MITSUBISHI ELECTRIC

PROGRAMMABLE CONTROLLERS

MELSEC iQ-F series

MELSEC iQ-F
FX5 User's Manual (Positioning Control)

1. The Basics of Positioning Control

1.1 What is positioning control?

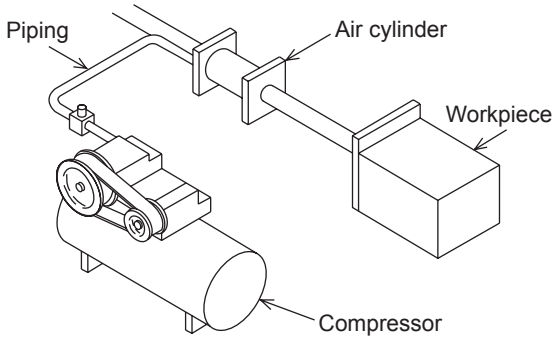
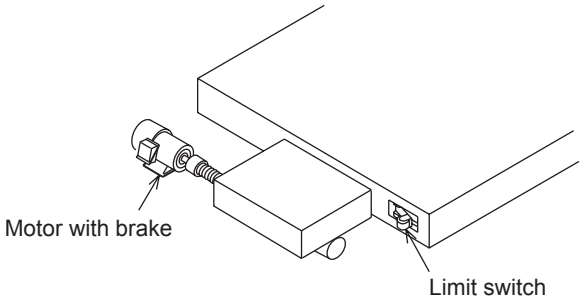
The positioning controller, together with the programmable logic controller, personal computer and operator interface, is one of the four main units of FA (factory automation).
Among these units, the positioning controller plays an important role and is regarded as the center of the mechatronics field in which many senior engineers have been playing active roles.

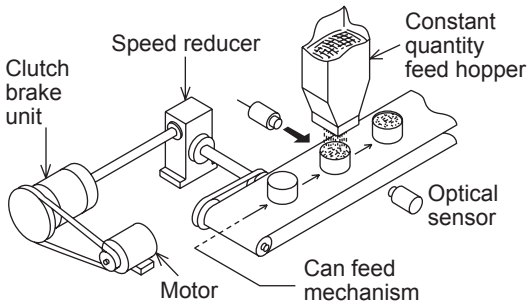
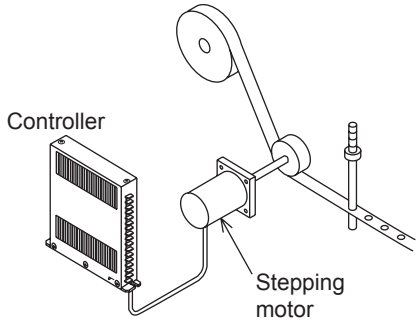
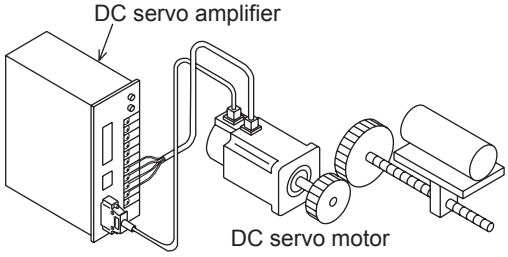
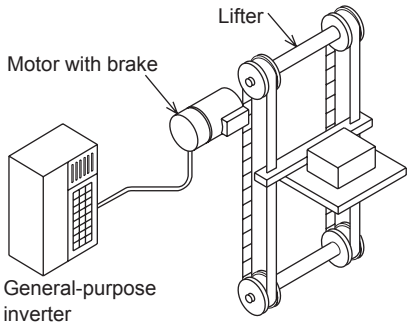
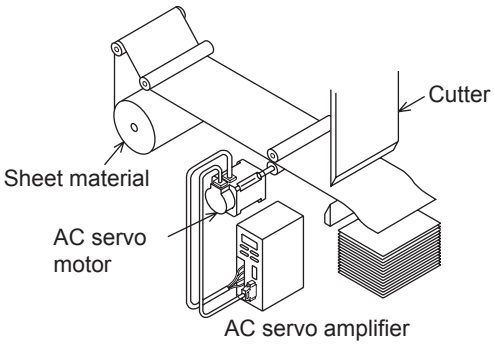
Positioning is all about motion, and motion often involves speed and precision. And since speed can be directly related to productivity, positioning is an area of much development. When the speed of a machine increases, a problem with the stop precision is often generated. In order to solve this problem, diversified grades of positioning controllers have been required and developed.

Improving machine efficiency generates immeasurable added value, including reduced labor costs and improved conservation of machine floor space for the same quantity of production. If there are no problems related to the positioning aspect of a machine, it may mean that the machine is not running as efficiently as it could be. This is where the science of developing and retrofitting an optimum positioning control system comes in.

1.2 Actuators for positioning

The options available for positioning control depend on the type of actuator driving the system. An actuator is a mechanical device that moves or controls a specific element or a series of elements within a system.
In a mechanical system, an actuator is often used with a sensor to detect the motion or position of a workpiece. The following illustrations provide examples of diversified actuators, their features and their weak points.

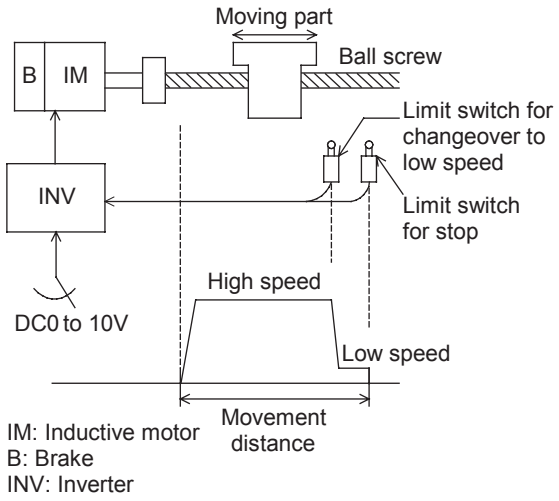
Actuator(s)	Features and Drawbacks	Schematic drawing
Pneumatic	• Air source and high grade piping are required. • High torque is not available. • Multi-point positioning is complex and very difficult to achieve. • Change in positioning is difficult.	
Brake motor	• Positioning mechanism is simple. • Repeatability is poor. • Change in positioning is difficult. (When optical sensors or limit switches are used for stop)	

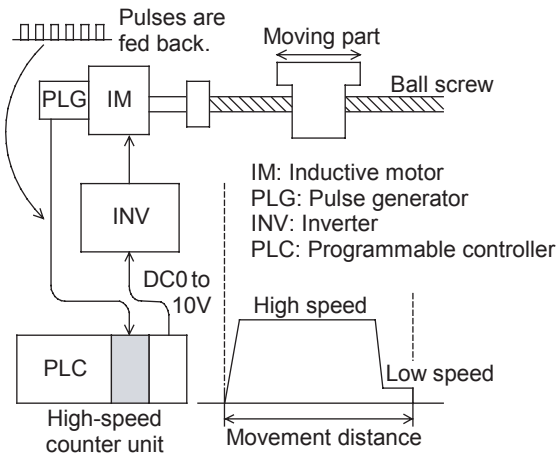
Actuator(s)	Features and Drawbacks	Schematic drawing
Clutch brake	• Frequent positioning is possible. • Life of friction plate is limited. • Change in positioning is difficult. (When optical sensors or limit switches are used for stop)	
Stepping motor	• Simple positioning mechanism. • If load is heavy, motor may step out and displacement can occur. • Motor capacity is small. • Precision is poor at high speed.	
DC servo system	• Positioning precision is accurate. • Maintenance is required for motor brushes. • It is not suitable for rotation at high speed.	
General purpose inverter and general purpose motor	• Multi-speed positioning is available using a high-speed counter. • High precision positioning is not available. • Large torque is not available at start. (Specialized inverter is required)	
AC servo system	• Positioning precision is good. • Maintenance is not required. • Positioning address can be easily changed. • It is compact, and offers high power.	

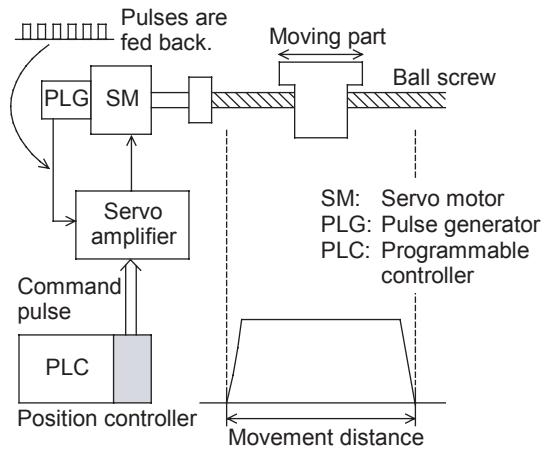
1.3 Positioning method type

In general, there are two methods to control the movement of a workpiece: speed control and position control. For basic, more rudimentary positioning, speed control can be used with an inverter and general purpose motor. For systems where precision is a must, servo systems are required for the advanced handling of pulse commands.

<table>
<tr><th colspan="2">Control method</th><th>Description</th><th>Schematic drawing</th></tr>
<tr><td rowspan="2">Speed control</td><td>Limit switch method</td><td>Two limit switches are provided in places where a system's moving part passes. At the first limit switch, the motor speed is reduced. At the second limit switch, the motor turns off and the brake turns on to stop the moving part.
In this method, because position controllers are not required, the system configuration can be realized at reasonable cost.

(Guideline of stopping precision: Approximately ±1.0 to 5.0 mm)*1</td><td> 
</td></tr>
<tr><td>Pulse count method</td><td>A position detector (such as a pulse encoder) is set up in a motor or rotation axis. The pulse number generated from the position detector is counted by a high-speed counter. When the pulse number reaches the preset value, the moving part stops.
In this method, because limit switches are not used, the stop position can be easily changed.

(Guideline of stopping precision: Approximately ±0.1 to 0.5 mm)*1</td><td> 
</td></tr>
<tr><td>Position control</td><td>Pulse command method</td><td>An AC servo motor which rotates in proportion to the input pulse number is used as the drive motor.
When the pulse number corresponding to the movement distance is input to the servo amplifier of the AC servo motor, positioning can be performed at high speed in proportion to the pulse frequency.

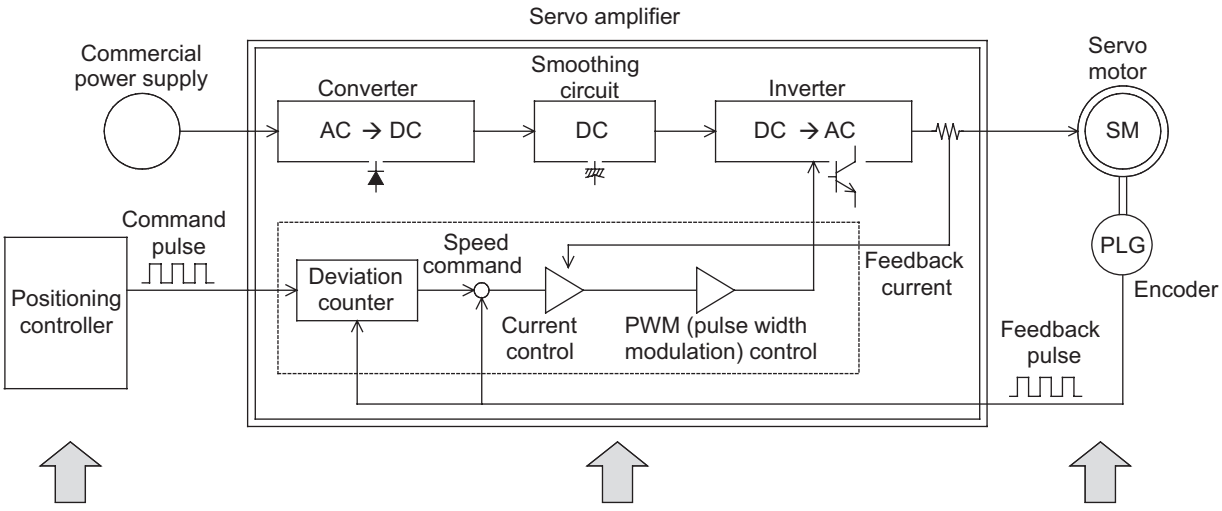
(Guideline of stopping precision: Approximately ±0.01 to 0.05 mm)*1</td><td> 
</td></tr>
</table>

*1. The stop precision shows a value in a case where the low speed is 10 to 100 mm/s.

2. Positioning by AC Servo System

2.1 Advantages for using an AC servo system

With an AC servo system, positioning can be performed by many diversified methods. Typically, a position controller, servo amplifier and servo motor are required for positioning with an AC servo system. The representative servo system configuration is shown below.



The positioning controller generates a specified quantity of forward rotation (or reverse rotation) pulses at a specified frequency.

The command pulse number is subtracted by the feedback pulse number, and the speed command to drive the servo motor is made from the deviation (accumulated pulse number).
When the accumulated pulse number becomes 0, the servo motor stops.

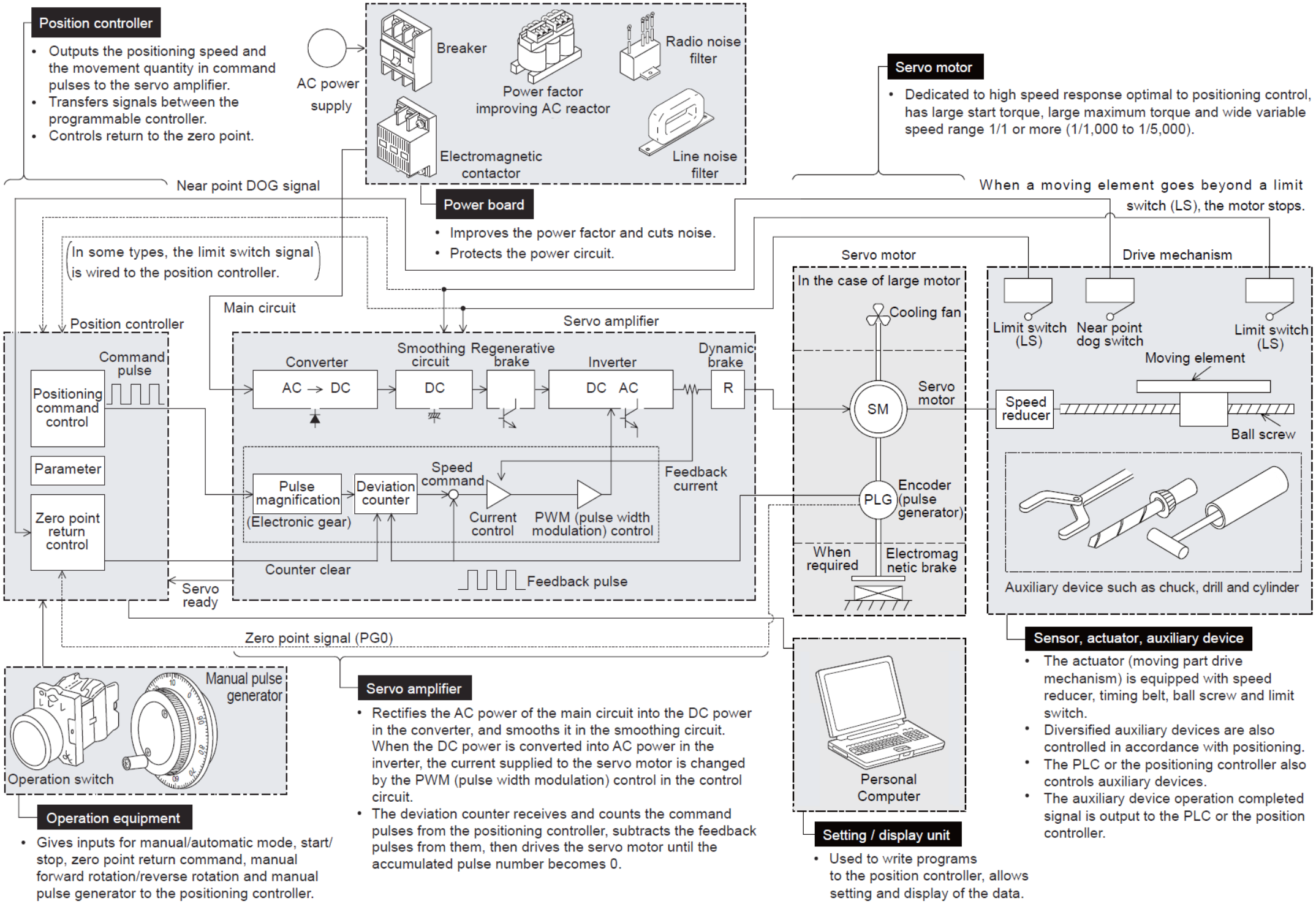
The servo motor is equipped with a built-in encoder (pulse generator), dedicated to high speed response, and suitable for positioning control.

In the latest AC servo systems, conventional weak points have been improved as follows:

- Although the latest systems are completely digital, they are equipped with parameters in conformance to diversified mechanical specifications and electrical specifications so that simple set-up is possible.
- As frequent operation is enabled by a low inertia motor, the maximum torque is increased and the system can be applied to a wide variety of machines.
- The latest systems are equipped with an auto tuning function, with which the servo amplifier automatically detects the load inertia moment and adjusts the gain. This is possible even if the load inertia moment is unknown.
- The command communication cycle from the controller to the servo amplifier is improved for synchronization accuracy and better speed/positioning accuracy.
- The latest systems also allow for long-distance wiring, reduced noise resistance, and simplified wiring.

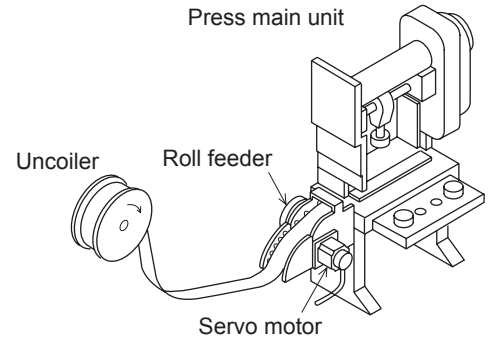
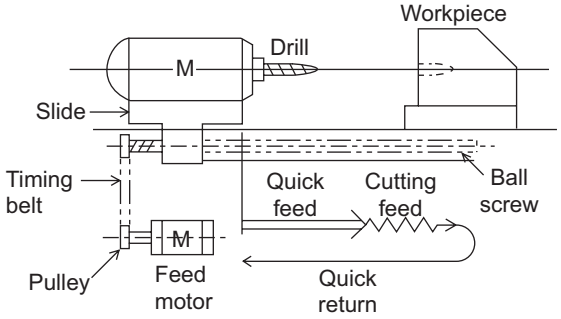
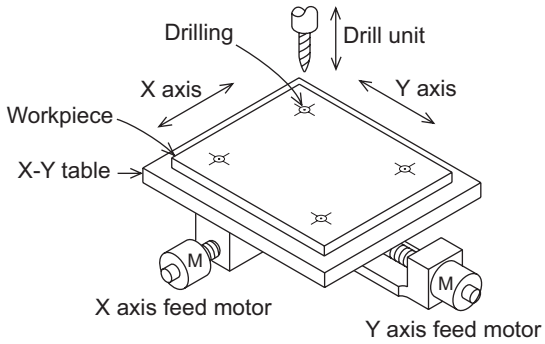
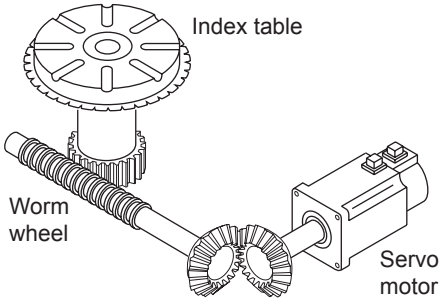
The top advantages to using an AC servo system are described below.

