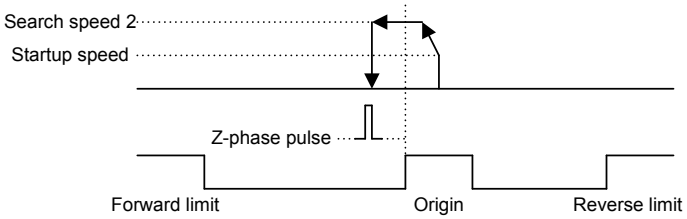
For details on automatic origin search behavior, see Section 8.6.2, "Automatic Origin Search."

● Automatic Origin Search (0: Origin input is used)

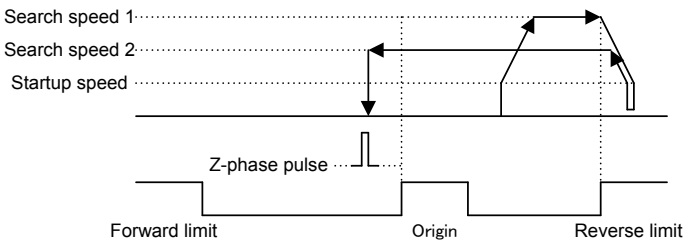
- **If the axis is on the forward direction side of the origin switch at origin search start**



- **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 reverse limit switch at origin search start**



- **If the axis is right on the reverse limit switch at origin search start**

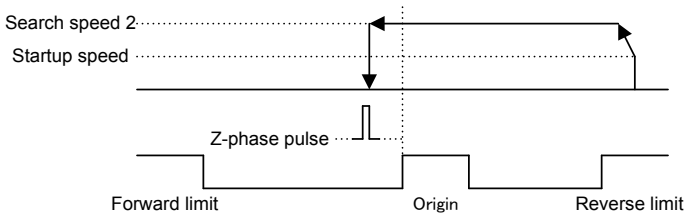
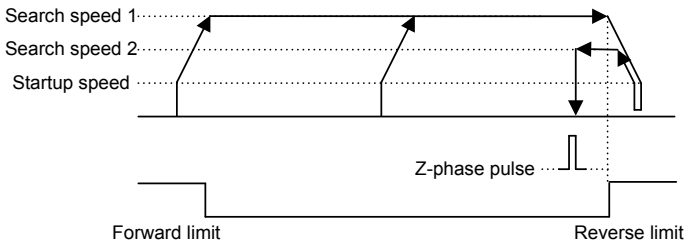


Figure 3.10 Automatic Origin Search (mode 0, reverse direction search)

● Automatic Origin Search (1: Origin input is not used)

- **If the axis is away from the reverse limit switch at origin search start**



- **If the axis is right on the reverse limit switch at origin search start**

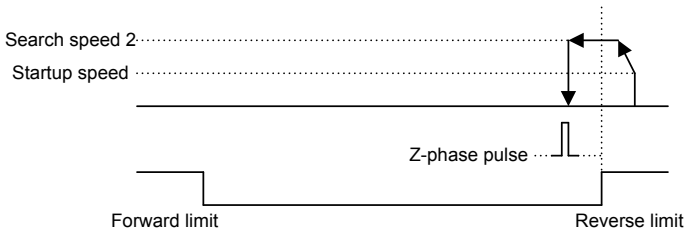


Figure 3.11 Automatic Origin Search (mode 1, reverse direction search)

3.3.2 Manual Origin Search

In manual origin search, the module searches for the origin according to the command parameter values as it detects changes in external contact inputs. When the required change is detected, it either stops or shifts to Z-phase search.

If configured to perform Z-phase search, the module counts the number of Z-phase pulses defined by the Z-phase Search Count parameter, and then stops the axis immediately. The stop position is taken as the origin. The module then outputs a deviation pulse clear signal for a duration defined by the Deviation Pulse Clear Time parameter. If the Z-phase Search Count is set to 0, no deviation pulse clear signal is generated.

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 origin search, split the origin search process into different phases, varying the parameters for each phase, and perform manual search operations. This strategy allows you to customize your origin-search operation to a desired search pattern.

For details on manual origin search behavior, see Section 8.6.1, "Manual Origin Search."

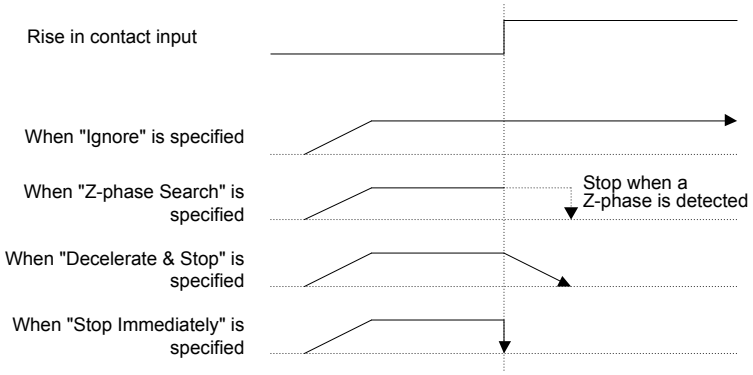


Figure 3.12 Manual Origin Search

3.4 Manual Control

There are two types of manual control: jog and manual pulse generator mode.

In both jog and manual pulse generator mode, you can specify whether to stop the operation with an error (a pulse overflow error) or continue it as unlimited rotation, if the operating range (32 bit) of the positioning module is exceeded. During a jog or manual pulse generator mode operation, error detection on forward and reverse limit values is not performed. (Note that a forward/reverse limit error does not occur.)

3.4.1 Jog

You can use a jog operation to operate a motor manually.

You can specify the target speed, acceleration time, and deceleration time for a jog operation, or even change the speed during a jog operation.

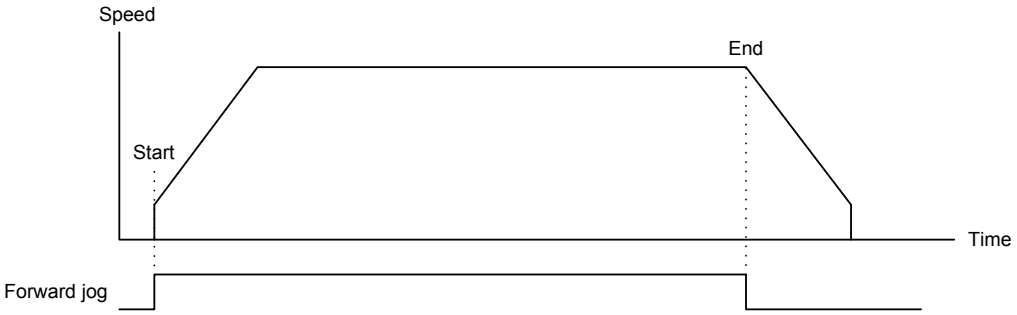


Figure 3.13 Jog Operation (Forward Direction, Automatic Trapezoidal Acceleration/Deceleration)

3.4.2 Manual Pulse Generator Mode

In manual pulse generator mode, you can operate a motor manually by using a manual pulse generator connected to the counter input.

The number of input pulses of a manual pulse generator and the movement amount for a motor satisfy the following relational expression:

Motor movement amount
= Number of input pulses × Manual Pulse Generator M Value / Manual Pulse Generator N Value

You can set a value between 1 through 32,767 for the Manual Pulse Generator M Value and Manual Pulse Generator N Value. You can also set a first order lag filter for the counter input.

In manual pulse generator mode, the speed is limited by the target speed. Any input pulses exceeding the target speed are stored and output when the speed falls below the target speed.

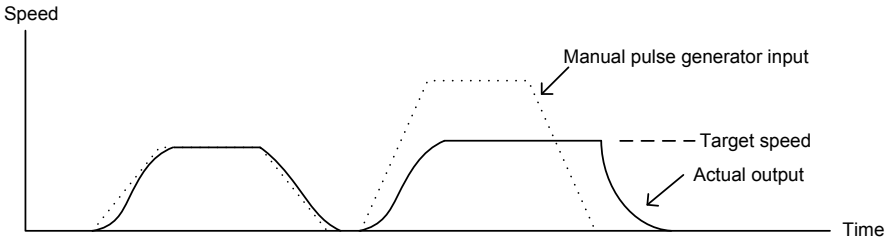


Figure 3.14 Manual Pulse Generator Mode

3.5 Speed Change Operation

You can change the operation speed during a positioning operation, speed control operation, or jog operation.

The following restrictions apply to changing the speed during an operation.

The speed cannot be changed during a positioning operation if the speed change prevents the axis from stopping at the target position during an acceleration, deceleration, speed change, or target position change operation.

Any speed change operation during a speed control or jog operation is suspended until a constant speed operation starts.

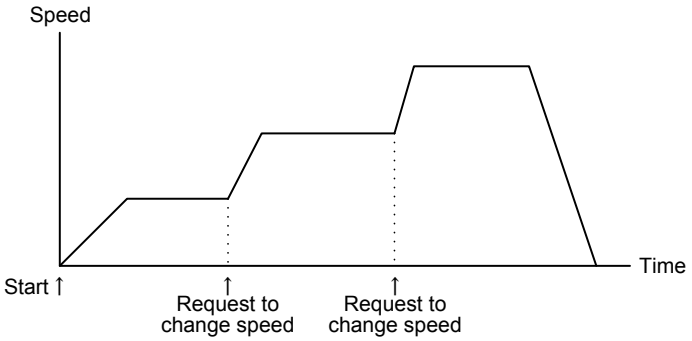


Figure 3.15 Changing Speed during a Positioning Operation

3.6 Counter Functions

The module has a counter input channel that allows input at up to 8 Mpps, three high-speed contact inputs for a counter, and two high-speed contact outputs for a counter.

General counter functions, such as the counter enable/disable control function, counter latch function (two channels), and counter preset function, are available.

A change in counter input states can be used as a trigger condition for a positioning operation.

When the counter functions are used in a positioning operation, the module can detect the position of an external device and start positioning based on the position on an index table or the movement amount on a conveyor.

3.6.1 Counter Coincidence Detection

This function detects the coincidence of two setting values. Coincidence detection can be specified for a trigger condition of a positioning operation or for a high-speed contact output.

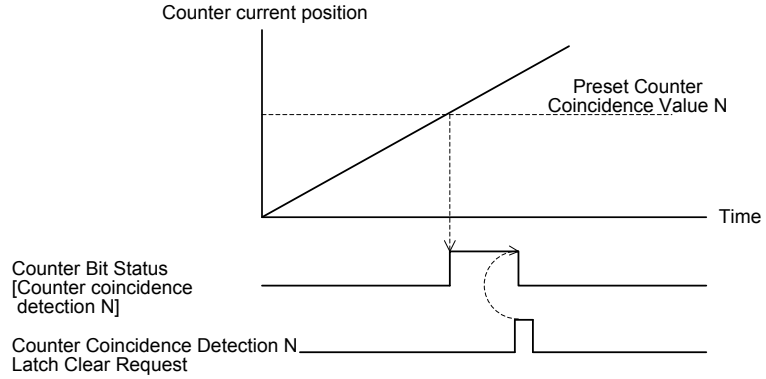


Figure 3.16 Counter Coincidence Detection (N = 1, 2)

3.6.2 Counter Zone Coincidence Detection

This function detects the coincidence of up to 16 zones. The module internally performs comparison operations at up to a 1 us interval. If the counter value does not remain in the range (or out of the range) for 1 us or more, the module may not detect the coincidence.

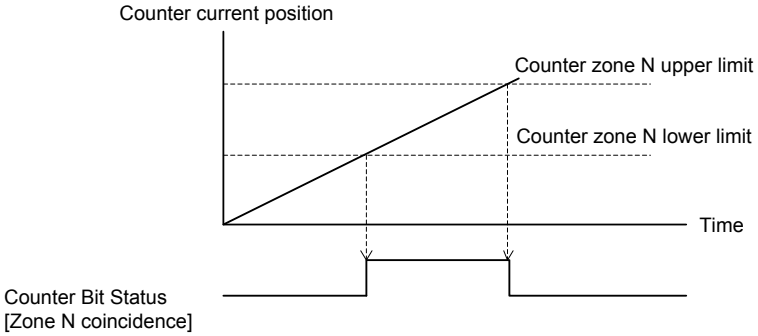


Figure 3.17 Counter Zone Coincidence Detection (N = 1 to 16)

3.7 Trigger Functions

You can specify a trigger condition for a positioning operation, speed control operation, or decelerate and stop operation.

You must issue a command with a trigger beforehand in the same procedure as the standard command, and when the trigger occurs, the specified operation starts immediately.

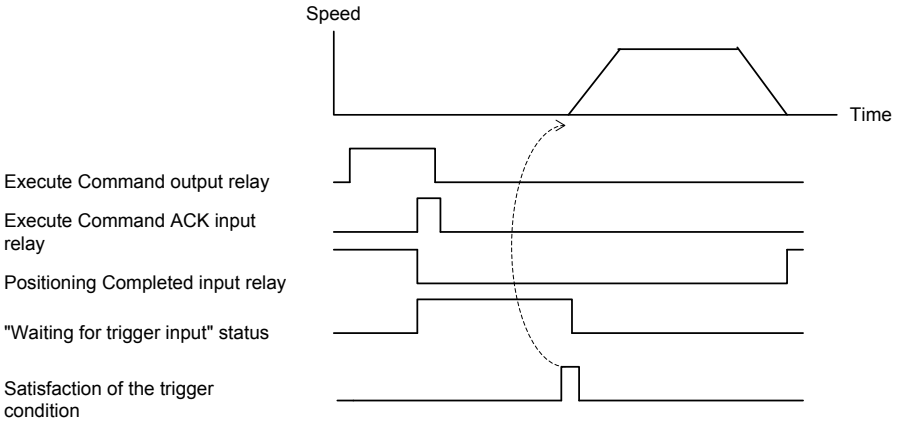


Figure 3.18 Trigger Functions (Example of a Start Positioning Command with a Trigger)

● Software Trigger

A trigger can be activated by an application program.

When a WRITE instruction from the CPU module writes "1" to the trigger-specific "Software Trigger Request" parameter, the trigger is activated.

● External Contact Input Trigger

A trigger can be activated when an external contact input is ON for an axis.

You can use a reverse limit input, forward limit input, or origin input for the external contact input.

● Counter Status Trigger

A trigger can be activated by a status change of a counter function.

You can use, for example, the ON status of counter coincidence detection 1 and 2, or the ON status of counter contact inputs 1 to 3.

● Counter Zone Coincidence Trigger

A trigger can be activated when the zone coincidence detection of a counter function is ON.

You can specify Zone Coincidence Detection 1 to 16 as a trigger condition.

● Positioning Completed Input Relay Trigger

A trigger can be activated when a Positioning Completed input relay is ON for another axis.

3.8 Save to/Initialize Flash Memory

● Save to Flash Memory

After specifying parameters, you can save the parameters to the flash memory in this module.

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

Table 3.2 List of Parameters to Be Saved to the Flash Memory

Parameters to Be Saved
Registered parameters for each axis (parameters specified by a Set Registered Parameters command)
Position data records
Counter registered parameters (parameters specified with Counter Registered Parameters Request)
Part of counter control parameters (Counter Preset Value, Preset Counter Coincidence Value 1 to 2, Counter Zone 1 to 16 Lower Limit/Upper Limit)

● Initialize Flash Memory

You can initialize the parameters saved in the flash memory to the factory defaults.

CAUTION

- 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 the parameters to the flash memory only when required.
- The module operates properly even if you do not save all parameters to the flash memory.

  (When you use an application program that is configured from the CPU module at power up, you do not need to save parameters to the flash memory.)

4. Preparing for Operation

Figure 4.1 shows the procedure flowchart for operation preparation. For details on the task in each box, refer to the table on the next page.

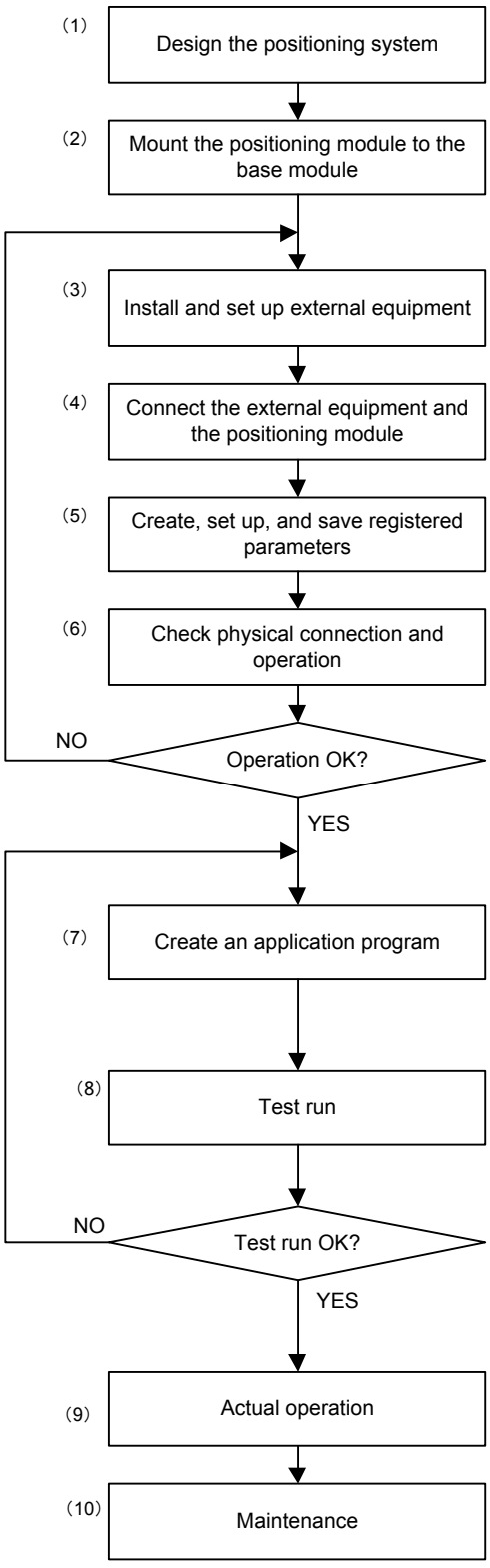


Figure 4.1 Flowchart for Operation Preparation

Table 4.1 Description and Reference for Each Task

Task	Description	See Also
(1)	Design the system after understanding the functions and usage of the positioning module and external devices.	- 1. Overview - 2. Specification - 3. Function Overview
(2)	Mount the positioning module to the base module.	- 12.1 Attaching and Detaching Modules
(3)	Install and set up external devices such as motors/drivers and various limit switches by referring to their respective instruction manuals.	- User's manuals for external devices
(4)	Connect the positioning module to external devices such as motors/drivers and other limit switches. Connect I/O modules to external devices as required.	- 12.2. Signal Specifications - 12.3 Examples of Connections to Motors/Drivers - User's manuals for external devices
(5)	Use a program to create registered parameters and counter registered parameters and to set the data in the positioning module.	- 5. Input/Output Relays - 6. Positioning Parameters and Statuses - 7. Counter Parameters and Statuses - 8.3 Set Registered Parameters - 9.3 Set Counter Registered Parameters - User's manuals for external devices
(6)	Use a program to check physical connections to external devices (i.e., check contact input statuses). Perform a jog or other operations to check the behavior.	- 5. Input/Output Relays - 6. Positioning Parameters and Statuses - 7. Counter Parameters and Statuses - 8. Positioning Programs - 9. Counter Programs - 12.2 Signal Specifications - 12.3 Examples of Connections to Motors/Drivers - User's manuals for external devices
(7)	Create a program to perform an application.	- 5. Input/Output Relays - 6. Positioning Parameters and Statuses - 7. Counter Parameters and Statuses - 8. Positioning Programs - 9. Counter Programs
(8)	Debug the program and adjust the positioning operations.	- 5. Input/Output Relays - 6. Positioning Parameters and Statuses - 7. Counter Parameters and Statuses - 8. Positioning Programs - 9. Counter Programs
(9)	Start the actual operation. Monitor the positioning operation as needed.	- 5. Input/Output Relays - 6. Positioning Parameters and Statuses - 7. Counter Parameters and Statuses
(10)	When an error or warning occurs, identify the possible causes by referring to the error codes, and troubleshoot accordingly.	- 11. Errors and Troubleshooting

5. Input/Output Relays

The positioning module has 32 output relays and 32 input relays for interfacing to the FA-M3 CPU module.

CAUTION

- For the F3YP22-0P module, NEVER set the output relays for axes 3 to 8; moreover, input relays for axes 3 to 8 have no meaning.
- For the F3YP24-0P module, NEVER set the output relays for axes 5 to 8; moreover, input relays for axes 5 to 8 have no meaning.
- For the F3YP28-0P module, when you specify to use the counter input relays, the Stop Immediately ACK relays for axes 5 to 8 become unavailable. In this case, use the Positioning Completed relays instead of the Stop Immediately ACK relays.

CAUTION

- For a multiple CPU system, specify only one CPU module that uses this module. For details on configuration settings, refer to "FA-M3 Programming Tool WideField3 (Offline)" (IM 34M06Q16-02E).

CAUTION

- When you assign refreshing of input/output relays of the module to the sensor control block in the input/output settings for the configuration of the CPU module, operations (such as parameter download, action test) by the ToolBox for Positioning Modules cannot be performed. When you want to use the ToolBox for Positioning Modules, do not assign input/output refreshing to the sensor control block. For details on configuration settings, refer to " FA-M3 Programming Tool WideField3 (Offline)" (IM 34M06Q16-02E).

5.1 Input Relays

Table 5.1 lists the input relays available in the positioning module.

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

Note that "□□□" in the table represents the number of the FA-M3 slot where the positioning module is installed.

For the F3YP28-0P module, when you need to send a counter status change (e.g., counter coincidence detection and external counter latch request) to the CPU module by using input relays, you can assign Stop Immediately ACK relays for positioning functions to the input relays. For the F3YP28-0P module, when you use the counter input relays, the Stop Immediately ACK relays for axes 5 to 8 become unavailable.

Table 5.1 List of Input Relays

Input Relay No.	Signal	Description	Relationship with Other Relays
X□□□01	AX1 Execute Command ACK	Turns on when command execution for axis 1 is successfully completed.	Turning off Y□□□33 turns off this relay.
X□□□02	AX2 Execute Command ACK	Turns on when command execution for axis 2 is successfully completed.	Turning off Y□□□34 turns off this relay.
X□□□03	AX3 Execute Command ACK	Turns on when command execution for axis 3 is successfully completed.	Turning off Y□□□35 turns off this relay.
X□□□04	AX4 Execute Command ACK	Turns on when command execution for axis 4 is successfully completed.	Turning off Y□□□36 turns off this relay.
X□□□05	AX5 Execute Command ACK	Turns on when command execution for axis 5 is successfully completed.	Turning off Y□□□37 turns off this relay.
X□□□06	AX6 Execute Command ACK	Turns on when command execution for axis 6 is successfully completed.	Turning off Y□□□38 turns off this relay.
X□□□07	AX7 Execute Command ACK	Turns on when command execution for axis 7 is successfully completed.	Turning off Y□□□39 turns off this relay.
X□□□08	AX8 Execute Command ACK	Turns on when command execution for axis 8 is successfully completed.	Turning off Y□□□40 turns off this relay.
X□□□09	AX1 Stop Immediately ACK	Turns on when a Stop Immediately command for axis 1 is successfully completed.	Turning off Y□□□41 turns off this relay.
X□□□10	AX2 Stop Immediately ACK	Turns on when a Stop Immediately command for axis 2 is successfully completed.	Turning off Y□□□42 turns off this relay.
X□□□11	AX3 Stop Immediately ACK	Turns on when a Stop Immediately command for axis 3 is successfully completed.	Turning off Y□□□43 turns off this relay.
X□□□12	AX4 Stop Immediately ACK	Turns on when a Stop Immediately command for axis 4 is successfully completed.	Turning off Y□□□44 turns off this relay.
X□□□13[*1]	AX5 Stop Immediately ACK /Counter Input Relay 1	Turns on when a Stop Immediately command for axis 5 is successfully completed. /Turns on the flag assigned to the counter relay 1.	Turning off Y□□□45 turns off this relay. /-
X□□□14[*1]	AX6 Stop Immediately ACK /Counter Input Relay 2	Turns on when a Stop Immediately command for axis 6 is successfully completed. /Turns on the flag assigned to the counter relay 2.	Turning off Y□□□46 turns off this relay. /-
X□□□15[*1]	AX7 Stop Immediately ACK /Counter Input Relay 3	Turns on when a Stop Immediately command for axis 7 is successfully completed. /Turns on the flag assigned to the counter relay 3.	Turning off Y□□□47 turns off this relay. /-
X□□□16[*1]	AX8 Stop Immediately ACK /Counter Input Relay 4	Turns on when a Stop Immediately command for axis 8 is successfully completed. /Turns on the flag assigned to the counter relay 4.	Turning off Y□□□48 turns off this relay. /-

Input Relay No.	Signal	Description	Relationship with Other Relays
X□□□17	AX1 Error Detected	Turns on when an error occurs on axis 1.	-
X□□□18	AX2 Error Detected	Turns on when an error occurs on axis 2.	-
X□□□19	AX3 Error Detected	Turns on when an error occurs on axis 3.	-
X□□□20	AX4 Error Detected	Turns on when an error occurs on axis 4.	-
X□□□21	AX5 Error Detected	Turns on when an error occurs on axis 5.	-
X□□□22	AX6 Error Detected	Turns on when an error occurs on axis 6.	-
X□□□23	AX7 Error Detected	Turns on when an error occurs on axis 7.	-
X□□□24	AX8 Error Detected	Turns on when an error occurs on axis 8.	-
X□□□25	AX1 Positioning Completed	Turns on when a positioning operation for axis 1 is completed.	-
X□□□26	AX2 Positioning Completed	Turns on when a positioning operation for axis 2 is completed.	-
X□□□27	AX3 Positioning Completed	Turns on when a positioning operation for axis 3 is completed.	-
X□□□28	AX4 Positioning Completed	Turns on when a positioning operation for axis 4 is completed.	-
X□□□29	AX5 Positioning Completed	Turns on when a positioning operation for axis 5 is completed.	-
X□□□30	AX6 Positioning Completed	Turns on when a positioning operation for axis 6 is completed.	-
X□□□31	AX7 Positioning Completed	Turns on when a positioning operation for axis 7 is completed.	-
X□□□32	AX8 Positioning Completed	Turns on when a positioning operation for axis 8 is completed.	-

*1: For the F3YP22-0P and F3YP24-0P modules, these input relays work as the counter input relays 1 to 4.
For the F3YP28-0P module, you can select whether to use them as the Stop Immediately ACK relays for positioning functions or as the counter input relays 1 to 4.

5.2 Output Relays

Table 5.2 lists the output relays available in the positioning module.

Note that "□□□" in the table represents the number of the FA-M3 slot where the positioning module is installed.

Table 5.2 List of Output Relays

Output Relay No.	Signal	Description	Relationship with Other Relays
Y□□□33	AX1 Execute Command	Request to execute a command for axis 1	Turn this relay off after confirming that X□□□01 has turned on.
Y□□□34	AX2 Execute Command	Request to execute a command for axis 2	Turn this relay off after confirming that X□□□02 has turned on.
Y□□□35	AX3 Execute Command	Request to execute a command for axis 3	Turn this relay off after confirming that X□□□03 has turned on.
Y□□□36	AX4 Execute Command	Request to execute a command for axis 4	Turn this relay off after confirming that X□□□04 has turned on.
Y□□□37	AX5 Execute Command	Request to execute a command for axis 5	Turn this relay off after confirming that X□□□05 has turned on.
Y□□□38	AX6 Execute Command	Request to execute a command for axis 6	Turn this relay off after confirming that X□□□06 has turned on.
Y□□□39	AX7 Execute Command	Request to execute a command for axis 7	Turn this relay off after confirming that X□□□07 has turned on.
Y□□□40	AX8 Execute Command	Request to execute a command for axis 8	Turn this relay off after confirming that X□□□08 has turned on.
Y□□□41	AX1 Stop Immediately	Request to stop axis 1 immediately	Turn this relay off after confirming that X□□□09 has turned on.
Y□□□42	AX2 Stop Immediately	Request to stop axis 2 immediately	Turn this relay off after confirming that X□□□10 has turned on.
Y□□□43	AX3 Stop Immediately	Request to stop axis 3 immediately	Turn this relay off after confirming that X□□□11 has turned on.
Y□□□44	AX4 Stop Immediately	Request to stop axis 4 immediately	Turn this relay off after confirming that X□□□12 has turned on.
Y□□□45	AX5 Stop Immediately	Request to stop axis 5 immediately	Turn this relay off after confirming that X□□□13 has turned on.
Y□□□46	AX6 Stop Immediately	Request to stop axis 6 immediately	Turn this relay off after confirming that X□□□14 has turned on.
Y□□□47	AX7 Stop Immediately	Request to stop axis 7 immediately	Turn this relay off after confirming that X□□□15 has turned on.
Y□□□48	AX8 Stop Immediately	Request to stop axis 8 immediately	Turn this relay off after confirming that X□□□16 has turned on.

Output Relay No.	Signal	Description	Relationship with Other Relays
Y□□□49	AX1 Forward Jog	Forward jog request for axis 1	
Y□□□50	AX2 Forward Jog	Forward jog request for axis 2	
Y□□□51	AX3 Forward Jog	Forward jog request for axis 3	
Y□□□52	AX4 Forward Jog	Forward jog request for axis 4	
Y□□□53	AX5 Forward Jog	Forward jog request for axis 5	
Y□□□54	AX6 Forward Jog	Forward jog request for axis 6	
Y□□□55	AX7 Forward Jog	Forward jog request for axis 7	
Y□□□56	AX8 Forward Jog	Forward jog request for axis 8	
Y□□□57	AX1 Reverse Jog	Reverse jog request for axis 1	
Y□□□58	AX2 Reverse Jog	Reverse jog request for axis 2	
Y□□□59	AX3 Reverse Jog	Reverse jog request for axis 3	
Y□□□60	AX4 Reverse Jog	Reverse jog request for axis 4	
Y□□□61	AX5 Reverse Jog	Reverse jog request for axis 5	
Y□□□62	AX6 Reverse Jog	Reverse jog request for axis 6	
Y□□□63	AX7 Reverse Jog	Reverse jog request for axis 7	
Y□□□64	AX8 Reverse Jog	Reverse jog request for axis 8	

5.3 Behavior of Input/Output Relays

■ Input Relays

● 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 operation 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 Detected Relay (X□□□17 to X□□□24)

When an error occurs on a particular axis, the Error Detected 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 Detected relay.

An error arising from a Set Registered Parameters command (error code 2□□□) cannot be reset with the Reset Error command. Run the Set Registered Parameters command again with proper data.

● Positioning Completed Relay (X□□□25 to X□□□32)

This relay is on when the axis is in the Positioning Completed status (i.e., when the axis is at rest). It is off during a positioning or jog operation (i.e., when the motor is in motion). In addition, it is also off during a trigger waiting state in a positioning operation.

● Counter Input Relay (X□□□13, X□□□14, X□□□15, X□□□16)

You can assign some of the counter statuses (e.g., counter coincidence detection, external counter latch request) to the input relays. By assigning them to the input relays, you can notify the CPU module of a counter status change as an input relay interrupt.

For details on assignment methods and assignment contents, see Chapter 9.

For the F3YP28-0P module, when you use the counter input relays, the Stop Immediately ACK relays for axes 5 to 8 become unavailable. In this case, use the Positioning Completed relays instead of the Stop Immediately ACK relays.

■ Output Relays

● Execute Command Relay (Y□□□33 to Y□□□40)

Turning on one of these relays starts an operation specified by a command code stored in the command parameter for each axis.

When the operation specified 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).

For the F3YP28-0P module, when you use the counter input relays, the Stop Immediately ACK relays for axes 5 to 8 become unavailable. In this case, use the Positioning Completed relays instead of the Stop Immediately ACK relays.

● Forward Jog Relay (Y□□□49 to Y□□□56)

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

● Reverse Jog Relay (Y□□□57 to Y□□□64)

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

6. Positioning Parameters and Statuses

Table 6.1 shows the layout of the parameter area and status area for the positioning module. For details, refer to Sections 6.1 and 6.2.

Table 6.1 Layout of the Parameter and Status Areas

Data Position No. (Word Basis)	Description
0001 to 0040	AX1 Registered Parameters
0041 to 0080	AX1 Command Parameters
0081 to 0100	AX1 Status
0101 to 0140	AX2 Registered Parameters
0141 to 0180	AX2 Command Parameters
0181 to 0200	AX2 Status
0201 to 0240	AX3 Registered Parameters
0241 to 0280	AX3 Command Parameters
0281 to 0300	AX3 Status
0301 to 0340	AX4 Registered Parameters
0341 to 0380	AX4 Command Parameters
0381 to 0400	AX4 Status
0401 to 0440	AX5 Registered Parameters
0441 to 0480	AX5 Command Parameters
0481 to 0500	AX5 Status
0501 to 0540	AX6 Registered Parameters
0541 to 0580	AX6 Command Parameters
0581 to 0600	AX6 Status
0601 to 0640	AX7 Registered Parameters
0641 to 0680	AX7 Command Parameters
0681 to 0700	AX7 Status
0701 to 0740	AX8 Registered Parameters
0741 to 0780	AX8 Command Parameters
0781 to 0800	AX8 Status
0801 to 0980	Counter Parameters and Statuses
0981 to 1000	Common Statuses for All Axes
1001 to 1100	AX1 Position Data Record
1101 to 1200	AX2 Position Data Record
1201 to 1300	AX3 Position Data Record
1301 to 1400	AX4 Position Data Record
1401 to 1500	AX5 Position Data Record
1501 to 1600	AX6 Position Data Record
1601 to 1700	AX7 Position Data Record
1701 to 1800	AX8 Position Data Record
1801 to	(System reserved)

■ Reading and Writing Two-word Data

Among the positioning parameters and statuses given in Tables 6.2 to 6.14, those listed with two data position numbers are two-word data. The smaller data position number contains the low-order word, and the larger data position number contains the high-order word.

Each data position number corresponds to a word. Use only READ and WRITE instructions on a word basis when accessing from a CPU program.

Only for specific statuses, by using a long-word-basis READ instruction (READ L instruction), concurrency of the high-order word and low-order word of two-word data is assured. Note that data position numbers used in a long-word-basis READ L instruction are different from the ones used in a word-basis READ instruction.

For details on the statuses that can be used by a long-word-basis READ instruction and the data position numbers for a READ L instruction used from the CPU module, see Table 6.13.

CAUTION

When a word-basis READ instruction is used from the CPU module to read two-word data, concurrency of the high-order word and low-order word of two-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.

CAUTION

Data concurrency cannot be assured when reading from a BASIC CPU because a BASIC CPU cannot perform long-word access to the positioning module.

■ Units of Speed Data

The positioning module supports two types of units of speed data. You can specify the unit of speed data by the command speed unit selection of the Speed Mode Selection registered parameter. Usually specify "1: pulse/s". "0: (1/65536) pulse/ms" is the unit of speed supported for compatibility with the F3YP14-0N and F3YP18-0N positioning modules. Select this unit only when you use a program coded for the previous models. For details on handling speed data in "0: (1/65536) pulse/ms" units, see Appendix 2, "Handling Compatible Speed Units for F3YP14-0N/ F3YP18-0N."

6.1 Parameters

6.1.1 List of Registered Parameters

At power up or system reset, the contents of the flash memory are automatically reloaded to the registered parameters. To change the settings of the registered parameters, write new parameter settings from the CPU module, and execute the Set Registered Parameters command.

Table 6.2 List of Registered Parameters

Data Position No. (Word Basis)	Parameter	Description	See Also
*01	Speed Mode Selection	Bit 0: Maximum speed selection 0: Standard mode, 1: High-speed mode Bit 1: Command speed unit selection 0: (1/65536) pulse/ms, 1: pulse/s Bit 2: Acceleration/deceleration time unit selection 0: ms, 1: 0.01 ms (10 us) [Factory default: 0]	6-5
*02	Pulse Output Mode	0: CW/CCW pulse 1: Travel/direction 2: Phase A/B (x4) 3: Phase A/B (x2) 4: Phase A/B (x1) [Factory default: 0]	6-7
*03	Motor Direction Selection	0: Forward movement produces CW pulse output 1: Reverse movement produces CW pulse output [Factory default: 0]	6-8
*04	Contact Input Setting	$0000 or greater (bit data for each contact) (Settings for NO contact, NC contact, and filter) [Factory default: 0]	6-8
*05/*06	Forward Limit	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 2,147,483,647]	6-9
*07/*08	Reverse Limit	-2,147,483,648 to (Forward Limit -1) [pulses] [Factory default: -2,147,483,648]	6-9
*09/*10	Speed Limit	1 to 7,996,000 [pulse/s] 1 to 524,025,856 [(1/65536) pulse/ms] (The unit varies depending on the setting of the command speed unit selection of the Speed Mode Selection. The upper limit is restricted by the maximum speed selection and the pulse output mode.) [Factory default: 32,751,616 [(1/65536) pulse/ms]]	6-9
*11	AOS Mode	0: Use origin switch 1: Do not use origin switch (limit switch) [Factory default: 0]	6-9
*12	AOS Direction	0: Reverse, 1: Forward [Factory default: 0]	6-9
*13/*14	AOS Speed 1	1 to Speed Limit [command speed unit*1] [Factory default: 655360 [(1/65536) pulse/ms]]	6-10
*15/*16	AOS Speed 2	1 to AOS Speed 1 [command speed unit*1] [Factory default: 65536 [(1/65536) pulse/ms]]	6-10
*17/*18	AOS Startup Speed	0 to AOS Speed 2 [command speed unit*1] [Factory default: 0 [(1/65536) pulse/ms]]	6-10
*19	AOS Acceleration Time	0 to 32767 [acceleration/deceleration time unit*2] [Factory default: 1000 [ms]]	6-10
*20	AOS Deceleration Time	0 to 32767 [acceleration/deceleration time unit*2] [Factory default: 1000 [ms]]	6-11
*21	AOS Z-phase Edge Selection	0: Rising edge, 1: Falling edge [Factory default: 0]	6-11
*22	AOS Z-phase Search Count	0 to 32767 [pulses] [Factory default: 0]	6-11
*23/*24	AOS Z-phase Search Range	0 to 2,147,483,647/AOS Z-phase Search Count [pulses] [Factory default: 2,147,483,647]	6-11
*25	AOS Deviation Pulse Clear Time	0 to 32767 [ms] [Factory default: 1000]	6-12
*26/*27	AOS Offset	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	6-12

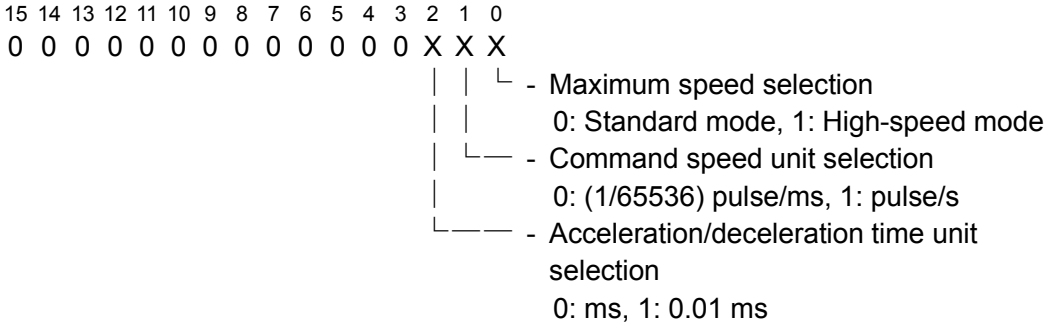
*28	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-
*29	Unlimited Rotation Setting	0: Detect an overflow error during jogging or MPG mode 1: Do not detect an overflow error during jogging or MPG mode [Factory default: 0]	6-12
*30	Z-phase Setting	0: Do not use Z-phase filter 1: Use at frequency of 1 Mpps or less 2: Use at frequency of 500 Kpps or less. 3: Use at frequency of 100 Kpps or less. [Factory default: 0]	6-13
*31	Deviation Pulse Clear Setting	0: Automatic output (the output is performed according to the deviation pulse clear time during manual origin search or automatic origin search.) 1: Program output (the output is performed in any timing by a program.) [Factory default: 0]	6-13
*32	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-
*33/*34	Acceleration Setting	0 to 2,147,483,647 [command speed unit*1/ms] [Factory default: 32751 [(1/65536) pulse/ms/ms]]	6-13
*35/*36	Deceleration Setting	0 to 2,147,483,647 [command speed unit*1/ms] [Factory default: 32751 [(1/65536) pulse/ms/ms]]	6-13
*37/*38	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-
*39	Pulse Output External Power Source Detection Setting	0: Do not detect errors on external power source for pulse output 1: Detect errors on external power source for pulse output (Only the setting for axis 1 is valid. The setting for axis 1 is applied also to axes 2 to 8.) [Factory default: 0]	6-14
*40	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-

The symbol '*' represents the value of (axis number -1). The values for axis 1 to axis 8 are 0 to 7, respectively.
*1: The command speed unit is the unit selected for the command speed unit selection of the Speed Mode Selection registered parameter.
*2: The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

6.1.2 Description of Registered Parameters

● Speed Mode Selection

[Data Range] **$0000 to $0007 (bit data)**
[Factory default] **$0000**
[Data Position No.] ***01 (The symbol '*' represents the axis number minus 1.)**
Selects the maximum output pulse speed and the units for speed and acceleration/deceleration time parameters/statuses.



- Maximum speed selection
Set the maximum speed of output pulses. Specify "0: Standard mode" when using a stepper motor. If "1: High-speed mode" is selected when using a stepper motor, the performance is not guaranteed. When using a servomotor, if its maximum speed is less than the maximum speed [pulse/s] allowed in standard mode, select "0: Standard mode." The following shows the maximum speed values for various pulse output modes.

Table 6.3 Maximum Speed of Output Pulses

Maximum Speed Selection	Pulse Output Mode	Maximum Speed [pulse/s]	Maximum Speed [0: (1/65536) pulse/ms]
0: Standard mode	0: CW/CCW pulse	1,999,000	131,006,464
	1: Travel/direction	1,999,000	131,006,464
	2: Phase A/B (x4)	1,999,000	131,006,464
	3: Phase A/B (x2)	999,500	65,503,232
	4: Phase A/B (x1)	499,750	32,751,616
1: High-speed mode	0: CW/CCW pulse	7,996,000	524,025,856
	1: Travel/direction	7,996,000	524,025,856
	2: Phase A/B (x4)	7,99,6000	524,025,856
	3: Phase A/B (x2)	3,998,000	262,012,928
	4: Phase A/B (x1)	1,999,000	131,006,464

- Command speed unit selection
Select the unit of speed for parameters and statuses used for each axis.

Usually specify "1: pulse/s". "0: (1/65536) pulse/ms" is the unit of speed supported for compatibility with the F3YP14-0N and F3YP18-0N positioning modules. Select this unit only when you use a program coded for the previous models. For details on handling speed data in "0: (1/65536) pulse/ms" units, see Appendix 2, "Handling Compatible Speed Units for F3YP14-0N/ F3YP18-0N."

- Acceleration/deceleration time unit selection
Select the unit of acceleration/deceleration time for parameters used for each axis.

Select either "0: ms" or "1: 0.01ms".

Table 6.4 List of Parameters and Statuses Handled Differently Depending on the Command Speed Unit Selection

	Data Position No. (Word Basis)	Parameter	Description
Registered Parameters	*09/*10	Speed Limit	1 to 7,996,000 [pulse/s] 1 to 524,025,856 [(1/65536) pulse/ms]
	*13/*14	AOS Speed 1	1 to Speed Limit [command speed unit]
	*15/*16	AOS Speed 2	1 to AOS Speed 1 [command speed unit]
	*33/*34	Acceleration Setting	0 to 2,147,483,647 [command speed unit/ms]
	*35/*36	Deceleration Setting	0 to 2,147,483,647 [command speed unit/ms]
Command Parameters	*46/*47	Target Speed	In position control mode: 1 to Speed Limit [command speed unit] In speed control mode: - (Speed Limit) to Speed Limit [command speed unit]
Position Data Records	Depends on each position data record	Target Speed	1 to Speed Limit [command speed unit]
Statuses	*85/*86	Current Speed Status	- (Speed Limit) to Speed Limit [command speed unit] When "[pulse/s]" is specified, the value can be positive or negative depending on the motor rotation direction. When "[(1/65536) pulse/ms]" is specified, the value is always positive regardless of the motor rotation direction.

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

Table 6.5 List of Parameters and Statuses Handled Differently Depending on the Acceleration/Deceleration Time Unit selection

	Data Position No. (Word Basis)	Parameter	Description
Registered Parameters	*19	AOS Acceleration Time	0 to 32767 [acceleration/deceleration time unit]
	*20	AOS Deceleration Time	0 to 32767 [acceleration/deceleration time unit]
Command Parameters	*48	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration
	*49	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration
Position Data Records	Depends on each position data record	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration
		Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration

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

CAUTION

When you change the command speed unit selection or acceleration/deceleration time unit selection, always change related parameter values as well. If you change a unit selection and do not change related parameter values, unintended motor operation may result.

● Pulse Output Mode

[Data Range] **0: CW/CCW pulse**
1: Travel/direction
2: Phase A/B (x4)
3: Phase A/B (x2)
4: Phase A/B (x1)
[Factory default] **0: CW/CCW pulse**
[Data Position No.] ***02 (The symbol '*' represents the axis number minus 1.)**
Specifies the output pulse mode.
The actual output pulses vary depending on the Pulse Output Mode as shown below.

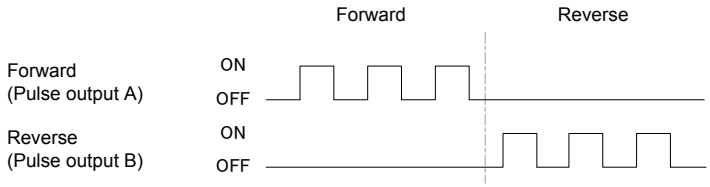
Pulse Output Mode and Actual Output Pulses

Pulse Output Mode	Pulse Output A	Pulse Output B
CW/CCW pulse	CW	CCW
Travel/direction	Travel	Direction
Phase A/B	Phase A	Phase B

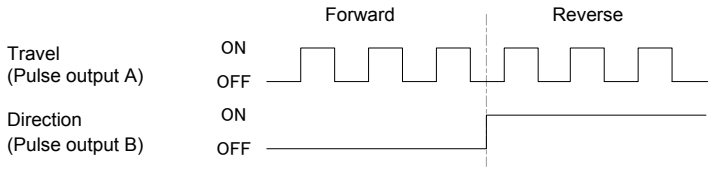
Signal Output Statuses When a Pulse Is On or Off

Signal	When the Pulse Is Off	When the Pulse Is On
+ Signal	Differential + (high level)	Differential - (low level)
- Signal	Differential - (low level)	Differential + (high level)

- CW/CCW pulse



- Travel/direction



- Phase A/B

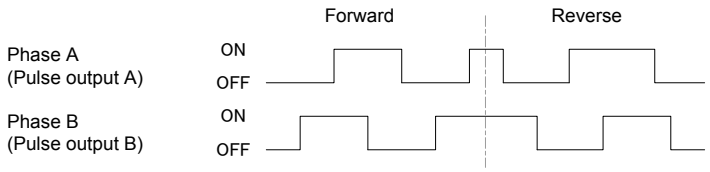


Figure 6.1 Pulse Output Mode and Output Pulses

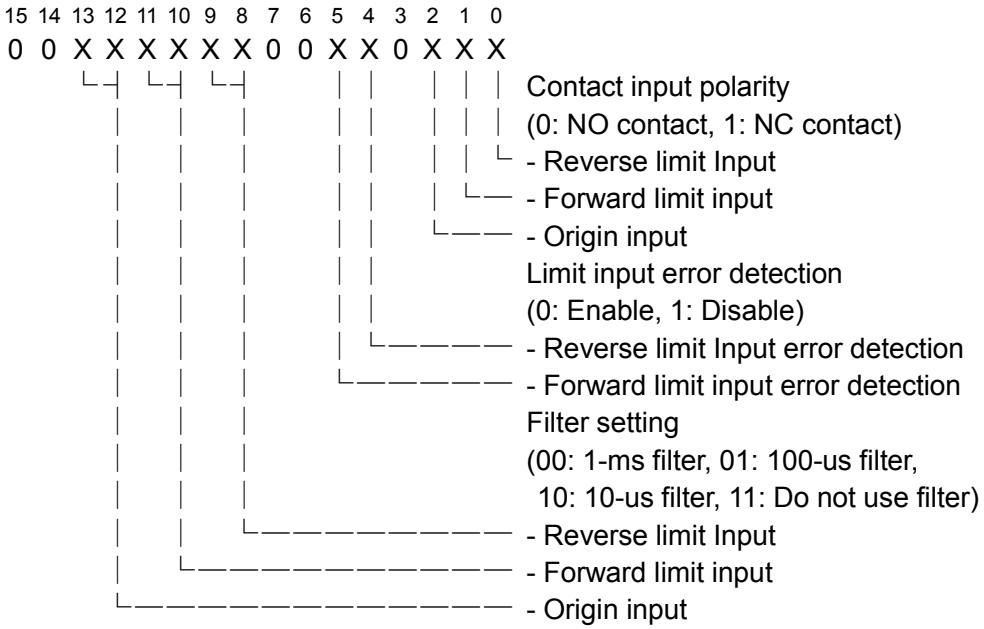
● Motor Direction Selection

[Data Range] **0: Forward movement produces CW pulse output**
1: Reverse movement produces CW pulse output
[Factory default] **0: Forward movement produces CW pulse output**
[Data Position No.] ***03 (The symbol '*' represents the axis number minus 1.)**
Maps the sign of position data set from the CPU module to the direction of pulse output.

Forward or reverse movement is indicated by the sign of the position data set from the CPU module.

● Contact Input Setting

[Data Range] **$0000 to $3F37 (bit data)**
[Factory default] **$0000**
[Data Position No.] ***04 (The symbol '*' represents the axis number minus 1.)**
Specifies the polarity for the external contact input, whether the limit input is enabled or disabled, and filter setting.



- **Contact input polarity**
  Specify the logic of the external contact inputs. An NO contact input is an input which is true when a signal input exists, and an NC contact input is an input which is true when no signal input exists.

  For example, an NC contact limit input is detected when there is no limit signal and false when there is a limit signal.

- **Limit input error detection**
  Specify whether to enable or disable the detection of forward/reverse limit input errors.

- **Filter setting**
  Specify a digital filter for each contact input.

● Forward Limit

[Data Range] **-2,147,483,648 to 2,147,483,647 [pulses]**
[Factory default] **2,147,483,647**
[Data Position No.] ***05/*06 (The symbol '*' represents the axis number minus 1.)**
Specifies the value for the limit on forward movement from the origin.

Specifying a target position that exceeds this range and starting the system will result in an error during startup and the motor will not operate. If the origin search is not used, the current position at power up is used as the origin. During a speed control, origin search, jog, or manual pulse generator mode operation, these limit values are disregarded (no error occurs).

● Reverse Limit

[Data Range] **-2,147,483,648 to (Forward Limit -1) [pulses]**
[Factory default] **-2,147,483,648**
[Data Position No.] ***07/*08 (The symbol '*' represents the axis number minus 1.)**
Specifies the value for the limit on reverse movement from the origin.

Specifying a target position that exceeds this range and starting the system will result in an error during startup and the motor will not operate. If the origin search is not used, the current position at power up is used as the origin. During a speed control, origin search, jog, or manual pulse generator mode operation, these limit values are disregarded (no error occurs).

● Speed Limit

[Data Range] **1 to 7,996,000 [pulse/s]**
1 to 524,025,856 [(1/65536) pulse/ms]
(The unit varies depending on the command speed unit selection.)
[Factory default] **32,751,616 [(1/65536) pulse/ms]**
[Data Position No.] ***09/*10 (The symbol '*' represents the axis number minus 1.)**
Specifies the limit value for the target speed, etc.

Specifying a target speed that exceeds this value and starting the system will result in an error during startup and the system will not operate. The maximum speed of output pulses that can be set for the Speed Limit parameter is determined by the Speed Mode Selection and Pulse Output Mode as shown in Table 6.3. The unit of the factory default value is "(1/65536) pulse/ms". If you have changed the command speed unit to "pulse/s", change the speed limit value to a suitable value.

● AOS Mode

[Data Range] **0: Use origin switch**
1: Do not use origin switch (limit switch)
[Factory default] **0: Use origin switch**
[Data Position No.] ***11 (The symbol '*' represents the axis number minus 1.)**
Specifies whether to use origin switch and origin input in automatic origin search.
For details on automatic origin search, see Section 8.6.2, "Automatic Origin Search."

● AOS Direction

[Data Range] **0: Reverse**
1: Forward
[Factory default] **0: Reverse**
[Data Position No.] ***12 (The symbol '*' represents the axis number minus 1.)**
Specifies the direction of rotation for moving at AOS Speed 1 in automatic origin search.

● AOS Speed 1

[Data Range] **1 to Speed Limit [pulse/s]**
1 to Speed Limit [(1/65536) pulse/ms]
(The unit varies depending on the command speed unit selection.)
[Factory default] **655,360 [(1/65536) pulse/ms]**
[Data Position No.] ***13/*14 (The symbol '*' represents the axis number minus 1.)**
Specifies the high speed for automatic origin search.

Set a value higher than the startup speed if a startup speed is set.

The unit of the factory default value is "(1/65536) pulse/ms". If you have changed the command speed unit to "pulse/s", change the speed limit value to a suitable value.

● AOS Speed 2

[Data Range] **1 to AOS Speed 1 [pulse/s]**
1 to AOS Speed 1 [(1/65536) pulse/ms]
(The unit varies depending on the command speed unit selection.)
[Factory default] **65,536 [(1/65536) pulse/ms]**
[Data Position No.] ***15/*16 (The symbol '*' represents the axis number minus 1.)**
Specifies the low speed for automatic origin search.

Set a value higher than the startup speed if a startup speed is set.

The unit of the factory default value is "(1/65536) pulse/ms". If you have changed the command speed unit to "pulse/s", change the speed limit value to a suitable value.

● AOS Startup Speed

[Data Range] **0 to AOS Speed 2 [pulse/s]**
0 to AOS Speed 2 [(1/65536) pulse/ms]
(The unit varies depending on the command speed unit selection.)
[Factory default] **0 [(1/65536) pulse/ms]**
[Data Position No.] ***17/*18 (The symbol '*' represents the axis number minus 1.)**
Specifies the speed during startup and the speed immediately before stopping during decelerate and stop in an automatic origin search.

When the positioning module is used to control a stepper 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). Set it 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".

● AOS Acceleration Time

[Data Range] **0 to 32,767 [Acceleration/Deceleration Time Unit]**
(The unit varies depending on the acceleration/deceleration time unit selection.)
[Factory default] **1,000 [ms]**
[Data Position No.] ***19 (The symbol '*' represents the axis number minus 1.)**
Specifies the time taken to accelerate from Startup Speed to AOS Speed 1 in automatic origin search. The system accelerates to AOS Speed 2 at the same rate as when accelerating to AOS Speed 1.

● AOS Deceleration Time

[Data Range] **0 to 32,767 [Acceleration/Deceleration Time Unit]**
(The unit varies depending on the acceleration/deceleration time unit selection.)
[Factory default] **1,000 [ms]**
[Data Position No.] ***20 (The symbol '*' represents the axis number minus 1.)**
Specifies the time taken to decelerate and stop from AOS Speed 1 in an automatic origin search.

The system decelerates from AOS Speed 2 at the same rate as when decelerating from AOS Speed 1.

● AOS Z-phase Edge Selection

[Data Range] **0: Rising edge**
1: Falling edge
[Factory default] **0: Rising edge**
[Data Position No.] ***21 (The symbol '*' represents the axis number minus 1.)**
Specifies the Z-phase edge direction when detecting Z-phase in an automatic origin search.

● AOS Z-phase Search Count

[Data Range] **0 to 32767 [pulses]**
[Factory default] **0**
[Data Position No.] ***22 (The symbol '*' represents the axis number minus 1.)**
Specifies the number of Z-phase pulses to be counted when detecting Z-phase in an automatic origin search. When "0" is set, the position where Z-phase search is started (the position where the origin input or forward/reverse limit input becomes off without any Z-phase being detected) is used as the origin.

● AOS Z-phase Search Range

[Data Range] **0 to 2,147,483,647/AOS Z-phase Search Count [pulses]**
[Factory default] **2,147,483,647**
[Data Position No.] ***23/*24 (The symbol '*' represents the axis number minus 1.)**
An error will be generated during automatic origin search if Z-phase detection is still not successful even after moving beyond the Z-phase search range.

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.

When the AOS Z-phase Search Count is set to "0", it is not necessary to set this parameter.

● AOS Deviation Pulse Clear Time

[Data Range] **0 to 32,767 [ms]**
[Factory default] **1000**
[Data Position No.] ***25 (The symbol '*' represents the axis number minus 1.)**
Specifies the duration for deviation pulse clear output after completing the origin search using Z-phase detection in an automatic origin search. When the AOS Z-phase Search Count is set to "0", it is not necessary to set this parameter and no deviation pulse clear signal is output.

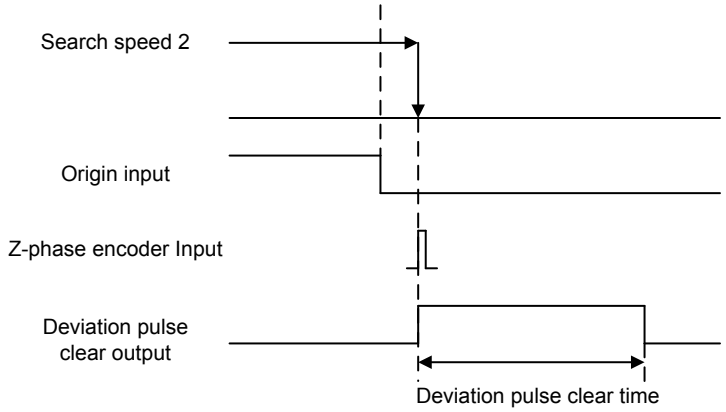


Figure 6.2 Behavior of Deviation Pulse Clear Signal Output

● AOS Offset

[Data Range] **-2,147,483,648 to 2,147,483,647 [pulses]**
[Factory default] **0**
[Data Position No.] ***26/*27 (The symbol '*' represents the axis number minus 1.)**
Specifies the offset to be applied to obtain the origin when the automatic origin search is completed.

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.

● Unlimited Rotation Setting

[Data Range] **0: Detect an overflow error during jogging or MPG mode**
1: Do not detect an overflow error during jogging or MPG mode
[Factory default] **0: Detect an overflow error during jogging or MPG mode**
[Data Position No.] ***29 (The symbol '*' represents the axis number minus 1.)**
Specifies whether to detect an error if the pulse current position overflows during jogging or MPG mode.

When you specify to detect an overflow error, if the operation range of the positioning module (-2,147,483,648 to 2,147,483,647) is exceeded, a pulse overflow error occurs. When you specify not to detect any overflow error, the operation is performed without any error being detected. (The current pulse position is counted by a 32-bit ring operation.)

● Z-phase Setting

[Data Range] **0: Do not use Z-phase filter**
1: Use at frequency of 1 Mpps or less.
2: Use at frequency of 500 Kpps or less.
3: Use at frequency of 100 Kpps or less.
[Factory default] **0: Do not use Z-phase filter**
[Data Position No.] ***30 (The symbol '*' represents the axis number minus 1.)**
Specifies the digital filter for Z-phase input. Set if noise causes malfunctions.

● Deviation Pulse Clear Setting

[Data Range] **0: Automatic output**
1: Program output
[Factory default] **0: Automatic output**
[Data Position No.] ***31 (The symbol '*' represents the axis number minus 1.)**
Specifies the output method for the deviation pulse clear signal.

If you select "0: Automatic output", the positioning module automatically outputs the signal according to the specified deviation pulse clear time (AOS Deviation Pulse Clear Time) when a Z-phase is detected in origin search (automatic origin search).

If you select "1: Program output", the On/Off status of the deviation pulse clear signal can be controlled by programmatically writing "0"/"1" in the "Deviation Pulse Clear Request" command parameter in any timing.

● Acceleration Setting

[Data Range] **0 to 2,147,483,647 [pulse/s/ms]**
0 to 2,147,483,647 [(1/65536) pulse/ms/ms]
(The unit varies depending on the command speed unit selection.)
[Factory default] **32,751 [(1/65536) pulse/ms/ms]**
[Data Position No.] ***33/*34 (The symbol '*' represents the axis number minus 1.)**
Specifies the acceleration used in positioning.

The setting unit is "command speed unit/ms". Specify the increase in speed per 1 ms in command speed units. If you specify "0", an acceleration time of 0 ms is used for operations.

For each positioning operation, you can select whether to use the acceleration specified in this parameter or specify an individual acceleration time.

● Deceleration Setting

[Data Range] **0 to 2,147,483,647 [pulse/s/ms]**
0 to 2,147,483,647 [(1/65536) pulse/ms/ms]
(The unit varies depending on the command speed unit selection.)
[Factory default] **32,751 [(1/65536) pulse/ms/ms]**
[Data Position No.] ***35/*36 (The symbol '*' represents the axis number minus 1.)**
Specifies the deceleration used in positioning.

The setting unit is "command speed unit/ms". Specify the decrease in speed per 1 ms in command speed units. If you specify "0", an acceleration time of 0 ms is used for operations.

For each positioning operation, you can select whether to use the deceleration specified in this parameter or specify an individual deceleration time.

● Pulse Output External Power Source Detection Setting (Emergency Stop Setting)

[Data Range] **0: Do not detect errors on external power source for pulse output**
1: Detect errors on external power source for pulse output
[Factory default] **0: Do not detect errors on external power source for pulse output**
[Data Position No.] ***39 (The symbol '*' represents the axis number minus 1.)**
Specifies whether to monitor the external power source for pulse output.

When you select "0: Do not detect errors on external power source for pulse output", if the power source is not provided to the external power source for pulse output at startup of or during a positioning operation, an external power source error occurs and the operation stops due to the error. This parameter is valid only when it is set for axis 1. The setting for axis 1 is applied also to axes 2 to 8.

6.1.3 Example for Setting Registered Parameters

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

● Motor to Be Controlled

Rated rotating speed: 3,000 rpm

Encoder pulse count: 8,000 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 registered 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 +1,000 mm

Maximum speed: 12,000 mm/min (200 mm/s)

Contact Inputs: Forward/reverse limit input (NC contact), origin (NO contact)

● Calculation of Registered Parameters

- **Speed Mode Selection (*01)**

  Since a servomotor is used here, select 1 for the maximum speed selection.

  To specify [pulse/s] for the command speed unit, select 1 for the command speed unit selection. To specify [ms] for the acceleration/deceleration time unit, select 0 for the acceleration/deceleration time unit selection. Thus, specify $0003 for the Speed Mode Selection.

  (3 in decimal notation, $0003 in hexadecimal notation, 0000_0000_0000_0011 in binary notation)

- **Pulse Output Mode (*02)**

  Set this parameter to 0 to use CW/CCW pulse output.

- **Motor Direction Selection (*03)**

  Set this parameter to 0 so that positive data indicates CW pulse output.

- **Contact Input Setting (*04)**

  Reverse limit input: NC contact, 1-ms filter, and reverse limit input error detection enabled

  Forward limit input: NC contact, 1-ms filter, and forward limit input error detection enabled

  Origin input: NO contact, 100-us filter

  Thus, set $1003 for the Contact Input Setting.

  (4099 in decimal notation, $1003 in hexadecimal notation, 0001_0000_0000_0011 in binary notation)

- **Forward Limit (*05/*06)**

  1000 [mm] ÷ 5 [mm/rot] × 8000 [pulse/rot] = 1600000 [pulses]

- **Reverse Limit (*07/*08)**

  -500 [mm] ÷ 5 [mm/rot] × 8000 [pulse/rot] =-800000 [pulses]

- **Speed Limit (*09/*10)**

  The maximum pulse output speed allowed by the motor is:
  3,000 [rpm] ÷ 60 [s/min] × 8,000 [pulse/rot] = 400,000 [pulse/s].
  The maximum pulse output speed allowed by the ball screw is:
  200 [mm/s] ÷ 5 [mm/rot] × 8,000 [pulse/rot] = 320,000 [pulse/s]
  Thus, set the Speed Limit to 320,000 [pulse/s], which is the maximum pulse output speed for this system.

- **AOS Mode (*11)**

  Set this parameter to 0 to use the origin input.

- **AOS Direction (*12)**

  Set this parameter to 0 to move the axis in the reverse direction to search for the origin.

- **AOS Speed 1 (*13/*14)**

  Assume that the origin search speed 1 is 50 [mm/s].
  50 [mms] ÷ 5 [mm/rot] × 8,000 [pulse/rot] = 80,000 [pulse/s]

- **AOS Speed 2 (*15/*16)**

  Assume that the origin search speed 2 is 2 [mm/s].
  2 [mms] ÷ 5 [mm/rot] × 8,000 [pulse/rot] = 3,200 [pulse/s]

- **AOS Startup Speed (*17/*18)**

  Set this parameter to 0 [pulse/ms] as the motor used is a servomotor.

- **AOS Acceleration Time (*19)**

  Set this parameter to 500 [ms].

- **AOS Deceleration Time (*20)**

  Set this parameter to 500 [ms].

- **AOS Z-phase Edge Selection (*21)**

  Set this parameter to 0 to use the rising edge.

- **AOS Z-phase Search Count (*22)**

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

- **AOS Z-phase Search Range (*23/*24)**

  Set this parameter to 8,000 [pulse] as the encoder outputs 8,000 pulses per rotation.

- **AOS Deviation Pulse Clear Time (*25)**

  Set this parameter to 1,000 [ms] to output the deviation pulse clear signal for 1 second.

- **AOS Offset (*26/*27)**

  Set this parameter to 0 [pulse] to specify the Z-phase detection position for the origin.

- **Unlimited Rotation Setting (*29)**

  Set this parameter to 0 because unlimited rotation is not used for control.

- **Z-phase Setting (*30)**

  Set this parameter to 0.

- **Deviation Pulse Clear Setting (*31)**

  Set this parameter to 0 to enable automatic output during automatic origin search.

- **Acceleration Setting (*33/*34)**

  To accelerate to the maximum speed of 320,000 [pulse/s] in 500 ms, set this parameter to
  320,000 [pulse/s] ÷ 500 ms = 640 [pulse/s/ms].

- **Deceleration Setting (*35/*36)**

  To decelerate and stop from the maximum speed of 320,000 [pulse/s] in 500 ms, set this parameter to
  320,000 [pulse/s] ÷ 500 ms = 640 [pulse/s/ms].

- **Pulse Output External Power Source Detection Setting (*39)**

  Set this parameter to 1 to enable error detection.

6.1.4 List of 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 6.6 Command Parameters

Data Position No. (Word Basis)	Parameter	Description	See Also
*41	Command Code	0 to 32,767	6-22
*42	Target Position Mode /Position Data Record No.	In direct operation: 0: Using ABS position, 1: Using INC position In position data record operation: 1 to 10 [Position data record number]	6-23
*43/*44	Target Position	Reverse limit to forward limit [pulses]	6-23
*45	Accel/Decel Mode	0: Trapezoidal acceleration/deceleration (With startup speed), 1: S-shape acceleration/deceleration	6-23
*46/*47	Target Speed	In position control mode: 1 to Speed Limit [command speed unit*1] In speed control mode: -(Speed Limit) to Speed Limit [command speed unit*1]	6-23
*48	Acceleration Time	0 to 32,767 [acceleration/deceleration time unit*2], -1: Default acceleration	6-24
*49	Deceleration Time	0 to 32,767 [acceleration/deceleration time unit*2], -1: Default deceleration	6-24
*50/*51	Startup Speed	0 to target speed [command speed unit*1] (valid only for trapezoidal acceleration/deceleration)	6-25
*52	Origin Search Mode	$0000 to $0FFF (Specify details as bit data.)	6-25
*53	Origin Search Direction	0: Reverse, 1: Forward	6-25
*54	Z-phase Edge Selection	0: Rising edge, 1: Falling edge	6-25
*55	Z-phase Search Count	0 to 32,767 [pulses]	6-26
*56/*57	Z-phase Search Range	0 to 2,147,483,647/Z-phase Search Count [pulses]	6-26
*58	Deviation Pulse Clear Time	0 to 32,767 [ms]	6-26
*59	(System reserved)	Do not set a value other than 0.	-
*60	Manual Pulse Generator M Value	-32,768 to 32,767	6-27
*61	Manual Pulse Generator N Value	1 to 32,767	6-27
*62	Manual Pulse Generator Filter	0 to 10,000 [ms]	6-27
*63	Trigger Setting	0: Software trigger 1: Contact input trigger 2: Counter status trigger 3: Counter zone coincidence trigger 4: Positioning Completed input relay trigger	6-27
*64	Trigger Axis Setting	0, 1 to 8 axes (If set to 0, an axis from which the command is issued is used.)	6-28
*65	Trigger Contact Setting	0: Reverse limit input 1: Forward limit input 2: Origin input	6-28
*66	Counter Status Trigger Setting	$0000 or greater (bit data)	6-28
*67	Counter Zone Coincidence Trigger Setting	$0000 or greater (bit data)	6-29
*68	(System reserved)	Do not set a value other than 0.	-
*69	Preset Override Value	1 to 500 [%]	6-29
*70 to *76	(System reserved)	Do not set a value other than 0.	-
*77*2	Software Trigger Request*3	1: A software trigger is activated by writing "1" during a software trigger wait state.	6-29
*78*2	Deviation Pulse Clear Request*3	0: Deviation pulse clear signal Off 1: Deviation pulse clear signal On (Valid only when program output is selected for the Deviation Pulse Clear Setting registered parameter.)	6-29
*79 to *80	(System reserved)	Do not set a value other than 0.	-

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

*1: The command speed unit is the unit selected for the command speed unit selection of the Speed Mode Selection registered parameter.

*2: The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

*3: Unlike other parameters, Software Trigger Request and Deviation Pulse Clear Request are not the parameters to be set when a command is executed, but are used to start a specific operation immediately when a value is set to them.

6.1.5 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 6.7 shows the required parameters for each command.

Table 6.7 Required Parameters for Each Command (1/3)

Data Position No.	Parameter	Command										
		Stop Immediately	Forward or Reverse Jog	Start Positioning	Decelerate and Stop	Manual Origin Search	Set Registered Parameters	Set Current Position	Reset Error	Change Speed	Change Target Position	Automatic Origin Search
*41	Command Code			0	1	2	3	4	5	6	7	8
*42	Target Position Mode/ Position Data Record No.			○							○	
*43/*44	Target Position			○				○			○	
*45	Accel/Decel Mode		○	○							△	
*46/*47	Target Speed		○	○		○				○	△	
*48	Acceleration Time		○	○		○				○	△	
*49	Deceleration Time		○	○		○				○	△	
*50/*51	Startup Speed		▲	▲		○					△	
*52	Origin Search Mode					○						
*53	Origin Search Direction					○						
*54	Z-phase Edge Selection					○						
*55	Z-phase Search Count					○						
*56/*57	Z-phase Search Range					○						
*58	Deviation Pulse Clear Time					○						
*60	Manual Pulse Generator M Value											
*61	Manual Pulse Generator N Value											
*62	Manual Pulse Generator Filter											
*63	Trigger Setting											
*64	Trigger Axis Setting											
*65	Trigger Contact Setting											
*66	Counter Status Trigger Setting											
*67	Counter Zone Coincidence Trigger Setting											
*69	Preset Override Value											

The symbol '*' represents the value of (axis number -1). The values for axis 1 to axis 8 are 0 to 7, respectively.
○: Mandatory parameters.
△: Mandatory if the command is to be executed in the Positioning Completed status.
▲: Mandatory depending on the values of other parameters.
Blank: Not used (have no effect on the operation of the commands if used).

Table 6.7 Required Parameters for Each Command (2/3)

Data Position No.	Parameter	Command									
		Start Positioning with Resetting Current Position	Change Target Position with Resetting Current Position	Start Positioning with Position Data Record	Change Target Position with Position Data Record	Set Override	Start Speed Control	Speed Control to Position Control (with a current position zero reset)	Speed Control to Position Control (without a current position reset)	Start MPG Mode	Stop MPG Mode
*41	Command Code	10	17	20	27	300	400	401	402	500	501
*42	Target Position Mode/ Position Data Record No.			○	○				○		
*43/*44	Target Position	○	○					○	○		
*45	Accel/Decel Mode	○	△				○				
*46/*47	Target Speed	○	△				○			○	
*48	Acceleration Time	○	△				○				
*49	Deceleration Time	○	△				○				
*50/*51	Startup Speed	▲	△				▲				
*52	Origin Search Mode										
*53	Origin Search Direction										
*54	Z-phase Edge Selection							▲	▲		
*55	Z-phase Search Count							○	○		
*56/*57	Z-phase Search Range										
*58	Deviation Pulse Clear Time										
*60	Manual Pulse Generator M Value									○	
*61	Manual Pulse Generator N Value									○	
*62	Manual Pulse Generator Filter									○	
*63	Trigger Setting										
*64	Trigger Axis Setting										
*65	Trigger Contact Setting										
*66	Counter Status Trigger Setting										
*67	Counter Zone Coincidence Trigger Setting										
*69	Preset Override Value					○					

The symbol '*' represents the value of (axis number -1). The values for axis 1 to axis 8 are 0 to 7, respectively.
○: Mandatory parameters.
△: Mandatory if the command is to be executed in the Positioning Completed status.
▲: Mandatory depending on the values of other parameters.
Blank: Not used (have no effect on the operation of the commands if used).

