Panasonic®

PROGRAMMABLE CONTROLLER

FP2 Positioning Unit

Manual

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2013.7 | panasonic.net/id/pidsx/global

Safety Precautions

Observe the following notices to ensure personal safety or to prevent accidents.
To ensure that you use this product correctly, read this User's Manual thoroughly before use.
Make sure that you fully understand the product and information on safety.
This manual uses two safety flags to indicate different levels of danger.

WARNING

If critical situations that could lead to user's death or serious injury is assumed by mishandling of the product.

-Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
-Do not use this product in areas with inflammable gas. It could lead to an explosion.
-Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.

CAUTION

If critical situations that could lead to user's injury or only property damage is assumed by mishandling of the product.

-To prevent excessive exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assured in these specifications.
-Do not dismantle or remodel the product. It could cause excessive exothermic heat or smoke generation.
-Do not touch the terminal while turning on electricity. It could lead to an electric shock.
-Use the external devices to function the emergency stop and interlock circuit.
-Connect the wires or connectors securely.
The loose connection could cause excessive exothermic heat or smoke generation.
-Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It could cause excessive exothermic heat or smoke generation.
-Do not undertake construction (such as connection and disconnection) while the power supply is on. It could lead to an electric shock.

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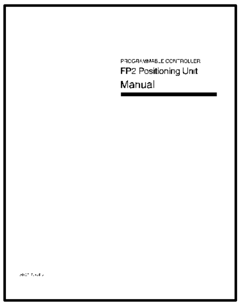
Precaution before using FP2 Positioning unit

There are two types of FP2 Positioning Units: Conventional type and Multifunction type. Their manuals look very similar. Be sure to use the Unit according to the appropriate manual.

This manual

FP2 Positioning unit

Object product number
:AFP2430
:AFF2431



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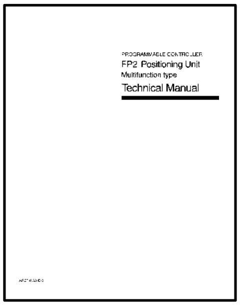
Similarity manual

FP2 Positioning unit
Multifunction type

Object product number
:AFP2432
:AFP2434
:AFP2433
:AFP2435



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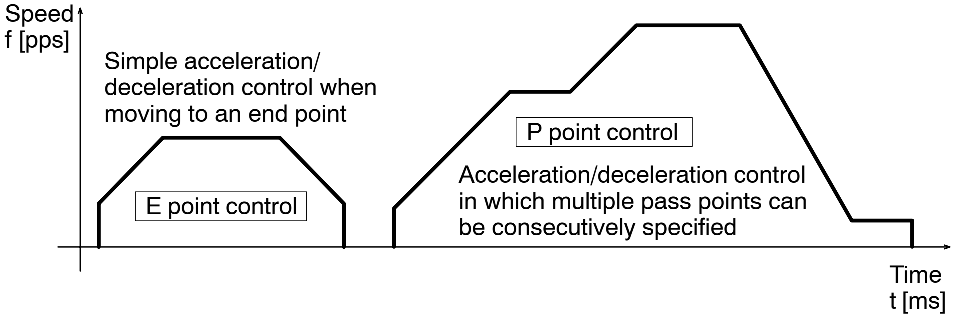
Glossary

E point control

This is a method of control which is initiated up to an end point, and in this manual is referred to as "E point control". This method is used when single-speed acceleration/deceleration is used.

P point control

This refers to control which passes through a "Pass Point", and is called "P point control" in this manual. This method is used when a multi-stage target speed is to be specified.



Startup time

This is the time from when the startup output signal is output from the CPU of the FP2, until pulse output is issued from the positioning unit.

Acceleration/deceleration time

This is the acceleration time during which the speed changes from the startup speed to the target speed after the motor has started up, or the time that it takes for the speed to slow from the target speed to the startup speed.

CW, CCW

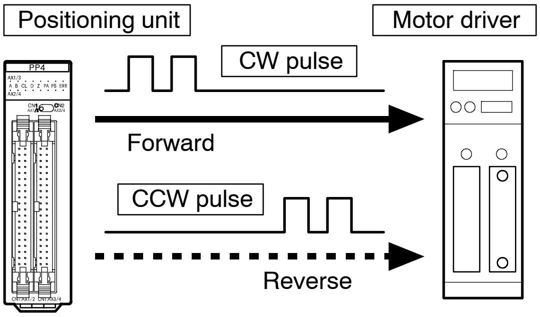
Generally, these indicate the direction in which the motor is rotating, with CW referring to clockwise rotation and CCW to counterclockwise rotation.

CW/CCW output method (2 pulses output method)

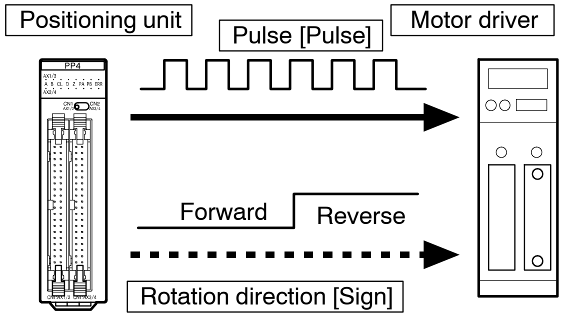
This is a method in which control is carried out using two pulses, a forward rotation pulse and a reverse rotation pulse. With the FP2 positioning unit, this is specified using the dip switches on the rear panel, and is set to match the driver specifications.

Pulse/Sign output method (1 pulse output method)

This is a method in which control is carried out using one pulse to specify the speed, and on/off signals to specify the direction of rotation. With the FP2 positioning unit, this is specified using the dip switches on the rear panel, and is set to match the driver specifications.



CW/CCW output method



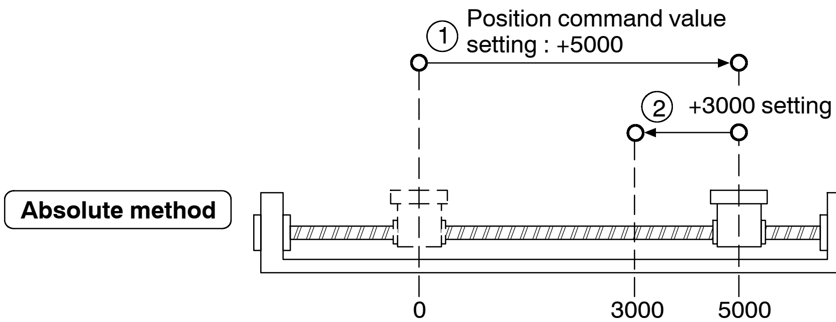
Pulse/Sign output method

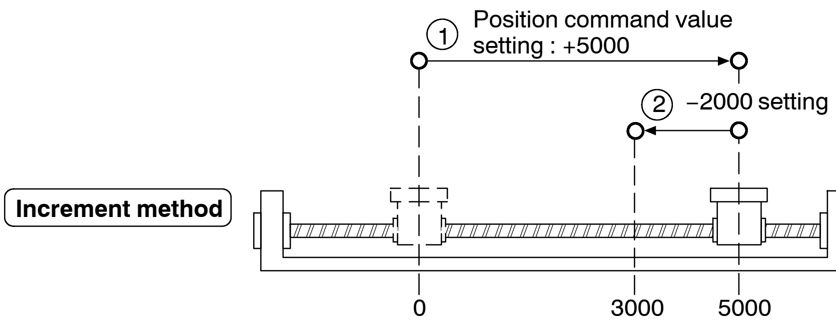
Absolute method (absolute value control method)

This is a control method in which the target position is specified as an absolute position from the home position. With the FP2 positioning unit, this is specified in the user program, using the control codes and the position command values.

Increment method (relative value control method)

This is a control method in which the distance from the current position to the target position is specified as a relative position. With the FP2 positioning unit, this is specified in the user program, using the control codes and the position command values.



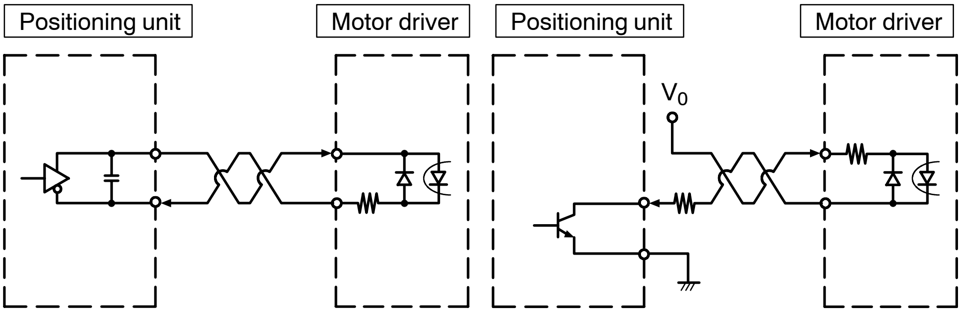


Line driver output

This is one output format used in pulse output signal circuits, in which the push–pull output of the line driver is used. Because this format offers better resistance to noise than the open collector output format, a larger distance to the driver is possible. The line driver must be supported on the motor driver side. Most servo motor drivers are equipped with this format.

Open collector output

This is one output format used in pulse output signal circuits, in which connections can be made in accordance with the voltage of the power supply being used, by connecting an external resistance. This is used when connecting a driver that does not have line driver input, such as a stepping motor.



Line driver method Open collector method

Jog operation

This refers to operation in which the motor is rotated only while operation commands are being input. This is used to forcibly rotate the motor using input from an external switch, for instance when adjustments are being made. Depending on the circumstances, this can also be applied to unlimited feeding in some cases.

Deceleration stop

This is a function which interrupts the operation in progress, slows the rotation and brings it to a stop. This is used to stop whatever operation is being carried out.

Forced stop

This is a function which interrupts the operation in progress, and stops it immediately. It is used to initiate an emergency stop using an external switch, and to initiate a temporary stop through an overrun.

Twisted pair cable

This refers to a cable constructed of two wires, which suppresses the effects of noise. Because current of the same size is flowing in the reverse direction, noise is blanked out, which reduces the effects of the noise.

Home return

In terms of positioning, the position that serves as a reference is called the home position, and a movement back to that position is called a home return, or return to home position. The table travels to a reference position (home position) specified ahead of time, and the coordinates of that position are set as the zero of the absolute position.

Home input

This refers to input of the reference position used for positioning, and is connected to the Z phase signal of the servo motor driver, or to an external input switch and sensor.

Near home input

In order to stop the table at the home position, a position called the near home position is specified, at which deceleration begins. This is connected to an external input switch and sensor.

Input logic

Depending on the type of sensor and switch connected to the home input and near home input, it is necessary to confirm whether the input signal will be valid when current is flowing, or whether input will be valid when no current is flowing. This is called the "input logic". With the FP2 positioning unit, this setting is entered using a control code in the program.

Deviation counter

This is located inside the servo motor driver, and counts the difference between command pulses and the feedback from the encoder. Command pulses are counted as plus values and feedback pulses are counted as negative values, with control being initiated so that the difference between them is zero.

Deviation counter clear signal

This is installed in the FP2 positioning unit, and goes on when a home position return is completed, to notify the driver that the table has arrived at the home position.

Pulser operation

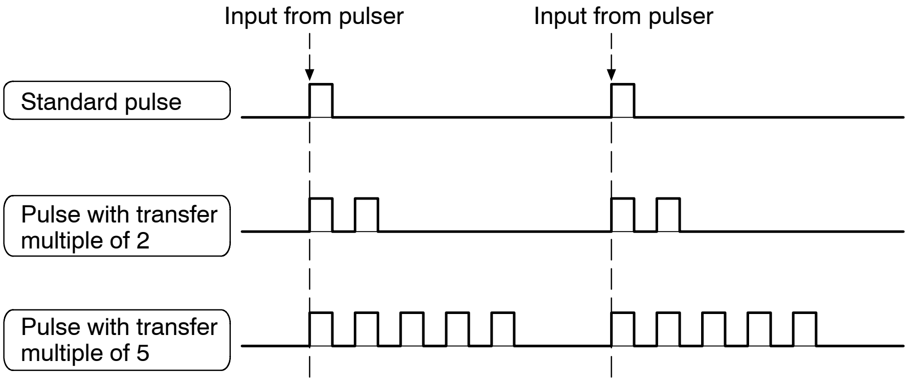
This is a device which generates pulses manually, and is used for adjustment when manual operation is used. The same type of output as that from the encoder is obtained, and the FP2 positioning unit is equipped with a dedicated input terminal.

Transfer multiple

With the FP2 positioning unit, this can be specified when the pulser input operation function is used. When the number of pulses output is double the number of pulser input signals, the transfer multiple is said to be "2", and when the number of pulses is five times that of the pulser input signals, the transfer multiple is said to be "5".

Example:

FP positioning unit and the pulser input transfer multiple function



Chapter 1

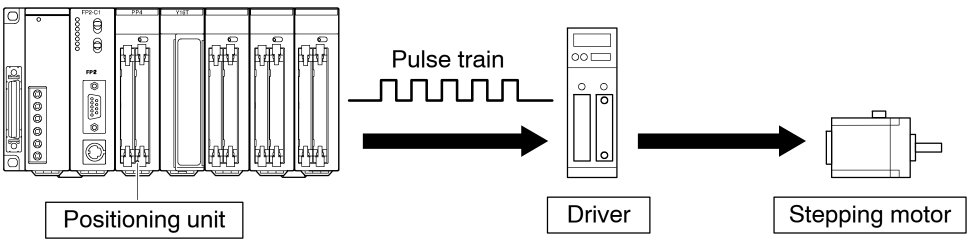
Functions of Unit and Restrictions on Combination

1.1 Functions of FP2 Positioning Unit

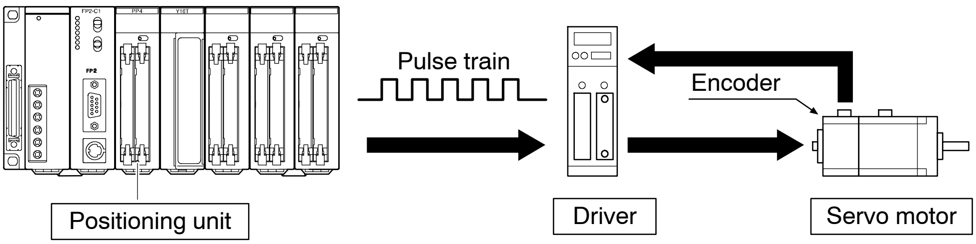
1.1.1 Functions of Unit

Positioning can be controlled through the combination of a stepping motor with a driver using the pulse train input method, and a servo motor.

Positioning control using a stepping motor



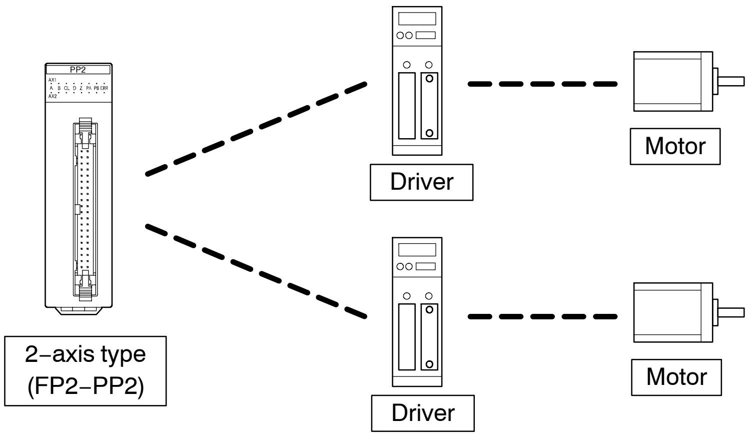
Positioning control using a servo motor



2–axis and 4–axis types are available.

Multiple axes can be controlled with a single unit.

2–axis type



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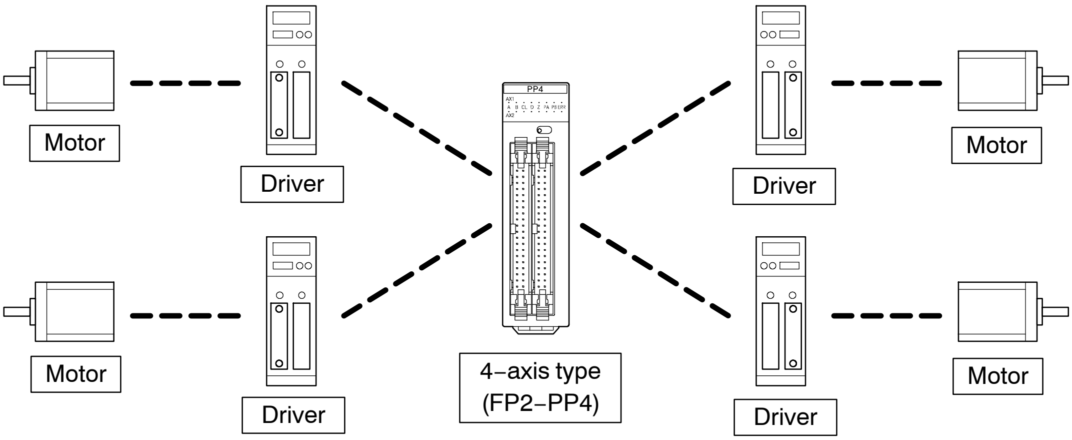
1.1 Functions of FP2 Positioning Unit

4–axis type

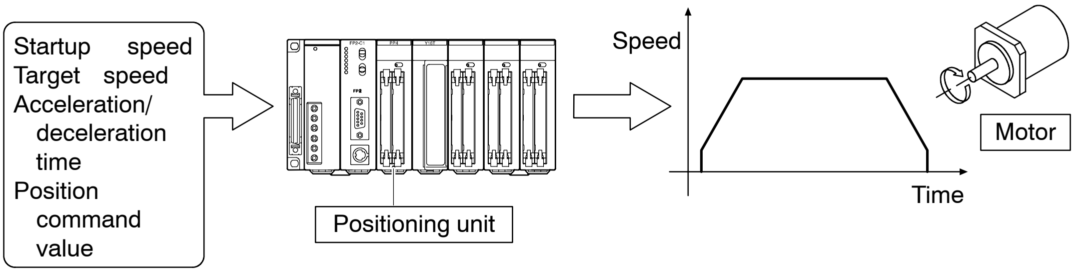


The user may select line driver output or open collector output.

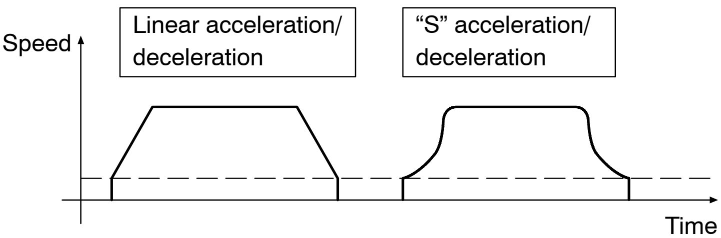
Line driver output which supports high–speed control is provided.

Drivers available only with stepping motors and open collectors are also supported. If both types can be used, we recommend using the line driver for connection.

Automatic acceleration and deceleration can be controlled simply by providing the startup speed, target speed, acceleration/deceleration time, and position command values, as data.



The linear acceleration/deceleration and "S" acceleration/deceleration can be selected simply by setting parameters, enabling support of the necessary control for smooth acceleration and deceleration.



Linear interpolation possible through user programs

The FP2 positioning unit can handle simultaneous startup of multiple axes, enabling simultaneous control of linear interpolation and other elements through user programs.

1.1.2 Unit Types

Unit type and order number

Type	Function	Order number
2–axis type	For 2–axis control	FP2–PP2
4–axis type	For 4–axis control	FP2–PP4

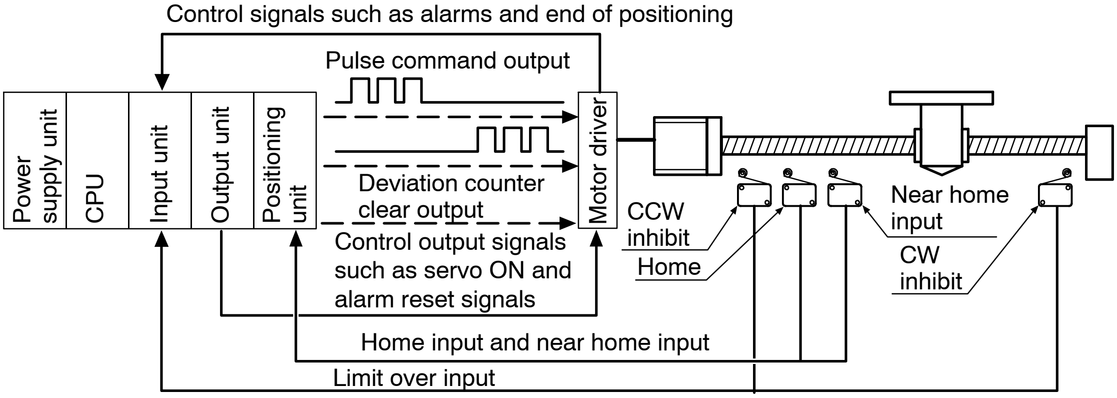
☞ **Note**

Wire–pressed connectors are provided as accessories with the various units (one for 2–axis type, and two for 4–axis type).

For detailed information about connectors provided ☛ Section 3.1

1.2 Unit Functioning and Operation Overview

1.2.1 Unit Combinations for Positioning Control



Interfaces provided with the positioning unit

In addition to pulse command output for the motor driver, the positioning unit is equipped with home input and near home input terminals, and with deviation counter clear output for the servo driver.

Safety circuit for PLC and control signal interfaces use input unit and output unit.

In addition to the positioning unit, an input unit and output unit are used in combination for input from the limit over input circuit, servo ON signals and other connections between the driver and external output.

Number of output pulses counted by internal high−speed counter.

The number of pulses output is counted as an absolute value by an internal high−speed counter, which counts them as the “elapsed value”.

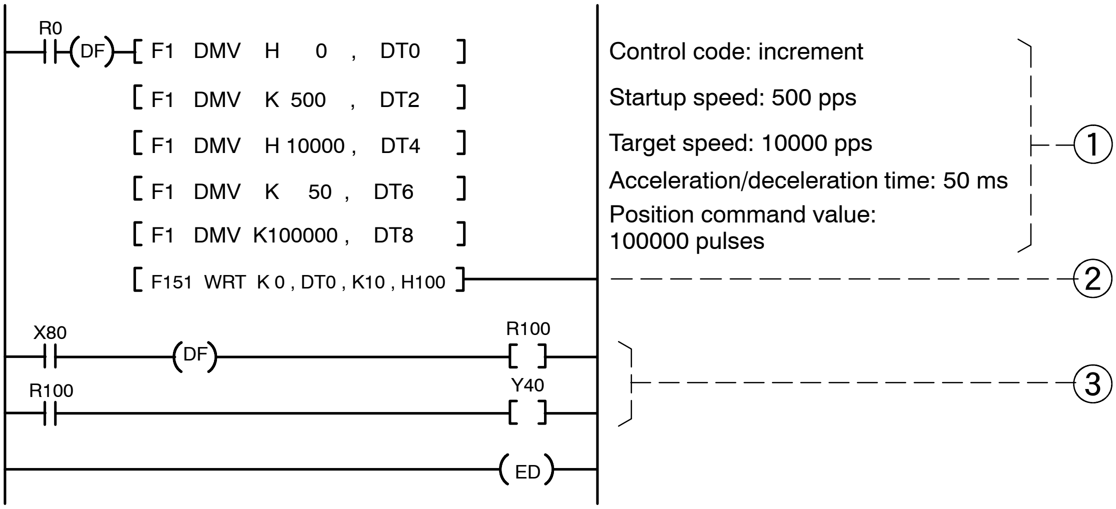
Counting range: −2,147,483,648 to +2,147,483,647 (signed 32−bit)

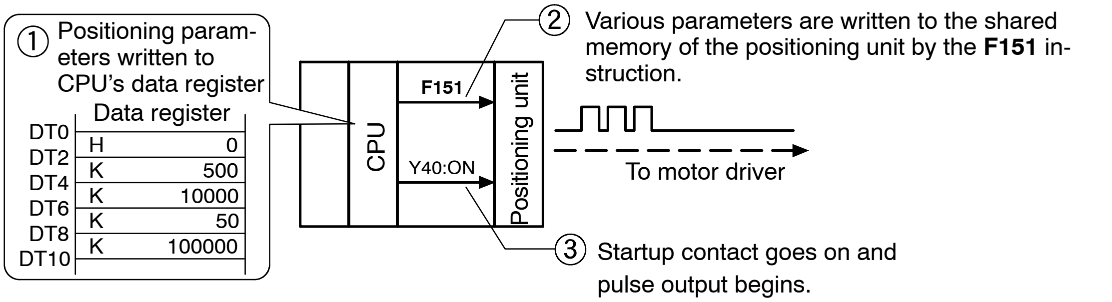
☞ **Note**

If the elapsed value exceeds the maximum (minimum) value, the value returns automatically to the minimum (maximum) value and continues from that point. The motor does not stop if this occurs, and no error occurs.

1.2.2 Basic Operation of FP2 Positioning Unit

Control proceeds by turning the shared memory and input/output contact on and off.





① **Determining the necessary data**

The types of data written to the positioning unit include control codes, the startup speed, the target speed, the acceleration/deceleration time, and the position command value. The types and number of required data varies depending on the objective. Programming is set up so that these data values may be written to any desired data register.

② **Transfer to the shared memory**

The data stored in the data registers is sent to the positioning unit by means of the **F151** or **P151** instruction, where it waits for further instructions. The memory area which receives that transferred data is called the "shared memory" of the positioning unit. This area is used for various types of control, including E point control, P point control, jog operation, home return, and pulser input operation, and a separate shared memory area is provided for each of the axes.

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③ Initiating control operations

In order to execute the data waiting in the positioning unit, the startup contacts of the various operation modes are turned on. The abovementioned programming example shows this process for Y40. Y40 is the number of the contact that starts up the first axis when the unit is installed in slot 0. Separate contacts are provided for each of the axes, for E point control, P point control, home return, jog operation, and other types of control.

1.3 Restrictions on Units Combination

1.3.1 Restrictions on Combinations Based on Current Consumption

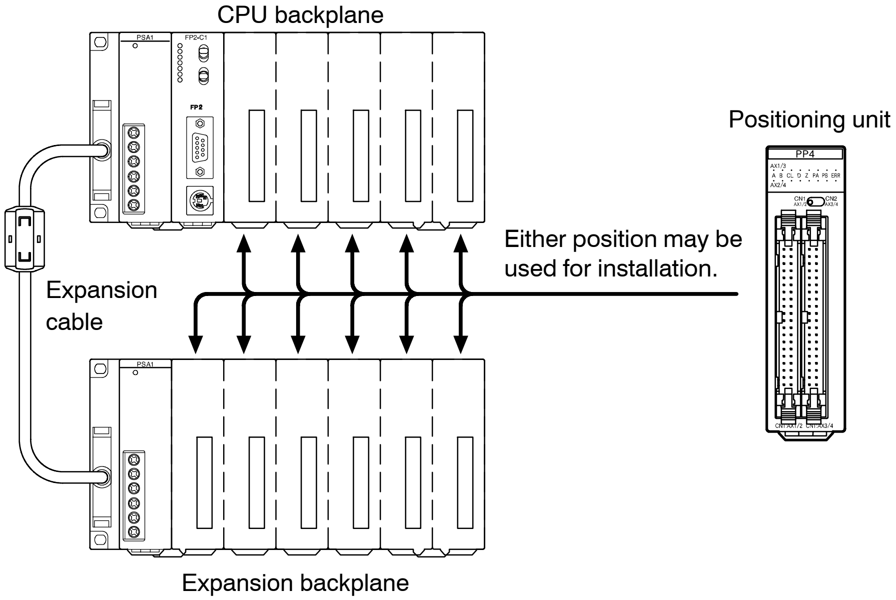
The internal current consumption (at 5 V DC power supply) for the positioning units are noted below. When the system is configured, the other units being used should be taken into consideration, and a power supply unit with a sufficient capacity should be used.

Type	Order number	Current consumption at 5 V DC
FP2 2−axis type positioning unit	FP2−PP2	225 mA
FP2 4−axis type positioning unit	FP2−PP4	400 mA

For information on restrictions applying to combinations based on current consumption, refer to the FP2 hardware manual.

1.3.2 Restrictions on Unit Installation Position

The positioning unit may be installed in either the CPU backplane or the expansion backplane position. However, it should be installed to the right of the power supply unit and CPU.



1.3.3 Restrictions on the Number of Units Installed

There are no restrictions on the number of units that may be installed, as long as the number is within the restriction range noted for conditions 1.3.1 and 1.3.2 above.

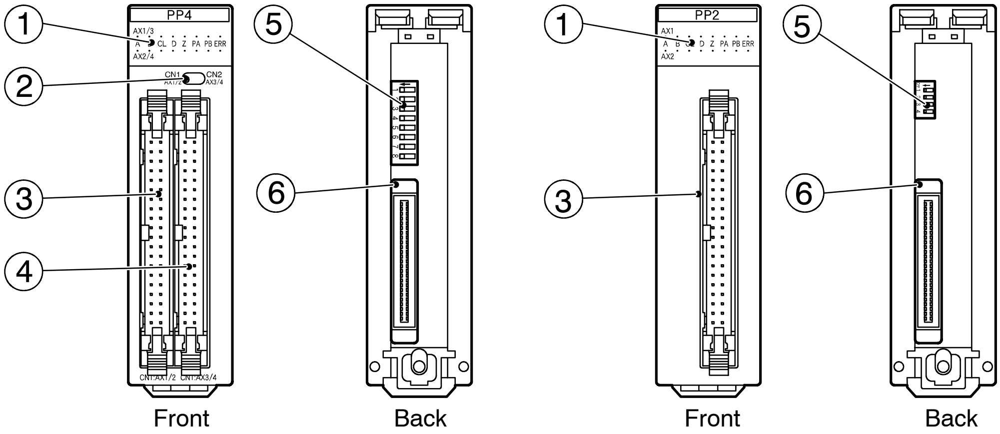
1.3 Restrictions on Units Combination

Chapter 2

Parts and Specifications

2.1 Parts and Specifications

2.1.1 Parts and Specifications



4−axis type (FP2−PP4) 2−axis type (FP2−PP2)

① **Operation status display LEDs**
These display operation conditions for two axes.

② **Operation status display switch (for FP2−PP4 only)**
This switches between displaying operation conditions for axes 1 and 2, and axes 3 and 4.

③ **User interface connector for 1−axis/2−axis**
This connector is used to connect a motor driver or external interface.

④ **User interface connector for 3−axis/4−axis (for FP2−PP4 only)**
This connector is used to connect a motor driver or external interface.

⑤ **Operation mode setting switches**
These switches are used to specify the direction of rotation and the pulse output method for each of the axes.
When the unit is shipped from the factory, the rotation direction is set to "Normal" (forward rotation, in which the elapsed value increases), and the pulse output method is set to the "Pulse/Sign" mode.
To set the rotation direction to the opposite direction of that specified in the program, set this to the "Off" position.
The pulse output method should be set to match that of the motor driver connected to the unit.

⑥ **Backplane connector**
This connector is used to connect the unit to the slot on the backplane.

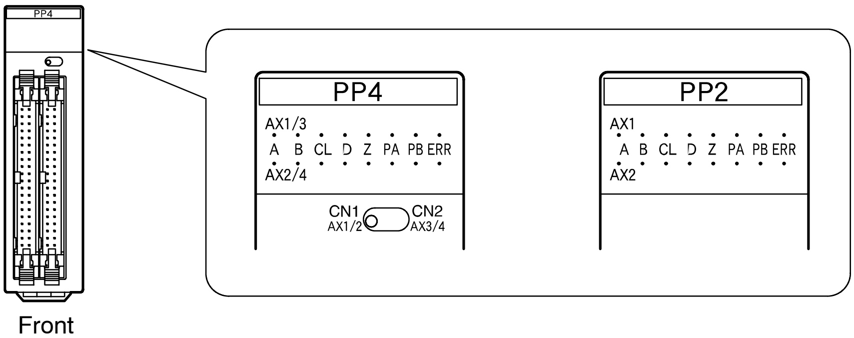
☞ **next page**

☞ **Note**

The settings of the operation mode setting switches become valid at the point when the power is turned on.

2.1.2 Operation Status Display LEDs

Information on two axes can be displayed at once on the LEDs. For a 4−axis type, display can be switched between axes 1 and 2 and axes 3 and 4 with the switch. The LEDs show the same information for each axis.



Operation Status Display LEDs

LED	Description		LED on	LED off	LED blinks
A	Pulse output signal A display (* 1)	When set to pulse/sign output	————	During stop	During pulse output
		When set to CW/CCW output	————	During stop (forward)	During pulse output (forward)
B	Pulse output signal B display (* 1)	When set to pulse/sign output	Reverse direction command	Forward direction command	————
		When set to CW/CCW output	————	During stop (reverse)	During pulse output (reverse)
CL	Counter clear signal output display		Output: on	Output: off	————
D	Near home status display (* 2)		On	Off	————
Z	Home input status display (* 2)		On	Off	————
PA	Pulser signal input display (* 3)		Displays input status of pulser input signal A		
PB	Pulser signal input display (* 3)		Displays input status of pulser input signal B		
ERR	Setting value error display		Setting value: error	Setting value: normal	————

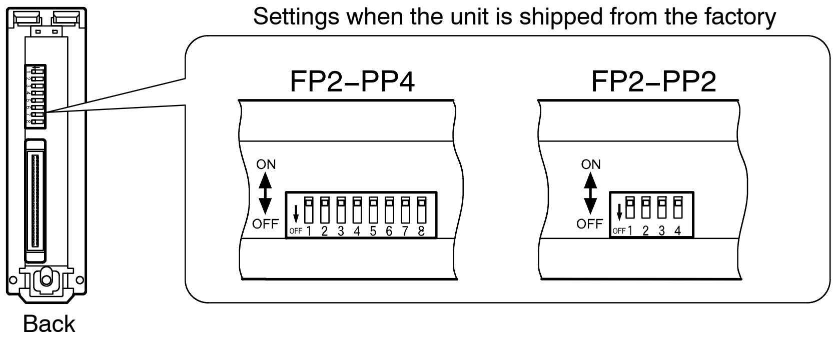
Notes

1) The pulse output signal display LEDs (A and B) blink at the output frequency (speed). For this reason, they may appear to light steadily at high output speeds.

2) The near home (D) and home input (Z) LEDs light when the respective input becomes valid. The input logic is specified using the control codes in the program. When the power is first turned on, the (D) LED is not lighted, and the (Z) LED is lighted.

3) The pulser signal input LEDs (PA and PB) indicates the input status of the pulser signal. This lights if nothing has been connected to the pulse input circuit.

2.1.3 Operation Mode Setting Switches



Operation mode setting switches

<table>
<tr><th colspan="2">Type</th><th>Switch</th><th>Axis</th><th>Description</th><th>ON
(factory setting)</th><th>OFF</th></tr>
<tr><td rowspan="8">FP2–PP4</td><td rowspan="4">FP2–PP2</td><td>1</td><td rowspan="2">1 axis</td><td>Rotation direction</td><td>Normal setting</td><td>Reverse setting</td></tr>
<tr><td>2</td><td>Pulse output mode</td><td>Pulse/sign mode</td><td>CW/CCW mode</td></tr>
<tr><td>3</td><td rowspan="2">2 axes</td><td>Rotation direction</td><td>Normal setting</td><td>Reverse setting</td></tr>
<tr><td>4</td><td>Pulse output mode</td><td>Pulse/sign mode</td><td>CW/CCW mode</td></tr>
<tr><td></td><td>5</td><td rowspan="2">3 axes</td><td>Rotation direction</td><td>Normal setting</td><td>Reverse setting</td></tr>
<tr><td></td><td>6</td><td>Pulse output mode</td><td>Pulse/sign mode</td><td>CW/CCW mode</td></tr>
<tr><td></td><td>7</td><td rowspan="2">4 axes</td><td>Rotation direction</td><td>Normal setting</td><td>Reverse setting</td></tr>
<tr><td></td><td>8</td><td>Pulse output mode</td><td>Pulse/sign mode</td><td>CW/CCW mode</td></tr>
</table>

☞ **Note**

The settings of the operation mode setting switches become valid at the point when the power is turned on.

For detailed information about switch setting method ☛ Section 4.1

Chapter 3

Wiring

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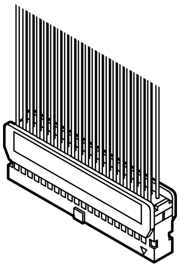
3.1 Connecting with Wire−pressed Terminal Type Connector

3.1.1 Specifications of Wire−pressed Connector

This is a connector that allows loose wires to be connected without removing the wire's insulation.

The pressure connection tool (AXY52000FP) is required to connect the loose wires.



Wire−pressed connector (40 pins)

Suitable wire (twisted wire)

Size	Cross section area	Insulation thickness	Rated current
AWG22	0.3 mm^2	dia. 1.5 to dia. 1.1	3 A
AWG24	0.2 mm^2		

Wire−pressed connector (accessories for unit)

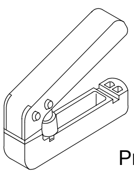
Company	Composition of parts	Unit type and required quantity	
		2−axis type	**4−axis type**
Panasonic Electric Works SUNX Co., Ltd.	**Housing (40P)**	1 piece x 1 set	1 piece x 2 sets
	Semi−cover (40P)	2 pieces x 1 set	2 pieces x 2 set
	Contact (for AW22 and AW24) 5−pin	8 pieces x 1 set	8 pieces x 2 set

☞ **Note**

The 2−axis type comes with one set and the 4−axis type with two sets.
When purchasing additional sets, please order AFP2801 (containing two sets).

Pressure connection tool

Company	Order number
Panasonic Electric Works SUNX Co., Ltd.	AXY52000FP



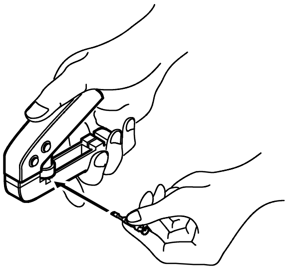
Pressure connection tool

3.1.2 Assembly of Wire−pressed Connector

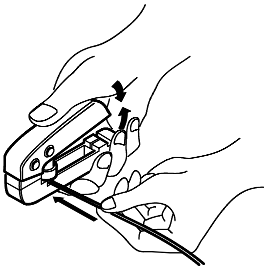
The wire end can be directly press-fitted without removing the wire's insulation, saving labor.

Procedure:

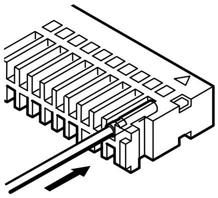
1. **Bend the contact back from the carrier, and set it in the pressure connection tool.**



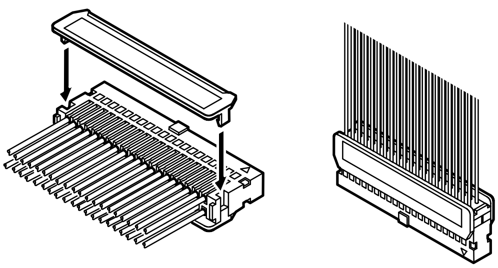
2. **Insert the wire without removing its insulation until it stops, and lightly grip the tool.**



3. **After press-fitting the wire, insert it into the housing.**

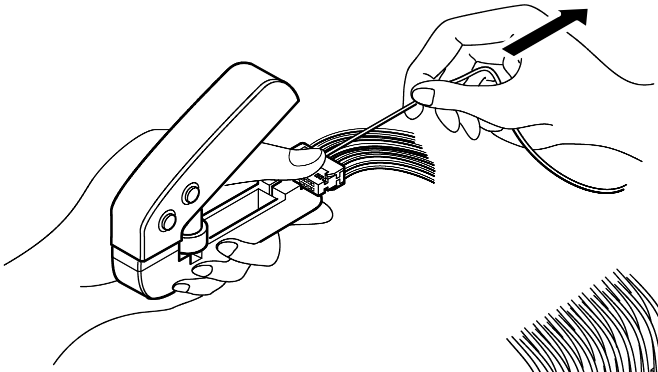


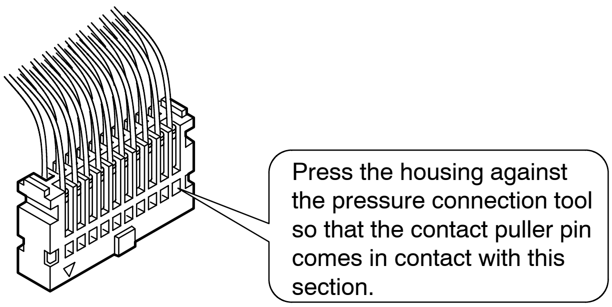
4. **When all wires has been inserted, fit the semi-cover into place.**



Contact puller pin for rewiring

If there is a wiring mistake or the wire is incorrectly pressure-connected, the contact puller pin provided with the fitting can be used to remove the contact.

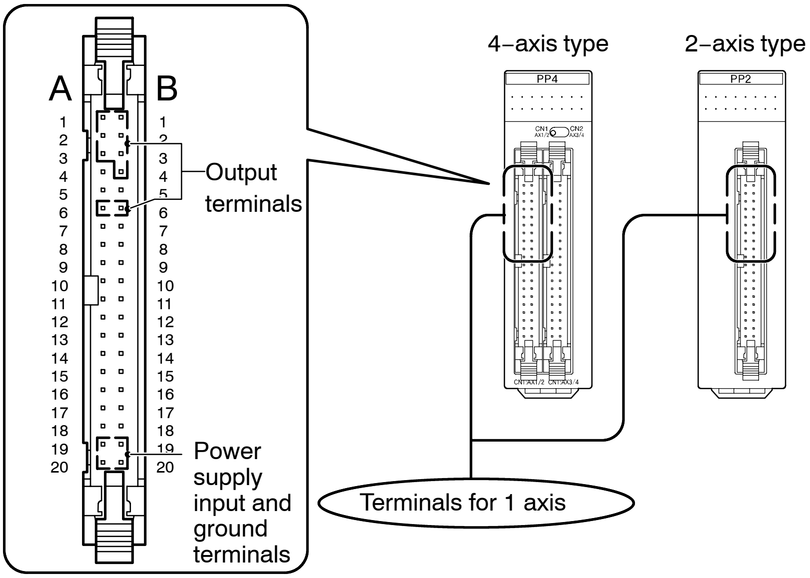




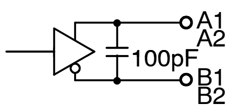
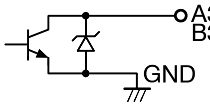
3.2 Input/Output Specifications and Connector Pin Layout

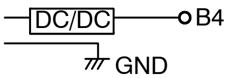
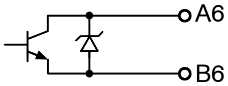
3.2.1 Pin Layout for One Axis

3.2.1.1 Output and Power Supply Terminals for One Axis

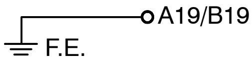
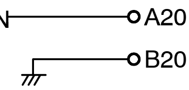


Output terminals

Pin number	Signal name	Circuit	Item	Specification
A1	Pulse output A: line driver (+)		Output form	Line driver output Equivalent to AM26C31
B1	Pulse output A: line driver (–)			
A2	Pulse output B: line driver (+)			
B2	Pulse output B: line driver (–)			
A3	Pulse output A: open collector		Output form	Open collector
			Operating voltage range	4.75 to 26.4 V DC
B3	Pulse output B: open collector		Max. load current	15 mA
			ON voltage drop	0.6 V or less

Pin number	Signal name	Circuit	Item	Specification
B4	5 V DC output		Output voltage range	4.75 to 5.25 V DC
			Max. load current	Total 120 mA (at 5 V DC output)
A6	Deviation counter clear (+)		Output form	Open collector
			Operating voltage range	4.75 to 26.4 V DC
B6	Deviation counter clear (–)		Max. load current	15 mA
			ON voltage drop	1.2 V or less

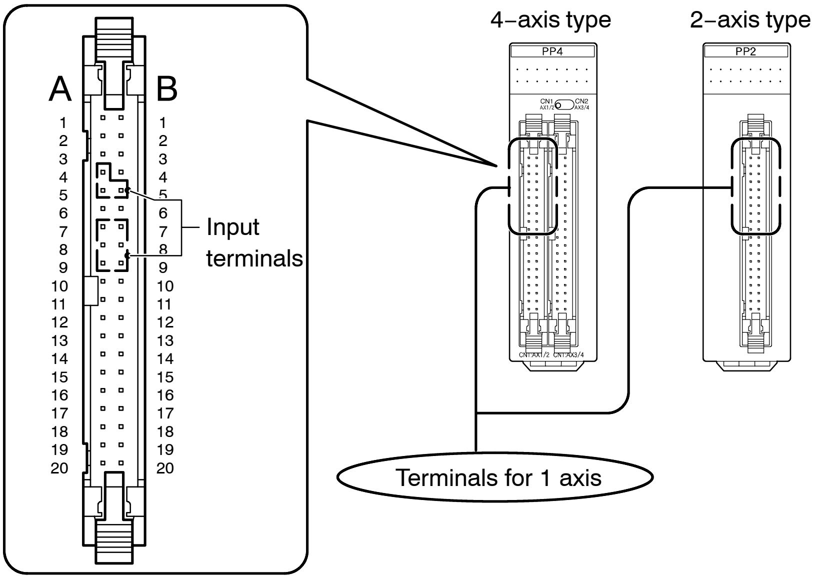
Power supply input and ground terminals

Pin number	Signal name	Circuit	Item	Specification
A19 **B19**	F.E.		————	————
A20	External power supply input: 24 V DC (+)		Power supply voltage range	21.4 to 26.4 V DC
B20	External power supply input: 24 V DC (–)		Current consumption	4–axis type: 90 mA or less 2–axis type: 45 mA or less

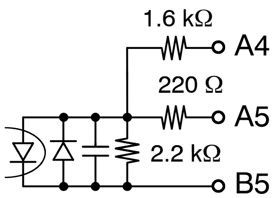
Notes

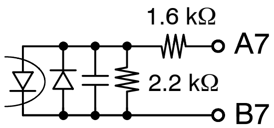
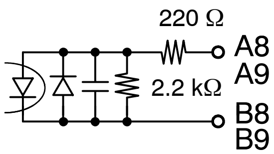
- **Pin numbers A19, B19, A20, and B20 are shared among all of the axes.**
- **For the 4–axis type, pin numbers A19, B19, A20, and B20 are connected internally, using the A19, B19, A20, and B20 pins for the 3–axis and 4–axis connectors.**

3.2.1.2 Input Terminals for One Axis



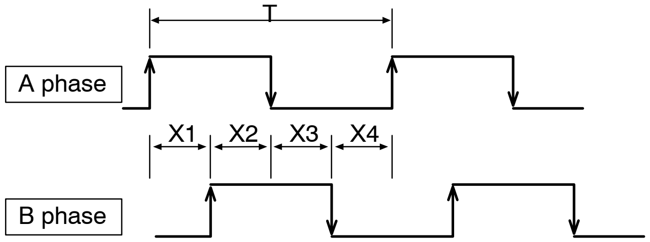
Input terminals

Pin number	Signal name	Circuit	Item		Specification
A4	Home input: 24 V DC (+)		24 V	Input voltage range	11.4 to 26.4 V DC
				Min. ON voltage/ current	10.5 V/6 mA
				Max. OFF voltage/ current	2.0 V/0.5 mA
A5	Home input: 5V DC (+)			Input impedance	Approx. 1.6 kΩ
			5V	Input voltage range	3.5 to 5.25 V DC
				Min. ON voltage/ current	3.0 V/6 mA
B5	Home input (–)			Max. OFF voltage/ current	1.0 V/0.5 mA
				Input impedance	Approx. 220 Ω
			Min. input pulse width		100 µs

Pin number	Signal name	Circuit	Item	Specification
A7	Near home input (+)		Input voltage range	4.75 to 26.4 V DC
			Min. ON voltage/current	4.0 V/2 mA
B7	Near home input (–)		Max. OFF voltage/current	1.5 V/0.5 mA
			Input impedance	Approx. 1.6 kΩ
			Min. input pulse width	500 µs
A8	Pulser input A (+)		Input voltage range	3.5 to 5.25 V DC
B8	Pulser input A (–)		Min. ON voltage/current	3.0 V/6 mA
A9	Pulser input B (+)		Max. OFF voltage/current	1.0 V/0.5 mA
B9	Pulser input B (–)		Input impedance	Approx. 220 Ω
			Min. input pulse width	2 µs or higher (max. 250 kHz each phase)

Note

Pulser input signals A and B are input at different phase. When the phase of A leads the phase of B, the elapsed value increments.



T = 4 µs or higher

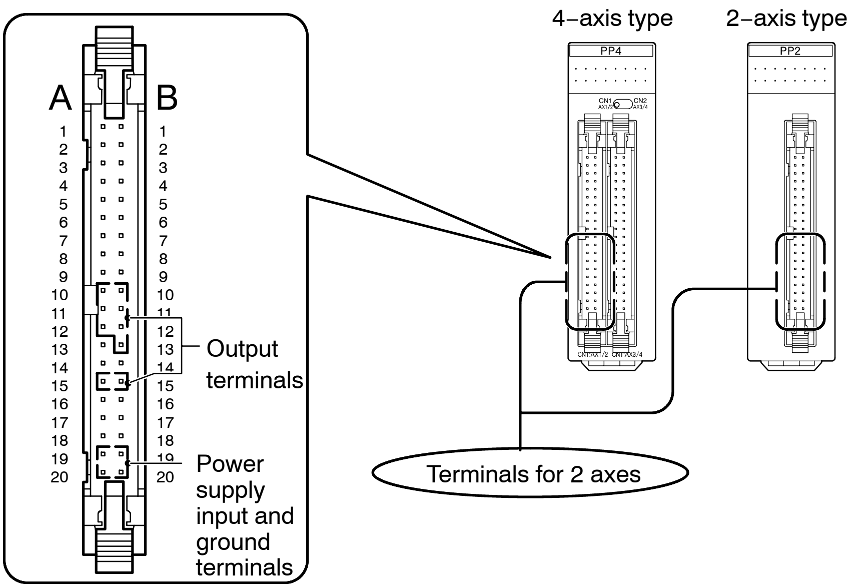
$X1 + X2 = 0.5T \pm 0.1T$

$X2 + X3 = 0.5T \pm 0.1T$

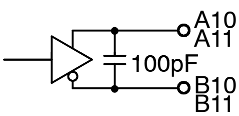
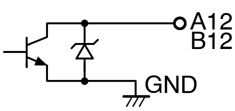
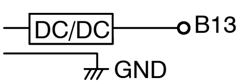
$Xn \geqq 0.125T$ (n = 1, 2, 3, 4)

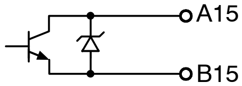
3.2.2 Pin Layout for Two Axes

3.2.2.1 Output and Power Supply Terminals for Two Axes

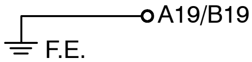
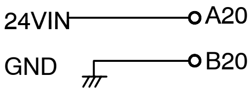


Output terminals

Pin number	Signal name	Circuit	Item	Specification
A10	Pulse output A: line driver (+)		Output form	Line driver output Equivalent to AM26C31
B10	Pulse output A: line driver (–)			
A11	Pulse output B: line driver (+)			
B11	Pulse output B: line driver (–)			
A12	Pulse output A: open collector		Output form	Open collector
			Operating voltage range	4.75 to 26.4 V DC
B12	Pulse output B: open collector		Max. load current	15 mA
			ON voltage drop	0.6 V or less
B13	5 V DC output		Output voltage range	4.75 to 5.25 V DC
			Max. load current	Total 120 mA (at 5 V DC output)

Pin number	Signal name	Circuit	Item	Specification
A15	Deviation counter clear (+)		Output form	Open collector
			Operating voltage range	4.75 to 26.4 V DC
B15	Deviation counter clear (–)		Max. load current	15 mA
			ON voltage drop	1.2 V or less

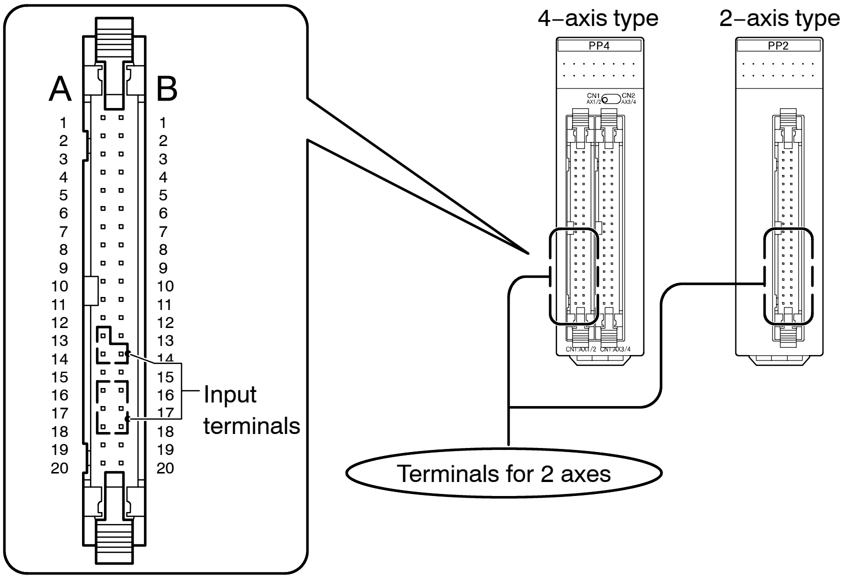
Power supply input and ground terminals

Pin number	Signal name	Circuit	Item	Specification
A19 B19	F.E.		——————	——————
A20	External power supply input: 24 V DC (+)		Power supply voltage range	21.4 to 26.4 V DC
B20	External power supply input: 24 V DC (–)		Current consumption	4–axis type: 90 mA or less 2–axis type: 45 mA or less

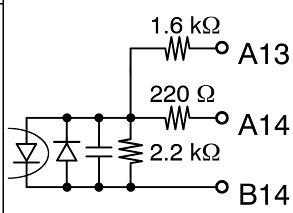
Notes

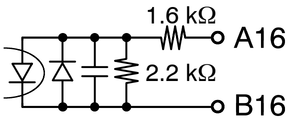
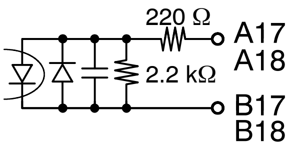
- **Pin numbers A19, B19, A20, and B20 are shared among all of the axes.**
- **For the 4–axis type, pin numbers A19, B19, A20, and B20 are connected internally, using the A19, B19, A20, and B20 pins for the 3–axis and 4–axis connectors.**

3.2.2.2 Input Terminals for Two Axis



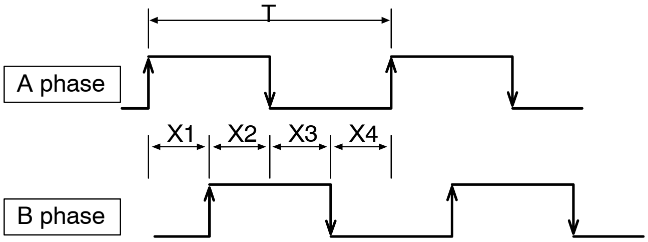
Input terminals

Pin number	Signal name	Circuit	Item		Specification
A13	Home input: 24 V DC (+)		24 V	Input voltage range	11.4 to 26.4 V DC
				Min. ON voltage/ current	10.5 V/6 mA
				Max. OFF voltage/ current	2.0 V/ 0.5 mA
A14	Home input: 5V DC (+)			Input impedance	Approx. 1.6 kΩ
			5V	Input voltage range	3.5 to 5.25 V DC
				Min. ON voltage/ current	3.0 V/6 mA
B14	Home input (–)			Max. OFF voltage/ current	1.0 V/0.5 mA
				Input impedance	Approx. 220 Ω
			Min. input pulse width		100 µs

Pin number	Signal name	Circuit	Item	Specification
A16	Near home input (+)		Input voltage range	4.75 to 26.4 V DC
			Min. ON voltage/current	4.0 V/ 2 mA
B16	Near home input (–)		Max. OFF voltage/current	1.5 V/ 0.5 mA
			Input impedance	Approx. 1.6 kΩ
			Min. input pulse width	500 µs
A17	Pulser input A (+)		Input voltage range	3.5 to 5.25 V DC
B17	Pulser input A (–)		Min. ON voltage/current	3.0 V/6 mA
A18	Pulser input B (+)		Max. OFF voltage/current	1.0 V/0.5 mA
B18	Pulser input B (–)		Input impedance	Approx. 220 Ω
			Min. input pulse width	2 µs or higher (max. 250 kHz each phase)

Note

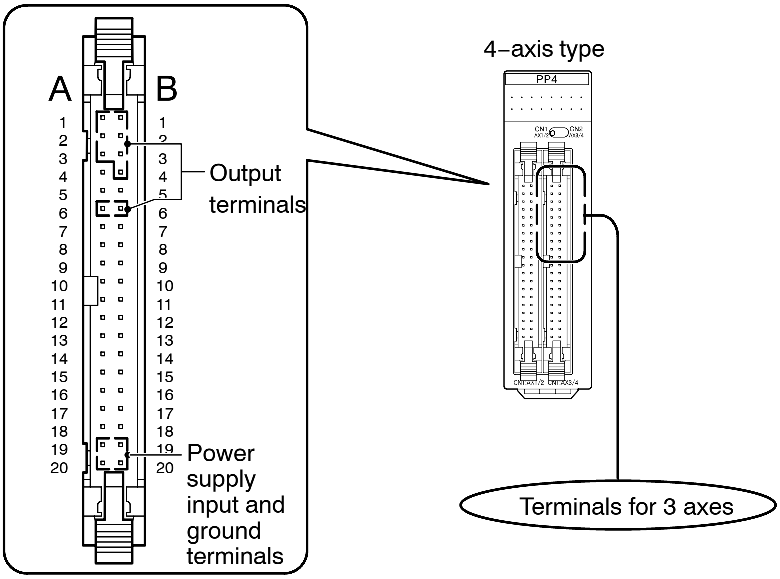
Pulser input signals A and B are input at different phase. When the phase of A leads the phase of B, the elapsed value increments.



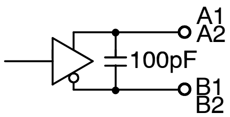
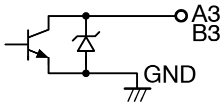
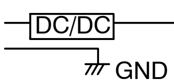
T = 4 µs or higher
X1 + X2 = 0.5T ± 0.1T
X2 + X3 = 0.5T ± 0.1T
Xn ≧ 0.125T (n = 1, 2, 3, 4)

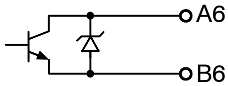
3.2.3 Pin Layout for Three Axes

3.2.3.1 Output and Power Supply Terminals for Three Axes

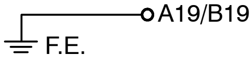
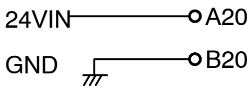


Output terminals

Pin number	Signal name	Circuit	Item	Specification
A1	Pulse output A: line driver (+)		Output form	Line driver output Equivalent to AM26C31
B1	Pulse output A: line driver (–)			
A2	Pulse output B: line driver (+)			
B2	Pulse output B: line driver (–)			
A3	Pulse output A: open collector		Output form	Open collector
			Operating voltage range	4.75 to 26.4 V DC
B3	Pulse output B: open collector		Max. load current	15 mA
			ON voltage drop	0.6 V or less
B4	5 V DC output		Output voltage range	4.75 to 5.25 V DC
			Max. load current	Total 120 mA (at 5 V DC output)

Pin number	Signal name	Circuit	Item	Specification
A6	Deviation counter clear (+)		Output form	Open collector
			Operating voltage range	4.75 to 26.4 V DC
B6	Deviation counter clear (–)		Max. load current	15 mA
			ON voltage drop	1.2 V or less

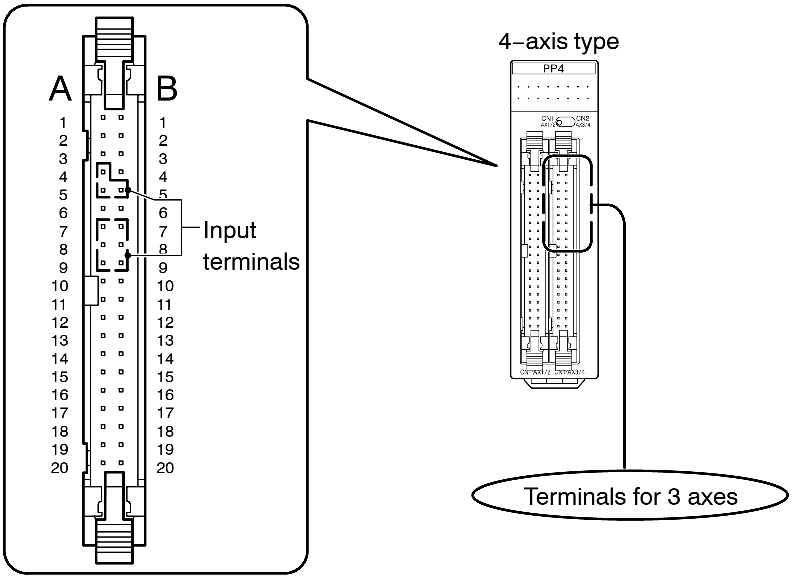
Power supply input and ground terminals

Pin number	Signal name	Circuit	Item	Specification
A19 **B19**	F.E.		————	————
A20	External power supply input: 24 V DC (+)		Power supply voltage range	21.4 to 26.4 V DC
B20	External power supply input: 24 V DC (–)		Current consumption	4–axis type: 90 mA or less

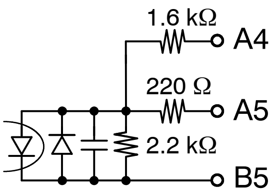
Notes

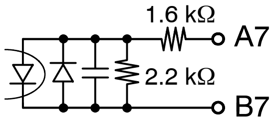
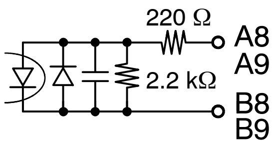
- **Pin numbers A19, B19, A20, and B20 are shared among all of the axes.**
- **For the 4–axis type, pin numbers A19, B19, A20, and B20 are connected internally, using the A19, B19, A20, and B20 pins for the 1–axis and 2–axis connectors.**

3.2.3.2 Input Terminals for Three Axes



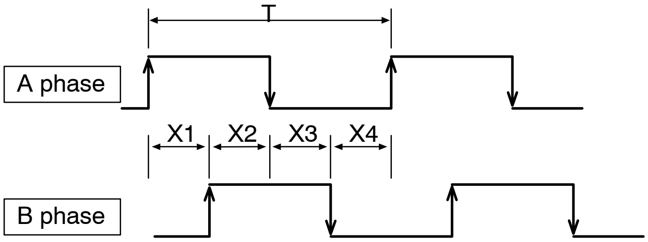
Input terminals

Pin number	Signal name	Circuit	Item		Specification
A4	Home input: 24 V DC (+)		24 V	Input voltage range	11.4 to 26.4 V DC
				Min. ON voltage/ current	10.5 V/6 mA
				Max. OFF voltage/ current	2.0 V/ 0.5 mA
A5	Home input: 5V DC (+)			Input impedance	Approx. 1.6 kΩ
			5 V	Input voltage range	3.5 to 5.25 V DC
				Min. ON voltage/ current	3.0 V/6 mA
B5	Home input (–)			Max. OFF voltage/ current	1.0 V/0.5 mA
				Input impedance	Approx. 220 Ω
			Min. input pulse width		100 µs

Pin number	Signal name	Circuit	Item	Specification
A7	Near home input (+)		Input voltage range	4.75 to 26.4 V DC
			Min. ON voltage/current	4.0 V/ 2 mA
B7	Near home input (–)		Max. OFF voltage/current	1.5 V/ 0.5 mA
			Input impedance	Approx. 1.6 kΩ
			Min. input pulse width	500 µs
A8	Pulser input A (+)		Input voltage range	3.5 to 5.25 V DC
B8	Pulser input A (–)		Min. ON voltage/current	3.0 V/6 mA
A9	Pulser input B (+)		Max. OFF voltage/current	1.0 V/0.5 mA
B9	Pulser input B (–)		Input impedance	Approx. 220 Ω
			Min. input pulse width	2 µs or higher (max. 250 kHz each phase)

☞ **Note**

Pulser input signals A and B are input at different phase. When the phase of A leads the phase of B, the elapsed value increments.



T = 4 µs or higher

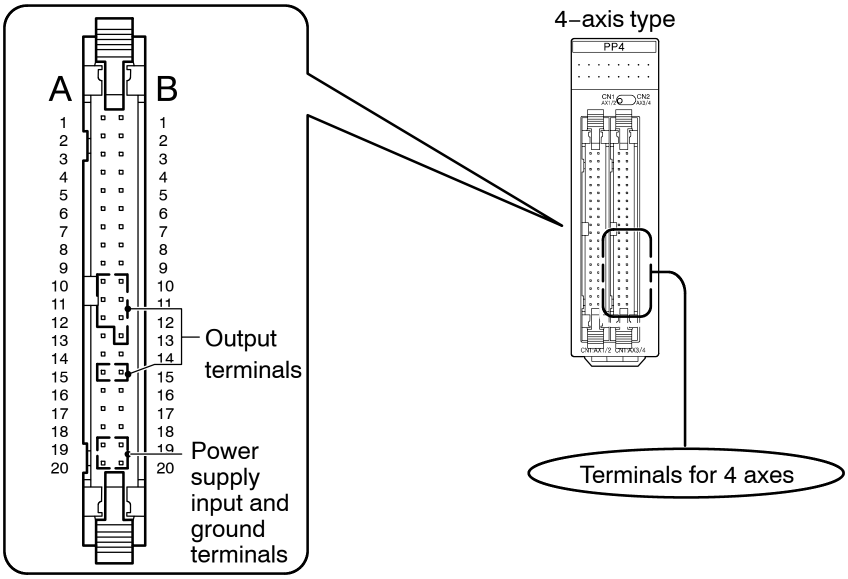
X1 + X2 = 0.5T ± 0.1T

X2 + X3 = 0.5T ± 0.1T

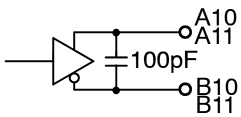
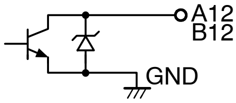
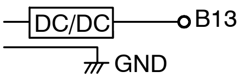
Xn ≧ 0.125T (n = 1, 2, 3, 4)

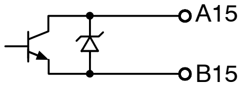
3.2.4 Pin Layout for Four Axes

3.2.4.1 Output and Power Supply Terminals for Four Axes

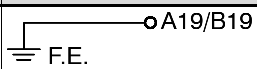
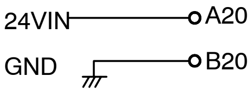


Output terminals

Pin number	Signal name	Circuit	Item	Specification
A10	Pulse output A: line driver (+)		Output form	Line driver output Equivalent to AM26C31
B10	Pulse output A: line driver (–)			
A11	Pulse output B: line driver (+)			
B11	Pulse output B: line driver (–)			
A12	Pulse output A: open collector		Output form	Open collector
			Operating voltage range	4.75 to 26.4 V DC
B12	Pulse output B: open collector		Max. load current	15 mA
			ON voltage drop	0.6 V or less
B13	5 V DC output		Output voltage range	4.75 to 5.25 V DC
			Max. load current	Total 120 mA (at 5 V DC output)

Pin number	Signal name	Circuit	Item	Specification
A15	Deviation counter clear (+)		Output form	Open collector
			Operating voltage range	4.75 to 26.4 V DC
B15	Deviation counter clear (–)		Max. load current	15 mA
			ON voltage drop	1.2 V or less

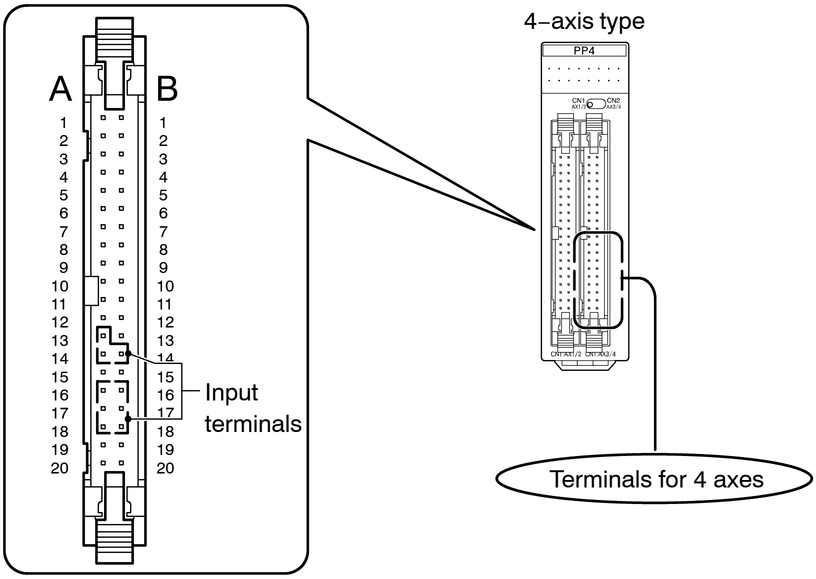
Power supply input and ground terminals

Pin number	Signal name	Circuit	Item	Specification
A19 **B19**	F.E.		———	———
A20	External power supply input: 24 V DC (+)		Power supply voltage range	21.4 to 26.4 V DC
B20	External power supply input: 24 V DC (–)		Current consumption	4–axis type: 90 mA or less

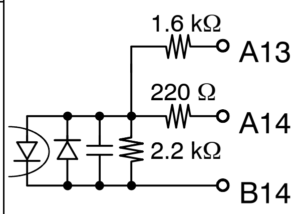
Notes

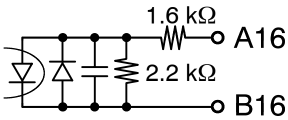
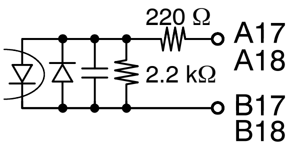
- **Pin numbers A19, B19, A20, and B20 are shared among all of the axes.**
- **For the 4–axis type, pin numbers A19, B19, A20, and B20 are connected internally, using the A19, B19, A20, and B20 pins for the 1–axis and 2–axis connectors.**

3.2.4.2 Input Terminals for Four Axes



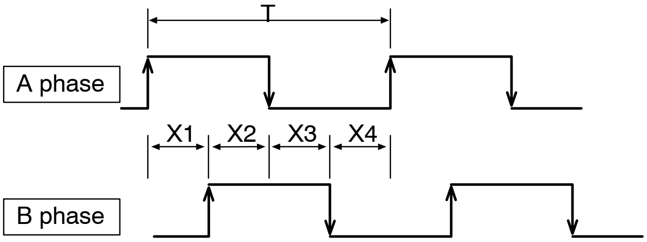
Input terminals

Pin number	Signal name	Circuit	Item		Specification
A13	Home input: 24 V DC (+)		24 V	Input voltage range	11.4 to 26.4 V DC
				Min. ON voltage/ current	10.5 V/6 mA
				Max. OFF voltage/ current	2.0 V/ 0.5 mA
A14	Home input: 5V DC (+)			Input impedance	Approx. 1.6 kΩ
			5V	Input voltage range	3.5 to 5.25 V DC
				Min. ON voltage/ current	3.0 V/6 mA
B14	Home input (–)			Max. OFF voltage/ current	1.0 V/0.5 mA
				Input impedance	Approx. 220 Ω
			Min. input pulse width		100 μs

Pin number	Signal name	Circuit	Item	Specification
A16	Near home input (+)		Input voltage range	4.75 to 26.4 V DC
			Min. ON voltage/current	4.0 V/ 2 mA
B16	Near home input (–)		Max. OFF voltage/current	1.5 V/ 0.5 mA
			Input impedance	Approx. 1.6 kΩ
			Min. input pulse width	500 µs
A17	Pulser input A (+)		Input voltage range	3.5 to 5.25 V DC
B17	Pulser input A (–)		Min. ON voltage/current	3.0 V/6 mA
A18	Pulser input B (+)		Max. OFF voltage/current	1.0 V/0.5 mA
B18	Pulser input B (–)		Input impedance	Approx. 220 Ω
			Min. input pulse width	2 µs or higher (max. 250 KHz each phase)

Note

Pulser input signals A and B are input at different phase. When the phase of A leads the phase of B, the elapsed value increments.



