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 FP ∑ 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 FP ∑ 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 FP ∑ 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 FP ∑ 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 ∑ 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 Σ 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 Σ 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 Σ positioning unit is equipped with a dedicated input terminal.
Transfer multiple
With the FP Σ 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

Functions of Unit and Restrictions on Combination
1.1 Functions of FP Σ 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
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 Σ 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Output type</th>
<th>Part number</th>
<th>Product number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – axis type</td>
<td>Transistor output</td>
<td>FPG-PP11</td>
<td>AFPG430</td>
</tr>
<tr>
<td>2 – axis type</td>
<td>Transistor output</td>
<td>FPG-PP21</td>
<td>AFPG431</td>
</tr>
<tr>
<td>1 – axis type</td>
<td>Line driver output</td>
<td>FPG-PP12</td>
<td>AFPG432</td>
</tr>
<tr>
<td>2 – axis type</td>
<td>Line driver output</td>
<td>FPG-PP22</td>
<td>AFPG433</td>
</tr>
</tbody>
</table>

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 FPΣ 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

<table>
<thead>
<tr>
<th>FP2 positioning unit (Multifunction type)</th>
<th>Motor driver I/F terminal</th>
<th>Connection cable used with a positioning unit</th>
<th>MINAS A III series</th>
<th>MINAS S series</th>
<th>MINAS A series</th>
<th>MINAS EX series</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP2 positioning unit (Multifunction type)</td>
<td></td>
<td>Dedicated cable for A III series</td>
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<tr>
<td>AFPG434, 2435</td>
<td>Motor driver I/F terminal II</td>
<td>1 m: AFP85131</td>
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<td>1-axis type: AFP8503</td>
<td>2 m: AFP85141</td>
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<td>2-axis type: AFP8504</td>
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<td></td>
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</tr>
</tbody>
</table>

BRK OFF signal cannot be used.

Dedicated cable for EX series

1 m: AFP85121
2 m: AFP85122
1.2 Unit Functioning and Operation Overview

1.2.1 Unit Combinations for Positioning Control

Interfaces provided with the positioning unit
In addition to pulse command output for the motor driver, the positioning unit is equipped with home input and near home input terminals, 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 $Σ$ 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 Σ 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.

<table>
<thead>
<tr>
<th>Part number</th>
<th>Product number</th>
<th>Current consumption at 5 V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPG-PP11</td>
<td>AFPG430</td>
<td>150mA</td>
</tr>
<tr>
<td>FPG-PP21</td>
<td>AFPG431</td>
<td>220mA</td>
</tr>
<tr>
<td>FPG-PP12</td>
<td>AFPG432</td>
<td>150mA</td>
</tr>
<tr>
<td>FPG-PP22</td>
<td>AFPG433</td>
<td>220mA</td>
</tr>
</tbody>
</table>

1.3.2 Restrictions on Unit Installation Position

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

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.
Fanctions of FP Σ Positioning Unit
Chapter 2

Parts and Specifications
2.1 Parts and Specifications

2.1.1 Parts and Specifications

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.

![Image of Operation Status Display LEDs]

### Operation Status Display LEDs

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

**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

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)](image)

**Suitable wire (twisted wire)**

<table>
<thead>
<tr>
<th>Size</th>
<th>Official cross section area</th>
<th>Insulation thickness</th>
<th>Rated current</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG22</td>
<td>0.3mm²</td>
<td>1.5 to 1.1 dia.</td>
<td>3A</td>
</tr>
<tr>
<td>AWG24</td>
<td>0.2mm²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Component parts</th>
<th>Unit type and required quantit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panasonic Electric Works SUNX Co., Ltd.</td>
<td>Housing(40P)</td>
<td>2-axis type: 1 pc x 1, 4-axis type: 1 pc x 2</td>
</tr>
<tr>
<td></td>
<td>Semi-cover(40P)</td>
<td>2-axis type: 2 pcs x 1, 4-axis type: 2 pcs x 2</td>
</tr>
<tr>
<td></td>
<td>Contact (for AWG22 and AWG24) 5pin</td>
<td>2-axis type: 8 pcs x 1, 4-axis type: 8 pcs x 2</td>
</tr>
</tbody>
</table>