Table 6.7 Required Parameters for Each Command (3/3)

Data Position No.	Parameter	Command								
		Save to Flash Memory	Initialize Flash Memory	Start Positioning with Trigger	Decelerate and Stop with Trigger	Start Positioning with Trigger and Resetting Current Position	Start Positioning with Position Data Record with Trigger	Start Speed Control with Trigger	Speed Control to Position Control with Trigger (with a current position zero reset)	Speed Control to Position Control with Trigger (without a current position reset)
*41	Command Code	9	99	1000	1001	1010	1020	1400	1401	1402
*42	Target Position Mode/ Position Data Record No.			○			○			○
*43/*44	Target Position			○		○			○	○
*45	Accel/Decel Mode			○		○		○		
*46/*47	Target Speed			○		○		○		
*48	Acceleration Time			○		○		○		
*49	Deceleration Time			○		○		○		
*50/*51	Startup Speed			▲		▲		▲		
*52	Origin Search Mode									
*53	Origin Search Direction									
*54	Z-phase Edge Selection								▲	▲
*55	Z-phase Search Count								○	○
*56/*57	Z-phase Search Range									
*58	Deviation pulse clear time									
*60	Manual Pulse Generator M Value									
*61	Manual Pulse Generator N Value									
*62	Manual Pulse Generator Filter									
*63	Trigger Setting			○	○	○	○	○	○	○
*64	Trigger Axis Setting			▲	▲	▲	▲	▲	▲	▲
*65	Trigger Contact Setting			▲	▲	▲	▲	▲	▲	▲
*66	Counter Status Trigger Setting			▲	▲	▲	▲	▲	▲	▲
*67	Counter Zone Coincidence Trigger Setting			▲	▲	▲	▲	▲	▲	▲
*69	Preset Override Value									

The symbol '*' represents the value of (axis number -1). The values for axis 1 to axis 8 are 0 to 7, respectively.
○: Mandatory parameters.
△: Mandatory if the command is to be executed in the Positioning Completed status.
▲: Mandatory depending on the values of other parameters.
Blank: Not used (have no effect on the operation of the commands if used).

6.1.6 Description of Command Parameters

● Command Code

[Data Range] **0 to 32,767**
[Data Position No.] ***41 (The symbol '*' represents the axis number minus 1.)**
Set the command type for command execution using the Execute Command relay.

Table 6.8 List of Command Codes

Command Code	Command	Function	See Also
0	Start Positioning	Starts a positioning operation.	8-35
1	Decelerate and Stop	Decelerates and stops a current positioning, speed control operation, etc.	8-68
2	Manual Origin Search	Performs origin search in any pattern.	8-20
3	Set Registered Parameters	Sets the registered parameters.	8-5
4	Set Current Position	Changes the current position.	8-32
5	Reset Error	Clears an error condition.	8-9
6	Change Speed	Changes the speed during a positioning, jog, or speed control operation.	8-74
7	Change Target Position	Changes the target position during a positioning operation.	8-43
8	Automatic Origin Search	Performs automatic origin search according to the registered parameters.	8-27
9	Save to Flash Memory*1	Saves the registered parameters and position data records for all axes, and counter registered parameters to the flash memory.	8-104
99	Initialize Flash Memory*1	Initializes the contents of the flash memory.	8-104
10	Start Positioning with Resetting Current Position	Resets the current position to 0 and starts a positioning operation.	8-51
17	Change Target Position with Resetting Current Position	Resets the target position of the current operation to 0 and changes the target position.	8-55
20	Start Positioning with Position Data Record	Performs a positioning operation based on data in a position data record.	8-39
27	Change Target Position with Position Data Record	Changes the target position based on data in a position data record.	8-47
300	Set Override	Sets the override setting value and changes the target speed to 1% to 500% of the current value.	8-78
400	Start Speed Control	Starts a speed control operation.	8-59
401	Speed Control to Position Control (with a current position zero reset)	Clears the current position to 0 during a speed control operation, switches to position control, and performs a position control operation to the target position.	8-63
402	Speed Control to Position Control (without a current position reset)	Switches from speed control to position control, and performs a position control operation to the target position.	8-63
500	Start MPG Mode	Switches the operating mode to manual pulse generator mode.	8-15
501	Stop MPG Mode	Stops manual pulse generator mode.	8-15
1000	Start Positioning with Trigger	Specifies a trigger condition and executes a Start Positioning command.	8-35 8-81
1001	Decelerate and Stop with Trigger	Specifies a trigger condition and executes a Decelerate and Stop command.	8-68 8-81
1010	Start Positioning with Trigger and Resetting Current Position	Specifies a trigger condition and executes a Start Positioning with Resetting Current Position command.	8-51 8-81
1020	Start Positioning with Position Data Record with Trigger	Specifies a trigger condition and executes a Start Positioning with Position Data Record command.	8-39 8-81
1400	Start Speed Control with Trigger	Specifies a trigger condition and executes a Start Speed Control command.	8-74 8-81
1401	Speed Control to Position Control with Trigger (with a current position zero reset)	Specifies a trigger condition and executes a Speed Control to Position Control command (with a current position zero reset).	8-63 8-81
1402	Speed Control to Position Control with Trigger (without a current position reset)	Specifies a trigger condition and executes a Speed Control to Position Control command (without a current position reset).	8-63 8-81

*1: These commands can be executed for any axes. Note, however, that the execution affects the registered parameters for all axes, some of the counter registered parameters and counter control parameters (Counter Preset Value, Preset Counter Coincidence Value 1 to 2, Counter Zone 1 to 16 Lower Limit/Upper Limit), and the position data records.

● Target Position Mode/Position Data Record No.

[Data Range] **In direct operation:**
0: Using ABS position, 1: Using INC position
In position data record operation:
1 to 10 [Position data record number]
[Data Position No.] ***42 (The symbol '*' represents the axis number minus 1.)**
Specifies how to specify a target position.

In the absolute position mode, the specified target position represents a new target position regardless of the current position.

In the incremental position mode, the specified target position represents a new target position relative to 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).

For a position data record operation (started by a Start Positioning with Position Data Record command or Change Target Position with Position Data Record command), specify a position data record number between 1 through 10.

● Target Position

[Data Range] **-2,147,483,648 to 2,147,483,647 [pulses]**
[Data Position No.] ***43/*44**
(The symbol '*' represents the axis number minus 1.)
Sets the target position for a Start Positioning command or a setting value of a Set Current Position command.

Set this parameter so that the target position determined from the Target Position and Target Position Mode can be between the Forward Limit and Reverse Limit parameter values.

● Accel/Decel Mode

[Data Range] **0: Trapezoidal acceleration/deceleration (With startup speed)**
1: S-shape acceleration/deceleration
[Data Position No.] ***45 (The symbol '*' represents the axis number minus 1.)**
Specifies the Accel/Decel mode.

● Target Speed

[Data Range] **1 to Speed Limit [command speed unit]**
or -(Speed Limit) to Speed Limit [command speed unit]
[Data Position No.] ***46/*47**
(The symbol '*' represents the axis number minus 1.)
Sets the operation speed used by a Start Positioning command, Start Speed Control command, or in a jog operation. Usually set a positive value. For a Start Speed Control command, however, set a positive or negative value to specify the rotation direction by the sign.

Set a target speed smaller than the Speed Limit parameter value. When a startup speed has been set, set a value greater than or equal to the startup speed.

If the target speed is "0", no operation can be performed.

If an override setting is specified, the operation speed is set to the target speed × the current override value [%]. (Note that override setting is not applied to manual pulse generator mode, manual origin search, and automatic origin search operations.)

● Acceleration Time

[Data Range] **0 to 32,767 [acceleration/deceleration time unit]**
-1: The Acceleration Setting registered parameter is used.
[Data Position No.] ***48 (The symbol '*' represents the axis number minus 1.)**
Sets the acceleration time to reach the target speed from the startup speed. For a speed change operation, set acceleration/deceleration time.

The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

If "-1" is set, operations are performed using the acceleration value specified for the relevant registered parameter.

● Deceleration Time

[Data Range] **0 to 32,767 [acceleration/deceleration time unit]**
-1: The Deceleration Setting registered parameter is used.
[Data Position No.] ***49 (The symbol '*' represents the axis number minus 1.)**
Sets the deceleration time to decelerate and stop from the target speed.

The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

If "-1" is set, operations are performed using the deceleration value specified for the relevant registered parameter.

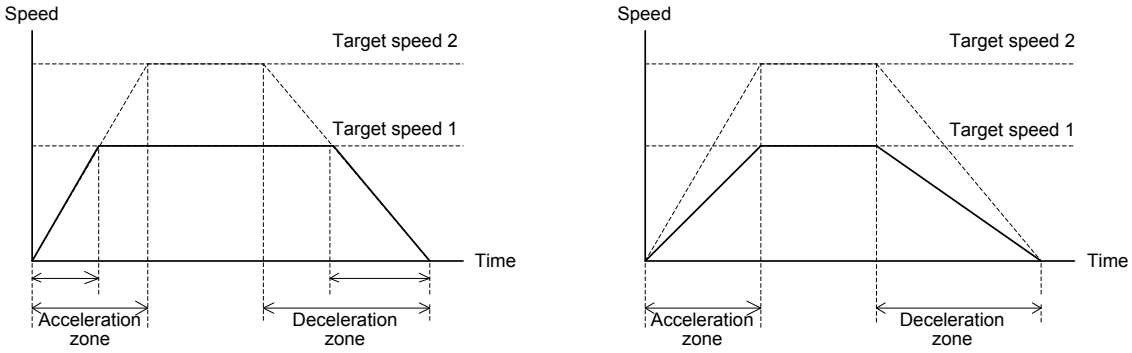


Figure 6.3 Acceleration/Deceleration Time Setting

The left figure in Figure 6.3 shows the case when the Acceleration Time and Deceleration Time are set to "-1". Regardless of the target speed, the operation is performed using the acceleration and deceleration values specified for the relevant registered parameters.

The right figure in Figure 6.3 shows the case when the Acceleration Time and Deceleration Time are set to a value between 1 ms through 32,767 ms. Regardless of the target speed, the operation is performed using the specified acceleration and deceleration times.

● Startup Speed

[Data Range] **0 to target speed [command speed unit]**
[Data Position No.] ***50/*51**
(The symbol '*' represents the axis number minus 1.)

This parameter is valid only when the Accel/Decel Mode is "0: Trapezoidal acceleration/deceleration (With startup speed)". This parameter specifies the startup speed at the beginning of the positioning operation and the speed just before stopping when the positioning is completed.

When the positioning module is used to control a stepper 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).

Set 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".

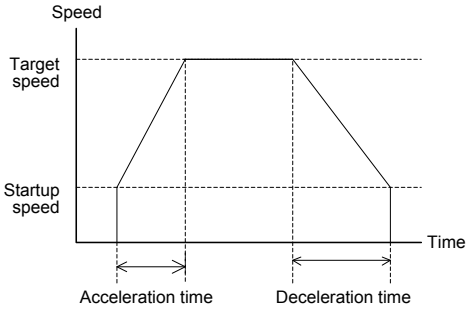


Figure 6.4 Startup Speed

● Origin Search Mode

[Data Range] **$0000 to $0FFF**
[Data Position No.] ***52 (The symbol '*' represents the axis number minus 1.)**

Defines, using bit patterns, the behavior of the motor when the edges of each contact input is detected during a manual origin search operation.

For details, see Section 8.6.1, "Manual Origin Search."

● Origin Search Direction

[Data Range] **0: Reverse**
1: Forward
[Data Position No.] ***53 (The symbol '*' represents the axis number minus 1.)**

Sets the motor rotation direction during an origin search operation.

● Z-phase Edge Selection

[Data Range] **0: Rising edge**
1: Falling edge
[Data Position No.] ***54 (The symbol '*' represents the axis number minus 1.)**

Defines the Z-phase edge direction for Z-phase detection during a manual origin search operation.

This parameter is used also when Z-phases are used in a speed control to position control switchover operation.

● Z-phase Search Count

[Data Range] **0 to 32,767 [pulses]**
[Data Position No.] ***55 (The symbol '*' represents the axis number minus 1.)**
Specifies how many Z-phase inputs must be detected before an origin can be found during manual origin search. When "0" is set, the position where Z-phase search is started (the position where the origin input or forward/reverse limit input becomes off without any Z-phase being detected) is used as the Z-phase detection position.

This parameter is used also when Z-phases are used in a speed control to position control switchover operation. Set it to 0 if you do not use Z-phases in a speed control to position control switchover operation.

● Z-phase Search Range

[Data Range] **0 to 2,147,483,647/Z-phase Search Count [pulses]**
[Data Position No.] ***56/*57**
(The symbol '*' represents the axis number minus 1.)
When you execute a Manual Origin Search command to perform a Z-phase search operation, an error occurs if a Z-phase cannot be detected within this pulse count range during the manual origin search operation.

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

[Data Range] **0 to 32,767 [ms]**
[Data Position No.] ***58 (The symbol '*' represents the axis number minus 1.)**
Sets the length of time to output the deviation pulse clear signal when a Z-phase (origin) is detected when a Manual Origin Search command is executed.

If "0" is specified for the Z-phase Search Count parameter or if "1: Program output" is selected for the Deviation Pulse Clear Setting registered parameter, the deviation pulse clear signal is not output.

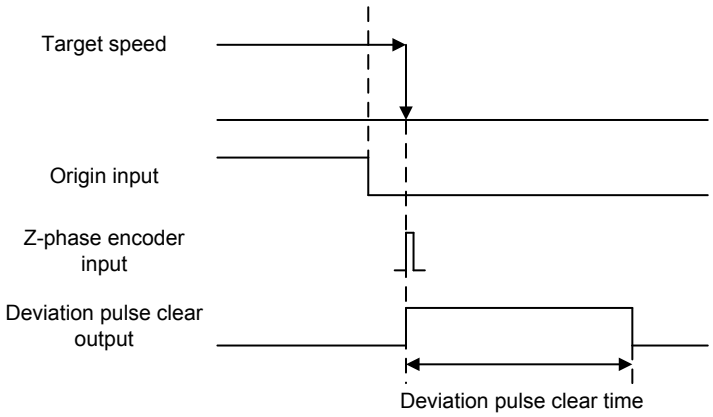


Figure 6.5 Behavior of Deviation Pulse Clear Signal Output

● Manual Pulse Generator M Value

[Data Range] **-32,768 to 32,767**
[Data Position No.] ***60 (The symbol '*' represents the axis number minus 1.)**
Sets the M value used in manual pulse generator mode.

● Manual Pulse Generator N Value

[Data Range] **1 to 32,767**
[Data Position No.] ***61 (The symbol '*' represents the axis number minus 1.)**
Sets the N value used in manual pulse generator mode.

The movement amount can be calculated from the expression:

Change in counter inputs × Manual Pulse Generator M Value / Manual Pulse Generator N Value

in manual pulse generator mode.

Usually set a positive value. By setting a negative value for the Manual Pulse Generator M Value parameter, CCW pulses against counter inputs can be output.

● Manual Pulse Generator Filter

[Data Range] **0 to 10,000 [ms]**
[Data Position No.] ***62 (The symbol '*' represents the axis number minus 1.)**
Sets a filter for counter inputs in manual pulse generator mode. Set a time constant for a first order lag filter in [ms]. When a filter is specified, it takes about 20 times the filter time constant until the pulse is stabilized.

● Trigger Setting

[Data Range] **0: Software trigger**
1: External contact input trigger
2: Counter status trigger
3: Counter zone coincidence trigger
4: Positioning Completed input relay trigger
[Data Position No.] ***63 (The symbol '*' represents the axis number minus 1.)**
Specifies the type of the trigger used by a command with a trigger condition.

Table 6.9 List of Trigger Types

	Trigger Type	Function	See Also
0	Software trigger	A trigger is activated by writing "1" from the CPU module into "Software Trigger Request (*77)."	8-81
1	External contact input trigger	A trigger is activated when an external contact input (reverse limit input, forward limit input, or origin input) is On.	8-86
2	Counter status trigger	A trigger is activated according to the status of a counter input. (Counter coincidence detection, counter contact inputs, etc.)	8-90
3	Counter zone coincidence trigger	A trigger is activated when a zone coincidence occurs for a counter input.	8-95
4	Positioning Completed input relay trigger	A trigger is activated when a Positioning Completed input relay is ON for another axis.	8-100

● Trigger Axis Setting

[Data Range] **0, 1 to 8 axes**
[Data Position No.] ***64 (The symbol '*' represents the axis number minus 1.)**
Specifies a target axis used as a trigger input when "software trigger" or "Positioning Completed input relay trigger" is selected for the Trigger Setting parameter.

For a software trigger, when this parameter is set to "0", an axis from which the command is issued is used as the target axis.

For a Positioning Completed input relay trigger, the On state of a Positioning Completed relay cannot be used as a trigger condition for an axis from which the command is issued.

For example, when this parameter is set to "3", a software trigger is activated by writing "1" to the Software Trigger Request for axis 3.

● Trigger Contact Setting

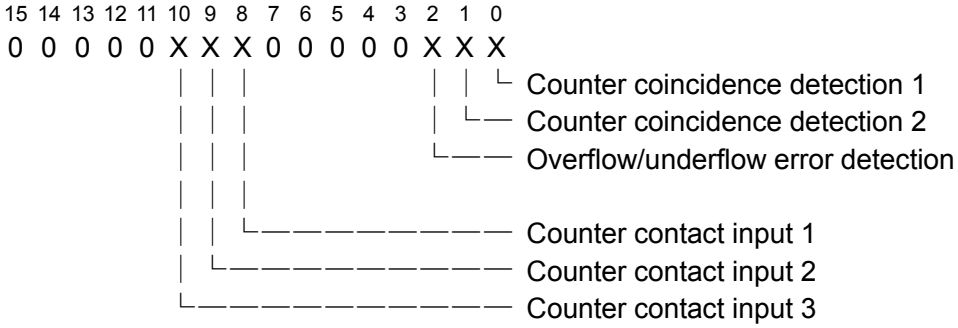
[Data Range] **0: Reverse limit input**
1: Forward limit input
2: Origin input
[Data Position No.] ***65 (The symbol '*' represents the axis number minus 1.)**
Specifies a contact input terminal used as a trigger input when "external contact input trigger" is selected for the Trigger Setting parameter.

When you select the reverse or forward limit input as a trigger input, disable the limit input error detection in the Contact Input Setting registered parameter.

● Counter Status Trigger Setting

[Data Range] **$0000 to $0400 (Select only one of the bits.)**
[Data Position No.] ***66 (The symbol '*' represents the axis number minus 1.)**
Specifies a counter bit status used as a trigger input when "counter status trigger" is selected for the Trigger Setting parameter. If you specify two or more bits, the performance is not guaranteed.

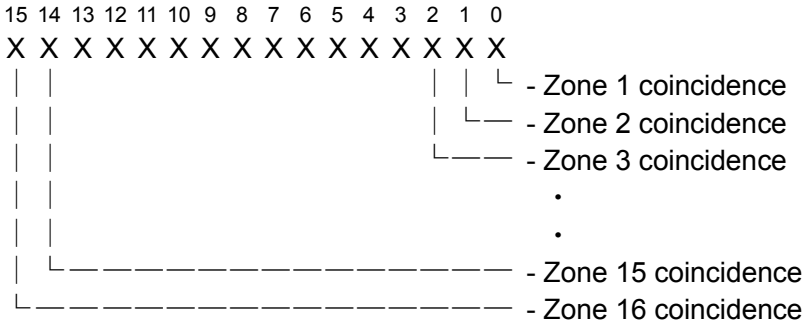
The On state of the selected counter bit is used as a trigger condition. For details on counter statuses, refer to Section 7.2, "Counter Statuses."



● Counter Zone Coincidence Trigger Setting

[Data Range] **$0000 to $8000 (Select only one of the bits.)**
[Data Position No.] ***67 (The symbol '*' represents the axis number minus 1.)**
Specifies a counter bit status used as a trigger input when "counter zone coincidence trigger" is selected for the Trigger Setting parameter. If you specify two or more bits, the performance is not guaranteed.

The On state of the selected counter bit is used as a trigger condition. For details on counter statuses, refer to Section 7.2, "Counter Statuses."



● Preset Override Value

[Data Range] **1 to 500 [%]**
[Data Position No.] ***69 (The symbol '*' represents the axis number minus 1.)**
Specifies a preset override value used to change the operation speed to 1% to 500% of the target speed. Specify a suitable preset override value so that the target speed x the preset override value [%] can be smaller than the Speed Limit registered parameter value. If a startup speed is specified, the value of the above expression must be larger than the startup speed.

● Software Trigger Request

[Data Range] **1**
[Data Position No.] ***77 (The symbol '*' represents the axis number minus 1.)**
By writing "1" to this parameter during a software trigger wait state, a software trigger is activated. Do not write any value other than "1".

Any attempt to read this parameter always returns 0.

This is not a parameter to be set when issuing a command.

● Deviation Pulse Clear Request

[Data Range] **0: Deviation pulse clear signal Off**
1: Deviation pulse clear signal On
[Data Position No.] ***78 (The symbol '*' represents the axis number minus 1.)**
This parameter is valid only when "1: program output" is selected for the Deviation Pulse Clear Setting registered parameter. By writing a suitable value to the Deviation Pulse Clear Request parameter using a program on the CPU module in any timing, you can control the On/Off status of the deviation pulse clear signal.

This is not a parameter to be set when issuing a command.

6.1.7 List of Position Data Records

Table 6.10 Position Data Record (Table Number 1 for Axis 1)

Data Position No. (Word Basis)	Parameter	Description	See Also
1001	Target Position Mode	0: Using ABS position, 1: Using INC position [Factory default: 0]	6-31
1002/1003	Target Position	Reverse limit to forward limit [pulses] [Factory default: 0]	6-31
1004	Accel/Decel Mode	0: Trapezoidal acceleration/deceleration (With startup speed), 1: S-shape acceleration/deceleration [Factory default: 0]	6-31
1005/1006	Target Speed	1 to Speed Limit [command speed unit*1] [Factory default: 0]	6-31
1007	Acceleration Time	0 to 32,767 [acceleration/deceleration time unit*2], -1: Default acceleration [Factory default: 0]	6-31
1008	Deceleration Time	0 to 32,767 [acceleration/deceleration time unit*2], -1: Default deceleration [Factory default: 0]	6-31
1009/1010	Startup Speed	0 to target speed [command speed unit*1] [Factory default: 0]	6-32

*1: The command speed unit is the unit selected for the command speed unit selection of the Speed Mode Selection registered parameter.
*2: The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

Table 6.11 Position Data Records and First Data Position Numbers

Axis No.	Record No.	Data Position No.
1	1	1001 to 1010
1	2	1011 to 1020
1	3	1021 to 1030
1	4	1031 to 1040
1	5	1041 to 1050
1	6	1051 to 1060
1	7	1061 to 1070
1	8	1071 to 1080
1	9	1081 to 1090
1	10	1091 to 1100

Axis No.	Record No.	Data Position No.
2	1	1101 to 1110
2	2	1111 to 1120
2	3	1121 to 1130
2	4	1131 to 1140
2	5	1141 to 1150
2	6	1151 to 1160
2	7	1161 to 1170
2	8	1171 to 1180
2	9	1181 to 1190
2	10	1191 to 1200

Axis No.	Record No.	Data Position No.
3	1	1201 to 1210
3	2	1211 to 1220
3	3	1221 to 1230
3	4	1231 to 1240
3	5	1241 to 1250
3	6	1251 to 1260
3	7	1261 to 1270
3	8	1271 to 1280
3	9	1281 to 1290
3	10	1291 to 1300

Axis No.	Record No.	Data Position No.
4	1	1301 to 1310
4	2	1311 to 1320
4	3	1321 to 1330
4	4	1331 to 1340
4	5	1341 to 1350
4	6	1351 to 1360
4	7	1361 to 1370
4	8	1371 to 1380
4	9	1381 to 1390
4	10	1391 to 1400

Axis No.	Record No.	Data Position No.
5	1	1401 to 1410
5	2	1411 to 1420
5	3	1421 to 1430
5	4	1431 to 1440
5	5	1441 to 1450
5	6	1451 to 1460
5	7	1461 to 1470
5	8	1471 to 1480
5	9	1481 to 1490
5	10	1491 to 1500

Axis No.	Record No.	Data Position No.
6	1	1501 to 1510
6	2	1511 to 1520
6	3	1521 to 1530
6	4	1531 to 1540
6	5	1541 to 1550
6	6	1551 to 1560
6	7	1561 to 1570
6	8	1571 to 1580
6	9	1581 to 1590
6	10	1591 to 1600

Axis No.	Record No.	Data Position No.
7	1	1601 to 1610
7	2	1611 to 1620
7	3	1621 to 1630
7	4	1631 to 1640
7	5	1641 to 1650
7	6	1651 to 1660
7	7	1661 to 1670
7	8	1671 to 1680
7	9	1681 to 1690
7	10	1691 to 1700

Axis No.	Record No.	Data Position No.
8	1	1701 to 1710
8	2	1711 to 1720
8	3	1721 to 1730
8	4	1731 to 1740
8	5	1741 to 1750
8	6	1751 to 1760
8	7	1761 to 1770
8	8	1771 to 1780
8	9	1781 to 1790
8	10	1791 to 1800

6.1.8 Description of Position Data Records

● Target Position Mode

[Data Range] 0: Using ABS position, 1: Using INC position
Specifies how to specify a target position.

In the absolute position mode, the specified target position represents a new target position regardless of the current position.

In the incremental position mode, the specified target position represents a new target position relative to 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).

● Target Position

[Data Range] -2,147,483,648 to 2,147,483,647 [pulses]
Sets the target position for a Start Positioning command.

Set this parameter so that the target position determined from the Target Position and Target Position Mode can be between the Forward Limit and Reverse Limit parameter values.

● Accel/Decel Mode

[Data Range] 0: Trapezoidal acceleration/deceleration (With startup speed)
1: S-shape acceleration/deceleration
Specifies the Accel/Decel mode.

● Target Speed

[Data Range] 1 to Speed Limit [command speed unit]
Sets the operation speed for a Start Positioning command.

Set a target speed smaller than the Speed Limit parameter value. When a startup speed has been set, set a value greater than or equal to the startup speed.

If the target speed is "0", no operation can be performed.

If an override setting is specified, the operation speed is set to the target speed × the current override value [%].

● Acceleration Time

[Data Range] 0 to 32,767 [acceleration/deceleration time unit]
-1: The Acceleration Setting registered parameter is used.
Sets the acceleration time to reach the target speed from the startup speed.

The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

If "-1" is set, operations are performed using the acceleration value specified for the relevant registered parameter.

● Deceleration Time

[Data Range] 0 to 32,767 [acceleration/deceleration time unit]
-1: The Deceleration Setting registered parameter is used.
Sets the deceleration time to decelerate and stop from the target speed.

The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

If "-1" is set, operations are performed using the acceleration value specified for the relevant registered parameter.

● Startup Speed

[Data Range] 0 to target speed [command speed unit]
This parameter is valid only when the Accel/Decel Mode is "0: Trapezoidal acceleration/deceleration (With startup speed)". This parameter specifies the startup speed at the beginning of the positioning operation and the speed just before stopping when the positioning is completed.

When the positioning module is used to control a stepper 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).

Set 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".

6.2 Statuses

Statuses refer to data which the CPU module reads from the positioning module. You can check the state of the positioning module using these statuses and input relays.

Only for specific statuses, by using a long-word-basis READ instruction (READ L instruction), concurrency of the high-order word and low-order word of two-word data is assured. Note that data position numbers used in a long-word-basis READ L instruction are different from the ones used in a word-basis READ instruction.

For details on the statuses that can be used by a long-word-basis READ instruction and the data position numbers for a READ L instruction used from the CPU module, see Table 6.13.

CAUTION

When a word-basis READ instruction is used from the CPU module to read two-word data, concurrency of the high-order word and low-order word of two-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.

CAUTION

Data concurrency cannot be assured when reading from a BASIC CPU because a BASIC CPU cannot perform long-word access to the positioning module.

6.2.1 List of Statuses for Each Axis/List of Common Statuses for All Axes

Table 6.12 List of Statuses for Each Axis (Word Basis)

Data Position No. (Word Basis)	Status	Description	See Also
*81/*82	Target Position Status	-2,147,483,648 to 2,147,483,647 [pulses]	6-35
*83/*84	Current Position Status	-2,147,483,648 to 2,147,483,647 [pulses]	6-35
*85/*86	Current Speed Status	-(Speed Limit) to Speed Limit [command speed unit*1]	6-35
*87	Contact Input Status	States of contact inputs (bit data)	6-36
*88	Error Status	Error information when an error occurs	6-36
*89	Warning Status	Warning information when a warning is raised	6-36
*90	Origin Search Status	Status related to an origin search operation	6-36
*91	Extended Status	Operation status such as accelerating, decelerating, and changing speed (bit data)	6-37
*92/*93	No. of Write Operations to Flash Memory	Value starts from 0 [times]	6-37
*94	Current Override Value Status	1 to 500 [%]	6-37

The symbol '*' represents the value of (axis number -1). The values for axis 1 to axis 8 are 0 to 7, respectively.
*1: The command speed unit is the unit selected for the command speed unit selection of the Speed Mode Selection registered parameter.

Table 6.13 List of Statuses for Each Axis (Data Position Numbers for Long-word Access)

Axis	Status	Data Position No. (Word Basis)	Data Position No. (Long-word Basis)
1	Target Position Status	081/082	041
1	Current Position Status	083/084	042
1	Current Speed Status	085/086	043
2	Target Position Status	181/182	091
2	Current Position Status	183/184	092
2	Current Speed Status	185/186	093
3	Target Position Status	281/282	141
3	Current Position Status	283/284	142
3	Current Speed Status	285/286	143
4	Target Position Status	381/382	191
4	Current Position Status	383/384	192
4	Current Speed Status	385/386	193
5	Target Position Status	481/482	241
5	Current Position Status	483/484	242
5	Current Speed Status	485/486	243
6	Target Position Status	581/582	291
6	Current Position Status	583/584	292
6	Current Speed Status	585/586	293
7	Target Position Status	681/682	341
7	Current Position Status	683/684	342
7	Current Speed Status	685/686	343
8	Target Position Status	781/782	391
8	Current Position Status	783/784	392
8	Current Speed Status	785/786	393

Table 6.14 List of Common Statuses for All Axes

Data Position No. (Word Basis)	Parameter	Description	See Also
0981	Module Information	"F3"	6-38
0982	Module Information	"YP"	6-38
0983	Module Information	"22", "24", or "28"	6-38
0984	Module Information	"0P"	6-38
0985	Module Information	" "	6-38
0986	Module Information	" "	6-38
0987	Module Information	"RV"	6-38
0988	Module Information	"□□" ("□□" represents a revision data.)	6-38
0989	(System reserved)		-
0990	Pulse Output External 24V Power Source	0: Off 1: On	6-38
0991-992	No. of Write Operations to Flash Memory	Value starts from 0 [times]	6-38
0993-1000	(System reserved)		-

6.2.2 Description of Statuses for Each Axis/Common Statuses for All Axes

● Target Position Status

[Data Position No.] *81/*82 (The symbol '*' represents the axis number minus 1.)
[Data Range] -2,147,483,648 to 2,147,483,647 [pulses]
Used to read the target position during a positioning operation.

The target position is determined from "Target Position Mode" and "Target Position" that are set at the beginning of the positioning.

● Current Position Status

[Data Position No.] *83/*84 (The symbol '*' represents the axis number minus 1.)
[Data Range] -2,147,483,648 to 2,147,483,647 [pulses]
Used to read the current position of a motor as output pulse counts of the positioning module.

It is thus different from the actual motor position when a servomotor is used.

● Current Speed Status

[Data Position No.] *85/*86 (The symbol '*' represents the axis number minus 1.)
[Data Range] -(Speed Limit) to Speed Limit [pulse/s]
0 to Speed Limit [(1/65536) pulse/ms]
(The unit varies depending on the command speed unit selection.)
Used to read 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. The unit varies depending on the command speed unit selection of the Speed Mode Selection registered parameter.

When "[pulse/s]" is specified for the command speed unit selection, the value can be positive or negative depending on the motor rotation direction.

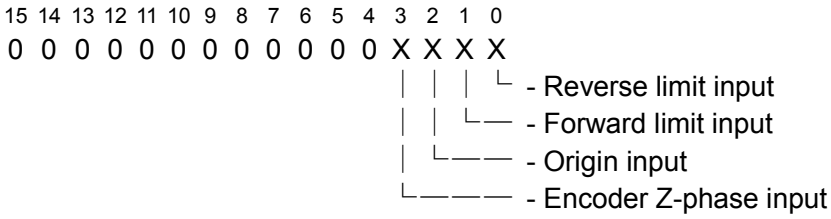
When "[(1/65536) pulse/ms]" is specified for the command speed unit selection, the value is always positive regardless of the motor rotation direction.

● Contact Input Status

[Data Position No.] *87 (The symbol '*' represents the axis number minus 1.)
[Data Range] $0000 to $000F

Used to read 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).



● Error Status

[Data Position No.] *88 (The symbol '*' represents the axis number minus 1.)
[Data Range] 0 to 32,767

Used to read the error code if an error occurs.

If the "Error Detected input relay" is Off, this parameter has no meaning. For details on error codes, refer to Section 11.2, "List of Positioning Error Codes."

● Warning Status

[Data Position No.] *89 (The symbol '*' represents the axis number minus 1.)
[Data Range] 0 to 32,767

Used to read the warning code when a warning occurs.

A value of '0' indicates no warning.

There is no separate warning notification relay. Read the warning status when a new position operation starts to check if the last operation has been performed correctly. For details on warning codes, see Section 11.4, "List of Positioning Warning Codes."

● Origin Search Status

[Data Position No.] *90 (The symbol '*' represents the axis number minus 1.)
[Data Range] 0 to 5

Used to read the status during or at the completion of an origin search.

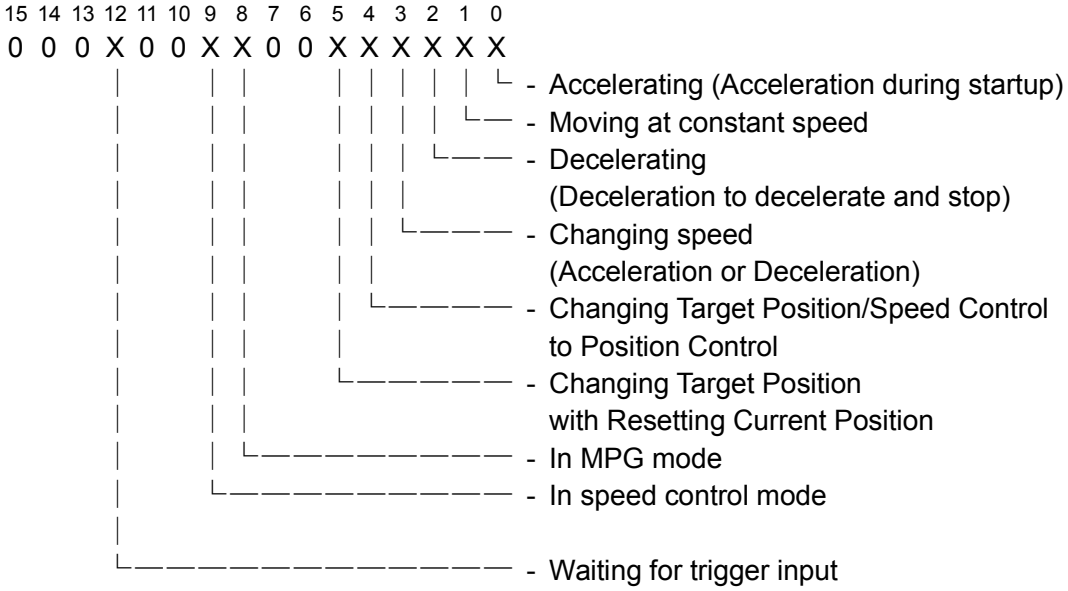
0: On power-up or at the normal completion of the origin search
1: Stopped upon detection of an input edge when Stop immediately or Decelerate and Stop is specified as the operation to be performed on contact input edge detection.
2: Stopped because a [Stop Immediately] output relay is turned on or stopped by a Decelerate and Stop command. Or, stopped due to an error that occurs during an operation other than an origin search.
3: Stopped due to an error that occurs during an origin search operation.
4: During a Z-phase search
5: Before a Z-phase search

● Extended Status

[Data Position No.] *91 (The symbol '*' represents the axis number minus 1.)
[Data Range] $0000 to $133F (bit data)
Used to read operation information that represents the positioning operation state of an axis on a bit basis.

When the axis is in a particular operation, the corresponding bit is set to '1'.

This parameter is not updated during an origin search. Read the Origin Search Status to check the operation status during an origin search.



● No. of Write Operations to Flash Memory

[Data Position No.] *92/*93
[Data Range] Value starts from 0 [times]
Used to read 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 written to the flash memory (100,000 times max.), you should save the registered parameters to the flash memory only when required. The performance of the flash memory is not assured after 100,000 writes. The same value is stored for all axes.

● Current Override Value Status

[Data Position No.] *94 (The symbol '*' represents the axis number minus 1.)
[Data Range] 1 to 500 [%]
Used to read the current Preset Override Value parameter.

The Preset Override Value parameter can be changed by using the Set Override command.

At power up, an operation is performed at 100 [%].

● Module Information

[Data Position No.] **0981 to 0988**
[Data Range] **Module type: "F3YP220P", "F3YP240P", or "F3YP280P"**
Revision: "RV□□"

Used to read the module type and revision as module information.

● Pulse Output External 24V Power Source

[Data Position No.] **0990**
[Data Range] **0: The external 24V power source for pulse outputs is off.**
1: The external 24V power source for pulse outputs is on.

Used to read the state of the external 24 V power source for pulse outputs.

● No. of Write Operations to Flash Memory

[Data Position No.] **991/992**
[Data Range] **Value starts from 0 [times]**

Used to read 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 written to the flash memory (100,000 times max.), you should save the registered parameters to the flash memory only when required. The performance of the flash memory is not assured after 100,000 writes. The same values are stored for the status of each axis.

7. Counter Parameters and Statuses

Table 7.1 shows the layout of the parameter area and status area for the positioning module. For details, refer to Sections 7.1 and 7.2.

Table 7.1 Layout of the Parameter and Status Areas

Data Position No. (Word Basis)	Description
0001 to 0040	AX1 Registered Parameters
0041 to 0080	AX1 Command Parameters
0081 to 0100	AX1 Status
0101 to 0140	AX2 Registered Parameters
0141 to 0180	AX2 Command Parameters
0181 to 0200	AX2 Status
0201 to 0240	AX3 Registered Parameters
0241 to 0280	AX3 Command Parameters
0281 to 0300	AX3 Status
0301 to 0340	AX4 Registered Parameters
0341 to 0380	AX4 Command Parameters
0381 to 0400	AX4 Status
0401 to 0440	AX5 Registered Parameters
0441 to 0480	AX5 Command Parameters
0481 to 0500	AX5 Status
0501 to 0540	AX6 Registered Parameters
0541 to 0580	AX6 Command Parameters
0581 to 0600	AX6 Status
0601 to 0640	AX7 Registered Parameters
0641 to 0680	AX7 Command Parameters
0681 to 0700	AX7 Status
0701 to 0740	AX8 Registered Parameters
0741 to 0780	AX8 Command Parameters
0781 to 0800	AX8 Status
0801 to 0980	Counter Parameters and Statuses
0981 to 1000	Common Statuses for All Axes
1001 to 1100	AX1 Position Data Record
1101 to 1200	AX2 Position Data Record
1201 to 1300	AX3 Position Data Record
1301 to 1400	AX4 Position Data Record
1401 to 1500	AX5 Position Data Record
1501 to 1600	AX6 Position Data Record
1601 to 1700	AX7 Position Data Record
1701 to 1800	AX8 Position Data Record
1801 to	(System reserved)

■ Reading and Writing Two-word Data

The counter parameters/statuses in Tables 7.2, 7.4 and 7.7 are two-word data (long-word data). The smaller data position number contains the low-order word, and the larger data position number contains the high-order word.

When a WRITE, WRITE L, READ, or READ L instruction is used for data access from a CPU program, the data position number varies depending on the instruction used.

Use a long-word-basis data position number for a WRITE L or READ L used for long-word-basis access from a CPU program.

Use a word-basis data position number for a WRITE L or READ L used for word-basis access from a CPU program.

CAUTION

When a word-basis READ/WRITE instruction is used from the CPU module to read or write two-word data, concurrency of the high-order word and low-order word of two-word data is not assured due to conflicts between the timing of reading or writing from the CPU module and the data update period of the positioning module.

By using a long-word-basis READ L/WRITE L instruction, concurrency of the high-order word and low-order word of two-word data is assured. Note that data position numbers used in long-word-basis READ L and WRITE L instructions are different from the ones used in word-basis READ and WRITE instructions.

CAUTION

Data concurrency cannot be assured when reading from a BASIC CPU because a BASIC CPU cannot perform long-word access to the positioning module.

7.1 Counter Parameters

7.1.1 List of Counter Registered Parameters

At power up or system reset, the contents of the flash memory are automatically reloaded to the counter registered parameters. To change the settings of the counter registered parameters, write new parameter settings from the CPU module, and then write '1' to the Counter Registered Parameters Request parameter.

Table 7.2 List of Counter Registered Parameters

Data Position No.		Parameter	Description	See Also
Long-word Basis	Word Basis			
401	801/802	Counter Count Mode Setting	0: Phase A/B (x1) 10: Phase A/B (x1) reverse 1: Phase A/B (x2) 11: Phase A/B (x2) reverse 2: Phase A/B (x4) 12: Phase A/B (x4) reverse 3: CW/CCW pulse 13: CW/CCW pulse reverse 4: Travel/direction 14: Travel/direction reverse [Factory default: 0]	7-4
402	803/804	Counter Filter Setting	0: Do not use filter 1: Use at frequency of 1 M pulse/s or less. 2: Use at frequency of 500 K pulse/s or less. 3: Use at frequency of 100 K pulse/s or less. [Factory default: 0]	7-5
403	805/806	Counter Action Mode Setting	0: Linear Counter (Coded 32 bit fixed) 1: Ring Counter (0 to the Preset Ring Counter Value) 2: Ring Counter (Coded 32 bit fixed) [Factory default: 0]	7-5
404	807/808	Preset Ring Counter Value	1 to 2,147,483,647 [pulses] (This parameter is valid only when Counter Action Mode Setting is "1: Ring counter". Set the number of counts per revolution -1.) [Factory default: 2,147,483,647]	7-6
405	809/810	Counter Contact Input Setting	$00000000 or greater (bit data for each contact) (Settings for NO contact, NC contact, and filter) [Factory default: 0]	7-6
406	811/812	Counter Z-phase Input Setting	$00000000 or greater (bit data) (This parameter specifies a filter and also the Z-phase input for an axis used as a counter Z-phase input.) [Factory default: 0]	7-7
407	813/814	Counter Contact Z-phase Input Function Layout	$00000000 or greater (bit data) (This parameter assigns the counter enable, counter preset, and counter latch functions to the contact inputs and Z-phase input.) [Factory default: 0]	7-8
408	815/816	Counter Contact Output 1 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter contact output 1.) [Factory default: 0]	7-10
409	817/818	Counter Contact Output 2 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter contact output 2.) [Factory default: 0]	7-10
410	819/820	Counter Coincidence Direction Setting	$00000000 or greater (bit data) (This parameter specifies the method of counter coincidence detection.) [Factory default: 0]	7-11
411	821/822	Counter Input Relay Setting	0: Counter Input Relay Not In Use (For F3YP28-0P, X□□□13 to X□□□16 are used as Stop Immediately ACK relays.) 1: Counter Input Relay In Use (For F3YP28-0P, X□□□13 to X□□□16 are used as counter input relays.) [Factory default: 0]	7-12

412	823/824	Counter Input Relay 1 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 1.) [Factory default: 0]	7-13
413	825/826	Counter Input Relay 2 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 2.) [Factory default: 0]	7-14
414	827/828	Counter Input Relay 3 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 3.) [Factory default: 0]	7-14
415	829/830	Counter Input Relay 4 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 4.) [Factory default: 0]	7-14
416	831/832	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-

7.1.2 Description of Counter Registered Parameters

● Counter Count Mode Setting

[Data Range] **0: Phase A/B (x1)** **10: Phase A/B (x1) Reverse**
1: Phase A/B (x2) **11: Phase A/B (x2) Reverse**
2: Phase A/B (x4) **12: Phase A/B (x4) Reverse**
3: CW/CCW pulse **13: CW/CCW pulse Reverse**
4: Travel/direction **14: Travel/direction Reverse**
[Factory default] **0: Phase A/B (x1)**
[Data Position No.] **401 (Long-word address)**
Specifies the counter input format.

The phase A/B inputs performs a forward count operation with phase B advance.

By selecting a reverse mode, you can change the rotation direction (i.e., the direction of counter increment/decrement).

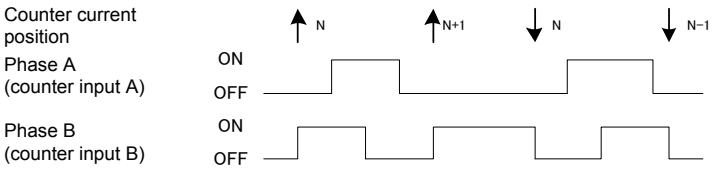


Figure 7.1 Counter Count Mode: Phase A/B (x1)

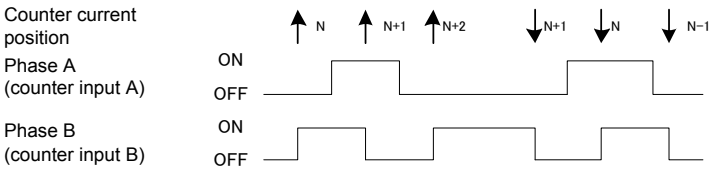


Figure 7.2 Counter Count Mode: Phase A/B (x2)

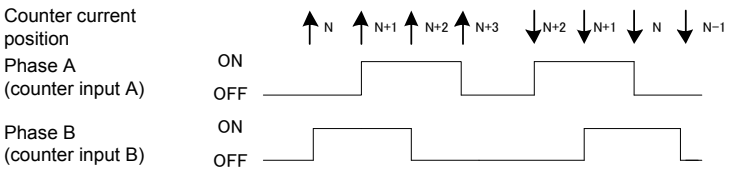


Figure 7.3 Counter Count Mode: Phase A/B (x4)

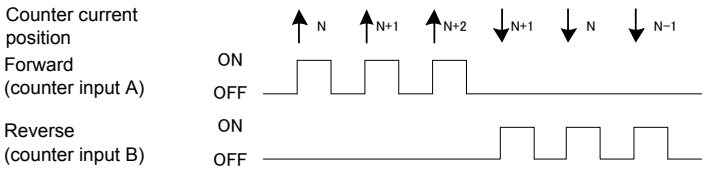


Figure 7.4 Counter Count Mode: CW/CCW Pulse

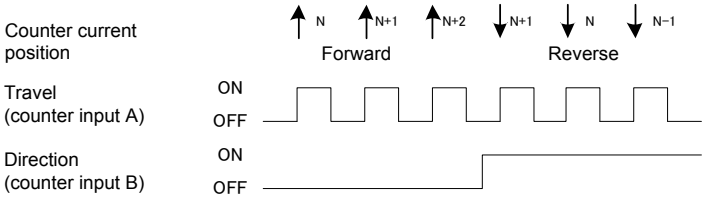


Figure 7.5 Counter Count Mode: Travel/Direction

● Counter Filter Setting

[Data Range] **0: Do not use filter**
1: Use at frequency of 1 Mpps or less.
2: Use at frequency of 500 Kpps or less.
3: Use at frequency of 100 Kpps or less.
[Factory default] **0: Do not use filter**
[Data Position No.] **402 (Long-word address)**

Specifies the counter input digital filter.

Specify a filter if a malfunction occurs due to noise. When you set a phase A/B input mode in Counter Count Mode Setting, select a filter suitable for the frequency counted from 1x pulses.

● Counter Action Mode Setting

[Data Range] **0: Linear Counter (Coded 32 bit fixed)**
1: Ring Counter (0 to the Preset Ring Counter Value)
2: Ring Counter (Coded 32 bit fixed)
[Factory default] **0: Linear Counter (Coded 32 bit fixed)**
[Data Position No.] **403 (Long-word address)**

Specifies the counter action mode.

When "0: Linear Counter (Coded 32 bit fixed)" is specified, the counter can operate within the range from -2,147,483,648 to 2,147,483,647. If the count becomes smaller than -2,147,483,648, an underflow error occurs. If the count becomes larger than 2,147,483,647, an overflow error occurs.

When "1: Ring Counter (0 to the Preset Ring Counter Value)" is specified, the counter can operate as a ring counter within the range from 0 to the Preset Ring Counter Value. If the current counter position becomes smaller than 0, the current counter position is changed to Preset Ring Counter Value. If the counter current position becomes larger than Preset Ring Counter Value, the counter current position is changed to 0.

When "2: Ring Counter (Coded 32 bit fixed)" is specified, the counter can operate as a ring counter within the range from -2,147,483,648 to 2,147,483,647. If the counter current position becomes smaller than -2,147,483,648, the counter current position is changed to 2,147,483,647. If the counter current position becomes larger than 2,147,483,647, the counter current position is changed to -2,147,483,648.

● Preset Ring Counter Value

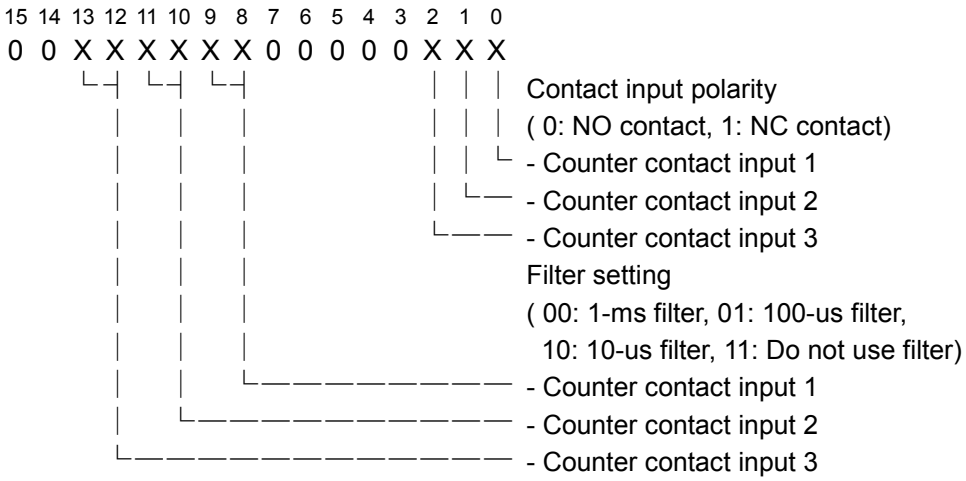
[Data Range] **1 to 2,147,483,647 [pulses]**
[Factory default] **2,147,483,647 [pulses]**
[Data Position No.] **404 (Long-word address)**
Specifies the maximum value of the ring counter when "1: Ring counter (0 to the Preset Ring Counter Value)" is specified for Counter Action Mode Setting.

The ring counter counts from 0 to the Preset Ring Counter Value. To detect the position within one revolution of a motor that rotates more than one revolution, set the value of "the number of counts per revolution -1".

For example, set this parameter to 1023 when you connect a motor with 1024 pulses per revolution and count the position in one revolution.

● Counter Contact Input Setting

[Data Range] **$00000000 or greater (bit data)**
[Factory default] **$00000000**
[Data Position No.] **405 (Long-word address)**
Specifies the polarity of the counter contact input and the filter setting as bit data.



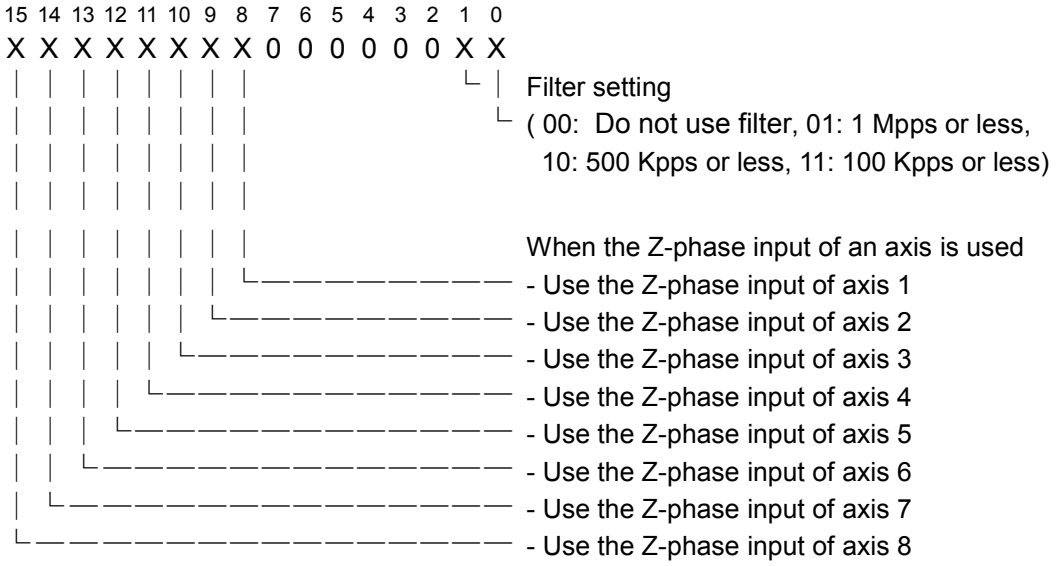
- **Contact input polarity**
  Specify the logic of the external contact inputs. An NO contact input is an input which is true when a signal input exists, and an NC contact input is an input which is true when no signal input exists. The filter setting sets a digital filter for each contact.

- **Filter setting**
  Specify a digital filter for each contact input.

● Counter Z-phase Input Setting

[Data Range] **$00000000 or greater (bit data)**
[Factory default] **$00000000**
[Data Position No.] **406 (Long-word address)**

Specifies the counter Z-phase input filter setting as bit data. Also specify this setting when using the Z-phase input wired to the Z-phase input for an axis as a counter Z-phase input.



- **Filter setting**
  Set a digital filter for Z-phase inputs. Specify a filter if a malfunction occurs due to noise.

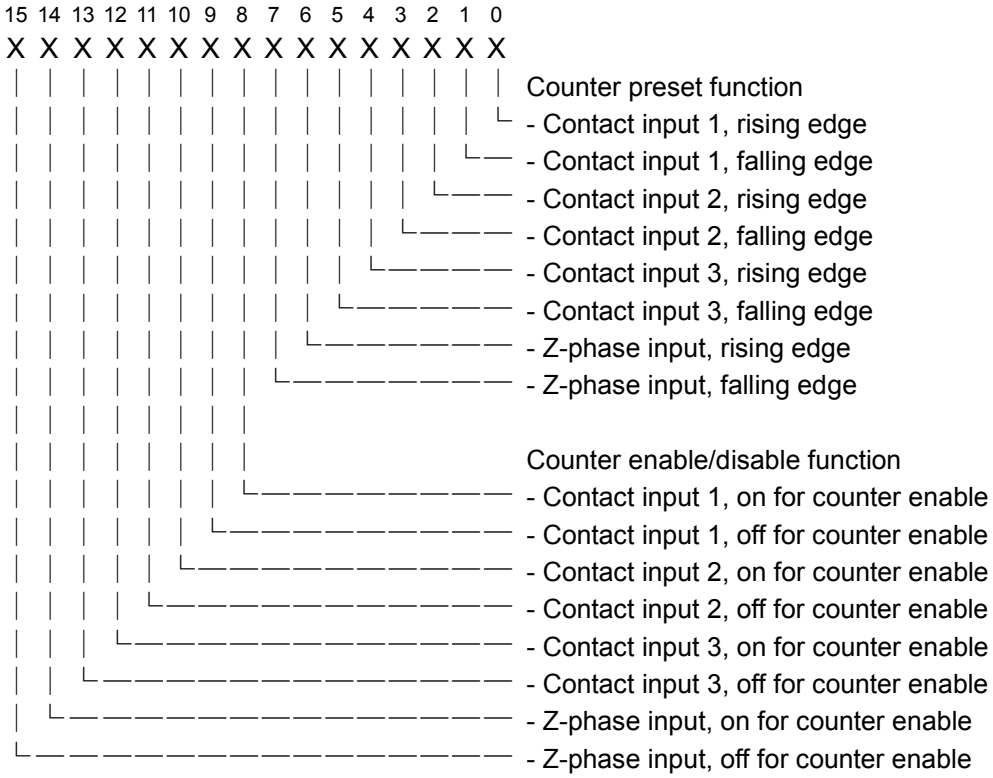
- **Use the Z-phase input of an axis**
  Specify this parameter when the Z-phase input wired to an axis is used as a Z-phase input for the counter. If you use the Z-phase input of an axis, select the relevant bit among bits 8 to 15 and set the bit to "1". Otherwise, set all of bits 8 to 15 to "0". If you specify to use the Z-phase input of an axis, the filter for the axis is applied to the Z-phase input.

● Counter Contact Z-phase Input Function Layout

[Data Range] **$00000000 or greater (bit data)**
[Factory default] **$00000000**
[Data Position No.] **407 (Long-word address)**

Specifies the Counter Contact Input 1 to 3, Z-phase Input, Counter Enable, Counter Preset, CNT Latched Request functions.

When you assign a function, select a contact and set the relevant bit to "1". You cannot assign a function to more than one input.

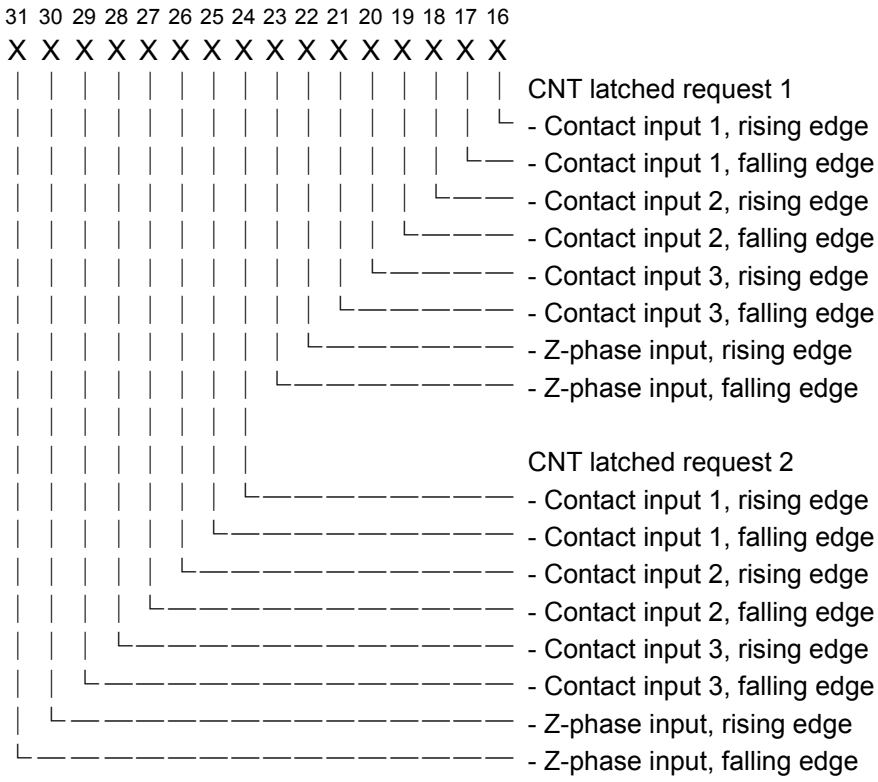


- **Counter preset function**
  When you assign the counter preset function to a counter contact input, select the relevant bit among bits 0 to 7 and set the bit to "1". When all of bits 0 to 7 are "0", counter preset control with a contact input is not performed.

  The counter preset function can be performed also by using the counter preset request from a program.

- **Counter enable/disable function**
  When you assign counter enable/disable control to a counter contact input, select the relevant bit among bits 8 to 15 and set the bit to "1". When all of bits 8 to 15 are "0", counter enable/disable control with a contact input is not performed.

  The counter enable function can be performed also by using the counter enable request from a program. When a contact input or program enables a counter, the counter performs counting.



- **Counter latch function**
  When you assign the counter latch function to counter contact inputs, select the relevant bits among bits 16 to 23 and/or bits 24 to 31 and set the bits to "1". When all of bits 16 to 23 and bits 24 to 31 are "0", CNT latched request control with contact inputs is not performed.

  The counter latch function can be enabled also by using the CNT latched request from a program.

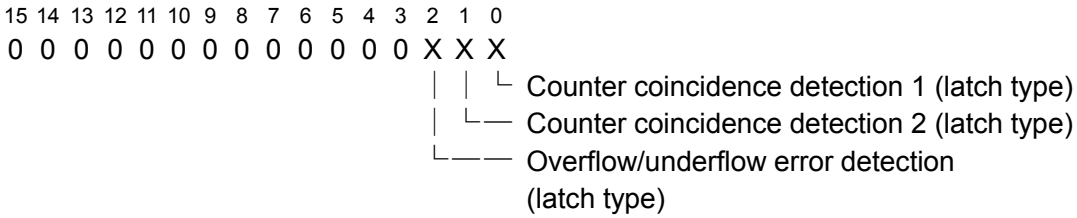
● Counter Contact Output 1 Layout

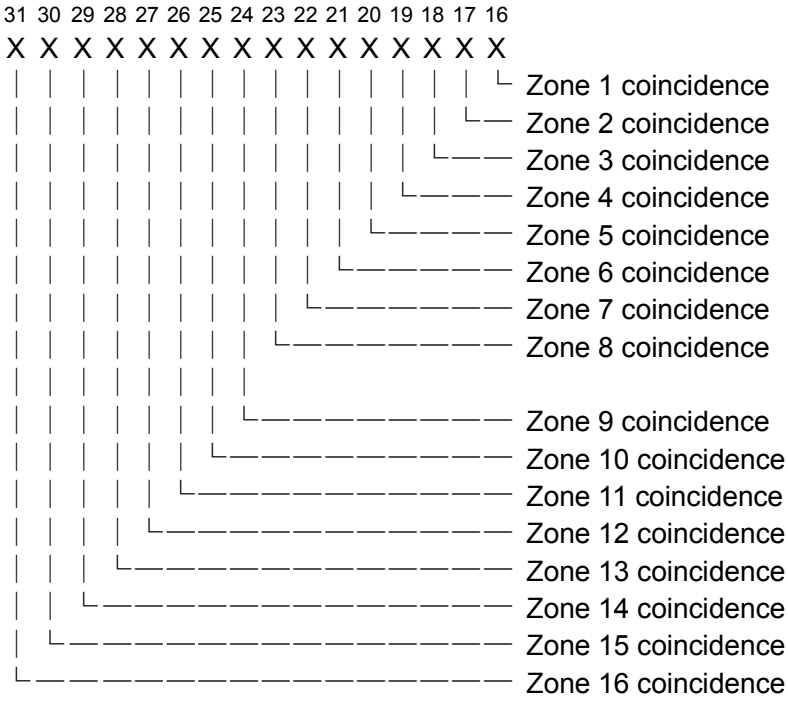
[Data Range] **$00000000 or greater (bit data)**
[Factory default] **$00000000**
[Data Position No.] **408 (Long-word address)**

Selects the function assigned to Counter Contact Output 1.

Selects a bit assigned to the contact output 1 from the counter bit status. If the bit status set to 1 becomes 1, the counter contact output turns ON. Multiple selections can be made. When making multiple selections, if any of the bit statuses set to 1 turns ON, output turns ON.

To start controlling the counter contact output 1, register counter registered parameters, and then write "1" to the Counter Contact Output 1 Control counter control parameter to enable the counter contact output 1.





● Counter Contact Output 2 Layout

[Data Range] **$00000000 or greater (bit data)**
[Factory default] **$00000000**
[Data Position No.] **409 (Long-word address)**

Selects the function assigned to Counter Contact Output 2.

The setting method is the same as the one for the counter contact output 1.

● Counter Coincidence Direction Setting

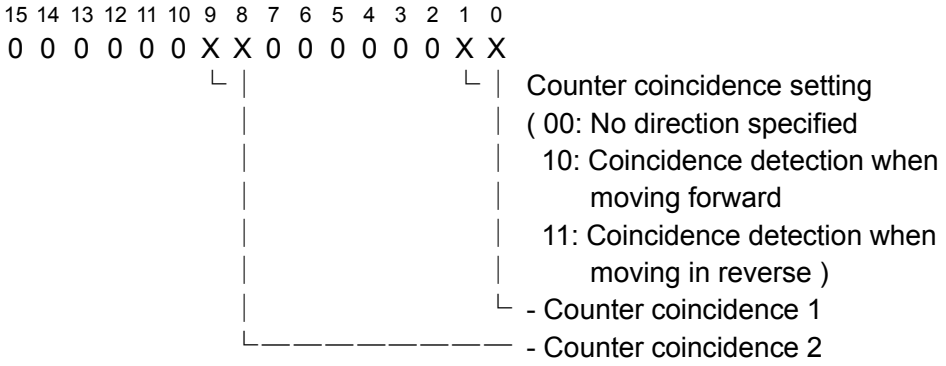
[Data Range] **$00000000 or greater (bit data)**
[Factory default] **$00000000**
[Data Position No.] **410 (Long-word address)**

Specifies the counter coincidence detection method.

If no direction is specified, a counter coincidence occurs when Counter Current Position Status changes and matches Counter Coincidence Value.

If coincidence detection when moving forward is specified, counter coincidence is detected when Counter Current Position Status is the same as Preset Counter Coincidence Value after Counter Current Position Status increases.

If coincidence detection when moving in reverse is specified, counter coincidence is detected when Counter Current Position Status is the same as Preset Counter Coincidence Value after Counter Current Position Status decreases.



● Counter Input Relay Setting

[Data Range] **0: Counter Input Relay Not In Use**
1: Counter Input Relay in Use
[Factory default] **0: Counter Input Relay Not In Use**
[Data Position No.] **411 (Long-word address)**

Specify this setting when using counter input relay when using F3YP28-0P.

If you specify "1: Counter Input Relay in Use ", you can use four input relays shown in Table 7.3 as counter input relays.

For the F3YP22-0P and F3YP24-0P modules, these four relays work as the counter input relays regardless of Counter Input Relay Setting.

Table 7.3 List of Input Relays

Input Relay No.	Signal	Description	Relationship with Other Relays
X□□□13	AX5 Stop Immediately ACK /Counter Input Relay 1	Turns on when a Stop Immediately command for axis 5 is successfully completed. /Turns on the flag assigned to the counter relay 1.	Turning off Y□□□45 turns off this relay. /-
X□□□14	AX6 Stop Immediately ACK /Counter Input Relay 2	Turns on when a Stop Immediately command for axis 6 is successfully completed. /Turns on the flag assigned to the counter relay 2.	Turning off Y□□□46 turns off this relay. /-
X□□□15	AX7 Stop Immediately ACK /Counter Input Relay 3	Turns on when a Stop Immediately command for axis 7 is successfully completed. /Turns on the flag assigned to the counter relay 3.	Turning off Y□□□47 turns off this relay. /-
X□□□16	AX8 Stop Immediately ACK /Counter Input Relay 4	Turns on when a Stop Immediately command for axis 8 is successfully completed. /Turns on the flag assigned to the counter relay 4.	Turning off Y□□□48 turns off this relay. /-

CAUTION

For the F3YP28-0P module, when you specify to use the counter input relays, the Stop Immediately ACK relays for axes 5 to 8 become unavailable. In this case, use the Positioning Completed relays instead of the Stop Immediately ACK relays.

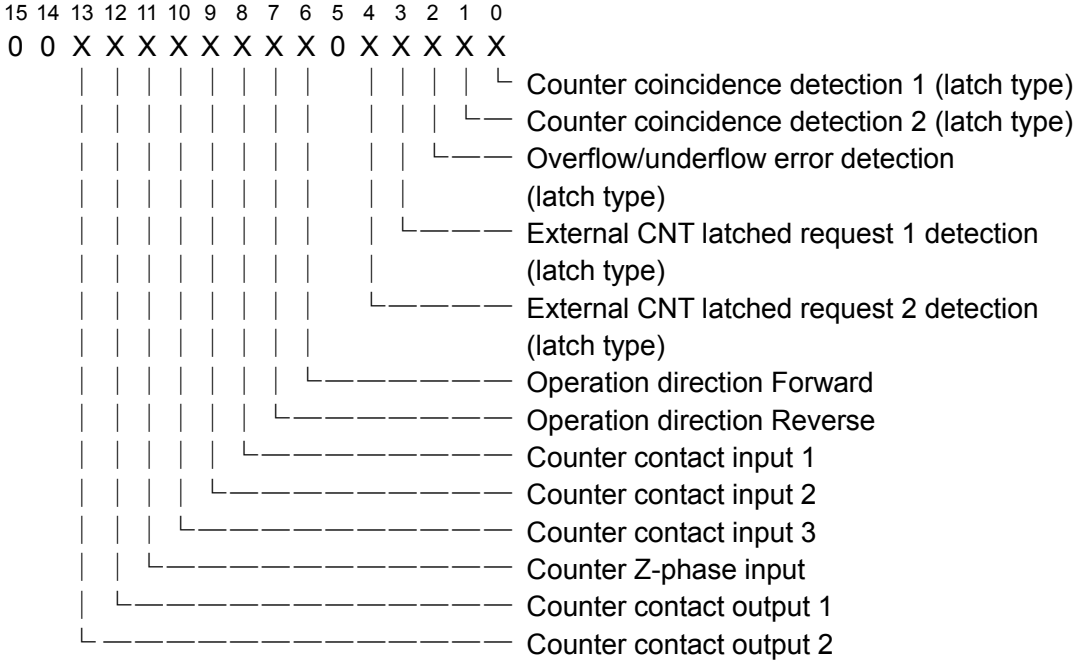
You can use a READ instruction from the CPU module to read the counter states without assigning input relays to the counter. When you want to receive counter states by interrupting the CPU module, you must assign input relays to the counter.

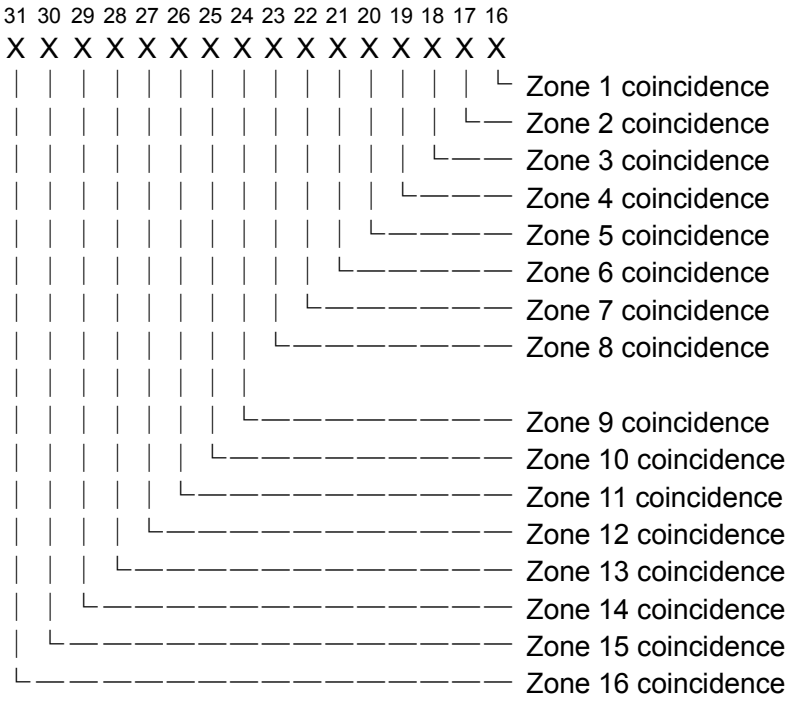
● Counter Input Relay 1 Layout

[Data Range] **$00000000 or greater (bit data)**
[Factory default] **$00000000**
[Data Position No.] **412 (Long-word address)**

Specifies a bit assigned to the counter input relay 1 from the counter bit status. Set the relevant bit to 1.

When the selected Counter Bit Status item is 1, the counter input relay 1 turns on. You can select more than one item. If you select multiple items, the counter input relay 1 turns on when any of the selected Counter Bit Status items is on.





● Counter Input Relay 2 to 4 Layout

[Data Range] **$00000000 or greater (bit data)**
[Factory default] **$00000000**
[Data Position No.] **Counter Input Relay 2, 413 (Long-word address)**
[Data Position No.] **Counter Input Relay 3, 414 (Long-word address)**
[Data Position No.] **Counter Input Relay 4, 415 (Long-word address)**

Specifies the counter bit status assigned to the counter input relays 2 to 4 in the same way as counter input relay 1.

