

PROGRAMMABLE CONTROLLER  
FP  $\Sigma$  Positioning Unit  
**Technical Manual**

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# 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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## **Record of Changes**



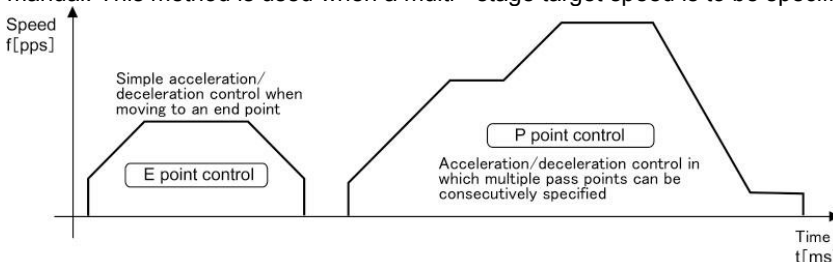
# Glossary

## 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 for a single - speed acceleration/deceleration.

## 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 signal is output from the CPU of the FPΣ to when the pulse output is issued from the positioning unit.

## Acceleration/deceleration time

Acceleration time: the time during which the speed changes from the startup speed to the target speed after the pulse output is issued.

Deceleration time: the time during which the speed changes from the target speed to the startup speed.

## CW, CCW

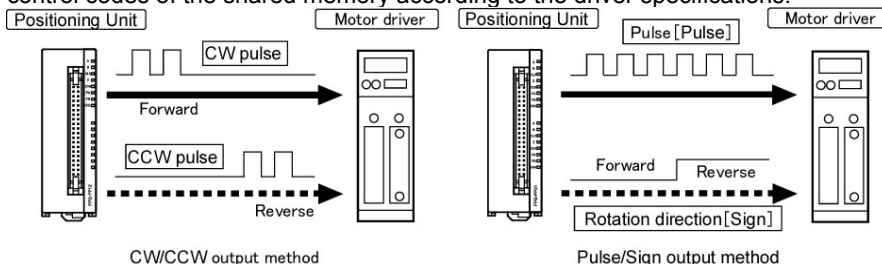
Generally, these indicate the direction in which the motor is rotating, with CW referring to clockwise rotation and CCW to counterclockwise rotation.

## CW/CCW output method (2-pulse 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 FPΣ positioning unit, this is specified using the control codes of the shared memory according to 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 FPΣ positioning unit, this is specified using the control codes of the shared memory according to the driver specifications.

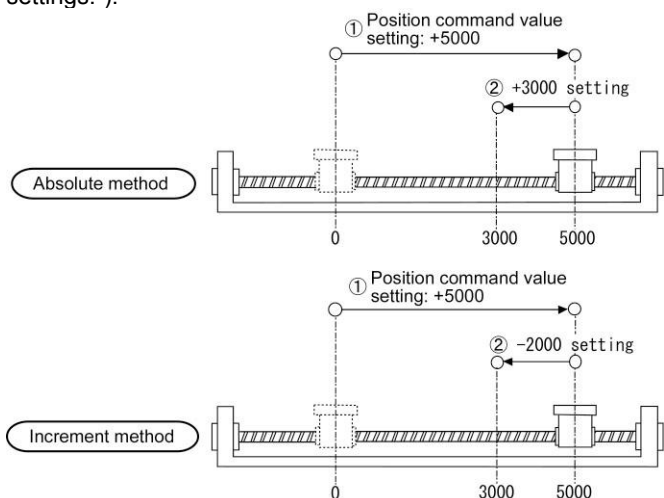


## Absolute method (absolute value control method)

This is a control method in which the target position is specified as an absolute position from the home position. With the FPΣ positioning unit, this is specified in the user program, using the control codes and the position command values (see Chapter 6.1.3 “Shared memory settings.”)

### 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 FP  $\Sigma$  positioning unit, this is specified in the user program, using the control codes and the position command values (see Chapter 6.1.1/6.1.2 “Shared memory settings.”).

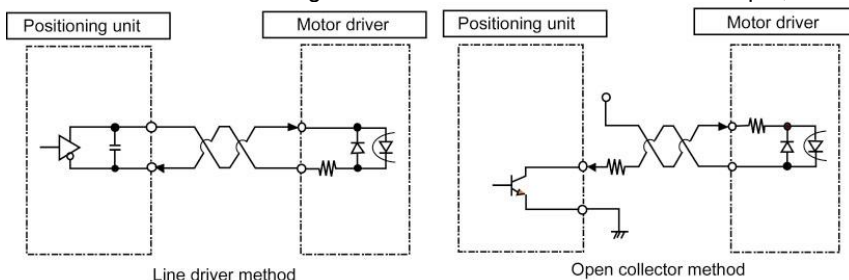


### Line driver output

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, enabling to make connections 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.



### JOG operation

This refers to an 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 to make adjustments. Depending on the circumstances, this can also be applied to unlimited feeding in some cases.

### Deceleration stop

This is a function that interrupts the operation in progress, slows the rotation and brings it to a stop. This is used to stop an operation halfway.

### JOG positioning operation

This refers to an operation to transfer a JOG operation to a positioning operation by an input from the external switch.

**Positioning control start input (Timing input)**

This is a JOG positioning operation input to transfer a JOG operation to a positioning operation. The pulse count settings can be output after the external switch input.

**Over limit input (+), Over limit input (-)**

This is an input to set a limit the motor movement. Over limit input (+) is the maximum limit and Over limit input(-) is the minimum limit.

**Home return, Home search**

The reference position for positioning is called a Home position and an operation to travel to a Home position is called Home return. The home position should be set in advance. This operation moves to the home position and its coordinate is set to be 0.

Home search automatically reverses the motor rotation when Over limit input(+) or Over limit input (-) is input and searches the home position or the near home position to return to the home position automatically.

**Forced stop**

This is 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 (the current in the same size flows in the opposite direction between the two, noise is blanked out, which reduces the effects of the noise.

**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 or sensor.

**Input valid 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 valid logic". With the FP  $\Sigma$  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 output signal**

This is installed in the FP  $\Sigma$  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.

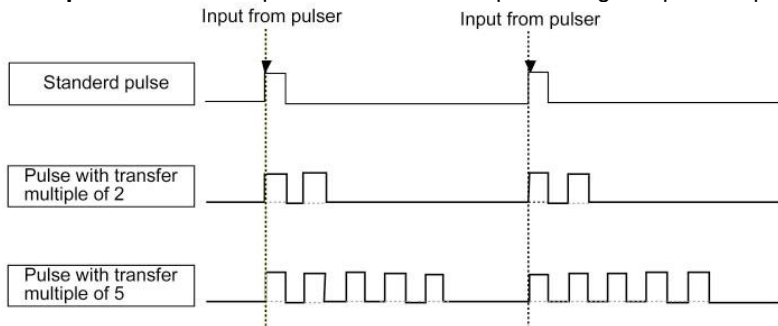
**Pulser input operation**

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 can be obtained, and the FP  $\Sigma$  positioning unit is equipped with a dedicated input terminal.

**Transfer multiple**

With the FP  $\Sigma$  positioning unit, this can be specified when the pulser operation function is used. Outputting the number of pulses doubled by 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:** Transfer multiple function of the FP positioning unit pulser input

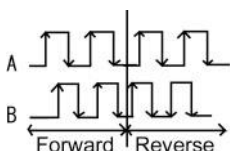


**Feedback pulse input**

This counts the feedback pulse from the encoder. 2-phase input, direction distinction input and individual input can be handled.

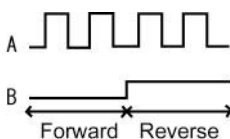
**2-phase input method**

This counts the signal of 2 pulses in the different phase (A phase, B phase). When A phase precedes B phase, the motor is rotated clockwise (count increment) and when B phase precedes A phase, the motor is rotated counter-clockwise (count decrement).



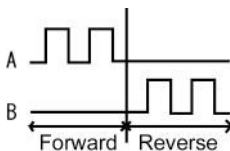
**Direction distinction input method**

This is a method to count using ON/OFF signal specifying the pulse signal and count direction.



**Individual input method**

This is a method to count using the count increment pulse signal and the count decrement pulse signal.





# **Chapter 1**

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## **Functions of Unit and Restrictions on Combination**

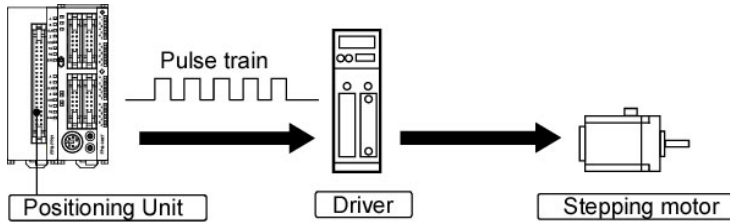


# 1.1 Functions of FPΣ Positioning Unit

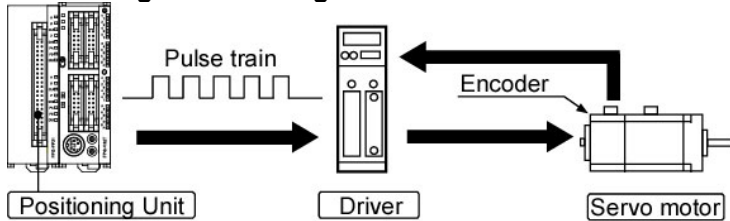
## 1.1.1 Functions of Unit

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

### Positioning control using a stepping motor



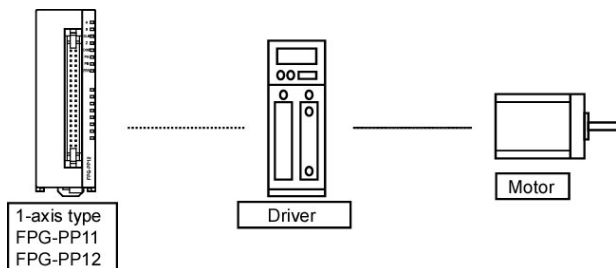
### Positioning control using a servo motor



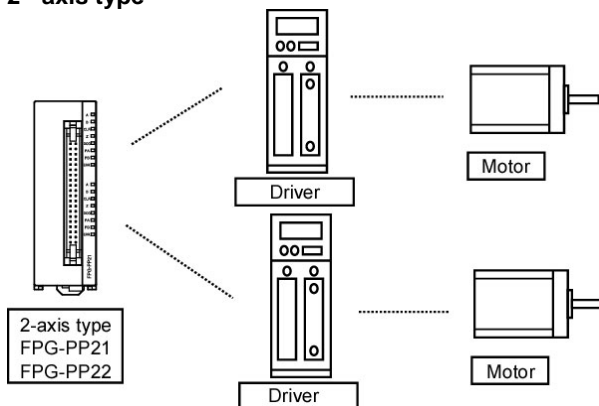
**1 - axis and 2 - axis types are available.**

Multiple axes (up to 2 axes) can be controlled with a single unit.

### 1 - axis type



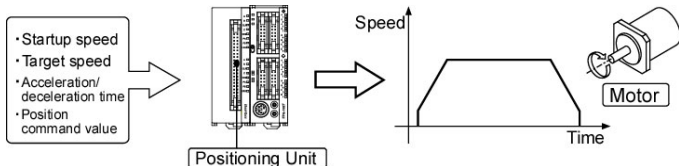
### 2 - axis type



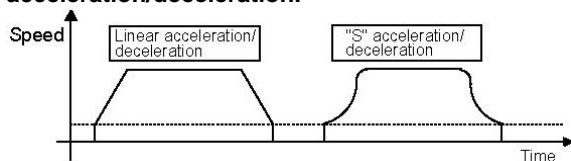
**Transistor output type (Open collector) and Line driver output type are available.**

The unit has 2 types; one is the Line driver output type, can handle the high-speed control, and another is the Transistor output type, can handle the driver can be connected with only the open collector such as a stepping motor. When either can be used, we recommend the Line driver output type.

**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 to cope with the control needs smooth acceleration and deceleration. Sin curve, Secondary curve, Cycloid curve, Third curve are available for “S” acceleration/deceleration.**



**Linear interpolation possible through user programs**

The FP  $\Sigma$  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 Product number**

Type	Output type	Part number	Product number
1 – axis type	Transistor output type	FPG-PP11	AFPG430
2 – axis type	Transistor output type	FPG-PP21	AFPG431
1 – axis type	Line driver output type	FPG-PP12	AFPG432
2 – axis type	Line driver output type	FPG-PP22	AFPG433

**Note:** Connector for a discrete-wire is attached with a unit. (1 each for 1-axis and 2-axis types.)

**Reference:** Refer to 3.1.1 for the attached connectors.

**1.1.3 Combination with MINAS Motor**

When using FP  $\Sigma$  Positioning Unit with MINAS Motor, an easy-connectable “Motor driver I/F terminal” is recommended.

**Reference:** < Motor driver I/F terminal catalog >

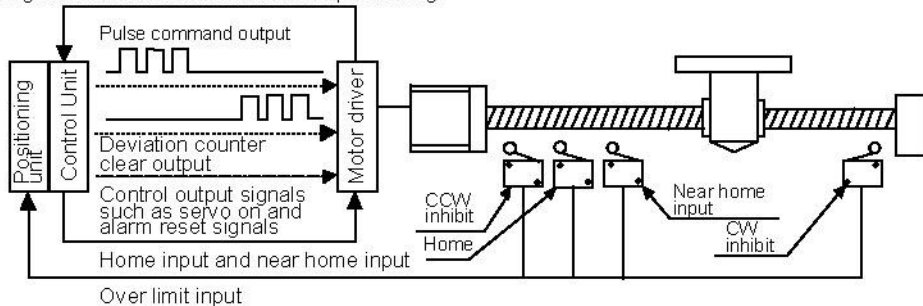
Available MINAS Motor

	Motor driver I/F terminal	Connection cable used with a positioning unit	MINAS AIII series	MINAS S series E series	MINAS A series	MINAS EX series
FP2 positioning unit (Multifunction type) AFP2434, 2435	Motor driver I/F terminal II 1-axis type: AFP8503 2-axis type: AFP8504	FP2 positioning connection cable 0.5 mm:	Dedicated cable for A III series 1 m: AFP85131 2 m: AFP85132	Dedicated cable for S series 1 m: AFP85141 2 m: AFP85142	Dedicated cable for A III series 1 m: AFP85131 2 m: AFP85132	N/A
FP $\Sigma$ positioning unit (Multifunction type) AFPG432, 433			N/A	BRK OFF signal cannot be used.	Dedicated cable for A series 1 m: AFP85111 2 m: AFP85112	
FP2 positioning unit AFP2430, 2431	Motor driver I/F terminal 1-axis type: AFP8501 2-axis type: AFP8502	AFP85100 1 mm: AFP85101				

## 1.2 Unit Functioning and Operation Overview

### 1.2.1 Unit Combinations for Positioning Control

Control signals such as alarms and end of positioning



#### 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, with Over limit input(+) and Over limit input(-) input, with Positioning control start input (Timing input) for JOG positioning operation, with deviation counter clear output with home input and near home input terminals, and with deviation counter clear output for the servo driver.

#### Use input unit and output unit for PLC safety circuit and control signal interfaces.

In addition to the positioning unit, input and output contacts of the Control unit or FP $\Sigma$  Expansion I/O Unit is used in combination for connections between the driver and external output such as servo ON signals.

#### 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.

#### The external encoder can count the feedback pulse from the external encoder.

The internal counter counts the pulse input as “Feedback pulse count value” as the absolute value.

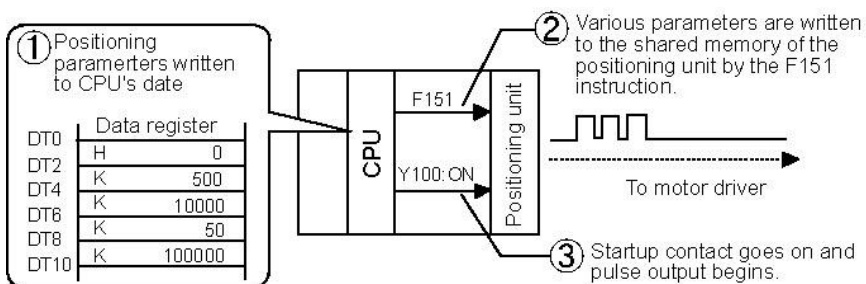
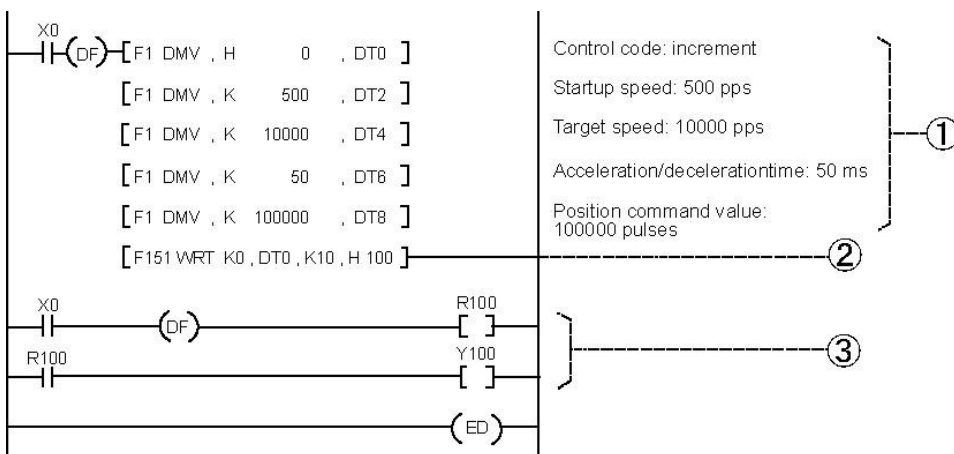
Counting range: - 2,147,483,648 to +2,147,483,647 (signed 32 - bit)

#### 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 FP $\Sigma$ Positioning Unit

Control proceeds by turning ON and OFF the shared memory and input/output flag.



### 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 Transferring to the shared memory.

The data stored in the data registers is sent to the positioning unit by means of the F151 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, JOG positioning operation, home return(home search), and pulser input operation, and a separate shared memory area is provided for each of the axes.

### ③ Initiating control operations.

In order to execute the data waiting in the positioning unit, the startup flag of the various operation modes are turned ON. The abovementioned-programming example shows this process for Y100. Y100 is the number of the flags that starts up the E point control of the first axis when the unit is installed in slot 0. Separate flags are provided for each of the axes, for E point control, P point control, home return, JOG operation, JOG positioning operation and other types of control.

## 1.3 Restrictions on Units Combination

### 1.3.1 Restrictions on Combinations Based on Current Consumption

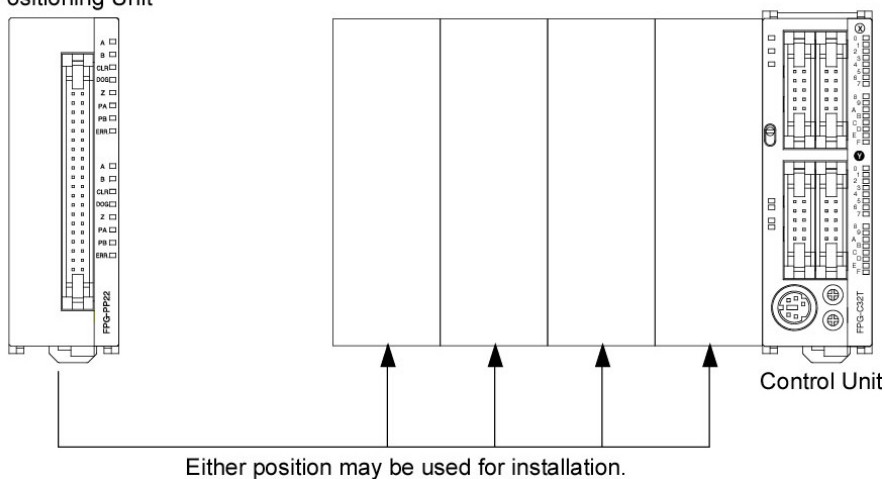
The internal current consumption (at 5 V DC power supply) for the positioning units is noted below. When the system is configured, the other units being used should be taken into consideration, and a power supply unit with a sufficient capacity should be used.

Part number	Product number	Current consumption at 5 V DC
FPG-PP11	AFPG430	150mA
FPG-PP21	AFPG431	220mA
FPG-PP12	AFPG432	150mA
FPG-PP22	AFPG433	220mA

### 1.3.2 Restrictions on Unit Installation Position

Up to 4 of the positioning units can be installed to the left of the FPΣ Control Unit. (Installing to the right is unavailable.)

Positioning Unit



### 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 restrictions described in 1.3.1 and 1.3.2 above are observed.





# Chapter 2

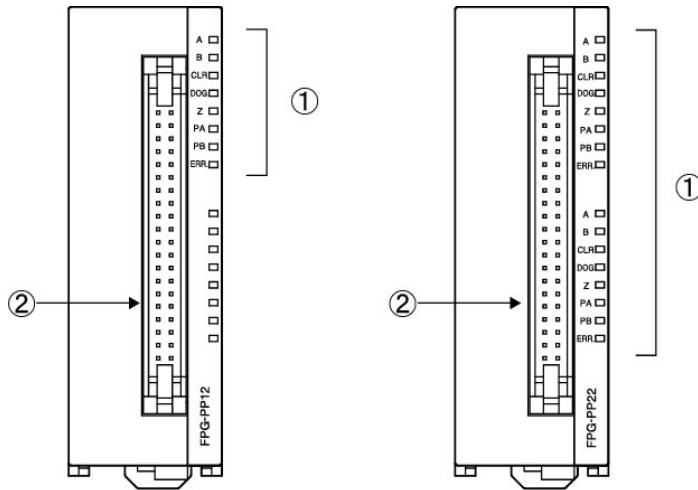
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## Parts and Specifications



## 2.1 Parts and Specifications

### 2.1.1 Parts and Specifications



1-axis type FP2-PP11  
FP2-PP12

2-axis type FP2-PP21  
FP2-PP22

#### ① Operation status display LEDs

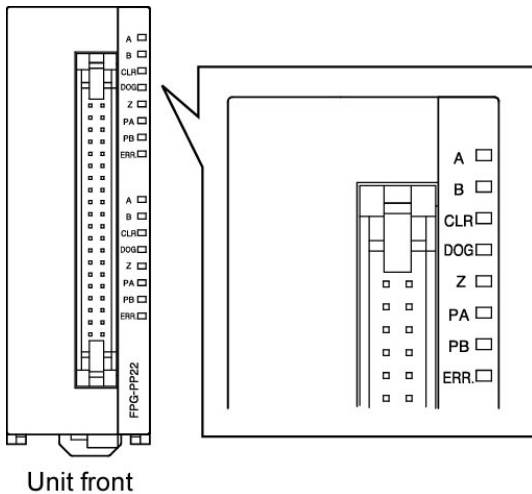
These display operation conditions.

#### ② User interface connector for 1 - axis/2 - axis

This connector is used to connect a motor driver or external interface.

### 2.1.2 Operation Status Display LEDs

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 method	—	During stop	During pulse output
		When set to CW/CCW output method	—	During stop (forward)	During pulse output (forward)
B	Pulse output signal B display (* 1)	When set to pulse/sign output method	Reverse direction command	Forward direction command	—
		When set to CW/CCW output method	—	During stop (reverse)	During pulse output (reverse)
CLR	Counter clear signal output display		Output: ON	Output: OFF	—
DOG	Near home status display (* 2)		ON	OFF	—
Z	Home input status display (* 2)		ON	OFF	—
PA	Pulse input A signal display (* 3)		Displays the input status of the pulse inupt A signal.		
PB	Pulse input B signal display (* 3)		Displays the input status of the pulse inupt B signal.		
ERR	Setting value error or Limit input error		Setting value: error	Setting value: normal	—

**Note:**

- (\*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-speed output.
- (\*2): The home input (Z) LED lights when the respective input becomes valid. The input valid logic is specified using the control codes in the program. (In the manual, “Z” is described as “ZSG”.)
- (\*3): Pulse input signal (PA) and (PB) display the pulse signal input status.

# Chapter 3

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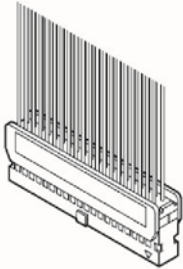
## Wiring



### 3.1 Connecting using Connector for a Discrete-Wire

#### 3.1.1 Specifications of Connector for Discrete-wire

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.



Discrete-wire connector ( 40P )

#### Suitable wire (twisted wire)

Size	Official cross section area	Insulation thickness	Rated current
AWG22	0.3mm <sup>2</sup>	1.5 to 1.1 dia.	3A
AWG24	0.2mm <sup>2</sup>		

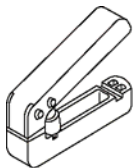
#### Discrete-wire connector (attached with a unit)

Manufacturer	Component parts	Unit type and required quantit	
		2-axis type	4-axis type
Panasonic Electric Works SUNX Co., Ltd.	Housing(40P)	1 pc x 1	1 pc x 2
	Semi-cover(40P)	2 pcs x 1	2 pcs x 2
	Contact (for AWG22 and AWG24) 5pin	8 pcs x 1	8 pcs x 2

\* 1 connector set and 2 connector sets are supplied with the 2-axis type unit and 4-axis type unit, respectively.

#### Dedicated tool

Manufacturer	Product number
Panasonic Electric Works SUNX Co., Ltd.	AXY52000FP



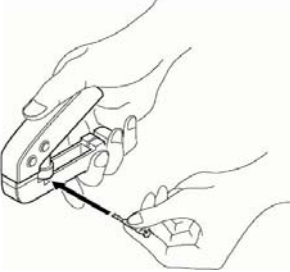
Pressure connection tool

### 3.1.2 Assembly of Discrete-Wire Connector

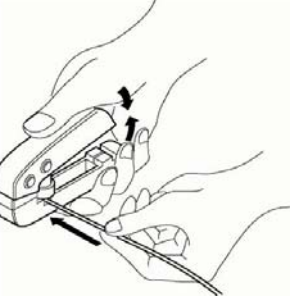
The wire end can be directly press-fitted without removing the wire's insulation, saving labor.

**Procedure:**

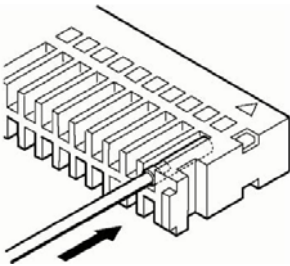
1. Bend the contact back from the carrier, and set it in the pressure connection tool.



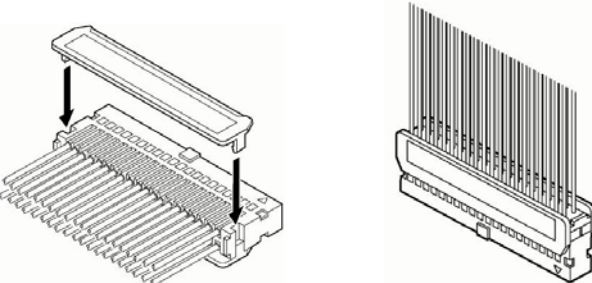
2. Insert the wire without removing its insulation until it stops, and lightly grip the tool.



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



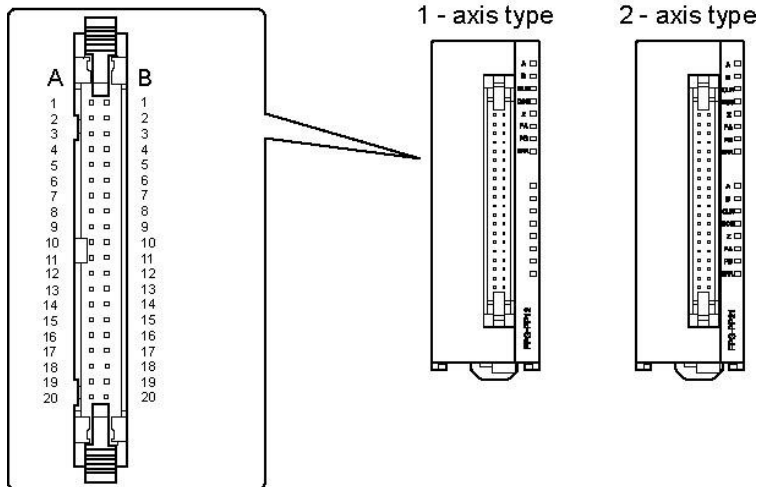
4. When all wires has been inserted, fit the semi-cover into place.





## 3.2 Input /Output Specifications and Out put terminal Layout

### 3.2.1 Input /Output Specifications

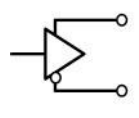


1-axis type uses the connector pins for only 1-axis type. The signal pins for 2 axes are assigned to a connector. Between the Transistor type and the Line driver type, the pulse output terminal performance is different, but the input terminal and the power supply terminal are in the same specifications.

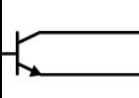
#### Output terminals (Transistor Output type)

Pin number		Circuit	Signal name		Item	Description
1 - axis	2 - axis					
A1	A10		Pulse output A: 5V DC output	Output Specifications	Output format	Open collector
B1	B10		Pulse output A: Open collector		Operating voltage range	4.75 V DC to 26.4 V DC
A2	A11		Pulse output B: 5V DC output		Max. load current	15 mA
B2	B11		Pulse output B: Open collector		ON Max. voltage drop	0.6 V

**Output terminals (Line driver output type)**


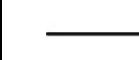
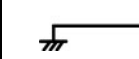
Pin number		Circuit	Signal name		Item	Description
1 - axis	2 - axis					
A1	A10		Pulse output A: Line driver (+)	Output Specifications	Output format	Line driver output Equivalent to AM26C31
B1	B10		Pulse output A: Line driver (-)			
A2	A11		Pulse output B: Line driver (+)			
B2	B11		Pulse output B: Line driver (-)			

**Output terminals (common)**

Pin number		Circuit	Signal name		Item	Description
1 - axis	2 - axis					
A7	A16		Deviation counter clear (+)	Output Specifications	Output format	Open collector
B7	B16		Deviation counter clear (-)		Operating voltage range	4.75 V DC to 26.4 V DC
			Max. load current		10mA	
			ON Max. voltage drop		1V	

**Note:** The deviation counter clear signal is output when the power supply is turned ON (about 1ms) and when the Home Return is complete. Its ON time can be selected using the Control code of the shared memory, from 1ms (factory setting) to 10ms.

**Power supply terminals and Earth terminals (common)**

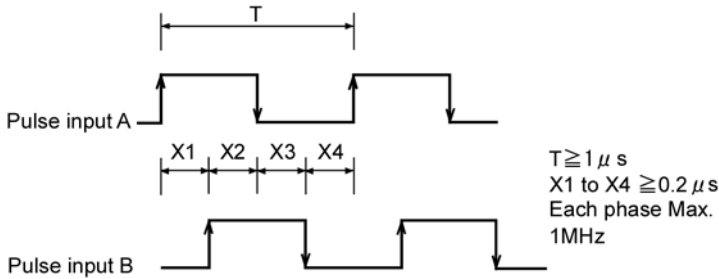
Pin number	Circuit	Signal name		Item	Description
A19/B19		F.E. (Field Earth)	Power specifications	—	—
A20		External power supply input: 24 V DC (+)		Power supply voltage range	21.4 V DC to 26.4 V DC
B20		External power supply input: 24 V DC (-)		Current consumption	2 - axis type: 35 mA or less 1 - axis type: 20 mA or less

**Input Terminals (common)**

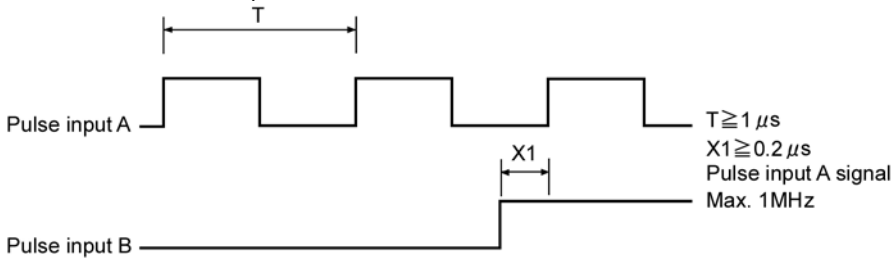
Pin number		Circuit	Signal name		Item	Description
1 - axis	2 - axis					
A3	A12		Home input: 24 V DC (+) (Z24)	Input specifications	Operating voltage range	21.6V DC to 26.4V DC
A4	A13		Home input: 5V DC (+) (Z5)		Min. ON voltage/current	19.2V DC/5.5mA
			Home input (-)		Max. OFF voltage/current	2V DC/2mA
		Home input (-)	Input impedance		Approx 3k Ω	
B3	B12			Input specifications	Min. input pulse width	100µs
B4	B13		COM	Input specifications	Operating voltage range	21.6V DC to 26.4V DC
A5	A14		Near home input (DOG)		Min. ON voltage/current	Near home input (DOG) 19.2V DC/5.0mA
A6	A15		Over limit input (+) (Limit +)		Max. OFF voltage/current	2V DC/1.5mA
B6	B15		Over limit input (-) (Limit -)		Input impedance	Near home input (DOG) Approx 3.6kΩ Over limit input (+) (Limit +) Over limit input (-) (Limit -) Positioning control start input (timing input) Approx 6.8kΩ
B5	B14		Positioning Control start input (Timing input)		Min. input	500µs
A8	A17		Pulse input A (+)	Input/Output specifications	Operating voltage range	3.5 to 5.25 V DC (5V DC, Line driver specifications)
B8	B17		Pulse input A (-)		Min. ON voltage/current	3V DC/3.2mA
A9	A18		Pulse input B (+)		Max. OFF voltage/current	1V DC/0.5mA
B9	B18		Pulse input B (-)		Input impedance	Approx 390 Ω
					Min. input pulse width	0.5µs(max. 1MHz each phase)

**Note: Please use under the specifications for pulse input A, B signal.**

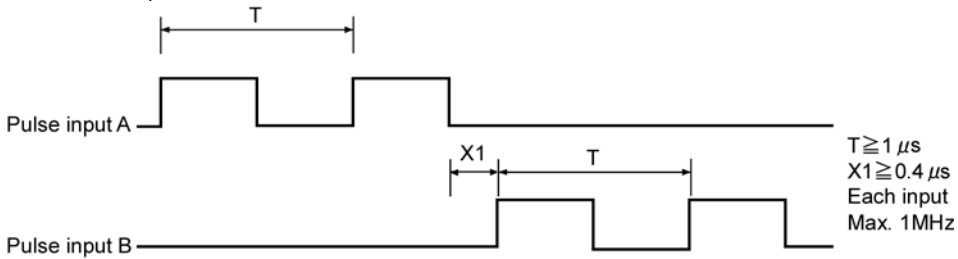
- 2 phases input method



- Direction distinction input method



- Individual input method

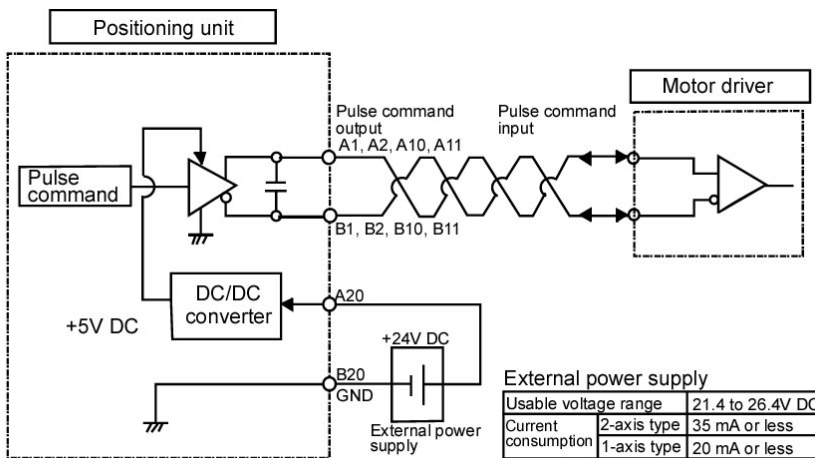


### 3.3 Supplying Power for Internal Circuit Drive

Always make sure an external +24V DC power supply is connected to the pins for external input power supply (pin No. A20 and B20).

The applied 24V DC 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.

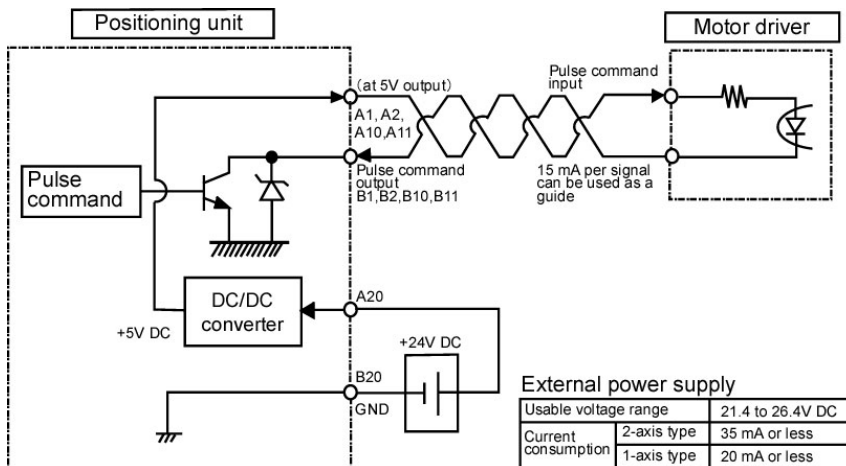
#### 3.3.1 Line Driver Output Type



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

#### 3.3.2 Transistor Output Type

The power supply for the pulser command output circuit can be taken from the 5V DC out put pins (pin No. A1, A2, A10 and A11)



**Note:**

When open collector pulse output (Transistor output) is used, the value of 15 mA per signal should be used as a guide. If exceeds the 15 mA, the appropriate resistance should be added.

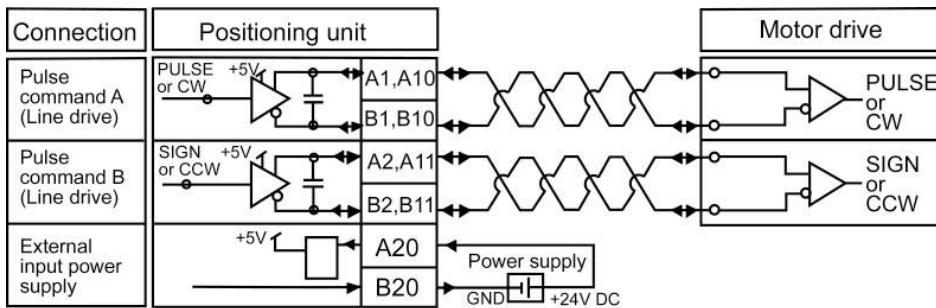
### 3.4 Connection of Pulse Command Output Signal

Two types of output types are available for the FPΣ positioning unit due to 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.

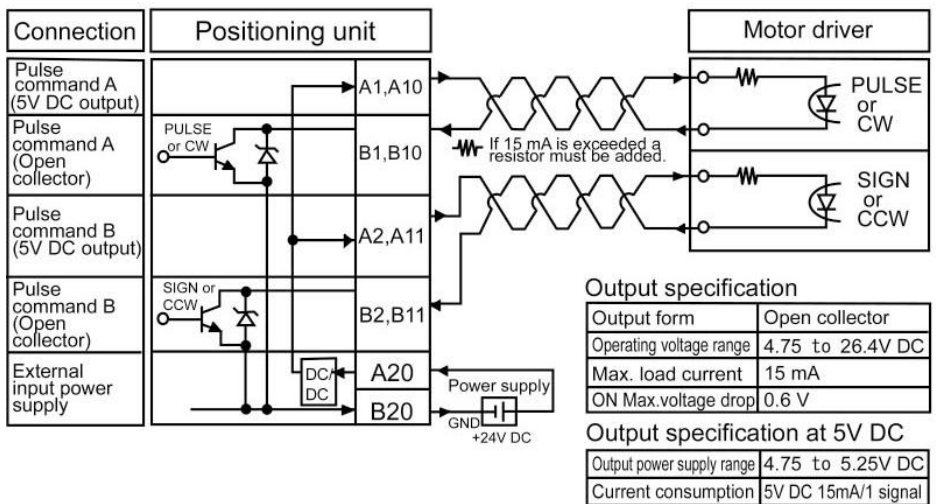
**Note:**

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

#### 3.4.1 Line Driver Output type

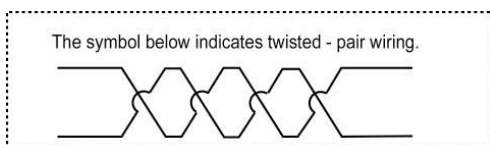


#### 3.4.2 Transistor Output Type



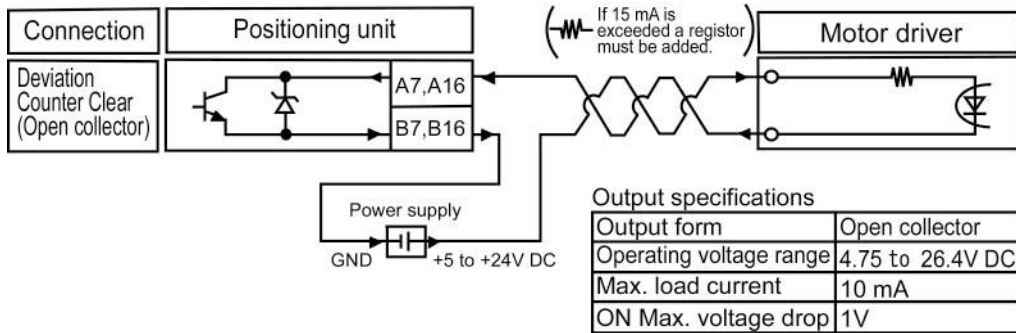
**Note:**

A value of 15 mA per signal should be used as a guide. If exceeds this, 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 to the servo motor driver. An external power supply (+5 V DC to +24 V DC) must be provided for the connection.



**Note:**

Always use twisted - pair cables for wiring.

The Current which can be conducted as the deviation counter clear output signal is 10 mA max. If 10 mA is exceeded, resistance should be added.

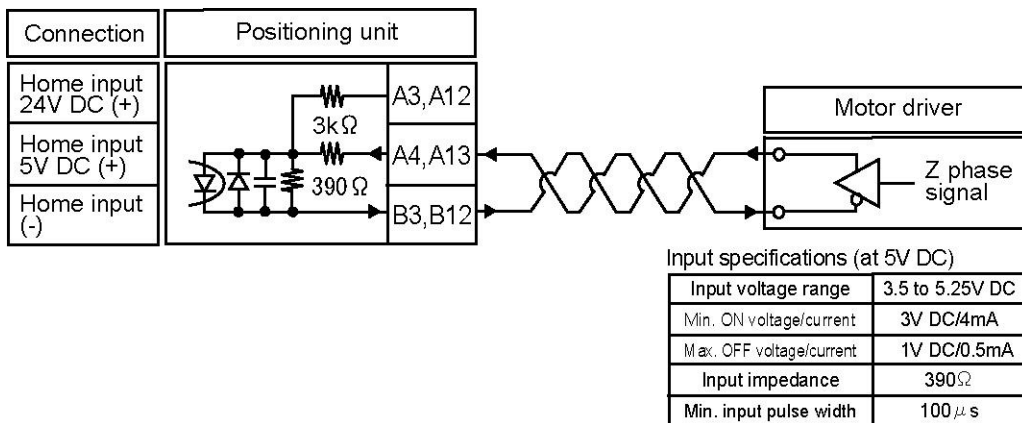
### 3.6 Connection of Home Input/Near Home Input Signals

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.

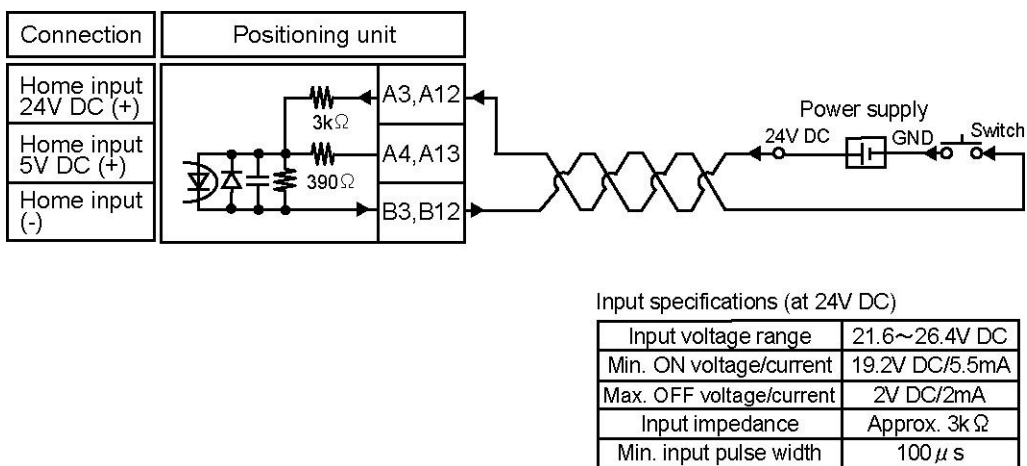
**Note:**

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)

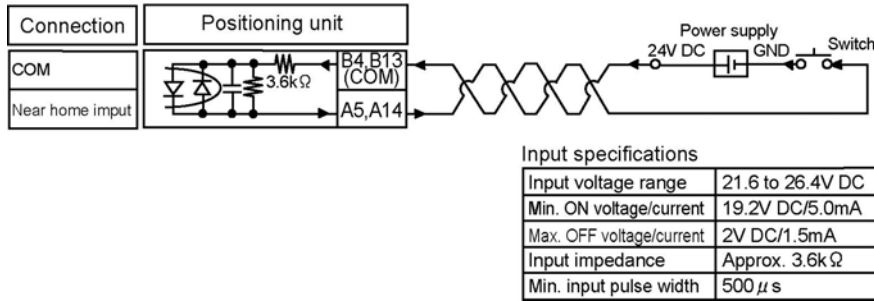


#### 3.6.2 Connection of Home Input (When connecting to an external switch/sensor)



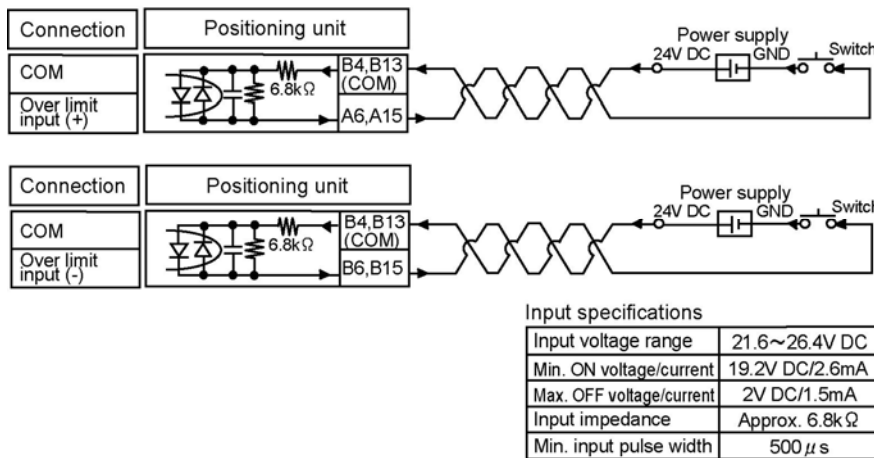


### 3.6.3 Connection of Near Home Input Signal



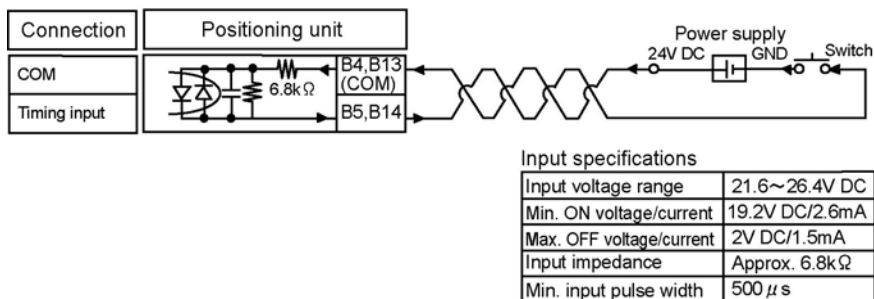
**Note:** No. B4 and B13 are common for the Near home input, Over limit input(+), Over limit input(-) and Positioning control start input(Timing input).

### 3.6.4 Connection of Over limit Input Signal



**Note:** No. B4 and B13 are common for the Near home input, Over limit input(+), Over limit input(-) and Positioning control start input(Timing input).

### 3.6.5 Connection of Positioning control start input(Timing Input) Signal



**Note:** No. B4 and B13 are common for the Near home input, Over limit input(+), Over limit input(-) and Positioning control start input(Timing input).

### 3.7 Connection of Pulse Input

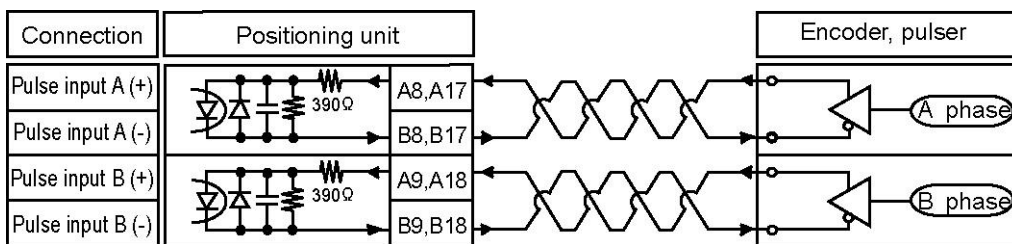
The signal output style may differ depending on Pulser or Encoder. Connect in accordance with the output style. Line driver type, Transistor open collector type and Transistor-resistance pull-up type are available for the output styles.

The same pulse input terminal is used for Pulser input operation and Feedback pulse count, so it is used for either.

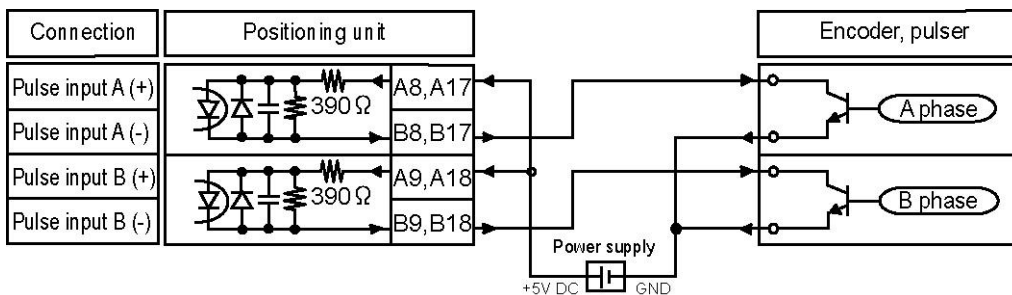
**Note:**

- We recommend using twisted - pair cables for connections, or twisting the cables used.
- When counting the 2-phase input such as the input from the encoder, set the pulse input transfer multiple to “4 multiple setting” (x 4) or “2 multiple setting” (x 2) using the control code to prevent counting error.

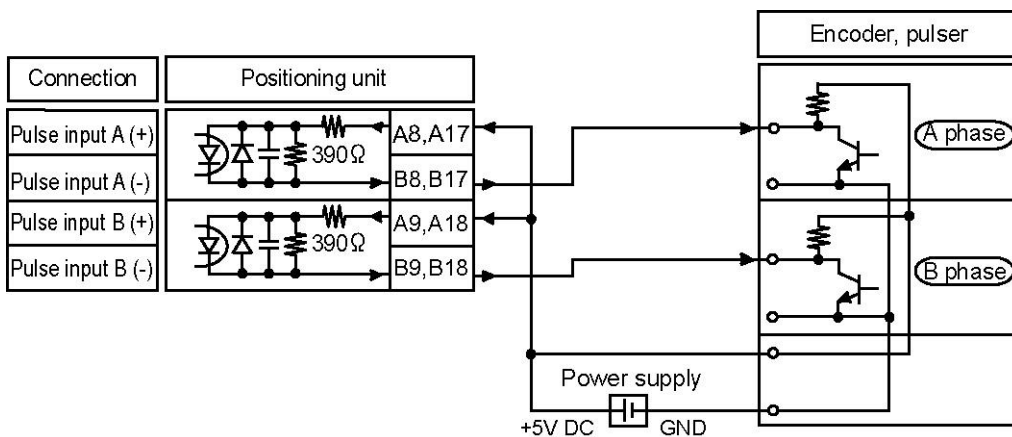
#### 3.7.1 Line Driver Type



#### 3.7.2 Transistor Open Collector Type



#### 3.7.3 Transistor - resistor Pull - up Type



### 3.8 Precautions on Wiring

---

Connect the wire in less than or the following length between the Transistor output type and the motor driver, and between the Line driver output type and the motor driver.

<Signals applicable>

Transistor output

Line driver output

Deviation counter clear output

Output type	Product number	Wiring length
Transistor output type	AFPG 430	10m
	AFPG 431	
Line driver output type	AFPG 432	
	AFPG 433	



## **Chapter 4**

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# **Confirming the Unit Settings and Design Contents**



## 4.1 Pulse Output Mode

---

### 4.1.1 Selection of Rotation Direction

---

Changing this settings allows to rotating a motor in a reverse direction under the same connection status and the driver settings.

**Shared momory Control code Higher the 8th. bit 0= forward rotation  
1= reverse rotation**

### 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.

**Shared memory Control code Higher the 9th. bit 0: Pulse / Sign  
1: CW/CCW**

#### **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 shared memory control code Higher 8 bit is 0 (default setting), 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 Setting the Shared Memory Control Code Relationship with Rotation Direction

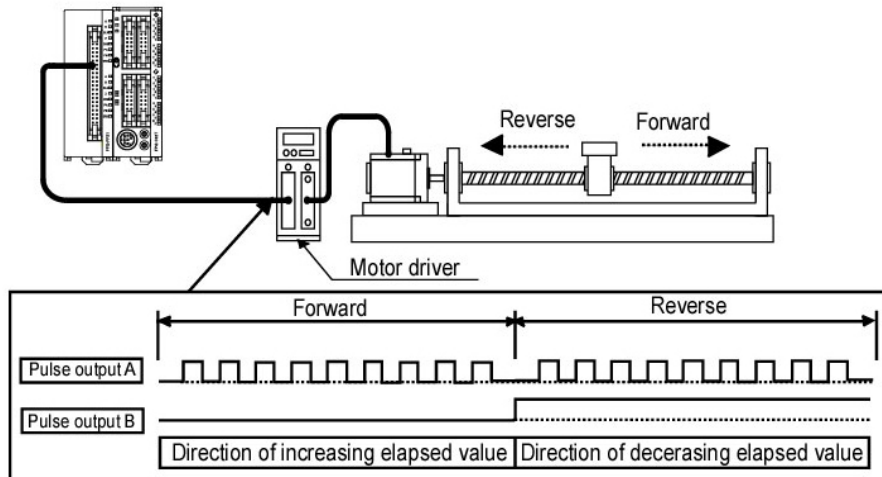
#### Pulse/Sign mode

Common memory Control code Higher

The 9th. bit  
0

The 8th. bit  
0

With forward rotation, the elapsed value increases.  
With reverse rotation, the elapsed value decreases.



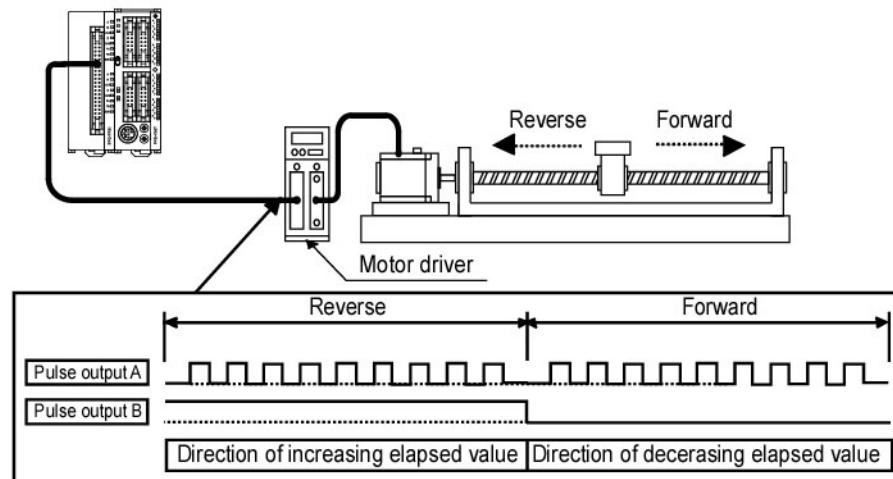
#### Pulse/Sign mode

Common memory Control code Higher

The 9th. bit  
0

The 8th. bit  
1

With forward rotation, the elapsed value decreases.  
With reverse rotation, the elapsed value increases.