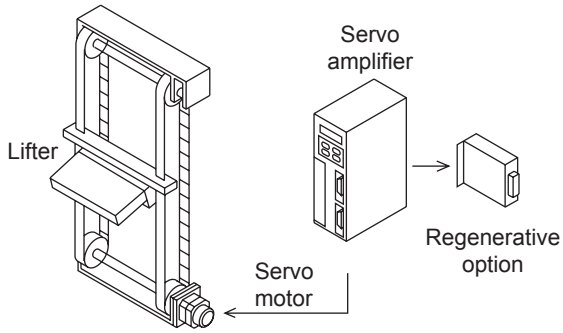
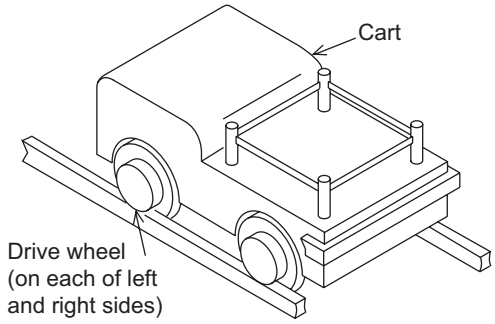
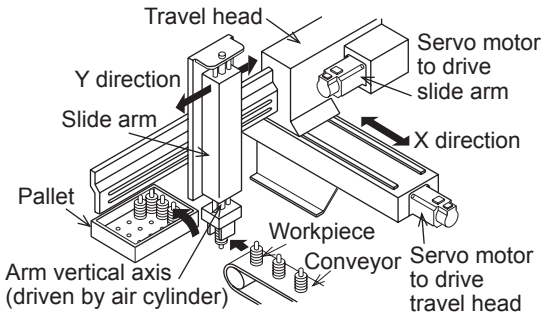
Compact and light servo system	Robust servo system	Easy servo system	Good cost performance servo system
In the FA workplace, a downsized AC servo system occupying less space is beneficial.	In accordance with severe operation conditions, a tougher AC servo system is often required.	AC servo systems are easier to handle than hydraulic equipment. Easy systems are also flexible for new staff.	An AC servo system with good cost performance saves a company in overall engineering costs.


Position controller
• Outputs the positioning speed and the movement quantity in command pulses to the servo amplifier.
• Transfers signals between the programmable controller.
• Controls return to the zero point.
AC power supply
Breaker
Power factor improving AC reactor
Radio noise filter
Electromagnetic contactor
Line noise filter
Power board
• Improves the power factor and cuts noise.
• Protects the power circuit.
Servo motor
• Dedicated to high speed response optimal to positioning control, has large start torque, large maximum torque and wide variable speed range 1/1 or more (1/1,000 to 1/5,000).
Near point DOG signal
When a moving element goes beyond a limit switch (LS), the motor stops.
(In some types, the limit switch signal is wired to the position controller.)
Main circuit
Position controller
Servo amplifier
Servo motor
Drive mechanism
In the case of large motor
Cooling fan
Command pulse
Converter
Smoothing circuit
Regenerative brake
Inverter
Dynamic brake
Positioning command control
AC → DC
DC
DC AC
R
Parameter
Zero point return control
Pulse magnification
(Electronic gear)
Deviation counter
Speed command
Current control
PWM (pulse width modulation) control
Feedback current
SM
Servo motor
PLG
Encoder (pulse generator)
When required
Electromagnetic brake
Limit switch (LS)
Near point dog switch
Limit switch (LS)
Moving element
Speed reducer
Ball screw
Auxiliary device such as chuck, drill and cylinder
Counter clear
Servo ready
Feedback pulse
Zero point signal (PG0)
Manual pulse generator
Operation switch
Servo amplifier
• Rectifies the AC power of the main circuit into the DC power in the converter, and smooths it in the smoothing circuit. When the DC power is converted into AC power in the inverter, the current supplied to the servo motor is changed by the PWM (pulse width modulation) control in the control circuit.
• The deviation counter receives and counts the command pulses from the positioning controller, subtracts the feedback pulses from them, then drives the servo motor until the accumulated pulse number becomes 0.
Personal Computer
Sensor, actuator, auxiliary device
• The actuator (moving part drive mechanism) is equipped with speed reducer, timing belt, ball screw and limit switch.
• Diversified auxiliary devices are also controlled in accordance with positioning.
• The PLC or the positioning controller also controls auxiliary devices.
• The auxiliary device operation completed signal is output to the PLC or the position controller.
Operation equipment
• Gives inputs for manual/automatic mode, start/stop, zero point return command, manual forward rotation/reverse rotation and manual pulse generator to the positioning controller.
Setting / display unit
• Used to write programs to the position controller, allows setting and display of the data.

2.2 Examples of AC servo systems

Positioning indicates the operation to move an object, such as a workpiece or tool (drill or cutter), from one point to another point and to stop it with efficiency and precision.
In other words, the principle of positioning is the control of speed in accordance with the position, performed to promptly eliminate the remaining distance to the target position. The flexibility to change the target position electrically and easily is an important requirement.
Several cases of positioning using an AC servo motor are systematically shown below.

Type of machine	Description	Schematic drawing
Constant feed	In the press/shear process for cutting, punching, etc., the processed material is positioned with high precision to produce a constant sized product.	
Tapping	In order to tap a workpiece, “1. Quick feed”, “2. Cutting feed” and “3. Quick return” are performed repeatedly.	
Drilling in steel sheet	In order to perform processing on a flat face, positioning with high precision is performed by two motors (X axis feed motor and Y axis feed motor).	
Index table	The position of the circular table is indexed. The index position is set on the outside (digital switch) or the inside (program). Shortcut drive is performed depending on the index position.	

Type of machine	Description	Schematic drawing
Lifter moving-up/down	As negative load is applied on the servo motor in positioning of the lifter in the vertical direction, a regenerative option is also used. In order to hold the lifter stationary and prevent drop of the lifter by power interruption, a servo motor with an electromagnetic brake is used.	
Cart travel control	A servo motor is mounted in the travel cart as the drive source. A mechanism such as rack and pinion is adopted to prevent slippage between the wheels and rails.	
Carrier robot	After the conveyor stops, the 2-axis servo system and the arm lifting mechanism transfer workpieces to a palette. The workpiece input positions on the palette can be set to many points so that setup change can be easily performed, even if the palette position and the palette shape change.	

3.1 Positioning controller

Positioning controllers use programs and parameters to send positioning commands to the servo amplifier. Contents related to programs and parameters are described below.

3.1.1 Command pulse control method

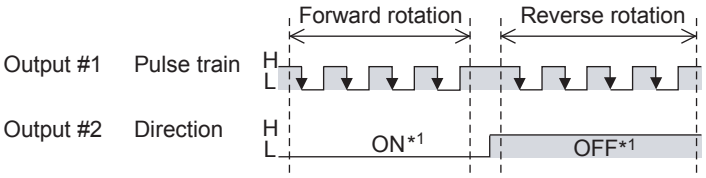
There are two types of control formats used for outputting command pulses from an FX Series positioning controller:

- PLS/DIR (Pulse/Direction) method
- FP/RP (Forward Pulse/Reverse Pulse) method

Each method requires two outputs from the controller to control specific signals for direction and pulse control. A third method, known as the A phase/B phase method, uses overlapping pulse signals to specify direction.

1. PLS/DIR method

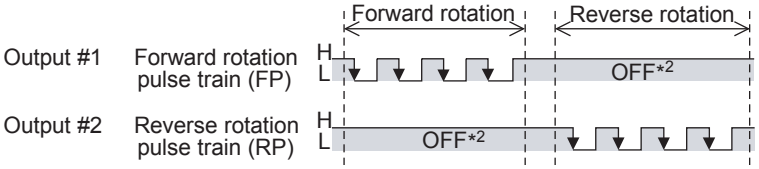
In the PLS/DIR method, one output sends pulses to the drive unit while the other output specifies the direction of travel.



*1. "ON" and "OFF" represent the status of the controller's output.
"H" and "L" respectively represent the HIGH status and the LOW status of the waveform. The command pulse pattern in the figure assumes negative logic.

2. FP/RP method

In the FP/RP method, each output has a different direction and operates individually to send pulses to the drive unit.



*2. "ON" and "OFF" represent the status of the controller's output.
"H" and "L" respectively represent the HIGH status and the LOW status of the waveform. The command pulse pattern in the figure assumes negative logic.

3.2 Servo amplifier and servo motor

The servo amplifier controls the movement quantity and the speed according to the commands given by the positioning controller. The servo motor then transmits rotation to the drive mechanism after receiving signals from the servo amplifier.

3.2.1 Positioning control in accordance with command pulse

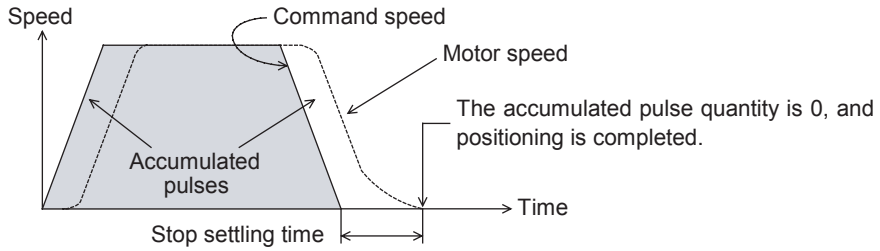
In accordance with speed and position command pulses from the positioning controller, PWM (pulse width modulation) control is performed by the main circuit of the servo amplifier in order to drive the motor. The rotation speed and the rotation quantity are fed back to the amplifier from the encoder attached to the servo motor.

3.2.2 Deviation counter function

The difference between the command pulses and the feedback pulses counted by the deviation counter in the servo amplifier is called accumulated pulses.

While the machine is operating at a constant speed, the accumulated pulse quantity is almost constant. During acceleration and deceleration, the accumulated pulse quantity changes more dramatically.

When the accumulated pulse quantity becomes equivalent to or less than a specified quantity (in-position set value) after command pulses have stopped, the servo amplifier outputs the positioning complete signal.
The servo motor continues operation even after that. Then, when the accumulated pulse quantity becomes 0, the servo motor stops.
The time after the servo motor outputs the positioning complete signal until it stops is called the stop settling time.



3.2.3 Servo lock function

The servo motor is controlled so that the accumulated pulse quantity counted in the deviation counter becomes 0.
For example, if an external force for forward rotation is applied on the servo motor, the servo motor performs the reverse rotation operation to eliminate the accumulated pulses.

Accumulated pulses in deviation counter	Servo motor
Minus pulses	Reverse rotation operation
Plus pulses	Forward rotation operation
0 (zero)	Stop

3.2.4 Regenerative brake function

During deceleration, because the servo motor rotates by the load inertia of the drive mechanism, it functions as a generator and electric power returns to the servo amplifier.
The regenerative resistor absorbs this electric power and functions as a brake (called a regenerative brake.)

A regenerative brake is required to prevent regenerative over voltage in the servo amplifier when the load inertia is large and operations are frequently performed.

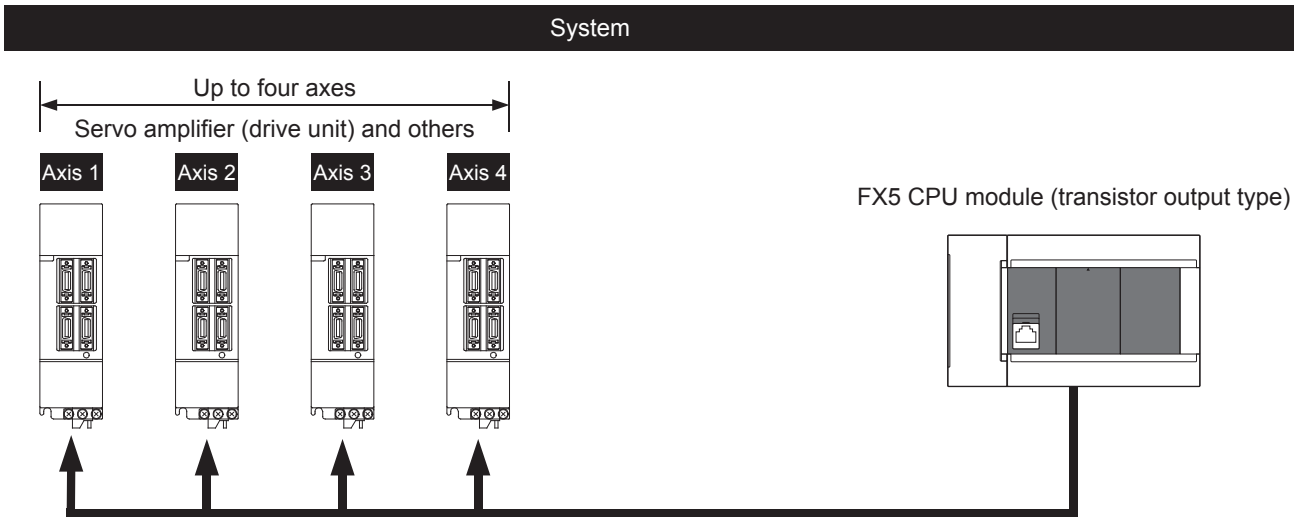
The regenerative resistor is required when the regenerative power generation quantity during deceleration exceeds the allowable regenerative electric power of the servo amplifier.

1 OUTLINE

The FX5 PLCs (transistor output) can perform positioning control by outputting pulse signals to servo motors or stepping motors. Increase the pulse frequency to increase the motor speed. Increase the number of pulses to increase the number of motor revolutions. In other words, set the pulse frequency to determine the workpiece transfer (positioning) speed. Set the number of pulses to determine the workpiece transfer distance.

1.1 Features

- The general outputs (Y0 to Y3) of the CPU module (transistor output) can control up to four axes for positioning operations.
- Use positioning instructions and positioning parameters of the CPU module for positioning control.
- The general outputs (Y0 to Y3) for the CPU module (transistor output) can output a pulse train of 200 Kpps.
- The CPU module (transistor output) pulse output method can be PULSE/SIGN mode or CW/CCW mode.
- The CPU module is compatible with the MELSERVO MR-J4□A series, MR-J3□A series and the MR-JN□A series servo amplifiers.



2 SPECIFICATIONS

For general specifications and power supply, refer to the following manual.

📖FX5U User's manual (Hardware)

📖FX5UC User's manual (Hardware)

2.1 Performance Specifications

The following list shows performance specifications of the positioning function.

For details on each positioning parameter and setting procedures, refer to ☞ Page 35 POSITIONING PARAMETER.

Item			Description
Number of control axes			Independent 4 axes*1 Pulse can be output from general-purpose outputs of the CPU module (axis1: Y0, axis2: Y1, axis3: Y2, and axis4: Y3).
Pulse output form			Transistor
Maximum frequency			2147483647 (200 Kpps in pulses)
Positioning program			Created in sequence program Table operation (can be set in GX Works3.) • When the positioning table data set to use device : 100 data points/axis • When the positioning table data is set to do not use device : 32 data points/axis
Position data			1 point (set in sequence program)
Positioning	Pulse output mode		PULSE/SIGN mode, CW/CCW mode
	Positioning range	Control unit	Motor system, machine system, multiple system,
		Number of pulses per rotation	0 to 2147483647
		Travel distance per rotation	1 to 2147483647
		Positioning data magnification	1, 10, 100, 1000 (times)
		Positioning range	-2147483648 to +2147483647 (motor/mechanical/multiple unit system)*2
	Speed command*3	Speed command unit	Determined by the set unit system
		Bias speed	0 to 200 Kpps (motor/multiple unit system) 0 to 2147483647 (machine unit system)
		Maximum speed	1 pps to 200 Kpps (motor/multiple unit system) 1 to 2147483647 (machine unit system)
		OPR speed	1 pps to 200 Kpps (motor/multiple unit system) 1 to 2147483647 (machine unit system)
		Creep speed	1 pps to 200 Kpps (motor/multiple unit system) 1 to 2147483647 (machine unit system)
		Acceleration time	0 to 32767 ms
		Deceleration time	0 to 32767 ms
	Acceleration/deceleration process		Trapezoidal acceleration/deceleration
	Absolute position detection (ABS current value reading)		DABS instruction used
	Interpolation		Simple linear interpolation by 2-axis simultaneous start
Start time (time until pulse output is started after execution of the instruction is started)			When using the external start signal: 50 μs or less Interpolation operation: 300 μs or less

*1 The number of control axes is two when the pulse output mode is CW/CCW mode.

*2 Set the number of output pulses per operation to 2147483647 or lower.

*3 For the start speed, refer to ☞ Page 64 Start speed.

Item			Specifications
Response time	FX5U-□MT□, FX5UC-32MT□	Y0 to Y3	2.5 μs or less at 10 mA or more (5 to 24 V DC)
	FX5U-□MT□	Y4 or more	0.2 ms or less at 200 mA (24 V DC)
	FX5UC-□MT□		0.2 ms or less at 100 mA (24 V DC)
Circuit insulation			Photo-coupler insulation
Indication of output motion			LED on panel turns on when output (DISP switch OUT side)

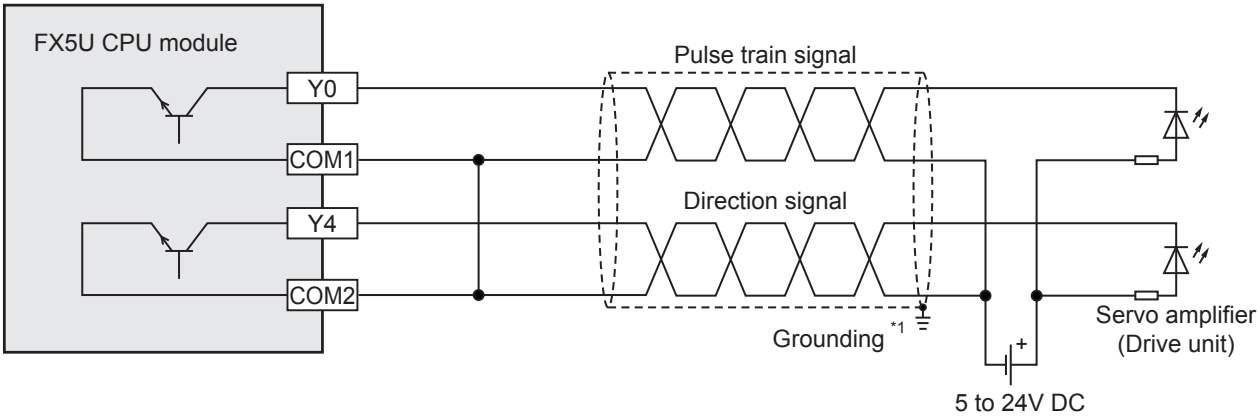
*1 When two COM■ (or +V■) terminals are connected outside the CPU module, the total load current (16 output point) is 1.6 A or less.
Where ■ indicates: 0 or 1

To use the positioning instruction, adjust the load current of the NPN open collector output to 10 to 100 mA (5 to 24 V DC).