7.1.3 Example of Setting Counter Registered Parameters

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

● Setting Items

Counter Input:	Phase A/B input (x1)
Counter input frequency:	1 M pulse/s or less
Counter Action Mode:	Linear counter
Counter contact inputs:	Counter contact input 1 to which the counter enable function is assigned Counter contact input 2 to which CNT latched request 1 is assigned Counter contact input 3 to be assigned to a relay as a generic contact input Counter Z-phase input to which the counter preset function is assigned
Counter contact outputs:	Counter contact output 1 to which counter coincidence detection 1 is assigned Counter contact output 2 to which zone coincidence detection 1 is assigned
Counter relays:	Counter input relay 1 to which counter coincidence detection 1 is assigned Counter input relay 2 to which CNT latched request 1 detection is assigned Counter input relay 3 to which zone coincidence detection 2 is assigned Counter input relay 3 to which counter contact input 3 is assigned

● Calculation of Counter Registered Parameters

- Counter Count Mode Setting (401, long-word address)
  Set this parameter to 0 to specify phase A/B input (x1).

- Counter Filter Setting (402, long-word address)
  Set this parameter to 1 to use the module at a frequency of 1 M pulse/s or less.

- Counter Action Mode Setting (403, long-word address)
  Set this parameter to 0 to use a linear counter.

- Preset Ring Counter Value (404, long-word address)
  You do not need to set this parameter because this example uses a linear counter.

- Counter Contact Input Setting (405, long-word address)
  Set this parameter to $00002A00 to specify NO contact input and 10-us filter settings for all of counter contact inputs 1 to 3.
  (Decimal notation: 10752, hexadecimal notation: $00002A00, binary notation: 0000_0000_0000_0000_0010_1010_0000_0000)

- Counter Z-phase Input Setting (406, long-word address)

  Set this parameter to $00000001 to use the Z-phase input connected to the connector for the counter and to use the module at a frequency of 1 Mpps or less.
  (Decimal notation: 1, hexadecimal notation: $00000001, binary notation:
  0000_0000_0000_0000_0000_0000_0000_0001)

- Counter Contact Z-phase Input Function Layout (407, long-word address)

  To assign the counter preset function to the rising edge of the Z-phase input, assign the counter enable/disable function to the On state of counter contact input 1, assign CNT latched request 1 to the rising edge of counter contact input 2, and not use the CNT latched request 2, set this parameter to $00080140.
  (Decimal notation: 524608, hexadecimal notation: $00080140, binary notation:
  0000_0000_0000_1000_0000_0001_0100_0000)

- Counter Contact Output 1 Layout (408, long-word address)

  Set this parameter to $00000001 to set the bit corresponding to counter coincidence detection 1 of Counter Bit Status to "1".
  (Decimal notation: 1, hexadecimal notation: $00000001, binary notation:
  0000_0000_0000_0000_0000_0000_0000_0001)

- Counter Contact Output 2 Layout (409, long-word address)

  Set this parameter to $00010000 to set the bit corresponding to zone coincidence detection 1 of Counter Bit Status to "1".
  (Decimal notation: 65536, hexadecimal notation: $00010000, binary notation:
  0000_0000_0000_0001_0000_0000_0000_0000)

- Counter Coincidence Direction Setting (410, long-word address)

  Set this parameter to 0 to not specify the direction for counter coincidence detection.

- Counter Input Relay Setting (411, long-word address)

  Set this parameter to 1 to use counter input relays.

- Counter Input Relay 1 Layout (412, long-word address)

  Set this parameter to $00000001 to set the bit corresponding to counter coincidence detection 1 of Counter Bit Status to "1".
  (Decimal notation: 1, hexadecimal notation: $00000001, binary notation:
  0000_0000_0000_0000_0000_0000_0000_0001)

- Counter Input Relay 2 Layout (413, long-word address)

  Set this parameter to $00000008 to set the bit corresponding to external CNT latched request 1 detection of Counter Bit Status to "1".
  (Decimal notation: 8, hexadecimal notation: $00000008, binary notation:
  0000_0000_0000_0000_0000_0000_0000_1000)

- Counter Input Relay 3 Layout (414, long-word address)

  Set this parameter to $00020000 to set the bit corresponding to zone coincidence detection 2 of Counter Bit Status to "1".
  (Decimal notation: 131072, hexadecimal notation: $00020000, binary notation:
  0000_0000_0000_0010_0000_0000_0000_0000)

- Counter Input Relay 4 Layout (415, long-word address)

  Set this parameter to $00000400 to set the bit corresponding to counter contact input 3 of Counter Bit Status to "1".

  (Decimal notation: 1024, hexadecimal notation: $00000400, binary notation: 0000_0000_0000_0000_0000_0100_0000_0000)

7.1.4 List of Counter Control Parameters

Table 7.4 List of Counter Control Parameters

Data Position No.		Parameter	Description	See Also
Long-word Basis	Word Basis			
424	847/848	Counter Registered Parameters Request	Requests to register the counter registered parameters. Writing "1" to this parameter performs the request to register the counter registered parameters. Reading this parameter returns "0" for normal termination or returns the error code if an error occurs.	7-19
425	849/850	Counter Control Command Request	Executes a counter control command corresponding to the command code written to this parameter. 1: Counter Coincidence Detection 1 Latch Clear Request 2: Counter Coincidence Detection 2 Latch Clear Request 3: Overflow/Underflow Error Detection Latch Clear Request 4: External Counter Latch Occurrence 1 Detection Latch Clear Request 5: External Counter Latch Occurrence 2 Detection Latch Clear Request 11: Counter Preset Request 12: CNT Latched Request 1 13: CNT Latched Request 2	7-19
426	851/852	Counter Enable Control	$00000000 or greater (bit data) [Default: 0: Disable the counter]	7-20
427	853/854	Counter Contact Output 1 Control	$00000000 or greater (bit data) [Default: 0: Counter contact output 1 forced off]	7-21
428	855/856	Counter Contact Output 2 Control	$00000000 or greater (bit data) [Default: 0: Counter contact output 2 forced off]	7-22
429	857/858	Counter Preset Value	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	7-22
430	859/860	Preset Counter Coincidence Value 1	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	7-22
431	861/862	Preset Counter Coincidence Value 2	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	7-22
432	863/864	(System reserved)	Do not set a value other than 0.	-
433	865/866	Counter Zone 1 Lower Limit	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	7-23
434	867/868	Counter Zone 1 Upper Limit		
435	869/870	Counter Zone 2 Lower Limit		
436	871/872	Counter Zone 2 Upper Limit		
437	873/874	Counter Zone 3 Lower Limit		
438	875/876	Counter Zone 3 Upper Limit		
439	877/878	Counter Zone 4 Lower Limit		
440	879/880	Counter Zone 4 Upper Limit		
441	881/882	Counter Zone 5 Lower Limit		
442	883/884	Counter Zone 5 Upper Limit		
443	885/886	Counter Zone 6 Lower Limit		
444	887/888	Counter Zone 6 Upper Limit		
445	889/890	Counter Zone 7 Lower Limit		
446	891/892	Counter Zone 7 Upper Limit		
447	893/894	Counter Zone 8 Lower Limit		
448	895/896	Counter Zone 8 Upper Limit		
449	897/898	Counter Zone 9 Lower Limit		
450	899/900	Counter Zone 9 Upper Limit		
451	901/902	Counter Zone 10 Lower Limit		
452	903/904	Counter Zone 10 Upper Limit		
453	905/906	Counter Zone 11 Lower Limit		
454	907/908	Counter Zone 11 Upper Limit		
455	909/910	Counter Zone 12 Lower Limit		
456	911/912	Counter Zone 12 Upper Limit		
457	913/914	Counter Zone 13 Lower Limit		
458	915/916	Counter Zone 13 Upper Limit		
459	917/918	Counter Zone 14 Lower Limit		
460	919/920	Counter Zone 14 Upper Limit		
461	921/922	Counter Zone 15 Lower Limit		
462	923/924	Counter Zone 15 Upper Limit		
463	925/926	Counter Zone 16 Lower Limit		
464	927/928	Counter Zone 16 Upper Limit		
465 to 475	929 to 950	(System reserved)	Do not set a value other than 0.	-

7.1.5 Description of Counter Control Parameters

● Counter Registered Parameters Request

[Data Range] **1: Write this value to request to register the counter registered parameters.**

[Data Position No.] **424 (Long-word address)**

Writing "1" to this parameter performs the request to register the counter registered parameters.

When the request to register the counter registered parameters is completed successfully, reading this parameter returns "0".

Reading this parameter returns an error code if an error occurs. For details on error codes, refer to Section 11.6, "List of Counter Registered Parameter Error Codes."

For details on how to register counter registered parameters, refer to Section 9.3, "Set Counter Registered Parameters."

● Counter Control Command Request

[Data Range]

1: Counter coincidence detection 1 latch clear request
2: Counter coincidence detection 2 latch clear request
3: Overflow/underflow error detection latch clear request
4: External counter latch occurrence 1 detection latch clear request
5: External counter latch occurrence 2 detection latch clear request
11: Counter preset request
12: CNT latched request 1
13: CNT latched request 2

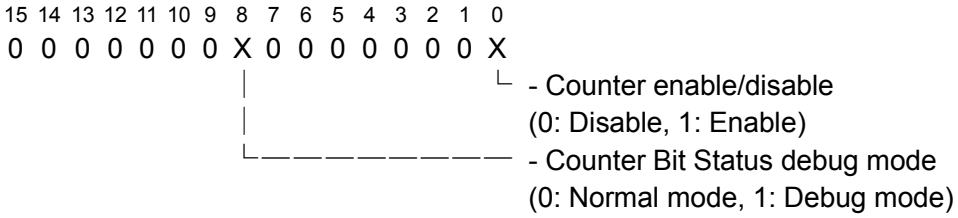
[Data Position No.] **425 (Long-word address)**

Writing a command code shown in [Data Range] to this parameter executes the relevant counter control command.

When a command code is written to this parameter, the command is executed immediately and reading this parameter returns "0".

● Counter Enable Control

[Data Range] **$00000000 or greater (bit data)**
[Default] **$00000000**
[Data Position No.] **426 (Long-word address)**
Specifies the counter enable/disable control by a program and the debug mode of Counter Bit Status. The setting is applied immediately when a value is written to this parameter.



- **Counter enable/disable**
  Writing "0" (default) disables the counter and writing "1" enables the counter. When the Counter Contact Z-phase Input Function Layout counter registered parameter is used to assign the counter enable/disable function to the external contact input, the counter is enabled when either this Counter Enable Control parameter or the external contact input is in an enable state.

- **Counter Bit Status debug mode**
  Writing "1" enables the debug mode of Counter Bit Status.

  In debug mode, Counter Bit Status cannot be updated automatically and the CPU module can read and write the status. In this case, Counter Bit Status has the value written last (while the default is "0").

  In debug mode, Counter Bit Status behaves as follows.

  Assignment of a Counter Bit Status item to a counter input relay:

  The value written to the corresponding Counter Bit Status item is reflected to the assigned input relay.

  Assignment of a Counter Bit Status item to a counter contact output:

  The value written to the corresponding Counter Bit Status item is reflected to the assigned counter contact output.

  Assignment of a Counter Bit Status item to a trigger condition for a positioning operation:

  The value that is written to the corresponding Counter Bit Status item works as a trigger condition for a positioning operation.

  Writing to a counter contact input in Counter Bit Status and a counter Z-phase input in Counter Bit Status:

  It is possible to write a value to this item, but the function specified with Counter Contact Z-phase Input Function Layout does not work.

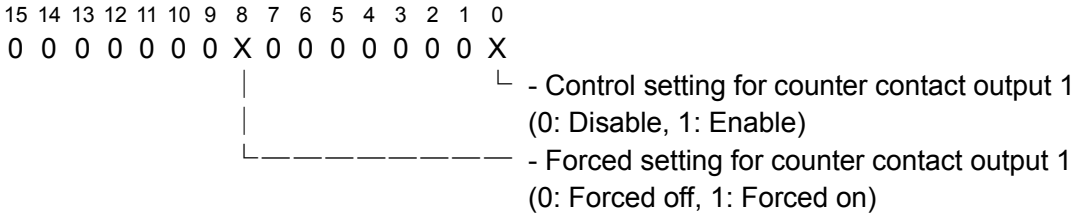
  Writing to a counter contact output in Counter Bit Status:

  It is possible to write a value to this item, but the written value is not output from the relevant counter contact output.

● Counter Contact Output 1 Control

[Data Range] **$00000000 or greater (bit data)**
[Default] **$00000000**
[Data Position No.] **427 (Long-word address)**

Specifies whether to enable or disable counter contact output 1 and the forced on/off setting of counter contact output 1. The setting is applied immediately when a value is written to this parameter.



When "Enable" is selected, the contact output automatically turns on or off according to the setting of the Counter Contact Output 1 Layout counter registered parameter.

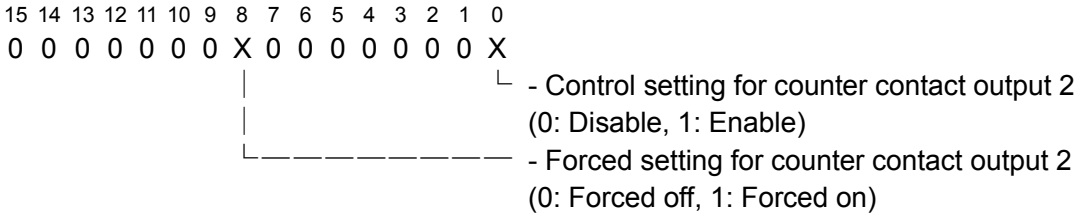
When "Disable" is selected, the contact output is forcibly turned on or off according to the forced setting for counter contact output 1.

Table 7.5 Counter Contact Output 1 Control

Forced setting for counter contact output 1 (bit 8)	Control setting for counter contact output 1 (bit 0)	Behavior of counter contact output 1
-	1: Enable	The contact output turns on or off according to the setting of the Counter Contact Output 1 Layout parameter.
0: Forced off	0: Disable	Off (Default)
1: Forced on	0: Disable	On

● Counter Contact Output 2 Control

[Data Range] **$00000000 or greater (bit data)**
[Default] **$00000000**
[Data Position No.] **428 (Long-word address)**
Specifies whether to enable or disable counter contact output 2 and the forced on/off setting of counter contact output 2. The setting is applied immediately when a value is written to this parameter.



When "Enable" is selected, the contact output automatically turns on or off according to the setting of the Counter Contact Output 2 Layout counter registered parameter.

When "Disable" is selected, the contact output is forcibly turned on or off according to the forced setting for counter contact output 2.

Table 7.6 Counter Contact Output 2 Control

Forced setting for counter contact output 2 (bit 8)	Control setting for counter contact output 2 (bit 0)	Behavior of counter contact output 2
-	1: Enable	The contact output turns on or off according to the setting of the Counter Contact Output 2 Layout parameter.
0: Forced off	0: Disable	Off (Default)
1: Forced on	0: Disable	On

● Counter Preset Value

[Data Range] **-2,147,483,648 to 2,147,483,647 [pulses]**
[Factory default] **0**
[Data Position No.] **429 (Long-word address)**
Specifies the value set for the Counter Current Position Status during Counter Preset.

The value is used for the counter preset function assigned to a contact input and also a counter preset request specified in Counter Control Command Request.

● Preset Counter Coincidence Value 1

[Data Range] **-2,147,483,648 to 2,147,483,647 [pulses]**
[Factory default] **0**
[Data Position No.] **430 (Long-word address)**
Specifies the value compared with the Counter Current Position Status for Counter Coincidence.

● Preset Counter Coincidence Value 2

[Data Range] **-2,147,483,648 to 2,147,483,647 [pulses]**
[Factory default] **0**
[Data Position No.] **431 (Long-word address)**
Specifies the value compared with the Counter Current Position Status for Counter Coincidence.

● Counter Zone N Lower Limit (N = 1 to 16)

[Data Range] **-2,147,483,648 to 2,147,483,647 [pulses]**
[Factory default] **0**
[Data Position No.] **433 or greater (Long-word address)**
Specifies the lower limit value compared with the Counter Current Position Status for Counter Zone Coincidence.

When Counter Zone N Lower Limit ≤ Counter Current Position Status ≤ Counter Zone N Upper Limit, zone N coincidence of Counter Bit status turns on.

● Counter Zone N Upper Limit (N = 1 to 16)

[Data Range] **-2,147,483,648 to 2,147,483,647 [pulses]**
[Factory default] **0**
[Data Position No.] **434 or greater (Long-word address)**
Specifies the upper limit value compared with the Counter Current Position Status for Counter Zone Coincidence.

When Counter Zone N Lower Limit ≤ Counter Current Position Status ≤ Counter Zone N Upper Limit, zone N coincidence of Counter Bit status turns on.

7.2 Counter Statuses

Counter statuses refer to data which the CPU module reads from the positioning module. You can check the state of the counter using these statuses.

CAUTION

When a word-basis READ instruction is used from the CPU module to read two-word data, concurrency of the high-order word and low-order word of two-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.

By using a long-word-basis READ L instruction, concurrency of the high-order word and low-order word of two-word data is assured. Note that data position numbers used in a long-word-basis READ L instruction are different from the ones used in a word-basis READ instruction.

7.2.1 List of Counter Statuses

Table 7.7 List of Counter Statuses

Data Position No.		Parameter	Description	See Also
Long-word Basis	Word Basis			
417	833/834	Counter Bit Status	Operation information (bit data) including counter coincidence detection, high-speed contact input/output, zone coincidence detection	7-25
418	835/836	Counter Current Position Status	-2,147,483,648 to 2,147,483,647 [pulses]	7-27
419	837/838	CNT Latched Position 1 Status	-2,147,483,648 to 2,147,483,647 [pulses]	7-27
420	839/840	CNT Latched Position 2 Status	-2,147,483,648 to 2,147,483,647 [pulses]	7-27
421	841/842	Counter Speed Status	-8,000,000 to 8,000,000 [pulse/s]	7-27
422 to 423	843 to 846	(System reserved)		-

7.2.2 Description of Counter Statuses

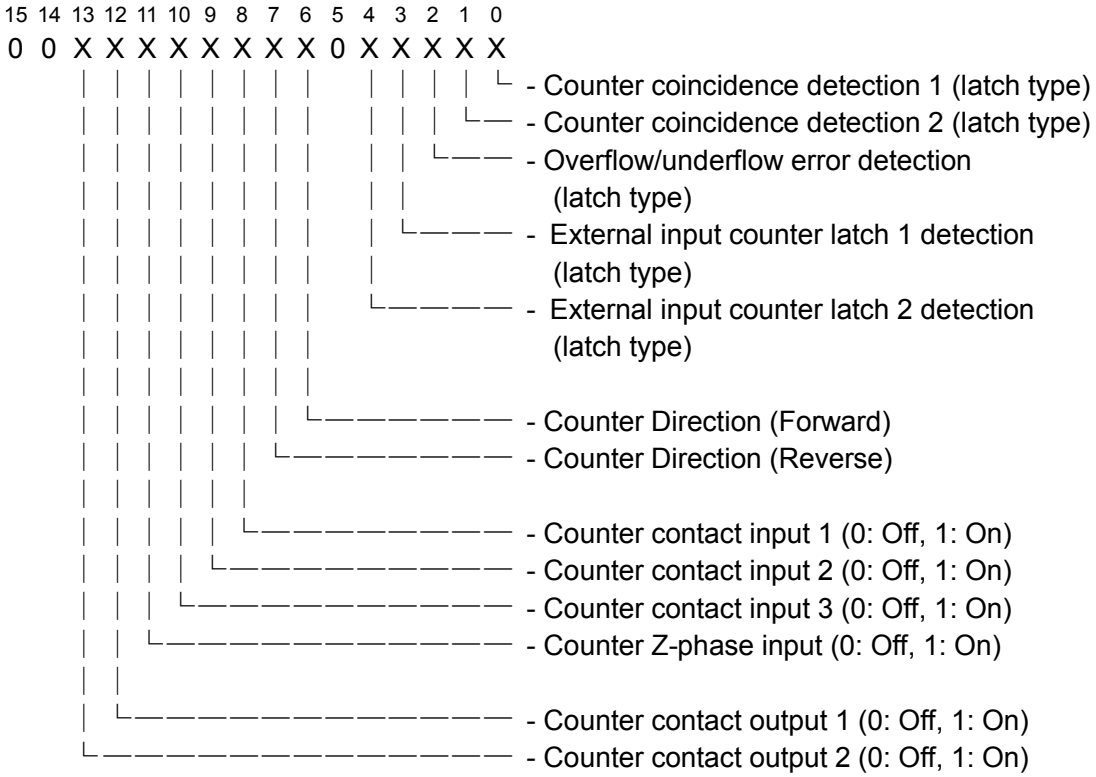
● Counter Bit Status

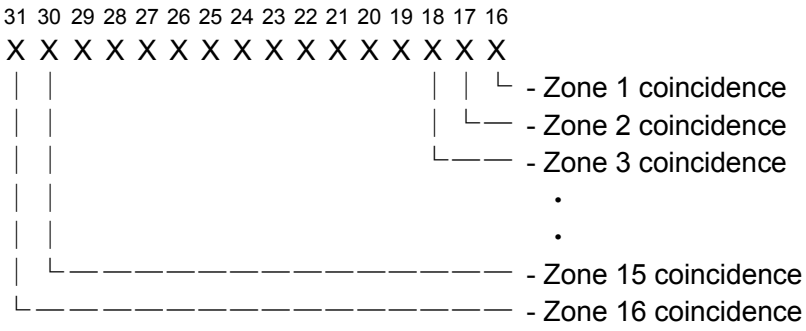
[Data Position No.] **417 (Long-word address)**
[Data Range] **$00000000 or greater**

Used to read the operation state of the counter as bit data.

Some Counter Bit Status items can be assigned to a counter contact output, counter input relay, or a trigger condition for a positioning operation. For details on how to assign them, refer to the description of counter registered parameters or setting a trigger condition for a positioning operation.

Data in Counter Bit Status can be modified by using the debug mode of Counter Bit Status.





- **Counter coincidence detection 1/2 (latch type)**
  These bits are "1" when Preset Counter Coincidence Value 1 or Preset Counter Coincidence Value 2 is the same as Counter Current Position Status.

  Because these are latch type bits, to clear the latch, write "1: Counter Coincidence Detection 1 Latch Clear Request" or "2: Counter Coincidence Detection 2 Latch Clear Request" to "Counter Control Command Request."

- **Overflow/underflow error detection (latch type)**
  This bit is "1" if an overflow or underflow occurs in Counter Current Position Status when Counter Action Mode Setting specifies a linear counter operation.

  Because this is a latch type bit, to clear the latch, write "3: Overflow/Underflow Error Detection Latch Clear Request" to "Counter Control Command Request."

- **External input counter latch 1/2 detection (latch type)**
  These bits are "1" if a counter latch occurs due to an external input when Counter Contact Z-phase Input Function Layout is used to assign the counter latch function to the external input.

  Because these are latch type bits, to clear the latch, write "4: External Counter Latch Occurrence 1 Detection Latch Clear Request " or "5: External Counter Latch Occurrence 2 Detection Latch Clear Request " to "Counter Control Command Request."

- **Counter direction**
  These "forward" and "reverse" bits indicate the operation direction of the counter input. When the counter input is not operating, either the " forward" or "reverse" bit is "1" depending on the last operation direction.

- **Counter contact input 1/2/3**
  These bits are used to read the state of the corresponding counter contact input.

  0: Off, 1: On

- **Counter Z-phase input**
  This bit is used to read the state of the counter Z-phase input.

  0: Off, 1: On

- **Counter contact output 1/2**
  These bits are used to read the state of the corresponding counter contact output.

  0: Off, 1: On

- **Zone N coincidence (N = 1 to 16, and up to 16 zones can be specified.)**
  These bits are "1" when Counter Current Position Status is between Counter Zone N Lower Limit and Counter Zone N Upper Limit.

  (These bits are on when Counter Zone N Lower Limit ≤ Counter Current Position Status ≤ Counter Zone N Upper Limit.)

● Counter Current Position Status

[Data Position No.] 418 (Long-word address)
[Data Range] -2,147,483,648 to 2,147,483,647 [pulses]
Used to read the current position of the counter.

You can also modify Counter Current Position Status by writing a value from the CPU module.

● CNT Latched Position 1 Status

[Data Position No.] 419 (Long-word address)
[Data Range] -2,147,483,648 to 2,147,483,647 [pulses]
Used to read the counter position latched by counter latch 1.

When more than one counter latch occurs, the last latch position is stored.

● CNT Latched Position 2 Status

[Data Position No.] 420 (Long-word address)
[Data Range] -2,147,483,648 to 2,147,483,647 [pulses]
Used to read the counter position latched by counter latch 2.

When more than one counter latch occurs, the last latch position is stored.

● Counter Speed Status

[Data Position No.] 421 (Long-word address)
[Data Range] -8,000,000 to 8,000,000 [pulse/s]
Used to read the counter speed.

The value can be either positive or negative depending on the rotation direction of the counter input.

Counter Speed Status is displayed with an accuracy of about two upper digits.

You can use Counter Speed Status for monitoring purpose, but do not use it as feedback to the control.

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8. Positioning Programs

This chapter describes the function, usage, and note of each command with one or more sample programs of the command.

The sample programs shown in this chapter assume the following:

- The positioning module is installed in slot 3 (slot #003) of the main unit.
- When only one axis is used in the example, it is axis 1.
- The command speed unit selection and acceleration/deceleration time unit selection are set to "pulse/s" and "ms", respectively.

CAUTION

For the F3YP22-0P module, NEVER set the output relays for axes 3 to 8; moreover, input relays for axes 3 to 8 have no meaning.

For the F3YP24-0P module, NEVER set the output relays for axes 5 to 8; moreover, input relays for axes 5 to 8 have no meaning.

8.1 Operation Procedure

Figure 8.1 shows an operation procedure flowchart for a typical positioning operation.

For details, refer to Sections 8.2 through 8.17.

When you use a certain function such as a jog operation or request to stop immediately, the procedure is different from Figure 8.1 and specific input/output relays are used.

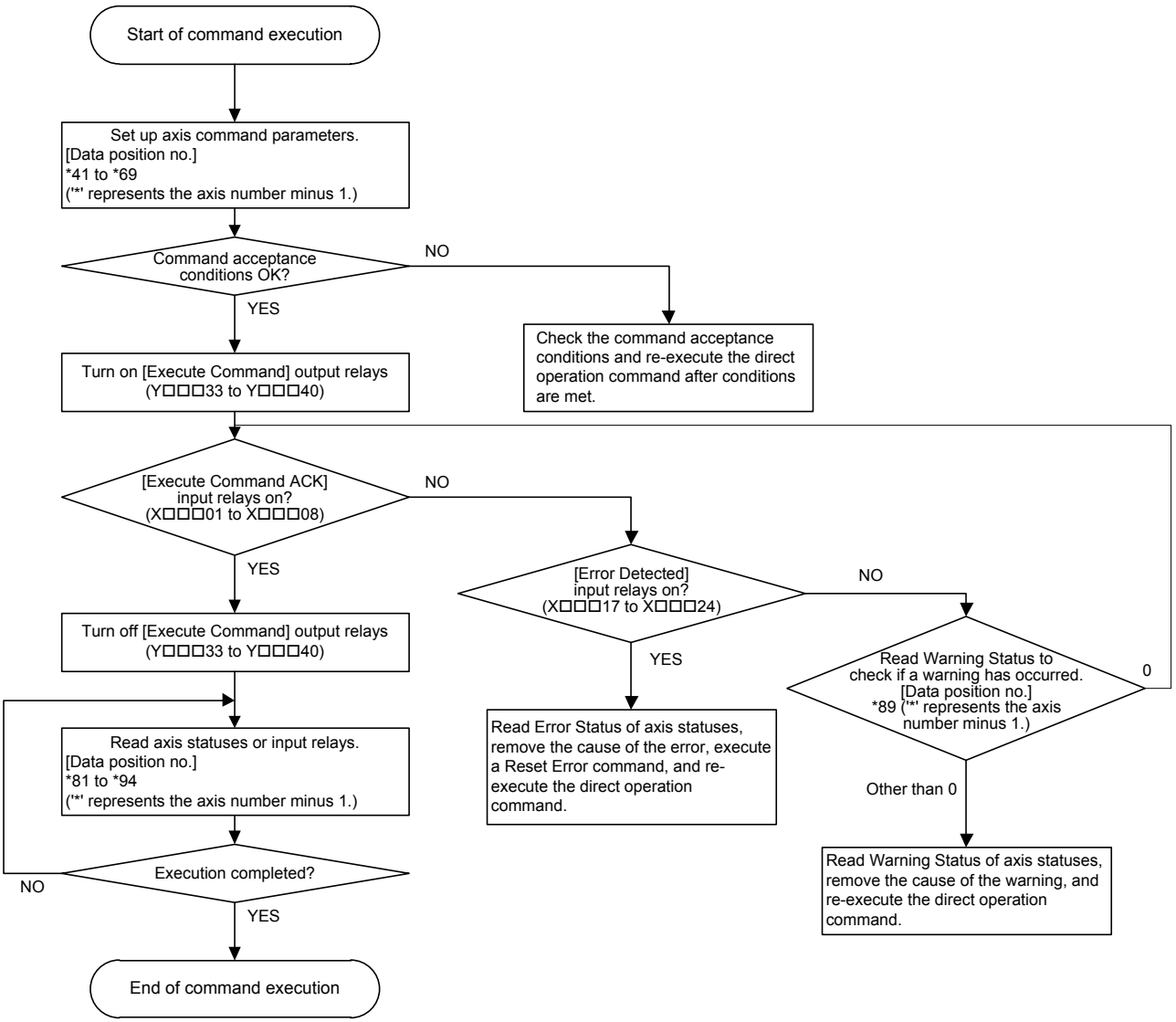


Figure 8.1 Operation Procedure Flowchart for a Direct Operation

8.2 Read Parameters/Statuses

■ Function

This operation reads parameters and statuses in the module.

■ Usage

● Command Parameters

No command parameters need to be set.

● Command Acceptance Conditions

This operation is always accepted.

● Procedure

(1) Read parameters and statuses of the module from the CPU module. For details on how to access the module from the CPU, see Chapter 10, "Accessing Modules."

■ Note

- Parameters and statuses listed with two data position numbers are two-word data. The smaller data position number contains the low-order word, and the larger data position number contains the high-order word.
- Each data position number corresponds to a word. Use only the word-basis READ and WRITE instructions when accessing from a sequence program. Similarly, always use word-basis instructions for access from a BASIC program.
- Only for specific statuses, by using a long-word-basis READ instruction (READ L instruction), concurrency of the high-order word and low-order word of two-word data is assured.

CAUTION

When a word-basis READ instruction is used from the CPU module to read two-word data, concurrency of the high-order word and low-order word of two-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.

Only for specific statuses, by using a long-word-basis READ instruction (READ L instruction), concurrency of the high-order word and low-order word of two-word data is assured. Note that data position numbers used in a long-word-basis READ L instruction are different from the ones used in a word-basis READ instruction.

For details on the statuses that can be used by a long-word-basis READ instruction and the data position numbers for a READ L instruction used from a sequence CPU, see Table 6.13.

■ Sample Program 1

● Description

This sample program reads all axis statuses of the module installed in slot 3.

(This program performs word-basis access. Concurrency of the high-order word and low-order word of two-word data is not assured.)

● List of Devices

Table 8.1 List of Devices Used by the Sample Program for Reading Parameters/Statuses

Device	Name	Data
/D00081/D00082	Target Position Status	See Section 6.2.1, " Statuses"
/D00083/D00084	Current Position Status	See Section 6.2.1, " Statuses"
/D00085/D00086	Current Speed Status	See Section 6.2.1, " Statuses"
/D00087	Contact Input Status	See Section 6.2.1, " Statuses"
/D00088	Error Status	See Section 6.2.1, " Statuses"
/D00089	Warning Status	See Section 6.2.1, " Statuses"
/D00090	Origin Search Status	See Section 6.2.1, " Statuses"
/D00091	Extended Status	See Section 6.2.1, " Statuses"
/D00092/D00093	No. of Write Operations to Flash Memory	See Section 6.2.1, " Statuses"
/D00094	Current Override Value Status	See Section 6.2.1, " Statuses"
/I00001 to /I00016	Contact Input Status bit data	See Section 6.2.1, " Statuses"
/I00017 to /I00032	Extended Status bit data	See Section 6.2.1, " Statuses"

● Program Code

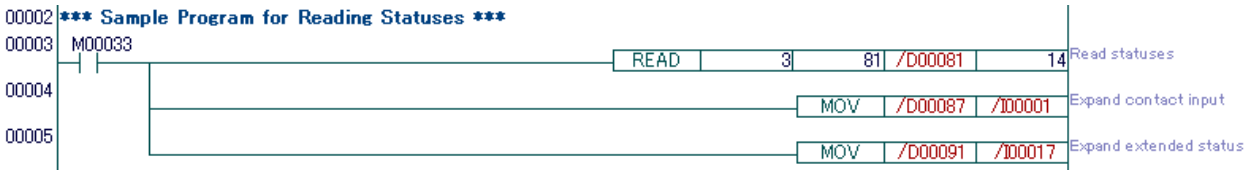


Figure 8.2 Sample Program for Reading Statuses (with Word-basis Access)

■ Sample Program 2

● Description

This sample program reads statuses of axis 1 of the module installed in slot 3.

(This program performs long-word access. Concurrency of the high-order word and low-order word of two-word data is assured.)

● List of Devices

Table 8.2 List of Devices Used in the Sample Program for Reading Parameters/Statuses

Device	Name	Data
/D00081/D00082	Target Position Status	See Section 6.2.1, " Statuses"
/D00083/D00084	Current Position Status	See Section 6.2.1, " Statuses"
/D00085/D00086	Current Speed Status	See Section 6.2.1, " Statuses"

● Program Code

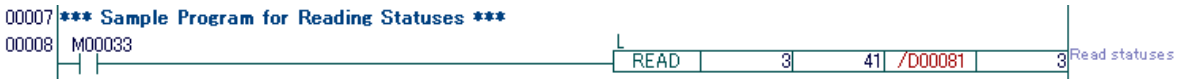


Figure 8.3 Sample Program for Reading Statuses (with Long-word Access)

8.3 Set Registered Parameters

■ Function

This command sets the registered parameters.

■ Usage

● Command Parameters

Table 8.3 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.3 Required Parameters for the Set Registered Parameters Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	3: Set Registered Parameters	○
*01 to *31	Registered Parameters	Refer to Section 6.1.1, "List of Registered Parameters" on how to set these parameters.	○

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

● Command Acceptance Conditions

Table 8.4 shows pre-conditions for command execution.

Table 8.4 Command Acceptance Conditions for the Set Registered Parameters Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Registered parameters are valid.	○	
In a Positioning Completed state.		○

● Procedure

(1) Set up registered parameters, and write the [3: Set Registered Parameters] command code to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the command is successfully executed, the [Execute Command ACK] input relay turns on. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

■ Note

- The registered parameters set using the Set Registered Parameters command are cleared at power off. Execute the Save to Flash Memory command to save parameter data if required.

  Even if registered parameters are not saved to the flash memory, they can be used by executing the Set Registered Parameters command each time the module is powered on.
- The Reset Error command cannot be used to clear a registered parameter setting error encountered during execution of a Set Registered Parameters command. To clear such an error, check and correct the registered parameters and execute the Set Registered Parameters command again.

■ Sample Program

● Description

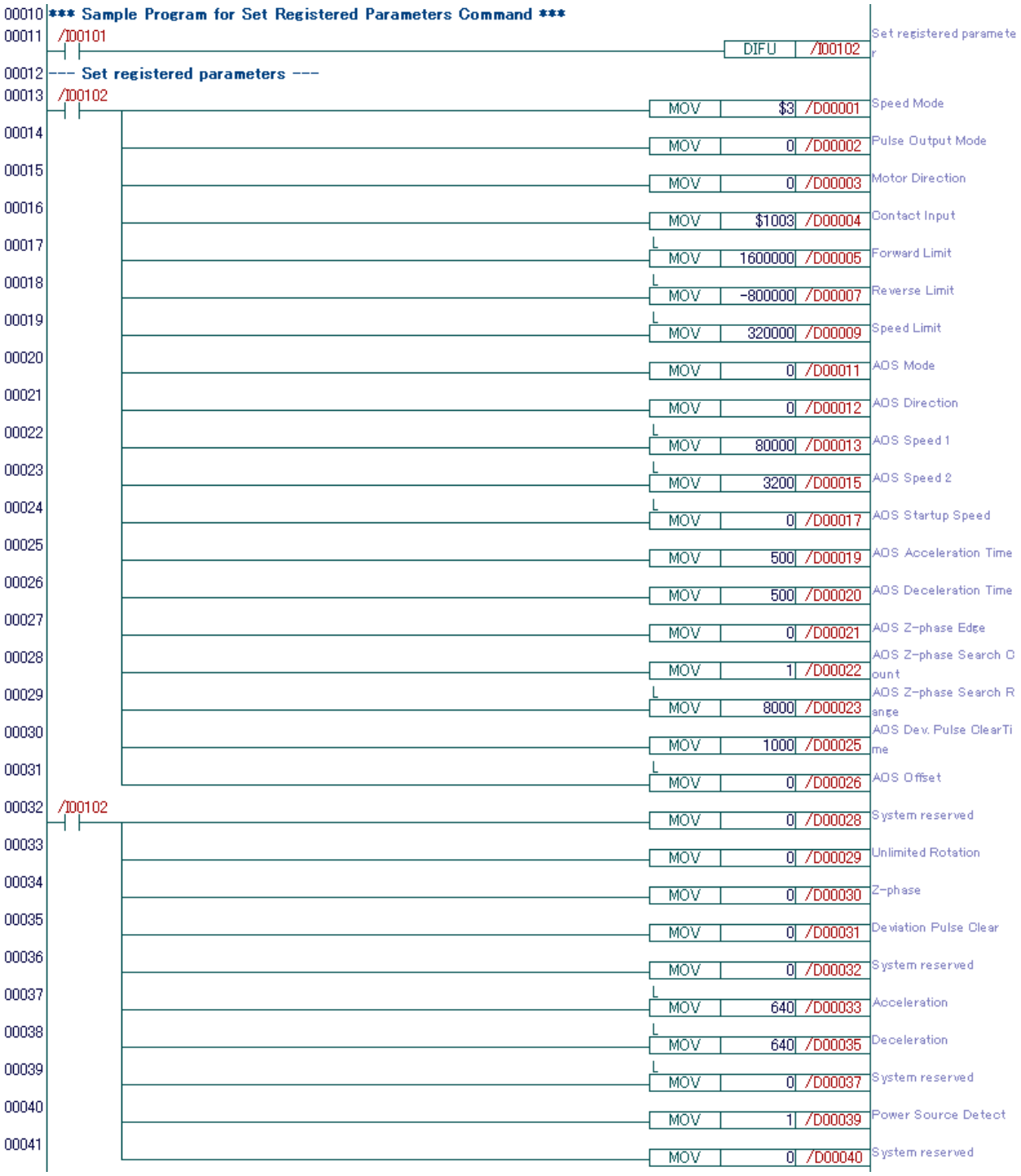
This sample program sets up registered parameters of axis 1 for the positioning module installed in slot 3.

● List of Devices

Table 8.5 List of Devices Used in the Sample Program for the Set Registered Parameters Command

Device	Name	Data
/D00001 to /D00040	Registered Parameters	Set up data in this area before executing the Set Registered Parameters command.
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
I00099	Command execution disable (to be set elsewhere)	
/I00101	Set Registered Parameters	
/I00102	Set Registered Parameters (differential up)	
/I00103	Waiting for execute command ACK	
/I00104	Command executing	

● Program Code



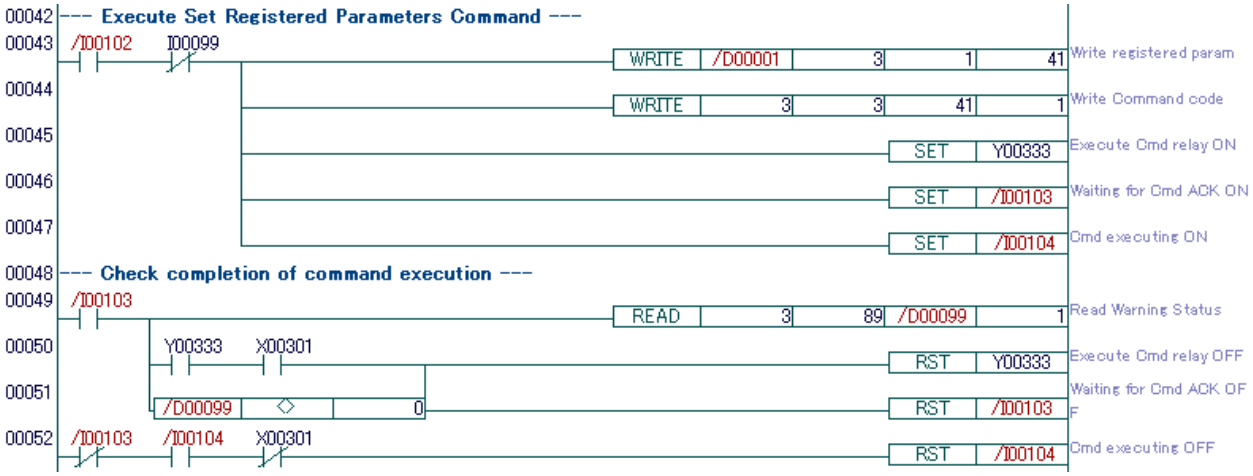


Figure 8.4 Sample Program for the Set Registered Parameters Command

● Timing Chart

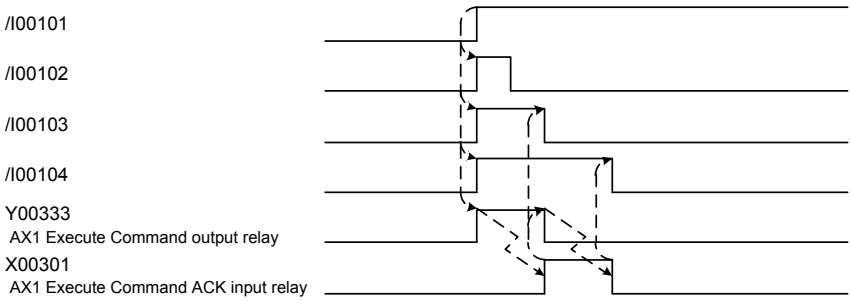


Figure 8.5 Timing Chart for the Set Registered Parameters Command

8.4 Reset Error

■ Function

This command clears the error status (state where the [Error Detected] input relay is on) of an axis. However, it cannot be used to clear a registered parameter setting error.

■ Usage

● Command Parameters

Table 8.6 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.6 Required Parameters for the Reset Error Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	5: Reset Error	○

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

● Command Acceptance Conditions

Table 8.7 shows pre-conditions for command execution.

Table 8.7 Command Acceptance Conditions for the Reset Error Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another direct operation command is in progress.		
An error has been detected (excluding a registered parameter setting error).		○

● Procedure

(1) Write the "5: Reset Error" command code to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the command is successfully executed, the [Execute Command ACK] input relay turns on. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

■ Note

- When an error has occurred (and the [Error Detected] input relay is on), execute the Reset Error command to clear the error status.
- The Reset Error command cannot be used to clear a registered parameter setting error encountered during execution of a Set Registered Parameters command. To clear such an error, check and correct the registered parameters and execute the Set Registered Parameters command again.

■ Sample Program

● Description

This sample program clears an error on axis 1 of the positioning module installed in slot 3.

● List of Devices

Table 8.8 List of Devices Used in the Sample Program for the Reset Error Command

Device	Name	Data
/D00041	Command Code	5: Reset Error command
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
I00099	Command execution disable (to be set elsewhere)	
/I00201	Reset error	
/I00202	Reset error (differential up)	
/I00203	Waiting for execute command ACK	
/I00204	Command executing	

● Program Code

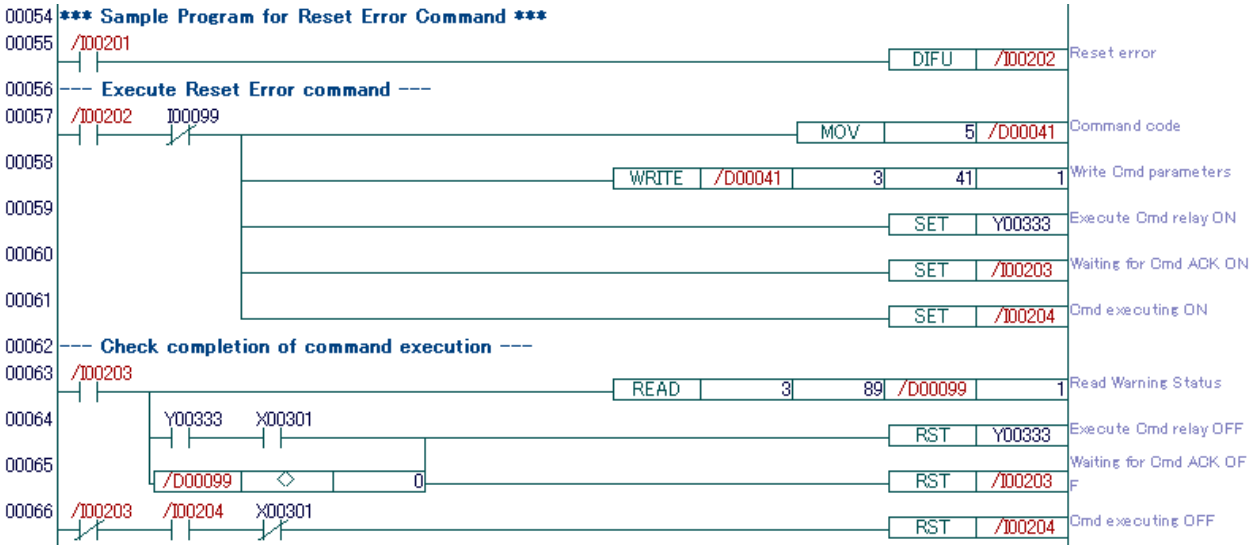


Figure 8.6 Sample Program for the Reset Error Command

● Timing Chart

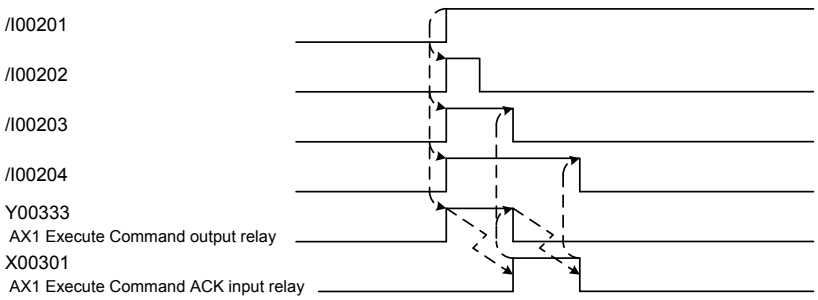


Figure 8.7 Timing Chart for the Reset Error Command

8.5 Manual Control

You can use a jog or manual pulse generator operation to operate a motor manually.

This section describes the details of jog commands and the Start MPG Mode command.

8.5.1 Jog

■ Function

While the [Forward Jog] output relay or the [Reverse Jog] output relay is on, the motor rotates in the forward or reverse direction, respectively.

A jog operation continues until the [Forward Jog] output relay or the [Reverse Jog] output relay is turned off, or the [Stop Immediately] output relay is turned on.

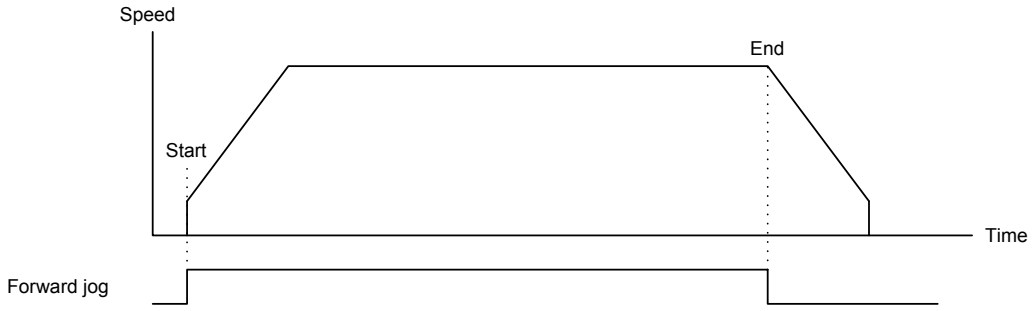


Figure 8.8 Forward Jog Operation (Trapezoidal Acceleration and Deceleration)

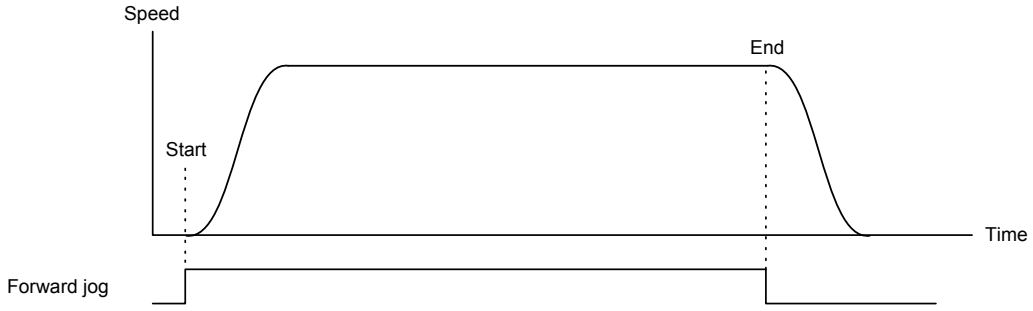


Figure 8.9 Forward Jog Operation (S-shape Acceleration and Deceleration)

■ Usage

● Command Parameters

Table 8.9 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.9 Required Parameters for Jog Commands

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*45	Accel/Decel Mode	0: Trapezoidal acceleration and deceleration, 1: S-shape acceleration and deceleration	○
*46/*47	Target Speed	1 to Speed Limit [command speed unit]	○
*48	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	○
*49	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	○
*50/*51	Startup Speed	0 to target speed [command speed unit] (Set this parameter when Accel/Decel Mode is trapezoidal acceleration and deceleration.)	▲

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

● Command Acceptance Conditions

Table 8.10 shows pre-conditions for command execution.

Table 8.10 Command Acceptance Conditions for Jog Commands

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
In a Positioning Completed state.		○

● Procedure

(1) Write the required parameters to the command parameter area of the command axis.

(2) Turn on the [Forward Jog] output relay or [Reverse Jog] output relay, and the motor begins jog movements in the forward or reverse direction respectively.

- If parameter data is invalid, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Forward (Reverse) Jog] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns off when the jog operation starts. Turning off the [Forward (Reverse) Jog] output relay stops the jog operation, and the [Positioning Completed] input relay turns on.

■ Note

- Executing a Decelerate and Stop command during a jog operation is not allowed and will generate a warning. To stop a jog operation, turn off the [Forward (Reverse) Jog] output relay, or turn on the [Stop Immediately] output relay.
- The setting values of the Forward/Reverse Limit registered parameters are ignored during a jog operation.
- You can use the Unlimited Rotation Setting registered parameter to specify whether or not to detect an overflow error on the current pulse position during a jog operation. If you specify to detect an overflow error and the operation range of the positioning module (-2,147,483,648 to 2,147,483,647) is exceeded, a pulse overflow error can be detected. If you specify not to detect any overflow error, the operation is performed without any error being detected. (The current pulse position is counted by a 32-bit ring operation.)

■ Sample Program

● Description

This sample program performs a jog operation for axis 1 of the positioning module installed in slot 3.

● List of Devices

Table 8.11 List of Devices Used in the Sample Program for a Jog Operation

Device	Name	Data
/D00045	Accel/Decel Mode	0:Trapezoidal acceleration/deceleration
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00099	Warning Status	
Y00349	AX1 Forward Jog output relay	
X00325	AX1 Positioning Completed input relay	
X00317	AX1 Error Detected input relay	
I00099	Command execution disable (to be set elsewhere)	
/I00301	Start/stop forward jog operation	
/I00302	Start forward jog operation (differential up)	
/I00303	Stop forward jog operation (differential down)	
/I00304	Forward jogging in progress	

● Program Code

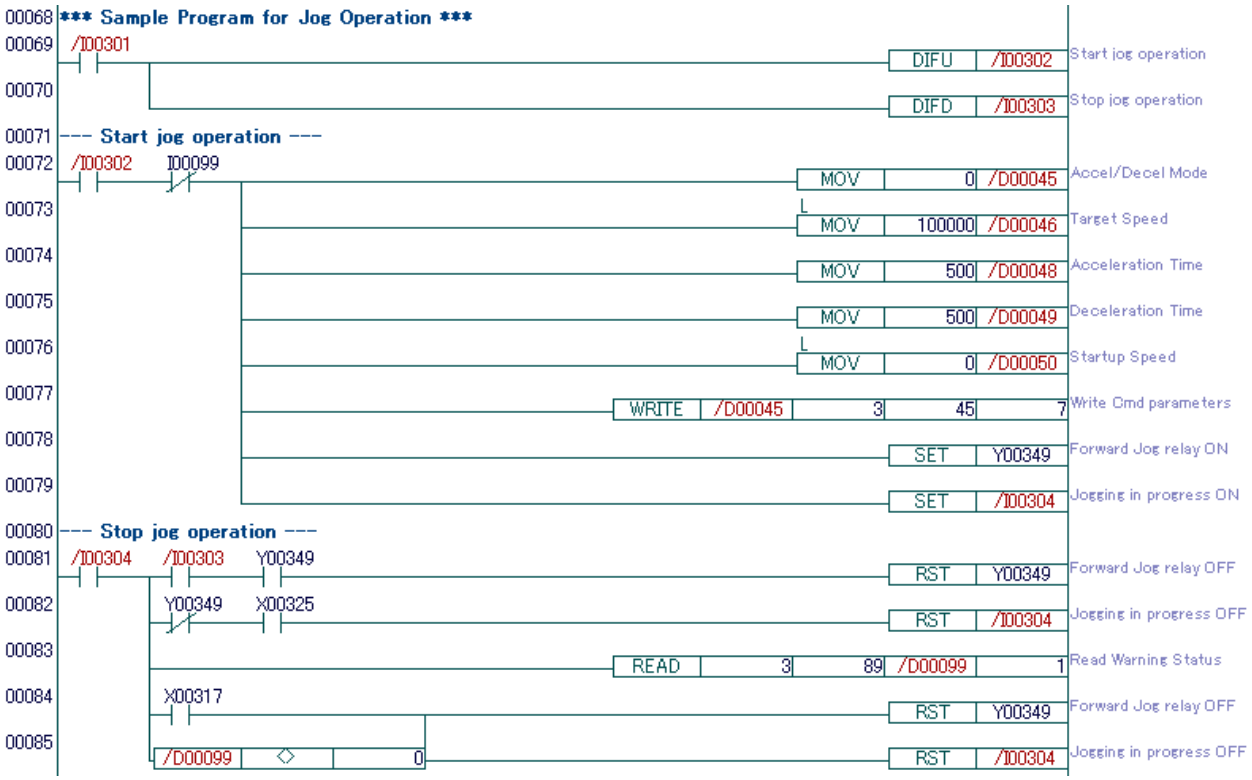


Figure 8.10 Sample Program for a Jog Operation

● Timing Chart

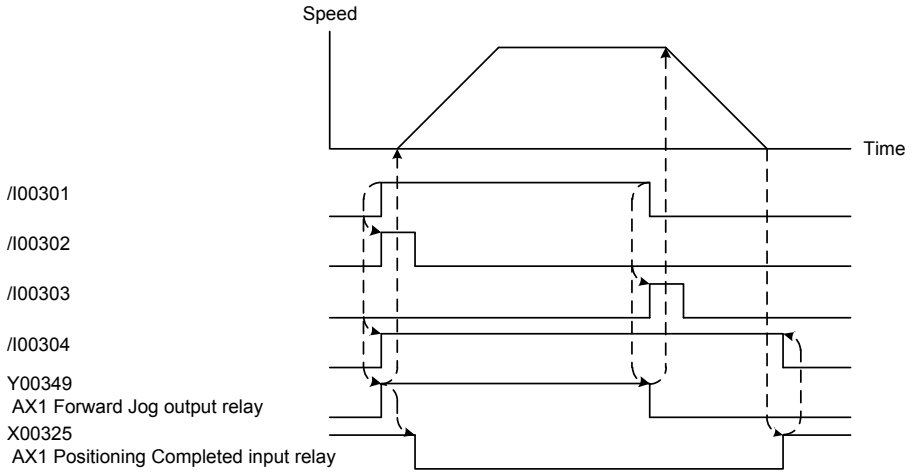


Figure 8.11 Timing Chart for a Jog Operation

8.5.2 Manual Pulse Generator Mode

■ Function

In manual pulse generator mode, you can operate a motor using a manual pulse generator.

Manual pulse generator mode continues until a Stop MPG Mode command is executed, an error occurs, or the [Stop Immediately] output relay is turned from off to on.

- The ratio of the number of counter input pulses and the number of counter output pulses can be specified by using the ratio of the Manual Pulse Generator M Value and Manual Pulse Generator N Value command parameters.
- You can set a first order lag filter for the counter input.

The movement amount can be calculated from the expression:

Change in the number of counter input pulses × Manual Pulse Generator M Value / Manual Pulse Generator N Value

in manual pulse generator mode.

The operation direction can be determined from the expression:

Change direction of the counter input × Sign of the Manual Pulse Generator M Value

in manual pulse generator mode.

- In manual pulse generator mode, the speed is limited by the target speed. Any pulses exceeding the target speed are stored and output when the speed falls below the target speed.

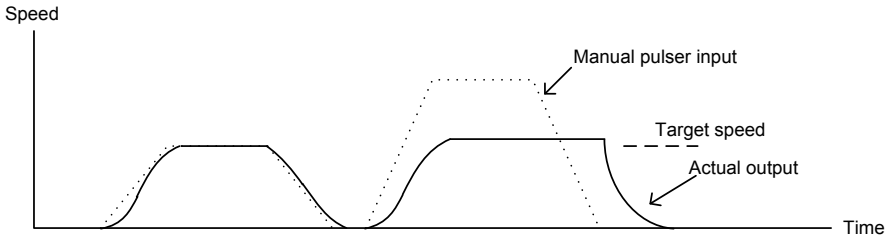


Figure 8.12 Manual Pulse Generator Mode

CAUTION

Do not switch to manual pulse generator mode if the encoder feedback of a servomotor is connected to a counter input, or the motor may not operate as expected.

During manual pulse generator mode, do not rewrite the counter current position and also avoid any counter preset operation. Otherwise, such operations may be counted as a change in the counter input.

■ Usage

● Command Parameters

Table 8.12 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.12 Required Parameters for the Start/Stop MPG Mode Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	500: Start MPG Mode 501: Stop MPG Mode	○
*46/*47	Target Speed	1 to Speed Limit [command speed unit]	○
*60	Manual Pulse Generator M Value	-32,768 to 32,767 (excluding 0)	○
*61	Manual Pulse Generator N Value	1 to 32,767	○
*62	Manual Pulse Generator Filter	0 to 10,000 [ms]	○

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

● Command Acceptance Conditions

Tables 8.13 and 8.14 show pre-conditions for command execution.

Table 8.13 Command Acceptance Conditions for the Start MPG Mode Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
In a Positioning Completed state.		○

Table 8.14 Command Acceptance Conditions for the Stop MPG Mode Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
In manual pulse generator mode.		○

● Procedure

(1) Write the "500: Start MPG Mode" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the command is successfully executed, the [Execute Command ACK] input relay turns on. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns off when manual pulse generator mode is activated.

(5) Pulses are output when any change occurs in the counter input.

(6) To stop manual pulse generator mode, write the "501: Stop MPG Mode" command code to the command parameter area of the command axis.

(7) Turn on the [Execute Command] output relay for the command axis.

(8) When the command is successfully executed, the [Execute Command ACK] input relay turns on. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

(9) The [Positioning Completed] input relay turns on when manual pulse generator mode is deactivated.

■ Note

- The [Positioning Completed] input relay remains off during manual pulse generator mode.
- To stop manual pulse generator mode, execute a Stop MPG Mode command or turn off the [Stop Immediately] output relay. When a Stop MPG Mode command is executed, the module stops checking changes in the counter input, outputs the pulses that have been stored due to the limit based on the target speed, and after confirming that the first order lag filter output is stabilized, the module stops manual pulse generator mode.
- During manual pulse generator mode, forward/reverse limit input error detection is performed based on the Contact Input Setting registered parameter.
- If an error occurs during manual pulse generator mode, manual pulse generator mode stops.
- The setting values of the Forward and Reverse Limit registered parameters are ignored during manual pulse generator mode.
- You can use the Unlimited Rotation Setting registered parameter to specify whether or not to detect an overflow error on the current pulse position during manual pulse generator mode. If you specify to detect an overflow error and the operation range of the positioning module (-2,147,483,648 to 2,147,483,647) is exceeded, a pulse overflow error can be detected. If you specify not to detect any overflow error, the operation is performed without any error being detected. (The current pulse position is counted by a 32-bit ring operation.)
- During manual pulse generator mode, due to the internal processing of the fractional part of pulse data in the positioning module, a position deviation of ±1 pulse may occur between Current Position Status and actual pulse output.
- When manual pulse generator mode stops, if pulse data in the positioning module contains a fractional part, the fractional part is rounded up.
- During manual pulse generator mode, do not rewrite the counter current position and also avoid any counter preset operation.
- When a manual pulse generator filter is specified, it takes about 20 times the filter setting value until the pulse is stabilized. Thus, when a large filter value is specified and a Stop MPG Mode command is executed to stop manual pulse generator mode, it will take a long time to stop it.

■ Sample Program

● Description

This sample program starts manual pulse generator mode for axis 1 of the module installed in slot 3.

● List of Devices

Table 8.15 List of Devices Used in the Sample Program for the Start MPG Mode Command

Device	Name	Data
/D00041	Command Code	500: Start MPG Mode
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00060	Manual Pulse Generator M Value	1
/D00061	Manual Pulse Generator N Value	1
/D00062	Manual Pulse Generator Filter	10(ms)
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I00401	Start manual pulse generator mode	
/I00402	Start manual pulse generator mode (differential up)	
/I00403	Waiting for execute command ACK	
/I00404	Command executing	

● Program Code

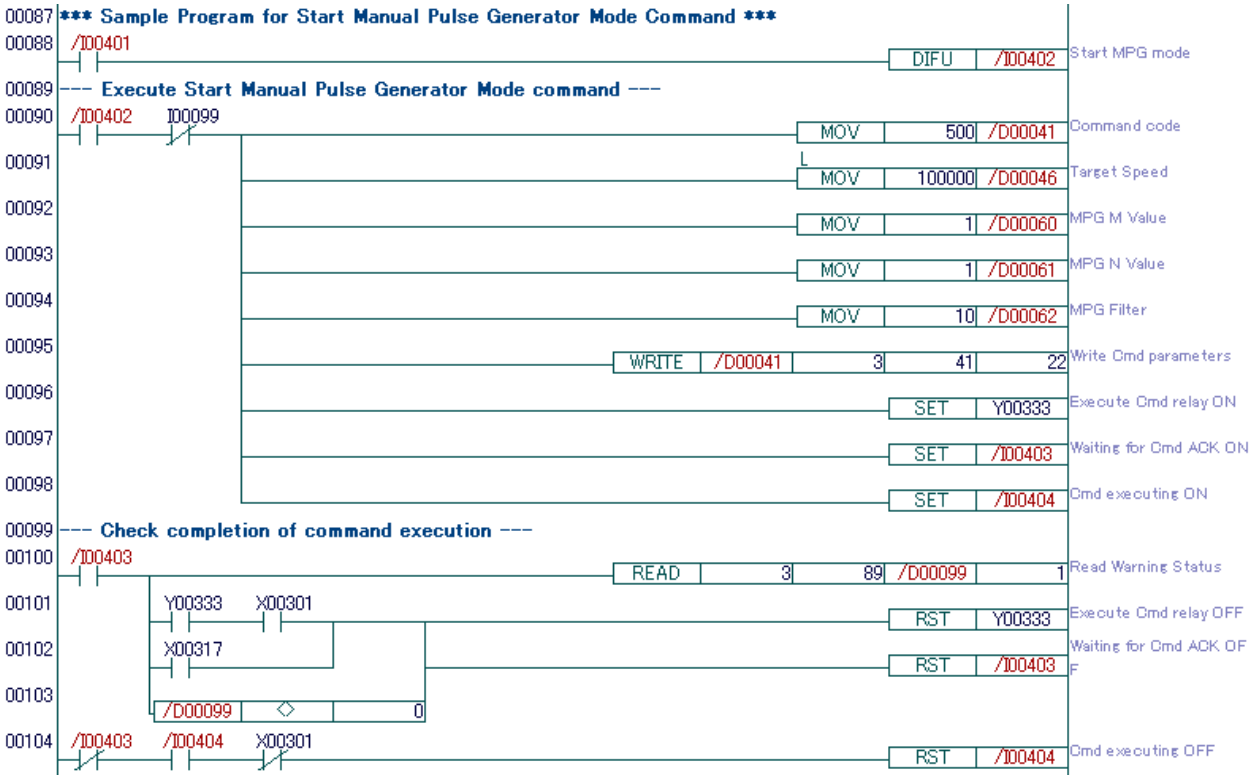


Figure 8.13 Sample Program for the Start MPG Mode Command

● Timing Chart

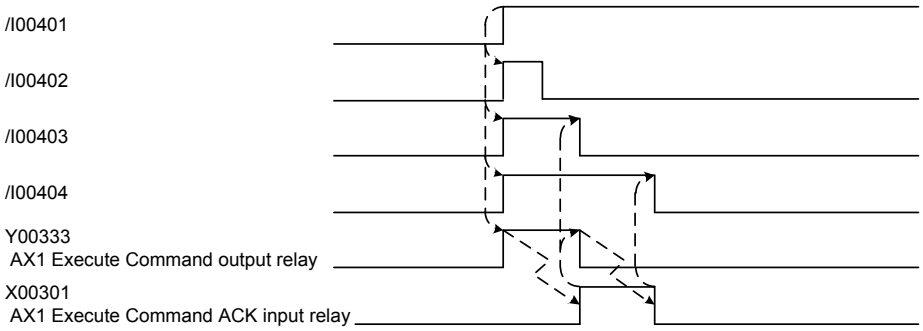


Figure 8.14 Timing Chart for the Start MPG Mode Command

8.6 Origin Search

There are two ways to perform origin search: automatic and manual. In automatic origin search, the origin search behavior is defined by registered parameters. In manual origin search, the origin search behavior is arbitrarily defined by an application program.

This section describes the details of the Automatic Origin Search command and the Manual Origin Search command.

8.6.1 Manual Origin Search

■ Function

This command performs an origin search operation based on the setting values of the parameters such as Target Speed, Origin Search Direction, Origin Search Mode, and Z-phase Edge Selection.

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 origin search, split the origin search process into different phases, varying the parameters for each phase, and execute a Manual Origin Search command for each phase. This strategy allows you to customize your origin-search operation to a desired search pattern.

- Three external contact inputs can be used in manual origin search: origin input, forward limit input, and reverse limit input. Manual origin search mode uses bit data to specify the operation (stop immediately, decelerate and stop, shift to Z-phase search, or ignore) that is performed when a rising or falling edge of each of the above three inputs (six in total) is detected.
- In Z-phase search, the module counts the number of Z-phase pulses defined by the Z-phase Search Count parameter, and then stops the axis immediately. The stop position is taken as the origin.
- When a manual origin search operation is completed, the module outputs the deviation pulse clear signal for a duration defined by the Deviation Pulse Clear Time parameter.

● Origin Search Mode

The Origin Search Mode parameter uses bit combination data to specify the operation to be performed when a specific edge is detected for each of the three external contact inputs related to manual origin search.

You can specify one of four 2-bit combinations for each rising/falling edge of an external contact input. If all bits are 0, the operation shifts to a Z-phase search immediately after the start of the origin search.

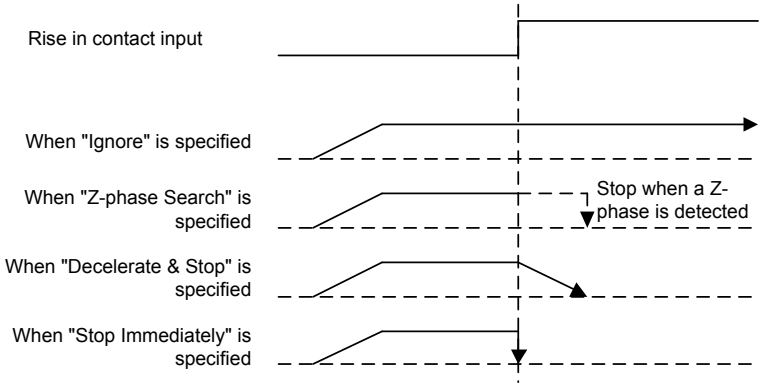
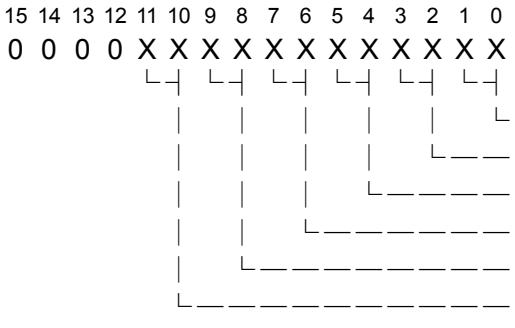


Figure 8.15 Manual Origin Search



00: Ignore (Stop due to an error at the rising edge of the limit input in the direction of the operation)
01: Shift to Z-phase search
10: Decelerate and stop
11: Stop immediately

■ Usage

● Command Parameters

Table 8.16 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.16 Required Parameters for the Manual Origin Search Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	2: Manual Origin Search	○
*46/*47	Target Speed	1 to Speed Limit [command speed unit]	○
*48	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	○
*49	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	○
*50/*51	Startup Speed	0 to target speed [command speed unit]	○
*52	Origin Search Mode	$0000 to $0FFF (Specify details as bit data.)	○
*53	Origin Search Direction	0: Reverse, 1: Forward	○
*54	Z-phase Edge Selection	0: Rising edge, 1: Falling edge	○
*55	Z-phase Search Count	0 to 32767 [pulses]	○
*56/*57	Z-phase Search Range	0 to 2,147,483,647/Z-phase Search Count [pulses]	○
*58	Deviation Pulse Clear Time	0 to 32767 [ms]	○

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

● Command Acceptance Conditions

Table 8.17 shows pre-conditions for command execution.

Table 8.17 Command Acceptance Conditions for the Manual Origin Search Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
In a Positioning Completed state.		○

● Procedure

(1) Write the "2: Manual Origin Search" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) After Z-phase search starts, when Z-phase pulses are detected for the specified number of times (if this number is specified as "0", the module skips the Z-phase search), the current position is specified as the origin and the axis stops immediately. After the deviation pulse clear signal is output for the duration specified in the Deviation Pulse Clear Time parameter, the [Positioning Completed] input relay

turns on.

(5) Confirm the state of the origin search by checking Origin Search Status. If the value of Origin Search Status is "0", the origin search has been completed following a successful Z-phase search.

■ Note

- A manual origin search operation ends when a specified external contact input is detected and the axis is stopped. Change the parameters and execute the Manual Origin Search command 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 manual origin search is aborted:
  - A limit input is detected in the origin search direction but the Origin Search Mode parameter is set to "00: ignore" to ignore both the rising and falling edges of the limit input.
  - After shifting to Z-phase search, the limit input 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 Z-phase search range.
- If you want to change the setup values according to the state of the external contact input at the beginning of the origin search operation, read the state from Contact Input Status before executing a Manual Origin Search command.
- After shifting to Z-phase search, even if the external contact input for which "11: Stop immediately" or "10: Decelerate and stop" is specified is detected, the Z-search operation continues.
- The setting values of the Forward and Reverse Limit registered parameters are ignored during a manual origin search operation.
- When the Contact Input Setting registered parameter is specified to ignore limit input errors, no limit input error is detected, but functions other than the limit input error detection work on the contact.
- The setting values of the Forward and Reverse Limit registered parameters are ignored during an origin search operation.
- If you want to control the deviation pulse clear signal using a Manual Origin Search command, specify "0: Automatic output" for the Deviation Pulse Clear Setting registered parameter. If "1: Program output" is specified for the Deviation Pulse Clear Setting registered parameter, the Manual Origin Search command cannot be used to control the deviation pulse clear signal.

■ Sample Program

● Description

This sample program performs a manual origin search operation on axis 1 of the positioning module installed in slot 3.

The search moves in the reverse direction with the following behavior: (1) Stops immediately when a rising edge of the reverse limit is detected. (2) Decelerates and stops when a rising edge of the origin input is detected. (3) Shifts to Z-phase search when a falling edge of the origin search is detected.