**CW/CCW mode**

**Common memory Control code Higher**

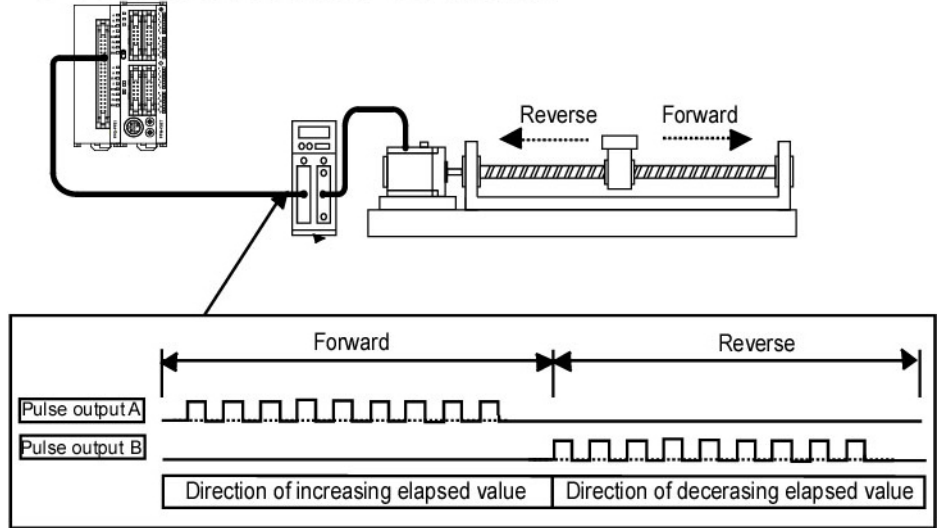
The 9th. bit

1

The 8th. bit

0

With forward rotation, the elapsed value increases.  
With reverse rotation, the elapsed value decreases.



**CW/CCW mode**

**Common memory Control code Higher**

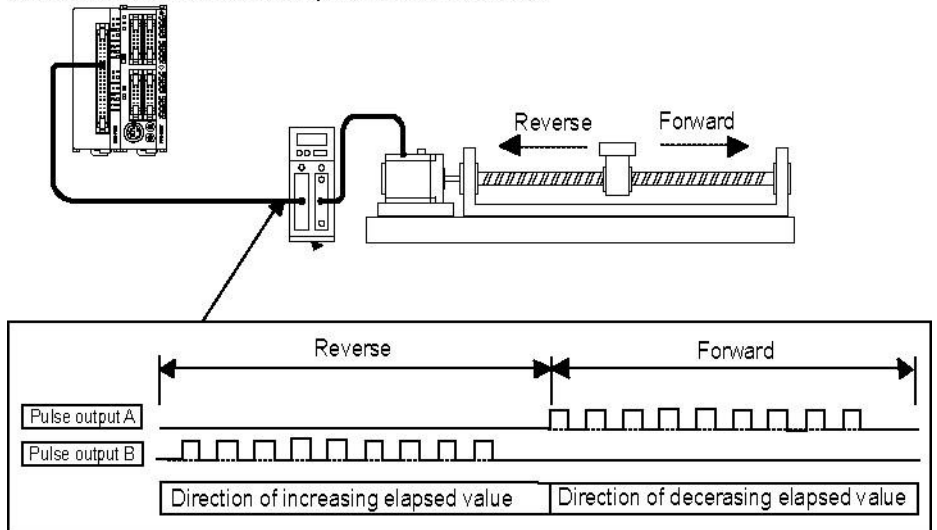
The 9th. bit

1

The 8th. bit

1

With forward rotation, the elapsed value decreases.  
With reverse rotation, the elapsed value increases.



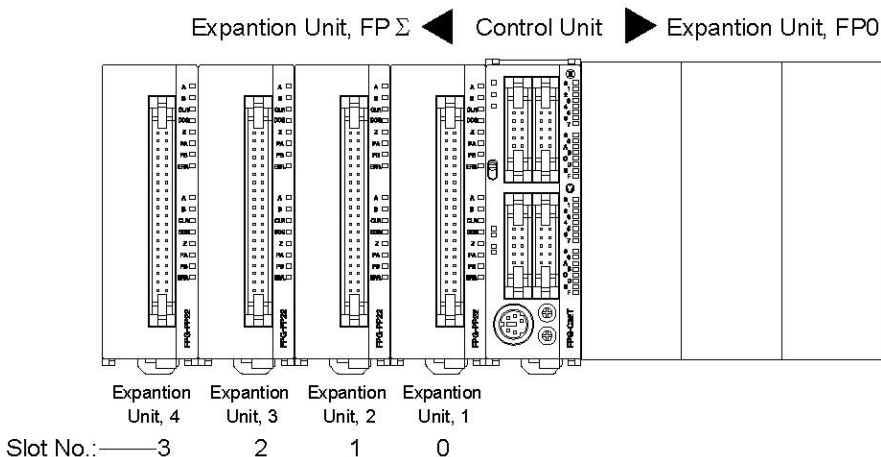
**Note:**

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 Slot Number

Slot Number shows the position of the expansion unit, which is used for a programming. I/O Area allocation varies depending on the Slot Number.



### 4.2.2 I/O Area Allocation

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 and a 2 - axis type has 64 points (32 input points and 32 output points).

These are common for the Transistor output type and the Line driver output type.

FPΣ automates occupied I/O area when attached with a unit. Not necessity for a setup.

The I/O area allocation is decided depending on an installation and its configuration is as follows:

Type	Points (allocated using the tool software)	I/O No.				
		Axis	Slot 0	Slot 1	Slot 2	Slot 3
1-axis type	Input 16 points	1st. axis	X100 to X10F (WX10)	X180 to X18F (WX18)	X260 to X260F (WX26)	X340 to X34F (WX34)
	Output 16 points		Y100 to Y10F (WY10)	Y180 to Y18F (WY18)	Y260 to Y26F (WY26)	Y340 to Y34F (WY34)
2-axis type	Input 32 points	1st. axis	X100 to X10F (WX10)	X180 to X18F (WX18)	X260 to X26F (WX26)	X340 to X34F (WX34)
		2nd. axis	X110 to X11F (WX11)	X190 to X19F (WX19)	Y260 to Y26F (WY26)	Y340 to Y34F (WY34)
	Output 32 points	1st. axis	Y100 to Y10F (WY10)	Y180 to Y18F (WY18)	X270 to X27F (WX27)	X350 to X35F (WX35)
		2nd. axis	Y110 to Y11F (WY11)	Y190 to Y19F (WY19)	Y270 to Y27F (WY27)	Y350 to Y35F (WY35)

### 4.2.3 Contents of Input and Output Allocations

Flag	Name		Description	I/O flag number (* 5)		
				1 - axis type	2 - axis type	
				1st axis	1st axis	2nd axis
X_0	Pulse output busy	BUSY	ON during pulse output. (* 1)	X100	X100	X110
X_1	Pulse output done	EDP	Goes ON when pulse output ends. (* 2)	X101	X101	X111
X_2	Acceleration zone	ACC	ON during acceleration zone.	X102	X102	X112
X_3	Constant speed zone	CON	ON during constant speed zone.	X103	X103	X113
X_4	Deceleration zone	DEC	ON during deceleration zone.	X104	X104	X114
X_5	Rotation direction	DIR	Monitors direction of rotation (On during the elapsed value increment)	X105	X105	X115
X_6	Home input	ZSG	Goes ON when home input becomes valid.	X106	X106	X116
X_7	Near home input	DOG	Goes ON when near home input becomes valid.	X107	X107	X117
X_8	Home return done	ORGE	Turns ON when home return is done. (*3)	X108	X108	X118
X_9	Comparison result	CLEP	ON when elapsed value of internal counter is greater than or equal to the number of comparison pulse.	X109	X109	X119
X_A	Set value change confirmation	CEN	With P point control, this is used to confirm rewriting of set values. (* 4)	X10A	X10A	X11A
X_B	Over limit input (+)	LMTP	Monitor flag of Over limit Input (+) signal.	X10B	X10B	X11B
X_C	Over limit input (-)	LMTM	Monitor flag of Over limit Input (-) signal.	X10C	X10C	X11C
X_D	Timing input monitor	TIMM	Monitor flag of JOG positioning timing.	X10D	X10D	X11D
X_E	Set value error	SERR	ON when a set value error occurs.	X10E	X10E	X11E
X_F	Limit error	LERR	ON when Over limit input is made during operation or at startup.	X10F	X10F	X11F

- \*1): This goes ON during pulse output in various operations such as E point control, P point control, home return, JOG operation, JOG positioning 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, JOG positioning operation, and pulser input operation have been completed. It also goes ON when deceleration stop have been completed, and when a forced stop has been completed. It goes OFF when the next operation such as E point control, P point control, JOG operation, JOG positioning operation, a home return, or pulser input operation is initiated.
- \*3): This goes ON when Home return is completed. It goes OFF when the next operation such as E point control, P point control, JOG operation, JOG positioning operation, a home return, or pulser input operation is initiated.
- \*4): 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.
- \*5): The input and output flag numbers indicate the number when the slot number is 0. The numbers actually used change depending on the position in which the unit is installed.

Flag	Name		Description	I/O flag number (* 5)		
				1 - axis type	2 - axis type	
				1st axis	1st axis	2nd axis
Y_0	E point control start	EST	When turned ON in the user program, E point control is initiated.	Y100	Y100	Y110
Y_1	P point control start	PST	When turned ON in the user program, P point control is initiated.	Y101	Y101	Y111
Y_2	Home return start	ORGS	When turned ON in the user program, a home return is initiated.	Y102	Y102	Y112
Y_3	Forward JOG	JGF	When turned ON in the user program, JOG forward rotation is initiated.	Y103	Y103	Y113
Y_4	Reverse JOG	JGR	When turned ON in the user program, JOG reverse rotation is initiated.	Y104	Y104	Y114
Y_5	Forced stop	EMR	When turned ON in the user program, operations currently running are interrupted and forcibly terminated.	Y105	Y105	Y115
Y_6	Deceleration stop	DCL	When turned ON in the user program, operations currently running are interrupted, and decelerate to a stop.	Y106	Y106	Y116
Y_7	Pulser input enabled	PEN	When turned ON in the user program, pulser input is enabled (valid only while on).	Y107	Y107	Y117
Y_8	JOG positioning operation start	JGST	ON during JOG positioning operation.	Y108	Y108	Y118
Y_9	JOG positioning start	TIM	ON at the timing of the positioning start after JOG operation,(when JOG positioning is confirmed.)	Y109	Y109	Y119
Y_A	—			Y10A	Y10A	Y11A
Y_B	—			Y10B	Y10B	Y11B
Y_C	—			Y10C	Y10C	Y11C
Y_D	—			Y10D	Y10D	Y11D
Y_E	—			Y10E	Y10E	Y11E
Y_F	Error clear	ECLR	If an error occurs, the error is canceled when this is turned ON in the user program.	Y10F	Y10F	Y11F

## 4.3 Increment and Absolute

There are two ways to set the position command value. Specify whichever due to your usage.

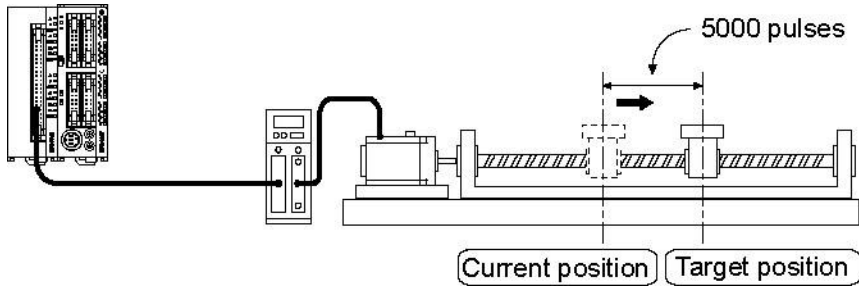
### 4.3.1 Increment (relative value control)

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

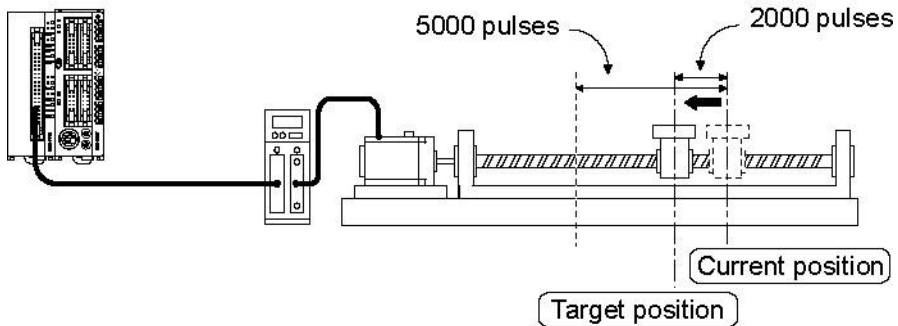
**Example:**

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.

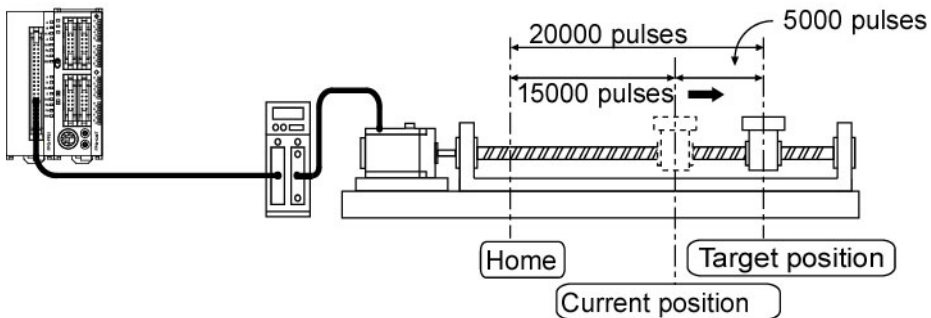


### 4.3.2 Absolute (absolute value control)

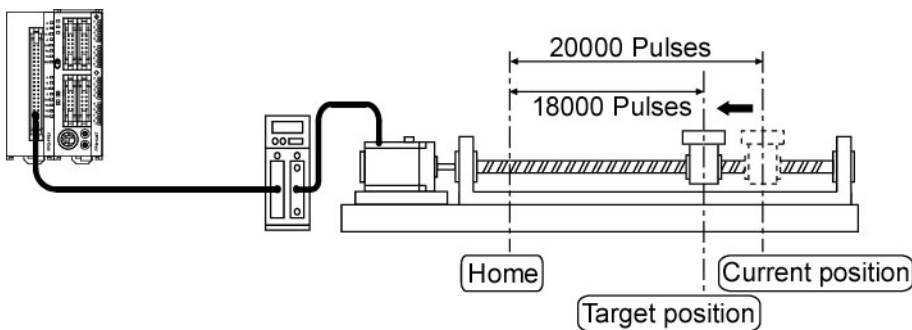
The position command value is normally specified as the absolute position from the home position, using a number of pulses.

**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.



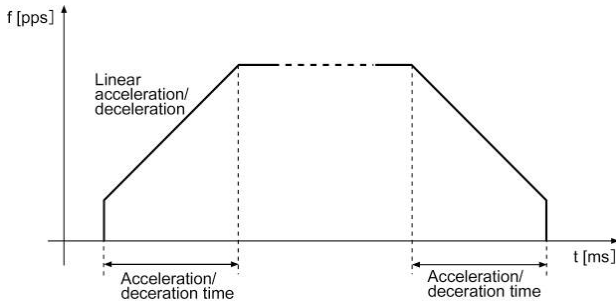
“ + 18000 pulses” is set as the next position command value, and travel is carried out.



## 4.4 Selection of Acceleration / Deceleration Method

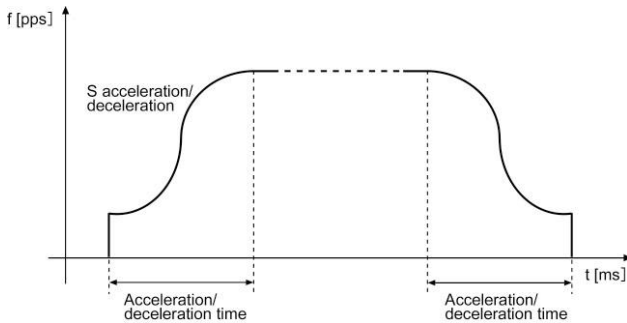
### 4.4.1 Linear and S Acceleration/Decelerations

The FP  $\Sigma$  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) are carried out in a straight line. (acceleration and deceleration take place at a constant percentage.)



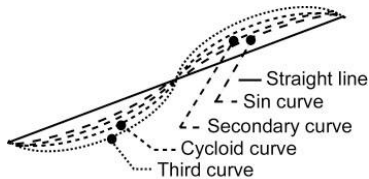
S acceleration/deceleration is carried out along an S - shaped curve. When acceleration or deceleration is first begun, the speed is relatively slow, and gradually increases.

When the acceleration or deceleration has been almost completed, the speed slows once again. This results in comparatively smooth movement. Sin curve, Secondary curve, Cycloid curve and Third curve are available for S acceleration/deceleration. The acceleration/deceleration will be completed for the time set in the shared memory.



### 4.4.2 S Acceleration/Deceleration Pattern

S acceleration/deceleration curve grade: Third curve > Cycloid curve > Secondary curve > Sin curve

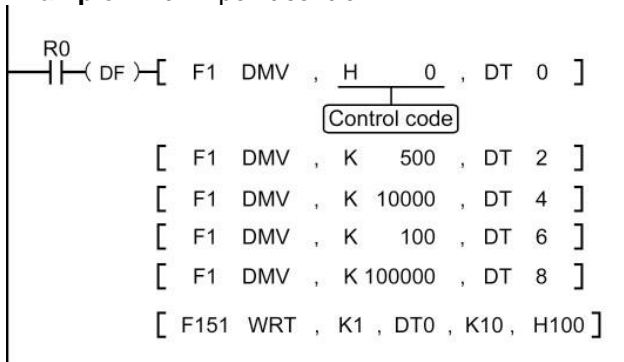


### 4.4.3 Indicating the Method of Acceleration / Deceleration

#### Indicating the method of acceleration/deceleration

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

**Example:** With E point control



The method of control varies depending on the control code.

- When the code is H0: increment method, linear acceleration/deceleration
- When the code is H1: absolute method, linear acceleration/deceleration
- When the code is H2: increment method, S acceleration/deceleration (Sin curve)
- When the code is H3: absolute method, S acceleration/deceleration (Sin curve)
- When the code is H1002: increment method, S acceleration/deceleration (Secondary)
- When the code is H1003: absolute method, S acceleration/deceleration (Secondary)
- When the code is H2002: increment method, S acceleration/deceleration (Cycloid)
- When the code is H2003: absolute method, S acceleration/deceleration (Cycloid)
- When the code is H3002: increment method, S acceleration/deceleration (Third)
- When the code is H3003: absolute method, S acceleration/deceleration (Third)

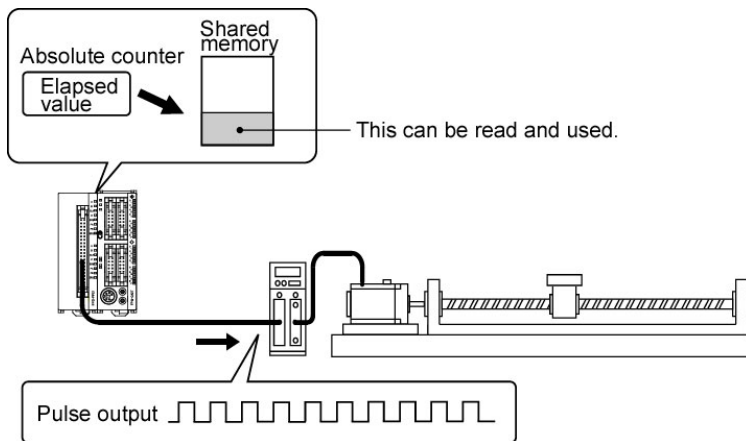


## 4.5 Internal Absolute Counter

### 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.
- The counted value of each axis is stored in the shared memory area of the positioning unit.
- 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.

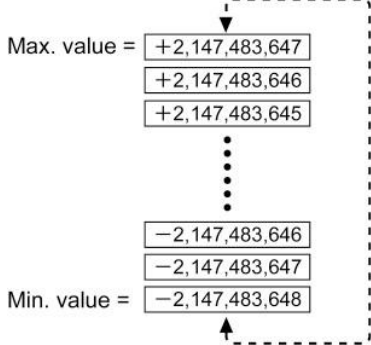


#### How the internal absolute counter operates

- When the power supply is turned OFF, the counter value is set to zero (0).
- When the table returns to the home position by a home return, the counter value automatically 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 instruction in the user program.
- The counter value can be overwritten using the F151 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**

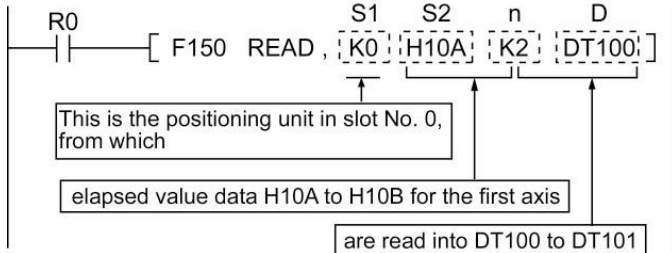
Address of shared memory (hexadecimal)		Description	
1st. axis	2nd. axis		
10Ah	11Ah	Elapsed value count (absolute value)	Signed 32 - bit - 2,147,483,648 to +2,147,483,647
10Bh	11Bh		

### 4.5.2 Reading Elapsed Value

The F150 instruction is used to read the elapsed value from the shared memory of the positioning unit.

#### F150 (READ) instruction

This is the instruction used to read data from the memory of the positioning 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”.

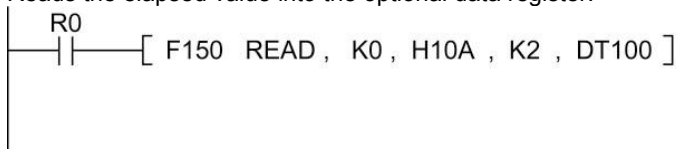
#### Specified addresses

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

Address of shared memory (hexadecimal)		Description	
1st. axis	2nd. axis	Elapsed value count (absolute value)	Signed 32 – bit - 2,147,483,648 to +2,147,483,647
10Ah	11Ah		
10Bh	11Bh		

#### Program example

Reads the elapsed value into the optional data register.

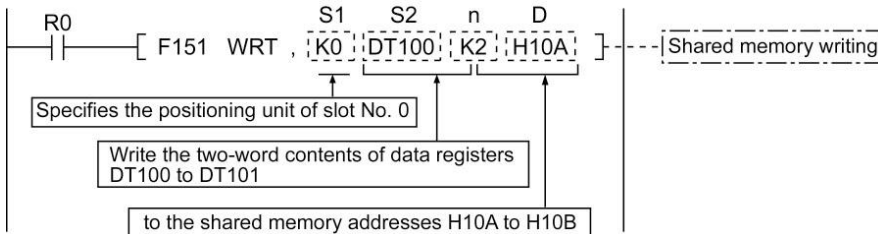


### 4.5.3 Writing Elapsed Value

The F151 instruction is used to write data to the shared memory of the positioning unit.

#### F151 (WRT) instruction

This is the instruction that write data to the shared memory of the positioning 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.

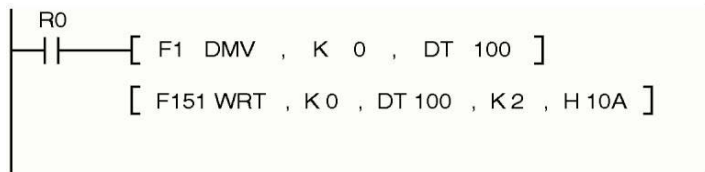
Address of shared memory (hexadecimal)		Description	
1st. axis	2nd. axis		
10Ah	11Ah	Elapsed value count (absolute value)	Signed 32 - bit - 2,147,483,648 to +2,147,483,647
10Bh	11Bh		

#### Note:

Elapsed values should be written while the operation is stopped.

#### Program example

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



## **Chapter 5**

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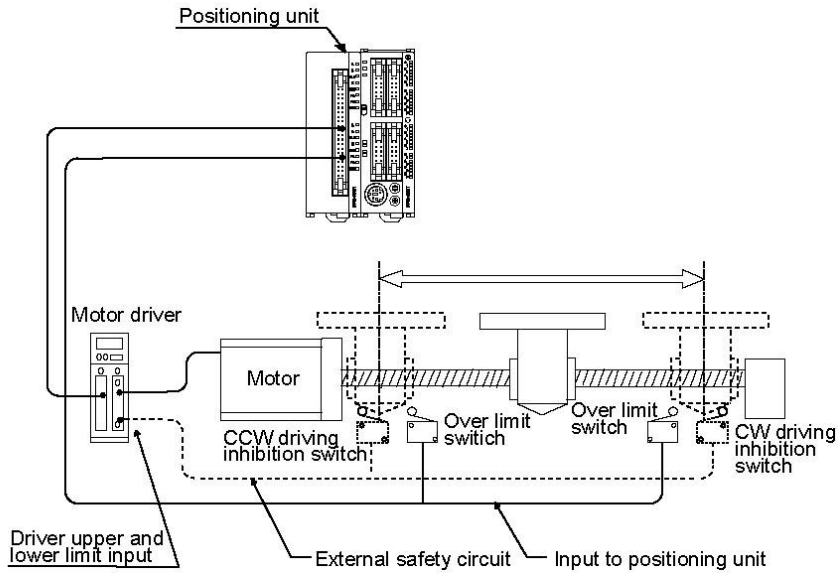
# **Power ON and OFF, and Booting the System**



## 5.1 Safety Circuit Design

### Example of a safety circuit

Installation of the Over limit switch



### Safety circuit based on Positioning unit

Install Over limit switches as shown above.

Connect them to Over limit input(+) and Over limit input (-) of the Positioning unit.

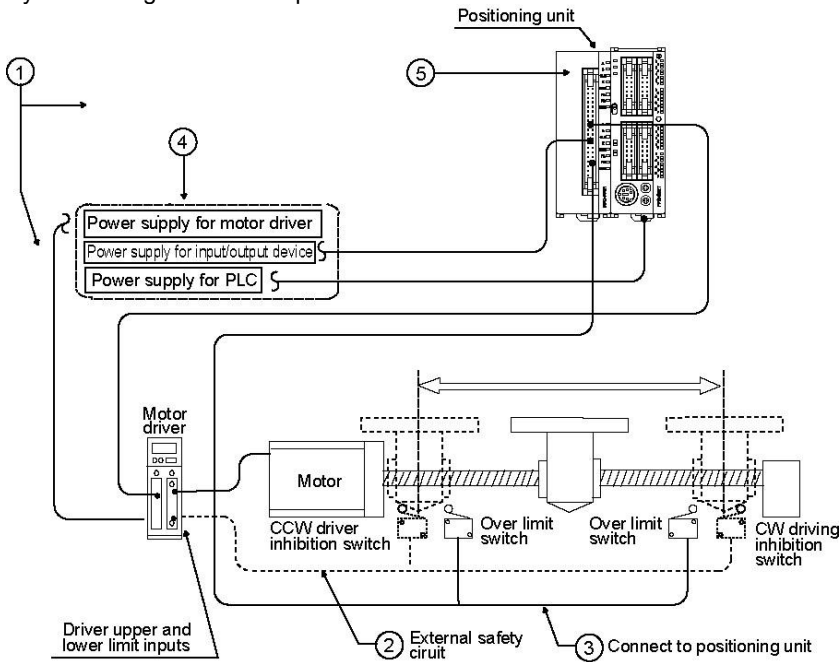
### Safety circuit based on external circuit

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 (wiring and installation of Over limit switch) based on an external circuit has been installed securely.

#### ③ Checking the installation of the safety circuit based on the Positioning unit.

Check to make sure the connection of the Positioning unit with Over limit switches.

Check to make sure that Over limit switches have been properly installed.

#### 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 start flag for the various operations of the positioning unit are OFF. If they are ON, a set value error will occur for the positioning unit, unless the data settings for the shared memory have been entered.



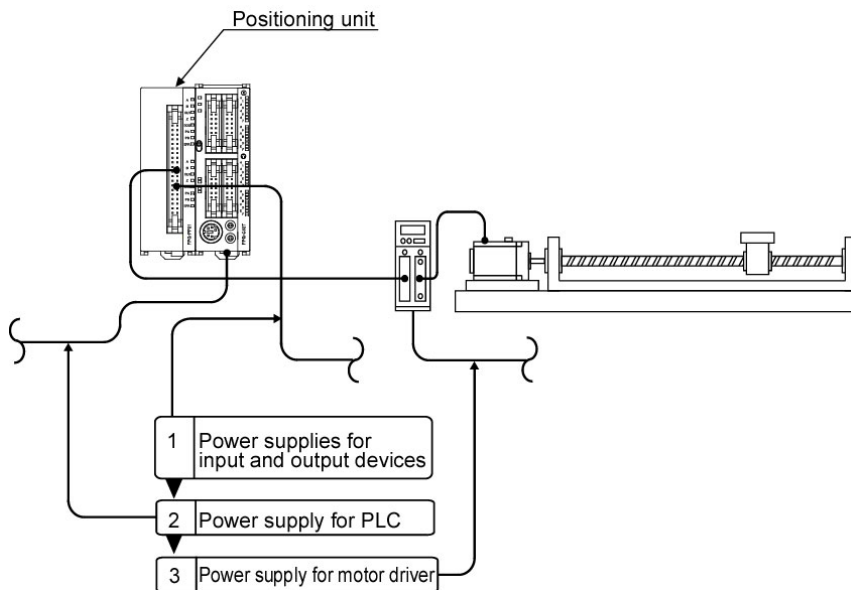
## 5.3 Procedure for Turning ON the Power

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:**

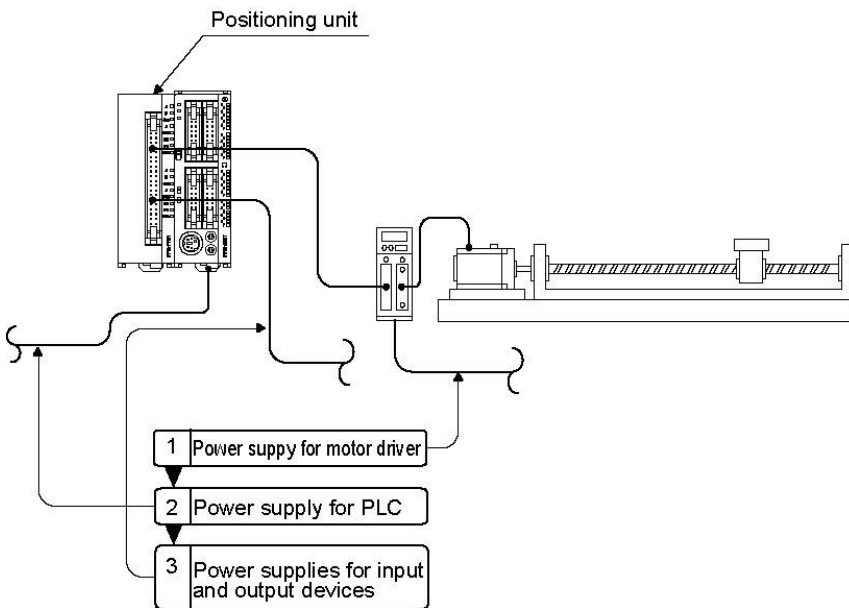
1. Turn ON the power supplies for input and output devices connected to the PLC (including the power supply for the line driver output or open collector output).
2. Turn ON the power supply for the PLC.
3. Turn ON the power supply for the motor driver.



### 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**

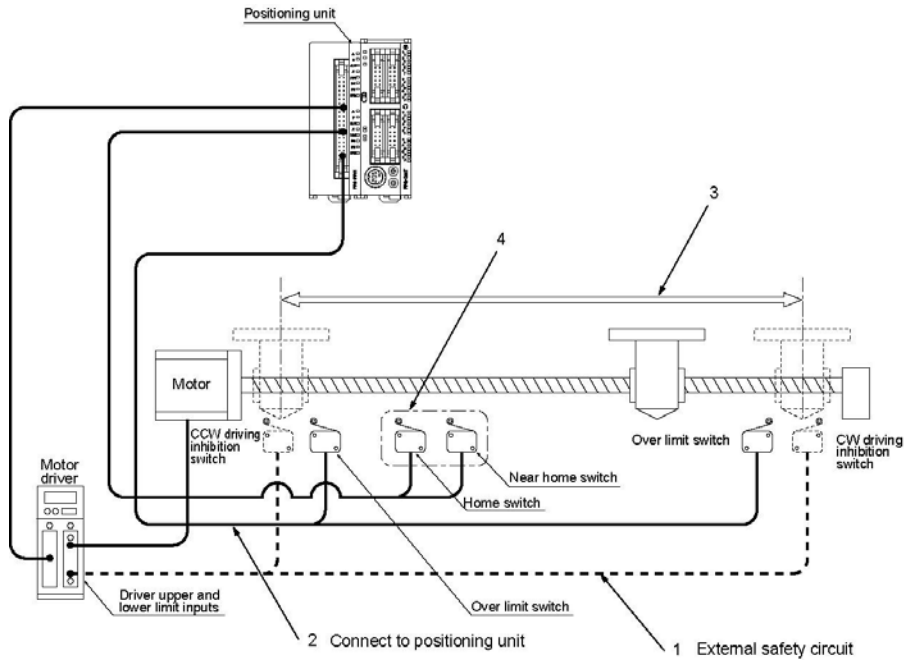
The flags of the operation memory are initialized simply by initializing the CPU, but the flags of the shared memory for the positioning unit are retained.

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 flags of the shared memory can be cleared when the power supply is turned OFF.

## 5.4 Confirming while the Power is ON

### Items to check when the power is ON

System configuration example



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

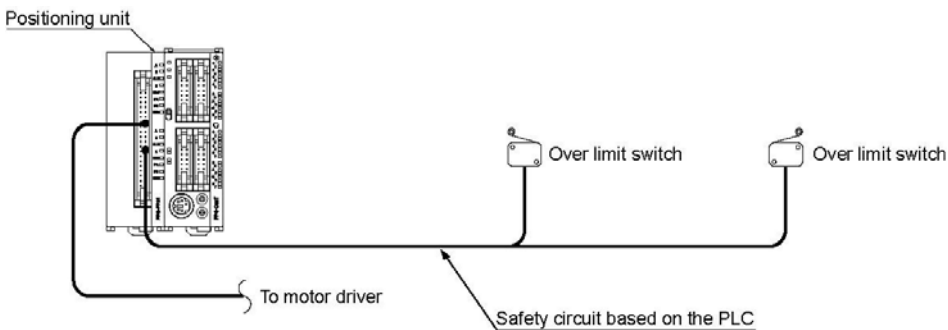
### 5.4.1 Checking the External Safety Circuit

Check the safety circuit recommended by the manufacturer of the motor to confirm the power supply cutoff of the motor driver and other functions by turning ON the CW/CCW driving inhibition switch of an external circuit.

## 5.4.2 Checking the Safety Circuit based on Positioning Unit

### Procedure:

1. Using forced operation of Over limit switch for the external safety circuit of the positioning unit, check to see if the Over limit input is being properly taken into the positioning unit. Whether or not Over limit input is taken can be confirmed by the input flag. In addition, the Over limit input valid logics can be changed using the control code in the user program.
2. If necessary, input a program to start the JOG operation. Then operate the over Over limit input forcibly to check whether the motor will stop.
3. Using the JOG operation, check to see if the Over limit switch is functioning properly.



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

### Procedure:

1. Check to see if the directions of rotation and travel are correct using the JOG operation or the automatic acceleration/deceleration.

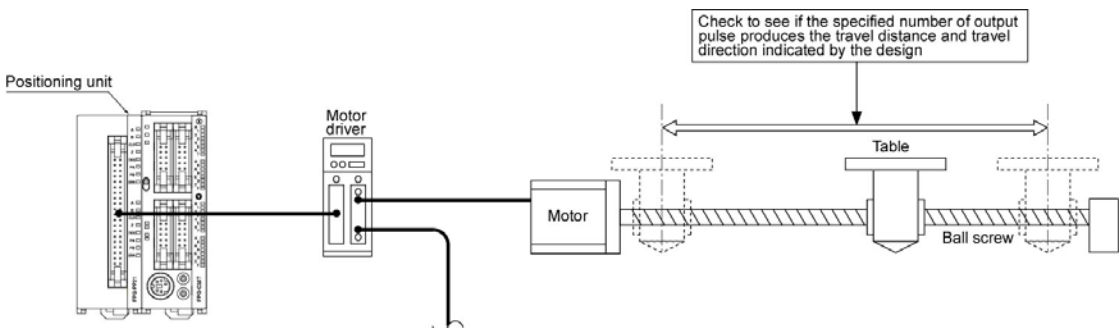
#### Points to check

The direction of rotation is determined by the driver wiring, the settings of the positioning unit shared memory control code and the program setting. At the back of the unit, and the data set in the program.

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 ratio, 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 flag (When X\_6 is ON, the home input is properly done. When X\_7 is ON, the near home input is properly done.), and check LEDs light.
2. Input the home return program, and actually carry out a home return to check if near home input produces deceleration.

### Points to check

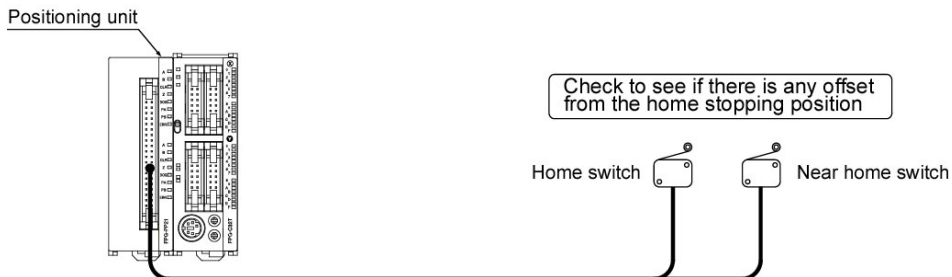
The input valid logic for the home input and near home input is determined by the control codes of the program.

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 cause 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.





## **Chapter 6**

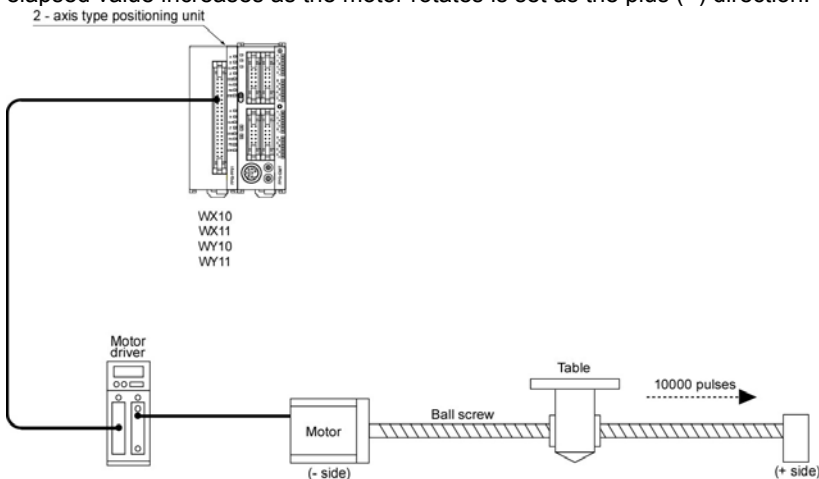
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### **E Point Control: Single - Speed Acceleration / Deceleration**

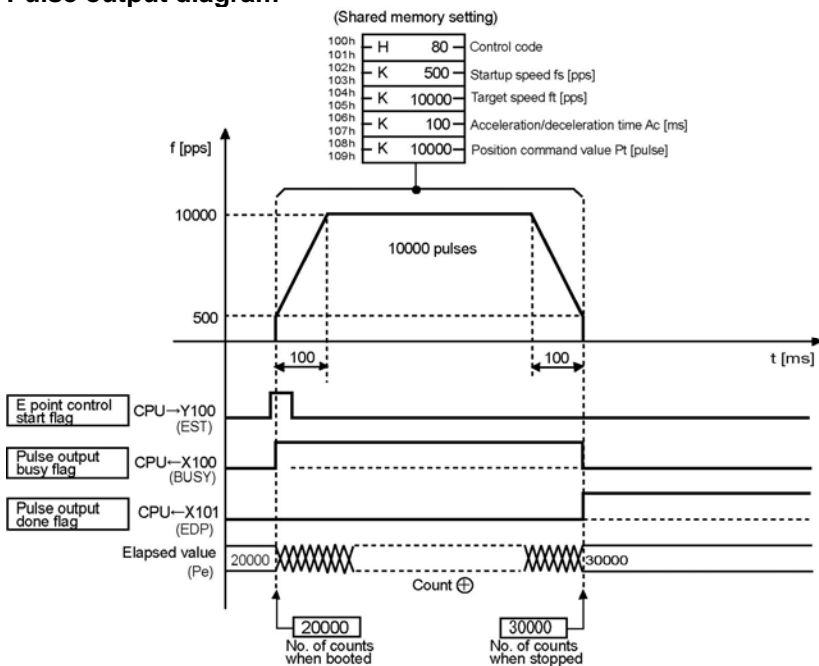
## 6.1 Sample Program

### 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.



#### Pulse output diagram



#### Operations of the various flag

The pulse output busy flag (X100) goes ON when E point control is initiated, and goes OFF when pulse output is completed.

The pulse output done flag (X101) goes ON when pulse output is completed, and is maintained until the next E point control, P point control, JOG operation, JOG positioning 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.

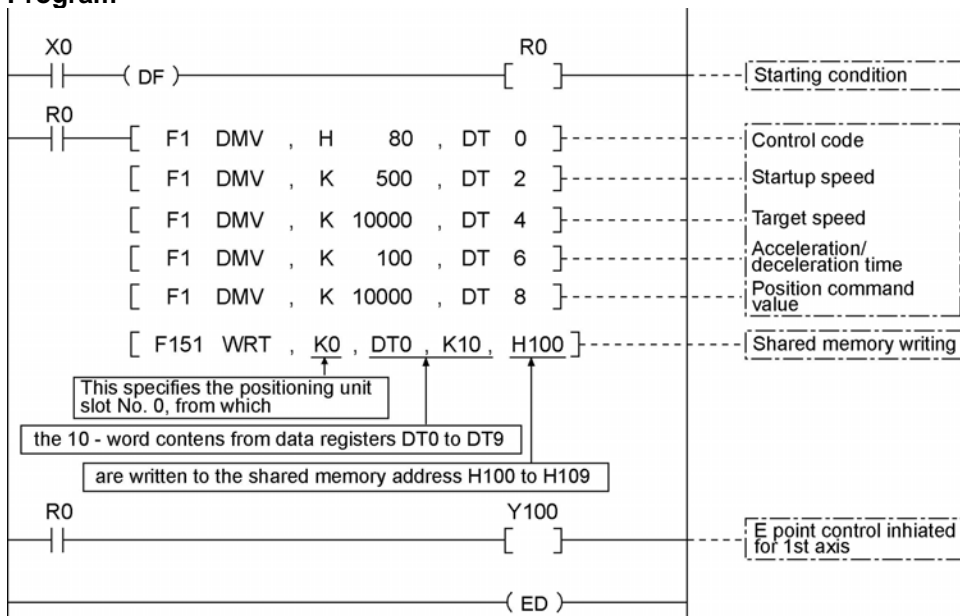


### Shared memory settings

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H80 Note: <Increment method, Linear acceleration/deceleration>	Refer to page 16-7.
Startup speed (pps)	K500	K0 to K4,000,000
Target speed (pps)	K10000	K1 to K4,000,000 Set a value larger than the startup speed.
Acceleration/deceleration time (ms)	K100	K0 to K32,767
Position command value (pulse)	K10000	K-2,147,483,648 to K2,147,483,647

**Note:** If the limit error occurs, set H0 as the limit input valid logic can be changed.

### Program



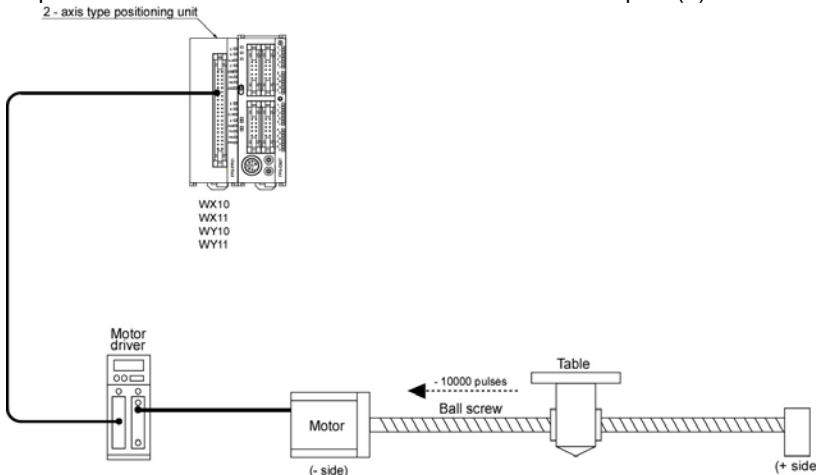
### Precautions concerning the program

When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

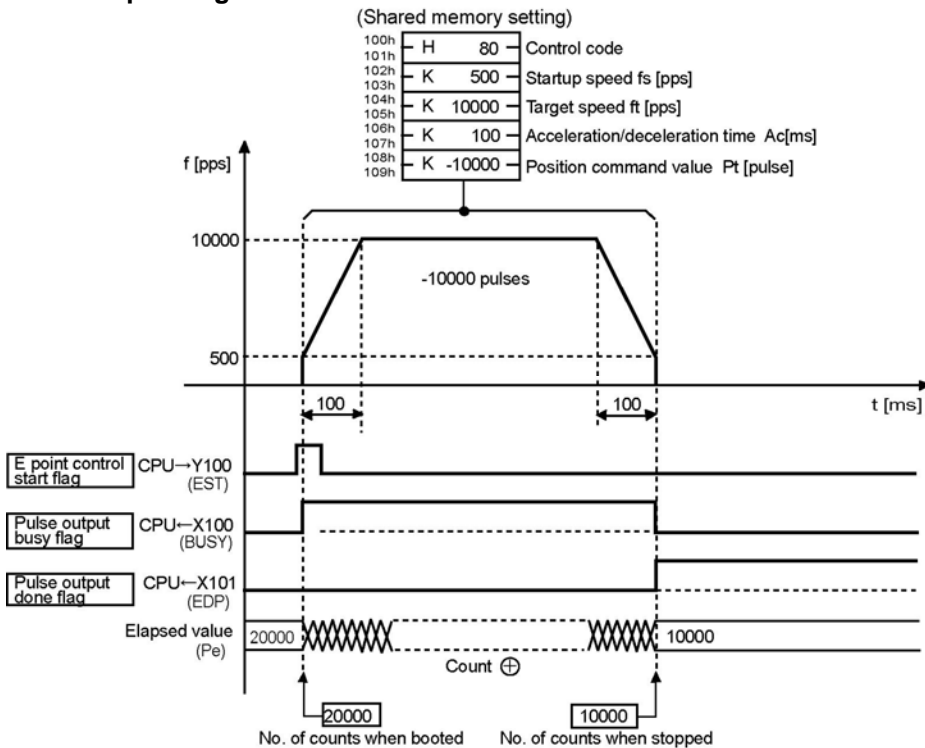
- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning operation, home return, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, 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 start flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

### 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.



**Pulse output diagram**



#### Operations of the various flag

The pulse output busy flag (X100) goes ON when E point control is initiated, and goes OFF when pulse output is completed.

The pulse output done flag (X101) goes ON when pulse output is completed, and is maintained until the next E point control, P point control, JOG operation, JOG positioning operation, home return, or pulser input enabled status is initiated.

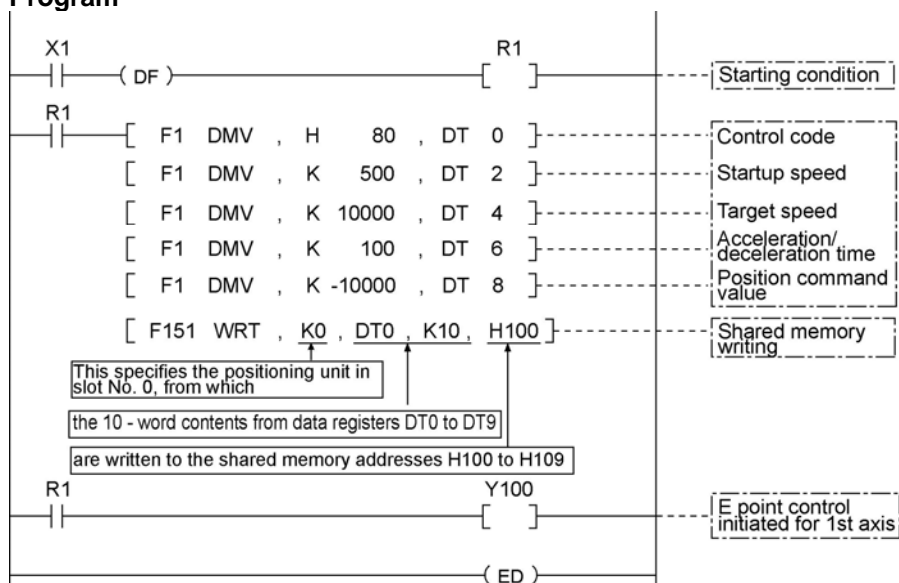
The elapsed value is stored as the absolute value in the counter in the positioning unit.

### Shared memory settings

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H80 Note: <Increment method, Linear acceleration/deceleration>	Refer to page 16-7.
Startup speed (pps)	K500	K0 to K4,000,000
Target speed (pps)	K10000	K1 to K4,000,000 Set a value larger than the startup speed.
Acceleration/deceleration time (ms)	K100	K0 to K32,767
Position command value (pulse)	K-10000	K-2,147,483,648 to K2,147,483,647

**Note:** If the limit error occurs, set H0 as the limit input valid logic can be changed.

### Program



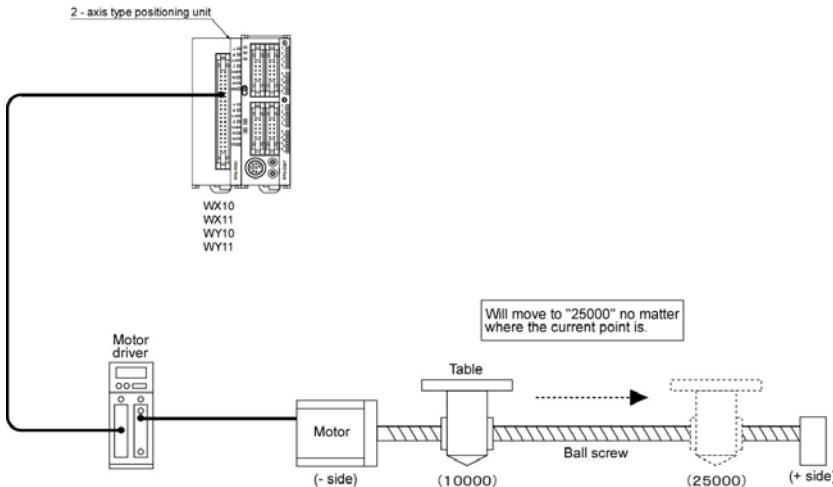
### Precautions concerning the program

When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

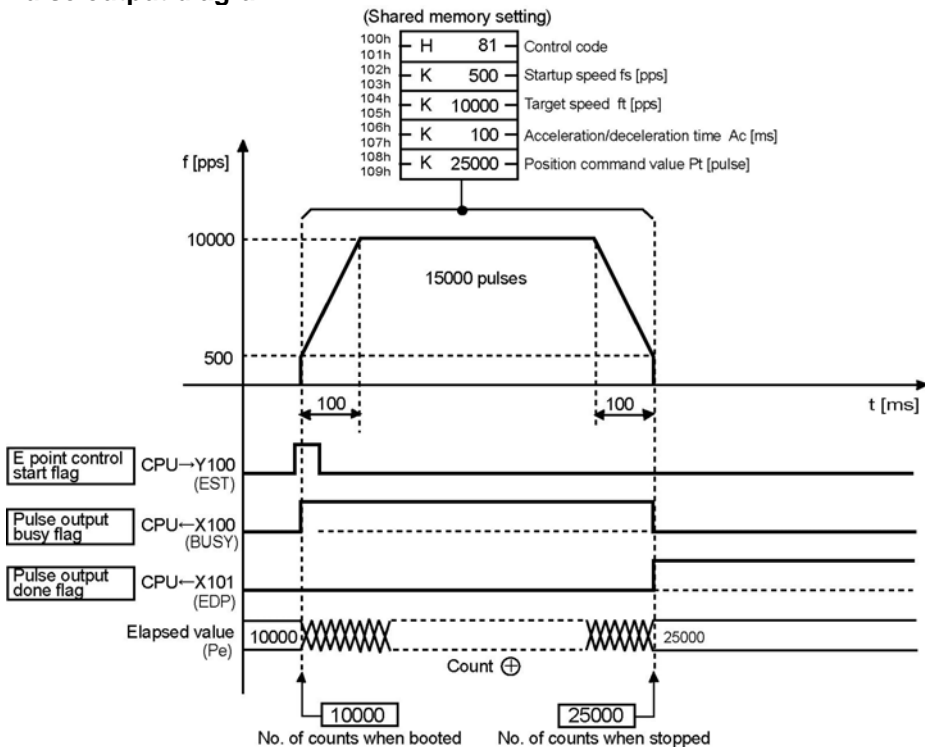
- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning operation, home returns, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed,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

### 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.



#### Pulse output diagram



#### Operations of the various flag

The pulse output busy flag (X100) goes ON when E point control is initiated, and goes OFF when pulse output is completed.

The pulse output done flag (X101) goes ON when pulse output is completed, and is maintained until the next E point control, P point control, JOG operation, JOG positioning operation, home return, or pulser input enabled status is initiated.

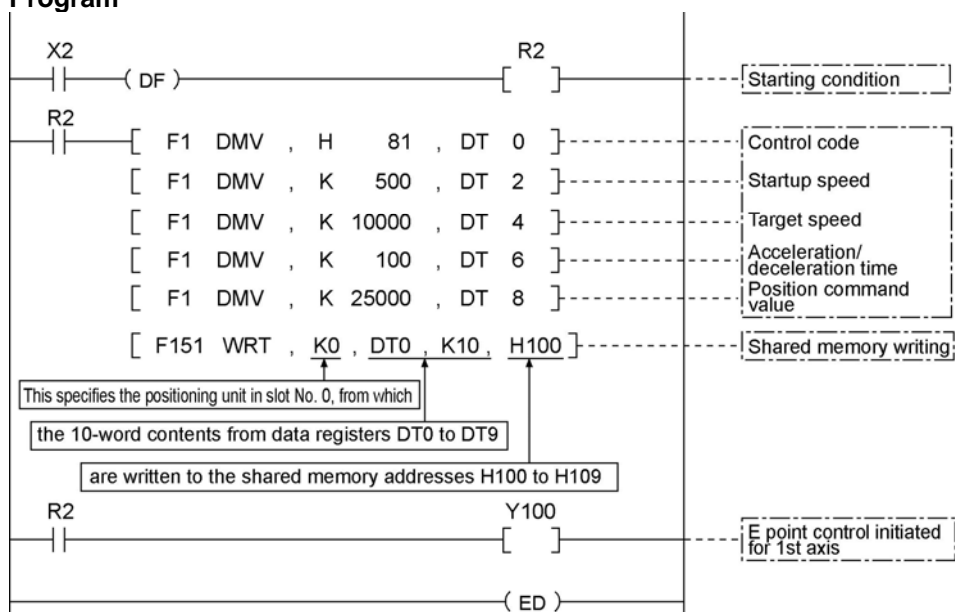
The elapsed value is stored as the absolute value in the counter in the positioning unit.