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

**Dedicated tool**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Product number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panasonic Electric Works SUNX Co., Ltd.</td>
<td>AXY52000FP</td>
</tr>
</tbody>
</table>

![Pressure connection tool](image)
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 Output 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)**

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Circuit</th>
<th>Signal name</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-axis</td>
<td>2-axis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>A10</td>
<td>Pulse output A: 5V DC output</td>
<td>Output format</td>
<td>Open collector</td>
</tr>
<tr>
<td>B1</td>
<td>B10</td>
<td>Pulse output A: Open collector</td>
<td>Operating voltage range</td>
<td>4.75 V DC to 26.4 V DC</td>
</tr>
<tr>
<td>A2</td>
<td>A11</td>
<td>Pulse output B: 5V DC output</td>
<td>Max. load current</td>
<td>15 mA</td>
</tr>
<tr>
<td>B2</td>
<td>B11</td>
<td>Pulse output B: Open collector</td>
<td>ON Max. voltage drop</td>
<td>0.6 V</td>
</tr>
</tbody>
</table>
### Output terminals (Line driver output type)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Circuit</th>
<th>Signal name</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - axis</td>
<td>2 - axis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1 A10</td>
<td>A1/A10</td>
<td>Pulse output A: Line driver (+)</td>
<td>Output format</td>
<td>Line driver output Equivalent to AM26C31</td>
</tr>
<tr>
<td>B1 B10</td>
<td>A2/A11</td>
<td>Pulse output A: Line driver (-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 A11</td>
<td>B1/B10</td>
<td>Pulse output B: Line driver (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2 B11</td>
<td>B2/B11</td>
<td>Pulse output B: Line driver (-)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Output terminals (common)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Circuit</th>
<th>Signal name</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - axis</td>
<td>2 - axis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7 A16</td>
<td>A7/A16</td>
<td>Deviation counter clear (+)</td>
<td>Output format</td>
<td>Open collector</td>
</tr>
<tr>
<td>B7 B16</td>
<td>B7/B16</td>
<td>Deviation counter clear (-)</td>
<td>Operating voltage range</td>
<td>4.75 V DC to 26.4 V DC</td>
</tr>
</tbody>
</table>