● List of Devices

Table 8.18 List of Devices Used in the Sample Program for the Manual Origin Search Command

Device	Name	Data
/D00041	Command Code	2: Manual Origin Search command
/D00046/D00047	Target Speed	80,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00052	Origin Search Mode	$0C09
/D00053	Origin Search Direction	0: Reverse
/D00054	Z-phase Edge Selection	0: Rising edge
/D00055	Z-phase Search Count	1(times)
/D00056/D00057	Z-phase Search Range	8000(pulse)
/D00058	Deviation Pulse Clear Time	1000(ms)
/D00099	Warning Status	
/D00100	Origin Search Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I00501	Manual origin search	
/I00502	Manual origin search (differential up)	
/I00503	Waiting for execute command ACK	
/I00504	Manual origin search in progress	

● Program Code

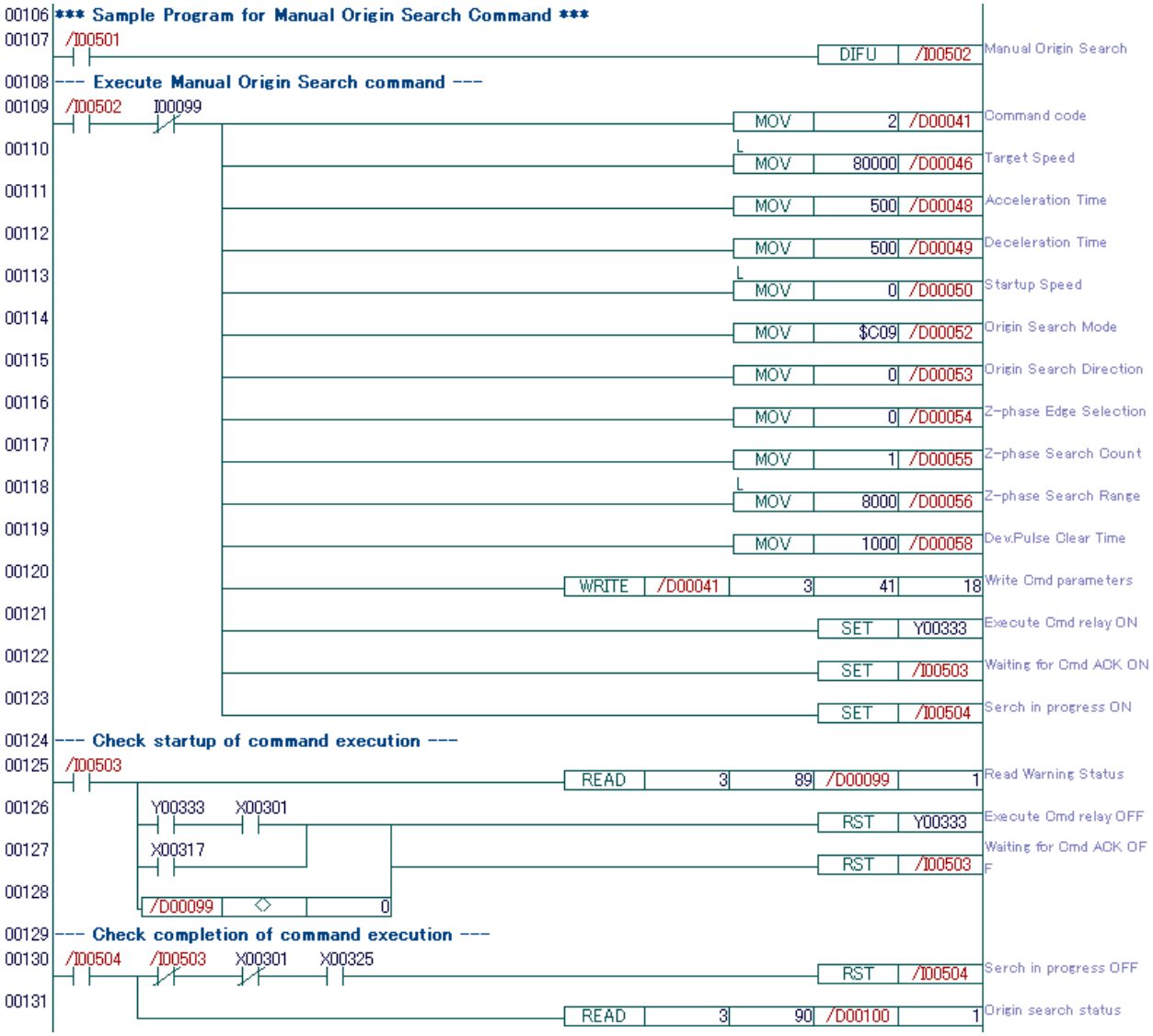


Figure 8.16 Sample Program for the Manual Origin Search Command

● Timing Chart

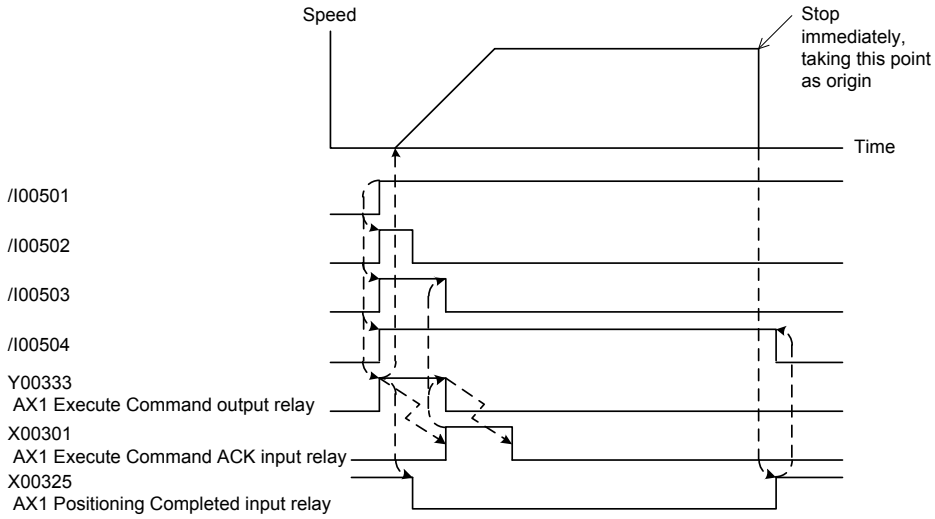


Figure 8.17 Timing Chart for the Manual Origin Search Command

8.6.2 Automatic Origin Search

■ Function

This command performs an origin search operation according to the origin search method specified by registered parameters.

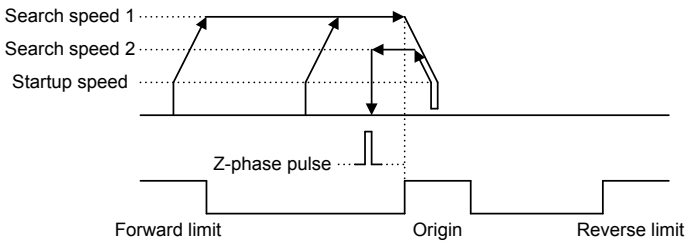
- Automatic origin search uses one of two operation modes depending on the setting of the AOS Mode registered parameter. One mode uses the origin switch input, whilst the other mode does not use the origin switch input but uses the forward/reverse limit switch input instead.
- In Z-phase detection, when the number of Z-phase pulses defined in the AOS Z-phase Search 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 AOS Offset parameter).
- When an automatic origin search operation is completed, the module outputs the deviation pulse clear signal for the duration specified by the AOS Deviation Pulse Clear Time parameter.

■ Description of Automatic Origin Search (0: Origin input is used)

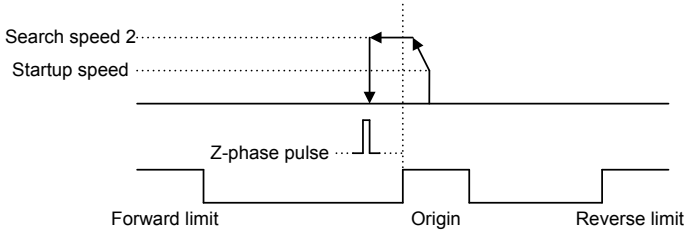
Figure 8.18 illustrates automatic origin search operations initiated at different start positions where AOS Mode is "0: Origin input is used" and AOS Direction is "0: Reverse." If AOS Direction is "1: Forward", swap the forward limit and the reverse limit shown in Figure 8.18.

1. At the start of automatic origin search, if the origin input or the reverse limit input is off (not reached), the axis moves in the reverse direction at the speed specified by AOS Speed 1. If the origin input or the reverse limit input 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 reverse limit input.
3. The axis then restarts in the forward direction at the speed specified by AOS Speed 2.
4. The axis shifts into the Z-phase detection operation at the falling edge of the origin input.

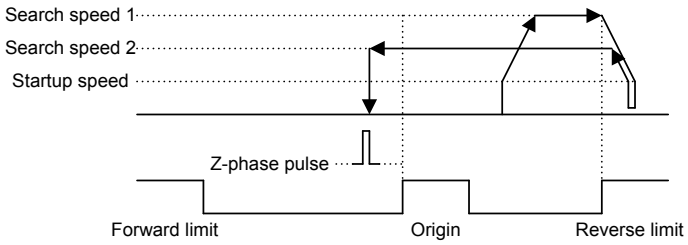
● If the axis is on the forward direction side of the origin switch at origin search start



● 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 reverse limit switch at origin search start



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

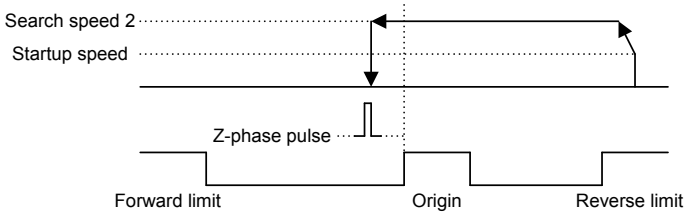


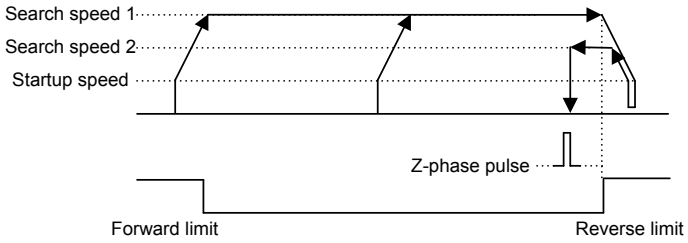
Figure 8.18 Automatic Origin Search (Mode 0, Reverse Direction Search)

■ Description of Automatic Origin Search (1: Origin input is not used)

Figure 8.19 illustrates the automatic origin search operations initiated at different start positions AOS Mode is "1: Origin input is not used" and AOS Direction is "0: Reverse." If AOS Direction is "1: Forward", swap the forward limit and the reverse limit shown in Figure 8.19.

1. At the start of automatic origin search, if the reverse limit input is off (not reached), the axis moves in the reverse direction at the speed specified by AOS Speed 1. If the reverse limit input 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 reverse limit input.
3. The axis then restarts in the forward direction at the speed specified by AOS Speed 2.
4. The axis shifts into the Z-phase detection operation at the falling edge of the reverse limit input.

● If the axis is away from the reverse limit switch at origin search start



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

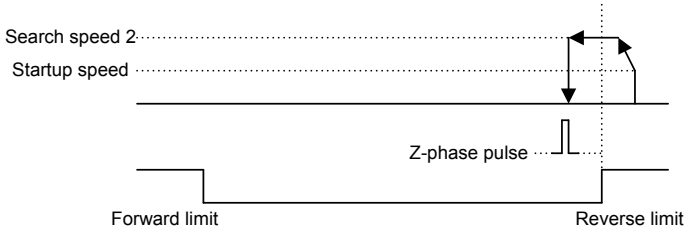


Figure 8.19 Automatic Origin Search (Mode 1, Reverse Direction Search)

■ Usage

● Command Parameters

Table 8.19 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.19 Required Parameters for the Automatic Origin Search Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	8: Automatic Origin Search	○

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

● Command Acceptance Conditions

Table 8.20 shows pre-conditions for command execution.

Table 8.20 Command Acceptance Conditions for the Automatic Origin Search Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another direct operation command is in progress.		
No error has occurred.		○
In a Positioning Completed state.		○

● Procedure

(1) Use the Set Registered Parameters command as described in Section 8.3 to set up parameters to be used in automatic origin search.

(2) Write the "8: Automatic Origin Search" command code to the command parameter area of the command axis.

(3) Turn on the [Execute Command] output relay for the command axis.

(4) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(5) After Z-phase search starts, when Z-phase pulses are detected for the specified number of times (if this number is specified as "0", the module skips the Z-phase search), the position, after adjusted by AOS Offset, is specified as the origin and the axis stops immediately. After the deviation pulse clear signal is output for the duration specified by the AOS Deviation Pulse Clear Time parameter, the [Positioning Completed] input relay turns on.

(6) Confirm the state of the origin search by checking Origin Search Status. If the value of Origin Search Status is "0", the origin search has been completed following a successful Z-phase search.

■ Note

- In the following cases, an error occurs and the origin search is aborted:
  - The limit input for the direction opposite to the AOS direction is detected when the axis is moving in that direction at the speed specified by AOS Speed 2.
  - After shifting to Z-phase search, no Z-phase pulse is detected within the AOS Z-phase search range.
- When the Contact Input Setting registered parameter is specified to ignore limit input errors, no limit input error is detected, but functions other than the limit input error detection work on the contact.
- The setting values of the Forward and Reverse Limit registered parameters are ignored during an automatic origin search operation.
- If you want to control the deviation pulse clear signal using an Automatic Origin Search command, specify "0: Automatic output" for the Deviation Pulse Clear Setting registered parameter. If "1: Program output" is specified for the Deviation Pulse Clear Setting registered parameter, the Automatic Origin Search command cannot be used to control the deviation pulse clear signal output.

■ Sample Program

● Description

This sample program performs an automatic origin search operation on axis 1 of the positioning module installed in slot 3.

● List of Devices

Table 8.21 List of Devices Used in the Sample Program for the Automatic Origin Search Command

Device	Name	Data
/D00041	Command Code	8: Automatic Origin Search command
/D00099	Warning Status	
/D00100	Origin Search Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I00601	Automatic origin search	
/I00602	Automatic origin search (differential up)	
/I00603	Waiting for execute command ACK	
/I00604	AOS in progress	

● Program Code

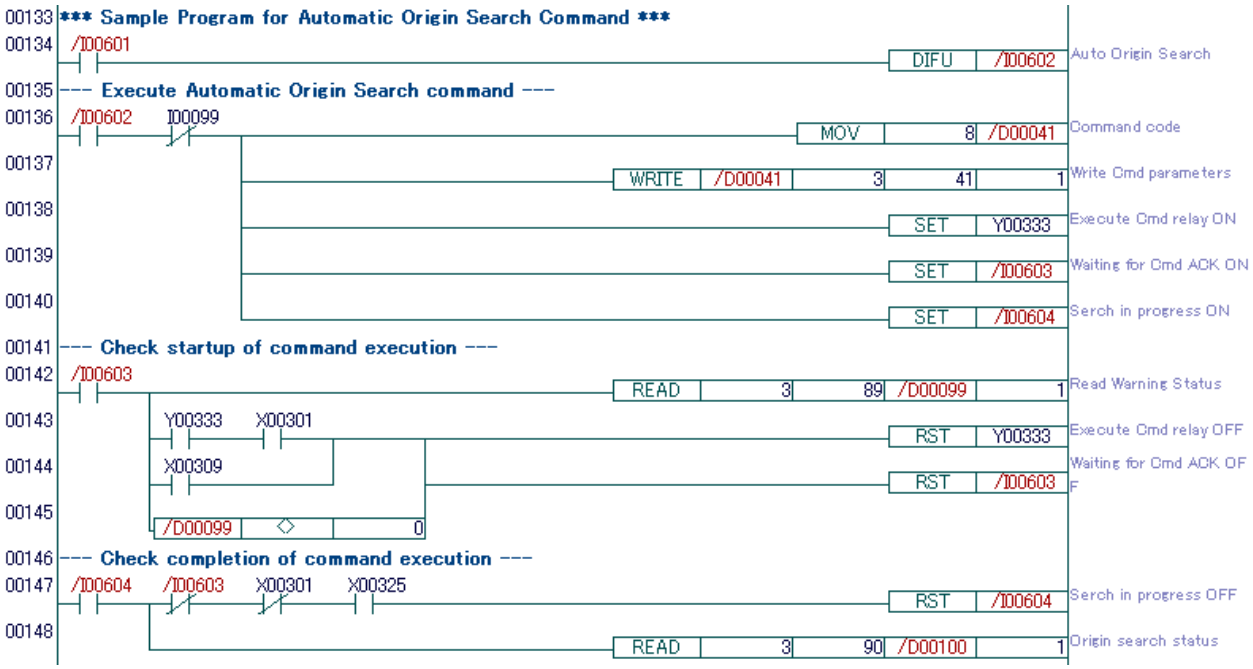


Figure 8.20 Sample Program for the Automatic Origin Search Command

● Timing Chart

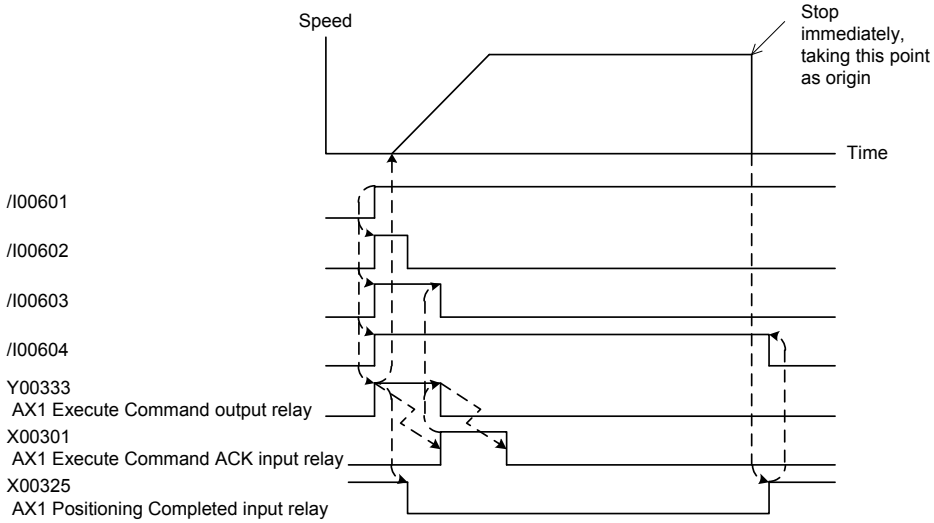


Figure 8.21 Timing Chart for the Automatic Origin Search Command

8.7 Set Current Position

■ Function

This command changes the current position.

■ Usage

● Command Parameters

Table 8.22 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.22 Required Parameters for the Set Current Position Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	4: Set Current Position	○
*43/*44	Target Position	Reverse limit to forward limit [pulses]	○

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

● Command Acceptance Conditions

Table 8.23 shows pre-conditions for command execution.

Table 8.23 Command Acceptance Conditions for the Set Current Position Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
In a Positioning Completed state.		○

● Procedure

(1) Write the "4: Set Current Position" direct operation command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the command is successfully executed, the [Execute Command ACK] input relay turns on. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

■ Note

- Specify a value between Reverse Limit and Forward Limit for the position to be set by the Set Current Position command. Otherwise, an error occurs.

■ Sample Program

● Description

This sample program changes the current position to 1,000,000 [pulses] for axis 1 of the module installed in slot 3.

● List of Devices

Table 8.24 List of Devices Used in the Sample Program for the Set Current Position Command

Device	Name	Data
/D00041	Command Code	4: Set Current Position command
/D00043/D00044	Target Position	1,000,000(pulse)
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
I00099	Command execution disable (to be set elsewhere)	
/I00701	Set Current Position	
/I00702	Set Current Position (differential up)	
/I00703	Waiting for execute command ACK	
/I00704	Command executing	

● Program Code

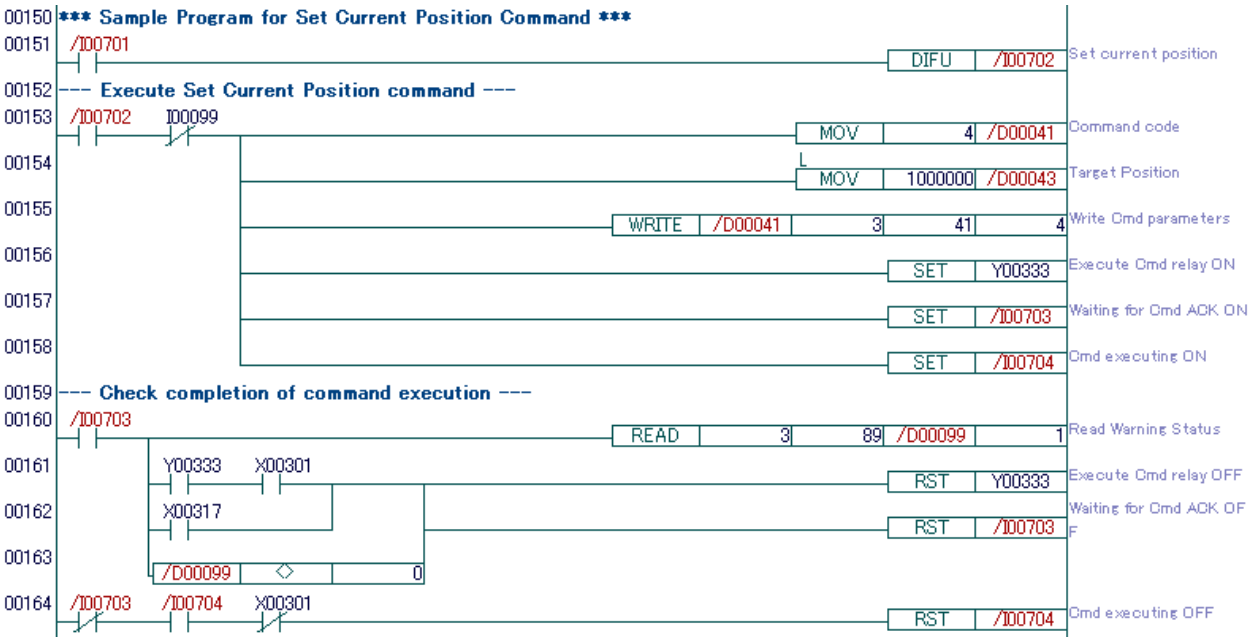


Figure 8.22 Sample Program for the Set Current Position Command

● Timing Chart

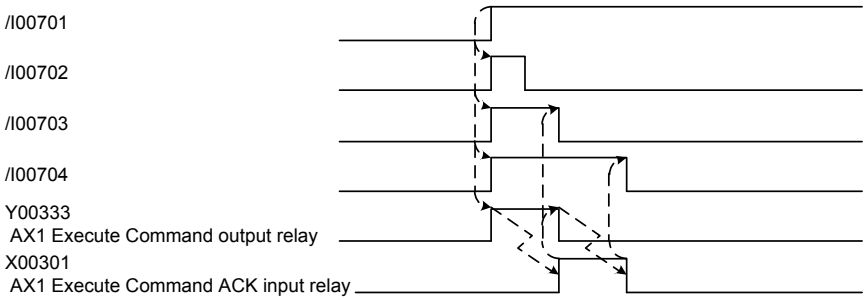


Figure 8.23 Timing Chart for the Set Current Position Command

8.8 Positioning Operation

8.8.1 Start Positioning

■ Function

This command performs a positioning operation using the specified target position, target speed, acceleration time, and deceleration time.

- You can specify an absolute position or incremental position as the target position.
- You can also specify a trigger condition.

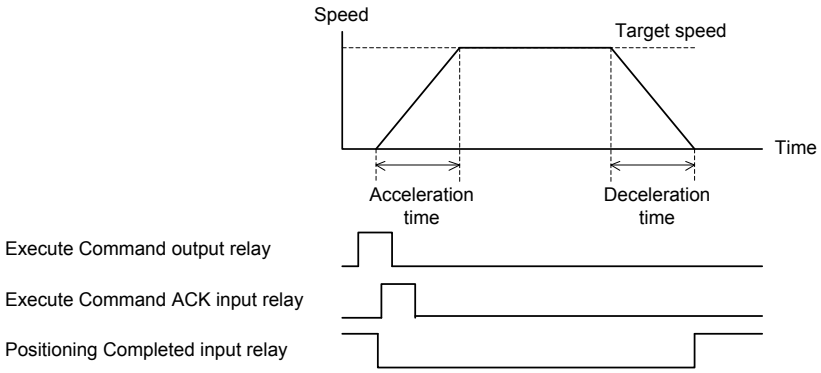


Figure 8.24 Start Positioning

■ Usage

● Command Parameters

Table 8.25 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.25 Required Parameters for the Start Positioning Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	0: Start Positioning 1000: Start Positioning with Trigger	○
*42	Target Position Mode /Position Data Record No.	0: Using ABS position, 1: Using INC position	○
*43/*44	Target Position	Reverse limit to forward limit [pulses]	○
*45	Accel/Decel Mode	0: Trapezoidal acceleration and deceleration, 1: S-shape acceleration and deceleration	○
*46/*47	Target Speed	1 to Speed Limit [command speed unit]	○
*48	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	○
*49	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	○
*50/*51	Startup Speed	0 to target speed [command speed unit] (Set this parameter when Accel/Decel Mode is trapezoidal acceleration and deceleration.)	▲
*63 to *67	Parameters for the trigger condition	Settings for the trigger condition (see 8.16). (Set them for the command with a trigger condition.)	▲

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

● Command Acceptance Conditions

Table 8.26 shows pre-conditions for command execution.

Table 8.26 Command Acceptance Conditions for the Start Positioning Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
In a Positioning Completed state.		○

● Procedure

(1) Write the "0: Start Positioning" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns off when the positioning operation starts. The [Positioning Completed] input relay turns on when the positioning operation reaches the target position.

■ Note

- When you want to execute the command with a trigger condition, specify "1000: Start Positioning with Trigger" for the command code and also set up parameters for the trigger condition.

■ Sample Program

● Description

This sample program starts a positioning operation for axis 1 of the positioning module installed in slot 3.

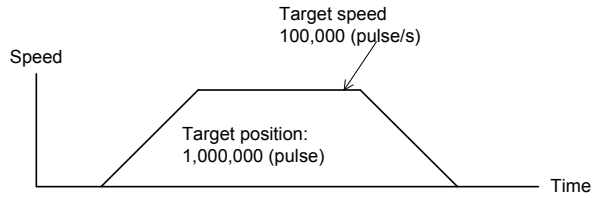


Figure 8.25 Operation Example of the Start Positioning Command

● List of Devices

Table 8.27 List of Devices Used in the Sample Program for the Start Positioning Command

Device	Name	Data
/D00041	Command Code	0: Start Positioning command
/D00042	Target Position Mode/Data Record No.	0: Using ABS position
/D00043/D00044	Target Position	1,000,000(pulse)
/D00045	Accel/Decel Mode	0:Trapezoidal acceleration/deceleration
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I00801	Positioning	
/I00802	Positioning (differential up)	
/I00803	Waiting for execute command ACK	
/I00804	Positioning in progress	

● Program Code

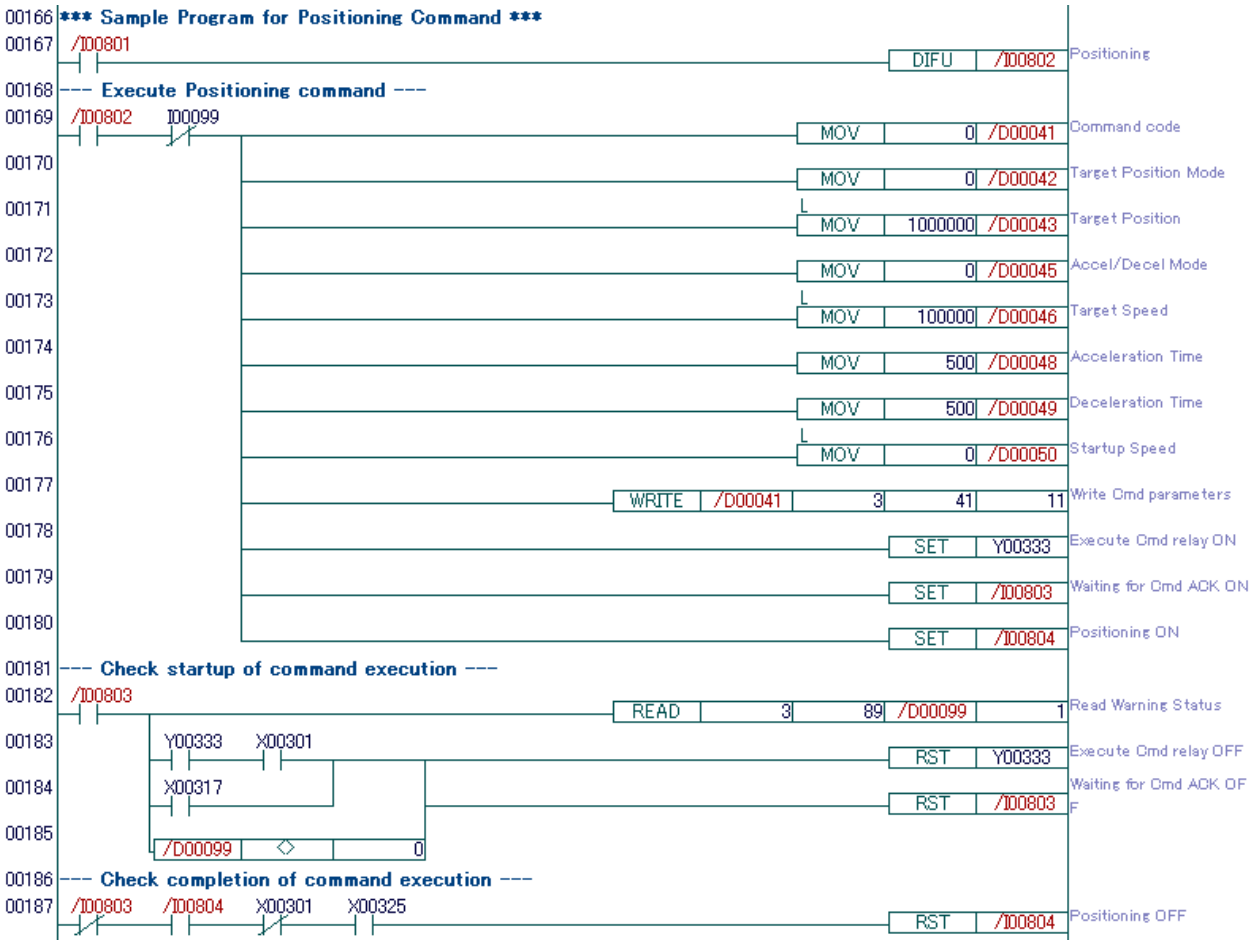


Figure 8.26 Sample Program for the Start Positioning Command

● Timing Chart

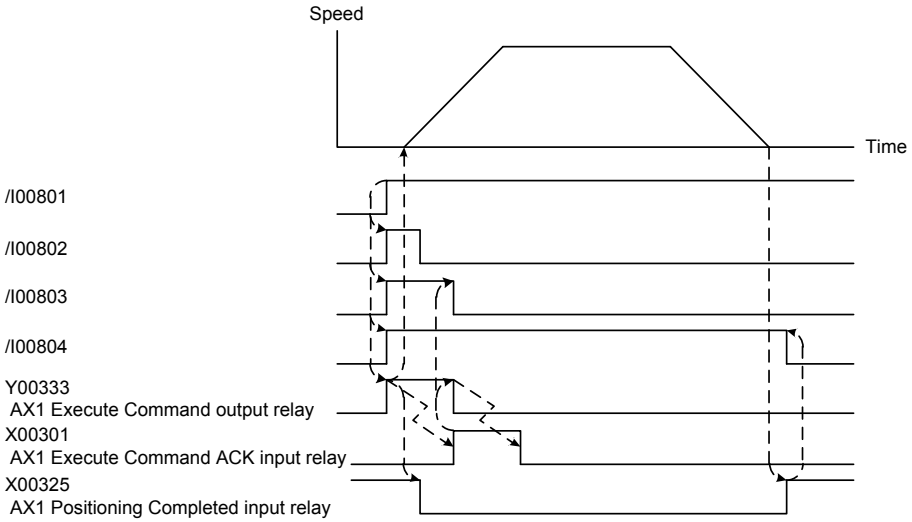


Figure 8.27 Timing Chart for the Start Positioning Command

8.8.2 Start Positioning with Position Data Record

■ Function

This command performs a positioning operation based on the position data record specified by a record number.

- In the position data record, you can set up parameters equivalent to the ones used in the Start Positioning command.
- You can also specify a trigger condition.

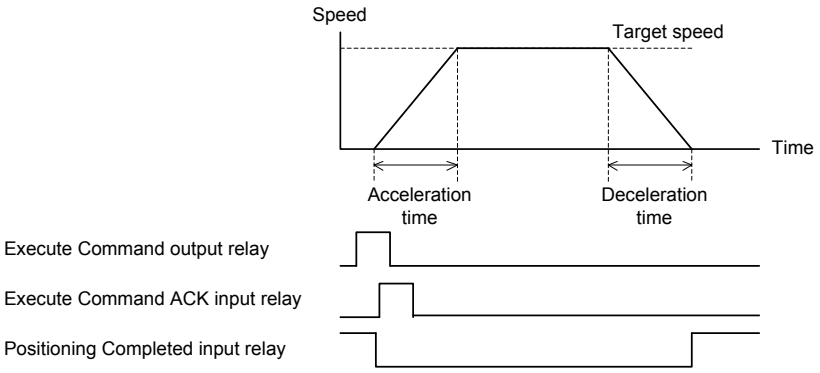


Figure 8.28 Start Positioning with Position Data Record

■ Usage

● Command Parameters

Tables 8.28 and 8.29 show the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.28 Required Parameters for the Start Positioning with Position Data Record Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	20: Start Positioning with Position Data Record 1020: Start Positioning with Position Data Record with Trigger	○
*42	Target Position Mode /Position Data Record No.	1 to 10 [Position data record number]	○
*63 to *67	Parameters for the trigger condition	Settings for the trigger condition (see 8.16). (Set them for the command with a trigger condition.)	▲

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

Table 8.29 Position Data Record (Data Position Numbers Are for Axis 1 and Pattern No. 101)

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not	See Also
1001	Target Position Mode	0: Using ABS position, 1: Using INC position	○	6.1.7
1002/1003	Target Position	Reverse limit to forward limit [pulses]	○	6.1.7
1004	Accel/Decel Mode	0: Trapezoidal acceleration/deceleration (With startup speed), 1: S-shape acceleration/deceleration	○	6.1.7
1005/1006	Target Speed	1 to Speed Limit [command speed unit]	○	6.1.7
1007	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	○	6.1.7
1008	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	○	6.1.7
1009/1010	Startup Speed	0 to target speed [command speed unit] (Set this parameter when Accel/Decel Mode is trapezoidal acceleration and deceleration.)	▲	6.1.7

● Command Acceptance Conditions

Table 8.30 shows pre-conditions for command execution.

Table 8.30 Command Acceptance Conditions for the Start Positioning with Position Data Record Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
In a Positioning Completed state.		○

● Procedure

(1) Set up the required parameters on the position data record.

(2) Write the "20: Start Positioning with Position Data Record" command code and the required parameters to the command parameter area of the command axis. Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns off when the positioning operation starts. The [Positioning Completed] input relay turns on when the positioning operation reaches the target position.

■ Note

- When you want to execute the command with a trigger condition, specify "1020: Start Positioning with Position Data Record with Trigger" for the command code and also set up parameters for the trigger condition.
- Edit the position data record before issuing a Start Positioning with Position Data Record command.

■ Sample Program

● Description

This sample program starts a positioning operation based on a position data record for axis 1 of the positioning module installed in slot 3.

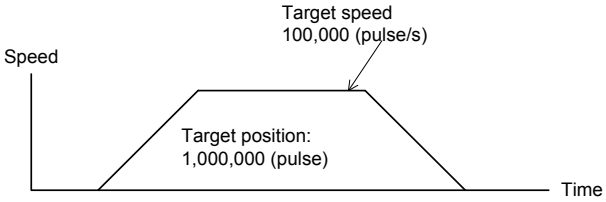


Figure 8.29 Operation Example of the Start Positioning with Position Data Record Command

● List of Devices

Table 8.31 List of Devices Used in the Sample Program for the Start Positioning with Position Data Record Command

Device	Name	Data
/D00041	Command Code	20: Start Positioning with Position Data Record command
/D00042	Target Position Mode/Data Record No.	1: Record No. 1
/D00099	Warning Status	
/D00101 to D00110	Position Data Record	Set up data in this area before executing the Positioning command.
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I00901	Positioning	
/I00902	Positioning (differential up)	
/I00903	Waiting for execute command ACK	
/I00904	Positioning in progress	

● Program Code

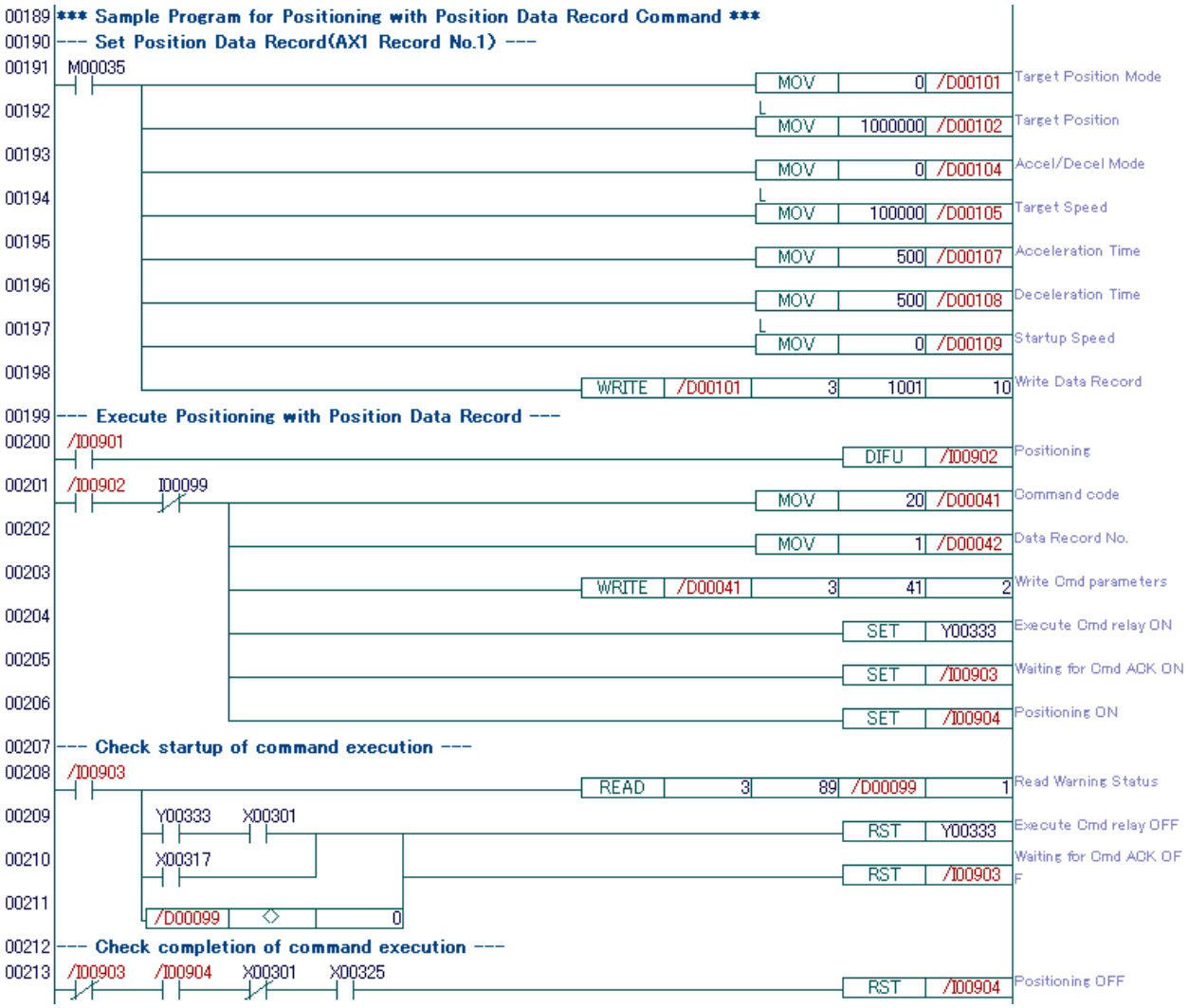


Figure 8.30 Sample Program for the Start Positioning with Position Data Record Command

● Timing Chart

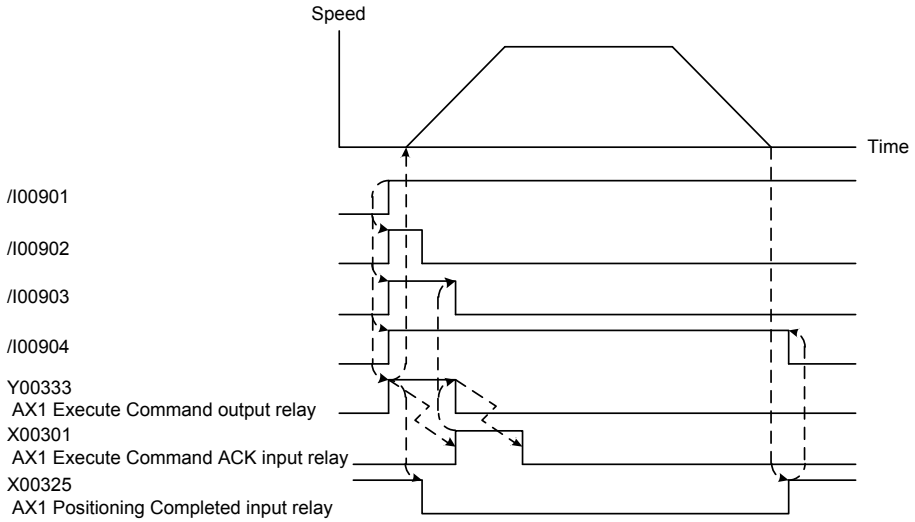


Figure 8.31 Timing Chart for the Start Positioning with Position Data Record Command

8.9 Target Position Change Operation

8.9.1 Change Target Position

■ Function

This command changes the current target position to a new target position during a positioning operation.

- You can specify an absolute position or incremental position as the target position. The incremental position is a position relative to the target position of the current operation.
- 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.

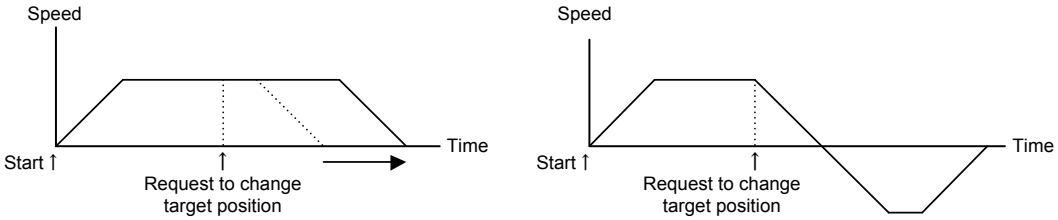


Figure 8.32 Target Position Change Operation

■ Usage

● Command Parameters

Table 8.32 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.32 Required Parameters for the Change Target Position Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	7: Change Target Position	○
*42	Target Position Mode /Position Data Record No.	0: Using ABS position, 1: Using INC position	○
*43/*44	Target Position	Reverse limit to forward limit [pulses]	○
*45	Accel/Decel Mode	0: Trapezoidal acceleration and deceleration, 1: S-shape acceleration and deceleration	△
*46/*47	Target Speed	1 to Speed Limit [command speed unit]	△
*48	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	△
*49	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	△
*50/*51	Startup Speed	0 to target speed [command speed unit] (Set this parameter when Accel/Decel Mode is trapezoidal acceleration and deceleration.)	△

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

● Command Acceptance Conditions

Table 8.33 shows pre-conditions for command execution.

Table 8.33 Command Acceptance Conditions for the Change Target Position Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
Not in a jog operation.		○
Not in manual pulse generator mode.		○
Not in a speed control operation.		○
Not in an origin search operation.		○
Not in a change target position operation.		○
Not waiting for any trigger.		○

● Procedure

(1) Write the "7: Change Target Position" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns on when the positioning operation reaches the target position.

■ Note

- If a Change Target Position command is issued in a Positioning Completed state, the command is executed just as a Start Positioning command. (In this case, parameters including Target Speed, Acceleration Time, and Deceleration Time must be specified.)
- If a parameter setting error occurs in a Change Target Position command executed during a positioning operation, the positioning operation is stopped (immediately) due to the error.
- 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.
- When the Change Target Position command is being executed, no commands other than Decelerate-and-Stop and Stop Immediately are available.
- The Change Target Position command cannot change the target speed, acceleration time, or deceleration time.

■ Sample Program

● Description

This sample program changes the target position of axis 1 of the module installed in slot 3.

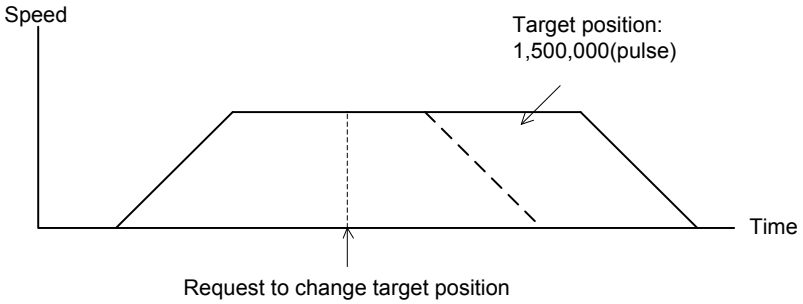


Figure 8.33 Operation Example of the Change Target Position Command

● List of Devices

Table 8.34 List of Devices Used in the Sample Program for the Change Target Position Command

Device	Name	Data
/D00041	Command Code	7: Change Target Position command
/D00042	Target Position Mode/Data Record No.	0: Using ABS position
/D00043/D00044	Target Position	1,500,000(pulse)
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I01001	Change target position	
/I01002	Change target position (differential up)	
/I01003	Waiting for execute command ACK	
/I01004	Positioning in progress	

● Program Code

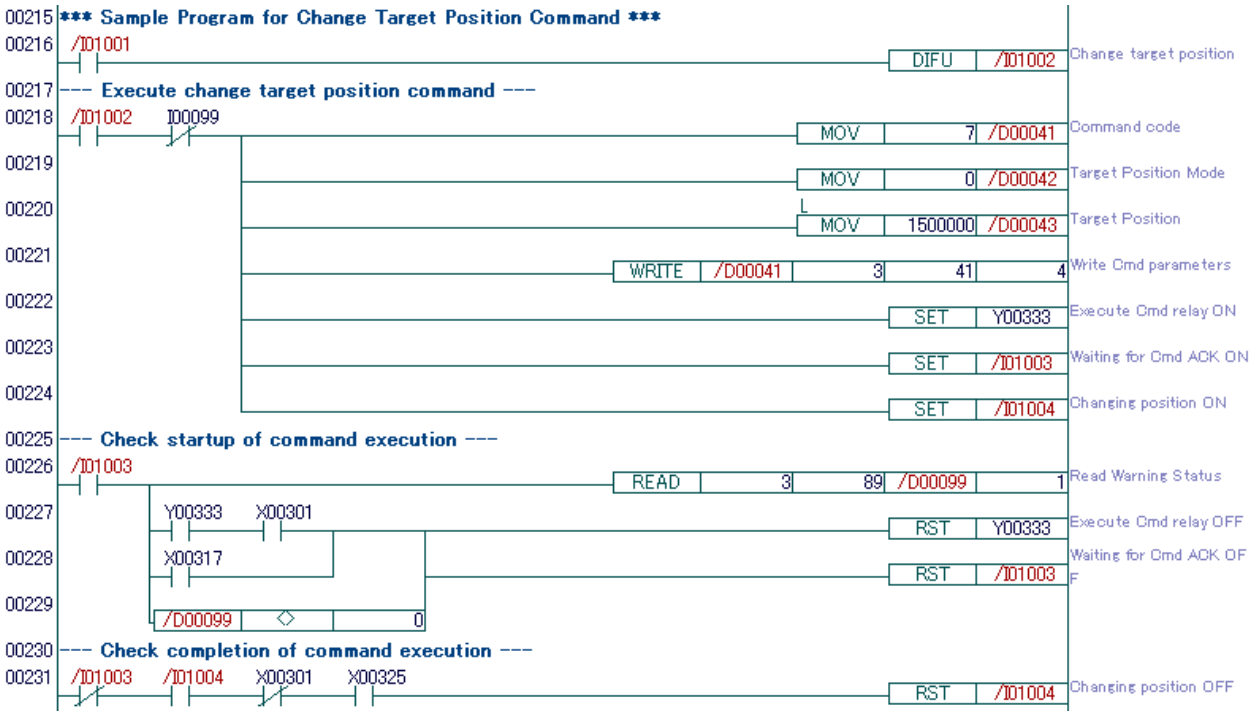


Figure 8.34 Sample Program for the Change Target Position Command

● Timing Chart

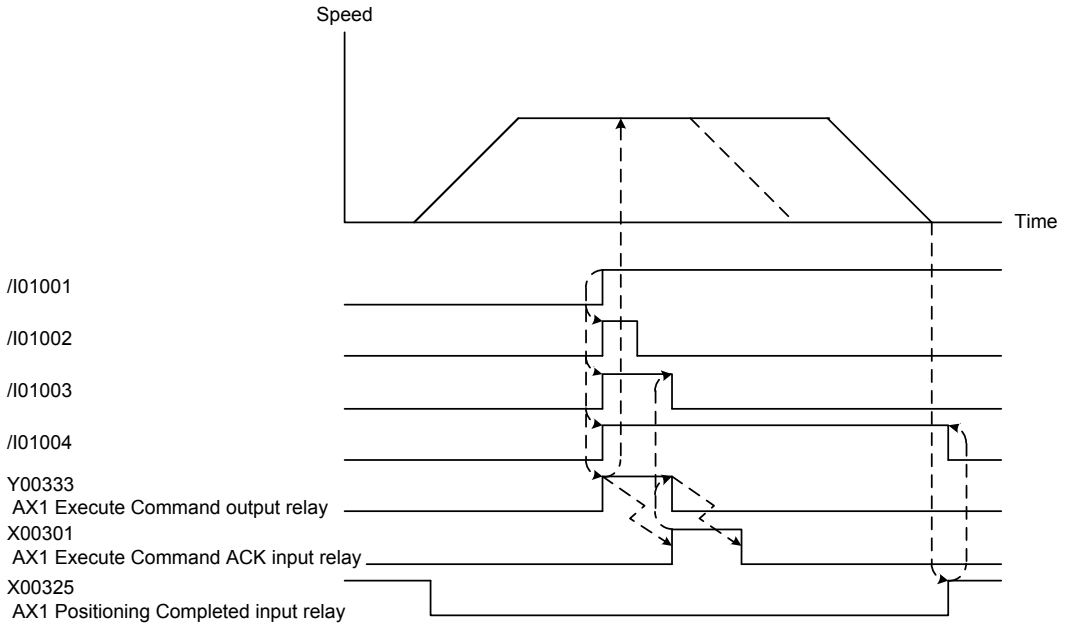


Figure 8.35 Timing Chart for the Change Target Position Command

8.9.2 Change Target Position with Position Data Record

■ Function

This command changes the target position based on the position data record specified by a record number.

In the position data record, you can set up parameters equivalent to the ones used in the Change Target Position command.

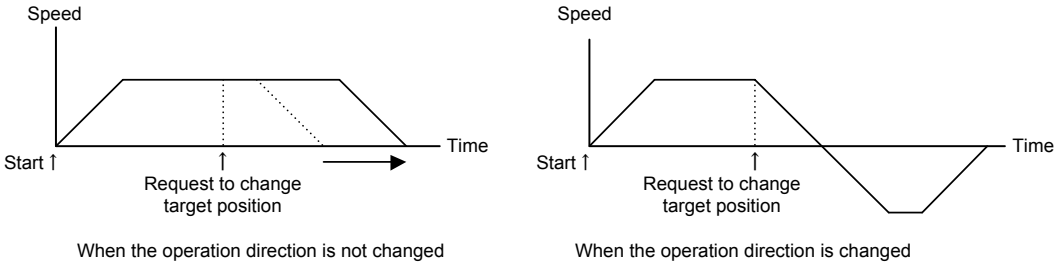


Figure 8.36 Target Position Change Operation

■ Usage

● Command Parameters

Tables 8.35 and 8.36 show the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.35 Required Parameters for the Change Target Position with Position Data Record Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	27: Change Target Position with Position Data Record	○
*42	Target Position Mode /Position Data Record No.	1 to 10 [Position data record number]	○

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

Table 8.36 Example of a Position Data Record (Data Position Numbers Are for Axis 1 and Pattern No. 1)

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not	See Also
1001	Target Position Mode	0: Using ABS position, 1: Using INC position	○	6.1.7
1002/1003	Target Position	Reverse limit to forward limit [pulses]	○	6.1.7
1004	Accel/Decel Mode	0: Trapezoidal acceleration/deceleration (With startup speed), 1: S-shape acceleration/deceleration	△	6.1.7
1005/1006	Target Speed	1 to Speed Limit [command speed unit]	△	6.1.7
1007	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	△	6.1.7
1008	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	△	6.1.7
1009/1010	Startup Speed	0 to target speed [command speed unit] (Set this parameter when Accel/Decel Mode is trapezoidal acceleration and deceleration.)	△	6.1.7

● Command Acceptance Conditions

Table 8.37 shows pre-conditions for command execution.

Table 8.37 Command Acceptance Conditions for the Change Target Position with Position Data Record Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
Not in a jog operation.		○
Not in manual pulse generator mode.		○
Not in a speed control operation.		○
Not in an origin search operation.		○
Not in a change target position operation.		○
Not waiting for any trigger.		○

● Procedure

(1) Set up the required parameters on the position data record.

(2) Write the "27: Change Target Position with Position Data Record" command code and the required parameters to the command parameter area of the command axis. Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns on when the positioning operation reaches the target position.

■ Note

- If a Change Target Position command is issued in a Positioning Completed state, the command is executed just as a Start Positioning command. (In this case, parameters including Target Speed, Acceleration Time, and Deceleration Time must be specified.)
- If a parameter setting error occurs in a Change Target Position command executed during a positioning operation, the positioning operation is stopped (immediately) due to the error.
- 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.
- When the Change Target Position command is being executed, no commands other than Decelerate-and-Stop and Stop Immediately are available.
- The Change Target Position command cannot change the target speed, acceleration time, or deceleration time.

■ Sample Program

● Description

This sample program changes the target position based on a position data record for axis 1 of the module installed in slot 3.

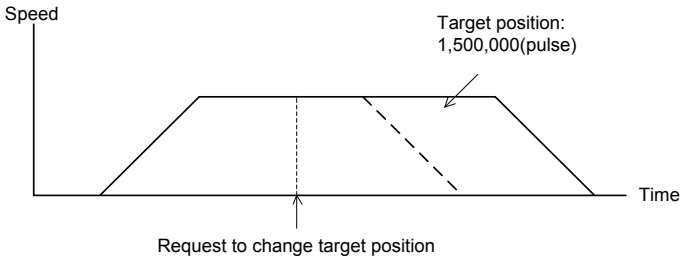


Figure 8.37 Operation Example of the Change Target Position with Position Data Record Command

● List of Devices

Table 8.38 List of Devices Used in the Sample Program for the Change Target Position with Position Data Record Command

Device	Name	Data
/D00041	Command Code	27: Change Target Position with Position Data Record Command
/D00042	Target Position Mode/Data Record No.	2: Record No. 2
/D00099	Warning Status	
/D00111 to D00120	Position Data Record	Set up data in this area before executing the Positioning command.
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I01101	Change target position	
/I01102	Change target position (differential up)	
/I01103	Waiting for execute command ACK	
/I01104	Positioning in progress	

● Program Code

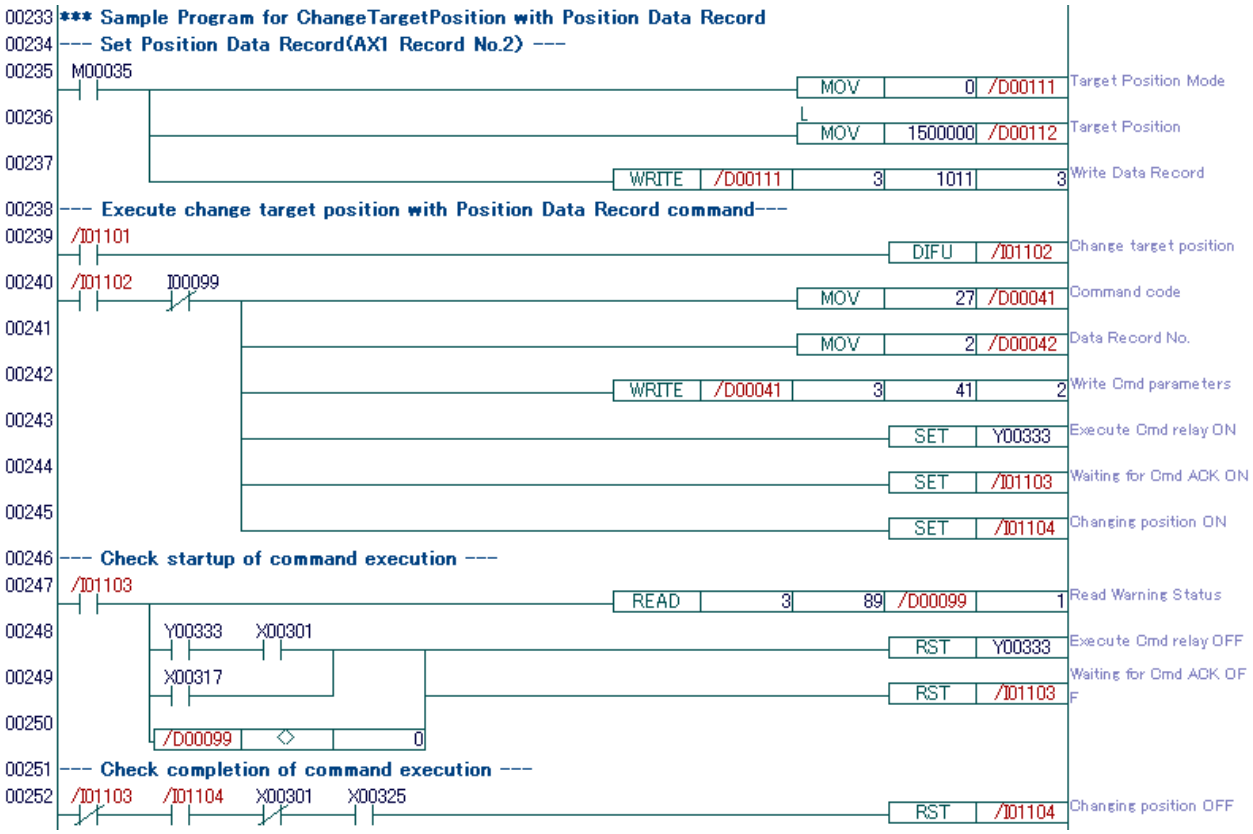


Figure 8.38 Sample Program for the Change Target Position with Position Data Record Command

● Timing Chart

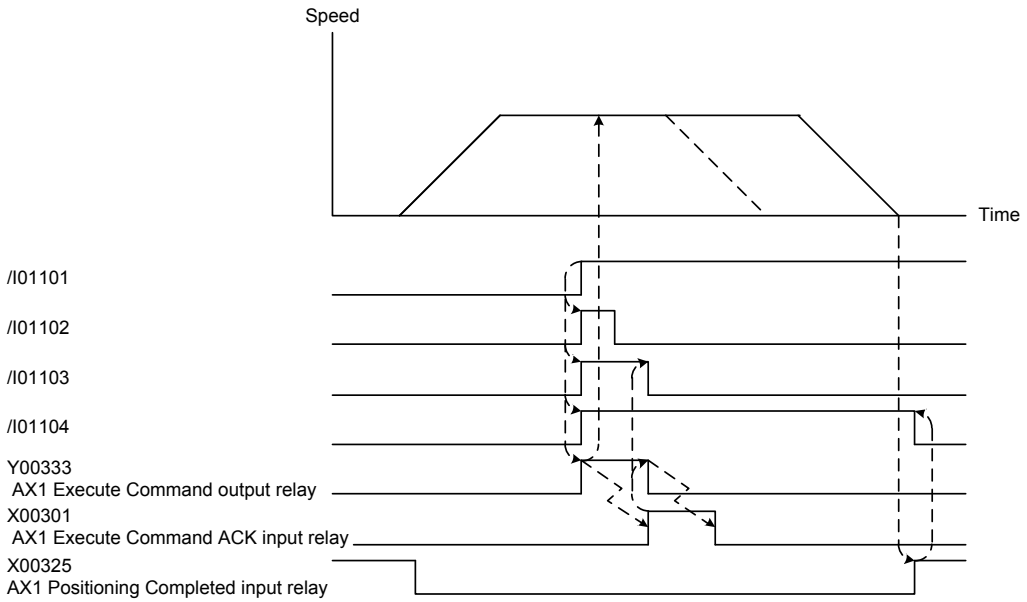


Figure 8.39 Timing Chart for the Change Target Position with Position Data Record Command

8.10 Positioning Operation with Resetting Current Position

8.10.1 Start Positioning with Resetting Current Position

■ Function

This command performs a positioning operation after resetting the current position to "0".

- By executing a single command, you can execute a Set Current Position command to write "0" for the current position and then execute a Start Positioning command.
- This command is useful to control a rotation axis that repeats an operation in a single direction, because this command can avoid an overflow error that occurs if the operating range (32 bit) of the positioning module is exceeded.

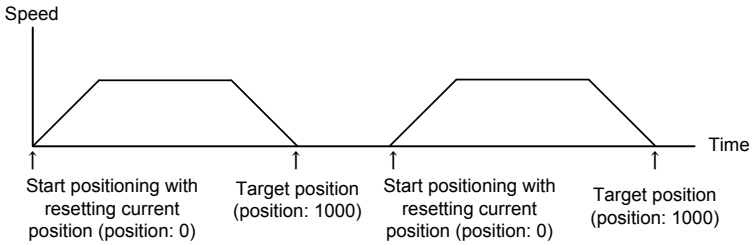


Figure 8.40 Positioning Operation with Resetting Current Position

■ Usage

● Command Parameters

Table 8.39 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.39 Required Parameters for the Start Positioning with Resetting Current Position Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	10: Start Positioning with Resetting Current Position 1010: Start Positioning with Trigger and Resetting Current Position	○
*43/*44	Target Position	Reverse limit to forward limit [pulses]	○
*45	Accel/Decel Mode	0: Trapezoidal acceleration and deceleration, 1: S-shape acceleration and deceleration	○
*46/*47	Target Speed	1 to Speed Limit [command speed unit]	○
*48	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	○
*49	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	○
*50/*51	Startup Speed	0 to target speed [command speed unit] (Set this parameter when Accel/Decel Mode is trapezoidal acceleration and deceleration.)	▲
*63 to *67	Parameters for the trigger condition	Settings for the trigger condition (see 8.16). (Set them for the command with a trigger condition.)	▲

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

● Command Acceptance Conditions

Table 8.40 shows pre-conditions for command execution.

Table 8.40 Command Acceptance Conditions for the Start Positioning with Resetting Current Position Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
In a Positioning Completed state.		○

● Procedure

(1) Write the "10: Start Positioning with Resetting Current Position" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns off when the positioning operation starts. The [Positioning Completed] input relay turns on when the positioning operation reaches the target position.

■ Note

- When you want to execute the command with a trigger condition, specify "1010: Start Positioning with Trigger and Resetting Current Position" for the command code and also set up parameters for the trigger condition. When a trigger condition is specified, the current position is reset to 0 when the command is issued. The positioning operation starts after the trigger condition is met.

■ Sample Program

● Description

This sample program starts a positioning operation with resetting current position for axis 1 of the positioning module installed in slot 3.

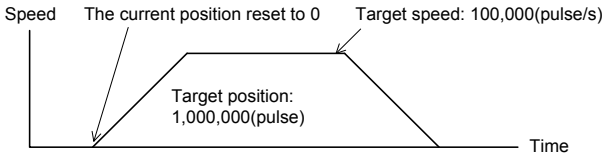


Figure 8.41 Operation Example of the Positioning Operation with Resetting Current Position Command

● List of Devices

Table 8.41 List of Devices Used in the Sample Program for the Start Positioning with Resetting Current Position Command

Device	Name	Data
/D00041	Command Code	10: Start Positioning with Resetting Current Position Command
/D00043/D00044	Target Position	1,000,000(pulse)
/D00045	Accel/Decel Mode	0:Trapezoidal acceleration/deceleration
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I01201	Start Positioning	
/I01202	Start Positioning (differential up)	
/I01203	Waiting for execute command ACK	
/I01204	Positioning in progress	

● Program Code

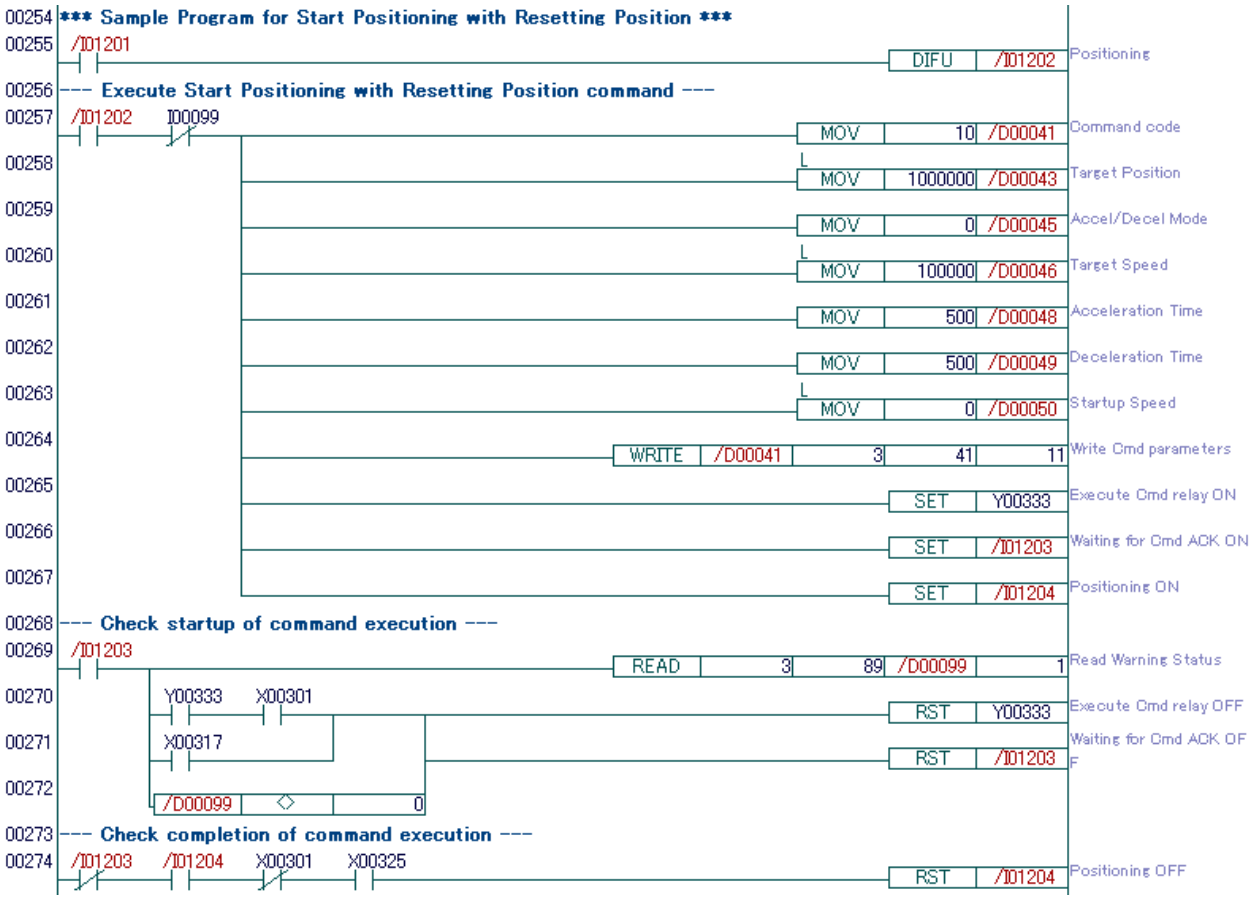


Figure 8.42 Sample Program for the Start Positioning with Resetting Current Position Command

● Timing Chart

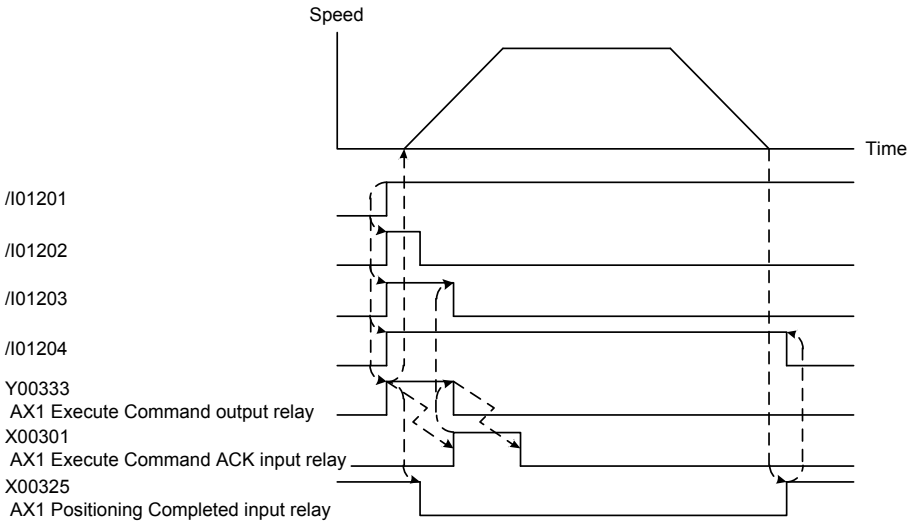


Figure 8.43 Timing Chart for the Start Positioning with Resetting Current Position Command

8.10.2 Change Target Position with Resetting Current Position

■ Function

This command changes the current position so that the target position of the current positioning operation becomes "0", and then performs a positioning operation toward the new target position.

- The target position can be set only to a positive value during a forward operation or a negative value during a reverse operation. (Note that the operation direction cannot be changed in a target position change operation.)

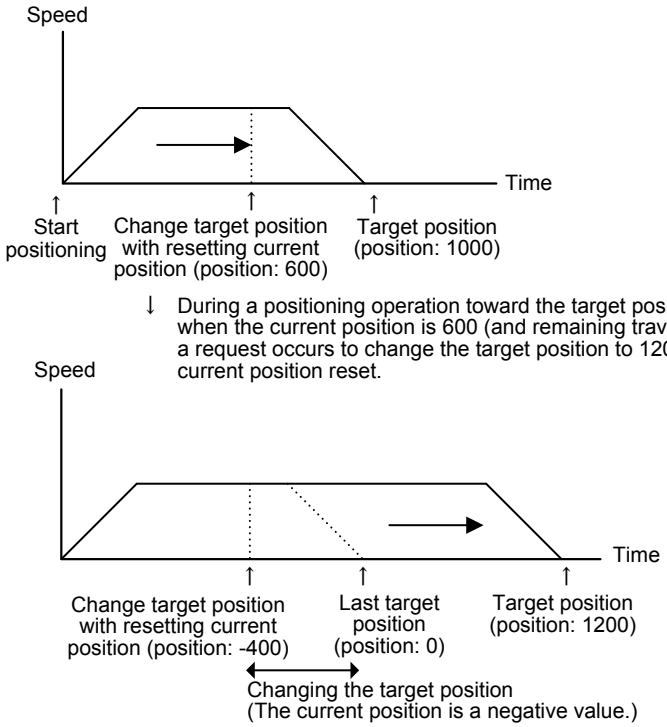


Figure 8.44 Change Target Position with Resetting Current Position

■ Usage

● Command Parameters

Table 8.42 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.42 Required Parameters for the Change Target Position with Resetting Current Position Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	17: Change Target Position with Resetting Current Position	○
*43/*44	Target Position	Reverse limit to forward limit [pulses]	○
*45	Accel/Decel Mode	0: Trapezoidal acceleration and deceleration, 1: S-shape acceleration and deceleration	△
*46/*47	Target Speed	1 to Speed Limit [command speed unit]	△
*48	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	△

*49	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	△
*50/*51	Startup Speed	0 to target speed [command speed unit] (Set this parameter when Accel/Decel Mode is trapezoidal acceleration and deceleration.)	△

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

● Command Acceptance Conditions

Table 8.43 shows pre-conditions for command execution.

Table 8.43 Command Acceptance Conditions for the Change Target Position with Resetting Current Position Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
Not in a jog operation.		○
Not in manual pulse generator mode.		○
Not in a speed control operation.		○
Not in an origin search operation.		○
Not in a change target position operation.		○
Not waiting for any trigger.		○

● Procedure

(1) Write the "17: Change Target Position with Resetting Current Position" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns on when the positioning operation reaches the target position.

■ Note

- If a Change Target Position with Resetting Current Position command is issued in a Positioning Completed state, the command is executed just as a Start Positioning with Resetting Current Position command. (In this case, parameters including Target Speed, Acceleration Time, and Deceleration Time must be specified.)
- If a parameter setting error occurs in a Change Target Position with Resetting Current Position command executed during a positioning operation, the positioning operation is stopped (immediately) due to the error.
- 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.
- When a Change Target Position with Resetting Current Position command is being executed, no commands other than Decelerate-and-Stop and Stop Immediately are available (until the current position reaches "0").
- The Change Target Position with Resetting Current Position command cannot change the target speed, acceleration time, or deceleration time.

■ Sample Program

● Description

This sample program performs a change target position operation with resetting current position for axis 1 of the positioning module installed in slot 3.