### Shared memory settings

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H81 Note: <Absolute method, Linear acceleration/deceleration>	Refer to page 16-7.
Startup speed (pps)	K500	K0 to K4,000,000
Target speed (pps)	K10000	K1 to K4,000,000 Set a value larger than the startup speed
Acceleration/deceleration time (ms)	K100	K0 to K32,767
Position command value (pulse)	K25000	K-2,147,483,648 to K2,147,483,647

**Note:** If the limit error occurs, set H1 as the limit input valid logic can be changed.

### Program



### Precautions concerning the program

When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

-The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning 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 start flag varies depending on the number of axes the unit has, and the installation position.

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

## 6.2 Flow of E Point Control Operation

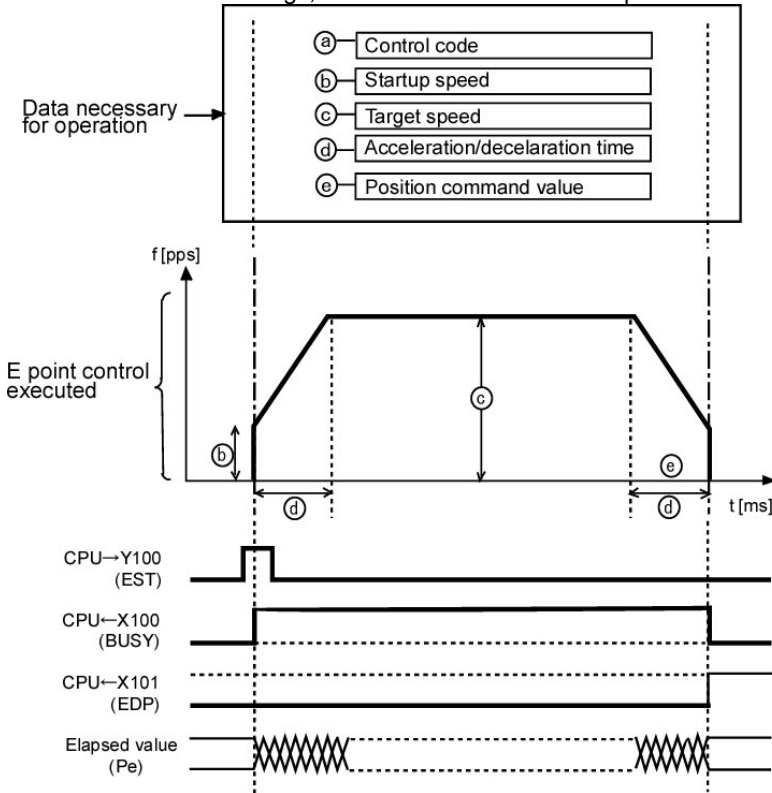
### E point control: Single - speed acceleration/deceleration

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.

#### When is mounted in slot 0

#### Operation example

When the flag for E point control (Y100) is turned ON, acceleration/deceleration is carried out in accordance with the settings, and the table travels and stops.



When Y100 is set to ON in the program, the motor of the first axis begins accelerating. X100 is a Pulse output busy flag (BUSY) that indicates that the operation is in progress, and X101 is a Pulse output done flag (EDP) that indicates that the operation is done. The EDP flag 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. For repeating the same operation, the re-setting is not necessary. If the control code is not changed, re-setting per startup is not necessary as its settings are retained by the one-time writing after the positioning unit power supply is turned ON.

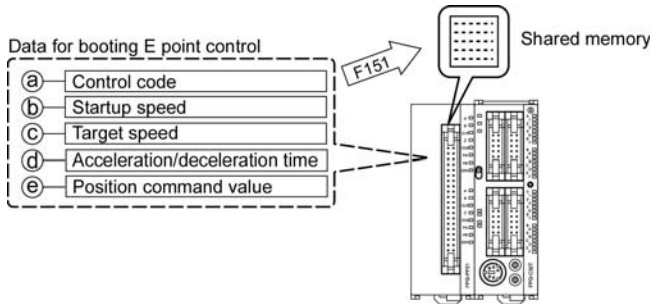
Operation is determined by these five types of data.

- 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.



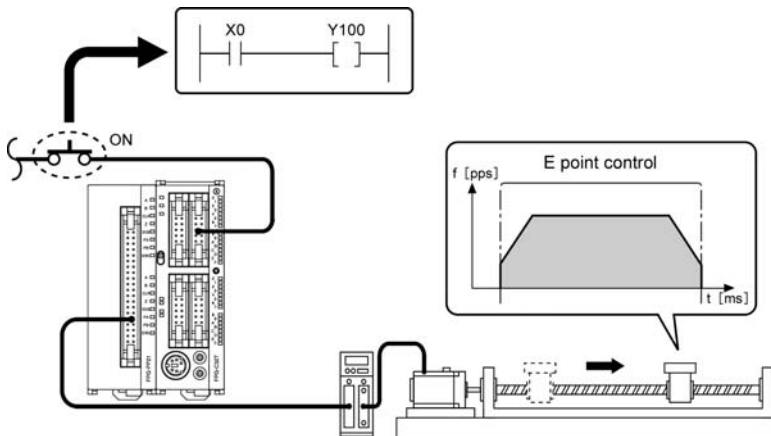
### Step 2: Executing the operations

Operation begins when the flag Y100 for E point control is turned ON.

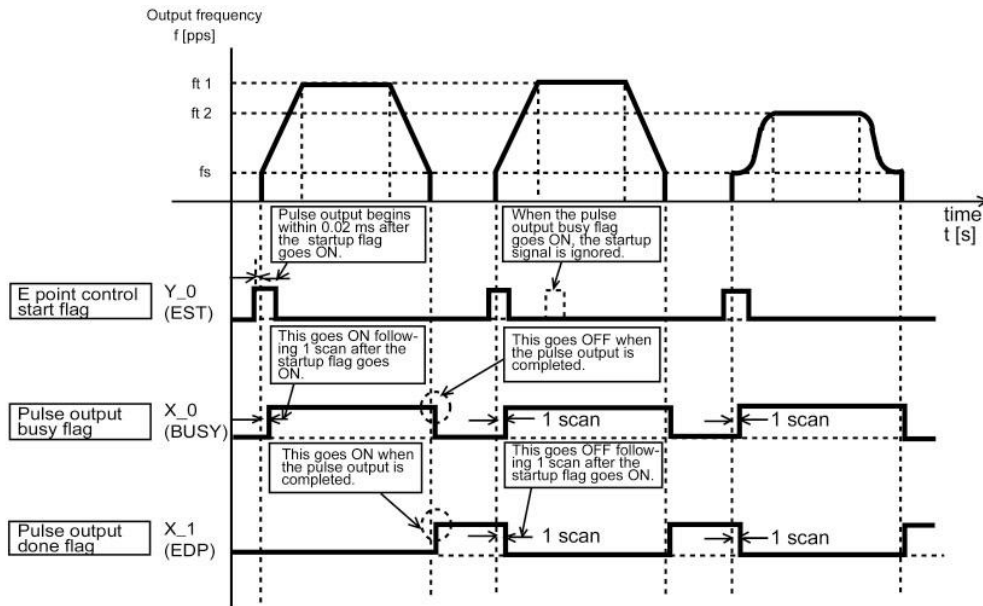
The control code determines whether S acceleration/deceleration or linear acceleration/deceleration is used.

Acceleration is carried out from the startup speed to the target speed, and then the speed slows to the startup speed.

This amount of travel is determined by the position command value.



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



### E point control start flag (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. (It is already initiated.)
3. This 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 is reset when the power supply is turned OFF.

-This flag is shared among E point control, P point control, JOG operation, JOG positioning operation and home return. (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, JOG positioning 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, JOG positioning operation and pulser input enabled operation.



## 6.4 Operation at Over limit Input

---

E point control operation is as follows when Over limit input(+) and Over limit input(-) is ON.

Condition	Direction	Limit status	Operation
<b>When E point control is turned ON</b>	Forward	Over limit input (+) ON	Table not to move, Limit error occurs.
		Over limit input (-) ON	Table not to move, Limit error occurs.
	Reverse	Over limit input (+) ON	Table not to move, Limit error occurs.
		Over limit input (-) ON	Table not to move, Limit error occurs.
<b>During E point control operation</b>	Forward	Over limit input (+) ON	Table stops, Limit error occurs.
	Reverse	Over limit input (-) ON	Table stops, Limit error occurs.



## **Chapter 7**

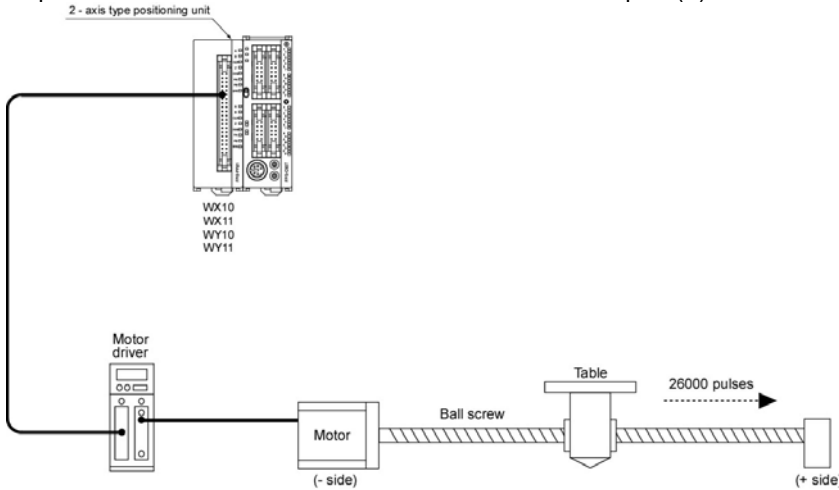
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### **P Point Control: Multi - Stage Acceleration / Deceleration**

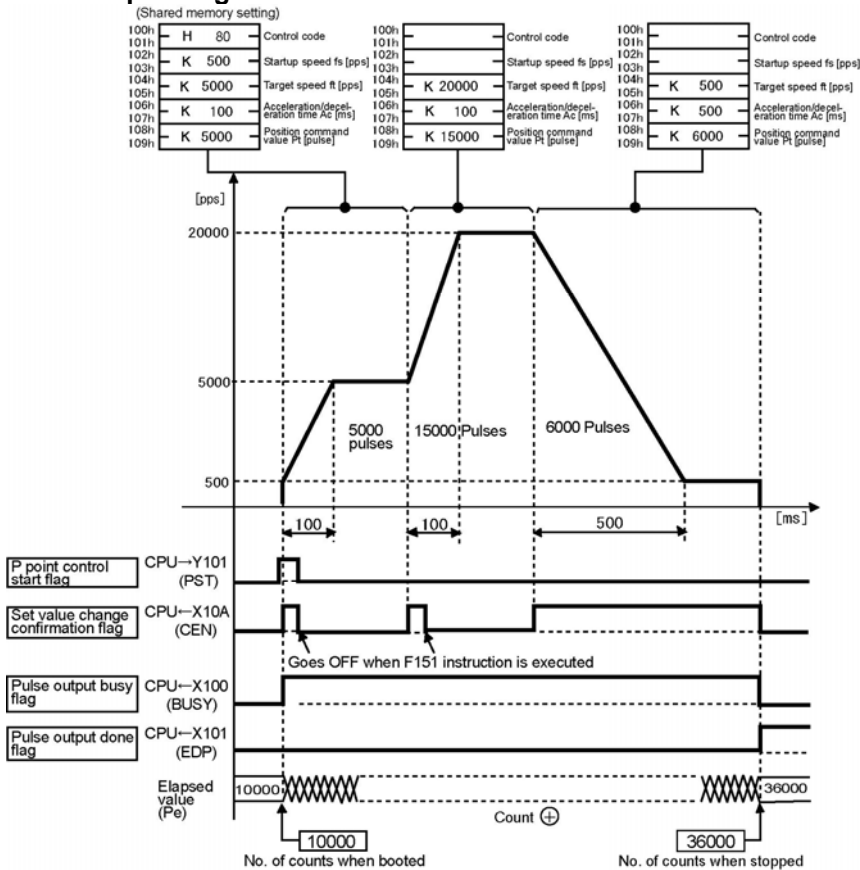
# 7.1 Sample Program

## 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.



### Pulse output diagram

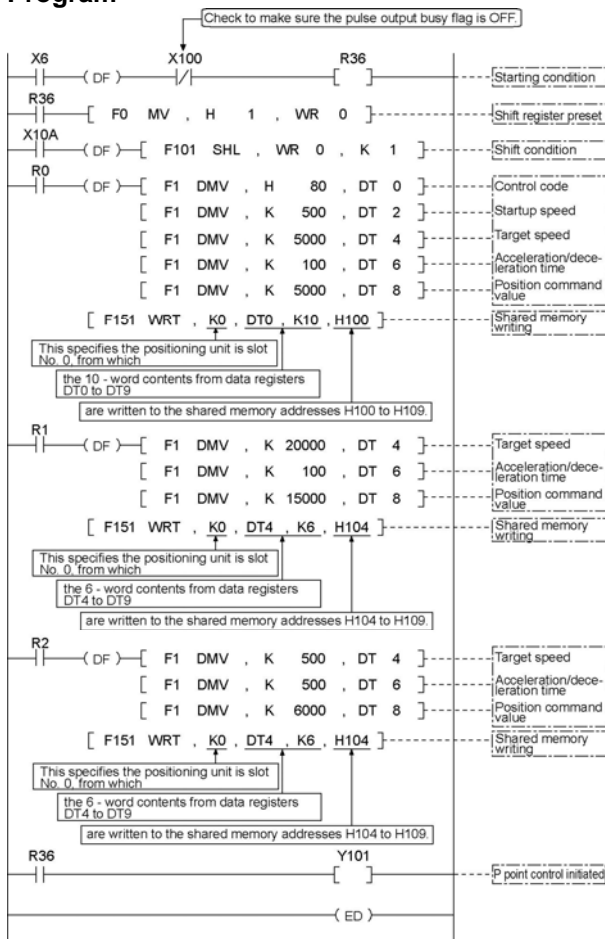


**Shared memory settings**

Control parameter setting content	Set values in sample program example			Range of acceptable settings
	1st speed	2nd speed	3rd speed	
Control code	H80 Note: Increment method, Linear acceleration/ deceleration	The same as left	The same as left	Refer to page 16-7
Startup speed (pps)	K500	The same as left	The same as left	K0 to K4,000,000
Target speed (pps)	K5000	K20000	K500	K1 to K4,000,000 The target speed for the first speed should be set to a value larger than the startup speed.
Acceleration/deceleration time(ms)	K100	K100	K500	K0 to K32,767
Position command value (pulse)	K5000	K15000	K6000	K-2,147,483,648 to K2,147,483,647

**Note:** If the limit error occurs, set H0 as the limit input valid logic can be changed.

**Program**

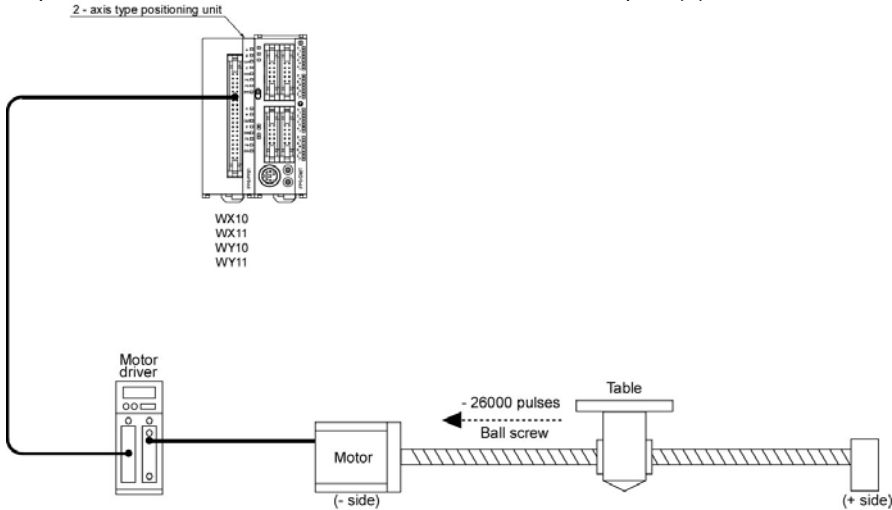


**Precautions concerning the program**

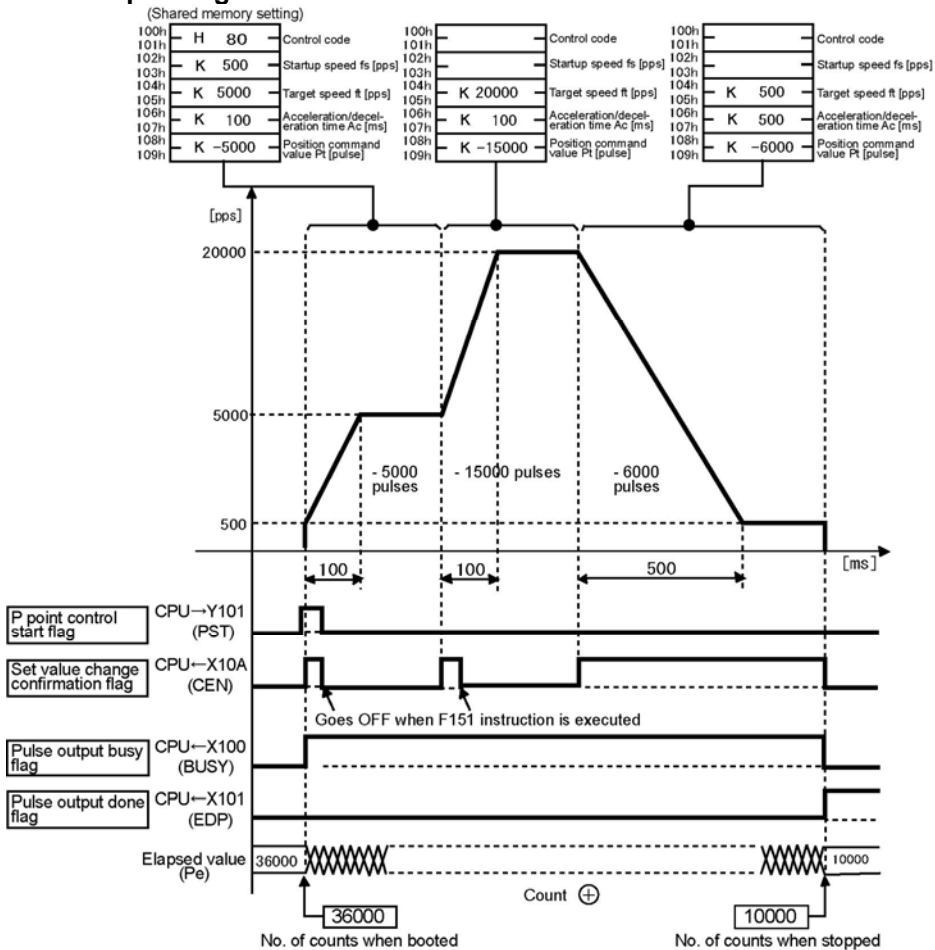
When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

### 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.



#### Pulse output diagram

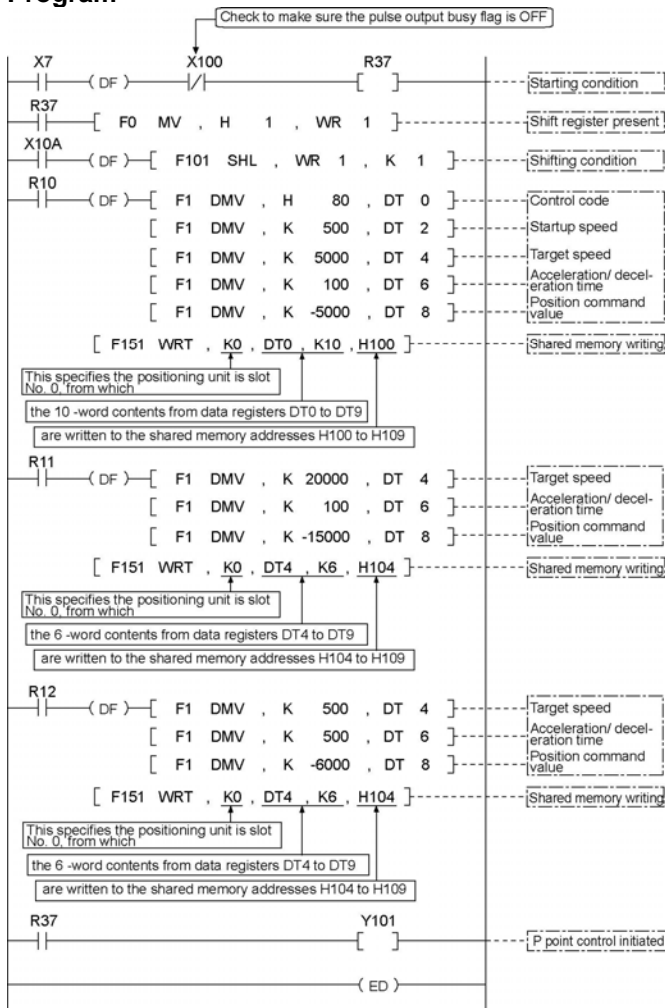


### Shared memory settings

Control parameter setting content	Set values in sample program example			Range of acceptable settings
	1st speed	2nd speed	3rd speed	
Control code	H80 Note: Increment method, Linear acceleration/ deceleration	The same as left	The same as left	Refer to page 16-7.
Startup speed (pps)	K500	The same as left	The same as left	K0 to K4,000,000
Target speed (pps)	K5000	K20000	K500	K1 to K4,000,000 The target speed for the first speed should be set to a value larger than the startup speed.
Acceleration/ deceleration time(ms)	K100	K100	K500	K0 to K32,767
Position command value (pulse)	K-5000	K-15000	K-6000	K-2,147,483,648 to K2,147,483,647

**Note:** If the limit error occurs, set H0 as the limit input valid logic can be changed.

### Program

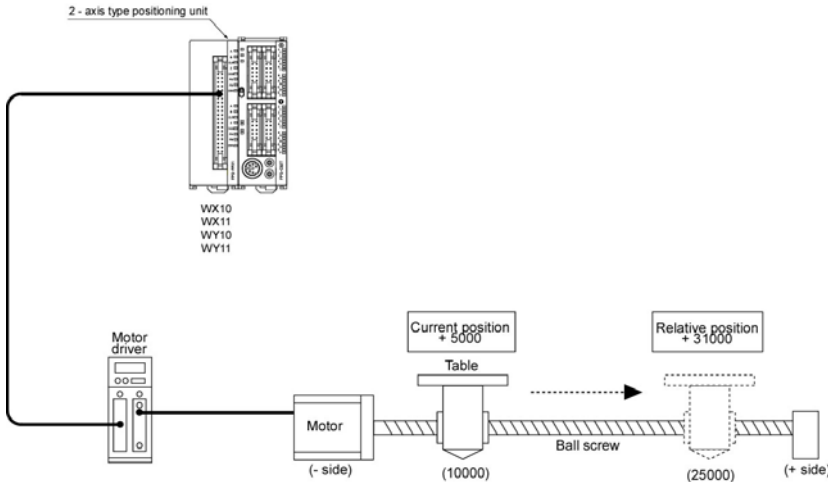


### Precautions concerning the program

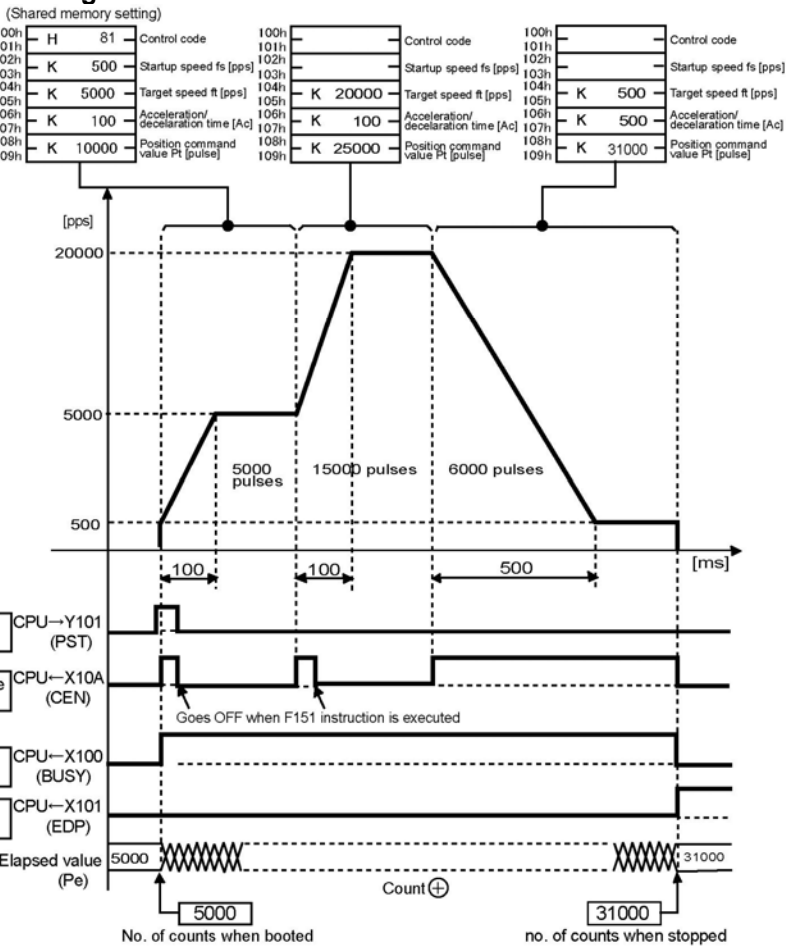
When Over limit switch (+) and Over limit switch (-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

### 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.



#### Pulse output diagram



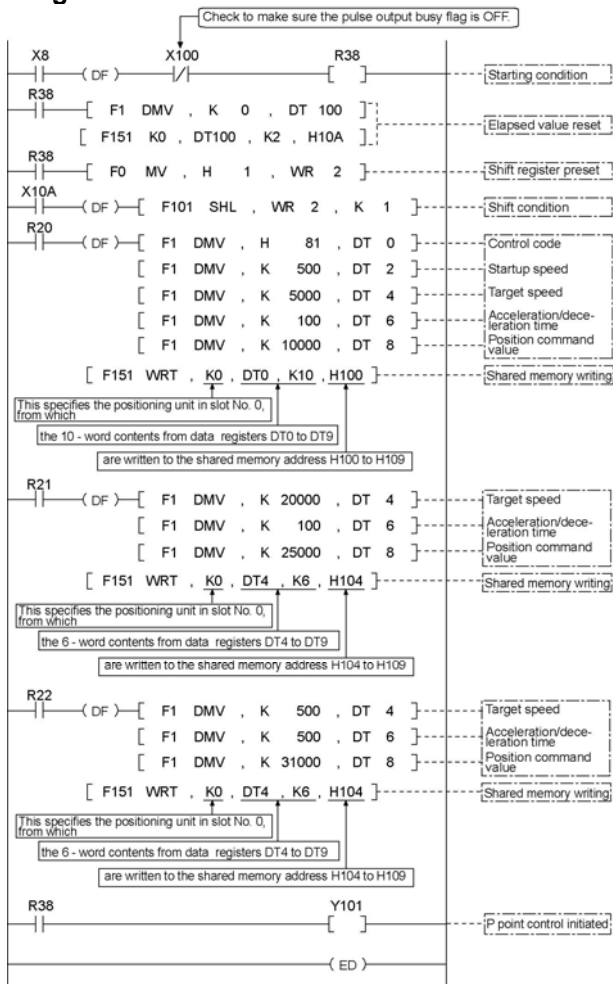


**Shared memory settings**

Control parameter setting content	Set values in sample program example			Range of acceptable settings
	1st speed	2nd speed	3rd speed	
Control code	H81 Note: Absolute method, Linear acceleration/ deceleration	The same as left	The same as left	Refer to page 16-7.
Startup speed (pps)	K500	The same as left	The same as left	K0 to K4,000,000
Target speed (pps)	K5000	K20000	K500	K1 to K4,000,000 The target speed for the first speed should be set to a value larger than the startup speed.
Acceleration/deceleration time (ms)	K100	K100	K500	K0 to K32,767
Position command value (pulse)	K10000	K25000	K31000	K-2,147,483,648 to K2,147,483,647

**Note:** If the limit error occurs, set H1 as the limit input valid logic can be changed.

**Program**



**Precautions concerning the program**

When Over limit switch (+) and Over limit switch (-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the limit switch connection.

## 7.2 Flow of P Point Control Operation

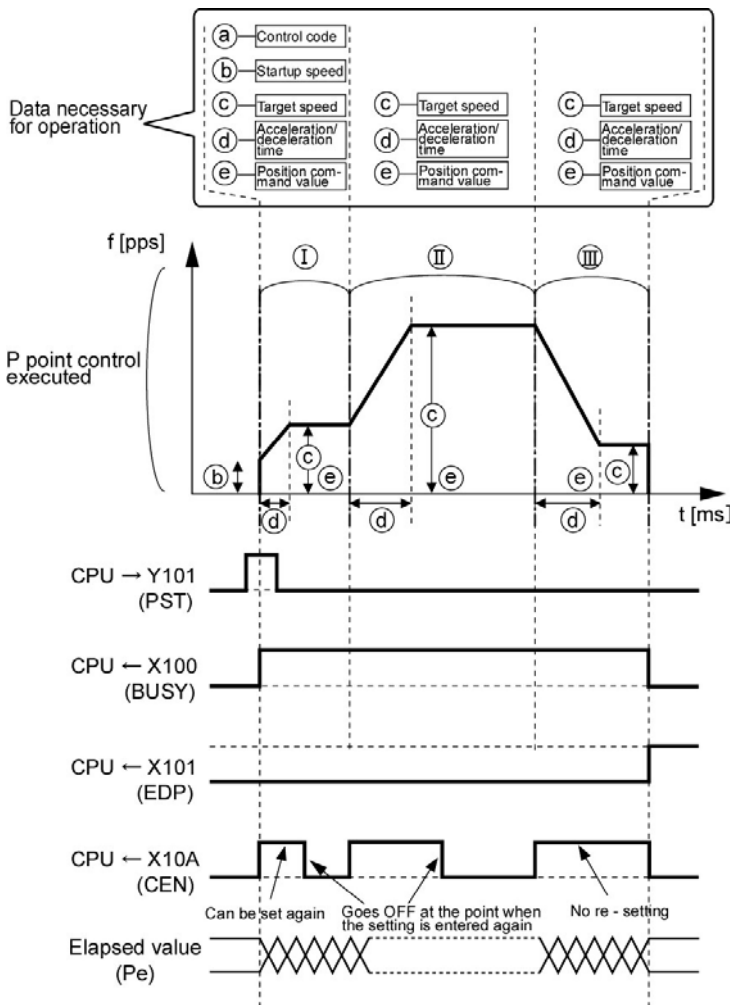
### P point control: Multi - stage acceleration/deceleration

- When the flag for initiating P point control (Y\_1) 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.
- Sin curve, Secondary curve, Cycloid curve and Third curve can be selected for S acceleration/deceleration can also be selected.
- The acceleration/deceleration time can be specified separately for each travel point.

### When is mounted in slot 0

#### Operation example

When the flag for initiating P point control (Y41) is turned ON, acceleration/deceleration is carried out repeatedly in accordance with the settings.



When Y101 is set to ON in the program, the motor of the first axis begins accelerating. X100 is a Pulse output busy (BUSY) flag that indicates that operation is in progress, while X101 is a Pulse output done (EDP) flag that indicates that operation has been completed. After operation has been completed, the EDP flag 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. In the illustration below, the operations and processing of the P point control consists of sections I to III are explained.

**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.

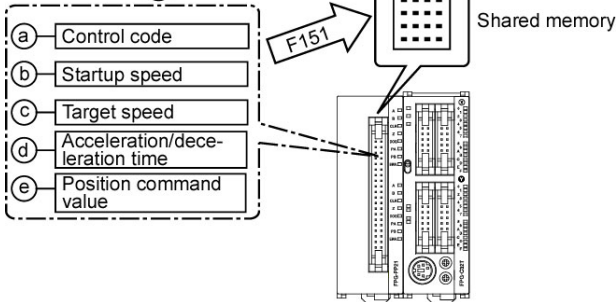
- Target speed
- Acceleration/deceleration time
- Position command value

**Operation steps**

**Step 1: Preparatory stage**

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

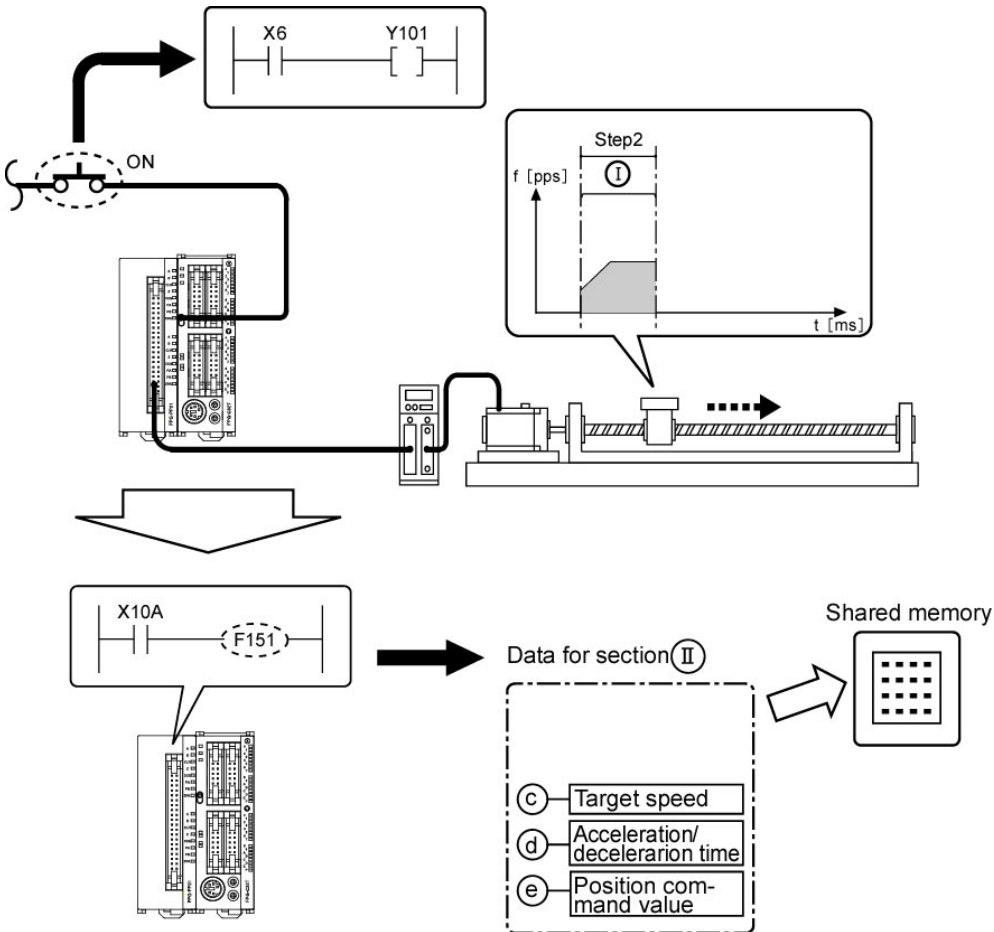
Data for section I



**Step 2: Executing the operation of Section I**

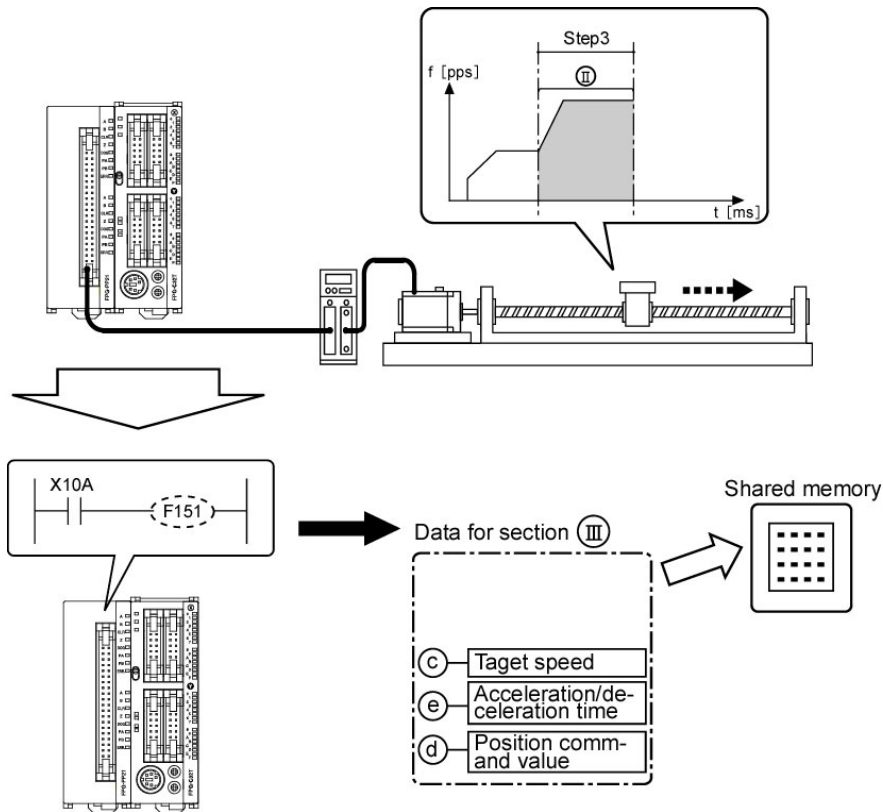
Operation begins when the flag Y101 for P point control start is turned ON.

(At this point, X10A goes ON. When X10A goes ON, the data for the operation of section II is transferred to the shared memory. X10A goes OFF after the data has been transferred.)



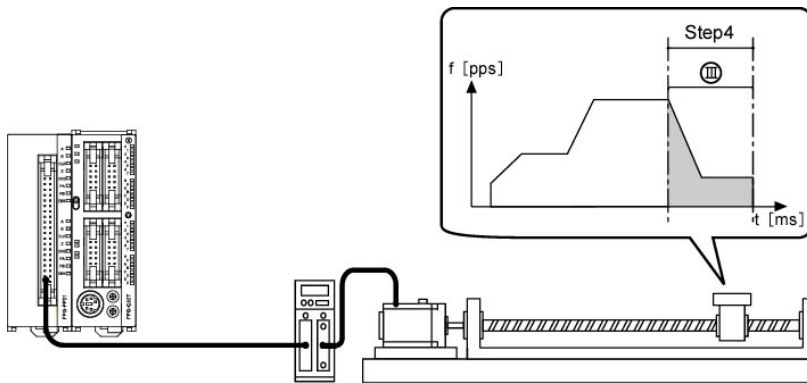
**Step 3: Executing the operation of Section II**

When the operation of section I is completed, operation shifts to section II.  
 (At this point, X10A goes ON. When X10A goes ON, the data for the operation of section III is transferred to the shared memory. X10A goes OFF after the data has been transferred.)



**Step 4: Executing the operation of Section III**

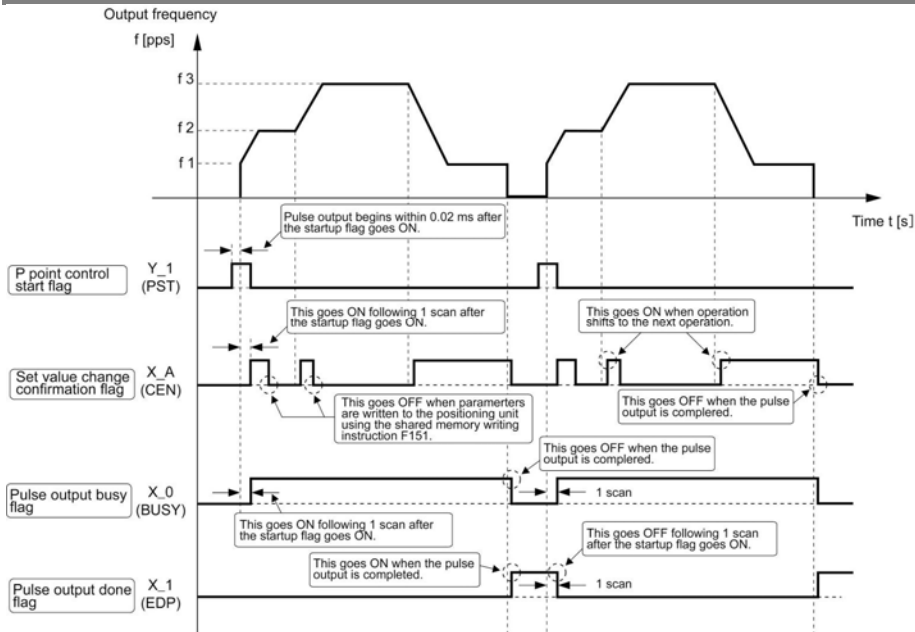
When the operation of section II is completed, operation shifts to section III.



**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 Operation of the Input and Output Flag Before and After P Point Control



### P point control start flag (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.

### Set 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 shared memory write instruction is executed, and the new parameter is written to the shared memory, and then goes OFF after the parameters have been written to the unit.
  3. This is reset when the power supply is turned OFF.
- This 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 is reset when the power supply is turned OFF.
- This flag is shared among E point control, P point control, JOG operation, JOG positioning operation and home return. (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, JOG positioning 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, JOG positioning operation and pulser input enabled operation.

## **7.4 Precautions When Creating P Point Control Programs**

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### **7.4.1 Precautions Concerning the Set Value Change Confirmation Flag X\_A**

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The set 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.

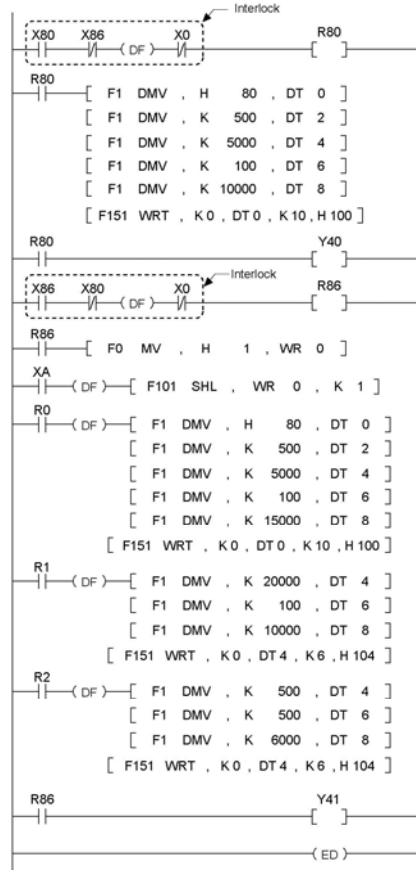
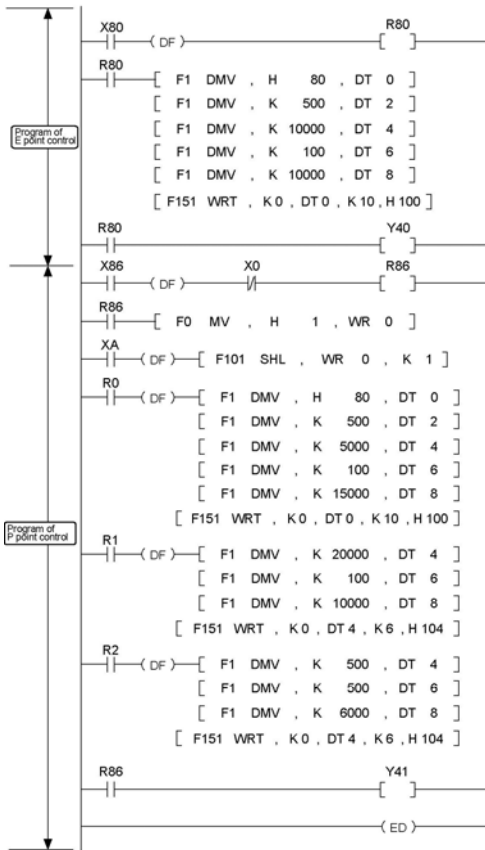
#### **Conditions for turning the flag from OFF to ON**

- 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 interlock should be applied to each circuit, so that F151 instruction cannot be executed and the set value change confirmation flag X\_A cannot be rewritten under any other conditions.



If the P point control program is booted while the E point control program has been booted and is running, the flag X10A changes, resulting in affecting the P point control program operation.

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.



## 7.5 Operation at Over limit Input

P point control operation is as follows when Over limit input (+) or Over limit input (-) is ON.

Condition	Direction	Limit status	Operation
<b>When P point control is turned ON.</b>	Forward	Over limit input (+):ON	Table not to move, Limit error occurs.
		Over limit input (-):ON	Table not to move, Limit error occurs.
	Reverse	Over limit input (+):ON	Table not to move, Limit error occurs.
		Over limit input (-):ON	Table not to move, Limit error occurs.
<b>During P point control operation</b>	Forward	Over limit input (+):ON	Table stops, Limit error occurs.
	Reverse	Over limit input (-):ON	Table stops, Limit error occurs.



# Chapter 8

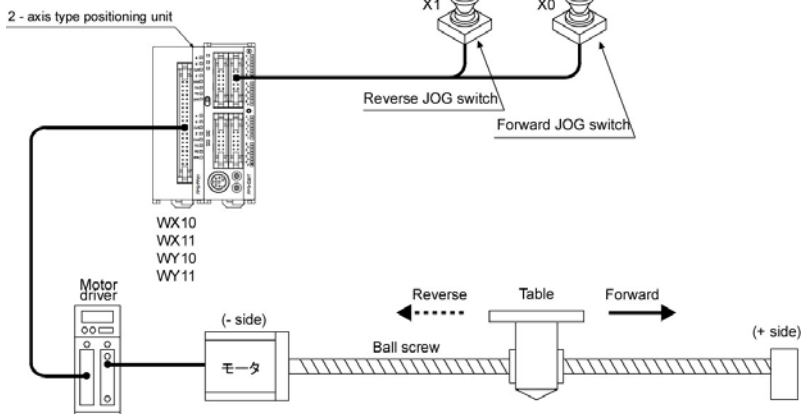
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## JOG Operation

# 8.1 Sample Program

## 8.1.1 JOG Operation (Forward and Reverse)

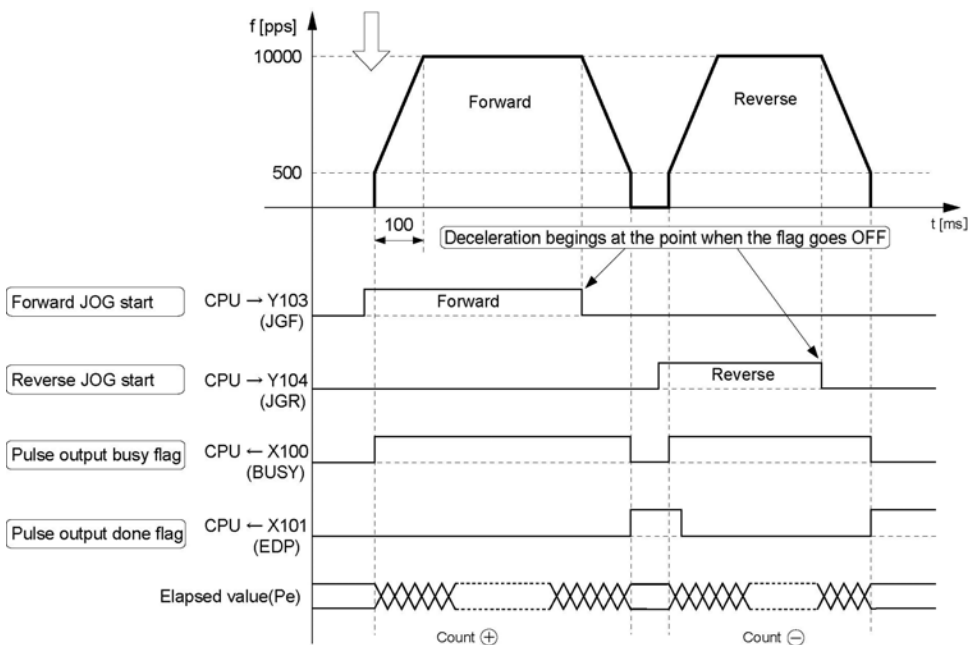
**This is the basic program for forward and reverse rotation using the external switch.**  
 The direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction.  
 -Pulses are output as long as the startup flag is ON in the manual mode.  
 -There are two flags for startup, one for forward rotation and another for reverse rotation.



### Pulse output diagram

(Shared memory setting)

100h	H	80	Control code
101h			
102h	K	500	Startup speed $f_s$ [pps]
103h			
104h	K	10000	Target speed $f_t$ [pps]
105h			
106h	K	100	Acceleration/deceleration time $A_c$ [ms]
107h			

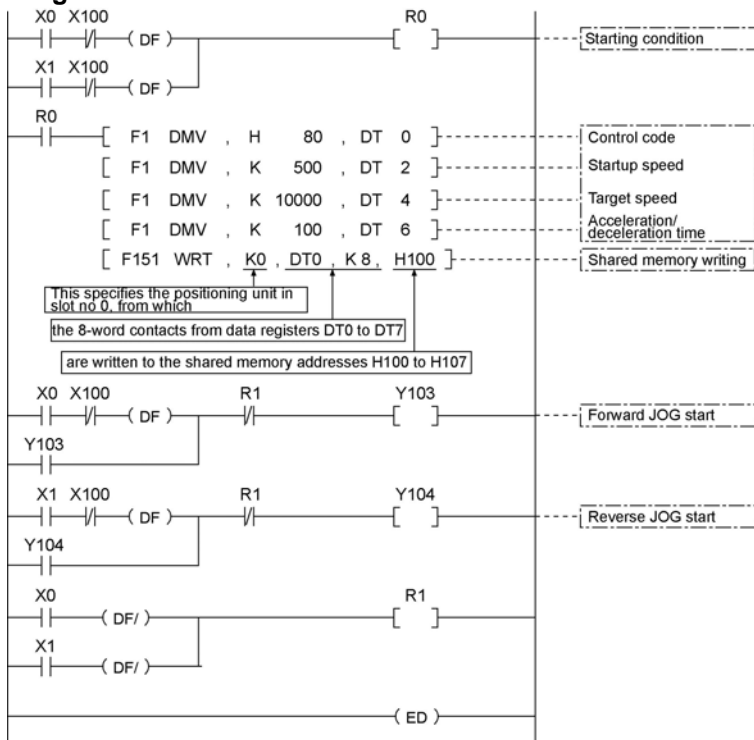


**Shared memory settings**

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H80 Note: Linear acceleration/deceleration	Refer to page 16-7
Startup speed (pps)	K500	K0 to K4,000,000
Target speed (pps)	K10000	K1 to K4,000,000 Specify a value larger than the startup speed.
Acceleration/deceleration time (ms)	K100	K0 to K32,767

**Note:** If the limit error occurs, set H0 as the limit input valid logic can be changed.

**Program**



**Precautions concerning the program**

When Over limit switch (+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG positioning operation, home return, 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 start flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.
- If forward and reverse rotations 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.
- When re-started during deceleration, the rotation will again accelerate if in the same direction.

### 8.1.2 JOG Operation (Forward, Reverse and Speed Changes)

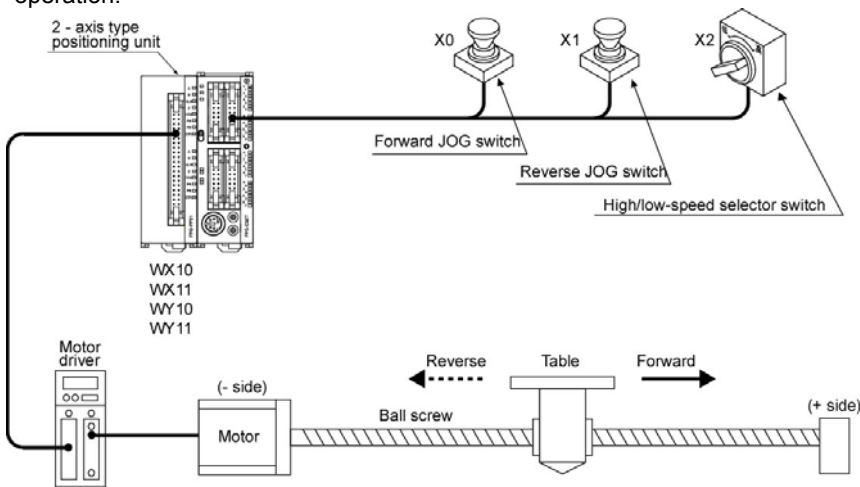
**This is the basic program for forward and reverse rotation using the external switch.**

The direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction

-Pulses are output as long as the startup flag is ON in the manual mode.

-There are two flags for start, one for forward rotation and one for reverse rotation.

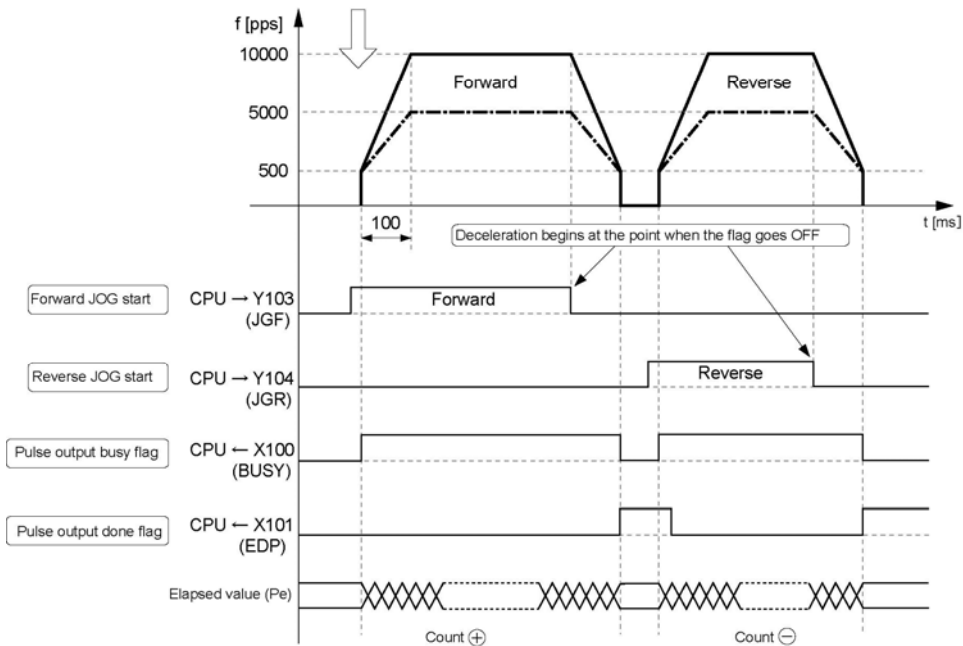
-In the example shown below, the selector switch is used to switch between high-speed and low-speed operation.