Item	Description
Operation voltage range	5 to 24 V DC
Operation current range	10 to 100 mA
Output frequency	200 Kpps or less

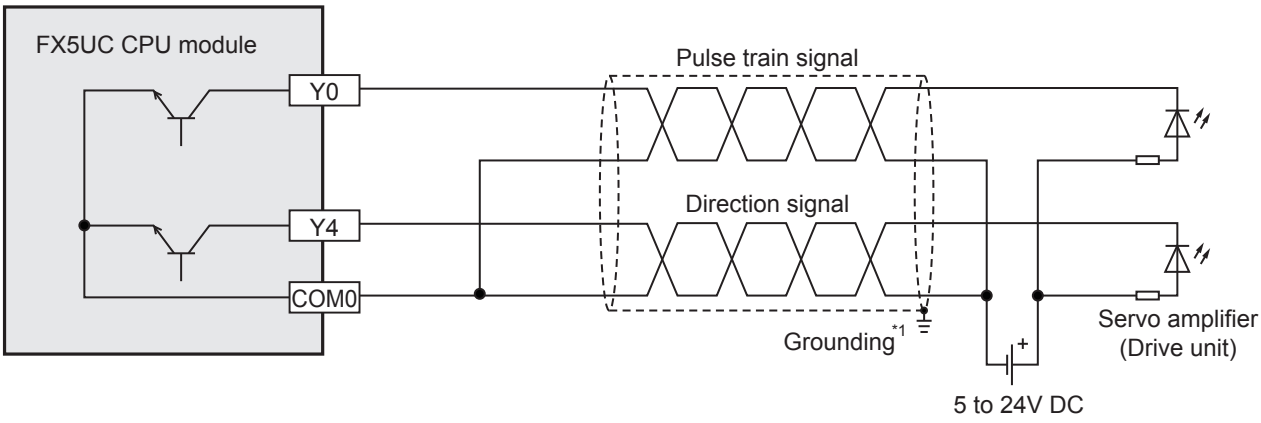
Sink internal output circuit

■FX5U CPU module



*1 To ground the unit, refer to the servo amplifier (drive unit) manual.
If the grounding method is not specified, carry out class-D grounding.

■FX5UC CPU module



*1 To ground the unit, refer to the servo amplifier (drive unit) manual.
If the grounding method is not specified, carry out class-D grounding.

Basic Setting

The items set in basic setting correspond to the positioning parameters of each axis. In special devices corresponding to parameters, values set in the basic setting are stored as the initial values when the power is turned on from off or system is reset.

When items occupying I/O are changed, the high speed I/O assignment parameters are also refreshed together.

For parameters, refer to ☞ Page 39 Details of Parameters.

Window

Navigation window ⇨Parameter ⇨ FX5UCPU ⇨ Module Parameter ⇨ High Speed I/O ⇨ Output Function ⇨ Positioning ⇨ Detailed Setting ⇨ Basic Setting

Item	Axis1	Axis2	Axis3	Axis4
Basic Parameter 1	**Set basic parameter 1.**			
Pulse Output Mode	2:CW/CCW	1:PULSE/SIGN	0: Not Used	1:PULSE/SIGN
Output Device (PULSE/CW)	Y0	Y1	Y2	Y3
Output Device (SIGN/CCW)	Y2	Y5	Y6	Y7
Rotation Direction Setting	0: Current Address Increment with Forward Run Pulse Output	1: Current Address Increment with Reverse Run Pulse Output	0: Current Address Increment with Forward Run Pulse Output	0: Current Address Increment with Forward Run Pulse Output
Unit Setting	0: Motor System (pulse, pps)	1: Machine System (um, cm/min)	0: Motor System (pulse, pps)	2: Machine System (0.0001inch, inch/min)
Pulse No. of per Rotation	2000 pulse	3000 pulse	2000 pulse	2000 pulse
Movement Amount per Rotation	1000 pulse	20000 um	1000 pulse	1000 X 0.0001 inch
Position Data Magnification	1: X Single	1: X Single	1: X Single	10: X 10 Times
Basic Parameter 2	**Set basic parameter 2.**			
Interpolation Speed Specified Method	1: Reference Axis Speed	0: Composite Speed	0: Composite Speed	0: Composite Speed
Max. Speed	120000 pps	200000 cm/min	100000 pps	150000 inch/min
Bias Speed	1500 pps	1300 cm/min	0 pps	1000 inch/min
Acceleration Time	1000 ms	1000 ms	100 ms	1000 ms
Deceleration Time	100 ms	100 ms	100 ms	100 ms
Detailed Setting Parameter	**Set the detailed setting parameter.**			
External Start Signal Enable/Disable	1: Valid	0: Invalid	0: Invalid	1: Valid
External Start Signal Device No.	X0	X0	X0	X6
External Start Signal Logic	0: Positive Logic	0: Positive Logic	0: Positive Logic	0: Positive Logic
Interrupt Input Signal 1 Enable/Disable	0: Invalid	0: Invalid	0: Invalid	1: Valid
Interrupt Input Signal 1 Device No.	X0	X0	X0	X2
Interrupt Input Signal 1 Logic	0: Positive Logic	0: Positive Logic	0: Positive Logic	0: Positive Logic
Interrupt Input Signal 2 Logic	0: Positive Logic	0: Positive Logic	0: Positive Logic	1: Negative Logic
OPR Parameter	**Set the OPR parameter.**		**neter.**	
OPR Enable/Disable	1: Valid	1: Valid	0: Invalid	0: Invalid
OPR Direction	1: Positive Direction (Address Increment Direction)	0: Negative Direction (Address Decrement Direction)	0: Negative Direction (Address Decrement Direction)	0: Negative Direction (Address Decrement Direction)
Starting Point Address	100 pulse	-10000 um	0 pulse	0 X 0.001 inch
Clear Signal Output Enable/Disable	1: Valid	1: Valid	1: Valid	1: Valid
Clear Signal Output Device No.	Y10	Y11	Y0	Y0
OPR Dwell Time	0 ms	100 ms	0 ms	0 ms
Near-point Dog Signal Device No.	X7	X10	X0	X0
Near-point Dog Signal Logic	0: Positive Logic	1: Negative Logic	0: Positive Logic	0: Positive Logic
Zero Signal Device No.	X4	X5	X0	X0
Zero Signal Logic	0: Positive Logic	1: Negative Logic	0: Positive Logic	0: Positive Logic
Zero Signal OPR Zero Signal Counts	1	1	1	1
Zero Signal Count Start Time	0: Near-point Dog Latter Part	1: Near-point Dog Front Part	0: Near-point Dog Latter Part	0: Near-point Dog Latter Part

Parameter list

The following table lists the positioning parameters that can be set in Basic Setting.

Item		Setting value	Initial value	Reference
■Basic Parameter 1				
Pulse Output Mode		0: Not Used, 1: PULSE/SIGN, 2: CW/CCW	0: Not Used	Page 39
Output Device	PULSE/CW	Y0 to Y3*1	—	Page 40
	SIGN/CCW	Y0 to Y17*2	—	
Rotation Direction Setting		0: Current Address Increment with Forward Run Pulse Output 1: Current Address Increment with Reverse Run Pulse Output	0: Current Address Increment with Forward Run Pulse Output	Page 40
Unit Setting		0: Motor System (pulse, pps) 1: Machine System (μm, cm/min) 2: Machine System (0.0001 inch, inch/min) 3: Machine System (mdeg, 10 deg/min) 4: Multiple System (μm, pps) 5: Multiple System (0.0001 inch, pps) 6: Multiple System (mdeg, pps)	0: Motor System (pulse, pps)	Page 41
Pulse No. of per Rotation		1 to 2147483647	2000	Page 42
Movement Amount per Rotation		1 to 2147483647	1000	Page 43
Position Data Magnification		1: × Single, 10: × 10 Times, 100: × 100 Times, 1000: × 1000 Times	1: × Single	Page 43
■Basic Parameter 2				
Interpolation Speed Specified Method		0: Composite Speed, 1: Reference Axis Speed	0: Composite Speed	Page 59
Max. Speed		1 to 2147483647	100000	Page 44
Bias Speed		0 to 2147483647	0	Page 45
Acceleration Time		0 to 32767	100 ms	Page 45
Deceleration Time		0 to 32767	100 ms	Page 45
■Detailed Setting Parameter				
External Start Signal	Enabled/Disabled	0: Invalid, 1: Valid	0: Invalid	Page 49
	Device No.	X0 to X17	X0	
	Logic	0: Positive Logic, 1: Negative Logic	0: Positive Logic	
Interrupt Input Signal 1	Enabled/Disabled	0: Invalid, 1: Valid	0: Invalid	Page 48
	Device No.	X0 to X17	X0	
	Logic	0: Positive Logic, 1: Negative Logic	0: Positive Logic	
Interrupt Input Signal 2 Logic		0: Positive Logic, 1: Negative Logic	0: Positive Logic	Page 57
■OPR Parameter				
OPR Enabled/Disabled		0: Invalid, 1: Valid	0: Invalid	Page 52
OPR Direction		0: Negative Direction (Address Decrement Direction) 1: Positive Direction (Address Increment Direction)	0: Negative Direction (Address Decrement Direction)	Page 52
Starting Point Address		-2147483648 to +2147483647	0	Page 52
Clear Signal Output	Enabled/Disabled	0: Invalid, 1: Valid	1: Valid	Page 54
	Device No.	Y0 to Y17	Y0	
OPR Dwell Time		0 to 32767 ms	0 ms	Page 54
Near-point Dog Signal	Device No.	X0 to X17	X0	Page 55
	Logic	0: Positive Logic, 1: Negative Logic	0: Positive Logic	
Zero Signal	Device No.	X0 to X17	X0	Page 55
	Logic	0: Positive Logic, 1: Negative Logic	0: Positive Logic	
	OPR Zero Signal Counts	0 to 32767	1	
	Count Start Time	0: Near-point Dog Latter Part 1: Near-point Dog Front Part	0: Near-point Dog Latter Part	

*1 PULSE/CW is fixed to the output device (Y) of "axis number - 1".

*2 CW/CCW is fixed to Y0(CW)/Y2(CCW), Y1(CW)/Y3(CCW).

Input Check

The usage status of the built-in input (X0 to X17) can be checked from input check.
Inputs do not need to be set in this window because the basic setting is applied.

Window

Navigation window ⇨ Parameter ⇨ FX5UCPU ⇨ Module Parameter ⇨ High Speed I/O ⇨ Input Check ⇨ Positioning

Item	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17
Positioning																
Axis 1 External Start Signal Positive Logic	()															
Axis 1 External Start Signal Negative Logic																
Axis 1 Interrupt Input Signal 1 High Speed																
Axis 1 Interrupt Input Signal 1 Standard Positive Logic																
Axis 1 Interrupt Input Signal 1 Standard Negative Logic																
Axis 1 Near-point Dog Signal								()								
Axis 1 Zero Signal Positive Logic					()											
Axis 1 Zero Signal Negative Logic																
Axis 1 Interrupt Input Signal 2																
Axis 2 External Start Signal Positive Logic																
Axis 2 External Start Signal Negative Logic																

Output Confirmation

The usage status of the built-in output (Y0 to Y17) can be checked from output check.
Outputs do not need to be set in this window because the basic setting is applied.

Window

Navigation window ⇨ Parameter ⇨ FX5UCPU ⇨ Module Parameter ⇨ High Speed I/O ⇨ Output Confirmation ⇨ Positioning

Item	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17
Positioning																
Axis 1 Pulse Output (PULSE)																
Axis 1 Pulse Output (SIGN)																
Axis 1 Pulse Output (CW)	()															
Axis 1 Pulse Output (CCW)			()													
Axis 1 Clear Signal									()							
Axis 2 Pulse Output (PULSE)		()														
Axis 2 Pulse Output (SIGN)						()										
Axis 2 Pulse Output (CW)																
Axis 2 Pulse Output (CCW)																
Axis 2 Clear Signal										()						
Axis 3 Pulse Output (PULSE)																
Axis 3 Pulse Output (SIGN)																
Axis 3 Pulse Output (CW)																
Axis 3 Pulse Output (CCW)																
Axis 3 Clear Signal																
Axis 4 Pulse Output (PULSE)				()												
Axis 4 Pulse Output (SIGN)								()								
Axis 4 Pulse Output (CW)																
Axis 4 Pulse Output (CCW)																
Axis 4 Clear Signal																

19.6 General-purpose Input Functions

The FX5 PLC general-purpose inputs are explained below.

Outline of general-purpose input functions

For general-purpose inputs of the FX5 PLC, the input response time can be set by parameters.

Specifications of general-purpose inputs

Performance specifications

Input response times can be set to general-purpose inputs.

■Input response time setting

Input response times that can be set are shown below. The default value is 10 ms.

Input number set value	Input response time set value
X0 to X377	10 μs, 50 μs, 0.1 ms, 0.4 ms, 0.6 ms, 1 ms, 5 ms, 10 ms, 20 ms, 70 ms

Point

The value obtained by adding on the value of the hardware filter is the actual input response time.

■Hardware filter value

The delay times of the hardware filter on the CPU module is shown below.

The hardware filter value of I/O modules is 50 μs when ON, and 150 μs when OFF.

Input number		Hardware filter value	
FX5U-32M□, FX5UC-32M□	FX5U-64M□, FX5U-80M□	ON	OFF
X0 to X5	X0 to X7	2.5 μs	2.5 μs
X6 to X17	X10 to X17	30 μs	50 μs
—	X20 or later	50 μs	150 μs

■Input response time setting units

The following table lists the units (1 point unit/8 point unit) that can be set for the input response time of each CPU module.

CPU module	X0 to X7	X10 to X17	X20 to X27	X30 to X37	X40 to X47
FX5U-32M□	1 point unit	1 point unit	—	—	—
FX5U-64M□	1 point unit	1 point unit	1 point unit	1 point unit	—
FX5U-80M□	1 point unit	1 point unit	1 point unit	1 point unit	8 points units*1

*1 When 1 point unit is set for the input response time using GX Works3, X41 to X47 operate with the input response time set to X40.

General-purpose input function parameters

This section explains the general-purpose input parameters.

Set the input response time parameters in GX Works3.

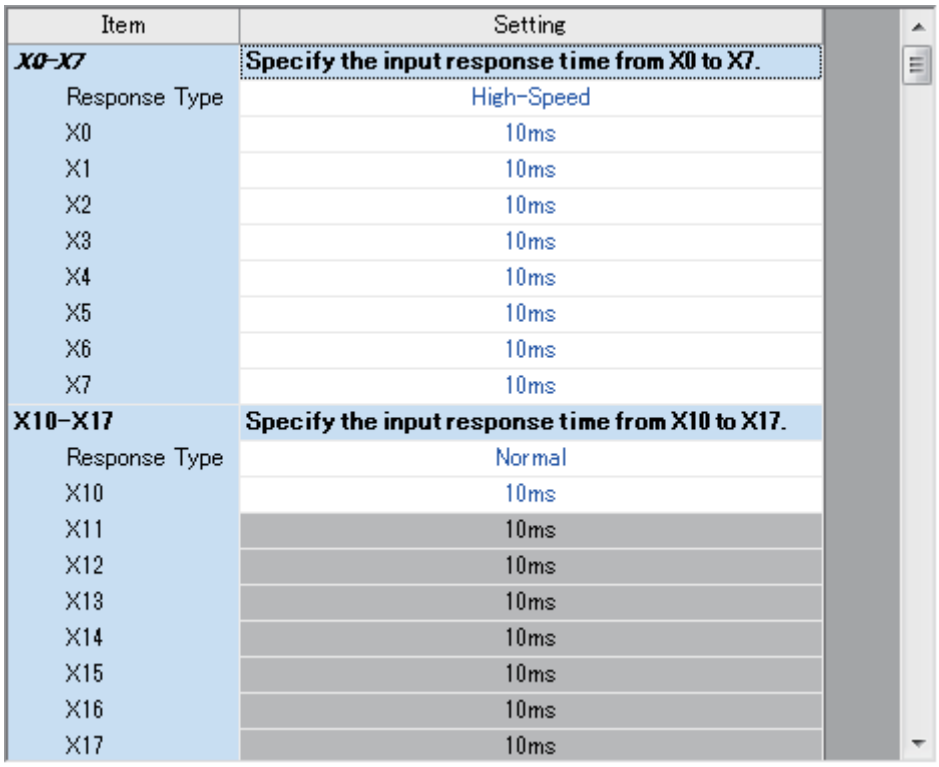
Parameter setting

This section explains how to set the input response time parameters.

Set the input response time.

Navigation window ⇨ [Parameter] ⇨ [FX5UCPU] ⇨ [Module Parameter] ⇨ [Input Response Time]

Window



Displayed items

Item	Description	Setting range	Default
Response Type	Select the input response time between 1 point unit and 8 point unit. High-Speed: Unit of 1 point Normal: Unit of 8 points	• High-Speed • Normal	—
X0 to X377	Set the input response time.	• No Setting • 10micro-s (μs) • 50micro-s (μs) • 0.1ms • 0.4ms • 0.6ms • 1ms • 5ms • 10ms • 20ms • 70ms	10ms

Point

Parameters are enabled when the CPU module is powered ON or after a reset.

Current address

Store the current address operated by the positioning instruction. The current address stores an absolute address and is increased or decreased depending on the rotation direction.

■Current address (user unit)

The unit is the machine/multiple system unit, and the value indicated includes positioning data magnification. (☞ Page 41 Unit Setting, Page 43 Position Data Magnification) The address range is -2147483648 to +2147483647.

■Special Device

Name	FX5 dedicated				R/W
	Axis 1	Axis 2	Axis 3	Axis 4	
Current address (user unit)	SD5500, SD5501	SD5540, SD5541	SD5580, SD5581	SD5620, SD5621	R/W

R/W: Read/Write

When the value in the devices above is changed, the current address (pulse unit) is also changed.

Point

- Writing can be performed to the current address (user unit) only by the HCMOV/DHCMOV instruction. During positioning operation, the value written to the current address is applied when the instruction is completed.
- Reading can be performed to the current value by the HCMOV/DHCMOV instruction.

Precautions

The current address (user unit) functions within the range of -2147483648 to +2147483647. However, an overflow or underflow occurs before the current address (pulse unit) is reached if the axis parameter is set in such a way that the number of pulses per rotation is less than the number of transfer distance units per rotation. If that happens, overflow/underflow to the upper or lower limit value is stored in the device.

■Current address (pulse unit)

The unit is the motor system unit (pulse unit), and the value indicated includes positioning data magnification. (☞ Page 41 Unit Setting, Page 43 Position Data Magnification) The address range is -2147483648 to +2147483647.