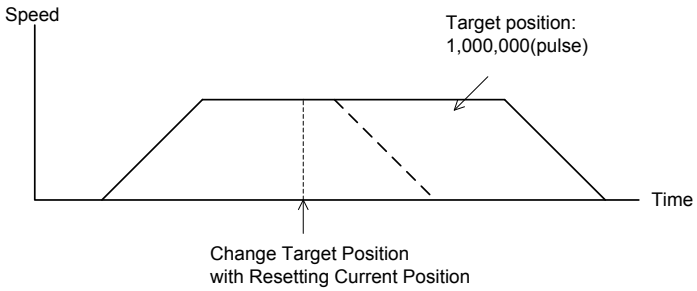


Figure 8.45 Operation Example of the Change Target Position with Resetting Current Position Command

● List of Devices

Table 8.44 List of Devices Used in the Sample Program for the Change Target Position with Resetting Current Position Command

Device	Name	Data
/D00041	Command Code	17: Change Target Position with Resetting Current Position Command
/D00043/D00044	Target Position	1,000,000(pulse)
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I01301	Change Target Position	
/I01302	Change Target Position (differential up)	
/I01303	Waiting for execute command ACK	
/I01304	Positioning in progress	

● Program Code

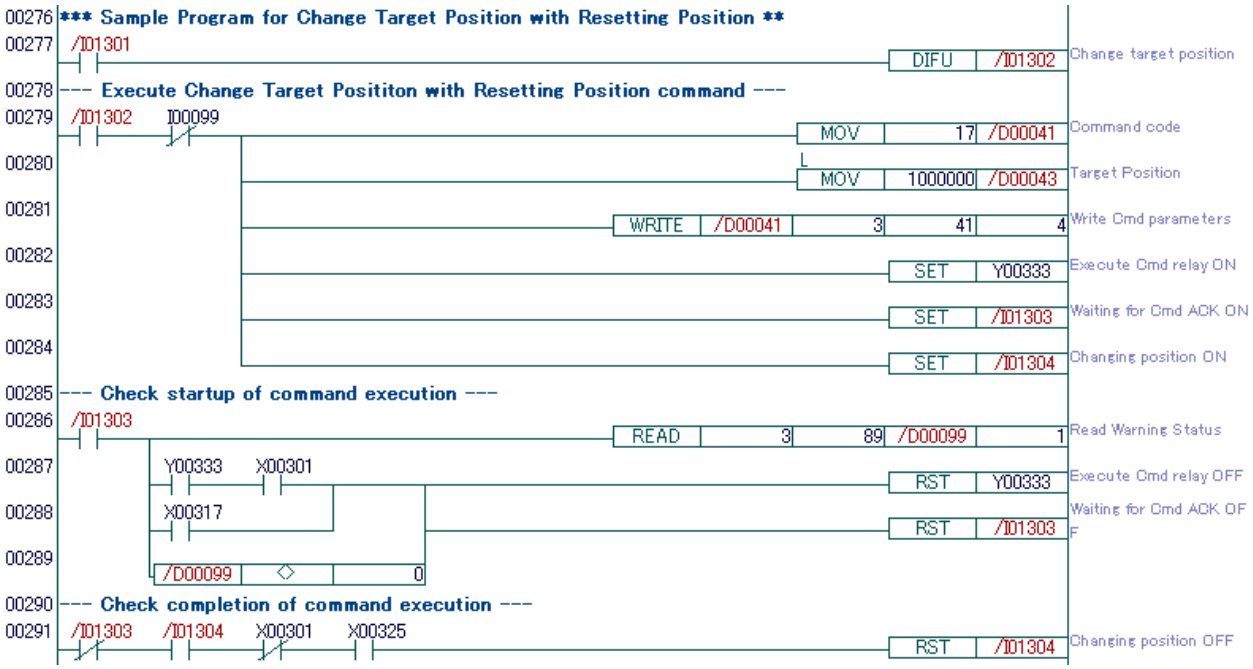


Figure 8.46 Sample Program for the Change Target Position with Resetting Current Position Command

● Timing Chart

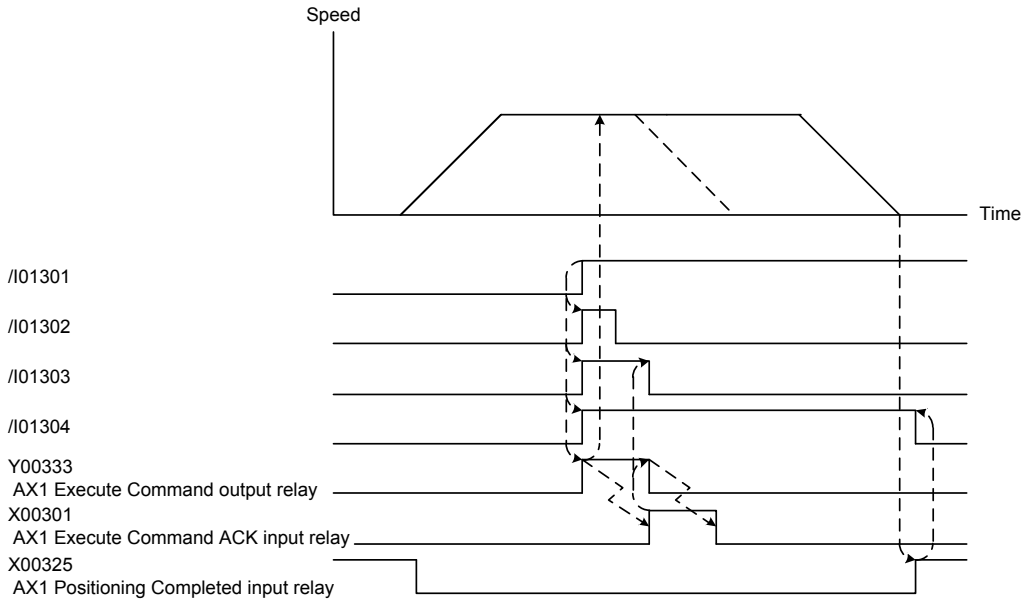


Figure 8.47 Timing Chart for the Change Target Position with Resetting Current Position Command

8.11 Speed Control Operation

8.11.1 Start Speed Control

■ Function

This command performs a speed control operation using the specified target speed, acceleration time, and deceleration time.

The speed control operation continues until a Speed Control to Position Control command is executed, a Decelerate and Stop command is executed, an error occurs, or the [Stop Immediately] output relay is turned from off to on.

- You can use the sign of the target speed to specify the rotation direction.
- You can also specify a trigger condition.

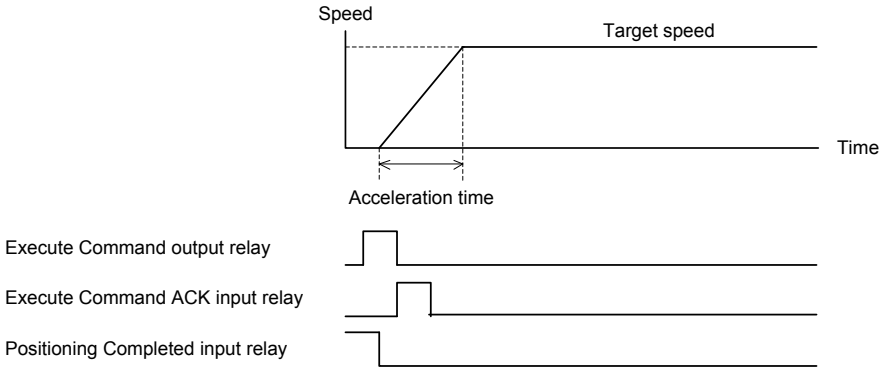


Figure 8.48 Speed Control Operation

■ Usage

● Command Parameters

Table 8.45 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.45 Required Parameters for the Start Speed Control Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	400: Start Speed Control 1400: Start Speed Control with Trigger	○
*45	Accel/Decel Mode	0: Trapezoidal acceleration and deceleration, 1: S-shape acceleration and deceleration	○
*46/*47	Target Speed	Startup Speed to Speed Limit [command speed unit] The sign of this parameter specifies the operation direction of the speed control.	○
*48	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	○
*49	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	○
*50/*51	Startup Speed	0 to target speed [command speed unit] (Set this parameter when Accel/Decel Mode is trapezoidal acceleration and deceleration.)	▲
*63 to *67	Parameters for the trigger condition	Settings for the trigger condition (see 8.16). (Set them for the command with a trigger condition.)	▲

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

● Command Acceptance Conditions

Table 8.46 shows pre-conditions for command execution.

Table 8.46 Command Acceptance Conditions for the Start Speed Control Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
In a Positioning Completed state.		○

● Procedure

(1) Write the "400: Start Speed Control" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns off when the speed control operation starts.

■ Note

- When you want to execute the command with a trigger condition, specify "1400: Start Speed Control with Trigger" for the command code and also set up parameters for the trigger condition.
- To stop a speed control operation, execute a Decelerate and Stop command or turn off the [Stop Immediately] output relay.
- During a speed control operation, forward/reverse limit input error detection is performed based on the Contact Input Setting registered parameter.
- If an error occurs during a speed control operation, the operation is stopped (immediately) due to the error.
- The setting values of the Forward and Reverse Limit registered parameters are ignored during a speed control operation.
- Current Position Status is working during a speed control operation. If an overflow occurs during the operation, a 32-bit ring operation is performed. (During a reverse operation, if the value of Current Position Status becomes smaller than -2,147,483,648, the value is set to 2,147,483,647 and the decrement continues. During a forward operation, if the value of Current Position Status becomes larger than 2,147,483,647, the value is set to -2,147,483,648 and the increment continues.)

■ Sample Program

● Description

This sample program performs a speed control operation for axis 1 of the module installed in slot 3.

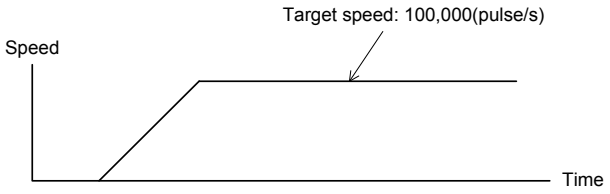


Figure 8.49 Operation Example of the Start Speed Control Command

● List of Devices

Table 8.47 List of Devices Used in the Sample Program for the Start Speed Control Command

Device	Name	Data
/D00041	Command Code	400: Start Speed Control
/D00045	Accel/Decel Mode	0:Trapezoidal acceleration/deceleration
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I01401	Start Speed Control	
/I01402	Start Speed Control (differential up)	
/I01403	Waiting for execute command ACK	
/I01404	Command executing	

● Program Code

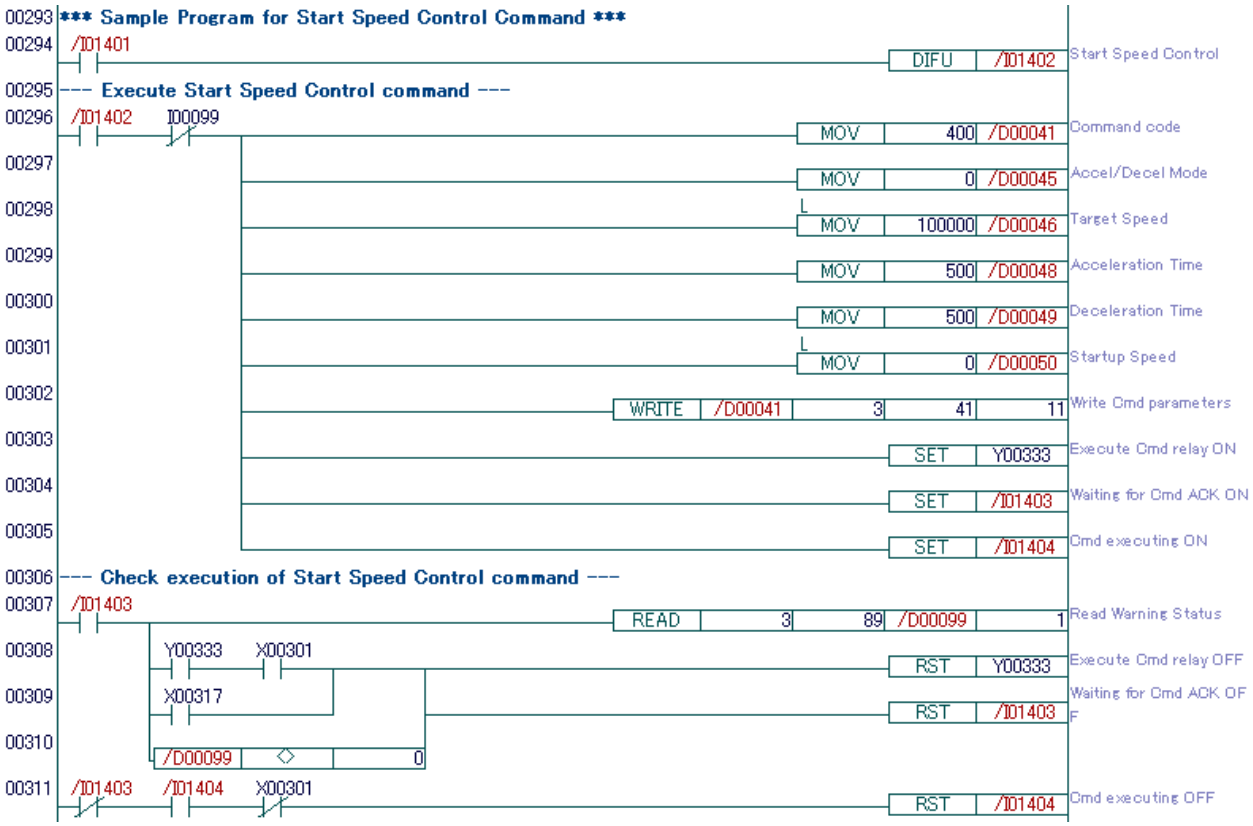


Figure 8.50 Sample Program for the Start Speed Control Command

● Timing Chart

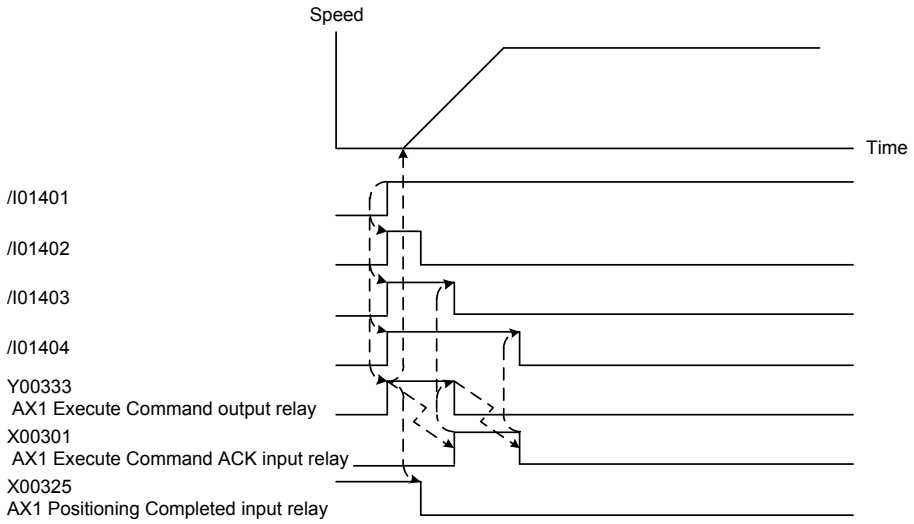


Figure 8.51 Timing Chart for the Start Speed Control Command

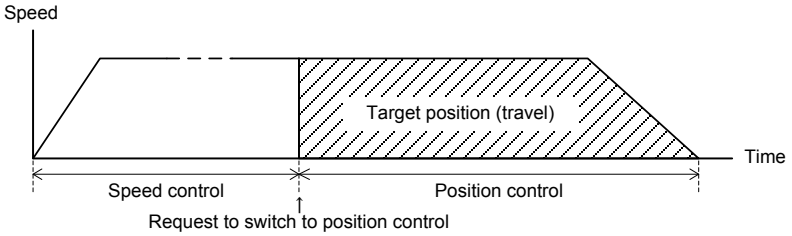
8.11.2 Speed Control to Position Control Switchover

■ Function

During a speed control operation, this command stops the operation at the specified target position (travel distance).

- You can select whether or not to reset the current position to "0" when speed control is switched to position control.
- You cannot use this command to change speed-related parameters, such as the target speed, acceleration time, and deceleration time.
- You can specify to use the encoder Z-phase input as a condition for switching to position control.
- You can also specify a trigger condition for executing a command before the encoder Z-phase input. (For example, you can specify a trigger condition that uses an external contact input and then the encoder Z-phase input or that uses counter coincidence and then the encoder Z-phase input.)

- When Z-phase Search Count is not specified (Z-phase Search Count: 0)



- When Z-phase Search Count is specified (Z-phase rising edge is selected, Z-phase Search Count: 2)

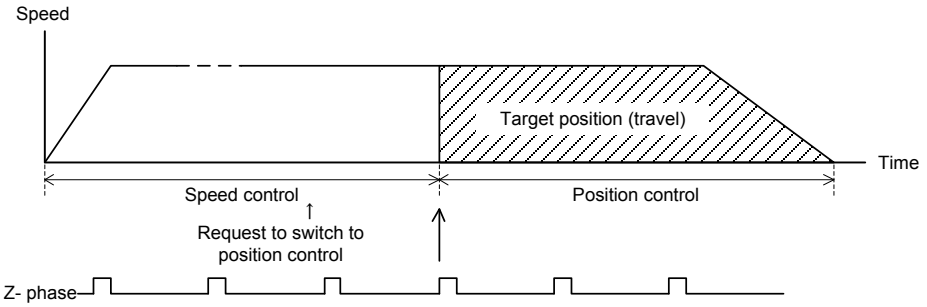


Figure 8.52 Speed Control to Position Control Switchover

■ Usage

● Command Parameters

Table 8.48 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.48 Required Parameters for the Speed Control to Position Control Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	401: Speed Control to Position Control (with a current position zero reset) 402: Speed Control to Position Control (without a current position reset) 1401: Speed Control to Position Control with Trigger (with a current position zero reset) 1402: Speed Control to Position Control with Trigger (without a current position reset)	○
*42	Target Position Mode /Position Data Record No.	0: Using ABS position, 1: Using INC position (Set this parameter when the current position is not reset.)	▲
*43/*44	Target Position	Reverse limit to forward limit [pulses]	○
*54	Z-phase Edge Selection	0: Rising edge, 1: Falling edge	▲
*55	Z-phase Search Count	0 to 32767 [pulses]	○
*63 to *67	Parameters for the trigger condition	Settings for the trigger condition (see 8.16). (Set them for the command with a trigger condition.)	▲

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

● Command Acceptance Conditions

Table 8.49 shows pre-conditions for command execution.

Table 8.49 Command Acceptance Conditions for the Speed Control to Position Control Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
Not in a Positioning Completed state.		○
Not waiting for any trigger.		○
In a speed control operation.		○
Not decelerating in a speed control operation		○

● Procedure

(1) Write the "401: Speed Control to Position Control (with a current position zero reset)" or "402: Speed Control to Position Control (without a current position reset)" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the command is successfully executed, the [Execute Command ACK] input relay turns on. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns on when the positioning operation reaches the target position.

■ Note

- When you do not specify any trigger condition, specify "401: Speed Control to Position Control (with a current position zero reset)" or "402: Speed Control to Position Control (without a current position reset)" for the command code. If Z-phase Search Count is set to 0, the operation mode is switched to position control when the command is issued, and then the positioning operation is performed toward the target position. If Z-phase Search Count is set to a value other than 0, the operation mode is switched to Z-phase search when the command is issued, and after Z-phase edges are detected as many as the specified number of counts, the operation is switched to position control and the positioning operation is performed toward the target position.
- When you specify a trigger condition, specify "1401: Speed Control to Position Control with Trigger (with a current position zero reset)" or "1402: Speed Control to Position Control with Trigger (without a current position reset)" for the command code and also set up parameters for the trigger condition. If Z-phase Search Count is set to 0, the operation mode is switched to position control after the trigger condition is met, and then the positioning operation is performed toward the target position. If Z-phase Search Count is set to a value other than 0, the operation mode is switched to Z-phase search after the trigger condition is met, and then after Z-phase edges are detected as many as the specified number of counts, the operation is switched to position control and the positioning operation is performed toward the target position.
- In a Speed Control to Position Control operation, the positioning operation is performed toward the target position based on the speed parameters specified for the speed control operation. In this case, if the positioning module determines that the parameters do not allow the axis to stop at the target position normally, it decelerates and stops the axis and then re-initiates the operation in the reverse direction.
- If speed control is switched to position control in the acceleration zone of a speed control operation, the positioning operation is performed toward the target position at the speed that has been used at the time of the switchover.
- Current Position Status is working during a speed control operation. However, the status is counted by a 32-bit ring operation, and an overflow may occur. Therefore, if the current position is not reset at the time of the switchover and the target position is specified as an absolute position, the target position may be an unexpected position. When the current position is not reset, specify the target position properly so that the current position does not overflow.
- When speed control is switched to position control, if the target position is specified and the axis stops temporarily, the forward and reverse limit values at the stop position are checked for a software limit error and the target position is checked for a setting error.

■ Sample Program

● Description

This sample program switches from speed control to position control and performs a positioning operation for axis 1 of the positioning module installed in slot 3.

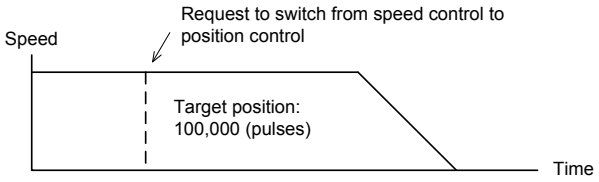


Figure 8.53 Operation Example of the Speed Control to Position Control Command

● List of Devices

Table 8.50 List of Devices Used in the Sample Program for the Speed Control to Position Control Command

Device	Name	Data
/D00041	Command Code	401:Speed Control to Position Control (with a current position zero reset)
/D00043/D00044	Target Position	100,000(pulse)
/D00054	Z-phase Edge Selection	0
/D00055	Z-phase Search Count	0
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I01501	Speed control to position control	
/I01502	Speed control to position control (differential up)	
/I01503	Waiting for execute command ACK	
/I01504	Positioning in progress	

● Program Code

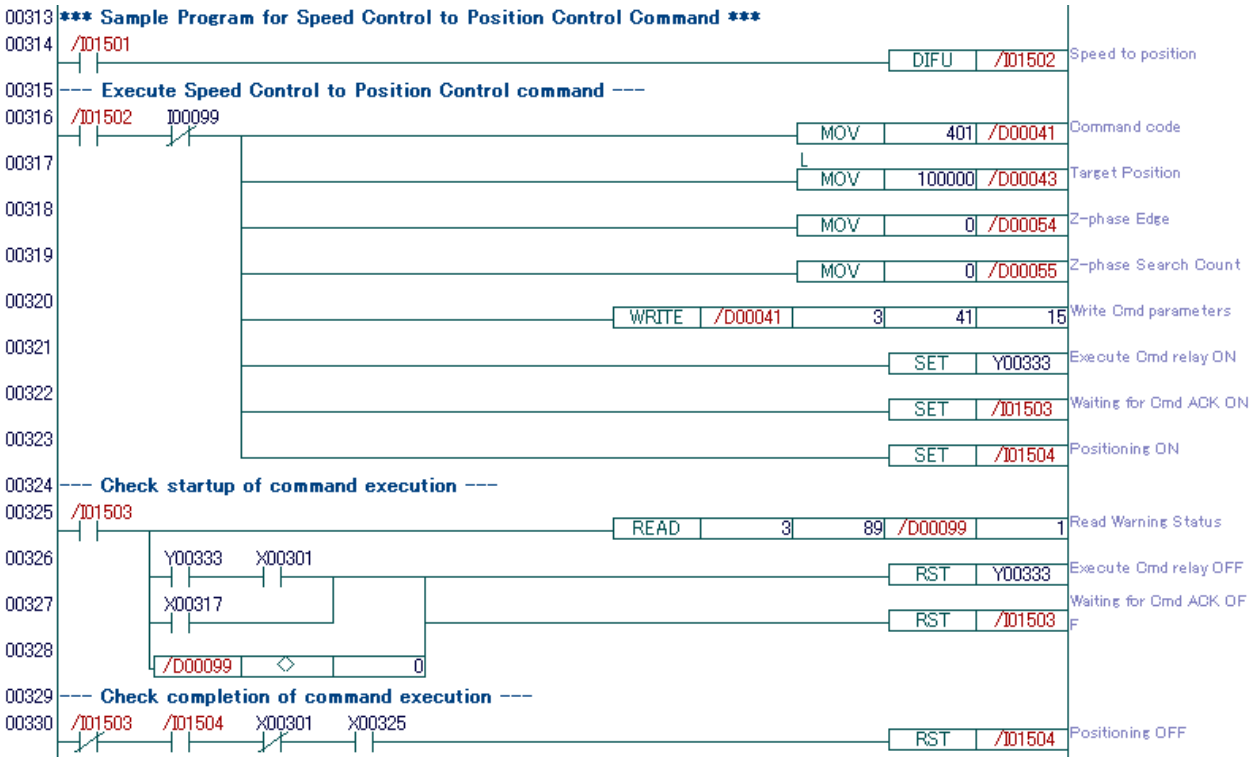


Figure 8.54 Sample Program for the Speed Control to Position Control Command

● Timing Chart

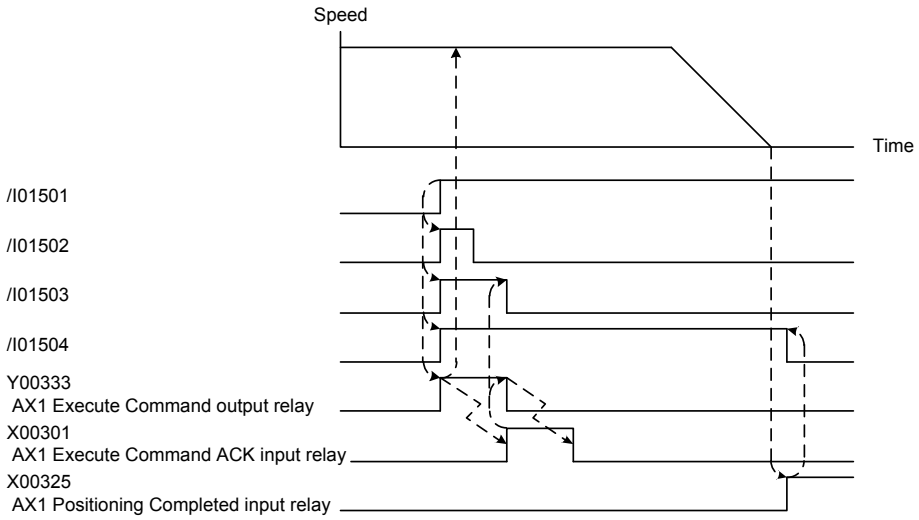


Figure 8.55 Timing Chart for the Speed Control to Position Control Command

8.12 Decelerate and Stop

■ Function

This command decelerates and stops a moving motor during an operation, such as positioning, speed control, or origin search.

- The deceleration time is based on the setting specified when the operation is started.
- If there is a command whose execution is pending until a trigger condition is met, the command is cancelled when a Decelerate and Stop command is executed.
- You can also specify a trigger condition for a decelerate-and-stop operation.

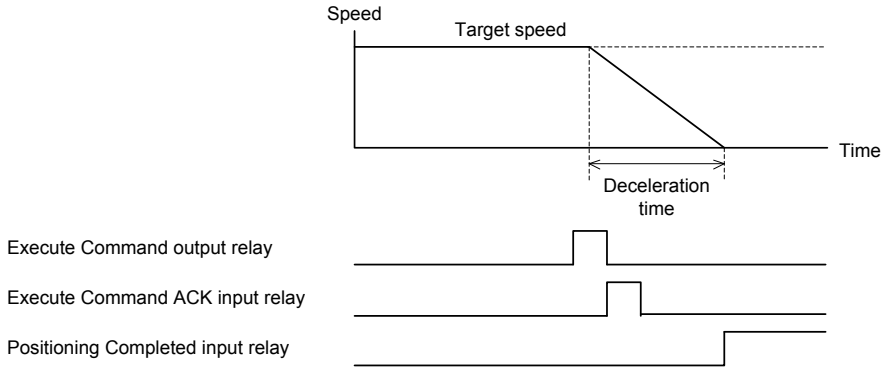


Figure 8.56 Decelerate and Stop Operation

■ Usage

● Command Parameters

Table 8.51 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.51 Required Parameters for the Decelerate and Stop Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	1: Decelerate and Stop 1001: Decelerate and Stop with Trigger	○
*63 to *67	Parameters for the trigger condition	Settings for the trigger condition (see 8.15). (Set them for the command with a trigger condition.)	▲

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

● Command Acceptance Conditions

Table 8.52 shows pre-conditions for command execution.

Table 8.52 Command Acceptance Conditions for the Decelerate and Stop Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
Not in a manual pulse generator mode operation.		○
Not in a jog operation.		○
Not in a Positioning Completed state (for the Decelerate and Stop with Trigger command).		○
Not waiting for any trigger (for the Decelerate and Stop with Trigger command).		○
Not in an origin search operation (for the Decelerate and Stop with Trigger command).		○

● Procedure

(1) Write the "1: Decelerate and Stop" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) The [Positioning Completed] input relay turns on when a positioning or speed control operation is decelerated and stopped.

■ Note

- When you want to execute the command with a trigger condition, specify "1001: Decelerate and Stop with Trigger" for the command code and also set up parameters for the trigger condition. If the positioning operation ends before the trigger condition is met, the trigger condition of the Decelerate and Stop command is cancelled.
- You cannot execute the Decelerate and Stop command during a jog operation. Terminate the jog operation first (by turning off the corresponding jog relay), if necessary.
- You cannot execute the Decelerate and Stop command during manual pulse generator mode. To stop manual pulse generator mode, execute a Stop MPG Mode command.
- The deceleration time is based on the setting specified when the operation is started. (The time needed to decelerate from the target speed to the startup speed is set for the Deceleration Time parameter.)
- When a decelerate-and-stop operation is performed from a speed below the target speed, the deceleration rate is the same as the deceleration rate used when a decelerate-and-stop operation is performed from the target speed.

■ Sample Program

● Description

This sample program decelerates and stops a positioning operation for axis 1 of the positioning module installed in slot 3.

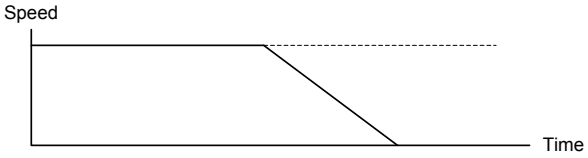


Figure 8.57 Operation Example of the Decelerate and Stop Command

● List of Devices

Table 8.53 List of Devices Used in the Sample Program for the Decelerate and Stop Command

Device	Name	Data
/D00041	Command Code	1: Decelerate and Stop command
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I01601	Decelerate and stop	
/I01602	Decelerate and stop (differential up)	
/I01603	Waiting for execute command ACK	
/I01604	Decelerating and stopping	

● Program Code

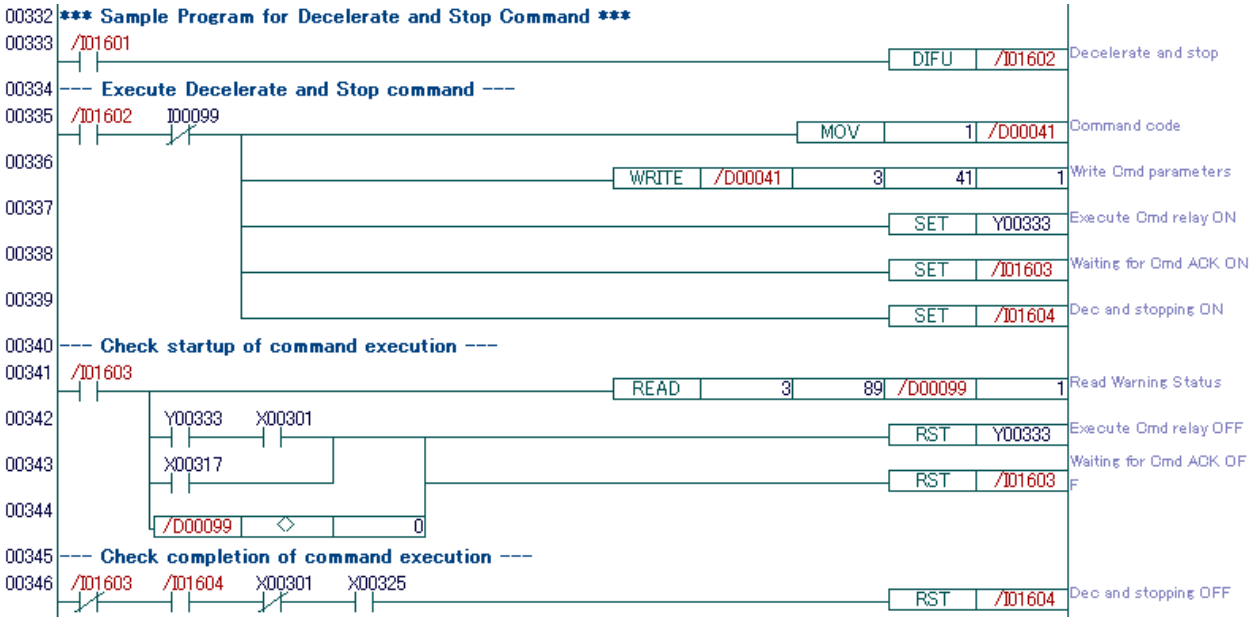


Figure 8.58 Sample Program for the Decelerate and Stop Command

● Timing Chart

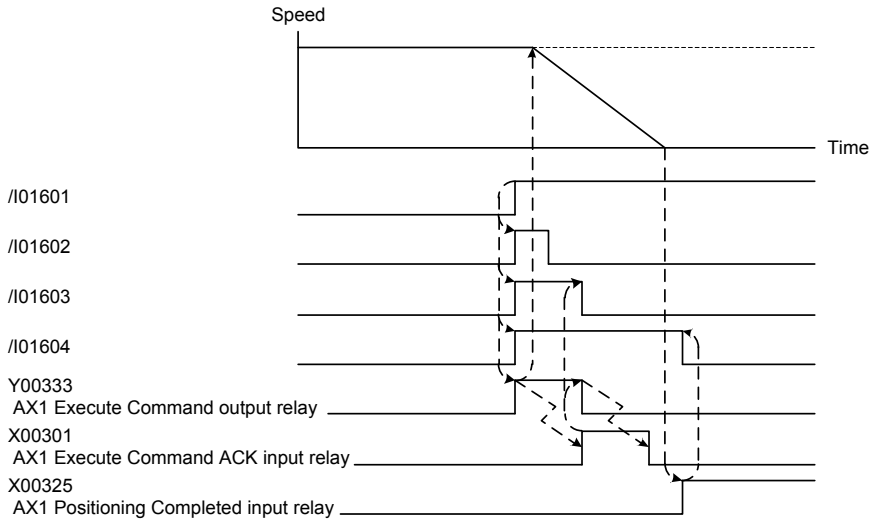


Figure 8.59 Timing Chart for the Decelerate and Stop Command

8.13 Stop Immediately

■ Function

This command stops an operating motor immediately without deceleration during a positioning operation, speed control, origin search, etc. This command can be used also to stop manual pulse generator mode or a jog operation immediately without deceleration of the motor.

- If there is a command whose execution is pending until a trigger condition is met, the command is cancelled when a Stop Immediately command is executed.

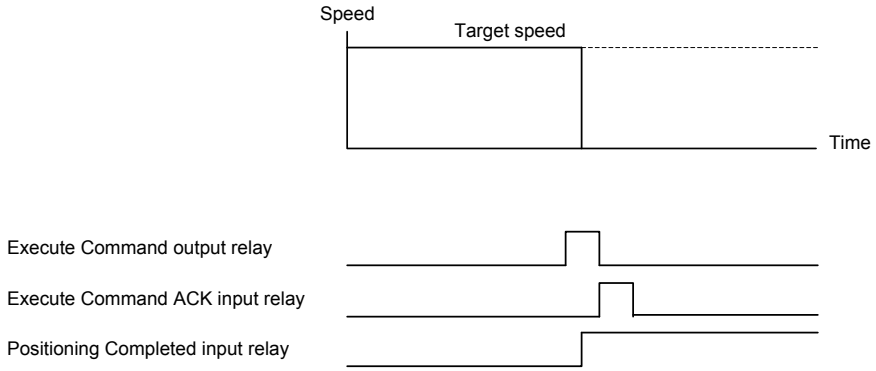


Figure 8.60 Stop Immediately Operation

■ Usage

● Command Parameters

No command parameters need to be set.

● Command Acceptance Conditions

This command is always accepted.

● Procedure

(1) Turn on the [Stop Immediately] output relay for the command axis.

(2) When the [Stop Immediately ACK] input relay turns on, the operation starts. Turn off the [Stop Immediately] output relay after confirming that the [Stop Immediately ACK] input relay has turned on. If the [Stop Immediately ACK] input relay has been assigned to the counter relay, confirm that the [Positioning Completed] input relay has turned on instead of confirming the [Stop Immediately ACK] input relay.

(3) The [Positioning Completed] input relay turns on when a positioning, speed control, or jog operation is stopped immediately.

■ Note

- Take care when stopping a motor operating at high speed as the sudden stop may result in a shock to the system.

■ Sample Program

● Description

This sample program immediately stops a positioning operation for axis 1 of the positioning module installed in slot 3.

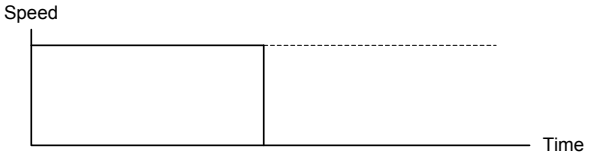


Figure 8.61 Operation Example of the Stop Immediately Command

● List of Devices

Table 8.54 List of Devices Used in the Sample Program for the Stop Immediately Command

Device	Name	Data
Y00341	AX1 Stop Immediately output relay	
X00325	AX1 Positioning Completed input relay	
/I01701	Stop immediately	
/I01702	Stop immediately (differential up)	

● Program Code

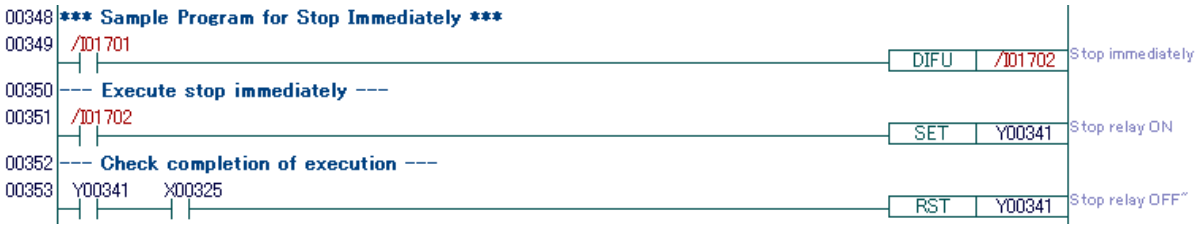


Figure 8.62 Sample Program for the Stop Immediately Command

● Timing Chart

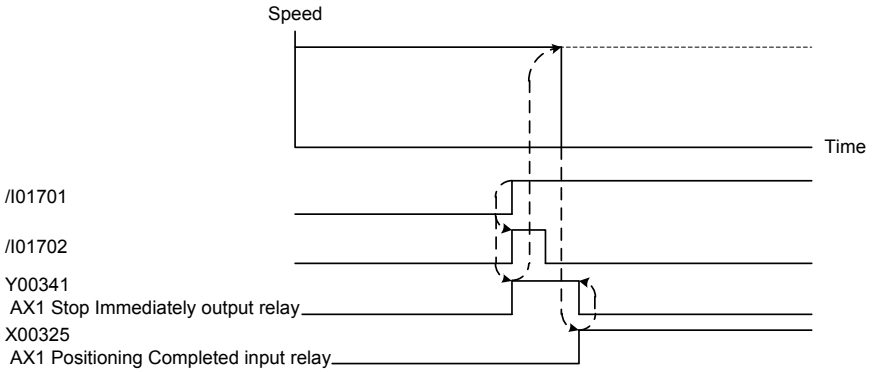


Figure 8.63 Timing Chart for the Stop Immediately Command

8.14 Change Speed

■ Function

This command changes the current speed to a new target speed during a positioning, speed control, or jog operation.

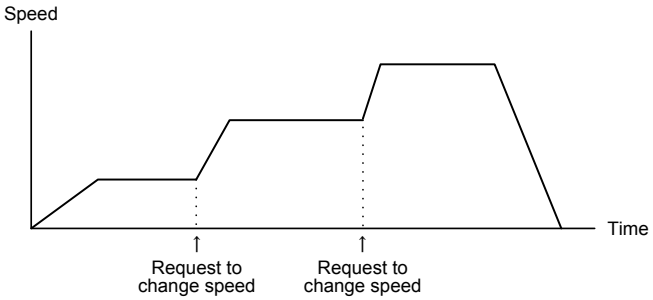


Figure 8.64 Speed Change Operation

This command accelerates or decelerates from the current speed to the target speed in the time specified by the Acceleration Time parameter.

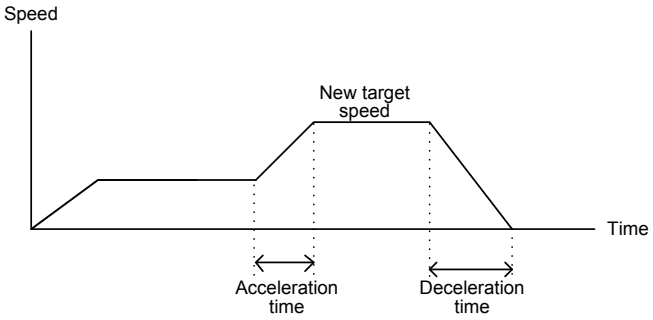


Figure 8.65 Speed Change Operation (Speed Control)

After the speed is changed, when the operation reaches the target position and stops or when a Decelerate and Stop command is issued, the deceleration rate is determined by the new target speed and the deceleration time specified when the Change Speed command is executed.

■ Usage

● Command Parameters

Table 8.55 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.55 Required Parameters for the Change Speed Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	6: Change Speed	○
*46/*47	Target Speed	In position control mode: 1 to Speed Limit [command speed unit] In speed control mode: -(Speed Limit) to Speed Limit [command speed unit]	○
*48	Acceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default acceleration	○
*49	Deceleration Time	0 to 32767 [acceleration/deceleration time unit], -1: Default deceleration	○

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

● Command Acceptance Conditions

Table 8.56 shows pre-conditions for command execution.

Table 8.56 Command Acceptance Conditions for the Change Speed Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
Not in a Positioning Completed state.		○
No origin search is in progress.		○
Not in manual pulse generator mode.		○
Not waiting for any trigger.		○
Not accelerating, changing the speed, or changing the target position in a positioning operation. Not decelerating and stopping in a jog or speed control operation.		○
During a positioning operation, the axis can stop at the target position even after changing to the new speed.		○

● Procedure

(1) Write the "6: Change Speed" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, the speed change operation starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

■ Note

- This command cannot be used to change the operation speed in an origin search or manual pulse generator mode operation.
- If a parameter setting error occurs in a Change Speed command executed during a positioning operation, the positioning operation is stopped (immediately) due to the error.
- The speed cannot be changed in a positioning operation but a warning code is issued if the speed change prevents the axis from stopping at the target position during an acceleration, deceleration, speed change, or target position change operation.
- During a speed control operation, the sign of the target speed specifies the rotation direction. Note, however, that the operation direction cannot be changed in a speed change operation.

  To change the operation direction, execute a Decelerate and Stop command, and then re-execute a Start Speed Control command for the opposite direction.
- If a Change Speed command is issued during a jog or speed control 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, only the new command is executed.

■ Sample Program

● Description

This sample program performs a speed change operation during a speed control operation for axis 1 of the module installed in slot 3.

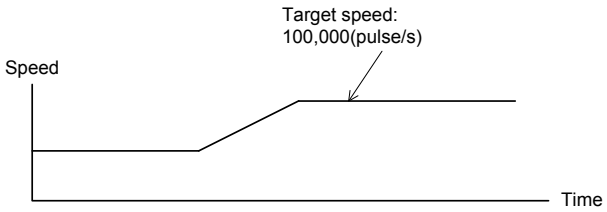


Figure 8.66 Operation Example of the Change Speed Command

● List of Devices

Table 8.57 List of Devices Used in the Sample Program for the Change Speed Command

Device	Name	Data
/D00041	Command Code	6: Change Speed command
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	1000(ms)
/D00049	Deceleration Time	500(ms)
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I01801	Change speed	
/I01802	Change speed (differential up)	
/I01803	Waiting for execute command ACK	
/I01804	Command executing	

● Program Code

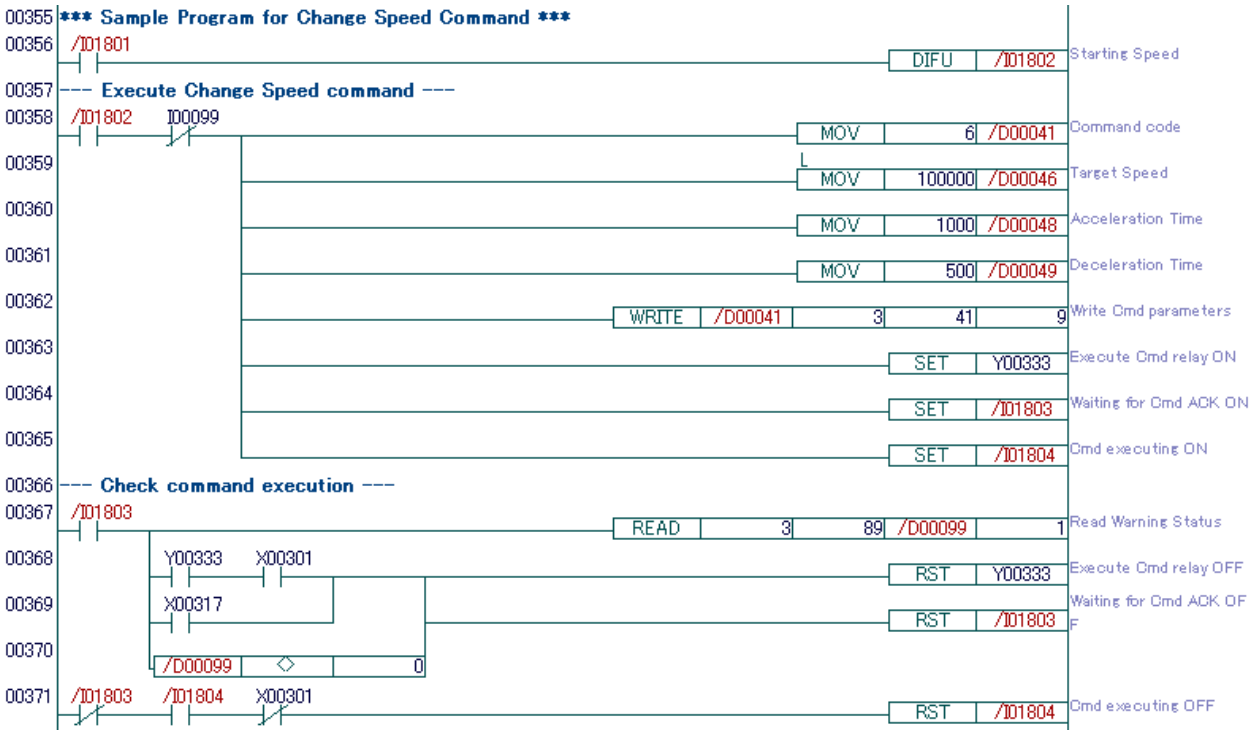


Figure 8.67 Sample Program for the Change Speed Command

● Timing Chart

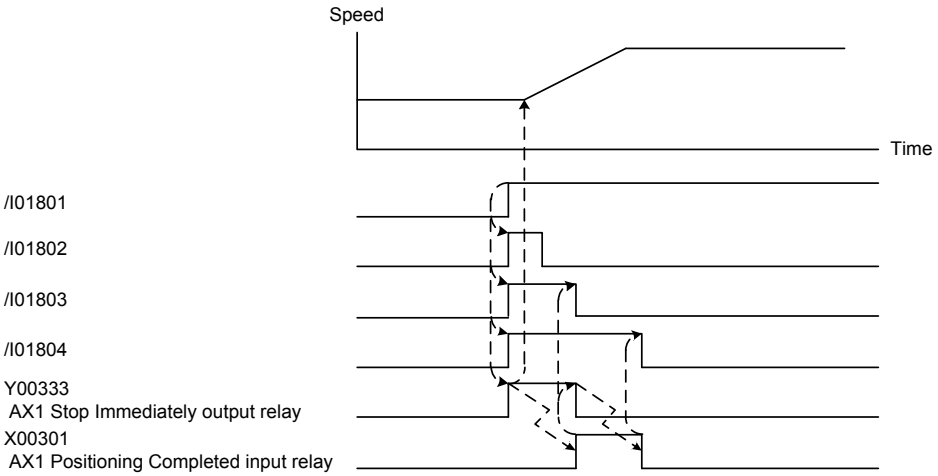


Figure 8.68 Timing Chart for the Change Speed Command

8.15 Set Override

■ Function

This command changes the target speed to 1% to 500% of the current value in a positioning, speed control, or jog operation.

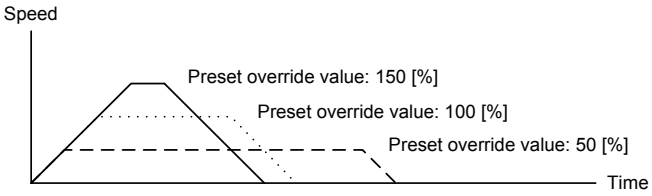


Figure 8.69 Set Override

Regardless of the override setting value, the acceleration/deceleration rate is always determined from the acceleration time, deceleration time, and target speed for an override setting value of 100%.

■ Usage

● Command Parameters

Table 8.58 shows the required parameters for this command.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.58 Required Parameters for the Set Override Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	300: Set Override	○
*69	Preset Override Value	1 to 500 [%]	○

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

● Command Acceptance Conditions

Table 8.59 shows pre-conditions for command execution.

Table 8.59 Command Acceptance Conditions for the Set Override Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress.		
Command parameters are valid.	○	
No error has occurred.		○
In a Positioning Completed state.		○

● Procedure

(1) Write the "300: Set Override" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the command is successfully executed, the [Execute Command ACK] input relay turns on. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

■ Note

- The Set Override command cannot be used in a manual pulse generator mode, manual origin search, and automatic origin search operation. Even if the override value is set to a value other than 100%, the operation is performed with the target speed.
- When the override setting value is changed to a value other than 100%, the acceleration/deceleration rate for an override setting value of 100% is used. Thus, if the current speed does not increase to the target speed, for example, when the current position is close to the target position in a positioning operation, specifying an override setting value larger than 100% may not change the operation (i.e., the current speed may not increase).

■ Sample Program

● Description

This sample program sets the override setting value to 50% for axis 1 of the positioning module installed in slot 3.

● List of Devices

Table 8.60 List of Devices Used in the Sample Program for the Set Override Command

Device	Name	Data
/D00041	Command Code	300: Set Override command
/D00069	Preset Override Value	50 [%]
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
I00099	Command execution disable (to be set elsewhere)	
/I01901	Set override	
/I01902	Set override (differential up)	
/I01903	Waiting for execute command ACK	
/I01903	Command executing	

● Program Code

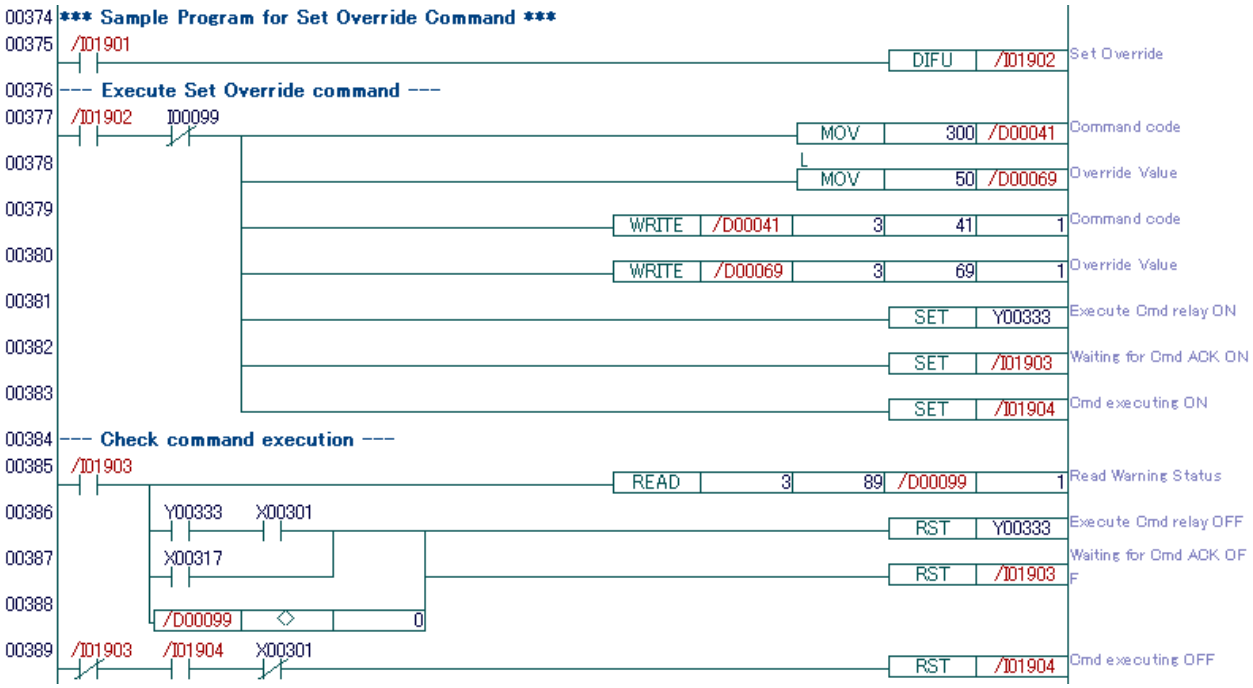


Figure 8.70 Sample Program for the Set Override Command

● Timing Chart

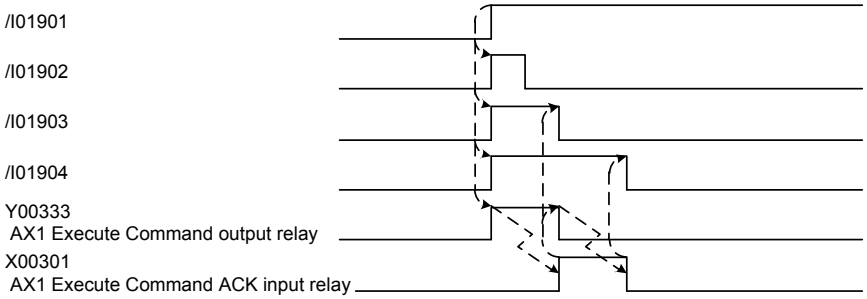


Figure 8.71 Timing Chart for the Set Override Command

8.16 Trigger Setting

There are five types of triggers: software trigger, contact input trigger, counter status trigger, counter zone coincidence trigger, and Positioning Completed input relay trigger. A software trigger is activated from a user application. A contact input trigger is activated when a contact input (forward limit input, reverse limit input, or origin input) for an axis is on. A counter status trigger is activated according to the status for the counter function. A counter zone coincidence trigger is activated when zone coincidence is detected in the counter function. A Positioning Completed input relay trigger is activated when a Positioning Completed input relay for another axis is on.

8.16.1 Software Trigger

■ Function

This trigger is activated when a writing instruction is executed from the CPU module after a command is issued with a trigger condition.

■ Usage

● Command Parameters

Tables 8.61 and 8.62 show the required parameters for executing a command with this type of trigger.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.61 Required Parameters for Executing a Command with a Software Trigger

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	1000: Start Positioning with Trigger 1001: Decelerate and Stop with Trigger 1010: Start Positioning with Trigger and Resetting Current Position 1020: Start Positioning with Position Data Record with Trigger 1400: Start Speed Control with Trigger 1401: Speed Control to Position Control with Trigger	○
*42 to *57	Parameters for each command	The parameters depend on each command.	○
*63	Trigger Setting	0: Software trigger	○
*64	Trigger Axis Setting	0, 1 to 8 [axes] (If 0 is selected, the trigger is activated when a writing operation is performed to the software trigger request for the axis from which the command is issued. If a value from 1 to 8 is selected, the trigger is activated when a writing operation is performed to the software trigger request for the data position number of the axis corresponding to the selected value.)	○

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

Table 8.62 Parameters for the Software Trigger Request

Data Position No. (Word Basis)	Parameter	Description
*77	Software Trigger Request	1: A software trigger is activated by writing "1" during a software trigger wait state.

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

● Command Acceptance Conditions

The command acceptance conditions for the command to be executed are applied.

● Procedure (for the Start Positioning with Trigger Command)

(1) Write the "1000: Start Positioning with Trigger" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, a trigger input wait state starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.
- In a trigger input wait state, the [Positioning Completed] input relay turns off even if no positioning operation is being performed.

(4) Write 1 from an application to "Software Trigger Request" to activate the trigger.

(5) When the trigger is activated and the positioning operation reaches the target position, the [Positioning Completed] input relay turns on.

■ Note

- To cancel a trigger input wait state, execute a Decelerate and Stop command or issue a stop immediately request. A trigger input wait state is cancelled also when the operation stops due to an error.
- Software Trigger Request (*77) can be used only for writing. Writing 1 to this parameter during a software trigger wait state activates the software trigger. Reading this parameter has no effect.
- After a command that refers to a position data record is issued and a trigger wait state starts, the contents of the position data record cannot be modified. The contents that are in the position data record when the command is issued are used when the command is executed.

■ Sample Program

● Description

This sample program executes a positioning operation with a software trigger for axis 1 of the positioning module installed in slot 3.

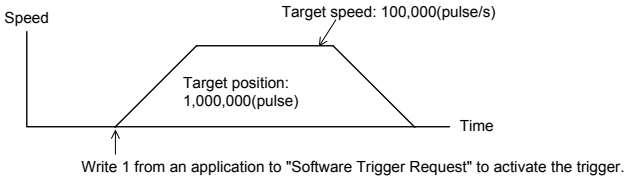


Figure 8.72 Example of a Positioning Operation with a Software Trigger

● List of Devices

Table 8.63 List of Devices Used in the Sample Program for a Start Positioning Command with a Software Trigger

Device	Name	Data
/D00041	Command Code	1000: Start Positioning with Trigger command
/D00042	Target Position Mode/Data Record No.	0: Using ABS position
/D00043/D00044	Target Position	1,000,000(pulse)
/D00045	Accel/Decel Mode	0:Trapezoidal acceleration/deceleration
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00063	Trigger Setting	0: Software trigger
/D00064	Trigger Axis Setting	0:an axis from which the command is issued is used.
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I02001	Positioning	
/I02002	Positioning (differential up)	
/I02003	Waiting for execute command ACK	
/I02004	Positioning in progress	
/I02005	Request software trigger	
/I02006	Request software trigger (differential up)	

■ Program Code

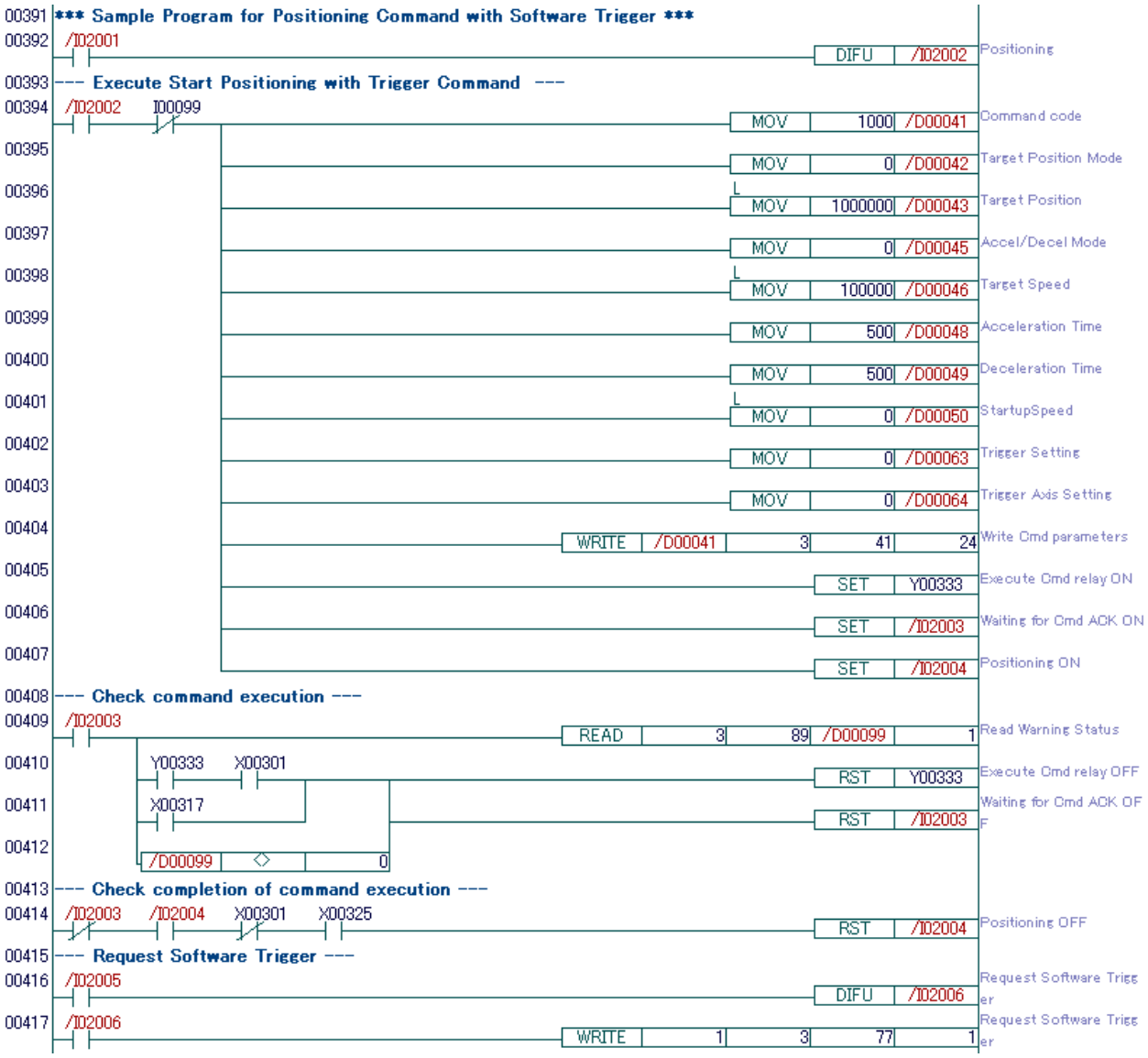


Figure 8.73 Sample Program for a Start Positioning Command with a Software Trigger

● Timing Chart

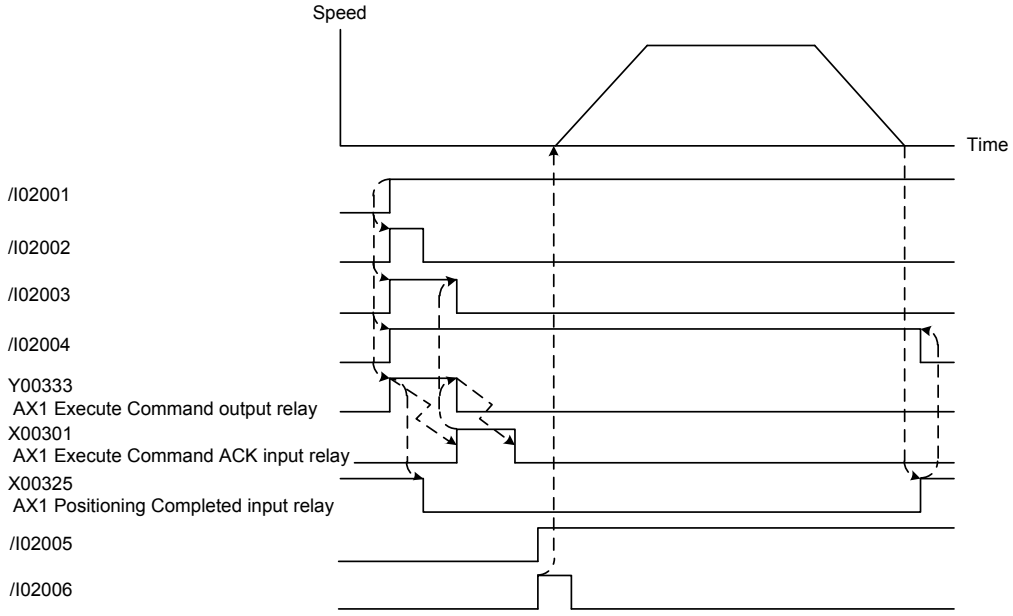


Figure 8.74 Timing Chart for a Start Positioning Command with a Software Trigger

8.16.2 Contact Input Trigger

■ Function

This trigger is activated when a contact input (forward limit input, reverse limit input, or origin input) is on after a command is issued with a trigger condition.

■ Usage

● Command Parameters

Table 8.64 shows the required parameters for executing a command with this type of trigger.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.64 Required Parameters for Executing a Command with a Contact Input Trigger

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	1000: Start Positioning with Trigger 1001: Decelerate and Stop with Trigger 1010: Start Positioning with Trigger and Resetting Current Position 1020: Start Positioning with Position Data Record with Trigger 1400: Start Speed Control with Trigger 1401: Speed Control to Position Control with Trigger	○
*42 to *57	Parameters for each command	The parameters depend on each command.	○
*63	Trigger Setting	1: Contact input trigger	○
*65	Trigger Contact Setting	0: Reverse limit input 1: Forward limit input 2: Origin input	○

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

● Command Acceptance Conditions

The command acceptance conditions for the command to be executed are applied.

● Procedure (for the Start Positioning with Trigger Command)

(1) Write the "1000: Start Positioning with Trigger" command code and the required parameters to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, a trigger input wait state starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.
- In a trigger input wait state, the [Positioning Completed] input relay turns off even if no positioning operation is being performed.

(4) When the contact specified by Trigger Contact Setting is on, the trigger is activated and the positioning operation starts.

■ Note

- To cancel a trigger input wait state, execute a Decelerate and Stop command or issue a stop immediately request. A trigger input wait state is cancelled also when the operation stops due to an error.
- When you use the forward or reverse limit input as a trigger input, disable the limit input error detection in the Contact Input Setting registered parameter.
- A contact input trigger is activated when a contact input is on. When a command with a trigger condition is issued, if the contact input is already on, the command is processed immediately. (Note that this is not a trigger input by a rising edge of the contact input.)
- After a command that refers to a position data record is issued and a trigger wait state starts, the contents of the position data record cannot be modified. The contents that are in the position data record when the command is issued are used when the command is executed.
- To specify a high-speed contact input for the counter as a trigger condition, use a counter status trigger instead of a contact input trigger.

■ Sample Program

● Description

This sample program executes a positioning operation that uses the on state of the origin input as a contact input trigger for axis 1 of the positioning module installed in slot 3.

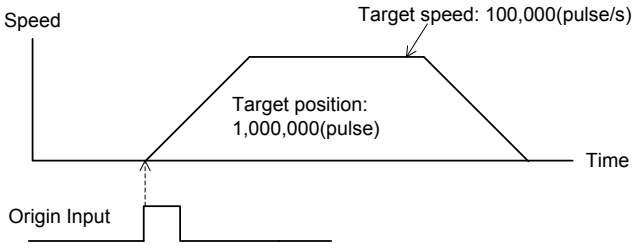


Figure 8.75 Example of a Positioning Operation with a Contact Input Trigger

● List of Devices

Table 8.65 List of Devices Used in the Sample Program for a Start Positioning Command with a Contact Input Trigger

Device	Name	Data
/D00041	Command Code	1000: Start Positioning with Trigger command
/D00042	Target Position Mode/Data Record No.	0: Using ABS position
/D00043/D00044	Target Position	1,000,000(pulse)
/D00045	Accel/Decel Mode	0:Trapezoidal acceleration/deceleration
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00063	Trigger Setting	1: Contact input trigger
/D00065	Trigger Contact Setting	2: Origin input
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I02101	Positioning	
/I02102	Positioning (differential up)	
/I02103	Waiting for execute command ACK	
/I02104	Positioning in progress	

■ Program Code

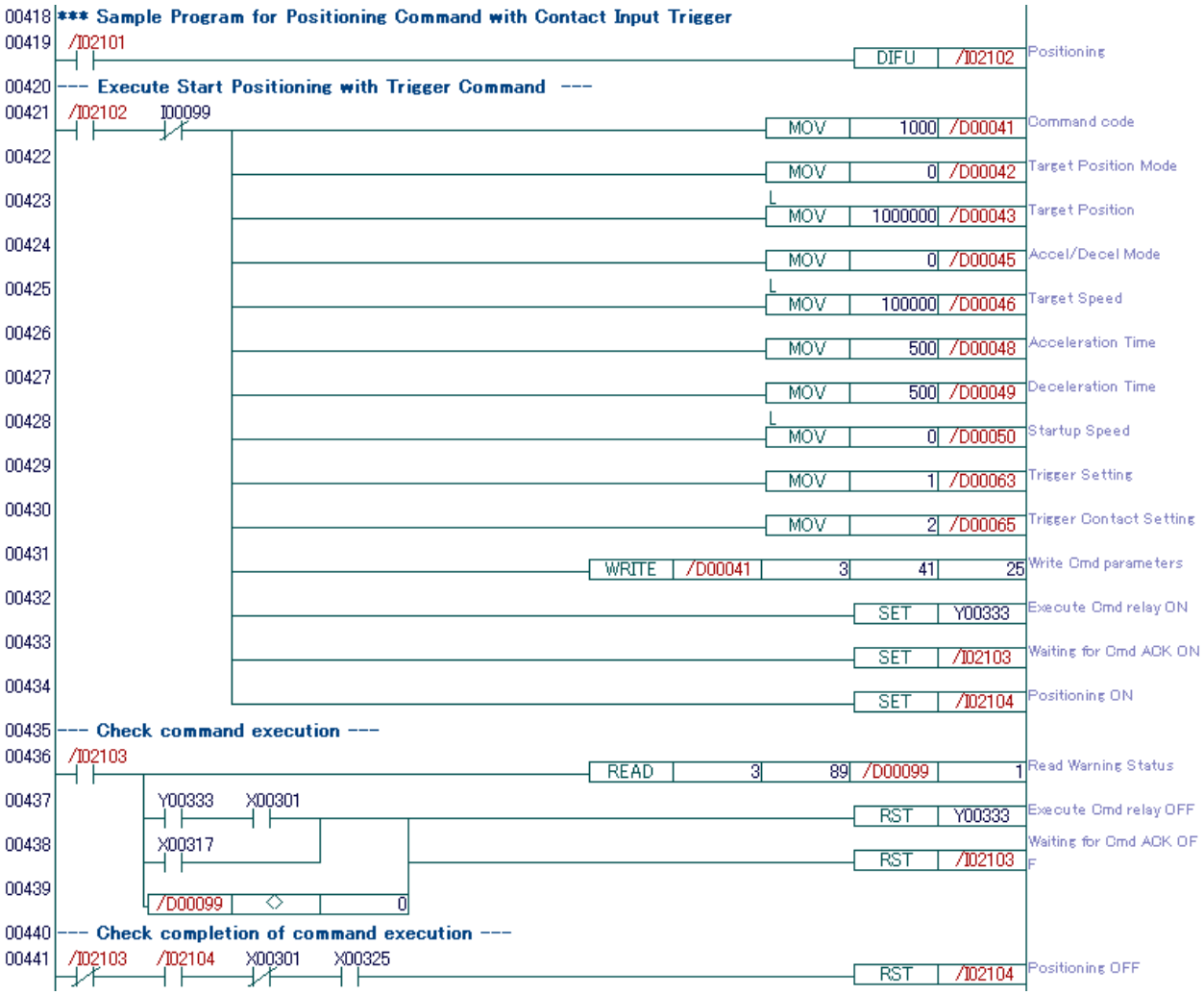


Figure 8.76 Sample Program for a Start Positioning Command with a Contact Input Trigger

● Timing Chart

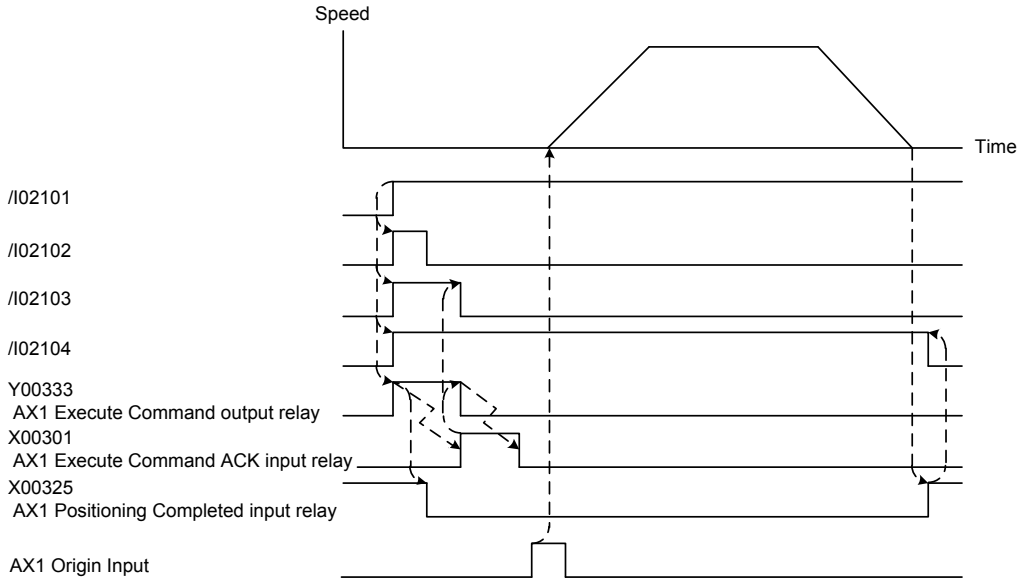


Figure 8.77 Timing Chart for a Start Positioning Command with a Contact Input Trigger

8.16.3 Counter Status Trigger

■ Function

This trigger is activated when a counter bit status of a counter input (such as counter coincidence detection or counter contact input) is on after a command is issued with a trigger condition.