T = 4 µs or higher

$X1 + X2 = 0.5T \pm 0.1T$

$X2 + X3 = 0.5T \pm 0.1T$

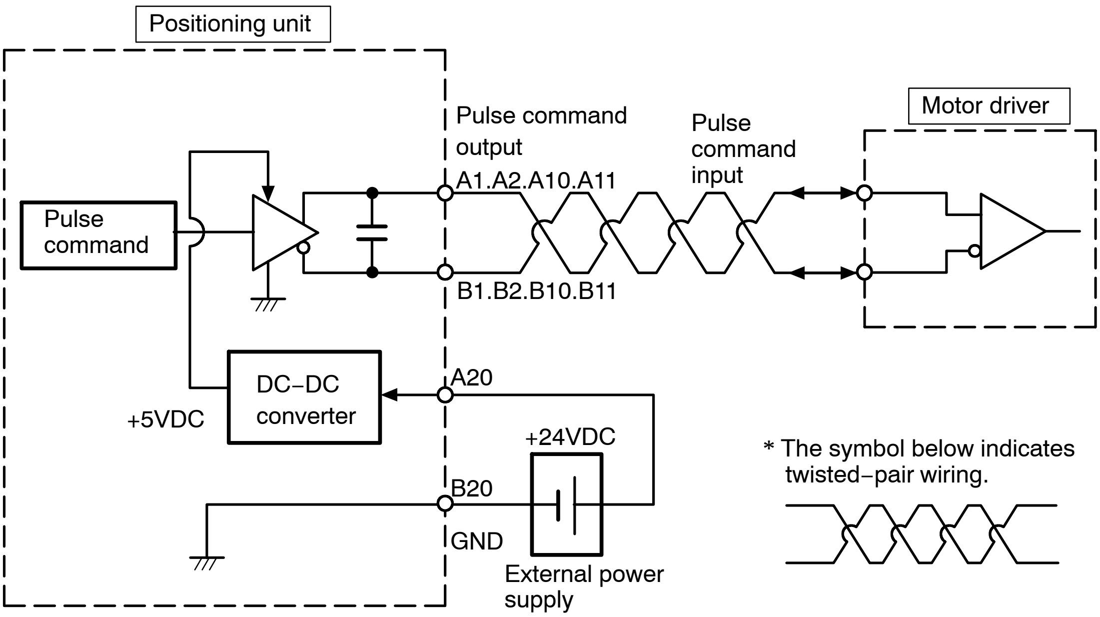
$Xn \geqq 0.125T$ (n = 1, 2, 3, 4)

3.3 Supplying Power for Internal Circuit Drive

Always make sure an external +24 VDC power supply is connected to the pins for external input power supply (pin nos. A20 and B20).

The applied 24 VDC voltage passes through an internal DC−DC converter and is converted to 5 V DC voltage. It is then supplied to the various internal circuits as a power supply for internal circuit drive of the pulse command output pin.

3.3.1 Line Driver Output



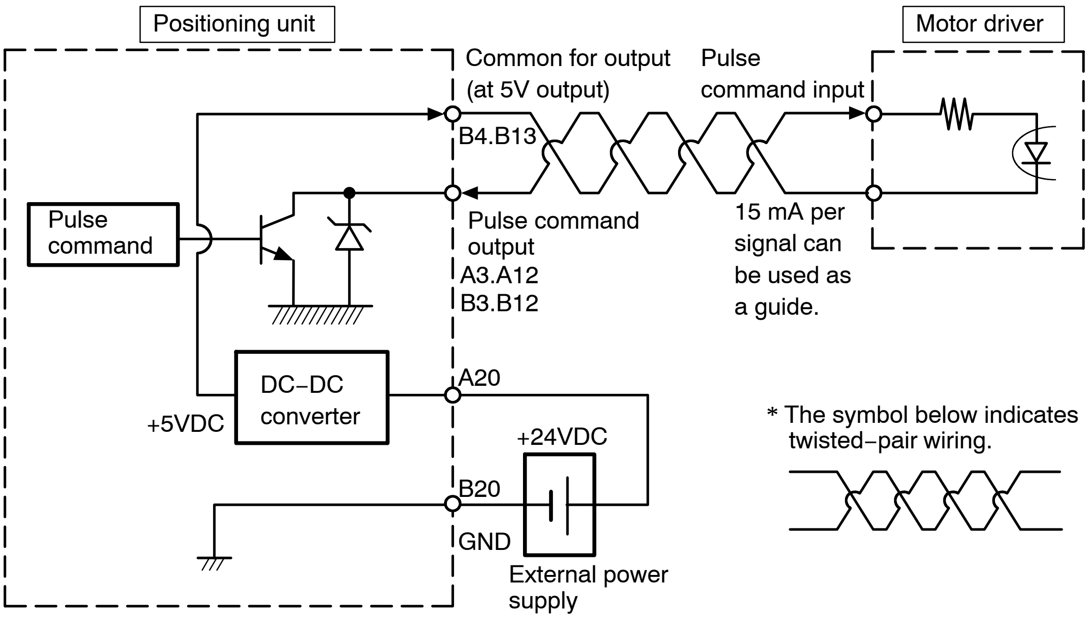
The illustration shows one signal component extracted from the overall configuration.

External power supply

Usable voltage range		21.4 to 26.4 V DC
Current consumption	**4−axis type**	90 mA or less
	2−axis type	45 mA or less

3.3.2 Open Collector Output

The power supply for the pulse command output circuit can be taken from the 5 VDC output pins (pin nos. B4 and B13).



The illustration shows one signal component extracted from the overall configuration.

External power supply

Usable voltage range		21.4 to 26.4 V DC
Current consumption	**4−axis type**	90 mA or less
	2−axis type	45 mA or less

Note

The current capacity of the +5 VDC output common pins (B4 and B13) is a total of 120 mA max. for all of the 5V output common pins.
When open collector pulse output is used, the value of 15 mA per signal should be used as a guide. If the 15 mA is exceeded, the appropriate resistance should be added.

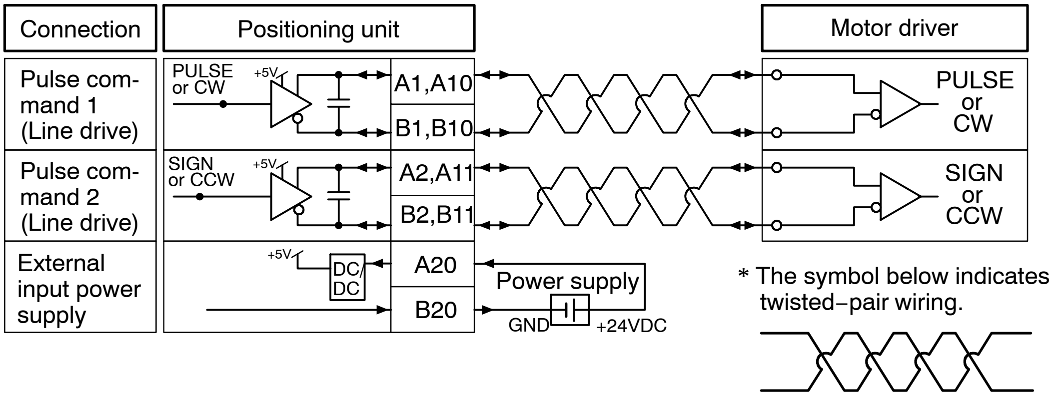
3.4 Connection of Pulse Command Output Signal

The FP2 positioning unit is equipped with two types of the interfaces of motor driver. Select and connect one or the other, depending on the interface of the motor driver being used.

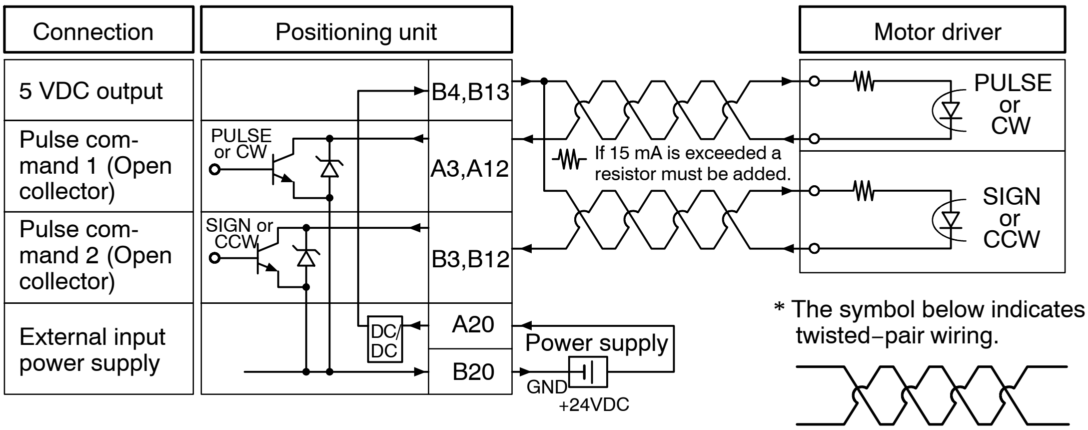
Note

We recommend using twisted-pair cables as the wiring between the positioning unit output and the motor driver, or twisting the cables used.

3.4.1 Line Driver



3.4.2 Transistor Open Collector



Output specifications

Output form	Open collector
Operating voltage range	4.75 to 26.4 V DC
Max. load current	15 mA
ON voltage drop	0.6 V or less

Output specifications at 5 V DC

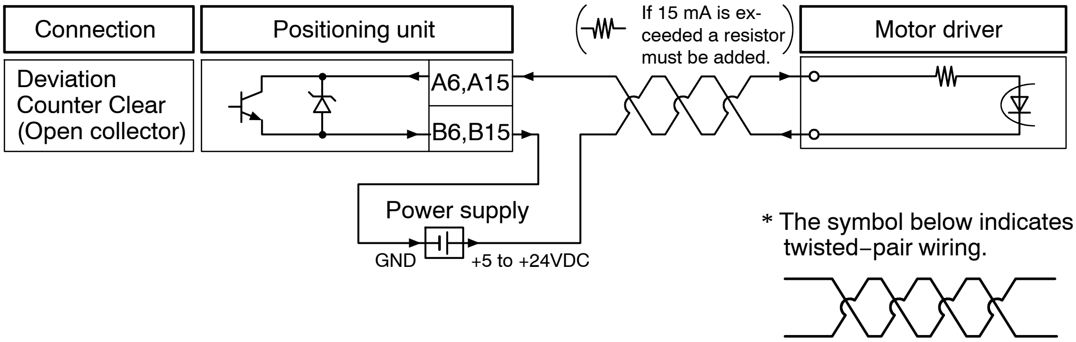
Output power supply range	4.75 to 5.25 V DC
Current consumption	120 mA (at total 5 V DC)

☞ **Note**

The total of the internal 5 VDC output and 5 V output common is 120 mA. A value of 15 mA per signal should be used as a guide. If this capacity is exceeded, resistance should be added.

3.5 Connection of Deviation Counter Clear Output Signal (for servo motor)

This is an example showing connection of the counter clear input for the servo motor driver. An external power supply (+5 V DC to +24 V DC) must be provided for the connection.



Output specifications

Output form	Open collector
Operating voltage range	4.75 to 26.4 V DC
Max. load current	15 mA
ON voltage drop	1.2 V or less

Notes

- **Always use twisted−pair cables for wiring.**
- **Current which can be conducted as the deviation counter signal is 15 mA max. If 15 mA is exceeded, resistance should be added.**

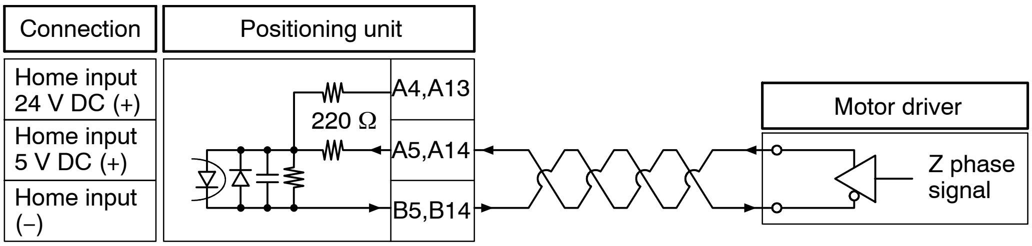
3.6 Connection of Home Input/Near Home Input Signals

This is the home signal input connection for the home return.
It should be connected to the Z phase output (line driver output or transistor output) of the motor driver, or to an external switch and sensor.

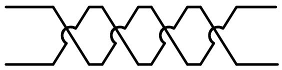
☞ **Note**

We recommend using twisted−pair cables as the wiring between the positioning unit output and the motor driver, or twisting the cables used.

3.6.1 Connection of Home Input (When connecting to motor driver Z phase output)



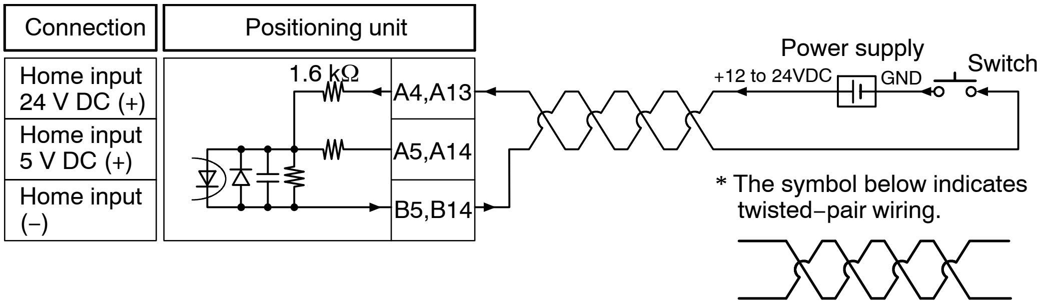
* The symbol below indicates twisted−pair wiring.



Input specifications (at 5 V DC)

Input voltage range	3.5 to 5.25 V DC
Min. ON voltage/current	3.0 V/6 mA
Max. OFF voltage/current	1.0 V/0.5 mA
Input impedance	Approx. 220 Ω
Min. input pulse width	100 μs

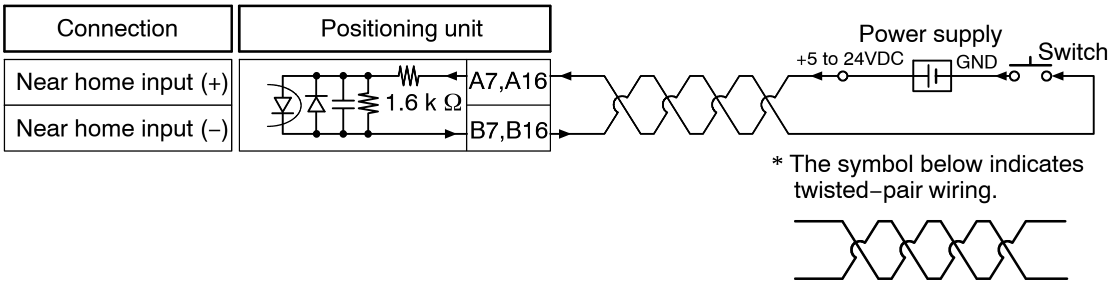
3.6.2 Connection of Home Input (When connecting to an external switch/sensor)



Input specifications (at 24 V DC)

Input voltage range	11.4 to 26.4 V DC
Min. ON voltage/current	10.5 V/6 mA
Max. OFF voltage/current	2.0 V/0.5 mA
Input impedance	Approx. 1.6 kΩ
Min. input pulse width	100 μs

3.6.3 Connection of Near Home Input Signal

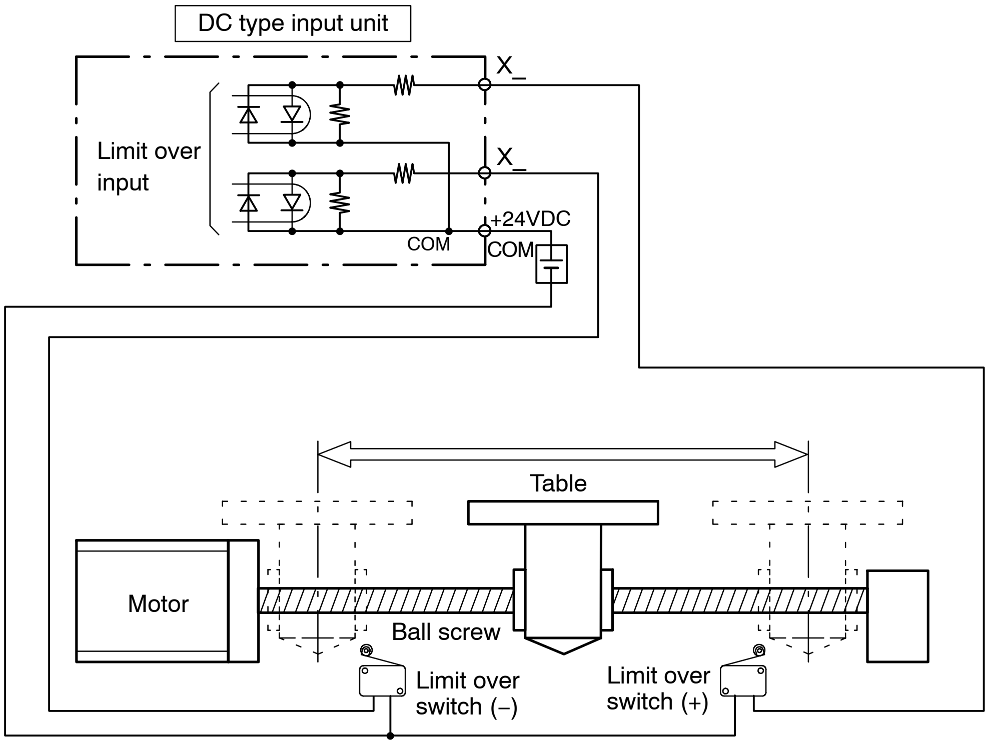


Input specifications

Input voltage range	4.75 to 26.4 V DC
Min. ON voltage/current	4.0 V/2 mA
Max. OFF voltage/current	1.5 V/0.5 mA
Input impedance	Approx. 1.6 kΩ
Min. input pulse width	500 μs

3.7 Connection of Limit Over Input

The input unit should be used for limit over input to the PLC. In addition to that, any circuits recommended by the motor manufacturers should be provided externally.



An emergency stop circuit appropriate to the system should be programmed.

For detailed information about overruns ☛ Section 11.1.1

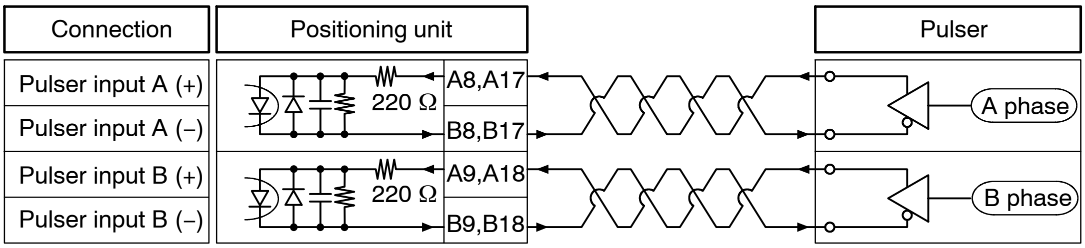
3.8 Connection of Pulser (Only when pulser is used)

The output configuration of the signal varies depending on the pulser, so make connections based on the type of pulser. Three types of output configurations are available: a line driver type, a transistor open collector type, and a transistor–resistor pull–up type.

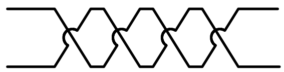
Note

We recommend using twisted–pair cables for connections, or twisting the cables used.

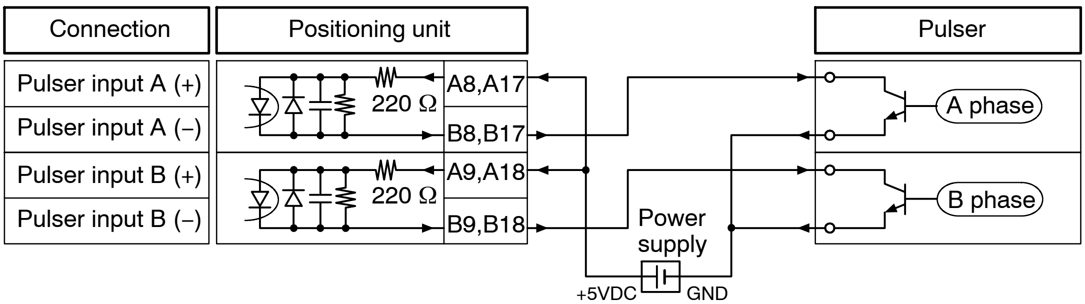
3.8.1 Line Driver Type



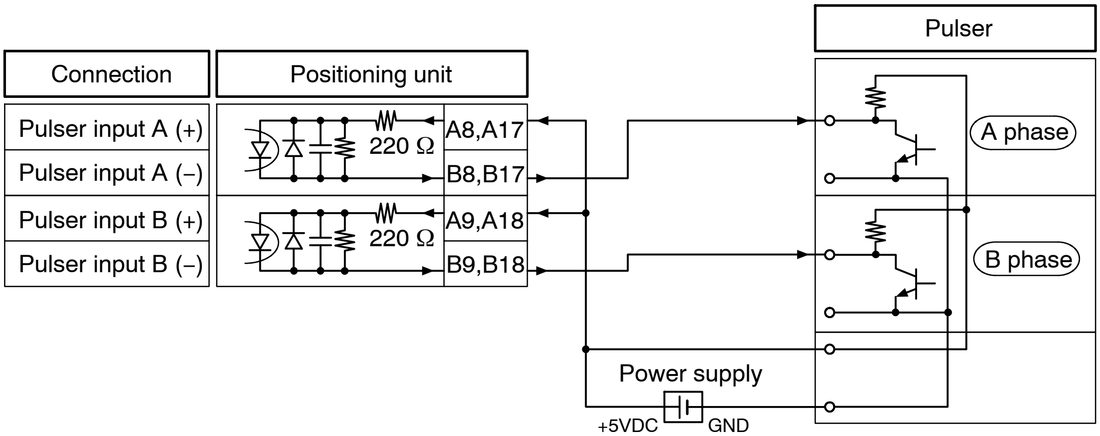
* The symbol below indicates twisted–pair wiring.



3.8.2 Transistor Open Collector Type



3.8.3 Transistor−resistor Pull−up Type



3.9 Precautions Concerning Wiring

Both for the line driver output and the transistor output, the length of the wiring between the positioning unit and the motor driver should be within the distance below.

Corresponding signals

- Line driver output
- Transistor output
- Deviation counter clear

Type of output	Wiring distance
Line driver output	10 m
Transistor output	

We recommend using twisted−pair cables for connections that are less subject to noise.

3.9 Precautions Concerning Wiring

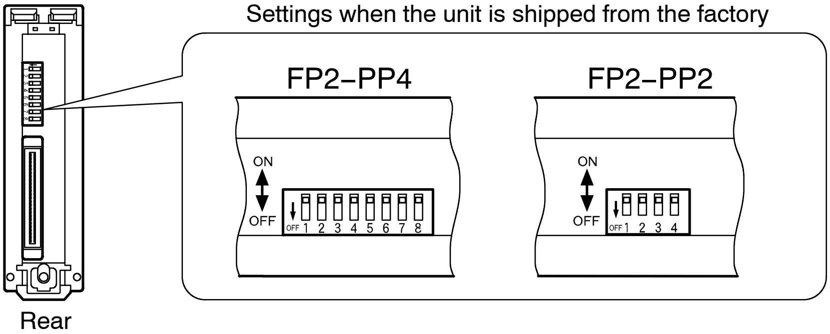
Chapter 4

Confirming the Unit Settings and Design Contents

☛ next page

4.1 Setting the Operation Mode Setting Switches

Before attaching the positioning unit to the backplane, always make sure the operation mode setting switches on the rear panel have been set to match the specifications of the system being designed.



The operation mode setting switches are used to select the motor rotation direction and the pulse output mode for each of the axes.

Switch	Axis	Description	ON (factory setting)	OFF
1	1 axis	Rotation direction	Normal setting	Reverse setting
2		Pulse output mode	Pulse/sign mode	CW/CCW mode
3	2 axes	Rotation direction	Normal setting	Reverse setting
4		Pulse output mode	Pulse/sign mode	CW/CCW mode
5	3 axes	Rotation direction	Normal setting	Reverse setting
6		Pulse output mode	Pulse/sign mode	CW/CCW mode
7	4 axes	Rotation direction	Normal setting	Reverse setting
8		Pulse output mode	Pulse/sign mode	CW/CCW mode

☞ **Notes**

- **The factory setting for all switches is ON.**
- **The settings of the operation mode setting switches become effective at the point when the power is turned on.**

4.1.1 Selection of Rotation Direction

Setting of rotation direction switch

Normally, this is used in the “On” position.
The position of this switch can be changed to reverse only the rotation direction of the motor, with the connection status and the driver settings remaining exactly the same.

4.1.2 Selection of Pulse Output Mode

The pulse output mode can be selected to match the pulse input mode supported by the motor driver. The two types of pulse output described below can be selected.

Pulse/sign output method

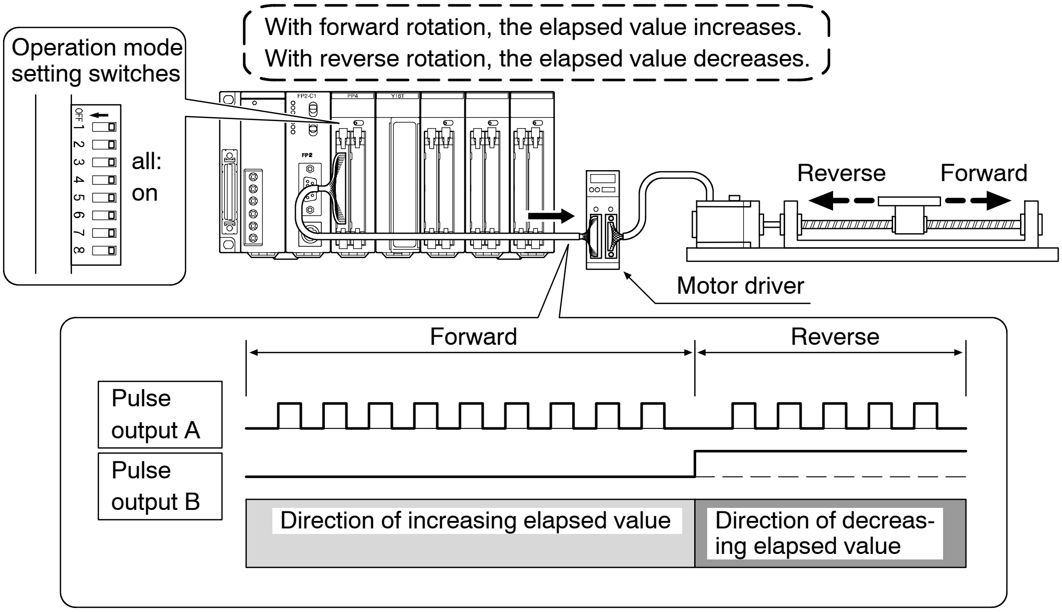
With this method, pulse output signals for motor drive (signals that determine the rotation speed of the motor) and signals that determine the rotation direction of the motor are output.
Pulse signals (pulses) are output from the pulse output A pin, while signals that determine the rotation direction (signs) are output from the pulse output B pin.

CW/CCW output method

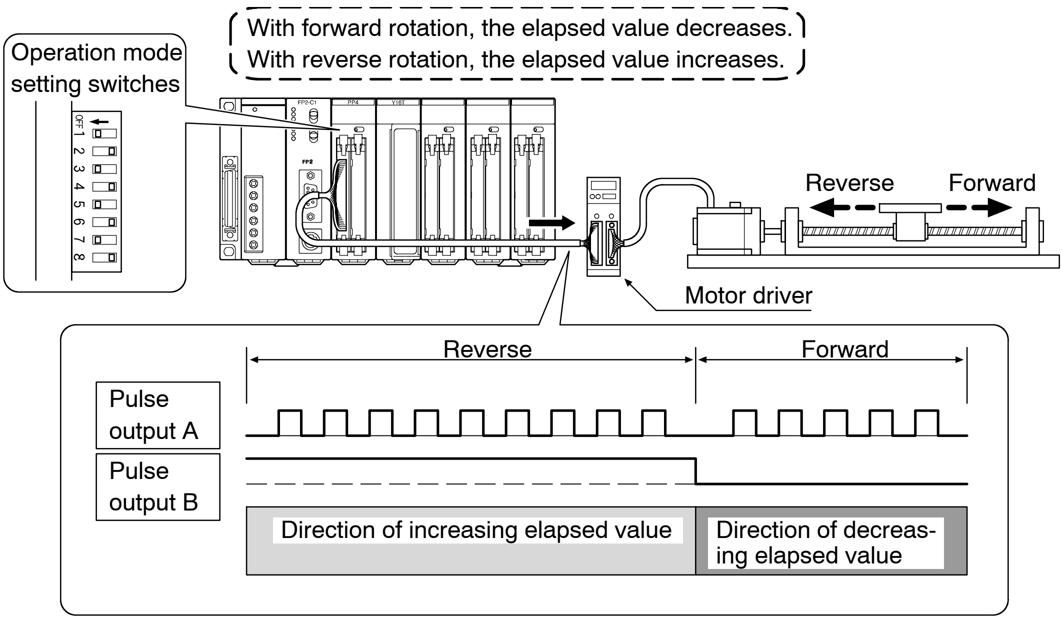
With this method, pulse output signals for forward rotation and pulse output signals for reverse rotation are output in response to the direction in which the motor is rotating (CW/CCW: clockwise/counter−clockwise).
When the rotation direction switch is set to the normal setting (ON), forward rotation (CW: clockwise) pulse signals are output from the pulse output A pin, and reverse rotation (CCW: counter−clockwise) pulse signals are output from the pulse output B pin.

4.1.3 Relationship Between Switch Setting and Rotation Direction

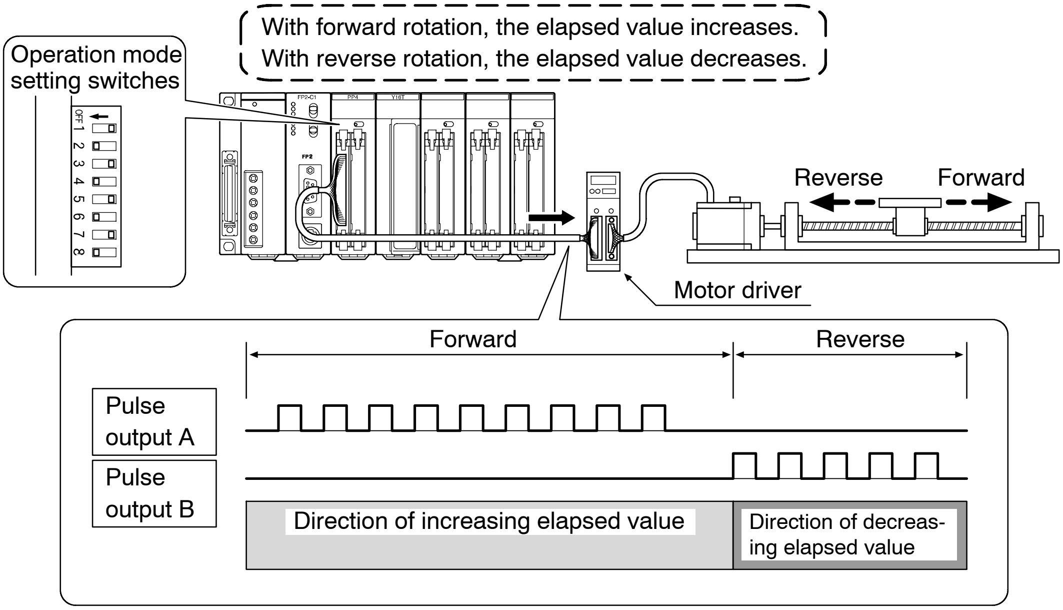
Pulse/sign mode (Rotation direction switch: normal setting)



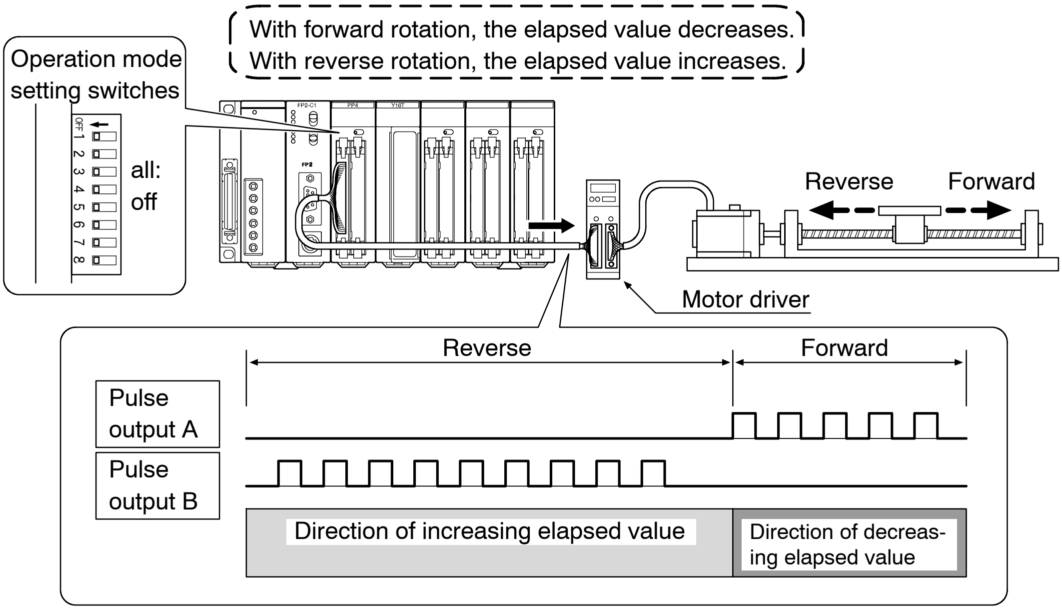
Pulse/sign mode (Rotation direction switch: reverse setting)



CW/CCW mode (Rotation direction switch: normal setting)



CW/CCW mode (Rotation direction switch: reverse setting)



Note

The direction of rotation varies depending on the wiring, the motor driver settings, the position command value in the program, and other factors.

4.2 Confirming the Slot Number and I/O Number Allocations

4.2.1 Occupied I/O Area

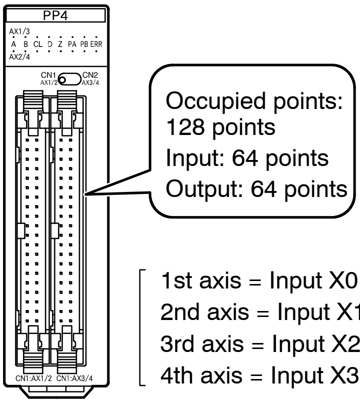
With the positioning unit, as with other I/O units, allocations are entered for the input (X) and output (Y).

The positioning unit has 16 input points and 16 output points per axis, for a total of 32. Consequently, a 4−axis type has 128 points, and a 2−axis type has 64 points.

The configuration of the occupied I/O area is as shown below.

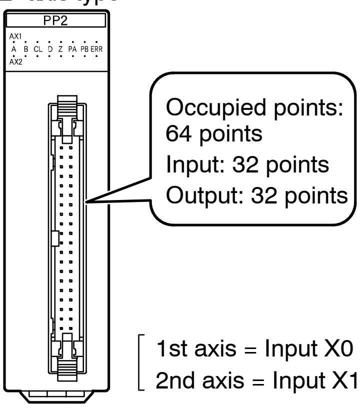
When installed in slot 0

4−axis type



1st axis = Input X0 to XF (WX0)	Output Y40 to Y4F (WY4)
2nd axis = Input X10 to X1F(WX1)	Output Y50 to Y5F (WY5)
3rd axis = Input X20 to X2F (WX2)	Output Y60 to Y6F (WY6)
4th axis = Input X30 to X3F (WX3)	Output Y70 to Y7F (WY7)

2−axis type



1st axis = Input X0 to XF (WX0)	Output Y20 to Y2F (WY2)
2nd axis = Input X10 to X1F(WX1)	Output Y30 to Y3F (WY3)

4.2.2 Contents of Input and Output Allocations

Contact (Relay)	Name		Description	I/O contact (relay) number					
				2–axis type		4–axis type			
				1st axis	2nd axis	1st axis	2nd axis	3rd axis	4th axis
X_0	Pulse output busy	BUSY	Goes on during pulse output. (* Note 1)	X0	X10	X0	X10	X20	X30
X_1	Pulse output done	EDP	Goes on when pulse output ends. (* Note 2)	X1	X11	X1	X11	X21	X31
X_2	Acceleration zone	ACC	Goes on during acceleration zone.	X2	X12	X2	X12	X22	X32
X_3	Constant speed zone	CON	Goes on during constant speed zone.	X3	X13	X3	X13	X23	X33
X_4	Deceleration zone	DEC	Goes on during deceleration zone.	X4	X14	X4	X14	X24	X34
X_5	Rotation direction	DIR	Monitor contact for direction of rotation (direction of increasing elapsed value when on).	X5	X15	X5	X15	X25	X35
X_6	Home input	ZSG	Goes on when home input becomes valid	X6	X16	X6	X16	X26	X36
X_7	Near home input	DOG	Goes on when near home input becomes valid	X7	X17	X7	X17	X27	X37
X_8	Home return done	ORGE	Turns on when home return is done. Goes on until next home return is initiated.	X8	X18	X8	X18	X28	X38
X_9	Comparison result	CLEP	Goes on when elapsed value of internal counter is greater than or equal to the number of comparison pulse.	X9	X19	X9	X19	X29	X39
X_A	Set value change confirmation	CEN	With P point control, this is used to confirm rewriting of set values. (* Note 3)	XA	X1A	XA	X1A	X2A	X3A
X_B	————	——	————	XB	X1B	XB	X1B	X2B	X3B
X_C	————	——	————	XC	X1C	XC	X1C	X2C	X3C
X_D	————	——	————	XD	X1D	XD	X1D	X2D	X3D
X_E	Set value error	SERR	Goes on when a set value error occurs.	XE	X1E	XE	X1E	X2E	X3E
X_F	————	——	————	XF	X1F	XF	X1F	X2F	X3F
Y_0	E point control start	EST	When turned on in the user program, E point control is initiated.	Y20	Y30	Y40	Y50	Y60	Y70
Y_1	P point control start	PST	When turned on in the user program, P point control is initiated.	Y21	Y31	Y41	Y51	Y61	Y71
Y_2	Home return start	ORGS	When turned on in the user program, a home return is initiated.	Y22	Y32	Y42	Y52	Y62	Y72
Y_3	Forward jog	JGF	When turned on in the user program, jog forward rotation is initiated.	Y23	Y33	Y43	Y53	Y63	Y73
Y_4	Reverse jog	JGR	When turned on in the user program, jog reverse rotation is initiated.	Y24	Y34	Y44	Y54	Y64	Y74

Contact (Relay)	Name		Description	I/O contact (relay) number					
				2–axis type		4–axis type			
				1st axis	2nd axis	1st axis	2nd axis	3rd axis	4th axis
Y_5	Forced stop	EMR	When turned on in the user program, operations currently running are interrupted and forcibly terminated.	Y25	Y35	Y45	Y55	Y65	Y75
Y_6	Deceleration stop	DCL	When turned on in the user program, operations currently running are interrupted, and decelerate to a stop.	Y26	Y36	Y46	Y56	Y66	Y76
Y_7	Pulser input enabled	PEN	When turned on in the user program, pulser input is enabled (valid only while on).	Y27	Y37	Y47	Y57	Y67	Y77
Y_8	————	——	————	Y28	Y38	Y48	Y58	Y68	Y78
Y_9	————	——	————	Y29	Y39	Y49	Y59	Y69	Y79
Y_A	————	——	————	Y2A	Y3A	Y4A	Y5A	Y6A	Y7A
Y_B	————	——	————	Y2B	Y3B	Y4B	Y5B	Y6B	Y7B
Y_C	————	——	————	Y2C	Y3C	Y4C	Y5C	Y6C	Y7C
Y_D	————	——	————	Y2D	Y3D	Y4D	Y5D	Y6D	Y7D
Y_E	————	——	————	Y2E	Y3E	Y4E	Y5E	Y6E	Y7E
Y_F	Error clear	ECLR	If a set value error occurs, the error is canceled when this is turned on in the user program.	Y2F	Y3F	Y4F	Y5F	Y6F	Y7F

Notes

1) **This goes on during pulse output in various operations such as E point control, P point control, home return, and jog operation, and remains on until the operation has been completed.**

2) **This goes on when the various operations such as E point control, P point control, jog operation, and pulser input operation have been completed.**
It also goes on when deceleration stop have been completed, and when a forcible stop has been completed.
It goes off when the next operation such as E point control, P point control, jog operation, a home return, or pulser input operation is initiated.

3) **This goes on when P point control or E point control is initiated, and goes off when the shared memory write instruction F151 is executed, and data of any kind is written to the shared memory of the positioning unit.**

4) **The input and output relay numbers indicate the number when the unit number is 0. The numbers actually used change depending on the position in which the unit is installed.**

4.2.3 Confirming the Allotted I/O Number and Slot Number

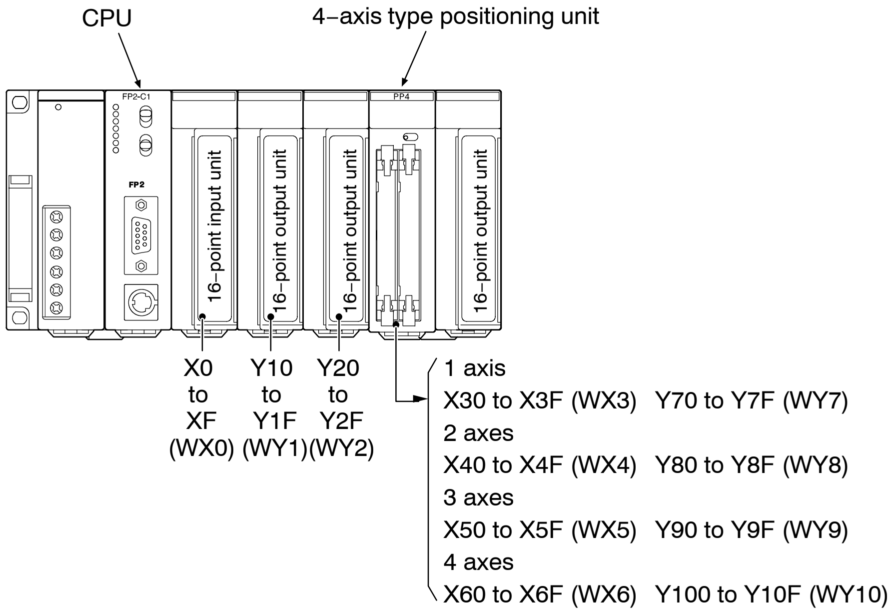
The I/O numbers and slot numbers are always required when creating a program. These change depending on the position at which the unit is installed on the backplane, and should always be checked to make sure they match the design.
For information on allocating I/O numbers, refer to the FP2 hardware manual, “section: I/O Allocation”.

4.2.3.1 Confirming I/O Number Allocations

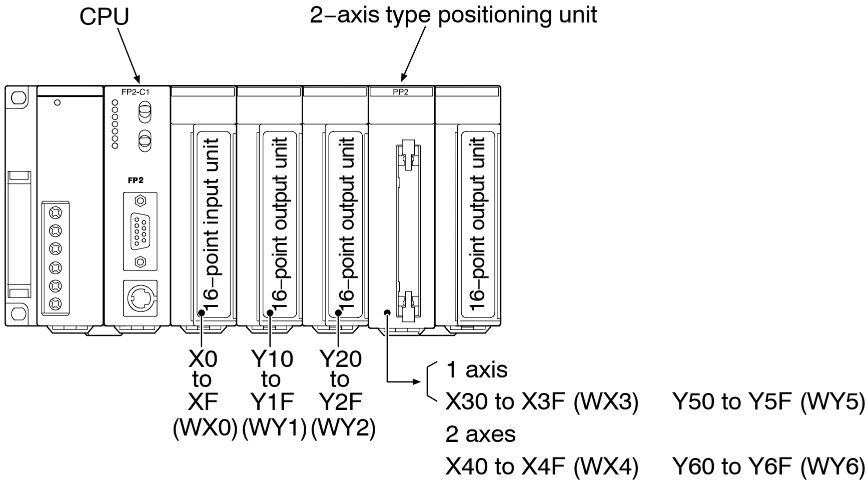
The occupied I/O areas for all of the units mounted between the CPU and the positioning unit should be confirmed. These are allocated as I/O areas for the positioning unit, starting from the serial number.

Example:

The following is an example of a 4−axis type positioning unit being mounted in succession following three 16−point units.



The following is an example of a 2–axis type positioning unit being mounted in succession following three 16–point units.



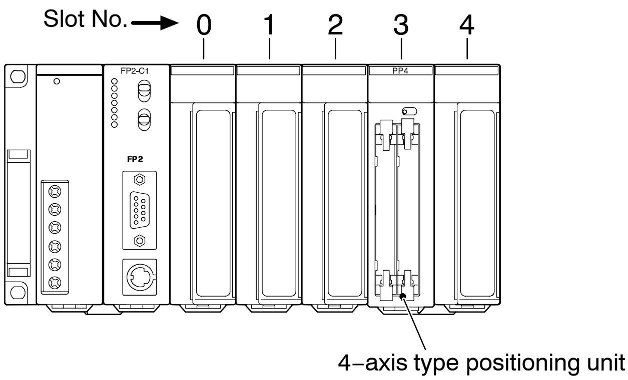
Notes

- **If there are any empty slots between the CPU and the positioning unit, check to see whether an I/O area has been allocated to the empty slot.**
- **If I/O mount allocation and automatic allocation are being carried out, 16 points for each type of allocation will automatically be assigned to empty slots.**
- **If the CPU being used is a 2–module type, also check any I/O areas occupying the units incorporated in the CPU.**

4.2.3.2 Confirming Slot No.

When mounted on the CPU backplane

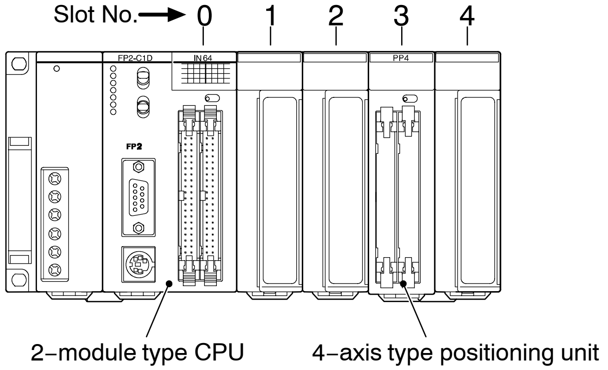
Slots are numbered in sequential order, with the slot to the right of the CPU being No. 0.



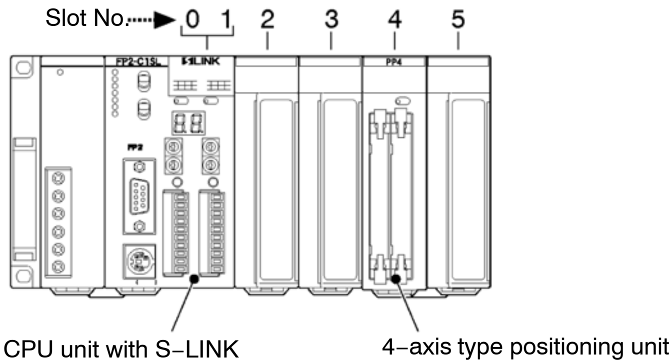
4.2 Confirming the Slot Number and I/O Number Allocations

Notes

- **If the CPU being used is a 2−module type, the slot number of the unit incorporated in the CPU should be counted as “0”.**

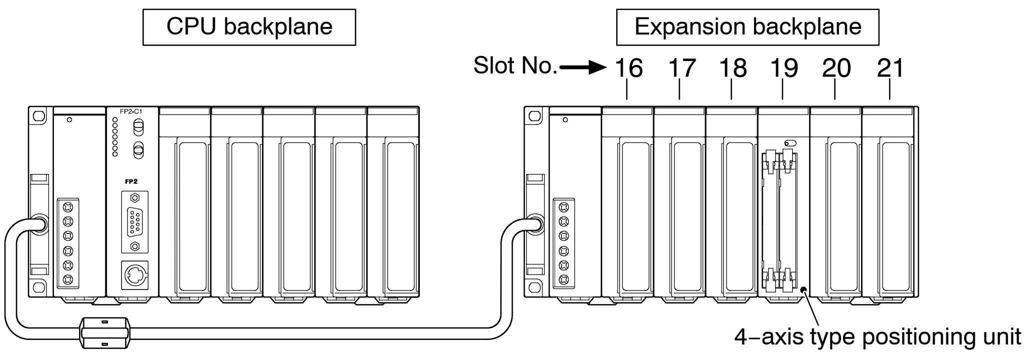


- **If the CPU unit with S−LINK is used, the slot number of the unit incorporated in the CPU should be counted as “0 and 1”.**



When mounted on an expansion backplane

The slot number of the slot to the right of the power supply unit on the expansion backplane should be counted as “16”.



4.3 Increment and Absolute

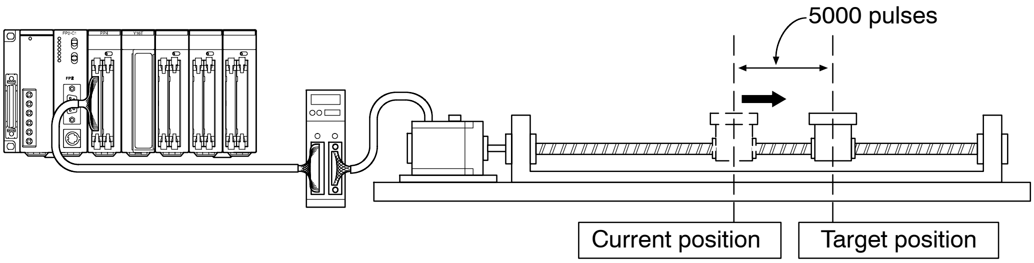
With automatic acceleration/deceleration control, the position command value should be specified in advance as a numeric value (a number of pulses).
There are two ways to specify this numeric value, described below. Select whichever method is appropriate for the usage conditions. (For detailed information on entering settings, refer to Chapter 6, "Automatic Acceleration/Deceleration Control (E point control)", and Chapter 7, "Automatic Acceleration/Deceleration Control (P point control)".

4.3.1 Increment (relative value control)

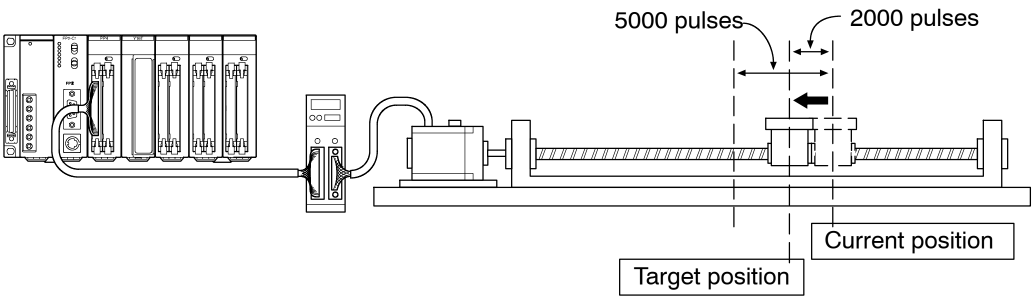
The position command value is normally specified as the relative position from the current position, using a number of pulses.

Example:

Travels from the current position to a position + 5,000 pulses away.
"+5000" pulses is set as the position command value, and travel is carried out.



"−2000 pulses" is set as the next position command value, and travel is carried out.

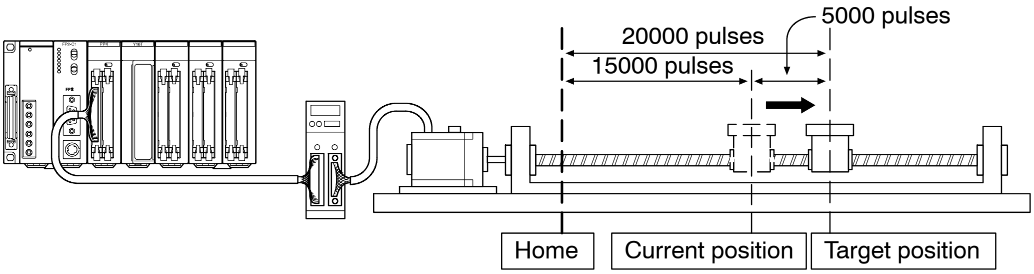


4.3.2 Absolute (absolute value control)

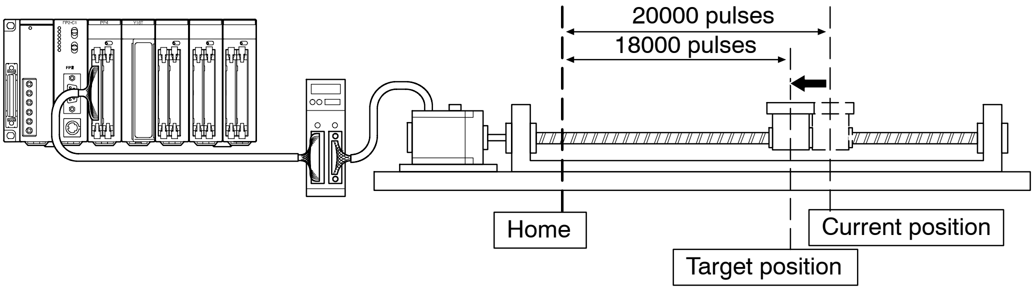
The position command value is normally specified as the absolute position from the home position, using a number of pulses.

Example:

If the unit is 15,000 pulses away from the home position, it travels +5,000 pulses.
"+20000 pulses" is set as the position command value, and travel is carried out.



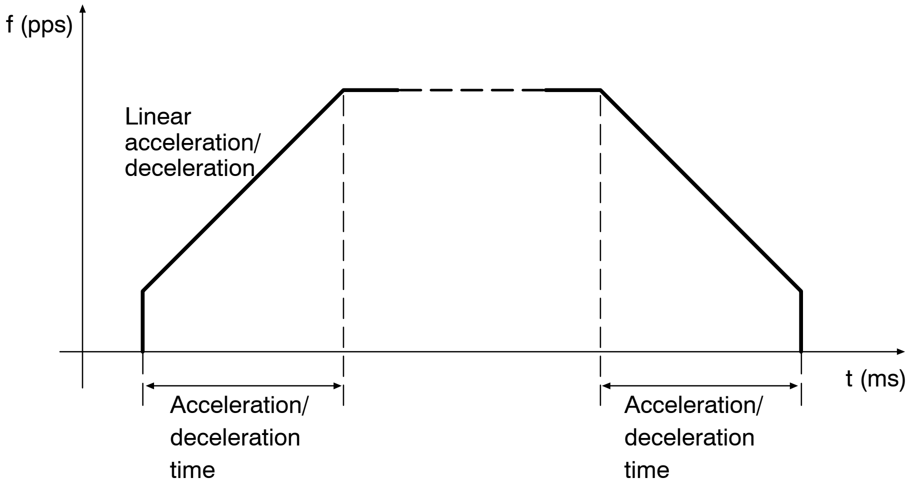
"+18000 pulses" is set as the next position command value, and travel is carried out.



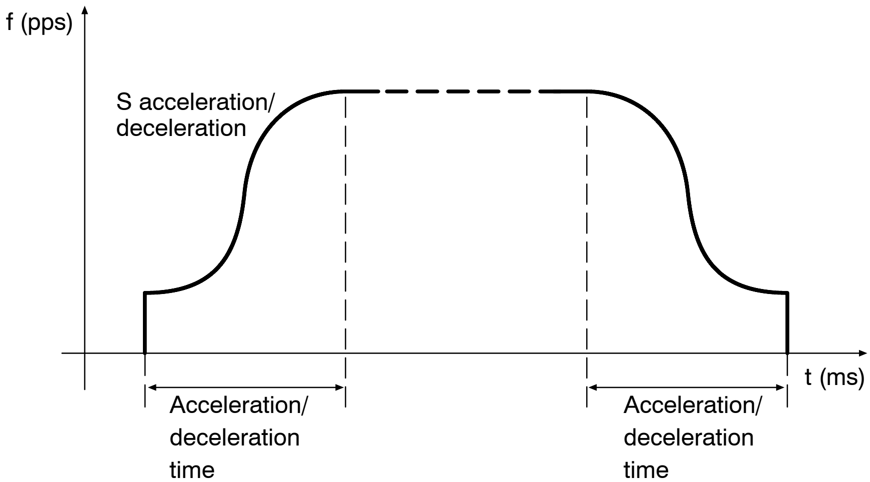
4.4 Selection of Acceleration/Deceleration Method

4.4.1 Linear and S Acceleration/Decelerations

The FP2 positioning unit has two methods of acceleration and deceleration which can be selected: linear acceleration/deceleration and S acceleration/deceleration. With linear acceleration/deceleration, acceleration and deceleration (the acceleration from the starting speed to the target speed, and the reverse) are carried out in a straight line (acceleration and deceleration take place at a constant percentage).



S acceleration/deceleration is carried out along an S−shaped curve. When acceleration or deceleration is first begun, the speed is relatively slow, and gradually increases. When the acceleration or deceleration has been almost completed, the speed slows once again. This results in comparatively smooth movement.



4.4.2 Indicating the Method of Acceleration/Deceleration

Indicating the method of acceleration/deceleration

This is specified in the program, as a control code.

Example: With E point control

```
 R0
-| |--(DF)--[ F1  DMV  , H   0   ,  DT 0 ]
                        (Control code)
            [ F1  DMV  , K  500   ,  DT 2 ]
            [ F1  DMV  , K10000   ,  DT 4 ]
            [ F1  DMV  , K  100   ,  DT 6 ]
            [ F1  DMV  , K100000  ,  DT 8 ]

            [ F151 WRT , K 1 , DT 0 , K 10 , H 100 ]
```

The method of control varies depending on the control code.

- When the code is H0: increment, linear acceleration/deceleration
- When the code is H1: absolute, linear acceleration/deceleration
- When the code is H2: increment, S acceleration/deceleration
- When the code is H3: absolute, S acceleration/deceleration

4.5 Internal Absolute Counter

4.5.1 How the Internal Absolute Counter Works

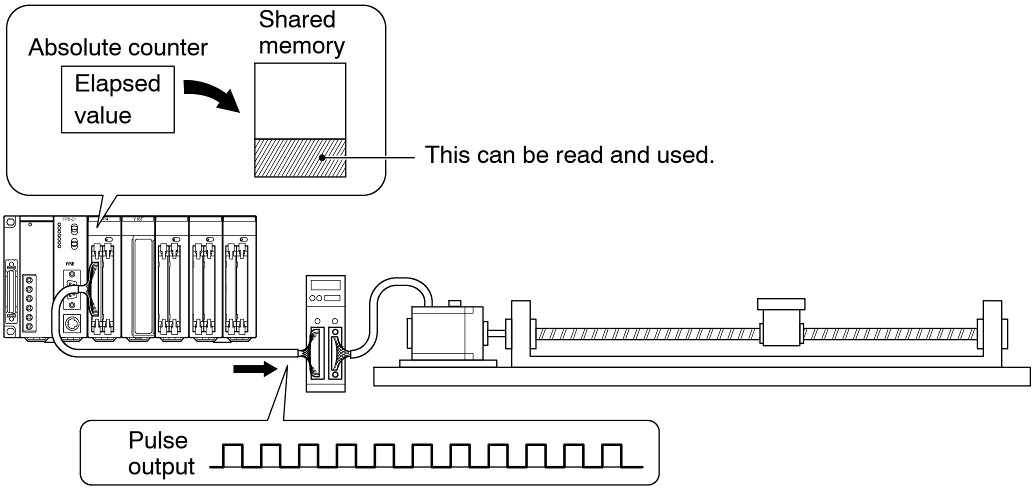
How the internal absolute counter works

The positioning unit is equipped with a function that counts the number of pulses output through pulse output.

The counted value is stored in the shared memory area of each of the axes.

The stored value is read by the user program, enabling the position data (absolute value) to be discerned. This is used in functions such as teaching during jog operation.

Using the comparison relay output function, external output can be obtained in response to the count value, through the user program.



How the internal absolute counter operates

When the power supply is turned off, the counter value is set to zero (0).

When the table returns to the home position in a home return, the counter value becomes zero (0).

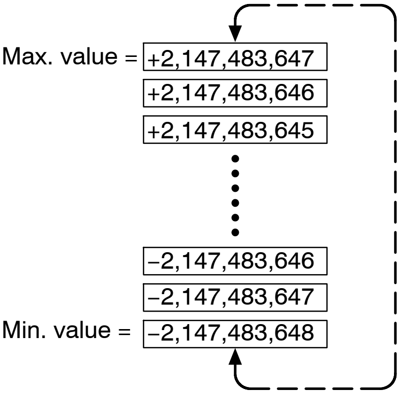
The counter value is counted as an absolute value, based on the pulse output value.

The value stored in the shared memory can be read using the **F150**/**P150** instruction in the user program.

The counter value can be overwritten using the **F151**/**P151** instruction in the user program.
Overwriting should be done while the operation is stopped.

Countable range of the counter

–2,147,483,648 to +2,147,483,647



If the elapsed value exceeds the maximum (or minimum) value, it returns to the minimum (maximum) value. Pulse output does not stop if this occurs, and no error occurs.

Shared memory address in which the counter value is stored

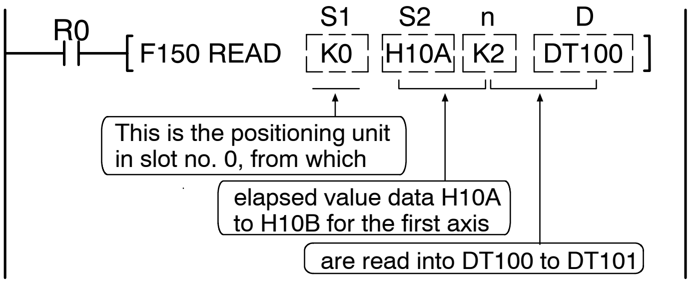
Address of shared memory (hexadecimal)				**Description**	
1 axis	**2 axes**	**3 axes**	**4 axes**		
10Ah	11Ah	12Ah	13Ah	Elapsed value count (absolute)	Signed 32–bit –2,147,483,648 to +2,147,483,647
10Bh	11Bh	12Bh	13Bh		

4.5.2 Reading Elapsed Value

The **F150/P150** instructions are used to read the elapsed value from the shared memory of the positioning unit.

F150 (READ)/P150 (PREAD) instruction

These are the instructions used to read data from the memory of the intelligent unit.



Explanation

“n” words of the data stored in the shared memory of the unit mounted in the slot specified by “S1” are read from the address specified by “S2”, and are stored in the area of the CPU specified by “D”.

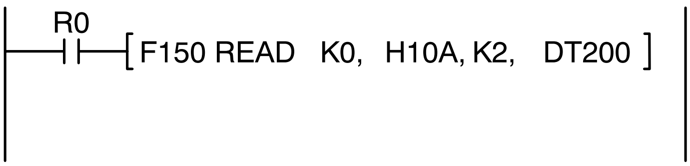
Specified addresses

Data (elapsed values) are stored as 32−bit data.

Address of shared memory (hexadecimal)				Description	
1 axis	2 axes	3 axes	4 axes		
10Ah	11Ah	12Ah	13Ah	Elapsed value count (absolute)	Signed 32−bit −2,147,483,648 to +2,147,483,647
10Bh	11Bh	12Bh	13Bh		

Program example

Reads the elapsed value stored in the addresses starting from H10A of the positioning unit’s shared memory and stores the elapsed value in the data registers DT200 and DT201.

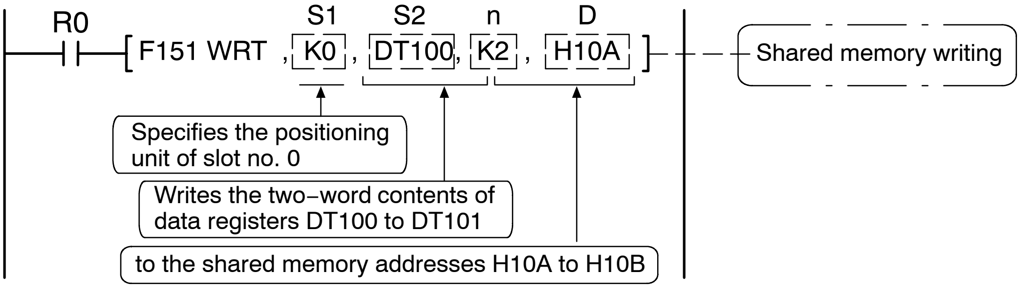


4.5.3 Writing Elapsed Value

The **F151**/**P151** instructions are used to write data to the shared memory of the positioning unit.

F151 (WRT)/P151 (PWRT) instruction

These are the instructions that write data to the shared memory of the intelligent unit.



Explanation

This stores the contents of the CPU area specified by “S2” and “n” in the address specified by “D” of the shared memory of the unit mounted in the slot specified by “S1”, at the beginning of the memory area.

Specified addresses

Data (elapsed values) are stored as 32–bit data.

Address of shared memory (hexadecimal)				**Description**	
1 axis	**2 axes**	**3 axes**	**4 axes**		
10Ah	11Ah	12Ah	13Ah	Elapsed value count (absolute)	Signed 32–bit –2,147,483,648 to +2,147,483,647
10Bh	11Bh	12Bh	13Bh		

Note

Elapsed values should be written while the operation is stopped.