#### Pulse output diagram

(Shared memory setting)

100h	H	80	Control code
101h	K	500	Startup speed fs [pps]
102h	K	10000	Target speed ft [pps]
103h	K	100	Acceleration/deceleration time Ac [ms]
104h			
105h			
106h			
107h			

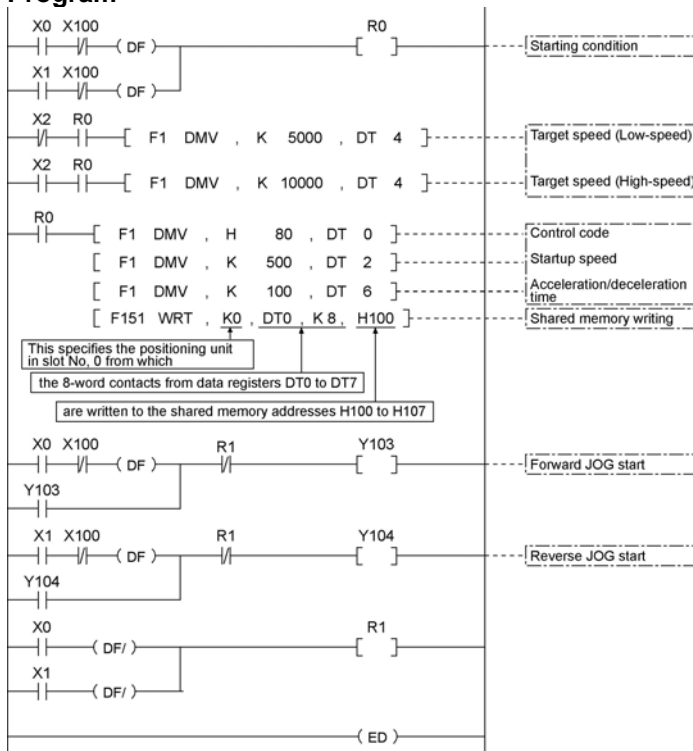


**Shared memory settings**

Control parameter setting content	Set values in sample program example		Range of acceptable settings
	Low – speed settings	High – speed settings	
Control code	H80 Note: Linear acceleration/deceleration		Refer to page 16-7
Startup speed (pps)	K500		K0 to K4,000,000
Target speed (pps)	K5000	K10000	K1 to K4,000,000 Specify a value larger than the startup speed.
Acceleration/ deceleration time(ms)	K100		K0 to K32,767

**Note:** If the limit error occurs, set H0 as the limit input valid logic can be changed.

**Program**



**Precautions concerning the program**

When Over limit switch (+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG positioning operation, home return, 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 start flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.
- 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

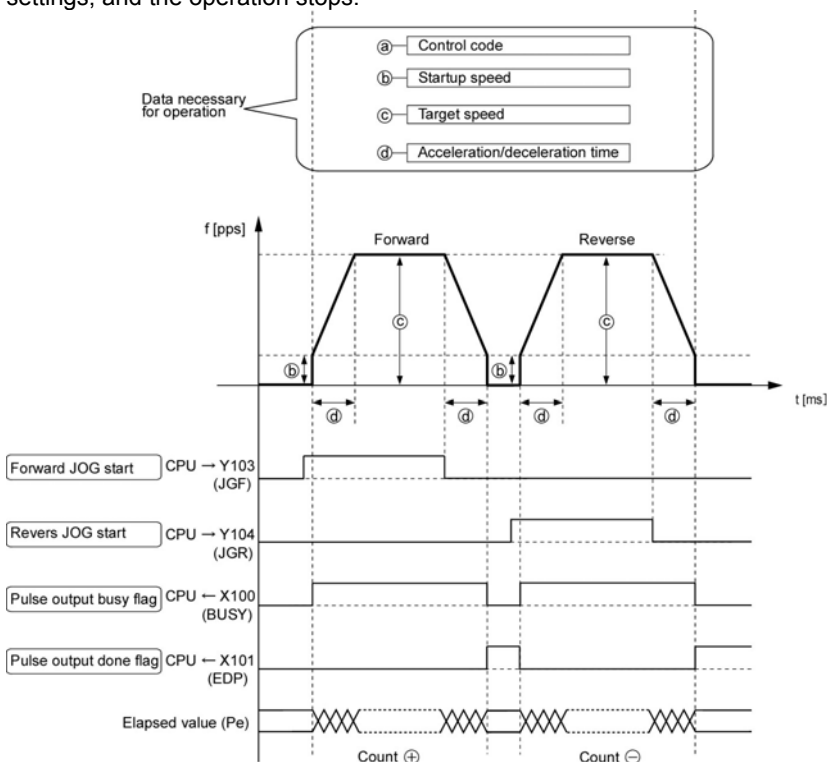
### JOG operation

When is mounted in slot 0

#### Operation example

When the flag for forward rotation (Y103) (JGF) is turned ON, forward rotation begins and acceleration is initiated based on the settings. When the flag is turned OFF, deceleration takes place based on the settings, and the operation stops.

When the flag for reverse rotation (Y104) (JGR) is turned ON, reverse rotation begins and acceleration is initiated based on the settings. When the flag is turned OFF, deceleration takes place based on the settings, and the operation stops.



When Y103 is turned ON in the program above, the motor for the first axis begins to turn in the forward direction, and accelerates to the target speed. When Y103 is turned OFF, the motor decelerates and stops.

Reverse rotation can be carried out in the same way, with Y104 being turned ON and OFF.

X100 is the Pulse output busy (BUSY) flag that indicates that operation is in progress, and X101 is the Pulse output done (EDP) flag that indicates that operation has been completed. The EDP flag remains on until the next operation request is issued.

#### Data necessary for settings

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

When the Control code is not changed, re-setting per startup is not necessary since the settings written once after the power ON are retained.

Operation is determined by the following four types of data.

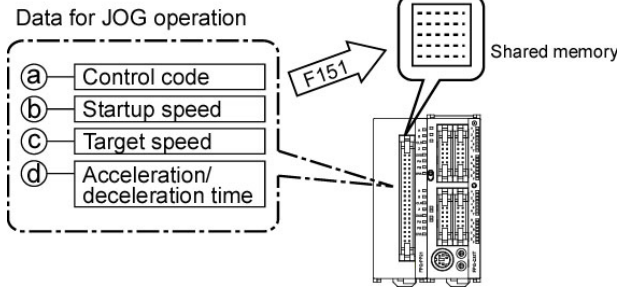
- Control code
- Startup speed
- Target speed
- Acceleration/deceleration time



**Operation steps**

**Step 1: Preparatory stage**

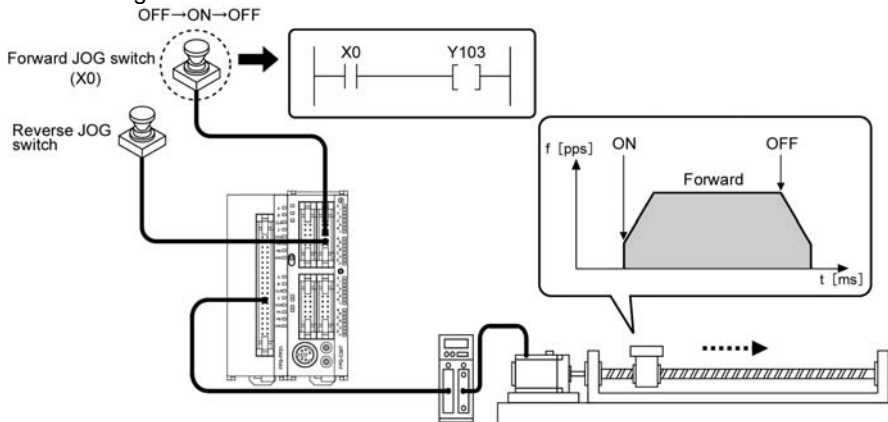
The data for operation is transferred to the shared memory ahead of time.



**Step 2: Executing the operations**

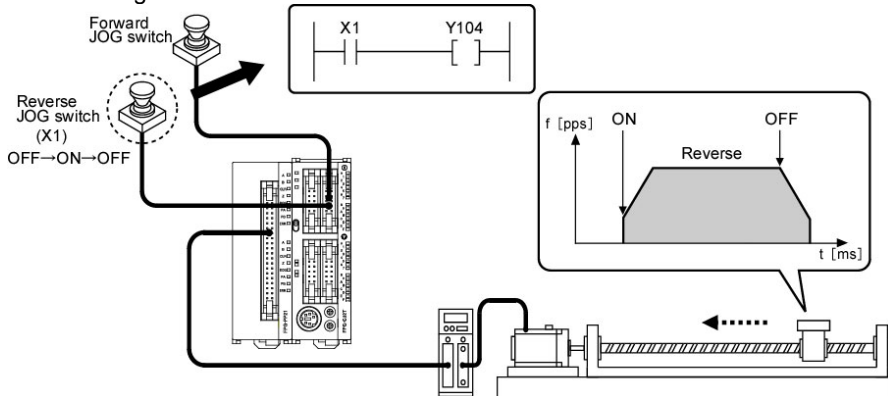
**Forward**

The start flag Y103 for forward rotation is turned ON.



**Reverse**

The start flag Y104 for reverse rotation is turned ON.



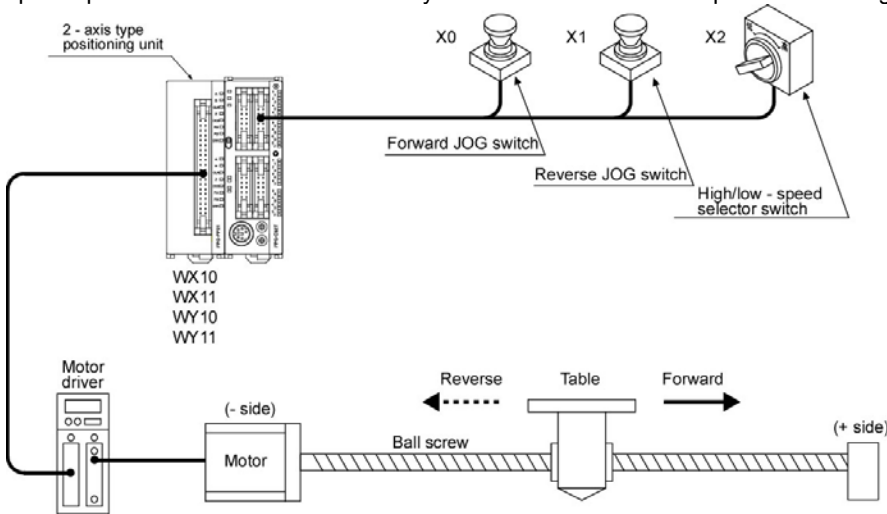
The control codes determine whether S acceleration/deceleration or linear acceleration/deceleration is used.

When the start flag is turned ON, acceleration takes place from the startup speed to the target speed for the acceleration/deceleration time. When the flag is turned OFF, deceleration takes place until the startup speed is reached, and operation then stops.

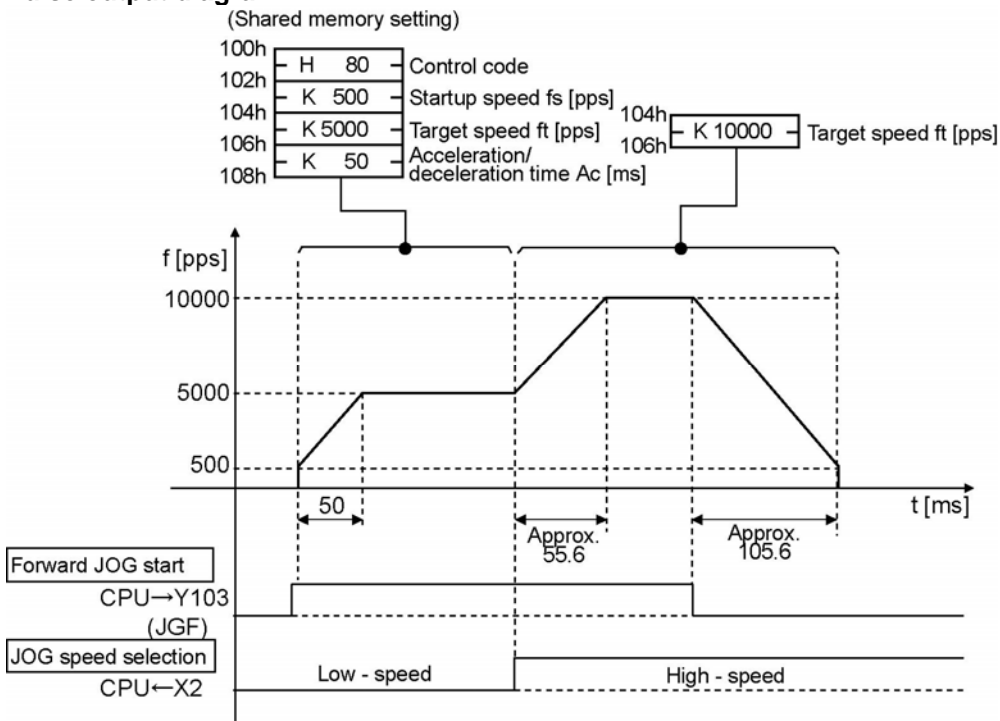
### 8.3 Changing the Speed During JOG Operation

#### 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.

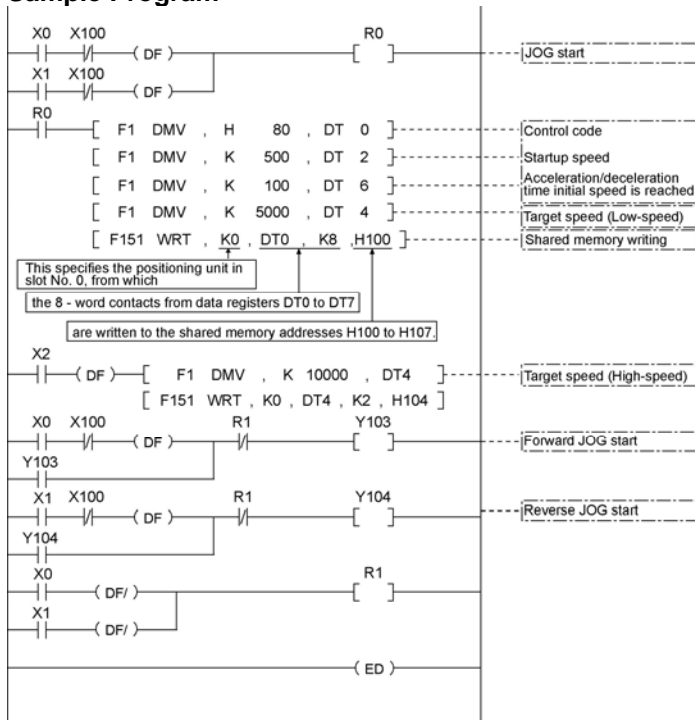


#### Pulse output diagram



**Note:** The target speed change during JOG operation is available only for Linear acceleration/deceleration. When S acceleration/deceleration is selected, the target speed changed will be ignored. Do not change the target speed during the speed down by turning ON and then OFF Forward JOG flag.

**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

1. Time until the low - speed specification for JOG operation

The acceleration/deceleration time specified by the program serves as the acceleration/deceleration time, just as it is.

Acceleration/deceleration time = 50ms

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

2. Time from the JOG speed of the low - speed specification to the JOG speed of the high - speed specification

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

3. 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.

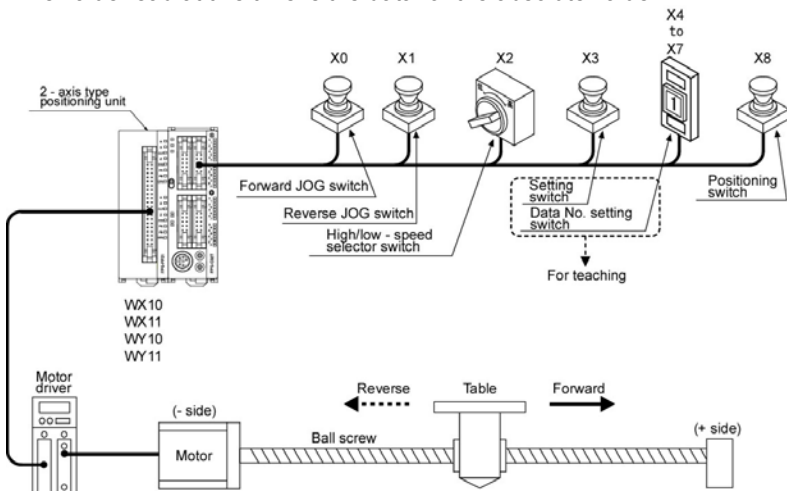
When Over limit switch (+) and Over limit switch (-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

## 8.4 Teaching Following JOG Operation

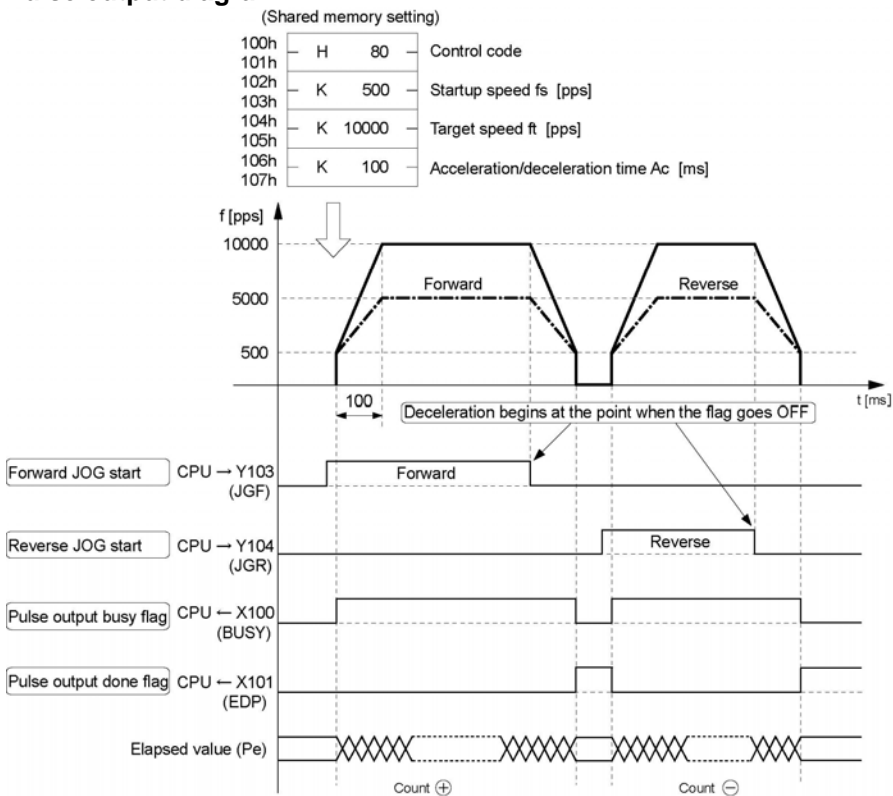
### 8.4.1 Example of Teaching Settings, and Sample Program

#### Example of teaching operation following JOG operation

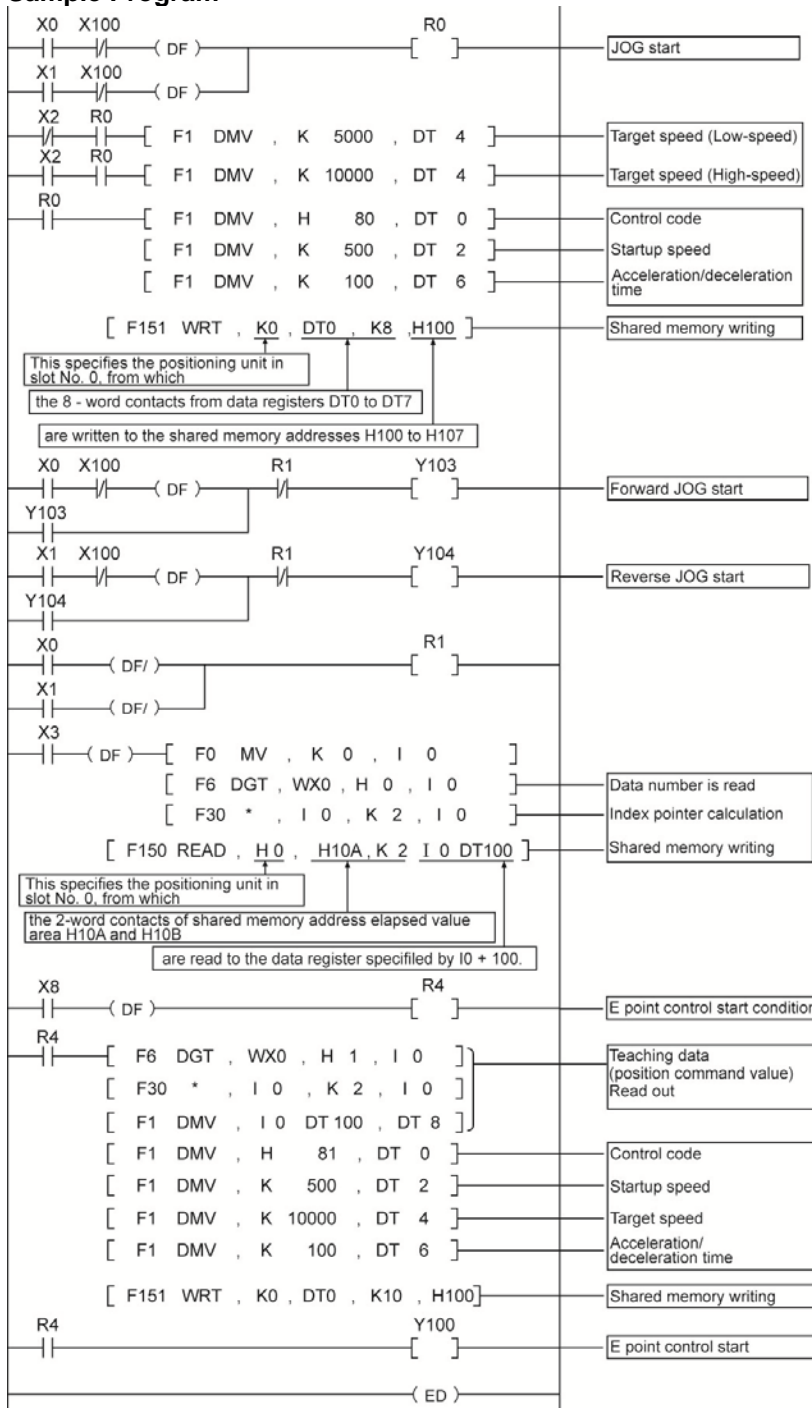
- The current position can be determined by reading the counter value stored in the shared memory of the unit after JOG operation has taken place.
- The value read at this time is the data for the absolute value.



#### Pulse output diagram



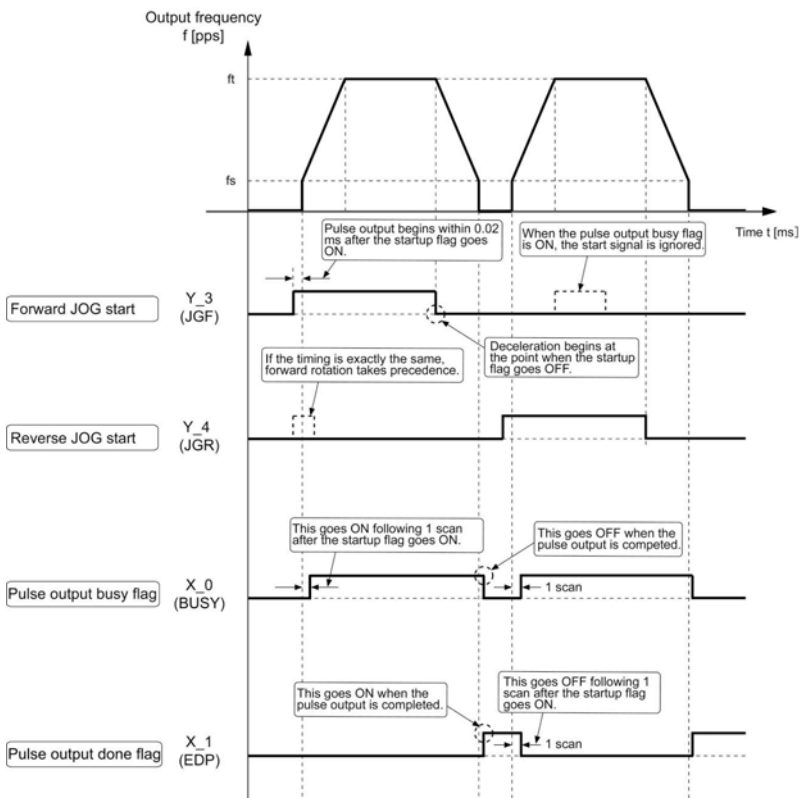
**Sample Program**



**Precautions concerning the program**

When Over limit switch (+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

## 8.5 Action of the I/O Flag Before and After JOG Operation



### Forward JOG flag (Y\_3)/Reverse JOG flag (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 start flag for forward and reverse rotation go ON at exactly the same timing, forward rotation takes precedence.

### 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, JOG positioning operation and home return. (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, JOG positioning 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, JOG positioning operation, and pulser input enabled operation.

## 8.6 Operation at Over limit Input

JOG operation is as follows when Over limit input (+) and Over limit input (-) is ON .  
The operation is possible for the direction in opposite of the input limit.

Condition	Direction	Limit status	Operation
When JOG operation is turned ON	Forward	Over limit input(+):ON	Table not to move, Limit error occurs.
		Over limit input (-):ON	Table to move.
	Reverse	Over limit input (+):ON	Table to move.
		Over limit input (-):ON	Table not to move, Limit error occurs.
During JOG operation	Forward	Over limit input (+):ON	Table stops, Limit error occurs.
	Reverse	Over limit input (-):ON	Table stops, Limit error occurs.

## 8.7 Cautions on an Over Limit Switch

---

An over limit input valid for a Jog operation, Home return (including Home search) and Pulser input is the one logically found in the direction of the table movement. i.e. if an Over limit switch (-) is input for a movement in (+) direction or an Over limit switch (+) is input for a movement in (-) direction, the table will not stop. Please observe the followings;

### - Before startup

Please make sure that an Over limit switch (+) is set in the direction of the elapsed value increment and an Over limit switch (-) in the direction of the elapsed value decrement.

### - When a switch is not set in the correct direction

The followings might be a cause. Check your settings and correct them;

- 1) An Over limit switch, (+) or (-), is not set in a correct direction.
- 2) CW/CCW output method is set reverse for the connection of the Positioning unit and the motor driver.
- 3) A Sign input logic is set reverse for the connection of the Positioning unit and the motor driver.
- 4) The control codes are to specify the reverse direction of the rotation for the pulse output (forward or reverse) in the program.



# Chapter 9

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## JOG Positioning Operation

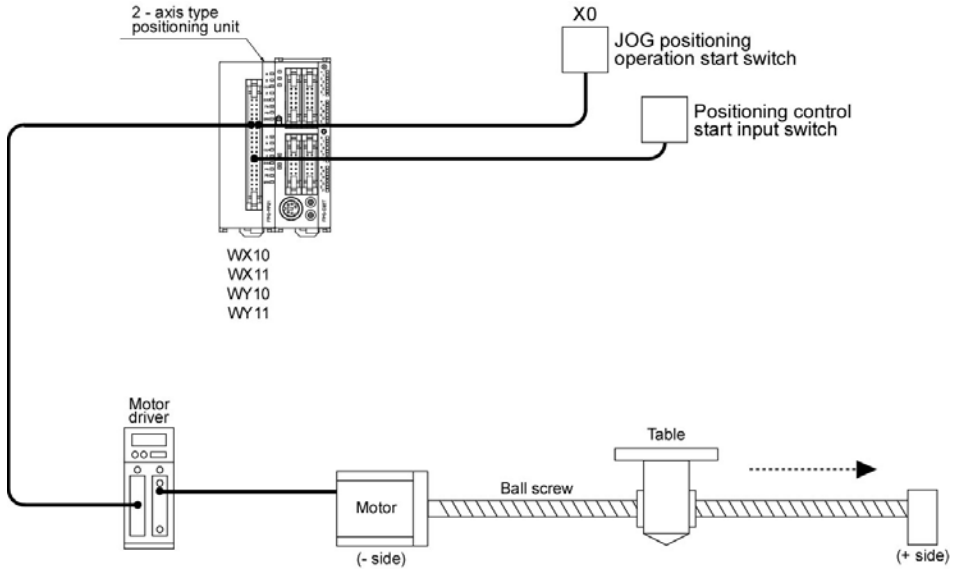


## 9.1 Sample Program

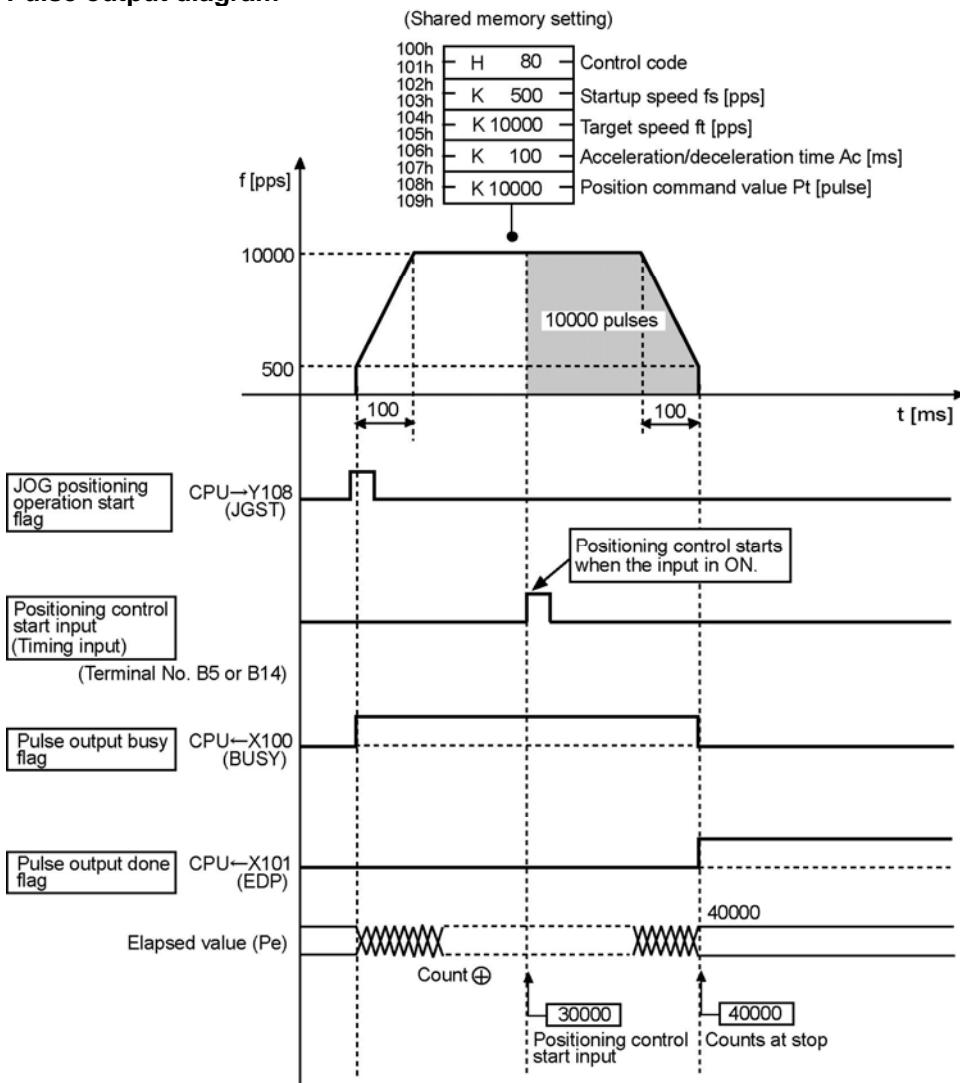
### 9.1.1 Increment (Relative Value Control): Plus (+) Direction

This is a program to start the JOG positioning operation (speed control -> position control) from JOG operation by the external switch input.

The "Increment" method is used for the travel amount setting and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction.



**Pulse output diagram**



**Operations of the various flag**

- X100, the Pulse output busy (BUSY) flag, is turned ON during the JOG positioning operation and is turned OFF when the pulse output is completed.
- X101, the Pulse output done (EDP) flag, is turned ON when the pulse output is completed and remains until any of E point control, P point control, JOG operation, JOG positioning operation, home return or pulser input enabled operations is started up.
- The elapsed value is stored in the counter inside the positioning unit as an absolute value.

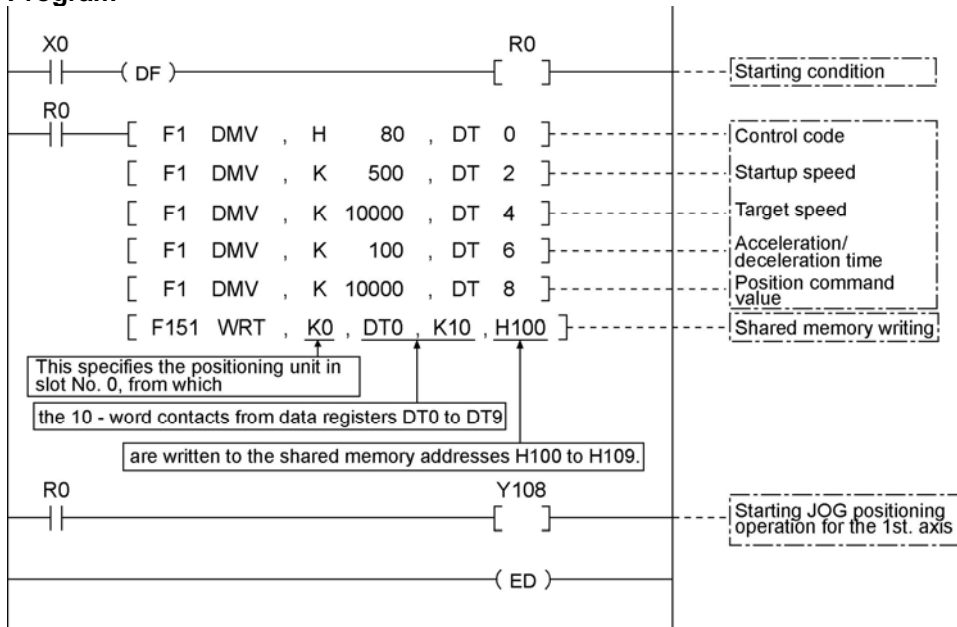
**Shared memory settings**

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H80 Note 1: <Increment method, Linear acceleration/deceleration>	Refer to page 16-7.
Startup speed (pps)	K500	K0 to K4,000,000
Target speed (pps)	K10000	K1 to K4,000,000 Specify a value larger than the startup speed.
Acceleration/deceleration time(ms)	K100	K0 to K32,767
Position command value (pulse)	K10000 Note 2:	K - 2,147,483,648 to K2,147,483,647

**Note 1:** If the limit error occurs, set H0 as the limit input valid logic can be changed.

**Note 2:** A set value error occurs in Absolute method.

**Program**



**Precautions concerning the program**

When Over limit switch (+) and Over limit switch (-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation JOG positioning operation, home return, and other types of control.  
These should not be overwritten by other conditions.
- Set the position command value in the "Increment" method. A set value error occurs with the absolute value.
- 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 start flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

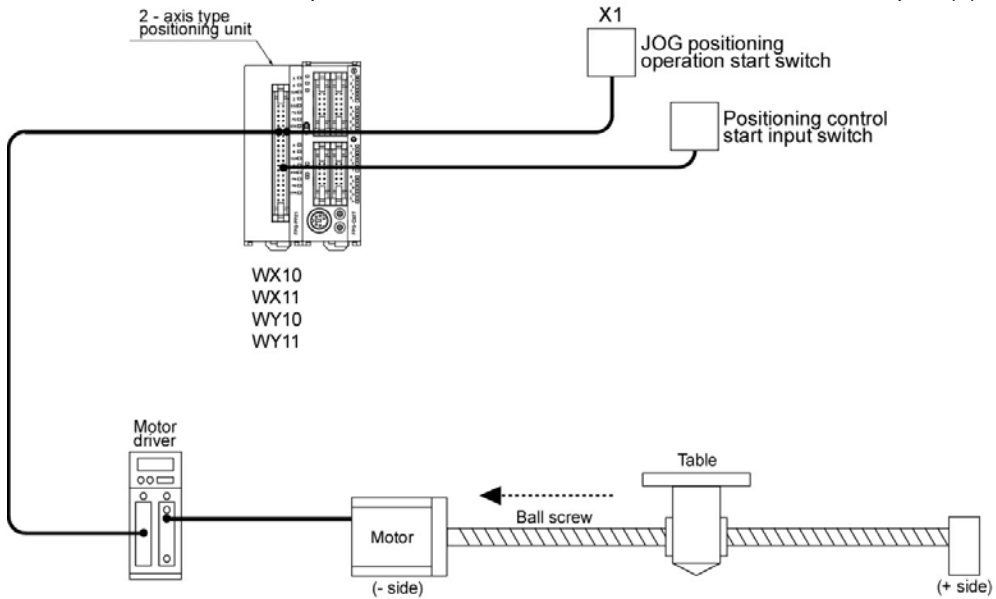
**JOG positioning operation start input timing**

When the positioning control start input (Timing input) has been already ON when turned ON the JOG positioning operation start flag (Y\_8), the positioning control is immediately started. When the positioning control start input (Timing input) is turned ON during acceleration, also the positioning control is immediately started.

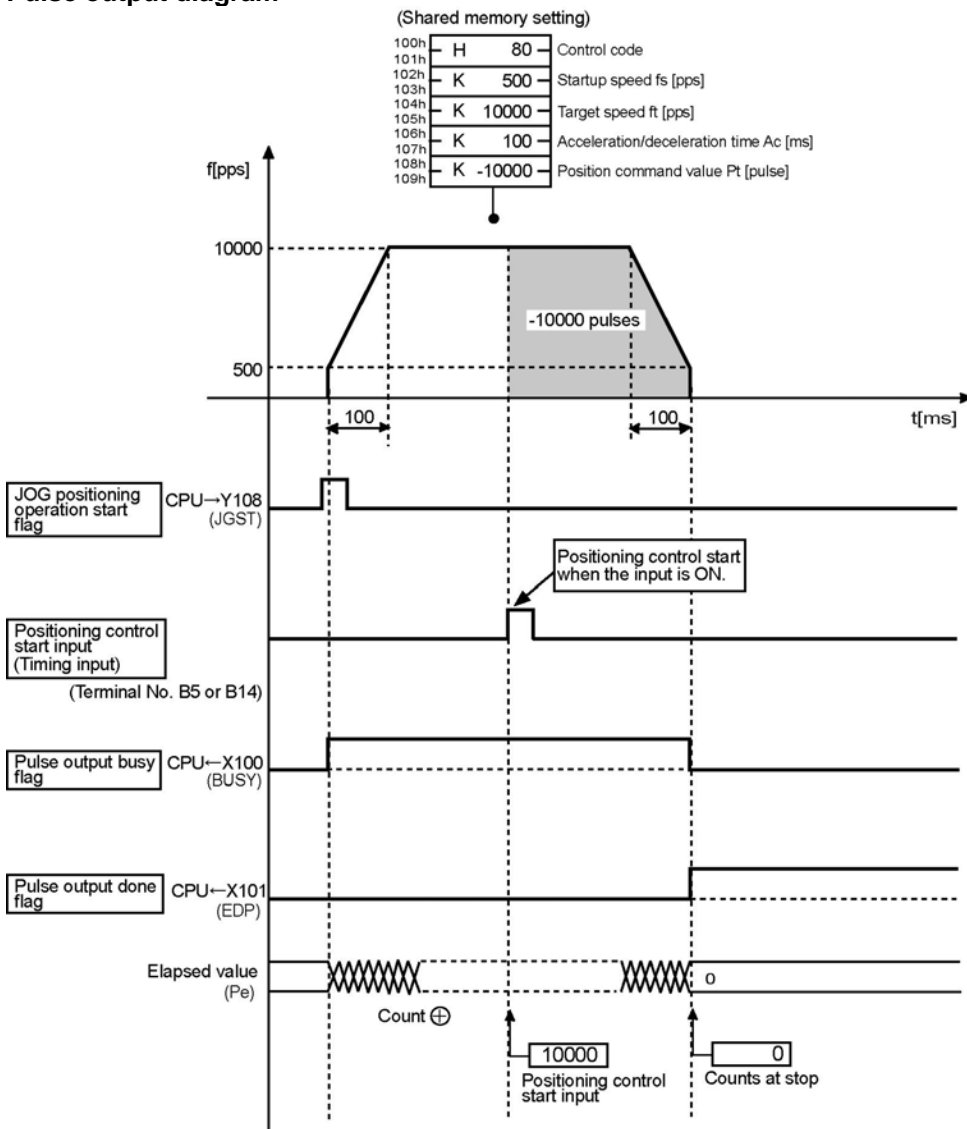
When the positioning control start input (Timing input) does not go ON after the JOG positioning operation started up, the pulses keep going out.

### 9.1.2 Increment (Relative Value Control): Minus (-) Direction

This is a program to start the JOG positioning operation (speed control -> position control) from JOG operation by the external switch input. The "Increment" method is used for the travel amount setting and the direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction.



**Pulse output diagram**



**Operations of the various flag**

- X100, the Pulse output busy (BUSY) flag, is turned ON during the JOG positioning operation and is turned OFF when the pulse output is completed.
- X101, the Pulse output done (EDP) flag, is turned ON when the pulse output is completed and remains until any of E point control, P point control, JOG operation, JOG positioning operation, home return or pulser input enabled operations is started up.
- The elapsed value is stored in the counter inside the positioning unit as an absolute value.



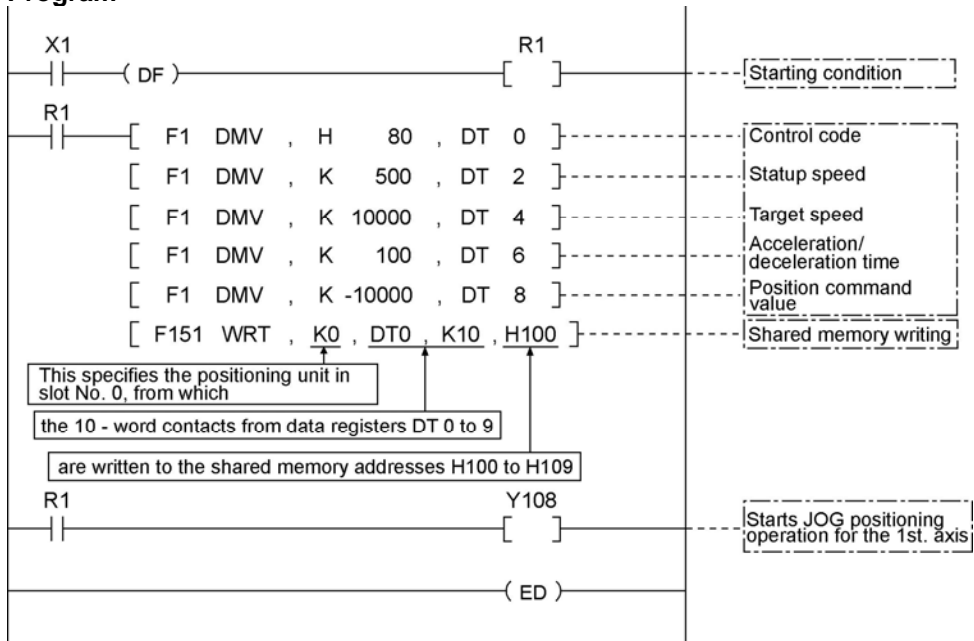
**Shared memory settings**

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H80 Note 1: Increment method, Linear acceleration/deceleration	Refer to page 16-7.
Startup speed (pps)	K500	K0 to K4,000,000
Target speed (pps)	K10000	K1 to K4,000,000 Set a value larger than the startup speed.
Acceleration/deceleration time(ms)	K100	K0 to K32,767
Position command value (pulse)	K-10000 Note 2:	K - 2,147,483,648 to K2,147,483,647

**Note 1:** If the limit error occurs, set H0 as the limit input valid logic can be changed.

**Note 2:** A set value error occurs in Absolute method.

**Program**



**Precautions concerning the program**

When Over limit switch (+) and Over limit switch (-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning operation, home return, and other types of control. These should not be overwritten by other conditions.
- Set the position command value in the "Increment" method. A set value error occurs with the absolute value.
- If the values for the startup speed, the target speed, position command value 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 start flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.

**JOG positioning operation start input timing**

When the positioning control start input (Timing input) has been already ON when turned ON the JOG positioning operation start flag (Y\_8), the positioning control is immediately started. When the positioning control start input (Timing input) is turned ON during acceleration, also the positioning control is immediately started.

When the positioning control start input (Timing input) does not go ON after the JOG positioning operation started up, the pulses keep going out.

## 9.2 Flow of JOG Positioning

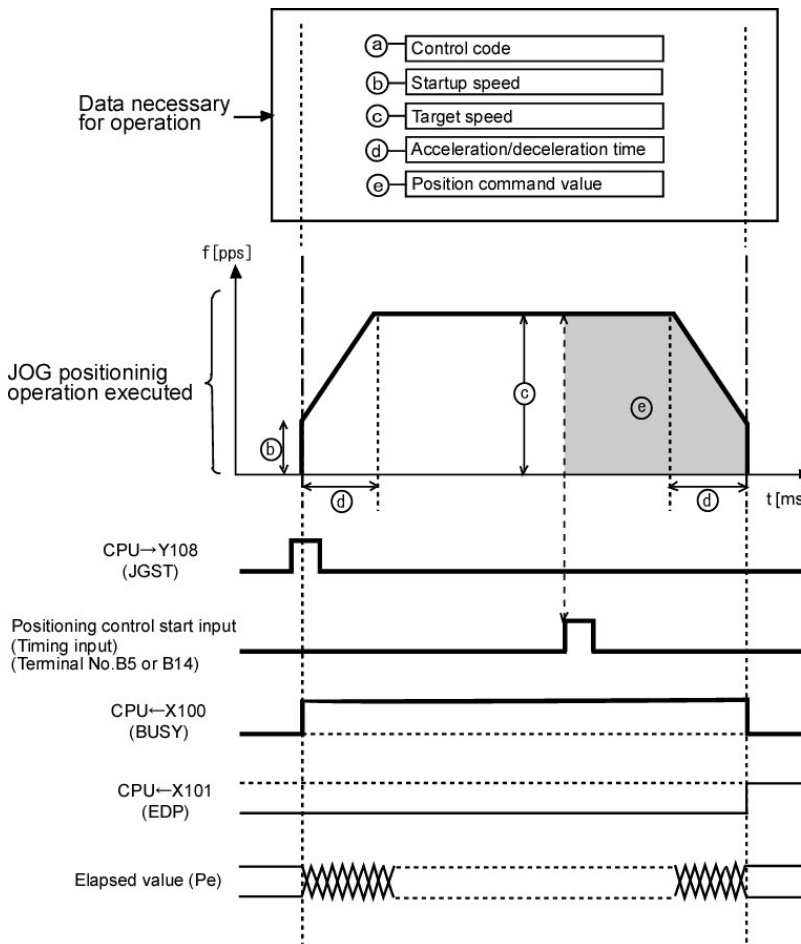
### JOG positioning operation

-When the flag for JOG positioning operation start flag (JGST) (Y\_8) is turned ON, a speed control, automatic acceleration/deceleration, in accordance with the specified data table, and the table travels for the value set by the positioning control start input.  
 -S Acceleration/Deceleration can be selected. (Sin curve, Secondary curve, Cycloid curve, Third curve)

### When is mounted in slot 0

### Operation example

When the flag for initiating JOG positioning operation is turned ON, acceleration/deceleration is carried out repeatedly, in accordance with the settings, and then the operation stops.



When Y108 is set to ON in the program, the motor of the first axis begins accelerating. X100 is a Pulse output busy (BUSY) flag that indicates that operation is in progress, while X101 is a Pulse output done (EDP) flag that indicates that operation has been completed. After operation has been completed, the EDP flag remains ON until the next operation request is issued.

When the positioning control start input (Timing input) is turned ON, the pulse for the position command value is output.

**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. However, for repeating the same operation, re-setting is not necessary.

When the control code is not changed, re-setting every startup is not necessary since the values written once after Power ON are retained.

Operation is determined by these five types of data.

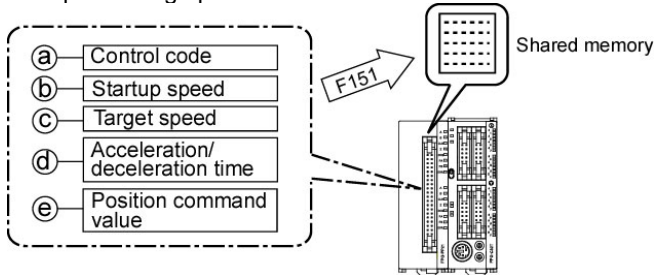
- Control code
- Startup speed
- Target speed
- Acceleration/deceleration time
- Position command value

**Operation steps**

**Step 1: Preparatory stage**

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

Data for  
JOG positioning operation



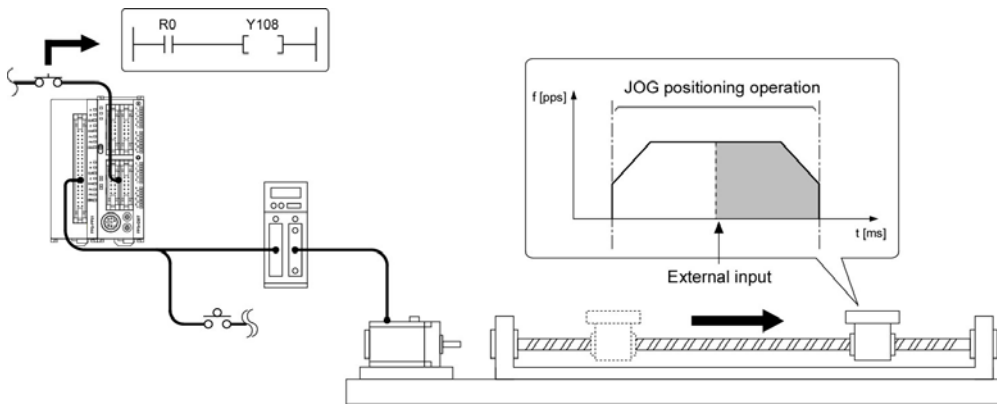
**Step 2: Executing the operations**

Operation begins when the flag Y108 for JOG positioning operation is turned ON.

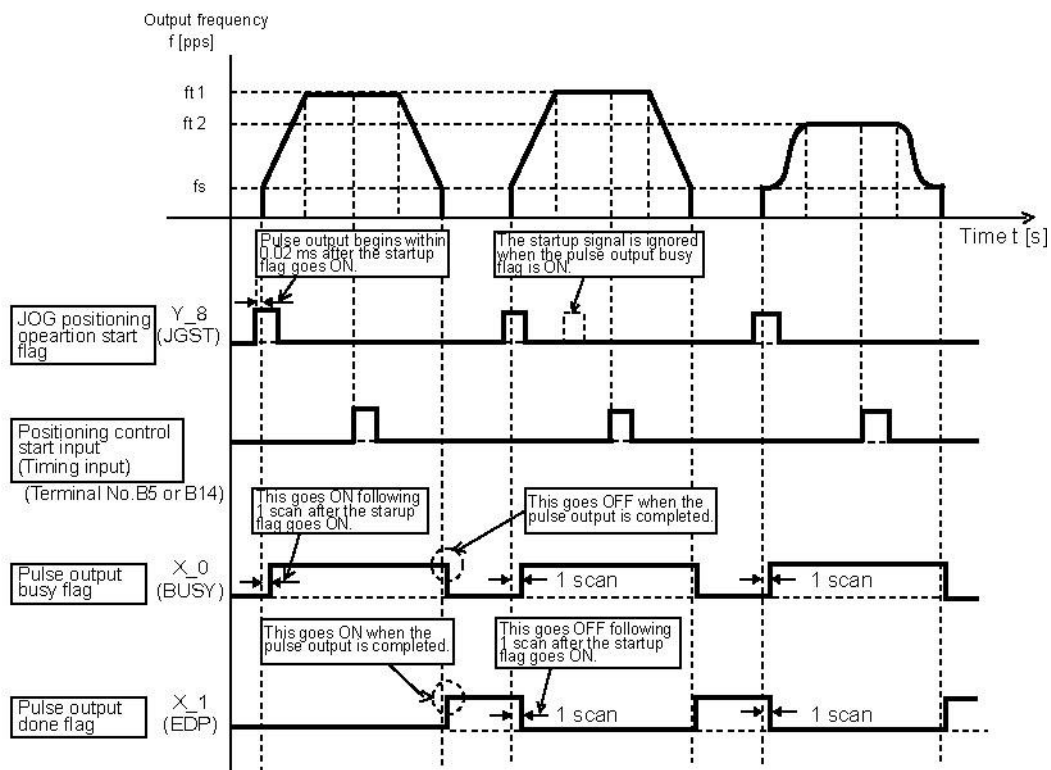
The control code determines whether S acceleration/deceleration or linear acceleration/deceleration is used.

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 pulse count for the position command value, which are output after the positioning control start input.



## 9.3 Operation of the Input and Output Flag at JOG Positioning Operation



### JOG positioning operation start flag(Y\_8)

1. JOG positioning operation is initiated based on the parameters written to the positioning unit.
2. JOG positioning operation is not initiated during the time that the pulse output busy flag (X\_0) is ON. (already initiated.)
3. JOG positioning operation start flag is reset when the power supply is turned OFF.

### Pulse output busy flag(X\_0)

1. This goes ON with the next scan after JOG positioning 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 flag is reset when the power supply is turned OFF.
- This flag is shared among E point control, P point control, JOG operation, JOG positioning operation and home return. (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, JOG positioning 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, JOG positioning operation and pulser input enabled operation.

## 9.4 Operation at Over limit Input

JOG positioning operation is as follows when Over limit input (+) or Over limit input(-) is ON.  
The operation is possible for the direction in opposite of the input limit.

Condition	Direction	Limit status	Operation
<b>When JOG positioning operation is turned ON</b>	Forward	Over limit input (+):ON	Table not to move, Limit error occurs.
		Over limit input (-):ON	Table not to move, Limit error occurs
	Reverse	Over limit input (+):ON	Table not to move, Limit error occurs
		Over limit input (-):ON	Table not to move, Limit error occurs.
<b>During JOG positioning operation</b>	Forward	Over limit input (+):ON	Table stops, Limit error occurs.
	Reverse	Over limit input (-):ON	Table stops, Limit error occurs.

## 9.5 Special Mention

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### **Positioning control start input (Timing input) and where to stop**

The FP  $\Sigma$  Positioning unit performs the process in the very high speed, so that it starts counting the number of the output pulses within 15 $\mu$ s from when the positioning control start input (timing input) is ON during the JOG positioning operation. The time is always stable, enabling the table to stop at the specified very accurately. Since each axis is completely independent, the high-accurate stop is possible even with the multiple axes.

### **Role of JOG positioning start flag(Y\_9)**

Turn ON this flag in the program, so that the JOG positioning operation starts. Even if the Positioning control start input (Timing input) (to terminal No. B5 or B14) is OFF, this can be used for confirming the operation status.

### **Role of timing input monitor flag (X\_D)**

Turn ON this flag in the program, so that the Positioning control start input (Timing input) status can be monitored.



# Chapter 10

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## Home Return



# 10.1 How to Use Home Return

## 10.1.1 Return to Home Position by a Home Search

### Home Search

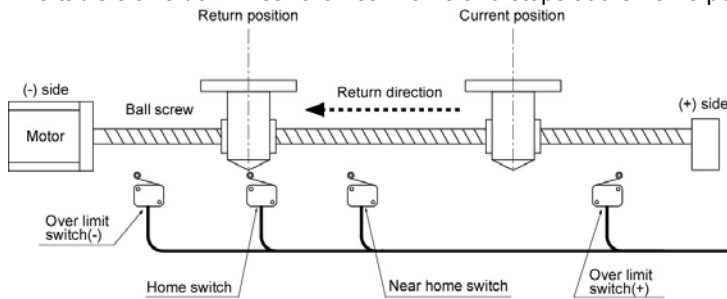
Over limit switch(+) or Over limit switch(-) when the home position is in between where the table travels or when the direction of the home return could be in the both directions, so that the Home return in the both directions will be possible.

Setting the control code Lower the 6th. bit to 1 allows a home position search.

When the near home input is made during acceleration, the table automatically reverses the direction to check ON near home input and then OFF near home input. Then, the home return operation is automatically executed.