**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)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Circuit</th>
<th>Signal name</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A19/B19</td>
<td>A19/B19</td>
<td>F.E. (Field Earth)</td>
<td>Power specifications</td>
<td>Power supply voltage range</td>
</tr>
<tr>
<td>A20</td>
<td>A20</td>
<td>External power supply input: 24 V DC (+)</td>
<td>Current consumption</td>
<td>2 - axis type: 35 mA or less</td>
</tr>
<tr>
<td>B20</td>
<td>B20</td>
<td>External power supply input: 24 V DC (-)</td>
<td>Current consumption</td>
<td>1 - axis type: 20 mA or less</td>
</tr>
</tbody>
</table>
### Input Terminals (common)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Circuit</th>
<th>Signal name</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - axis</td>
<td>2 - axis</td>
<td></td>
<td>Input specifications</td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>A12</td>
<td>Home input: 24 V DC (+) (Z24)</td>
<td>Operating voltage range</td>
<td>21.6V DC to 26.4V DC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min. ON voltage/current</td>
<td>19.2V DC/5.5mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max. OFF voltage/current</td>
<td>2V DC/2mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Input impedance</td>
<td>Approx 3k Ω</td>
</tr>
<tr>
<td>A4</td>
<td>A13</td>
<td>Home input: 5V DC (+) (Z5)</td>
<td>Operating voltage range</td>
<td>3.5V DC to 5.25 (5V DC, Line driver specifications)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min. ON voltage/current</td>
<td>3V DC/4mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max. OFF voltage/current</td>
<td>1V DC/0.5mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Input impedance</td>
<td>Approx. 390 Ω</td>
</tr>
<tr>
<td>B3</td>
<td>B12</td>
<td>Home input (-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min. input pulse width</td>
<td>100μs</td>
</tr>
<tr>
<td>B4</td>
<td>B13</td>
<td>COM</td>
<td>Operating voltage range</td>
<td>21.6V DC to 26.4V DC</td>
</tr>
<tr>
<td>A5</td>
<td>A14</td>
<td>Near home input (DOG)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min. ON voltage/current</td>
<td>Over limit input (+) (Limit +)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Over limit input (-) (Limit –)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Positioning control start input (timing input)</td>
<td>19.2V DC/2.6mA</td>
</tr>
<tr>
<td>A6</td>
<td>A15</td>
<td>Over limit input (+) (Limit +)</td>
<td>Max. OFF voltage/current</td>
<td>2V DC/1.5mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over limit input (-) (Limit –)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Positioning control start input (timing input)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Near home input (DOG)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Approx 3.6kΩ</td>
</tr>
<tr>
<td>B6</td>
<td>B15</td>
<td>Over limit input (-) (Limit –)</td>
<td>Input impedance</td>
<td>Over limit input (+) (Limit +)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Over limit input (-) (Limit –)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Positioning control start input (timing input)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Approx 6.8kΩ</td>
</tr>
<tr>
<td>B5</td>
<td>B14</td>
<td>Positioning Control start input (Timing input)</td>
<td>Min. input</td>
<td>500μs</td>
</tr>
<tr>
<td>A8</td>
<td>A17</td>
<td>Pulse input A (+)</td>
<td>Operating voltage range</td>
<td>3.5 to 5.25 V DC (5V DC, Line driver specifications)</td>
</tr>
<tr>
<td>B8</td>
<td>B17</td>
<td>Pulse input A (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A9</td>
<td>A18</td>
<td>Pulse input B (+)</td>
<td>Min. ON voltage/current</td>
<td>3V DC/3.2mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max. OFF voltage/current</td>
<td>1V DC/0.5mA</td>
</tr>
<tr>
<td>B9</td>
<td>B18</td>
<td>Pulse input B (-)</td>
<td>Input impedance</td>
<td>Approx 390 Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Min. input pulse width</td>
</tr>
</tbody>
</table>
**Note: Please use under the specifications for pulse input A, B signal.**

- **2 phases input method**

  
  - Pulse input A
  
  - Pulse input B

  \[ T \geq 1 \mu s \]
  \[ X_1 \text{ to } X_4 \geq 0.2 \mu s \]
  \[ \text{Each phase Max. 1MHz} \]

- **Direction distinction input method**

  
  - Pulse input A
  
  - Pulse input B

  \[ T \geq 1 \mu s \]
  \[ X_1 \geq 0.2 \mu s \]
  \[ \text{Pulse input A signal Max. 1MHz} \]

- **Individual input method**

  
  - Pulse input A
  
  - Pulse input B

  \[ T \geq 1 \mu s \]
  \[ X_1 \geq 0.4 \mu s \]
  \[ \text{Each input Max. 1MHz} \]
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

![Diagram showing line driver output type](image)

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 output pins (pin No. A1, A2, A10 and A11)

![Diagram showing transistor output type](image)

**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 FP Σ 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

<table>
<thead>
<tr>
<th>Connection</th>
<th>Positioning unit</th>
<th>Motor drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse command A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Line drive)</td>
<td>A1, A10</td>
<td>PULSE or CW</td>
</tr>
<tr>
<td></td>
<td>B1, B10</td>
<td>or CCW</td>
</tr>
<tr>
<td>Pulse command B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Line drive)</td>
<td>A2, A11</td>
<td>SIGN or CW</td>
</tr>
<tr>
<td></td>
<td>B2, B11</td>
<td>or CCW</td>
</tr>
<tr>
<td>External input power supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A20</td>
<td>+24V DC</td>
</tr>
<tr>
<td></td>
<td>B20</td>
<td></td>
</tr>
</tbody>
</table>

### 3.4.2 Transistor Output Type

<table>
<thead>
<tr>
<th>Connection</th>
<th>Positioning unit</th>
<th>Motor driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse command A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5V DC output)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse command A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Open collector)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse command B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5V DC output)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse command B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Open collector)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External input power supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC</td>
<td></td>
</tr>
</tbody>
</table>

Output specification

- **Open collector**
  - Operating voltage range: 4.75 to 26.4V DC
  - Max. load current: 15 mA
  - ON Max voltage drop: 0.6 V

Output specification at 5V DC

- Output power supply range: 4.75 to 5.25V DC
- Current consumption: 5V DC, 15mA/1 signal

Note:
A value of 15 mA per signal should be used as a guide. If exceeds this, resistance should be added.