Program example

Writes the data “0 (zero)” into the elapsed value area.

```
R0
--| |----[ F1  DMV  ,  K  0 ,  DT 100 ]
         [ F151 WRT, K 0 , DT 100 , K 2 , H 10A ]
```

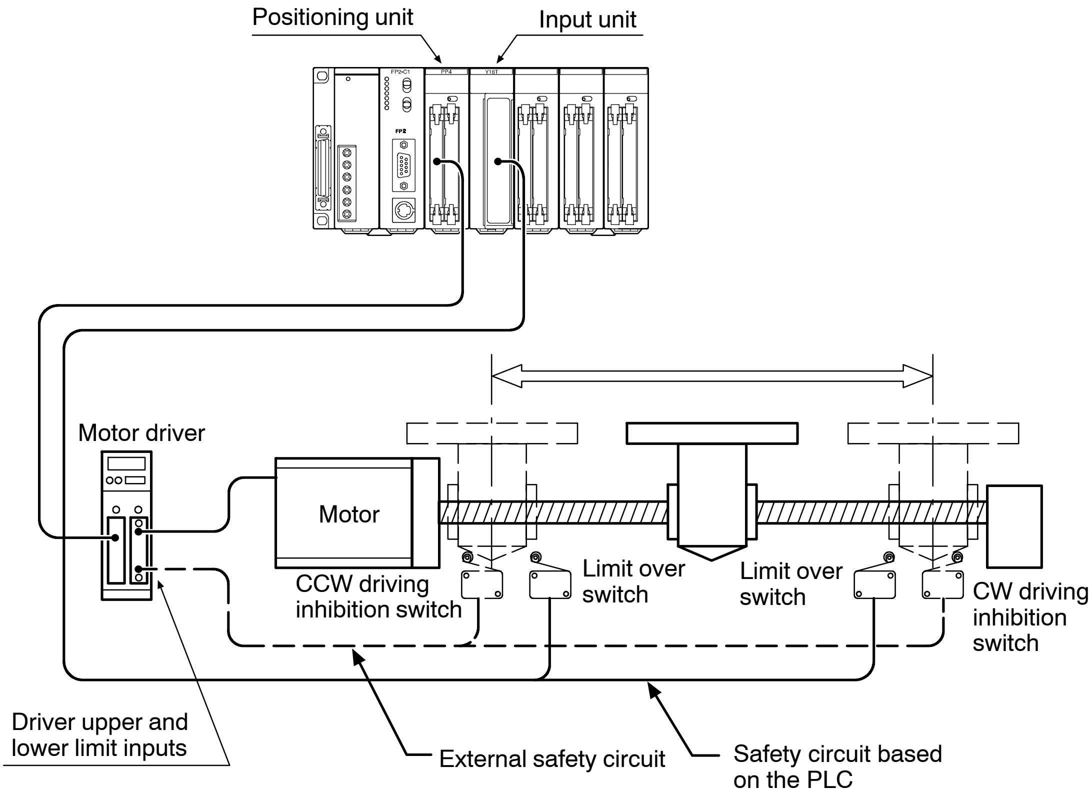
Chapter 5

Turning the Power On and Off, and Booting the System

5.1 Safety Circuit Design

Example of a safety circuit

Installation of the limit over switch



Safety circuit based on the PLC

Install the limit over switch as shown in the illustration above.

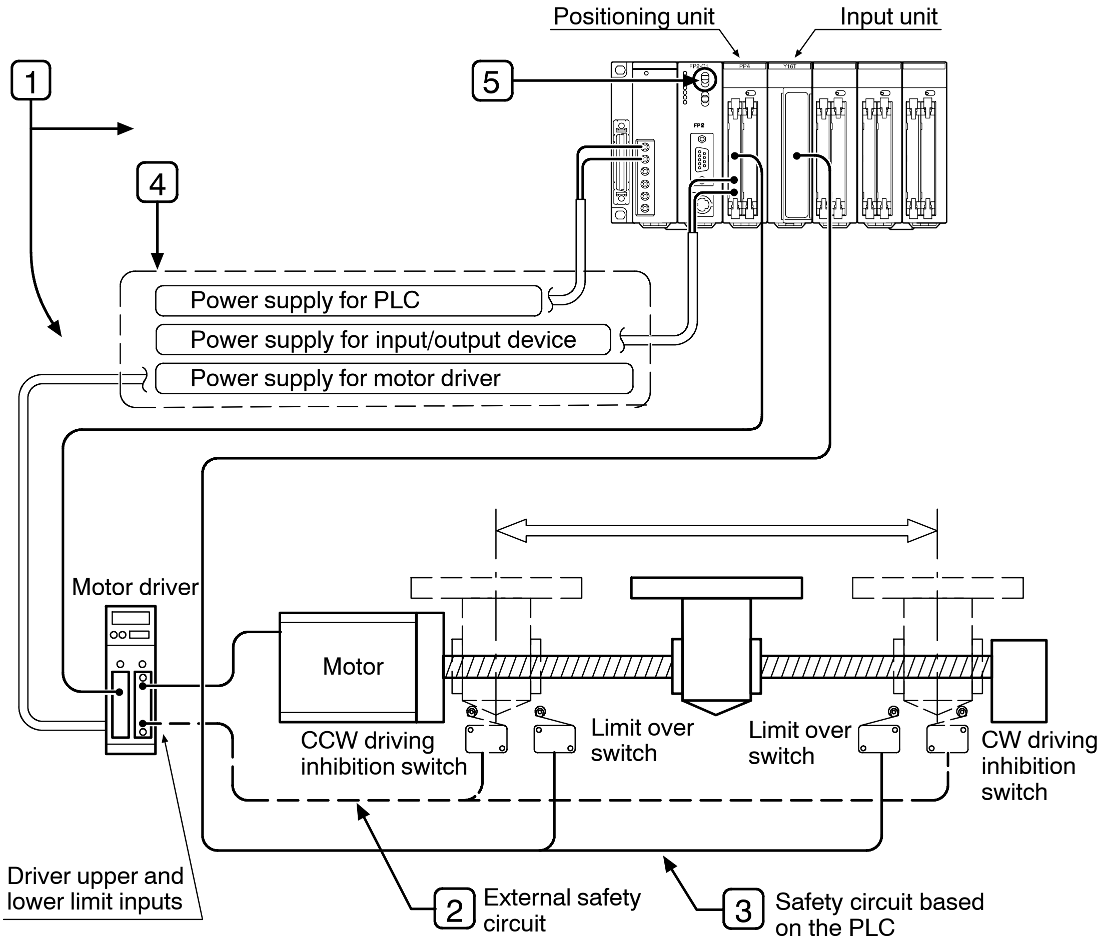
Safety circuit based on external circuit

Install the safety circuit recommended by the manufacturer of the motor being used.

5.2 Before Turning ON the Power

Items to check before turning on the power

System configuration example



1. Checking connections to the various devices

Check to make sure the various devices have been connected as indicated by the design.

2. Checking the installation of the external safety circuit

Check to make sure the safety circuit based on an external circuit (wiring and installation of limit over switch) has been installed securely.

3. Checking the installation of the safety circuit based on the PLC

Check the connections between the input unit for the PLC and the limit over switch. Also check to make sure the limit over switch has been installed correctly.

4. Checking the procedure settings for turning on the power supplies

Make sure settings have been entered so that power supplies will be turned on according to the procedure outlined in section 5.3.1, “Procedure for Turning On the Power”.

5. Checking the CPU mode selection switch

Set the CPU in the PROG. mode. Setting it in the RUN mode can cause inadvertent operation.

☞ **Note**

When the power to the PLC is turned on, internal data in the shared memory will be cleared (set to zero). Check to see whether the startup contact relays for the various operations of the positioning unit are on. If they are, a set value error will occur for the positioning unit, unless the data settings for the shared memory have been entered.

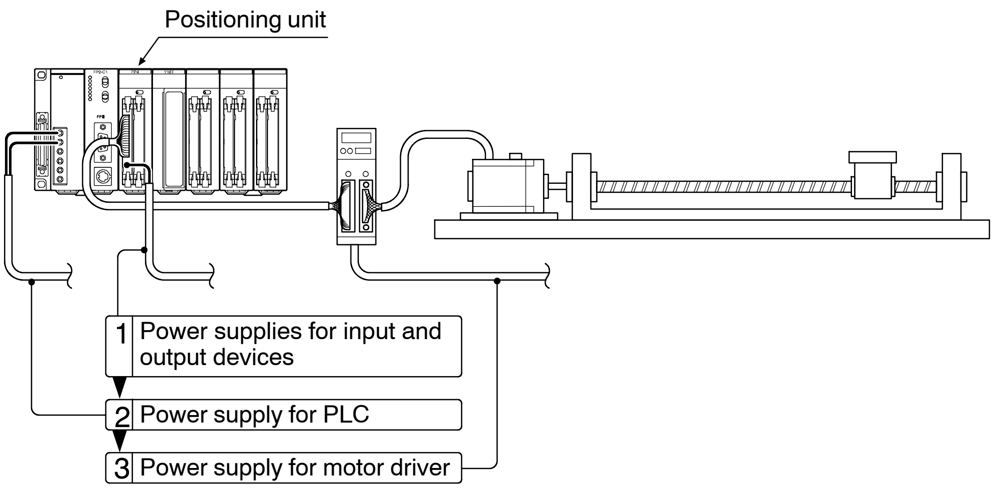
5.3 Procedure for Turning On the Power

When turning on the power to the system incorporating the positioning unit, the nature and statuses of any external devices connected to the system should be taken into consideration, and sufficient care should be taken that turning on the power does not initiate unexpected movements or operations.

5.3.1 Procedure for Turning On the Power

Procedure:

1. **Turn on the power supplies for input and output devices connected to the PLC (including the power supply for the line driver output or open collector output).**
2. **Turn on the power supply for the PLC.**
3. **Turn on the power supply for the motor driver.**



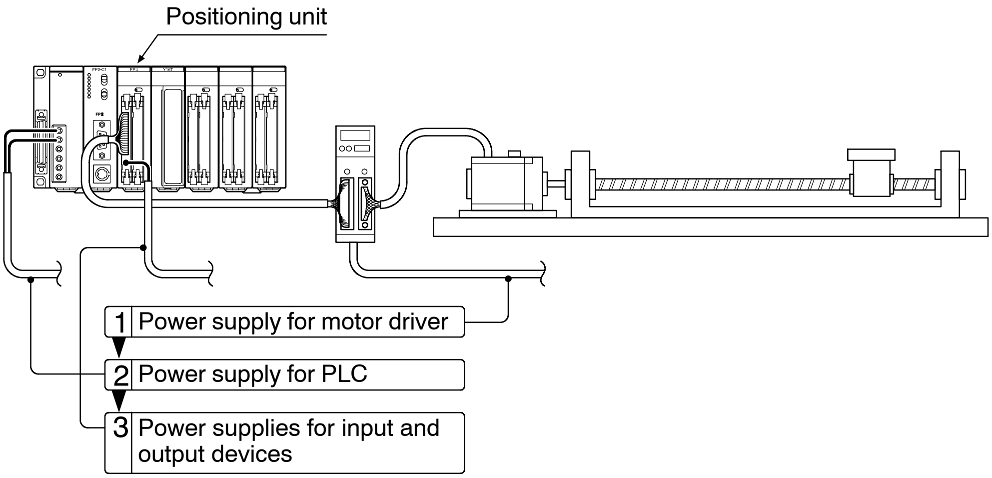
Note

The power supply for the PLC should not be turned on and off with the power supply for the motor driver on. When the power supply is turned on and off, one pulse may be output from the unit, causing the motor to move. The program should be set up so that, for normal operation, a home return is carried out when the power supply is turned on.

5.3.2 Procedure for Turning Off the Power

Procedure:

1. **Check to make sure the rotation of the motor has stopped, and then turn off the power supply for the motor driver.**
2. **Turn off the power supply for the PLC.**
3. **Turn off the power supplies for input and output devices connected to the PLC (including the power supply for the line driver output or open collector output).**



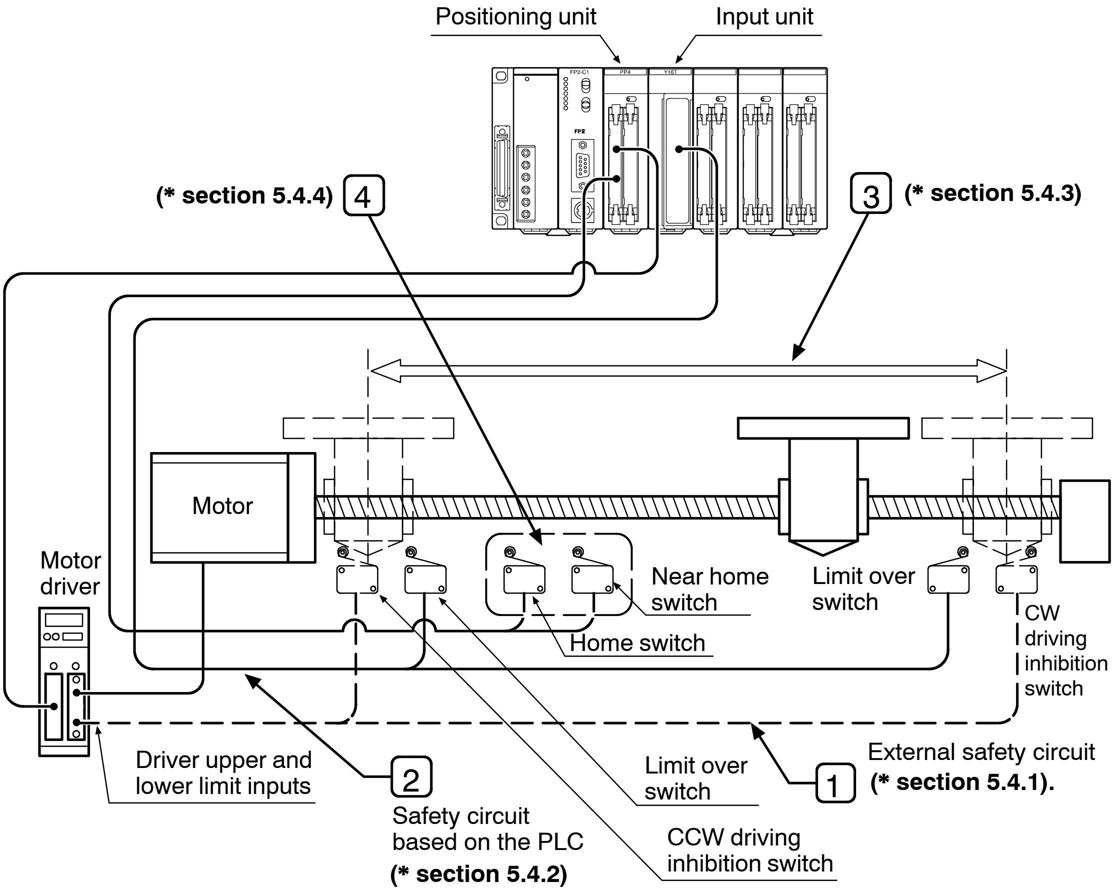
Precautions when rebooting the system

The contents of the operation memory are initialized simply by initializing the CPU, but the contents of the shared memory for the positioning unit are retained.
If the positioning unit is operated with data still in the shared memory, operation may be carried out based on any set values which have been retained, in some cases. The contents of the shared memory are cleared when the power supply is turned off.

5.4 Procedure Prior to Starting Operation

Items to check when the power is on

System configuration example



Checking should be carried out in the four general stages shown below.

5.4.1 Checking the External Safety Circuit

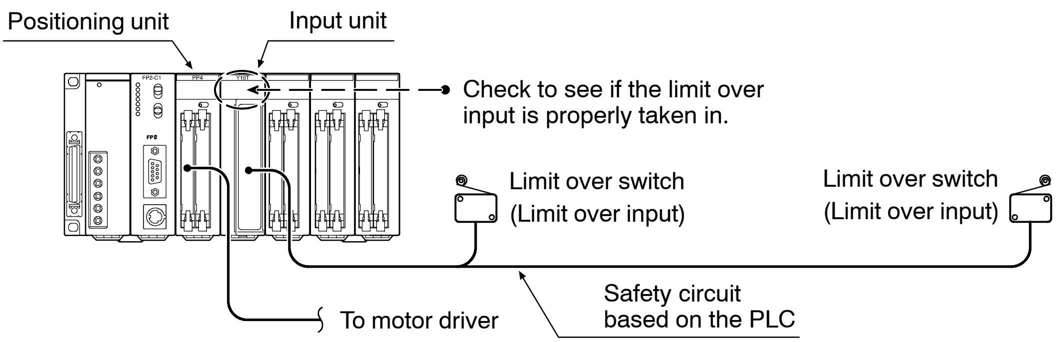
Check the safety circuit recommended by the manufacturer of the motor, by checking the power supply cutoff of the motor driver and other functions, using limit over input through an external circuit.

5.4.2 Checking the Safety Circuit Based on the PLC

Procedure:

1. **Using forced operation of the limit over input for the PLC safety circuit, check to see if the limit input is being properly taken in by the input unit for the PLC.**
2. **If necessary, input a program that causes the emergency stop circuit of the positioning unit to be triggered when the limit over input is activated. Check both the jog operation and forced operation of the limit input.**
3. **Using the jog operation, check to see if the limit over input is functioning properly.**

For detailed information about jog operation ☛ chapter 8



5.4.3 Checking the Rotation and Travel Directions, and the Travel Distance

Procedure:

1. **Using jog operation or automatic acceleration/deceleration, check to make sure that the directions of rotation and travel are correct.**

   Points to check

   The direction of rotation is determined by the driver wiring, the settings of the dip switches at the back of the unit, and the data set in the program.

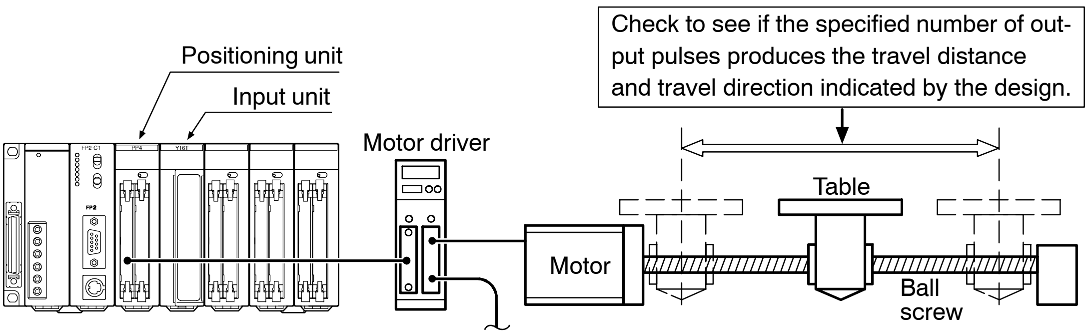
   For information on automatic acceleration/deceleration, refer to chapter 6 or chapter 7.

   For information on dip switch settings at the back of the unit, refer to chapter 4.

2. **Check to see if the specified number of pulses produces the travel distance indicated by the design.**

   Points to check

   The travel distance is determined by the ball screw pitch, the reduction gear, the electronic multiplication ratio of the driver, the number of pulses specified in the program, and other factors.



5.4.4 Checking the Operation of the Near Home Switch and Home Switch

Procedure:

1. **Using forced operation of the home input and near home input, check to make sure the operation display LEDs on the positioning unit light. At the same time, using programming tools, monitor the X_6 and X_7 input contact relays, and check them in the same way.**

2. **Input the home return program, and actually carry out a home return, checking to see if near home input produces deceleration.**

   Points to check

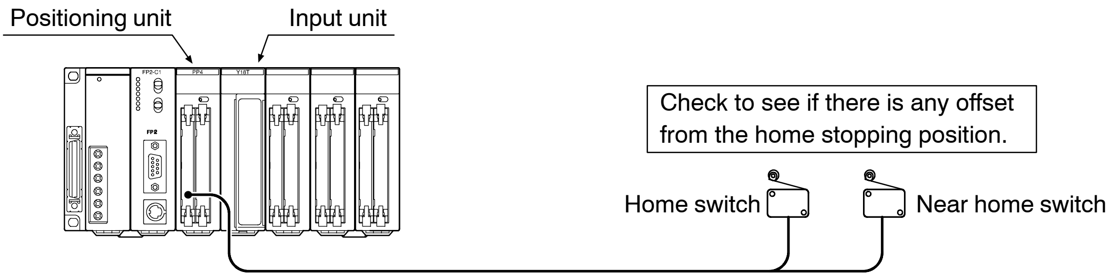
   The input valid logic for the home input and near home input is determined by the control codes of the program.

3. **Using repeated jog operation and home return operation, check to make sure the table stops properly at the home position, with no offset.**

   Points to check

   There may be times when near home input, the home input position, and the return speed causes offset from the home position.

4. **If the table does not stop precisely at the home position, either change the position of the near home input, or reduce the home return speed, so that the table stops precisely at the home position.**



Note

If the CPU is switched from the RUN to the PROG. mode while the positioning unit is in operation, the table decelerates and stops.

For detailed information about deceleration and stopping ☛ chapter 11.

Chapter 6

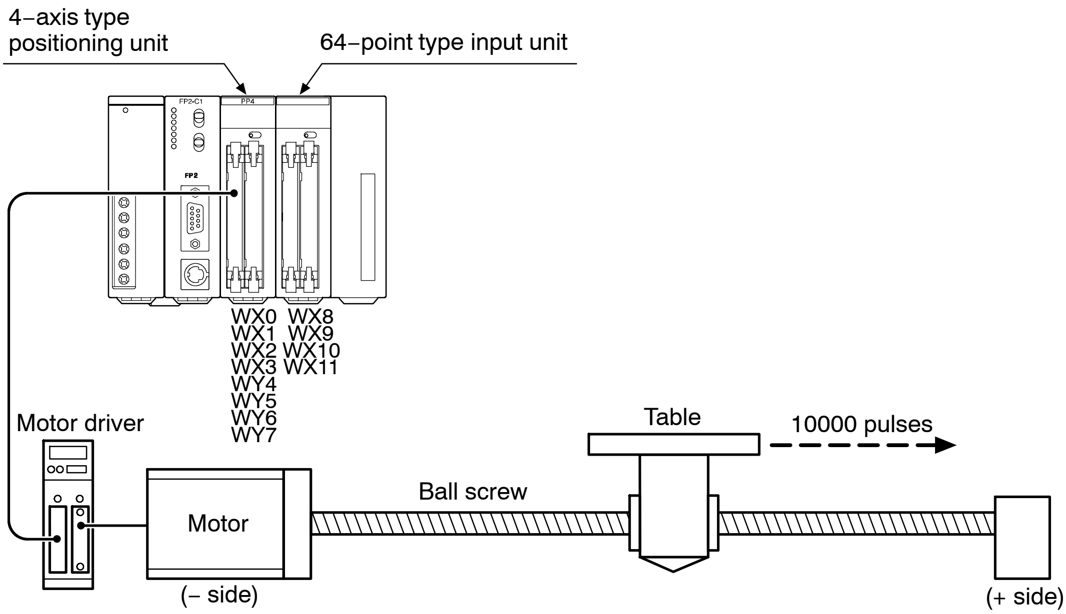
Automatic Acceleration/Deceleration Control

(E Point Control: Single–Speed Acceleration/Deceleration)

6.1 Sample Program

6.1.1 Increment (Relative Value Control): Plus (+) Direction

For this control, the "Increment" method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side.



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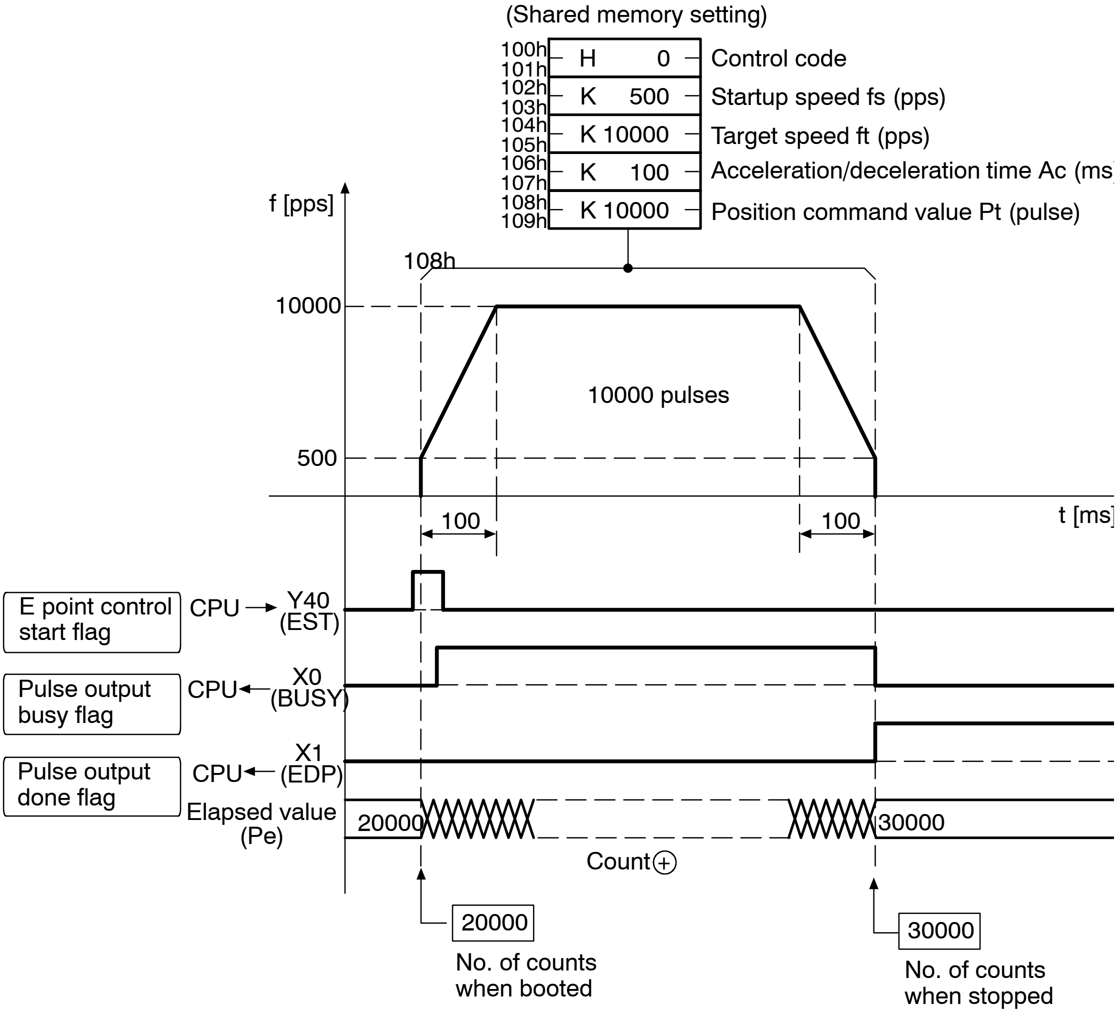
Pulse output diagram



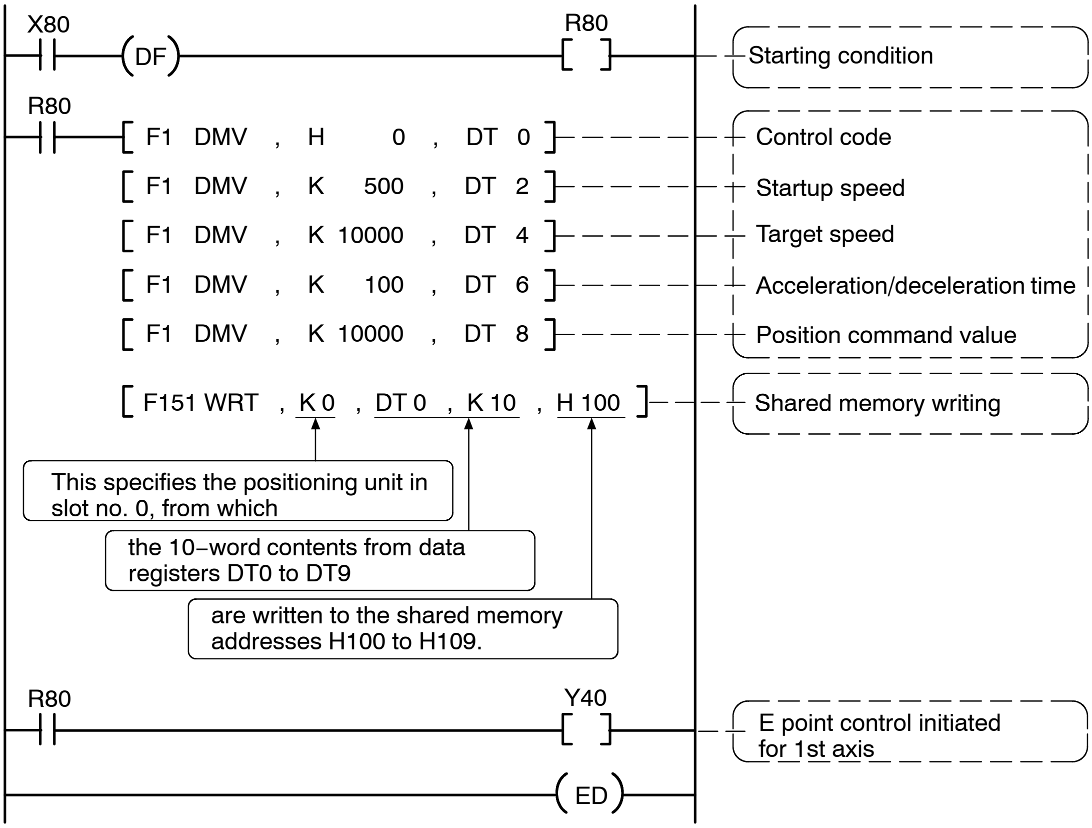
Operations of the various flags

- The pulse output busy flag (X0) goes on when E point control is initiated, and goes off when pulse output is completed.
- The pulse output done flag (X1) goes on when pulse output is completed, and is maintained until the next E point control, P point control, Jog operation, home return, or pulser input enabled status is initiated.
- The elapsed value is stored as the absolute value in the counter in the positioning unit.

Shared memory setting

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H0 Increment, Linear acceleration/deceleration	H0: Increment, Linear acceleration/deceleration H2: Increment, S acceleration/deceleration
Startup speed (pps)	K500	K10 to K1000000 (K10 is the recommended value.)
Target speed (pps)	K10000	K11 to K1000000 Set a value larger than the startup speed. (K11 is the recommended value.)
Acceleration/ deceleration time (ms)	K100	K0 to K32767
Position command value (pulse)	K10000	K−2147483648 to K2147483647

Program



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Precautions concerning the program

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, jog operation, home returns, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, the target speed, the acceleration/deceleration time, or the position command value exceed the range of values which can be specified, a set value error will occur, and operation cannot be initiated.
- The number of the startup contact relay varies depending on the number of axes the unit has, and the installation position.

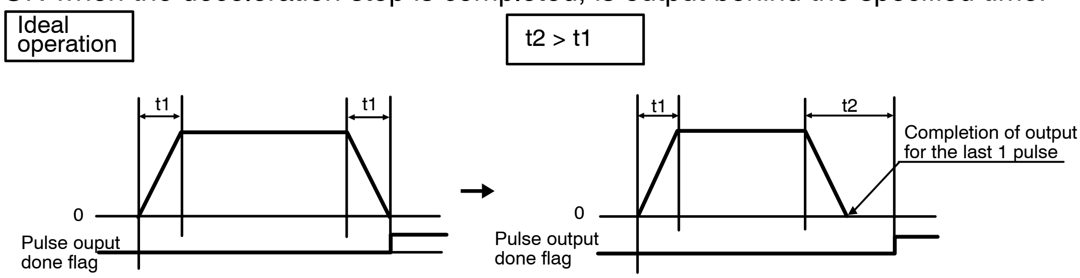
For detailed information about contact relay number ☛ Section 4.2.3.1 and 14.3

- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

For detailed information about slot number ☛ Section 4.2.3.2

For detailed information about shared memory area address ☛ Section 14.2

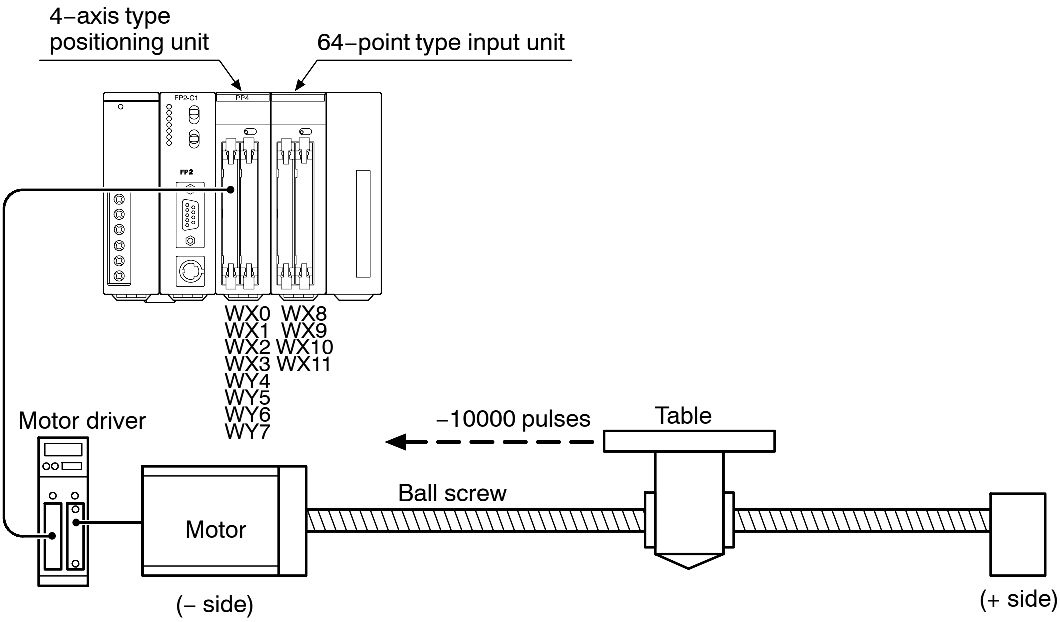
- In the case where the startup speed is set to the extremely small value (0 to few pps) in E point control and P point control, the pulse output done flag, which turns ON when the deceleration stop is completed, is output behind the specified time.



For the ideal deceleration stop, the startup speed of 10 pps or more is recommended to set.

6.1.2 Increment (Relative Value Control): Minus (–) Direction

For this control, the "Increment" method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side.



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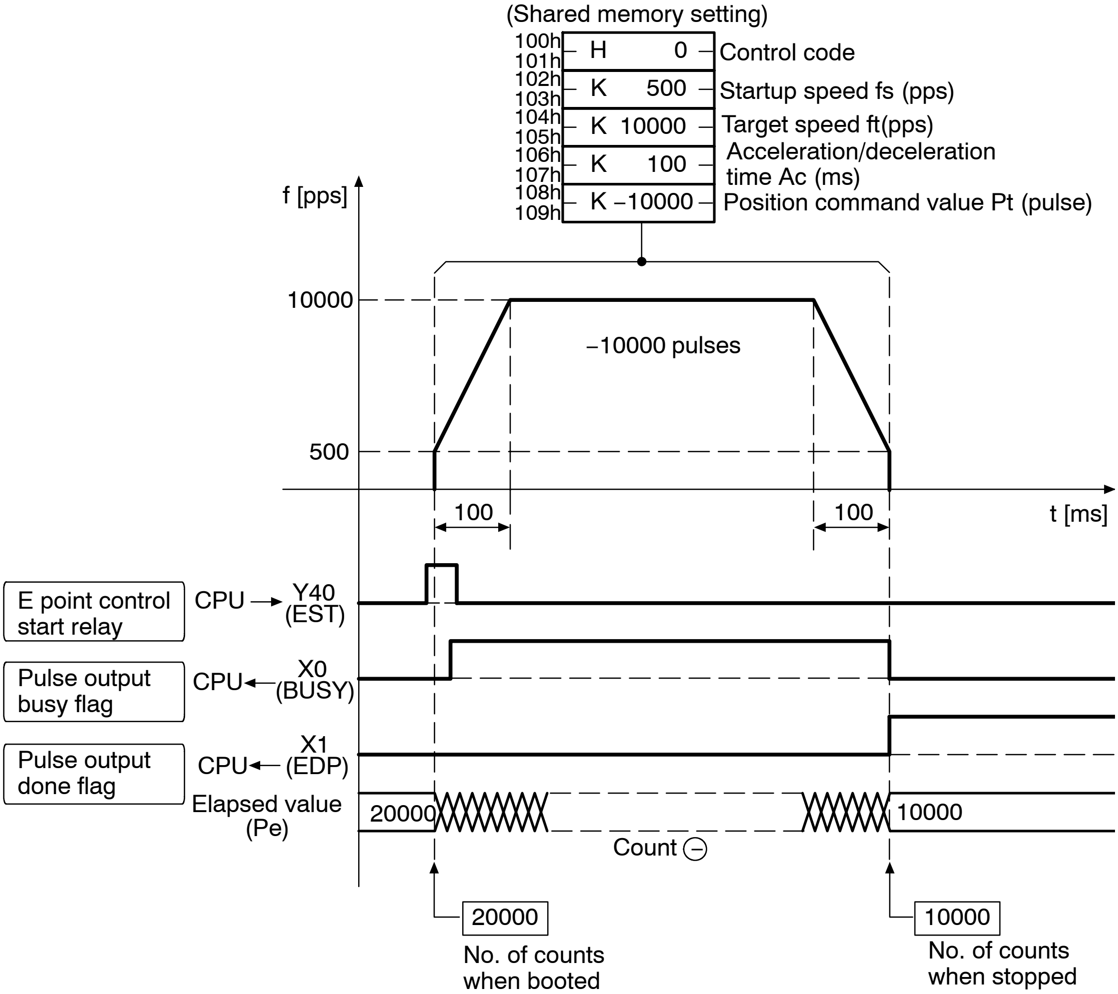
Pulse output diagram



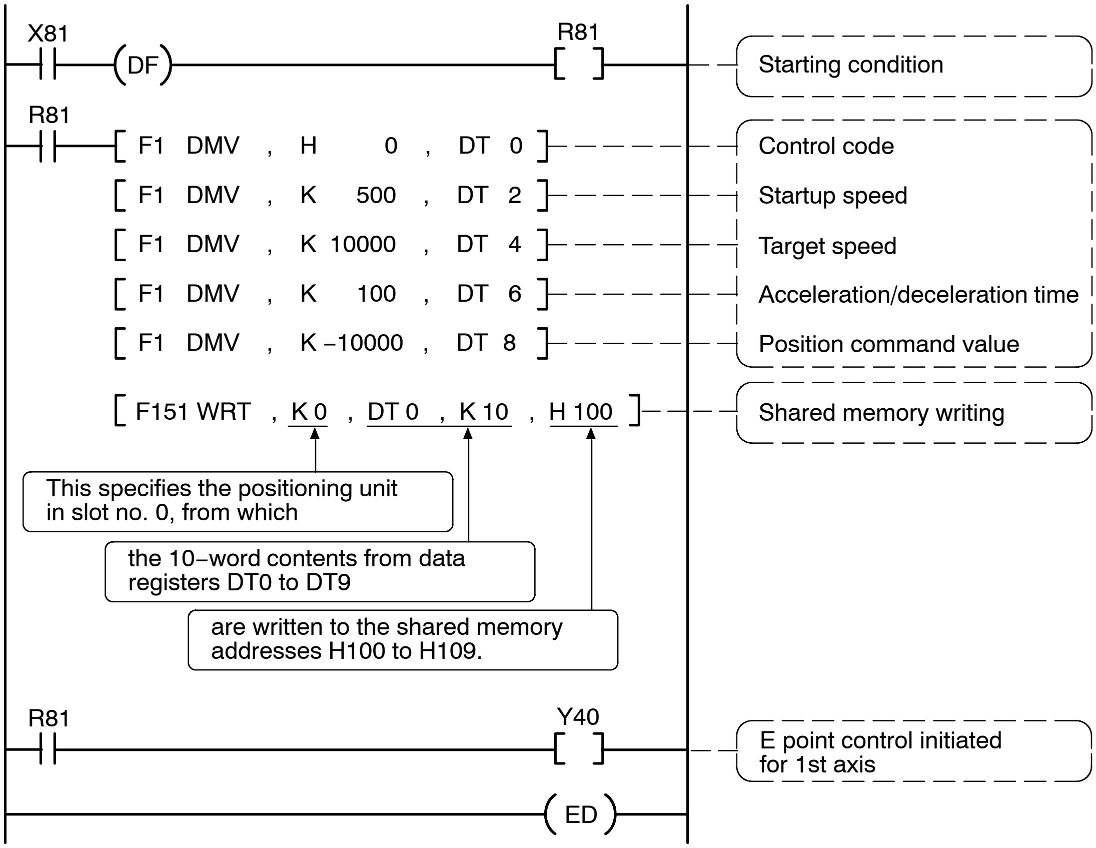
Operations of the various flags

- The pulse output busy flag (X0) goes on when E point control is initiated, and goes off when pulse output is completed.
- The pulse output done flag (X1) goes on when pulse output is completed, and is maintained until the next E point control, P point control, jog operation, home return, or pulser input enabled status is initiated.
- The elapsed value is stored as the absolute value in the counter in the positioning unit.

Shared memory setting

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H0 Increment, Linear acceleration/deceleration	H0: Increment, Linear acceleration/ deceleration H2: Increment, S acceleration/deceleration
Startup speed (pps)	K500	K10 to K1000000 (K10 is the recommended value.)
Target speed (pps)	K10000	K11 to K1000000 Set a value larger than the startup speed. (K11 is the recommended value.)
Acceleration/ deceleration time (ms)	K100	K0 to K32767
Position command value (pulse)	K–10000	K–2147483648 to K2147483647

Program



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Precautions concerning the program

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, jog operation, home returns, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, the target speed, the acceleration/deceleration time, or the position command value exceed the range of values which can be specified, a set value error will occur, and operation cannot be initiated.
- The number of the startup contact relay varies depending on the number of axes the unit has, and the installation position.

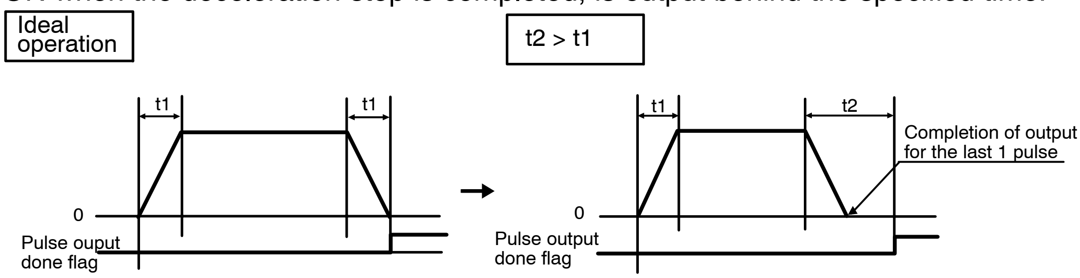
For detailed information about contact relay number ☛ Section 4.2.3.1 and 14.3

- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

For detailed information about slot number ☛ Section 4.2.3.2

For detailed information about shared memory area address ☛ Section 14.2

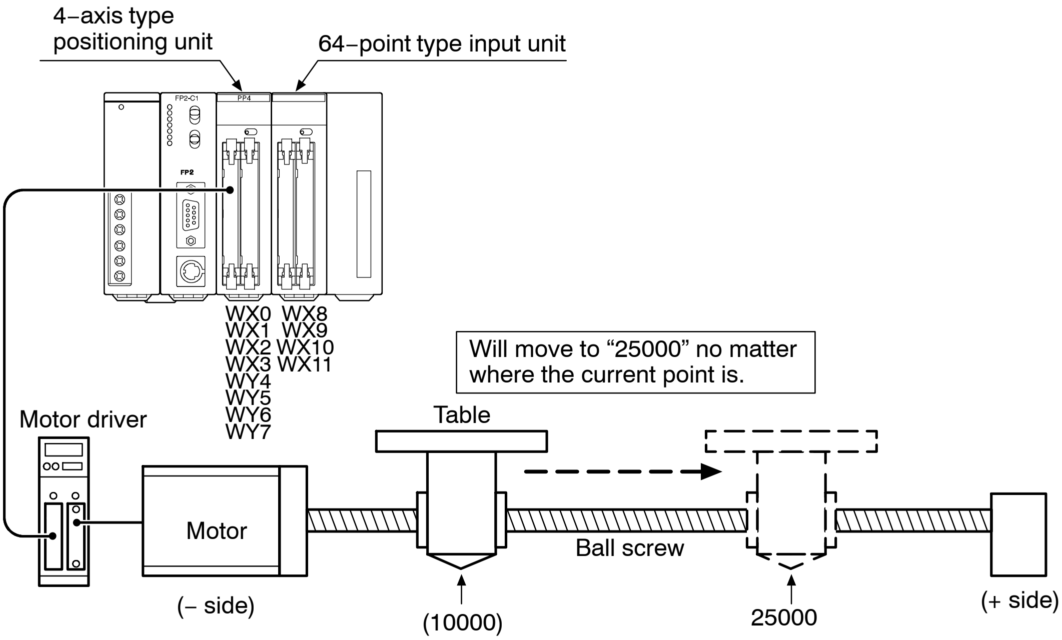
- In the case where the startup speed is set to the extremely small value (0 to few pps) in E point control and P point control, the pulse output done flag, which turns ON when the deceleration stop is completed, is output behind the specified time.



For the ideal deceleration stop, the startup speed of 10 pps or more is recommended to set.

6.1.3 Absolute (Absolute Value Control)

For this control, the “Absolute” method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side.



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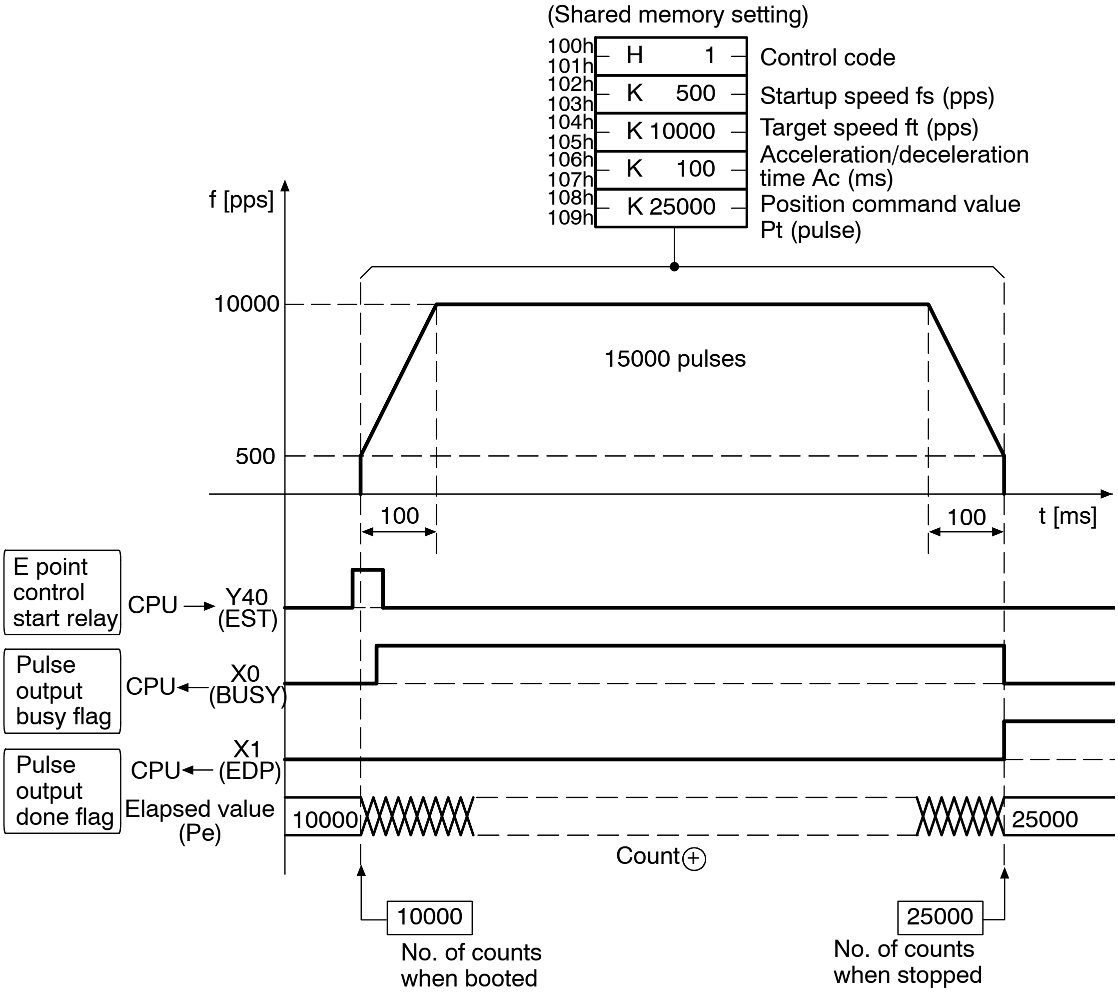
Pulse output diagram



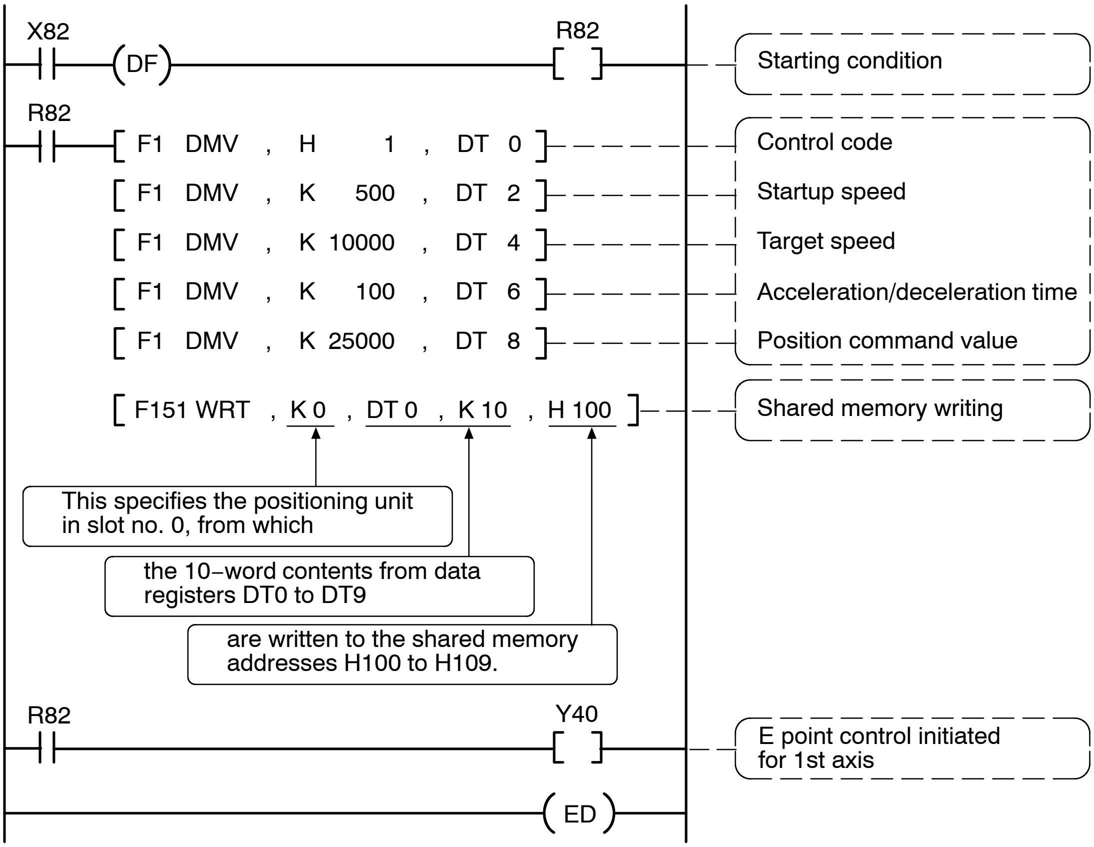
Operations of the various flags

- The pulse output busy flag (X0) goes on when E point control is initiated, and goes off when pulse output is completed.
- The pulse output done flag (X1) goes on when pulse output is completed, and is maintained until the next E point control, P point control, jog operation, home return, or pulser input enabled status is initiated.
- The elapsed value is stored as the absolute value in the counter in the positioning unit.

Shared memory setting

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H1 Absolute, Linear acceleration/ deceleration	H1: Absolute, Linear acceleration/deceleration H3: Absolute, S acceleration/deceleration
Startup speed (pps)	K500	K10 to K1000000 (K10 is the recommended value.)
Target speed (pps)	K10000	K11 to K1000000 Set a value larger than the startup speed. (K11 is the recommended value.)
Acceleration/ deceleration time (ms)	K100	K0 to K32767
Position command value (pulse)	K25000	K−2147483648 to K2147483647

Program



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Precautions concerning the program

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, jog operation, home returns, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, the target speed, the acceleration/deceleration time, or the position command value exceed the range of values which can be specified, a set value error will occur, and operation cannot be initiated.
- The number of the startup contact relay varies depending on the number of axes the unit has, and the installation position.

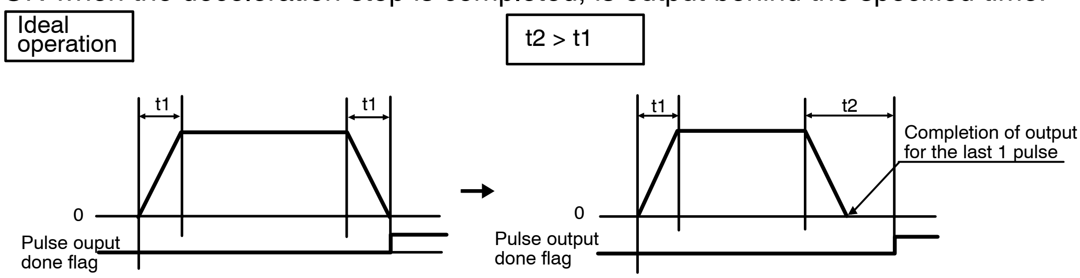
For detailed information about contact relay number ☛ Section 4.2.3.1 and 14.3

- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

For detailed information about slot number ☛ Section 4.2.3.2

For detailed information about shared memory area address ☛ Section 14.2

- In the case where the startup speed is set to the extremely small value (0 to few pps) in E point control and P point control, the pulse output done flag, which turns ON when the deceleration stop is completed, is output behind the specified time.



For the ideal deceleration stop, the startup speed of 10 pps or more is recommended to set.

6.2 Flow of E Point Control Operation

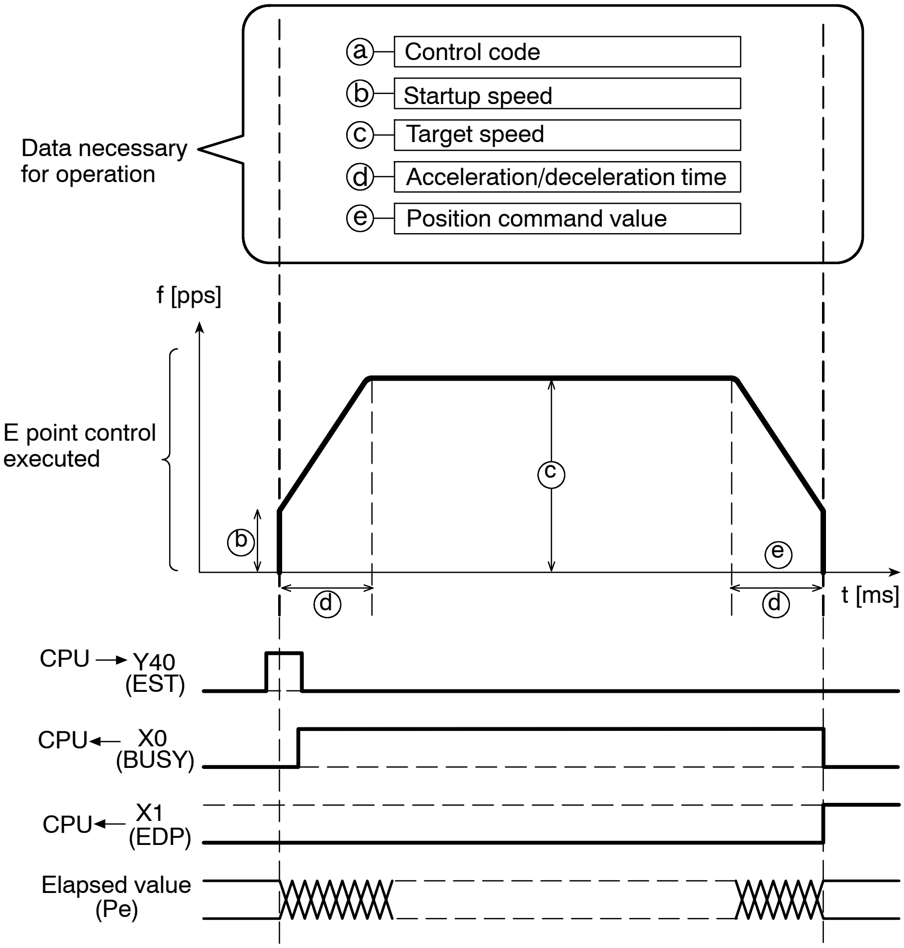
E point control: Single–speed acceleration/deceleration

- When the E point control startup relay (EST) is turned on, acceleration/deceleration control is carried out automatically at a single speed, in accordance with the specified data table.
- S acceleration/deceleration can also be selected.

When the 4–axis type positioning unit is mounted in slot 0

Operation example

When the contact relay for E point control is turned on, acceleration/deceleration is carried out in accordance with the settings, and the table travels and stops.



When Y40 is set to on in the program, the motor of the first axis begins accelerating. Input X0 is a BUSY contact that indicates that the operation is in progress, and X1 is an EDP contact that indicates that the operation is done. The EDP contact remains on until a request for another operation is received.

Data necessary for settings

The following data items must be written to the specified addresses in the shared memory.

If the same operation is being repeated, it is not necessary to enter the data settings each time.

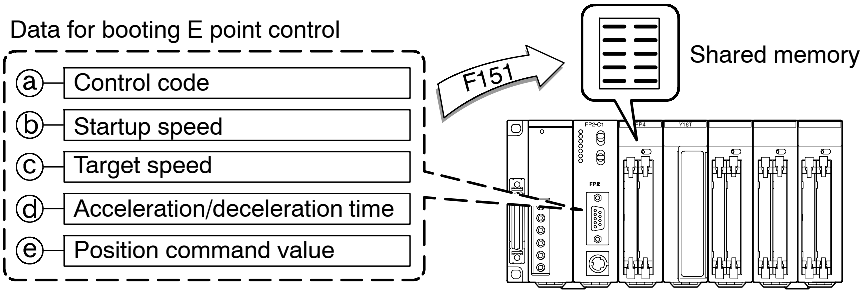
Operation is determined by these five types of data.

- Control code
- Startup speed
- Target speed
- Acceleration/deceleration time
- Position command value

Operation steps

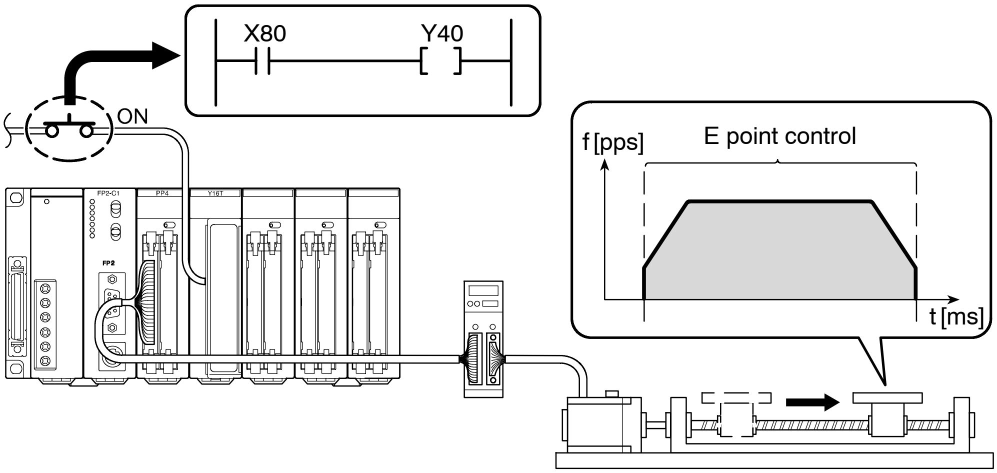
Step 1: Preparatory stage

The data required for operation is transferred to the shared memory in advance.

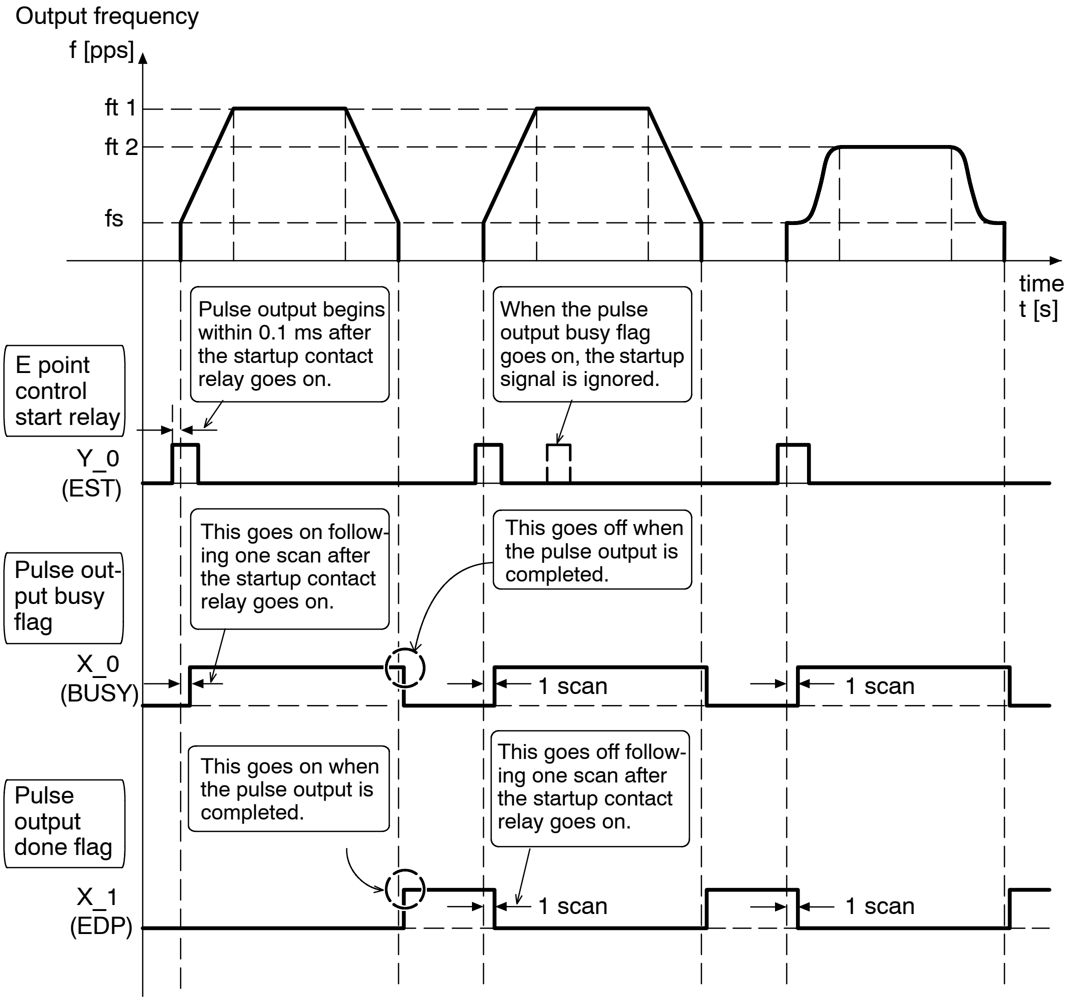


Step 2: Executing the operations

Operation begins when the contact relay Y40 for E point control is turned on.
The control code determines whether S acceleration/deceleration or linear acceleration/deceleration is used.
Acceleration is carried out from the startup speed to the target speed, and then the speed slows to the startup speed, and the table stops.
This amount of travel is determined by the position command value.



6.3 Operation of the Input and Output Contacts Before and After E Point Control



E point control start relay (Y_0)

1. E point control is initiated based on the parameters written to the positioning unit.
2. E point control is not initiated during the time that the pulse output busy flag (X_0) is on.
3. E point control start relay is reset when the power supply is turned off.

Pulse output busy flag (X_0)

1. This goes on with the next scan after E point control has been initiated, and goes off when the pulse output is completed.
2. Operation cannot be shifted to any other operation while this signal is on (except for a forced stop and a deceleration and stop).
3. This flag is reset when the power supply is turned off.

This flag is shared among E point control, P point control, jog operation, and home returns (except for a pulser input enabled operation).

Pulse output done flag (X_1)

1. This goes on when the pulse output is completed, and is maintained until the next E point control, P point control, jog operation, home return, or pulser input enabled status is initiated.
2. This flag is reset when the power supply is turned off.

This flag is shared among E point control, P point control, jog operation, and pulser input enabled operation.

6.3 Operation of the Input and Output Contacts Before and After E Point Control

Chapter 7

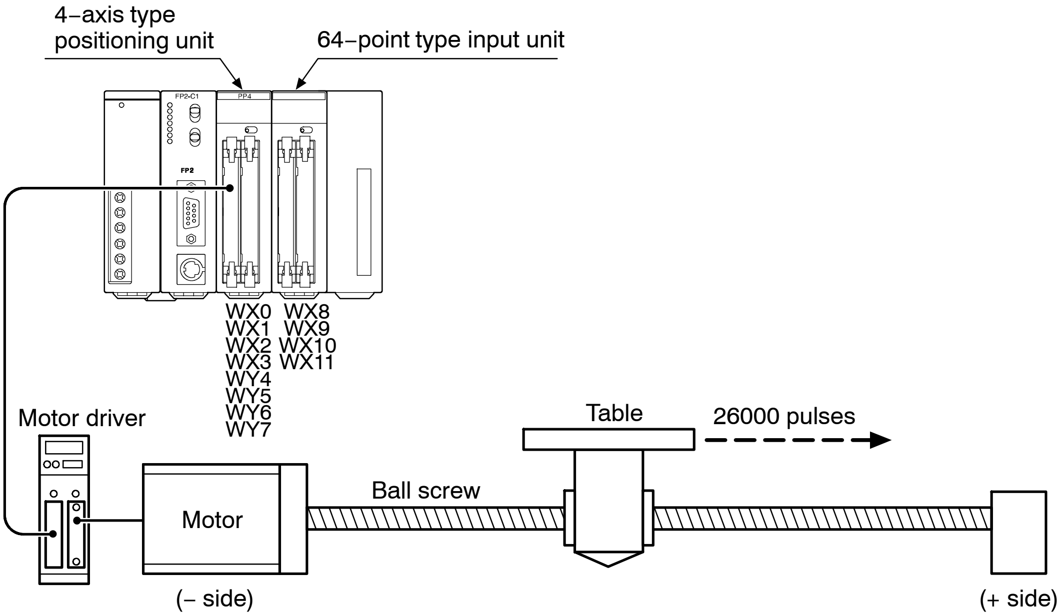
Automatic Acceleration/Deceleration Control

(P Point Control: Multi–Stage Acceleration/Deceleration)

7.1 Sample Program

7.1.1 Increment (Relative Value Control): Plus (+) Direction

For this control, the “Increment” method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side.