■Special Device

Name	FX5 dedicated				For compatibility with FX3				R/W
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 1	Axis 2	Axis 3	Axis 4	
Current address (pulse unit)	SD5502 SD5503	SD5542 SD5543	SD5582 SD5583	SD5622 SD5623	SD8340 SD8341	SD8350 SD8351	SD8360 SD8361	SD8370 SD8371	R/W

R/W: Read/Write

When the value in the devices above changes, the current address (user unit) also changes automatically. When reading ABS data from the servo amplifier using the DABS instruction, read the device above.

Point

- Writing can be performed to the current address (pulse unit) only by the HCMOV/DHCMOV instruction. During positioning operation, the value written to the current address is applied when the instruction is completed.
- Reading can be performed to the current value by the HCMOV/DHCMOV instruction.

Precautions

The current address (pulse unit) functions with the range of -2147483648 to +2147483647 pulses. However, if the upper limit is exceeded, current address overflows to the lower limit. If below the lower limit, current address underflows to the upper limit.

Positioning instruction activation

Use "positioning instruction activation" to check whether or not a positioning instruction is being executed.
Even if no pulse is output, this flag is on while the instruction is being driven. Even after the drive contact of the positioning instruction is turned off, this flag remains on until the pulse output is stopped. Use this flag to prevent simultaneous activation of two or more positioning instructions for the same axis.

■Special Device

Name	FX5 dedicated				For compatibility with FX3				R/W
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 1	Axis 2	Axis 3	Axis 4	
Positioning instruction activation	SM5500	SM5501	SM5502	SM5503	SM8348	SM8358	SM8368	SM8378	R

R: Read only

Precautions

Do not write to the pulse output monitor using a transfer instruction. This may change the value and cause abnormal monitoring.

Positioning error occurrence

▶Setting method: Special Device

Use the positioning error occurrence to check whether or not an error specific to the positioning instruction occurs.
This flag turns on when an error specific to the positioning instruction occurs.

■Special Device

Name	FX5 dedicated				R/W
	Axis 1	Axis 2	Axis 3	Axis 4	
Positioning error occurrence	SM5532	SM5533	SM5534	SM5535	R/W

R/W: Read/Write

After the positioning error occurrence is turned on, an error code is stored in the corresponding positioning error (error code).

Precautions

The positioning error occurrence flag is not cleared by eliminating the error cause.
Turn on SM50 (Error Detection Reset Completion) from program or engineering tool, or use the continuation error batch clear function in the module diagnosis window of GX Works3 to clear the flag. (GX Works3 Operating Manual)

Positioning error (error code)

▶Setting method: Special Device

Use the following devices to check the error code of an error that has occurred in the positioning operation.
For the error codes, refer to ☞ Page 167 Error Check.

■Special Device

Name	FX5 dedicated				R/W
	Axis 1	Axis 2	Axis 3	Axis 4	
Positioning error (error code)	SD5510	SD5550	SD5590	SD5630	R/W

R/W: Read/Write

After the positioning error occurrence flag turns on, an error code is stored in the device above. If multiple errors occur, the old error is overwritten by a new error.

Precautions

The error code in the positioning error (error code) is not cleared by eliminating the error cause.
Turn on SM50 (Error Detection Reset Completion) from program or engineering tool, or the continuation error batch clear function in the module diagnosis window of GX Works3 to clear the flag. (GX Works3 Operating Manual)

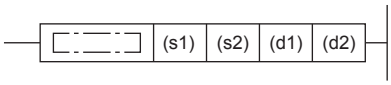
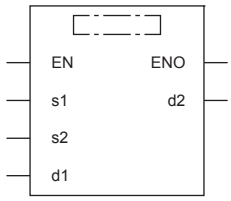
5.3 Mechanical OPR

If forward rotation pulses or reverse rotation pulses are generated, the positioning instruction will increase or decrease the value of the current address.

When the power of the CPU module is turned off, the value stored in the current address will be erased. For this reason, after turning on the power again, be sure to adjust the value of the current address in the CPU module to the current position of the machine. The positioning function uses the DSZR/DDSZR instruction (OPR instruction) to adjust the value of the current address in the CPU module to the current mechanical position.

DSZR/DDSZR

This instruction executes mechanical OPR.

Ladder	ST	FBD/LD
	ENO:=DSZR(EN,s1,s2,d1,d2); ENO:=DDSZR(EN,s1,s2,d1,d2);	

Setting data

■Description, range, data type (DSZR)

• FX5 operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing OPR speed or data*1	1 to 65535 (User system unit)	16-bit unsigned binary	ANY_ELEMENTARY (WORD)
(s2)	Word device number storing creep speed or data*1	1 to 65535 (User system unit)	16-bit unsigned binary	ANY_ELEMENTARY (WORD)
(d1)	Axis number from which pulses are output	K1 to 4	16-bit unsigned binary	ANY_ELEMENTARY (WORD)
(d2)	Bit device number of the instruction execution complete flag and abnormal end flag	—	Bit	ANY_BOOL

• FX3 compatible operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Bit device number to which the near-point dog signal is input	—	Bit	ANY_ELEMENTARY (BOOL)
(s2)	Bit device number to which the zero signal is input	—	Bit	ANY_ELEMENTARY (BOOL)
(d1)	Output bit device number (Y) from which pulses are output	0 to 3	Bit	ANY_ELEMENTARY (BOOL)
(d2)	Bit device number from which rotation direction is output	—	Bit	ANY_BOOL

*1 OPR speed and creep speed can be changed during positioning operation. (☞ Page 32 Command speed change during positioning operation)

■Description, range, data type (DDSZR)[*1]

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing OPR speed or data[*2]	1 to 2147483647 (User system unit)	32-bit signed binary	ANY32
(s2)	Word device number storing creep speed or data[*2]	1 to 2147483647 (User system unit)	32-bit signed binary	ANY32
(d1)	Axis number from which pulses are output	K1 to 4	16-bit unsigned binary	ANY16_U
(d2)	Bit device number of the instruction execution complete flag and abnormal end flag	—	Bit	ANY_BOOL

*1 The DDSZR instructions have only one operand specification method.
*2 OPR speed and creep speed can be changed during positioning operation.

■Available device (DSZR/DDSZR[*1])

• FX5 operand

Operand	Bit			Word			Double word		Indirect specification	Constant			Others (DX)
	X, Y, M, L, SM, F, B, SB, S	U□\G□	T, ST, C, LC	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○	—	—	○	○	○	○[*2]	○[*2]	○	○	—	—	—
(s2)	○	—	—	○	○	○	○[*2]	○[*2]	○	○	—	—	—
(d1)	—	—	—	○	○	○	—	—	○	○	—	—	—
(d2)[*3]	○	—	—	○[*4]	—	—	—	—	—	—	—	—	—

• FX3 compatible operand

Operand	Bit			Word			Double word		Indirect specification	Constant			Others (DX)
	X, Y, M, L, SM, F, B, SB, S	U□\G□	T, ST, C, LC	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○[*5]	—	—	—	—	—	—	—	—	—	—	—	—
(s2)	○[*5*6]	—	—	—	—	—	—	—	—	—	—	—	—
(d1)	○[*7]	—	—	—	—	—	—	—	—	—	—	—	—
(d2)	○[*8]	—	—	—	—	—	—	—	—	—	—	—	—

*1 The DDSZR instructions have only one operand specification method.
*2 Only available for DDSZR instruction.
*3 Two devices are occupied from the specified device.
*4 T, ST, C cannot be used.
*5 For X devices, always specify the device set in high speed I/O parameter.
*6 For device other than X device, set the device to which the near-point dog signal (s1) is assigned.
*7 Only Y0 to Y3 devices can be used.
*8 When the output mode is CW/CCW, specify the CCW axis. When the output mode is PULSE/SIGN, only the SIGN output of the axis or general-purpose output can be specified.

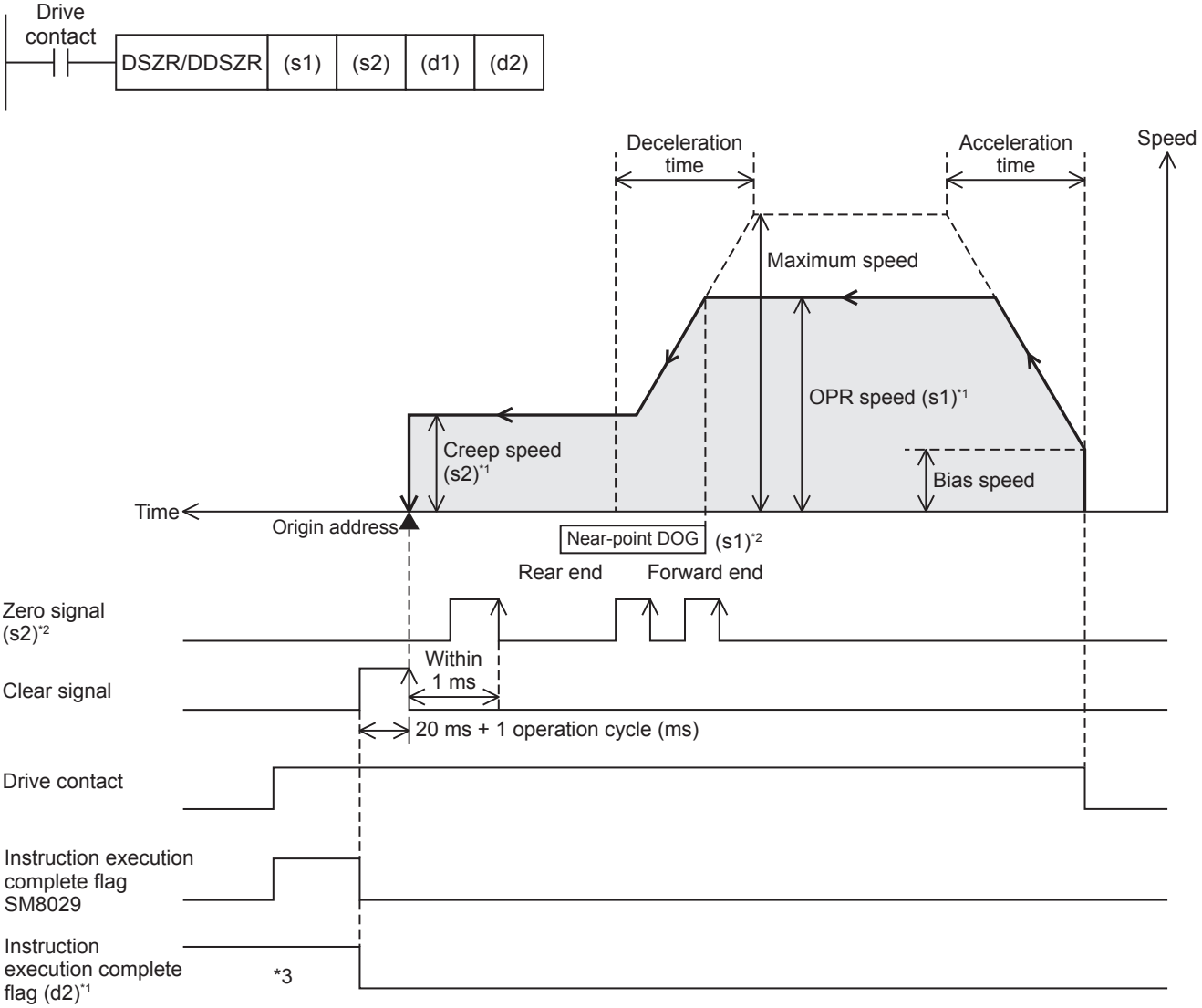
Processing details

This instruction executes mechanical OPR. With the forward limit and reverse limit, OPR using the dog search function can be executed. (☞ Page 28 Dog search function)

Outline of operation

For each speed, refer to ☞ Page 43 Items related to speed.

For the items related to OPR, refer to ☞ Page 52 Items related to OPR.



*1 When FX5 operand is specified

*2 When the FX3 compatible operand is specified

*3 Remains on until it is turned off by program or engineering tool or the positioning instruction is next driven again.

Basic operation

The following describes the basic operation.

1. After the drive contact is turned on, pulse output is started and the speed is increased from the bias speed.

2. After the speed has reached the OPR speed, the operation will be performed at the OPR speed.

3. After the near-point dog is detected, the speed is decreased.

4. After the speed has reached the creep speed, the operation will be performed at the creep speed.

5. After the near-point dog is turned from ON to OFF, pulse output is stopped when the zero signal is detected.

Operand specification

■When FX5 operand is specified or the DDSZR instruction is used

(1) For (s1), specify the OPR speed. Set to a value 1 pps to 200 Kpps in pulse.
- DSZR : 1 to 65535 (User system unit)
- DDSZR : 1 to 2147483647 (User system unit)

(2) For (s2), specify the creep speed. Set to a value 1 pps to 200 Kpps in pulse.
- DSZR : 1 to 65535 (User system unit)
- DDSZR : 1 to 2147483647 (User system unit)

(3) For (d1), specify an axis number (K1 to K4) for which OPR is executed.
Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

(4) For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 62 Complete flag)
- (d2) : Instruction execution complete flag
- (d2)+1 : Instruction execution abnormal end flag

■When the FX3 compatible operand is specified

(1) For (s1), specify the near-point dog signal input device number.
When an input device (X) is used, only the device that is specified with the high speed I/O parameter can be specified. The logic set with the high speed I/O parameter is applied. Bit devices can be specified, in addition to input devices (X). In that case, the relay operates on a rising edge.

(2) For (s2), specify the zero signal input device number.
When an input device (X) is used, only the device that is specified with the high speed I/O parameter can be specified. (☞ Page 39 Pulse Output Mode) The logic set with the high speed I/O parameter is applied. Bit devices can be specified, in addition to input devices (X). In that case, the relay operates on a rising edge.

(3) For (d1), specify the pulse output number in the range of Y0 to Y3.
Specify an output device (Y) number (equivalent to the axes 1 to 4) set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

(4) For (d2), specify the rotation direction signal output device number. (☞ Page 40 Rotation Direction Setting)
When an output device (Y) is used, only the device that is specified with the positioning parameter or a general-purpose output can be specified. However, if an output device (Y) to which PWM or CW/CCW axis is assigned is specified, an error occurs without any operation.
For the PWM function, refer to 📖User's manual (Application).

OPR direction

The pulse output direction is determined by the OPR direction and rotation direction setting. The following table lists operations performed when the origin return direction and rotation direction setting are used in combination. (☞ Page 40 Rotation Direction Setting)

		Rotation Direction Setting	
		Current Value Increment with Forward Run Pulse Output	Current Value Increment with Reverse Run Pulse Output
OPR Direction	Positive Direction (Address Increment Direction)	Output direction: Forward Address: Increment	Output direction: Reverse Address: Increment
	Negative Direction (Address Decrement Direction)	Output direction: Reverse Address: Decrement	Output direction: Forward Address: Decrement

Operand change in positioning operation

During positioning operation for the OPR speed (s1) and creep speed (s2), the command speed can be changed before the zero signal is detected. If it is changed after the zero signal is detected, the change is applied when the DSZR/DDSZR instruction is next driven again.

Operation of the complete flags

The following describes the operation timings of the complete flags.

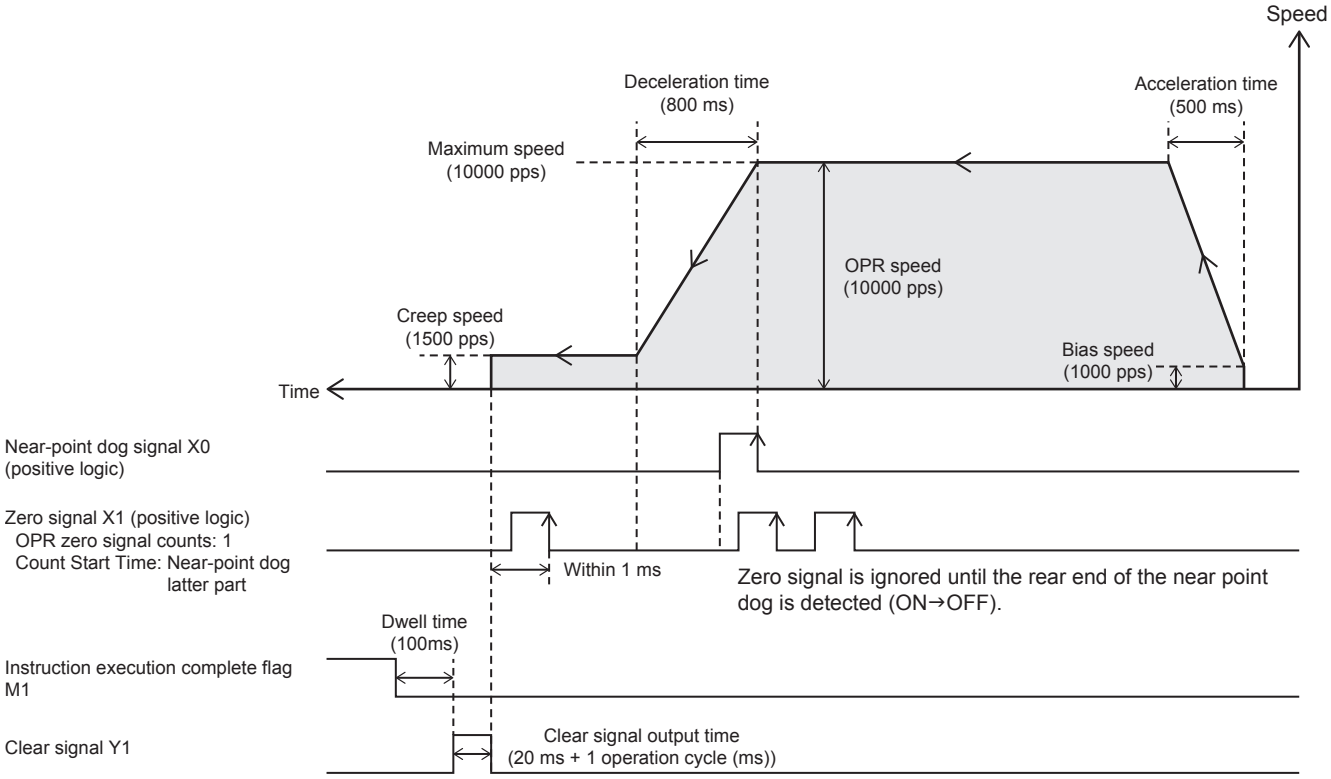
The user-specified complete flags are valid only when specified using FX5 operand. If dwell time is specified, the user-specified complete flag turns on after the dwell time elapses.

	FX3 compatible		User specification	
	Instruction execution complete flag (SM8029)	**Instruction execution abnormal end flag (SM8329)**	**Instruction execution complete flag (d2)**	**Instruction execution abnormal end flag (d2)+1**
ON condition	From when OPR is completed to when the drive contact is turned off	From when the following operation or function is completed to when the drive contact is turned off • The axis is already used.*1 • Pulse output stop command • Pulse decelerate and stop command • All outputs disabled (SM8034) • Write during RUN • Deceleration stop after OPR speed and creep speed are changed to 0 • Deceleration stop at limit detection after the near-point dog is detected	From when OPR is completed to when the ON → OFF condition is met	From when the following operation or function is completed to when the ON → OFF condition is met • The axis is already used. • The drive contact is turned off during positioning operation • Pulse output stop command • Pulse decelerate and stop command • All outputs disabled (SM8034) • Write during RUN • Deceleration stop after OPR speed and creep speed are changed to 0 • Deceleration stop at limit detection after the near-point dog is detected
ON → OFF condition	When the drive contact is turned off		The flag remains on until either of the following is executed. • Turning off the flag by the user • Restarting the positioning instruction	

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

Program example

The following is a program example of OPR operation (axis 1).