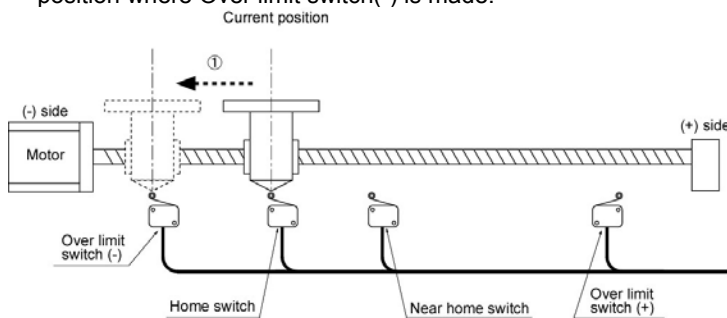
#### -When Near home input exists in the direction of home return

The table slows down near the near home and stops at the home position.

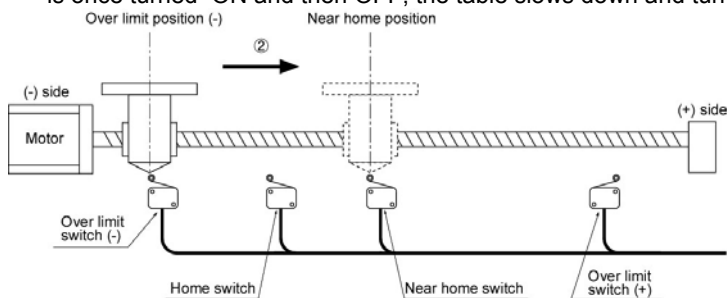


#### -When Near home input does not exist in the direction of home return

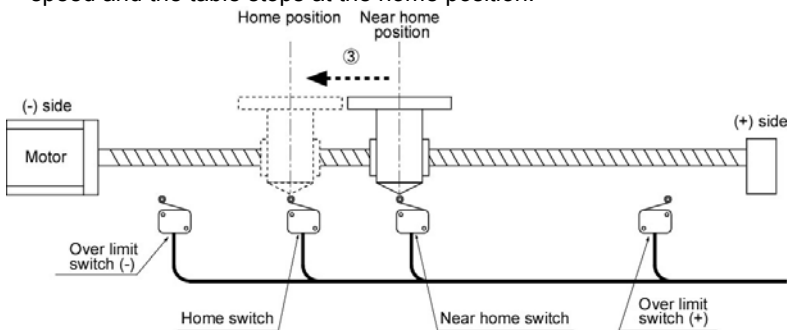
- ① Home return operation starts in the direction specified in the program. The table travels to the position where Over limit switch(-) is made.



- ② When Over limit switch(-) is detected, the table reverses the direction. When the near home input is once turned ON and then OFF, the table slows down and turns around.

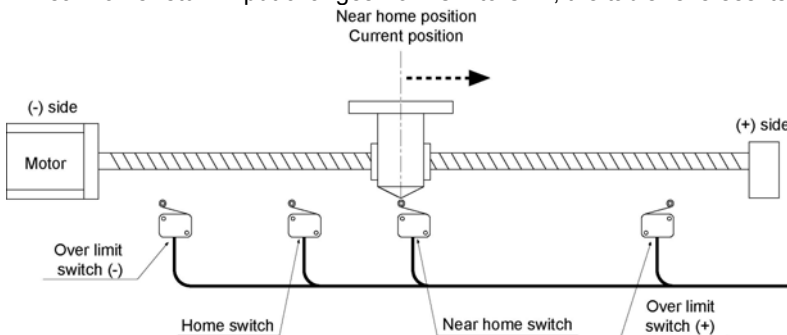


3) When the near home is detected again, the speed slows down from the target speed to the startup speed and the table stops at the home position.

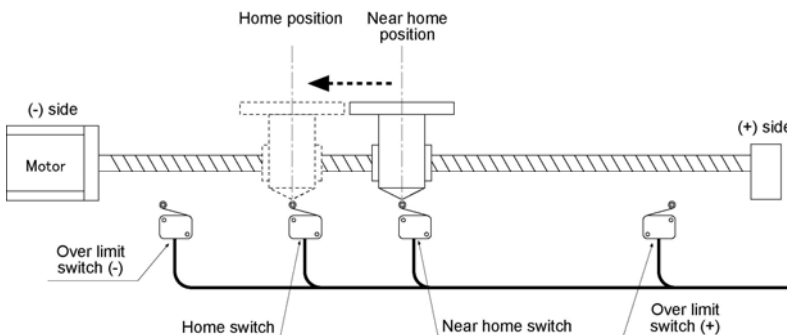


**-When Near home input is ON during home return**

1) Home return operation starts in the opposite direction of the one specified in the program. When the near home return input changes from ON to OFF, the table reverses its direction.



2) When the near home is detected again, the speed slows down from the target speed to the startup speed and the table stops at the home position.



**Note:** The above operation is also applicable when the speed does not reach the target one before the table comes to the Near home position.

### 10.1.2 Home Return (Home search invalid mode)

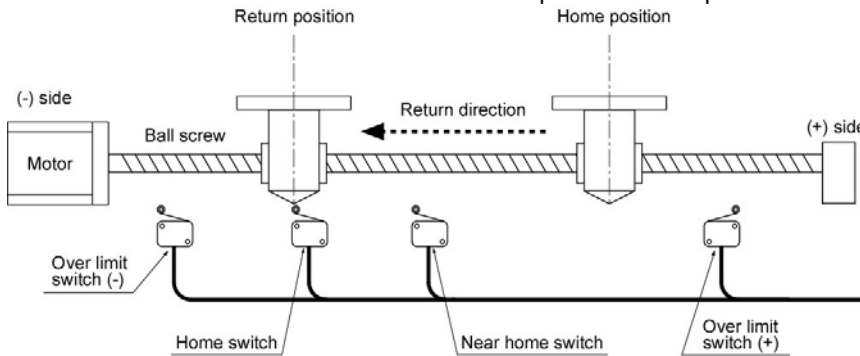
#### Home search invalid mode

When the home position is in between where the table travels, the table does not reverse the direction but stops by detecting Over limit switch (+) or (-).

Setting the control code Lower the 6th. bit to 0 invalidates a home position search.

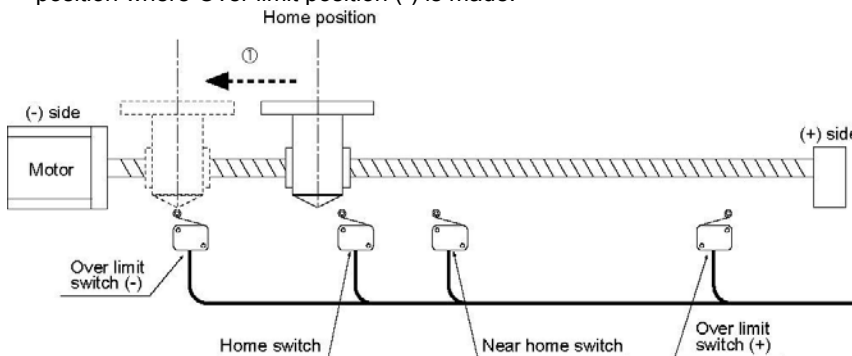
#### -When Near home input exists in the direction of home

The table slows down near the near home and stops at the home position.



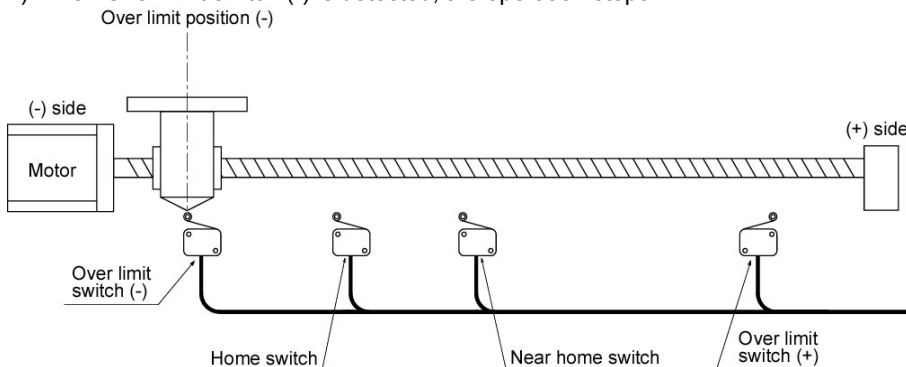
#### -When Near home input does not exist in the direction of home return

1) Home return operation starts in the direction specified in the program. The table travels to the position where Over limit position (-) is made.



**Note:** If the home switch is ON when Home return is requested, the unit recognizes the table is already home-returned. Therefore, the table will not move and completes Home return.

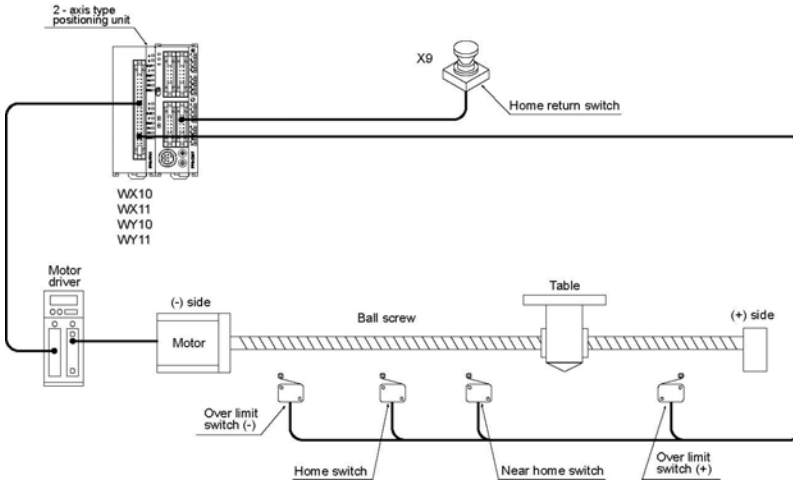
2) When Over limit switch (-) is detected, the operation stops.



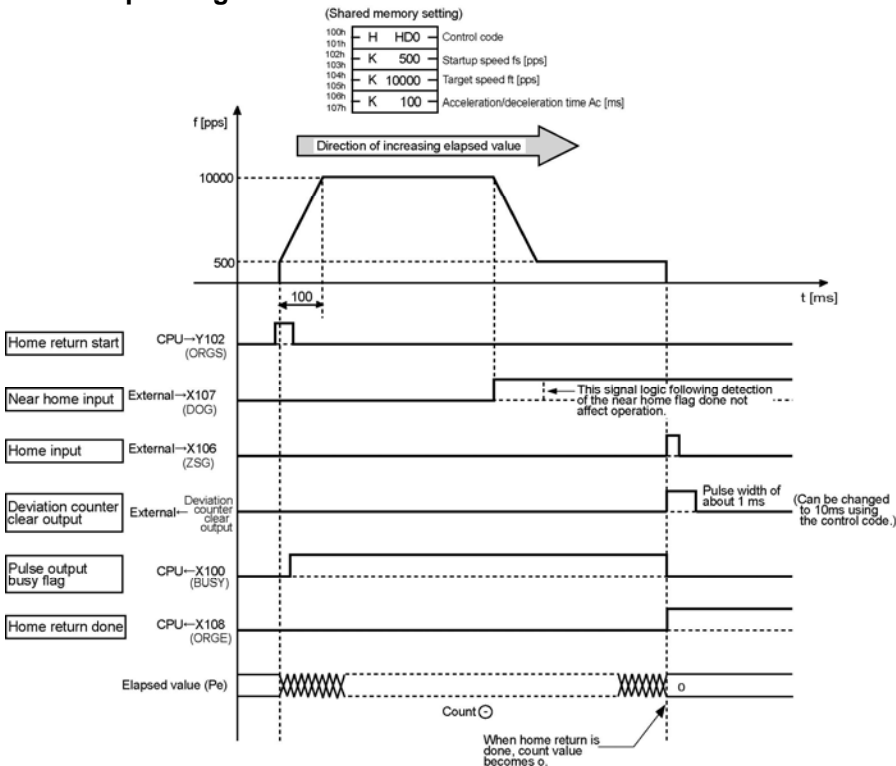
## 10.2 Sample Program

### 10.2.1 Search to home in the Minus Direction

Search to the home position are carried out in the minus direction. The direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. The home input is connected to the Z phase output of the motor driver, or to an external switch or a sensor.



### Pulse output diagram



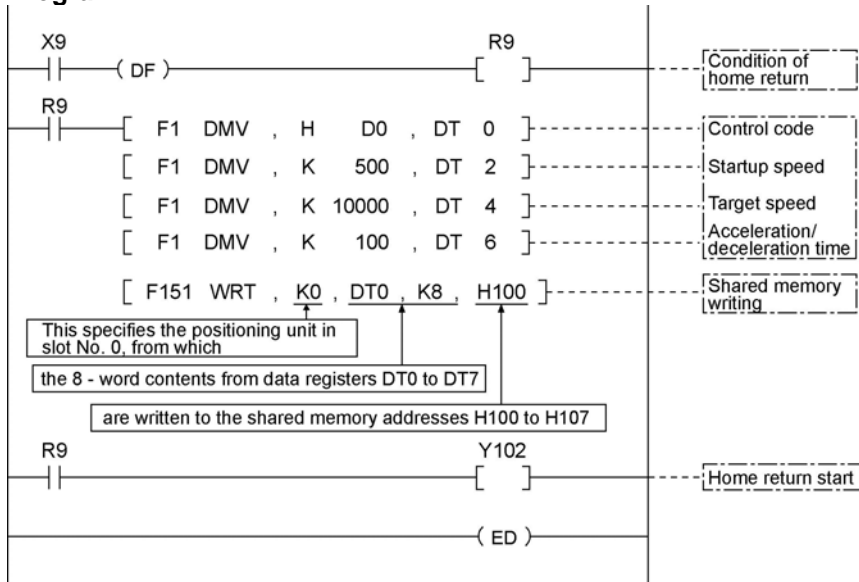
**Shared memory settings**

Control parameter setting content	Set values in sample program example	Range of acceptable settings
<b>Control code</b>	HD0 Note: Acceleration/deceleration method: Linear acceleration/deceleration Direction of home return: - direction of elapsed value 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. (Refer to page 16-7.)
<b>Startup speed (pps)</b>	K500	K1 to K4,000,000
<b>Target speed (pps)</b>	K10000	K1 to K4,000,000 Specify a value larger than the startup speed.
<b>Acceleration/deceleration time(ms)</b>	K100	K0 to K32,767

**Note:** Home search function is valid.

**Note:** If the limit error occurs, set H50 as the limit input valid logic can be changed.

**Program**



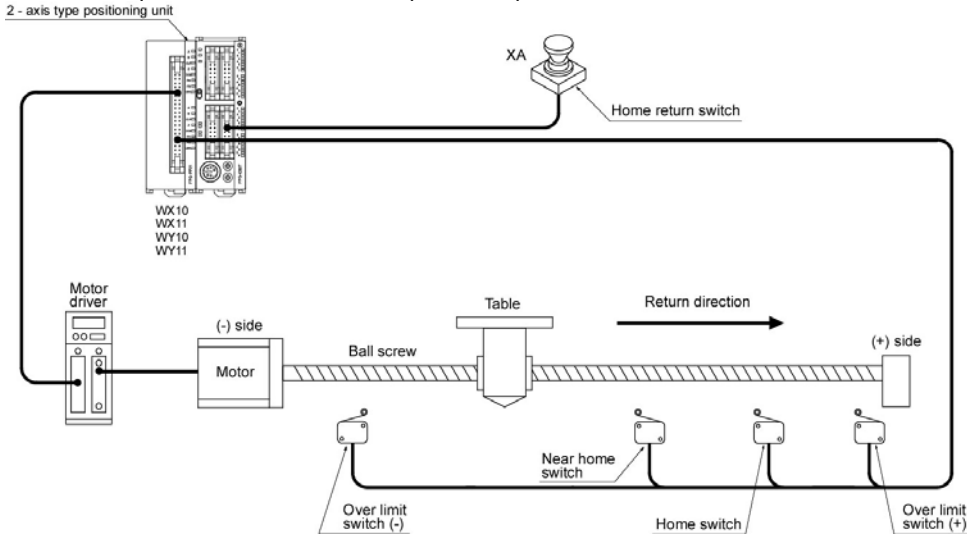
**Precautions concerning the program**

When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

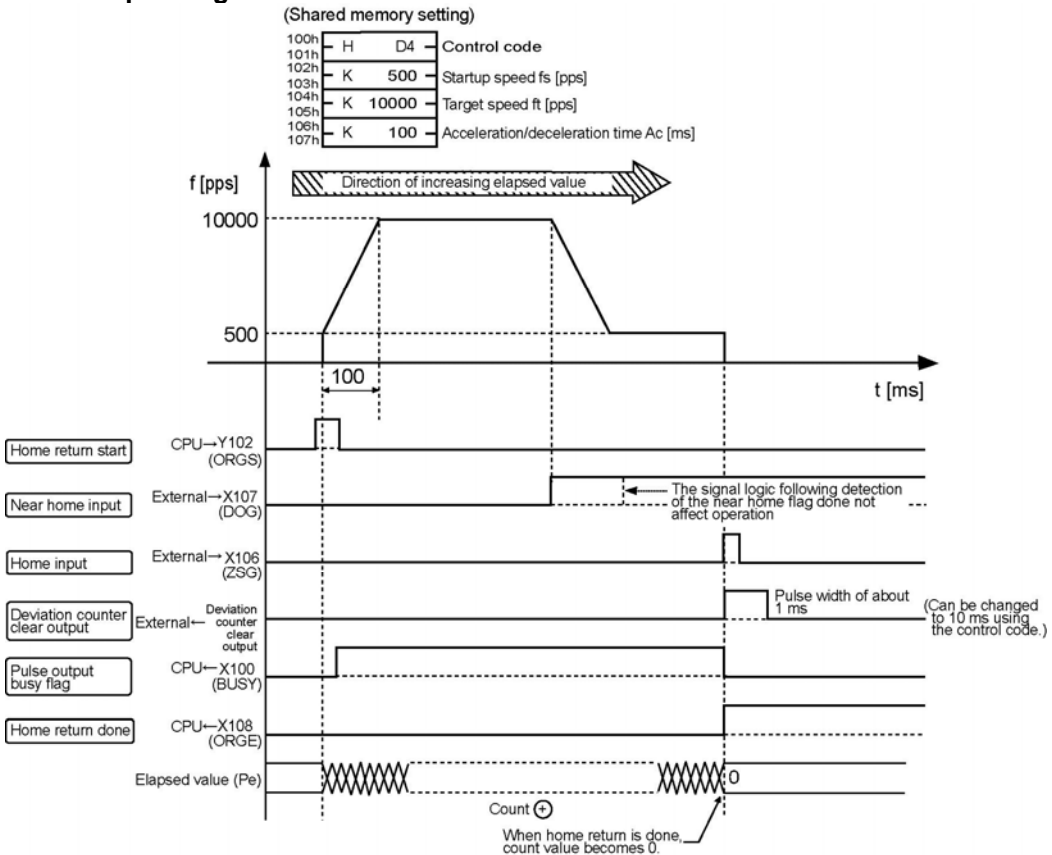
- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning operation, home return, and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, 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. Set the startup speed to 1pps or more.
- The number of the start flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.
- The control code settings vary depending on the logic of the near home input and the home return input which have been connected.

### 10.2.2 Search to the home in the Plus Direction

Search to the home position is carried out in the plus direction. The direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. The home input is connected to the Z phase output of the motor driver, or to an external switch or sensor.



### Pulse output diagram





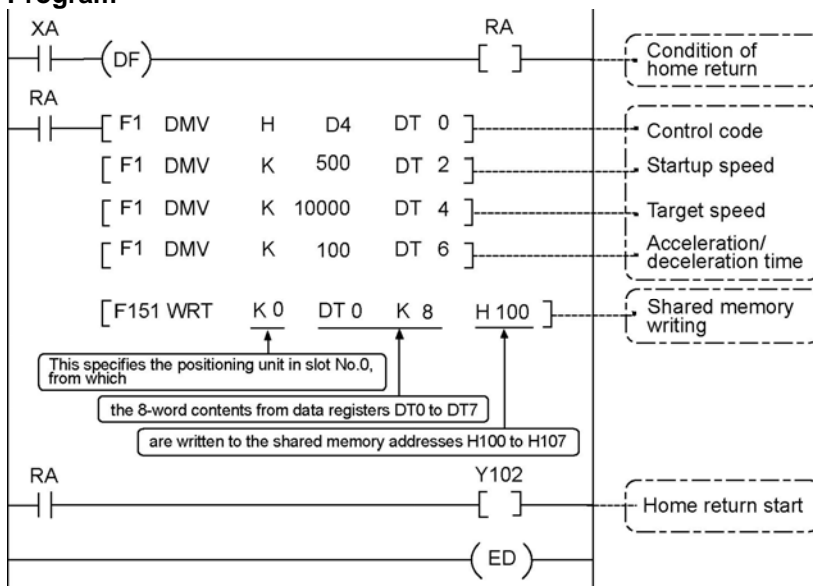
**Shared memory settings**

Control parameter setting content	Set values in sample program example	Range of acceptable settings
<b>Control code</b>	HD4 Note: Acceleration/deceleration method: Linear acceleration /deceleration Direction of home return: + direction of elapsed value 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. (Refer to page 16-7.)
<b>Startup speed (pps)</b>	K500	K1 to K4,000,000
<b>Target speed (pps)</b>	K10000	K1 to K4,000,000 Specify a value larger than the startup speed.
<b>Acceleration/deceleration time(ms)</b>	K100	K0 to K32,767

**Note:** Home search function is valid.

**Note:** If the limit error occurs, set H54 as the limit input valid logic can be changed.

**Program**



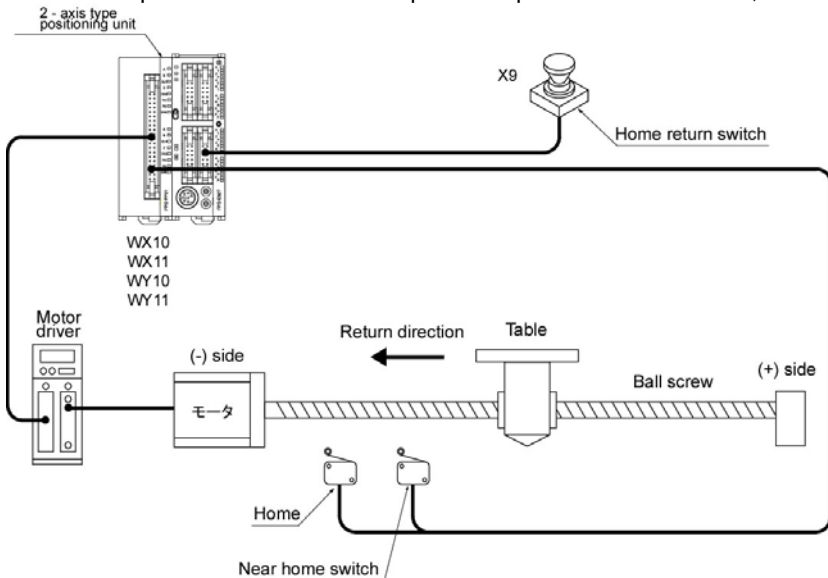
**Precautions concerning the program**

When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, the input existing without the Over limit switch connection.

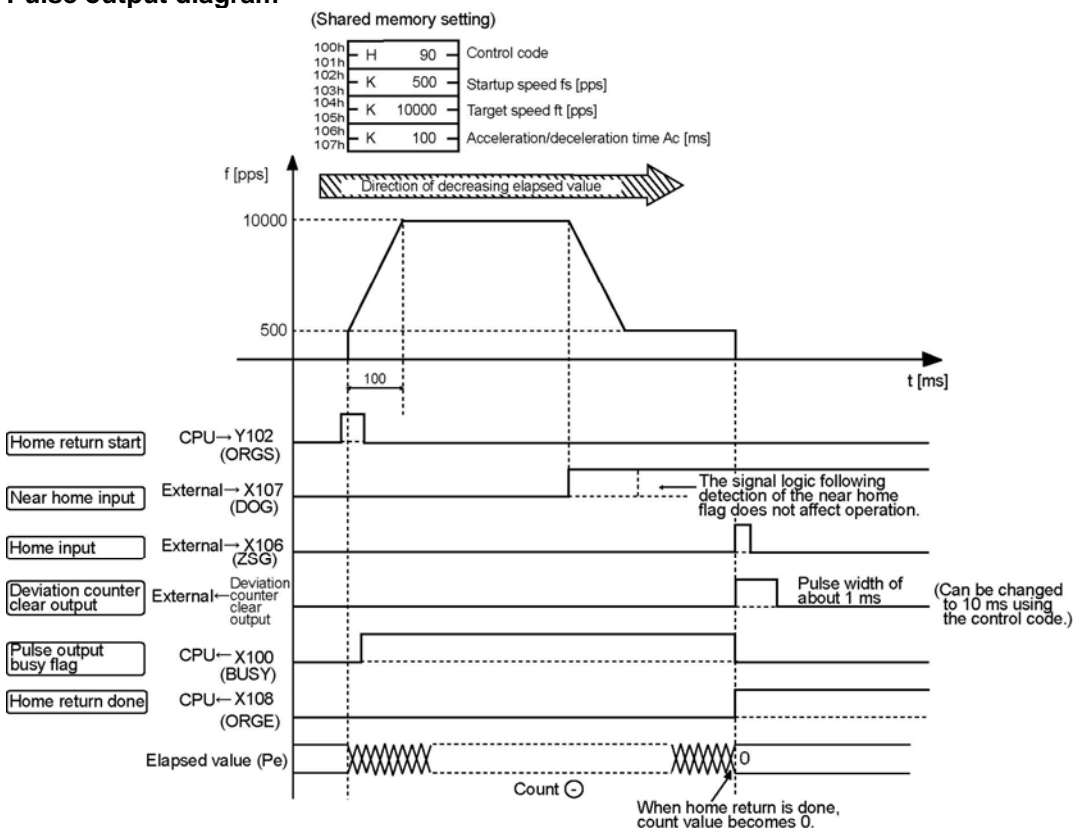
- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning operation, home return and other types of control. These should not be overwritten by other conditions.
- If the values for the startup speed, 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. Set the startup speed to 1pps or more.
- The number of the startup flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.
- The control code settings vary depending on the logic of the home input and the near home input which have been connected.

### 10.2.3 Home Return in the Minus Direction (Home search invalid mode)

Returns to the home position are carried out in the minus direction. The direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. The home input is connected to the Z phase output of the motor driver, or to an external switch or sensor.



#### Pulse output diagram

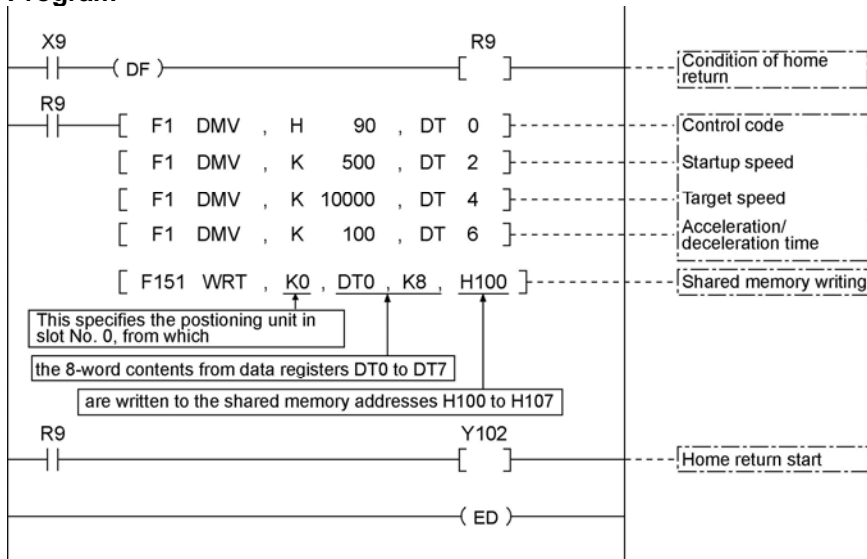


**Shared memory settings**

Control parameter setting content	Set values in sample program example	Range of acceptable settings
<b>Control code</b>	H90 Note: 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. (Refer to page 16-7.)
<b>Startup speed (pps)</b>	K500	K1 to K4,000,000
<b>Target speed (pps)</b>	K10000	K1 to K4,000,000 Specify a value larger than the startup speed.
<b>Acceleration/deceleration time(ms)</b>	K100	K0 to K32,767

**Note:** If the limit error occurs, set H10 as the limit input valid logic can be changed.

**Program**



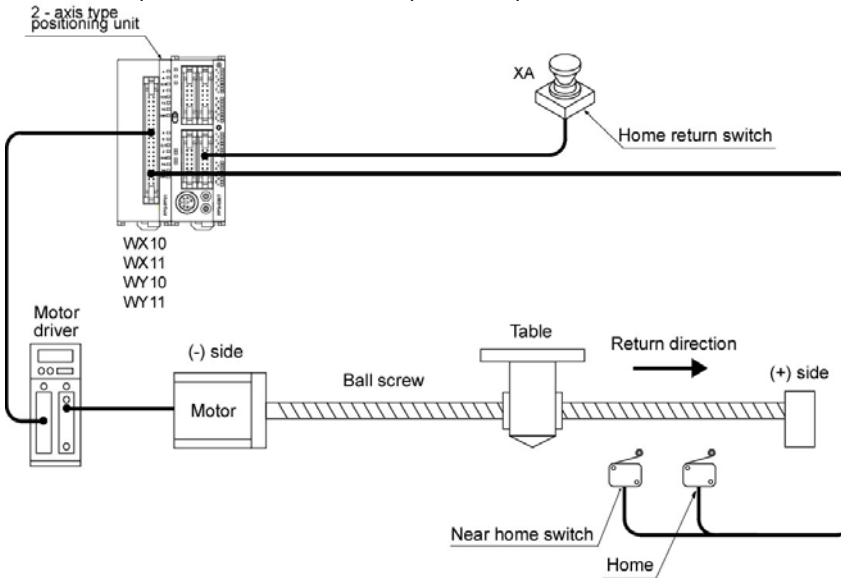
**Precautions concerning the program**

When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning operation, home return, 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. Set the startup speed to 1pps or more.
- The number of the start flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.
- The control code settings vary depending on the logic of the home return input and the near home input which have been connected.

### 10.2.4 Home Return in the Plus Direction (Home search invalid mode)

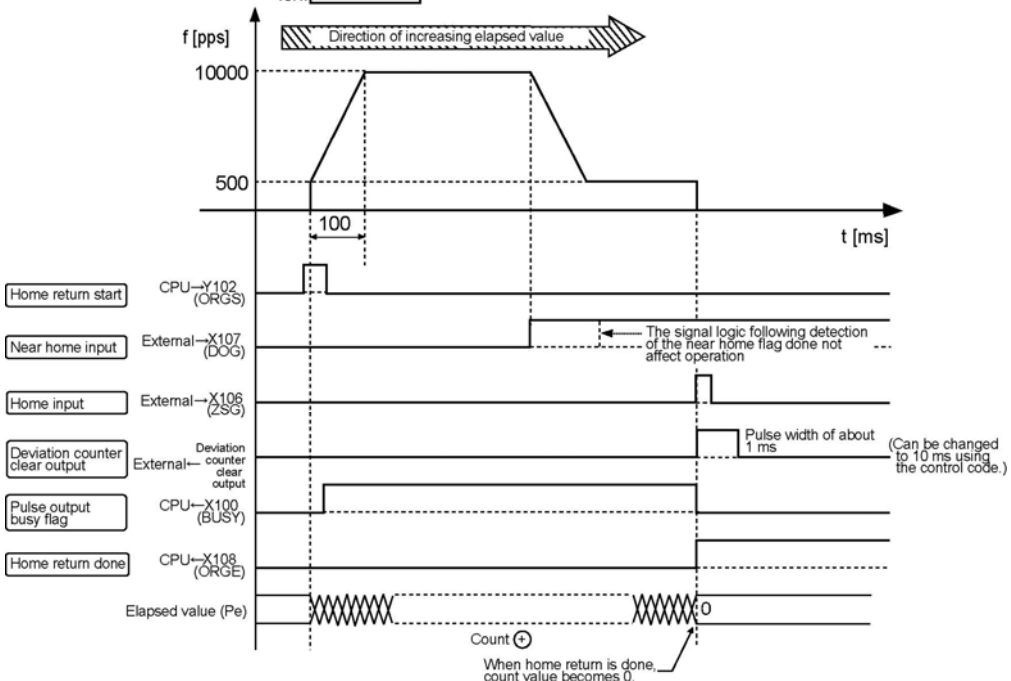
Returns to the home position are carried out in the plus direction. The direction in which the elapsed value increases as the motor rotates is set as the plus (+) direction. The home input is connected to the Z phase output of the motor driver, or to an external switch or sensor.



#### Pulse output diagram

(Shared memory setting)

100h	H	94	Control code
101h	K	500	Startup speed fs [pps]
102h	K	10000	Target speed ft [pps]
103h			
104h	K	10000	Target speed ft [pps]
105h			
106h	K	100	Acceleration/deceleration time Ac [ms]
107h			

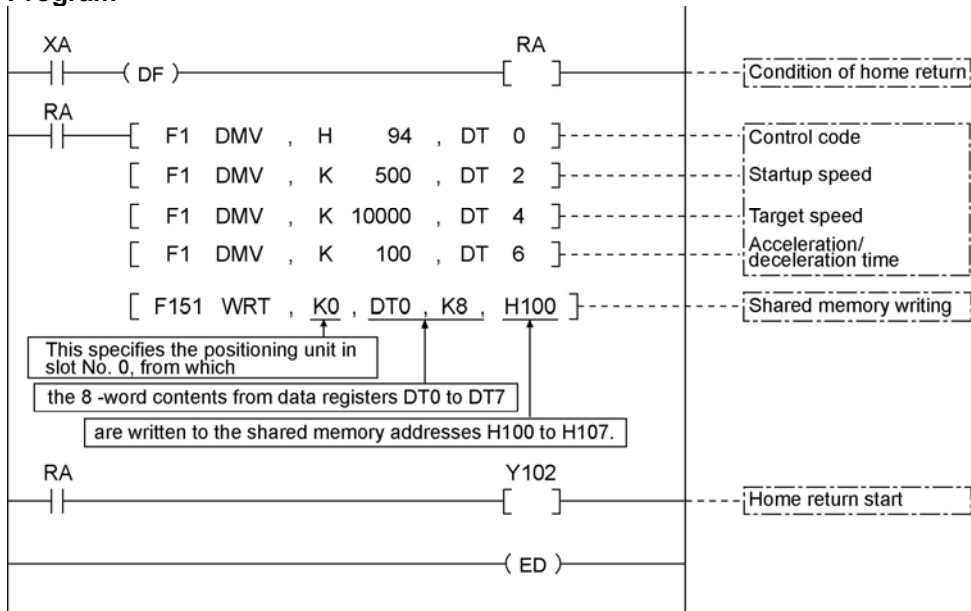


**Shared memory settings**

Control parameter setting content	Set values in sample program example	Range of acceptable settings
<b>Control code</b>	H94 Note: Acceleration/deceleration method: Linear acceleration/ deceleration Direction of home return: + direction of elapsed value 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. (Refer to page 16-7.)
<b>Startup speed (pps)</b>	K500	K1 to K4,000,000
<b>Target speed (pps)</b>	K10000	K1 to K4,000,000 Specify a value larger than the startup speed.
<b>Acceleration/deceleration time (ms)</b>	K100	K0 to K32,767

**Note:** If the limit error occurs, set H14 as the limit input valid logic can be changed.

**Program**



**Precautions concerning the program**

When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, the input existing without the Over limit switch connection.

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning operation, home return, 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. Set the startup speed to 1pps or more.
- The number of the start flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.
- The control code settings vary depending on the logic of the home return input and the near home input which have been connected.

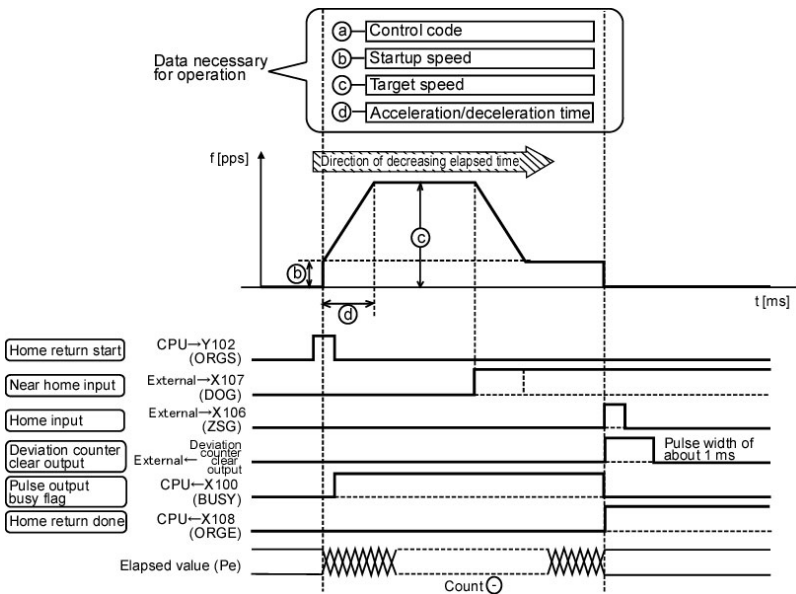
## 10.3 Flow of Operation Following a Home Return

### Home return

#### When is mounted in slot 0

#### Operation example

When the startup flag 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 Y102 is turned ON in the program above, 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

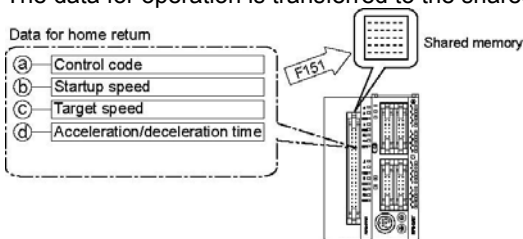
- The following data must be written to the specified addresses of the shared memory.
- Control code can change the home return direction, home input valid logic, near home input valid logic, with or without home search and limit input valid logic.
- Operation is determined by the following four types 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.

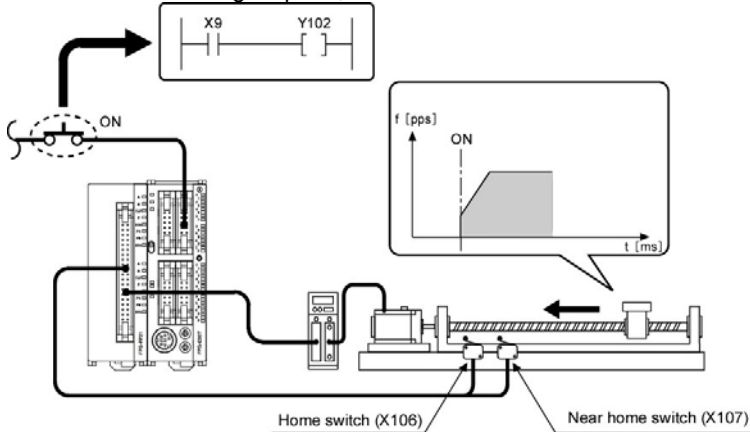


**Step 2: Executing the operations**

The startup flag Y102 is turned ON.

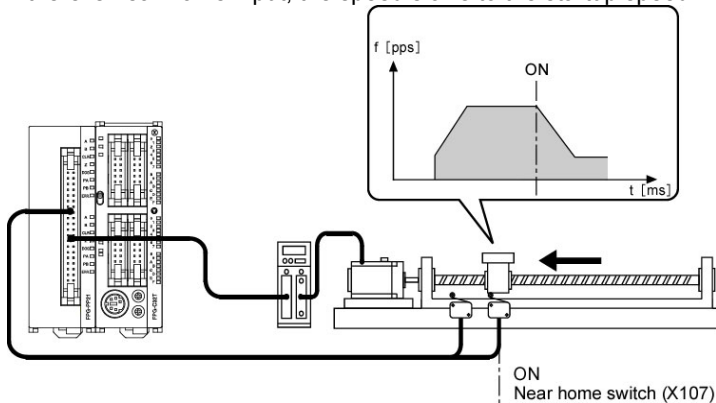
The control code determines whether S acceleration/deceleration or linear acceleration/deceleration is used.

When the startup flag is turned ON, acceleration takes places for the acceleration/deceleration time it takes to reach the target speed, and the table moves.



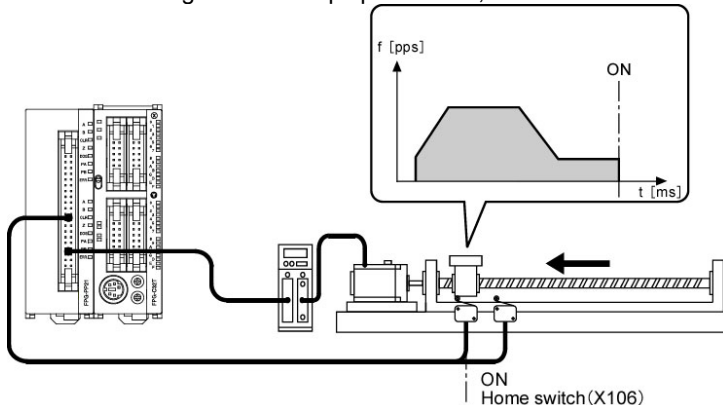
**Step 3: Near home input**

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



**Step 4: Home input**

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



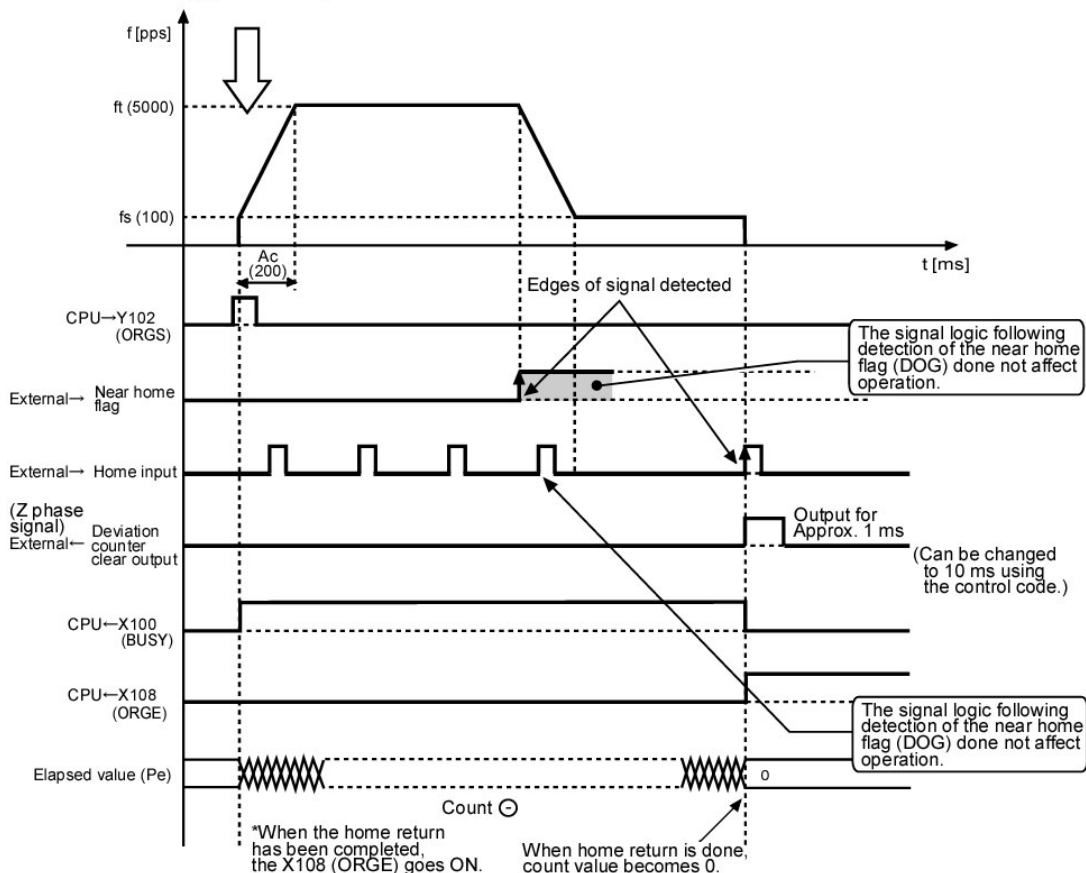
### 10.3.1 Operation If the Home Input is the Z Phase of the Servo Driver

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 is mounted in slot 0

(Shared memory setting)

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



**Note:**

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

**Note:**

When Home return is completed, the elapsed value stored in the shared memory is cleared and the deviation counter clear output signal is output for about 1ms at the same time. This output time can be changed to about 10ms using the control code.

**Note:**

When the home return is started at where the both of the near home and home inputs are valid, the operation will be as follows;  
 Home Return: does not operate.  
 Home Search: starts home search operation.



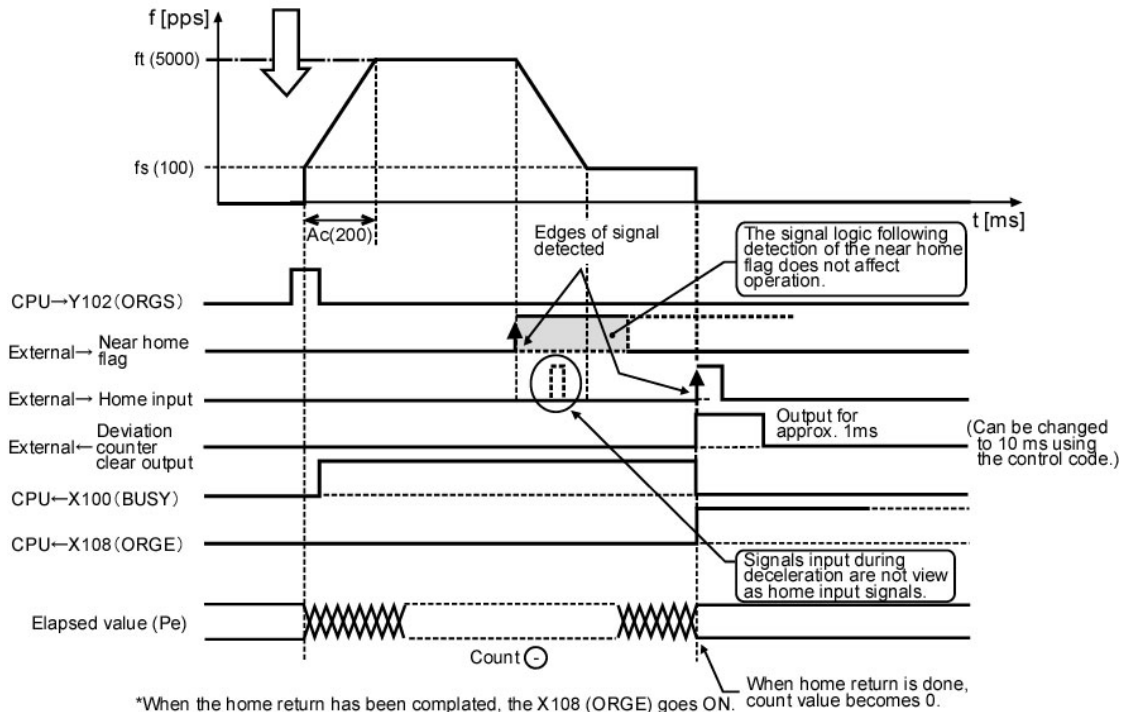
### 10.3.2 Operation If the Home Input is Through an External Switch

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

#### When is mounted in slot 0

Example of specified data  
(Shared memory setting)

100h	- H	10	Control code
101h			
102h	- K	100	Startup speed $f_s$ [pps]
103h			
104h	- K	5000	Target speed $f_t$ [pps]
105h			
106h	- K	200	Acceleration/deceleration time $A_c$ [ms]
107h			



**Note:**

Home input signals input during deceleration are not viewed as home input signals. Deceleration continues without stop ping until the startup speed is reached, and then the motor continues to rotate at the startup speed until a home input signal is input.

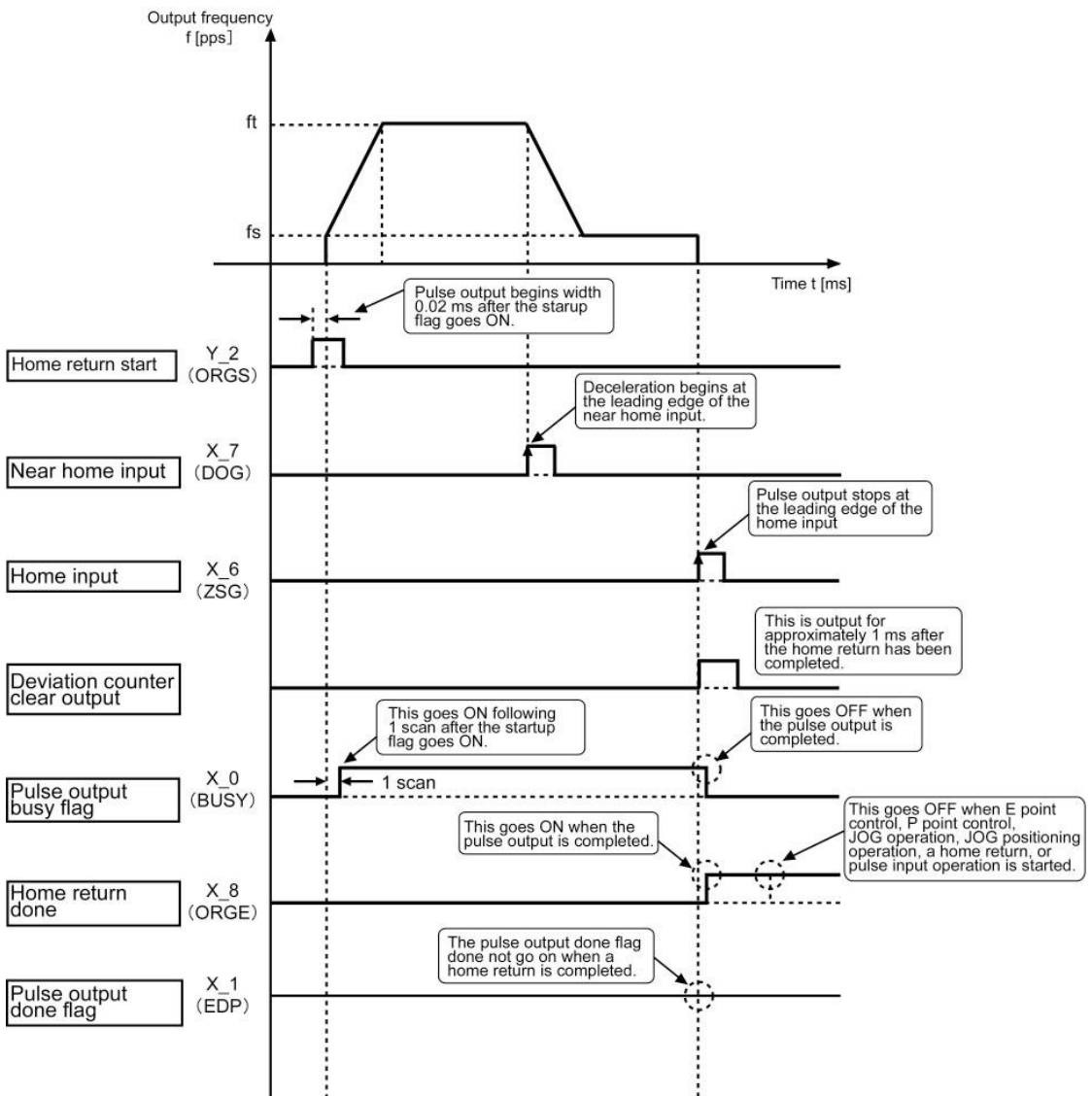
**Note:**

When Home return is completed, the elapsed value stored in the shared memory is cleared and the deviation counter clear output signal is output for about 1ms at the same time. This output time can be changed to about 10ms using the control code.

**Note:**

When the home return is started at where the both of the near home and home inputs are valid, the operation will be as follows;  
Home Return: does not operate.  
Home Search: starts home search operation.

# 10.4 Action of the I/O Flag Before and After a Home Return Operation



**Home return start flag (Y\_2)**

1. Home return is initiated based on the parameters written to the positioning unit.
2. The flag is not initiated during the time that the pulse output busy flag (X\_0) is ON. (It has already been initiated).
3. The flag 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 page 10-24.>

**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 page 10-24.>

**Deviation counter clear output**

1. This goes ON for approximately 1 ms or 10ms after the home return has been completed.

- This is used in systems in which a servomotor 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, JOG positioning operation and home return. (except for the pulser input operation)

**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, JOG positioning operation, a home return, or pulser input 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, JOG positioning operation or pulser input 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, JOG positioning operation and pulser input operation.

## 10.5 Checking the Home and Near Home Input Logic

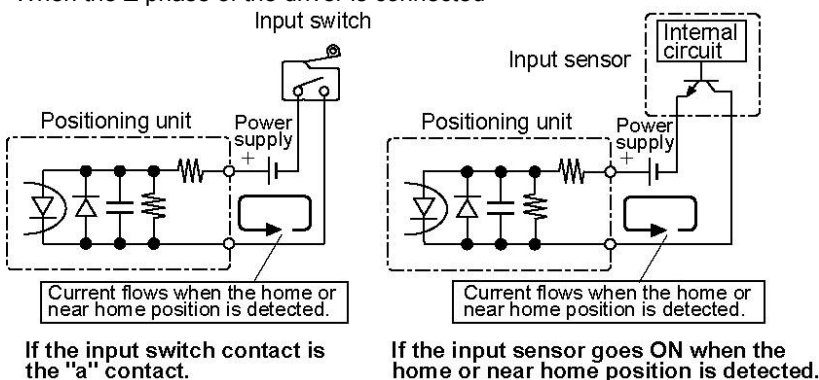
### 10.5.1 When “Input Valid When Power is Supplied” is Specified

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 page 16-7.)

#### When to specify “Input valid when power is supplied”:

- 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



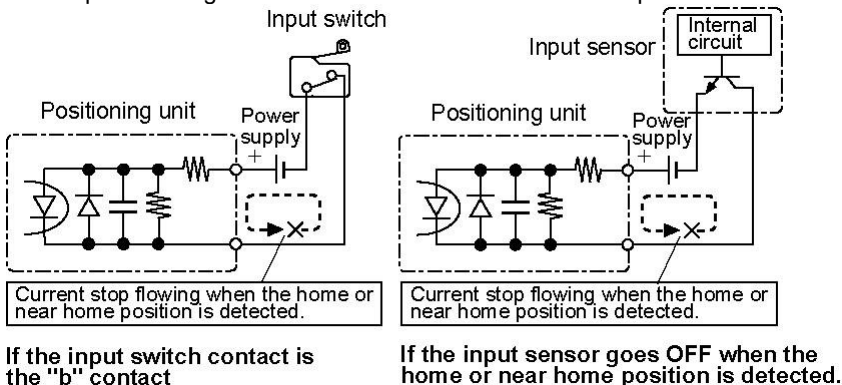
### 10.5.2 When “Input Valid When Power is not Supplied” is Specified

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 page 16-7.)

#### When to specify “Input valid when power is not supplied”:

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



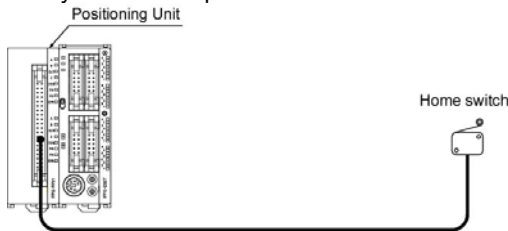
## 10.6 Practical Use for a Home Return

### 10.6.1 When One 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 settings

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

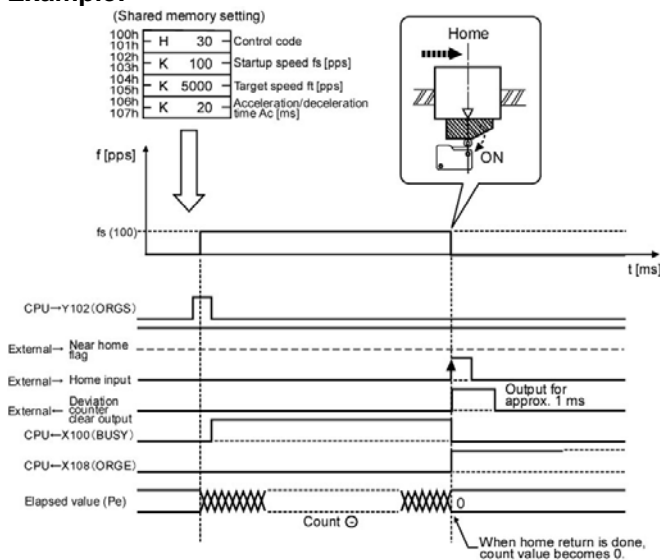
When Home return is started, the motor rotates in the direction of home return

The motor rotates at the startup speed.