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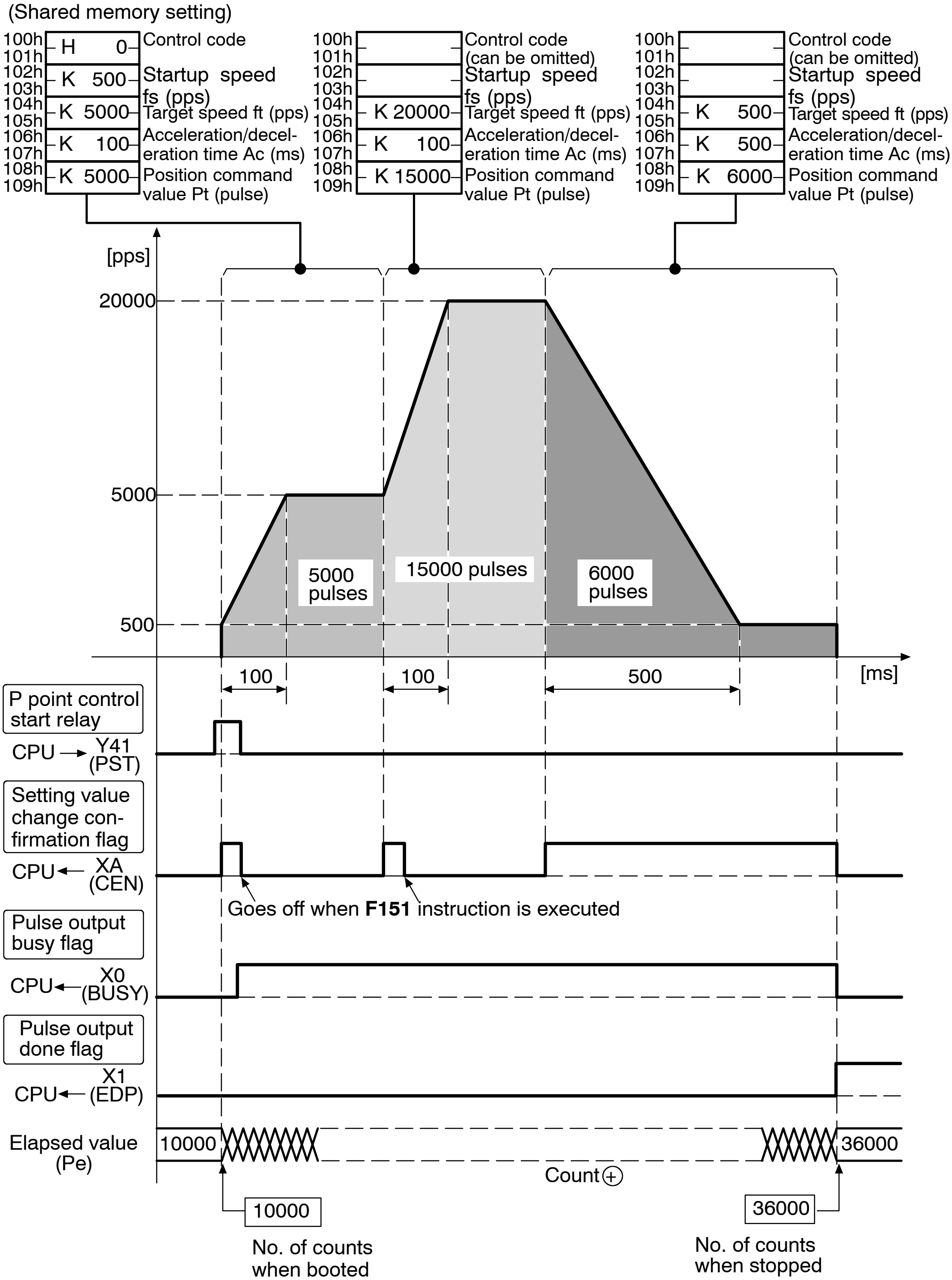
Pulse output diagram

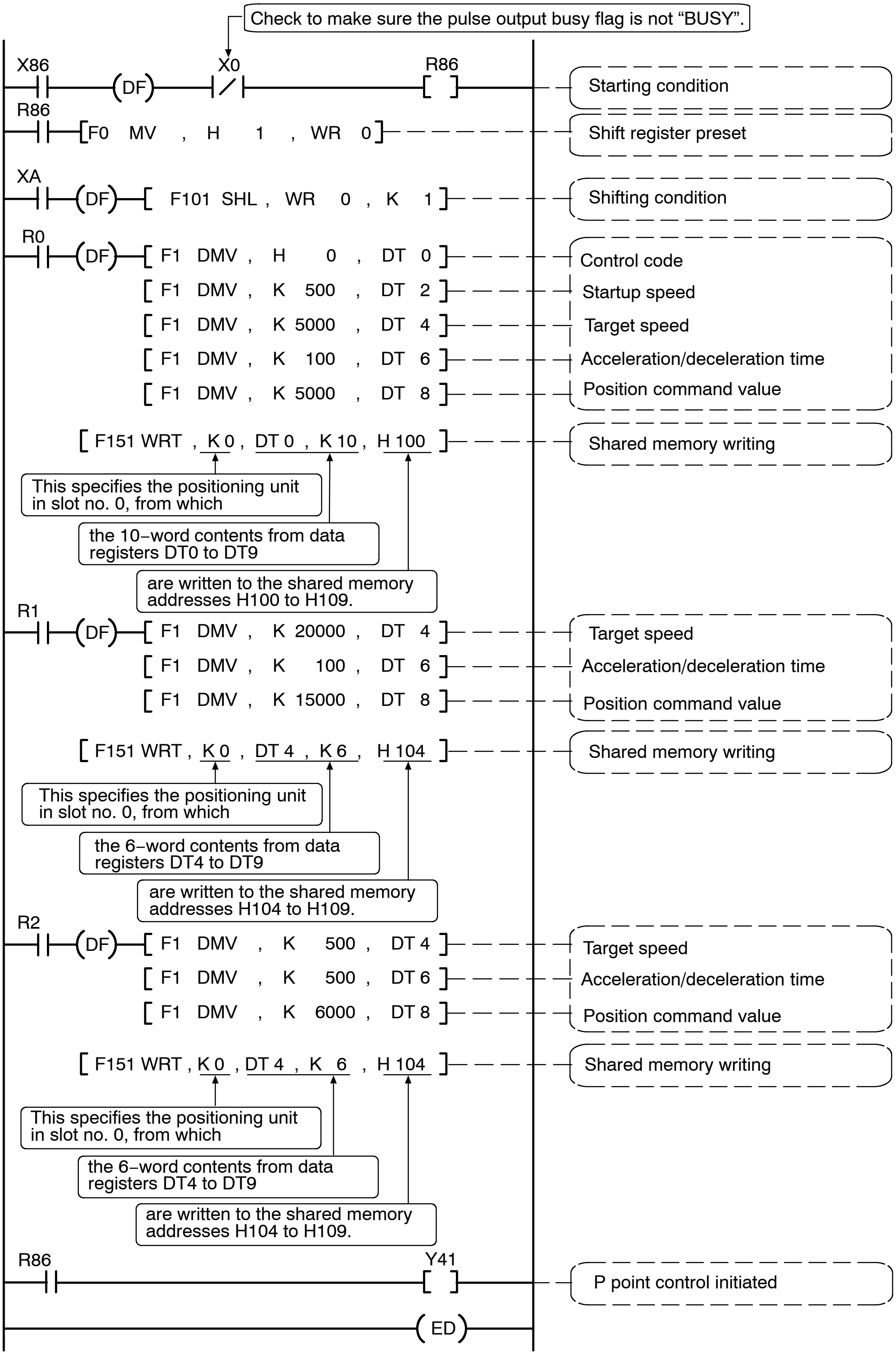


Shared memory setting

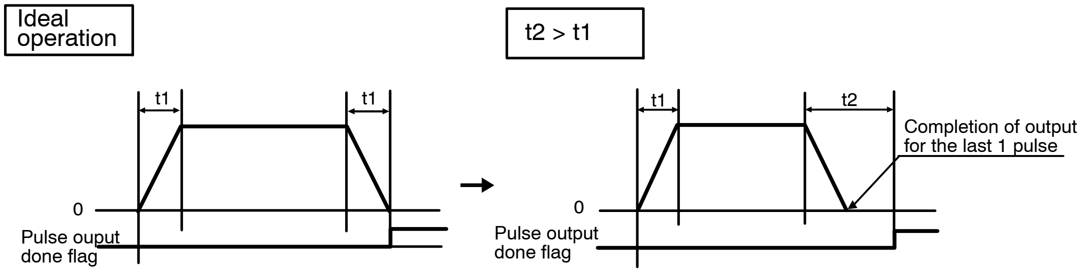
Control parameter setting content	Set values in sample program example			Range of acceptable settings
	1st speed	2nd speed	3rd speed	
Control code	H0 Increment, Linear acceleration/ deceleration	The same as left	The same as left	H0: Increment, Linear acceleration/deceleration H2: Increment, S acceleration/deceleration
Startup speed (pps)	K500	The same as left	The same as left	K10 to K1000000 (K10 is the recommended value)
Target speed (pps)	K5000	K20000	K500	K11 to K1000000 The target speed for the first speed should be set to a value larger than the startup speed. (K11 is the recommended value)
Acceleration/ deceleration time (ms)	K100	K100	K500	K1 to K32767
Position command value (pulse)	K5000	K15000	K6000	K–2147483648 to K2147483647

7.1 Sample Program

Program



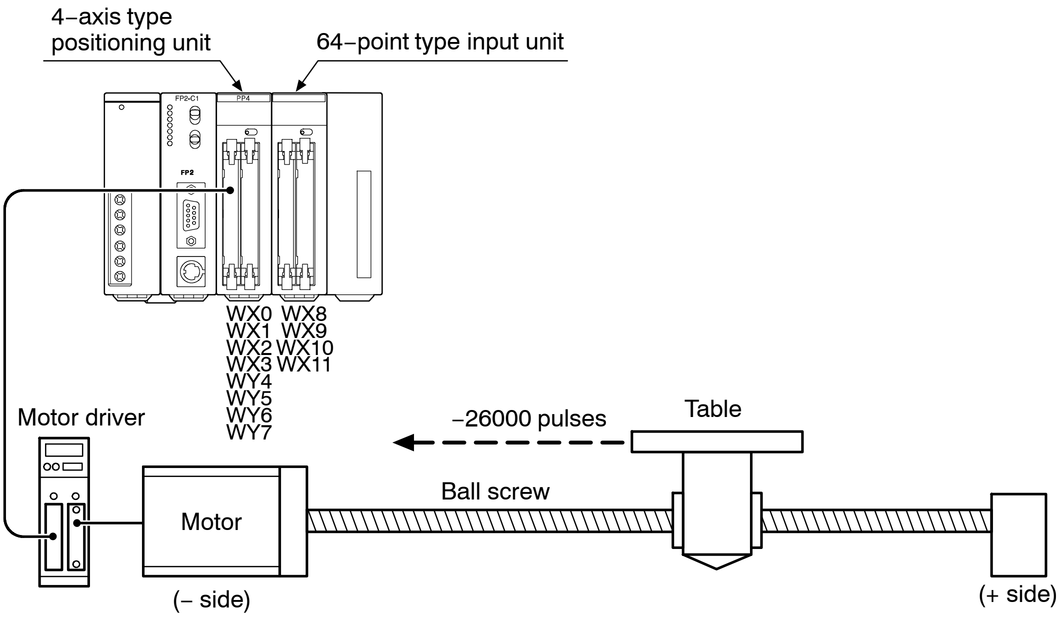
- In the case where the startup speed is set to the extremely small value (0 to few pps) in E point control and P point control, the pulse output done flag, which turns ON when the deceleration stop is completed, is output behind the specified time.



For the ideal deceleration stop, the startup speed of 10 pps or more is recommended to set.

7.1.2 Increment (Relative Value Control): Minus (–) Direction

For this control, the “Increment” method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side.



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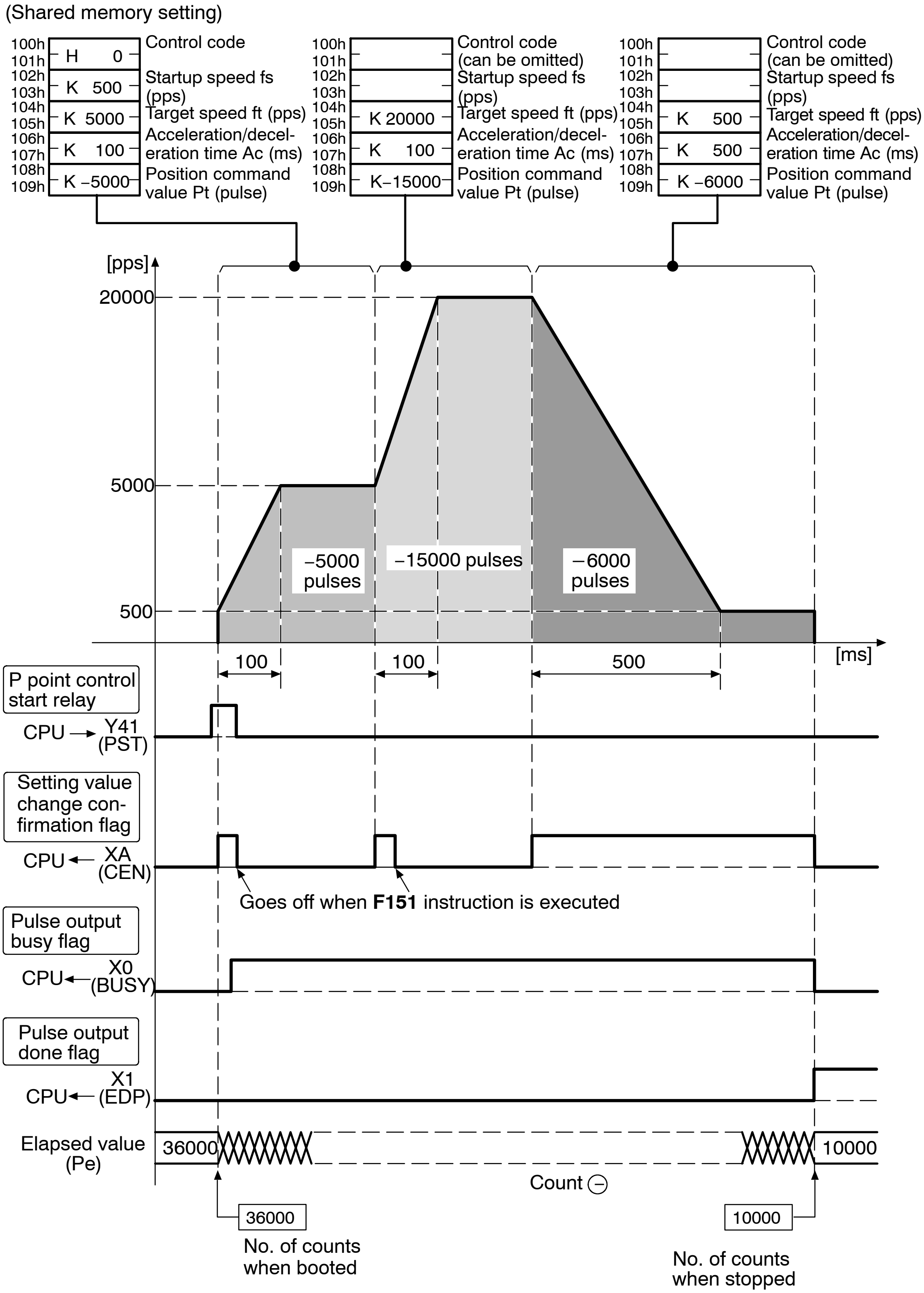
Pulse output diagram



Shared memory setting

Control parameter setting content	Set values in sample program example			Range of acceptable settings
	1st speed	2nd speed	3rd speed	
Control code	H0 Increment, Linear acceleration/ deceleration	The same as left	The same as left	H0: Increment, Linear acceleration/deceleration H2: Increment, S acceleration/deceleration
Startup speed (pps)	K500	The same as left	The same as left	K10 to K1000000 (K10 is the recommended value)
Target speed (pps)	K5000	K20000	K500	K11 to K1000000 The target speed for the first speed should be set to a value larger than the startup speed. (K11 is the recommended value)
Acceleration/ deceleration time (ms)	K100	K100	K500	K1 to K32767
Position command value (pulse)	K–5000	K–15000	K–6000	K–2147483648 to K2147483647

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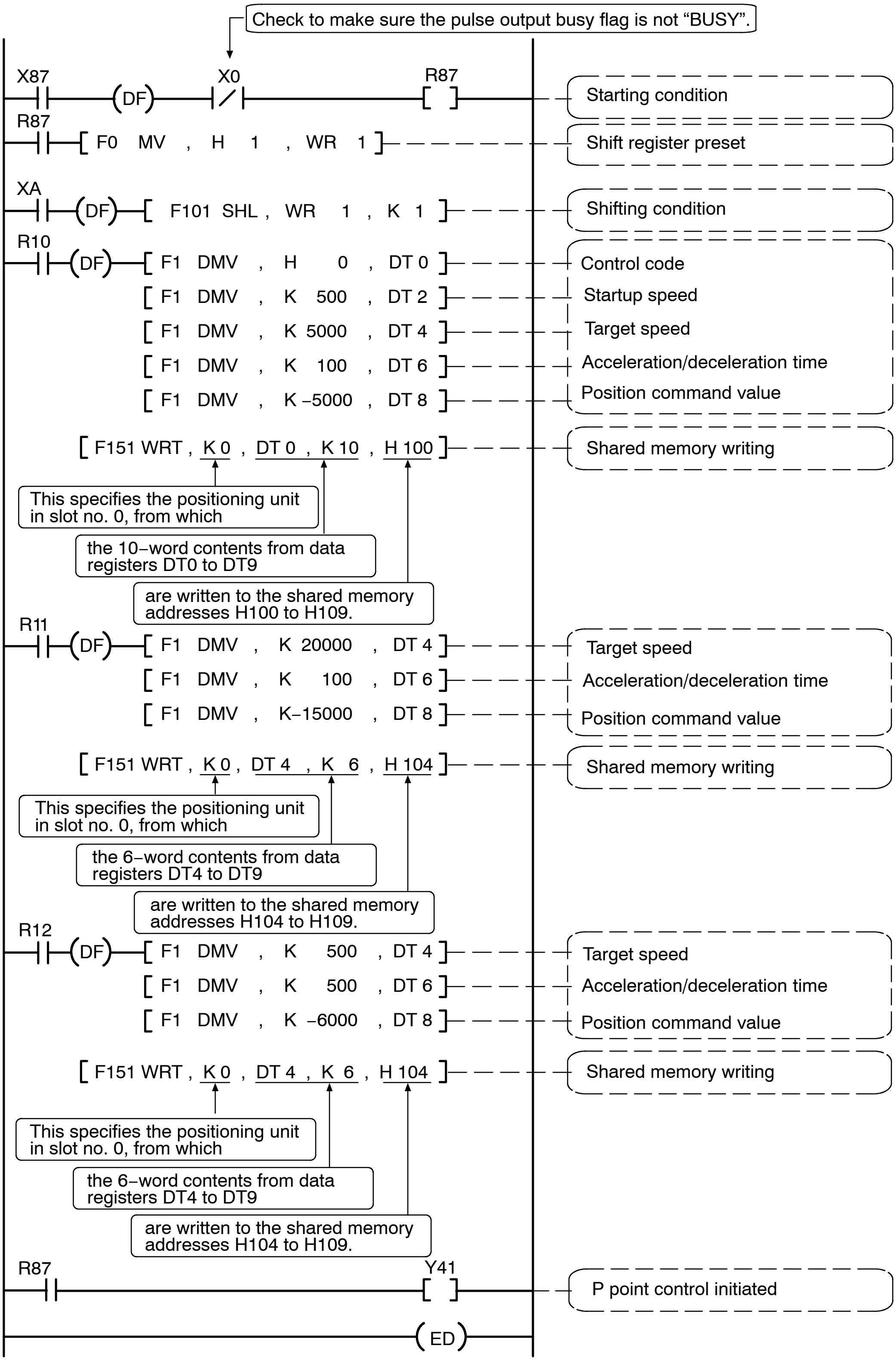
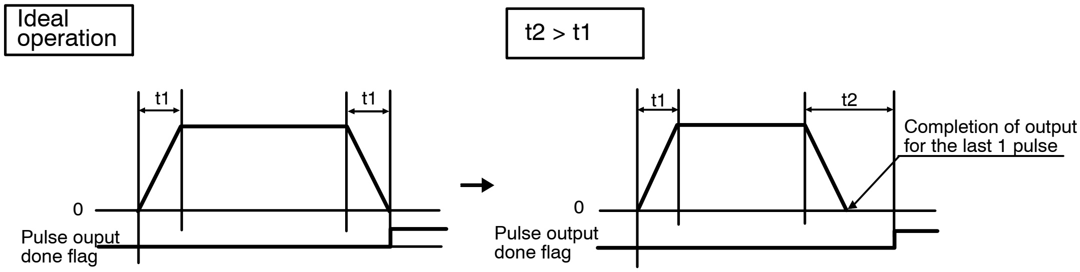
7.1 Sample Program

Program



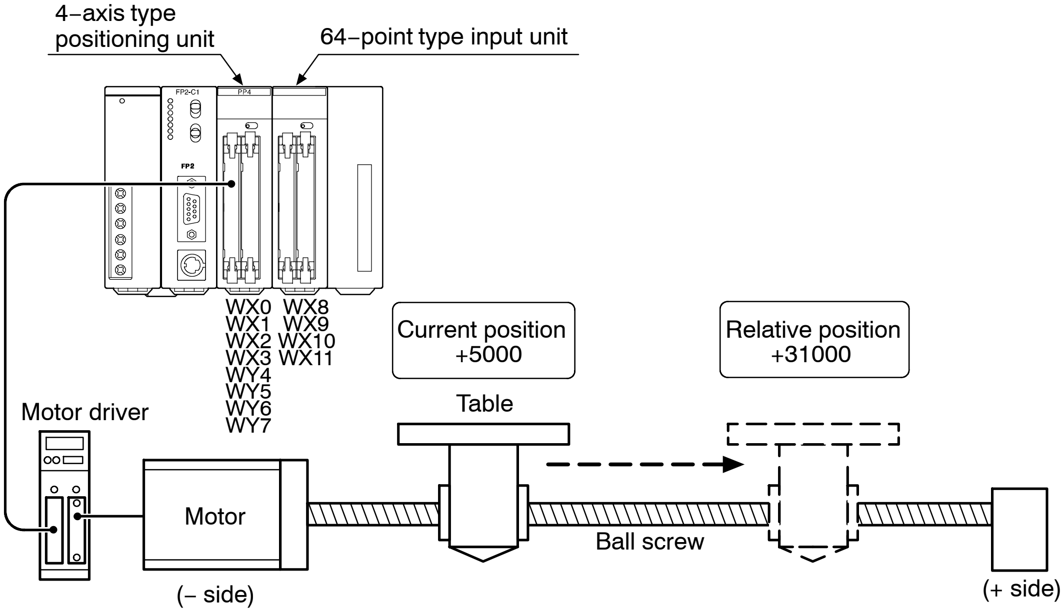
- In the case where the startup speed is set to the extremely small value (0 to few pps) in E point control and P point control, the pulse output done flag, which turns ON when the deceleration stop is completed, is output behind the specified time.



For the ideal deceleration stop, the startup speed of 10 pps or more is recommended to set.

7.1.3 Absolute (Absolute Value Control)

For this control, the "Absolute" method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side.



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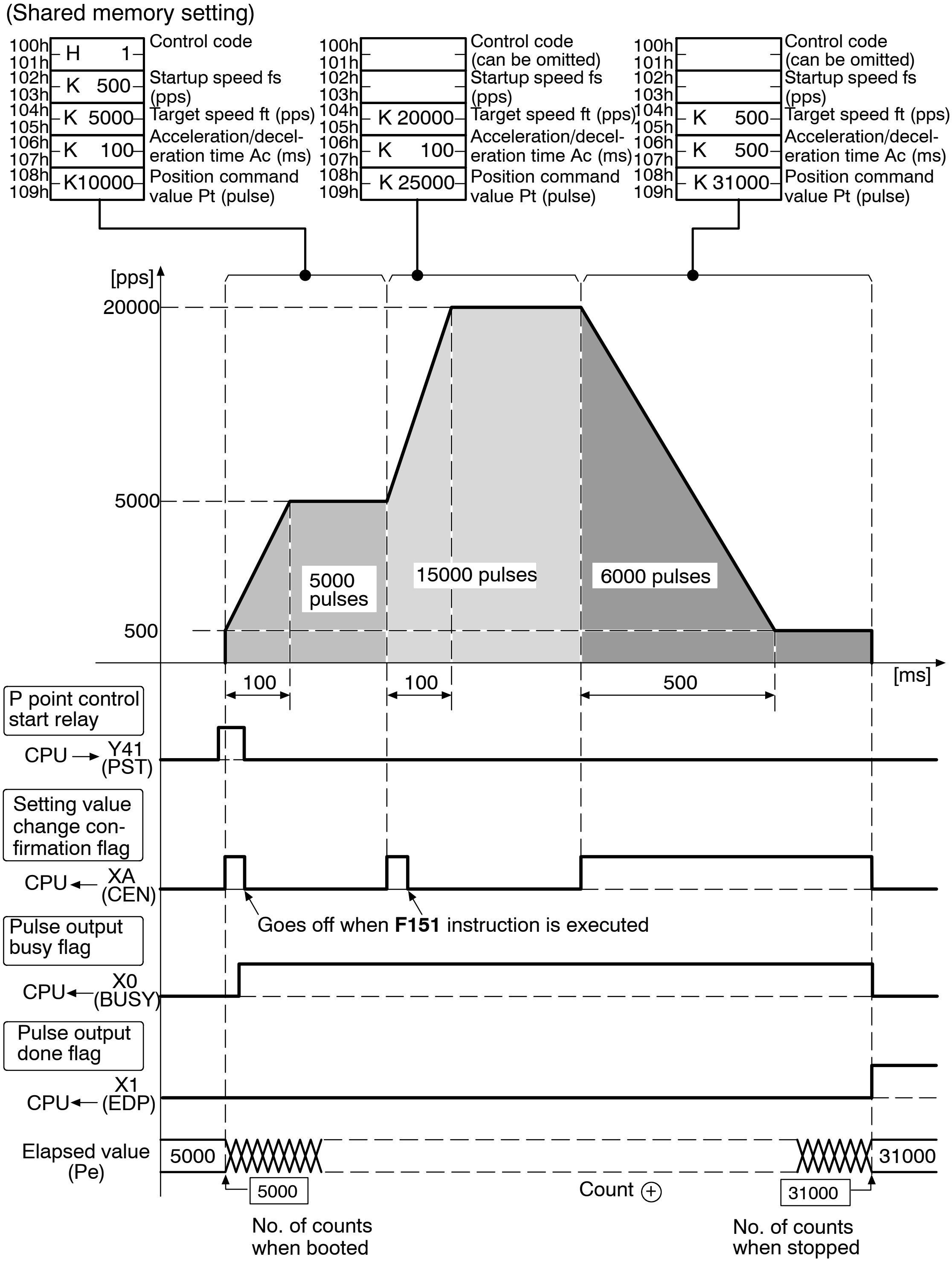
Pulse output diagram



Shared memory setting

Control parameter setting content	Set values in sample program example			Range of acceptable settings
	1st speed	2nd speed	3rd speed	
Control code	H1 Absolute, Linear acceleration/ deceleration	The same as left	The same as left	H1: Absolute, Linear acceleration/deceleration H3: Absolute, S acceleration/deceleration
Startup speed (pps)	K500	The same as left	The same as left	K10 to K1000000 (K10 is the recommended value)
Target speed (pps)	K5000	K20000	K500	K11 to K1000000 The target speed for the first speed should be set to a value larger than the startup speed. (K11 is the recommended value)
Acceleration/ deceleration time (ms)	K100	K100	K500	K1 to K32767
Position command value (pulse)	K10000	K25000	K31000	K–2147483648 to K2147483647

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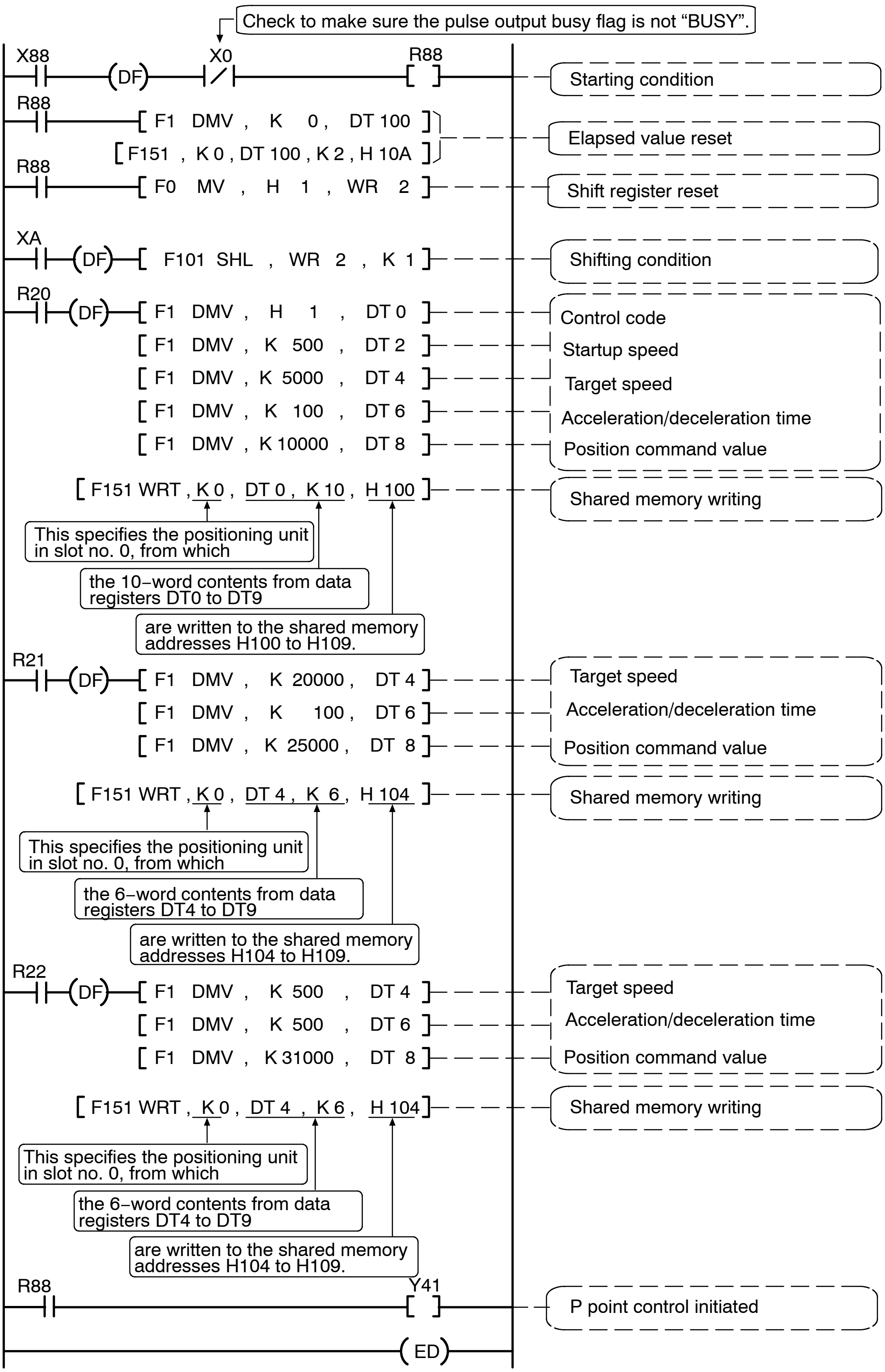
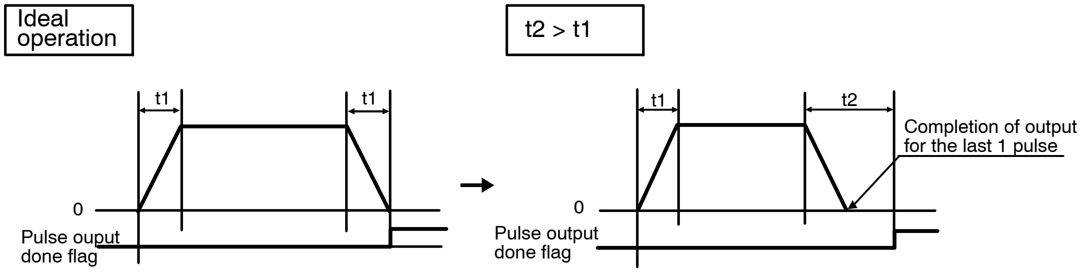
7.1 Sample Program

Program



- In the case where the startup speed is set to the extremely small value (0 to few pps) in E point control and P point control, the pulse output done flag, which turns ON when the deceleration stop is completed, is output behind the specified time.



For the ideal deceleration stop, the startup speed of 10 pps or more is recommended to set.

7.2 Flow of P Point Control Operation

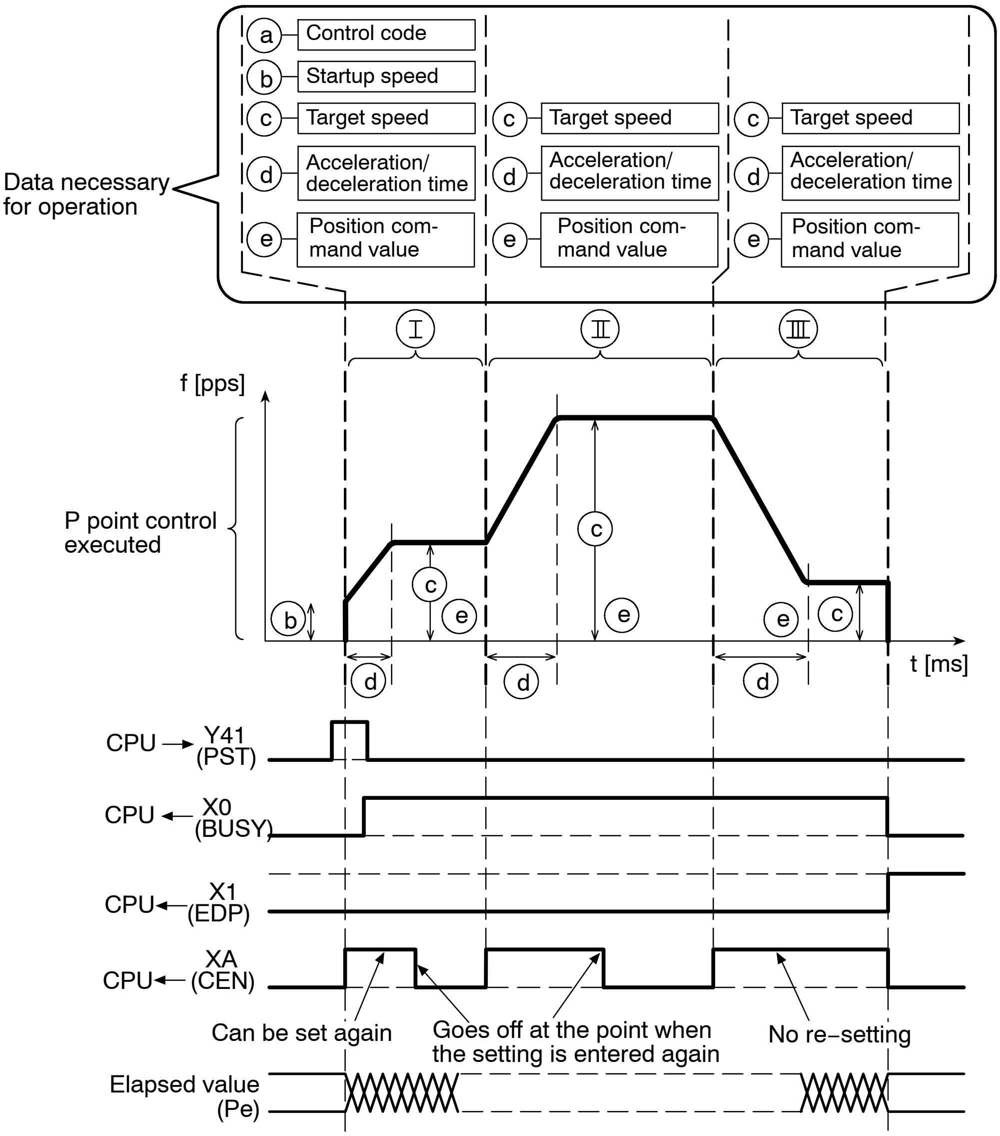
P point control: Multi–stage acceleration/deceleration

- When the contact for initiating control is turned on, acceleration/deceleration control is carried out repeatedly, in accordance with the specified data table, and then the operation stops.
- Multiple accelerations/decelerations can be specified between starting and stopping.
- S acceleration/deceleration can also be selected.
- The acceleration/deceleration time can be specified separately for each travel point.

When the 4–axis type positioning unit is mounted in slot 0

Operation example:

When the contact for initiating P point control is turned on, acceleration/deceleration is carried out repeatedly, in accordance with the settings, and then the operation stops.



When Y41 is set to on in the program, the motor of the first axis begins accelerating.

The input X0 is the BUSY contact that indicates that operation is in progress, while X1 is the EDP contact that indicates that operation has been completed. After operation has been completed, the EDP contact remains on until the next operation request is issued.

Data necessary for settings

As shown below, data items must be written to the specified addresses in the shared memory, in the order in which operations are to be executed.
As shown in the illustration, the operations and processing are explained by the P point control, which consists of sections I to III.

Section I:

Operation is determined by these five types of data.

- Control code
- Startup speed
- Target speed
- Acceleration/deceleration time
- Position command value

Section II and III:

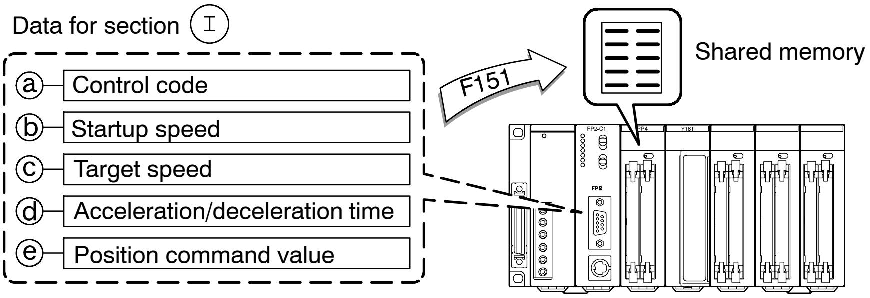
Operation is determined by these three types of data.

- Target speed
- Acceleration/deceleration time
- Position command value

Operation steps

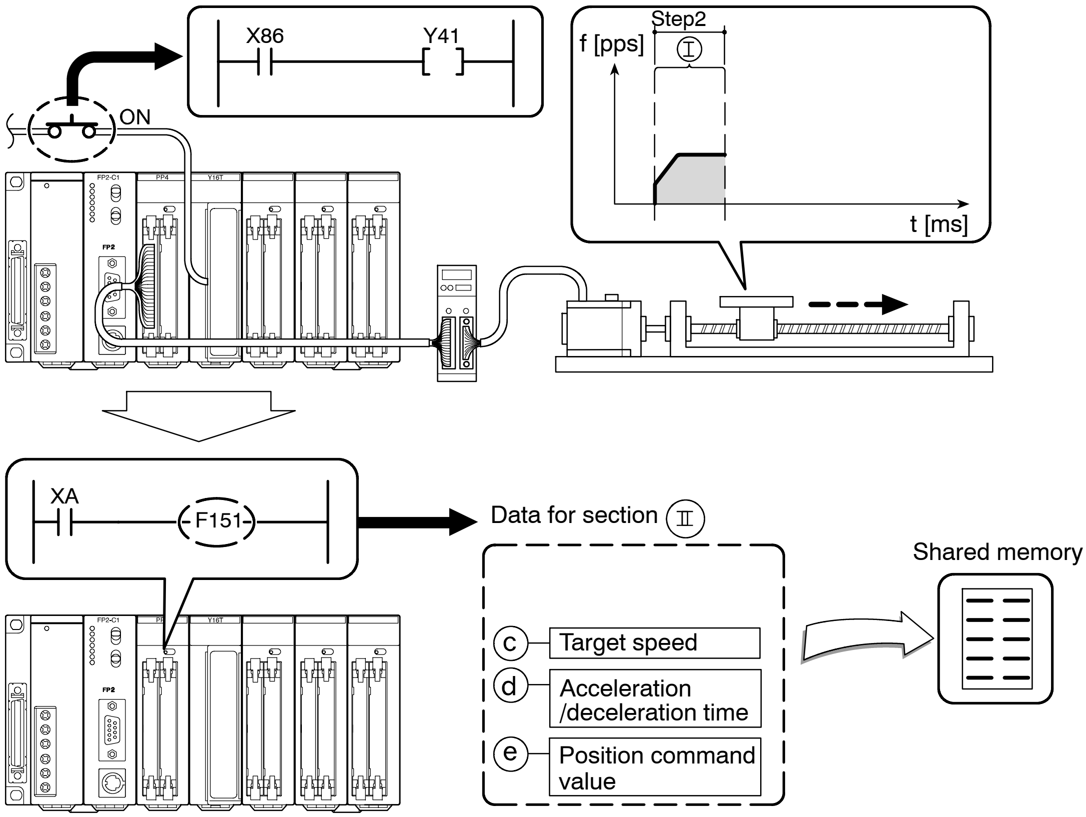
Step 1: Preparatory stage

The data required for section I of the operation is transferred to the shared memory in advance.



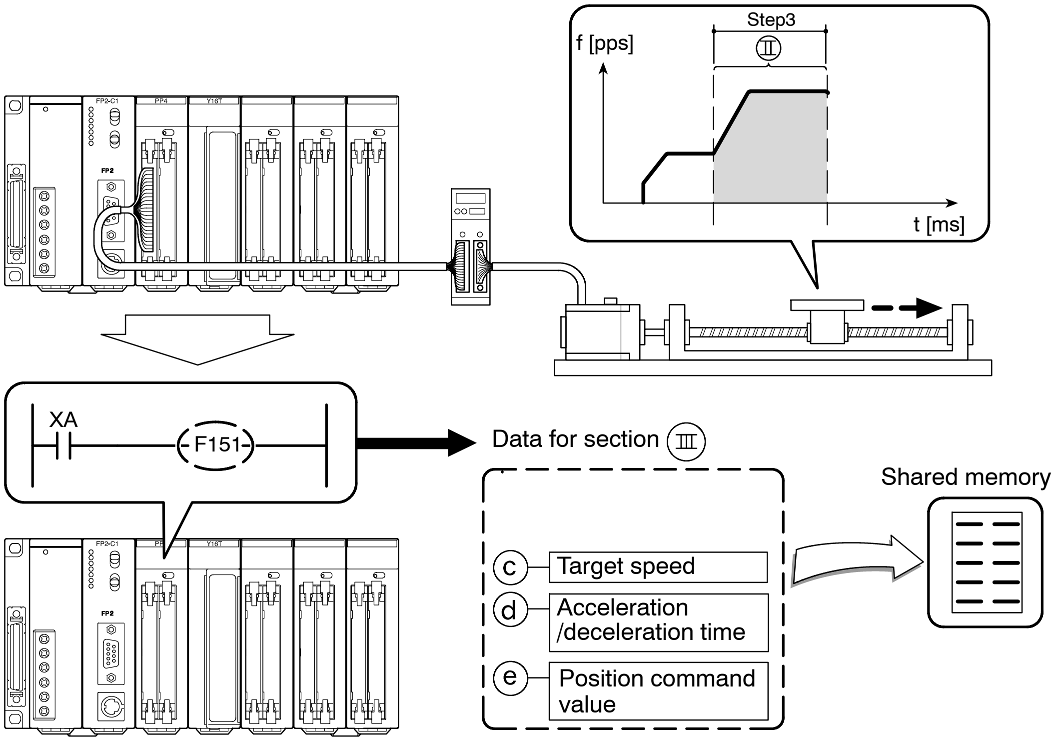
Step 2: Executing the operation of Section I

Operation begins when the contact relay Y41 for P point control is turned on.
(At this point, X_A goes on. When X_A goes on, the data for the operation of section II is transferred to the shared memory. X_A goes off after the data has been transferred.)



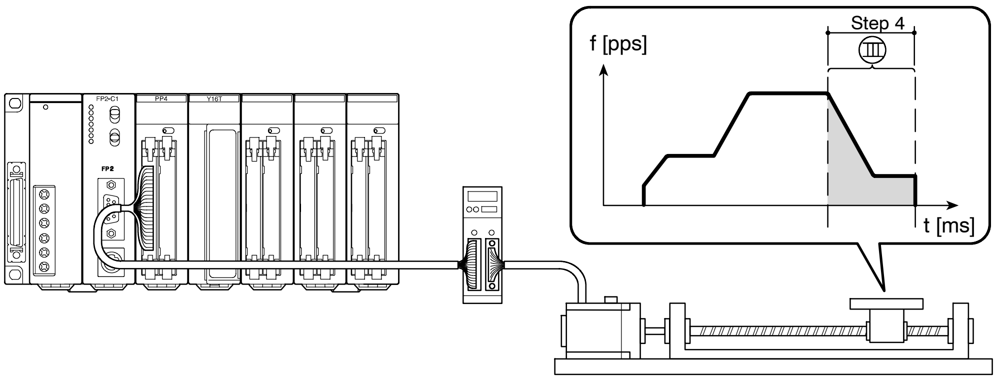
Step 3: Executing the operation of Section II

When the operation of section I is completed, operation shifts to section II.
(At this point, X_A goes on. When X_A goes on, the data for the operation of section III is transferred to the shared memory. X_A goes off after the data has been transferred.)



Step 4: Executing the operation of Section III

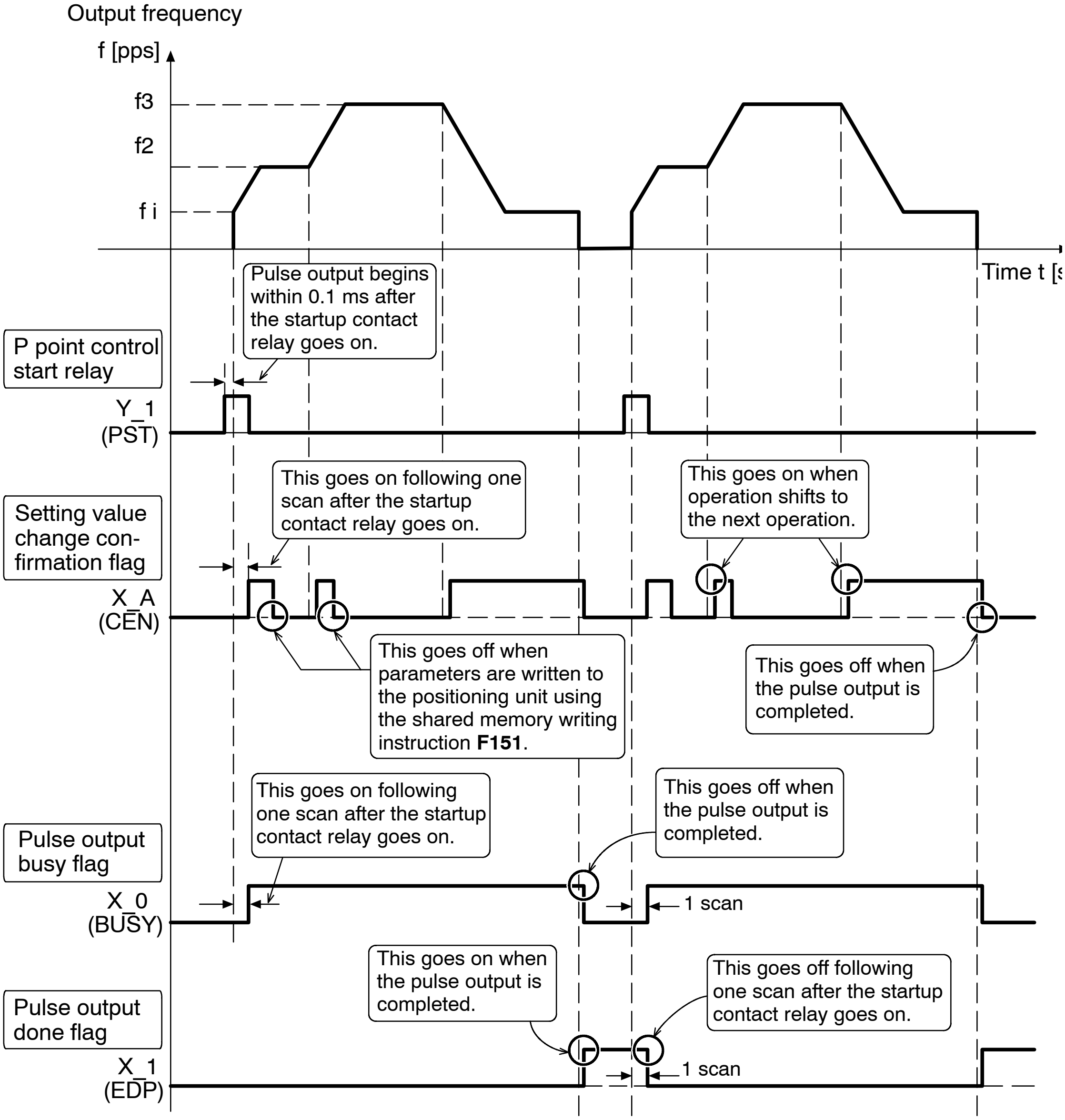
When the operation of section II is completed, operation shifts to section III.



Step 5: Completing the operation of Section III

Because no data for the next operation is specified during the operation of section III, operation automatically stops.

7.3 Action of the I/O Contacts Before and After P Point Control



P point control start relay (Y_1)

1. P point control is initiated based on the parameters written to the positioning unit.
2. Control is not initiated during the time that the pulse output busy flag (X_0) is on. (it has already been initiated).
3. Control is reset when the power supply is turned off.

Setting value change confirmation flag (X_A)

1. This goes on with the next scan after P point control has been initiated.
2. It remains on until the next **F151** or **P151** shared memory write instruction is executed, and the new parameters are written to the shared memory, and then goes off after the parameters have been written to the unit.
3. This flag is reset when the power supply is turned off.

This flag is used for P point control, and the user must be careful that it does not overlap other control programs. (Refer to *section 7.4.)

Pulse output busy flag (X_0)

1. This goes on with the next scan after P point control has been initiated, and goes off when the pulse output is completed.
2. Operation cannot be shifted to any other operation while this signal is on (except for a forced stop and a deceleration and stop).
3. This flag is reset when the power supply is turned off.

This flag is shared among E point control, P point control, jog operation, and home returns (except a pulser input enabled operation).

Pulse output done flag (X_1)

1. This goes on when the pulse output is completed, and is maintained until the next E point control, P point control, jog operation, home return, or pulser input enabled status is initiated.
2. This flag is reset when the power supply is turned off.

This flag is shared among E point control, P point control, jog operation, and pulser input enabled operation.

7.4 Precautions When Creating P Point Control Programs

7.4.1 Precautions Concerning the Setting Value Change Confirmation Flag X_A

The setting value change confirmation flag is turned on and off at the timing noted below, so an interlock should be applied to prevent the shared memory or other data from being overwritten at the same timing.

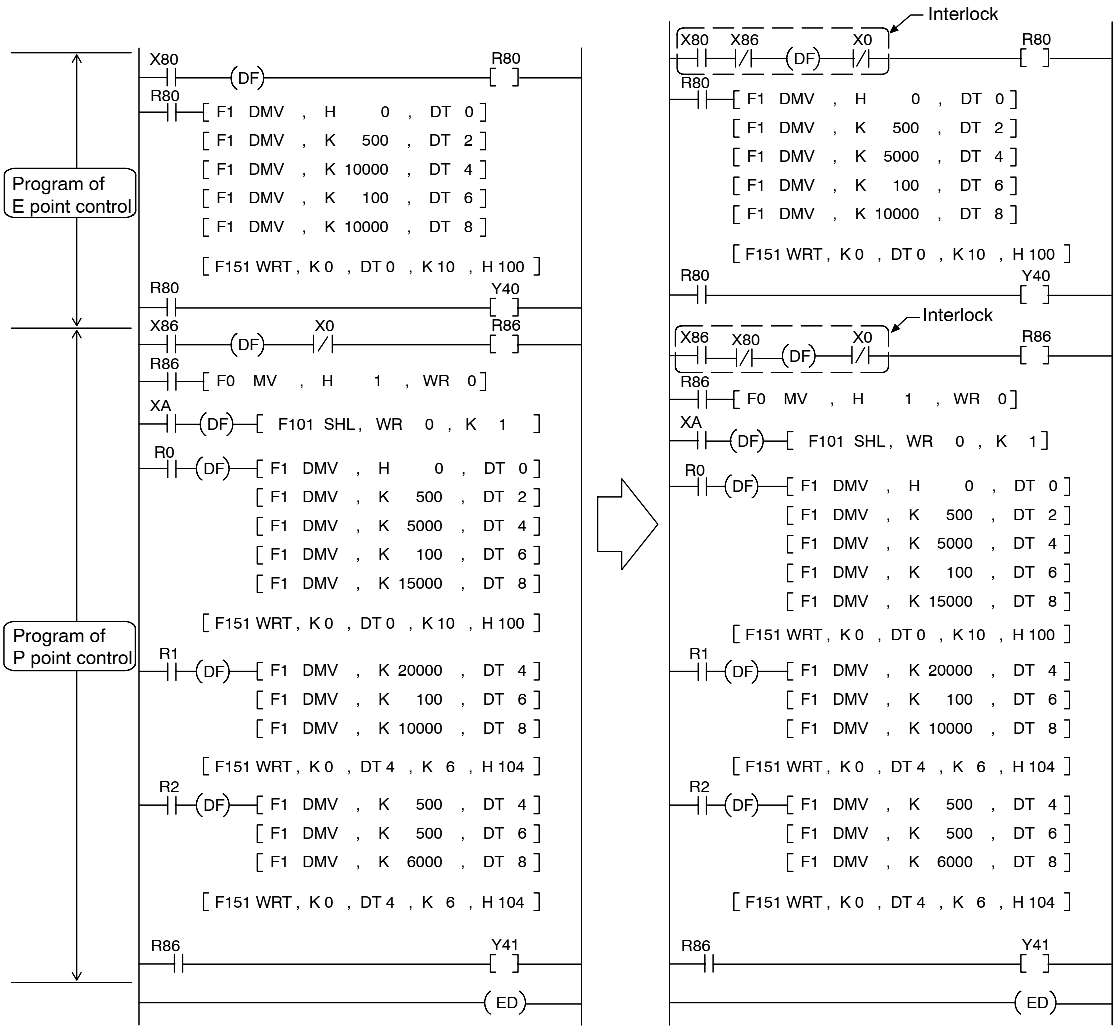
Conditions for turning the flag from off to on

- This flag goes on when P point control or E point control is initiated.
- It goes on at the point when the next data can be written.

Conditions for turning the flag from on to off

- This flag goes off when pulse output is completed after P point control or E point control is initiated.
- It goes off when the shared memory write instruction **F151** is executed, and any type of data is written to the shared memory of the positioning unit.

The program should be structured in such a way that **F151** instruction cannot be executed and the setting value change confirmation flag X_A cannot be rewritten under any other conditions.



If the E point control program is booted while the P point control program has been booted and is running, the flag X_A changes, and the P point control program is affected by the change.

Because an interlock is in effect, the E point control program cannot be booted if the P point control program has already been booted. This prevents E point control from affecting P point control.

7.4 Precautions When Creating P Point Control Programs

Chapter 8

Jog Operation

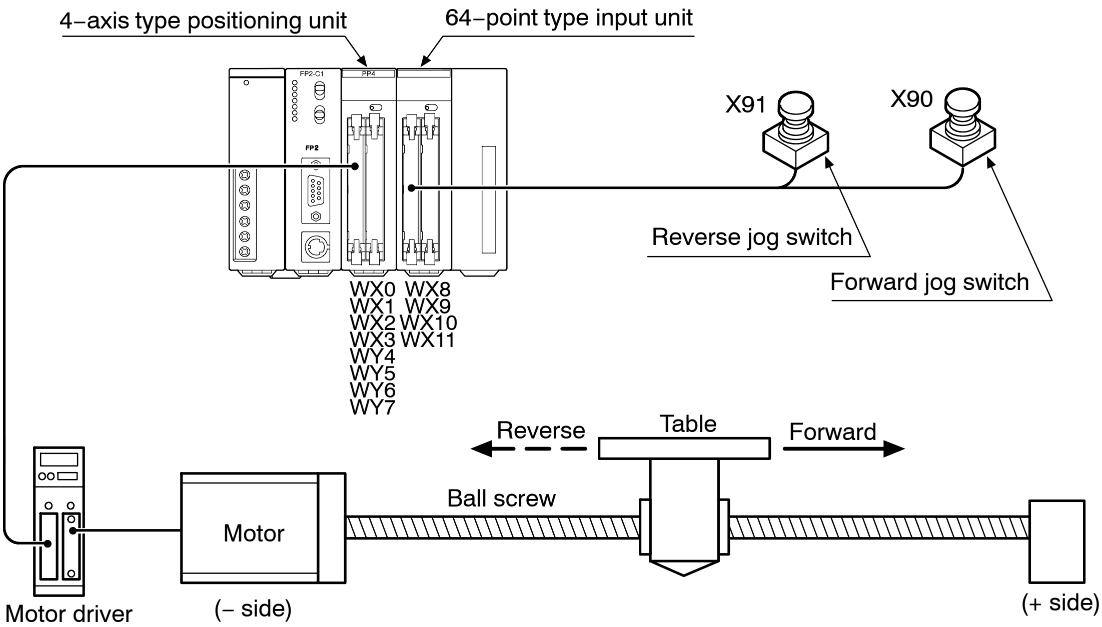
8.1 Sample Program

8.1.1 Jog Operation (Forward and Reverse)

This is the basic program for forward and reverse rotation using the external switch.

For this control, the “Increment” method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side.

- Pulses are output as long as the startup contact is on in the manual mode.
- There are two contacts (switches) for startup, one for forward rotation and one for reverse rotation.



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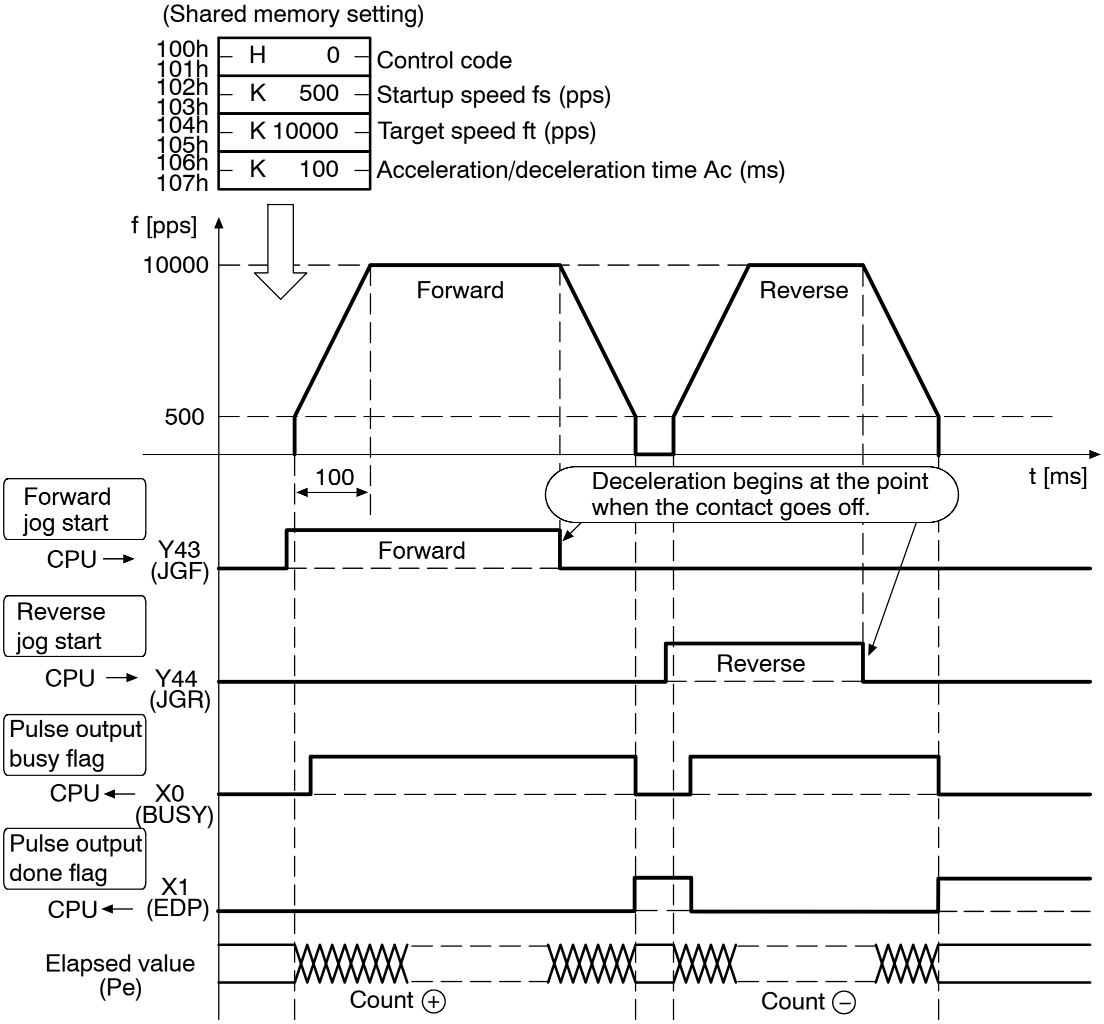
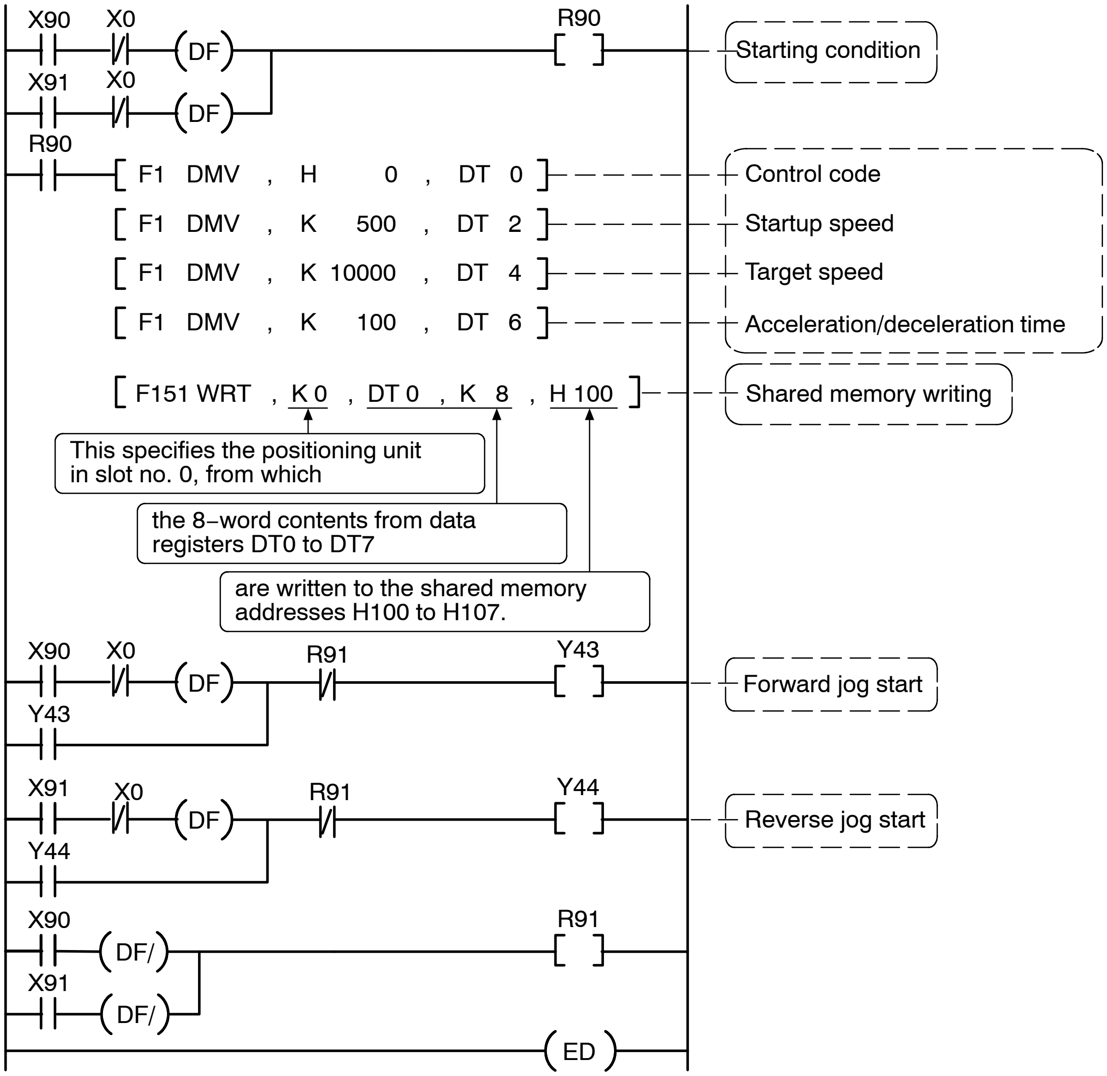
Pulse output diagram



Shared memory setting

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H0 Linear acceleration/deceleration is specified.	H0: Linear acceleration/deceleration H2: S acceleration/deceleration
Startup speed (pps)	K500	K0 to K1000000
Target speed (pps)	K10000	K1 to K1000000 Specify a value larger than the startup speed.
Acceleration/deceleration time (ms)	K100	K0 to K32767

Program



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Precautions concerning the program

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, home returns, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, the target speed, or the acceleration/deceleration time exceed the range of values which can be specified, a set value error will occur, and operation cannot be initiated.
- The number of the startup contact varies depending on the number of axes the unit has, and the installation position.

For detailed information about contact number ☛ Section 4.2.3.1 and 14.3.

- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

For detailed information about slot number ☛ Section 4.2.3.2

For detailed information about sSared memory area address ☛ Section 14.2

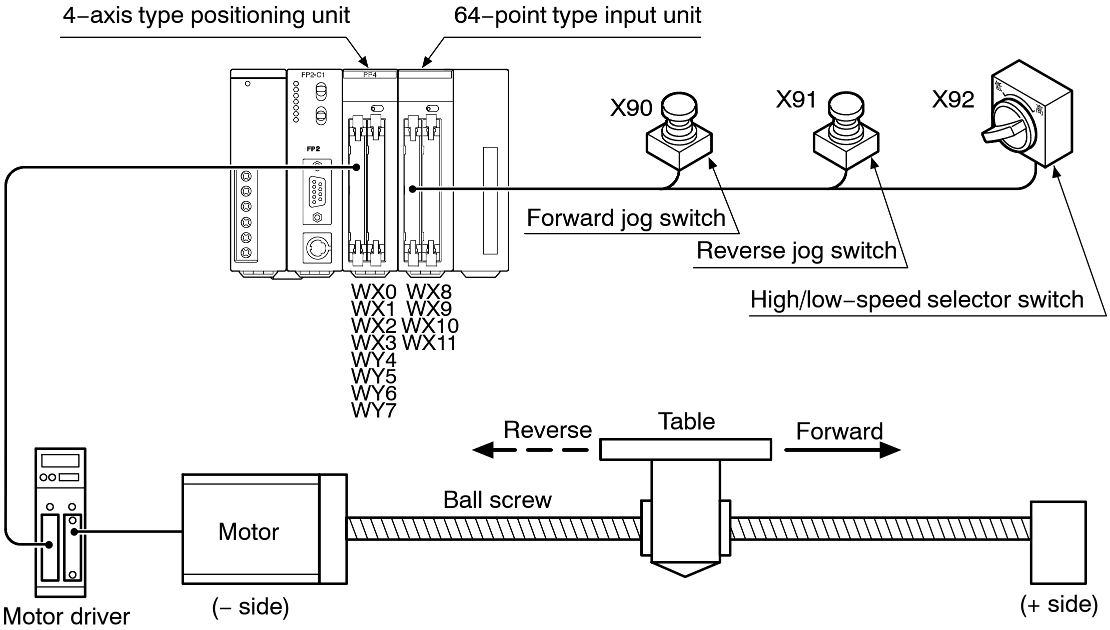
- If forward and reverse rotation are started at the same timing, forward rotation takes precedence. Also, if one or the other is started first, rotation in that direction takes precedence.
- During deceleration, the restart operation will be ignored.

8.1.2 Jog Operation (Forward, Reverse and Speed Changes)

This is the basic program for forward and reverse rotation using the external switch.

For this control, the “Increment” method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side.

- Pulses are output as long as the startup contact is on in the manual mode.
- There are two contacts (switches) for startup, one for forward rotation and one for reverse rotation.
- In the example shown below, the selector switch is used to switch between high−speed and low−speed operation.