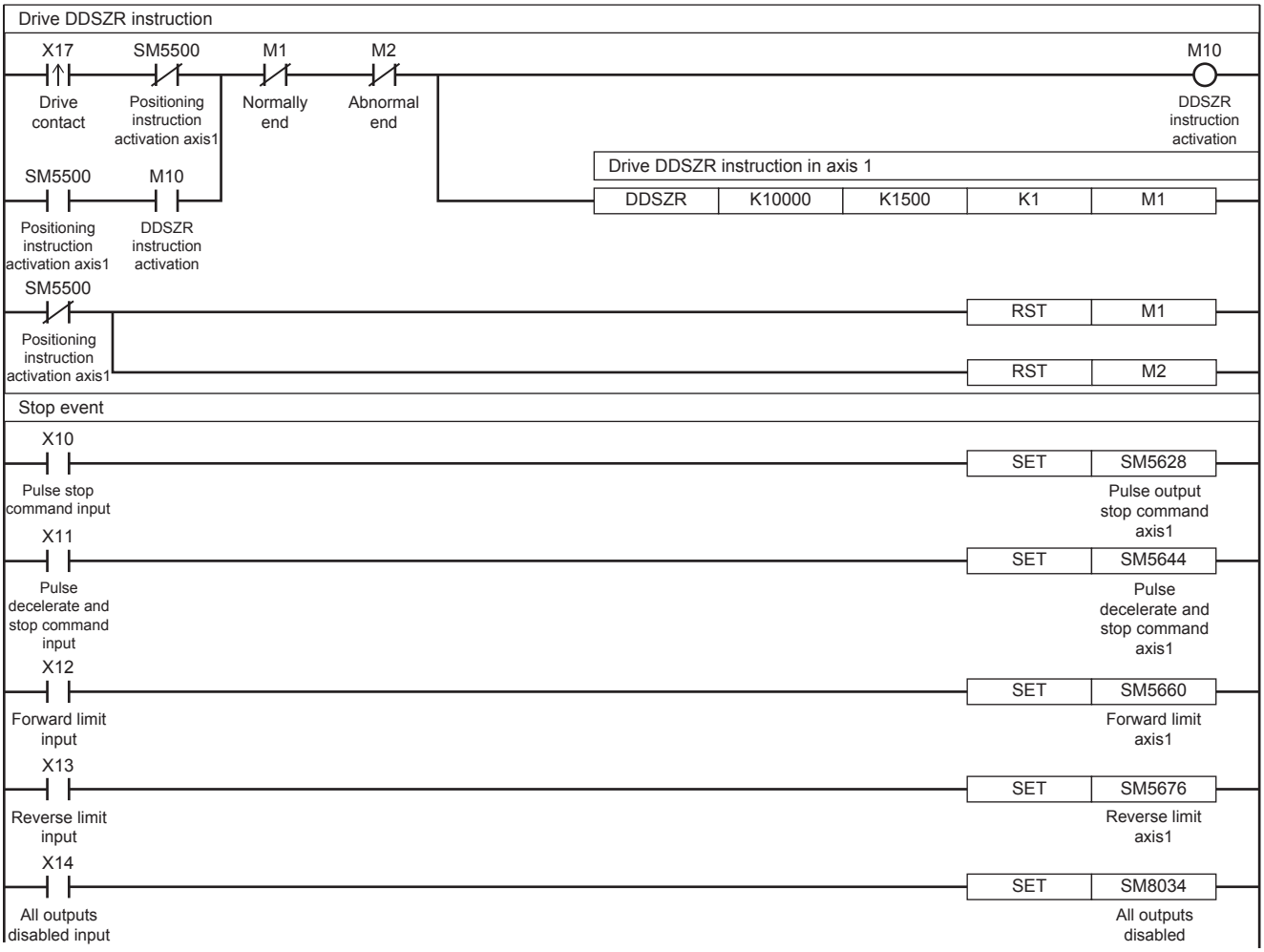


Setting data

■Positioning parameter (high speed I/O parameter)

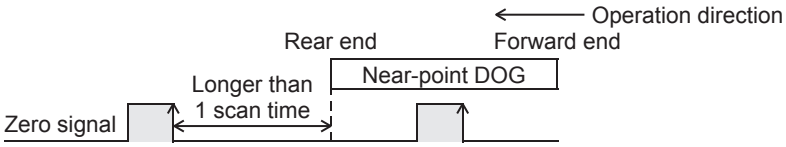
Item	Axis 1		Item	Axis 1
■Basic Parameter 1			■Detailed Setting Parameter	
Pulse Output Mode	1: PULSE/SIGN		External Start Signal Enabled/Disabled	0: Invalid
Output Device (PULSE/CW)	Y0		Interrupt Input Signal 1 Enabled/ Disabled	0: Invalid
Output Device (SIGN/CCW)	Y4			
Rotation Direction Setting	0: Current Address Increment with Forward Run Pulse Output		Interrupt Input Signal 2 Logic	0: Positive Logic
			■OPR Parameter	
Unit Setting	0: Motor System (pulse, pps)		OPR Enabled/Disabled	1: Valid
Pulse No. of per Rotation	2000 pulse		OPR Direction	0: Negative Direction (Address Decrement Direction)
Movement Amount per Rotation	1000 pulse			
Position Data Magnification	1: × Single		Starting Point Address	0 pulse
■Basic Parameter 2			Clear Signal Output Enabled/Disabled	1: Valid
Interpolation Speed Specified Method	0: Composite Speed		Clear Signal Output Device No.	Y1
Max. Speed	10000 pps		OPR Dwell Time	100 ms
Bias Speed	1000 pps		Near-point Dog Signal Device No.	X0
Acceleration Time	500 ms		Near-point Dog Signal Logic	0: Positive Logic
Deceleration Time	800 ms		Zero Signal Device No.	X1
—			Zero Signal Logic	0: Positive Logic
			Zero Signal OPR Zero Signal Counts	1
			Zero Signal Count Start Time	0: Near-point Dog Latter Part

Program example

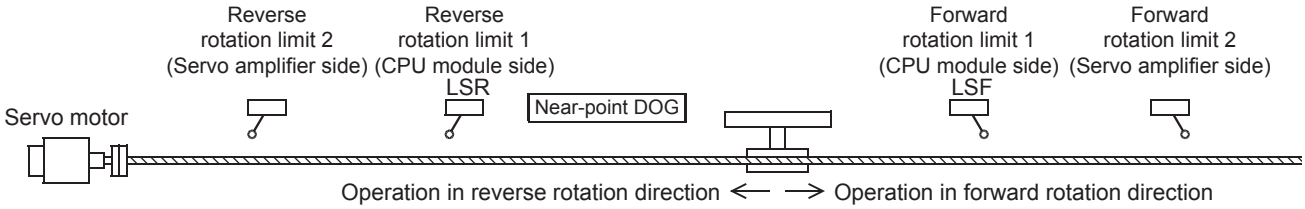


Caution

- Detection of (the rear end and the front end of) the near-point dog will be affected by the input response time and the scan time of the sequence program. Secure 1 scan time or more from the rear end of the near-point dog to turning ON of the zero signal.
- Since the zero signal of the servo motor is used, adjust the relation between the rear end of the near-point dog and the zero signal as shown in the following figure. If fine adjustment of the origin position is needed, adjust the position of the near-point dog.



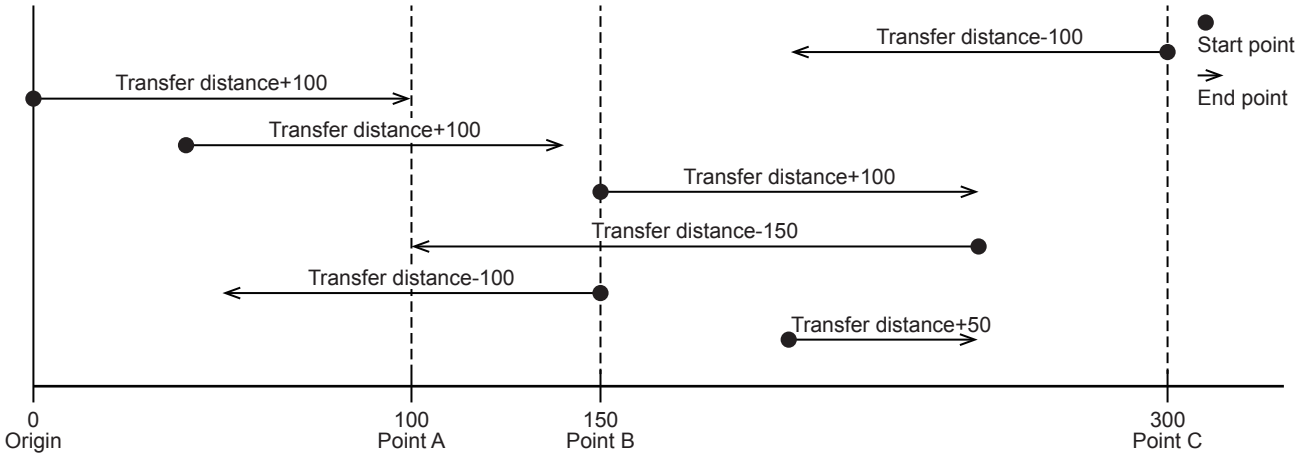
- Properly set the near-point dog so that the near-point dog can be kept at the ON status until the speed is reduced to the creep speed. Deceleration to the creep speed starts at the front end of the near-point dog, the operation stops at "the rear end of the near-point dog" or at "detection of the first zero signal after the rear end of the near-point dog", and the current address is cleared. If the speed is not reduced to the creep speed before detecting the rear end of the near-point dog, the operation may not be stopped at the specified position.
- Use the near-point dog between the reverse rotation limit 1 (LSR) and the forward rotation limit 1 (LSF). The intended operation may not be performed if the relationship among the near-point dog, reverse rotation limit 1 (LSR), and forward rotation limit 1 (LSF) is not as shown in the figure below.



- The creep speed should be sufficiently slow. Deceleration stop is not performed. For this reason, if the creep speed is not slow enough, the operation may not be stopped at the specified position due to inertia.
- If the dog search function cannot detect the near-point dog signal, the speed will decelerate and the operation will stop. The execution of the instruction ends with an error.

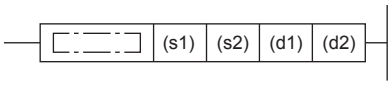
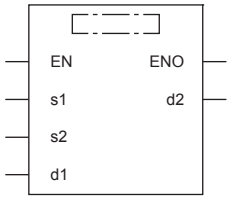
5.4 Relative Positioning

This instruction performs 1-speed positioning in the incremental method (positioning operation with a relative address). While regarding the current position as the start point, specify the transfer direction and the transfer distance (relative address) to determine the target position.



DRVI/DDRVI

This instruction executes 1-speed positioning by relative address.

Ladder	ST	FBD/LD
	ENO:=DRVI(EN,s1,s2,d1,d2); ENO:=DDRVI(EN,s1,s2,d1,d2);	

Setting data

■Description, range, data type (DRVI)

• FX5 operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-32768 to +32767 (User system unit)	16-bit signed binary	ANY16
(s2)	Word device number storing command speed or data*2	1 to 65535 (User system unit)	16-bit unsigned binary	ANY16
(d1)	Axis number from which pulses are output	K1 to 4	16-bit unsigned binary	ANY_ELEMENTARY (WORD)
(d2)	Bit device number of the instruction execution complete flag and abnormal end flag	—	Bit	ANY_BOOL

• FX3 compatible operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-32768 to +32767 (User system unit)	16-bit signed binary	ANY16
(s2)	Word device number storing command speed or data*2	1 to 65535 (User system unit)	16-bit unsigned binary	ANY16
(d1)	Output bit device number (Y) from which pulses are output	0 to 3	Bit	ANY_ELEMENTARY (BOOL)
(d2)	Bit device number from which rotation direction is output	—	Bit	ANY_BOOL

*1 The positioning address can be changed during positioning operation. (☞ Page 31 Positioning address change during positioning operation)

*2 Command speed can be changed during positioning operation. (☞ Page 32 Command speed change during positioning operation)

■Description, range, data type (DDRVI)

• FX5 operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-2147483648 to +2147483647 (User system unit)	32-bit signed binary	ANY32
(s2)	Word device number storing command speed or data*2	1 to 2147483647 (User system unit)	32-bit signed binary	ANY32
(d1)	Axis number from which pulses are output	K1 to 4	16-bit unsigned binary	ANY_ELEMENTARY (WORD)
(d2)	Bit device number of the instruction execution complete flag and abnormal end flag	—	Bit	ANY_BOOL

• FX3 compatible operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-2147483648 to +2147483647 (User system unit)	32-bit signed binary	ANY32
(s2)	Word device number storing command speed or data*2	1 to 2147483647 (User system unit)	32-bit signed binary	ANY32
(d1)	Output bit device number (Y) from which pulses are output	0 to 3	Bit	ANY_ELEMENTARY (BOOL)
(d2)	Bit device number from which rotation direction is output	—	Bit	ANY_BOOL

*1 The positioning address can be changed during positioning operation.
*2 Command speed can be changed during positioning operation.

■Available device (DRVI/DDRVI)

• FX5 operand

Operand	Bit			Word			Double word		Indirect specification	Constant			Others (DX)
	X, Y, M, L, SM, F, B, SB, S	U□\G□	T, ST, C, LC	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○	—	—	○	○	○	○*1	○*1	○	○	—	—	—
(s2)	○	—	—	○	○	○	○*1	○*1	○	○	—	—	—
(d1)	—	—	—	○	○	○	—	—	○	○	—	—	—
(d2)*2	○	—	—	○*3	—	—	—	—	—	—	—	—	—

• FX3 compatible operand

Operand	Bit			Word			Double word		Indirect specification	Constant			Others (DX)
	X, Y, M, L, SM, F, B, SB, S	U□\G□	T, ST, C, LC	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○	—	—	○	○	○	○*1	○*1	○	○	—	—	—
(s2)	○	—	—	○	○	○	○*1	○*1	○	○	—	—	—
(d1)	○*4	—	—	—	—	—	—	—	—	—	—	—	—
(d2)	○*5	—	—	○*3	—	—	—	—	—	—	—	—	—

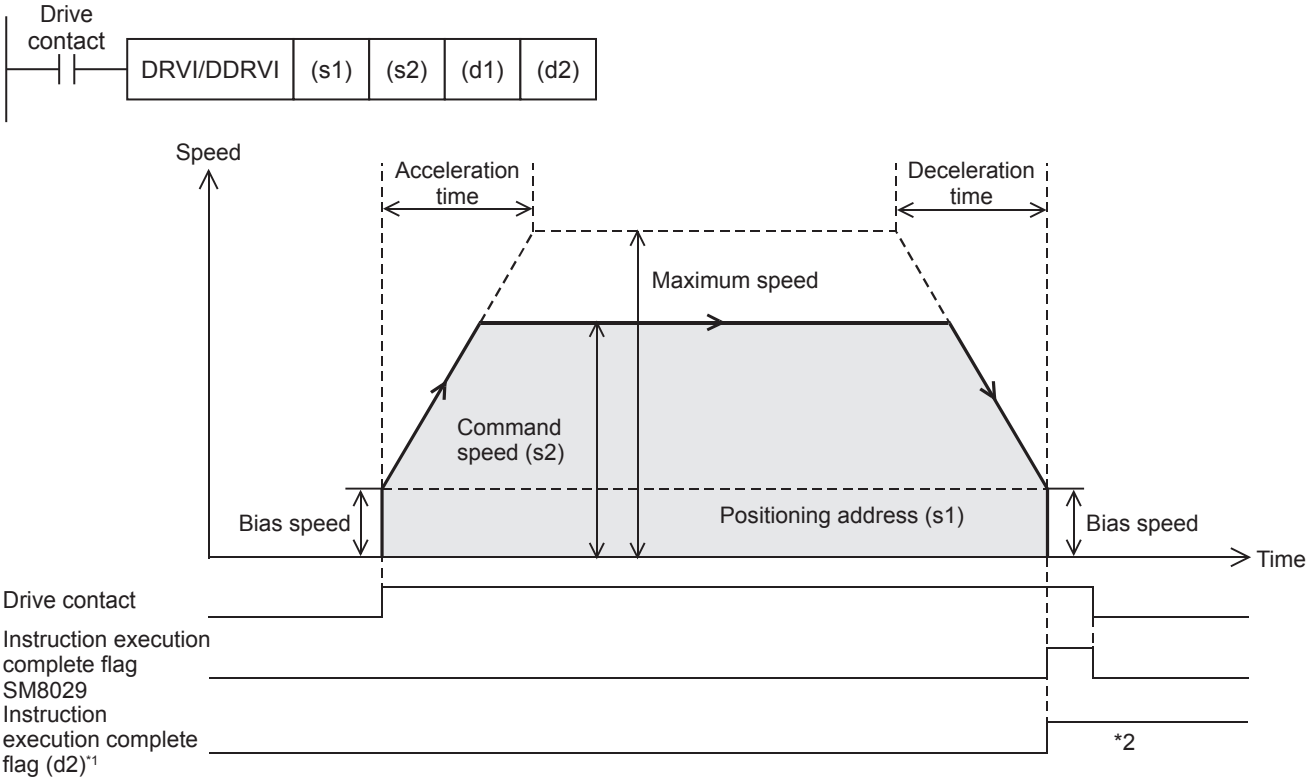
*1 Only available for DDRVI instruction.
*2 Two devices are occupied from the specified device.
*3 T, ST, C cannot be used.
*4 Only Y0 to Y3 devices can be used.
*5 When the output mode is CW/CCW, specify the CCW axis. When the output mode is PULSE/SIGN, only the SIGN output of the axis or general-purpose output can be specified.

Processing details

This instruction executes 1-speed positioning by relative address. The target positioning address is specified in the incremental method, in which transfer direction and transfer distance (relative address) from current address are specified for positioning operation.

Outline of operation

For each speed, refer to ☞ Page 43 Items related to speed.



*1 When FX5 operand is specified

*2 Remains on until it is turned off by program or engineering tool or the positioning instruction is next driven again.

Basic operation

The following describes the basic operation.

1. After the drive contact is turned on, pulse output is started and the speed is increased from the bias speed.

2. After the speed has reached the specified speed, the operation will be performed in the specified speed.

3. Deceleration starts from near the target position.

4. After movement to the specified positioning address, pulse output is stopped.

Operand specification

■When FX5 operand is specified

(1) For (s1), specify the relative positioning address. (☞ Page 46 Positioning address) Set to a value -2147483647 to +2147483647 in pulse.

- DRVI : -32768 to +32767 (User system unit)
- DDRVI : -2147483648 to +2147483647 (User system unit)

(2) For (s2), specify the command speed. Set to a value 1 pps to 200 Kpps in pulse.