At this time, the near home input is already ON due to the Input logic setting.

The motor stops when the home input is made.

#### Example:



#### Note:

- Home return is executed at the startup speed.
- When the home input is connected to the Z phase output of the motor driver, one switch can not be used as the home input.
- The above example is only applicable when the home return (in a Home search invalid mode) is executed.

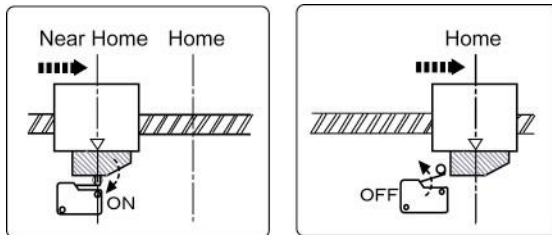
#### Reference (Key Points):

- 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.
- There is only home input switch.

## 10.6.2 When One Switch ON and OFF are assigned to Near Home Input and Home

### Environment available for this

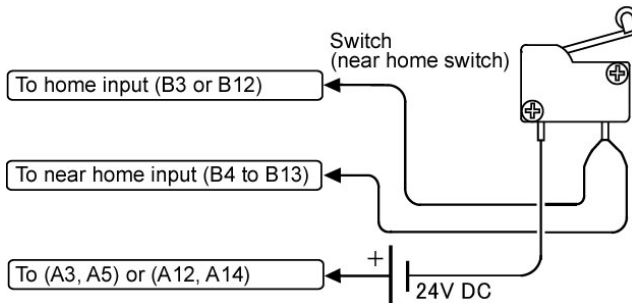
The system in which the near home input switch is once turned ON and then OFF when the home return is started.



### Example of usage method

#### -Connection

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



#### -Input logic setting (When using the switch of "a" contact)

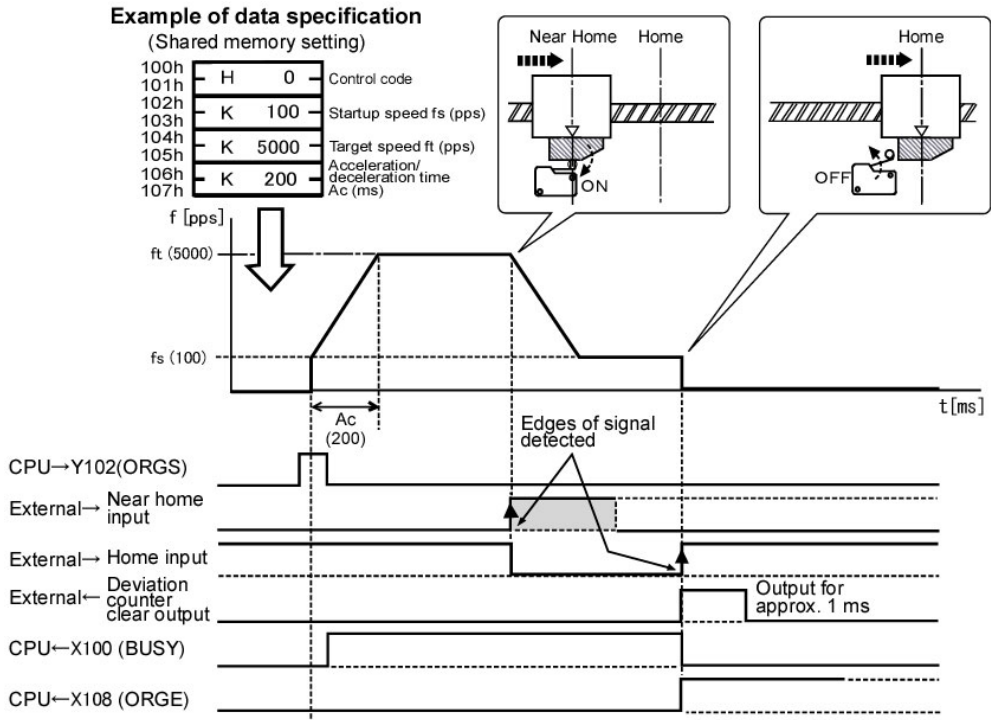
Set the control code of the shared memory for the following;

Home input logic: Input Valid when power is not supplied

Near home input logic: Input Valid when power is supplied

**-Operation**

When a home return begins, the motor rotates in the direction of the home return.  
 When the near home input switch is turned ON, the speed slows down to the startup speed.  
 The motor rotates the further and the near home input will be OFF.  
 At this point, the home input should already be ON, as a result of the input logic, and the motor stops.



## 10.7 Operation at Over limit Input

Home return operation is as follows when Over limit input (+) or Over limit input (-) is ON.  
The operation in the direction in opposite to the input limit is possible.

### Home Return (without home search)

Condition	Direction	Limit status	Operation
When Home return is turned ON	Forward	Over limit input (+):ON	Table not to move, Limit error occurs.
		Over limit input (-):ON	Table to move
	Reverse	Over limit input (+):ON	Table to move
		Over limit input (-):ON	Table not to move, Limit error occurs.
During Home return operation	Forward	Over limit input (+):ON	Table stops, Limit error occurs.
	Reverse	Over limit input (-):ON	Table stops, Limit error occurs.

### Home Return (with home search)

Condition	Direction	Limit status	Operation
When Home return is turned ON	Forward	Over limit input (+):ON	Table to move
		Over limit input (-):ON	Table to move
	Reverse	Over limit input (+):ON	Table to move
		Over limit input (-):ON	Table to move
During Home return operation	Forward	Over limit input (+):ON	Automatic-reverse operation
	Reverse	Over limit input (-):ON	Automatic-reverse operation



## 10.8 Cautions on an Over Limit Switch

---

A Over limit input valid for a Jog operation, Home return (including Home search) and Pulser input is the one logically found in the direction of the table movement. i.e. if an Over limit switch (-) is input for a movement in (+) direction or an Over limit switch (+) is input for a movement in (-) direction, the table will not stop. Please observe the followings;

### - Before startup

Please make sure that an Over limit switch (+) is set in the direction of the elapsed value increment and an Over limit switch (-) in the direction of the elapsed value decrement.

### - When a switch is not set in the correct direction

The followings might be a cause. Check your settings and correct them;

- 1) An Over limit switch, (+) or (-), is not set in a correct direction.
- 2) CW/CCW output method is set reverse for the connection of the Positioning unit and the motor driver.
- 3) A Sign input logic is set reverse for the connection of the Positioning unit and the motor driver.
- 4) The control codes are to specify the reverse direction of the rotation for the pulse output (forward or reverse) in the program.

## 10.9 Special Mention

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### **The time from the home input to the pulse output stop during the home return (home search)**

The FP  $\Sigma$  Positioning unit performs the process in the very high speed, so that it starts counting the number of the output pulses within 1 $\mu$ s from when the home input is ON. The time is always stable, enabling the accurate home return (home search) operation. Since each axis is completely independent, the home returns by the multiple axes at the same time are possible for the multiple-axis type.

# Chapter 11

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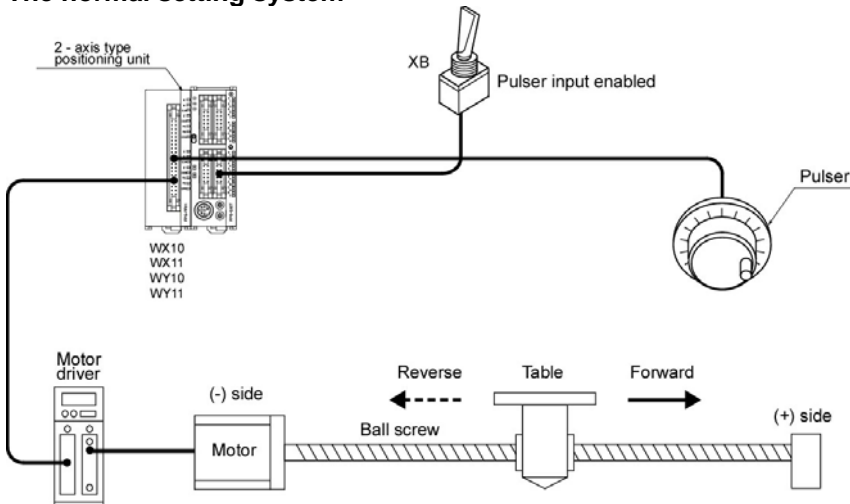
## Pulser Input Operation

# 11.1 Sample Program

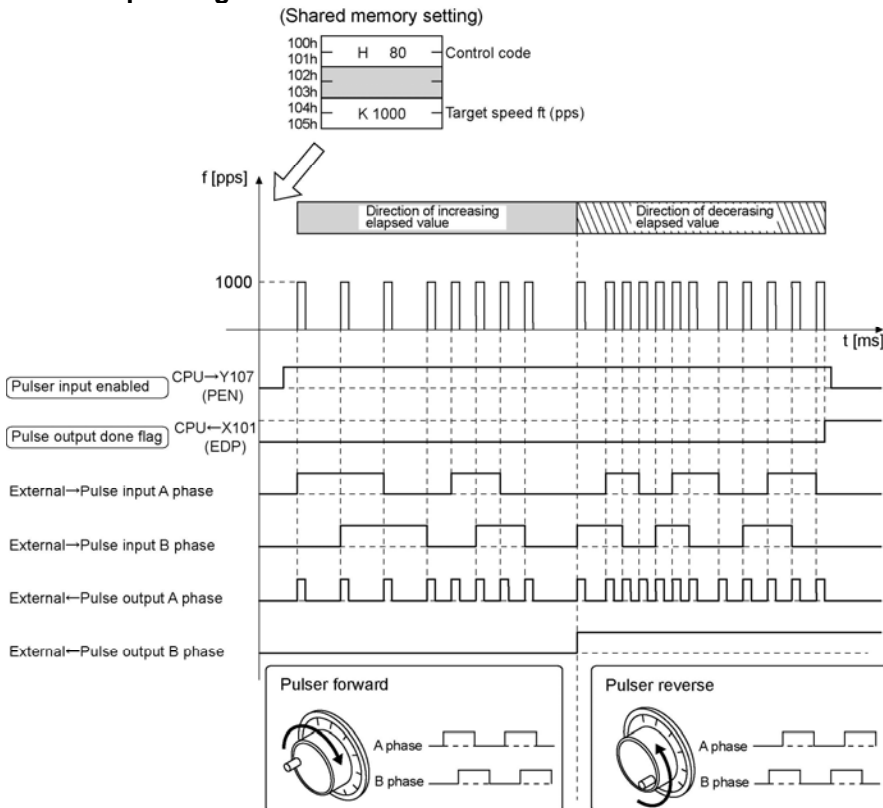
## 11.1.1 Pulser input operation (Transfer multiple: 1 multiple setting)

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.

### The normal setting system



### Pulse output diagram

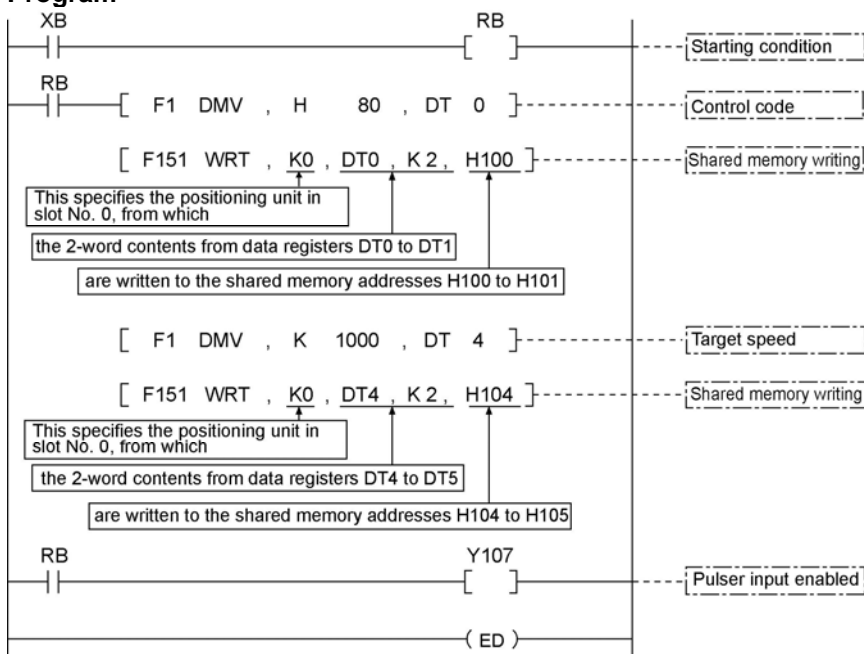


### Shared memory settings

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H80 Note: Multiplication ratio:×1 multiple	Refer to page 16-7.
Target speed (pps)	K1000	K1 to K4,000,000

**Note:** If the Over limit input error occurs, set H0 as the limit input valid logic can be changed.

### Program



### Precautions concerning the program

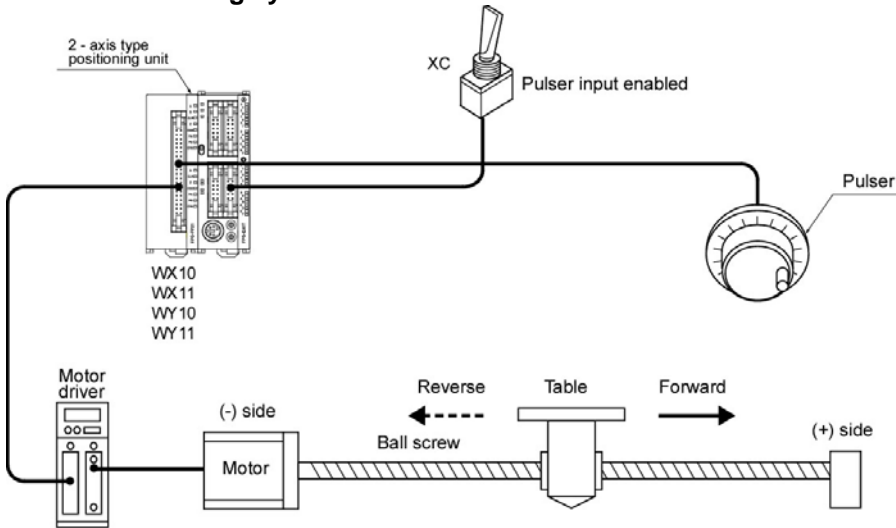
When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning operation, home return, 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 flag varies depending on the number of axes the pulser input unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.
- 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.
- Do not turn ON Y\_7 when using the feedback counter.

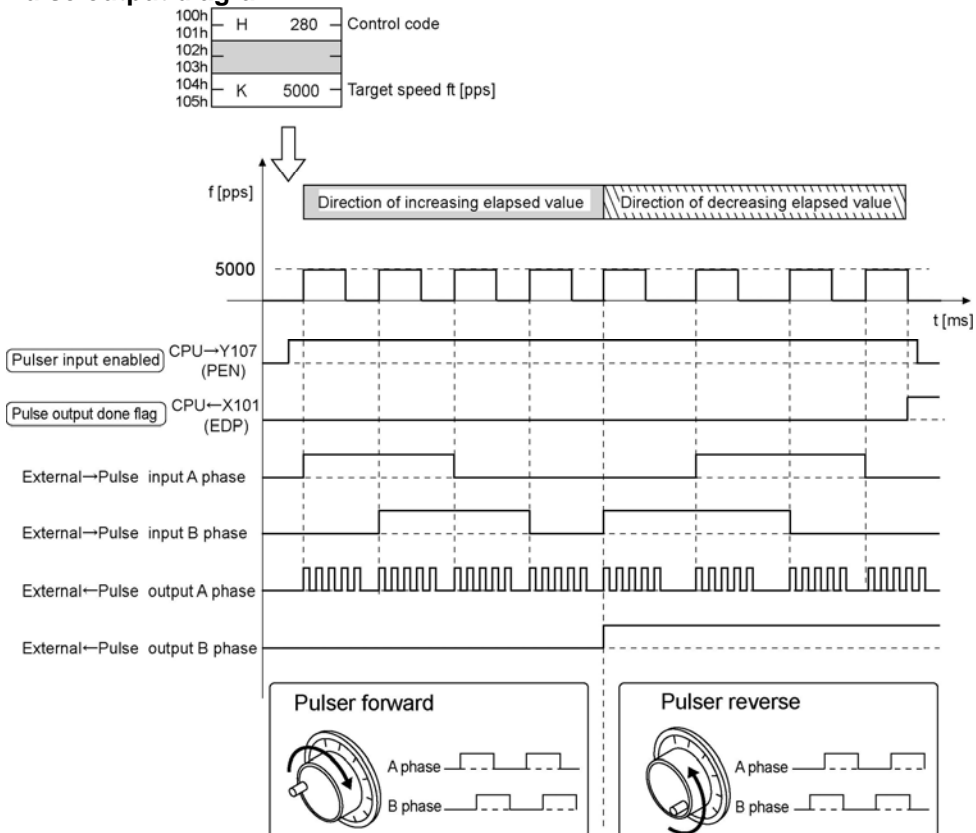
### 11.1.2 Pulser input operation (Transfer multiple: 5 multiple setting)

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.

#### The normal setting system



#### Pulse output diagram

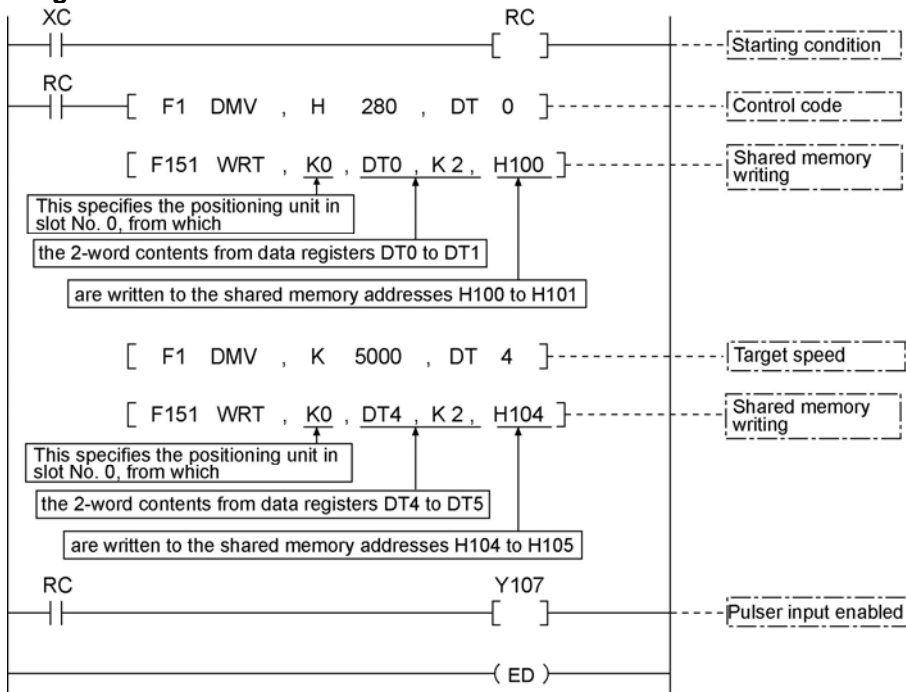


**Shared memory settings**

Control parameter setting content	Set values in sample program example	Range of acceptable settings
Control code	H280 Note: Multiplication ratio: $\times 5$ multiple	Refer to page 16-7.
Target speed (pps)	K10000	K1 to K4,000,000

**Note:** If the limit error occurs, set H200 as the limit input valid logic can be changed.

**Program**



**Precautions concerning the program**

When Over limit switch(+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

- The same shared memory areas to which the various control parameters are written are used for acceleration/deceleration control, JOG operation, JOG positioning operation, home return, 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 flag varies depending on the number of axes the unit has, and the installation position.
- The specified slot number and shared memory address vary depending on the slot position and axis number of the positioning unit.
- 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.
- Do not turn ON Y\_7 when using the feedback counter.

## 11.2 Sequence Flow for Pulser input operation

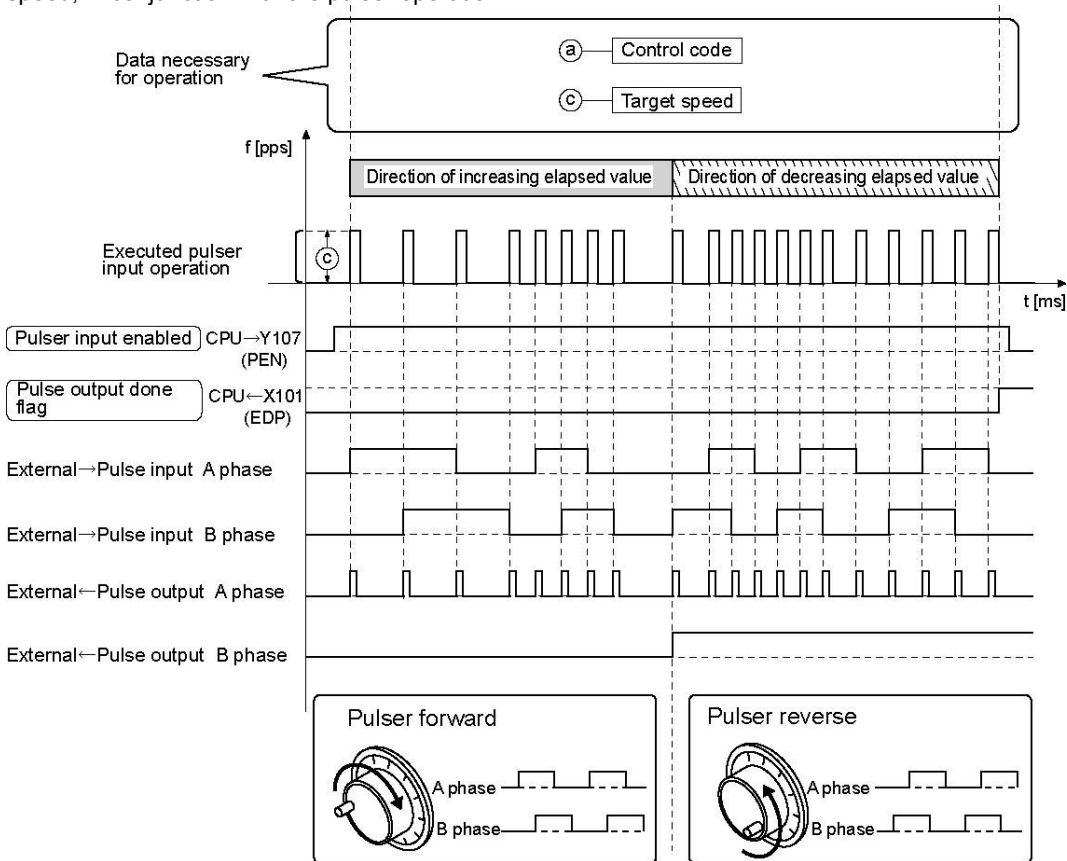
### Pulser input operation

- A pulse generator (pulser) can be connected, and the motor can be controlled in the manual mode.
- Pulser signals can be input while the pulser input enabled flag (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 is mounted in slot 0

### Operation example

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



When Y107 is turned ON in the above 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 X100 remains OFF, and its status does not change. The pulse output done flag X101 goes OFF when Y107 goes ON.

### Data necessary 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

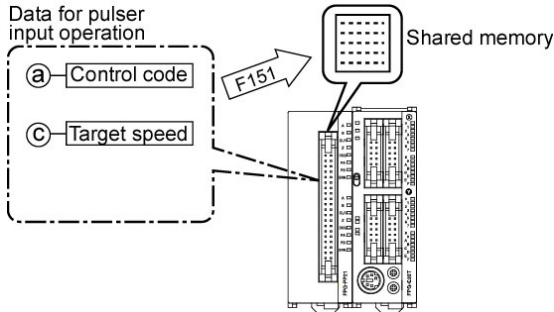


**Operation steps**

**Step 1: Preparatory stage**

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

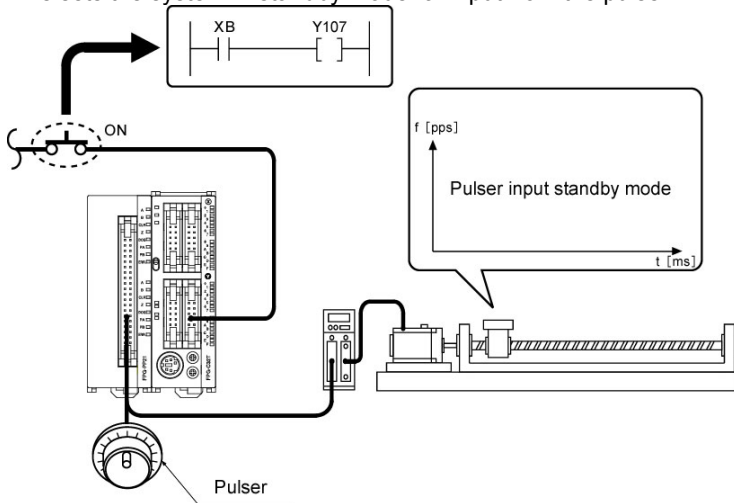
Data for pulser input operation



**Step 2: Executing the operations**

The input enabled flag Y107 is turned ON.

This sets the system in standby mode for input from the pulser.



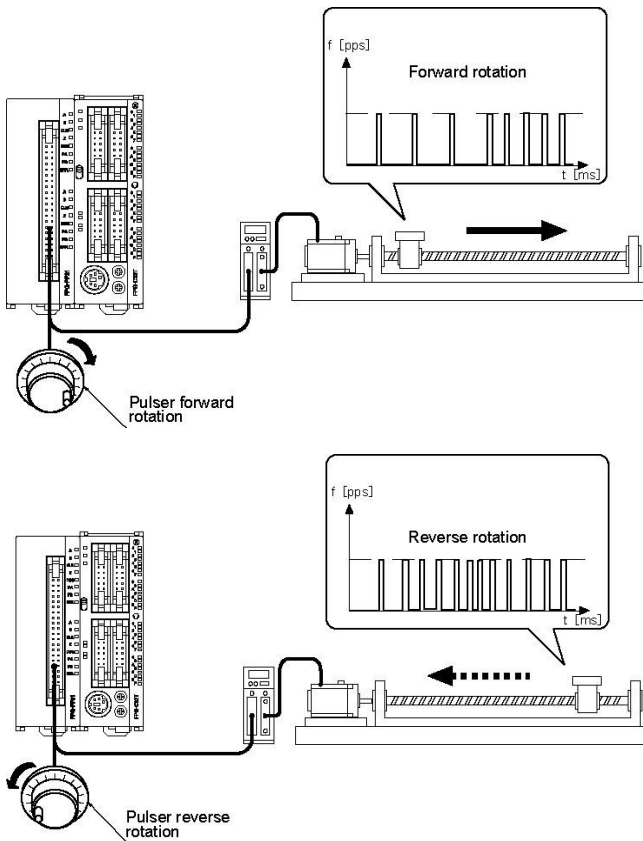
**Forward rotation**

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.

**Reference:****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 to the value counted by the counter.

**Note:****When the input signal from the pulser 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.

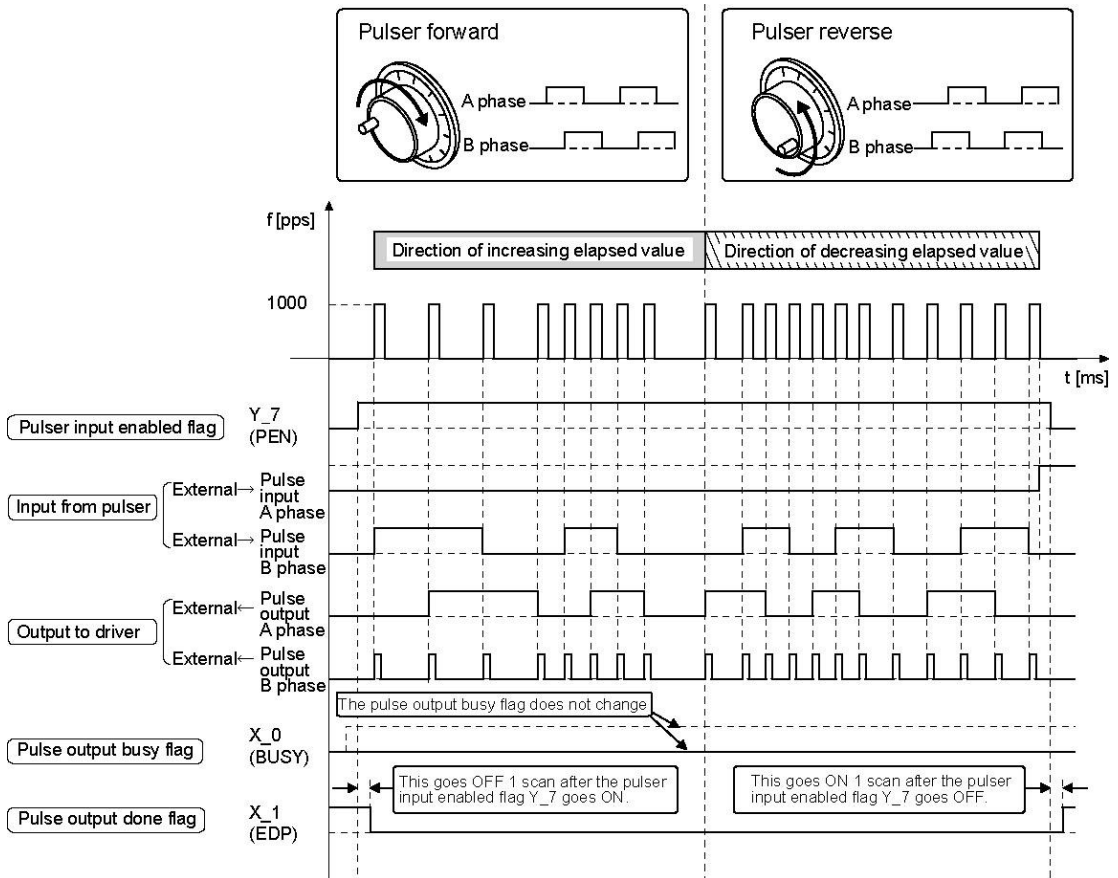
If this happens, the target speed should be changed to an appropriate value.

**Note:**

The pulser input operation and the feedback counter use the same pulse input terminal. Select either. Do not turn ON Y107 when using the feedback counter.

Feedback counter and pulser input operation are available for each axis, so either can be selected respectively per each axis.

### 11.3 Action of the I/O Flag During Pulsar Input Operation



#### Pulsar input enabled flag (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 flag 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 flag 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, JOG positioning operation or pulser input operation is completed before pulser input operation.
2. This goes from OFF to ON when the pulser input enabled flag 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, JOG positioning operation and pulser input operation.

## 11.4 Operation at Over limit Input

Pulser input operation is as follows when Over limit inout (+) or Over limit input(-) is ON. The operation is possible for the direction in opposite of the input limit.

Condition	Direction	Limit status	Operation
When Pulser input operation is turned ON	Forward	Over limit input(+):ON	Table not to move, Limit error occurs.
		Over limit input (-):ON	Table to move.
	Reverse	Over limit input(+):ON	Table to move.
		Over limit input (-):ON	Table not to move, Limit error occurs.
During Pulser input operation	Forward	Over limit input(+):ON	Table stops, Limit error occurs.
	Reverse	Over limit input (-):ON	Table stops, Limit error occurs.



**Note:** Pulse/Sign output mode can be started up.  
 When the CW/CCW output mode is set, the limit error will occur.  
 If the error occurs, solve it using the methods as described below.

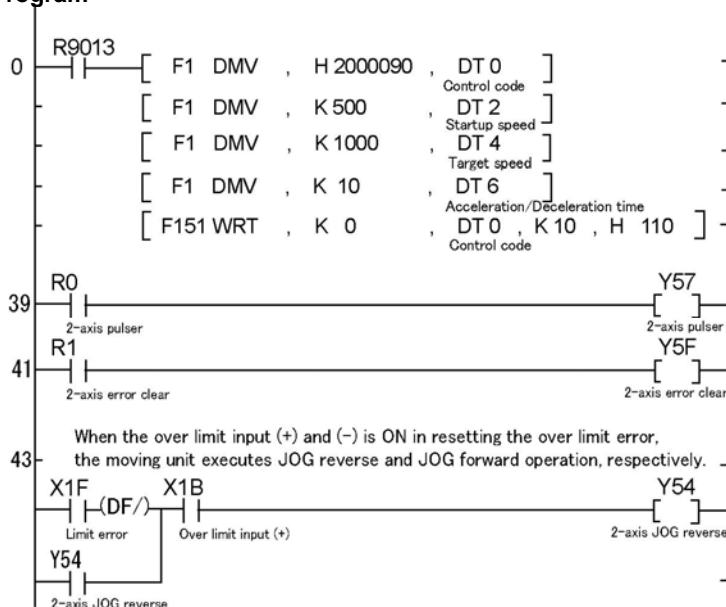
### -Using the home return function

- (1) Turn ON the Error clear (Y\_F) of the Over limit input (+), and then turn it OFF.
- (2) Turn ON the Home return start (Y\_F) (towards the elapsed value minus (-) direction), while the Over limit input (+) is ON.

### -Using the JOG operation function

- (1) Turn ON the Error clear (Y\_F) of the Over limit input (+), and then turn it OFF.
- (2) Turn ON the Reverse JOG (Y\_4), while the Over limit input (+) is ON.

#### Program



## 11.5 Cautions on an Over Limit Switch

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A over limit input valid for a Jog operation, Home return (including Home search) and Pulser input is the one logically found in the direction of the table movement. i.e. if an Over limit switch (-) is input for a movement in (+) direction or an Over limit switch (+) is input for a movement in (-) direction, the table will not stop. Please observe the followings;

### - Before startup

Please make sure that an Over limit switch (+) is set in the direction of the elapsed value increment and an Over limit switch (-) in the direction of the elapsed value decrement.

### - When a switch is not set in the correct direction

The followings might be a cause. Check your settings and correct them;

- 1) An Over limit switch, (+) or (-), is not set in a correct direction.
- 2) CW/CCW output method is set reverse for the connection of the Positioning unit and the motor driver.
- 3) A Sign input logic is set reverse for the connection of the Positioning unit and the motor driver.
- 4) The control codes are to specify the reverse direction of the rotation for the pulse output (forward or reverse) in the program.

## 11.6 Types of Manual Pulse Generators That Can be Used

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**A pulse generators 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 3.7

## **Chapter 12**

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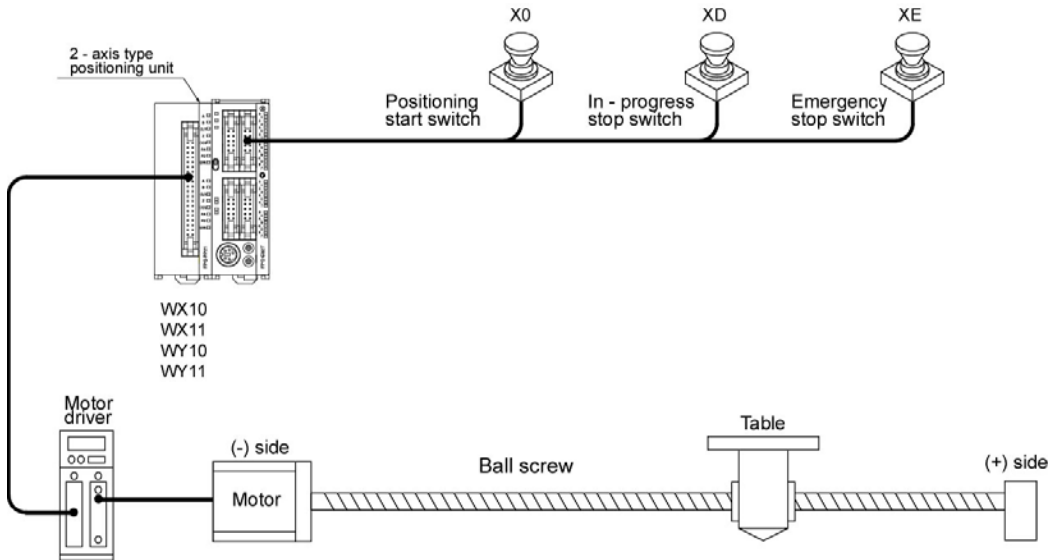
### **Deceleration Stop and Forced Stop**



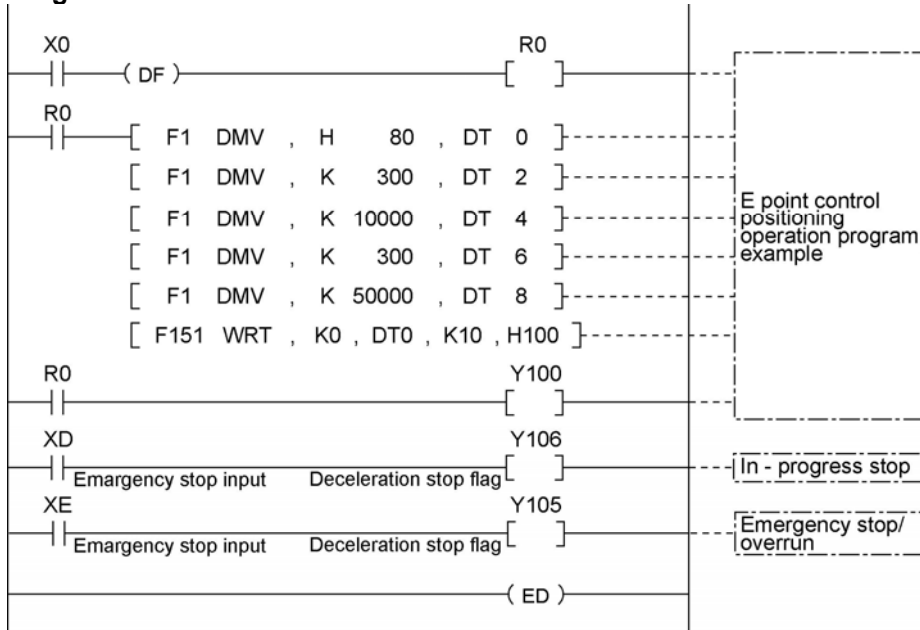


## 12.1 Sample Program

### 12.1.1 In - progress Stopping, Emergency Stopping



#### Program

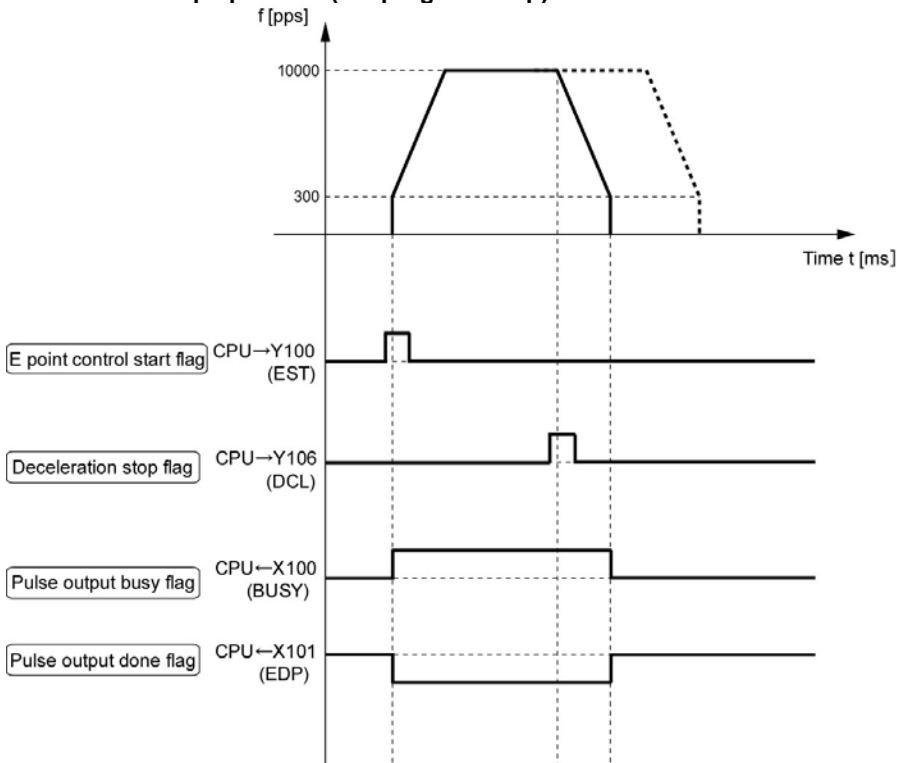


#### Precautions concerning the program

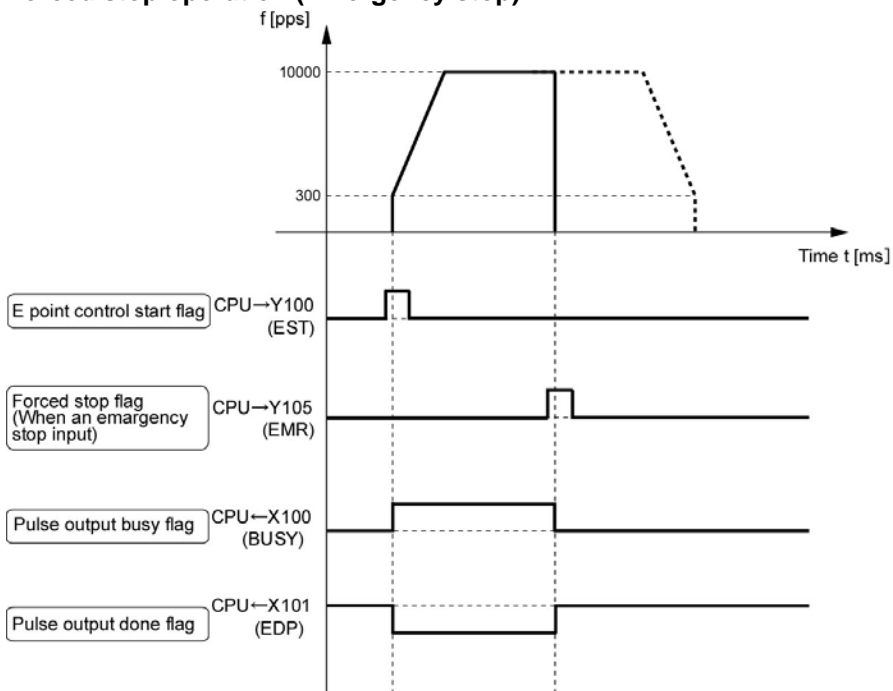
- The number of the stop input flag varies depending on the number of axes that the unit has, and the position in which it is mounted.
- If a deceleration stop or forced stop is triggered, the start flag for the various operations must be turned OFF before operation can be restarted. This content is common to E point control, P point control, home return, JOG operation, JOG positioning operation and pulser input operation.

**Pulse output diagram**

**Deceleration stop operation (In - progress stop)**



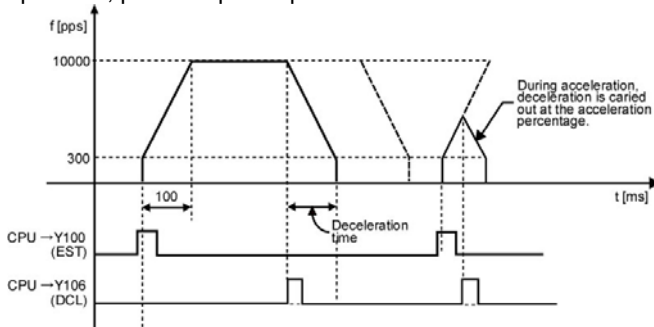
**Forced stop operation (Emergency stop)**



## 12.2 Operations for a Deceleration Stop and Forced Stop

### 12.2.1 Deceleration Stop

If the deceleration stop flag 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 return, JOG operation and JOG positioning operation. For pulser input operation, pulse output stops.

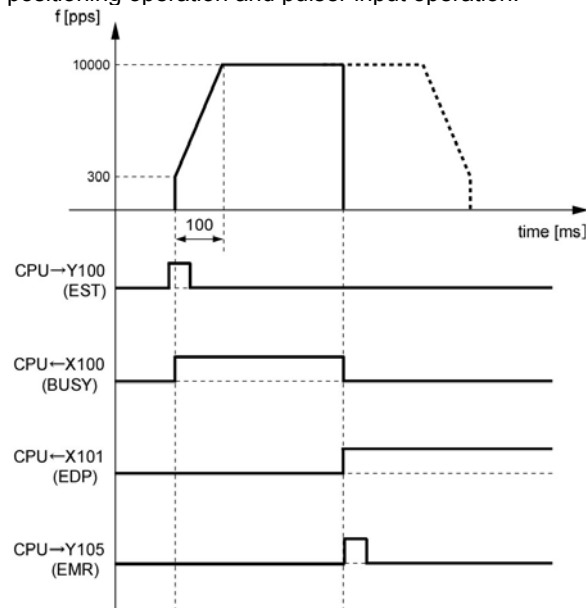


#### Important:

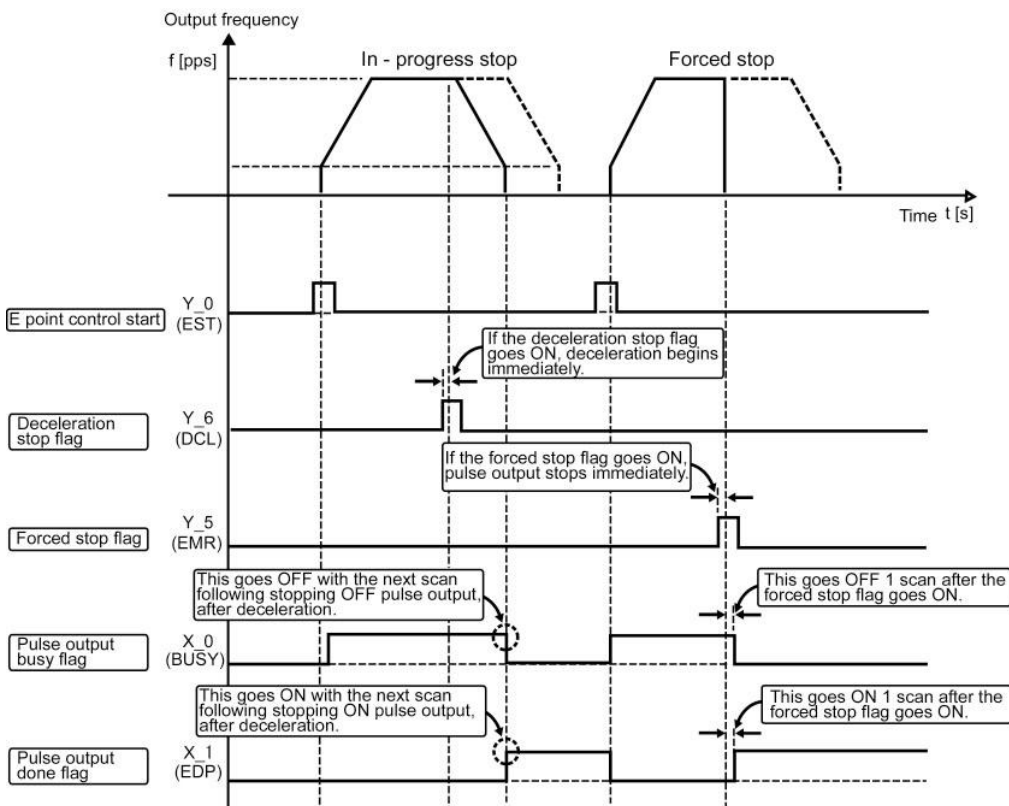
When a deceleration stop has been executed, deceleration is carried out based on the acceleration rate determined by the data specified in the shared memory area at that point, and continues until the startup speed is reached. Following that, operation stops. If the deceleration stop flag goes ON during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

### 12.2.2 Forced Stop

If the forced stop flag goes ON during operation, pulse output stops immediately. This operation is common to E point control, P point control, home return, JOG operation, JOG positioning operation and pulser input operation.



## 12.3 I/O Flag Operation Before and After a Stop



### Deceleration stop flag (Y\_6)

1. When the deceleration stop flag 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 flag is reset when the power supply is turned OFF.

### Forced stop flag (Y\_5)

1. When the forced stop flag goes ON, the operation in progress is interrupted immediately, and pulse output stops.
2. This flag is reset when the power supply is turned OFF.

### Pulse output busy flag (X\_0)

1. When the deceleration stop flag goes ON, this flag goes OFF when pulse output is completed.
2. When the forced stop flag goes ON, this flag goes OFF after 1 scan from when the flag 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 flag goes ON, this flag goes ON when pulse output is completed.
2. When the forced stop flag goes ON, this flag goes ON after 1 scan from when the flag has gone ON.
3. This flag is reset when the power supply is turned OFF.

## **12.4 Precautions Concerning Stopping Operations**

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### **12.4.1 Pulse Output Done Flag Status After a Stop**

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For either a deceleration stop or a forced 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 forced stop.

### **12.4.2 Restarting After a Stop**

---

When a deceleration stop or forced stop is triggered, the start flags for all operations must be turned OFF before operation can be restarted. This operation is common to E point control, P point control, home return, JOG operation, JOG positioning operation and pulser input operation.

### **12.4.3 Forced Stop Elapsed Value Data**

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Elapsed value data in the shared memory is saved after a forced 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 13

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## Feedback Counter

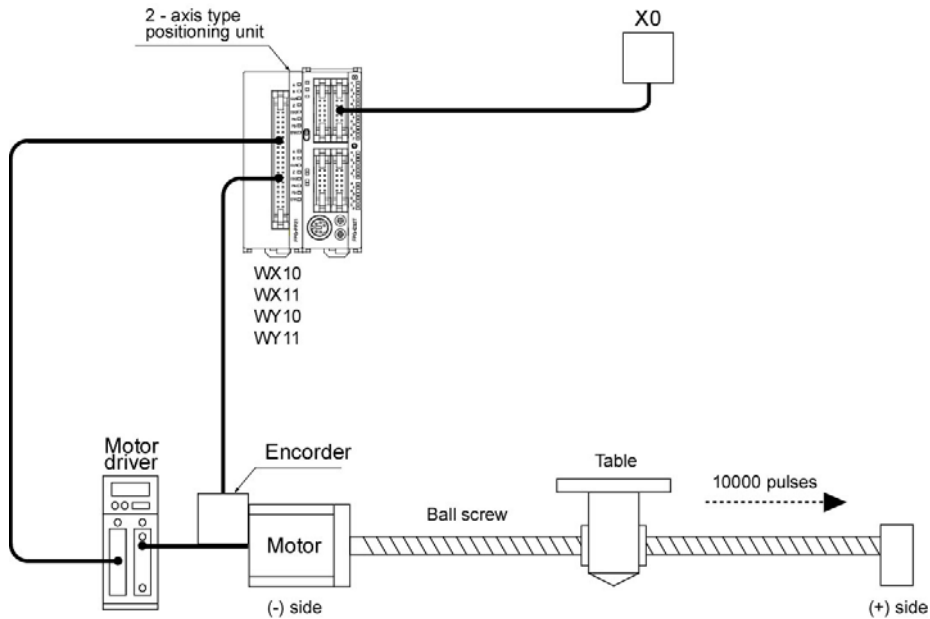




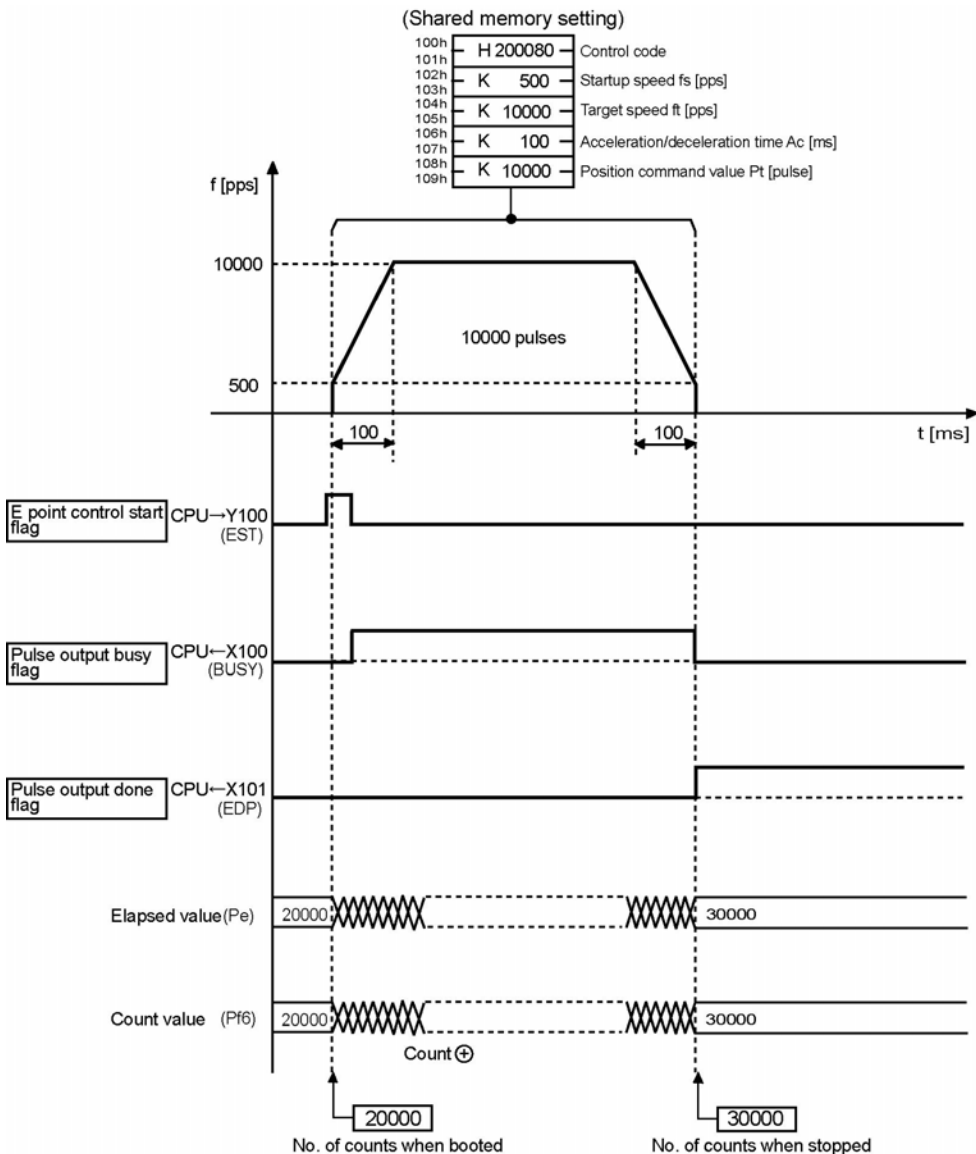
## 13.1 Sample Program

### 13.1.1 Detecting Power Swing by Comparing Feedback Count with Elapsed Value

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.