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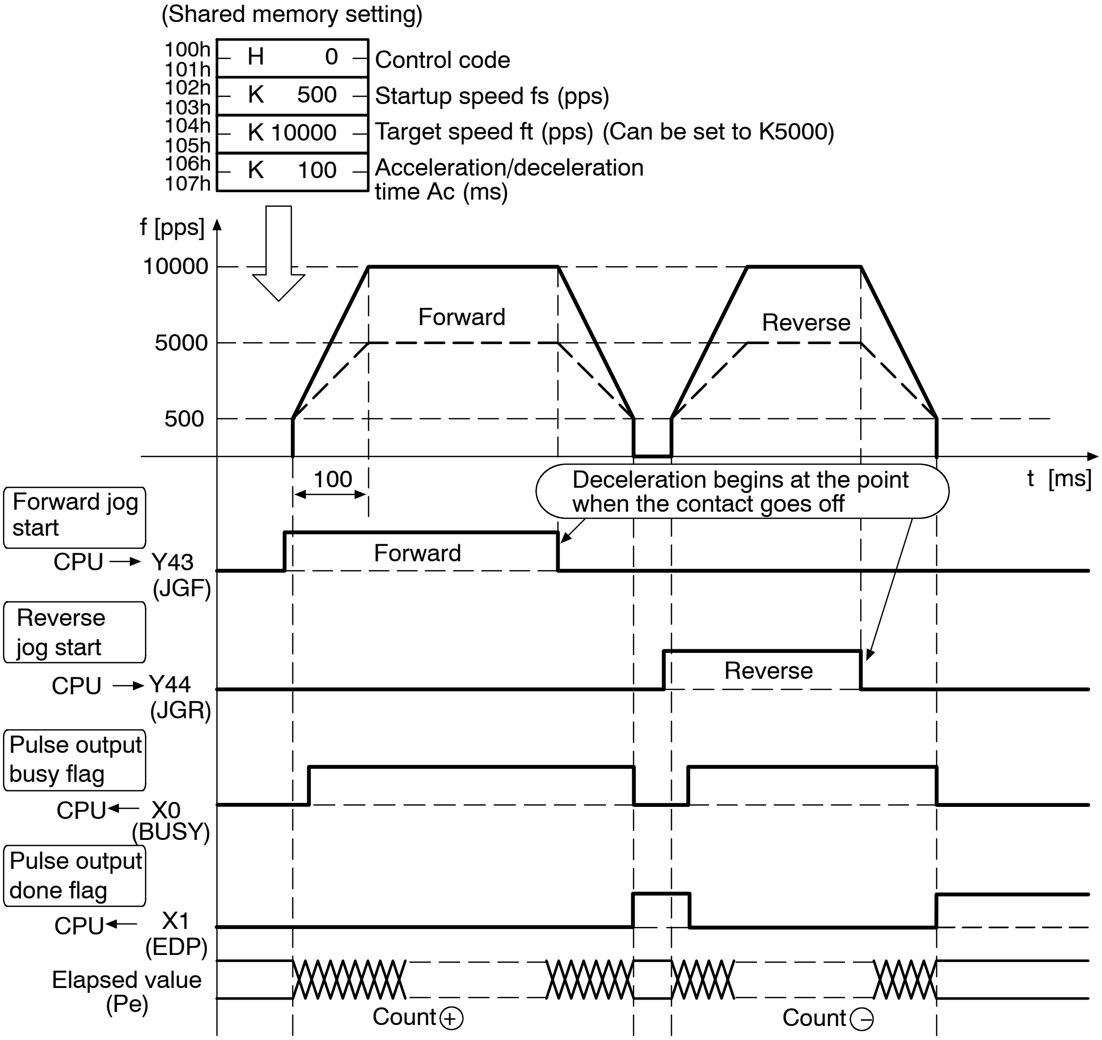
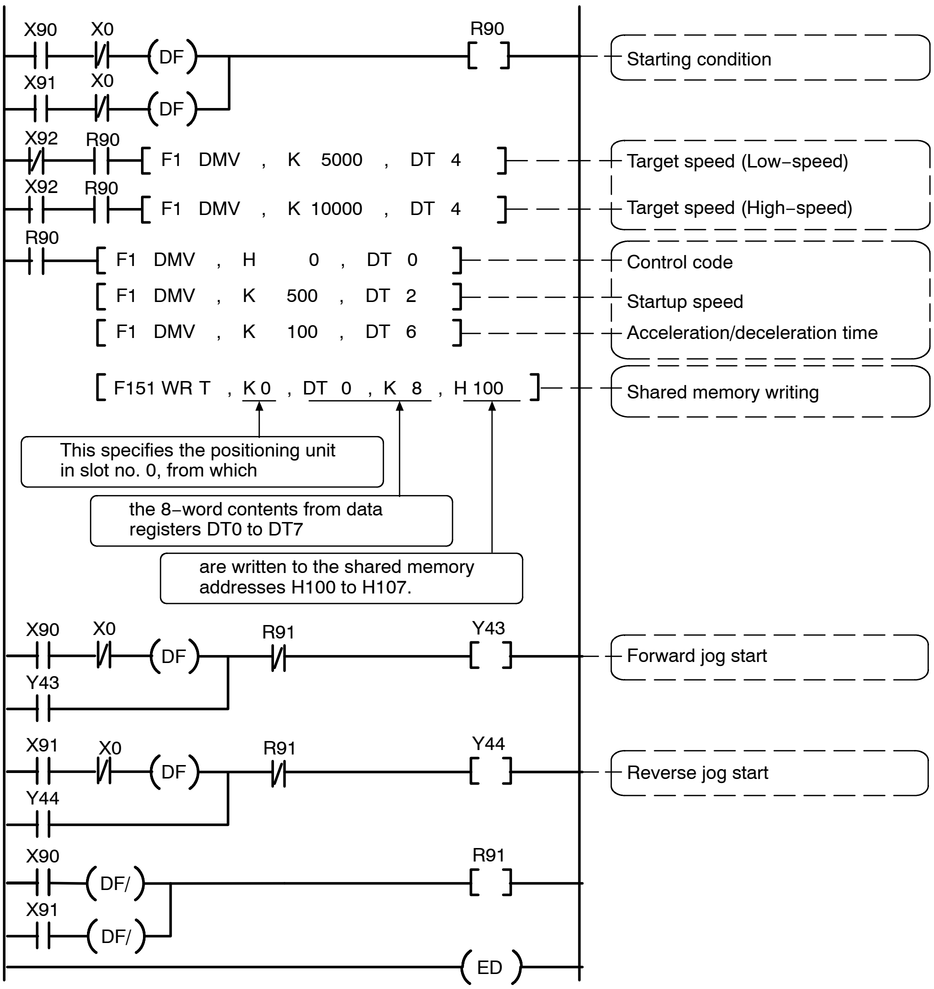
Pulse output diagram



Shared memory setting

Control parameter setting content	Set values in sample program example		Range of acceptable settings
	Low–speed setting	High–speed setting	
Control code	H0 Linear acceleration/deceleration is specified.		H0: Linear acceleration/ deceleration H2: S acceleration/deceleration
Startup speed (pps)	K500		K0 to K1000000
Target speed (pps)	K5000	K10000	K1 to K1000000 Specify a value larger than the startup speed.
Acceleration/ deceleration time (ms)	K100		K0 to K32767

Program



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Precautions concerning the program

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, home returns, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, the target speed, or the acceleration/deceleration time exceed the range of values which can be specified, a set value error will occur, and operation cannot be initiated.
- The number of the startup contact varies depending on the number of axes the unit has, and the installation position.

For detailed information about contact number ☛ Section 4.2.3.1 and 14.3.

- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

For detailed information about slot number ☛ Section 4.2.3.2

For detailed information about shared memory area address ☛ Section 14.2

- If forward and reverse rotation are started at the same timing, forward rotation takes precedence. Also, if one or the other is started first, rotation in that direction takes precedence.

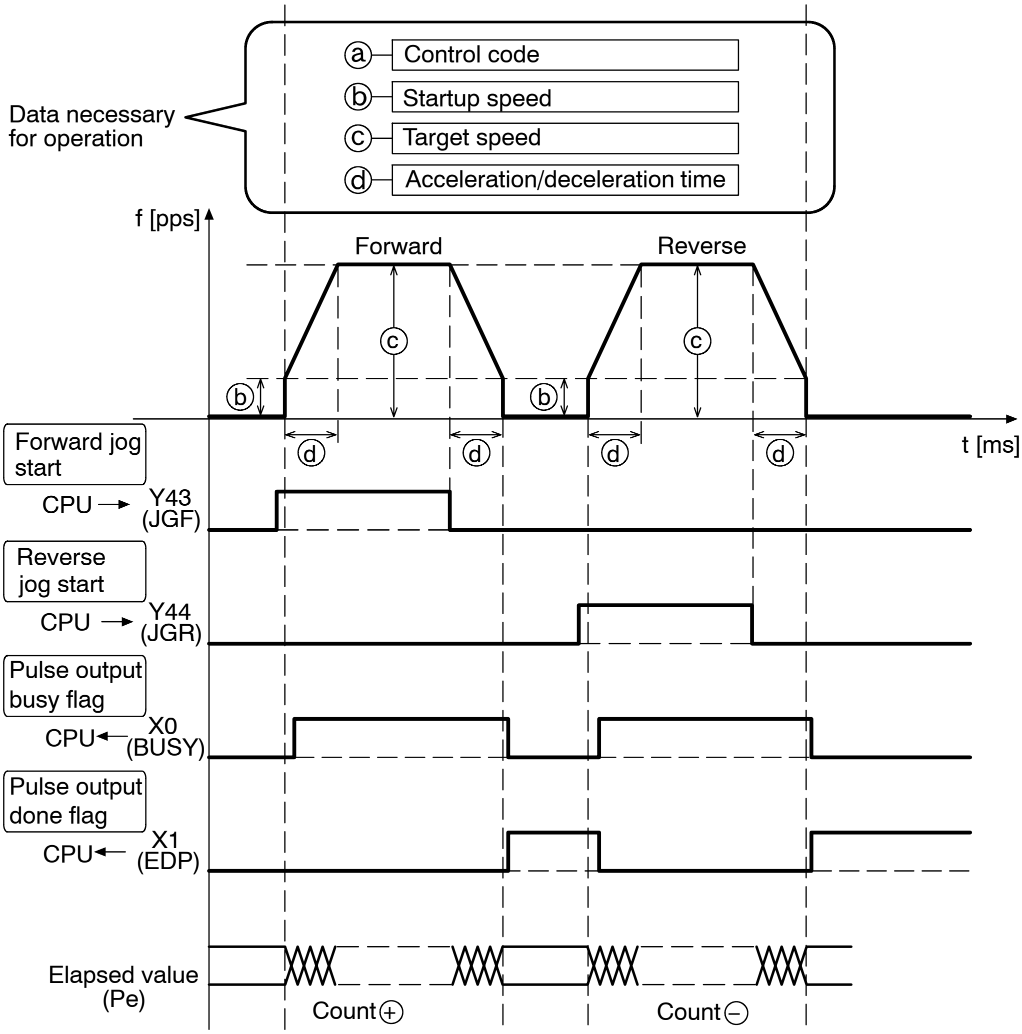
8.2 Sequence Flow for Jog Operation

Jog operation

When a 4−axis type positioning unit is mounted in slot 0

Operation example

When the contact for forward rotation is turned on, forward rotation begins and acceleration is initiated based on the settings. When the contact is turned off, deceleration takes place based on the settings, and the operation stops.
When the contact for reverse rotation is turned on, reverse rotation begins and acceleration is initiated based on the settings. When the contact is turned off, deceleration takes place based on the settings, and the operation stops.



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When Y43 is turned on through the program, the motor for the first axis begins to turn in the forward direction, and accelerates to the target speed. When Y43 is turned off, the motor decelerates and stops.
Reverse rotation can be carried out in the same way, with Y44 being turned on and off.
Input X0 is the BUSY contact that indicates that operation is in progress, and X1 is the EDP contact that indicates that operation has been completed. The EDP contact remains on until the next operation request is issued.

Data required for settings

The following data must be written to the specified addresses of the shared memory.

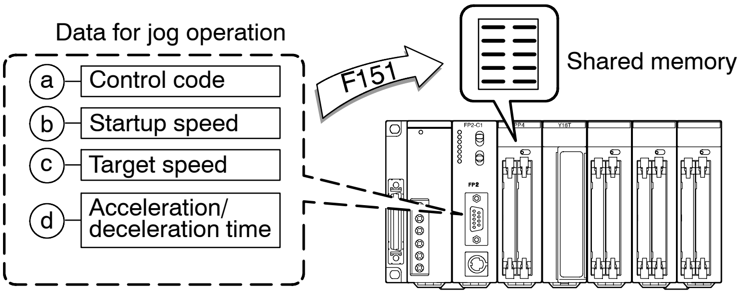
Operation is determined by the following four types of data.

- Control code
- Startup speed
- Target speed
- Acceleration/deceleration time

Operation steps

Step 1: Preparatory stage

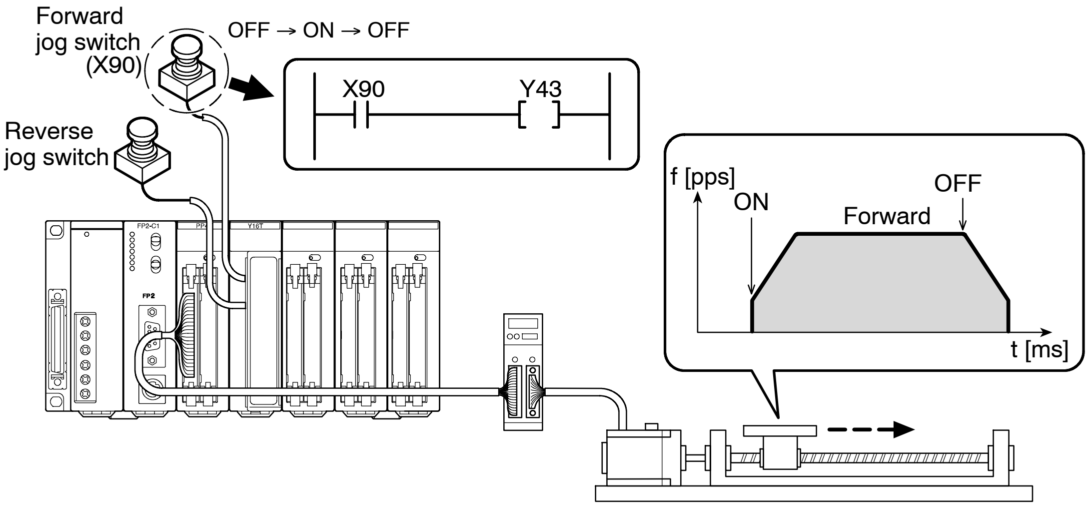
The data for operation is transferred to the shared memory ahead of time.



Step 2: Execution of operation

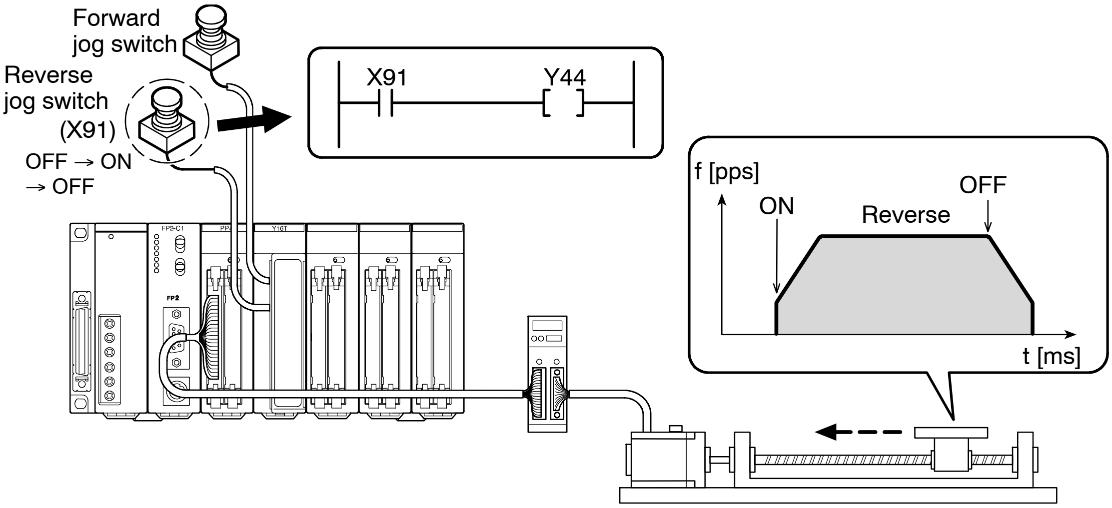
Forward

The startup contact relay Y43 for forward rotation is turned on.



Reverse

The startup contact relay Y44 for reverse rotation is turned on.

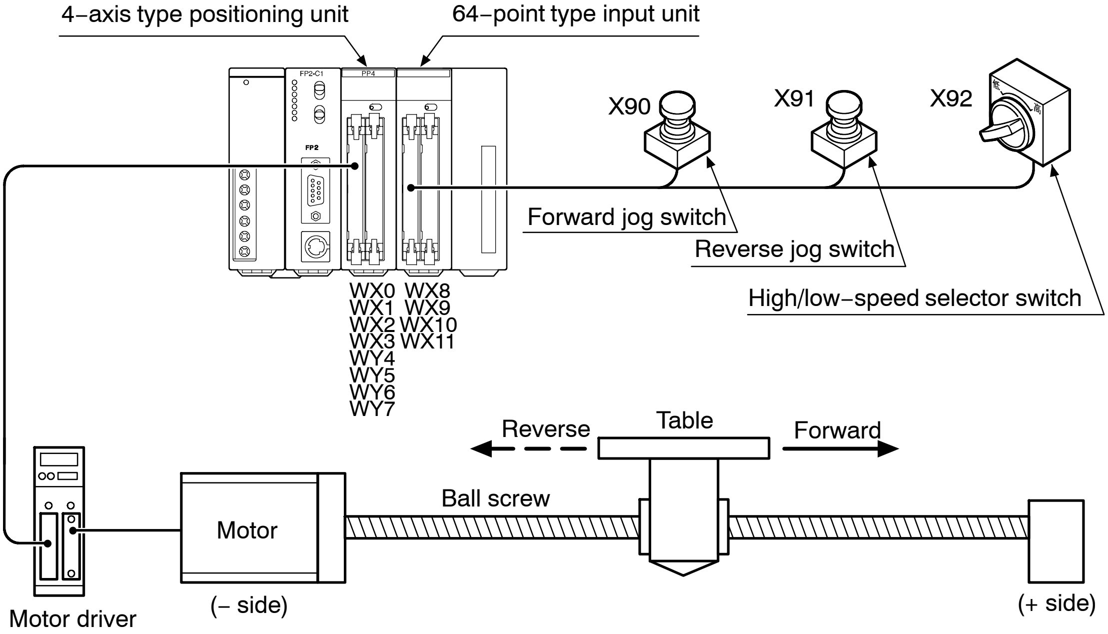


The control codes determine whether S acceleration/deceleration or linear acceleration/deceleration is used.
When the startup contact is turned on, acceleration takes places for the acceleration/deceleration time it takes to reach the target speed. When the contact is turned off, deceleration takes place until the startup speed is reached, and operation then stops.

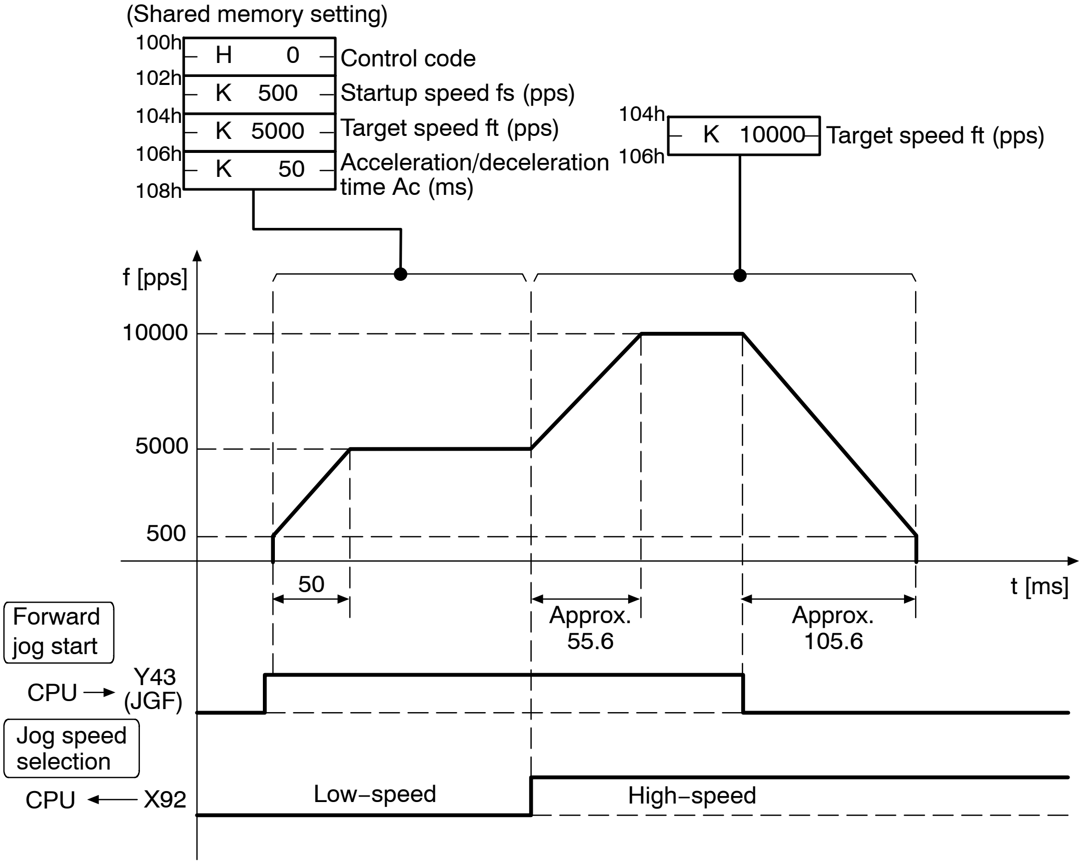
8.3 Changing the Speed During Jog Operation

Specifying a speed change during jog operation

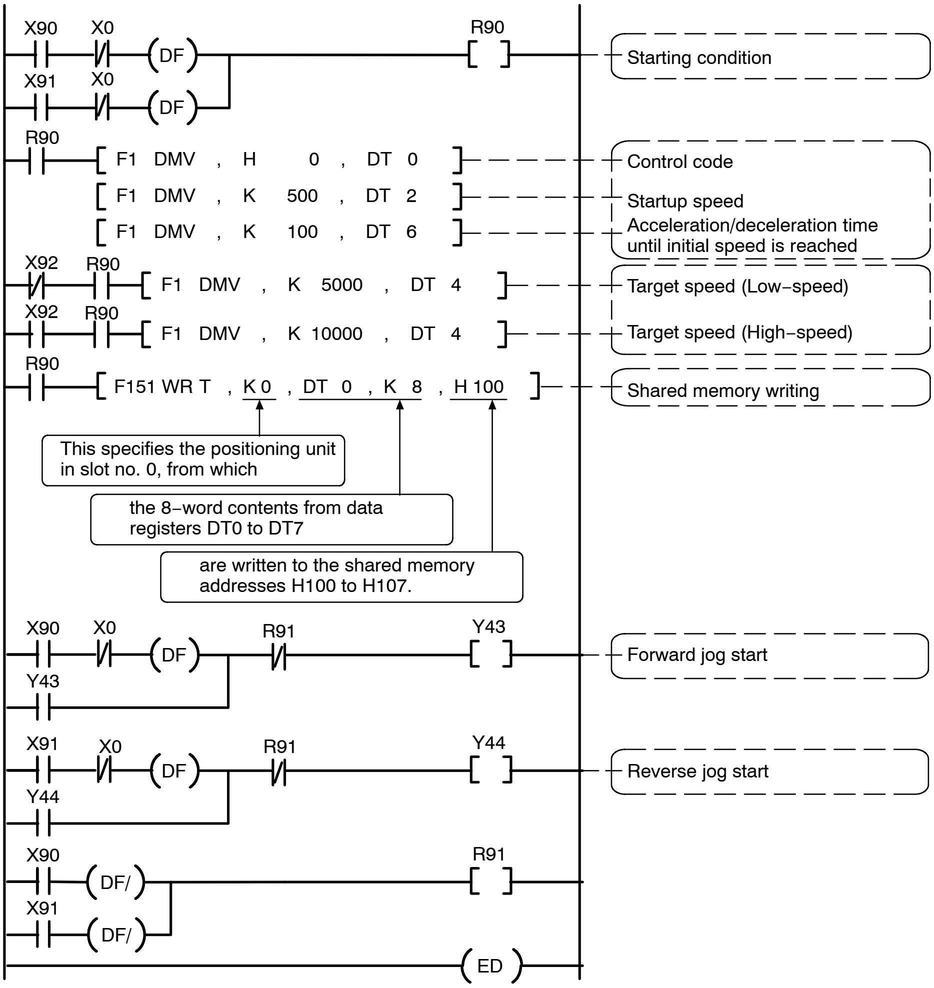
To change the speed during jog operation, the program should be set up so that only the “Target speed” parameter in the shared memory is overwritten after jog operation has begun.



Pulse output diagram



Sample program



Acceleration/deceleration time when the speed is changed

- If the jog speed is changed during jog operation, it is not possible to specify the acceleration/deceleration time when the speed changes.
- The acceleration/deceleration time is determined by the “Rate of acceleration”, which is the speed change from the startup speed to the point where the first target speed is reached, and the acceleration/deceleration time continues to change until this “Rate of acceleration” becomes constant.

Example:

Acceleration/deceleration time for a sample program

- Time until the low−speed specification for jog operation is reached
  The acceleration/deceleration time specified by the program serves as the acceleration/deceleration time, just as it is.

Acceleration/deceleration time = 50 ms

$$\text{Acceleration rate} = \frac{5000\ [\text{pps}] - 500\ [\text{pps}]}{50\ [\text{ms}]} = 90\ [\text{pps/ms}]$$

- Time from the jog speed of the low−speed specification to the jog speed of the high−speed specification

$$\text{Acceleration/deceleration time} = \frac{10000\ [\text{pps}] - 5000\ [\text{pps}]}{90\ [\text{pps/ms}]} = \text{Approx } 55.6\ [\text{ms}]$$

- Time from the jog speed of the high−speed specification to when pulse output stops

$$\text{Acceleration/deceleration time} = \frac{10000\ [\text{pps}] - 500\ [\text{pps}]}{90\ [\text{pps/ms}]} = \text{Approx } 105.6\ [\text{ms}]$$

For the sake of expedience, “pps/ms” is used as the unit for the acceleration rate.

Specifying the method of acceleration/deceleration

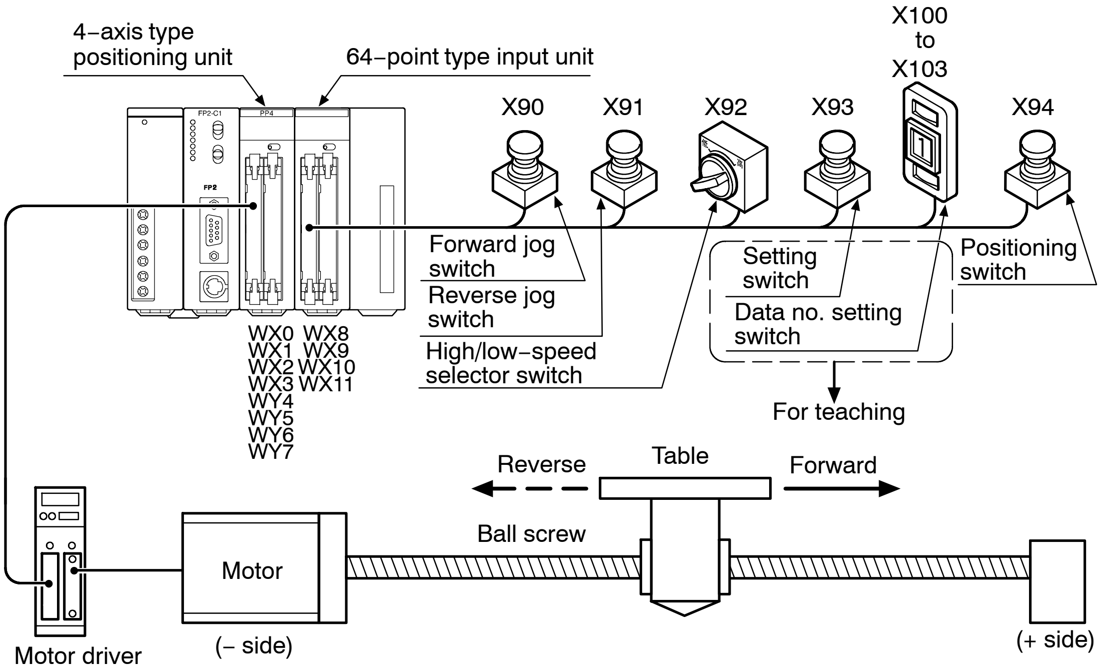
- If the jog speed is changed during jog operation, “linear acceleration/deceleration” should be specified. It is not possible to specify S acceleration/deceleration.
- If “S acceleration/deceleration” has been specified, jog operation continues at the initial speed.

8.4 Teaching Following Jog Operation

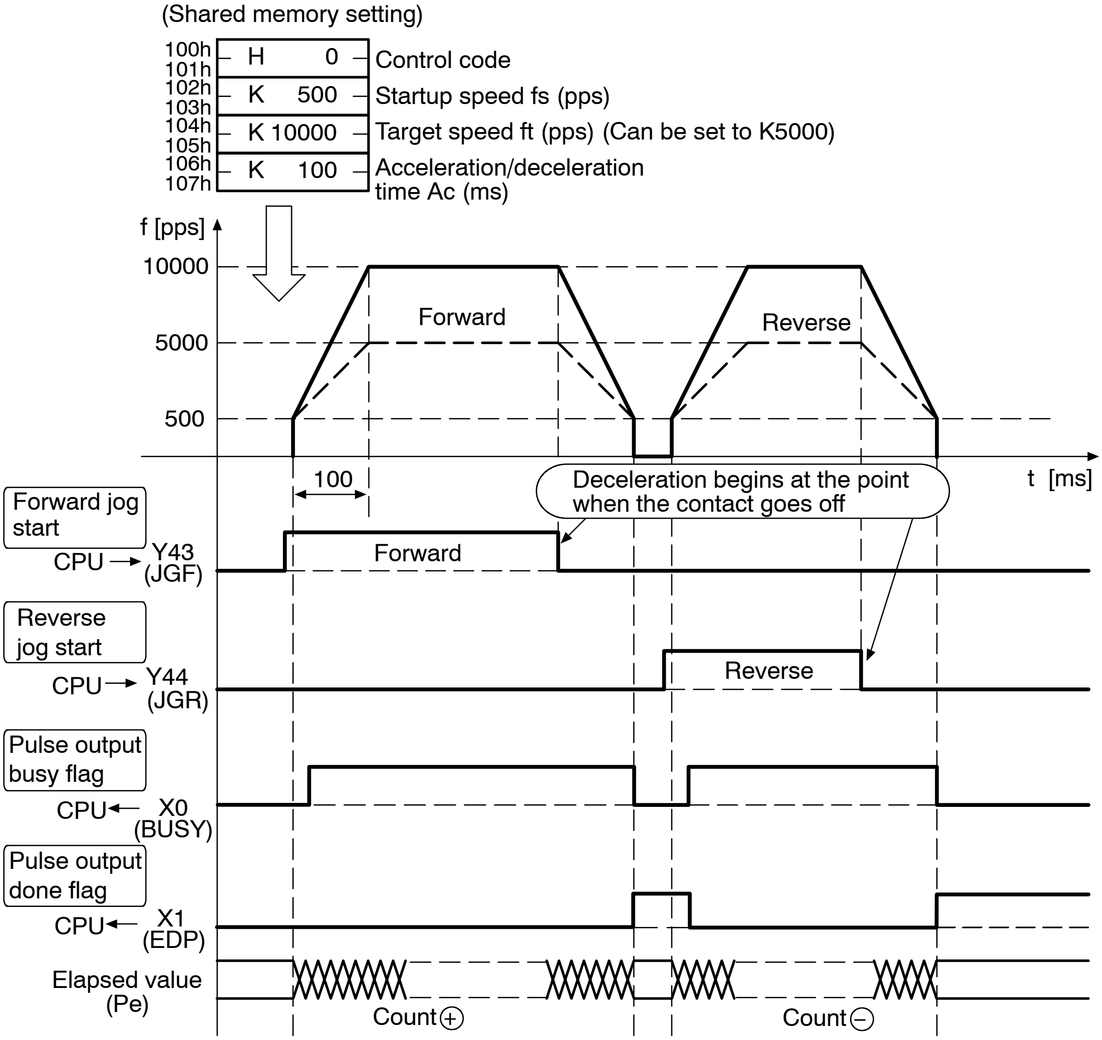
8.4.1 Example of Teaching Settings, and Sample Program

Example of teaching operation following jog operation

- The current position can be determined by reading the counter value stored in the shared memory of the unit after jog operation has taken place.
- The value read at this time is the data for the absolute value.

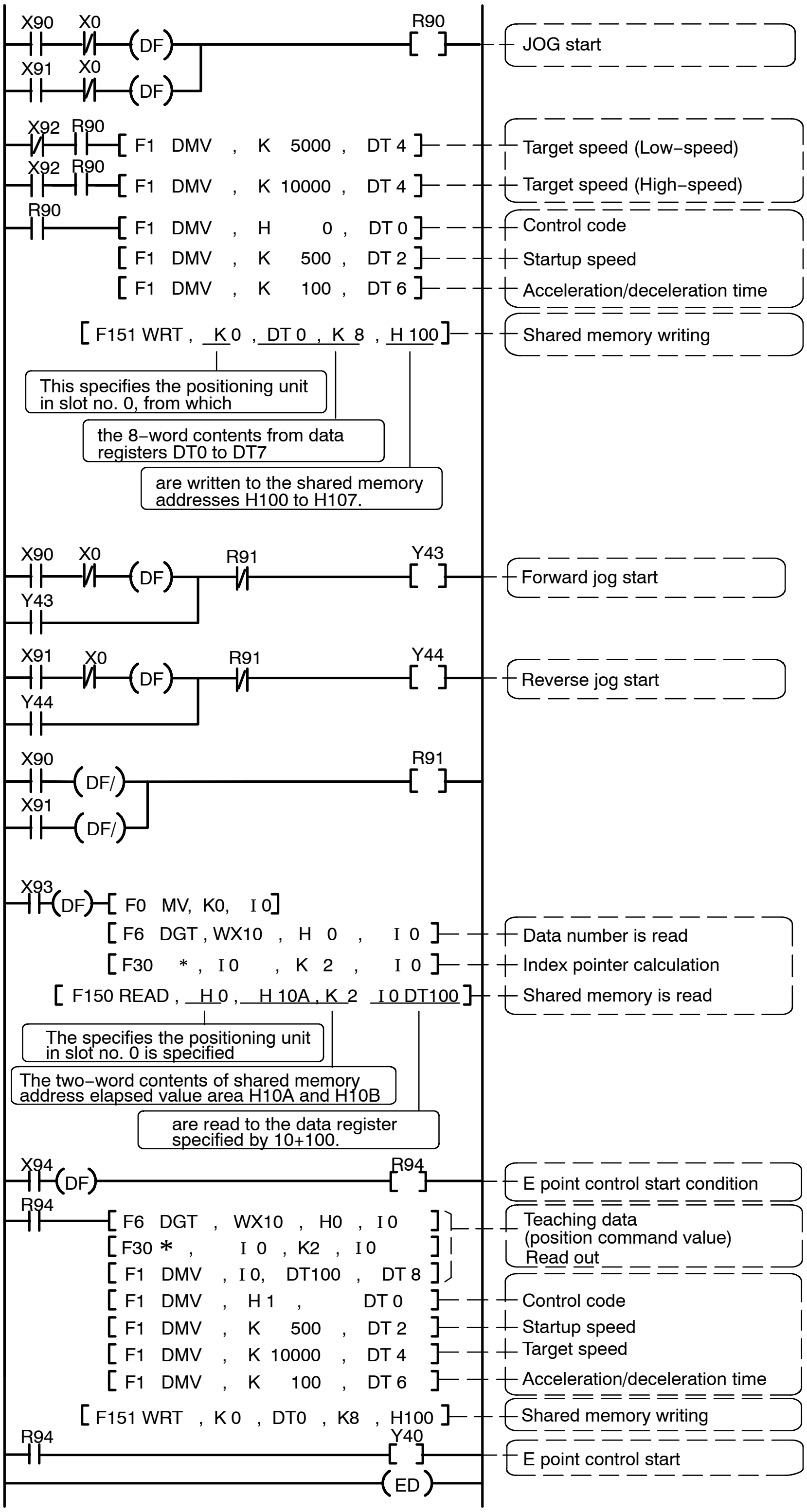


Pulse output diagram

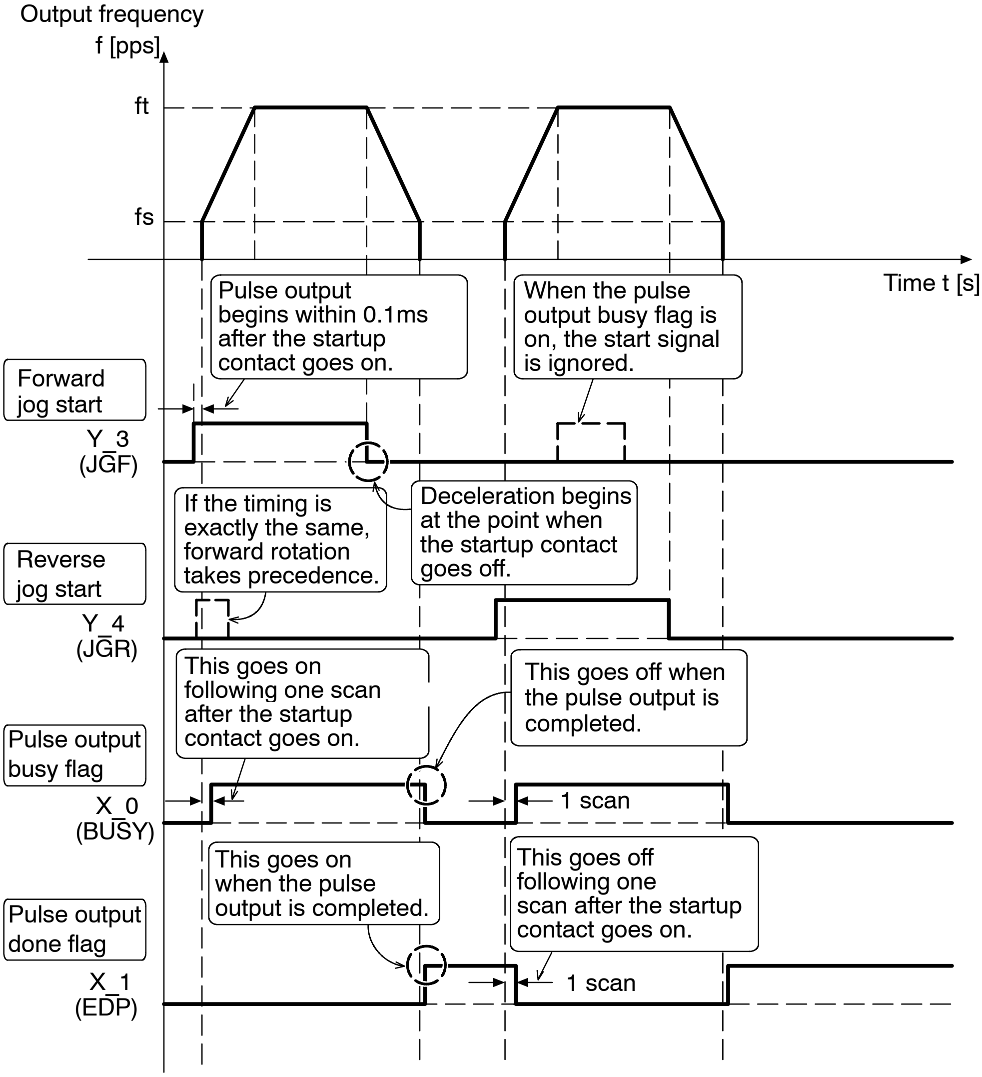


8.4 Teaching Following Jog Operation

Sample program



8.5 Action of the I/O Contact Before and After Jog Operation



Forward jog start relay (Y_3)/Reverse jog start relay (Y_4)

1. Jog operation is initiated based on the parameters written to the positioning unit.
2. The operation is not initiated during the time that the pulse output busy flag (X_0) is on. (it has already been initiated).
3. The operation is reset when the power supply is turned off.

If the startup contact for forward and reverse rotation go on at exactly the same timing, forward rotation takes precedence.

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Pulse output busy flag (X_0)

1. This goes on with the next scan after jog operation has been initiated, and goes off when the pulse output is completed.
2. Operation cannot be shifted to any other operation while this signal is on (except for a forced stop and a deceleration and stop).
3. This is reset when the power supply is turned off.

This flag is shared among E point control, P point control, jog operation, and home returns (except for pulse input enabled operation).

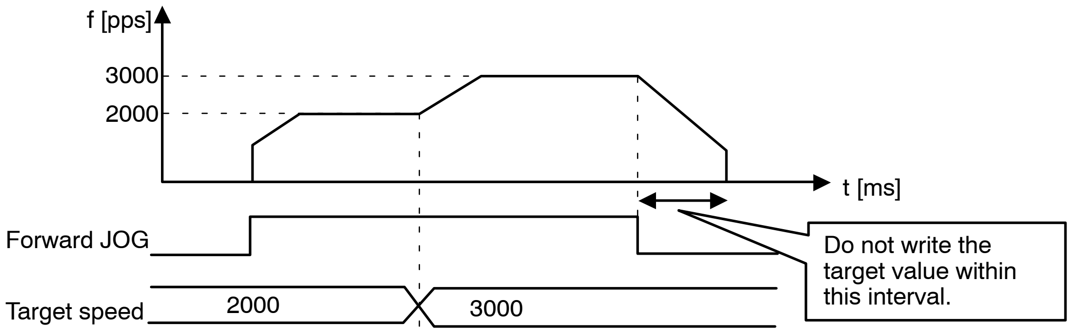
Pulse output done flag (X_1)

1. This goes on when the pulse output is completed, and is maintained until the next E point control, P point control, jog operation, home return, or pulser input enabled status is initiated.
2. This is reset when the power supply is turned off.

This flag is shared among E point control, P point control, jog operation, and pulser input enabled operation.

8.6 Precautions When Changing the Speed During JOG Operation

For changing the target speed during JOG operation (linear acceleration/deceleration setting only), do not change the target speed while deceleration takes place when the JOB contact goes on to off.



Chapter 9

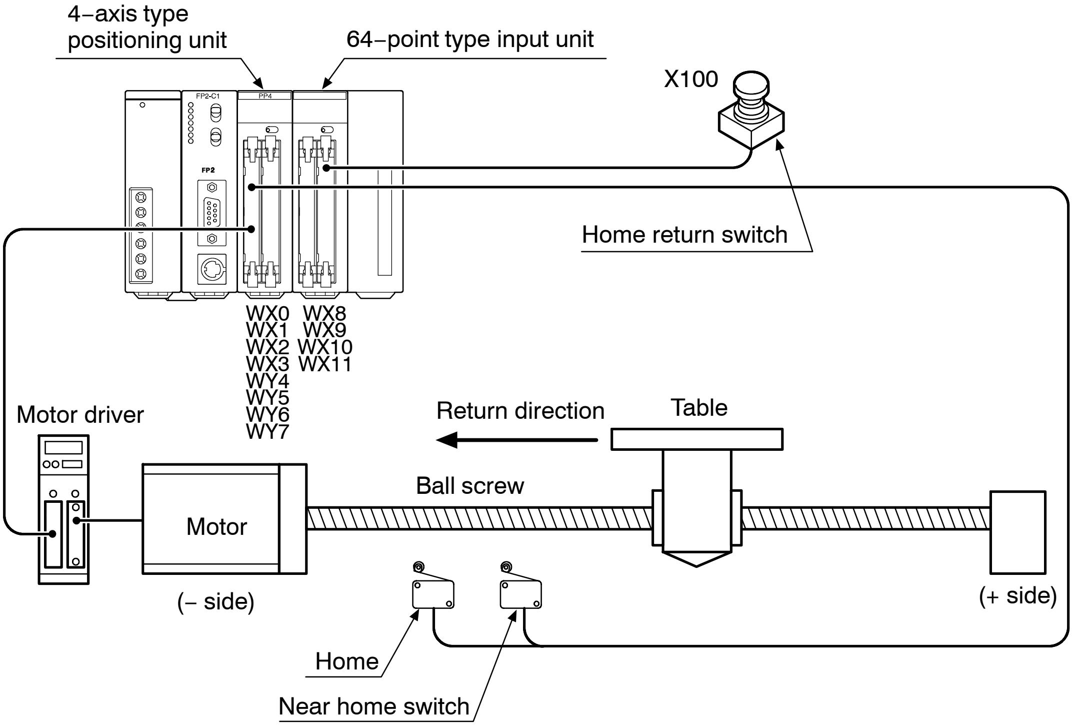
Home Return

9.1 Sample Program

9.1.1 Home Return in the Minus Direction

Returns to the home position are carried out in the minus direction.

For this control, the “Increment” method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side. The home input is connected to the Z phase output of the motor driver, or to an external switch and sensor.



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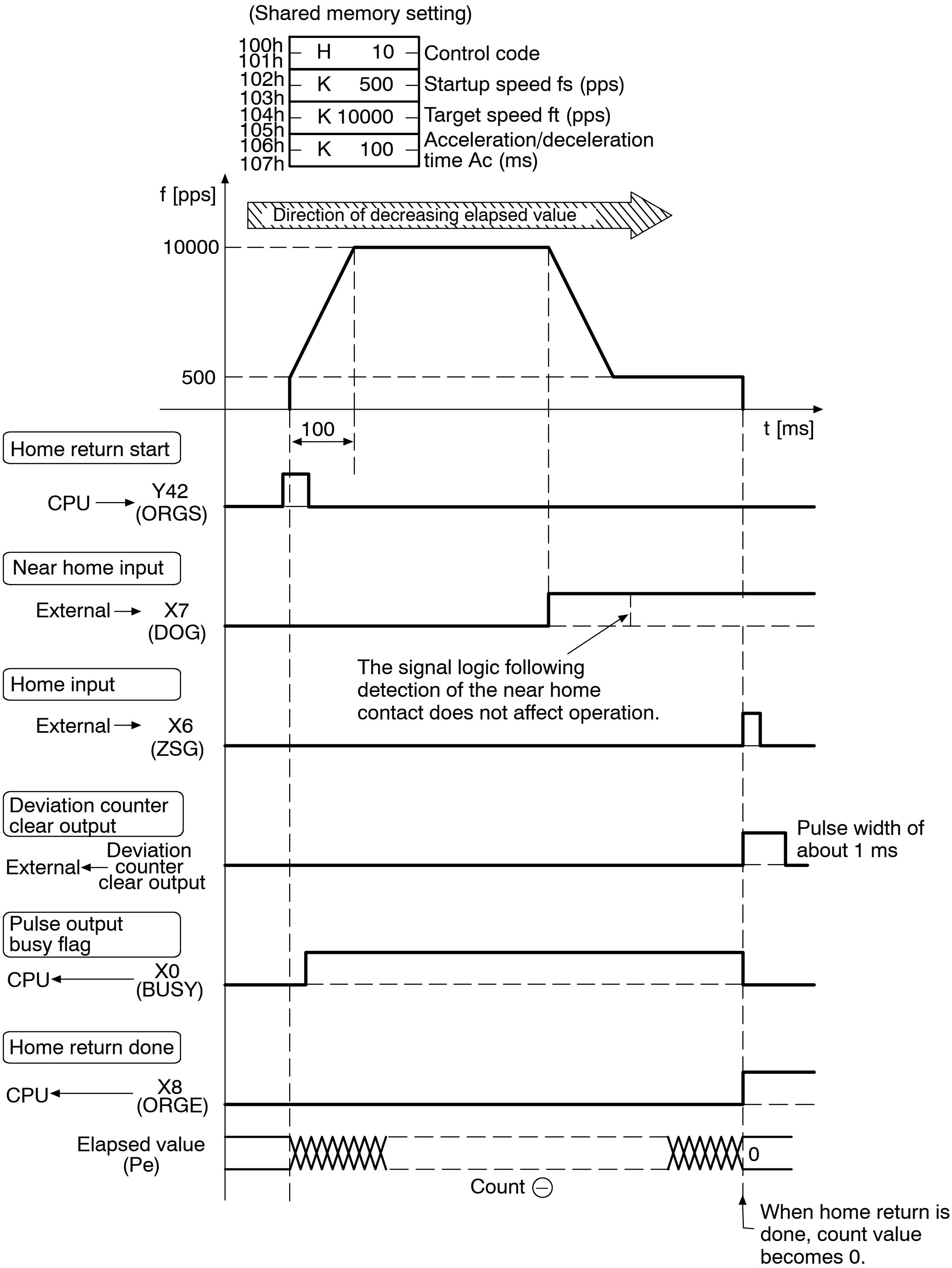
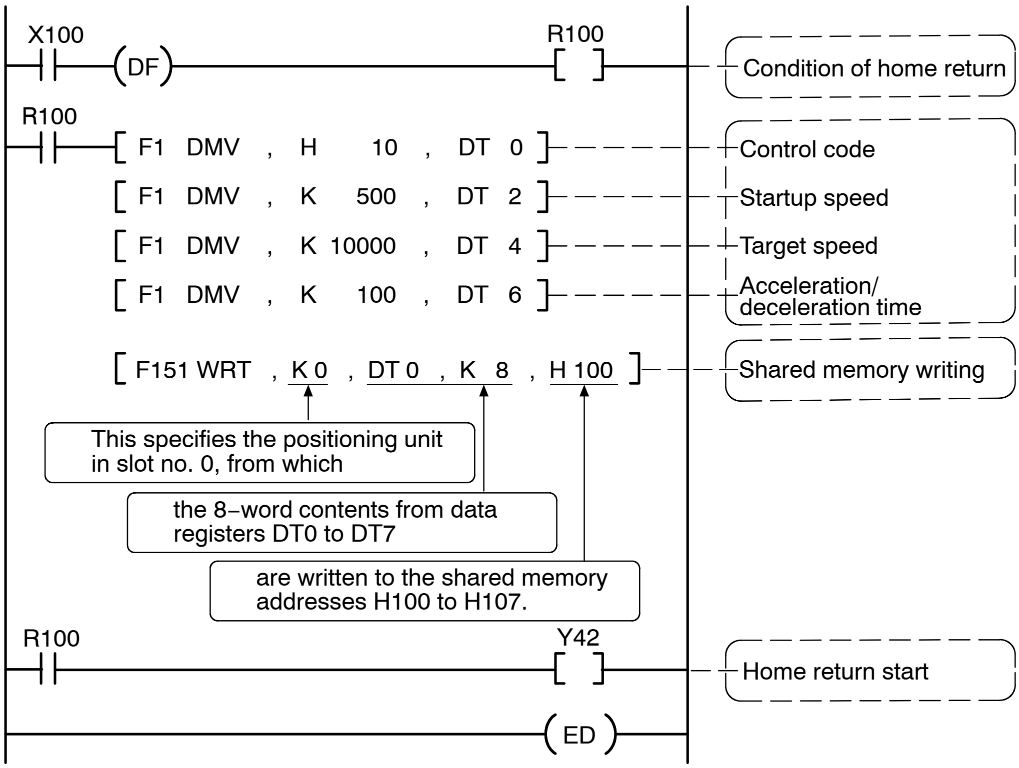
Pulse output diagram



Shared memory setting

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H10 Acceleration/deceleration method: Linear acceleration/ deceleration Direction of home return: – direction of elapsed value Home input logic: Input valid when the power is on Near home input logic: Input valid when the power is on	The specified values vary depending on the method of acceleration/deceleration, the home return direction, the home input logic, and the near home input logic (see page 9 – 7).
Startup speed (pps)	K500	K0 to K1000000
Target speed (pps)	K10000	K1 to K1000000 Specify a value larger than the startup speed.
Acceleration/ deceleration time (ms)	K100	K0 to K32767

Program



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Precautions concerning the program

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, home returns, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, the target speed, or the acceleration/deceleration time exceed the range of values which can be specified, a set value error will occur, and operation cannot be initiated.
- The number of the startup contact varies depending on the number of axes the unit has, and the installation position.

For detailed information about contact number ☛ Section 4.2.3 and 14.3.

- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

For detailed information about slot number ☛ Section 4.2.3.2

For detailed information about shared memory area address ☛ Section 14.2

- The settings vary depending on the logic of the home return input and near home input which have been connected.

For detailed information about input logic ☛ Section 9.4

Specifying the control code

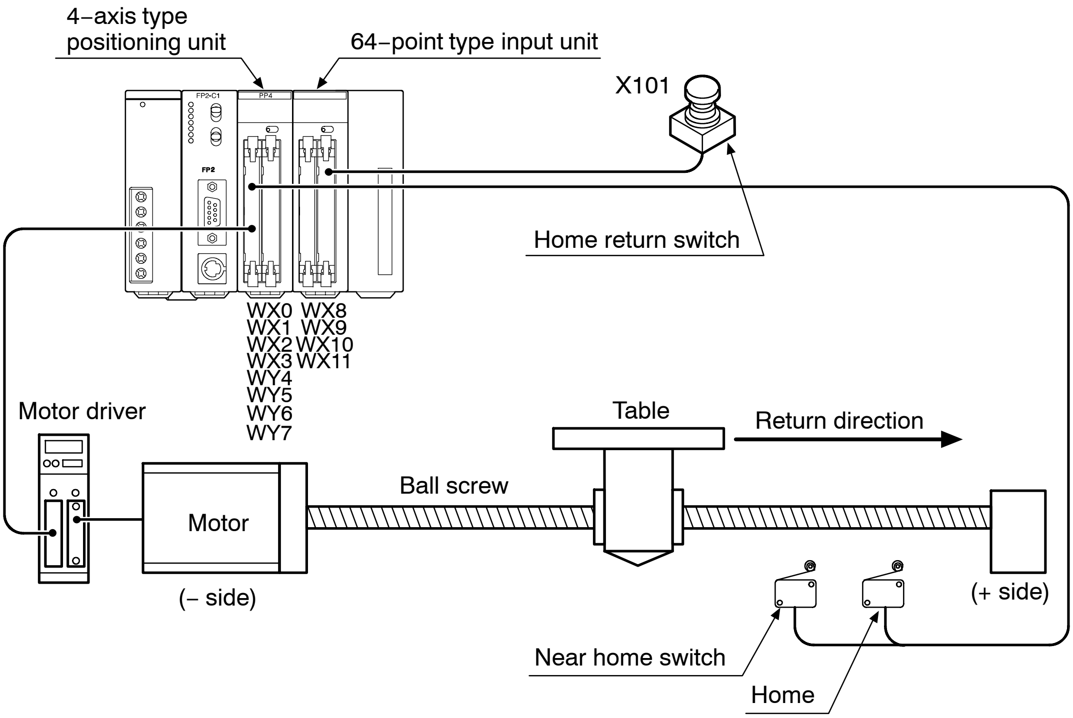
Control code	Description			
	Acceleration/ deceleration method	**Direction of home return**	**Home input logic**	**Near home input logic**
H0	Linear	– direction	Valid when power is not supplied	Valid when power is supplied
H2	S	– direction	Valid when power is not supplied	Valid when power is supplied
H10	Linear	– direction	Valid when power is supplied	Valid when power is supplied
H12	S	– direction	Valid when power is supplied	Valid when power is supplied
H20	Linear	– direction	Valid when power is not supplied	Valid when power is not supplied
H22	S	– direction	Valid when power is not supplied	Valid when power is not supplied
H30	Linear	– direction	Valid when power is supplied	Valid when power is not supplied
H32	S	– direction	Valid when power is supplied	Valid when power is not supplied

9.1.2 Home Return in the Plus Direction

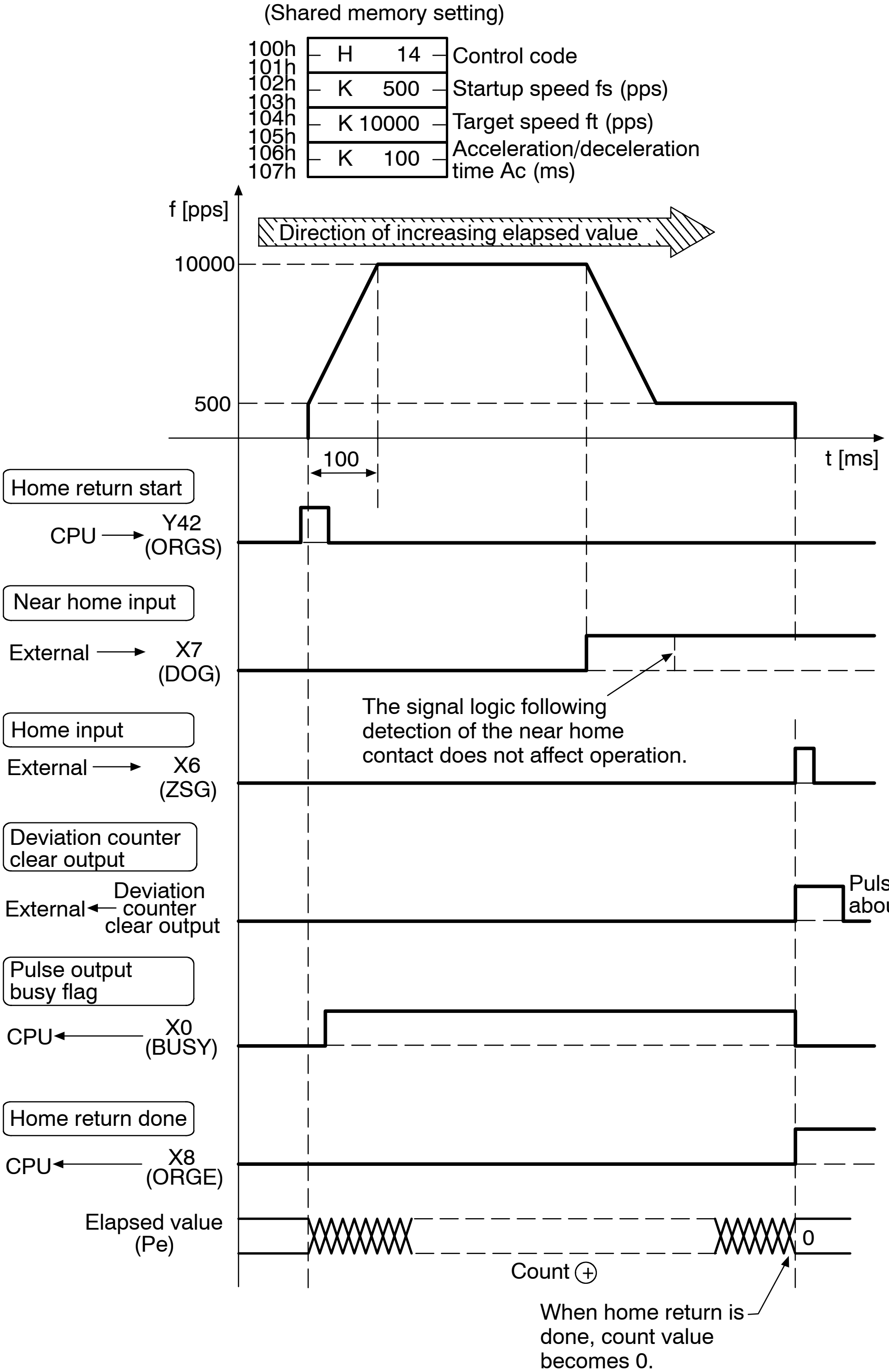
Returns to the home position are carried out in the plus direction.

For this control, the “Increment” method of travel amount setting is used, and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. This control assumes that the mode setting switches on the back of the positioning unit have been set to the normal setting side. The home input is connected to the Z phase output of the motor driver, or to an external switch and sensor.

Pulse output diagram



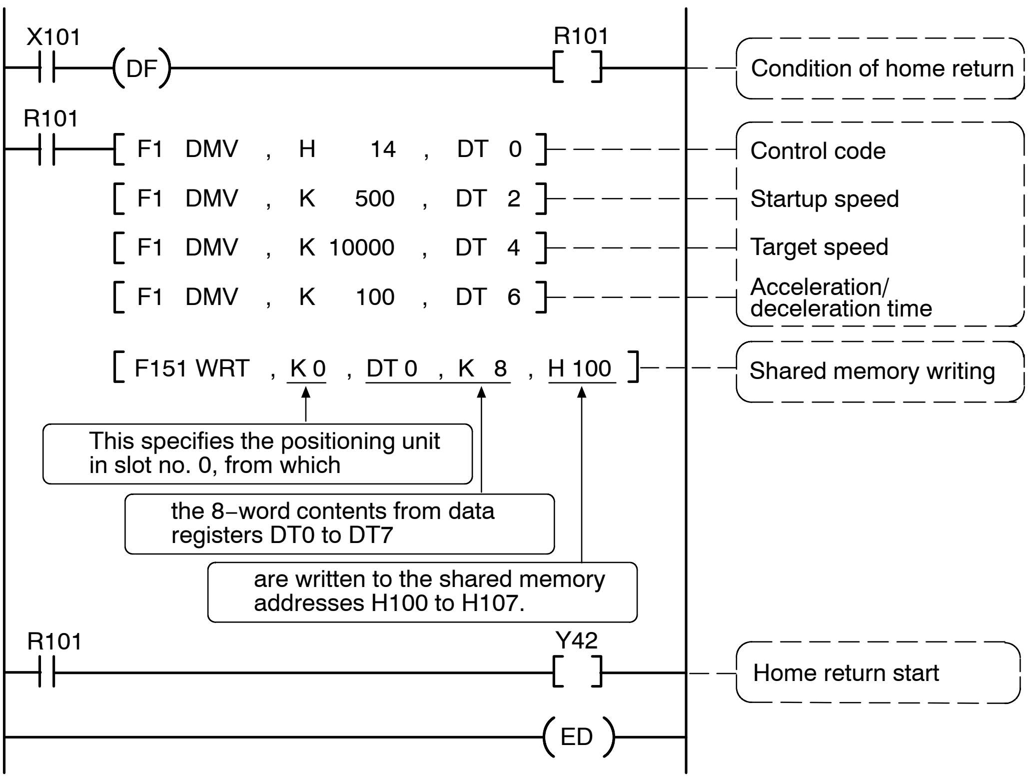
Pulse output diagram



Shared memory setting

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H14 Acceleration/deceleration method: Linear acceleration/ deceleration Direction of home return: + direction of elapsed value Home input logic: Input valid when the power is on Near home input logic: Input valid when the power is on	The specified values vary depending on the method of acceleration/deceleration, the home return direction, the home input logic, and the near home input logic (see page 9 – 12).
Startup speed (pps)	K500	K0 to K1000000
Target speed (pps)	K10000	K1 to K1000000 Specify a value larger than the startup speed.
Acceleration/ deceleration time (ms)	K100	K0 to K32767

Program



Precautions concerning the program

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, home returns, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, the target speed, or the acceleration/deceleration time exceed the range of values which can be specified, a set value error will occur, and operation cannot be initiated.
- The number of the startup contact varies depending on the number of axes the unit has, and the installation position.

For detailed information about contact number ☛ Section 4.2.3 and 14.3.

- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

For detailed information about slot number ☛ Section 4.2.3.2

For detailed information about shared memory area address ☛ Section 14.2

- The settings vary depending on the logic of the home input and near home input which have been connected.

For detailed information about input logic ☛ Section 9.4

Specifying the control code

Control code	Description			
	Acceleration/ deceleration method	**Direction of home return**	**Home input logic**	**Near home input logic**
H4	Linear	+ direction	Valid when power is not supplied	Valid when power is supplied
H6	S	+ direction	Valid when power is not supplied	Valid when power is supplied
H14	Linear	+ direction	Valid when power is supplied	Valid when power is supplied
H16	S	+ direction	Valid when power is supplied	Valid when power is supplied
H24	Linear	+ direction	Valid when power is not supplied	Valid when power is not supplied
H26	S	+ direction	Valid when power is not supplied	Valid when power is not supplied
H34	Linear	+ direction	Valid when power is supplied	Valid when power is not supplied
H36	S	+ direction	Valid when power is supplied	Valid when power is not supplied

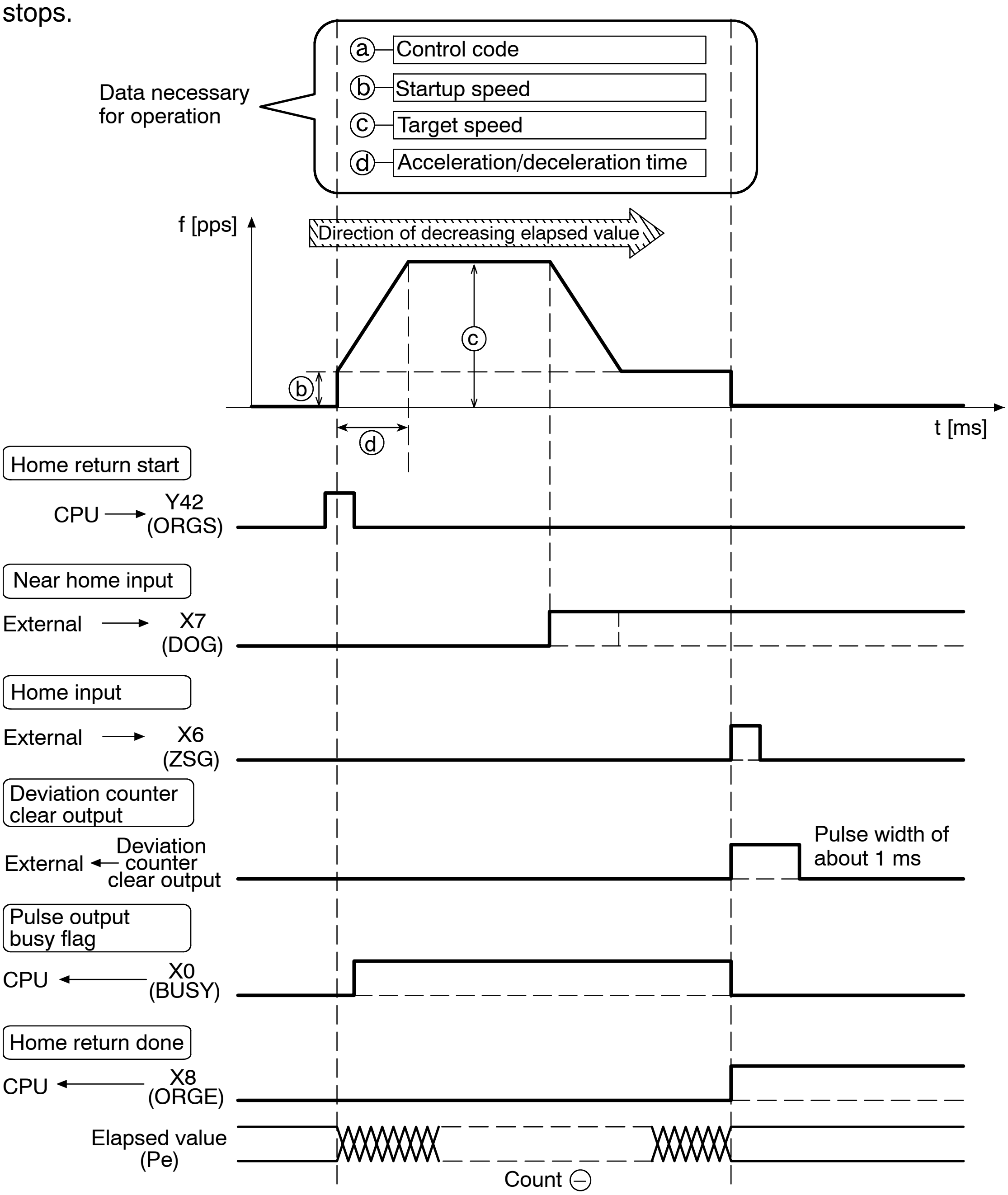
9.2 Flow of Operation Following a Home Return

Home return

When a 4–axis type positioning unit is mounted in slot 0

Operation example

When the startup contact is turned on, acceleration is carried out based on the settings, until the target speed is reached. If near home input exists at that point, the speed slows to the startup speed, and then, if home input exists at that point as well, the movement stops.



When Y42 is turned on through the program, the motor for the first axis begins to accelerate, and continues accelerating until the target speed is reached. If there is near home input at that point, the motor decelerates to the startup speed.
After deceleration has been completed, the motor stops if home input exists.

Data required for settings

The following data must be written to the specified addresses of the shared memory.

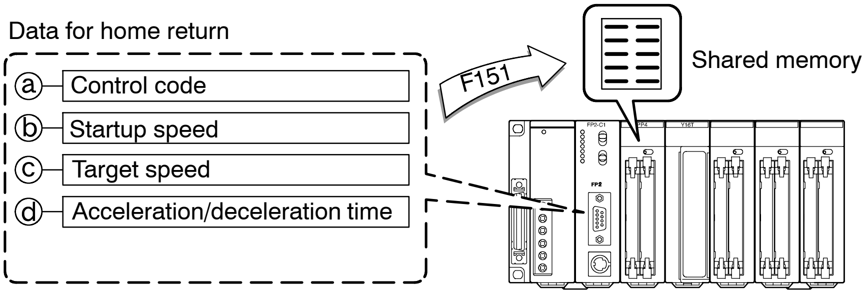
Operation is determined by the following four types of data.

- Control code
- Startup speed
- Target speed
- Acceleration/deceleration time

Operation steps

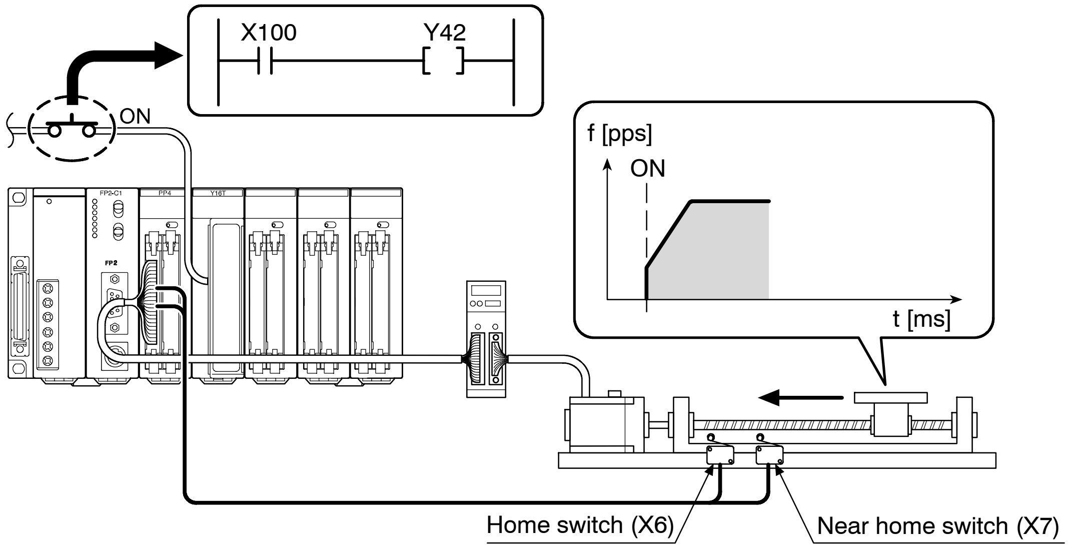
Step 1: Preparatory stage

The data for operation is transferred to the shared memory ahead of time.