■ Usage

● Command Parameters

Table 8.66 shows the required parameters for executing a command with this type of trigger.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

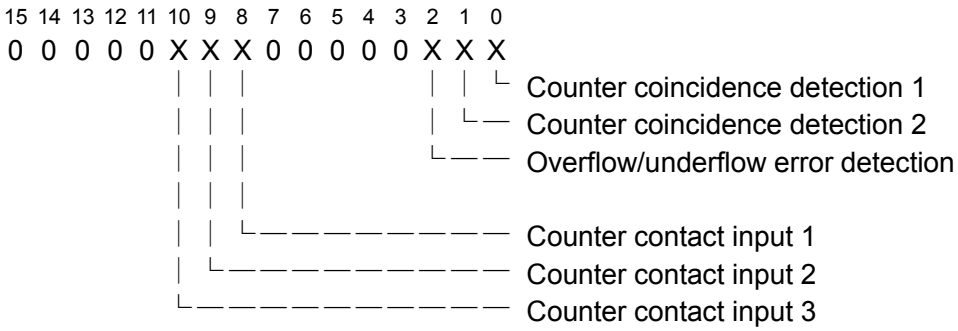
Table 8.66 Required Parameters for Executing a Command with a Counter Status Trigger

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	1000: Start Positioning with Trigger 1001: Decelerate and Stop with Trigger 1010: Start Positioning with Trigger and Resetting Current Position 1020: Start Positioning with Position Data Record with Trigger 1400: Start Speed Control with Trigger 1401: Speed Control to Position Control with Trigger	○
*42 to *57	Parameters for each command	The parameters depend on each command.	○
*63	Trigger Setting	2: Counter status trigger	○
*66	Counter Status Trigger Setting	$0000 or greater (bit data)	○

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

Counter Status Trigger Setting

Specify a bit in Counter Bit Status that is used as a trigger input. For details on Counter Bit Status, see 7.2.2, "Description of Counter Statuses."



● Command Acceptance Conditions

The command acceptance conditions for the command to be executed are applied.

● Procedure (for the Start Positioning with Trigger Command)

(1) Set up the counter so that the status bit of the counter turns on when an action occurs that activates a trigger.

(2) Write the "1000: Start Positioning with Trigger" command code and the required parameters to the command parameter area of the command axis. Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, a trigger input wait state starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.
- In a trigger input wait state, the [Positioning Completed] input relay turns off even if no positioning operation is being performed.

(4) When the specified bit of Counter Bit Status is on, the trigger is activated.

(5) When the trigger is activated and the positioning operation reaches the target position, the [Positioning Completed] input relay turns on.

■ Note

- To cancel a trigger input wait state, execute a Decelerate and Stop command or issue a stop immediately request. A trigger input wait state is cancelled also when the operation stops due to an error.
- A counter status trigger is activated when the relevant status is on. When a command with a trigger condition is issued, if the status is already on, the command is processed immediately. (Note that this is not a trigger input by a rising edge of a counter bit status.)
- After a command that refers to a position data record is issued and a trigger wait state starts, the contents of the position data record cannot be modified. The contents that are in the position data record when the command is issued are used when the command is executed.

■ Sample Program

● Description

This sample program executes a positioning operation with a counter status trigger for axis 1 of the positioning module installed in slot 3.

This sample program uses the on state of bit 1 (counter coincidence detection 2) of Counter Bit Status as a trigger condition.

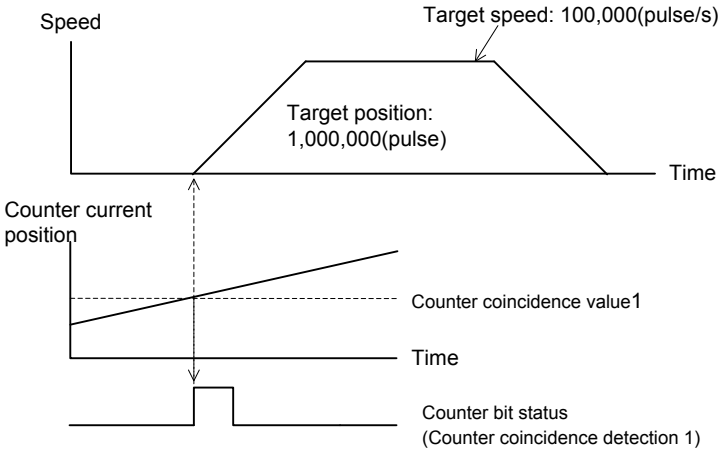


Figure 8.78 Example of a Positioning Operation with a Counter Status Trigger

● List of Devices

Table 8.67 List of Devices Used in the Sample Program for a Start Positioning Command with a Counter Status Trigger

Device	Name	Data
/D00041	Command Code	1000: Start Positioning with Trigger command
/D00042	Target Position Mode/Data Record No.	0: Using ABS position
/D00043/D00044	Target Position	1,000,000(pulse)
/D00045	Accel/Decel Mode	0:Trapezoidal acceleration/deceleration
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00063	Trigger Setting	2: Counter status trigger
/D00066	Counter Status Trigger Setting	$0002 (Counter coincidence detection 2)
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I02201	Positioning	
/I02202	Positioning (differential up)	
/I02203	Waiting for execute command ACK	
/I02204	Positioning in progress	

● Program Code

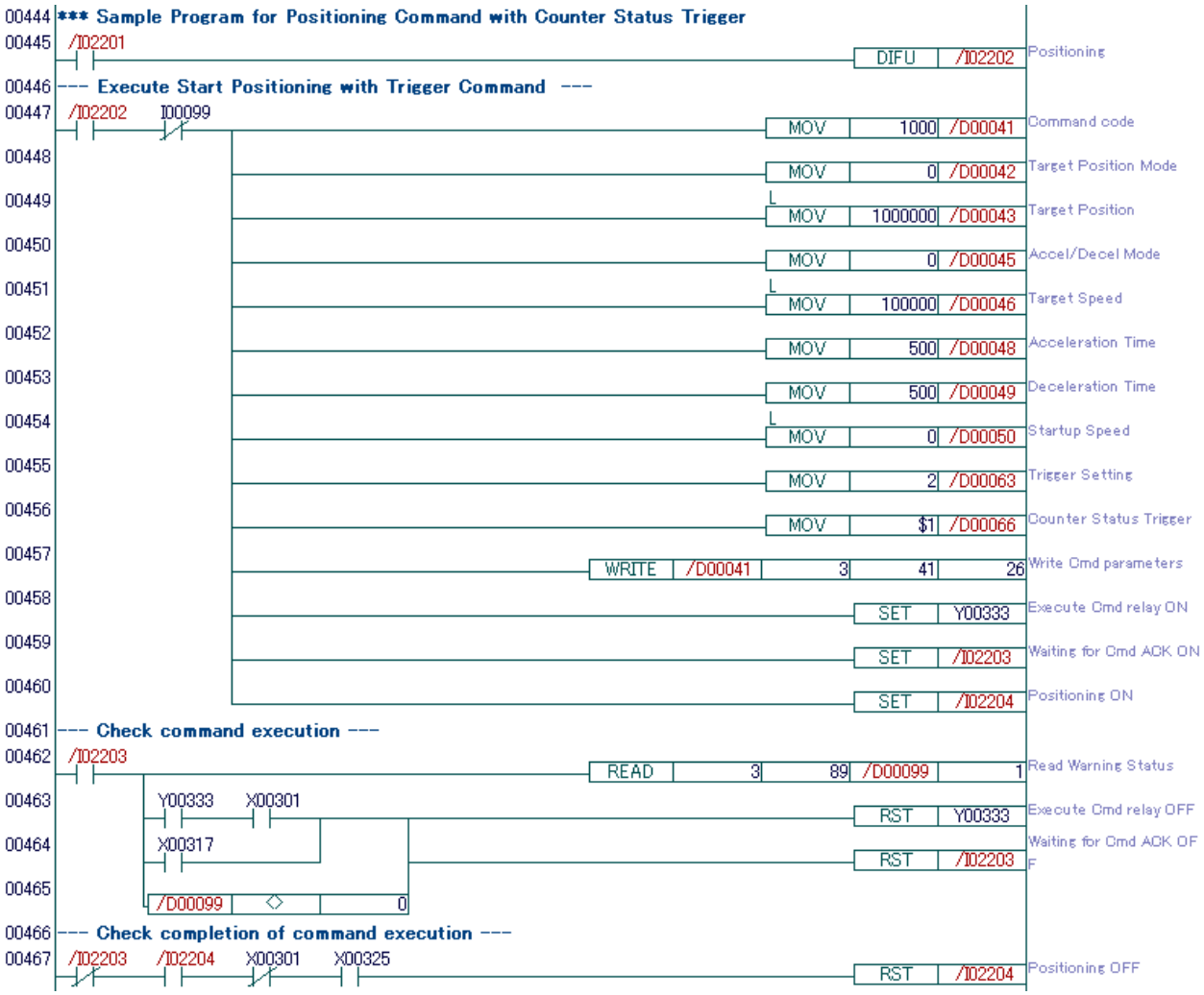


Figure 8.79 Sample Program for a Start Positioning Command with a Counter Status Trigger

● Timing Chart

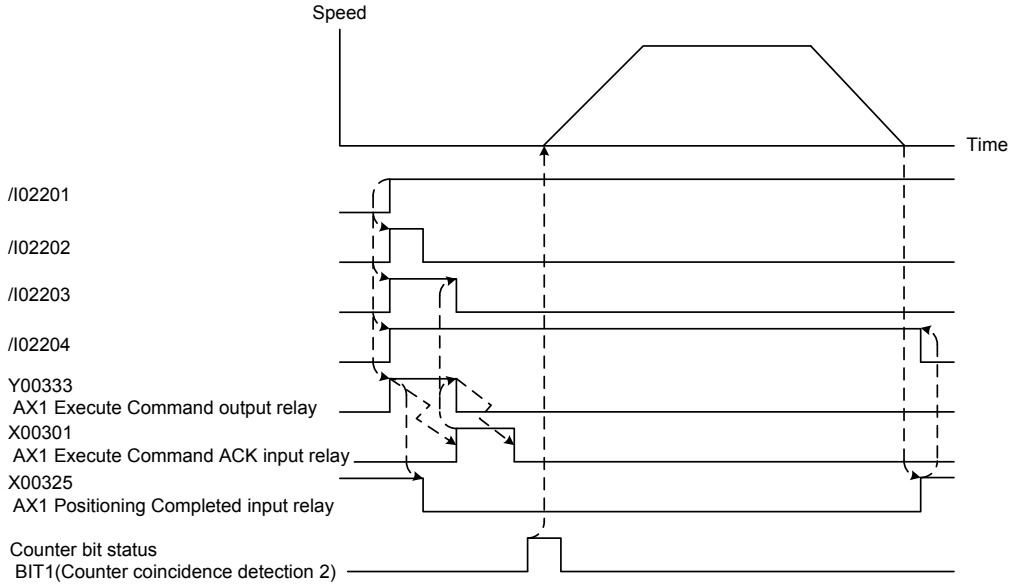


Figure 8.80 Timing Chart for a Start Positioning Command with a Counter Status Trigger

8.16.4 Counter Zone Coincidence Trigger

■ Function

This trigger is activated when a counter bit status of a counter input (counter zone coincidence) is on after a command is issued with a trigger condition.

■ Usage

● Command Parameters

Table 8.68 shows the required parameters for executing a command with this type of trigger.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

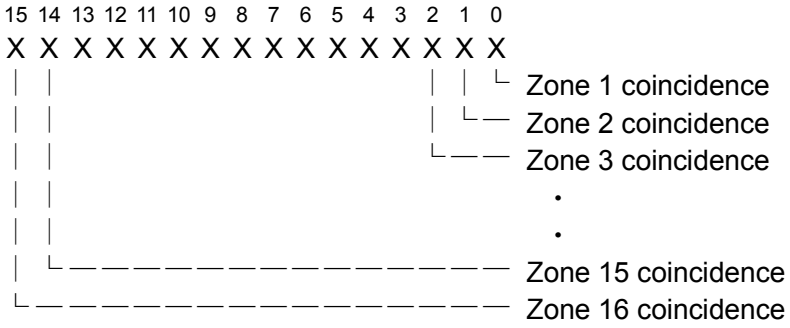
Table 8.68 Required Parameters for Executing a Command with a Counter Zone Coincidence Trigger

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	1000: Start Positioning with Trigger 1001: Decelerate and Stop with Trigger 1010: Start Positioning with Trigger and Resetting Current Position 1020: Start Positioning with Position Data Record with Trigger 1400: Start Speed Control with Trigger 1401: Speed Control to Position Control with Trigger	○
*42 to *57	Parameters for each command	The parameters depend on each command.	○
*63	Trigger Setting	3: Counter zone coincidence trigger	○
*67	Counter Zone Coincidence Trigger Setting	$0000 or greater (bit data)	○

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

Counter Zone Coincidence Trigger Setting

Specify a zone coincidence bit in Counter Bit Status that is used as a trigger input. For details on Counter Bit Status, see 7.2.2, "Description of Counter Statuses."



● Command Acceptance Conditions

The command acceptance conditions for the command to be executed are applied.

● Procedure (for the Start Positioning with Trigger Command)

(1) Specify the upper limit and lower limit of a counter zone so that a zone coincidence bit in Counter Bit Status turns on when the counter current position satisfies a trigger condition.

(2) Write the "1000: Start Positioning with Trigger" command code and the required parameters to the command parameter area of the command axis. Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, a trigger input wait state starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) When the counter current position is between the specified upper and lower limits of the counter zone, the specified zone coincidence detection bit in Counter Bit Status turns on and the trigger is activated.

(5) When the trigger is activated and the positioning operation reaches the target position, the [Positioning Completed] input relay turns on.

■ Note

- To cancel a trigger input wait state, execute a Decelerate and Stop command or issue a stop immediately request. A trigger input wait state is cancelled also when the operation stops due to an error.
- A counter zone coincidence trigger is activated when the relevant status is on. When a command with a trigger condition is issued, if the status is already on, the command is processed immediately. (Note that this is not a trigger input by a rising edge of a counter bit status.)
- After a command that refers to a position data record is issued and a trigger wait state starts, the contents of the position data record cannot be modified. The contents that are in the position data record when the command is issued are used when the command is executed.

■ Sample Program

● Description

This sample program executes a positioning operation with a counter zone coincidence trigger for axis 1 of the positioning module installed in slot 3.

This sample program uses the on state of bit 17 (counter zone coincidence 1) of Counter Bit Status as a trigger condition.

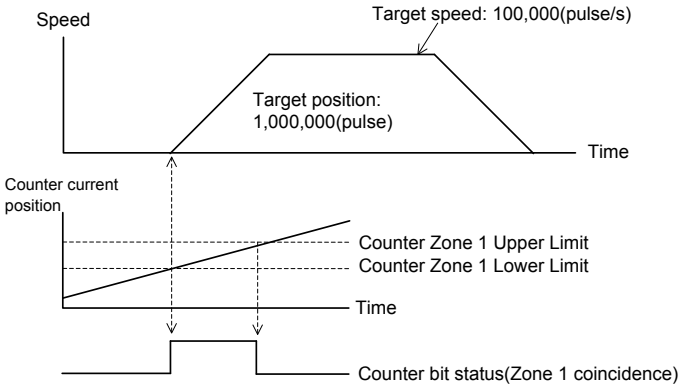


Figure 8.81 Example of a Positioning Operation with a Counter Zone Coincidence Trigger

● List of Devices

Table 8.69 List of Devices Used in the Sample Program for a Start Positioning Command with a Counter Zone Coincidence Trigger

Device	Name	Data
/D00041	Command Code	1000: Start Positioning with Trigger command
/D00042	Target Position Mode/Data Record No.	0: Using ABS position
/D00043/D00044	Target Position	1,000,000(pulse)
/D00045	Accel/Decel Mode	0:Trapezoidal acceleration/deceleration
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00063	Trigger Setting	3:Counter zone coincidence trigger
/D00067	Counter Zone Coincidence Trigger Setting	$0001 (Zone 1 coincidence)
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I02301	Positioning	
/I02302	Positioning (differential up)	
/I02303	Waiting for execute command ACK	
/I02304	Positioning in progress	

● Program Code

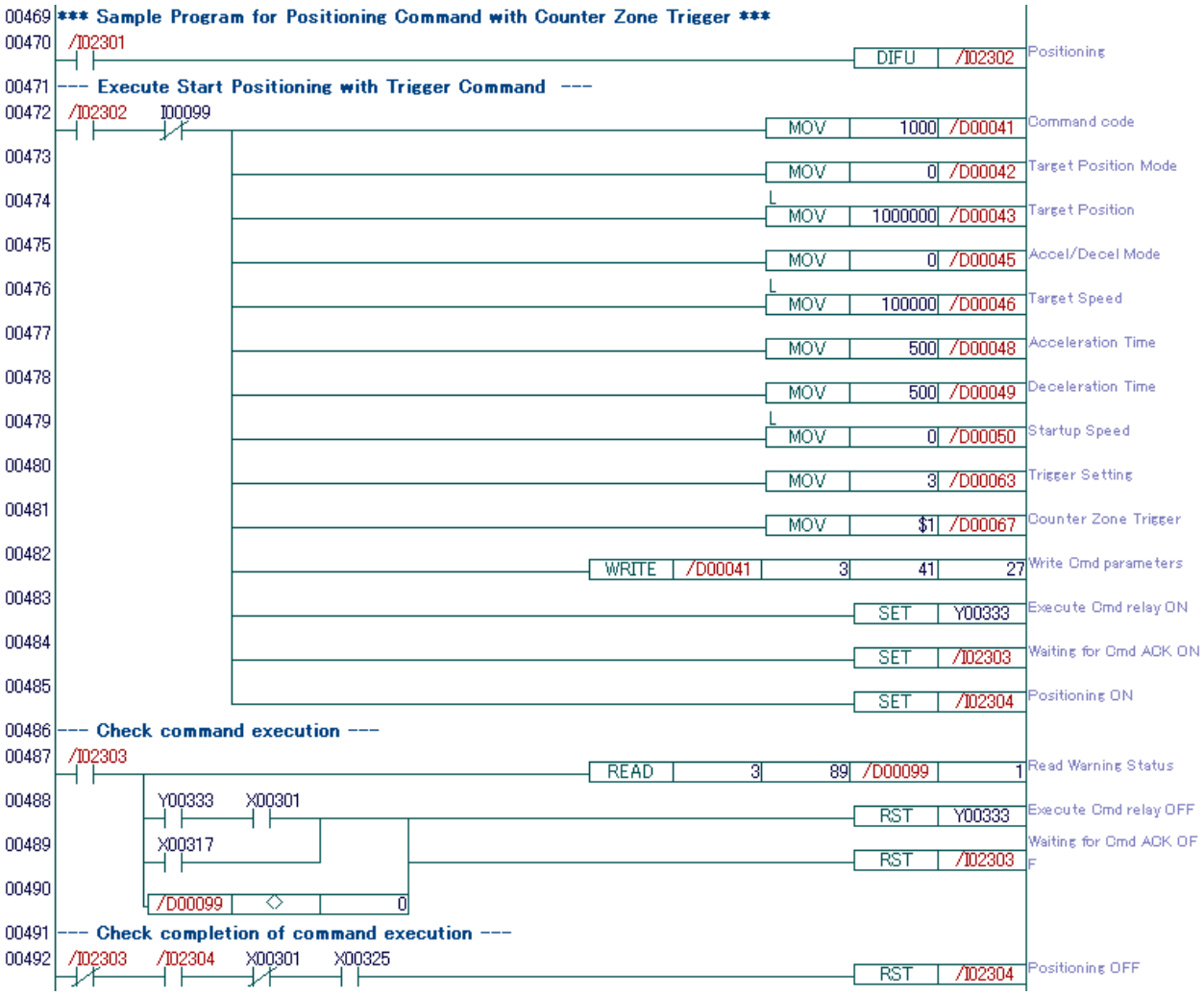


Figure 8.82 Sample Program for a Start Positioning with a Counter Zone Coincidence Trigger Command

● Timing Chart

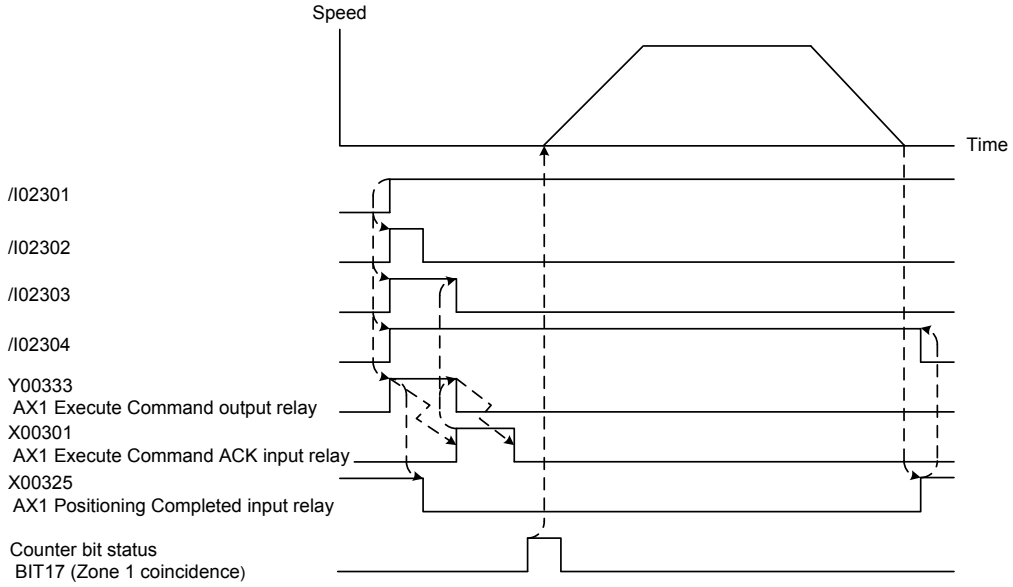


Figure 8.83 Timing Chart for a Start Positioning with a Counter Zone Coincidence Trigger Command

8.16.5 Positioning Completed Input Relay Trigger

■ Function

This trigger is activated when a Positioning Completed input relay for another axis is on after a command is issued with a trigger condition.

■ Usage

■ Command Parameters

Table 8.70 shows the required parameters for executing a command with this type of trigger.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.70 Required Parameters for Executing a Command with a Positioning Completed Input Relay Trigger

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	1000: Start Positioning with Trigger 1001: Decelerate and Stop with Trigger 1010: Start Positioning with Trigger and Resetting Current Position 1020: Position Data Record Start Positioning with Trigger 1400: Start Speed Control with Trigger 1401: Speed Control to Position Control with Trigger	○
*42 to *57	Parameters for each command	The parameters depend on each command.	○
*63	Trigger Setting	4: Positioning Completed input relay trigger	○
*64	Trigger Axis Setting	1 to 8 [axes] (An error occurs if the command axis is selected.)	○

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

● Command Acceptance Conditions

The command acceptance conditions for the command to be executed are applied.

● Procedure (for the Start Positioning with Trigger Command)

(1) Move another axis (by turning off the Positioning Completed input relay for the axis) that is specified by Trigger Axis Setting and used as a trigger condition.

(2) Write the "1000: Start Positioning with Trigger" command code and the required parameters to the command parameter area of the command axis. Turn on the [Execute Command] output relay for the command axis.

(3) When the [Execute Command ACK] input relay turns on, a trigger input wait state starts. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

(4) When the Positioning Completed input relay for the axis specified by Trigger Axis Setting is on, the trigger is activated.

(5) When the trigger is activated and the positioning operation reaches the target position, the [Positioning Completed] input relay turns on.

■ Note

- To cancel a trigger input wait state, execute a Decelerate and Stop command or issue a stop immediately request. A trigger input wait state is cancelled also when the operation stops due to an error.
- A Positioning Completed input relay trigger is activated when the relevant relay is on. When a command with a trigger condition is issued, if the relay is already on, the command is processed immediately. (Note that this is not a trigger input by a rising edge of a Positioning Completed input relay.)
- After a command that refers to a position data record is issued and a trigger wait state starts, the contents of the position data record cannot be modified. The contents that are in the position data record when the command is issued are used when the command is executed.

■ Sample Program

● Description

This sample program executes a positioning operation with a Positioning Completed input relay trigger for axis 1 of the positioning module installed in slot 3.

This sample program uses the on state of the AX2 Positioning Completed input relay as a trigger condition.

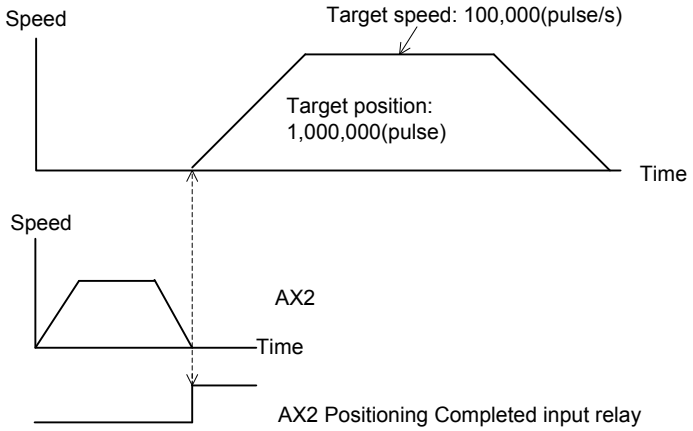


Figure 8.84 Example of a Positioning Operation with a Counter Zone Coincidence Trigger

● List of Devices

Table 8.71 List of Devices Used in the Sample Program for a Start Positioning Command with a Positioning Completed Input Relay Trigger

Device	Name	Data
/D00041	Command Code	1000: Start Positioning with Trigger command
/D00042	Target Position Mode/Data Record No.	0: Using ABS position
/D00043/D00044	Target Position	1,000,000(pulse)
/D00045	Accel/Decel Mode	0:Trapezoidal acceleration/deceleration
/D00046/D00047	Target Speed	100,000(pulse/s)
/D00048	Acceleration Time	500(ms)
/D00049	Deceleration Time	500(ms)
/D00050/D00051	Startup Speed	0(pulse/s)
/D00063	Trigger Setting	4: Positioning Completed input relay trigger
/D00064	Trigger Axis Setting	2: AX2 Positioning Completed input relay
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
X00325	AX1 Positioning Completed input relay	
I00099	Command execution disable (to be set elsewhere)	
/I02401	Positioning	
/I02402	Positioning (differential up)	
/I02403	Waiting for execute command ACK	
/I02404	Positioning in progress	

● Program Code

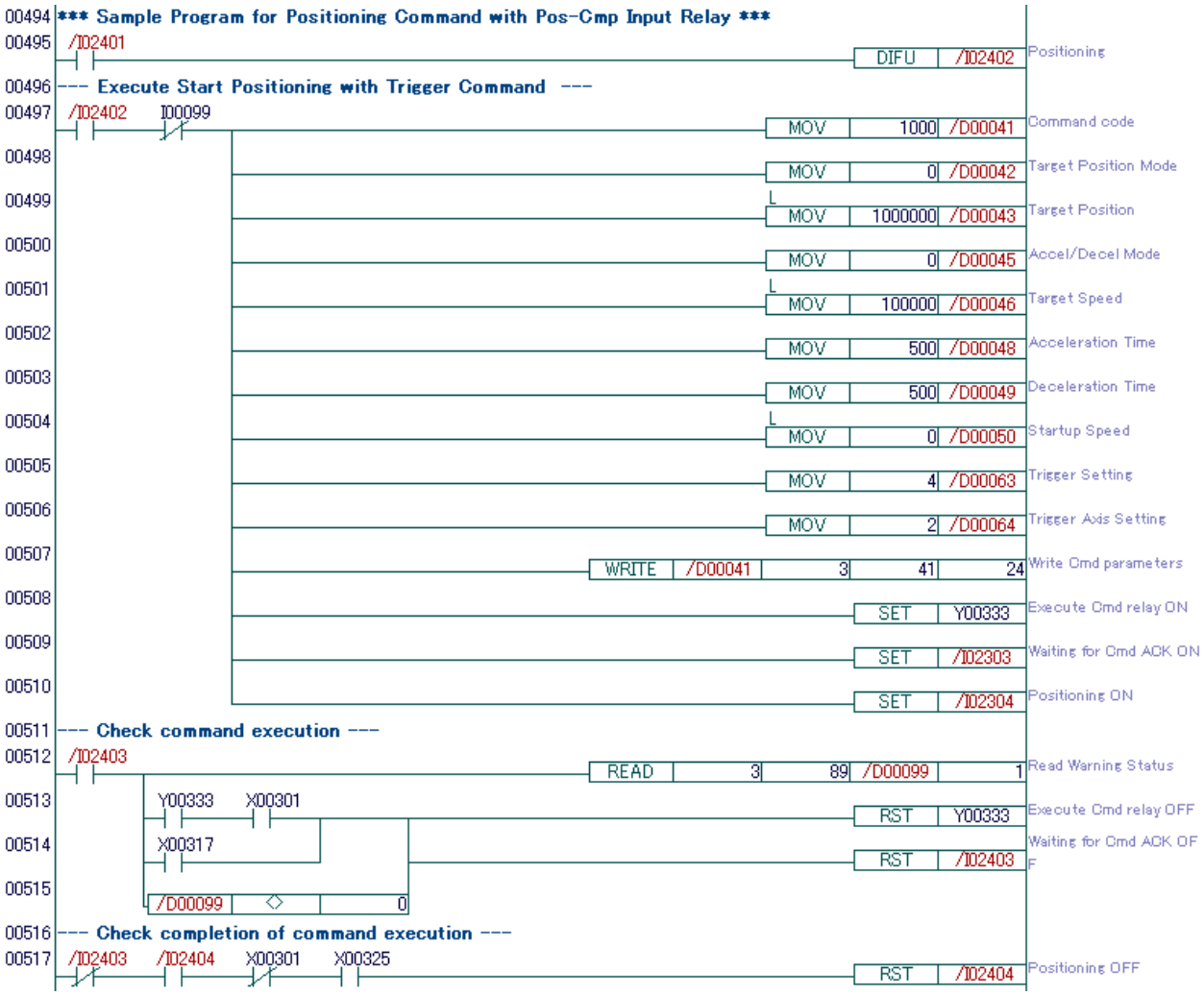


Figure 8.85 Sample Program for a Start Positioning Command with a Positioning Completed Input Relay Trigger

● Timing Chart

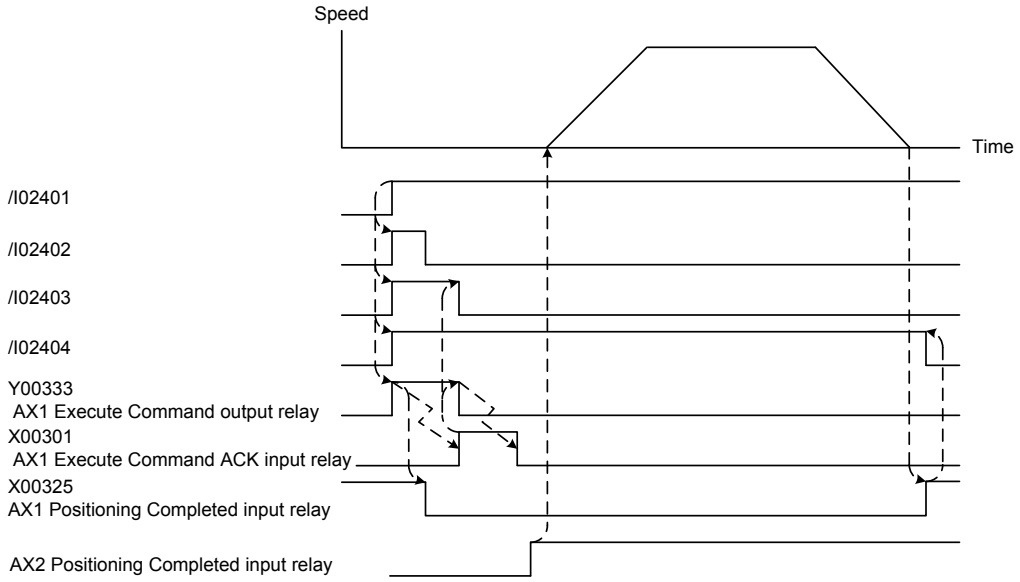


Figure 8.86 Timing Chart for a Start Positioning Command with a Positioning Completed Input Relay Trigger

8.17 Save to/Initialize Flash Memory

■ Function

● Save to Flash Memory

After specifying parameters, you can save the parameters to the flash memory in this module.

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

Table 8.72 Parameters to Be Saved to the Flash Memory

Parameters to Be Saved
Registered parameters for each axis (parameters specified by a Set Registered Parameters command)
Position data records
Counter registered parameters (parameters specified with Counter Registered Parameters Request)
Part of counter control parameters (Counter Preset Value, Preset Counter Coincidence Value 1 to 2, Counter Zone 1 to 16 Lower Limit/Upper Limit)

The registered parameters and counter registered parameters for each axis must be specified by a suitable command before executing the command. For the position data records and counter control parameters, the Save to Flash Memory command saves the values specified (or written) in them at the time when the command is executed.

● Initialize Flash Memory

You can initialize the parameters saved in the flash memory to the factory defaults.

CAUTION

- If the power to the positioning module is cut off while parameters are being saved, the contents of the parameters 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 the parameters to the flash memory only when required.
- The module operates properly even if you do not save all parameters to the flash memory.

  (When you use an application program that is configured from the CPU module at power up, you do not need to save parameters to the flash memory.)
- After executing the Initialize Flash Memory command, turn the power supply module off and on.

■ Usage

● Command Parameters

Table 8.73 shows the required parameters for these commands.

○: Mandatory parameters.

△: Mandatory if the command is to be executed in the Positioning Completed status.

▲: Mandatory depending on the values of other parameters.

Table 8.73 Required Parameters for the Save to/Initialize Flash Memory Command

Data Position No. (Word Basis)	Parameter	Description	Mandatory or not
*41	Command Code	9: Save to Flash Memory 99: Initialize Flash Memory	○

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

● Command Acceptance Conditions

Table 8.74 shows pre-conditions for command execution.

Table 8.74 Command Acceptance Conditions for the Save to/Initialize Flash Memory Command

Command Acceptance Conditions	Error Code	Warning Code
No acceptance of another command is in progress for any axes.		
No error has occurred for any axes.		○*1
All axes are in a Positioning Completed state.		○

*1: The Initialize Flash Memory command is accepted even if an error has occurred.

● Procedure

(1) Write the "9: Save to Flash Memory" or "99: Initialize Flash Memory" command code to the command parameter area of the command axis.

(2) Turn on the [Execute Command] output relay for the command axis.

(3) When the command is successfully executed, the [Execute Command ACK] input relay turns on. Turn off the [Execute Command] output relay after confirming that the [Execute Command ACK] input relay has turned on.

(4) If the Initialize Flash Memory command has been executed, turn the power supply module off and on to reset the module.

- If parameter data is invalid, the [Execute Command ACK] input relay does not turn on. Instead, the [Error Detected] input relay turns on, and an error code is stored in Error Status.
- If any command acceptance condition is not satisfied, the [Execute Command ACK] input relay does not turn on. Instead, the command is not executed, and a warning code is stored in Warning Status. Turning off the [Execute Command] output relay clears the warning code.

■ Note

- The Save to Flash Memory command and Initialize Flash Memory command can be executed for any axes. Note, however, that the execution affects the registered parameters and counter registered parameters for all axes, the contents of position data records, and some of the counter control parameters.
- If the power to the positioning module is cut off while parameters are being saved, the contents of the parameters will be lost. (The contents of the parameters previously saved may also 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 the parameters to the flash memory only when required.
- After executing the Initialize Flash Memory command, turn the power supply module off and on.

■ Sample Program

● Description

This sample program saves all parameters to the flash memory on the positioning module installed in slot 3. (To initialize the flash memory, change the command code to 99.)

● List of Devices

Table 8.75 List of Devices Used in the Sample Program for the Save to Flash Memory Command

Device	Name	Data
/D00041	Command Code	9: Save to Flash Memory command
/D00099	Warning Status	
Y00333	AX1 Execute Command output relay	
X00301	AX1 Execute Command ACK input relay	
X00317	AX1 Error Detected input relay	
I00099	Command execution disable (to be set elsewhere)	
/I02501	Save to flash memory	
/I02502	Save to flash memory(differential up)	
/I02503	Waiting for execute command ACK	
/I02504	Command executing	

● Program Code

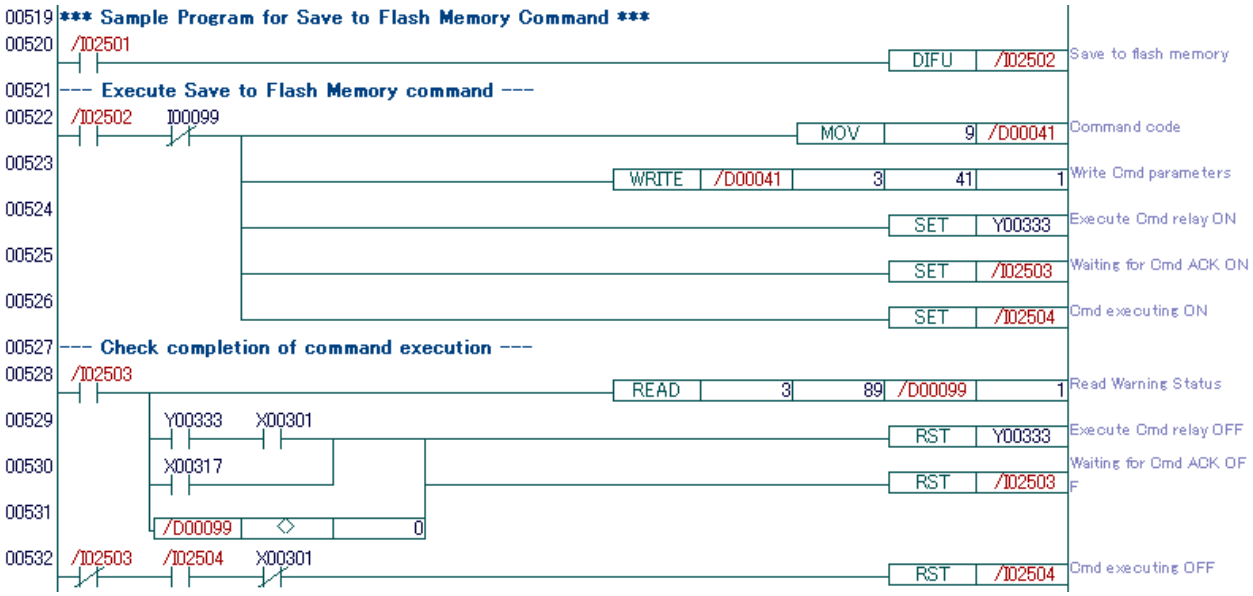


Figure 8.87 Sample Program for the Save to Flash Memory Command

● Timing Chart

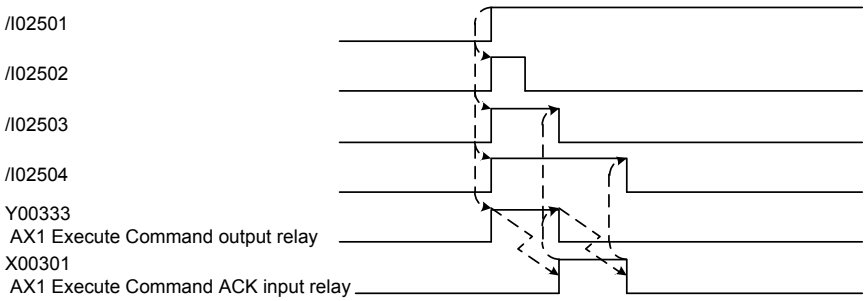


Figure 8.88 Timing Chart for the Save to Flash Memory Command

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9. Counter Programs

This chapter describes the functions, usage, and notes of the counter with sample programs.

The programming examples shown in this chapter assume that the positioning module is installed in slot 3 (slot #003) of the main unit.

9.1 Operation Procedure

Figure 9.1 shows an operation procedure flowchart for a typical operation with the counter.

For details, refer to Sections 9.2 through 9.8.

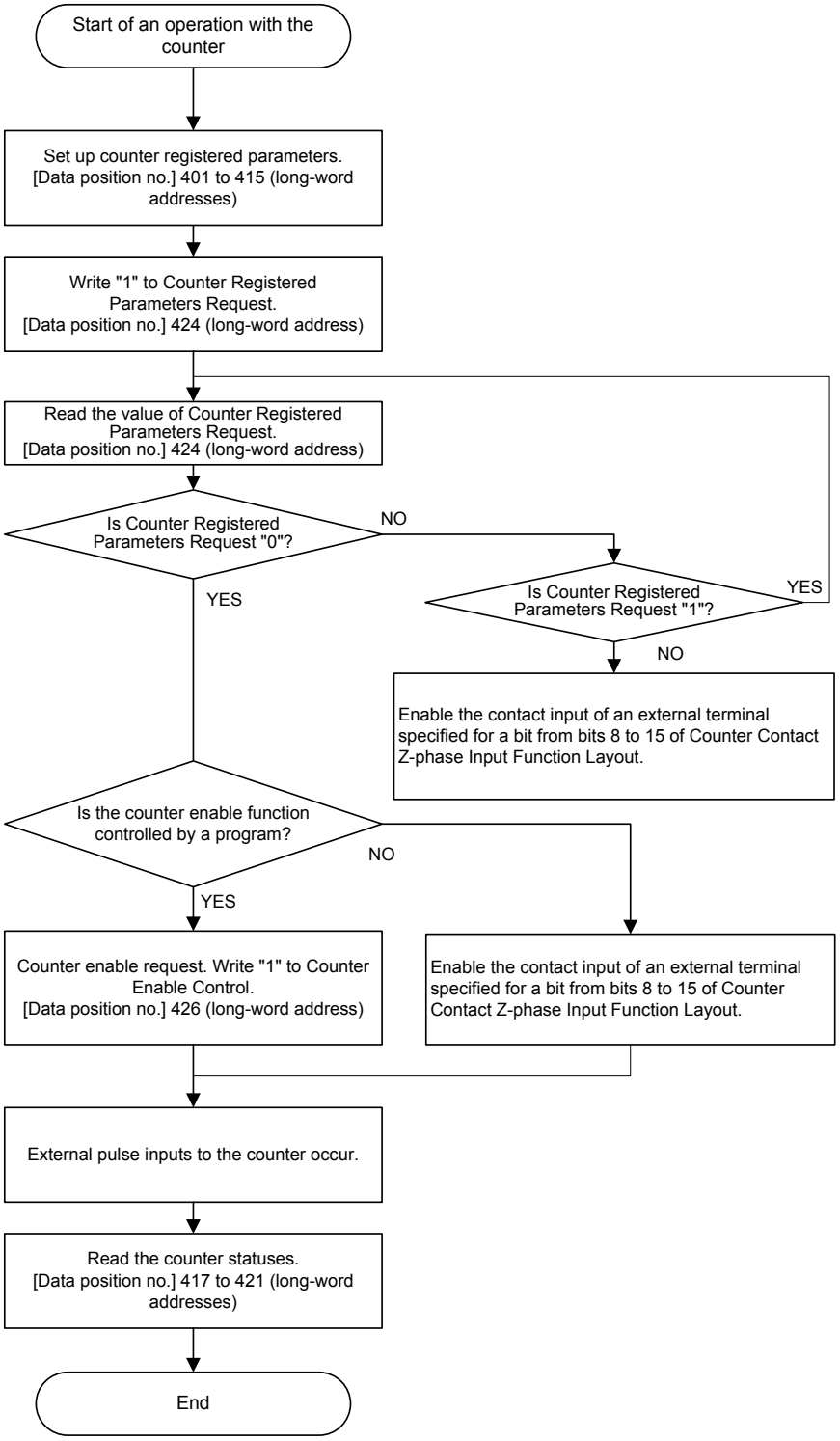


Figure 9.1 Operation Procedure Flowchart for an Operation with the Counter

9.2 Read Counter Parameters/Statuses

■ Function

This function reads counter parameters and counter statuses in the module.

■ Usage

● Procedure

(1) Read counter parameters and counter statuses of the module from the CPU module. For details on how to access the module from the CPU, see Chapter 10, "Accessing Modules."

■ Note

- The counter parameters/statuses are two-word data (long-word data). The smaller data position number contains the low-order word, and the larger data position number contains the high-order word.
- Use a long-word-basis data position number for a WRITE L or READ L used for long-word-basis access from a CPU program.
- Use a word-basis data position number for a WRITE L or READ L used for word-basis access from a CPU program.

CAUTION

When a word-basis READ/WRITE instruction is used from the CPU module to read or write two-word data, concurrency of the high-order word and low-order word of two-word data is not assured due to conflicts between the timing of reading or writing from the CPU module and the data update period of the positioning module.

By using a long-word-basis READ L/WRITE L instruction, concurrency of the high-order word and low-order word of two-word data is assured. Note that data position numbers used in long-word-basis READ L and WRITE L instructions are different from the ones used in word-basis READ and WRITE instructions.

CAUTION

Data concurrency cannot be assured when reading from a BASIC CPU because a BASIC CPU cannot perform long-word access to the positioning module.

■ Sample Program

● Description

This sample program reads all counter statuses of the module installed in slot 3.

● List of Devices

Table 9.1 List of Devices Used by the Sample Program for Reading Counter Statuses

Device	Name	Data
/D00001/D00002	Counter Bit Status	See Section 7.2, "Counter Status"
/D00003/D00004	Counter Current Position Status	See Section 7.2, "Counter Status"
/D00005/D00006	Counter Latched Position 1 Status	See Section 7.2, "Counter Status"
/D00007/D00008	Counter Latched Position 2 Status	See Section 7.2, "Counter Status"
/D00009/D00010	Counter Speed Status	See Section 7.2, "Counter Status"
/I00001 to /I00032	Extended Counter Bit Status data	See Section 7.2, "Counter Status"

● Program Code

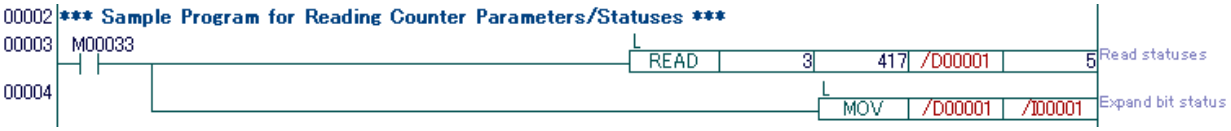


Figure 9.2 Sample Program for Reading Counter Statuses

9.3 Set Counter Registered Parameters

■ Function

This function sets the counter registered parameters.

■ Usage

● Counter Parameters to Be Used

Tables 9.2 and 9.3 show the parameters that must be set up.

Table 9.2 Counter Control Parameters

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
424	847/848	Counter Registered Parameters Request	Requests to register the counter registered parameters. Writing "1" to this parameter performs the request to register the counter registered parameters. Reading this parameter returns "0" for normal termination or returns the error code if an error occurs.

Table 9.3 List of Counter Registered Parameters

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
401	801/802	Counter Count Mode Setting	0: Phase A/B (x1), 10: Phase A/B (x1) Reverse, 1: Phase A/B (x2), 11: Phase A/B (x2) Reverse, 2: Phase A/B (x4), 12: Phase A/B (x4) Reverse, 3: CW/CCW pulse, 13: CW/CCW pulse Reverse, 4: Travel/direction, 14: Travel/direction Reverse [Factory default: 0]
402	803/804	Counter Filter Setting	0: Do not use filter 1: Use the module at a frequency of 1 M pulse/s or less. 2: Use the module at a frequency of 500K pulse/s or less. 3: Use the module at a frequency of 100 K pulse/s or less. [Factory default: 0]
403	805/806	Counter Action Mode Setting	0: Linear counter (Coded 32 bit fixed) 1: Ring Counter (0 to the Preset Ring Counter Value) 2: Ring Counter (Coded 32 bit fixed) [Factory default: 0]
404	807/808	Preset Ring Counter Value	1 to 2,147,483,647 [pulses] (This parameter is valid only when Counter Action Mode Setting is "1: Ring counter". Set the number of counts per revolution -1.) [Factory default: 2,147,483,647]
405	809/810	Counter Contact Input Setting	$00000000 or greater (bit data for each contact) (Settings for "a" contact, "b" contact, and filter) [Factory default: 0]
406	811/812	Counter Z-phase Input Setting	$00000000 or greater (bit data) (This parameter specifies a filter and also the Z-phase input for an axis used as a counter Z-phase input.) [Factory default: 0]
407	813/814	Counter Contact Z-phase Input Function Layout	$00000000 or greater (bit data) (This parameter assigns the counter enable, counter preset, and counter latch functions to the contact inputs and Z-phase input.) [Factory default: 0]
408	815/816	Counter Contact Output 1 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter contact output 1.) [Factory default: 0]

409	817/818	Counter Contact Output 2 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter contact output 2.) [Factory default: 0]
410	819/820	Counter Coincidence Direction Setting	$00000000 or greater (bit data) (This parameter specifies the method of counter coincidence detection.) [Factory default: 0]
411	821/822	Counter Input Relay Setting	0: Counter Input Relay Not In Use (For F3YP28-0P, X□□□13 to X□□□16 are used as Stop Immediately ACK relays.) 1: Counter Input Relay In Use (For F3YP28-0P, X□□□13 to X□□□16 are used as counter input relays.) [Factory default: 0]
412	823/824	Counter Input Relay 1 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 1.) [Factory default: 0]
413	825/826	Counter Input Relay 2 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 2.) [Factory default: 0]
414	827/828	Counter Input Relay 3 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 3.) [Factory default: 0]
415	829/830	Counter Input Relay 4 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 4.) [Factory default: 0]
416	831/832	(System reserved)	Do not set a value other than 0. [Factory default: 0]

● Procedure

(1) Write the counter registered parameters to the positioning module.

(2) Write "1" to "Counter Registered Parameters Request."

(3) When the request to register counter registered parameters is processed successfully, "0" is stored in "Counter Registered Parameters Request."

- If an error or warning occurs in the parameters, an error code is stored in "Counter Registered Parameters Request." For details on errors, refer to Section 11.5, "Counter Registered Parameter Errors."
- If an error code is stored in "Counter Registered Parameters Request", check and modify the counter registered parameters and then write "1" to "Counter Registered Parameters Request" again.

■ Note

- When an error occurs related to a request to register the counter registered parameters, the ERR LED on the front side of the module does not light up.
- If an axis is in a positioning operation or waiting for a trigger, issuing a request to register the counter registered parameters causes an error. (Register the parameters before starting a positioning operation.)
- The registered parameters set by using the function for setting the counter registered parameters are cleared at power off. Execute the Save to Flash Memory command to save parameter data if required.
- Even if counter registered parameters are not saved to the flash memory, they can be used by issuing a request to register counter registered parameters each time the module is powered on.

■ Sample Program

● Description

This sample program sets the counter registered parameters for axis 1 of the positioning module installed in slot 3.

● List of Devices

Table 9.4 List of Devices Used in the Sample Program for Setting the Counter Registered Parameters

Device	Name	Data
/D00101 to /D00132	Counter Registered Parameters	Set up data in this area before executing request.
/D00133/D00134	Read Counter Control Command Request	
/I00101	Request Counter Registered Parameters	
/I00102	Request Counter Registered Parameters(differential up)	
/I00103	Request executing	

● Program Code

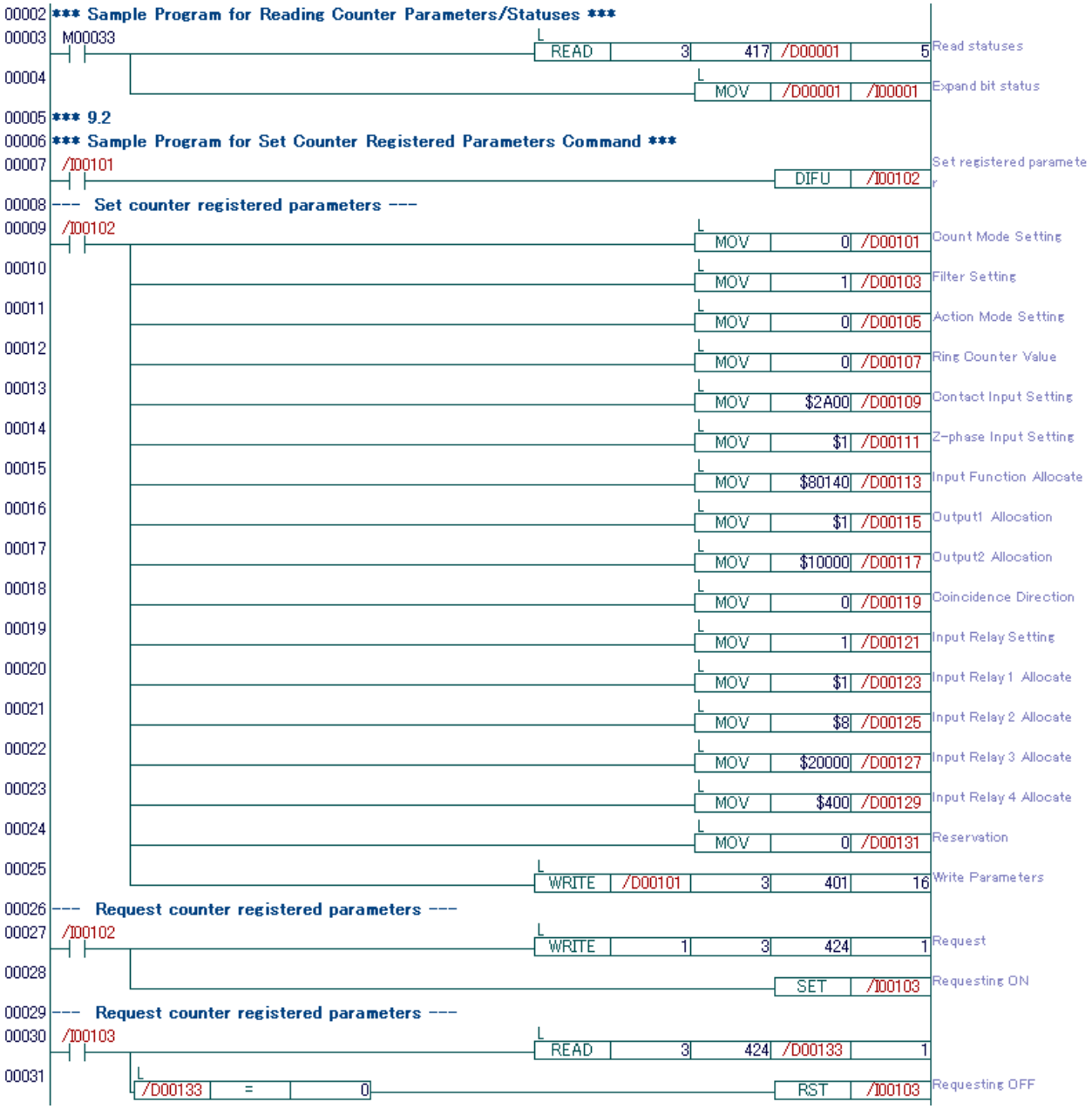


Figure 9.3 Sample Program for Setting the Counter Registered Parameters

9.4 Counter Enable/Disable

This function controls whether to enable or disable the counter (for counting input pulses).

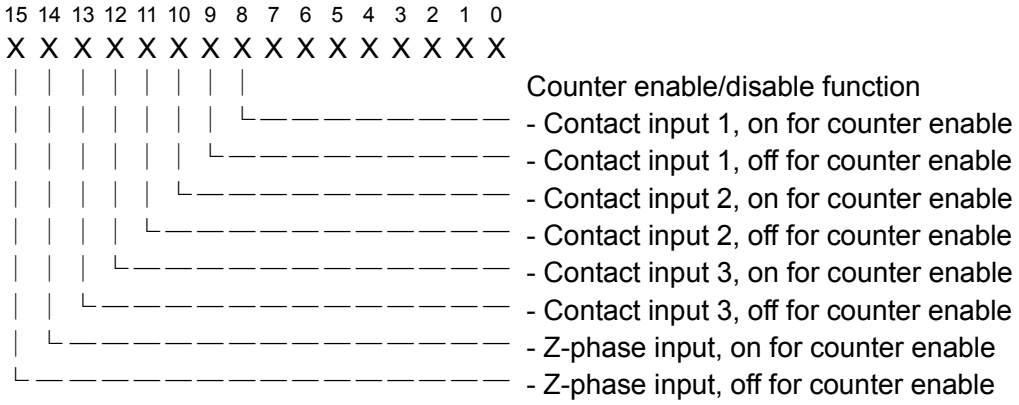
You can assign the enable/disable control to an external input signal (of the contact inputs 1 to 3 or Z-phase input of the counter). You can also use a program to enable or disable the counter from the CPU module. When the control with an external input signal or the control by a program enables the counter, the counter performs counting.

9.4.1 Control with an External Input Signal

When you assign counter enable/disable control to a counter contact input, use the function for setting the counter registered parameters to register the contact input to be assigned.

Select a bit corresponding to the contact input from bits 8 to 15 of "Counter Contact Z-phase Input Function Layout." When all of bits 8 to 15 are "0", counter enable/disable control with a contact input is not performed.

● Counter Contact Z-phase Input Function Layout (Low-order Word Only)



For example, when you want to specify the on state of contact input 2 for the counter enable function, specify $xxxx_04xx for the Counter Contact Z-phase Input Function Layout counter registered parameter (and use xxxx to specify the counter latch/counter preset function).

● Sample Program

For details on setting the counter registered parameters, refer to Section 9.3, "Set Counter Registered Parameters."

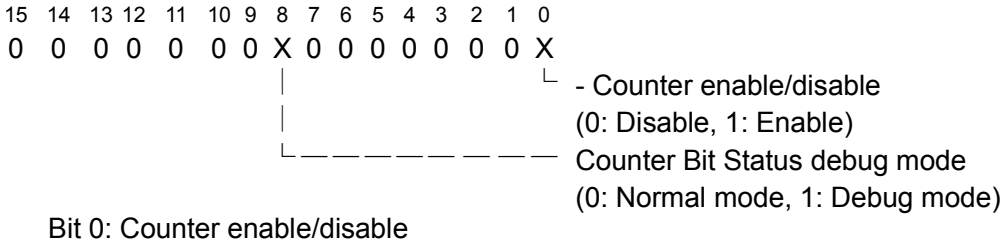
9.4.2 Control by a Program

When you want to use a program to enable or disable the counter, specify a suitable bit data for the "Counter Enable Control" counter control parameter.

● Counter Enable Control

Table 9.5 Counter Enable Control

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
426	851/852	Counter Enable Control	$0000 or greater (bit data) [Default: 0: Disable the counter]



Bit 0: Counter enable/disable

Setting this bit to "0" (default) disables the counter. Setting it to "1" enables the counter.

● Sample Program

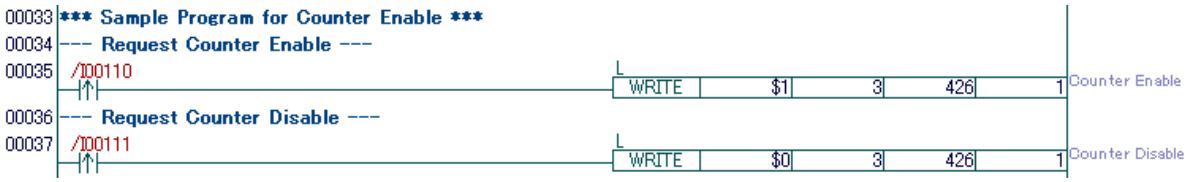


Figure 9.4 Sample Program for Using the Counter Enable Control Parameter

9.5 Counter Preset

The counter preset function changes the value of the counter current position to a value (Counter Preset Value) specified beforehand.

You can assign the counter preset control to an external input signal edge (of the high-speed contact inputs 1 to 3 or Z-phase input of the counter). You can also use a program to control the counter preset from the CPU module.

You can set Counter Preset Value from the CPU module at any time.

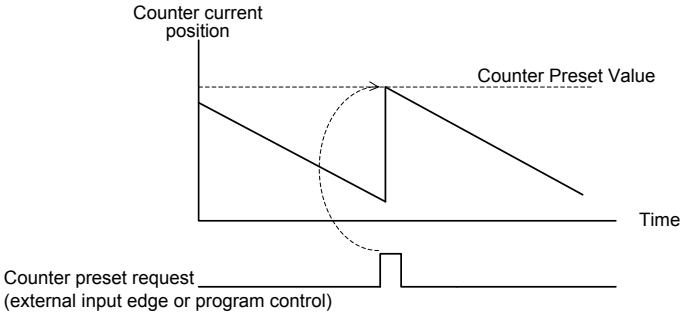


Figure 9.5 Counter Preset

● Counter Preset Value

Table 9.6 Counter Preset Value

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
429	857/858	Counter Preset Value	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]

You can set Counter Preset Value from the CPU module at any time.

When a counter preset request occurs, the value of Counter Current Position Status is replaced with the value of Counter Preset Value.

● Note

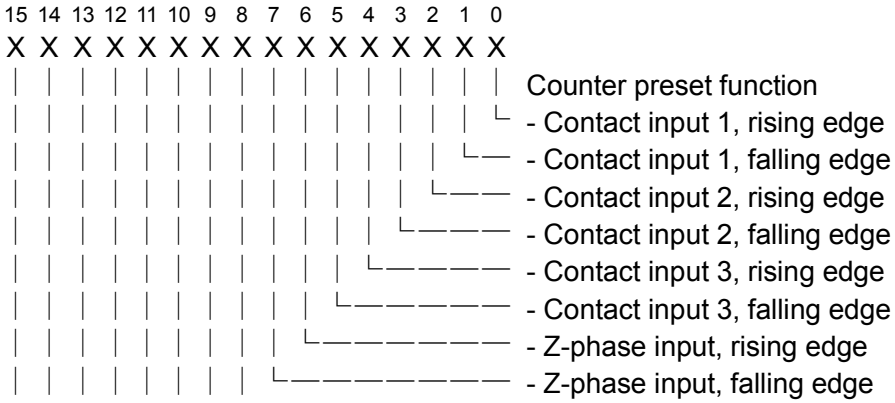
- Do not use the counter preset function during manual pulse generator mode for positioning control.

9.5.1 Control with an External Input Signal

When you assign the counter preset function to a counter contact input, use the function for setting the counter registered parameters to register the contact input to be assigned.

Select a bit corresponding to the contact input from bits 0 to 7 of "Counter Contact Z-phase Input Function Layout." When all of bits 0 to 7 are "0", counter preset control with a contact input is not performed.

● Counter Contact Z-phase Input Function Layout (Low-order Word Only)



For example, when you want to specify the on state of contact input 3 for the counter preset function, specify $xxxx_xx20 for the Counter Contact Z-phase Input Function Layout counter registered parameter (and use xx to specify the counter latch or counter enable function).

● Sample Program

For details on setting the counter registered parameters, refer to Section 9.3, "Set Counter Registered Parameters." For writing a value to Counter Preset Value, see Figure 9.6, "Sample Program for the Counter Preset Function."

9.5.2 Control by a Program

● Counter Control Command Request

Table 9.7 Counter Control Command Request

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
425	849/850	Counter Control Command Request	11: Counter preset request

When you want to use a program to perform a counter preset, write "11: Counter preset request" to the "Counter Control Command Request" counter control parameter. When the value is set to the counter control parameter, the counter preset is performed immediately without a command ACK.

● Sample Program

This sample program sets Counter Preset Value to 100000 and issues a counter preset request.

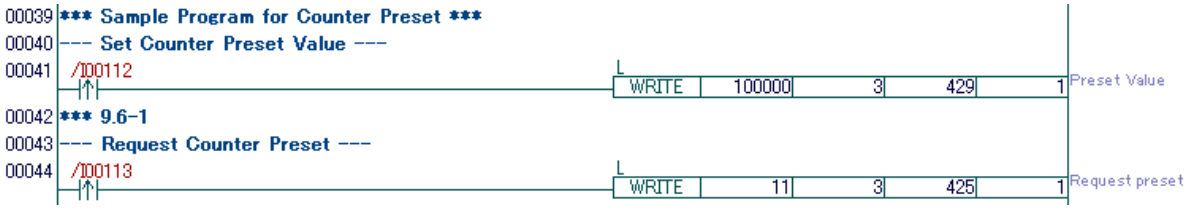


Figure 9.6 Sample Program for the Counter Preset Function

9.6 Counter Latch

The counter latch function stores the value of the counter current position into a counter latched position status when a CNT latched request occurs.

There are two counter latch channels, which can be used independently from each other.

When CNT latched request 1 or 2 occurs, the value of the counter current position is copied to CNT Latched Position 1 Status or CNT Latched Position 2 Status, respectively.

You can assign the counter latch function to an external input signal edge (of the counter contact inputs 1 to 3 or Z-phase input of the counter). You can also use a program to control the counter latch function from the CPU module.

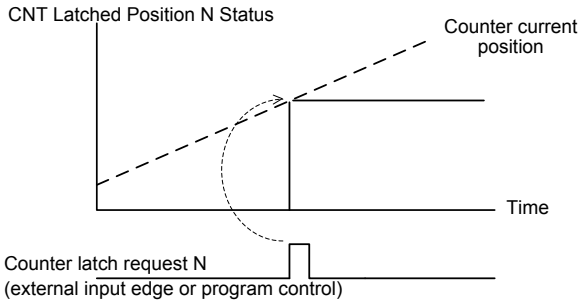


Figure 9.7 Counter Latch

● Counter Latched Position Statuses

Table 9.8 Counter Latched Position Statuses

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
419	837/838	CNT Latched Position 1 Status	-2,147,483,648 to 2,147,483,647 [pulses]
420	839/840	CNT Latched Position 2 Status	-2,147,483,648 to 2,147,483,647 [pulses]

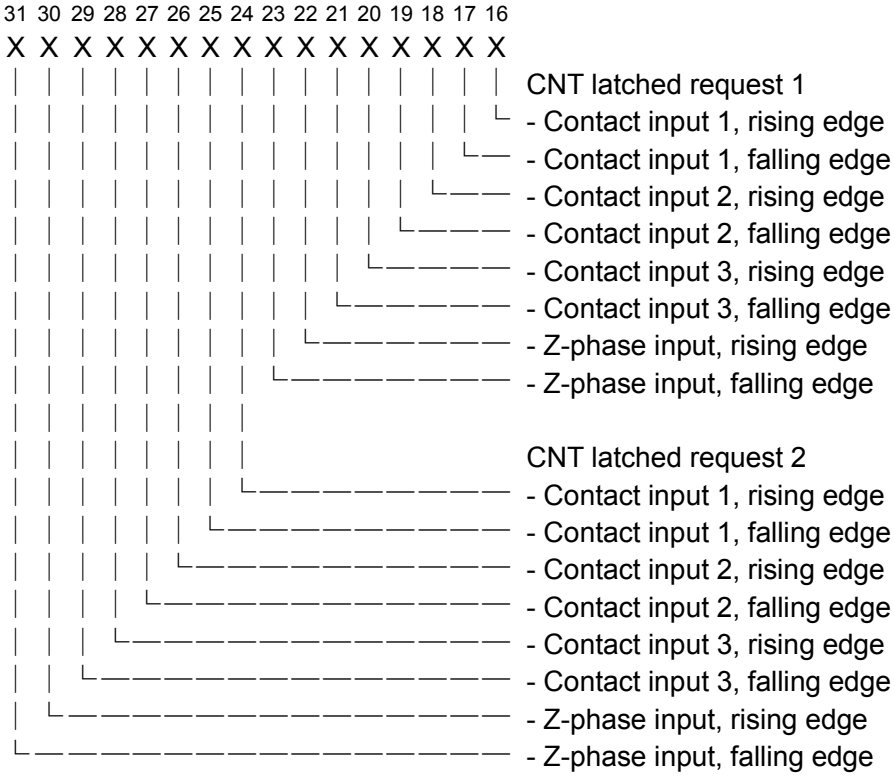
The value of a counter latched position status can be read from the CPU module at any time.

9.6.1 Control with an External Input Signal

When you assign the counter latch function to a counter contact input, use the function for setting the counter registered parameters to register the contact input to be assigned.

Select a bit corresponding to the contact input from bits 16 to 31 of "Counter Contact Z-phase Input Function Layout." When all of bits 16 to 31 are "0", counter latch control with a contact input is not performed.

● Counter Contact Z-phase Input Function Layout (Low-order Word Only)



For example, when you want to specify the settings so that counter latch 1 works at a falling edge of contact input 1 and counter latch 2 works at a falling edge of contact input 2, specify $0804_xxxx for the Counter Contact Z-phase Input Function Layout counter registered parameter (and use xx to specify the counter preset or counter enable function).

● Counter Bit Status

Table 9.9 Counter Latch Bit Status

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
417	833/834	Counter Bit Status	Operation information (bit data) including counter coincidence detection, high-speed contact input/output, zone coincidence detection

When the counter latch function is assigned to an external input and a counter latch occurs, Counter Current Position Status is copied to the corresponding counter latched position status and "bit 3: External Input Counter Latch 1 Detection " or "bit 4: External Input Counter Latch 2 Detection " of Counter Bit Status is set to "1", which notifies the CPU module of the occurrence of the latch.

● Counter Control Command Request

Table 9.10 Counter Control Command Request

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
425	849/850	Counter Control Command Request	4: External Counter Latch Occurrence 1 Detection Latch Clear Request 5: External Counter Latch Occurrence 2 Detection Latch Clear Request

The external input counter latches of Counter Bit Status are latch type statuses.

To clear these latches, write "4: External Counter Latch Occurrence 1 Detection Latch Clear Request " or "5: External Counter Latch Occurrence 2 Detection Latch Clear Request " to "Counter Control Command Request."

● Sample Program

For details on setting the counter registered parameters, refer to Section 9.3, "Set Counter Registered Parameters."

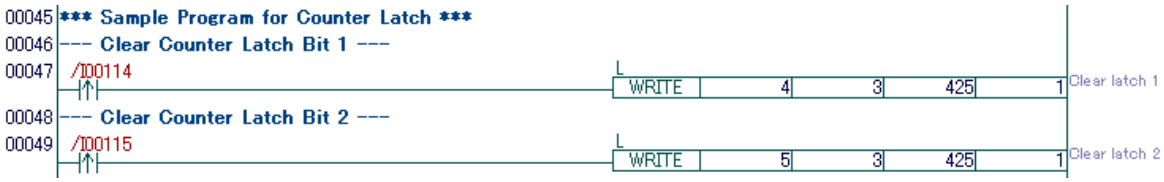


Figure 9.8 Sample Program for the Counter Latch Function

9.6.2 Control by a Program

● Counter Control Command Request

Table 9.11 Counter Control Command Request

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
425	849/850	Counter Control Command Request	12: CNT Latched Request 1 13: CNT Latched Request 2

When you want to use the counter latch function from a program, write "12: CNT Latched Request 1" or "13: CNT Latched Request 2" to the "Counter Control Command Request" counter control parameter. When the value is set to the counter control parameter, the counter latch is activated immediately without a command ACK.

● Sample Program

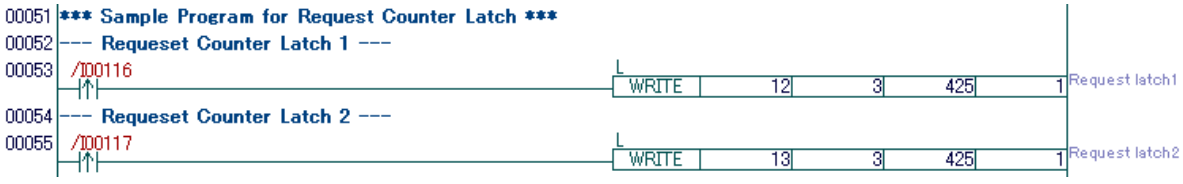


Figure 9.9 Sample Program for the Counter Latch Function

9.7 Counter Coincidence Detection

The counter coincidence detection function compares the value of the counter current position with a preset counter coincidence value and when both values are the same, the function sets a corresponding bit of Counter Bit Status to notify of the coincidence.

Each bit of Counter Bit Status has a specific function and can be used, for example, to indicate the status of a counter contact output or to specify a trigger condition for a positioning operation.

The counter coincidence detection function allows you to set two preset counter coincidence values, which work independently from each other.

You can also use the Counter Coincidence Direction Setting counter registered parameter to specify whether to detect counter coincidence only for forward pulse inputs or reverse pulse inputs.