### Pulse output diagram

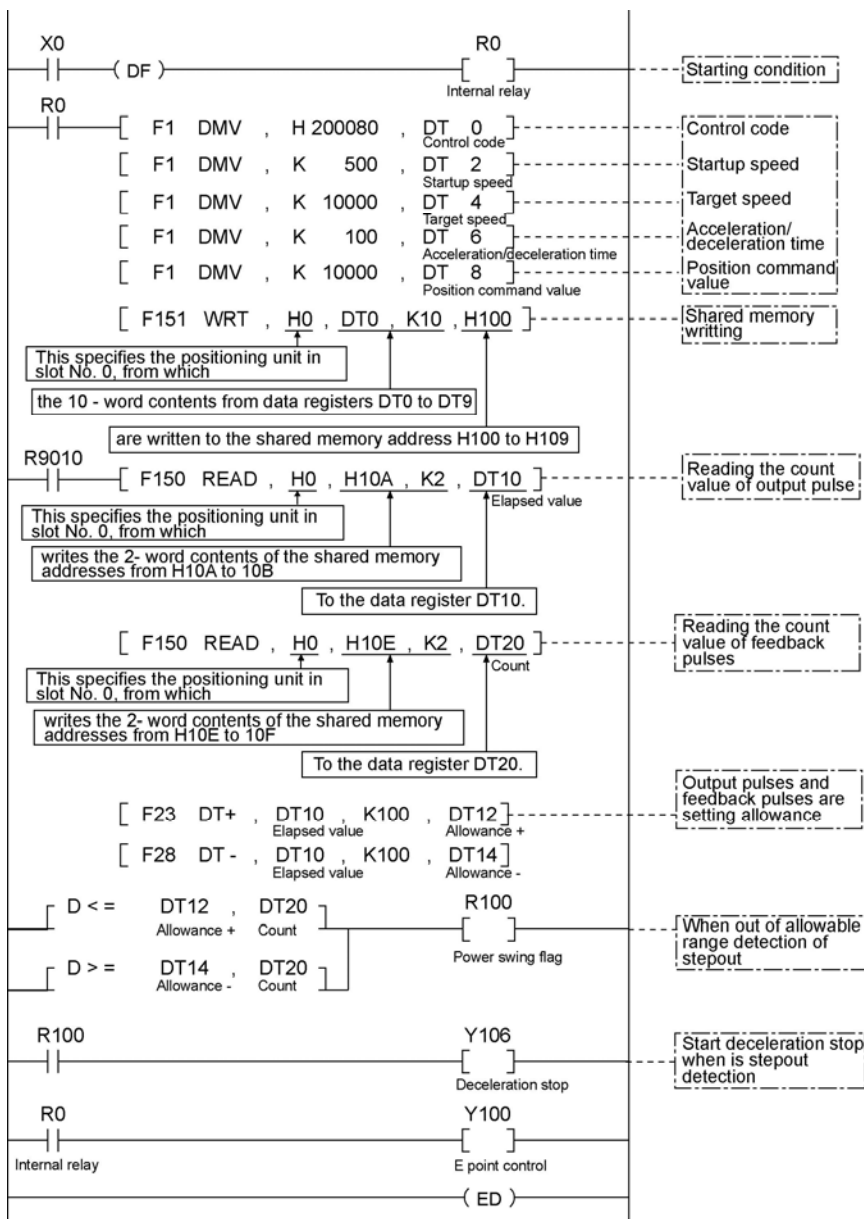


### Operations of the various flags

- Pulse output busy flag (X100) goes ON when E point control is started and goes OFF when the pulse output is completed.
- Pulse output done flag (X101) goes ON when the pulse output is completed. This remains ON until the next operation of either E point control, P point control, JOG operation, JOG positioning operation, home return or pulser input operations is started.
- The elapsed value is stored in the counter inside the positioning unit as absolute value.

### Program

The following example program compares the count of the output pulses with the count of the feedback pulses at the E point control and makes the deceleration stop if the count is out of the allowable range.



For the pulse count of the feedback counter, read the values in H10F, H10E for the 1st. axis, in H11F, H11E for the 2nd. axis, stored in the shared memory.

The feedback counter is available for every axis.

When counting the 2-phase input such as the input from the encoder, set the pulse input transfer multiple to "4 multiple setting" (x 4) or "2 multiple setting" (x 2) using the control code to prevent counting error.

Please note that the counter value will be cleared when the home return is completed or when the Error clear flag (Y\_F) is ON.

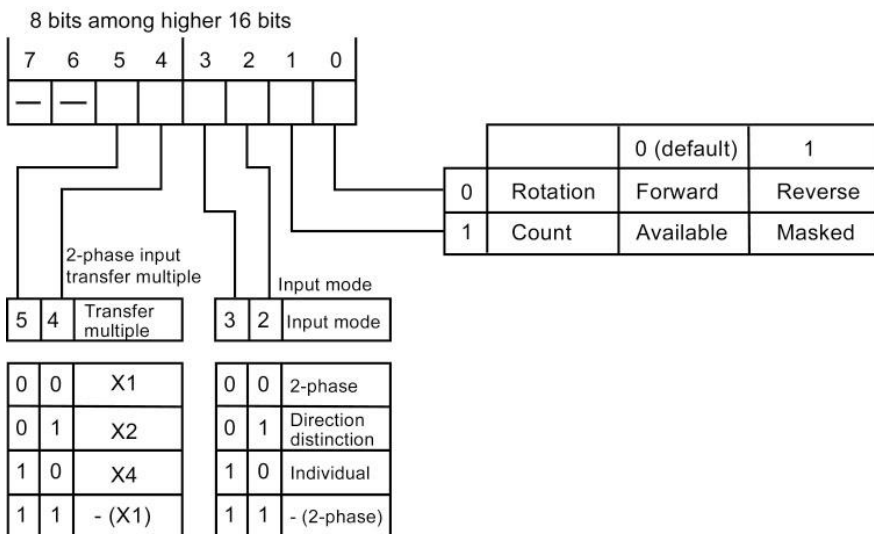
## 13.2 Feedback Counter Functions

- The feedback counter can be used as a general-purpose counter as 2-phase input, Direction distinction input or Individual input.
- The feedback counter uses the contact which is the same as the one for the pulse input signal. Accordingly, it can not function together with the pulser input operation.
- The feedback counter is available for each axis.  
Please note that the counter value is cleared when the home return is completed or when the Error clear flag (Y\_F) is ON. A special attention is required when using the feedback counter as a general-purpose high-speed counter.
- When counting the 2-phase input such as the input from the encoder, set the pulse input transfer multiple to "4 multiple setting" (x 4) or "2 multiple setting" (x 2) using the control code to prevent counting error.

The pulse count value for the feedback counter is stored in the addresses below;

	Shared memory address	Countable range
1st. axis	H10F, 10E	Signed 32 bits -2,147,483,648 to + 2,147,483,647
2nd. axis	H11F, 11E	

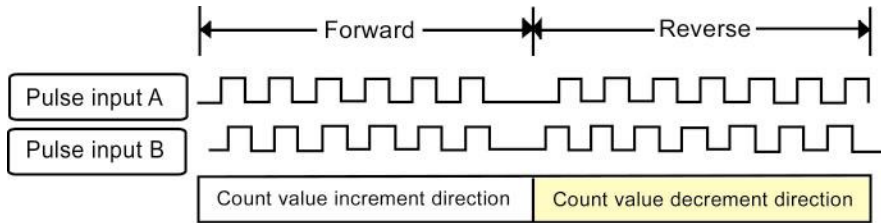
Feedback counter function control code table



### 13.3 Feedback Counter Input Method

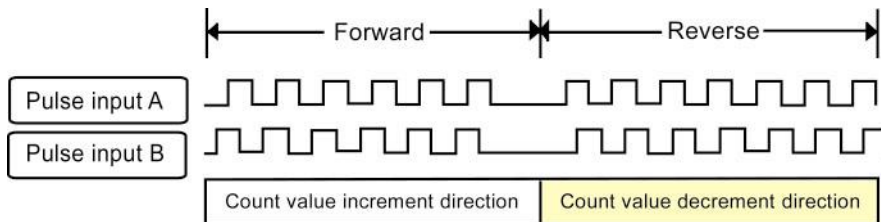
#### 2-phase input <normal settings>

Control code Higher side H0



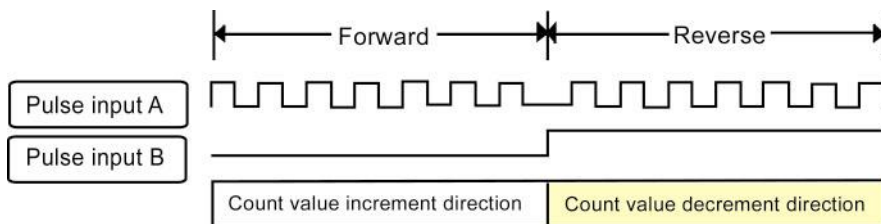
#### 2-phase input <reverse settings>

Control code Higher side H1



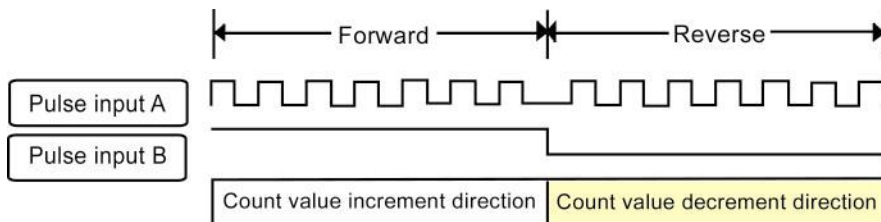
#### Direction distinction input <normal settings>

Control code Higher side H4



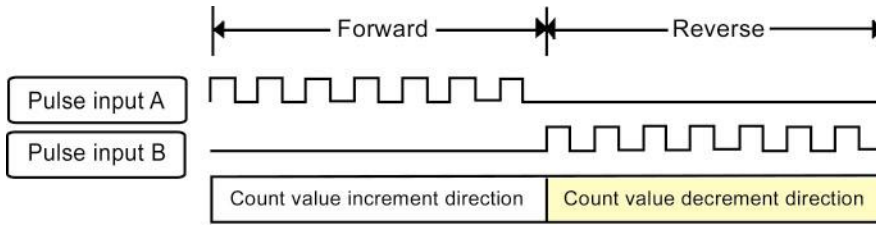
#### Direction distinction input <reverse settings>

Control code Higher side H5



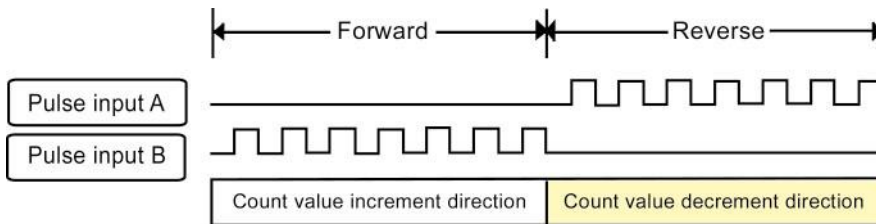
**Individual input <normal settings>**

**Control code Higher side H8**



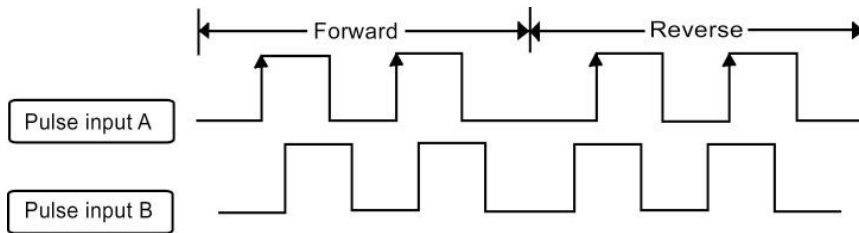
**Individual input <reverse settings>**

**Control code Higher side H9**

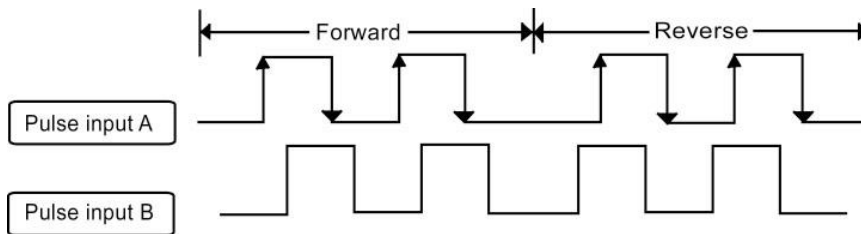


## 13.4 Feedback Counter Transfer Multiple Function

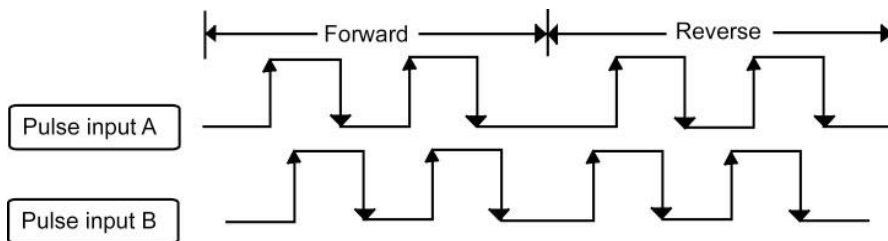
### 2-phase input: 1 transfer multiple



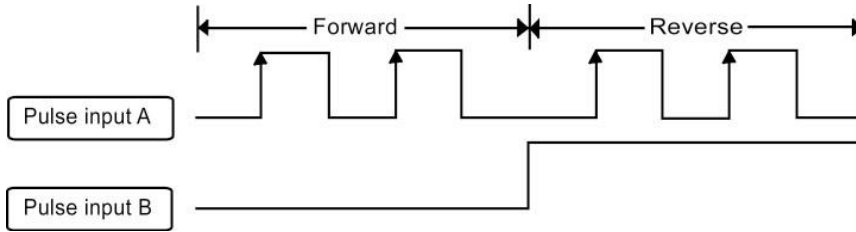
### 2-phase input: 2 transfer multiple



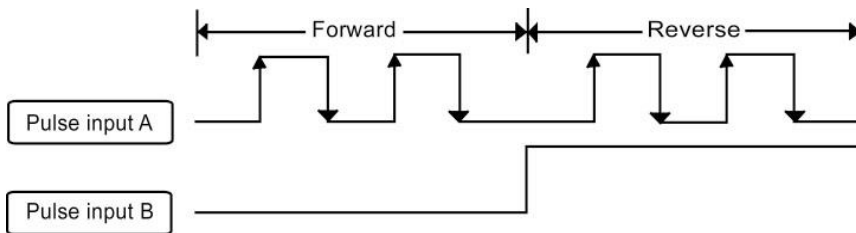
### 2-phase input: 4 transfer multiple



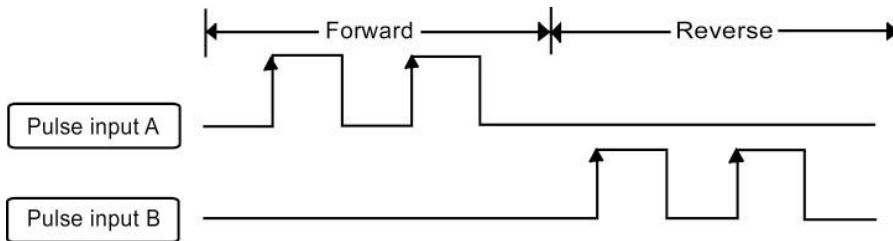
**Direction distinction input: 1 transfer multiple**



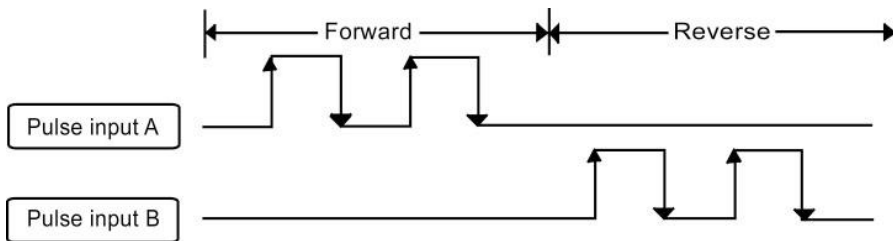
**Direction distinction input: 2 transfer multiple**



**Individual input: 1 transfer multiple**



**Individual input: 2 transfer multiple**





## **Chapter 14**

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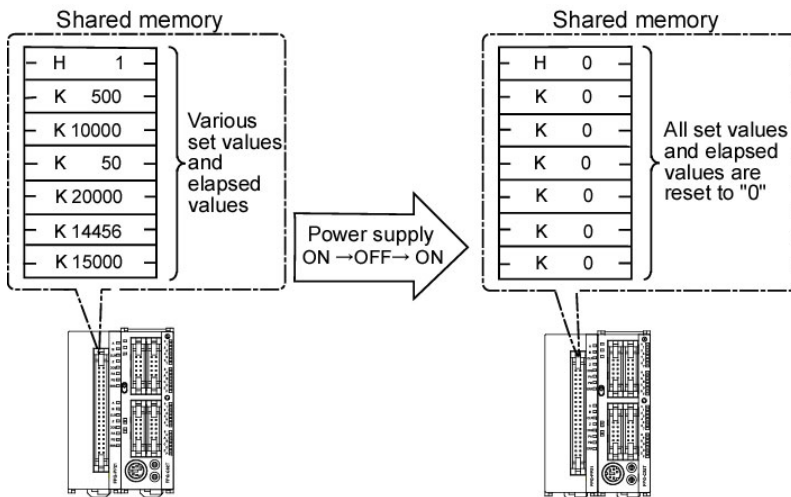
# **Precautions Concerning the operation and Programs**



## 14.1 Precautions Relating to Basic Operations of the Unit

### 14.1.1 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 start flags are turned ON.

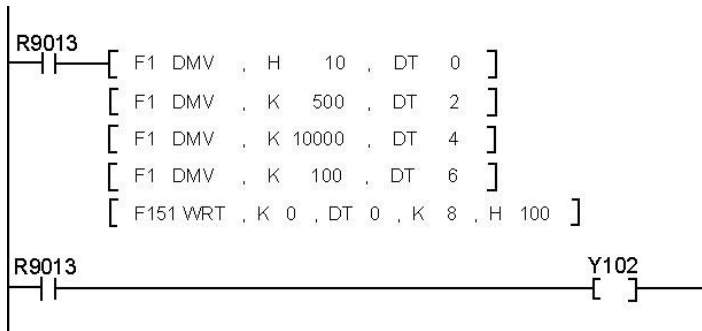


When the power supply is turned OFF, the various set values in the shared memory are set to "0". All of the control codes also return to the default values.

**Note:**

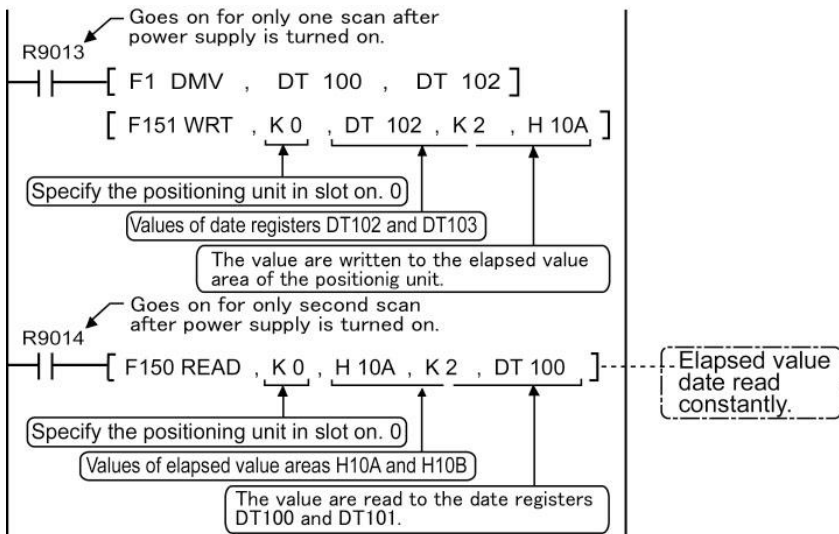
If the start flags are turned ON without writing the data to the memory, a set value error may occur, and the unit may not operate as expected.

If a home return is carried out when the power supply is ON, write the control codes to the memory before the home return start flag 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.



**Reference:**

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:**

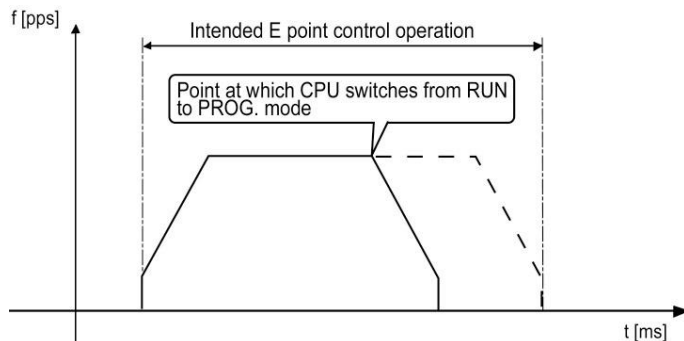
Before the power supply is turned OFF, the elapsed values of DT100 and DT101 are read, and when the power supply is turned ON, the contents of DT100 and DT101 are written to the elapsed value area of the unit, through DT102 and DT103.

### 14.1.2 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, JOG positioning operation or a home return, any positioning unit operations in progress at that point are interrupted, and the speed decelerates. In addition, the pulse output is stopped during the pulser operation.

**Example:**

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

**Note:**

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.

**Reference:**

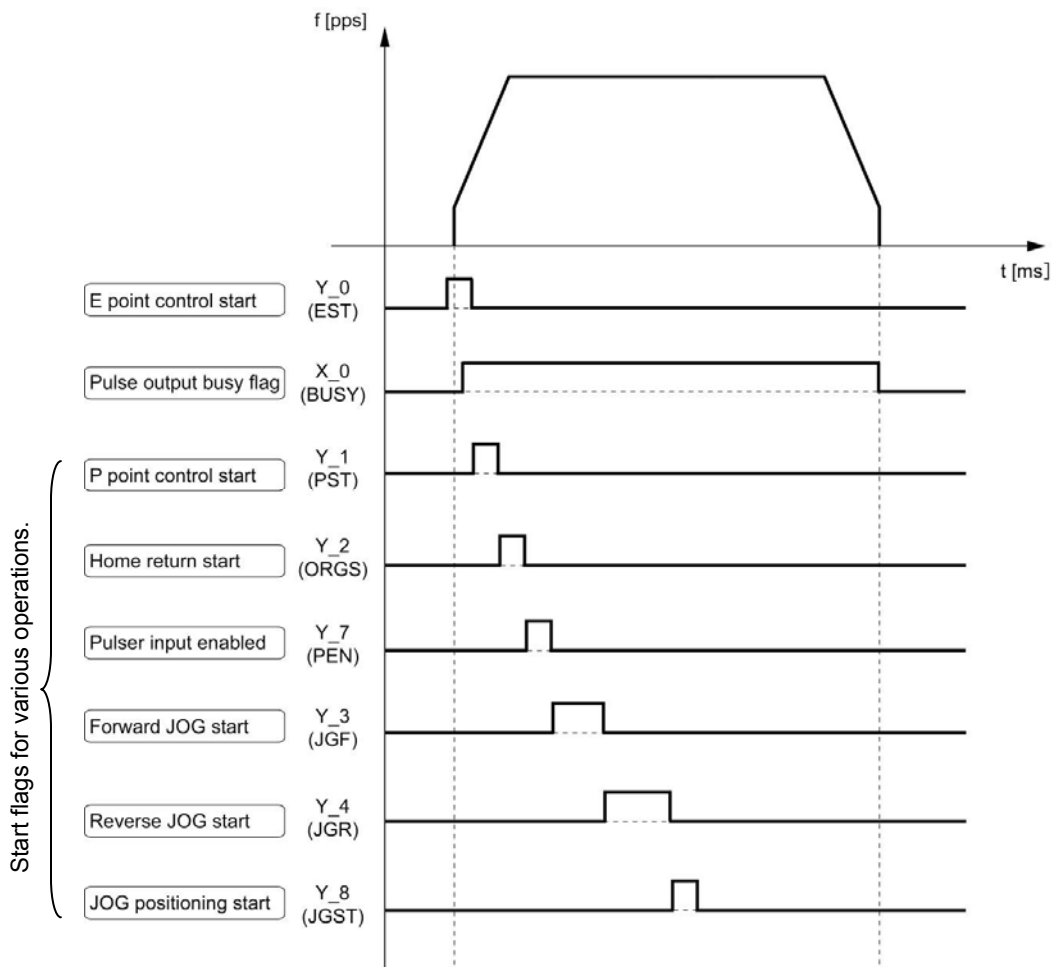
Deceleration Stop and Forced Stop, Chapter 12

### 14.1.3 Operation Cannot be Switched Once One Operation Has Started

If the startup flag for one of the six basic operations of the positioning unit (E point control, P point control, home return, JOG operation, JOG positioning operation and pulser operation) goes ON and operation is initiated, it is not possible to switch to another operation, even if the flag for that operation goes ON.

**Example:**

Once the E point control start flag has gone ON and E point control has begun, it is not possible to switch to P point control, a home return, JOG operation, JOG positioning operation or pulser operation, even if those flags are turned ON, while E point control is still in operation.



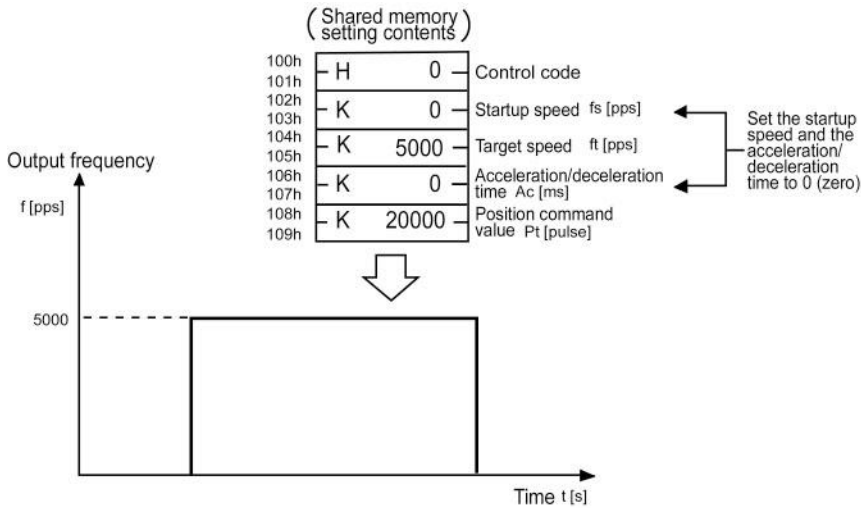
**Reference:**

If the flag for a deceleration stop or forced stop goes ON, the six basic operations noted above (E point control, P point control, Home return, Pulser operation, JOG operation, JOG positioning operation) stop immediately.

## 14.2 Precautions Concerning Practical Usage Methods

### 14.2.1 Setting the Acceleration/Deceleration to Zero

To initiate the target speed immediately without accelerating or decelerating (acceleration/deceleration Zero operation = 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.







# Chapter 15

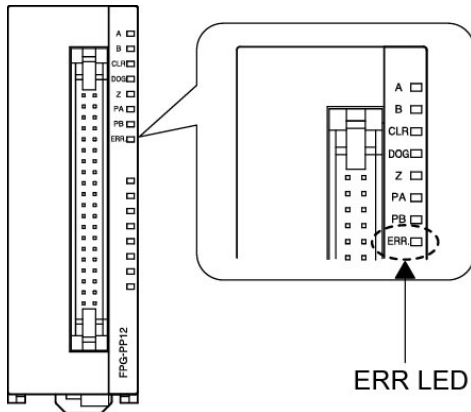
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## Operation if an Error Occurs



## 15.1 Positioning Unit Operation if an Error Occurs

### 15.1.1 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 return, JOG operation, JOG positioning 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, or if a limit error occurs during E point control, P point control, home return, JOG operation, JOG positioning operation or pulser operation, the positioning unit interrupts any operation currently in progress, and enters the "deceleration stop" status.

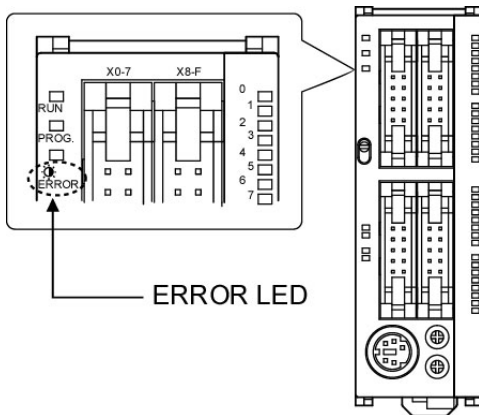
#### Reference:

When a set value error occurs or a limit error occurs, the error clear flag should be turned OFF, ON, and then OFF again. Operation cannot be restarted until the error has been cleared.

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

-> Deceleration stop operation (Reference: 12.2.1 Deceleration Stop)

## 15.1.2 If the CPU ERROR LED Lights



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

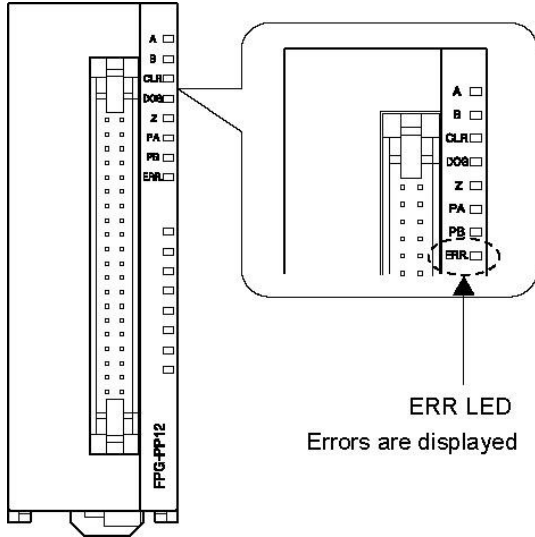
### Reference:

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

-> Deceleration stop operation (Reference: 12.2.1 Deceleration Stop)

## 15.2 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.



### Key Point:

The timing of a warning is when a start-up condition such as Y△0 is turned on.

**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				
	position command value (Increment)	No applicable condition						
	position command value (Absolute)	No applicable condition						
P point control	startup speed	Error		Error			No applicable condition	
	target speed	Error	Error	Error	Error	Error		
	Acceleration/deceleration time	Error		Error	Error	Error		
	position command value (Increment)	No applicable condition						
	position command value (Absolute)	No applicable condition						
Home return	startup speed	Error	Error	Error			No applicable condition	
	target speed	Error	Error	Error				
	Acceleration/deceleration time	Error		Error				
	position command value (Increment)	No applicable condition						
	position command value (Absolute)	No applicable condition						
JOG operation	startup speed	Error		Error			No applicable condition	
	target speed	Error	Error	Error	Error	Error		
	Acceleration/deceleration time	Error		Error				
	position command value (Increment)	No applicable condition						
	position command value (Absolute)	No applicable condition						
JOG positioning operation	startup speed	Error		Error			No applicable condition	
	target speed	Error	Error	Error				
	Acceleration/deceleration time	Error		Error				
	position command value (Increment)							
	position command value (Absolute)	Error	Error	Error				
Pulser input operation	startup speed						No applicable condition	
	target speed	Error	Error	Error				
	Acceleration/deceleration time	No applicable condition						
	position command value (Increment)	No applicable condition						
	position command value (Absolute)	No applicable condition						
<b>Operation when above error occurs</b>		Operation does not begin			Deceleration stop			

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

**Cases in which limit errors occur, and their contents**

		At startup		During operation	
		Over limit input (+)	Over limit input(-)	Over limit input (+)	Over limit input(-)
<b>E point control</b>	Forward	Error	Error	Error	Error
	Reverse	Error	Error	Error	Error
<b>P point control</b>	Forward	Error	Error	Error	Error
	Reverse	Error	Error	Error	Error
<b>Home return</b>	Forward	Error		Error	
	Reverse		Error		Error
<b>Home return (Home search)</b>	Forward	When the home position cannot be searched, a limit error occurs. (Refer to the notes below.)			
	Reverse				
<b>JOG operation</b>	Forward	Error		Error	
	Reverse		Error		Error
<b>JOG positioning operation</b>	Forward	Error	Error	Error	Error
	Reverse	Error	Error	Error	Error
<b>Pulser input operation</b>	Forward	Error		Error	
	Reverse	Note)	Error		Error
<b>Operation when above error occurs</b>		Operation does not begin		Stop	

1. Data of this area is not subject to errors.
2. When the near home input will not go ON but the Over limit input in the opposite goes ON after the table reversed the direction by the Over limit switch during the home search, a limit error occurs.



**Note:** Pulse/Sign output mode can be started up.

When the CW/CCW output mode is set, the limit error will occur.  
If the error occurs, solve it using the methods as described below.

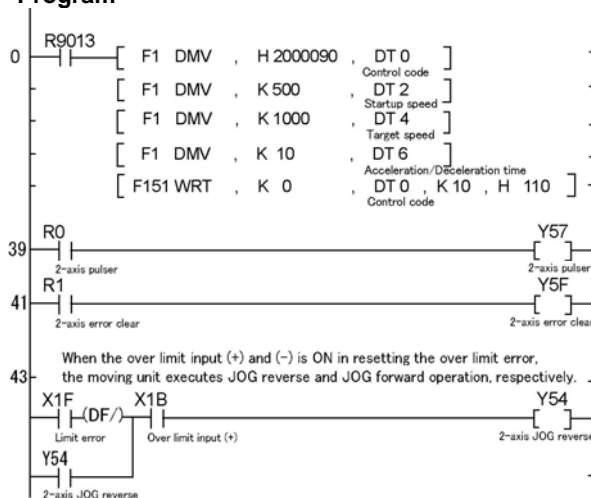
**-Using the home return function**

- (1) Turn ON the Error clear (Y\_F) of the Over limit input (+), and then turn it OFF.
- (2) Turn ON the Home return start (Y\_F) (towards the elapsed value minus (-) direction), while the Over limit input (+) is ON.

**-Using the JOG operation function**

- (1) Turn ON the Error clear (Y\_F) of the Over limit input (+), and then turn it OFF.
- (2) Turn ON the Reverse JOG (Y\_4), while the Over limit input (+) is ON.

**Program**



## 15.3 Resolving Problems

### 15.3.1 If the Positioning Unit ERR LED Lights

#### Conditions

There is a set value error for positioning or a limit error in the positioning data.

#### Procedure 1

Using programming tools, check the contents of an error.

X\_E ON: A set value error occurs.

X\_F ON: A limit error occurs.

In case of a limit error, go to Procedure 2.

In case of a set value error, go to Procedure 3.

#### Procedure 2

By either of the following, check a limit error.

1. When the set Over limit switch is ON, execute JOG operation, home return or any other operation to move the table until the Over limit switch goes OFF after a error is canceled.
2. In case of error with the set Over limit switch being OFF or without the Over limit switch, change the limit input valid logic using the control code.

Over limit switch (+) and (-) input status can be monitored by X\_B and X\_C.

Go to Procedure 5.

#### Procedure 3

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.

#### Range for positioning data setting

Type of parameter	Allowable setting range	Program specifications
Startup speed (pps)	0 to +4,000,000 [pps]	K0 to K4,000,000
Target speed (pps)	+1 to +4,000,000 [pps]	K1 to K4,000,000
Acceleration/deceleration time (ms)	0 to +32,767 [ms]	K0 to K32,767

#### Points to check:

1. 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, JOG positioning operation and home return, a value should be set which is larger than the startup speed.
2. Has the target speed been set to "0"?
3. Has a data register been set to a negative value?
4. 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.

#### Procedure 4

Modify the value out of the range in the program.

#### Procedure 5

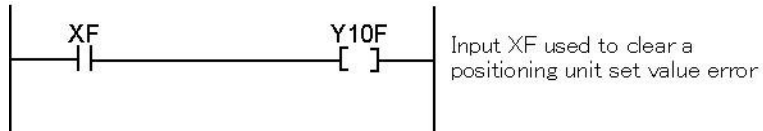
Turn off all the Y△0 to Y△9, and reset an error by any of the following methods.

1. Specify in the program so that the error clear flag (ECLR) goes OFF, ON and then OFF.
2. By the forced output using FPWIN-GR or FPWIN-Pro, make the error clear flag (ECLR) goes OFF, ON and then OFF.
3. Turn OFF once the driver and then PLC and turn ON again PLC and then the driver.



**Clearing an error by Error clear signal 1 (specify in the program)**

This is to clear an error in the program using the switch connected in advance. Make the optional input to turn ON the error clear signal applicable for each axis.

**Example:****Note:**

The number of relay to be used varies depending on the allocations.

**Clearing an error by Error clear signal 1 (forced output)****Procedure:**

1. Select [Forced I/O] from the menu of the programming tool software.
2. Specify the flag Y\_F for the forced output.
3. Make the target contact once ON and then OFF.
4. Cancel the forced status.

**Note:**

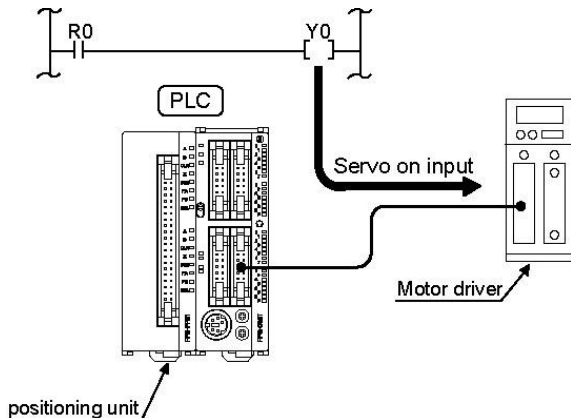
Without fail, execute “forced cancel” operation after the forced output.

The number of relay to be used varies depending on the allocations, axis number and the type of the unit installed.

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

#### Solution 1: For the servomotor

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.

→Check the control code items.

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

#### Solution

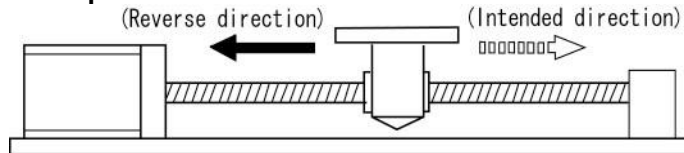
Review the program and correct it if necessary.

#### Points to check:

1. Check to make sure the I/O numbers are appropriate.
2. Check non-rewriting of the start flag in the program.
3. Check the input valid logic of the Over limit switch. (In this case, Error LED is blinking.)

### 15.3.4 Rotation/Movement Direction is Reversed

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**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.

-> "Connection of pulse output signal" (Refer to page 3-9.)

**Solution 2**

Check to make sure the control codes in the shared memory 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.

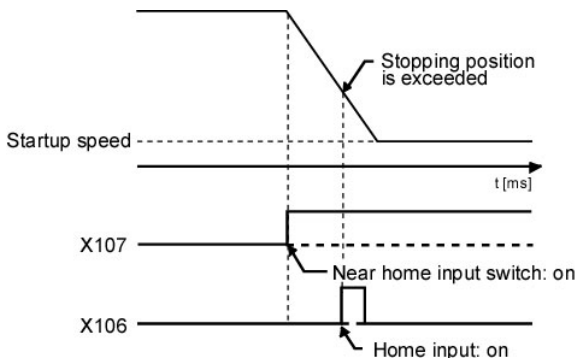
-> Increment and Absolute (Refer to page 4-13.)

**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 settings switches on the back of the unit.

-> "Pulse output mode" (Refer to page 4-2.)

### 15.3.5 The Stopping Position is OFF for a Home Return

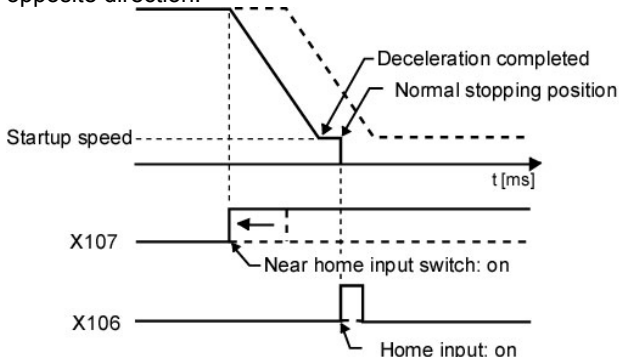


**Conditions**

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.

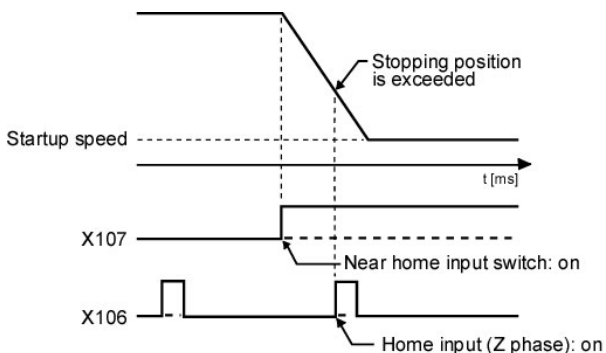
**Solution 1**

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:**

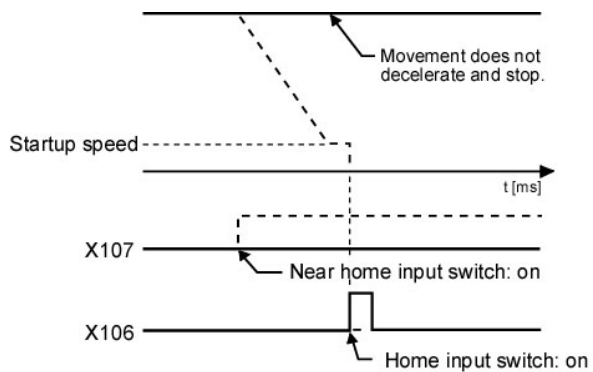
If the home input is connected to the Z phase of the servo motor driver, there may be cases in which the near home input position is close to the home input.



**Solution 2**

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

### 15.3.6 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 valid 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.

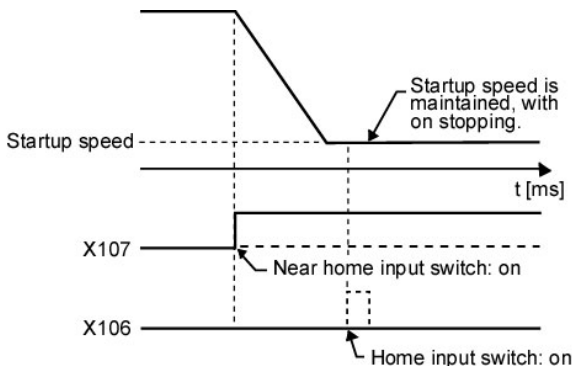
-> Control code: (Refer to page 16-7.)

-> Input valid logic: (Refer to page 10-24.)

#### Point to check:

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

### 15.3.7 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.

-> Control code: (Refer to page 16-7.)

-> Input valid logic: (Refer to page 10-24.)

#### Point to check:

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

# Chapter 16



# Specifications





## 16.1 Table of Performance Specification

### General specifications

Item	Description
<b>Ambient operating temperature</b>	0 to +55 °C/32F to +131F
<b>Ambient storage temperature</b>	-20 to +70 °C/ - 4F to +158F
<b>Ambient operating humidity</b>	30 to 85 % RH (at25°C non-condensing)
<b>Ambient storage humidity</b>	30 to 85 % RH (at25°C non-condensing)
<b>Breakdown voltage</b>	500 V AC, 1 minute Between the various pins of the external connector and the ground
<b>Insulation resistance</b>	100M $\Omega$ or more (measured with 500 V DC testing) Between the various pins of the external connector and the ground
<b>Vibration resistance</b>	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)
<b>Shock resistance</b>	Shock of 98 m/s <sup>2</sup> , 4 times in the X, Y, Z directions
<b>Noise immunity</b>	1,000 V[P-P] with pulse widths 50ns and 1 $\mu$ s (based on in-house measurements)
<b>Operating environment</b>	Free of corrosive gases and excessive dust

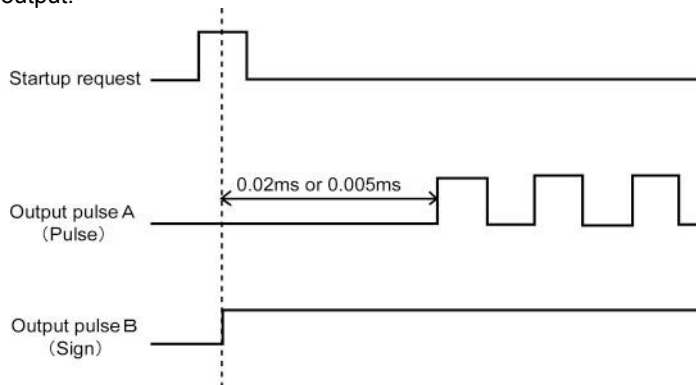
## Performance specifications

Item		AFPG430	AFPG431	AFPG432	AFPG433
Order number		FPG-PP11	FPG-PP21	FPG-PP12	FPG-PP22
Output type		Transistor		Line driver	
Occupied I/O points		Input: 16 points, Output: 16 points	Input: 32 points, Output: 32 points	Input: 16 points, Output: 16 points	Input: 32 points, Output: 32 points
Number of axes controlled		1 axis, independent	2 axes, independent	1 axis, independent	2 axes, independent
Position command	Command units	Pulse unit (The program specifies whether Increment or Absolute is used.)			
	Max, pulse count	Signed 32 bits ( - 2,147,483,648 to +2,147,483,647 pulses)			
Speed command	Command range	1pps to 500kpps (can set in 1pps.)		1pps to 4Mpps (can set in 1pps.)	
Acceleration/ deceleration command	Acceleration/ deceleration	Linear acceleration/deceleration, S acceleration/deceleration (this takes the form of an "S")			
	"S" Acceleration/ deceleration	can select from Sin curve, Secondary curve, Cycloid curve and Third curve.			
	Acceleration/ deceleration time	0 to 32,767 ms (can set in 1ms)			
Home return	Home Return speed	Speed setting possible (changes return speed and search speed)			
	Input terminals	Home input, Near home input, Over limit input (+), Over limit input(-)			
	Output terminals	Deviation counter clear output signal			
Operation mode		E point control (Linear and S accelerations/decelerations selecting possible) P point control (Linear and S accelerations/decelerations selecting possible) Home return function (Home search) JOG operation function (*1) JOG positioning function Pulser input function (*3) Transfer multiplication ratio ( $\times 1, \times 2, \times 5, \times 10, \times 50, \times 100, \times 500, \times 1000$ selecting possible) Real-time frequency change function Infinity output function			
Startup time		0.02ms or 0.005ms possible. (*2)			
Output interface	Output mode	1Pulse output (Pulse/Sign), 2Pulse output(CW/CCW)			
Feedback counter (*3)	Countable range	Signed 32-bit (-2,147,483,648 to +2,147,483,647 pulse)			
	Input mode	2-phase input, Direction distinction input, Individual input (transfer multiple available for each.)			
	Max. Coefficient speed	1 MHz			
Other functions		The flag to compare the elapsed value is built in. (The timing signal outputs at the optional position during an operation.)			
Internal current consumption (at 5 V DC) (*4)		150 mA max.	220 mA max.	150 mA max.	220 mA max.
External power supply (*5)	Voltage	21.6 V DC to 26.4 V DC			
	Current consumption	20mA	35mA	20mA	35mA
Weight		about 75g max.	about 80g max.	about 75g max.	about 80g max.

- \*1) When selected Linear acceleration/deceleration operation, the target speed can be changed during an operation.
- \*2) The startup time can be changed by the control code setting in the shared memory.  
The factory setting (default setting) is 0.02ms.

### About the startup time

The startup time is the time from the startup request to the pulse output. Particularly in Pulse/Sign mode, the output waveforms will be as follows since Sign signal should be output before the pulse output.



- \*3) Pulser input operation and feedback counter use the same pulse input terminal, so the both can not function simultaneously.
- \*4) To be supplied to the inside of the unit from FP  $\Sigma$  Control Unit.
- \*5) The power is supplied from the external to the unit connector.

## 16.2 Table of Shared Memory Area

### Shared Memory Area

The settings of the startup speed and target speed, specifying the direction of home return, selecting the type of S acceleration/deceleration should be made in the shared memory. The setting area (address) varies depending on the axis, but the setting contents are the same.

1st. axis: 100h to 10Fh occupied. 2nd. axis: 110h to 11Fh occupied.

When the settings is out of range, an error occurs when each is started and a set value error flag goes ON. Each setting value should be handled as the signed 32-bit data (double word).

The data in the shared memory will be cleared when the unit is turned OFF.

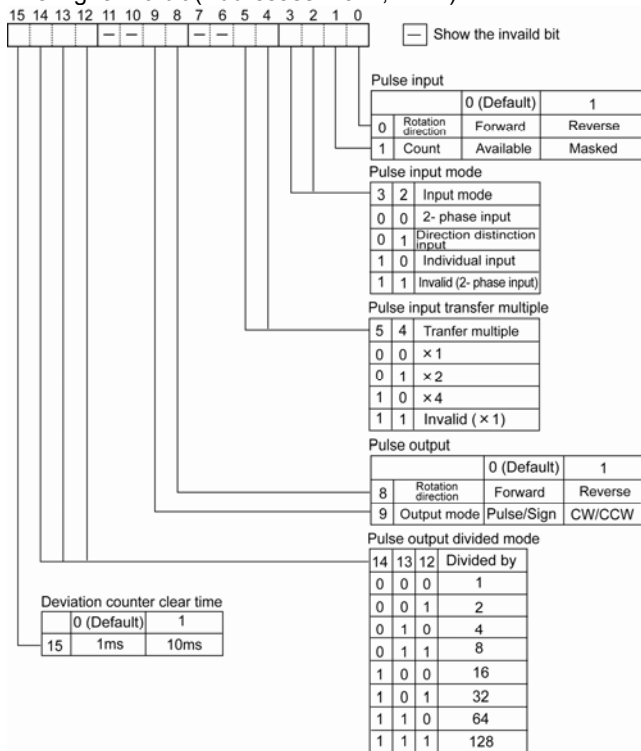
Shared memory address (Hexadecimal)		Name	Descriptions	Setting needed/not needed (Y: needed, N: not needed)					
1 axis	2 axis			E point control	P point control	JOG operation	JOG positioning operation	Home return	Pulser operation
100h	110h	Control code	Acceleration/deceleration (Linear, S) Control method (Increment, Absolute) Direction of home return and logic Pulser transfer multiple	Y	Y	Y	Y	Y	Y
101h	111h								
102h	112h	Startup speed fs [pps]	Startup speed setting range: 0 to +4,000,000[pps]	Y	Y (for 1st. speed only)	Y	Y	Y	N
103h	113h								
104h	114h	Target speed ft [pps]	Target speed setting Setting range: 1 to +4,000,000[pps]	Y	Y	Y	Y	Y	Y
105h	115h								
106h	116h	Acceleration/deceleration time Ac [ms]	Acceleration/deceleration time Setting range: 0 to 32,767 (ms)	Y	Y	Y	Y	N	N
107h	117h								
108h	118h	Position command value Pt [Pulse]	Position command value setting Signed 32-bit - 2,147,483,648 to +2,147,483,647[Pulse]	Y	Y	N	Y (Only for Increment)	N	N
109h	119h								
10Ah	11Ah	Elapsed value Pe [Pulse]	Count of elapsed value (Absolute) Signed 32-bit - 2,147,483,648 to +2,147,483,647[Pulse]	-	-	-	-	-	-
10Bh	11Bh								
10Ch	11Ch	Compare pulse count Pc [Pulse]	Comparison pulse setting Signed 32 bit - 2,147,483,648 to +2,147,483,647[Pulse]	-	-	-	-	-	-
10Dh	11Dh								
10Eh	11Eh	Feedback counter Ct [Pulse]	Feedback pulse count Signed 32-bit - 2,147,483,648 to +2,147,483,647[Pulse]	-	-	-	-	-	-
10Fh	11Fh								

#### Note:

1. The shared memory is shared between E point control, P point control, JOG operation, JOG positioning operation, home return, and pulser input operations. Be careful that the shared memory is not overwritten at the same timing.
2. For the first speed of E point control and P point control, and for JOG operation, JOG positioning operation and home return, the value set for the target speed should be larger than that set for the startup speed.
3. "-" is read and written as needed.
4. Up to 4Mpps can be set for the Line driver and transistor driver types, but set 500kpps max. for the transistor type.
5. Please note that the count of the feedback counter will be cleared when the home return is completed or when the Error clear flag (Y\_F) is ON.

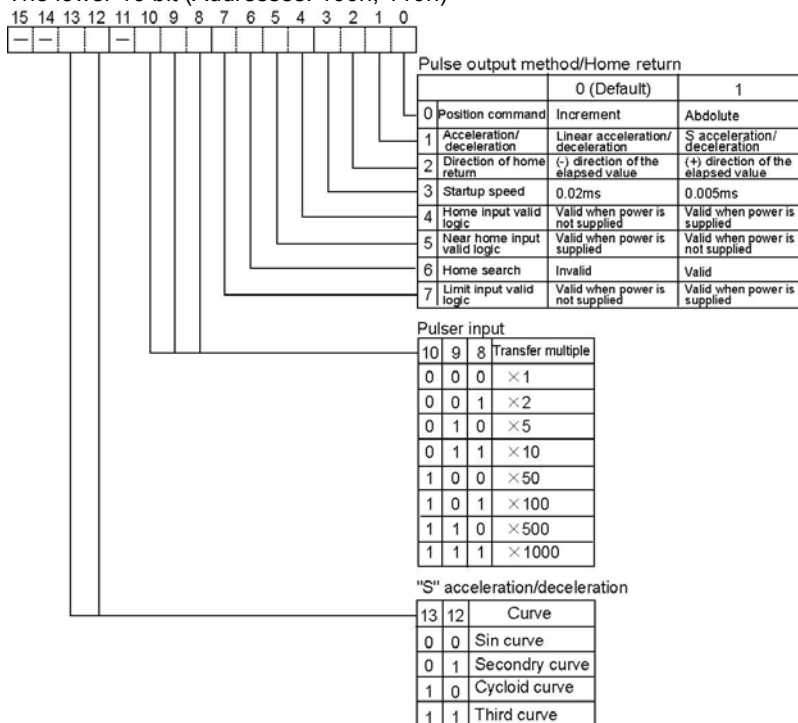
## 16.3 Control Code Details

The higher 16 bit (Addresses: 101h, 111h)



When counting the 2-phase input such as the input from the encoder, set the pulse input transfer multiple to "4 multiple setting" ( $\times 4$ ) or "2 multiple setting" ( $\times 2$ ) using the control code to prevent counting error.

The lower 16 bit (Addresses: 100h, 110h)



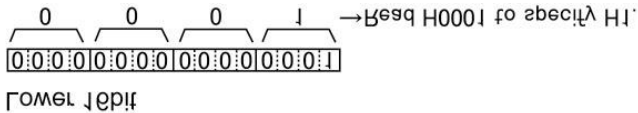
### How to specify the control code

32 bits are assigned to the control code as shown in the previous page. Specify the pulse output method or pulse input method. When you do not want to use any function, specify "0" for its applicable bit.

#### Example 1: Pulse output method at the default

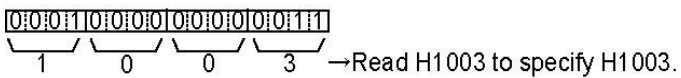
All bits are 0 at the default setting, that is, the lowest 2 bit is 0. Accordingly, the control is the increment method, and the acceleration/deceleration method is a linear acceleration/deceleration.

#### Example 2: The control code when changing the control method to the Absolute method



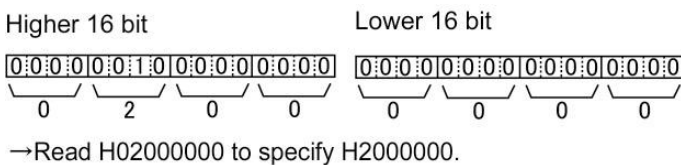
#### Example 3: The control code when changing "S" acceleration/deceleration to Secondary acceleration/deceleration in the Absolute method

Lower 16 bit



Example 4: The control code when changing the output method to CW/CCW in the

Increment method.



### Specifying the Pulse output divide mode

In the divided mode, the value set for the startup speed or the target speed can be divided by the optional value to output. This mode allows setting the frequency value less than 1pps.