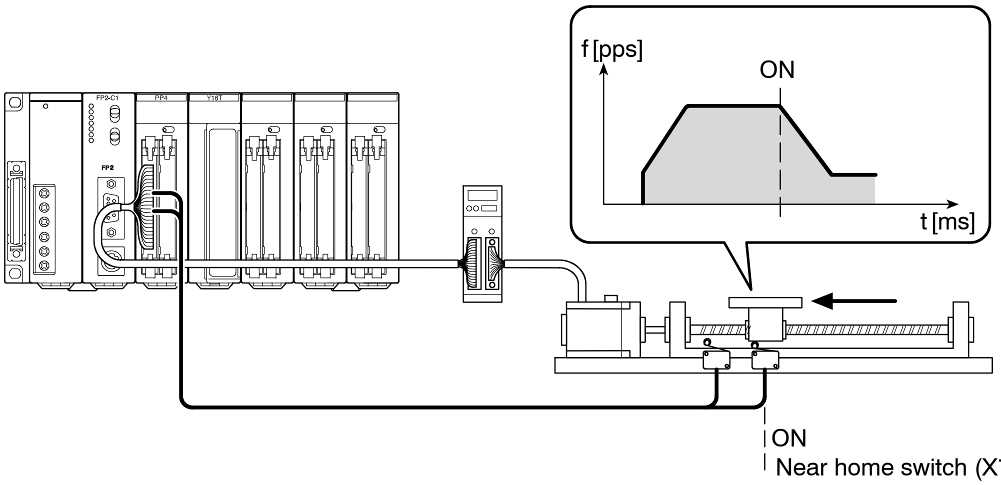
Step 2: Execution of operation

The startup contact relay Y42 is turned on.
The control code determines whether S acceleration/deceleration or linear acceleration/deceleration is used.
When the startup contact is turned on, acceleration takes places for the acceleration/deceleration time it takes to reach the target speed, and the table moves.



Step 3: Near home input

If there is near home input, the speed slows to the startup speed.



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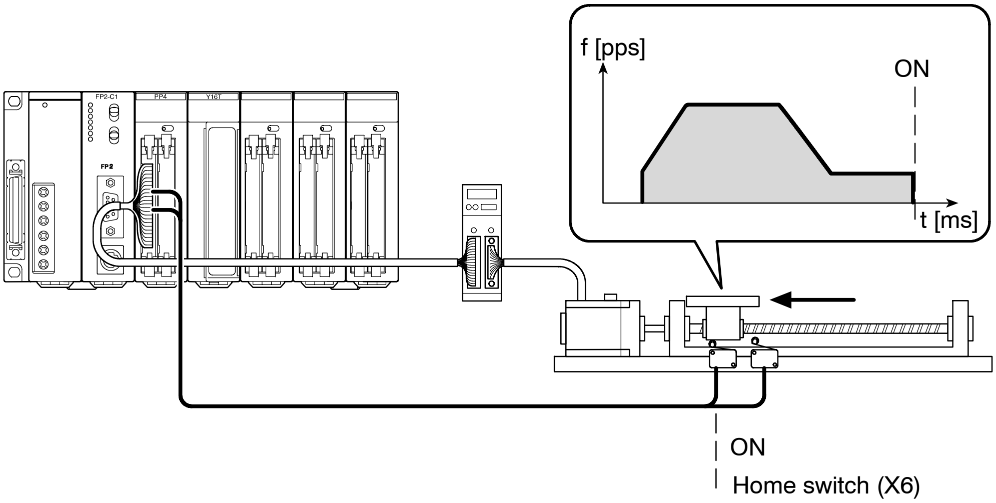
Step 4: Home input

After decelerating to the startup speed value, the movement unit stops if there is home input.



9.2.1 Operation If the Home Input is the Z Phase of the Servo Driver

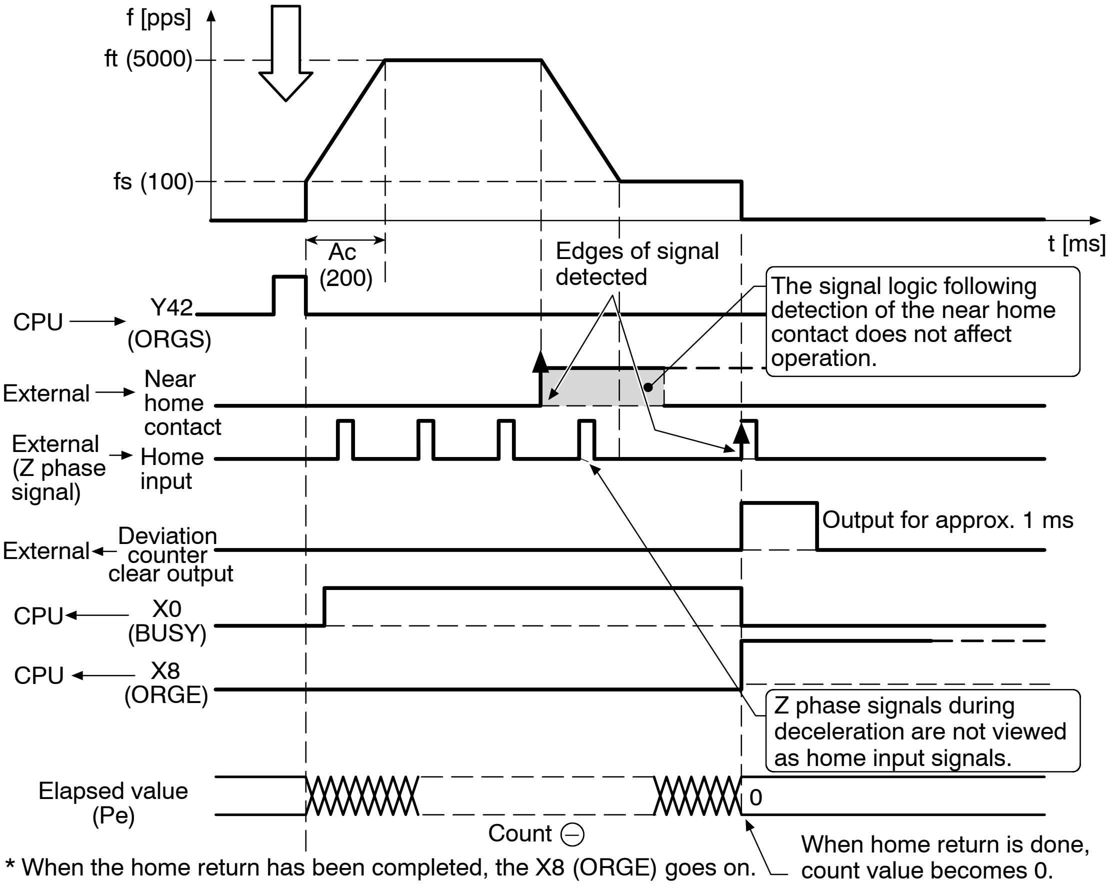
When near home input is input, the speed slows, and when the startup speed has been reached, the positioning unit recognizes the first input Z phase signal as the home input signal, and stops.

When a 4–axis type positioning unit is mounted in slot 0

Example of specified data

(Shared memory setting)

100h–101h	H 10	Control code
102h–103h	K 100	Startup speed fs (pps)
104h–105h	K 5000	Target speed ft (pps)
106h–107h	K 200	Acceleration/deceleration time Ac (ms)



When a home return has been completed, the elapsed value in the shared memory is cleared, and at the same time the deviation counter clear output signal is output for approximately 1 ms.

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☞ **Notes**

- **Z phase signals input during deceleration are not viewed as home input signals. Deceleration continues without stopping until the startup speed is reached, and then the motor continues to rotate at the startup speed until a Z phase signal is input.**
- **If a home return is started at whatever point both the near home and home input become valid, the table (positioning unit) does not move.**

9.2.2 Operation If the Home Input is Through an External Limit Switch

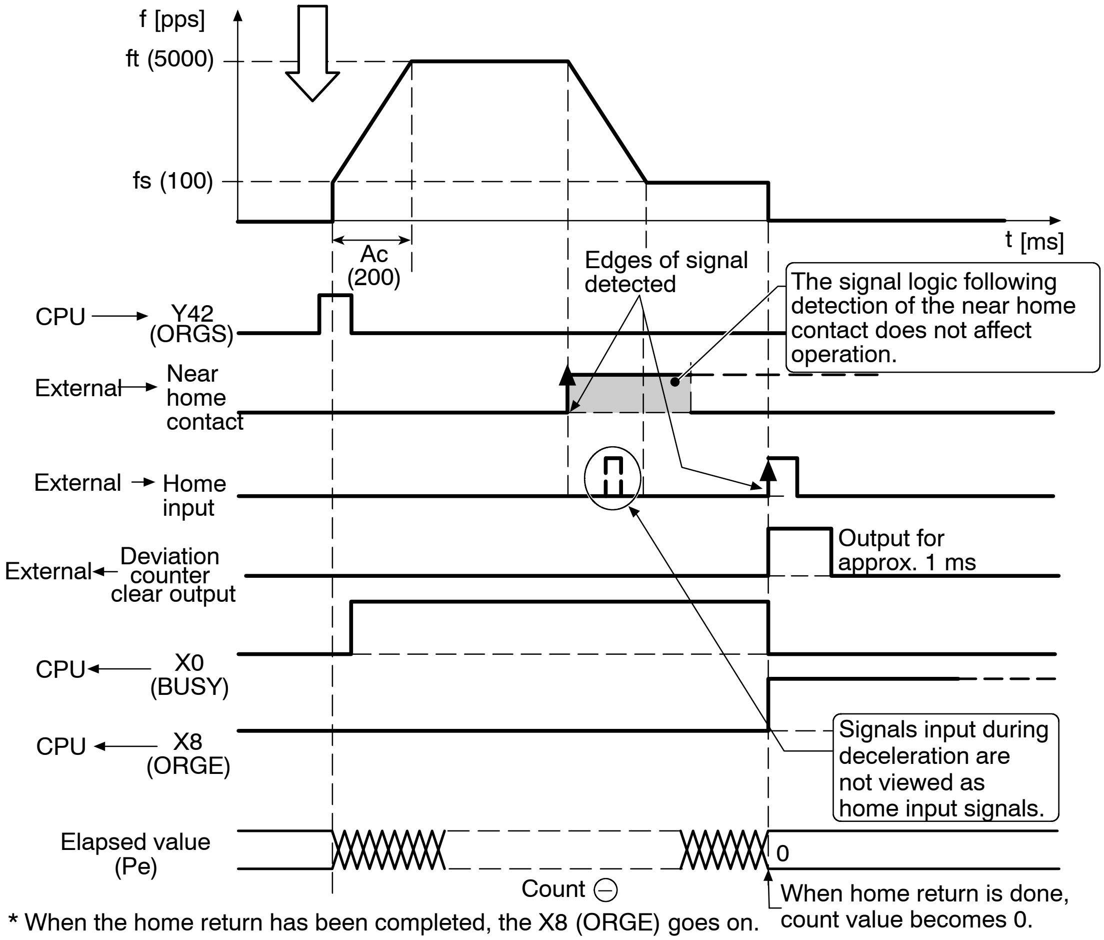
When near home input is input, the speed slows, and when the startup speed has been reached, the home input signal is input, and stops.

When a 4−axis type positioning unit is mounted in slot 0

Example of specified data

(Shared memory setting)

100h 101h	H 10	Control code
102h 103h	K 100	Startup speed fs (pps)
104h 105h	K 5000	Target speed ft (pps)
106h 107h	K 200	Acceleration/deceleration time Ac (ms)



* When the home return has been completed, the X8 (ORGE) goes on.

When a home return has been completed, the elapsed value in the shared memory is cleared, and at the same time the deviation counter clear output signal is output for approximately 1 ms.

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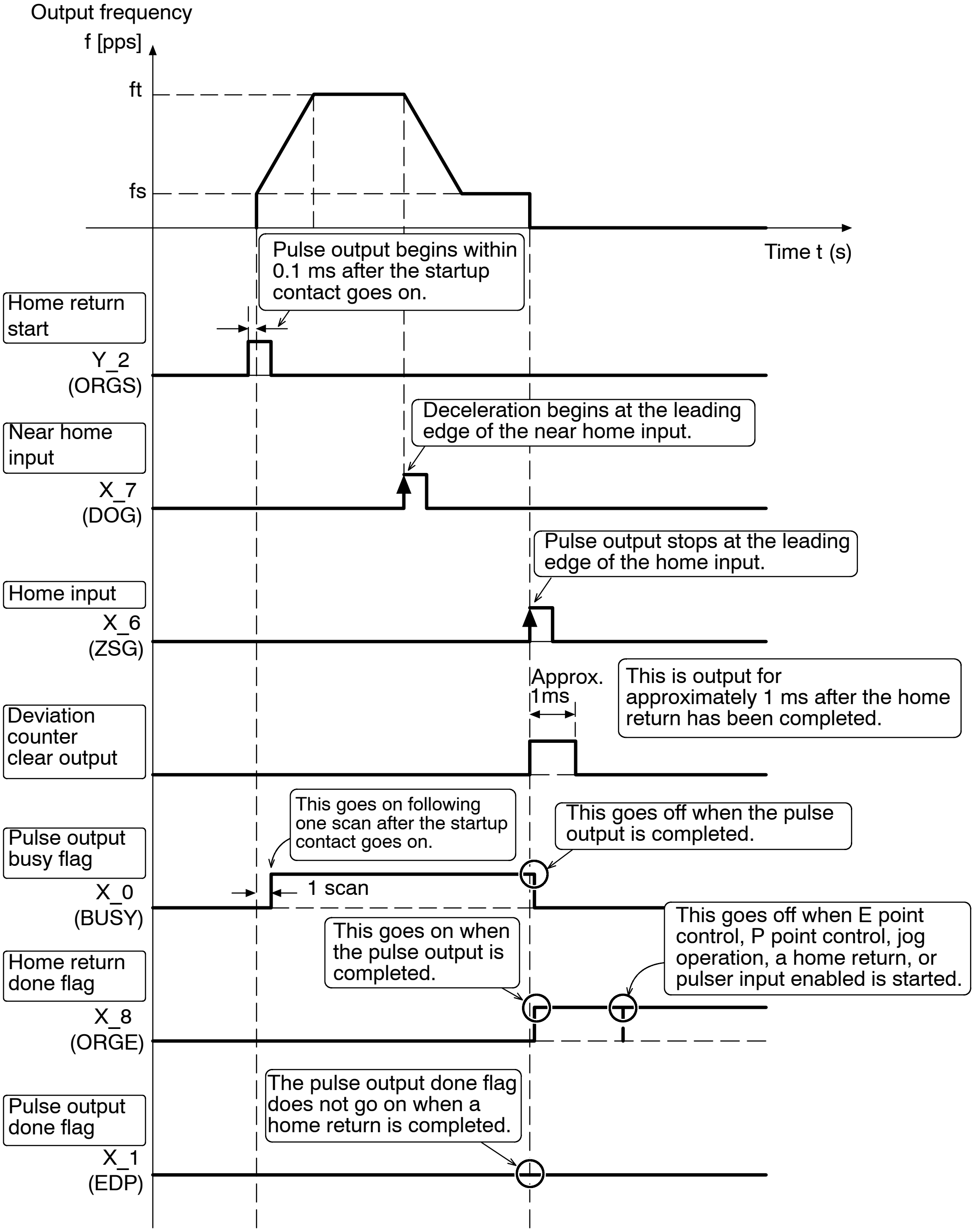
☞ Notes

- **Home input signals input during deceleration are not viewed as home input signals. Deceleration continues without stopping until the startup speed is reached, and then the motor continues to rotate at the startup speed until a home input signal is input.**
- **If a home return is started at whatever point both the near home and home input become valid, the table (positioning unit) does not move.**

9.3 Action of the I/O Contact Before and After a Home Return Operation



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Home return start contact (relay) (Y_2)

1. Home return is initiated based on the parameters written to the positioning unit.
2. The contact (relay) is not initiated during the time that the pulse output busy flag (X_0) is on. (it has already been initiated).
3. The contact (relay) is reset when the power supply is turned off.

Near home input (X_7)

1. Deceleration begins when the near home switch input connected to the positioning unit becomes valid.
2. The leading edge of the signal is detected, so changes to flags following the input do not affect operation.

Confirmation of the input logic is necessary. (Refer to ☛ section 9.4.)

Home input (X_6)

1. The table stops when the home switch input becomes valid after the near home switch input connected to the positioning unit became valid.
2. The leading edge of the signal is detected, so changes to flags following the input do not affect operation.

Confirmation of the input logic is necessary. (Refer to ☛ section 9.4.)

Deviation counter clear output

1. This goes on for approximately 1 ms after the home return has been completed.

This is used in systems in which a servo motor is used.

Pulse output busy flag (X_0)

1. This goes on with the next scan after home return has been initiated, and goes off when the pulse output is completed.
2. Operation cannot be shifted to any other operation while this signal is on (except for a forced stop and a deceleration and stop).
3. This is reset when the power supply is turned off.

This flag is shared among E point control, P point control, jog operation, and home returns (except when pulser input is enabled).

Home return done flag (X_8)

1. This goes on when a home return is completed, and is maintained until E point control, P point control, jog operation, a home return, or pulser input enabled operation is started.
2. This flag is reset when the power supply is turned off.

Pulse output done flag (X_1)

1. The pulse output done flag does not go on when a home return is completed.
2. Before a home return is started, this goes from on to off when E point control, P point control, jog operation, or pulser input enabled operation is completed.
3. If this is off before a home return is started, it remains off and does not change.
4. This flag is reset when the power supply is turned off.

This flag is common to E point control, P point control, jog operation, and pulser input enabled operation.

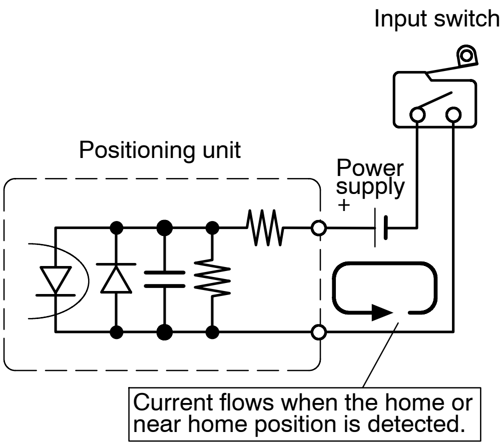
9.4 Checking the Home and Near Home Input Logic

9.4.1 When "Input Valid When Power is Supplied" is Specified

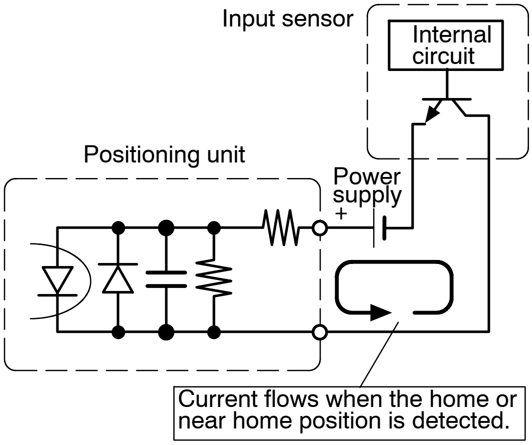
In cases like that below, when power is supplied to the input circuit of the unit, the "Power supplied" control code for the program is selected from the control code table.
(Refer to ☛ section 14.2.1)

When "Input valid when power is supplied" is specified:

- If the input switch contact is the "a" contact
- If the input sensor goes on when the home or near home position is detected
- When the Z phase of the driver is connected



If the input switch contact is "a" contact



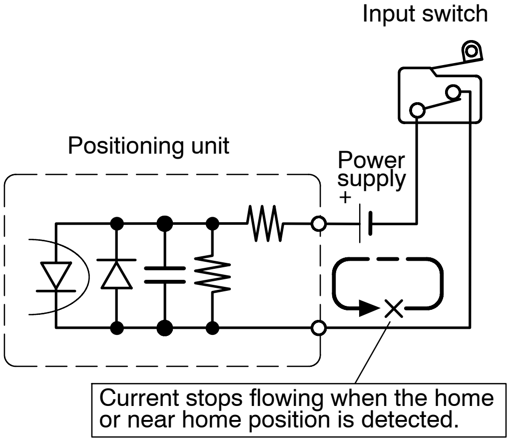
If the input sensor goes on when the home or near home position is detected

9.4.2 When “Input Valid When Power is not Supplied” is Specified

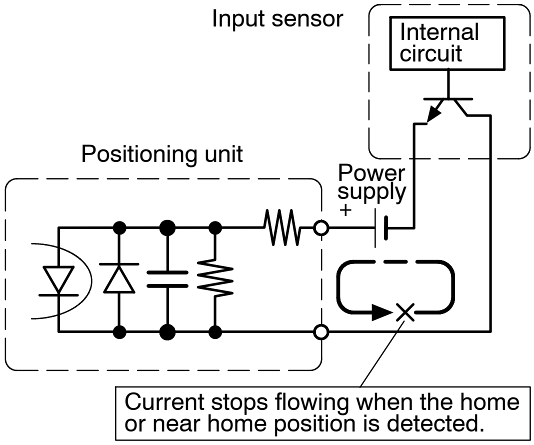
In cases like that below, when power is not being supplied to the input circuit of the unit, the “Power not supplied” control code for the program is selected from the control code table.
(Refer to ☛ section 14.2.1.)

When “Input valid when power is not supplied” is specified:

- If the input switch contact is the “b” contact
- If the input sensor goes off when the home or near home position is detected



If the input switch contact is the “b” contact



If the input sensor goes off when the home or near home position is detected

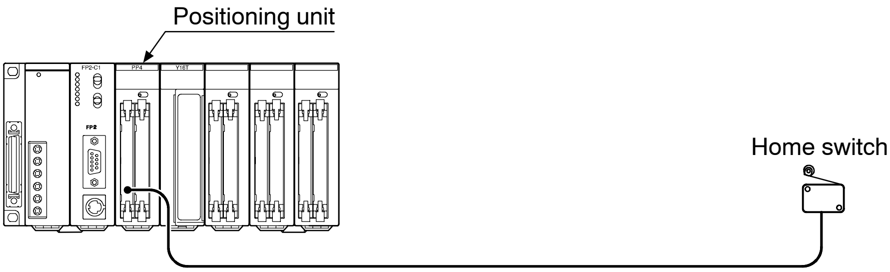
9.5 Practical Use for a Home Return

9.5.1 When One Limit Switch is Used as the Home Input

Example of usage method

Connection

Only the home input switch is installed and connected. (No near home input switch is connected.)



Input logic setting

The control code in the shared memory should be set as indicated below.

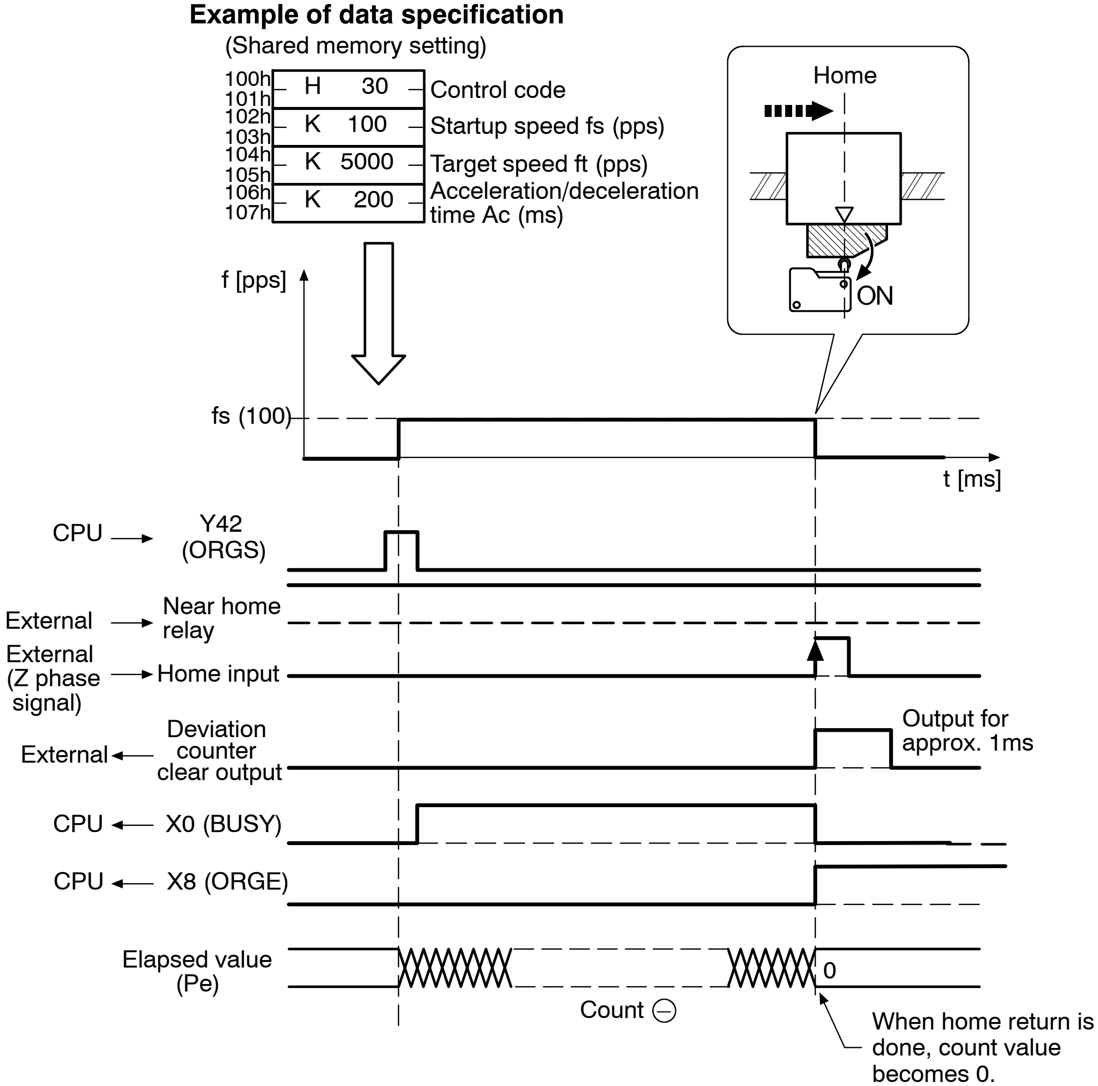
– Home input logic: Input exists when power is supplied.

– Near home input logic: Input exists when power is not supplied.

Operation

When a home return begins, the motor rotates in the direction of the home return. The motor rotates at the startup speed.
(At this point, the near home input should already be on, as a result of the input logic.)
If there is home input, the motor stops.

Example:



☞ Notes

- **The home return is carried out at the startup speed (one speed).**
- **The home input cannot be used if it is connected to the Z phase output of the motor driver.**

☛ next page

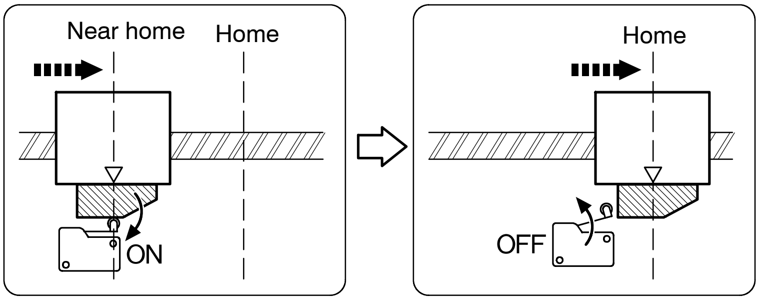
Key Points

- Practical application of input logic. The near home input is set to “Input exists when power is not supplied”, and is not connected.
- There is no near home switch.
- Only the home input switch is connected.

9.5.2 When the Near Home and Home Input are Allocated by Turning a Single Limit Switch On and Off

Environment in which this function can be used

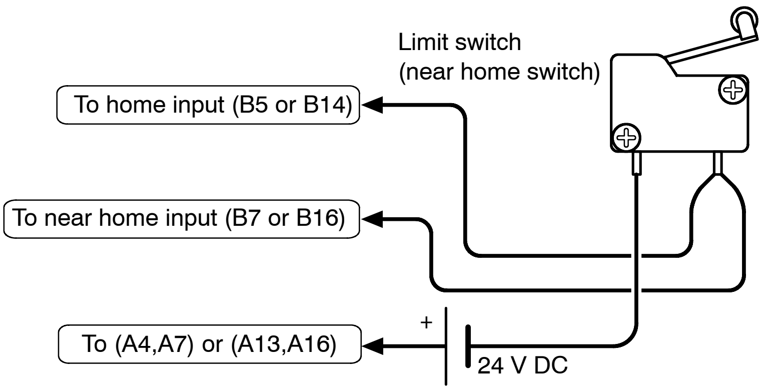
This can be used in a system in which, when a home return is begun, the near home input switch goes on and then off again.



Example of usage method

Connection

The near home and home input are connected to the near home input switch.



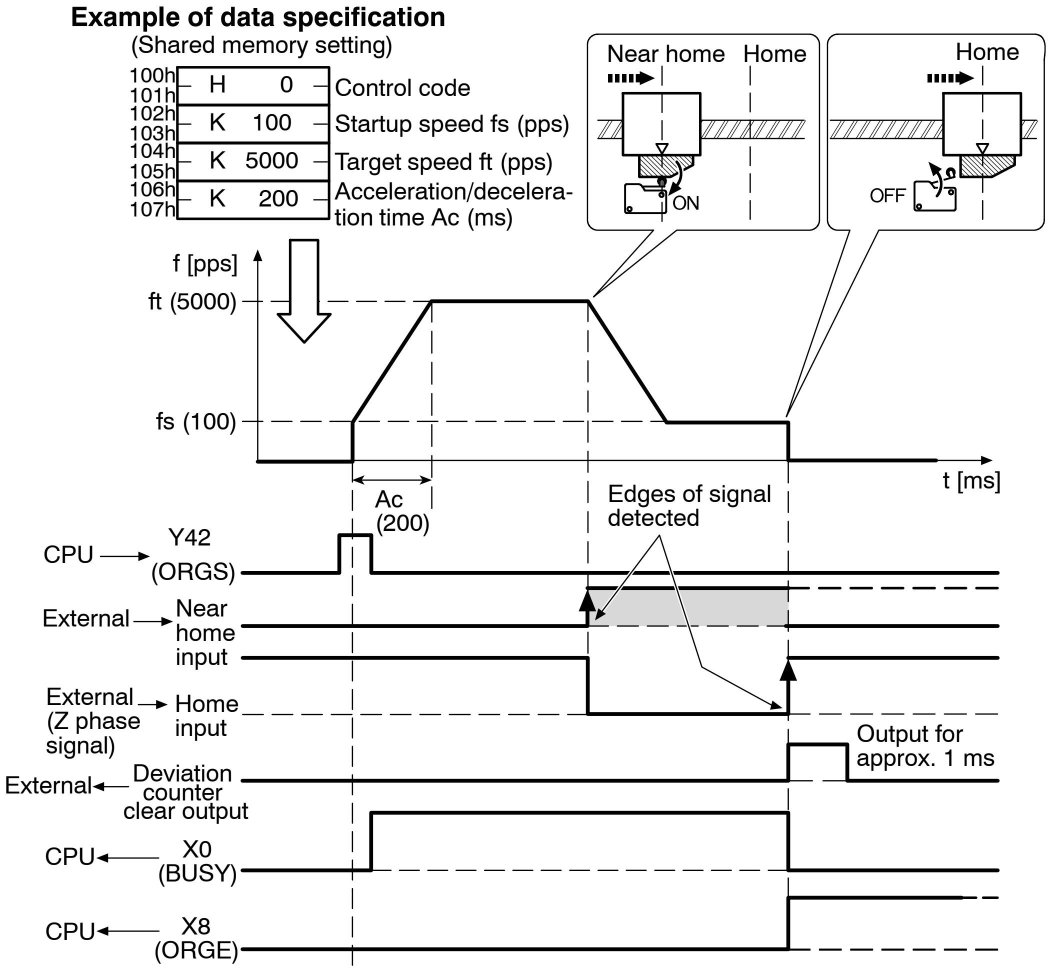
Input logic setting

The control code in the shared memory should be set as indicated below.

- Home input logic: Input exists when power is not supplied.
- Near home input logic: Input exists when power is supplied.

Operation

When a home return is begun, the motor rotates in the direction of the home return. Deceleration begins when the near home input switch goes on, and the speed slows to the startup speed.
Rotation continues until the near home input goes off.
At that point, there is considered to be home input, and rotation stops.



Notes

- **The near home input must be on for the deceleration time or longer.**
- **Near home input does not affect operation, even if the signal logic changes after the near home detection.**

Key Points

- Practical application of input logic. The logic of the home input and that of the near home input are reversed.
- Near input is valid when the limit switch goes on.
- Home input is valid when the limit switch goes off.
- Only one switch is connected to both home input and near home input.

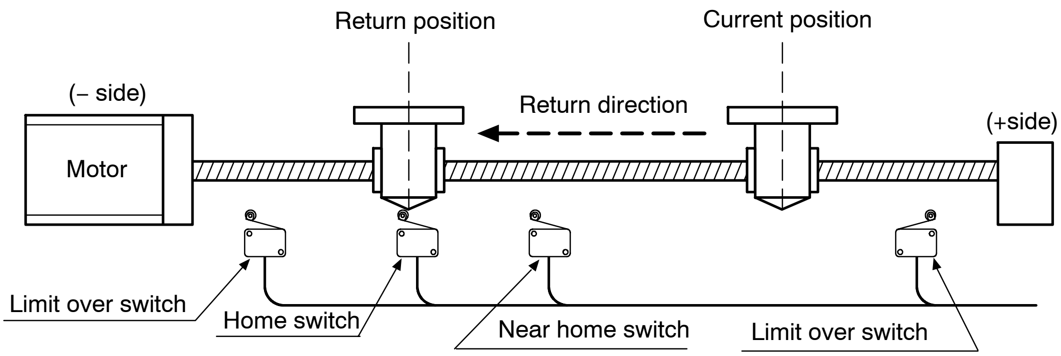
9.5.3 Home Return Based on a Home Search

What is a home search?

If control is being carried out which encompasses both sides of the home position, or the direction of the home return is not necessarily limited to one direction, the limit over input and the user program can be used to carry out a bi-directional home return, as shown in the illustration below.

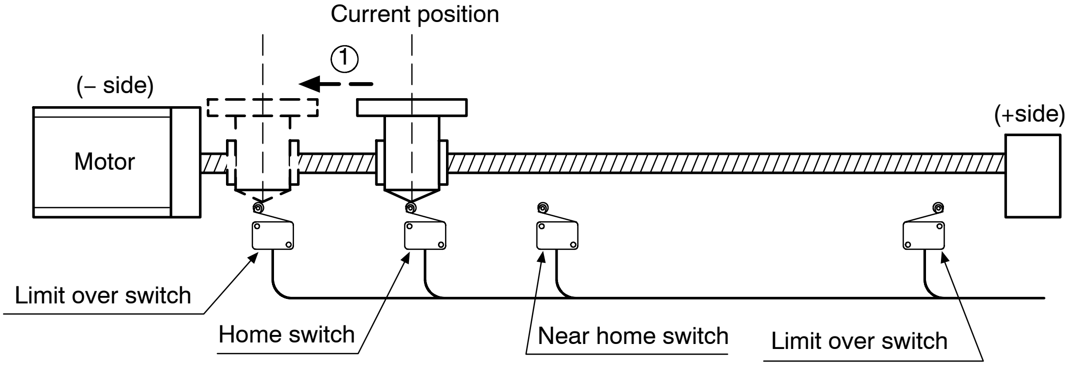
If the near home position is in the direction of the home return

The speed slows at the near home position, and the motor stops at the home input position.

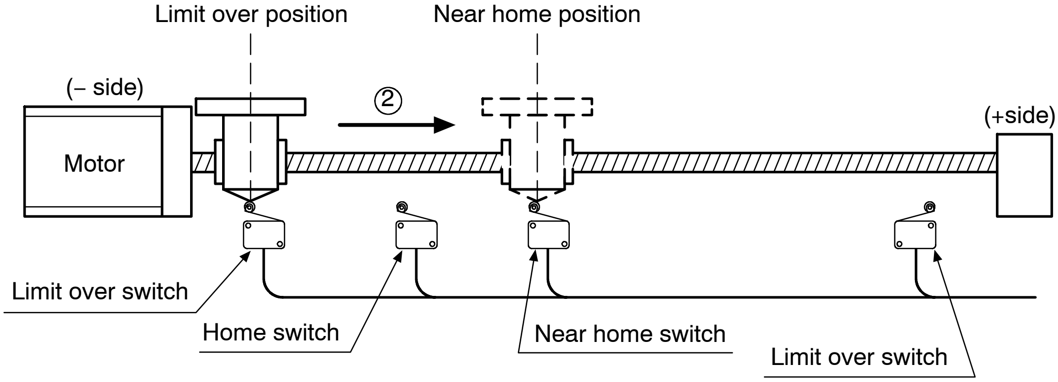


If the near home position is not in the direction of the home return

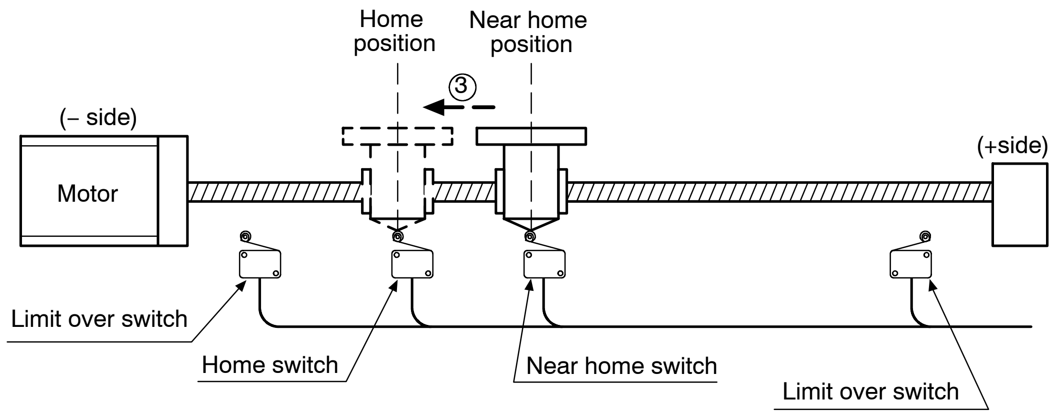
① The home return begins in the direction specified by the program. Movement is continued until the limit over input position is reached.



② When the limit over is detected, the direction of movement is reversed. Movement then continues until the near home input position, which briefly turns on then off again, is reached.

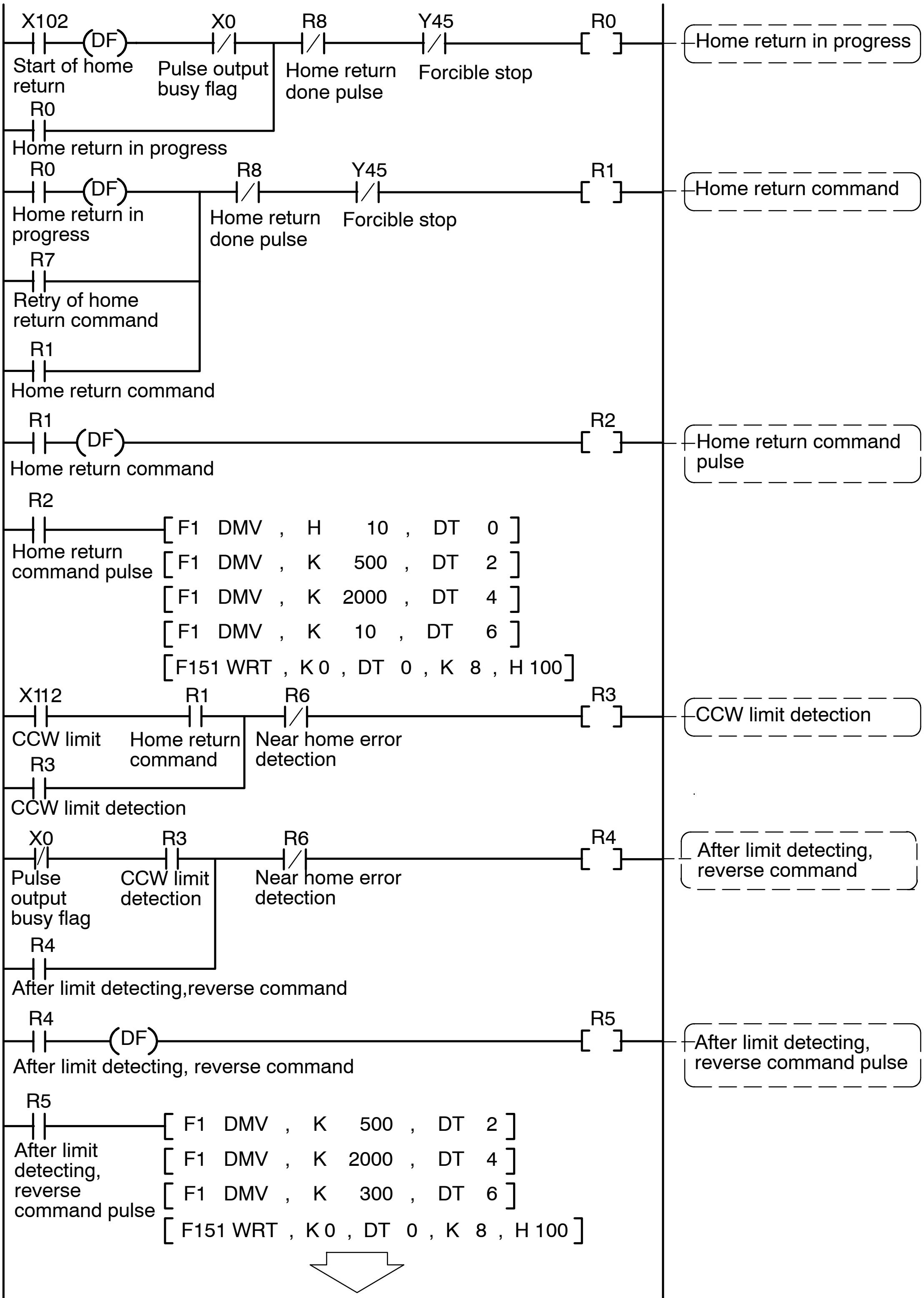


③ When the near home input is detected, the direction of movement is reversed again, and movement stops at the home position.

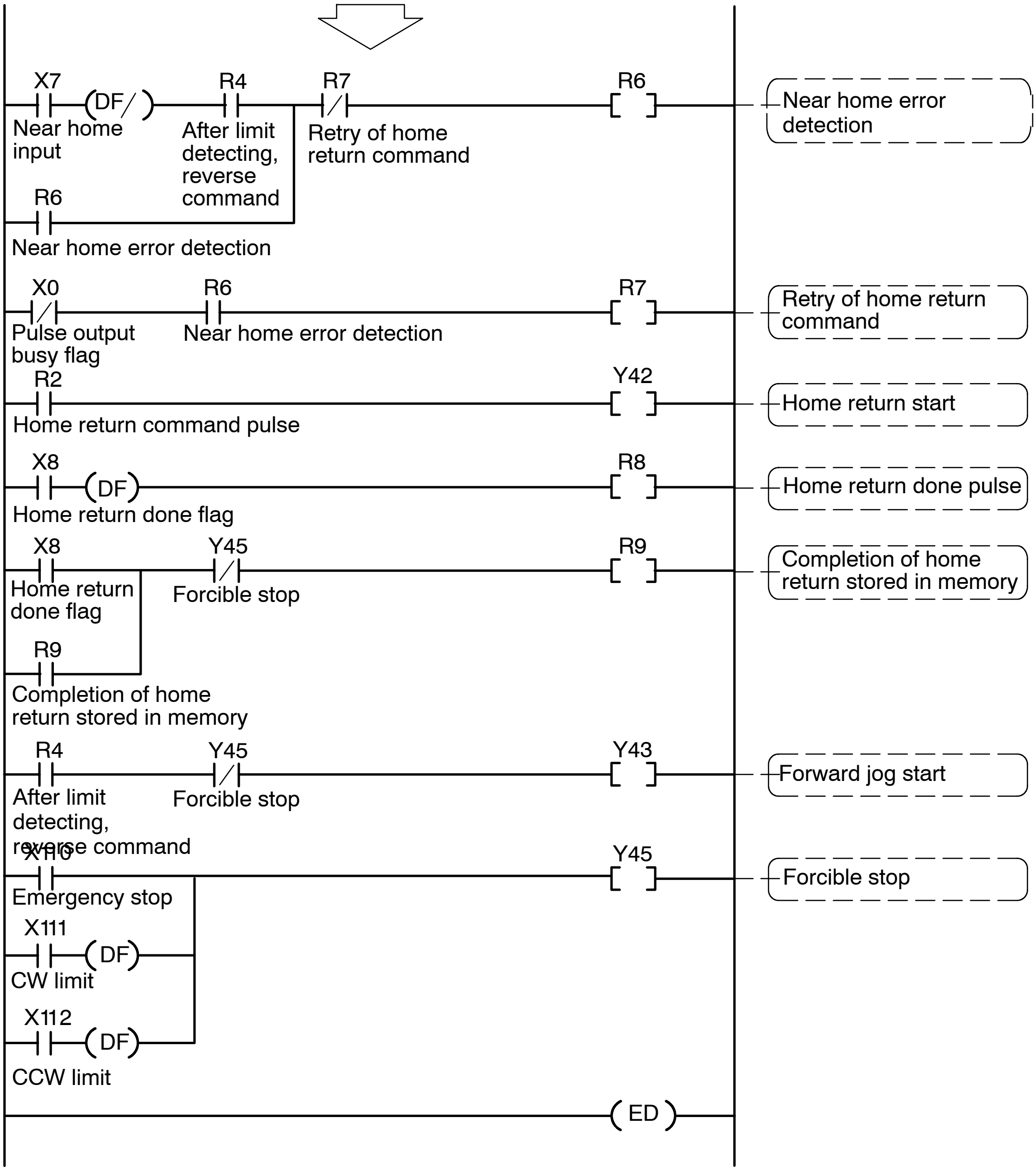


9.5 Practical Use for a Home Return

Sample program



next page


X7
DF/
Near home input
R4
After limit detecting, reverse command
R7
Retry of home return command
R6
R6
Near home error detection
Near home error detection
X0
Pulse output busy flag
R6
Near home error detection
R7
Retry of home return command
R2
Home return command pulse
Y42
Home return start
X8
DF
Home return done flag
R8
Home return done pulse
X8
Home return done flag
Y45
Forcible stop
R9
R9
Completion of home return stored in memory
Completion of home return stored in memory
R4
After limit detecting, reverse command
Y45
Forcible stop
Y43
Forward jog start
X110
Emergency stop
X111
DF
CW limit
X112
DF
CCW limit
Y45
Forcible stop
ED

9.5 Practical Use for a Home Return

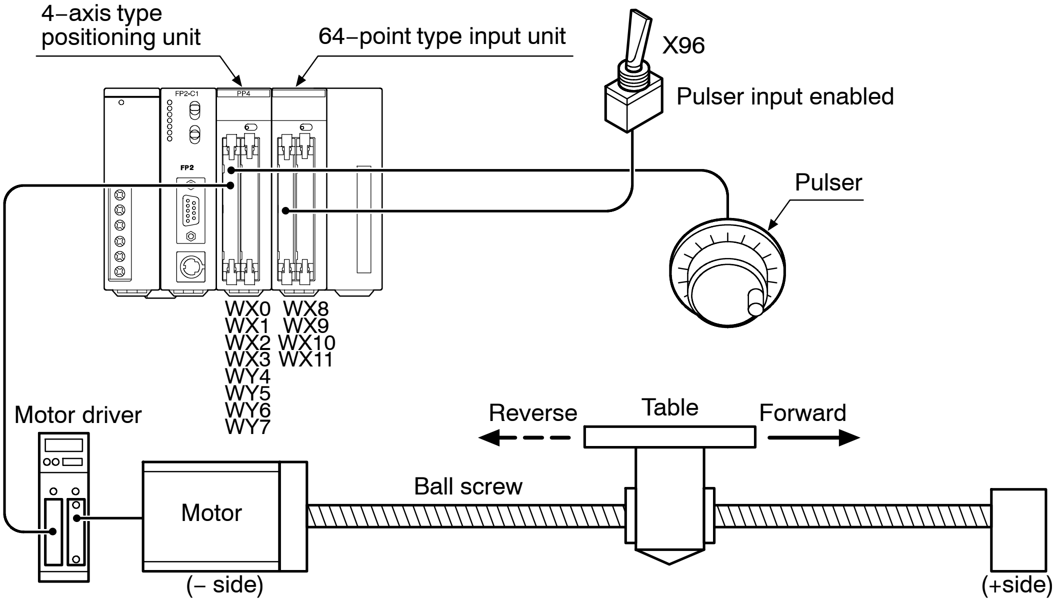
Chapter 10

Pulser Input Operation

10.1 Sample Programs

10.1.1 Pulser Input Operation (Transfer multiple: 1 multiple setting)

The rotation direction of the motor in which the elapsed value increases is set as the plus direction, and "pulse/sign" is set as the pulse output mode. Also, it is assumed that the mode setting switches on the back of the positioning unit are set to the normal setting side.



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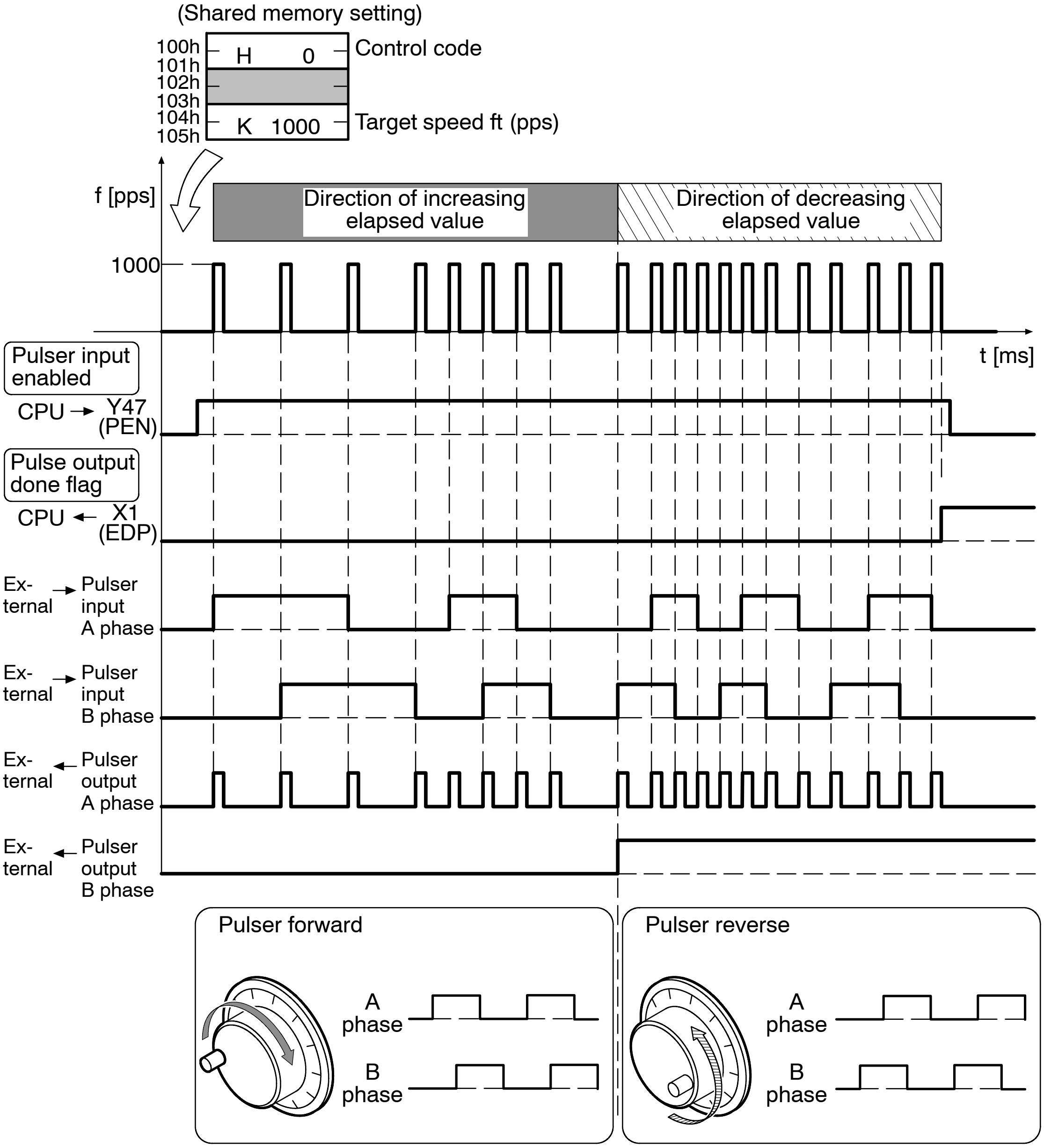
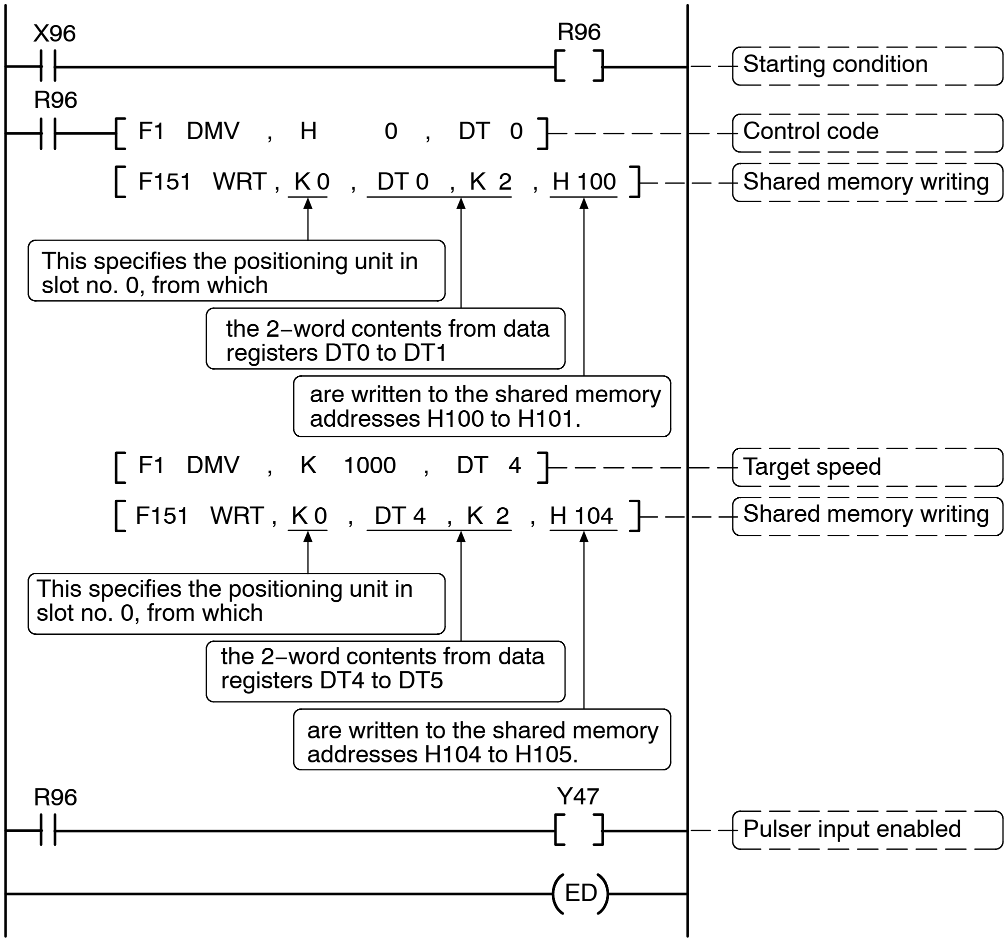
Pulse output diagram



Shared memory setting

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H0 Multiplication ratio: × 1 multiple	H0: × 1 transfer multiple H100: × 2 transfer multiple H200: × 5 transfer multiple H300: × 10 transfer multiple H400: × 50 transfer multiple H500: × 100 transfer multiple H600: × 500 transfer multiple H700: × 1000 transfer multiple
Target speed (pps)	K10000	K1 to K1000000

Program



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Precautions concerning the program

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, home returns, and other types of control. These should not be overwritten by other conditions.
- If the target speed is out of the range of possible settings, a set value error will occur, and pulser input cannot be accepted.
- The number of the startup contact varies depending on the number of axes the unit has, and the installation position.

For detailed information about contact number ☛ Section 4.2.3 and 14.3.

- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

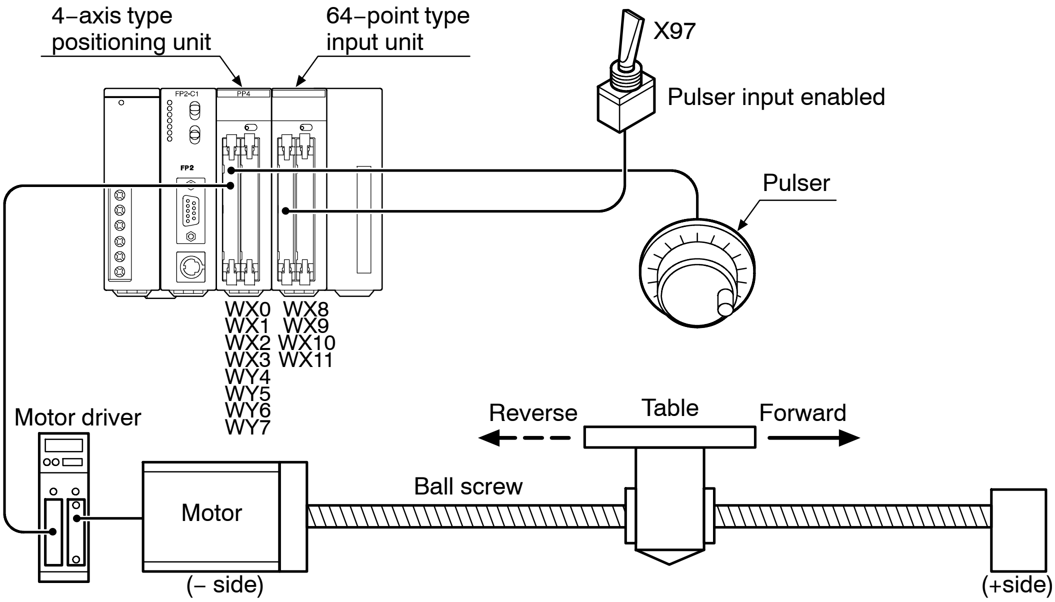
For detailed information about slot number ☛ Section 4.2.3.2

For detailed information about shared memory area address ☛ Section 14.2

- The target speed should be specified as an appropriately large value to match the multiplication ratio. If the multiplication ratio is high and the target speed is low, the next pulser input command may be received before the specified pulse output has been completed, making it impossible to obtain output of the input number of pulses.

10.1.2 Pulser Input Operation (Transfer multiple: 5 multiple setting)

The rotation direction of the motor in which the elapsed value increases is set as the plus direction, and “pulse/sign” is set as the pulse output mode. Also, it is assumed that the mode setting switches on the back of the positioning unit are set to the normal setting side.



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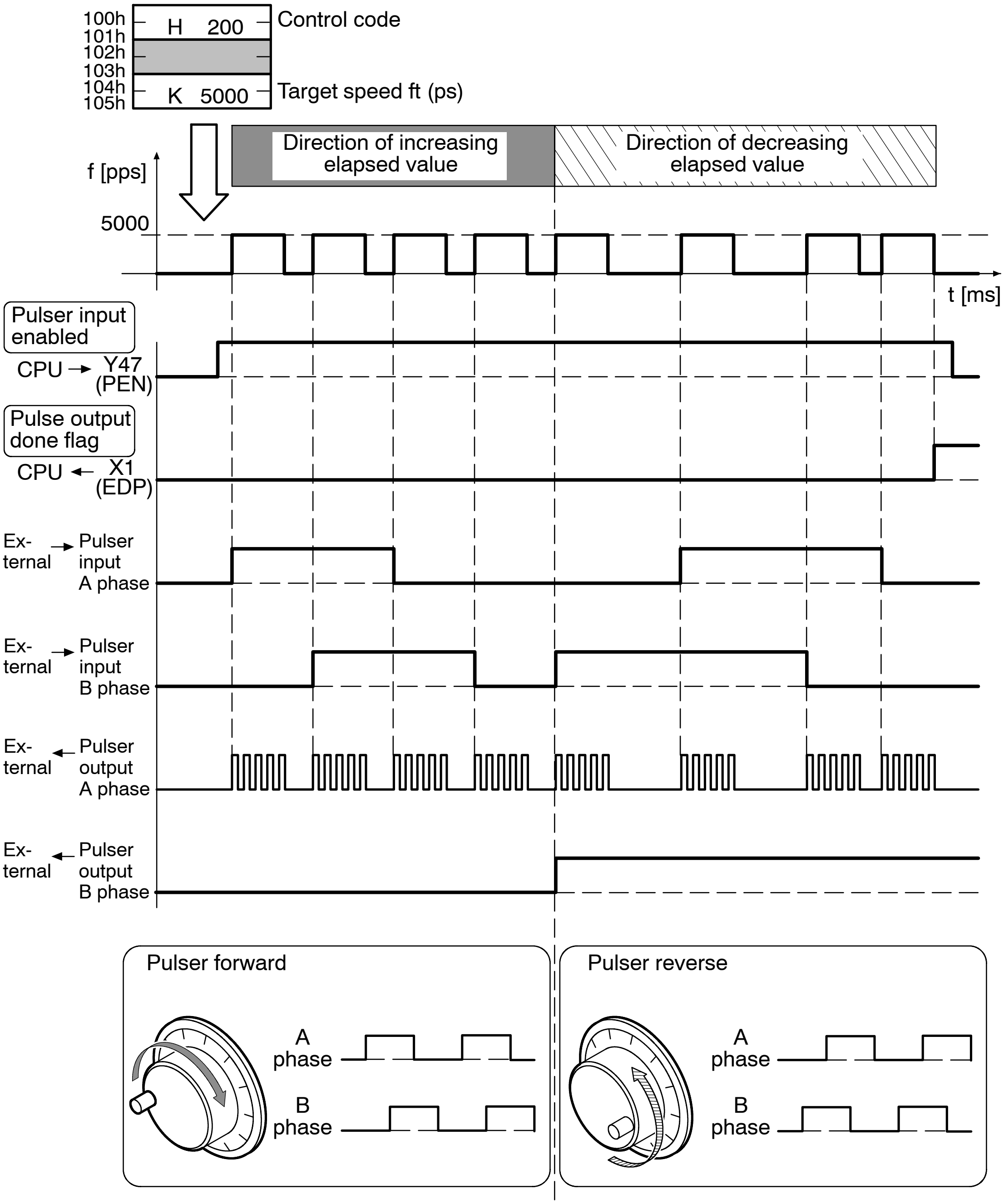
Pulse output diagram

Setting data example

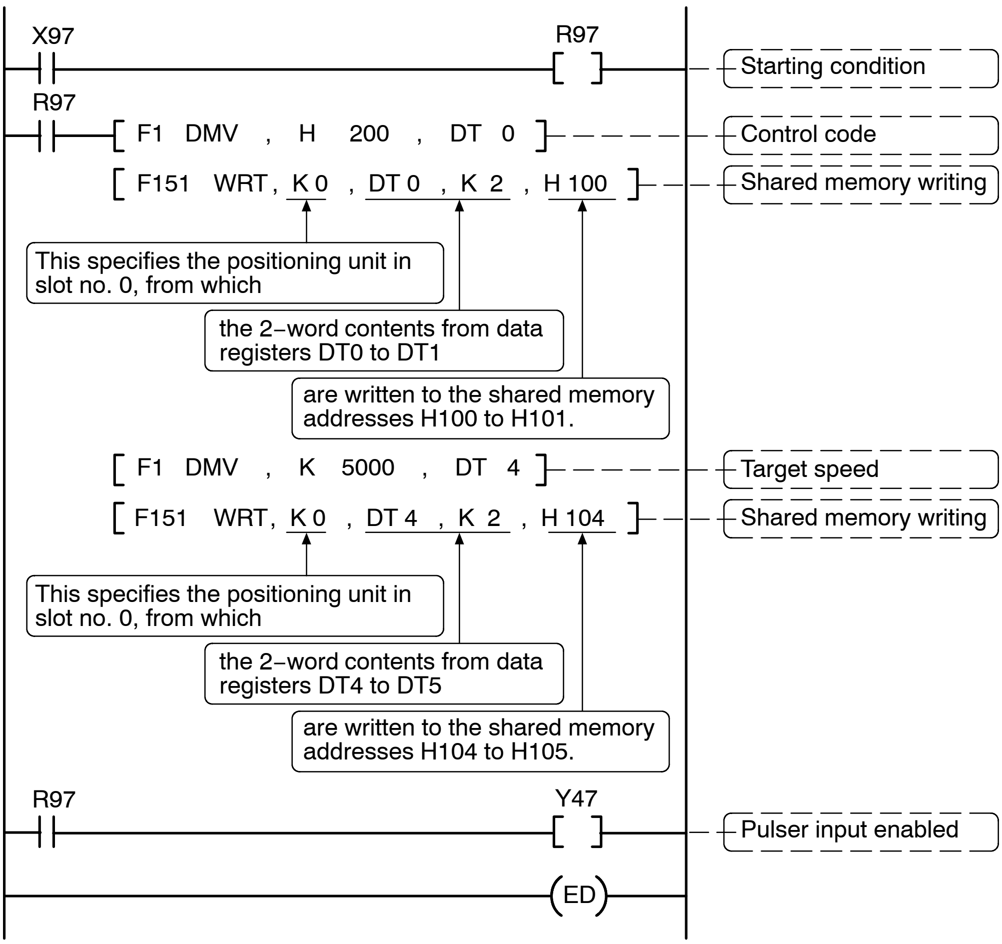
(Shared memory setting)



Shared memory setting

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H200 Multiplication ratio: ×5 multiple	H0: ×1 transfer multiple H100: ×2 transfer multiple H200: ×5 transfer multiple H300: ×10 transfer multiple H400: ×50 transfer multiple H500: ×100 transfer multiple H600: ×500 transfer multiple H700: ×1000 transfer multiple
Target speed (pps)	K5000	K1 to K1000000

Program



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Precautions concerning the program

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, home returns, and other types of control. These should not be overwritten by other conditions.
- If the target speed is out of the range of possible settings, a set value error will occur, and pulser input cannot be accepted.
- The number of the startup contact varies depending on the number of axes the unit has, and the installation position.

For detailed information about contact number ☛ Section 4.2.3 and 14.3.

- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

For detailed information about slot number ☛ Section 4.2.3.2

For detailed information about shared memory area address ☛ Section 14.2

- The target speed should be specified as an appropriately large value to match the multiplication ratio. If the multiplication ratio is high and the target speed is low, the next pulser input command may be received before the specified pulse output has been completed, making it impossible to obtain output of the input number of pulses.

10.2 Sequence Flow for Pulser Input Operation

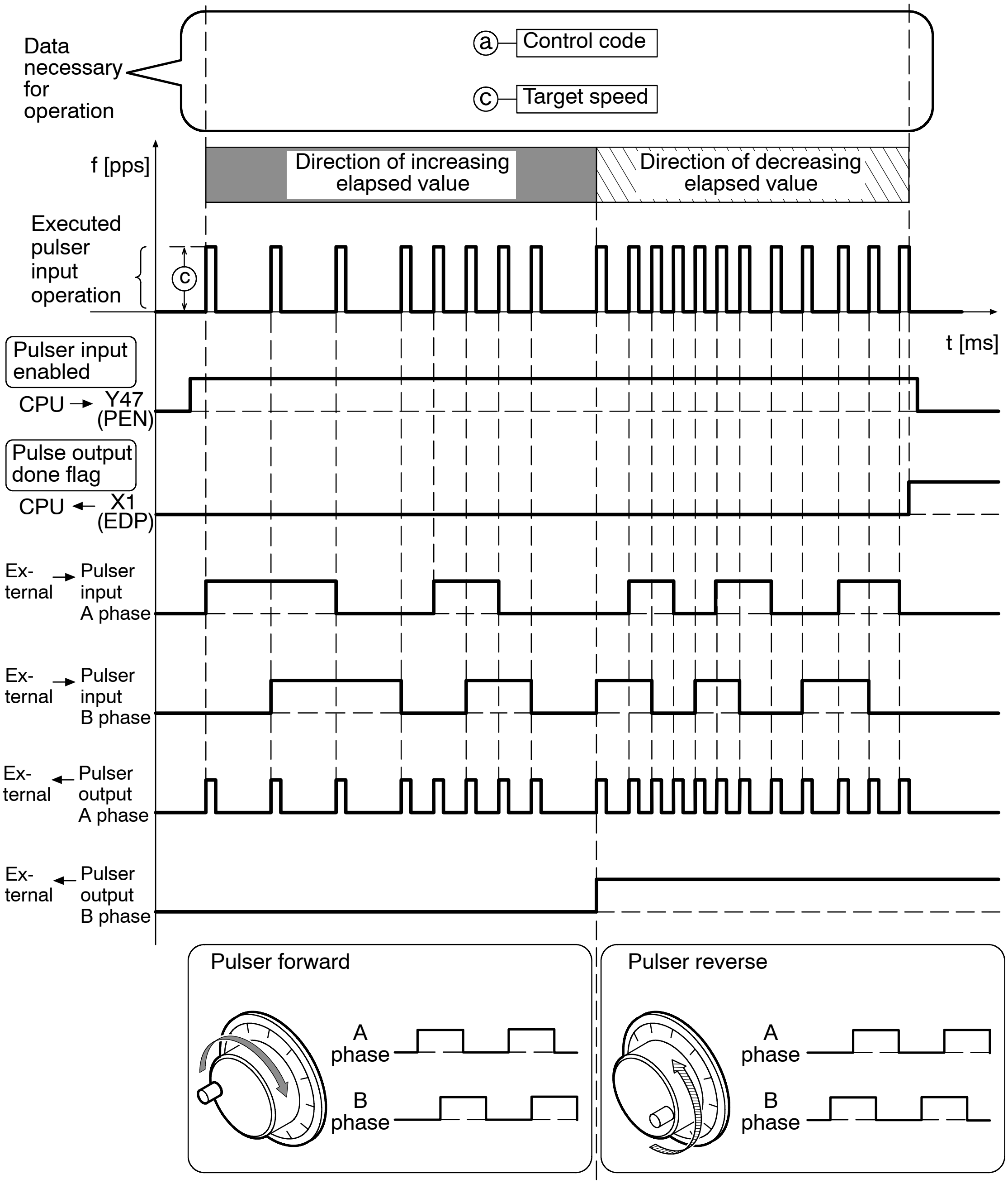
Pulser input operation

- A pulse generator (pulser) can be connected, and the motor controlled in the manual mode. Pulser signals can be input while the pulser input enabled contact (PEN) is on.
- The user can select the number of pulses to be sent to the motor driver in relation to one pulser signal pulse (by setting the control code in the shared memory).