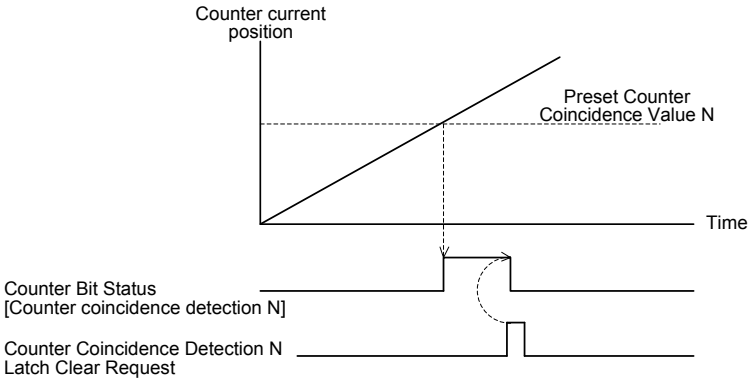


Figure 9.10 Counter Coincidence Detection

● Note

- The statuses of counter coincidence detection are of a latch type. To turn the statuses off, you must clear them by a program.
- If no direction is specified by Counter Coincidence Direction Setting, counter coincidence is detected when Counter Current Position Status is changed from a value to the preset counter coincidence value.

  Counter coincidence detection is performed also when Counter Current Position Status or a preset counter coincidence value is modified.
- If a direction is specified by Counter Coincidence Direction Setting, counter coincidence is detected when Counter Current Position Status is changed from a value to the preset counter coincidence value for pulse inputs with the specified direction.

● Preset Counter Coincidence Values

Table 9.12 Preset Counter Coincidence Values

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
430	859/860	Preset Counter Coincidence Value 1	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]
431	861/862	Preset Counter Coincidence Value 2	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]

These parameters specify a value that is compared with Counter Current Position Status for counter coincidence.

You can set the preset counter coincidence values from the CPU module at any time.

● Counter Bit Status

Table 9.13 Counter Bit Status

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
417	833/834	Counter Bit Status	Operation information (bit data) including counter coincidence detection, high-speed contact input/output, zone coincidence detection

When counter coincidence is detected, counter coincidence detection 1 or 2 of Counter Bit Status is set to "1", which notifies the CPU module of the occurrence of the counter coincidence.

● Counter Control Command Request

Table 9.14 Counter Control Command Request

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
425	849/850	Counter Control Command Request	1: Counter Coincidence Detection 1 Latch Clear Request 2: Counter Coincidence Detection 2 Latch Clear Request

The counter coincidence detections of Counter Bit Status are latch type statuses.

To clear them, write "1: Counter Coincidence Detection 1 Latch Clear Request" or "2: Counter Coincidence Detection 2 Latch Clear Request" to "Counter Control Command Request."

● Sample Program

This sample program sets Preset Counter Coincidence Values 1 and 2 to 10000 and 20000, respectively.

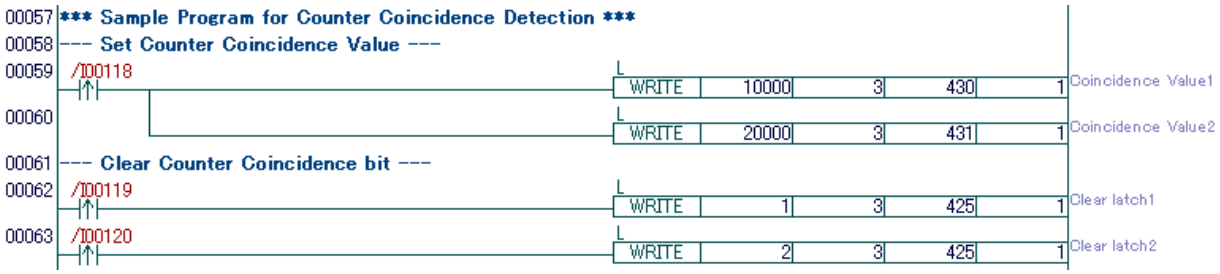


Figure 9.11 Sample Program for the Counter Coincidence Detection Function

9.8 Counter Zone Coincidence Detection

The counter zone coincidence detection function sets one or more bits of Counter Bit Status to notify that the value of Counter Current Position Status is in a specified range.

(The relevant bits of Counter Bit Status are on when Counter Zone N Lower Limit ≤ Counter Current Position Status ≤ Counter Zone N Upper Limit.)

Each bit of Counter Bit Status has a specific function and can be used, for example, to indicate the status of a counter contact output or to specify a trigger condition for a positioning operation.

You can specify up to 16 counter zone coincidence detection conditions.

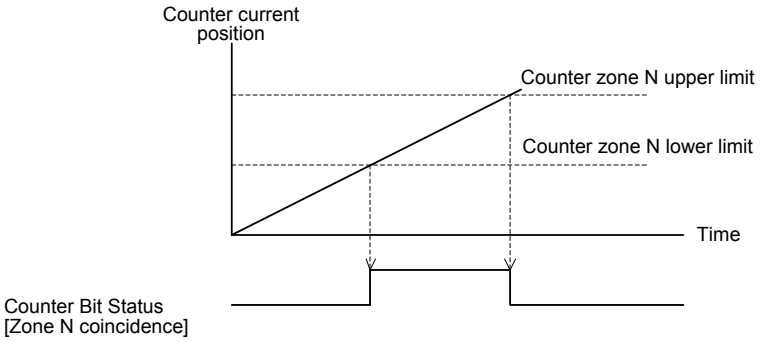


Figure 9.12 Counter Zone Coincidence Detection

● Note

- The statuses of counter zone coincidence detection are not of a latch type. Each status automatically turns off when the corresponding value changes to the outside of the zone.
- The counter zone coincidence function performs a comparison operation at up to a 1 us interval in the module. If the counter value does not remain in the range (or out of the range) for 1 us or more, the function may not detect coincidence.
- From the 16 counter zone coincidence detection conditions, only one coincidence condition can be met at a time. (For example, even if the same value is specified for zone 1 coincidence and zone 16 coincidence, both status bits cannot turn on at the same time.)

● Preset Counter Zone Coincidence Values

Table 9.15 Preset Counter Zone Coincidence Values

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
433	865/866	Counter Zone 1 Lower Limit	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]
434	867/868	Counter Zone 1 Upper Limit	
435	869/870	Counter Zone 2 Lower Limit	
436	871/872	Counter Zone 2 Upper Limit	
437	873/874	Counter Zone 3 Lower Limit	
438	875/876	Counter Zone 3 Upper Limit	
439	877/878	Counter Zone 4 Lower Limit	
440	879/880	Counter Zone 4 Upper Limit	
441	881/882	Counter Zone 5 Lower Limit	
442	883/884	Counter Zone 5 Upper Limit	
443	885/886	Counter Zone 6 Lower Limit	
444	887/888	Counter Zone 6 Upper Limit	
445	889/890	Counter Zone 7 Lower Limit	
446	891/892	Counter Zone 7 Upper Limit	
447	893/894	Counter Zone 8 Lower Limit	
448	895/896	Counter Zone 8 Upper Limit	
449	897/898	Counter Zone 9 Lower Limit	
450	899/900	Counter Zone 9 Upper Limit	
451	901/902	Counter Zone 10 Lower Limit	
452	903/904	Counter Zone 10 Upper Limit	
453	905/906	Counter Zone 11 Lower Limit	
454	907/908	Counter Zone 11 Upper Limit	
455	909/910	Counter Zone 12 Lower Limit	
456	911/912	Counter Zone 12 Upper Limit	
457	913/914	Counter Zone 13 Lower Limit	
458	915/916	Counter Zone 13 Upper Limit	
459	917/918	Counter Zone 14 Lower Limit	
460	919/920	Counter Zone 14 Upper Limit	
461	921/922	Counter Zone 15 Lower Limit	
462	923/924	Counter Zone 15 Upper Limit	
463	925/926	Counter Zone 16 Lower Limit	
464	927/928	Counter Zone 16 Upper Limit	

These parameters specify values that are compared with Counter Current Position Status for counter zone coincidence.

You can set the preset counter zone coincidence values from the CPU module at any time.

● Counter Bit Status

Table 9.16 Counter Bit Status

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
417	833/834	Counter Bit Status	Operation information (bit data) including counter coincidence detection, high-speed contact input/output, zone coincidence detection

When counter zone coincidence is detected, the relevant bit from bits 16 to 31 of Counter Bit Status turns on.

● Sample Program

This sample program specifies the ranges from 101 to 200, from 5000 to 7000, and from 10000 to 12000 for zone 1 coincidence, zone 2 coincidence, and zone 16 coincidence, respectively.

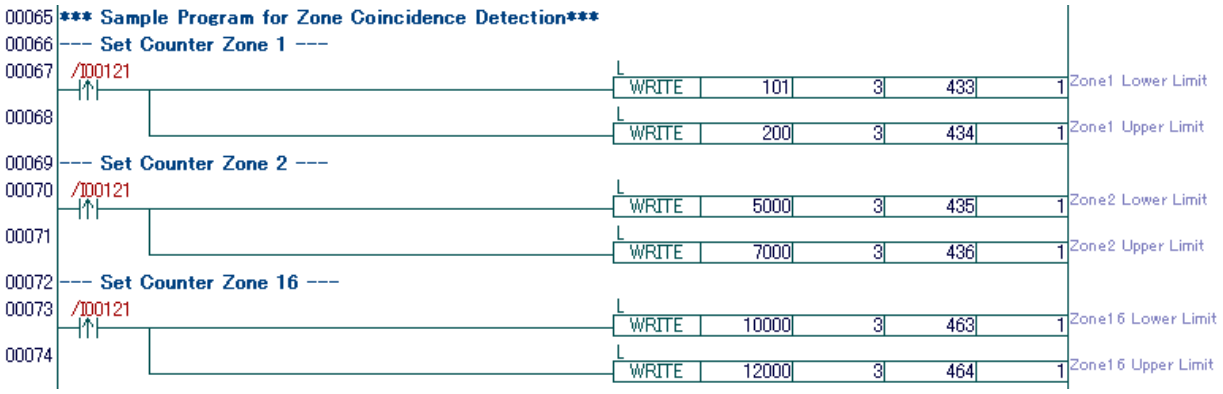


Figure 9.13 Sample Program for the Counter Zone Coincidence Detection Function

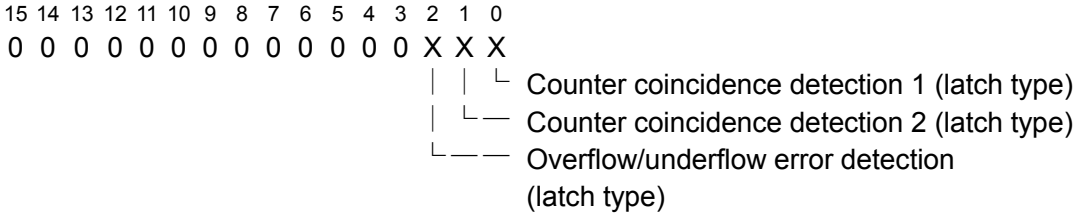
9.9 Counter Contact Outputs

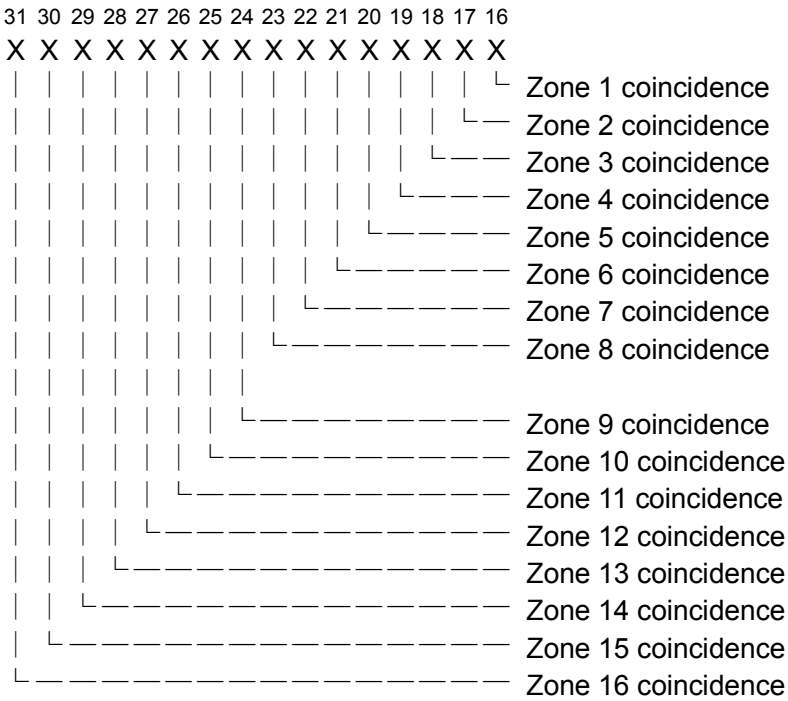
A counter contact output can be automatically turned on or off in the positioning module according to the Counter Contact Output 1 or 2 Layout counter registered parameter. Also, a counter contact output can be forced to be turned on or off from the CPU module.

9.9.1 Automatically Turning On/Off a Counter Contact Output

When you want to automatically turn on or off a counter contact output, use the Counter Contact Output N Layout counter registered parameter. Select a Counter Bit Status item to be assigned to counter contact output N and specify the corresponding bit data for Counter Contact Output N Layout. After setting the counter registered parameter, write $00000001 to Counter Contact Output N Control.

● Counter Contact Output N Layout

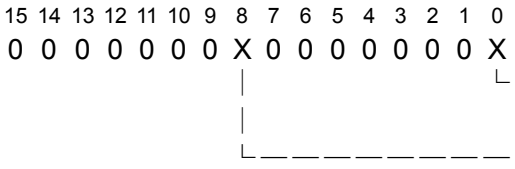




● Counter Contact Output N Control

Table 9.17 Counter Contact Output N Control

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
427	853/854	Counter Contact Output 1 Control	$0000 or greater (bit data) [Default: 0: Counter contact output 1 forced off]
428	855/856	Counter Contact Output 2 Control	$0000 or greater (bit data) [Default: 0: Counter contact output 2 forced off]



- Control setting for counter contact output N (0: Disable, 1: Enable)
- Forced setting for counter contact output N (0: Forced off, 1: Forced on)

When you want to automatically turn on or off the counter contact output N according to the setting of Counter Contact Output N Layout, specify $00000001 for Counter Contact Output N Control.

● Sample Program

For details on setting the counter contact output N layout, see Section 9.3, Set Counter Registered Parameters."

This sample program enables to control the counter contact output.

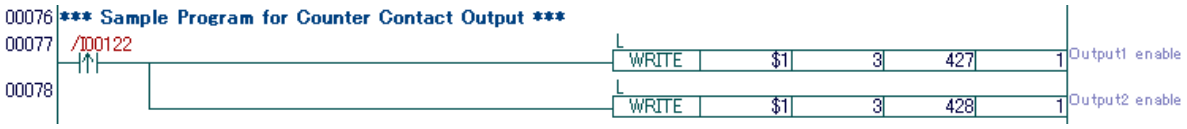


Figure 9.14 Sample Program for Controlling a Counter Contact Output

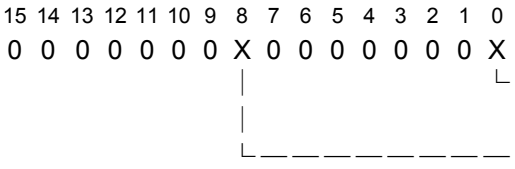
9.9.2 Forcibly Turning On/Off a Counter Contact Output

When you want to forcibly turn on or off a counter contact output, set a suitable value to Counter Contact Output N Control.

● Counter Contact Output N Control

Table 9.18 Counter Contact Output N Control

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
427	853/854	Counter Contact Output 1 Control	$0000 or greater (bit data) [Default: 0: Counter contact output 1 forced off]
428	855/856	Counter Contact Output 2 Control	$0000 or greater (bit data) [Default: 0: Counter contact output 2 forced off]



- Control setting for counter contact output N (0: Disable, 1: Enable)
- Forced setting for counter contact output N (0: Forced off, 1: Forced on)

To forcibly turn off counter contact output N,

set this parameter to $00000000 (i.e., 0 in decimal notation).

To forcibly turn on counter contact output N,

set this parameter to $00000100 (i.e., 256 in decimal notation).

● Sample Program

This sample program forcibly turn on or off the counter contact output.

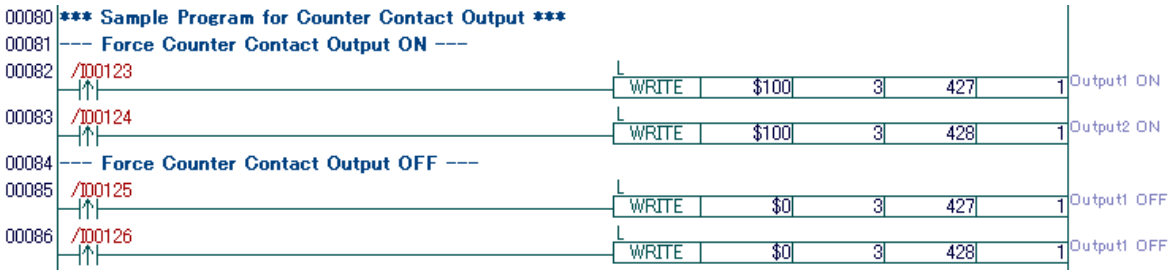


Figure 9.15 Sample Program for Controlling a Counter Contact Output

9.10 Counter Bit Status Debug Mode

The Counter Bit Status debug mode enables the CPU module to read and write status items of Counter Bit Status that can be assigned to external contact inputs, input relays, and so on.

In debug mode, Counter Bit Status cannot be updated automatically and has the value written last from the CPU module (while the default is "0").

In debug mode, Counter Bit Status behaves as follows.

Assignment of a Counter Bit Status item to a counter input relay:

The value written to the corresponding Counter Bit Status item is reflected to the assigned input relay.

Assignment of a Counter Bit Status item to a counter contact output:

The value written to the corresponding Counter Bit Status item is reflected to the assigned counter contact output.

Assignment of a Counter Bit Status item to a trigger condition for a positioning operation:

The value that is written to the corresponding Counter Bit Status item works as a trigger condition for a positioning operation.

Writing to a counter contact input in Counter Bit Status and a counter Z-phase input in Counter Bit Status:

It is possible to write a value to this item, but the function specified with Counter Contact Z-phase Input Function Layout does not work.

Writing to a counter contact output in Counter Bit Status:

It is possible to write a value to this item, but the written value is not output from the relevant counter contact output.

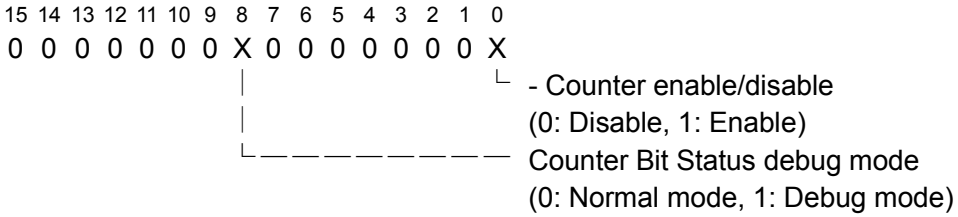
● Note

- When the module is switched from normal mode to debug mode, Counter Bit Status has the value written last from the CPU module (while the default is "0").

● Counter Enable Control

Table 9.19 Counter Enable Control

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
426	851/852	Counter Enable Control	$0000 or greater (bit data) [Default: 0: Disable the counter]



Bit 8: Counter Bit Status debug mode

Setting this bit to "0" (default) specifies normal mode. Setting it to "1" specifies debug mode.

● Counter Bit Status

Table 9.20 Counter Bit Status

Data Position No.		Parameter	Description
Long-word Basis	Word Basis		
417	833/834	Counter Bit Status	Operation information (bit data) including counter coincidence detection, high-speed contact input/output, zone coincidence detection

● Sample Program

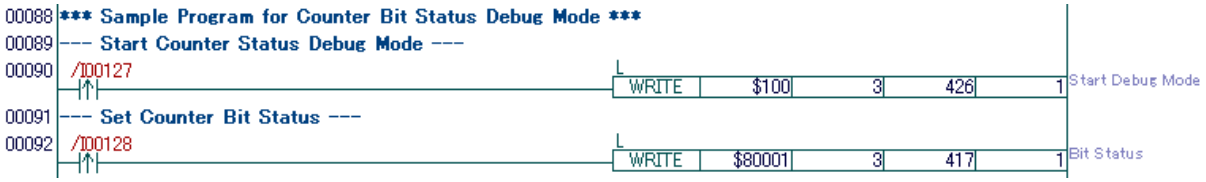


Figure 9.16 Sample Program for the Counter Bit Status Debug Mode

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10. Accessing Modules

10.1 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 Instruction Manual - Instructions” (IM 34M06P12-03E).

● Reading/Writing Parameters and Status (Word Basis)

To access parameters for which data position numbers are assigned on a word basis, use these instructions on a word basis.

- Specific Module Read Instruction (READ Instruction)

READ	SL	n1	D	k

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

- Specific Module Write Instruction (WRITE Instruction)

WRITE	S	SL	n2	k

S: first device for storing the write data, or written data
SL: number of slot where the module is installed
n2: data position number for the first word of data to be written (word basis address)
k: number of words of data to be written

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

HRD	SL	n1	D	k

SL: number of slot where the module is installed
n1: data position number for the first word of data to be read (word basis address)
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)

HWR	S	SL	n2	k

S: first device for storing the write data, or written data
SL: number of slot where the module is installed
n2: data position number for the first word of data to be written (word basis address)
k: number of words of data to be written

CAUTION

When a READ instruction is used on a word basis and the status of 2-word data from the CPU module is read, concurrency of the high-order word and low-order word of 2-word data is not assured due to conflicts between the timing of reading from the CPU module and the data update period of this module.

● Reading/Writing Parameters and Status (Long-word Basis)

To access parameters/status for which data position numbers are assigned on a long-word basis, use these instructions on a long-word basis.

- Specific Module Read Instruction (READ L Instruction)

L

READ	SL	n1	D	k

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

- Specific Module Write Instruction (WRITE L Instruction)

L

WRITE	S	SL	n2	k

S: first device for storing the write data, or written data
SL: number of slot where the module is installed
n2: data position number for the first long word of data to be written (long-word basis address)
k: number of long words of data to be written

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

L

HRD	SL	n1	D	k

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

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

L

HWR	S	SL	n2	k

S: first device for storing the write data, or written data
SL: number of slot where the module is installed
n2: data position number for the first long word of data to be written (long-word basis address)
k: number of long words of data to be written

CAUTION

To access only parameters/statuses for which data position numbers are shown on a long-word basis, you can use these instructions on a long-word basis. The data position number for accessing on a long-word basis and the data position number for accessing on a word basis are different.

Parameters/statuses that can be accessed by instructions on a long-word basis include some positioning statuses and counter parameters/statuses.

The use of instructions on a long-word basis assures the concurrency of the high-order word and low-order word.

● Interrupt Handling

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

INTP	S

IRET

S: input relay raising interrupt

10.2 Accessing from a BASIC CPU

You can use the following the 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 34M06Q22-01E).

This module can be accessed from a BASIC CPU only on a word basis. Access parameters/statuses with a data position number on a word basis.

Table 10.1 Accessing from a BASIC CPU

Function	Statement Format	Explanation

Module use declaration	`ASSIGN YP22=SL`
	`ASSIGN YP24=SL`
	`ASSIGN YP28=SL`
	`SL`: Slot number
		Declares use of a module or CPU module.

Reading parameters and status	`ENTER SL,n NOFORMAT;I` `SL`: Slot number `N`: Data position number `I`: Name of the integer/integer array variable for storing the read data	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).
Writing parameters	`OUTPUT SL,n NOFORMAT;I` `SL`: Slot number `N`: Data position number `I`: Name of the Integer/integer array variable for storing the write data	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).
Reading input relays*1	`STATUS SL,n;P` `SL`: Slot number `N`: Data position number (101 or 102) `P`: Name of the Integer variable for storing the read data	Reads the status of the input relays of the module that is installed in the slot (SL), and stores it in the variable (P).
Writing output relays*2	`CONTROL SL,n;P,M` `SL`: Slot number `n`: Data position number (101 or 102) `P`: Output data `M`: Mask pattern	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.

Declare interrupt	`ON INT SL,nn GOSUB {label}`
	`ON INT SL,nn CALL {subprogram}`
	`ON INT SL,nn GOTO {label}`
	`SL`: Slot number
	`nn`: Input relay number
		Declares branch destination for handling interrupt request from the CPU module.

Disable interrupt declaration	`OFF INT SL,nn` `SL`: Slot number `nn`: Input relay number	Disables an `ON INT` statement.

*1: For input relays, data position number 101 is for axes 1 to 4 (X□□□01 to X□□□16), and 102 is for axes 5 to 8 (X□□□17 to X□□□32).
*2: For output relays, data position number 101 is for axes 1 to 4 (Y□□□33 to Y□□□48), and 102 is for axes 5 to 8 (Y□□□49 to Y□□□64).

● How To Handle 2-Word (Long-Word) Data

This module can be accessed from a BASIC CPU only on a word basis. Access parameters/statuses with a data position number on a word basis.

You must convert long-word data to 2-word integer data before writing long-word parameters from a BASIC CPU to the module.

When reading 2-word (long-word) data from this module, you must convert the data to long-word data after reading the data as two integer variables. A sample program for these conversions is shown below.

```
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))
```

CAUTION

This module cannot be accessed via long word from a BASIC CPU, and therefore concurrency of 2-word data is not assured.

10.3 Accessing from RTOS-CPU VxWorks

You can use the following the functions to access from an RTOS CPU compatible with VxWorks.

For more information on each function, see the following manual.

-F3RP62-2☐

"RTOS-CPU Module (F3RP62-☐☐/L1) VxWorks BSP Reference Manual"
(IM 34M06M51-42E)

● I/O Access Procedure

I/O module use declaration (open())

- Open the device file for the I/O module being used, and acquire the fd (file descriptor).

Request to I/O module (ioctl())

- Send a request to the I/O module for the fd.

Disable the I/O module use declaration (close())

- Disable the use declaration for the I/O module for the fd.

● Functions for Reading/Writing Input/Output Relays

Use ioctl() to specify the following macros.

M3IO_READ_IN_RELAY	Reading input relays (1-bit data) (16-point)
M3IO_WRITE_OUT_RELAY	Writing output relays (1-bit data) (16-point)
M3IO_READ_IN_RELAY_POINT	Reading input relays (1-bit data) (1-point specified)
M3IO_WRITE_OUT_RELAY_POINT	Writing output relays (1-bit data) (1-point specified)

● Reading/Writing Parameters and Status (Word Basis)

Use ioctl() to specify the following macros.

To access parameters for which data position numbers are assigned on a word basis, use these instructions on a word basis.

M3IO_READ_DATA	Reading input/output registers (16-bit data)
M3IO_WRITE_DATA	Writing input/output registers (16-bit data)

● Reading/Writing Parameters and Status (Long-word Basis)

Use ioctl() to specify the following macros.

To access parameters/status for which data position numbers are assigned on a long-word basis, use these instructions on a long-word basis.

M3IO_READ_DATA_L	Reading input/output registers (32-bit data)
M3IO_WRITE_DATA_L	Writing input/output registers (32-bit data)

● Interrupt Handling

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

Create a message queue (msgQCreate())

- Create a message queue, and acquire a message ID.

Accept interrupt declaration (ioctl())

- Declare interrupt possible for the I/O module. Enable hardware interrupt for the applicable I/O module.
- Register a message ID on the interrupt management table managed by the driver. Only one message ID can be registered per I/O module.

Read a message queue (msgQReceive())

- Read interrupt data from the message queue.
- Data detected in the message queue is the input relay for which interrupt is declared possible.

Disable interrupt declaration (ioctl())

- Disable the declaration to make interrupt possible for the module.
- When the interrupt possible declaration is disabled for all input relays on the applicable I/O module, the message ID is deleted from the interrupt management table managed by the driver.

Delete a message queue (msgQDelete())

- Delete the message queue.

10.4 Accessing from RTOS-CPU Linux

You can use the following functions to access from an RTOS CPU compatible with Linux.

For more information on each function, see the following manual.

-F3RP61-2□

"RTOS-CPU Module (F3RP61-□□) Linux BSP Reference Manual" (IM 34M06M51-44E)

● I/O Access Procedure

I/O module use declaration (open())

- Open the device file for the I/O module being used, and acquire the fd (file descriptor).
  Example: fd = open("/dev/m3io", O_RDWR);

Request to I/O module (ioctl())

- Use the fd acquired with open () to send a request to the I/O module.
  Example: ioctl(fd, M3IO_READ_INRELAY,&drly);

Disable the I/O module use declaration (close())

- Disable the use declaration for the I/O module for the fd.
  Example: close(fd);

● Acquiring Module Information

M3IO_GET_MODULE_INFO Acquire information for each module.

● Functions for Reading/Writing Input/Output Relays

Use ioctl() to specify the following macros.

M3IO_READ_INRELAY	Read input contacts (16-point)
M3IO_WRITE_OUTRELAY	Write output contacts (16-point)
M3IO_READ_OUTRELAY	Read output contacts (16-point)
M3IO_READ_INRELAY_POINT	Read input contacts (1-point)
M3IO_WRITE_OUTRELAY_POINT	Write output contacts (1-point)
M3IO_READ_OUTRELAY_POINT	Read output contacts (1-point)

● Reading/Writing Parameters and Status (Word Basis)

Use ioctl() to specify the following macros.

To access parameters for which data position numbers are assigned on a word basis, use these instructions on a word basis.

M3IO_READ_REG	Read input/output registers
M3IO_WRITE_REG	Write input/output registers

● Reading/Writing Parameters and Status (Long-word Basis)

Use ioctl() to specify the following macros.

To access parameters/status for which data position numbers are assigned on a long-word basis, use these instructions on a long-word basis.

M3IO_READ_REG_L Read input/output registers (32-bit data)

M3IO_WRITE_REG_L Write input/output registers (32-bit data)

● Interrupt Handling

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

Create a message queue (msgQCreate())

- Use interrupt processing to create a message queue, and acquire a message ID.

Example:

```
msgQId=msgget(IPC_PRIVATE, 0555);
```

Accept interrupt declaration (ioctl())

- Declare interrupt possible for the I/O module. Enable hardware interrupt for the applicable I/O module.

M3IO_ENABLE_INTER Interrupt possible declaration (1-point)

M3IO_MASK_INTER Interrupt possible declaration/disable (all points)

Example:

```
ioctl(fd, M3IO_ENABLE_INTER, &arg);
```

Wait for interrupt (msgrcv ())

- Wait for interrupt. When an interrupt is detected, waiting is disabled and data such as the number of the terminal where the interrupt occurred is saved in the function structure.

Example:

```
msgrcv(msgQId, (struct msgbuf *)&msgbufx,sizeof(msgbufx),
M3IO_MSGTYPE_IO,MSG_NOERROR);
```

Disable interrupt declaration (ioctl())

- Disable the declaration to make interrupt possible for the module.

M3IO_DISABLE_INTER Disable interrupt possible declaration (1-point)

M3IO_MASK_INTER Interrupt possible declaration/disable (all points)

Delete a message queue (msgQDelete())

- Delete the message queue.

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11. Errors and Troubleshooting

The errors and warnings detected by this module include positioning function errors/warnings and counter registered parameter errors that occur when setting counter registered parameters.

When an error occurs in a positioning function, the ERR LED (red) on the front of the module comes on.

11.1 Positioning Error

● Positioning Operation Error

This occurs if an error that prevents continuous operation is detected when positioning starts or during operation. The Error Detected input relay for the axis where the error occurred comes ON, the error code is saved in the error status, and the positioning operation is immediately stopped due to the error.

● Positioning Command Execution Error

This occurs if an invalid parameter is set outside of the setting range for the command parameter when executing a command. The Error Detected input relay for the axis where the command was executed comes ON, the error code is saved in the error status, and the command is not executed. If an error occurs due to the execution of a Change Target Position command or a Change Speed command during positioning operation, the positioning operation stops due to the error (immediately stops). Use the Reset Error command to reset command execution errors. Further, if trigger conditions have been set, they might also be detected.

● Positioning Set Parameter Error

This occurs if an invalid parameter is set outside of the setting range for a registered parameter when executing a Set Registered Parameters command. The Error Detected input relay for the axis where the Set Registered Parameters command was executed comes ON, the error code is saved in the error status, and the Set Registered Parameters command is not executed for any axis.

A Set Parameter error cannot be reset using the Reset Error command. Confirm the parameter, and then execute the Set Registered Parameters command again.

Table 11.1 Error Detected Relays

Input Relay No.	Signal	Description
X□□□17	AX1 Error Detected	ON when an error is detected on axis 1.
X□□□18	AX2 Error Detected	ON when an error is detected on axis 2.
X□□□19	AX3 Error Detected	ON when an error is detected on axis 3.
X□□□20	AX4 Error Detected	ON when an error is detected on axis 4.
X□□□21	AX5 Error Detected	ON when an error is detected on axis 5.
X□□□22	AX6 Error Detected	ON when an error is detected on axis 6.
X□□□23	AX7 Error Detected	ON when an error is detected on axis 7.
X□□□24	AX8 Error Detected	ON when an error is detected on axis 8.

Table 11.2 Error Status

Data Position No. (Word Basis)	Status	Description
*88	Error Status	Error information when an error occurs.

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

11.2 List of Positioning Error Codes

Table 11.3 List of Positioning Operation Error Codes

Error Code	Description of Error	Cause of Warning	Trouble-shooting
10	External Power Source error (Stop immediately)	- Attempted to operate motor while external 24V power source for pulse output is not ON. - Turned the external 24V power source for pulse output OFF while the motor was operating. (Occurs only when pulse output external power source detection setting is enabled in the parameter settings for axis 1.)	Turn on the external 24V power source for pulse. The external 24V power source for pulse output for shared statuses on all axes can be viewed. (Or, pulse output external power source detection setting is disabled in the parameter settings for axis 1.)
11	Forward Limit error (Stop immediately)	- An attempt is made to output a forward pulse when the Forward Limit input is on. - The Forward Limit input is turned on during the output of a forward pulse. (Occurs only when forward limit input error is enabled in the contact input/output polarity parameter settings for each axis.)	Disable limit input. (Check the limit input wiring and contact input polarity.) You can check the contact input status for the limit input status. (Or, disable limit input error in the contact input polarity parameter settings for each axis.)
12	Reverse Limit error (Stop immediately)	- An attempt is made to output a reverse pulse when the Reverse limit input is on. - The Reverse limit input is turned on during the output of a reverse pulse. (Occurs only when reverse limit input error is enabled in the contact input polarity parameter settings for each axis.)	
31	Pulse overflow error (Stop immediately)	An attempt is made during jog or manual pulse generator operation to place the current position status beyond the operating range (-2147483648 to 2147483647 pulses). (Occurs only when unlimited rotation setting is disabled in the parameter settings for each axis.)	Always position an axis within the operating range of the positioning module. (It is also possible to make settings so that overflow errors are not detected during jog or manual pulse generator operation, by enabling unlimited rotation setting in the parameter settings.)
41	Origin search error (Stop immediately)	During manual origin search, Z-phase is not detected within the Z-phase search range after starting Z-phase search. During auto origin search, Z-phase is not detected within the Z-phase search range for auto origin search after starting Z-phase search.	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 for the Z-phase input.
51	ToolBox Positioning Module communication error (Decelerate and stop)	A communication error occurred during an action test for the ToolBox positioning module. Communication errors are detected to prevent excess motor operation.	Check the ToolBox communication timeout interval. To perform an action test with the ToolBox positioning module, perform the official procedure after completing an action test.
99	Flash memory error	The flash memory content is corrupted. (Error Detected relays are ON for all axes.) This occurs if the power is turned OFF while writing to flash memory, or if the writing of data exceeds the writing limits of the flash memory.	Execute the initialize command for flash memory, reset the error, and set the parameters again. If this error occurs frequently, the module might be malfunctioning. You can check the total number of flash memory write operations already performed so far by checking the operation status.
100	Positioning Module ECC error (Decelerate and stop)	A data error could not be corrected during an internal self-diagnosis of the module.	Reboot the system. If this error occurs frequently, the module might be malfunctioning.

Table 11.4 List of Positioning Command Error Codes

Error Code	Description of Error	Cause of Warning	Trouble-shooting
1041	Command Code setup error	The command parameters are outside the setting range. Even if the parameters are within the setting range, this error can occur due to the combination with other parameters or the status during the execution of the command. Further, if trigger conditions have been set, an error might also occur if a trigger is detected. The error code is the data position number for the axis 1 command parameter.	Reset the error, set an appropriate value for the command parameter, and then execute the direction operation command again. For details on command parameters, please refer to 6.1.6 “Description of Command Parameters.” (Examples related to status when executing a command) Target position setup error The starting position is important for incremental positioning commands. Target speed setup error/startup speed setup error The current override value is also important when executing a command.
1042	Target Position Mode/Position Data Record Number setup error		
1043	Target Position setup error		
1045	Accel/Decel Mode setup error		
1046	Target Speed setup error		
1048	Acceleration Time setup error		
1049	Deceleration Time setup error		
1050	Startup Speed setup error		
1052	Origin search mode setup error		
1053	Origin Search Direction setup error		
1054	Z-phase Edge Selection setup error		
1055	Z-phase Search Count setup error		
1056	Z-phase Search Range setup error		
1058	Deviation Pulse Clear Time setup error		
1060	Manual Pulse Generator M Value setup error		
1061	Manual Pulse Generator N Value setup error		
1062	Manual Pulse Generator Filter setup error		
1063	Trigger Setting setup error		
1064	Trigger Axis Setting setup error		
1065	Trigger Contact Setting setup error		
1066	Counter Status Trigger Setting setup error		
1067	Counter Zone Coincidence Trigger Setting setup error		
1069	Overdrive Setting setup error		

Table 11.5 List of Positioning Registered Parameter Error Codes

Error Code	Description of Error	Cause of Warning	Trouble-shooting
2001	Speed Mode Selection setup error	The registered parameters are outside the setting range. Even if the parameters are within the setting range, this error can occur due to the combination with other parameters. The error code is the data position number for the axis 1 registered parameter.	Set an appropriate value for the registered parameter, and then execute the registered parameter settings again. For details on registered parameters, please refer to 6.1.2 “Description of Registered Parameters.” These errors cannot be reset with the Clear Error command.
2002	Pulse Output Mode setup error		
2003	Motor Direction Selection setup error		
2004	Contact Input Setting setup error		
2005	Forward Limit setup error		
2007	Reverse Limit setup error		
2009	Speed Limit setup error		
2011	AOS Mode setup error		
2012	AOS Direction setup error		
2013	AOS Speed 1 setup error		
2015	AOS Speed 2 setup error		
2017	AOS Startup Speed setup error		
2019	AOS Acceleration Time setup error		
2020	AOS Deceleration Time setup error		
2021	AOS Z-phase Edge Selection setup error		
2022	AOS Z-phase Search Count setup error		
2023	AOS Z-phase Search Range setup error		
2025	AOS deviation pulse clear time setup error		
2026	AOS Offset setup error		
2029	Unlimited Rotation Setting setup error		
2030	Z-phase Setting setup error		
2031	Deviation Pulse Clear Setting setup error		
2033	Acceleration Setting setup error		
2035	Deceleration Setting setup error		
2039	Pulse Output External Power Source Detection Setting setup error		

11.3 Positioning Warning

This warning occurs if command conditions are not satisfied when a command is executed.

The warning code is saved in the warning status of the command execution axis, and the command is ignored. When this warning occurs, the Error Detected input relay does not come ON.

This warning code is cleared when the Execute Command output relay, Stop Immediately, Forward Jog, and Reverse Jog for the applicable axis are all OFF.

Table 11.6 Warning Status

Data position No. (Word Basis)	Status	Description
*89	Warning Status	Warning information when a warning is raised.

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

11.4 List of Positioning Warning Codes

Table 11.7 List of Warning Codes (1/2)

Warning Code	Type of Warning	Cause of Warning
1001	Start Positioning Command Failed warning (including start position with resetting current position, and start position for position data record)	Start positioning was executed in error state.
1002		Start positioning was executed before positioning was completed
1101	Decelerate and Stop Command Failed warning	Decelerate and Stop was executed in error state.
1102		Decelerate and Stop with Trigger Conditions was executed during positioning completion.
1103		Decelerate and Stop was executed during jogging.
1104		Decelerate and Stop with Trigger Conditions was executed during an origin search.
1120		Decelerate and Stop with Trigger Conditions was executed while waiting for trigger startup.
1140		Decelerate and Stop was executed in MPG mode.
1201	Manual Origin Search Command Failed warning	Origin Search was executed in error state.
1202		Origin Search was executed before positioning was completed.
1302	Set Registered Parameters command Failed warning	Parameter Setting was executed before positioning was completed.
1401	Set Current Position Command Failed warning	Set Current Position was executed in error state.
1402		Set Current Position was executed before positioning was completed.
1501	Reset Error Command Failed warning	Reset Error was executed when there was no error or when the parameters setup error occurred.
1601	Change Speed Command Failed warning	Change Speed was executed in error state.
1602		Change Speed was executed during positioning completion.
1604		Change Speed was executed during an origin search.
1605		"Change Speed was executed during positioning acceleration, deceleration and stop, or a speed change. Or, Change Speed was executed during jogging/during speed control deceleration and stop."
1606		Cannot stop in the target position due to a speed change.
1607		Change Speed was executed during Change Target Position or during Speed Control to Position Control.
1620		Change Speed was executed while waiting for trigger startup.
1640		Change Speed was executed in MPG mode.
1701	Change Target Position Command Failed warning (including change target position with resetting current position, and change target position for position data record)	Change Target Position was executed in error state.
1703		Change Target Position was executed during jogging.
1704		Change Target Position was executed during an origin search.
1707		Change Target Position was executed during Change Target Position or during Speed Control to Position Control.
1720		Change Target Position was executed while waiting for trigger startup.
1730		Change Target Position was executed during Speed Control.
1740		Change Target Position was executed in MPG mode.
1801	Automatic Origin Search Command Failed warning	Auto Origin Search was executed in error state.
1802		Auto Origin Search was executed before positioning was completed.
1901	Save/Initialize Flash Memory Failed warning	Save Parameters was executed in error state.
1902		Save Parameters was executed before positioning was completed.

Note: "During change of target position" includes change of target position by a target position command with resetting current position.
Note: Warning codes for commands with triggers are the same warning codes for the same commands without triggers.

Table 11.7 List of Warning Codes (1/2)

Warning Code	Type of Warning	Cause of Warning
2001	Jog Command Failed warning	Jog was executed in error state.
2002		Jog was executed before positioning was completed.
3001	Override Settings Failed warning	Set Override was executed in error state.
3002		Set Override was executed before positioning was completed.
4001	Speed Control Operation Failed warning	Speed Control Startup was executed in error state.
4002		Speed Control Startup was executed before positioning was completed.
4101	Speed Control to Position Control Failed warning	Speed Control to Position Control was executed in error state.
4102		Speed Control to Position Control was executed during positioning completion.
4120		Speed Control to Position Control was executed while waiting for trigger startup.
4130		Speed Control to Position Control was executed during an action other than speed control or during speed control deceleration and stop.
5001	Start MPG Mode Failed warning	Start MPG Mode was executed in error state.
5002		Start MPG Mode was executed before positioning was completed.
5140	Stop MPG Mode Failed warning	Stop MPG Mode was executed not in MPG mode.

Note: "During change of target position" includes change of target position by a target position command with resetting current position.

Note: Warning codes for commands with triggers are the same warning codes for the same commands without triggers.

11.5 Counter Registered Parameter Errors

These errors occur if normal execution of a command is not possible due to an invalid parameter set outside of the setting range for a counter registered parameter when setting a counter registered parameter.

If an error occurs due to a counter registered parameter request, the ERR LED on the front of the module comes on.

Table 11.8 Counter Control Parameters

Data Position No. (Long-word Basis)	Parameter	Description
424	Counter Registered Parameters Request	Requests registration of counter parameters. When "1" is written, registration of counter parameters is requested. If operation ends normally, "0" is displayed. If an error occurs, the error code is displayed.

11.6 List of Counter Registered Parameter Error Codes

Table 11.9 List of Counter Registered Parameter Error Codes

Error Code	Description of Error	Cause of Warning	Trouble-shooting
5001	Counter Registered Parameters acceptance condition error	This error occurs if there is an axis in positioning operation, and a counter registered parameter request is not possible.	Request counter registered parameters before starting positioning.
5401	Counter Count Mode Setting setup error	The counter registered parameters are outside the setting range. Even if the parameters are within the setting range, this error can occur due to the combination with other parameters.	Set an appropriate value for the counter registered parameter, and then execute the counter registered parameter settings again. For details on counter registered parameters, please refer to 7.1.2 “Description of Counter Registered Parameters.”
5402	Counter Filter Setting setup error		
5403	Counter Action Mode Setting setup error		
5404	Preset Ring Counter Value setup error		
5405	Counter Contact Input Setting setup error		
5406	Counter Z-phase Input Setting setup error		
5407	Counter Contact Z-phase Input Function Layout setup error		
5408	Counter Contact Output 1 Layout setup error		
5409	Counter Contact Output 2 Layout setup error		
5410	Counter Coincidence Direction Setting setup error		
5411	Counter Relay Setting setup error		
5412	Counter Input Relay 1 Layout setup error		
5413	Counter Input Relay 2 Layout setup error		
5414	Counter Input Relay 3 Layout setup error		
5415	Counter Input Relay 4 Layout setup error		

Note: Counter overflow/underflow errors are detected by the counter bit status.
(Since this is not a counter registered parameter setup error, it is not shown in this list of error codes.)

11.7 Troubleshooting

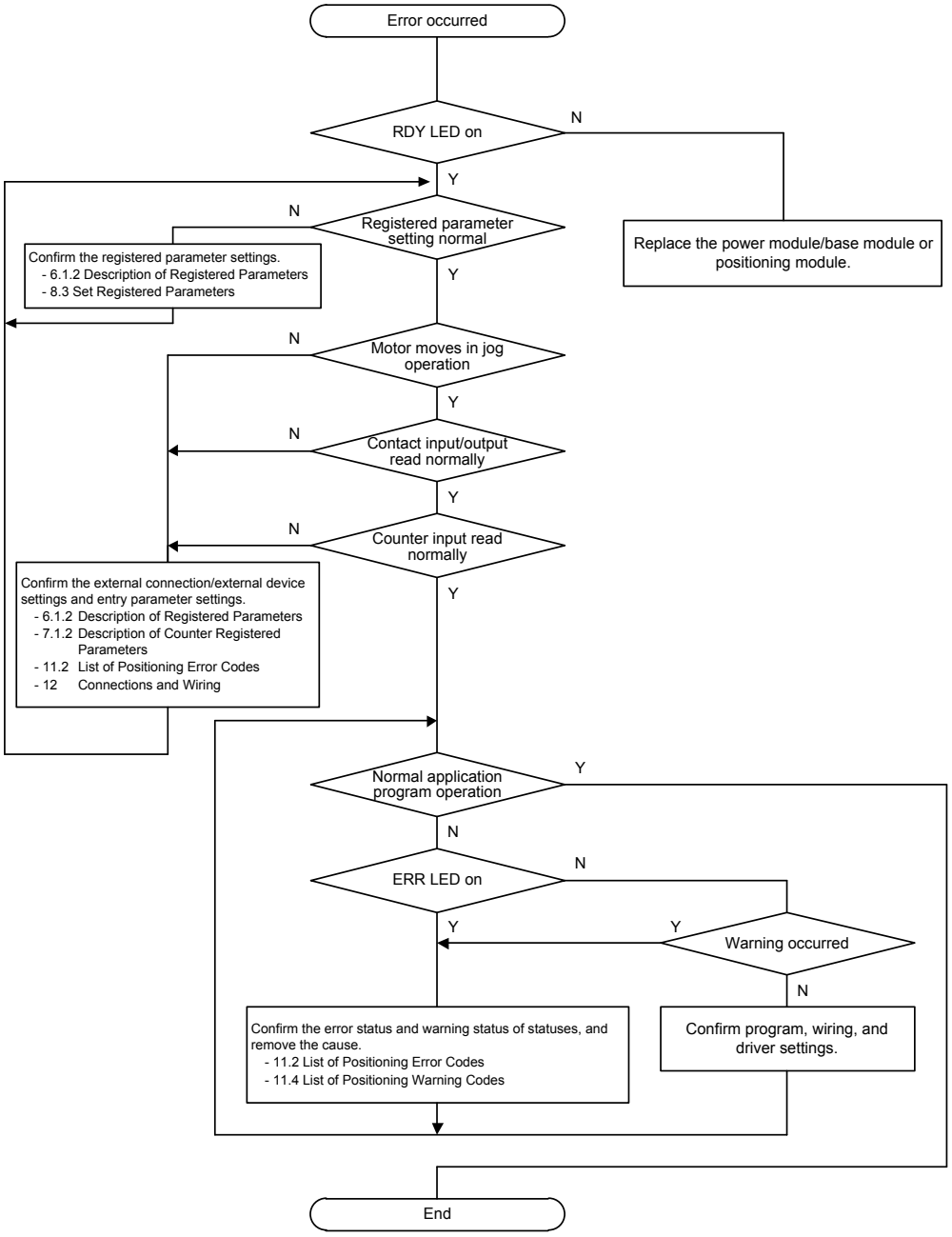

Figure 11.1 Troubleshooting

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12. Connections and Wiring

12.1 Attaching and Detaching Modules

■ Attaching Modules

Figure 12.1 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.

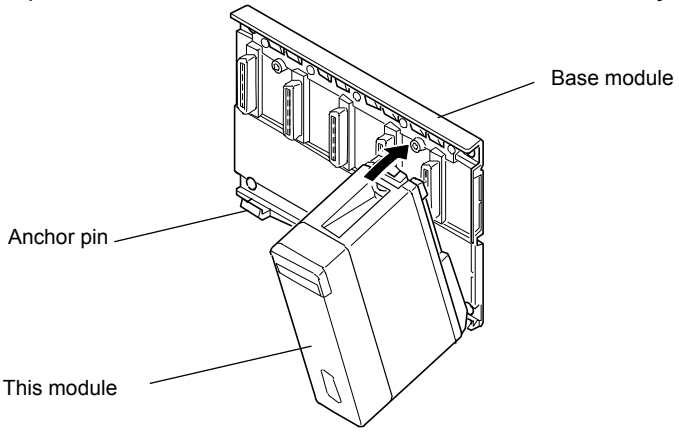


Figure 12.1 Attaching and Detaching This Module

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.

Screws to be used
M4 binder screws, 12-15 mm long (or 14-15 mm long for screws with washer)

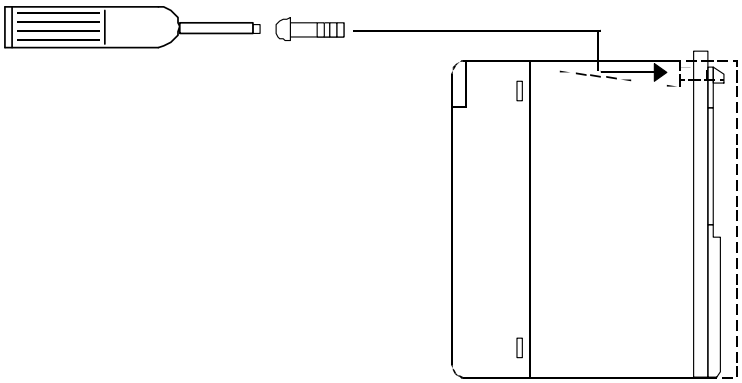


Figure 12.2 Fastening the Module with a Screw

■ Grounding Cables

Use a shielded cable for conforming equipment incorporating the positioning module to CE Marking. Remove part of the cable insulation to expose the shield, and ground and secure the shield with an FG clamp.

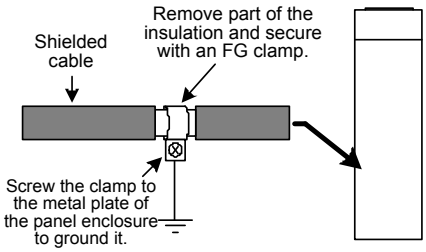


Figure 12.3 Grounding cables

12.2 Signal Specifications

For a list of the external connection signals, see Section 2.8, "Terminal Assignments and Connections ". This section describes the specifications and method of connection of each signal.

CAUTION

The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits. Thus, if a signal exceeds its rated voltage (or rated current) due to incorrect wiring or other reasons, it may lead to module failure.

CAUTION

For the module, changes have been made from F3YP14-0N and F3YP18-0N, such as a change in the voltage of external power for pulse output from 5 VDC to 24 VDC. Therefore, wiring for F3YP14-0N and F3YP18-0N cannot be used for F3YP24-0P and F3YP28-0P without first making changes.

In particular, if a 24 V connector is connected to external power for F3YP24-0P and F3YP28-0P pulses, and F3YP14-0N and F3YP18-0N are connected to 5VDC external power for pulse output, the F3YP14-0N and F3YP18-0N pulse output circuitry will malfunction.

12.2.1 Pulse Output

The positioning modules output positioning command pulses as RS422 compliant differential signals. Use shielded twisted pair wire for wiring.

24 VDC (20.4 to 26.4 VDC) external power is required for positioning command pulse output. The monitoring function for external power can be enabled/disabled in the registered parameter settings.

Further, the insulated DC/DC ground inside the module is connected to all connectors as the pulse output ground. If the pulse output is received by a line receiver, connect the pulse output ground to the ground of the other device.

Table 12.1 Signal Specifications

Item	Specifications
Isolation method	Isolated coupler
Electrical specification	RS-422 compliant differential signal (driver ISL32172E equivalent)
Maximum speed	7,996,000pps

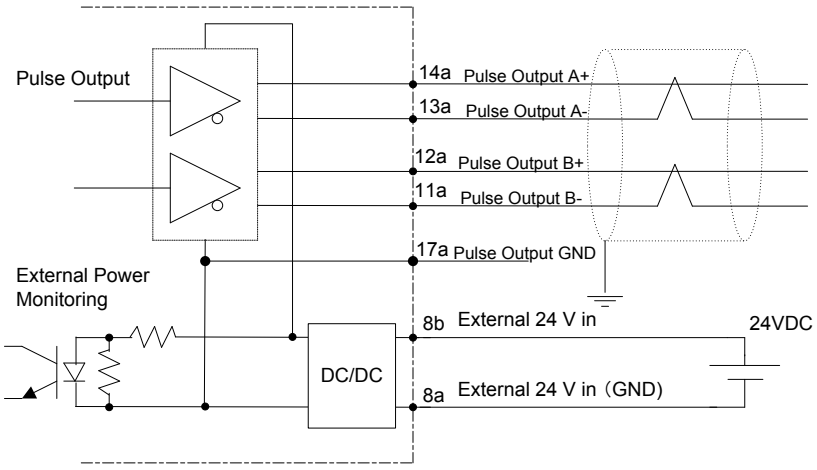


Figure 12.4 Pulse Output Connections

CAUTION

The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits. Thus, if a signal exceeds its rated voltage (or rated current) due to incorrect wiring or other reasons, it may lead to module failure.

The pulse output type can be set in the registered parameters to CW/CCW pulse, travel/direction, and Phase A/B. Make these settings according to the specifications of the connected motor/driver.

Table 12.2 Pulse Output Type and Output Signal

Pulse Output Type	Pulse Output A	Pulse Output B
CW/CCW pulse	CW	CCW
Travel/direction	Travel	Direction
Phase A/B	Phase A	Phase B

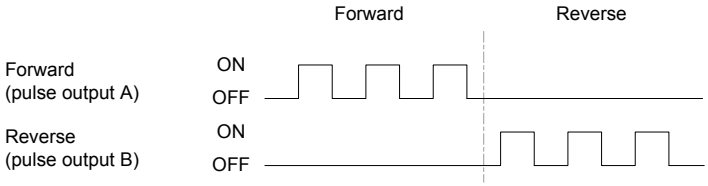
Table 12.3 Signal Polarity

Signal	Off (break)	On(mark)
Output (+)	High level (differential positive)	Low level (differential negative)
Output (-)	Low level (differential negative)	High level (differential positive)

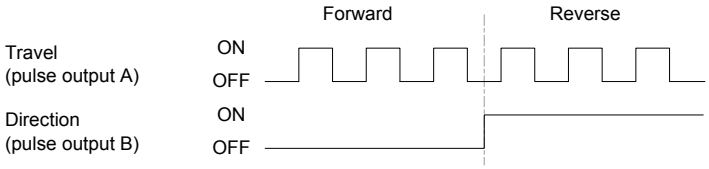
CAUTION

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.

● CW/CCW Pulse



● Travel/Direction



● Phase A/B

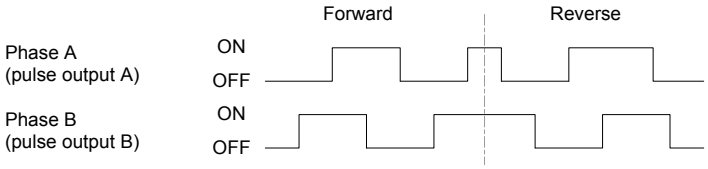


Figure 12.5 Rotation Direction and Pulse Output

12.2.2 External Contact Input

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

Connection inputs can be switched between a and b in the registered parameter settings. Forward limit input and reverse limit input can be set by enabling/disabling limit input error detection in the registered parameter settings.

Table 12.4 Signal Specifications

Item	Specifications
Isolation method	Photocoupler isolation
Input impedance	about 7.4 kΩ
Rated input voltage (allowable input voltage range)	24 V DC (20.4 to 26.4 V DC)
Rated input current	3.1mA
Voltage/current for ON signal (for normally open contact)	19.2 V DC min. /2.4 mA min.
Voltage/current for OFF signal (for normally open contact)	5.8 V DC max. /0.9 mA max.
Common type	Shared common
Response time *1	ON (connection A): Max. 0.4 ms OFF (connection A): Max. 2 ms

*1: The filter time set in the registered parameters is added to this value.

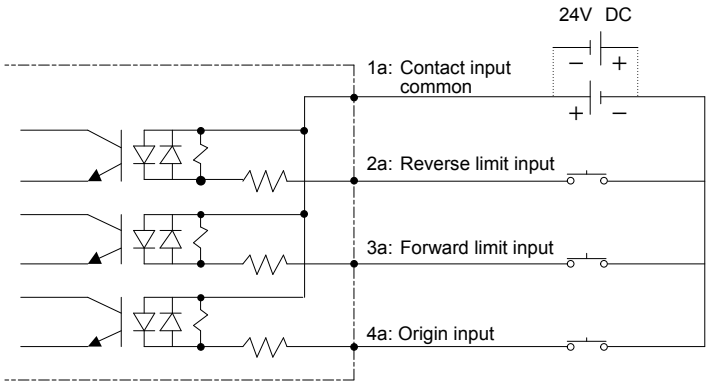


Figure 12.6 External Connection Input Connections

CAUTION

The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits. If the rated voltage (or rated current) for signal lines is exceed due to incorrect wiring, etc., the module might malfunction.

12.2.3 Z-phase Encoder Input

This is the input for connecting the Z-phase encoder. You may also connect a RS422A compliant differential input signal.

Use shielded twisted pair wire.

Table 12.5 Signal Specifications

Item	Specifications
Isolation method	Photocoupler isolation
Input impedance	240 Ω
Rated input voltage (allowable input voltage range)	5 V DC (4.25 to 5.5 V DC)
Rated input current	15.3 mA
Voltage/current for ON signal	3.5 V DC min./9 mA min.
Voltage/current for OFF signal	1.5 V DC max./ 2 mA max.
Common type	Separate commons
Response time *1	0.125 ms max.

*1: The filter time set in the registered parameters is added to this value.

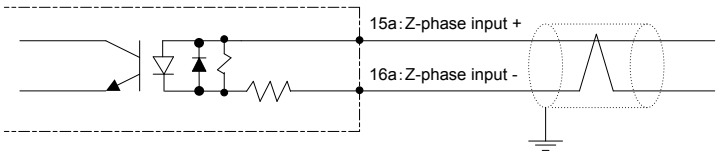


Figure 12.7 Z-phase Encoder Input Connection

CAUTION

The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits. The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits.

12.2.4 Deviation Pulse Clear Signal Output

When using a servomotor/driver, this output signal 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. The mode for automatic output during origin search and the mode turned ON/OFF by the program at the desired timing can be selected in the deviation pulse clear settings in the registered parameters.

Table 12.6 Signal Specifications

Item	Specifications
Isolation method	Photocoupler isolation
Rated load voltage	24 V DC
Maximum load current	100mA/point (200mA per common terminal)
OFF leakage current	0.1 mA max.
ON residual voltage	1.5 V DC max.
Common type	Shared common

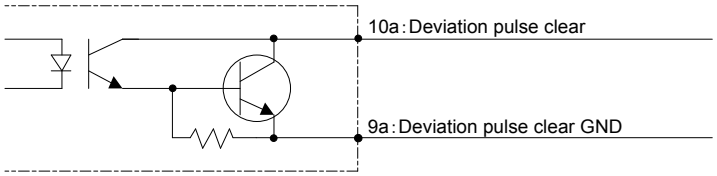


Figure 12.8 Deviation Pulse Clear Output Signal Connection

CAUTION

The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits. The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits.

12.2.5 Counter Input

The encoder input signal and manual pulse input signal are connected here. You may also connect a RS422A compliant differential input signal. Use shielded twisted pair wire.

Table 12.7 Signal Specifications

Item	Specifications
Isolation method	Photocoupler isolation
Input impedance	240 Ω
Rated input voltage (allowable input voltage range)	5 V DC (4.25 to 5.5 V DC)
Rated input current	15.3 mA
Voltage/current for ON signal	3.5 V DC min./9 mA min.
Voltage/current for OFF signal	1.5 V DC max./ 2 mA max.
Common type	Separate commons

Table 12.8 Counter Input Format

Counter Input Format	Counter Input A	Counter Input B
CW/CCW pulse	CW	CCW
Travel/direction	Pulse	Direction
Phase A/B	Phase A	Phase B

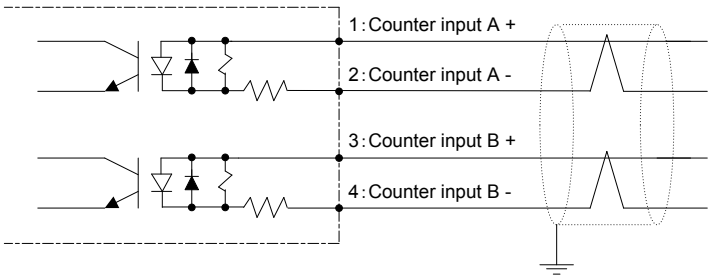
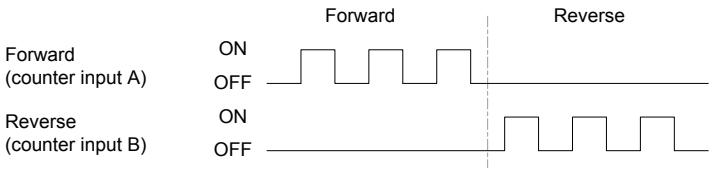


Figure 12.9 Counter Input Connections

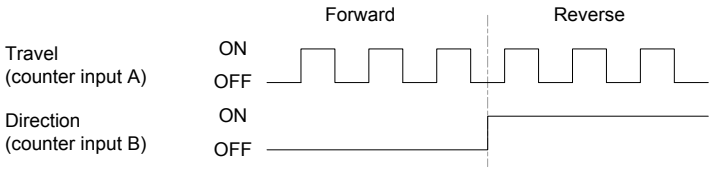
CAUTION

The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits. The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits.

● CW/CCW Pulse



● Travel/Direction



● Phase A/B

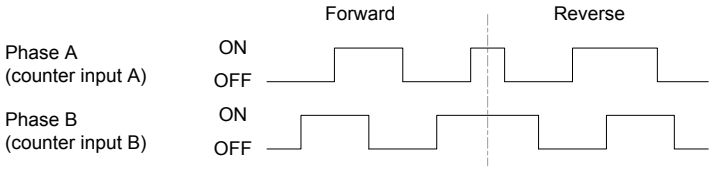


Figure 12.10 Phase A/B

CAUTION

The Phase A/B specifications for the motor/driver and the Phase A/B specifications for this module might be reversed. When wiring, refer to the manual to check the direction and phase relationships with the encoder to be connected.

For a Phase A/B input, connect the signal for the phase for rotation in the forward direction to the Phase B input of the counter.

12.2.6 Counter Z-phase Input

This is the input for connecting the Z-phase of the counter. You may also connect a RS422A compliant differential input signal.

Use shielded twisted pair wire.

The counter Z-phase input can be set to external input, such as counter latch requests and counter preset requests, in the counter registered parameter settings.

Table 12.9 Signal Specifications

Item	Specifications
Isolation method	Photocoupler isolation
Input impedance	240 Ω
Rated input voltage (allowable input voltage range)	5 V DC (4.25 to 5.5 V DC)
Rated input current	15.3 mA
Voltage/current for ON signal	3.5 V DC min./9 mA min.
Voltage/current for OFF signal	1.5 V DC max./ 2 mA max.
Common type	Separate commons
Response time *1	0.01 ms max.

*1: The filter time set in the registered parameters is added to this value.

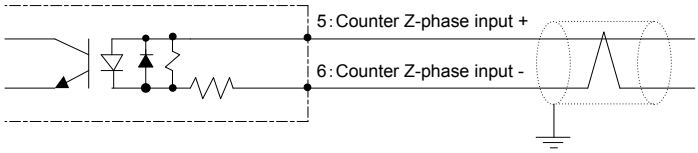


Figure 12.11 Counter Z-Phase Input Connections

CAUTION

The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits. The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits.

12.2.7 Counter Contact Input

These are 24 V DC inputs with a common terminal. Only a positive polarity can be used. It is insulated from the internal circuitry by a photocoupler.

It can be set as a contact input for counter enable/disable or for counter latch requests and counter preset requests, in the counter registered parameter settings. It can also be used as an external trigger input for positioning functions.

Table 12.10 Signal Specifications

Item	Specifications
Isolation method	Photocoupler isolation
Input impedance	about 3.45 kΩ
Rated input voltage (allowable input voltage range)	24 V DC (20.4 to 26.4 V DC)
Rated input current	6.5mA
Voltage/current for ON signal (for normally open contact)	19.2 V DC min./2.4 mA min
Voltage/current for OFF signal (for normally open contact)	5.8 V DC max. /0.9 mA max.
Common type	Shared common (positive)
Response time *1	0.01 ms max.

*1: The filter time set in the counter registered parameters is added to this value.

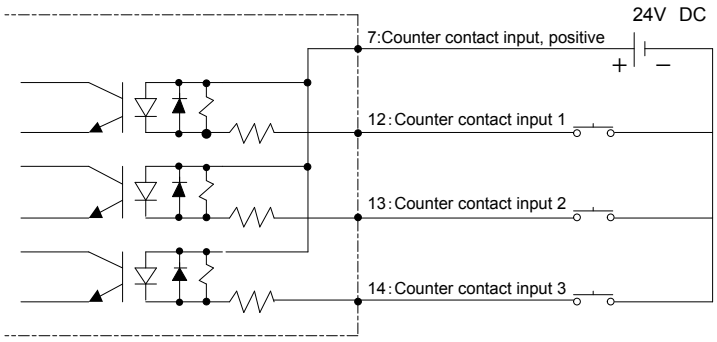


Figure 12.12 Counter Contact Input Connections

CAUTION

Only a positive polarity can be used for counter contact input. Be sure to use a positive polarity.

CAUTION

The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits. The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits.

12.2.8 Counter Contact Output

These are sink open collector outputs with a common terminal. DC24 V is required as an external power supply. It is insulated from the internal circuitry by a insulated coupler.

The counter high-speed contact output can be assigned to counter bit statuses, such as counter coincidence and counter range, in the counter registered parameter settings.

Table 12.11 Signal Specifications

Item	Specifications
Isolation method	Isolated coupler
Rated load voltage	24 V DC
Maximum load current	100 mA/point
OFF leakage current	0.1 mA max.
ON residual voltage	1.5 V DC max.
Common type	Shared common
External power supply	24 V DC
Response time	0.01 ms max.

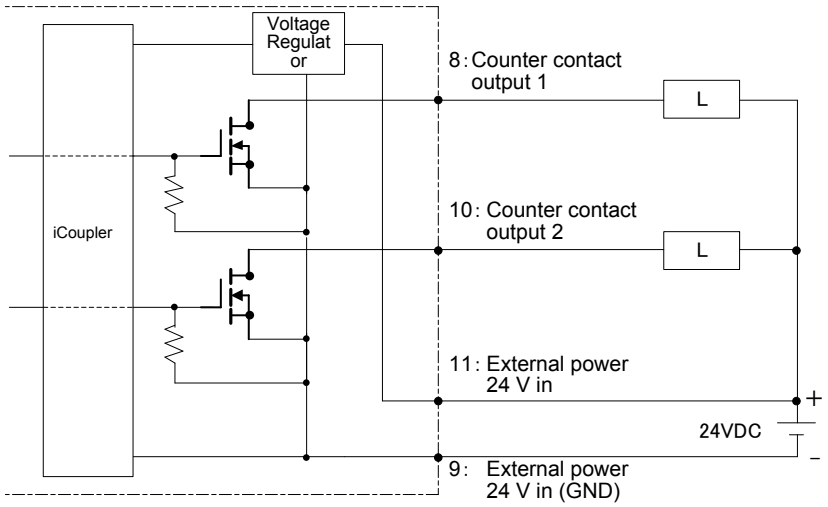


Figure 12.13 Counter Contact Output Connections

CAUTION

Since counter connection outputs operates at high speed, cross-talk noise might occur. Wire counter contact outputs 1 and 2 for an external power 24 V ground. In addition, when wiring with flat cables, take appropriate measures such as not wiring other signals nearby.

CAUTION

The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits. The positioning module is not provided with circuits to protect against overvoltage in input circuits and circuits to protect against short circuit in output circuits.

12.3 Examples of Connections to Motors/Drivers

This chapter presents examples of connections of the module to motor or drivers. Note that the figures indicate canonical connections. Other unconnected signals (surrounded with dotted lines in the examples) may also have to be connected depending on your application.

CAUTION

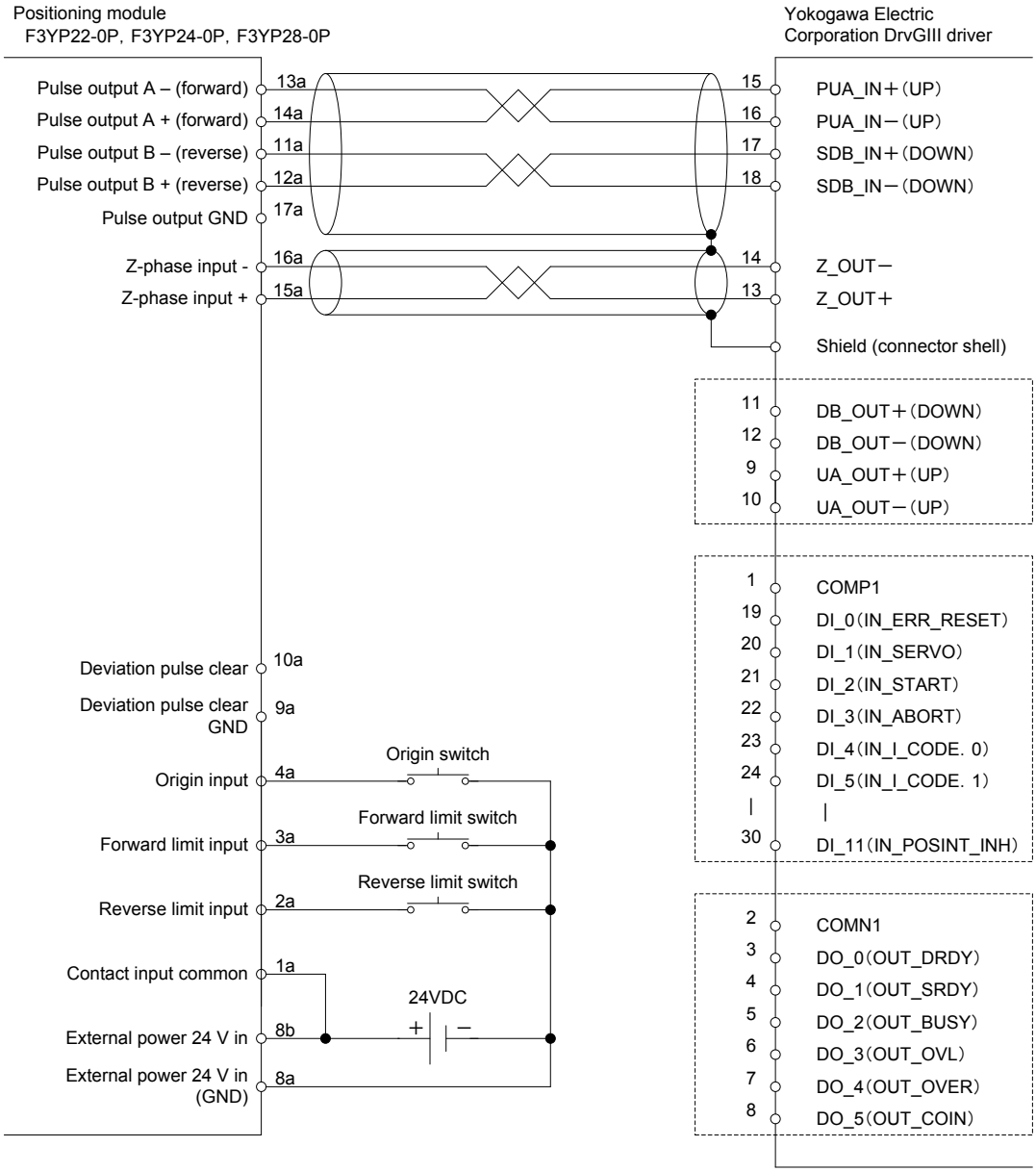
While wiring, be sure to check the specifications (connection methods, electrical specifications, etc.) for each signal line in the manuals for the devices to be connected.