- DRVI : 1 to 65535 (User system unit)
- DDRVI : 1 to 2147483647 (User system unit)

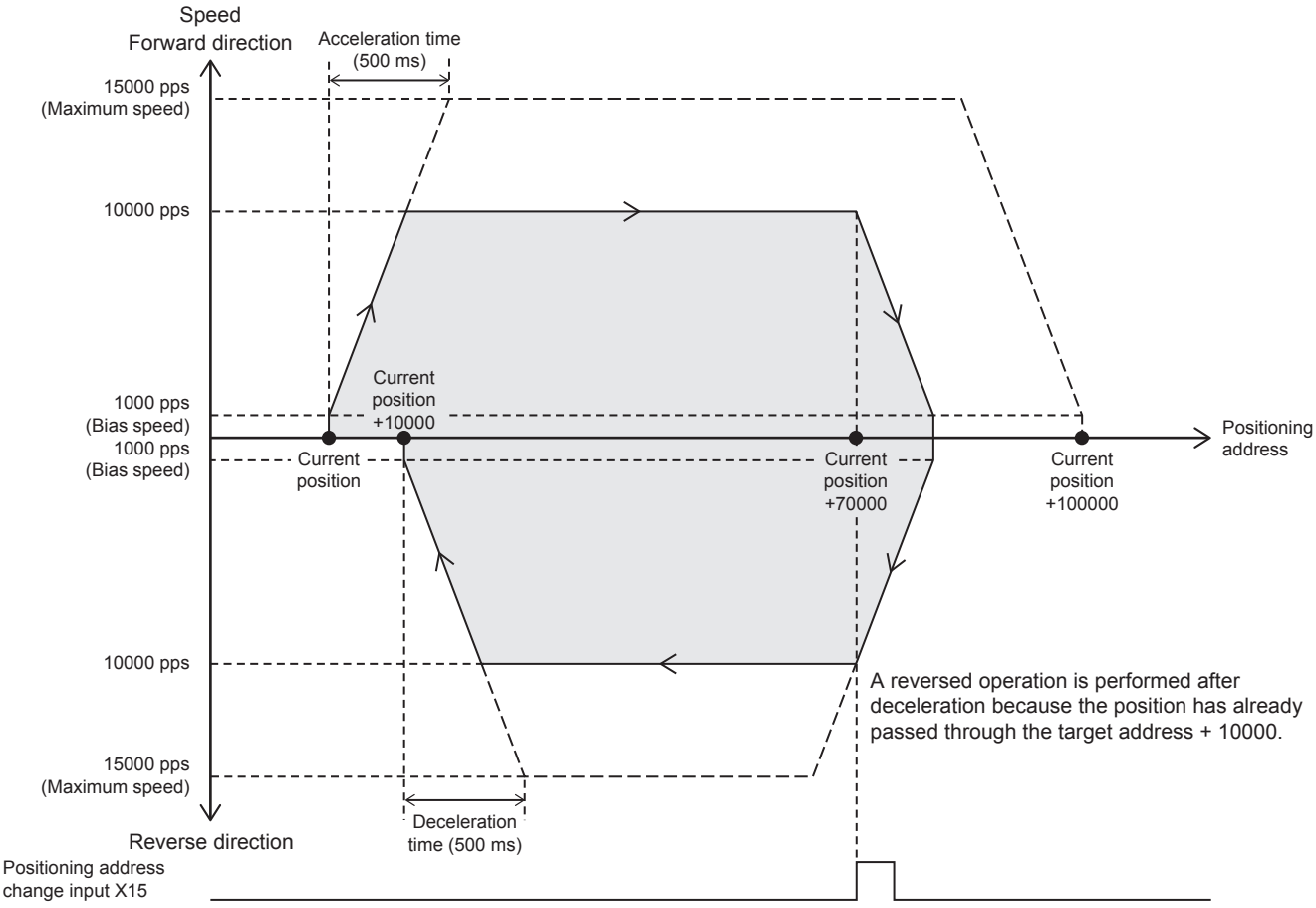
(3) For (d1), specify an axis number (K1 to K4) for which pulses are output.
Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

(4) For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 62 Complete flag)

- (d2) : Instruction execution complete flag
- (d2)+1 : Instruction execution abnormal end flag

Program example

This program example illustrates a reversed operation that is performed by changing the positioning address at the current position + 70000 during relative positioning operation (axis 1).

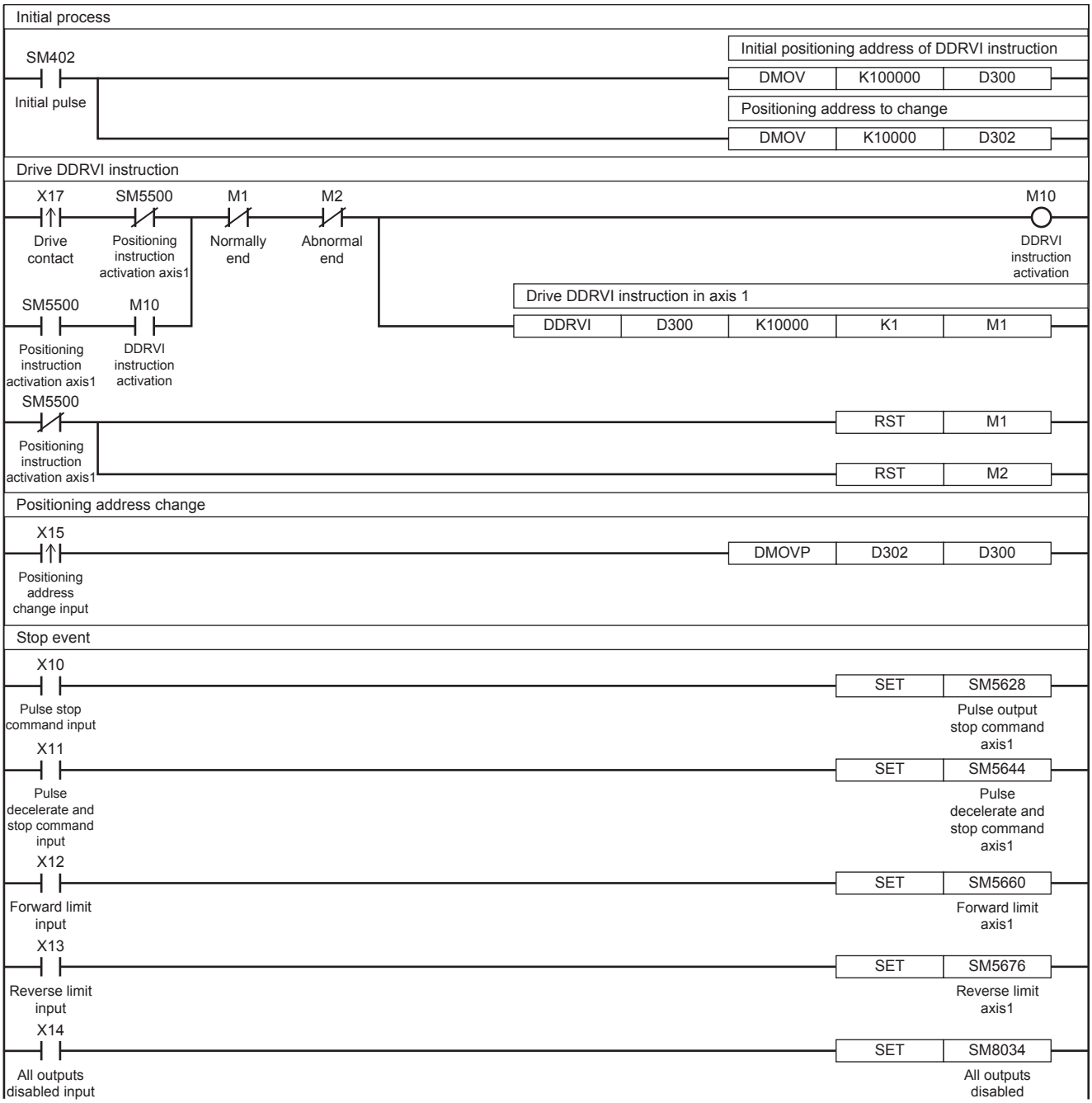


Setting data

■Positioning parameter (high speed I/O parameter)

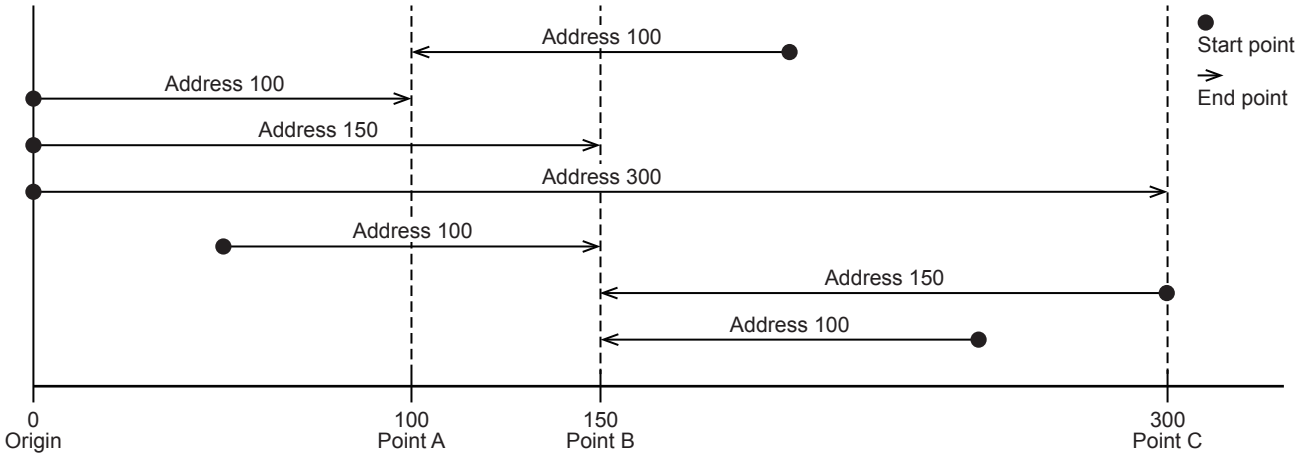
Item	Axis 1	Item	Axis 1
■Basic Parameter 1		■Basic Parameter 2	
Pulse Output Mode	1: PULSE/SIGN	Interpolation Speed Specified Method	0: Composite Speed
Output Device (PULSE/CW)	Y0	Max. Speed	15000 pps
Output Device (SIGN/CCW)	Y4	Bias Speed	1000 pps
Rotation Direction Setting	0: Current Address Increment with Forward Run Pulse Output	Acceleration Time	500 ms
		Deceleration Time	500 ms
Unit Setting	0: Motor System (pulse, pps)	■Detailed Setting Parameter	
Pulse No. of per Rotation	2000 pulse	External Start Signal Enabled/Disabled	0: Invalid
Movement Amount per Rotation	1000 pulse	Interrupt Input Signal 1 Enabled/ Disabled	0: Invalid
Position Data Magnification	1: × Single		
—		Interrupt Input Signal 2 Logic	0: Positive Logic
		■OPR Parameter	
		OPR Enabled/Disabled	0: Invalid

Program example



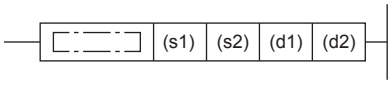
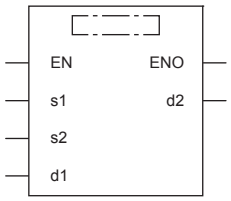
5.5 Absolute Positioning

This instruction performs 1-speed positioning in the absolute method (positioning operation with an absolute address). Specify the distance (absolute address) from the origin to the target position. In this case, any position can be the start point (current position).



DRVA/DDRVA

This instruction executes 1-speed positioning by absolute address.

Ladder	ST	FBD/LD
	ENO:=DRVA(EN,s1,s2,d1,d2); ENO:=DDRVA(EN,s1,s2,d1,d2);	

Setting data

■Description, range, data type (DRVA)

• FX5 operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-32768 to +32767 (User system unit)	16-bit signed binary	ANY16
(s2)	Word device number storing command speed or data*2	1 to 65535 (User system unit)	16-bit unsigned binary	ANY16
(d1)	Axis number from which pulses are output	K1 to 4	16-bit unsigned binary	ANY_ELEMENTARY (WORD)
(d2)	Bit device number of the instruction execution complete flag and abnormal end flag	—	Bit	ANY_BOOL

• FX3 compatible operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-32768 to +32767 (User system unit)	16-bit signed binary	ANY16
(s2)	Word device number storing command speed or data*2	1 to 65535 (User system unit)	16-bit unsigned binary	ANY16
(d1)	Output bit device number (Y) from which pulses are output	0 to 3	Bit	ANY_ELEMENTARY (BOOL)
(d2)	Bit device number from which rotation direction is output	—	Bit	ANY_BOOL

*1 The positioning address can be changed during positioning operation. (☞ Page 31 Positioning address change during positioning operation)

*2 Command speed can be changed during positioning operation. (☞ Page 32 Command speed change during positioning operation)

■Description, range, data type (DDRVA)

• FX5 operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-2147483648 to +2147483647 (User system unit)	32-bit signed binary	ANY32
(s2)	Word device number storing command speed or data*2	1 to 2147483647 (User system unit)	32-bit signed binary	ANY32
(d1)	Axis number from which pulses are output	K1 to 4	16-bit unsigned binary	ANY_ELEMENTARY (WORD)
(d2)	Bit device number of the instruction execution complete flag and abnormal end flag	—	Bit	ANY_BOOL

• FX3 compatible operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-2147483648 to +2147483647 (User system unit)	32-bit signed binary	ANY32
(s2)	Word device number storing command speed or data*2	1 to 2147483647 (User system unit)	32-bit signed binary	ANY32
(d1)	Output bit device number (Y) from which pulses are output	0 to 3	Bit	ANY_ELEMENTARY (BOOL)
(d2)	Bit device number from which rotation direction is output	—	Bit	ANY_BOOL

*1 The positioning address can be changed during positioning operation.
*2 Command speed can be changed during positioning operation.

■Available device (DRVA/DDRVA)

• FX5 operand

Operand	Bit			Word			Double word		Indirect specification	Constant			Others (DX)
	X, Y, M, L, SM, F, B, SB, S	U□\G□	T, ST, C, LC	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○	—	—	○	○	○	○*1	○*1	○	○	—	—	—
(s2)	○	—	—	○	○	○	○*1	○*1	○	○	—	—	—
(d1)	—	—	—	○	○	○	—	—	○	○	—	—	—
(d2)*2	○	—	—	○*3	—	—	—	—	—	—	—	—	—

• FX3 compatible operand

Operand	Bit			Word			Double word		Indirect specification	Constant			Others (DX)
	X, Y, M, L, SM, F, B, SB, S	U□\G□	T, ST, C, LC	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○	—	—	○	○	○	○*1	○*1	○	○	—	—	—
(s2)	○	—	—	○	○	○	○*1	○*1	○	○	—	—	—
(d1)	○*4	—	—	—	—	—	—	—	—	—	—	—	—
(d2)*2	○*5	—	—	○*3	—	—	—	—	—	—	—	—	—

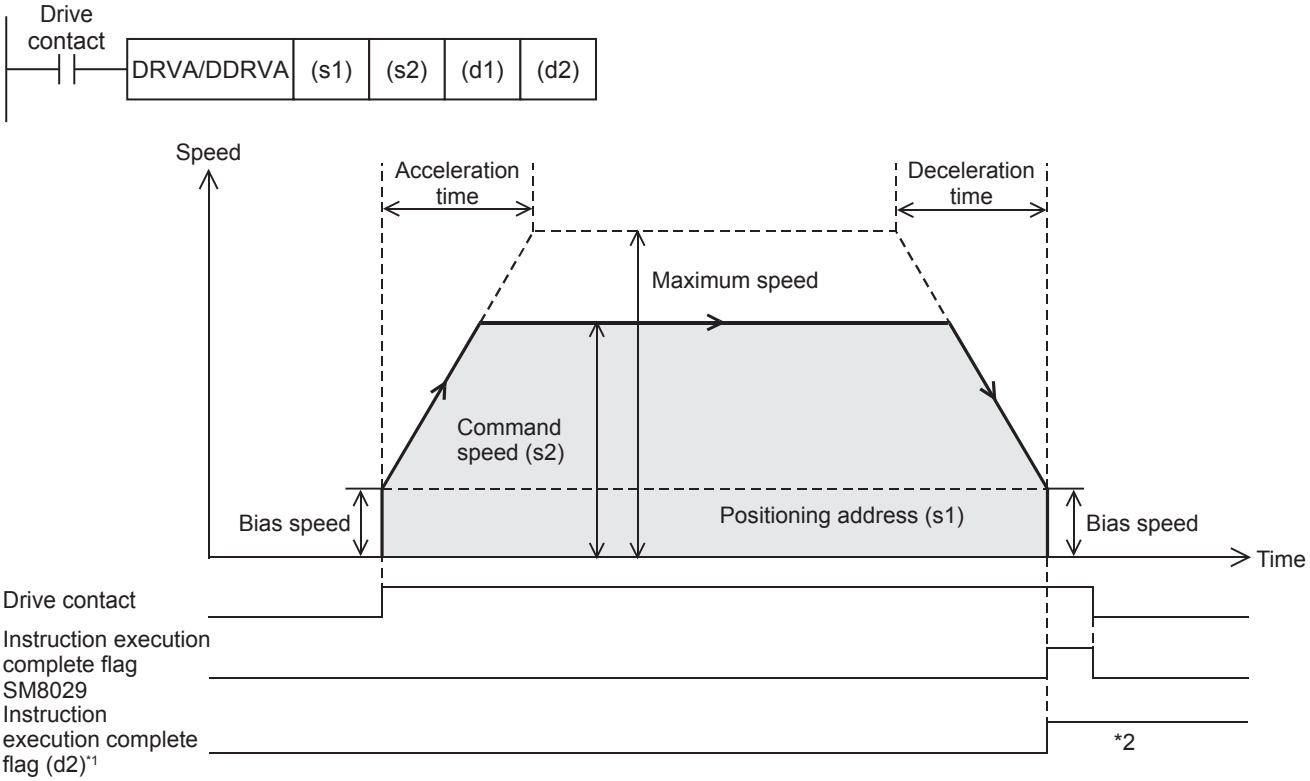
*1 Only available for DDRVA instruction.
*2 Two devices are occupied from the specified device.
*3 T, ST, C cannot be used.
*4 Only Y0 to Y3 devices can be used.
*5 When the output mode is CW/CCW, specify the CCW axis. When the output mode is PULSE/SIGN, only the SIGN output of the axis or general-purpose output can be specified.

Processing details

This instruction executes 1-speed positioning by absolute address drive. The target positioning address is specified in the absolute method, in which positioning is performed with the target position specified based on the origin (absolute address).

Outline of operation

For each speed, refer to ☞ Page 43 Items related to speed.



*1 When FX5 operand is specified

*2 Remains on until it is turned off by program or engineering tool or the positioning instruction is next driven again.

Basic operation

The following describes the basic operation.

1. After the drive contact is turned on, pulse output is started and the speed is increased from the bias speed.
2. After the speed has reached the specified speed, the operation will be performed in the specified speed.
3. Deceleration starts from near the target position.
4. At the specified positioning address, pulse output is stopped.