When the 4–axis type positioning unit is mounted in slot 0

Operation example

When the contact which enables pulser input is turned on, the motor rotates at the specified speed, in conjunction with the pulser operation.



When Y47 is turned on through the program, the motor for the first axis waits for pulser input. If the pulser is rotated in this state, the motor rotates also.

The pulse output busy flag X0 remains off, and its status does not change. The pulse output done flag X1 goes off when Y47 goes on.

Data required for settings

The following data must be written to the specified addresses of the shared memory.

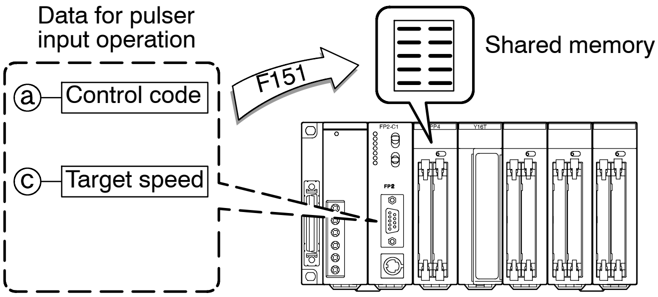
Operation is determined by the following two types of data.

- Control code
- Target speed

Operation steps

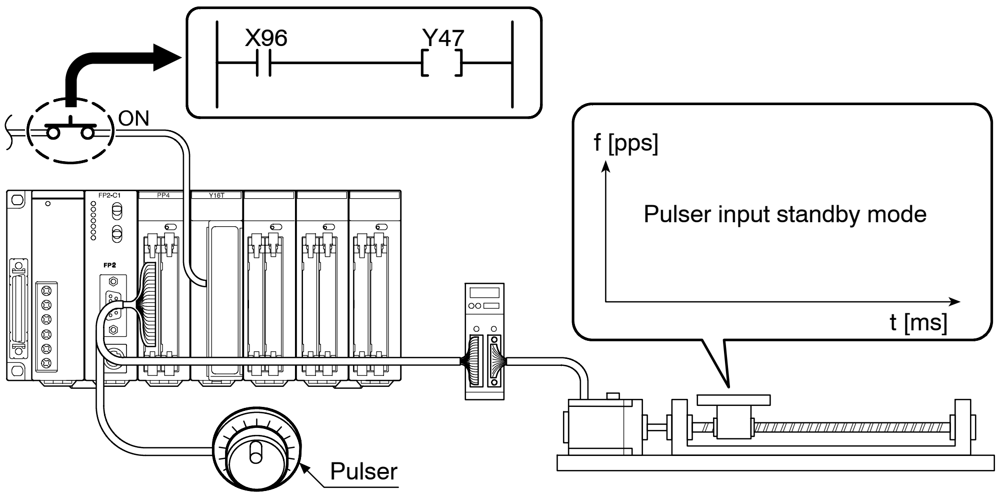
Step 1: Preparatory stage

The data required for operation is transferred to the shared memory in advance.



Step 2: Execution of the operation

The input enabled contact relay Y47 is turned on.
This sets the system in standby mode for input from the pulser.



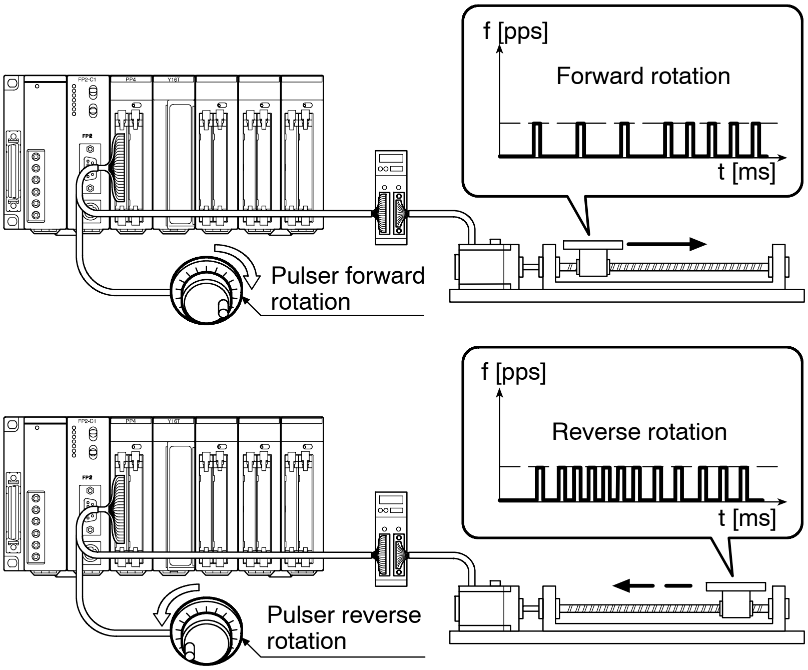
Forward rotation

The pulser rotates in the forward direction.

Reverse rotation

The pulser rotates in the reverse direction.

Forward rotation is the direction in which the elapsed value increases, and reverse rotation is the direction in which the elapsed value decreases. The direction in which the pulser rotates and that in which the motor rotates vary depending on how they are connected.



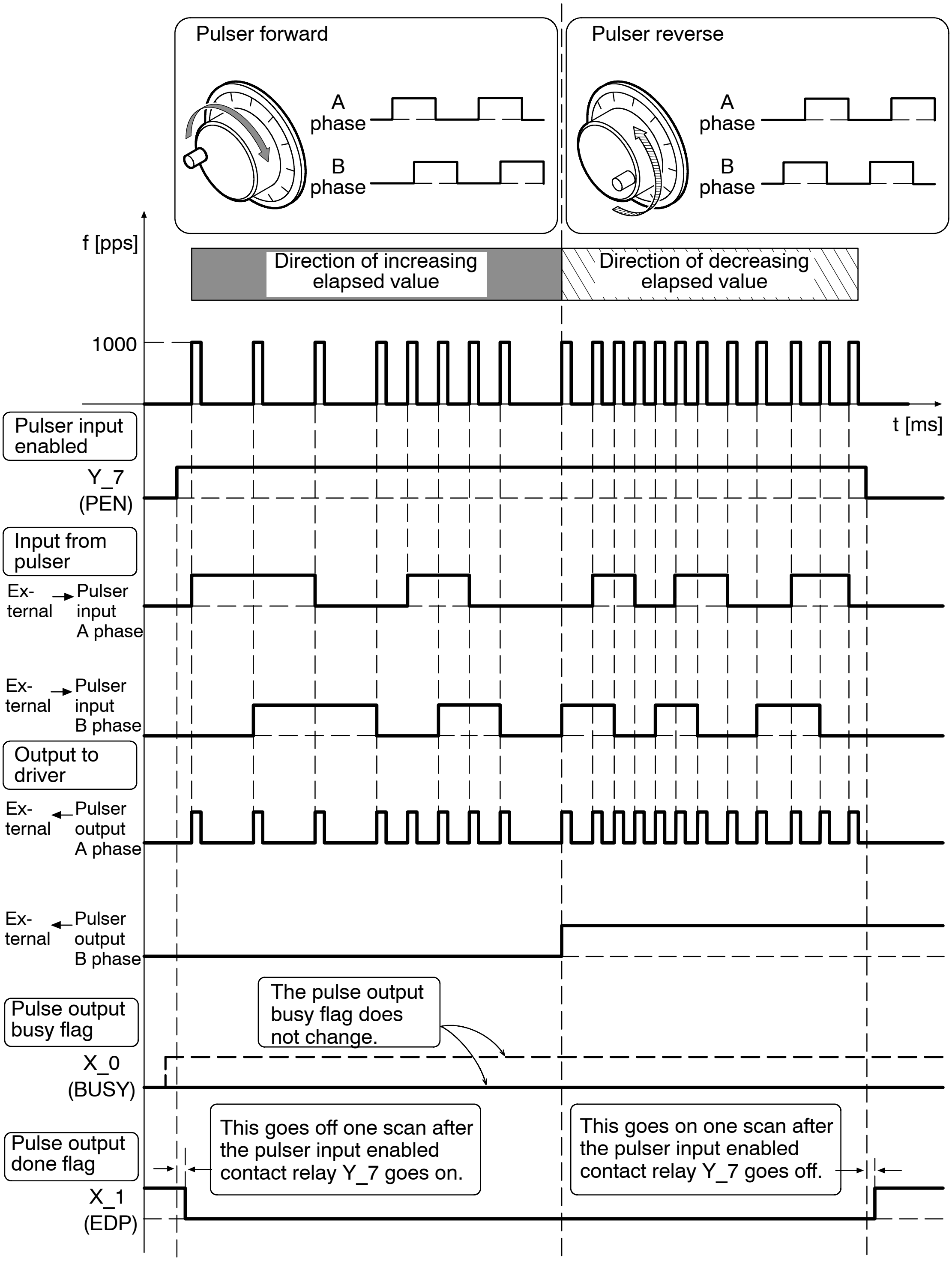
Value of the internal absolute counter during pulser input operation

The internal absolute counter counts the number of pulses output. Consequently, in the instant that pulses are being input, the number of pulses input from the pulser does not equal the value counted by the counter.

☞ **Note**

When pulser input is ignored
If the specified multiplication is high and the target speed is low, the next pulser input command may be received before the specified pulse output has been completed, making it impossible to obtain output of the input number of pulses.
If this happens, the target speed should be changed to an appropriate value.

10.3 Action of the I/O Contact During Pulser Input Operation



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Pulser input enabled relay (Y_7)

1. This is in pulser input operation status, based on the parameters written to the positioning unit.
2. This does not shift to enabled status while the pulse output busy flag X_0 is on.
3. This relay is reset when the power supply is turned off.

Pulse output busy flag (X_0)

The on/off status of the pulse output busy flag does not change, even if the pulser input enabled relay Y_7 goes on.

Pulse output done flag (X_1)

1. This goes from on to off if E point control, P point control, jog operation, or pulser input enabled operation is completed before pulser input is enabled.
2. This goes from off to on when the pulser input enabled relay Y_7 goes off.
3. This flag is reset when the power supply is turned off.

This flag is common to E point control, P point control, jog operation, and pulser input enabled operation.

10.4 Types of Manual Pulse Generators That Can be Used

A pulse generator should be used for which the number of output pulses is "25P/R" (25 pulses per cycle).

With the "100P/R" (100 pulses per cycle) type, four pulses are output per click, and operation may not be accurate in some cases.

A line driver output type is recommended.

A transistor open collector output type or transistor output type with pull−up resistance may be used.

For detailed information about connection methods ☛ Section 3.8

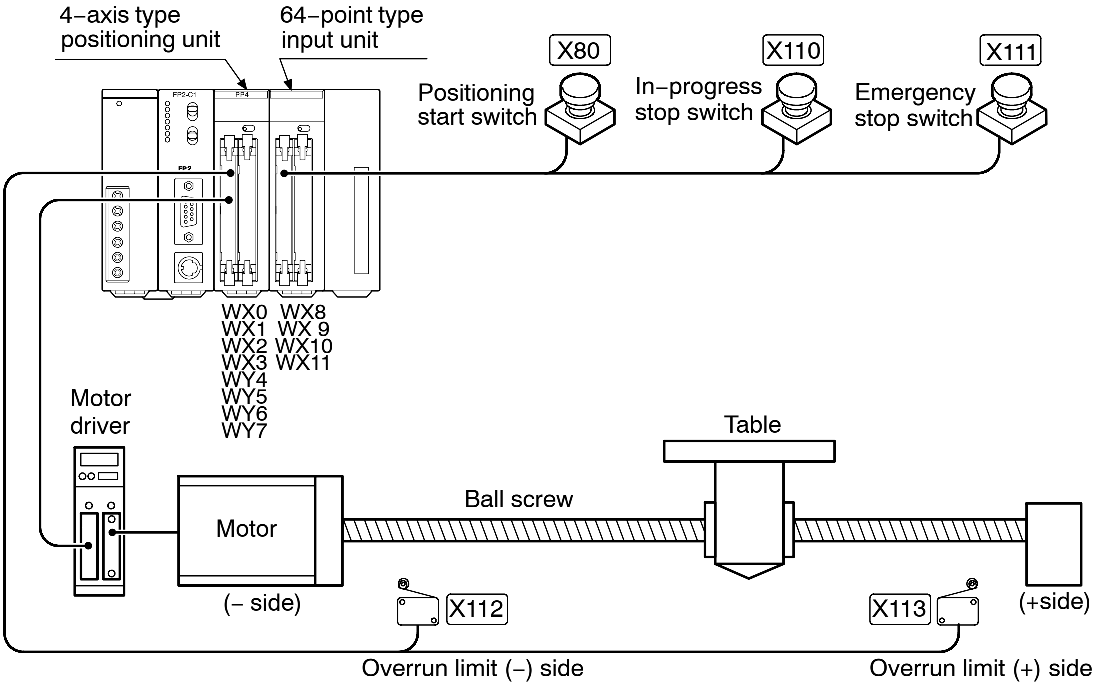
10.4 Types of Manual Pulse Generators That Can be Used

Chapter 11

Deceleration Stop and Forcible Stop

11.1 Sample Program

11.1.1 In–progress Stopping, Emergency Stopping, and Overruns



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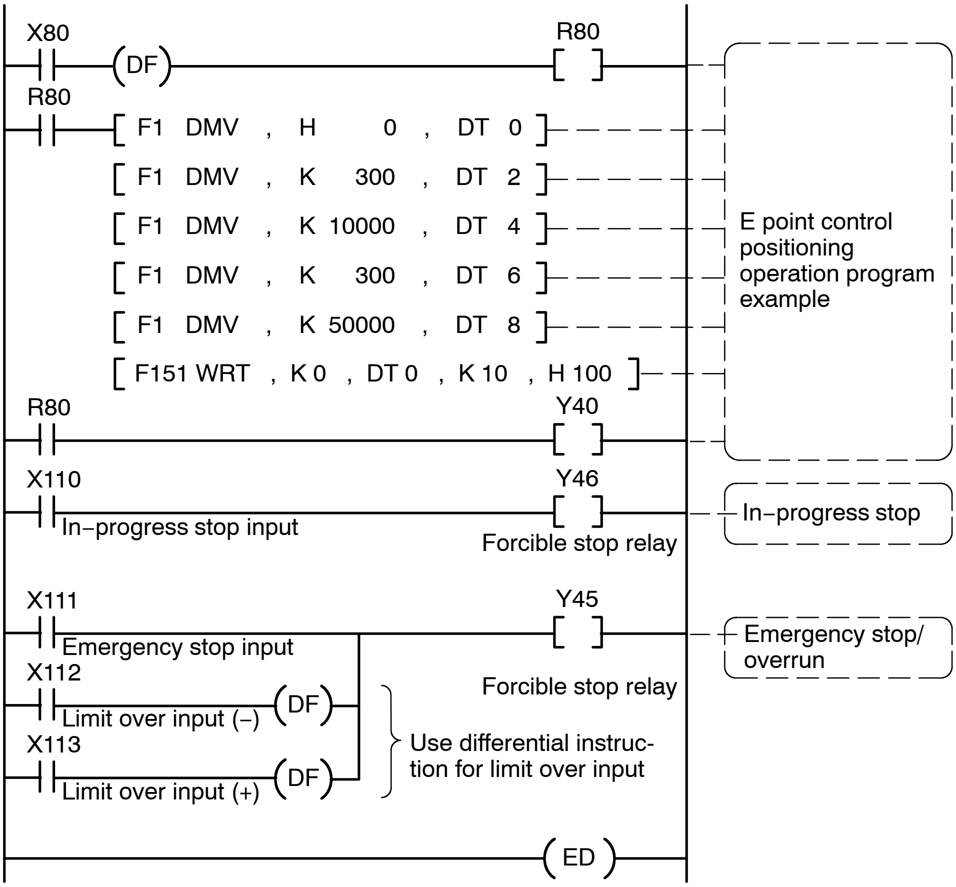
Program



Precautions concerning the program

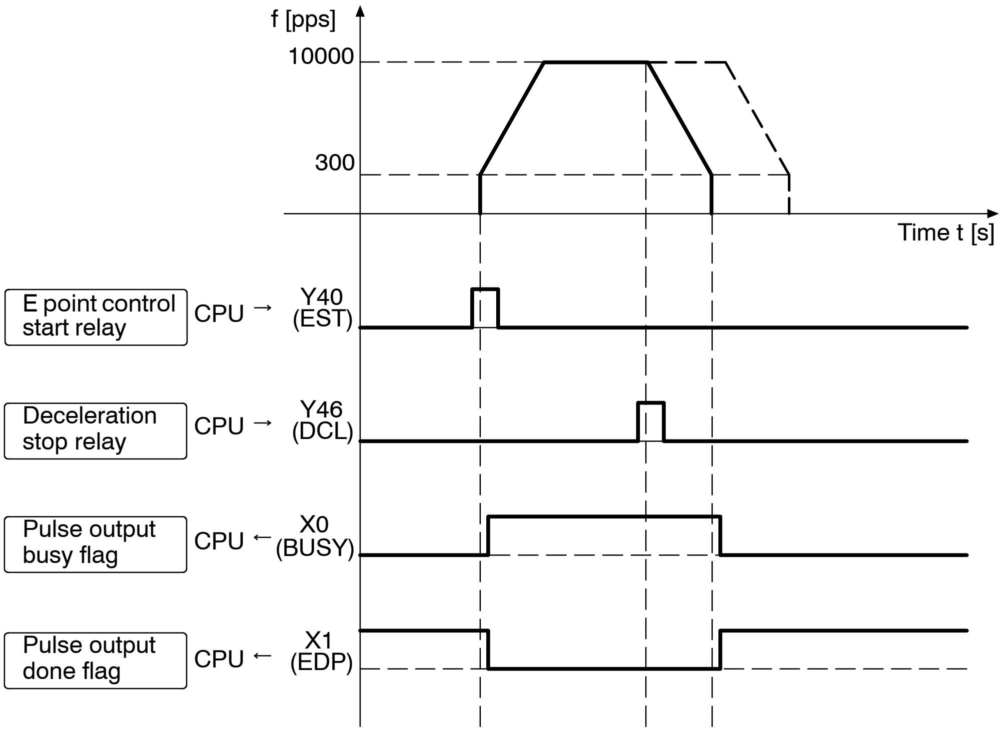
- The number of the stop input contact varies depending on the number of axes that the unit has, and the position in which it is mounted.

For detailed information about contact number ☛ Section 4.2 and 14.3.

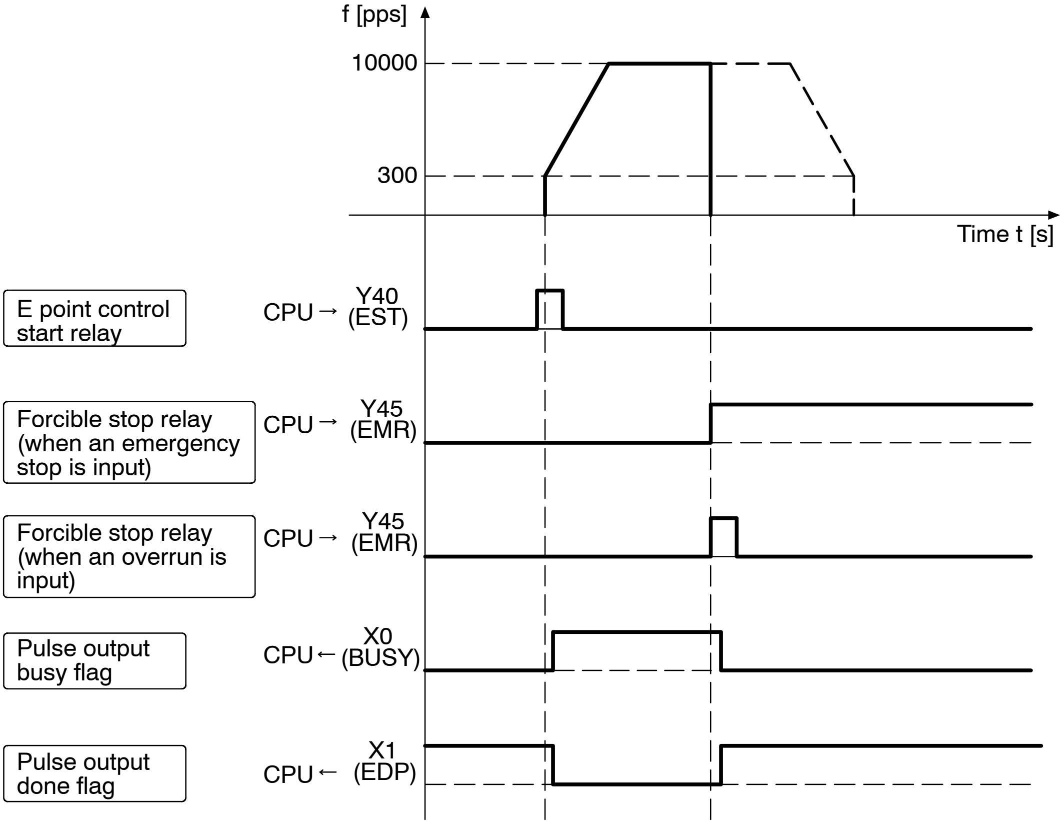
- If a deceleration stop or forcible stop is triggered, the startup contacts for the various operations must be turned off before operation can be restarted. This content is common to E point control, P point control, home returns, jog operation, and pulser input operation.

Pulse output diagram

Deceleration stop operation (In–progress stop)



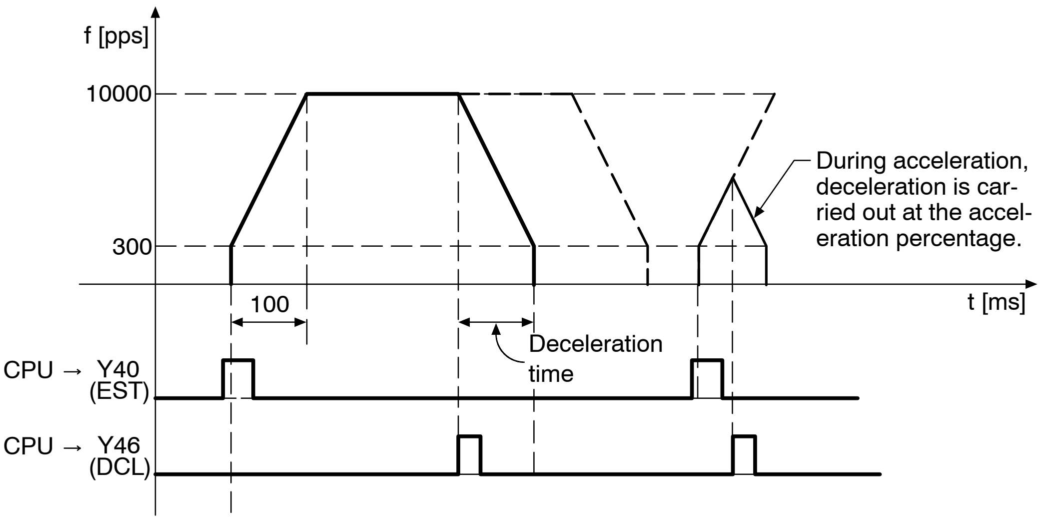
Forcible stop operation (Emergency stop and overrun)



11.2 Operations for a Deceleration Stop and Forcible Stop

11.2.1 Deceleration Stop

If the deceleration stop contact is turned on during operation, the operation is interrupted, and the speed slows. When the startup speed is reached, pulse output stops. This operation is common to E point control, P point control, home returns, and jog operation. For pulser input operation, pulse output stops.

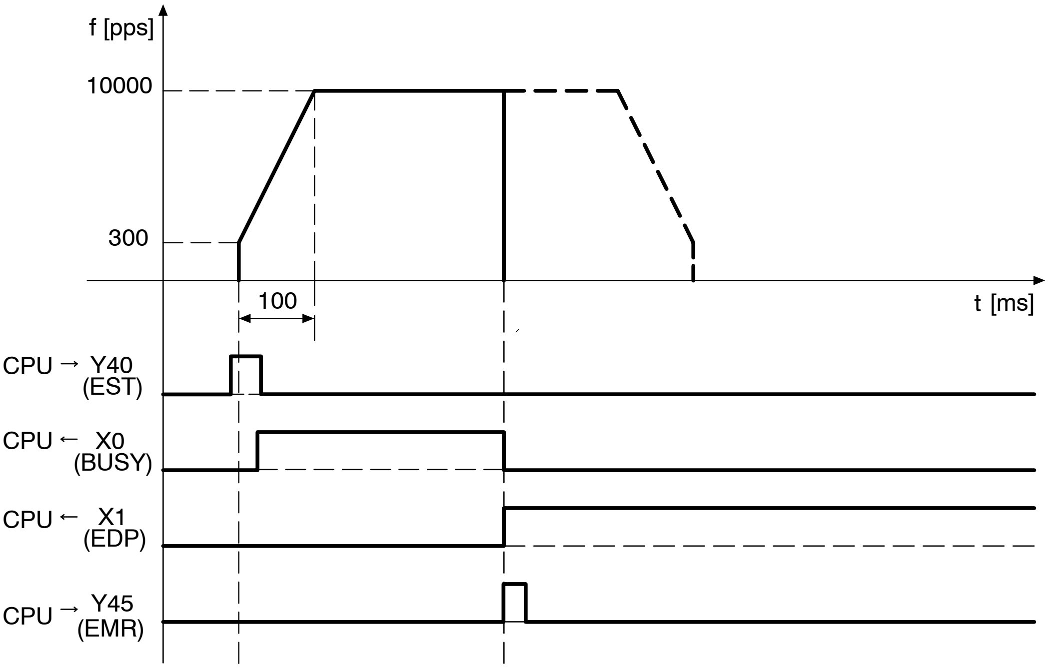


Important

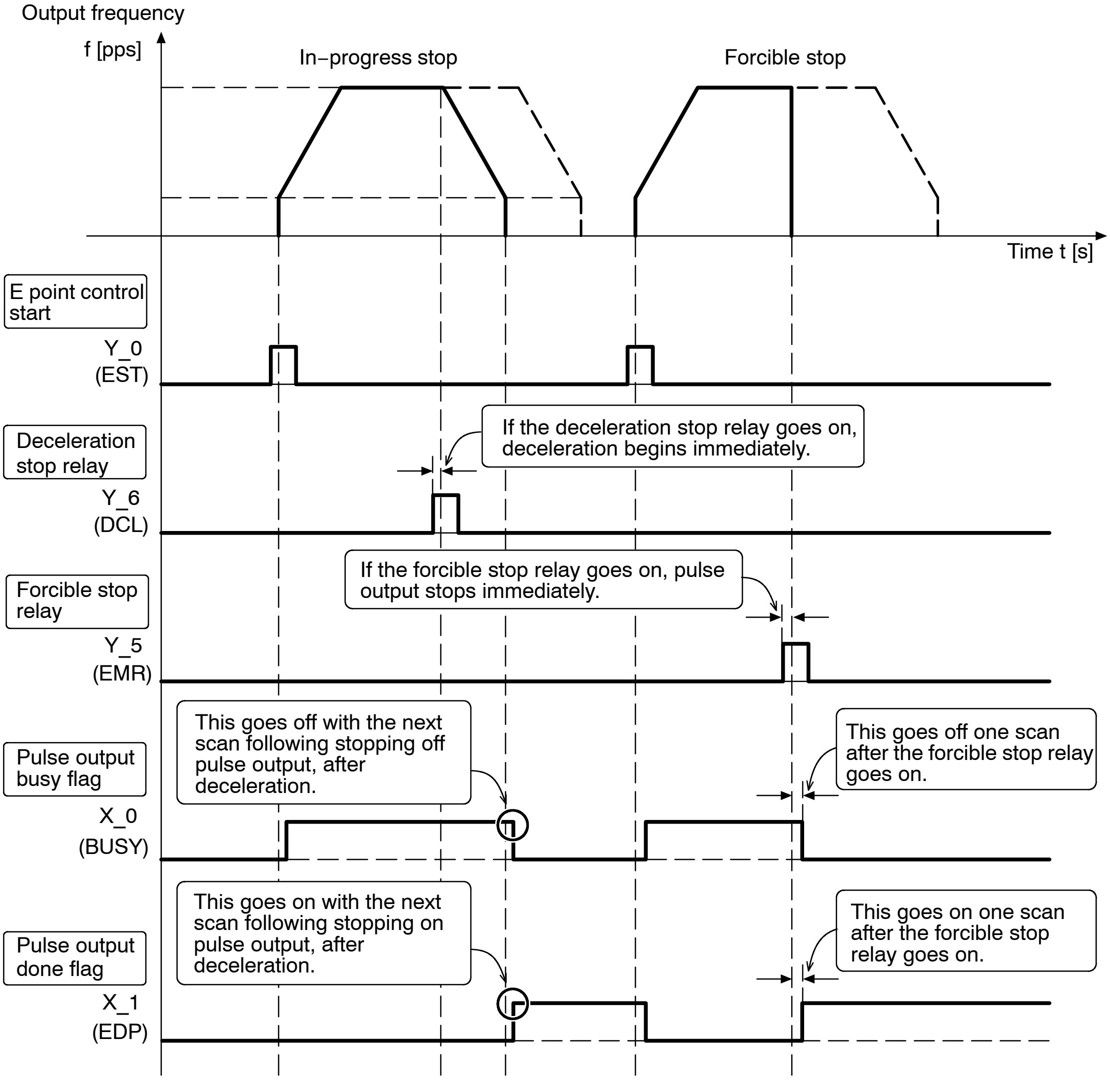
When a deceleration stop has been executed, deceleration is carried out based on the acceleration rate determined by the data specified in the shared memory area at that point, and continues until the startup speed is reached. Following that, operation stops. If the deceleration stop contact goes on during deceleration or acceleration, deceleration is carried out at the acceleration percentage in effect at that time, and operation stops.

11.2.2 Forcible Stop

If the forcible stop contact goes on during operation, pulse output stops immediately. This operation is common to E point control, P point control, home returns, jog operation, and pulser input operation.



11.3 I/O Contact Operation Before and After a Stop



Deceleration stop relay (Y_6)

1. When the deceleration stop relay goes on, the operation in progress is interrupted, and deceleration begins.
2. After deceleration has begun and the speed has slowed to the startup speed, pulse output stops.
3. This relay is reset when the power supply is turned off.

Forcible stop relay (Y_5)

1. When the forcible stop relay goes on, the operation in progress is interrupted immediately, and pulse output stops.
2. This relay is reset when the power supply is turned off.

☛ next page

Pulse output busy flag (X_0)

1. When the deceleration stop relay goes on, this flag goes off when pulse output is completed.
2. When the forcible stop relay goes on, this flag goes off one scan after the relay has gone on.
3. This flag is reset when the power supply is turned off.

Pulse output done flag (X_1)

1. When the deceleration stop relay goes on, this flag goes on when pulse output is completed.
2. When the forcible stop relay goes on, this flag goes on one scan after the relay has gone on.
3. This flag is reset when the power supply is turned off.

11.4 Precautions Concerning Stopping Operations

11.4.1 Pulse Output Done Flag Statuses After a Stop

For either a deceleration stop or a forcible stop, the pulse output done flag goes on after operation has stopped. If the pulse output done flag is being used as a trigger signal for operation after positioning has been completed, the program should be set up so that operation does not proceed to the next step following a deceleration stop or a forcible stop.

11.4.2 Restarting After a Stop

When a deceleration stop or forcible stop is triggered, the startup contacts for all operations must be turned off before operation can be restarted. This operation is common to E point control, P point control, home returns, jog operation, and pulser input operation.

11.4.3 Forcible Stop Elapsed Value Data

Elapsed value data in the shared memory is saved after a forcible stop is applied. Under normal conditions, it is possible that a mechanical error has occurred, so after home return, we recommend positioning control start.

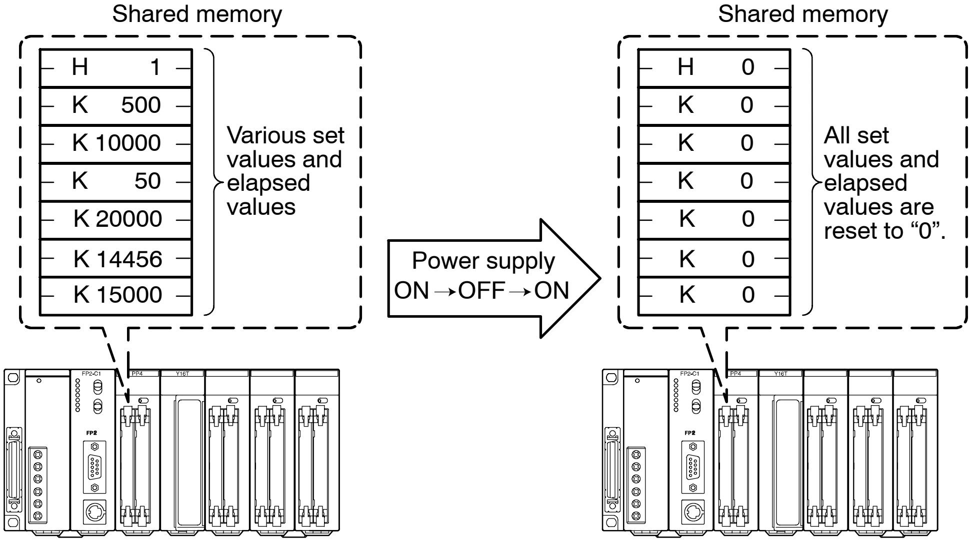
Chapter 12

Precautions Concerning the Operation and Programs

12.1 Precautions Relating to Basic Operations of the Unit

12.1.1 Values of Shared Memory are Cleared When Power is Turned Off

The data in the shared memory of the positioning unit is not backed up if a power failure occurs. As a result, when the power supply is turned on again, the default operation data should be written to the shared memory before the various startup contacts are turned on.



When the power supply is turned off, the various set values in the shared memory are set to “0”. All of the control codes also return to the default values.

☞ Notes

- **If the startup contacts are turned on without writing the data to the memory, a set value error may occur, and the unit may not operate as expected.**
- **If a home return is carried out when the power supply is turned on, control codes must be written to the memory before the home return startup contact is turned on. If the control codes are not written to the memory, problems may occur such as a discrepancy between the direction of the home return and the input logic, causing the unit to operate in unexpected ways.**

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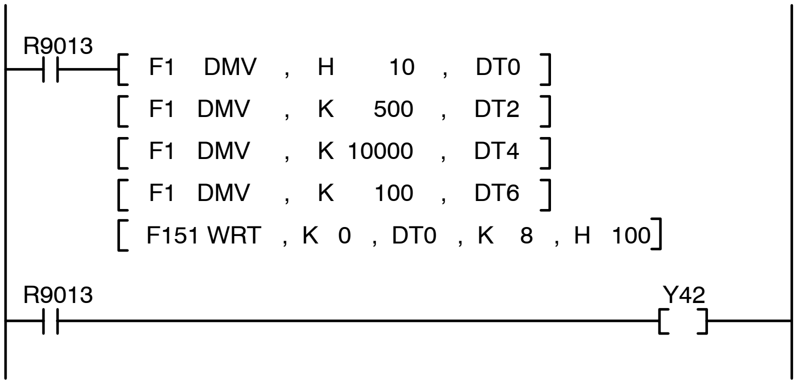
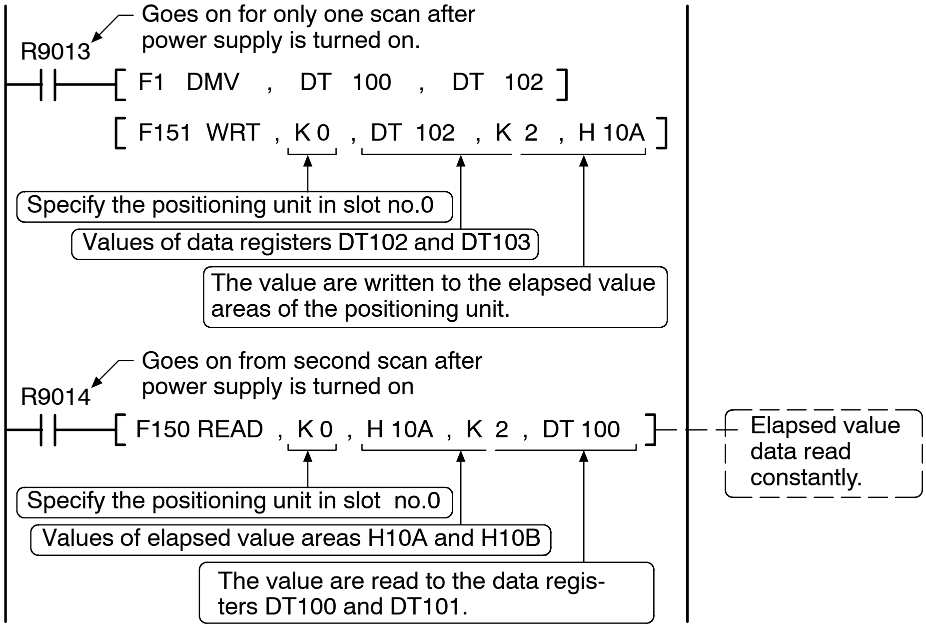


The following program should be written to the unit, so that after the power supply is turned on, the elapsed value data prior to the power supply being turned off will be read.



Example:

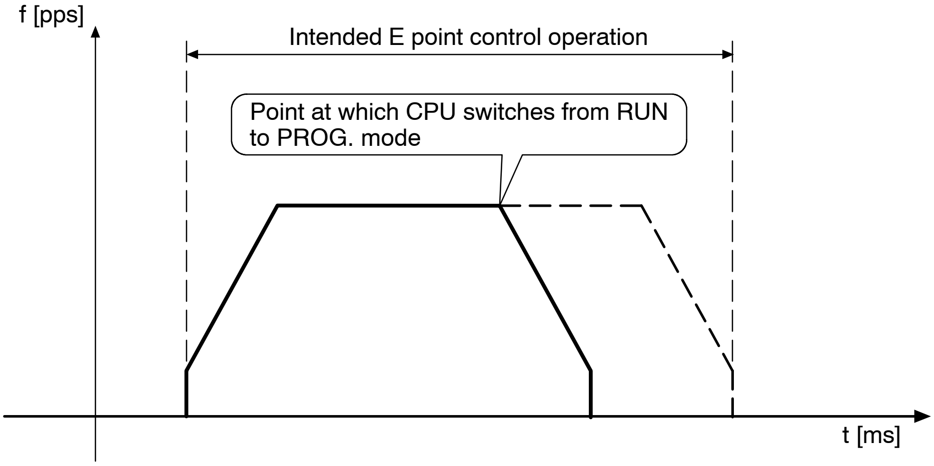
Before the power supply is turned off, the elapsed values are read to DT100 and DT101, and when the power supply is turned on, the contents of DT100 and DT101 are written to the elapsed value area of the unit, through DT102 and DT103.

12.1.2 Operation When the CPU Switches from RUN to PROG. Mode

For safety reasons, if the CPU mode switches to the PROG. mode during E point control, P point control, jog operation, or a home return, any positioning unit operations in progress at that point are interrupted, and the speed decelerates.

Example:

If the CPU switches from RUN to PROG. mode during E point control operation



Notes

- **At the point at which the CPU switches from the RUN to the PROG. mode, deceleration and stopping begin.**
  The acceleration rate used for deceleration at that point is that determined by the data stored in the shared memory when the switch is made from the RUN to the PROG. mode.
- **The CPU mode should not be switched from RUN to PROG. while positioning unit operation is being executed under normal usage conditions.**

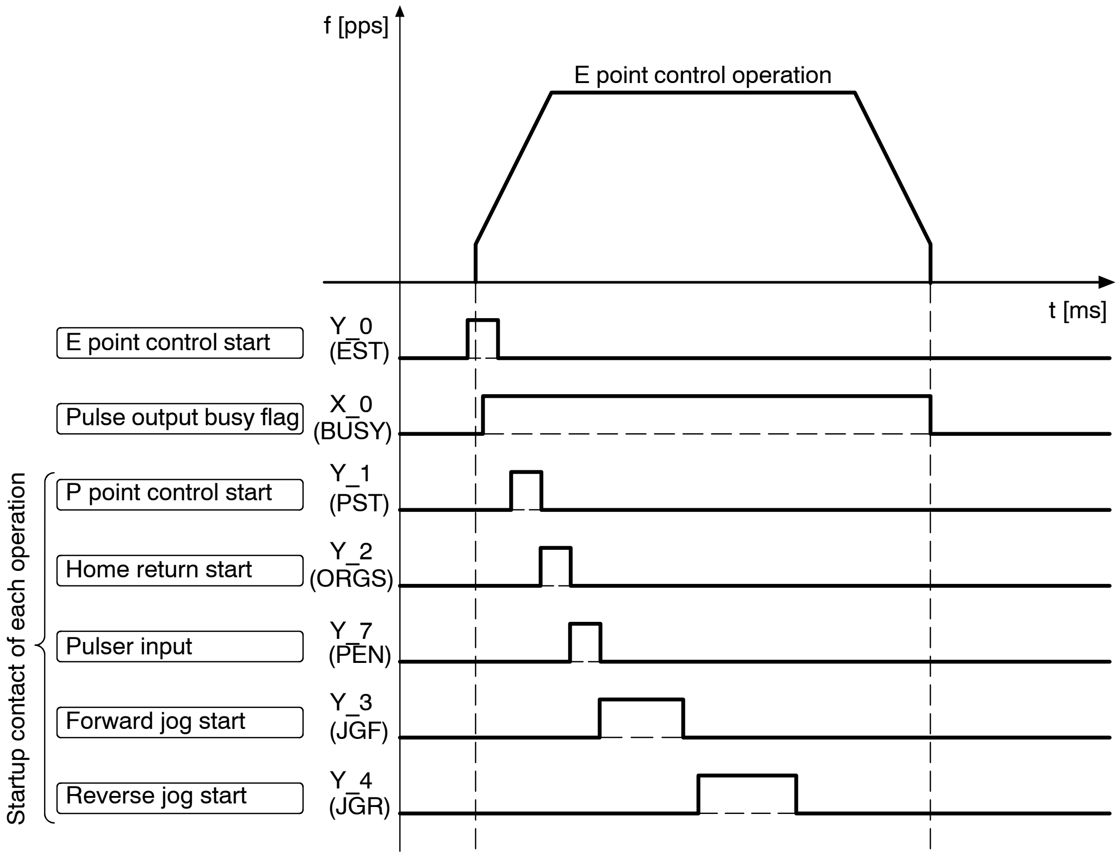
For detailed information about deceleration operation ☛ Chapter 11

12.1.3 Operation Cannot be Switched Once One Operation Has Started

If the startup contact for one of the five basic operations of the positioning unit (E point control, P point control, home return, jog operation, and pulser input operation) goes on and operation is initiated, it is not possible to switch to another operation, even if the contact for that operation goes on.

Example:

Once the E point control startup contact has gone on and E point control has begun, it is not possible to switch to P point control, a home return, jog operation, or pulser input operation, even if those contacts are turned on, while E point control is still in operation.

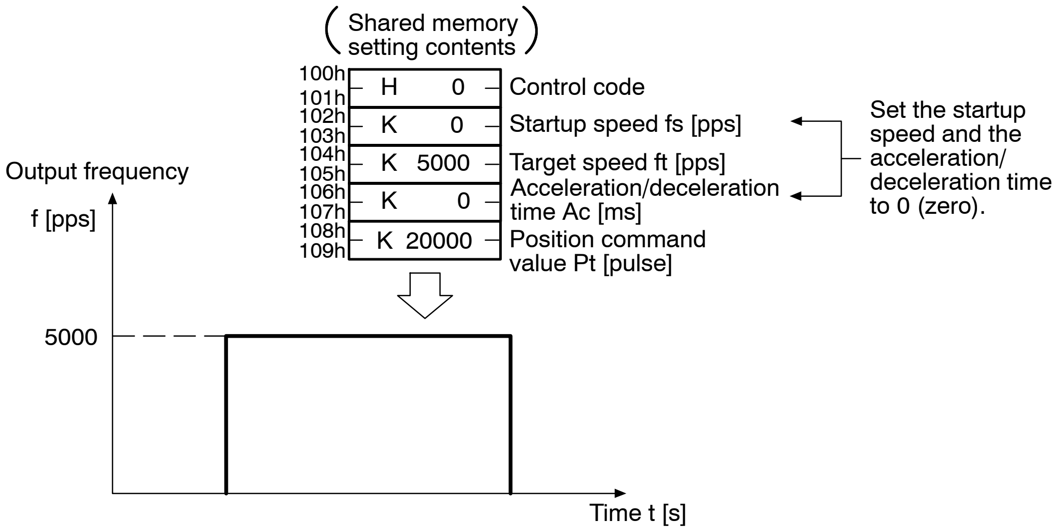


If the contact for a deceleration stop or forcible stop goes on, the five basic operations noted above stop immediately.

12.2 Precautions Concerning Practical Usage Methods

12.2.1 Setting the Acceleration/Deceleration to Zero

To initiate the target speed immediately, without accelerating or decelerating (automatic startup operation), the startup speed and acceleration/deceleration time should both be set to 0 (zero). This produces pulse output at the target speed, with an acceleration/deceleration time of 0 (zero). Setting the startup speed equal to the target speed results in a set value error, and the positioning unit will not start.



12.2.2 Precautions When Setting the Position Command Value to One Pulse

When the travel amount becomes one pulse by E point control or P point control, set the startup speed to one pps or more. When the startup speed is 0 pps, the operation will stop in the state that 1 pulse has been output. (It will be hanged.)

Control code	H	0
Startup speed	K	0
Target speed	K	1000
Acceleration/ deceleration time	K	100
Position command value	K	1

→

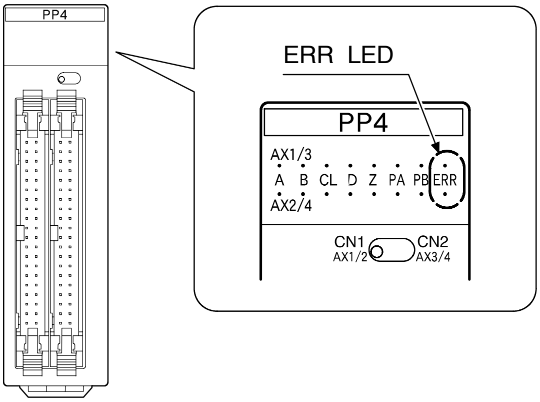
Control code	H	0
Startup speed	K	1
Target speed	K	1000
Acceleration/ deceleration time	K	100
Position command value	K	1

Chapter 13

Positioning Unit Operation if an Error Occurs

13.1 Positioning Unit Operation if an Error Occurs

13.1.1 If the Positioning Unit ERR LED Lights



When starting (stopped)

If a set value error occurs when the positioning unit is started (stopped), the various operations will not begin. This applies to E point control, P point control, home returns, jog operation, and pulser operation, none of which will be initiated.

During P point control operation or jog operation

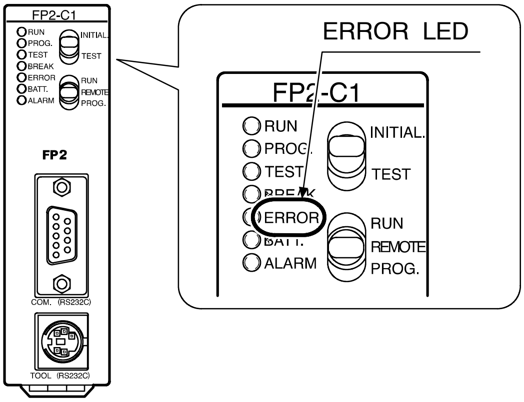
If a set value error occurs during P point control operation or during jog operation, the positioning unit interrupts any operation currently in progress, and enters the “deceleration stop” status.

When a set value error occurs, the error cancel contact should be turned off, on, and then off again. Operation cannot be restarted until the error has been canceled.

Operation continues on other axes where the set value error has not occurred.

For detailed information about deceleration stop operation ☛ Chapter 11

13.1.2 If the CPU ERROR LED Lights



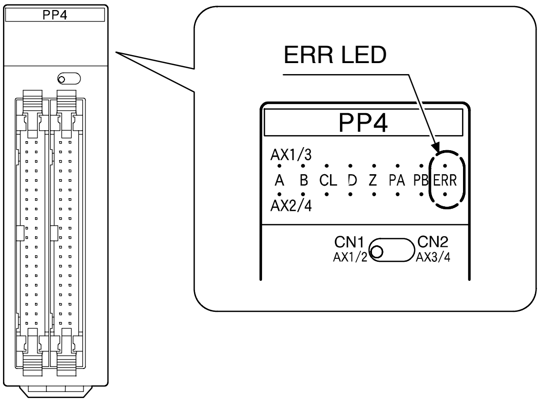
The positioning unit interrupts any operation currently in progress, and enters the “deceleration stop” status.

Operation is continued, however, if “Operation” has been specified in the system register settings for operation when an error of some kind occurs.

For detailed information about deceleration stop operation ☛ Chapter 11

13.2 Errors Which Occur in the Positioning Unit Itself

The positioning unit itself has a function which warns the user of an error if any of the parameters for the “Startup speed”, “Target speed”, and “Acceleration/deceleration time” settings are not appropriate.



Errors are displayed individually for each axis.

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Cases in which errors occur, and their contents

Item		At startup setting			At setting change during operation		
		Negative number	0	Out of range	Negative number	0	Out of range
E point control	Startup speed	Error		Error	No applicable condition		
	Target speed	Error	Error	Error			
	Acceleration/ deceleration time	Error		Error			
P point control	Startup speed	Error		Error			
	Target speed	Error	Error	Error	Error	Error	Error
	Acceleration/ deceleration time	Error		Error	Error		Error
Home return	Startup speed	Error	Error	Error	No applicable condition		
	Target speed	Error	Error	Error			
	Acceleration/ deceleration time	Error		Error			
Jog operation	Startup speed	Error		Error			
	Target speed	Error	Error	Error	Error	Error	Error
	Acceleration/ deceleration time	Error		Error			
Pulser input	Startup speed				No applicable condition		
	Target speed	Error	Error	Error			
	Acceleration/ deceleration time						
Operation when above error occurs		Operation does not begin			Deceleration stop		

- The position command value and the control code are not subject to setting errors regardless of whether the increment or absolute method is selected.
- Data of this area ▭ is not subject to errors.
- When starting any of the modes (except pulser input), an error will occur if the startup speed setting is greater than or equal to the target speed setting.
- A setting change can only be made during jog operation if linear acceleration/deceleration is selected.

13.3 Resolving Problems

13.3.1 If the Positioning Unit ERR LED Lights

Conditions

There is a setting error in the positioning data.

Procedure:

1. **Using programming tools, check to see if the values in the data registers being used as the positioning parameter data tables are within the allowable setting range.**

   Allowable setting range for positioning data

Type of parameter	Allowable setting range	Program specifications
Startup speed (pps)	0 to +1,000,000 (pps)	K0 to K1000000
Target speed (pps)	+1 to +1,000,000 (pps)	K1 to K1000000
Acceleration/ deceleration time (ms)	0 to +32,767 (ms)	K0 to K32767

   Points to check

   - Is the value for the startup speed larger than that for the target speed? An error occurs if the two values are the same, as well. For the first speed with E point control and P point control, and when carrying out jog operation and home returns, a value should be set which is larger than the startup speed.
   - Has the target speed been set to “0”?
   - Has a data register been set to a negative value?
   - If parameters have been set from an external source, and if operation is being carried out internally in the PLC, check to make sure the values match those specified by the design.

2. **Correct any values which are outside of the allowable range, in the program.**

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3. Use any of the following procedures to reset the set value error.

- In the program, turn the error clear contact “ECLR” off, on, and then off again.
- Using forced output based on the programming tool software, turn the error clear contact “ECLR” off, on, and then off again.
- Turn off the power supply for the driver and then that for the PLC, and then turn on the PLC power supply, followed by the driver power supply.

☞ **Note**

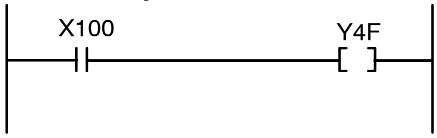
If the error clear contact “ECLR” is on, none of the positioning operations will start. Cancel the error first and then restart the various operations.

The startup contacts for the various operations become valid after the error has been canceled.
If the error clear signal is being cleared in the program, it is possible to clear the error with the other axes still in operational status.

Clearing an error with the error clear signal ① [Using the program to clear the error]

With this method, errors are cleared through the program, using a switch or other means connected ahead of time. Any desired input can be used to turn on the error clear signals corresponding to the various axes.

Example:



Input X100 is used to clear a positioning unit set value error.

Note

The relay number used varies depending on the allocated position ☛ Section 4.2 and 14.3.

Clearing an error with the error clear signal ② [Using forced output to clear the error]

Procedure:

1. **Select “FORCE I/O” on the menu of the programming tool software.**
2. **Specify the relay Y_F for the forced output.**
3. **Turn on the relay for the forced output, and turn it off.**
4. **Cancel the forced status.**

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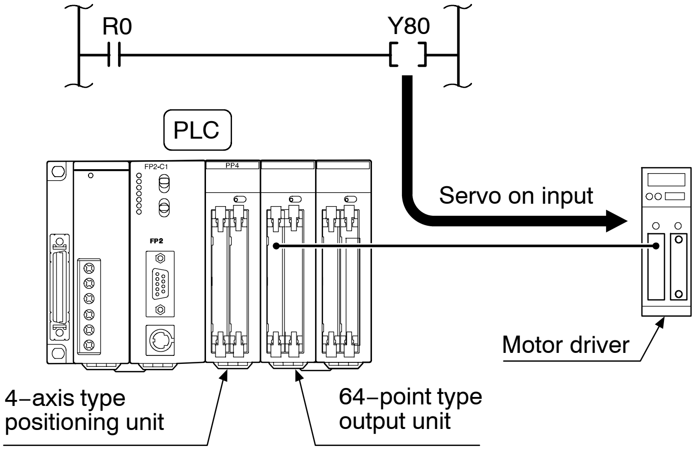
☞ **Note**

After using forced output, always cancel the forced status. The relay number used varies depending on the unit type, the allocated position and the number of axes ☛ Section 4.2 and 14.3.

13.3.2 If the Motor Does Not Turn or Operate (if the display LED for pulse output A or B is flashing or lighted)

Solution 1: For the servo motor

Check to make sure the servo on input is set to “On”.



Solution 2

Check to make sure the power supply for the driver is on.

Solution 3

Check to make sure the wiring between the positioning unit and the driver has been correctly connected.

Solution 4

Check to make sure the settings for the pulse output method (CW/CCW method or Pulse/Sign method) are appropriate for the driver.

For detailed information about ☛ mode switch settings (refer to section 4.1)

13.3.3 If the Motor Does Not Turn or Operate (if the display LED for pulse output A or B is not lighted)

Solution

Review the program and correct it if necessary.

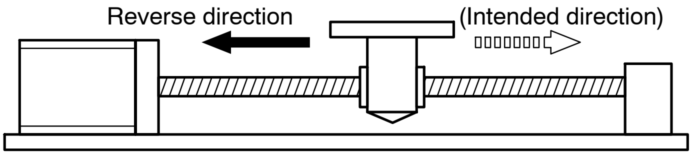
Points to check

① Check to make sure the I/O numbers are appropriate.

② Check to make sure the startup contacts have not been overwritten in the program.

13.3.4 Rotation/Movement Direction is Reversed

[Example of reversed rotation/movement direction]



Solution 1

Make sure the wiring between the positioning unit and the driver has been correctly connected.

Point to check

Make sure the CW/CCW output or the Pulse/Sign output has been connected to the pertinent input on the driver side.

For detailed information about connection of pulse output signal ☛ section 3.4

Solution 2

Check to make sure the control codes in the program match the specifications for the position command values.

Point to check

The settings for the increment "relative value control" and the absolute "absolute value control" are specified through the control codes in the program.

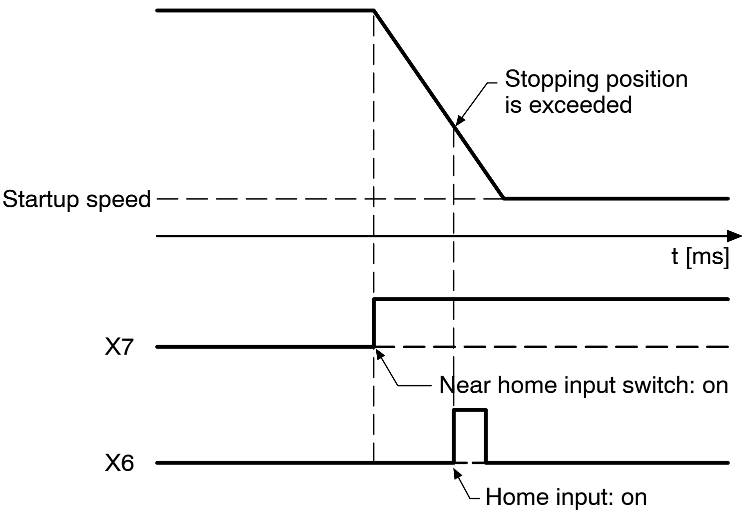
For detailed information about increment and Absolute ☛ section 4.3

Solution 3

If the settings for the position command data have been designed with the plus (+) and minus (−) directions reversed, change the direction of rotation, using the mode setting switches on the back of the unit.

For detailed information about operation mode setting switch setting o☛ section 4.1

13.3.5 The Stopping Position is Off for a Home Return

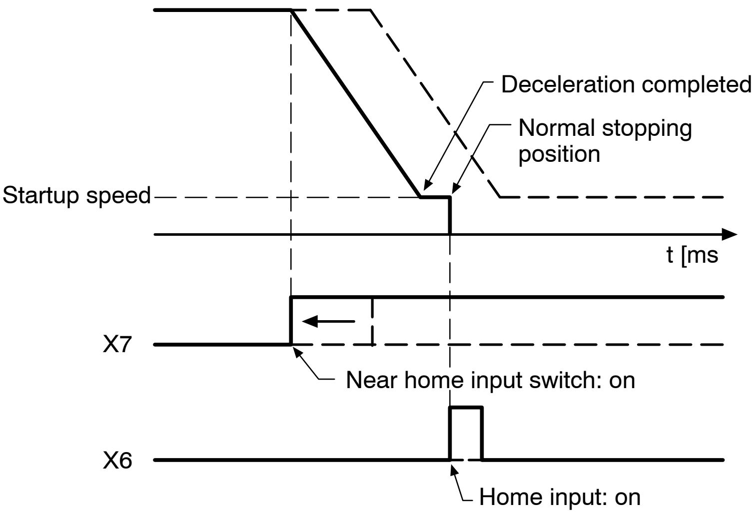


Conditions

When a home return is carried out, there is a possibility that the speed cannot be slowed sufficiently. If deceleration cannot be continued down to the startup speed, the unit will not stop even if there is home input.

Solution 1

Try shifting the position of the near home input switch in the direction of the home return, and in the opposite direction.



Point to check

If the home input is connected to the Z phase of the servo motor driver, there may be cases in which the near home input position is close to the home input.

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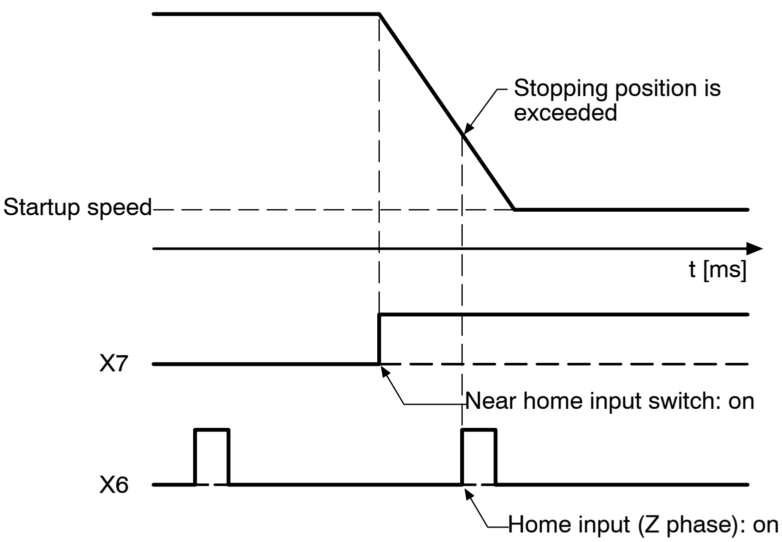
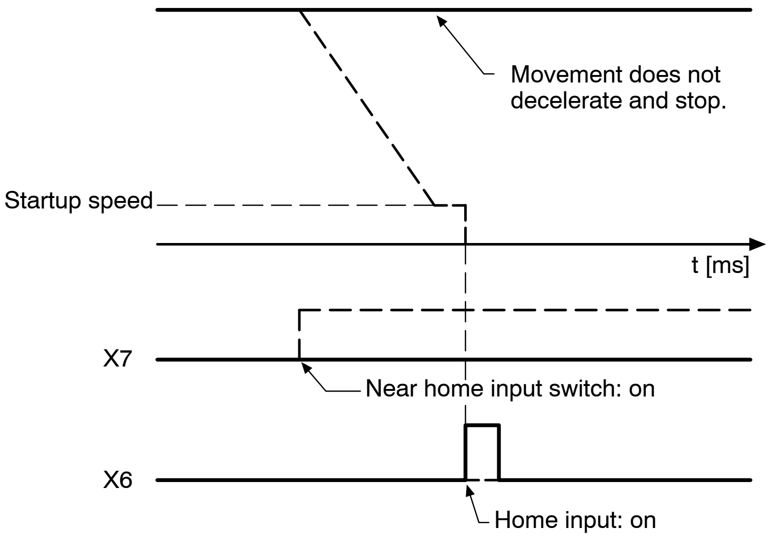


Solution 2

Correct the program and set the home return speed to a slower speed.

13.3.6 Speed Does not Slow for a Home Return



Conditions

There is a possibility that the near home input has not been read correctly.

Solution 1

Forcibly turn the near home input switch on and off from an external source, and check to see if the near home input display LED “D” on the positioning unit lights.

Solution 2

Check to make sure the input logic for the near home input switch is normally either on or off.

Solution 3

Check the specifications of the control codes in the home return program. The specified control codes vary depending on the input logic confirmed under “Solution 2.”

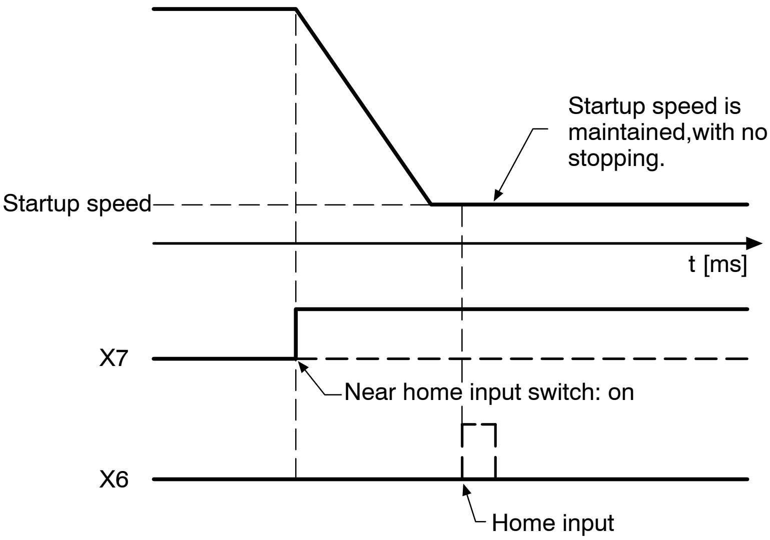
For detailed information about control code ☛ section 14.2.1

For detailed information about input logic ☛ section 9.4

Point to check

If no near home input has been connected, the near home input will be recognized as being off.

13.3.7 Movement Doesn't Stop at Home Position (after decelerating for home return)



Conditions

There is a possibility that the home input has not been read correctly.

Point to check

The home return makes home input subsequent to deceleration valid, so if the home signal is input during deceleration, that input will end up being ignored.

Solution 1

Forcibly turn the home input sensor on and off from an external source, and check to see if the home input display LED "Z" on the positioning unit lights.

Solution 2

Check to make sure the input logic for the home input is normally either on or off.

Solution 3

Check the specifications of the control codes in the home return program. The specified control codes vary depending on the input logic confirmed under "Solution 2".

For detailed information about control code ☛ section 14.2.1

For detailed information about input logic ☛ section 9.4

Point to check

If no home input has been connected, the home input will be recognized as being on.