**Example:** Target speed is 300 pps and divided mode is 16: 18.75pps is output.

## 16.4 Table of I/O Flag Allocation

Flag	Name		Description	I/O flag number (*5)		
				1 - axis type	2 - axis type	
				1st axis	1st axis	2nd axis
X_0	Pulse output busy	BUSY	ON during pulse output(*1)	X100	X100	X110
X_1	Pulse output done	EDP	ON when Pulse output ends. (*2)	X101	X101	X111
X_2	Acceleration zone	ACC	ON during acceleration zone.	X102	X102	X112
X_3	Constant speed zone	CON	ON during constant speed zone.	X103	X103	X113
X_4	Deceleration zone	DEC	ON during deceleration zone.	X104	X104	X114
X_5	Rotation direction	DIR	Monitors direction of rotation. (ON during the elapsed value increment.)	X105	X105	X115
X_6	Home input	ZSG	ON when home input becomes valid.	X106	X106	X116
X_7	Near home input	DOG	ON when near home input becomes valid.	X107	X107	X117
X_8	Home Return done	ORGE	ON when home return is done. (*3)	X108	X108	X118
X_9	Comparison result	CLEP	ON when elapsed value of internal counter is greater than or equal to the number of comparison pulse.	X109	X109	X119
X_A	Set value change confirmation	CEN	With P point control, this is used to confirm rewriting of set values. (*4)	X10A	X10A	X11A
X_B	Overt limit input (+)	LMT+	Monitors the flag of Over limit input (+) signal.	X10B	X10B	X11B
X_C	Overt limit input (-)	LMT-	Monitors the flag of Over limit input (-) signal.	X10C	X10C	X11C
X_D	Timing input monitor	TIMM	Monitors the flag of JOG positioning timing.	X10D	X10D	X11D
X_E	Set value Error	SERR	ON when a set value error occurs.	X10E	X10E	X11E
X_F	Limit Error	LERR	ON when Over limit input is made during operation or startup.	X10F	X10F	X11F

\*1) ON during the pulse output of E point control, P point control, home return, JOG operation, JOG positioning operation and maintained ON until each operation is completed.

\*2) ON when E point control, P point control, JOG operation, JOG positioning or pulser input operation ends. also ON at deceleration stop or forced stop.  
And if either of E point control, P point control, home return, JOG operation, JOG positioning operation or pulser input operation is started up, this goes OFF.

\*3) ON when the home return is completed.

This goes OFF when the next operation of E point control, P point control, JOG operation, JOG positioning operation, Home return or Pulser input operation is started.

\*4) ON at P point control or E point control startup. OFF when any data is written to the shared memory of the positioning unit by the instruction, F151 or P151 in the user program.

\*5) Flag number is the one when the slot No. is 0. The No. actually used varies depending on where the unit is installed.

Flag	Name		Description	I/O flag number (*5)		
				1 - axis type	2 - axis type	
				1st axis	1st axis	2nd axis
Y_0	E point Control start	EST	When turned ON in the user program, E point control is initiated.	Y100	Y100	Y110
Y_1	P point control start	PST	When turned ON in the user program, P point control is initiated.	Y101	Y101	Y111
Y_2	Home Return start	ORG S	When turned ON in the user program, Home return is initiated.	Y102	Y102	Y112
Y_3	Forward JOG	JGF	When turned ON in the user program, Forward JOG is initiated.	Y103	Y103	Y113
Y_4	Reverse JOG	JGR	When turned ON in the user program, Reverse JOG is initiated.	Y104	Y104	Y114
Y_5	Forced stop	EMR	When turned ON in the user program, operations currently running are interrupted and forcibly terminated.	Y105	Y105	Y115
Y_6	Deceleration stop	DCL	When turned ON in the user program, operations currently running are interrupted, and decelerate to a stop.	Y106	Y106	Y116
Y_7	Pulser input enabled	PEN	When turned ON in the user program, pulser input is enabled. (valid only while ON.)	Y107	Y107	Y117
Y_8	JOG positioning operation start	JGST	ON during the transfer from JOG operation to JOG positioning operation.	Y108	Y108	Y118
Y_9	JOG positioning start	TIM	ON when JOG positioning is started. (can be used to confirm if JOG positioning operation is ON.)	Y109	Y109	Y119
Y_A	-	-	-	Y10A	Y10A	Y11A
Y_B	-	-	-	Y10B	Y10B	Y11B
Y_C	-	-	-	Y10C	Y10C	Y11C
Y_D	-	-	-	Y10D	Y10D	Y11D
Y_E	-	-	-	Y10E	Y10E	Y11E
Y_F	Error clear	ECLR	ON when to cancel an error.	Y10F	Y10F	Y11F



# Chapter 17

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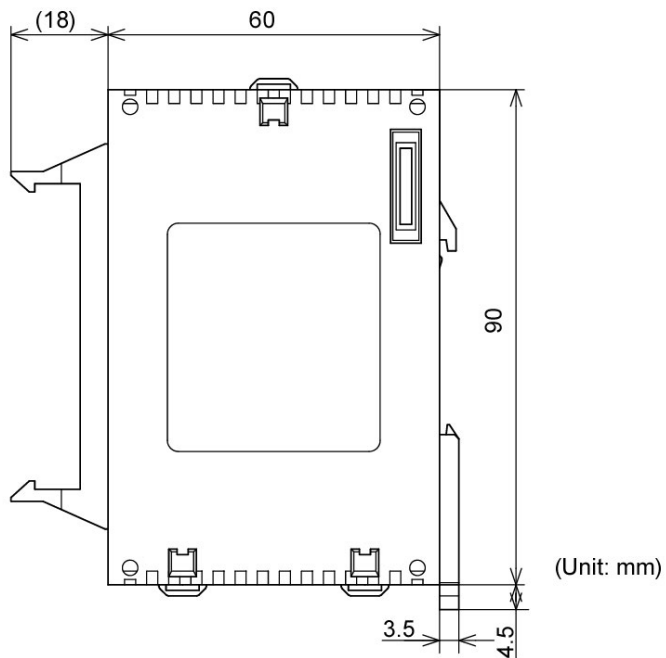
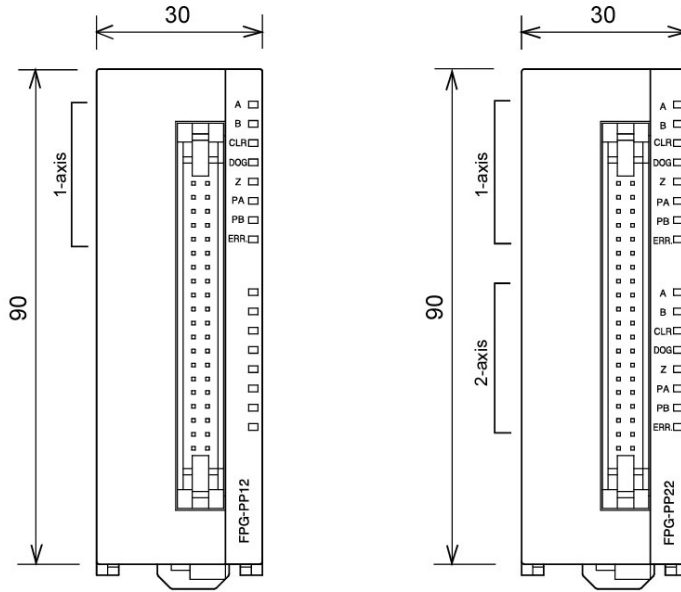
## Dimensions and Driver Wiring



# 17.1 Dimensions

FPG-PP11  
 (1 - axis transistor type)  
 FPG-PP12  
 (1 - axis line driver type)

FPG-PP21  
 (2 - axis transistor type)  
 FPG-PP22  
 (2 - axis line driver type)

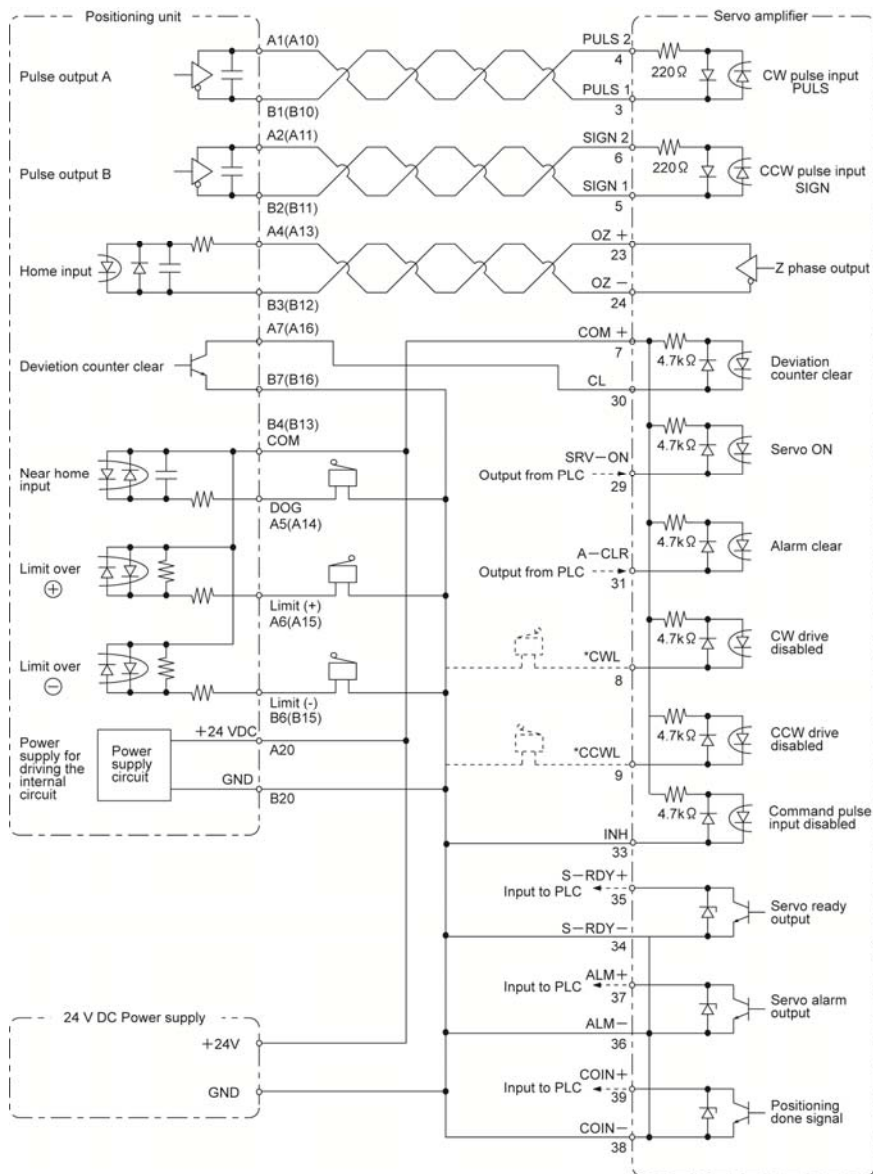


## 17.2 Wiring for Motor Driver

When using FPΣ Positioning Unit with MINAS Motor, an easy-connectable “Motor driver I/F terminal” is recommended.

**Reference:** < 1.1.3 Combination with MINAS Motor >

### 17.2.1 Panasonic MINAS A Series

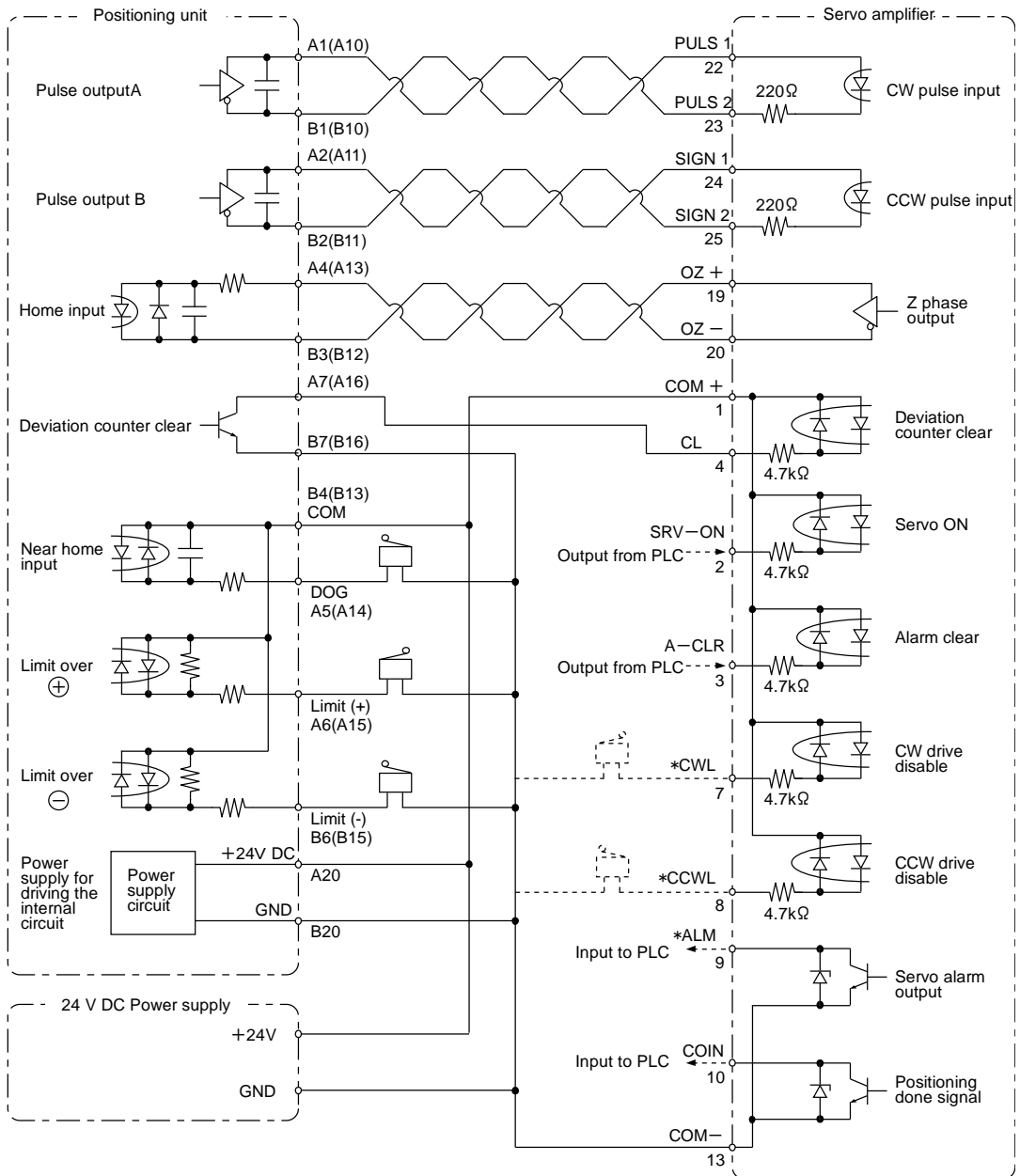


\*When connecting the CW drive disabled and CCW drive disabled input, the servo ready output, and the servo alarm output on the motor driver side, the circuits recommended by the various motor manufacturers should be used.

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

The above wiring is for the line driver output type.

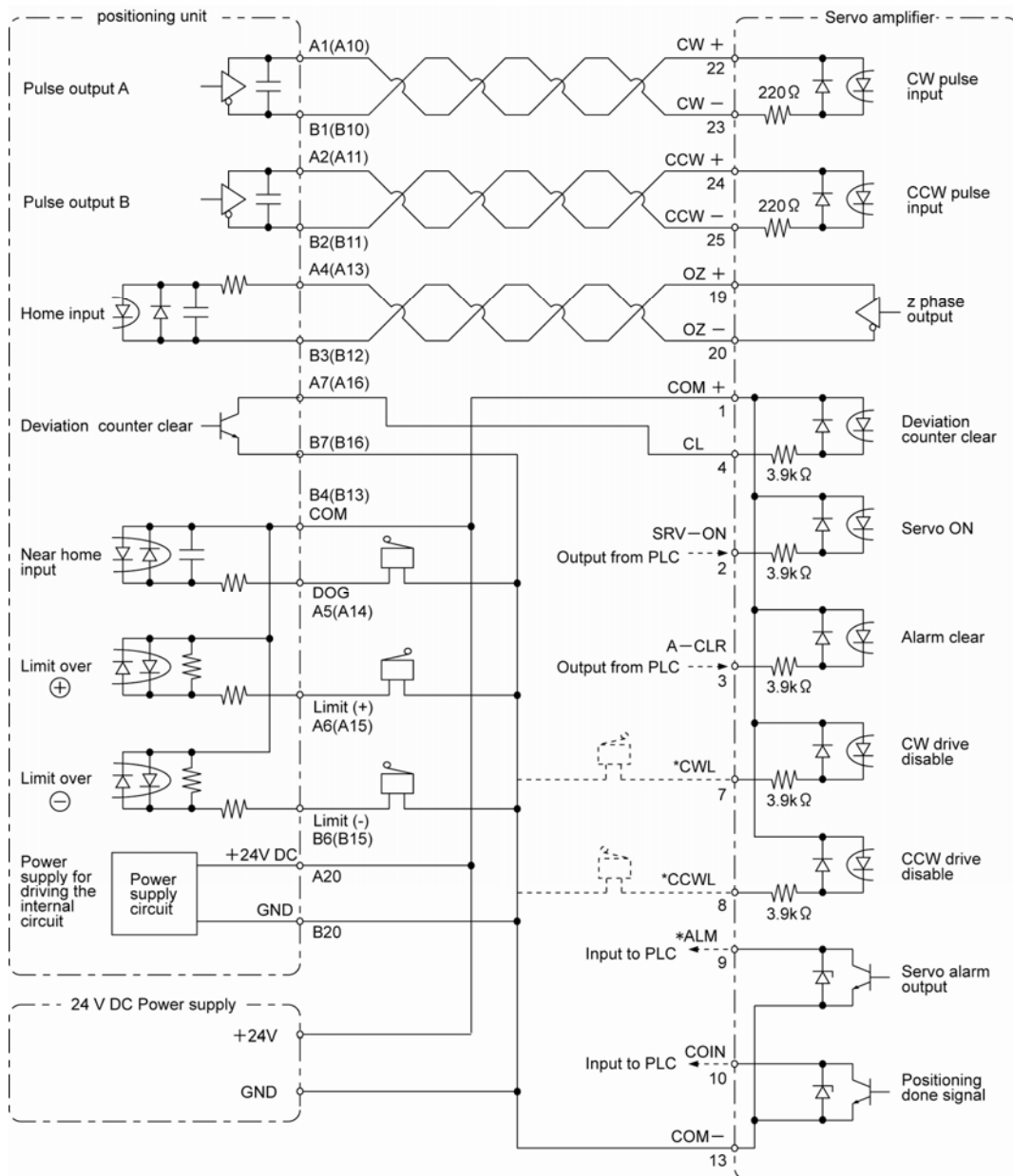
### 17.2.2 Panasonic MINAS S Series / E Series



\*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 axis.

The above wiring is for the line driver output type.

### 17.2.3 Panasonic MINAS EX Series

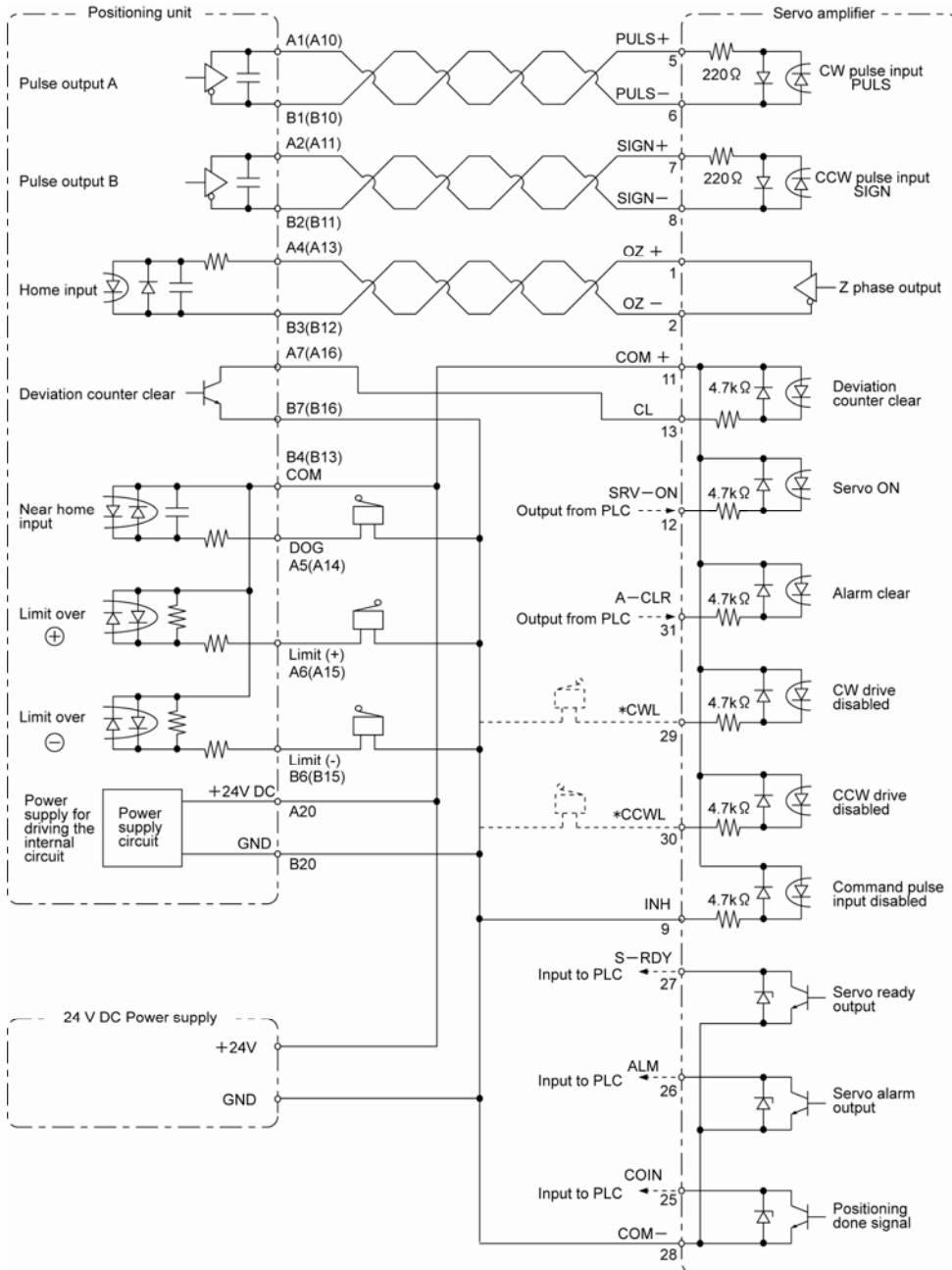


\*When connecting the CW drive disabled and CCW drive disabled input and the servo alarm output on the motor driver side, the circuits recommended by the various motor manufacturers should be used. Numbers in parentheses after the unit side indicate the pin number for the second axis.

The above wiring is for the line driver output type.

As of October 2008, this is the end-of-life (EOL) product.

### 17.2.4 Panasonic MINAS X (XX) Series



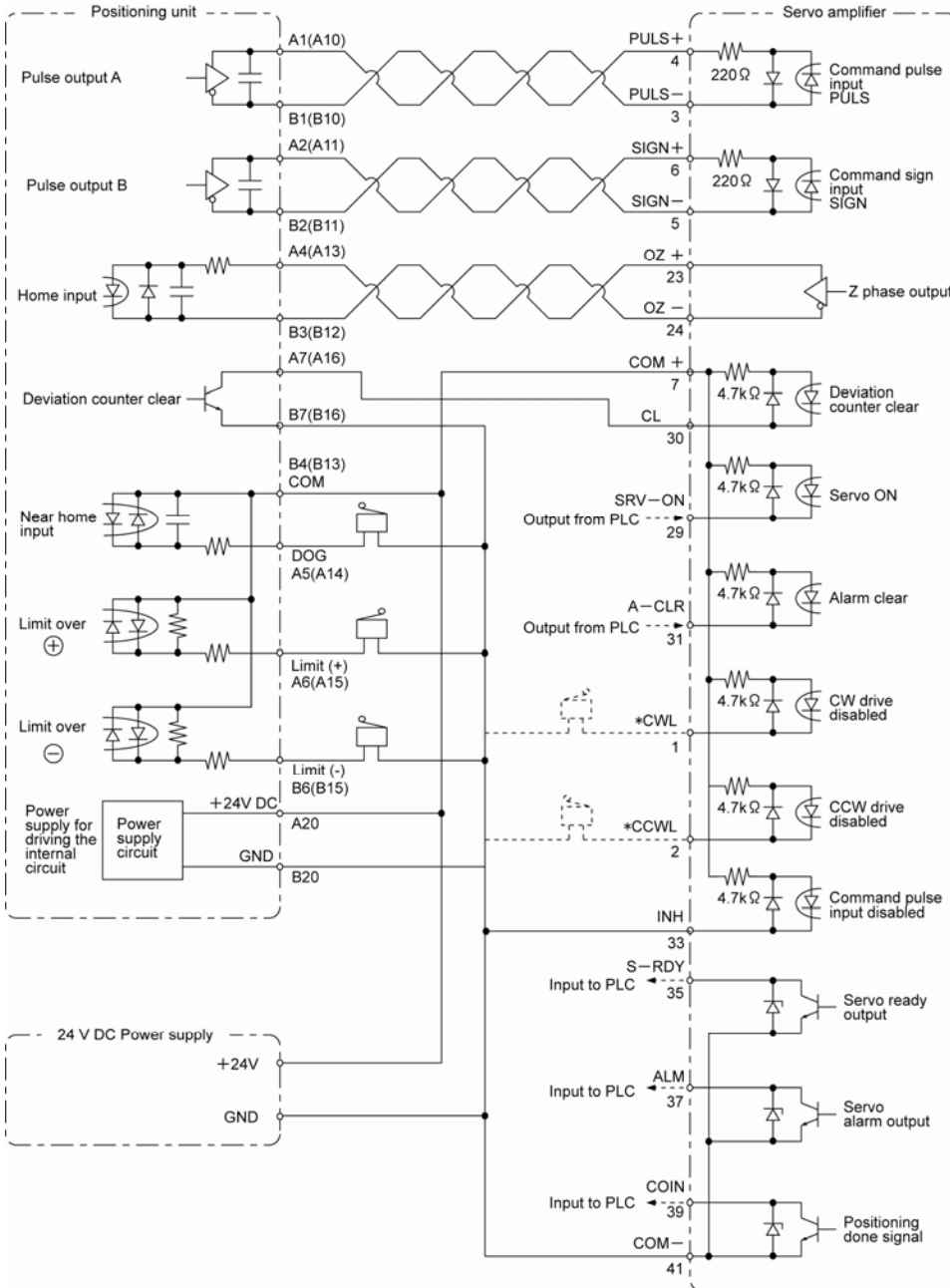
\*When connecting the CW drive disabled and CCW drive disabled input, the servo ready output, and the servo alarm output on the motor driver side, the circuits recommended by the various motor manufacturers should be used.

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

The above wiring is for the line driver output type.

As of October 2008, this is the end-of-life (EOL) product.

### 17.2.5 Panasonic MINAS 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.

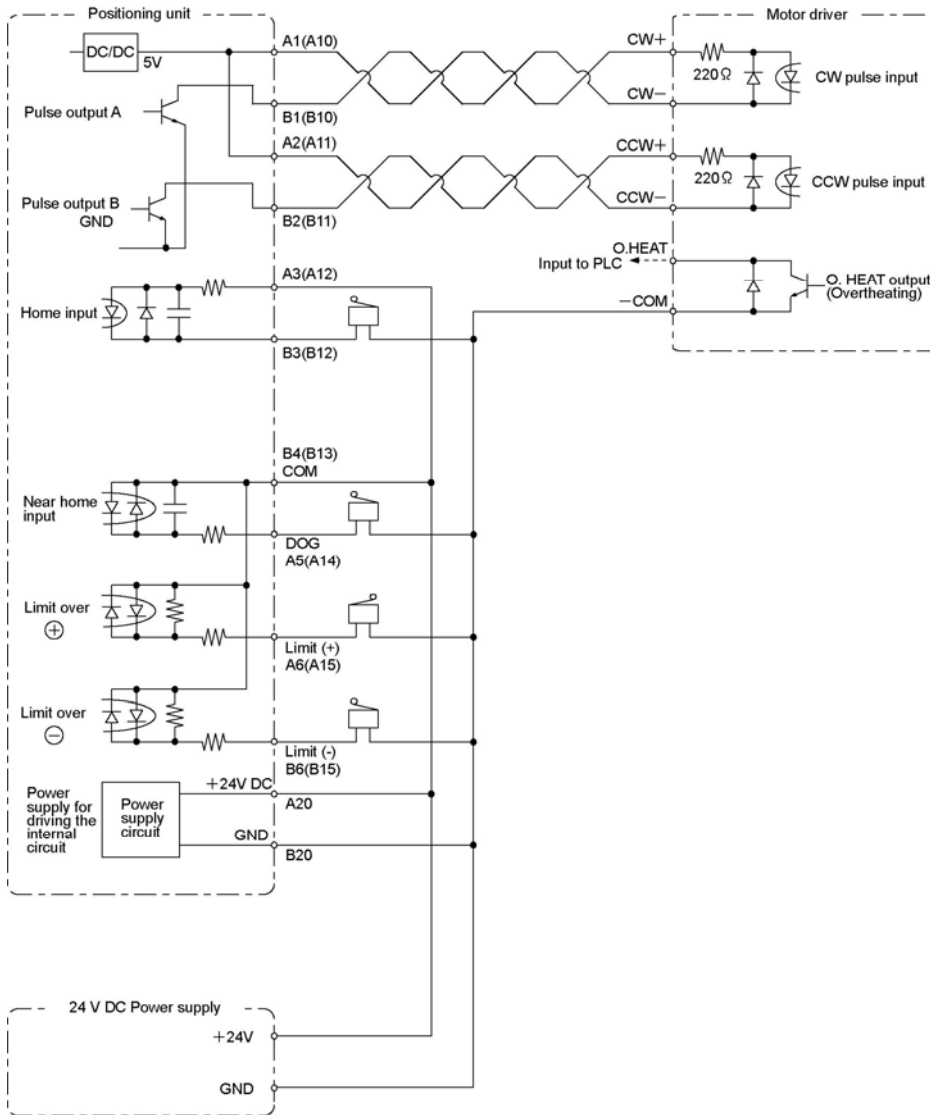
Numbers in parentheses after the unit side indicate the pin number for the second axis.

The above wiring is for the line driver output type.

As of October 2008, this is the end-of-life (EOL) product.



### 17.2.6 Oriental Motor UPK-W Series



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

### 17.2.7 Motor Driver I/F Terminal II

**-Unit type**

Product name		Product number
Motor Driver I/F Terminal II	1-axis type	AFP8503
	2-axis type	AFP8504

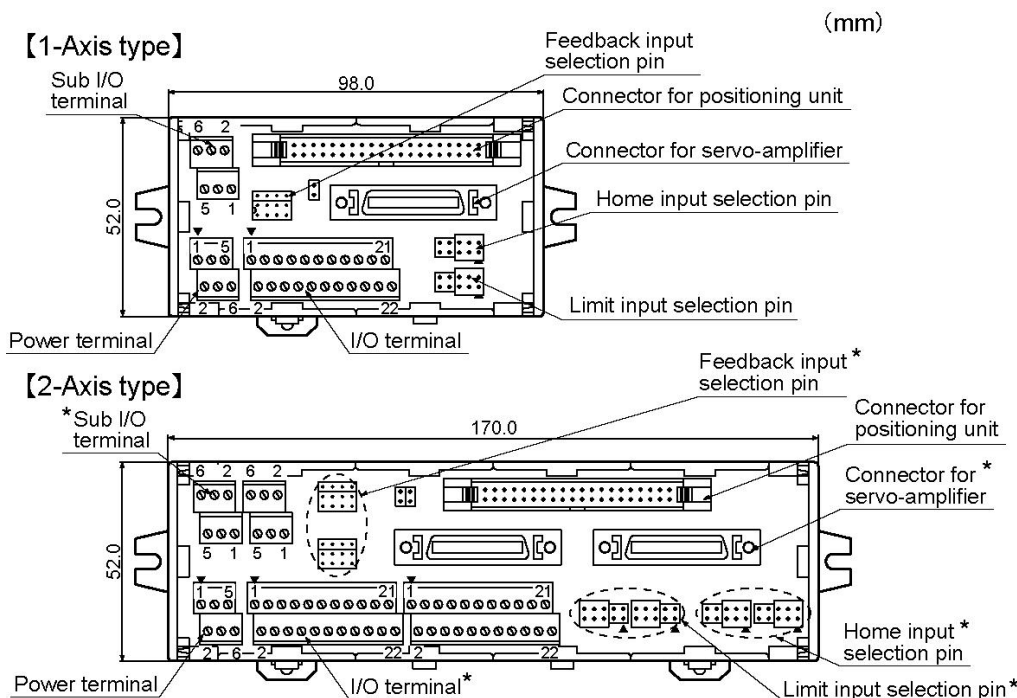
**-Positioning unit which can be used**

Product name		Product number
FP2 Positioning unit Multifunction type	2-axis type	AFP2434
	4-axis type	AFP2435
FPSigma Positionin unit	1-axis type	AFPG432
	2-axis type	AFPG433

**-Related products**

Product name		Product number
Cable for FP2 Positioning unit	0.5m	AFP85100
	1m	AFP85101
Cable for MINAS AIII series	1m	AFP85131
	2m	AFP85132
Cable for MINAS S series	1m	AFP85141
	2m	AFP85142

**-Parts and Dimension**

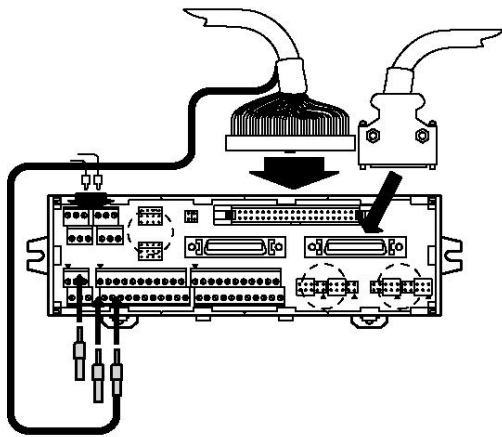


The asterix ( →\*) below indicates the following:  
 AX1 and AX2; AX(3) and AX(4) which you can see at the PWB of the I/F terminal, both share the same connector slot at the FP2 positioning unit side. (for PP22 type and PP42 type)  
 When the user will use the 3 and 4 axis connection from the FP2 positioning unit, the AX(3) and AX(4) can be used for this.

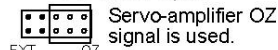
Note: Number 3 and 4 are parenthesized at the I/F terminal.

**-Connecting the wiring**

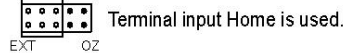
Caution: Be sure the power is turned off while connecting the wiring.

Home input selection pin

For Home input :



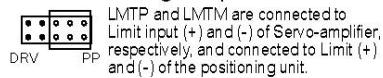
Servo-amplifier OZ signal is used.



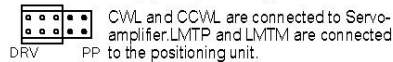
Terminal input Home is used.

Limit input selection pin

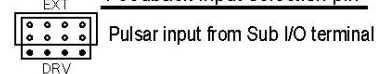
For Limit signal input to :



LMTP and LMTM are connected to Limit input (+) and (-) of Servo-amplifier, respectively, and connected to Limit (+) and (-) of the positioning unit.



CWL and CCWL are connected to Servo-amplifier. LMTP and LMTM are connected to the positioning unit.

Feedback input selection pin

Pulsar input from Sub I/O terminal



Feedback input from Servo-amplifier

-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.

-It can be switched whether Home input is received from the servo-amplifier OZ signal (direct connection) or from the terminal input Home, using Home input selection pin. (See the figure above.)

-(a) and (b) below can be switched using the limit input selection pin. (See the figure above.)

(a) : LMTP and LMTM signals of the I/O terminal are sent to the positioning unit and servo-amplifier simultaneously.

(b) : LMTP and LMTM signals are sent to the positioning unit and CWL and CCWL signals of the I/O terminal are sent to the servo-amplifier.

-It can be switched whether the pulse input of the positioning unit is sent to the PA/PB of the I/O terminal or to the encoder signal output, using the feedback input selection pin. (See the figure above.)

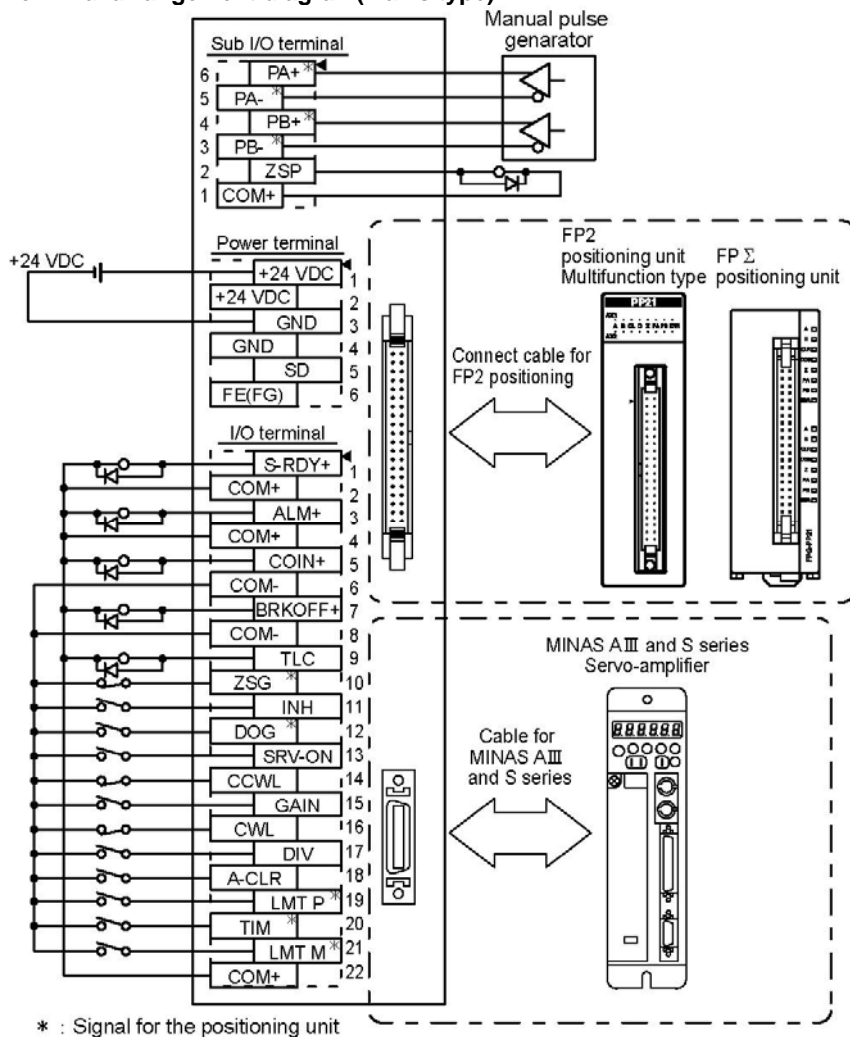
-Please connect the shielded cable terminal (cable type: AFP85100; AFP85101) to the FE terminal (at I/F terminal)

※When FP2 and the MINAS-AIII(S) servo-amplifier 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-AIII(S) servo-amplifier.

※SD terminal (of the I/F terminal) - this is connected to the GND pin of the CN I/F connector of the MINAS-AIII(S) servo-amplifier.

**-Terminal arrangement diagram(1 axis type)**



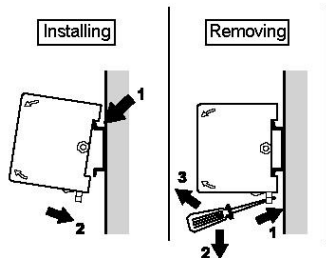
**-Pole terminal**

Manufacture	Part No.	Size	Tightening torque
Phoenix Contact Co.	AI 0.25-6BU	AWG#25-#22	0.22-0.25 N·m
	AI 0.34-6TQ	AWG#24-#22	
	AI 0.5-6WH	AWG#22-#20	

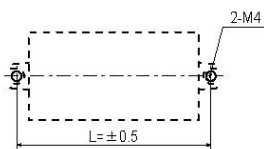
**-Installing the I/F terminal**

-DIN rail installation

(DIN EN50022 35 mm / 1.378 in. width)



-Screw-in installation



Type	Part number	L(mm)
1-axis type	AFP8503	106.0
2-axis type	AFP8504	178.0

# Chapter 18

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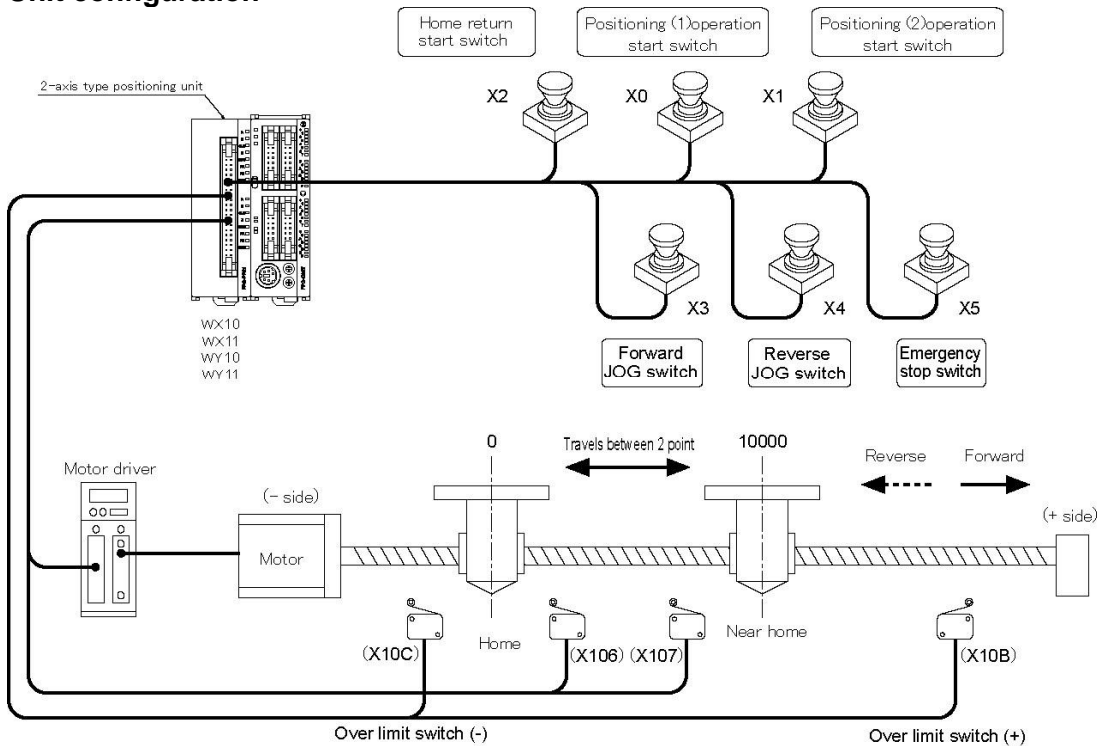
## Sample Program



## 18.1 Sample Program

### 18.1.1 Positioning Program for 1 Axis

#### Unit configuration



#### An overview of a sample program

This sample program uses the absolute method.

When Over limit switch is ON, the status is to be the power being supplied.

The positioning (1) and (2) operations will be valid after home return.

1. When input X0 is ON, the table moves to the absolute position 10000. [Positioning (1)]
2. When input X1 is ON, the table moves to the absolute position 0. [Positioning (2)]
3. When input X2 is ON, a return to the home position begins. (If the near home input is not in the return direction, a Over limit 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
X100	Pulse output busy flag	R0	during home return operation
X101	Positioning done flag	R1	Home return command pulse
X108	Home return done flag	R8	Home return done pulse
X0	Positioning(1) operation start	R9	Home return completed and stored in memory
X1	Positioning(2) operation start	R10	during positioning (1) operation
X2	Home Return start	R11	Positioning (1) operation command pulse
X3	Forward JOG	R12	Positioning (1) completed and stored in memory
X4	Reverse JOG	R13	Positioning (1) done pulse
X5	Emergency stop	R20	during positioning (2) operation
Y100	E point control start	R21	Positioning (2) operation command pulse
Y102	Home return start	R22	Positioning (2) completed and stored in memory
Y103	Forward JOG	R23	Positioning (2) done pulse
Y104	Reverse JOG	R30	Forward JOG setting
Y105	Forced stop	R31	Reverse JOG setting

**Reference:**

The switch input status can be checked at the following flag.

X106 Home input

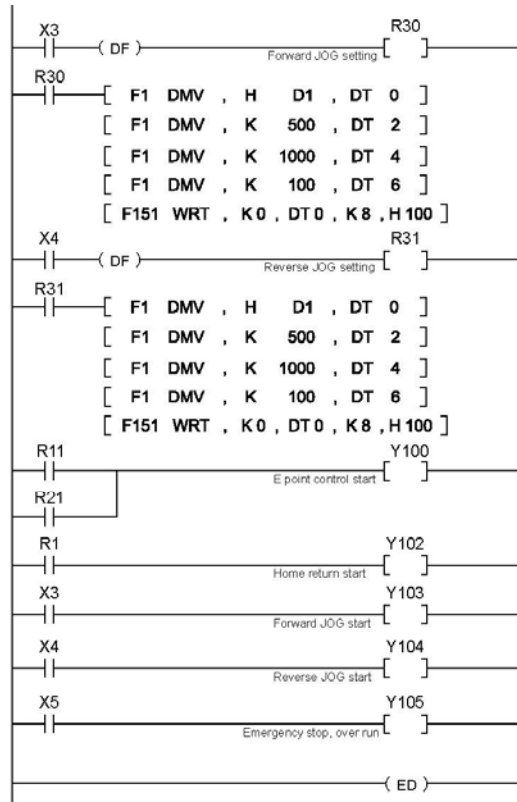
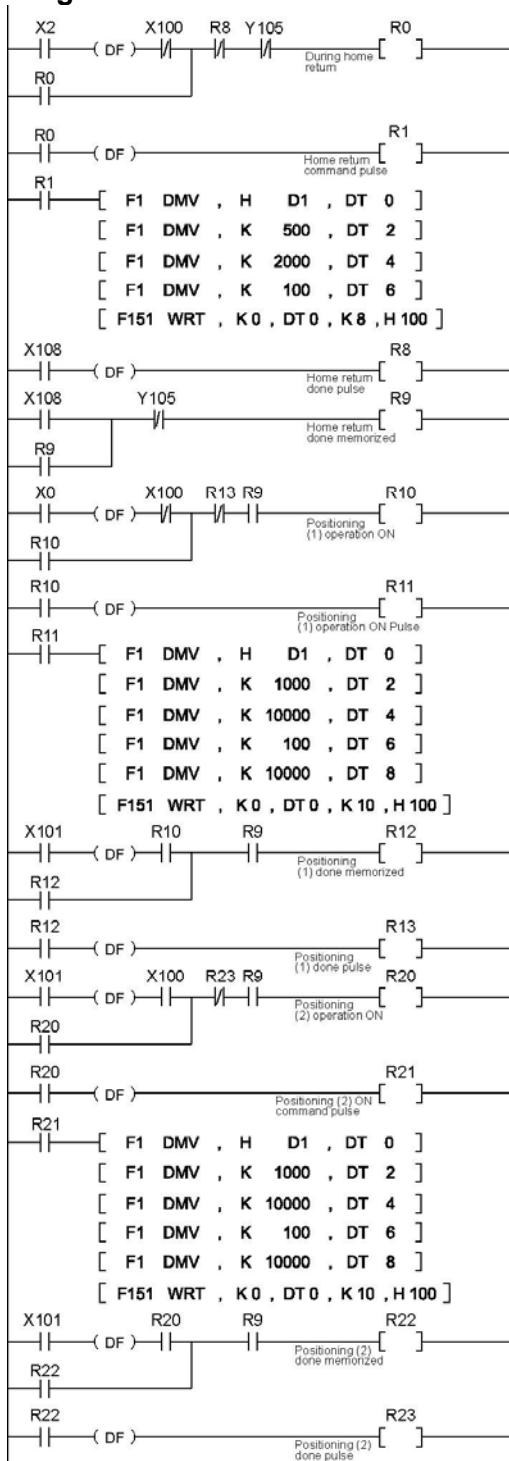
X107 Near home input

X10B Over limit input (+)

X10C Over limit input (-)

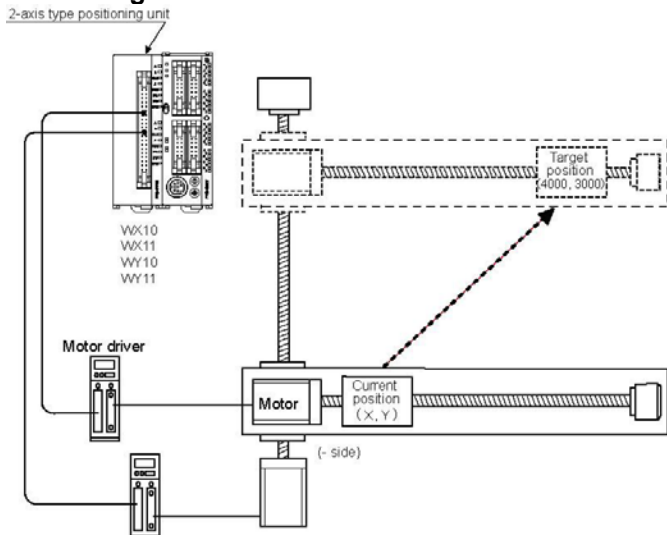


**Program**



### 18.1.2 Positioning for 2 Axes (Linear Interpolation Program)

#### Unit configuration



#### An overview of a sample program

This sample program uses the absolute method.

1. The current absolute position is read into the data table reads.
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 start up 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 flag is used and the startup conditions are specified.

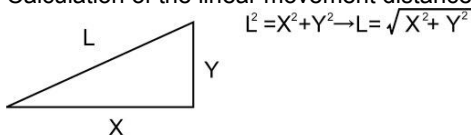
#### Items to be set for the program

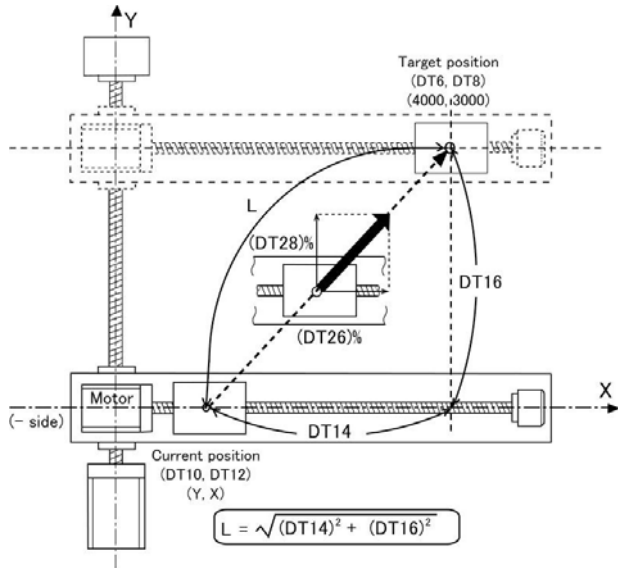
Data	Linear component	X axis component	Y axis component
Target position (absolute)	(X, Y)	X*	Y*
Current position (absolute)	(x, y)	x	y
Movement distance	$L = \sqrt{(X-x)^2 + (Y-y)^2}$	$Lx = X-x$	$Ly = Y-y$
startup speed	$Vs^*$	$Vsx = Vs \times \frac{ X-x }{L}$	$Vsy = Vs \times \frac{ Y-y }{L}$
target speed	$Vt^*$	$Vtx = Vt \times \frac{ X-x }{L}$	$Vty = Vt \times \frac{ Y-y }{L}$
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.

#### Reference:

Calculation of the linear movement distance

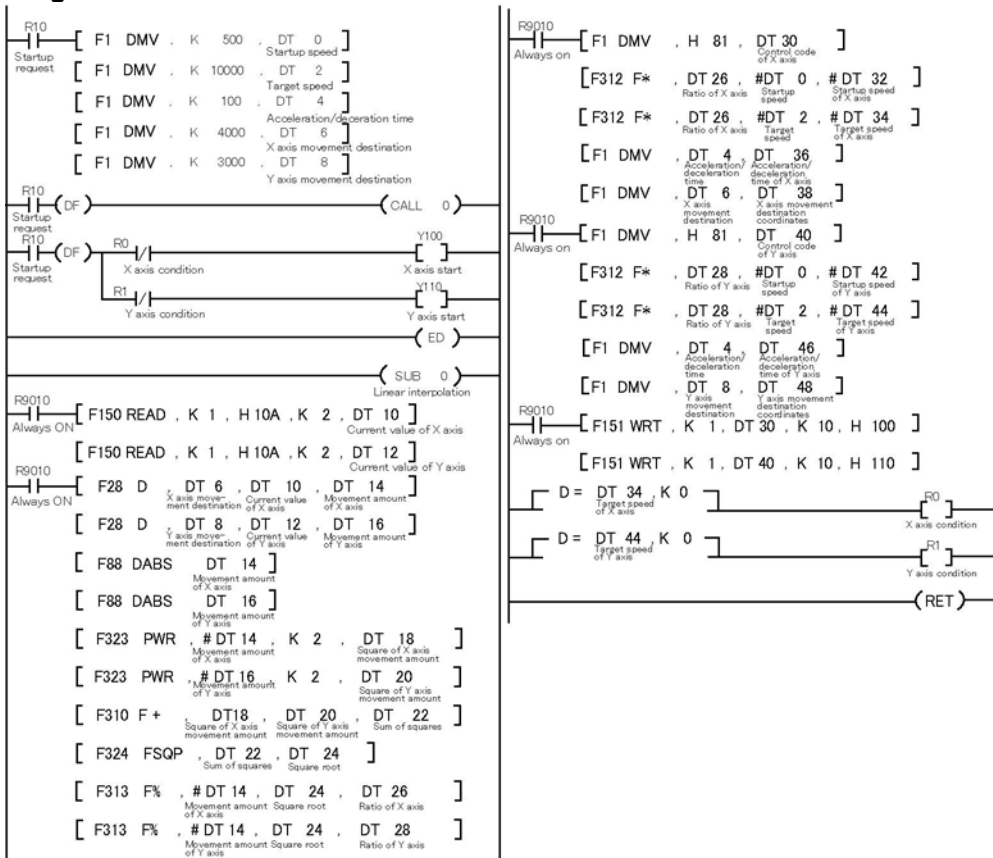




**Allocation of data registers**

Item	Data No.	Description	Calculation formula
User Setting area	DT0	startup speed	
	DT2	target speed	
	DT4	Acceleration/deceleration time	
	DT6	Target position of X axis	
	DT8	Target position of Y axis	
Data register the program is using	DT10	Current position of X axis	
	DT12	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	Control code of X axis	H1<Absolute>
	DT32	Startup speed of X axis component	$DT0*DT26$
	DT34	Target speed of X axis component	$DT2*DT26$
	DT36	Acceleration/deceleration time	DT4
	DT38	Target position of X axis	DT6
DT40	Control code of Y axis	H1<Absolute>	
DT42	Startup speed of Y axis component	$DT0*DT28$	
DT44	Target speed of Y axis component	$DT2*DT28$	
DT46	Acceleration/deceleration time	DT4	
DT48	Target position of Y axis	DT8	

**Program**



**Reference:**

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).

When Over limit switch (+) and Over limit switch(-) are not connected, change the limit input valid logic using the control code. The default setting is the input existing when the power is not supplied, that is, is the input existing without the Over limit switch connection.

# Record of changes

Manual No.	Date	Description of changes
ARCT1F365E	SEPT., 2002	First edition
ARCT1F365E-1	NOV., 2003	Second edition (PDF Only) Add: 17.2.7 MoterDriver I/F Terminal Changes: Input terminal specification To correct an error
ARCT1F365E-2	AUG. 2004	Third edition
ARCT1F365E-3	NOV. 2008	Fourth edition - Change in Corporate name
ARCT1F365E-4	AUG. 2011	Fifth edition - Change in Corporate name - Fixed Errors
ARCT1F365E-5	JUL. 2013	Sixth edition - Change in Corporate name





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