Operand specification

■When FX5 operand is specified

(1) For (s1), specify the absolute positioning address. (☞ Page 46 Positioning address)
Set to a value -2147483648 to +2147483647 in pulse. In addition, set the number of output pulses per positioning instruction execution to 2147483647 or lower.
- DRVA : -32768 to +32767 (User system unit)
- DDRVA : -2147483648 to +2147483647 (User system unit)

(2) For (s2), specify the command speed. Set to a value 1 pps to 200 Kpps in pulse.
- DRVA : 1 to 65535 (User system unit)
- DDRVA : 1 to 2147483647 (User system unit)

(3) For (d1), specify an axis number (K1 to K4) for which pulses are output.
Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

(4) For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 62 Complete flag)
- (d2) : Instruction execution complete flag
- (d2)+1 : Instruction execution abnormal end flag

■When the FX3 compatible operand is specified

(1) For (s1), specify the absolute positioning address.
Set to a value -2147483648 to +2147483647 in pulse. In addition, set the number of output pulses per positioning instruction execution to 2147483647 or lower.
- DRVA : -32768 to +32767 (User system unit)
- DDRVA : -2147483648 to +2147483647 (User system unit)

(2) For (s2), specify the command speed. Set to a value 1 pps to 200 Kpps in pulse.
- DRVA : 1 to 65535 (User system unit)
- DDRVA : 1 to 2147483647 (User system unit)

(3) For (d1), specify the pulse output number in the range of Y0 to Y3.
Specify an output device (Y) number (equivalent to the axes 1 to 4) set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

(4) For (d2), specify the rotation direction signal output device number. (☞ Page 40 Rotation Direction Setting)
When an output device (Y) is used, only the device that is specified with the positioning parameter or a general-purpose output can be specified. However, if an output device (Y) to which PWM or CW/CCW axis is assigned is specified, an error occurs without any operation.
For the PWM function, refer to 📖User's manual (Application).

Precautions

Set the number of output pulses per DRVA/DDRVA instruction execution to 2147483647 or lower. An error occurs if the number of pulses exceeds 2147483648.

Operation of the abnormal end flag

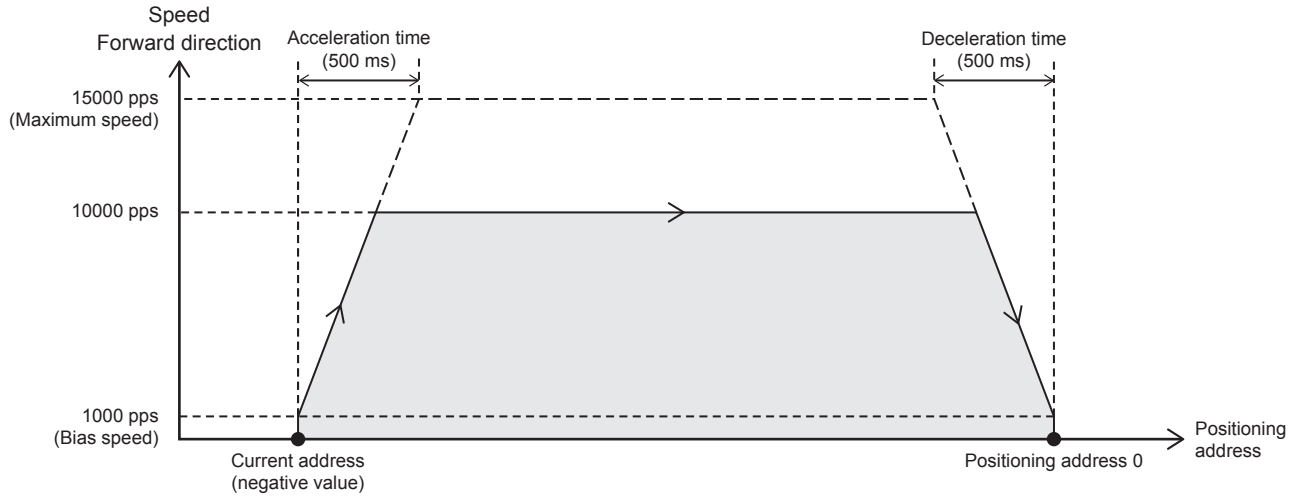
The following describes the operation timings of the complete flags.
The user-specified complete flags are valid only when specified using FX5 operand.

	FX3 compatible		User specification	
	Instruction execution complete flag (SM8029)	**Instruction execution abnormal end flag (SM8329)**	**Instruction execution complete flag (d2)**	**Instruction execution abnormal end flag (d2)+1**
ON condition	From when pulse output of the specified positioning address is completed to when the drive contact is turned off	From when the following operation or function is completed to when the drive contact is turned off • The axis is already used.*1 • Pulse output stop command • Pulse decelerate and stop command*2 • Limit of the moving direction • All outputs disabled (SM8034) • Write during RUN • Positioning address error • Deceleration stop after the command speed is changed to 0	From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met	From when the following operation or function is completed to when the ON → OFF condition is met • The axis is already used. • The drive contact is turned off during positioning operation • Pulse output stop command • Pulse decelerate and stop command*2 • Limit of the moving direction • All outputs disabled (SM8034) • Write during RUN • Positioning address error • Deceleration stop after the command speed is changed to 0
ON → OFF condition	When the drive contact is turned off		The flag remains on until either of the following is performed. • Turning off the flag by the user • Restarting the positioning instruction	

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.
*2 When remaining distance operation enabled is turned on, abnormal end flag will not turn on.

Program example

The following is a program example of absolute positioning (axis 1). If current address is a positive value, positioning operation would output in the reverse direction.

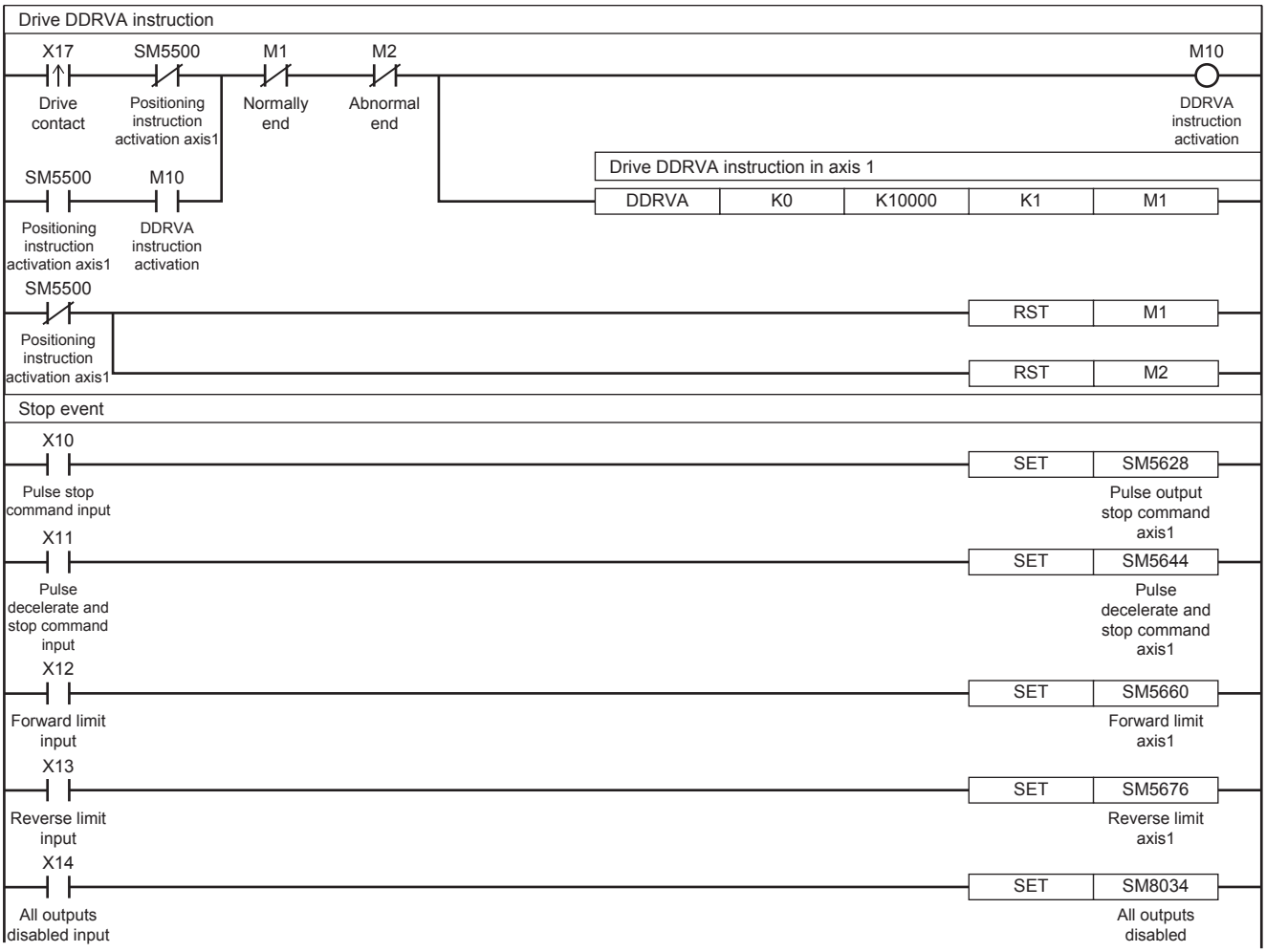


Setting data

■Positioning parameter (high speed I/O parameter)

Item	Axis 1		Item	Axis 1
■Basic Parameter 1			■Basic Parameter 2	
Pulse Output Mode	1: PULSE/SIGN		Interpolation Speed Specified Method	0: Composite Speed
Output Device (PULSE/CW)	Y0		Max. Speed	15000 pps
Output Device (SIGN/CCW)	Y4		Bias Speed	1000 pps
Rotation Direction Setting	0: Current Address Increment with Forward Run Pulse Output		Acceleration Time	500 ms
			Deceleration Time	500 ms
Unit Setting	0: Motor System (pulse, pps)		■Detailed Setting Parameter	
Pulse No. of per Rotation	2000 pulse		External Start Signal Enabled/Disabled	0: Invalid
Movement Amount per Rotation	1000 pulse		Interrupt Input Signal 1 Enabled/ Disabled	0: Invalid
Position Data Magnification	1: × Single			
—			Interrupt Input Signal 2 Logic	0: Positive Logic
			■OPR Parameter	
			OPR Enabled/Disabled	0: Invalid

Program example

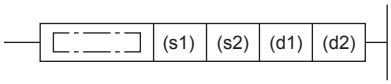
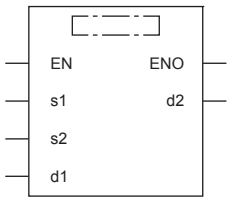


5.6 Interrupt 1-Speed Positioning

The positioning function uses the DVIT/DDVIT instruction to perform one-speed interrupt constant quantity feed.
With this instruction, interrupt signals can be controlled through user programs.

DVIT/DDVIT

This instruction executes one-speed interrupt constant quantity feed.

Ladder	ST	FBD/LD
	ENO:=DVIT(EN,s1,s2,d1,d2); ENO:=DDVIT(EN,s1,s2,d1,d2);	

Setting data

■Description, range, data type (DVIT)

• FX5 operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-32768 to +32767 (User system unit)	16-bit signed binary	ANY16
(s2)	Word device number storing command speed or data*2	1 to 65535 (User system unit)	16-bit unsigned binary	ANY16
(d1)	Axis number from which pulses are output	K1 to 4	16-bit unsigned binary	ANY_ELEMENTARY (WORD)
(d2)	Bit device number of the instruction execution complete flag and abnormal end flag	—	Bit	ANY_BOOL

• FX3 compatible operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-32768 to +32767 (User system unit)	16-bit signed binary	ANY16
(s2)	Word device number storing command speed or data*2	1 to 65535 (User system unit)	16-bit unsigned binary	ANY16
(d1)	Output bit device number (Y) from which pulses are output	0 to 3	Bit	ANY_ELEMENTARY (BOOL)
(d2)	Bit device number from which rotation direction is output	—	Bit	ANY_BOOL

*1 The positioning address can be changed during positioning operation. (☞ Page 31 Positioning address change during positioning operation)
*2 Command speed can be changed during positioning operation. (☞ Page 32 Command speed change during positioning operation)

■Description, range, data type (DDVIT)

• FX5 operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-2147483648 to +2147483647 (User system unit)	32-bit signed binary	ANY32
(s2)	Word device number storing command speed or data*2	1 to 2147483647 (User system unit)	32-bit signed binary	ANY32
(d1)	Axis number from which pulses are output	K1 to 4	16-bit unsigned binary	ANY_ELEMENTARY (WORD)
(d2)	Bit device number of the instruction execution complete flag and abnormal end flag	—	Bit	ANY_BOOL

• FX3 compatible operand

Operand	Description	Range	Data type	Data type (label)
(s1)	Word device number storing the positioning address or data*1	-2147483648 to +2147483647 (User system unit)	32-bit signed binary	ANY32
(s2)	Word device number storing command speed or data*2	1 to 2147483647 (User system unit)	32-bit signed binary	ANY32
(d1)	Output bit device number (Y) from which pulses are output	0 to 3	Bit	ANY_ELEMENTARY (BOOL)
(d2)	Bit device number from which rotation direction is output	—	Bit	ANY_BOOL

*1 The positioning address can be changed during positioning operation.
*2 Command speed can be changed during positioning operation.

■Available device (DVIT/DDVIT)

• FX5 operand

Operand	Bit			Word			Double word		Indirect specification	Constant			Others (DX)
	X, Y, M, L, SM, F, B, SB, S	U□\G□	T, ST, C, LC	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○	—	—	○	○	○	—	—	○	○	—	—	—
(s2)	○	—	—	○	○	○	—	—	○	○	—	—	—
(d1)	—	—	—	○	○	○	—	—	○	○	—	—	—
(d2)*1	○	—	—	○*2	—	—	—	—	—	—	—	—	—

• FX3 compatible operand

Operand	Bit			Word			Double word		Indirect specification	Constant			Others (DX)
	X, Y, M, L, SM, F, B, SB, S	U□\G□	T, ST, C, LC	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s1)	○	—	—	○	○	○	—	—	○	○	—	—	—
(s2)	○	—	—	○	○	○	—	—	○	○	—	—	—
(d1)	○*3	—	—	—	—	—	—	—	—	—	—	—	—
(d2)	○*4	—	—	○*2	—	—	—	—	—	—	—	—	—

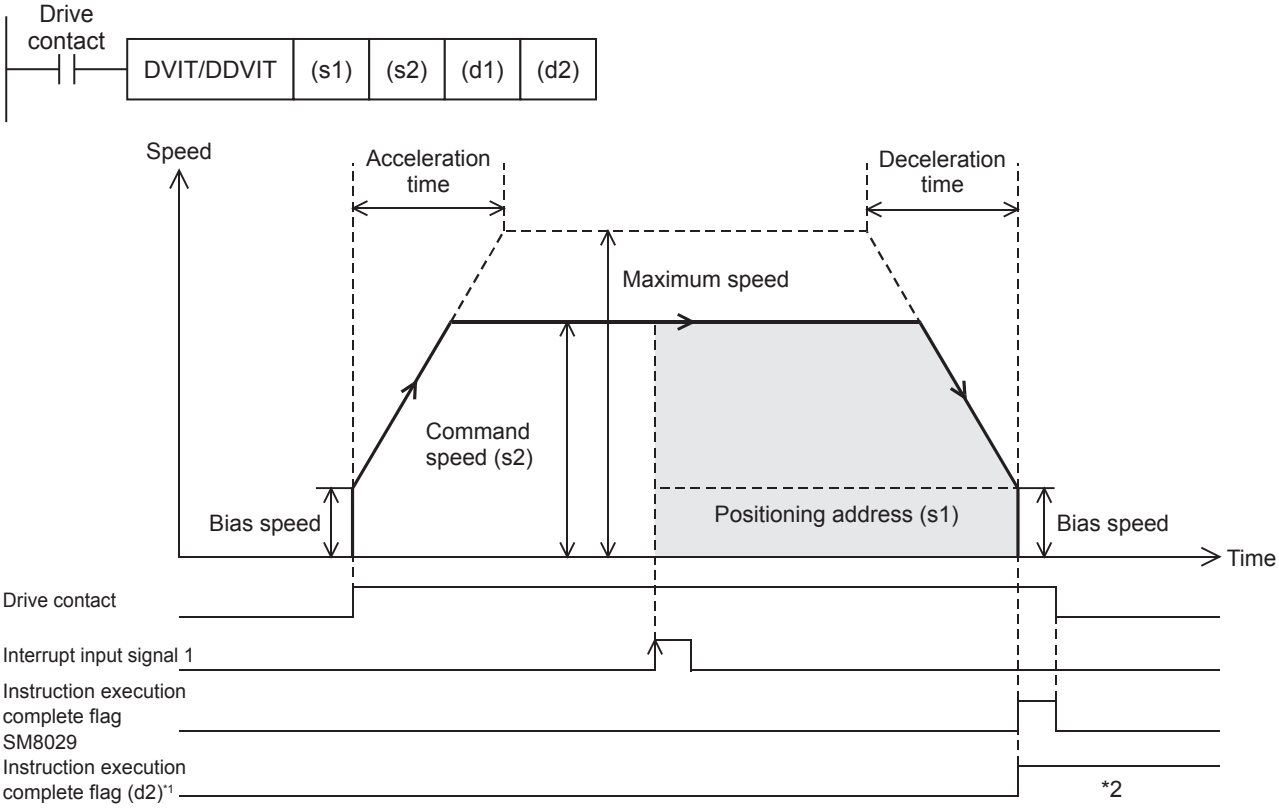
*1 Two devices are occupied from the specified device.
*2 T, ST, C cannot be used.
*3 Only Y0 to Y3 devices can be used.
*4 When the output mode is CW/CCW, specify the CCW axis. When the output mode is PULSE/SIGN, only the SIGN output of the axis or general-purpose output can be specified.

Processing details

This instruction executes one-speed interrupt constant quantity feed. From the point at which an interrupt input is detected, operation to the specified positioning address is performed at the specified speed.

Outline of operation

For each speed, refer to ☞ Page 43 Items related to speed.



*1 When FX5 operand is specified

*2 Remains on until it is turned off by program or engineering tool or the positioning instruction is next driven again.

Basic operation

The following describes the basic operation.

1. After the drive contact is turned on, pulse output is started and the speed is increased from the bias speed.
2. After the speed has reached the specified speed, the operation will be performed in the specified speed.
3. From the point at which the interrupt input signal 1 is detected, operation for the specified positioning address is performed. (☞ Page 48 Interrupt Input Signal 1)
4. Deceleration starts from near the target position.
5. At the specified positioning address, pulse output is stopped.

Operand specification

■When FX5 operand is specified

(1) For (s1), specify the positioning address after the interrupt input signal 1 is detected. (☞ Page 46 Positioning address) Set to a value -2147483647 to +2147483647 in pulse.

- DVIT : -32768 to +32767 (User system unit)
- DDVIT : -2147483648 to +2147483647 (User system unit)

(2) For (s2), specify the command speed. Set to a value 1 pps to 200 Kpps in pulse.