Chapter 14

Specifications

14.1 Table of Performance Specification

General specifications

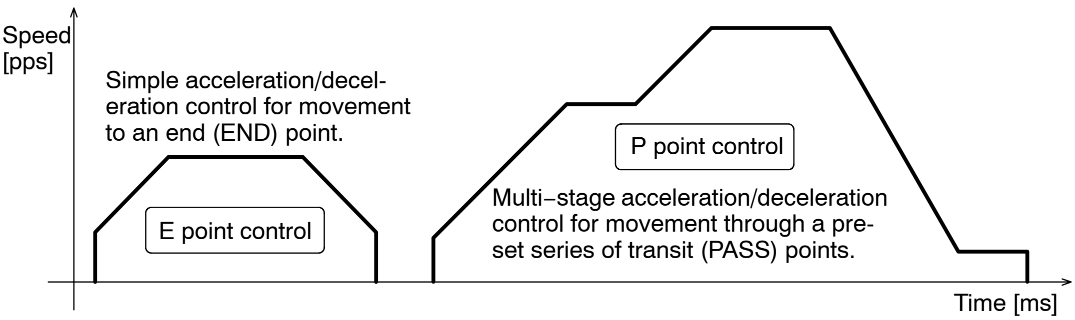
Item	Description
Ambient operating temperature	0 °C to +55 °C/32 °F to +131 °F
Ambient storage temperature	−20 °C to +70 °C/−4 °F to +158 °F
Ambient operating humidity	30 % to 85 % RH (25 °C non-condensing)
Ambient storage humidity	30 % to 85 % RH (25 °C non-condensing)
Breakdown voltage	500 V AC, 1 minute Between the various pins of the external connector and the ground, (except for the "F.E." pins)
Insulation resistance	100MΩ or more (measured with 500 V DC megger testing) Between the various pins of the external connector and the ground (except for the "F.E." pins)
Vibration resistance	10 to 55 Hz, 1 cycle/min. (double amplitude of 0.75 mm/0.030 in., 10 min. each in the X, Y, Z directions)
Shock resistance	Shock of 98 m/s^2, 4 times in the X, Y, Z directions
Noise immunity	1,000 Vp-p with pulse widths 50 ns and 1 μs (based on in-house measurements)
Operating environment	Free of corrosive gases and excessive dust

Performance specifications

Item		Descriptions	
Order number		**FP2–PP2**	**FP2–PP4**
Occupied I/O points		Input: 32 points, Output: 32 points	Input: 64 points, Output: 64 points
Number of axes controlled		2 axes, independent	4 axes, independent
Position command	**Command units**	Pulse unit (The program specifies whether Increment or Absolute is used.)	
	Command range	Signed 32 bits (–2,147,483,648 to +2,147,483,647 pulses)	
Speed command	**Command range**	When line driver is used: 1 pps to 1 Mpps (settings in units of 1 pps are possible) When open collector is used: 1 pps to 200 kpps (settings in units of 1 pps are possible)	
	Acceleration/ deceleration method	Linear acceleration/deceleration, S acceleration/deceleration (this takes the form of an “S”)	
	Acceleration/ deceleration time	0 to 32767 ms	
Home return	**Home return speed**	Speed setting possible (changes return speed and search speed)	
	Input terminals	Home input, Near home input	
Operation mode		E point control (Linear and S accelerations/decelerations selecting possible) (* Note 1) P point control (Linear and S accelerations/decelerations selecting possible) (* Note 1) Home return function (Linear and S accelerations/decelerations selecting possible) Jog operation function (Linear and S accelerations/decelerations selecting possible) (* Note 2) Pulser input function (Transfer multiplication ratio ×1, ×2, ×5, ×10, ×50, ×100, ×500, ×1000 selecting possible)	
Startup time		0.1 ms or less	
Output mode		Pulse/Sign mode, CW/CCW mode (Switched using the setting switch on the back of the unit)	
Other functions		Deviation counter clear signal output contact	
Internal current consumption (at 5 V DC) (*Note 3)		225 mA or less	400 mA or less
External power supply (*Note 4)		24 V DC (21.6 to 26.4 V DC) Current consumption: 45 mA or less	24 V DC (21.6 to 26.4 V DC) Current consumption: 90 mA or less
Max. coefficient speed		250 kHz	
Weight		Approx. 125 g/4.409 oz	Approx. 150 g/5.291 oz

☞ Notes

1) **E point and P point control shown in the following diagram are the acceleration/deceleration controls.**
2) **The target speed is changeable during operation when linear acceleration/deceleration operation is selected.**
3) **This is supplied to the interior of the unit from the power supply unit, through the backplane bus.**
4) **Power is supplied from an external source to the unit connector.**



14.2 Table of Shared Memory Area

Shared memory address (Hexadecimal)				Name	Descriptions	Setting needed/not needed (Y: needed, N: not needed)				
1 axis	2 axes	3 axes	4 axes			E point control	P point control	Jog operation	Home return	Pulser operation
100h	110h	120h	130h	Control code	Acceleration/deceleration method (Liner, S) Control method (Increment, Absolute) Home return direction and logic Pulser transfer multiple	Y	Y	Y	Y	Y
101h	111h	121h	131h							
102h	112h	122h	132h	Startup speed fs (pps)	Startup speed setting Setting range: 0 to 1,000,000 (pps)	Y	Y (for first speed only)	Y	Y	N
103h	113h	123h	133h							
104h	114h	124h	134h	Target speed ft (pps)	Target speed setting Setting range: 1 to 1,000,000 (pps)	Y	Y	Y	Y	Y
105h	115h	125h	135h							
106h	116h	126h	136h	Acceleration/ deceleration time Ac (ms)	Acceleration/deceleration time setting Setting range: 0 to 32,767 (ms)	Y	Y	Y	Y	N
107h	117h	127h	137h							
108h	118h	128h	138h	Position command value Pt (pulse)	Position command value setting Signed 32 bits −2,147,483,648 to 2,147,483,647 (pulses)	Y	Y	N	N	N
109h	119h	129h	139h							
10Ah	11Ah	12Ah	13Ah	Elapsed value Pe (pelse)	Count of elapsed value (Absolute) Signed 32 bits −2,147,483,648 to 2,147,483,647 (pulses)	*	*	*	*	*
10Bh	11Bh	12Bh	13Bh							
10Ch	11Ch	12Ch	13Ch	Comparison pulse count Pc (pulse)	Comparison pulse setting Signed 32 bits −2,147,483,648 to 2,147,483,647 (pulses)	*	*	*	*	*
10Dh	11Dh	12Dh	13Dh							

☞ Notes

- **The shared memory is shared between E point control, P point control, jog operation, home return, and pulser input operations. Be careful that the shared memory is not overwritten at the same timing.**
- **For the first speed of E point control and P point control, and for jog operation and home returns, the value set for the target speed should be larger than that set for the startup speed.**
- **“*” is read and written as needed.**

14.2.1 Quick Guide to Control Codes

E point control and P point control

Control code	Control method, Acceleration/deceleration method	Control code	Control method, Acceleration/deceleration method
H0	Increment, Linear acceleration/deceleration	**H2**	Increment, S acceleration/deceleration
H1	Absolute, Linear acceleration/deceleration	**H3**	Absolute, S acceleration/deceleration

Jog operation

Control code	Acceleration/deceleration method	Control code	Acceleration/deceleration method
H0	Linear acceleration/deceleration	**H1**	S acceleration/deceleration

Home return

Control code	Acceleration/de-celeration method	Direction of home return	Home input logic	Near home input logic
H0	Linear	– direction	Valid when power is not supplied	Valid when power is supplied
H2	S	– direction	Valid when power is not supplied	Valid when power is supplied
H4	Linear	+ direction	Valid when power is not supplied	Valid when power is supplied
H6	S	+ direction	Valid when power is not supplied	Valid when power is supplied
H10	Linear	– direction	Valid when power is supplied	Valid when power is supplied
H12	S	– direction	Valid when power is supplied	Valid when power is supplied
H14	Linear	+ direction	Valid when power is supplied	Valid when power is supplied
H16	S	+ direction	Valid when power is supplied	Valid when power is supplied
H20	Linear	– direction	Valid when power is not supplied	Valid when power is not supplied
H22	S	– direction	Valid when power is not supplied	Valid when power is not supplied
H24	Linear	+ direction	Valid when power is not supplied	Valid when power is not supplied
H26	S	+ direction	Valid when power is not supplied	Valid when power is not supplied
H30	Linear	– direction	Valid when power is supplied	Valid when power is not supplied
H32	S	– direction	Valid when power is supplied	Valid when power is not supplied
H34	Linear	+ direction	Valid when power is supplied	Valid when power is not supplied
H36	S	+ direction	Valid when power is supplied	Valid when power is not supplied

Pulser input operation

Control code	Transfer multiplication ratio	Control code	Transfer multiplication ratio
H0	×1 time	**H400**	×50 times
H100	×2 times	**H500**	×100 times
H200	×5 times	**H600**	×500 times
H300	×10 times	**H700**	×1000 times

Control codes are written to the shared memory area with the bit configuration shown below.
The settings for the control method, the method of acceleration and deceleration, the home return method, and the pulser transfer multiple ratio are all written to the same area, so be careful that overwriting is not done at the same timing.

Higher 16 bits (Address: 101h,111h,121h,131h,)

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

— Indicates the invalid bit

Lower 16 bits (Address: 100h,110h,120h,130h,)

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

10	9	8	Pulser transfer multiple
0	0	0	x1
0	0	1	x2
0	1	0	x5
0	1	1	x10
1	0	0	x50
1	0	1	x100
1	1	0	x500
1	1	1	x1000

		0 (Default value)	1
0	Control method	Increment	Absolute
1	Acceleration/ deceleration method	Linear acceleration /deceleration	S acceleration/ deceleration
2	Direction of home return	– direction of elapsed value	+ direction of elapsed value
4	Home input logic	Input valid when no power is supplied	Input valid when power is supplied
5	Near home input logic	Input valid when power is supplied	Input valid when no power is supplied

For detailed information about the checking of input logic ☛ section 9.4.

14.3 Table of I/O Contact (Relay) Allocation

Con-tact (Relay)	Name		Description	I/O contact (relay) number					
				2–axis type		4–axis type			
				1st axis	2nd axis	1st axis	2nd axis	3rd axis	4th axis
X_0	Pulse output busy	BUSY	Goes on during pulse output. (* Note 1)	X0	X10	X0	X10	X20	X30
X_1	Pulse output done	EDP	Goes on when pulse output ends. (* Note 2)	X1	X11	X1	X11	X21	X31
X_2	Acceleration zone	ACC	Goes on during acceleration zone.	X2	X12	X2	X12	X22	X32
X_3	Constant speed zone	CON	Goes on during constant speed zone.	X3	X13	X3	X13	X23	X33
X_4	Deceleration zone	DEC	Goes on during deceleration zone.	X4	X14	X4	X14	X24	X34
X_5	Rotation direction	DIR	Monitor contact for direction of rotation (direction of increasing elapsed value when on).	X5	X15	X5	X15	X25	X35
X_6	Home input	ZSG	Goes on when home input becomes valid	X6	X16	X6	X16	X26	X36
X_7	Near home input	DOG	Goes on when near home input becomes valid	X7	X17	X7	X17	X27	X37
X_8	Home return done	ORGE	Turns on when home return is done. Goes on until next home return is initiated.	X8	X18	X8	X18	X28	X38
X_9	Comparison result	CLEP	Goes on when elapsed value of internal counter is greater than or equal to the number of comparison pulse.	X9	X19	X9	X19	X29	X39
X_A	Set value change confirmation	CEN	With P point control, this is used to confirm rewriting of set values. (* Note 3)	XA	X1A	XA	X1A	X2A	X3A
X_B	————	———	————————	XB	X1B	XB	X1B	X2B	X3B
X_C	————	———	————————	XC	X1C	XC	X1C	X2C	X3C
X_D	————	———	————————	XD	X1D	XD	X1D	X2D	X3D
X_E	Set value error	SERR	Goes on when a set value error occurs.	XE	X1E	XE	X1E	X2E	X3E
X_F	————	———	————————	XF	X1F	XF	X1F	X2F	X3F
Y_0	E point control start	EST	When turned on in the user program, E point control is initiated.	Y20	Y30	Y40	Y50	Y60	Y70
Y_1	P point control start	PST	When turned on in the user program, P point control is initiated.	Y21	Y31	Y41	Y51	Y61	Y71
Y_2	Home return start	ORGS	When turned on in the user program, a home return is initiated.	Y22	Y32	Y42	Y52	Y62	Y72
Y_3	Forward jog	JGF	When turned on in the user program, jog forward rotation is initiated.	Y23	Y33	Y43	Y53	Y63	Y73

Con-tact (Relay)	Name		Description	I/O contact (relay) number					
				2–axis type		4–axis type			
				1st axis	2nd axis	1st axis	2nd axis	3rd axis	4th axis
Y_4	Reverse jog	JGR	When turned on in the user program, jog reverse rotation is initiated.	Y24	Y34	Y44	Y54	Y64	Y74
Y_5	Forced stop	EMR	When turned on in the user program, operations currently running are interrupted and forcibly stopped.	Y25	Y35	Y45	Y55	Y65	Y75
Y_6	Deceleration stop	DCL	When turned on in the user program, operations currently running are interrupted, and decelerate to a stop.	Y26	Y36	Y46	Y56	Y66	Y76
Y_7	Pulser input enabled	PEN	When turned on in the user program, pulser input is enabled (valid only while on).	Y27	Y37	Y47	Y57	Y67	Y77
Y_8	———	———	———	Y28	Y38	Y48	Y58	Y68	Y78
Y_9	———	———	———	Y29	Y39	Y49	Y59	Y69	Y79
Y_A	———	———	———	Y2A	Y3A	Y4A	Y5A	Y6A	Y7A
Y_B	———	———	———	Y2B	Y3B	Y4B	Y5B	Y6B	Y7B
Y_C	———	———	———	Y2C	Y3C	Y4C	Y5C	Y6C	Y7C
Y_D	———	———	———	Y2D	Y3D	Y4D	Y5D	Y6D	Y7D
Y_E	———	———	———	Y2E	Y3E	Y4E	Y5E	Y6E	Y7E
Y_F	Error clear	ECLR	If a set value error occurs, the error is canceled when this is turned on in the user program.	Y2F	Y3F	Y4F	Y5F	Y6F	Y7F

☞ Notes

1) This goes on during pulse output in various operations such as E point control, P point control, home return, and jog operation, and remains on until the operation has been completed.

**2) This goes on when the various operations such as E point control, P point control, jog operation, and pulser input operation have been completed.
It also goes on when deceleration and stopping have been completed, and when a forcible stop has been completed.
It goes off when the next operation such as E point control, P point control, jog operation, a home return, or pulser input operation is initiated.**

3) This goes on when P point control or E point control is initiated, and goes off when the shared memory write instruction F151/P151 is executed in the program, and data of any kind is written to the shared memory of the positioning unit.

☞ **next page**

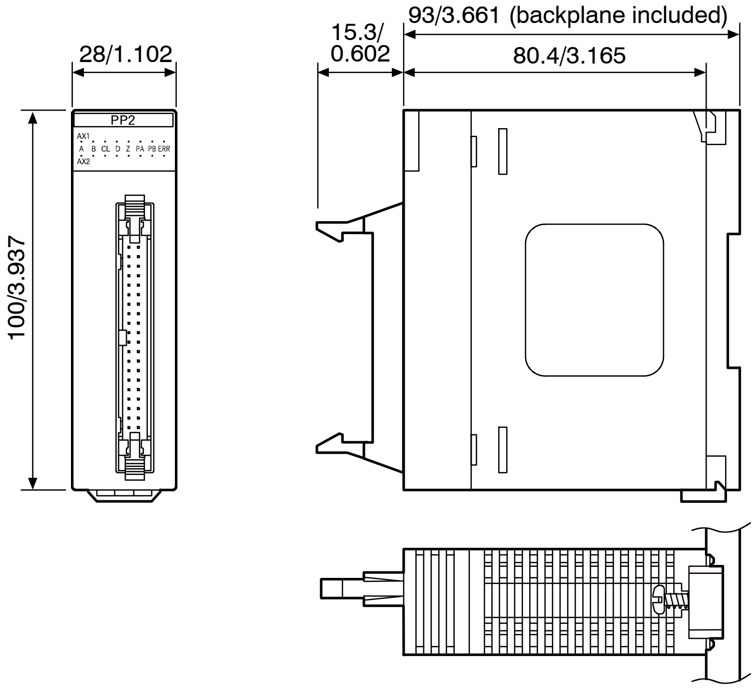
4) The input and output contact (relay) numbers indicate the number when the unit number is 0. The numbers actually used change depending on the position in which the unit is installed ☛ section 4.2.3.

Chapter 15

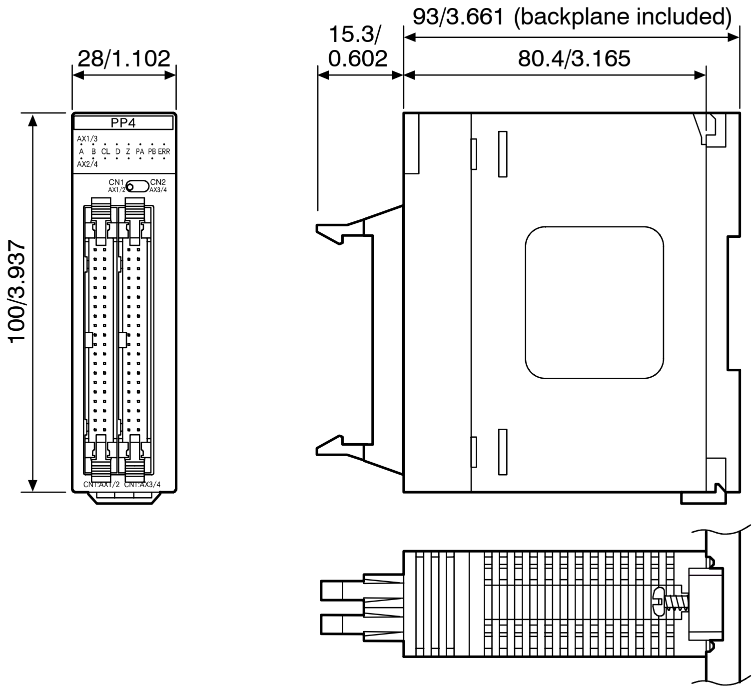
Dimensions and Driver Wiring

15.1 Dimensions

FP2−PP2 (2−axis type)



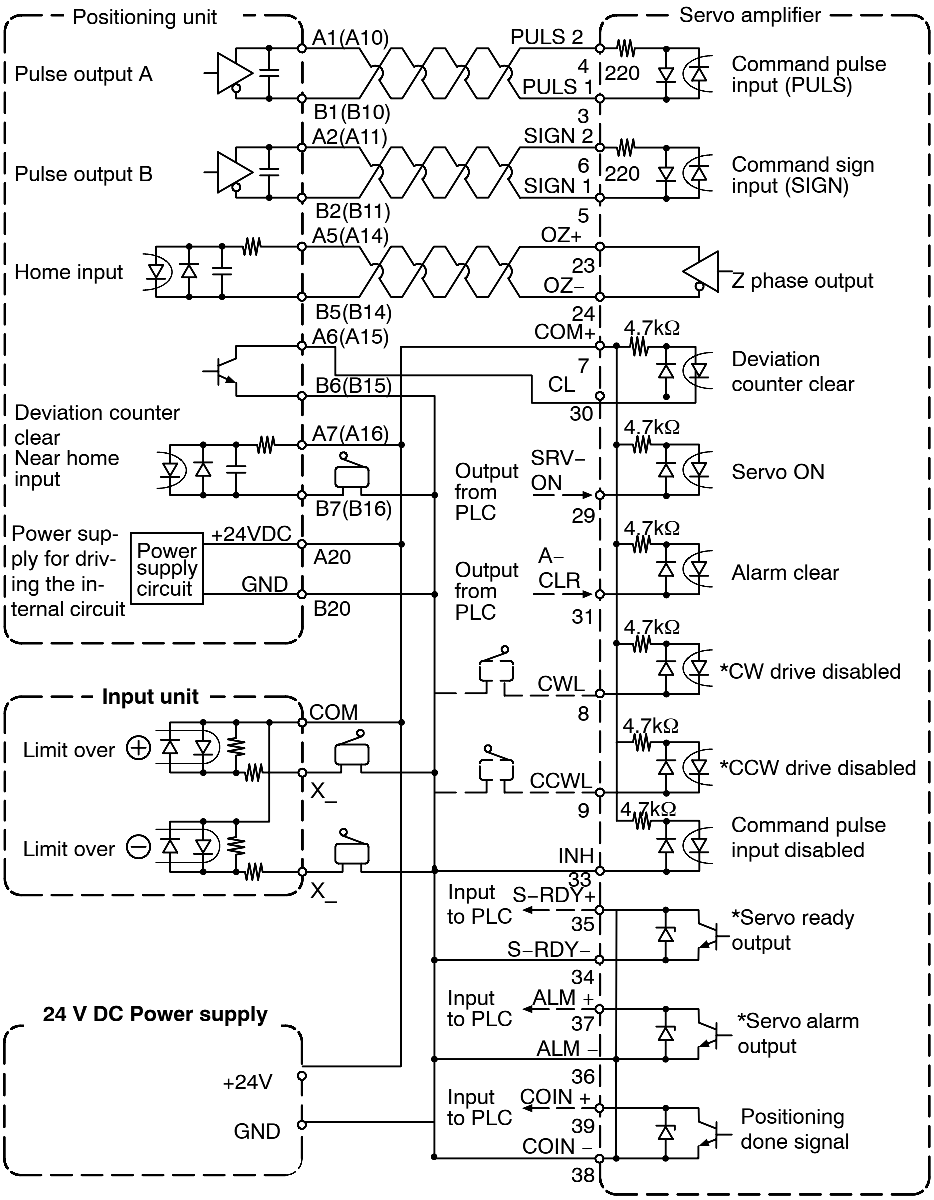
FP2−PP4 (4−axis type)



(Unit: mm/in.)

15.2 Wiring for Motor Driver

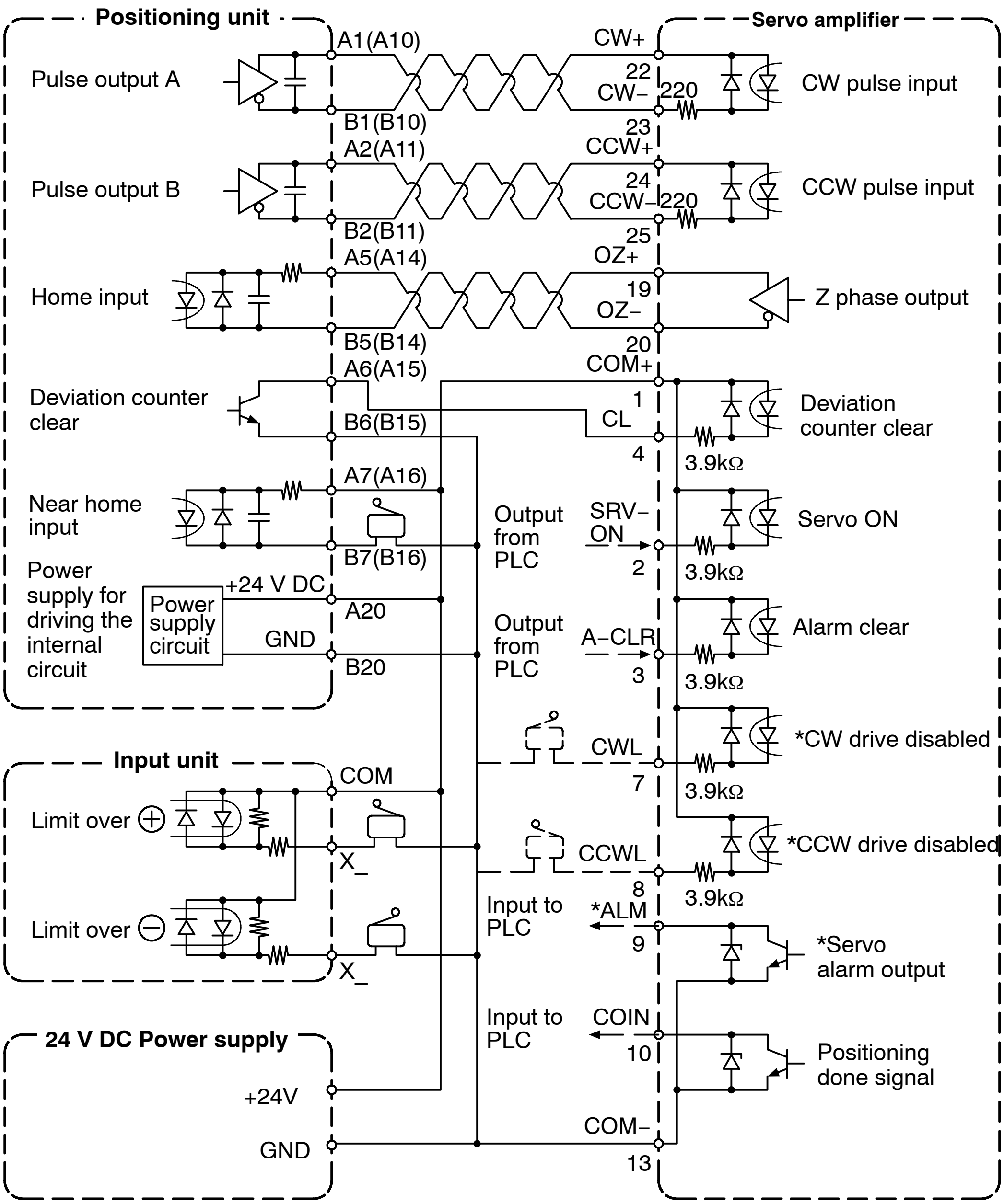
15.2.1 Panasonic A Series



* When connecting the CW drive disabled and CCW drive disabled input, the servo ready output, and the servo alarm output on the motor driver side, the circuits recommended by the various motor manufacturers should be used.

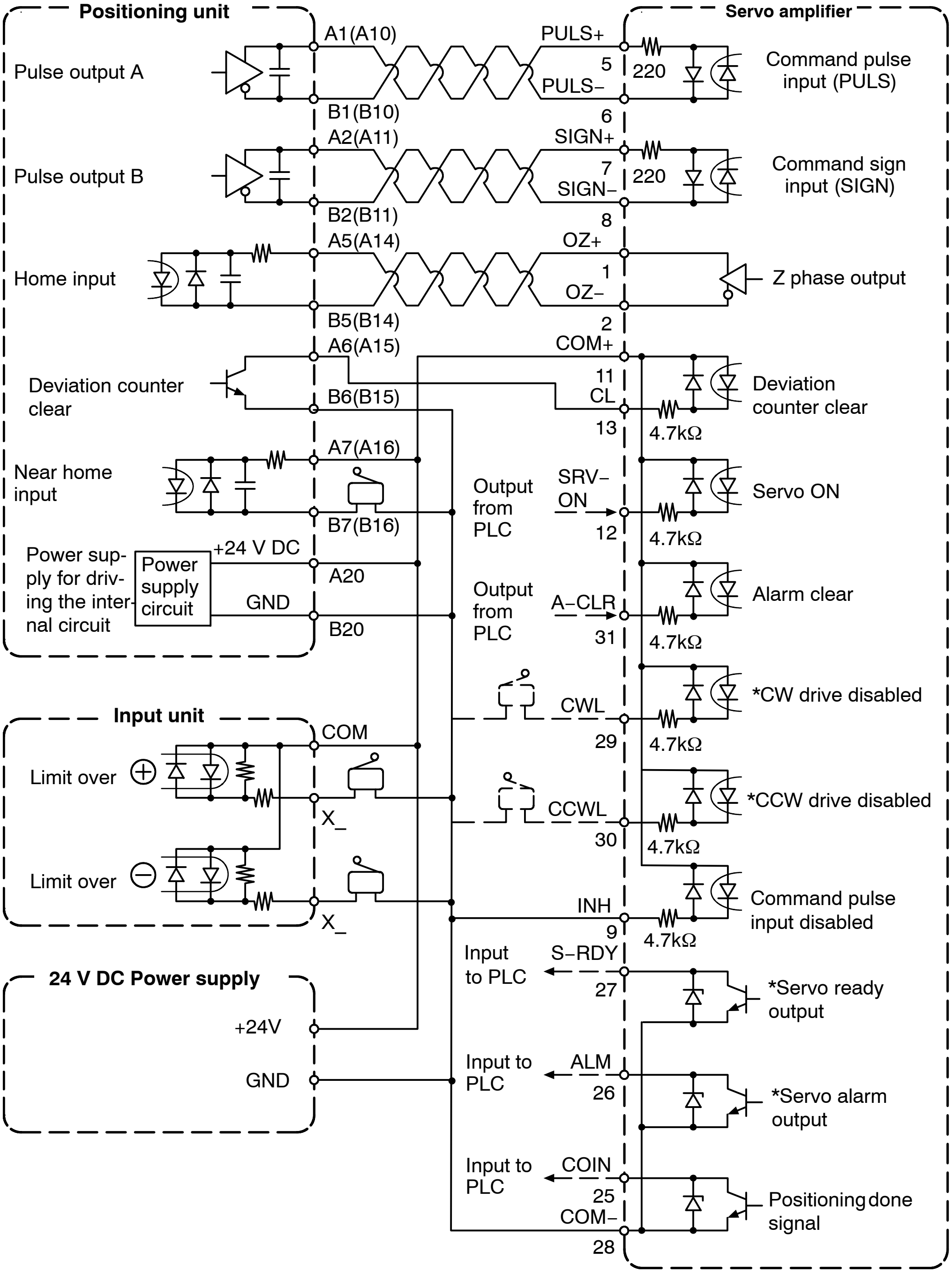
Numbers in parentheses after the unit side indicate the pin number for the second or fourth axis.

15.2.2 Panasonic EX Series



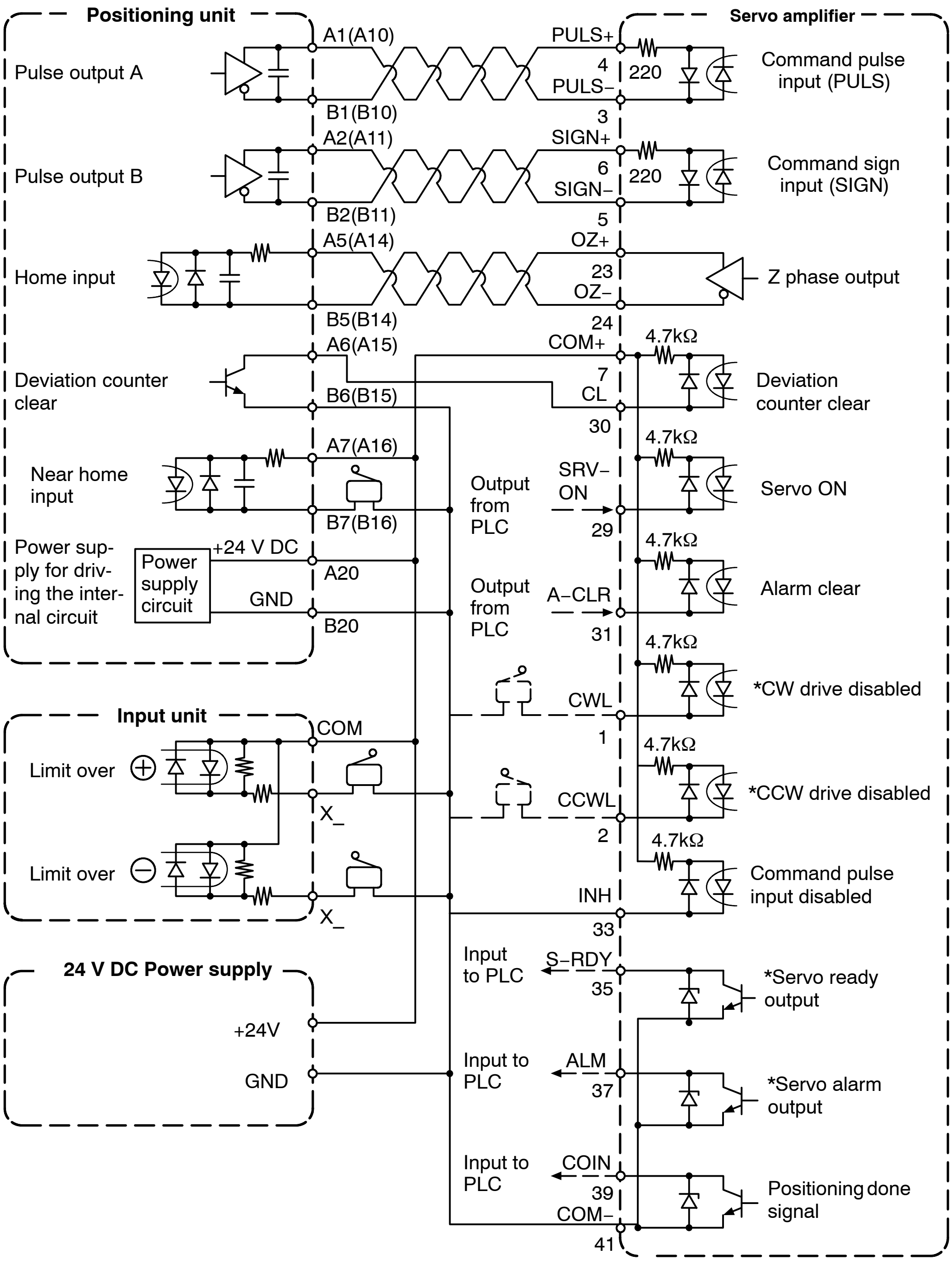
* When connecting the CW drive disabled and CCW drive disabled input and the servo alarm output on the motor driver side, the circuits recommended by the various motor manufacturers should be used.
Numbers in parentheses after the unit side indicate the pin number for the second or fourth axis.
As of October 2008, this is the end−of−life (EOL) product.

15.2.3 Panasonic X (xx) Series



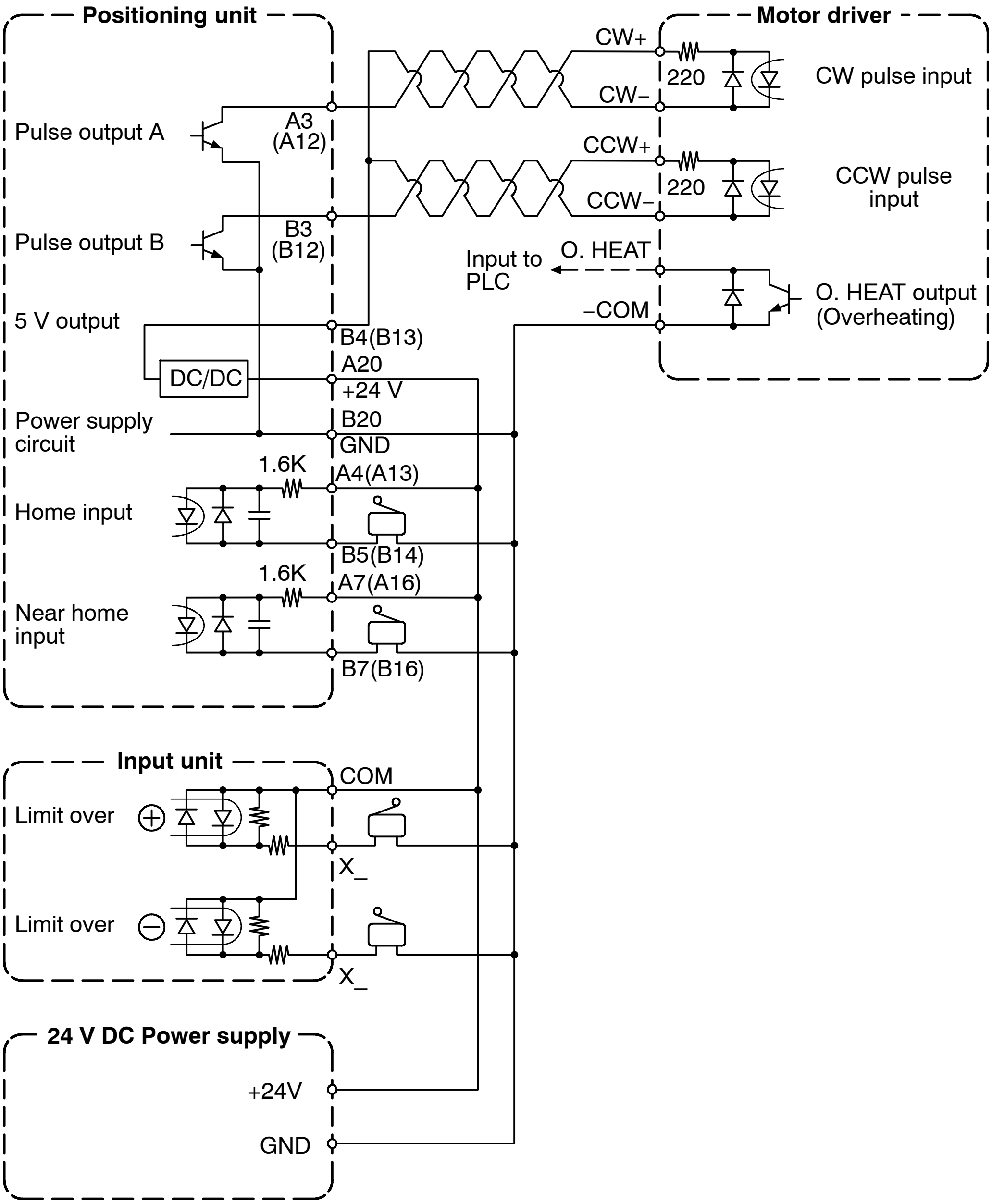
* When connecting the CW drive disabled and CCW drive disabled input, the servo ready output, and the servo alarm output on the motor driver side, the circuits recommended by the various motor manufacturers should be used.
Numbers in parentheses after the unit side indicate the pin number for the second or fourth axis. As of October 2008, this is the end−of−life (EOL) product.

15.2.4 Panasonic X (v) Series



* When connecting the CW drive disabled and CCW drive disabled input, the servo ready output, and the servo alarm output on the motor driver side, the circuits recommended by the various motor manufacturers should be used.
Numbers in parentheses after the unit side indicate the pin number for the second or fourth axis. As of October 2008, this is the end−of−life (EOL) product.

15.2.5 Oriental Motor UPK–W Series



Numbers in parentheses after the unit side indicate the pin number for the second or fourth axis.

15.2.6 Motor Driver I/F Terminal

1−axis type:AFP8501
2−axis type:AFP8502

Positioning unit which can be used

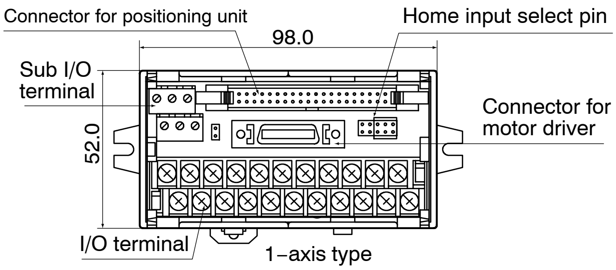
FP2 2−Axis type positioning unit	AFP2430
FP2 4−Axis type positioning unit	AFP2431

Related products

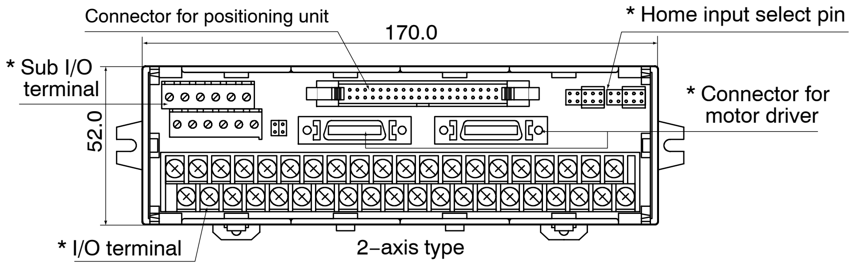
0.5 m Cable for FP2 positioning unit	AFP85100
1 m Cable for FP2 positioning unit	AFP85101
1 m Cable for MINAS A series	AFP85111
2 m Cable for MINAS A series	AFP85112
1 m Cable for MINAS EX series	AFP85121
2 m Cable for MINAS EX series	AFP85122

The I/F terminal

Dimensions



1−axis type



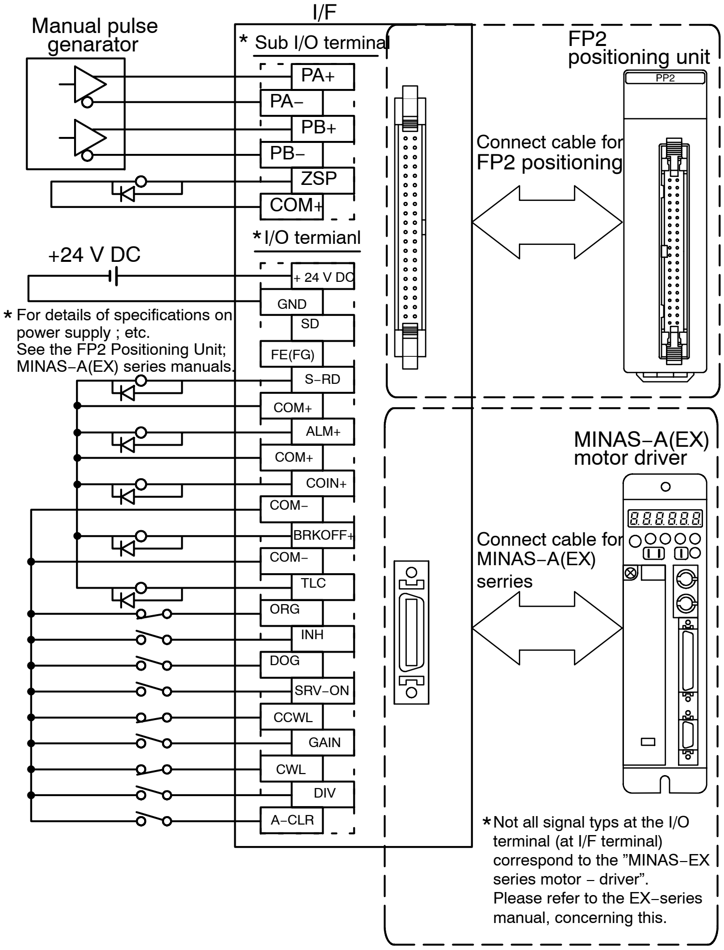
2−axis type

- The asterix (→ *) below indicates the following:
  AX1 and AX2; AX(3) and AX(4) which you can see at the PWB of the I/F terminal, both share the same connector slot at the FP2 positioning unit side. (for PP2 type and PP4 type)
  When the user will use the 3 and 4 axis connection from the FP2 positioning unit, the AX(3) and AX(4) can be used for this.

☞ **Note**

Number 3 and 4 is parenthesized at the I/F terminal.

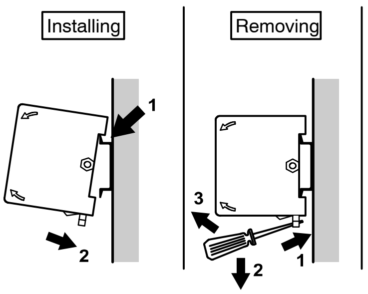
Terminal arrangement diagram (1 axis type)



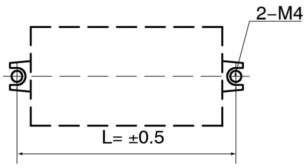
Installing the I/F terminal

DIN rail installation

(DIN EN50022 35 mm / 1.378 in.width)



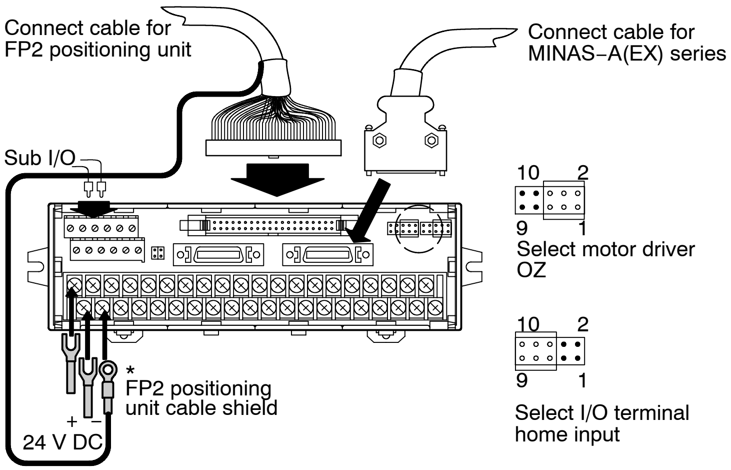
Screw–in installation



Type	Part number	L(mm)
1–axis type	AFP8501	106.0
2–axis type	AFP8502	178.0

Connecting the wiring

Caution: Be sure the power is turned off while connecting the wiring.



- I/F terminal−after connecting the cable, pulse output A, pulse output B (of the line driver), and the deviation counter clear signals are joined together at this I/F terminal.
- Home Input Selection−concerning the OZ signal of the motor driver and the I/O terminal home input (24V), it is possible to change to either with the home switching pins.
  The settings can be switched to either at the upper setting area.
  (→ see upper figure)
- Please connect the shielded cable terminal (cable type: AFP85100; AFP85101) to the FE terminal (at I/F terminal)

* When FP2 and the MINAS−A(EX) motor driver does not function properly due to reasons of noise influence, then connect the shielded cable terminal (cable type: AFP85100; AFP85101) to the SD terminal (at I/F terminal).

* FE terminal (of the I/F terminal) − this is either connected to the F.E. pin of the FP2 positioning unit or to the FG pin of the CN I/F connector of the MINAS−A(EX) motor driver.

* SD terminal (of the I/F terminal) − this is connected to the GND pin of the CN I/F connector of the MINAS−A(EX) motor driver.

15.2 Wiring for Motor Driver

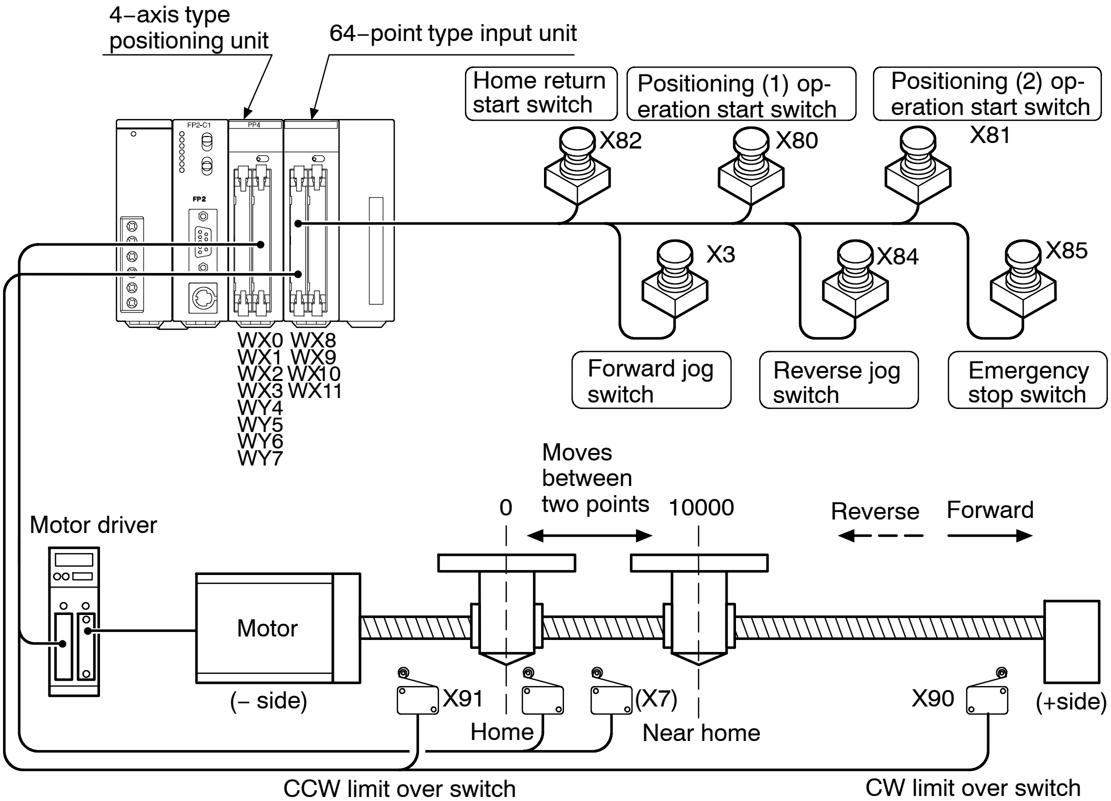
Chapter 16

Sample Programs

16.1 Sample Programs

16.1.1 Positioning Program for 1 Axis

Unit configuration



An overview of a sample program

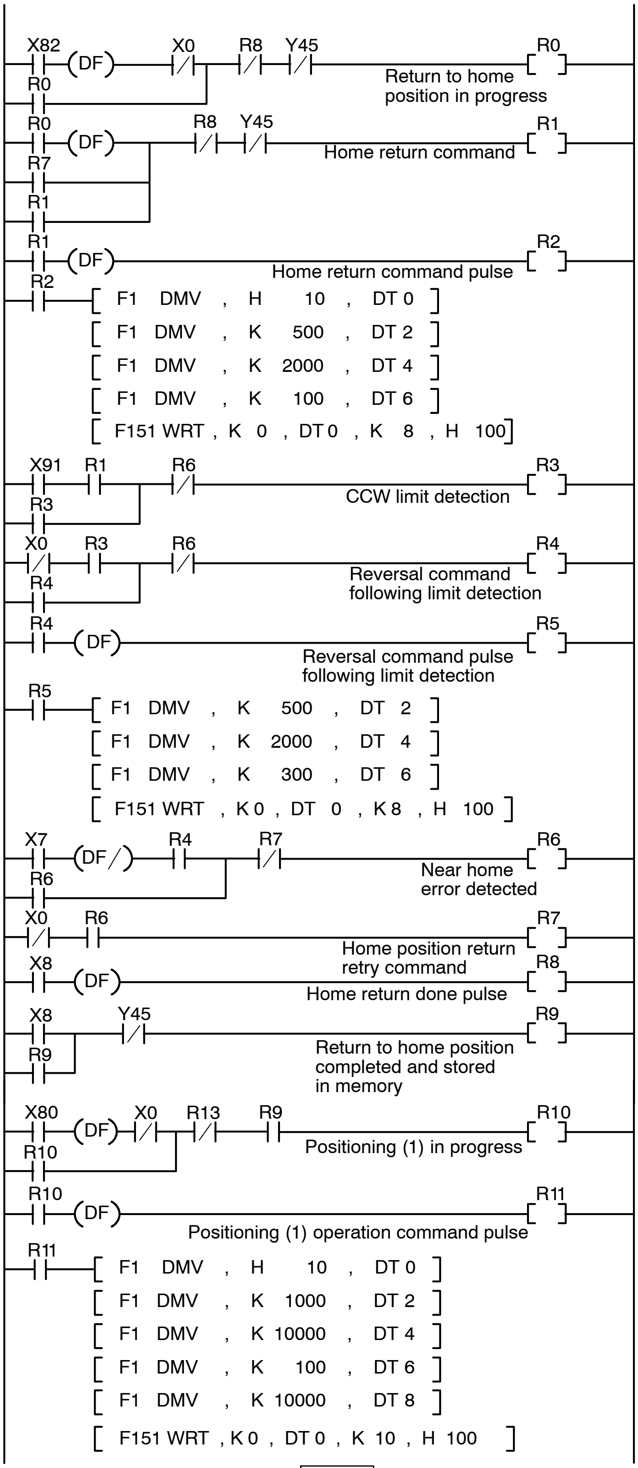
This sample program uses the absolute mode.

1. When input X1 is on, the table moves to the absolute position 10000. [Positioning (1)]
2. When input X2 is on, the table moves to the absolute position 0. [Positioning (2)]
3. When input X0 is on, a return to the home position begins. (If the near home input is not in the return direction, a limit over input is detected, and the direction is reversed. After the near home input (on → off) is detected, the return to the home position is begun again.)

I/O Allocation

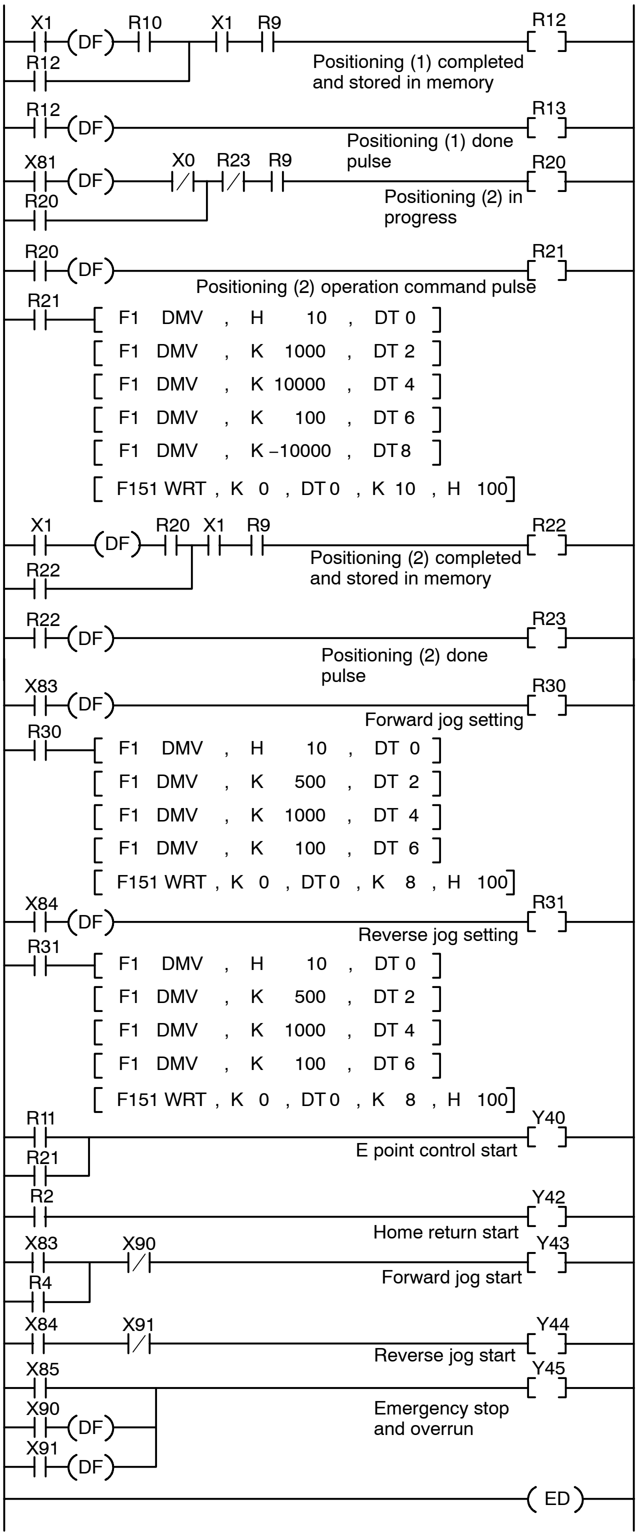
I/O No.	Description	I/O No.	Description
X0	Pulse output busy flag	**R1**	Home return movement in progress
X1	Positioning done flag	**R2**	Home return command pulse
X7	Near home input	**R3**	CCW limit detection
X8	Home return done flag	**R4**	Forward jog start
X80	Positioning (1) operation start	**R5**	Forward jog start pulse
X81	Positioning (2) operation start	**R6**	Near home sensor error detected
X82	Home return start	**R7**	Retry of home return
X83	Forward jog	**R8**	Home return done pulse
X84	Reverse jog	**R9**	Completion of home return stored in memory
X85	Emergency stop	**R10**	Positioning (1) in progress
X90	CW limit detection	**R11**	Positioning (1) operation command pulse
X91	CCW limit detection	**R12**	Positioning (1) completed and stored in memory
Y40	E point control start	**R13**	Positioning (1) done pulse
Y42	Home return start	**R20**	Positioning (2) in progress
Y43	Forward jog start	**R21**	Positioning (2) operation command pulse
Y44	Reverse jog start	**R22**	Positioning (2) completed and stored in memory
Y45	Forcible stop	**R23**	Positioning (2) done pulse
	————	**R30**	Forward jog setting
	————	**R31**	Reverse jog setting

Program



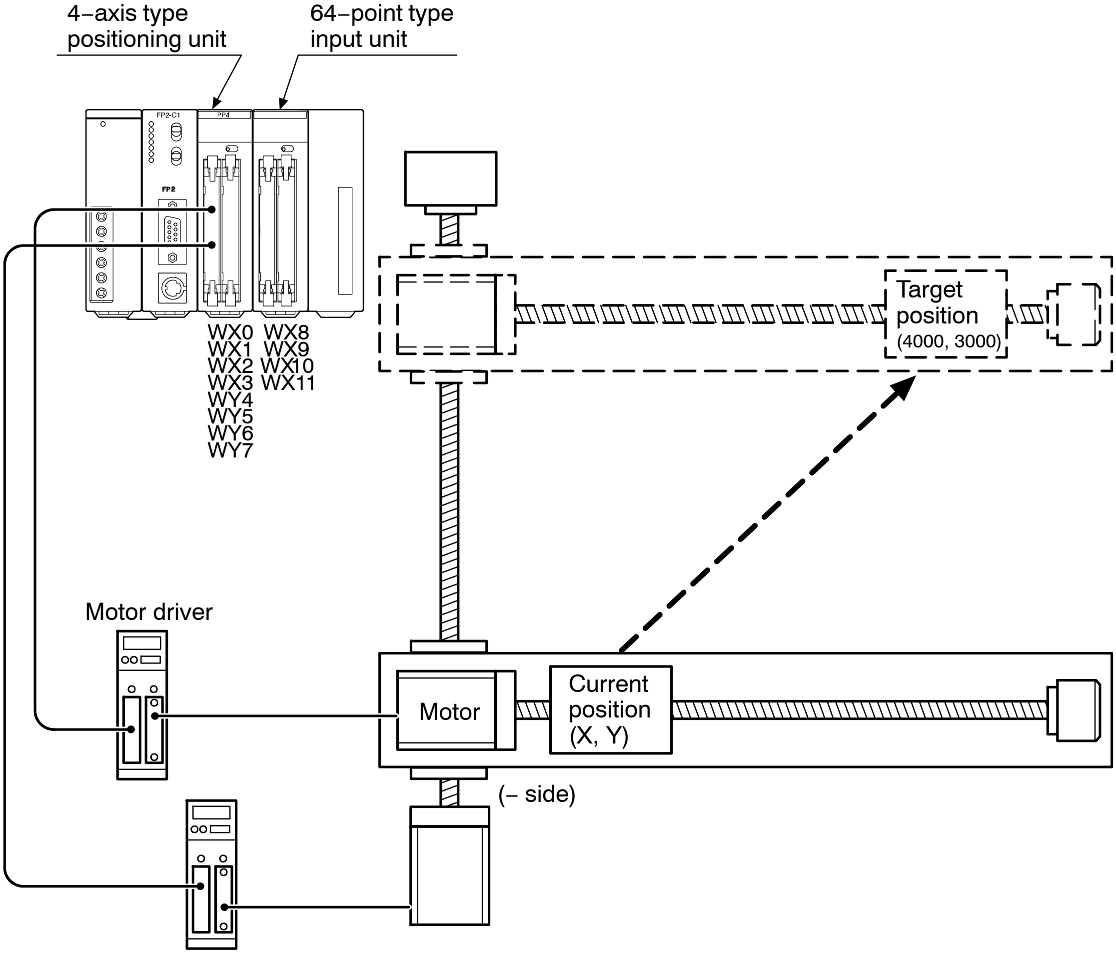
next page

16.1 Sample Programs



16.1.2 Positioning for 2 Axes (Linear Interpolation Program)

Unit configuration



An overview of a sample program

This sample program uses the absolute mode.

1. The current absolute position is read to the data table.
2. The distance from the current position to the target position (4000, 3000) is calculated.
3. The proportions of the X component and Y component included in the distance are calculated individually.
4. E point control is initiated simultaneously for the X and Y axes, the startup speed and target speed are output as the respective proportions, and linear interpolation is carried out.

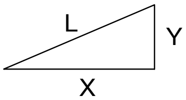
Because an error occurs if a startup is applied to an axis for which the target speed is 0 pps, an internal relay is used and the startup conditions are specified.

Items to be set for the program

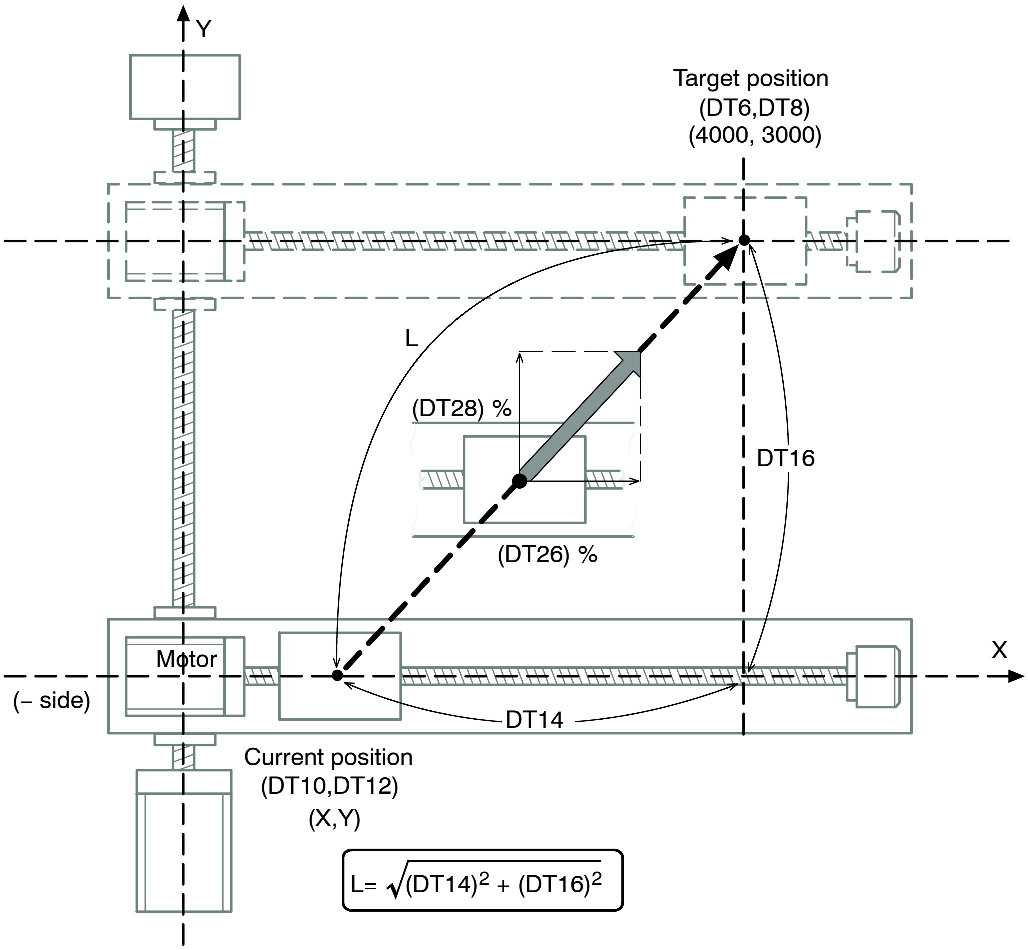
Data	Linear component	X axis component	Y axis component
Target position (absolute)	(X, Y)	X*	Y*
Current position (absolute)	(x, y)	x	y
Movement distance	$L = \sqrt{(X-x)^2 + (Y-y)^2}$	$Lx = X-x$	$Ly = Y-y$
Startup speed	Vs*	$Vsx = Vs \times \frac{\lvert X-x \rvert}{L}$	$Vsy = Vs \times \frac{\lvert Y-y \rvert}{L}$
Target speed	Vt*	$Vtx = Vt \times \frac{\lvert X-x \rvert}{L}$	$Vty = Vt \times \frac{\lvert Y-y \rvert}{L}$
Acceleration/deceleration time	Ac*	Acx = Ac	Acy = Ac

For items marked with an asterisk (*), the user may specify any desired value. Other items are handled through operation in the sample program.

Calculation of the linear movement distance



$$L^2 = X^2 + Y^2 \rightarrow L = \sqrt{X^2 + Y^2}$$


Y
Target position
(DT6,DT8)
(4000, 3000)
L
(DT28) %
DT16
(DT26) %
Motor
X
(– side)
DT14
Current position
(DT10,DT12)
(X,Y)
L= √(DT14)2 + (DT16)2

Allocation of data registers

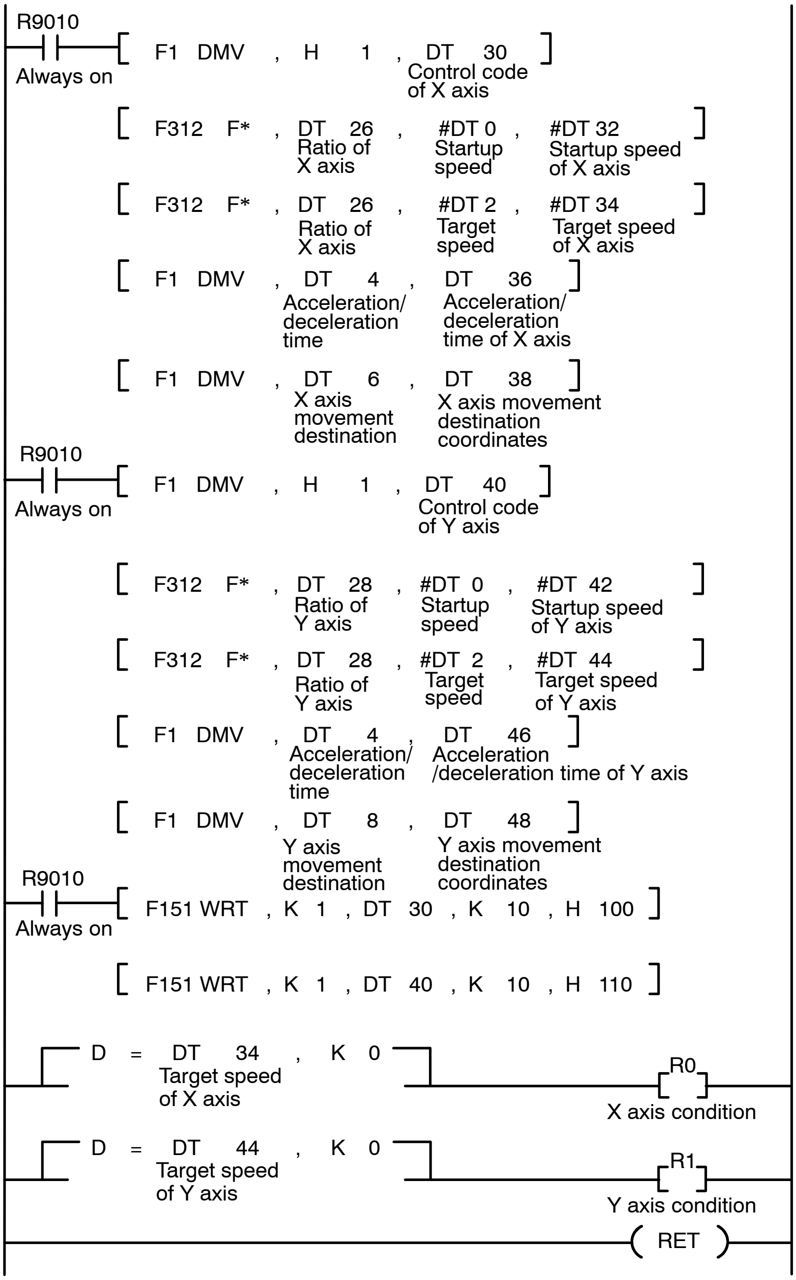
Item	Data No.	Description	Calculation formula
User setting area	DT0 DT2 DT4 DT6 DT8	Startup speed Target speed Acceleration/deceleration time Target position of X axis Target position of Y axis	————
Work area of this program	DT10 DT12	Current position of X axis Current position of Y axis	————
	DT14	Movement amount of X axis = absolute value of (target position of X axis – current position of X axis)	ABS (DT6–DT10)
	DT16	Movement amount of Y axis = absolute value of (target position of Y axis – current position of Y axis)	ABS (DT8–DT12)
	DT18	Movement amount of square of X axis	Square of (DT14)
	DT20	Movement amount of square of Y axis	Square of (DT16)
	DT22	Movement amount of square of X axis + movement amount of square of Y axis	DT18 + DT20
	DT24	Linear movement amount	$\sqrt{DT22}$
	DT26	Movement amount of X axis/Linear movement amount	DT14/DT24
	DT28	Movement amount of Y axis/Linear movement amount	DT16/DT24
	DT30 DT32 DT34 DT36 DT38	Control code of X axis Startup speed of X axis component Target speed of X axis component Acceleration/deceleration time Target position of X axis	H1 (Absolute) DT0 * DT26 DT2 * DT26 DT4 DT6
	DT40 DT42 DT44 DT46 DT48	Control code of Y axis Startup speed of Y axis component Target speed of Y axis component Acceleration/deceleration time Target position of Y axis	H1 (Absolute) DT0 * DT28 DT2 * DT28 DT4 DT8

Program

```
 R10
─┤├──[ F1  DMV  , K   500 , DT  0 ]
Startup                     Startup speed
request
     [ F1  DMV  , K 10000 , DT  2 ]
                            Target speed
     [ F1  DMV  , K   100 , DT  4 ]
                            Acceleration/
                            deceleration time
     [ F1  DMV  , K  4000 , DT  6 ]
                            X axis movement
                            destination
Startup
request
     [ F1  DMV  , K  3000 , DT  8 ]
                            Y axis movement
                            destination
 R10
─┤├─(DF)──────────────────────────────────(CALL  0)─
 R10
─┤├─(DF)─┬─ R0 ─┤/├──────────────────────────[ ]─  Y80
Startup  │   X axis condition               X axis start
request  └─ R1 ─┤/├──────────────────────────[ ]─  Y90
             Y axis condition               Y axis start
──────────────────────────────────────────────(ED)─
──────────────────────────────────────────(SUB  0)─
                                   Linear interpolation
 R9010
─┤├──[ F150 READ , K 1 , H 10A , K 2 , DT 10 ]
Always                             Current value
on                                 of X axis
     [ F150 READ , K 1 , H 11A , K 2 , DT 12 ]
                                   Current value
                                   of Y axis
 R9010
─┤├──[ F28  D-  DT 6 , DT 10 , DT 14 ]
Always     X axis move-      Current value   Movement amount
on         ment destination  of X axis       of X axis
     [ F28  D-  DT 8 , DT 12 , DT 16 ]
           Y axis move-      Current value   Movement amount
           ment destination  of Y axis       of Y axis
     [ F88  DABS , DT 14 ]
                   Movement amount
                   of X axis
     [ F88  DABS , DT 16 ]
                   Movement amount
                   of Y axis
     [ F323  PWR , #DT 14 , K 2 , DT 18 ]
                   Movement           Square of X axis
                   amount             movement amount
                   of X axis
     [ F323  PWR , #DT 16 , K 2 , DT 20 ]
                   Movement           Square of Y axis
                   amount             movement amount
                   of Y axis
     [ F310  F+ , DT 18 , DT 20 , DT 22 ]
             Square of X       Square of Y       Sum of squares
             axis movement     axis movement
             amount            amount
     [ F324  FSQR , DT 22 , DT 24 ]
                    Sum of   Square
                    squares  root
     [ F313  F% , # DT 14 , DT 24 , DT 26 ]
             Movement             Square root   Ratio of X axis
             amount of X axis
     [ F313  F% , # DT 16 , DT 24 , DT 28 ]
             Movement             Square root   Ratio of Y axis
             amount of Y axis
```

☛ next page

16.1 Sample Programs



The meaning of the “#” symbol in the program

The “#” symbol is specified when a real number operation instruction is used, to convert (integer data) to (real number data), or (real number data) to (integer data).

Record of changes

Manual No.	Date	Description of changes
ARCT1F282E/ ACG-M282E	JUL.1999	First edition
ARCT1F282E-1/ ACG-M282E-1	DEC.2000	Second edition
ARCT1F282E-2/ ACG-M282E-2	NOV.2006	Third edition
ARCT1F282E-3/ ACG-M282E-3	NOV.2008	Fourth edition - Change in Corporate name
ARCT1F282E-4	AUG.2011	Fifth edition - Change in Corporate name - Fixed Errors
ARCT1F282E-5	JUL.2013	Sixth edition - Change in Corporate name

Please contact ....

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