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.
- When connecting a motor/driver encoder to the counter input, the Phase A/B specifications for the motor/driver and the Phase A/B specifications for this module might be reversed. When wiring, refer to the manual to check the rotating direction and phase relationships with the encoder to be connected. Connect the signal for the phase for rotation in the forward direction to the Phase B input of the counter.
- Use shielded cables to connect signal lines and connect the shield to the FG terminal of the driver.

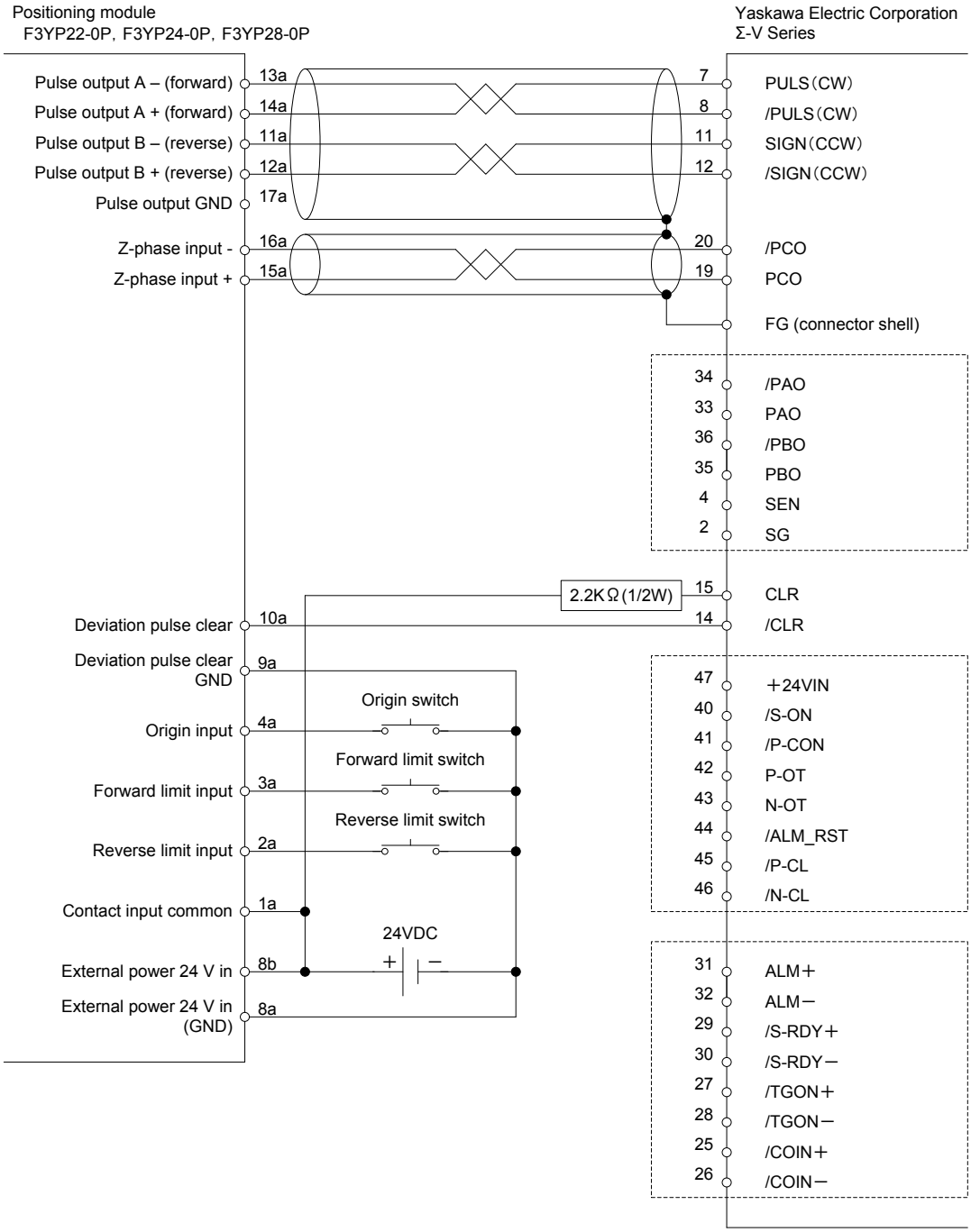
12.3.1 Example of Connection to Yokogawa Electric Corporation Servo Amp

■ Example of Connection to DrvGIII Driver



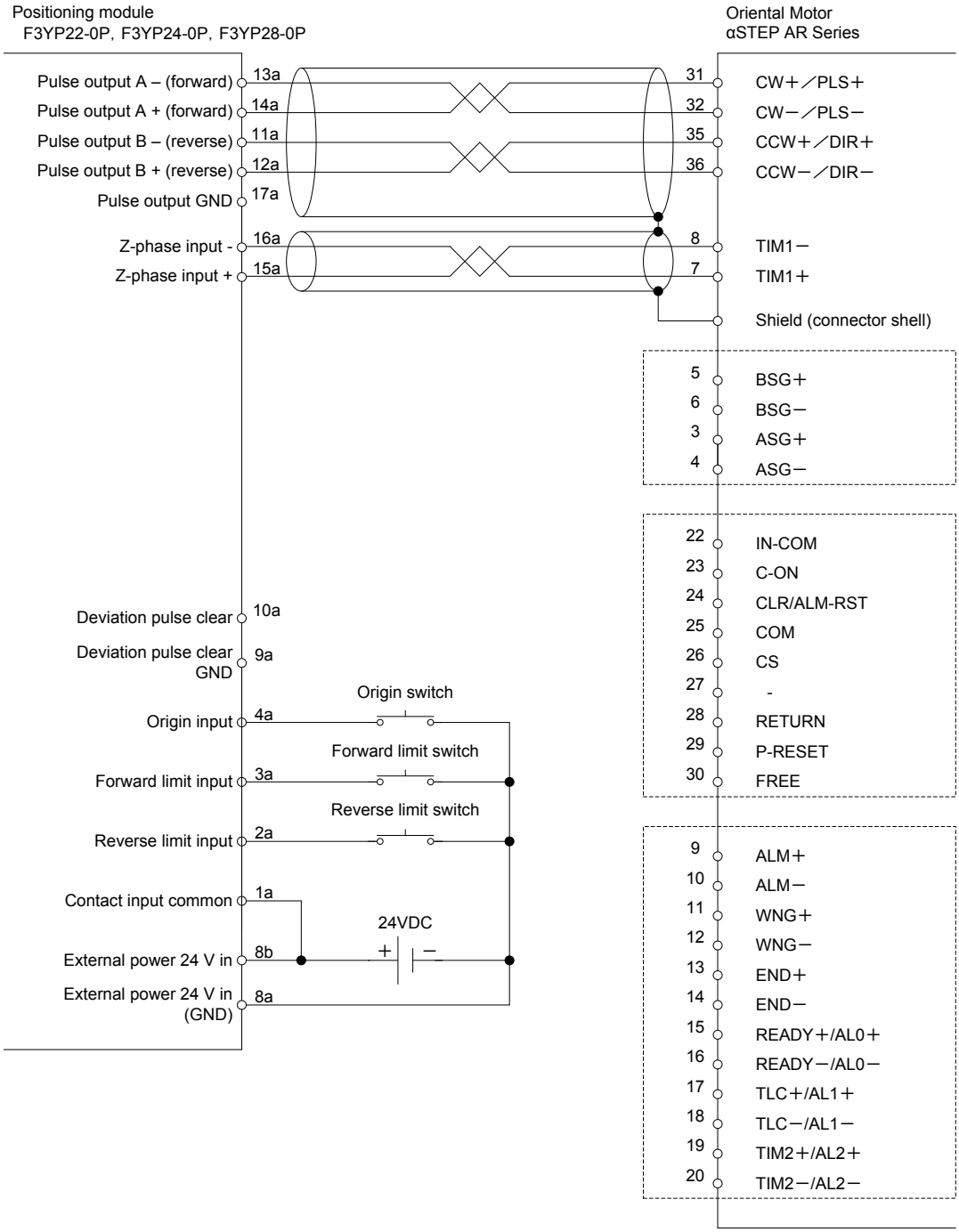
12.3.2 Example of Connection to Yaskawa Electric Corporation Servo Amp

■ Example of Connection to Σ-V Series



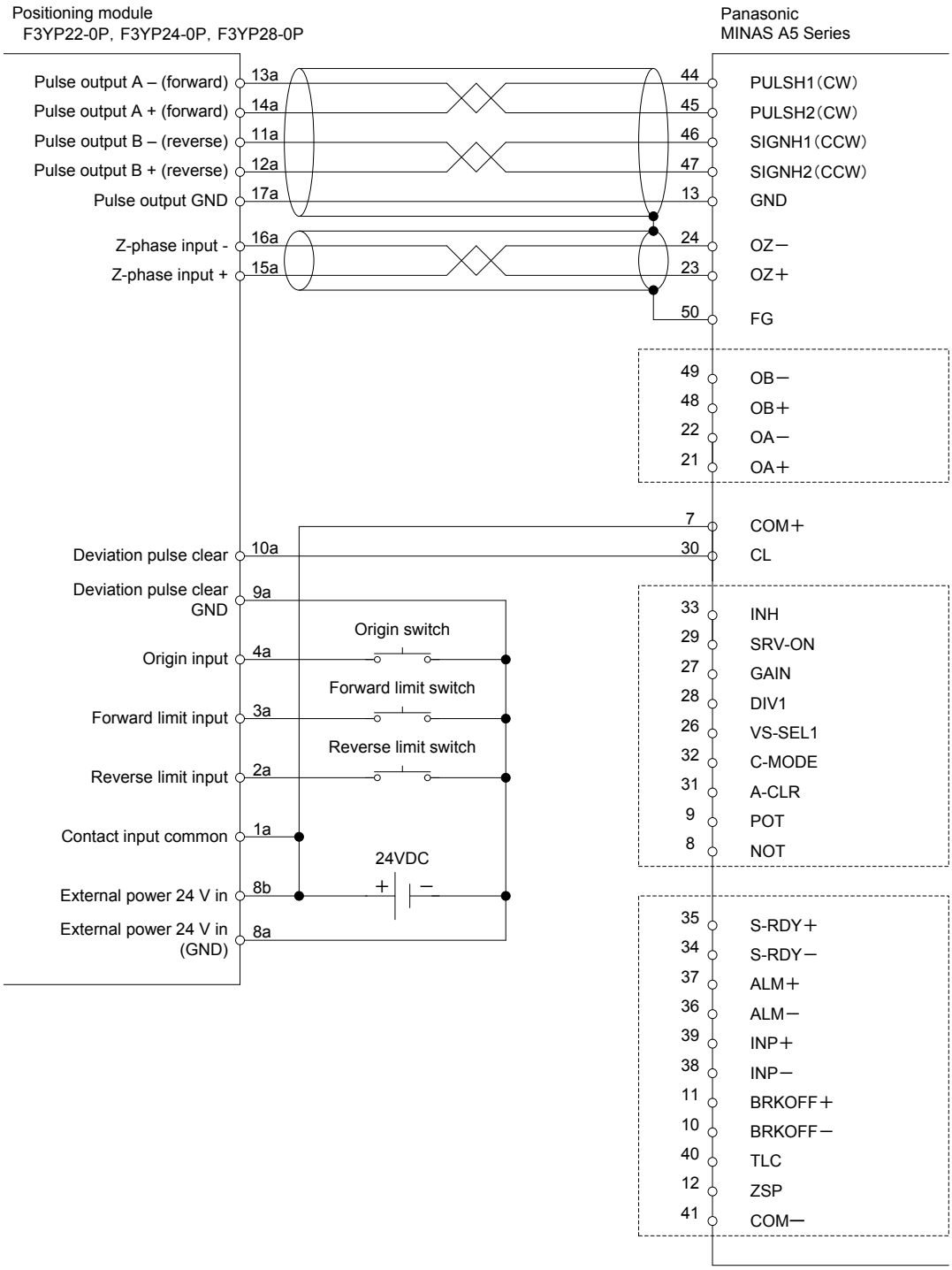
12.3.3 Example of Connection to Oriental Motor Stepping Motor

■ Example of Connection to α STEP AR Series



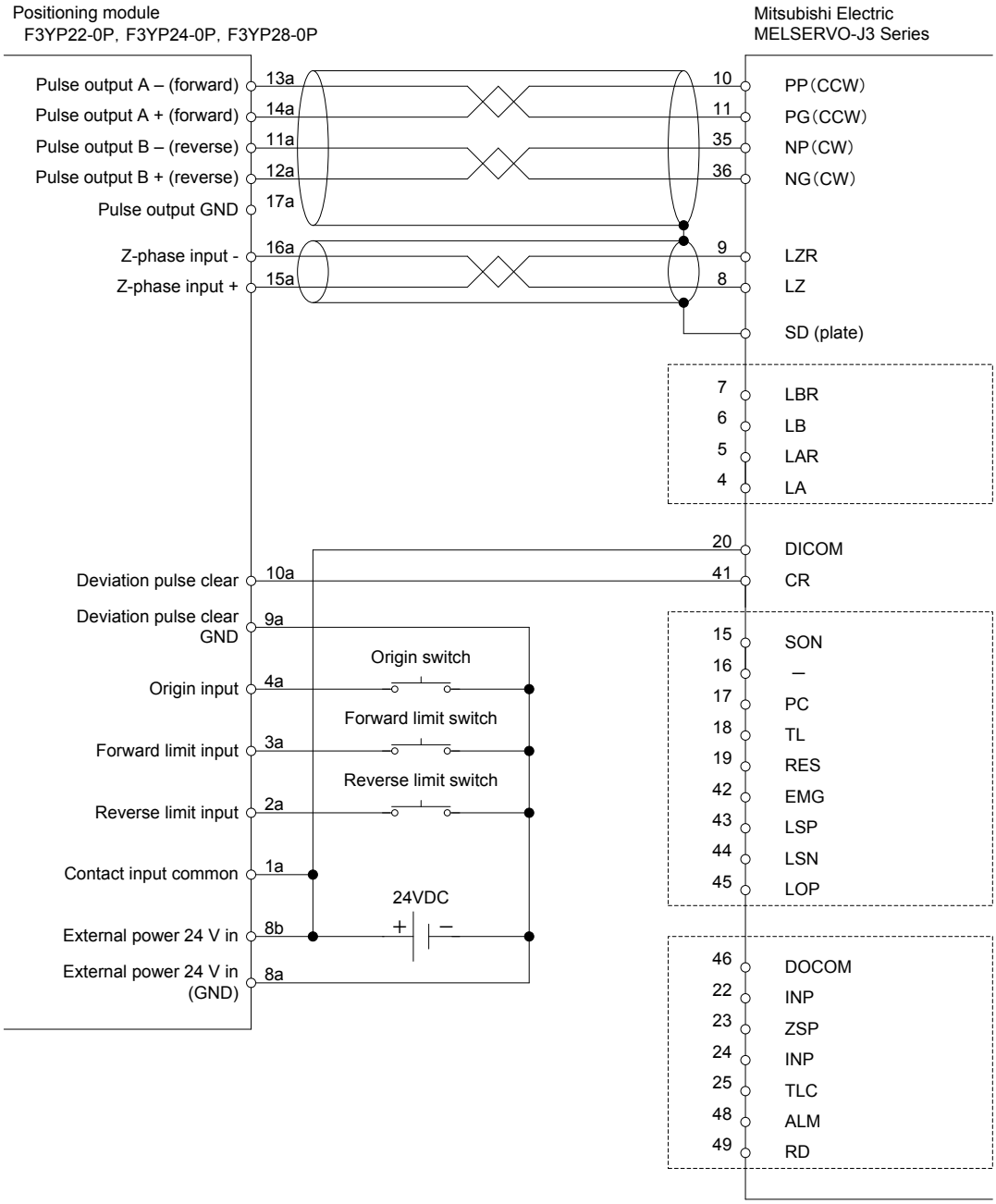
12.3.4 Example of Connection to Panasonic Servo Amp

■ Example of Connection to MINAS A5 Series



12.3.5 Example of Connection to Mitsubishi Electric Servo Amp

■ Example of Connection to MELSERVO-J3 Series



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Appendix 1. Differences with F3YP14-0N/F3YP18-0N

Appx. 1.1 General Specifications

Table Appx 1.1 General Specifications (1/2)

Item		Specifications	
		F3YP22-0P F3YP24-0P F3YP28-0P	**F3YP14-0N F3YP18-0N**
Control	**Number of controlled axes**	2, 4, 8	4, 8
	Control method	Open-loop control with positioning command pulse output	Open-loop control with positioning command pulse output
	Pulse output method	RS-422A compliant differential line driver (ISL32172E equivalent) CW/CCW pulse, travel/direction pulse, and phase A/B pulse for each axis	RS-422A compliant differential line driver (SN75ALS194 equivalent) CW/CCW pulse, travel/direction pulse selection for each axis
	Output pulse rate (pulse/s)	- When using a servo motor CW/CCW pulse : 7,996,000 Travel/Direction : 7,996,000 Phase A/B (x4) : 7,996,000 Phase A/B (x2) : 3,998,000 Phase A/B (x1) : 1,999,000 - When using a stepper motor CW/CCW pulse : 1,999,000 Travel/Direction : 1,999,000 Phase A/B (x4) : 1,999,000 Phase A/B (x2) : 999,500 Phase A/B (x1) : 499,750	- When using a servo motor CW/CCW pulse : 3,998,000 Travel/Direction : 3,998,000 - When using a stepper motor CW/CCW pulse : 499,750 Travel/Direction : 499,750
External contact input		4 inputs per axis (origin input, forward and reverse limit inputs, and Z-phase input) (A digital filter can be set for each input. Forward and reverse limit inputs can be used as generic inputs.)	4 inputs per axis (origin input, forward and reverse limit inputs, and Z-phase input)
External contact output		1 output per axis (deviation pulse clear signal)	1 output per axis (deviation pulse clear signal)
Positioning functions	**Control unit**	pulse	pulse
	Control mode	Position control (PTP control, multi-axis linear interpolation), speed control, and speed control to position control switchover	Position control (PTP control, multi-axis linear interpolation)
	Operation method	Direct operation Position data table operation (10 data/axis)	Direct operation
	Command position	Absolute/incremental positioning command -2,147,483,648 to 2,147,483,647 (pulses)	Absolute/incremental positioning command 2,147,483,648 to 2,147,483,647 (pulses)
	Command speed (pulse/s)	For servomotor, 1 to 7,996,000 For stepper motor, 1 to 1,999,000	For servomotor, 0.1 to 3,998,000 For stepper motor, 0.1 to 499,750
	Command speed units	Selectable: pulse/s, (1/65536) pulse/ms	(1/65536) pulse/ ms
	Acceleration/ deceleration system	Automatic trapezoidal acceleration/deceleration (startup speed programmable) Automatic S-shape acceleration/deceleration (startup speed fixed)	Automatic trapezoidal acceleration/deceleration (startup speed programmable) Automatic S-shape acceleration/deceleration (startup speed fixed)
	Acceleration/ deceleration time	0 to 32,767 (ms) (configurable for acceleration and deceleration separately) Select to set in 1 ms units or 0.01 ms units	0 to 32,767 (ms) (configurable for acceleration and deceleration separately) Set in 1 ms units.

Table Appx. 1.1 General Specifications (2/2)

Item		Specifications	
		F3YP22-0P F3YP24-0P F3YP28-0P	F3YP14-0N F3YP18-0N
Positioning functions	**Origin search**	Two types of automatic origin search Manual origin search (user-definable using a combination of external contact inputs)	Two types of automatic origin search Manual origin search (user-definable using a combination of external contact inputs)
	Manual control	Jog and manual pulse generator mode	Jog
	Other	Target position change during operation, speed change during operation, current position setup, software limit detection, override function, positioning start/stop by an external trigger, software trigger, or counter coincidence	Target position change during operation, speed change during operation, current position setup, software limit detection
Startup time[*1]	**1 axis**	0.04 ms	0.09 ms
	4 axes	0.09 ms	0.25 ms
	8 axes	0.15 ms	0.50 ms
Counter	**Number of channels**	1 channel	None
	Pulse input method	Pulse type selectable: CW/CCW pulse, travel/direction pulse, and phase A/B pulse	
	Input pulse rate (pulses/s)	CW/CCW pulse : 2,000,000 Travel/Direction : 2,000,000 Phase A/B (x4) : 8,000,000 Phase A/B (x2) : 4,000,000 Phase A/B (x1) : 2,000,000	
	Operation mode	Linear counter, ring counter	
	Counter functions	Counter enable function, counter preset function, counter coincidence detection function, cam-operated switch function, counter latch function, speed measurement function, positioning start/stop by an external trigger or counter coincidence	
	Counter Z-phase Input	1 input (latch input, present input, and so on can be assigned)	
	Counter external contact input	3 inputs (latch input, present input, enable input, trigger condition of the positioning function, and so on can be assigned)	
	Counter external contact output	2 outputs (counter coincidence output, cam-operated switch output, and so on can be assigned)	
Data backup		Backup to flash ROM (Number of rewrites: 100,000)	Backup to flash ROM (Number of rewrites: 100,000)
Current consumption (at 5 V DC)		8 axes : 280 mA 4 axes : 240 mA 2 axes : 210 mA	8 axes : 380 mA 4 axes : 320 mA
External power supply (For pulse output/counter contact output)		24 V DC 8 axes : 200 mA (190 mA/10 mA) 4 axes : 110 mA (100 mA/10 mA) 2 axes : 70 mA (60 mA/10 mA)	5 V DC 8 axes : 700 mA 4 axes : 350 mA
External wiring		8 axes : Two 48-pin connectors 4 axes : One 48-pin connector 2 axes : One 48-pin connector For counter : One 14-pin connector	8 axes : Two 48-pin connectors 4 axes : One 48-pin connector
External dimensions		28.9 (W) × 100 (H) × 83.2 (D) mm[*2]	28.9 (W) × 100 (H) × 83.2 (D) mm[*2]
Weight		8 axes : 175 g 4 axes : 110 g 2 axes : 110 g	8 axes : 145 g 4 axes : 125 g

*1: A delay of this value up to 0.125 ms (1 ms for F3YP14/18) may be added if another axis is in motion.
*2: Not including protrusions. (See the external dimension diagram for more details.)

Appx. 1.2 External connections

Table Appx. 1.2 External Connections: Connectors for Axes 1 to 4

F3YP22-0P, F3YP24-0P, F3YP28-0P			
24b		**24a**	
23b		**23a**	
22b		**22a**	
21b		**21a**	
20b		**20a**	
19b		**19a**	
18b		**18a**	
17b	Pulse output GND	**17a**	Pulse output GND
16b		**16a**	
15b		**15a**	
14b		**14a**	
13b		**13a**	
12b		**12a**	
11b		**11a**	
10b		**10a**	
9b	Deviation pulse clear GND	**9a**	Deviation pulse clear GND
8b	External power 24 V in	**8a**	External power 24 V in (GND)
7b		**7a**	
6b		**6a**	
5b		**5a**	
4b		**4a**	
3b		**3a**	
2b		**2a**	
1b		**1a**	

F3YP14-0N, F3YP18-0N			
24b	Axis 4 Z-phase input (-)	**24a**	Axis 2 Z-phase input (-)
23b	Axis 4 Z-phase input (+)	**23a**	Axis 2 Z-phase input (+)
22b	Axis 4 pulse output A (+)	**22a**	Axis 2 pulse output A (+)
21b	Axis 4 pulse output A (-)	**21a**	Axis 2 pulse output A (-)
20b	Axis 4 pulse output B (+)	**20a**	Axis 2 pulse output B (+)
19b	Axis 4 pulse output B (-)	**19a**	Axis 2 pulse output B (-)
18b	Axis 4 deviation pulse clear	**18a**	Axis 2 deviation pulse clear
17b	Axis 4 deviation pulse clear (GND)	**17a**	Axis 2 deviation pulse clear (GND)
16b	Axis 3 Z-phase input (-)	**16a**	Axis 1 Z-phase input (-)
15b	Axis 3 Z-phase input (+)	**15a**	Axis 1 Z-phase input (+)
14b	Axis 3 pulse output A (+)	**14a**	Axis 1 pulse output A (+)
13b	Axis 3 pulse output A (-)	**13a**	Axis 1 pulse output A (-)
12b	Axis 3 pulse output B (+)	**12a**	Axis 1 pulse output B (+)
11b	Axis 3 pulse output B (-)	**11a**	Axis 1 pulse output B (-)
10b	Axis 3 deviation pulse clear	**10a**	Axis 1 deviation pulse clear
9b	Axis 3 deviation pulse clear (GND)	**9a**	Axis 1 deviation pulse clear (GND)
8b	External power 5 Vin	**8a**	External power 5 Vin (GND)
7b	Axis 4 origin input	**7a**	Axis 2 origin input
6b	Axis 4 forward limit input	**6a**	Axis 2 forward limit input
5b	Axis 4 reverse limit input	**5a**	Axis 2 reverse limit input
4b	Axis 3 origin input	**4a**	Axis 1 origin input
3b	Axis 3 forward limit input	**3a**	Axis 1 forward limit input
2b	Axis 3 reverse limit input	**2a**	Axis 1 reverse limit input
1b	Contact input common	**1a**	Contact input common

* A blank field indicates no changes.

Table Appx. 1.3 External Connections: Connectors for Axes 5 to 8

F3YP28-0P			
24b		**24a**	
23b		**23a**	
22b		**22a**	
21b		**21a**	
20b		**20a**	
19b		**19a**	
18b		**18a**	
17b	Pulse output GND	**17a**	Pulse output GND
16b		**16a**	
15b		**15a**	
14b		**14a**	
13b		**13a**	
12b		**12a**	
11b		**11a**	
10b		**10a**	
9b	Deviation pulse clear GND	**9a**	Deviation pulse clear GND
8b	External power 24 V in	**8a**	External power 24 V in (GND)
7b			
6b			
5b			
4b			
3b			
2b			
1b			

F3YP18-0N			
24b	Axis 4 Z-phase input (-)	**24a**	Axis 2 Z-phase input (-)
23b	Axis 4 Z-phase input (+)	**23a**	Axis 2 Z-phase input (+)
22b	Axis 4 pulse output A (+)	**22a**	Axis 2 pulse output A (+)
21b	Axis 4 pulse output A (-)	**21a**	Axis 2 pulse output A (-)
20b	Axis 4 pulse output B (+)	**20a**	Axis 2 pulse output B (+)
19b	Axis 4 pulse output B (-)	**19a**	Axis 2 pulse output B (-)
18b	Axis 4 deviation pulse clear	**18a**	Axis 2 deviation pulse clear
17b	Axis 4 deviation pulse clear (GND)	**17a**	Axis 2 deviation pulse clear (GND)
16b	Axis 3 Z-phase input (-)	**16a**	Axis 1 Z-phase input (-)
15b	Axis 3 Z-phase input (+)	**15a**	Axis 1 Z-phase input (+)
14b	Axis 3 pulse output A (+)	**14a**	Axis 1 pulse output A (+)
13b	Axis 3 pulse output A (-)	**13a**	Axis 1 pulse output A (-)
12b	Axis 3 pulse output B (+)	**12a**	Axis 1 pulse output B (+)
11b	Axis 3 pulse output B (-)	**11a**	Axis 1 pulse output B (-)
10b	Axis 3 deviation pulse clear	**10a**	Axis 1 deviation pulse clear
9b	Axis 3 deviation pulse clear (GND)	**9a**	Axis 1 deviation pulse clear (GND)
8b	External power 5 Vin	**8a**	External power 5 Vin (GND)
7b	Axis 4 origin input	**7a**	Axis 2 origin input
6b	Axis 4 forward limit input	**6a**	Axis 2 forward limit input
5b	Axis 4 reverse limit input	**5a**	Axis 2 reverse limit input
4b	Axis 3 origin input	**4a**	Axis 1 origin input
3b	Axis 3 forward limit input	**3a**	Axis 1 forward limit input
2b	Axis 3 reverse limit input	**2a**	Axis 1 reverse limit input
1b	Contact input common	**1a**	Contact input common

* A blank field indicates no changes.

■ Appendix 1.2.1 External power/pulse output ground

F3YP22-0P, F3YP24-0P, and F3YP28-0P have been changed to a 24 V DC external power supply for pulse output. (F3YP14-0N and F3YP18-0 are 5 V DC.)

Further, the insulated DC/DC ground inside the module is connected to all connectors as the pulse output ground. If the pulse output is received by a line receiver, connect the pulse output ground to the ground of the other device.

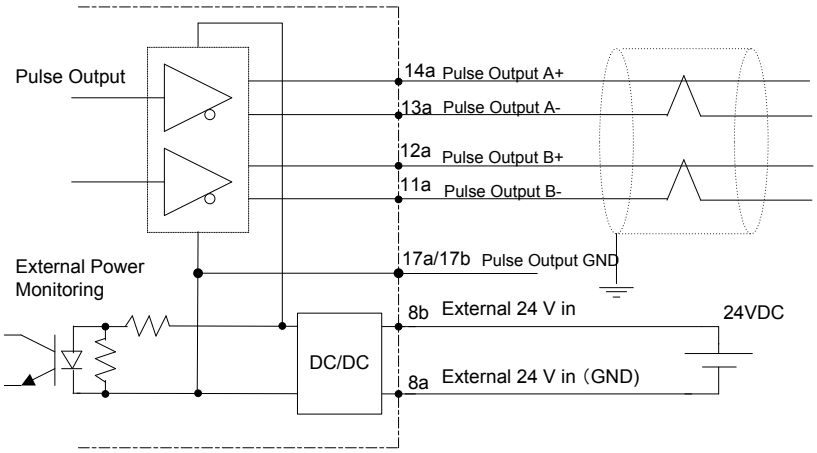

Figure Appx. 1.1 External Power/Pulse Output Ground for F3YP22-0P, F3YP24-0P, and F3YP28-0P

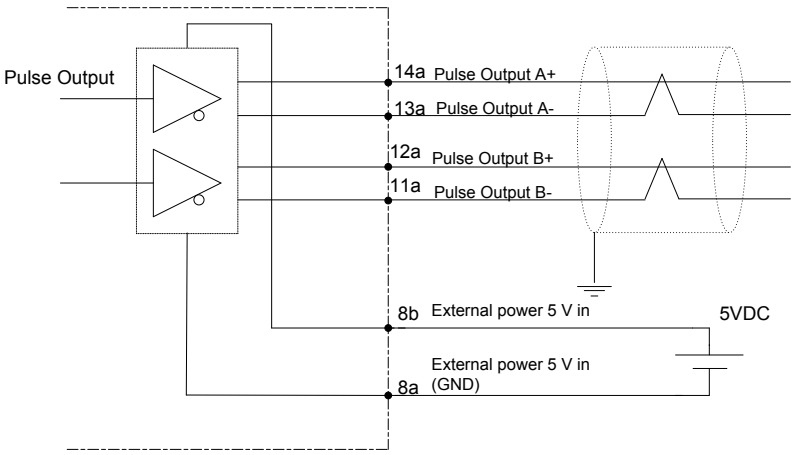

Figure Appx. 1.2 External Power Input for F3YP14-0N and F3YP18-0N

■ Appendix 1.2.2 Deviation pulse clear signals

F3YP22-0P, F3YP24-0P, and F3YP28-0P have a shared ground for deviation pulse clear signals. (F3YP14-0N and F3YP18-0 have independent grounds for each axis.)

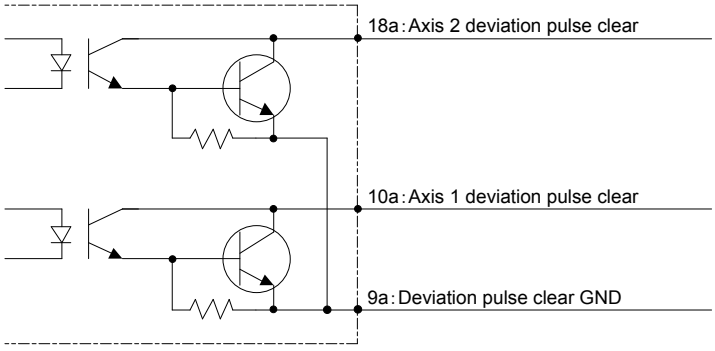

Figure Appx. 1.3 Deviation Pulse Clear Signals for F3YP22-0P, F3YP24-0P, and F3YP28-0P

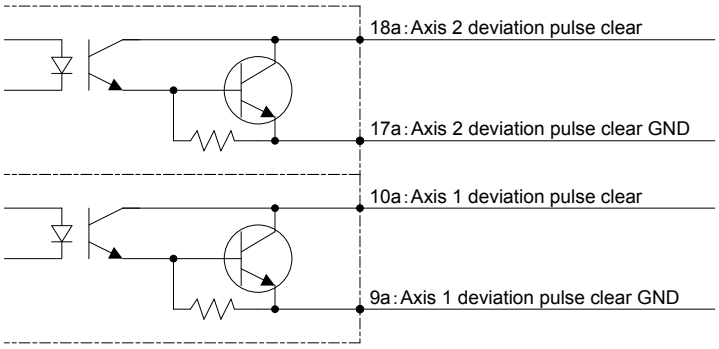

Figure Appx. 1.4 Deviation Pulse Clear Signals for F3YP14-0N and F3YP18-0N

Appx. 1.3 Added Command Codes

Table Appx. 1.4 List of Added Command Codes

Command code	Command	Function	See Also
10	Start Positioning with Resetting Current Position	Resets the current position to 0 and starts a positioning operation.	8-51
17	Change Target Position with Resetting Current Position	Resets the target position of the current operation to 0 and changes the target position.	8-55
20	Start Positioning with Position Data Record	Performs a positioning operation based on data in a position data record.	8-39
27	Change Target Position with Position Data Record	Changes the target position based on data in a position data record.	8-47
300	Set Override	Sets the override setting value and changes the target speed to 1% to 500% of the current value.	8-78
400	Start Speed Control	Starts a speed control operation.	8-59
401	Speed Control to Position Control (with a current position zero reset)	Clears the current position to 0 during a speed control operation, switches to position control, and performs a position control operation to the target position.	8-63
402	Speed Control to Position Control (without a current position reset)	Switches from speed control to position control, and performs a position control operation to the target position.	8-63
500	Start MPG Mode	Switches the operating mode to manual pulse generator mode.	8-15
501	Stop MPG Mode	Stops manual pulse generator mode.	8-15
1000	Start Positioning with Trigger	Specifies a trigger condition and executes a Start Positioning command.	8-35 8-81
1001	Decelerate and Stop with Trigger	Specifies a trigger condition and executes a Decelerate and Stop command.	8-68 8-81
1010	Start Positioning with Trigger and Resetting Current Position	Specifies a trigger condition and executes a Start Positioning with Resetting Current Position command.	8-51 8-81
1020	Start Positioning with Position Data Record with Trigger	Specifies a trigger condition and executes a Start Positioning with Position Data Record command.	8-39 8-81
1400	Start Speed Control with Trigger	Specifies a trigger condition and executes a Start Speed Control command.	8-74 8-81
1401	Speed Control to Position Control with Trigger (with a current position zero reset)	Specifies a trigger condition and executes a Speed Control to Position Control command (with a current position zero reset).	8-63 8-81
1402	Speed Control to Position Control with Trigger (without a current position reset)	Specifies a trigger condition and executes a Speed Control to Position Control command (without a current position reset).	8-63 8-81

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Appendix 2. Handling Compatible Speed Units for F3YP14-0N/ F3YP18-0N

The positioning module supports two types of units of speed data. You can specify the unit of speed data by the command speed unit selection of the Speed Mode Selection registered parameter. Usually specify "1: pulse/s". "0: (1/65536) pulse/ms" is the unit of speed supported for compatibility with the F3YP14-0N and F3YP18-0N positioning modules. Select this unit only when you use a program coded for the previous models.

Appx. 2.1 Fixed-decimal Point Data

Speed data with unit [(1/65536) pulse/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.

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 Appx. 2.1

bit	31(MSB)	30	···	17	16	15	14	···	1	0(LSB)
Value	Sign bit	16384	···	2	1	1/2	1/4	···	1/32768	1/65536
	High-order word					Low-order word				

- Example of fixed point data

  When setting speed data of 123.45 [pulse/ms] (=123450 [pulses/s]),
  123.45 x 65536 = 8090419.2 [(1/65536) pulse/ms]. Thus, we should set 8090419 as long-word data. The high-order word of this data is 123 because 8090419 ÷ 65536 = 123. The low-order word is the remainder, i.e., 29491.

Appx. 2.2 Speed Data Conversion Program 1

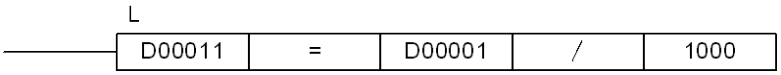
Here, we show a sample sequence program for converting speed data in [pulses/s] into unit [(1/65536) pulse/ms]. Let D0001 (long-word data) be the original data ([pulses/s]).

(1) Divide D0001 by 1000 (long-word division) and store the result in D0011.

In this case, since the maximum value of D0001 is 8,000,000 (8 Mpps) and it is positive, the maximum value of the result is 8000 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) pulse/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.

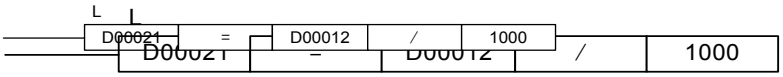


Computation result

D00014	D00013	D00012	D00011
0	Remainder	0	High-order setting data

(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 multiply 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 x 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) pulse/ms] to be set in the positioning module and the remainder is discarded.



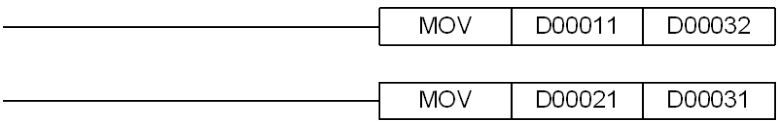
Computation result

D00024	D00023	D00022	D00021
0	Remainder	0	Low-order setting data

(3) Combine the contents of D0011 and D0021 into long-word data ([(1/65536) pulse/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.



Computation result

D00032	D00031
High-order setting data	Low-order setting data

- In the case of 123450 [pulse/s]

(1) D0011 = 123450/1000 (long-word division)

D00014	D00013	D00012	D00011
0	450	0	123
	29491200 (=450×65536)		

(2) D0021 = 29491200/1000 (long-word division)

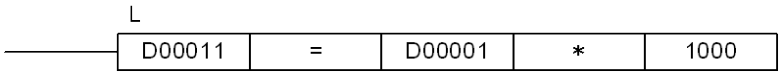
D00024	D00023	D00022	D00021
0	200	0	29491

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

Appx. 2.3 Speed Data Conversion Program 2

To convert data in [(1/65536) pulse/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) pulse/ms] units. The operation is as follows.



Computation result

D00014	D00013	D00012	D00011
	Resulting long word [pulse/ms]		Truncated portion

Blank Page

Appendix 3. Input/Output Relays

Appx. 3.1 Input relay

Table Appx. 3.1 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.

Note that "□□□" in the table represents the number of the FA-M3 slot where the positioning module is installed.

For the F3YP28-0P module, when you need to send a counter status change (e.g., counter coincidence detection and external counter latch request) to the CPU module by using input relays, you can assign Stop Immediately ACK relays for positioning functions to the input relays. For the F3YP28-0P module, when you use the counter input relays, the Stop Immediately ACK relays for axes 5 to 8 become unavailable.

Table Appx. 3.1 List of Input Relays

Input Relay No.	Signal	Description	Relationship with Other Relays
X□□□01	AX1 Execute Command ACK	Turns on when command execution for axis 1 is successfully completed.	Turning off Y□□□33 turns off this relay.
X□□□02	AX2 Execute Command ACK	Turns on when command execution for axis 2 is successfully completed.	Turning off Y□□□34 turns off this relay.
X□□□03	AX3 Execute Command ACK	Turns on when command execution for axis 3 is successfully completed.	Turning off Y□□□35 turns off this relay.
X□□□04	AX4 Execute Command ACK	Turns on when command execution for axis 4 is successfully completed.	Turning off Y□□□36 turns off this relay.
X□□□05	AX5 Execute Command ACK	Turns on when command execution for axis 5 is successfully completed.	Turning off Y□□□37 turns off this relay.
X□□□06	AX6 Execute Command ACK	Turns on when command execution for axis 6 is successfully completed.	Turning off Y□□□38 turns off this relay.
X□□□07	AX7 Execute Command ACK	Turns on when command execution for axis 7 is successfully completed.	Turning off Y□□□39 turns off this relay.
X□□□08	AX8 Execute Command ACK	Turns on when command execution for axis 8 is successfully completed.	Turning off Y□□□40 turns off this relay.
X□□□09	AX1 Stop Immediately ACK	Turns on when a Stop Immediately command for axis 1 is successfully completed.	Turning off Y□□□41 turns off this relay.
X□□□10	AX2 Stop Immediately ACK	Turns on when a Stop Immediately command for axis 2 is successfully completed.	Turning off Y□□□42 turns off this relay.
X□□□11	AX3 Stop Immediately ACK	Turns on when a Stop Immediately command for axis 3 is successfully completed.	Turning off Y□□□43 turns off this relay.
X□□□12	AX4 Stop Immediately ACK	Turns on when a Stop Immediately command for axis 4 is successfully completed.	Turning off Y□□□44 turns off this relay.
X□□□13[*1]	AX5 Stop Immediately ACK /Counter Input Relay 1	Turns on when a Stop Immediately command for axis 5 is successfully completed. /Turns on the flag assigned to the counter relay 1.	Turning off Y□□□45 turns off this relay. /-
X□□□14[*1]	AX6 Stop Immediately ACK /Counter Input Relay 2	Turns on when a Stop Immediately command for axis 6 is successfully completed. /Turns on the flag assigned to the counter relay 2.	Turning off Y□□□46 turns off this relay. /-
X□□□15[*1]	AX7 Stop Immediately ACK /Counter Input Relay 3	Turns on when a Stop Immediately command for axis 7 is successfully completed. /Turns on the flag assigned to the counter relay 3.	Turning off Y□□□47 turns off this relay. /-
X□□□16[*1]	AX8 Stop Immediately ACK /Counter Input Relay 4	Turns on when a Stop Immediately command for axis 8 is successfully completed. /Turns on the flag assigned to the counter relay 4.	Turning off Y□□□48 turns off this relay. /-

Input Relay No.	Signal	Description	Relationship with Other Relays
X□□□17	AX1 Error Detected	Turns on when an error occurs on axis 1.	-
X□□□18	AX2 Error Detected	Turns on when an error occurs on axis 2.	-
X□□□19	AX3 Error Detected	Turns on when an error occurs on axis 3.	-
X□□□20	AX4 Error Detected	Turns on when an error occurs on axis 4.	-
X□□□21	AX5 Error Detected	Turns on when an error occurs on axis 5.	-
X□□□22	AX6 Error Detected	Turns on when an error occurs on axis 6.	-
X□□□23	AX7 Error Detected	Turns on when an error occurs on axis 7.	-
X□□□24	AX8 Error Detected	Turns on when an error occurs on axis 8.	-
X□□□25	AX1 Positioning Completed	Turns on when a positioning operation for axis 1 is completed.	-
X□□□26	AX2 Positioning Completed	Turns on when a positioning operation for axis 2 is completed.	-
X□□□27	AX3 Positioning Completed	Turns on when a positioning operation for axis 3 is completed.	-
X□□□28	AX4 Positioning Completed	Turns on when a positioning operation for axis 4 is completed.	-
X□□□29	AX5 Positioning Completed	Turns on when a positioning operation for axis 5 is completed.	-
X□□□30	AX6 Positioning Completed	Turns on when a positioning operation for axis 6 is completed.	-
X□□□31	AX7 Positioning Completed	Turns on when a positioning operation for axis 7 is completed.	-
X□□□32	AX8 Positioning Completed	Turns on when a positioning operation for axis 8 is completed.	-

*1: For the F3YP22-0P and F3YP24-0P modules, these input relays work as the counter input relays 1 to 4.
For the F3YP28-0P module, you can select whether to use them as the Stop Immediately ACK relays for positioning functions or as the counter input relays 1 to 4.

Appx. 3.2 Output relay

Table Appx. 3.2 lists the output relays available in this positioning module.

Note that "□□□" in the table represents the number of the FA-M3 slot where the positioning module is installed.

Table Appx. 3.2 List of Output Relays

Output Relay No.	Signal	Description	Relationship with Other Relays
Y□□□33	AX1 Execute Command	Request to execute a command for axis 1	Turn this relay off after confirming that X□□□01 has turned on.
Y□□□34	AX2 Execute Command	Request to execute a command for axis 2	Turn this relay off after confirming that X□□□02 has turned on.
Y□□□35	AX3 Execute Command	Request to execute a command for axis 3	Turn this relay off after confirming that X□□□03 has turned on.
Y□□□36	AX4 Execute Command	Request to execute a command for axis 4	Turn this relay off after confirming that X□□□04 has turned on.
Y□□□37	AX5 Execute Command	Request to execute a command for axis 5	Turn this relay off after confirming that X□□□05 has turned on.
Y□□□38	AX6 Execute Command	Request to execute a command for axis 6	Turn this relay off after confirming that X□□□06 has turned on.
Y□□□39	AX7 Execute Command	Request to execute a command for axis 7	Turn this relay off after confirming that X□□□07 has turned on.
Y□□□40	AX8 Execute Command	Request to execute a command for axis 8	Turn this relay off after confirming that X□□□08 has turned on.
Y□□□41	AX1 Stop Immediately	Request to stop axis 1 immediately	Turn this relay off after confirming that X□□□09 has turned on.
Y□□□42	AX2 Stop Immediately	Request to stop axis 2 immediately	Turn this relay off after confirming that X□□□10 has turned on.
Y□□□43	AX3 Stop Immediately	Request to stop axis 3 immediately	Turn this relay off after confirming that X□□□11 has turned on.
Y□□□44	AX4 Stop Immediately	Request to stop axis 4 immediately	Turn this relay off after confirming that X□□□12 has turned on.
Y□□□45	AX5 Stop Immediately	Request to stop axis 5 immediately	Turn this relay off after confirming that X□□□13 has turned on.
Y□□□46	AX6 Stop Immediately	Request to stop axis 6 immediately	Turn this relay off after confirming that X□□□14 has turned on.
Y□□□47	AX7 Stop Immediately	Request to stop axis 7 immediately	Turn this relay off after confirming that X□□□15 has turned on.
Y□□□48	AX8 Stop Immediately	Request to stop axis 8 immediately	Turn this relay off after confirming that X□□□16 has turned on.

Output Relay No.	Signal	Description	Relationship with Other Relays
Y□□□49	AX1 Forward Jog	Forward jog request for axis 1	
Y□□□50	AX2 Forward Jog	Forward jog request for axis 2	
Y□□□51	AX3 Forward Jog	Forward jog request for axis 3	
Y□□□52	AX4 Forward Jog	Forward jog request for axis 4	
Y□□□53	AX5 Forward Jog	Forward jog request for axis 5	
Y□□□54	AX6 Forward Jog	Forward jog request for axis 6	
Y□□□55	AX7 Forward Jog	Forward jog request for axis 7	
Y□□□56	AX8 Forward Jog	Forward jog request for axis 8	
Y□□□57	AX1 Reverse Jog	Reverse jog request for axis 1	
Y□□□58	AX2 Reverse Jog	Reverse jog request for axis 2	
Y□□□59	AX3 Reverse Jog	Reverse jog request for axis 3	
Y□□□60	AX4 Reverse Jog	Reverse jog request for axis 4	
Y□□□61	AX5 Reverse Jog	Reverse jog request for axis 5	
Y□□□62	AX6 Reverse Jog	Reverse jog request for axis 6	
Y□□□63	AX7 Reverse Jog	Reverse jog request for axis 7	
Y□□□64	AX8 Reverse Jog	Reverse jog request for axis 8	

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Appendix 4. List of Parameters/Statuses

The overall configuration for parameters and statuses that are required when using this module are shown in Table Appx. 4.1. For details, see Appendix 4.1 to 4.7.

Table Appx. 4.1 Layout of the Parameter and Status Areas

Data Position No. (Word Basis)	Description
0001 to 0040	AX1 Registered Parameters
0041 to 0080	AX1 Command Parameters
0081 to 0100	AX1 Status
0101 to 0140	AX2 Registered Parameters
0141 to 0180	AX2 Command Parameters
0181 to 0200	AX2 Status
0201 to 0240	AX3 Registered Parameters
0241 to 0280	AX3 Command Parameters
0281 to 0300	AX3 Status
0301 to 0340	AX4 Registered Parameters
0341 to 0380	AX4 Command Parameters
0381 to 0400	AX4 Status
0401 to 0440	AX5 Registered Parameters
0441 to 0480	AX5 Command Parameters
0481 to 0500	AX5 Status
0501 to 0540	AX6 Registered Parameters
0541 to 0580	AX6 Command Parameters
0581 to 0600	AX6 Status
0601 to 0640	AX7 Registered Parameters
0641 to 0680	AX7 Command Parameters
0681 to 0700	AX7 Status
0701 to 0740	AX8 Registered Parameters
0741 to 0780	AX8 Command Parameters
0781 to 0800	AX8 Status
0801 to 0980	Counter Parameters and Statuses
0981 to 1000	Common Statuses for All Axes
1001 to 1100	AX1 Position Data Record
1101 to 1200	AX2 Position Data Record
1201 to 1300	AX3 Position Data Record
1301 to 1400	AX4 Position Data Record
1401 to 1500	AX5 Position Data Record
1501 to 1600	AX6 Position Data Record
1601 to 1700	AX7 Position Data Record
1701 to 1800	AX8 Position Data Record
1801 to	(System reserved)

Appx. 4.1 Registered Parameter

Table Appx. 4.2 List of Registered Parameters

Data Position No. (Word Basis)	Parameter	Description	See Also
*01	Speed Mode Selection	Bit 0: Maximum speed selection 0: Standard mode, 1: High-speed mode Bit 1: Command speed unit selection 0: (1/65536) pulse/ms, 1: pulse/s Bit 2: Acceleration/deceleration time unit selection 0: ms, 1: 0.01 ms (10 us) [Factory default: 0]	6-5
*02	Pulse Output Mode	0: CW/CCW pulse 1: Travel/direction 2: Phase A/B (x4) 3: Phase A/B (x2) 4: Phase A/B (x1) [Factory default: 0]	6-7
*03	Motor Direction Selection	0: Forward movement produces CW pulse output 1: Reverse movement produces CW pulse output [Factory default: 0]	6-8
*04	Contact Input Setting	$0000 or greater (bit data for each contact) (Settings for NO contact, NC contact, and filter) [Factory default: 0]	6-8
*05/*06	Forward Limit	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 2,147,483,647]	6-9
*07/*08	Reverse Limit	-2,147,483,648 to (Forward Limit -1) [pulses] [Factory default: -2,147,483,648]	6-9
*09/*10	Speed Limit	1 to 7,996,000 [pulse/s] 1 to 524,025,856 [(1/65536) pulse/ms] (The unit varies depending on the setting of the command speed unit selection of the Speed Mode Selection. The upper limit is restricted by the maximum speed selection and the pulse output mode.) [Factory default: 32,751,616 [(1/65536) pulse/ms]]	6-9
*11	AOS Mode	0: Use origin switch 1: Do not use origin switch (limit switch) [Factory default: 0]	6-9
*12	AOS Direction	0: Reverse, 1: Forward [Factory default: 0]	6-9
*13/*14	AOS Speed 1	1 to Speed Limit [command speed unit*1] [Factory default: 655360 [(1/65536) pulse/ms]]	6-10
*15/*16	AOS Speed 2	1 to AOS Speed 1 [command speed unit*1] [Factory default: 65536 [(1/65536) pulse/ms]]	6-10
*17/*18	AOS Startup Speed	0 to AOS Speed 2 [command speed unit*1] [Factory default: 0 [(1/65536) pulse/ms]]	6-10
*19	AOS Acceleration Time	0 to 32767 [acceleration/deceleration time unit*2] [Factory default: 1000 [ms]]	6-10
*20	AOS Deceleration Time	0 to 32767 [acceleration/deceleration time unit*2] [Factory default: 1000 [ms]]	6-11
*21	AOS Z-phase Edge Selection	0: Rising edge, 1: Falling edge [Factory default: 0]	6-11
*22	AOS Z-phase Search Count	0 to 32767 [pulses] [Factory default: 0]	6-11
*23/*24	AOS Z-phase Search Range	0 to 2,147,483,647/AOS Z-phase Search Count [pulses] [Factory default: 2,147,483,647]	6-11
*25	AOS Deviation Pulse Clear Time	0 to 32767 [ms] [Factory default: 1000]	6-12
*26/*27	AOS Offset	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	6-12
*28	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-
*29	Unlimited Rotation Setting	0: Detect an overflow error during jogging or MPG mode 1: Do not detect an overflow error during jogging or MPG mode [Factory default: 0]	6-12
*30	Z-phase Setting	0: Do not use Z-phase filter 1: Use at frequency of 1 Mpps or less 2: Use at frequency of 500 Kpps or less. 3: Use at frequency of 100 Kpps or less. [Factory default: 0]	6-13

*31	Deviation Pulse Clear Setting	0: Automatic output (the output is performed according to the deviation pulse clear time during manual origin search or automatic origin search.) 1: Program output (the output is performed in any timing by a program.) [Factory default: 0]	6-13
*32	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-
*33/*34	Acceleration Setting	0 to 2,147,483,647 [command speed unit*1/ms] [Factory default: 32751 [(1/65536) pulse/ms/ms]]	6-13
*35/*36	Deceleration Setting	0 to 2,147,483,647 [command speed unit*1/ms] [Factory default: 32751 [(1/65536) pulse/ms/ms]]	6-13
*37/*38	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-
*39	Pulse Output External Power Source Detection Setting	0: Do not detect errors on external power source for pulse output 1: Detect errors on external power source for pulse output (Only the setting for axis 1 is valid. The setting for axis 1 is applied also to axes 2 to 8.) [Factory default: 0]	6-14
*40	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-

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

*1: The command speed unit is the unit selected for the command speed unit selection of the Speed Mode Selection registered parameter.

*2: The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

Appx. 4.2 Command Parameters

Table Appx. 4.3 List of Command Parameters

Data Position No. (Word Basis)	Parameter	Description	See Also
*41	Command Code	0 to 32,767	6-22
*42	Target Position Mode /Position Data Record No.	In direct operation: 0: Absolute position, 1: Incremental position In position data record operation: 1 to 10 [Position data record number]	6-23
*43/*44	Target Position	Reverse limit to forward limit [pulses]	6-23
*45	Accel/Decel Mode	0: Trapezoidal acceleration/deceleration (With startup speed), 1: S-shape acceleration/deceleration	6-23
*46/*47	Target Speed	In position control mode: 1 to Speed Limit [command speed unit*1] In speed control mode: -(Speed Limit) to Speed Limit [command speed unit*1]	6-23
*48	Acceleration Time	0 to 32,767 [acceleration/deceleration time unit*2], -1: Default acceleration	6-24
*49	Deceleration Time	0 to 32,767 [acceleration/deceleration time unit*2], -1: Default deceleration	6-24
*50/*51	Startup Speed	0 to target speed [command speed unit*1] (valid only for trapezoidal acceleration/deceleration)	6-25
*52	Origin Search Mode	$0000 to $0FFF (Specify details as bit data.)	6-25
*53	Origin Search Direction	0: Reverse, 1: Forward	6-25
*54	Z-phase Edge Selection	0: Rising edge, 1: Falling edge	6-25
*55	Z-phase Search Count	0 to 32,767 [pulses]	6-26
*56/*57	Z-phase Search Range	0 to 2,147,483,647/Z-phase Search Count [pulses]	6-26
*58	Deviation Pulse Clear Time	0 to 32,767 [ms]	6-26
*59	(System reserved)	Do not set a value other than 0.	-
*60	Manual Pulse Generator M Value	-32,768 to 32,767	6-27
*61	Manual Pulse Generator N Value	1 to 32,767	6-27
*62	Manual Pulse Generator Filter	0 to 10,000 [ms]	6-27
*63	Trigger Setting	0: Software trigger 1: Contact input trigger 2: Counter status trigger 3: Counter zone coincidence trigger 4: Positioning Completed input relay trigger	6-27
*64	Trigger Axis Setting	0, 1 to 8 axes (If set to 0, an axis from which the command is issued is used.)	6-28
*65	Trigger Contact Setting	0: Reverse limit input 1: Forward limit input 2: Origin input	6-28
*66	Counter Status Trigger Setting	$0000 or greater (bit data)	6-28
*67	Counter Zone Coincidence Trigger Setting	$0000 or greater (bit data)	6-29
*68	(System reserved)	Do not set a value other than 0.	-
*69	Preset Override Value	1 to 500 [%]	6-29
*70 to *76	(System reserved)	Do not set a value other than 0.	-
*77*2	Software Trigger Request*3	1: A software trigger is activated by writing "1" during a software trigger wait state.	6-29
*78*2	Deviation Pulse Clear Request*3	0: Deviation pulse clear signal Off 1: Deviation pulse clear signal On (Valid only when program output is selected for the Deviation Pulse Clear Setting registered parameter.)	6-29
*79 to *80	(System reserved)	Do not set a value other than 0.	-

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

*1: The command speed unit is the unit selected for the command speed unit selection of the Speed Mode Selection registered parameter.

*2: The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

*3: Unlike other parameters, Software Trigger Request and Deviation Pulse Clear Request are not the parameters to be set when a command is executed, but are used to start a specific operation immediately when a value is set to them.

Appx. 4.3 List of Position Data Records

Table Appx. 4.4 List of Position Data Record (Table Number 1 for Axis 1)

Data Position No. (Word Basis)	Parameter	Description	See Also
1001	Target Position Mode	0: Using ABS position, 1: Using INC position [Factory default: 0]	6-31
1002/1003	Target Position	Reverse limit to forward limit [pulses] [Factory default: 0]	6-31
1004	Accel/Decel Mode	0: Trapezoidal acceleration/deceleration (With startup speed), 1: S-shape acceleration/deceleration [Factory default: 0]	6-31
1005/1006	Target Speed	1 to Speed Limit [command speed unit*1] [Factory default: 0]	6-31
1007	Acceleration Time	0 to 32,767 [acceleration/deceleration time unit*2], -1: Default acceleration [Factory default: 0]	6-31
1008	Deceleration Time	0 to 32,767 [acceleration/deceleration time unit*2], -1: Default deceleration [Factory default: 0]	6-31
1009/1010	Startup Speed	0 to target speed [command speed unit*1] [Factory default: 0]	6-32

*1: The command speed unit is the unit selected for the command speed unit selection of the Speed Mode Selection registered parameter.
*2: The acceleration/deceleration time unit is the unit selected for the acceleration/deceleration time unit selection of the Speed Mode Selection registered parameter.

Table Appx. 4.5 Position Data Records and First Data Position Numbers

Axis No.	Record No.	Data position No.
Axis 1	1	1001 to 1010
Axis 1	2	1011 to 1020
Axis 1	3	1021 to 1030
Axis 1	4	1031 to 1040
Axis 1	5	1041 to 1050
Axis 1	6	1051 to 1060
Axis 1	7	1061 to 1070
Axis 1	8	1071 to 1080
Axis 1	9	1081 to 1090
Axis 1	10	1091 to 1100

Axis No.	Record No.	Data position No.
Axis 5	1	1401 to 1410
Axis 5	2	1411 to 1420
Axis 5	3	1421 to 1430
Axis 5	4	1431 to 1440
Axis 5	5	1441 to 1450
Axis 5	6	1451 to 1460
Axis 5	7	1461 to 1470
Axis 5	8	1471 to 1480
Axis 5	9	1481 to 1490
Axis 5	10	1491 to 1500

Axis No.	Record No.	Data position No.
Axis 2	1	1101 to 1110
Axis 2	2	1111 to 1120
Axis 2	3	1121 to 1130
Axis 2	4	1131 to 1140
Axis 2	5	1141 to 1150
Axis 2	6	1151 to 1160
Axis 2	7	1161 to 1170
Axis 2	8	1171 to 1180
Axis 2	9	1181 to 1190
Axis 2	10	1191 to 1200

Axis No.	Record No.	Data position No.
Axis 6	1	1501 to 1510
Axis 6	2	1511 to 1520
Axis 6	3	1521 to 1530
Axis 6	4	1531 to 1540
Axis 6	5	1541 to 1550
Axis 6	6	1551 to 1560
Axis 6	7	1561 to 1570
Axis 6	8	1571 to 1580
Axis 6	9	1581 to 1590
Axis 6	10	1591 to 1600

Axis No.	Record No.	Data position No.
Axis 3	1	1201 to 1210
Axis 3	2	1211 to 1220
Axis 3	3	1221 to 1230
Axis 3	4	1231 to 1240
Axis 3	5	1241 to 1250
Axis 3	6	1251 to 1260
Axis 3	7	1261 to 1270
Axis 3	8	1271 to 1280
Axis 3	9	1281 to 1290
Axis 3	10	1291 to 1300

Axis No.	Record No.	Data position No.
Axis 7	1	1601 to 1610
Axis 7	2	1611 to 1620
Axis 7	3	1621 to 1630
Axis 7	4	1631 to 1640
Axis 7	5	1641 to 1650
Axis 7	6	1651 to 1660
Axis 7	7	1661 to 1670
Axis 7	8	1671 to 1680
Axis 7	9	1681 to 1690
Axis 7	10	1691 to 1700

Axis No.	Record No.	Data position No.
Axis 4	1	1301 to 1310
Axis 4	2	1311 to 1320
Axis 4	3	1321 to 1330
Axis 4	4	1331 to 1340
Axis 4	5	1341 to 1350
Axis 4	6	1351 to 1360
Axis 4	7	1361 to 1370
Axis 4	8	1371 to 1380
Axis 4	9	1381 to 1390
Axis 4	10	1391 to 1400

Axis No.	Record No.	Data position No.
Axis 8	1	1701 to 1710
Axis 8	2	1711 to 1720
Axis 8	3	1721 to 1730
Axis 8	4	1731 to 1740
Axis 8	5	1741 to 1750
Axis 8	6	1751 to 1760
Axis 8	7	1761 to 1770
Axis 8	8	1771 to 1780
Axis 8	9	1781 to 1790
Axis 8	10	1791 to 1800

Appx. 4.4 List of Statuses for Each Axis/Common Statuses for All Axes

Table Appx. 4.6 Statuses for Each Axis (Word Basis)

Data Position No. (Word Basis)	Status	Description	See Also
*81/*82	Target Position Status	-2,147,483,648 to 2,147,483,647 [pulses]	6-35
*83/*84	Current Position Status	-2,147,483,648 to 2,147,483,647 [pulses]	6-35
*85/*86	Current Speed Status	-(Speed Limit) to Speed Limit [command speed unit*1]	6-35
*87	Contact Input Status	States of contact inputs (bit data)	6-36
*88	Error Status	Error information when an error occurs	6-36
*89	Warning Status	Warning information when a warning is raised	6-36
*90	Origin Search Status	Status related to an origin search operation	6-36
*91	Extended Status	Operation status such as accelerating, decelerating, and changing speed (bit data)	6-37
*92/*93	No. of Write Operations to Flash Memory	Value starts from 0 [times]	6-37
*94	Current Override Value Status	1 to 500 [%]	6-37

The symbol '*' represents the value of (axis number -1). The values for axis 1 to axis 8 are 0 to 7, respectively.
*1: The command speed unit is the unit selected for the command speed unit selection of the Speed Mode Selection registered parameter.

Table Appx. 4.7 Statuses for Each Axis (Data Position Numbers for Long-word Access)

Axis	Status	Data Position No. (Word Basis)	Data Position No. (Long-word Basis)
1	Target Position Status	081/082	041
1	Current Position Status	083/084	042
1	Current Speed Status	085/086	043
2	Target Position Status	181/182	091
2	Current Position Status	183/184	092
2	Current Speed Status	185/186	093
3	Target Position Status	281/282	141
3	Current Position Status	283/284	142
3	Current Speed Status	285/286	143
4	Target Position Status	381/382	191
4	Current Position Status	383/384	192
4	Current Speed Status	3835386	193
5	Target Position Status	481/482	241
5	Current Position Status	483/484	242
5	Current Speed Status	485/486	243
6	Target Position Status	581/582	291
6	Current Position Status	583/584	292
6	Current Speed Status	585/586	293
7	Target Position Status	681/682	341
7	Current Position Status	683/684	342
7	Current Speed Status	685/686	343
8	Target Position Status	781/782	391
8	Current Position Status	783/784	392
8	Current Speed Status	785/786	393

Table Appx. 4.8 List of Common Statuses for All Axes

Data Position No. (Word Basis)	Parameter	Description	See Also
0981	Module Information	"F3"	6-38
0982	Module Information	"YP"	6-38
0983	Module Information	"22", "24", or "28"	6-38
0984	Module Information	"0P"	6-38
0985	Module Information	" "	6-38
0986	Module Information	" "	6-38
0987	Module Information	"RV"	6-38
0988	Module Information	"□□" ("□□" represents a revision data.)	6-38
0989	(System reserved)		-
0990	Pulse Output External 24V Power Source	0: Off 1: On	6-38
0991-992	No. of Write Operations to Flash Memory	Value starts from 0 [times]	6-38
0993-1000	(System reserved)		-

Appx. 4.5 List of Counter Registered Parameters

Table Appx. 4.9 List of Counter Registered Parameters

Data Position No.		Parameter	Description	See Also
Long-word Basis	Word Basis			
401	801/802	Counter Count Mode Setting	0: Phase A/B (x1) 10: Phase A/B (x1) reverse 1: Phase A/B (x2) 11: Phase A/B (x2) reverse 2: Phase A/B (x4) 12: Phase A/B (x4) reverse 3: CW/CCW pulse 13: CW/CCW pulse reverse 4: Travel/direction 14: Travel/direction reverse [Factory default: 0]	7-4
402	803/804	Counter Filter Setting	0: Do not use filter 1: Use at frequency of 1 M pulse/s or less. 2: Use at frequency of 500 K pulse/s or less. 3: Use at frequency of 100 K pulse/s or less. [Factory default: 0]	7-5
403	805/806	Counter Action Mode Setting	0: Linear Counter (Coded 32 bit fixed) 1: Ring Counter (0 to the Preset Ring Counter Value) 2: Ring Counter (Coded 32 bit fixed) [Factory default: 0]	7-5
404	807/808	Preset Ring Counter Value	1 to 2,147,483,647 [pulses] (This parameter is valid only when Counter Action Mode Setting is "1: Ring counter". Set the number of counts per revolution -1.) [Factory default: 2,147,483,647]	7-6
405	809/810	Counter Contact Input Setting	$00000000 or greater (bit data for each contact) (Settings for NO contact, NC contact, and filter) [Factory default: 0]	7-6
406	811/812	Counter Z-phase Input Setting	$00000000 or greater (bit data) (This parameter specifies a filter and also the Z-phase input for an axis used as a counter Z-phase input.) [Factory default: 0]	7-7
407	813/814	Counter Contact Z-phase Input Function Layout	$00000000 or greater (bit data) (This parameter assigns the counter enable, counter preset, and counter latch functions to the contact inputs and Z-phase input.) [Factory default: 0]	7-8
408	815/816	Counter Contact Output 1 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter contact output 1.) [Factory default: 0]	7-10
409	817/818	Counter Contact Output 2 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter contact output 2.) [Factory default: 0]	7-10
410	819/820	Counter Coincidence Direction Setting	$00000000 or greater (bit data) (This parameter specifies the method of counter coincidence detection.) [Factory default: 0]	7-11
411	821/822	Counter Input Relay Setting	0: Counter Input Relay Not In Use (For F3YP28-0P, X□□□13 to X□□□16 are used as Stop Immediately ACK relays.) 1: Counter Input Relay In Use (For F3YP28-0P, X□□□13 to X□□□16 are used as counter input relays.) [Factory default: 0]	7-12
412	823/824	Counter Input Relay 1 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 1.) [Factory default: 0]	7-13
413	825/826	Counter Input Relay 2 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 2.) [Factory default: 0]	7-14
414	827/828	Counter Input Relay 3 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 3.) [Factory default: 0]	7-14
415	829/830	Counter Input Relay 4 Layout	$00000000 or greater (bit data) (This parameter specifies a status to be assigned to the counter input relay 4.) [Factory default: 0]	7-14
416	831/832	(System reserved)	Do not set a value other than 0. [Factory default: 0]	-

Appx. 4.6 List of Counter Control Parameters

Table Appx. 4.10 List of Counter Control Parameters

Data Position No.		Parameter	Description	See Also
Long-word Basis	Word Basis			
424	847/848	Counter Registered Parameters Request	Requests to register the counter registered parameters. Writing "1" to this parameter performs the request to register the counter registered parameters. Reading this parameter returns "0" for normal termination or returns the error code if an error occurs.	7-19
425	849/850	Counter Control Command Request	Executes a counter control command corresponding to the command code written to this parameter. 1: Counter Coincidence Detection 1 Latch Clear Request 2: Counter Coincidence Detection 2 Latch Clear Request 3: Overflow/Underflow Error Detection Latch Clear Request 4: External Counter Latch Occurrence 1 Detection Latch Clear Request 5: External Counter Latch Occurrence 2 Detection Latch Clear Request 11: Counter Preset Request 12: CNT Latched Request 1 13: CNT Latched Request 2	7-19
426	851/852	Counter Enable Control	$00000000 or greater (bit data) [Default: 0: Disable the counter]	7-20
427	853/854	Counter Contact Output 1 Control	$00000000 or greater (bit data) [Default: 0: Counter contact output 1 forced off]	7-21
428	855/856	Counter Contact Output 2 Control	$00000000 or greater (bit data) [Default: 0: Counter contact output 2 forced off]	7-22
429	857/858	Counter Preset Value	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	7-22
430	859/860	Preset Counter Coincidence Value 1	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	7-22
431	861/862	Preset Counter Coincidence Value 2	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	7-22
432	863/864	(System reserved)	Do not set a value other than 0.	-
433	865/866	Counter Zone 1 Lower Limit	-2,147,483,648 to 2,147,483,647 [pulses] [Factory default: 0]	7-23
434	867/868	Counter Zone 1 Upper Limit		
435	869/870	Counter Zone 2 Lower Limit		
436	871/872	Counter Zone 2 Upper Limit		
437	873/874	Counter Zone 3 Lower Limit		
438	875/876	Counter Zone 3 Upper Limit		
439	877/878	Counter Zone 4 Lower Limit		
440	879/880	Counter Zone 4 Upper Limit		
441	881/882	Counter Zone 5 Lower Limit		
442	883/884	Counter Zone 5 Upper Limit		
443	885/886	Counter Zone 6 Lower Limit		
444	887/888	Counter Zone 6 Upper Limit		
445	889/890	Counter Zone 7 Lower Limit		
446	891/892	Counter Zone 7 Upper Limit		
447	893/894	Counter Zone 8 Lower Limit		
448	895/896	Counter Zone 8 Upper Limit		
449	897/898	Counter Zone 9 Lower Limit		
450	899/900	Counter Zone 9 Upper Limit		
451	901/902	Counter Zone 10 Lower Limit		
452	903/904	Counter Zone 10 Upper Limit		
453	905/906	Counter Zone 11 Lower Limit		
454	907/908	Counter Zone 11 Upper Limit		
455	909/910	Counter Zone 12 Lower Limit		
456	911/912	Counter Zone 12 Upper Limit		
457	913/914	Counter Zone 13 Lower Limit		
458	915/916	Counter Zone 13 Upper Limit		
459	917/918	Counter Zone 14 Lower Limit		
460	919/920	Counter Zone 14 Upper Limit		
461	921/922	Counter Zone 15 Lower Limit		
462	923/924	Counter Zone 15 Upper Limit		
463	925/926	Counter Zone 16 Lower Limit		
464	927/928	Counter Zone 16 Upper Limit		
465 to 475	929 to 950	(System reserved)	Do not set a value other than 0.	-

Appx. 4.7 List of Counter Statuses

Table Appx. 4.11 List of Counter Statuses

Data Position No.		Parameter	Description	See Also
Long-word Basis	Word Basis			
417	833/834	Counter Bit Status	Operation information (bit data) including counter coincidence detection, high-speed contact input/output, zone coincidence detection	7-25
418	835/836	Counter Current Position Status	-2,147,483,648 to 2,147,483,647 [pulses]	7-27
419	837/838	CNT Latched Position 1 Status	-2,147,483,648 to 2,147,483,647 [pulses]	7-27
420	839/840	CNT Latched Position 2 Status	-2,147,483,648 to 2,147,483,647 [pulses]	7-27
421	841/842	Counter Speed Status	-8,000,000 to 8,000,000 [pulse/s]	7-27
422 to 423	843 to 846	(System reserved)		-

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