- DVIT : 1 to 65535 (User system unit)
- DDVIT : 1 to 2147483647 (User system unit)

(3) For (d1), specify an axis number (K1 to K4) for which pulses are output.
Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

(4) For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 62 Complete flag)
- (d2) : Instruction execution complete flag
- (d2)+1 : Instruction execution abnormal end flag

■When the FX3 compatible operand is specified

(1) For (s1), specify the positioning address after the interrupt input signal 1 is detected. Set to a value -2147483647 to +2147483647 in pulse.
- DRVA : -32768 to +32767 (User system unit)
- DDRVA : -2147483648 to +2147483647 (User system unit)

(2) For (s2), specify the command speed. Set to a value 1 pps to 200 Kpps in pulse.
- DRVA : 1 to 65535 (User system unit)
- DDRVA : 1 to 2147483647 (User system unit)

(3) For (d1), specify the pulse output number in the range of Y0 to Y3.
Specify an output device (Y) number (equivalent to the axes 1 to 4) set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

(4) For (d2), specify the rotation direction signal output device number. (☞ Page 40 Rotation Direction Setting)
When an output device (Y) is used, only the device that is specified with the positioning parameter or a general-purpose output can be specified. However, if an output device (Y) to which PWM or CW/CCW axis is assigned is specified, an error occurs without any operation.
For the PWM function, refer to 📖User's manual (Application).

Interrupt input signal 1

After the interrupt input signal 1 is detected, pulses equivalent to the specified positioning address specified in (s1) are output starting from the detection point. Deceleration stop starts from point that deceleration must be performed.

Precautions

- When the interrupt input signal 1 is disabled, the DVIT/DDVIT signal cannot be used.
- If the interrupt input signal 1 is not detected, pulse output at the command speed of (s2) continues until the signal is detected.
- If the total of the pulses that have already been output and pulses to be output after an interrupt exceeds 2147483648 when the interrupt input signal 1 is detected, an error occurs. From the point at which the interrupt input signal 1 is detected, deceleration stop is performed.

Operation of the complete flags

The following describes the operation timings of the complete flags.
The user-specified complete flags are valid only when specified using FX5 operand.

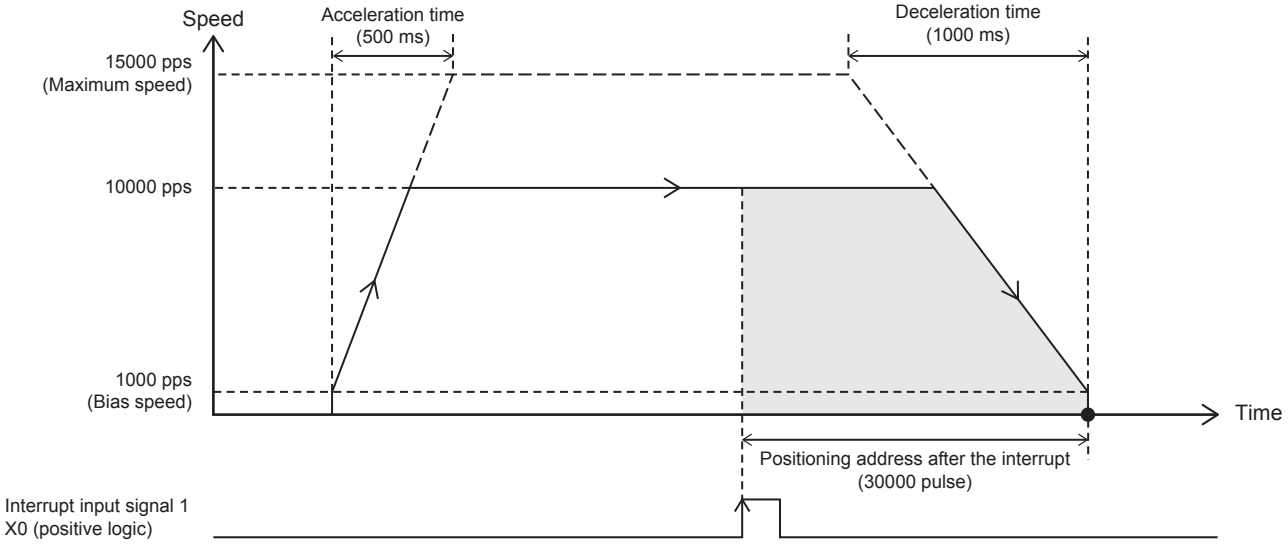
	FX3 compatible		User specification	
	Instruction execution complete flag (SM8029)	**Instruction execution abnormal end flag (SM8329)**	**Instruction execution complete flag (d2)**	**Instruction execution abnormal end flag (d2)+1**
ON condition	From when pulse output of the specified positioning address is completed to when the drive contact is turned off	From when the following operation or function is completed to when the drive contact is turned off • The axis is already used.*1 • Pulse output stop command • Pulse decelerate and stop command • Limit of the moving direction • All outputs disabled (SM8034) • Write during RUN • Positioning address error • Deceleration stop after the command speed is changed to 0	From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met	From when the following operation or function is completed to when the ON → OFF condition is met • The axis is already used. • The drive contact is turned off during positioning operation • Pulse output stop command • Pulse decelerate and stop command • Limit of the moving direction • All outputs disabled (SM8034) • Write during RUN • Positioning address error • Deceleration stop after the command speed is changed to 0

	FX3 compatible		User specification	
	Instruction execution complete flag (SM8029)	**Instruction execution abnormal end flag (SM8329)**	**Instruction execution complete flag (d2)**	**Instruction execution abnormal end flag (d2)+1**
ON → OFF condition	When the drive contact is turned off		The flag remains on until either of the following is performed. • Turning off the flag by the user • Restarting the positioning instruction	

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

Program example

The following is a program example of interrupt 1-speed positioning (axis 1).

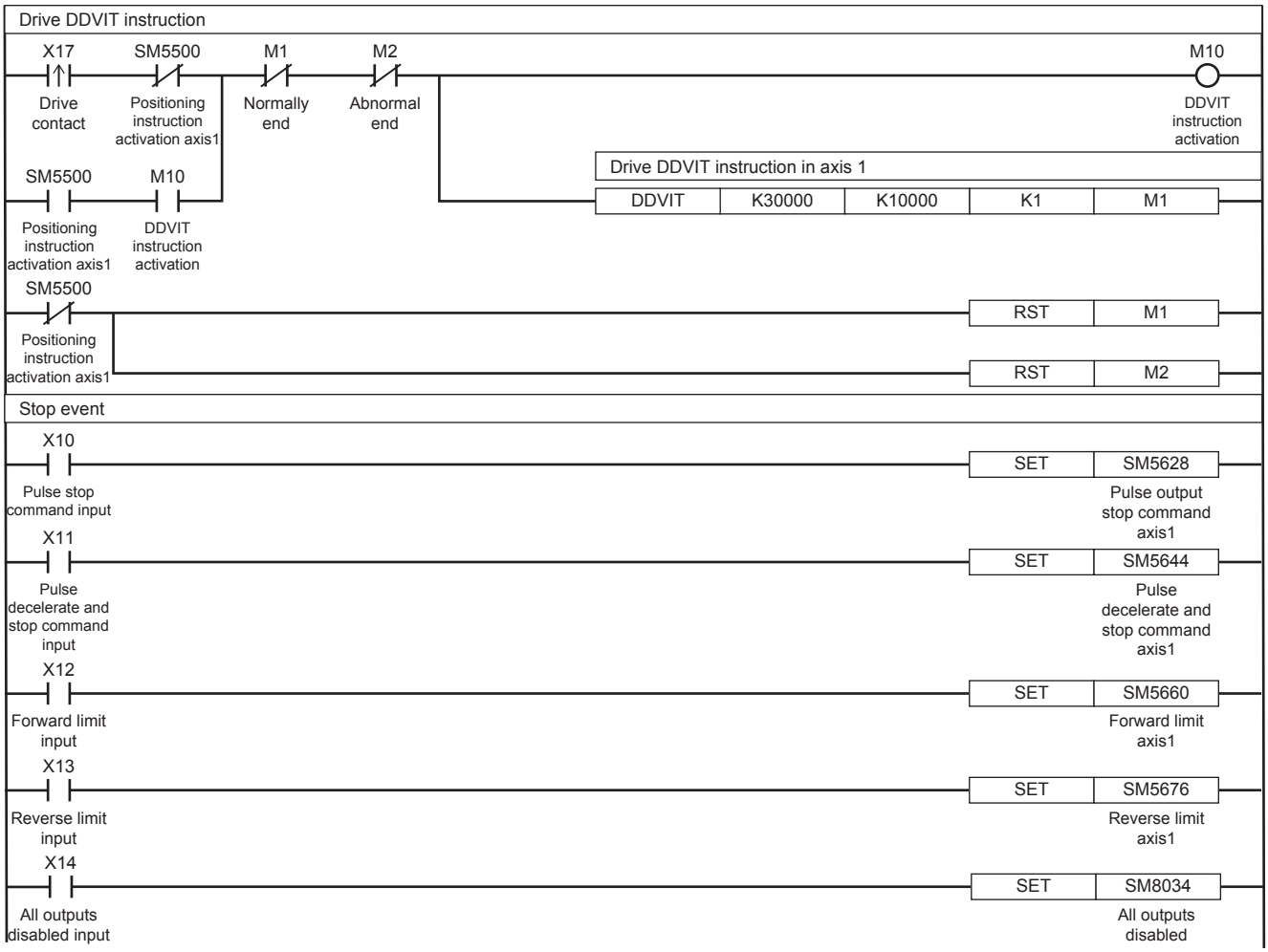


Setting data

■Positioning parameter (high speed I/O parameter)

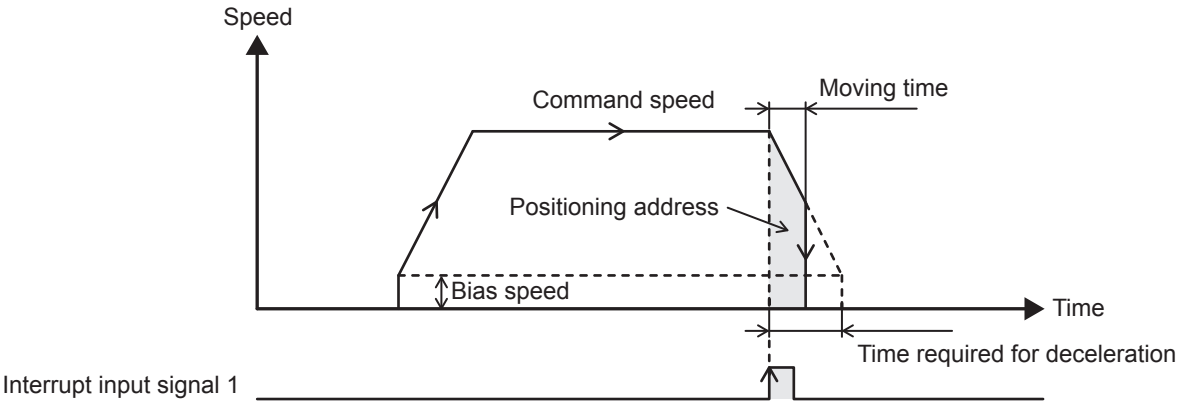
Item	Axis 1	Item	Axis 1
■Basic Parameter 1		■Basic Parameter 2	
Pulse Output Mode	1: PULSE/SIGN	Interpolation Speed Specified Method	0: Composite Speed
Output Device (PULSE/CW)	Y0	Max. Speed	15000 pps
Output Device (SIGN/CCW)	Y4	Bias Speed	1000 pps
Rotation Direction Setting	0: Current Address Increment with Forward Run Pulse Output	Acceleration Time	500 ms
		Deceleration Time	1000 ms
Unit Setting	0: Motor System (pulse, pps)	■Detailed Setting Parameter	
Pulse No. of per Rotation	2000 pulse	External Start Signal Enabled/Disabled	0: Invalid
Movement Amount per Rotation	1000 pulse	Interrupt Input Signal 1 Enabled/ Disabled	1: Valid
Position Data Magnification	1: × Single		
—		Interrupt Input Signal 1 Device No.	X0
		Interrupt Input Signal 1 Logic	0: Positive Logic
		Interrupt Input Signal 2 Logic	0: Positive Logic
		■OPR Parameter	
		OPR Enabled/Disabled	0: Invalid

Program example

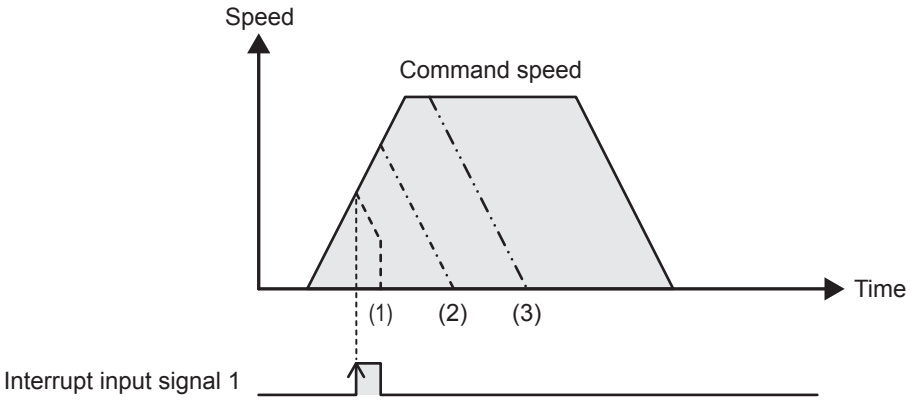


Caution

- When 0 is set for the positioning address (s1) at start of the instruction, the operation ends with an error.
- If the positioning address (s1) is changed to 0 before the interrupt input signal 1 is detected, the positioning operation continues and ends normally after the input interrupt occurs and two pulses are output.
- If the positioning address (s1) is changed to 0 after the interrupt input signal 1 is detected, the operation decelerates to a stop, the output direction is reversed, and the operation continues before ending normally at the positioning address where the input interrupt occurred.
- When transfer time to the positioning address is shorter than the time required for deceleration stop (the value set in (s1) is small), the operation immediately stops at the positioning address. Note that the immediate stop may damage the machine because the motor stops immediately.



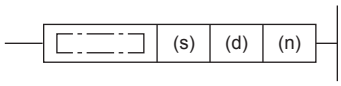
- When the interrupt input signal 1 is detected during acceleration, the operation differs depending on the positioning address value (s1) as shown below.
  (1) When the positioning address < the number of pulses required for deceleration from the current speed
  After the interrupt input signal 1 is turned on, deceleration immediately starts, and then the operation immediately stops when the positioning address is reached. Note that the immediate stop may damage the machine because the motor stops immediately.
  (2) When the number of pulses required for deceleration from the current speed ≤ positioning address < the number of pulses required for acceleration/deceleration from the current speed
  The speed is increased until the position at which the remaining number of pulses becomes the same as that required for deceleration. Then, deceleration stop is performed.
  (3) When the number of pulses required for acceleration/deceleration from the current speed ≤ positioning address
  The speed is increased to the command speed (s2). Then, deceleration stop is performed.



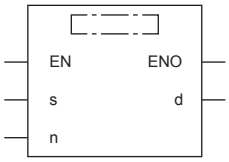
High-speed current value transfer of 32-bit data

DHCMOV(P)

These instructions read and write (updates) special register for high-speed counter, pulse width measurement, PWM, and positioning.

Ladder diagram	Structured text
	ENO:=DHCMOV(EN,s,n,d); ENO:=DHCMOVP(EN,s,n,d);

FBD/LD



Setting data

■Descriptions, ranges, and data types

Operand	Description	Range	Data type	Data type (label)
(s)	Transfer source device number	—	Bit/32-bit signed binary	ANY_ELEMENTARY
(d)	Transfer source device number	—	Bit/32-bit signed binary	ANY_ELEMENTARY
(n)	Specification to clear the device value of the transfer source after the transfer	K0, K1	16-bit unsigned binary	ANY16_U

■Applicable devices

Operand	Bit	Word			Double word		Indirect specification	Constant			Others
	X, Y, M, L, SM, F, B, SB, S	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s)	○	○	○	○	○	○	○	○	—	—	—
(d)	○	○	○	○	○	○	○	—	—	—	—
(n)	○	○	○	○	—	—	○	○	—	—	—

Processing details

These instructions transfer the data in the device specified by (s) to the device specified by (d). At this time, if the value of (n) is K0, the value of (s) is not cleared. If the value of (n) is K1, the value of (s) is cleared to "0" after the transfer. The value is cleared only for SD devices for the current value of high-speed counters or LC devices used as a high-speed counter when using the FX3 compatible high-speed counter.

Point

When (s) is a device supporting high-speed transfer

- When the DHCMOV instruction is executed, the latest value is acquired such as the current value of a high-speed counter and transferred to (d).

When (d) is a device supporting high-speed transfer

- When the DHCMOV instruction is executed, value such as the current value of a high-speed counter is changed.

■Effect of DHCMOV instruction

- By using both input interrupt and DHCMOV instruction, the current value of a high-speed counter can be received at the rising edge or falling edge of an external input.
- When DHCMOV instruction is used just before a comparison instruction (DCMP, DZCP or comparison contact instruction), the latest value of the high-speed counter is used in comparison.

Precautions

- When it is necessary to execute comparison and outputting as soon as the current value of a high-speed counter changes, use the high-speed comparison table, multi-output high-speed comparison table, or one of the DHSCS, DHSCR, and DHSZ instructions.
- Do not overwrite the current value of a high-speed counter using the DHCMOV instruction while executing the pulse density (rotation speed measurement) or the DSPD instruction.
- Transfer is not possible between an SM supporting high-speed transfer and an SD supporting high-speed transfer.
- When the device supporting high-speed transfer is set as the transfer source (s) by the DHCMOV instruction while the high-speed I/O function is stopped, the previous value before stop is read out. However, if the function is not executed even once, the initial value is read out.

Ex.

When SD5303, SD5302 (PWM pulse width) is set as the transfer source (s), the operation is executed as follows.

When the PWM function is not executed	"0" is read out. (This is not the value of the parameter that is set by GX Works3.)
When the PWM function was executed but it is currently stopped	The value when the PWM function was stopped is read out.
When the PWM function is executed	The latest value that is currently operating is read out.

- When a high-speed counter SD device (current value, maximum value, minimum value) is read out individually, only the read SD device will be updated. Thus, there may be cases when the high-speed counter's SD device does not satisfy the relation of minimum value ≤ current value ≤ maximum value temporarily. Refer to the MELSEC iQ-F FX5 User's Manual (Application) for details on the timing that the high-speed counter's SD device is updated.

Point

The DHCMOV instruction is mainly used to read the current value of the high-speed counter/pulse width measurement and change the current address (in the user units) or the current address (in the pulse unit) of positioning.

Operation error

Error code (SD0/SD8067)	Description
2801H	The channel number of a module that does not exist is specified.
2821H	Operands that execute transmission between an SM supporting high-speed transfer and an SD supporting high-speed transfer is designated.
3056H	Timeout occurred while communicating with the target modules during execution of the instruction.
3060H	Signal error was detected while accessing the target modules during execution of the instruction.
3405H	A value outside the data range is set in (n).
3580H	An instruction that cannot be used in an interrupt program is used.