The symbol below indicates twisted - pair wiring.
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

<table>
<thead>
<tr>
<th>Connection</th>
<th>Positioning unit</th>
<th>Encoder, pulser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse input A (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse input A (-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse input B (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse input B (-)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.7.2 Transistor Open Collector Type

<table>
<thead>
<tr>
<th>Connection</th>
<th>Positioning unit</th>
<th>Encoder, pulser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse input A (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse input A (-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse input B (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse input B (-)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.7.3 Transistor - resistor Pull-up Type

<table>
<thead>
<tr>
<th>Connection</th>
<th>Positioning unit</th>
<th>Encoder, pulser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse input A (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse input A (-)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse input B (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse input B (-)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 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

<table>
<thead>
<tr>
<th>Output type</th>
<th>Product number</th>
<th>Wiring length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transistor output type</td>
<td>AFPG 430</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AFPG 431</td>
<td></td>
</tr>
<tr>
<td>Line driver output type</td>
<td>AFPG 432</td>
<td>10m</td>
</tr>
<tr>
<td></td>
<td>AFPG 433</td>
<td></td>
</tr>
</tbody>
</table>
4.1 Pulse Output Mode

4.1.1 Selection of Rotation Direction
Changing this setting allows to rotating a motor in a reverse direction under the same connection status and the driver settings.

Shared memory 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.

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**

<table>
<thead>
<tr>
<th>The 9th. bit</th>
<th>The 8th. bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

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

**Pulse/Sign mode**  
**Common memory Control code Higher**

<table>
<thead>
<tr>
<th>The 9th. bit</th>
<th>The 8th. bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

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 The 8th. bit
1 0
With forward rotation, the elapsed value increases.
With reverse rotation, the elapsed value decreases.

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 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. FP Σ 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:

<table>
<thead>
<tr>
<th>Type</th>
<th>Points (allocated using the tool software)</th>
<th>I/O No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-axis type</td>
<td>Input 16 points</td>
<td>Axis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1st. axis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-axis type</td>
<td>Input 32 points</td>
<td>2nd. axis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1st. axis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2nd. axis</td>
</tr>
</tbody>
</table>
### 4.2.3 Contents of Input and Output Allocations

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

*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.
<table>
<thead>
<tr>
<th>Flag</th>
<th>Name</th>
<th>Description</th>
<th>I/O flag number (*5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1st axis</td>
</tr>
<tr>
<td>Y_0</td>
<td>E point control start</td>
<td>EST</td>
<td>When turned ON in the user program, E point control is initiated.</td>
</tr>
<tr>
<td>Y_1</td>
<td>P point control start</td>
<td>PST</td>
<td>When turned ON in the user program, P point control is initiated.</td>
</tr>
<tr>
<td>Y_2</td>
<td>Home return start</td>
<td>ORGS</td>
<td>When turned ON in the user program, a home return is initiated.</td>
</tr>
<tr>
<td>Y_3</td>
<td>Forward JOG</td>
<td>JGF</td>
<td>When turned ON in the user program, JOG forward rotation is initiated.</td>
</tr>
<tr>
<td>Y_4</td>
<td>Reverse JOG</td>
<td>JGR</td>
<td>When turned ON in the user program, JOG reverse rotation is initiated.</td>
</tr>
<tr>
<td>Y_5</td>
<td>Forced stop</td>
<td>EMR</td>
<td>When turned ON in the user program, operations currently running are interrupted and forcibly terminated.</td>
</tr>
<tr>
<td>Y_6</td>
<td>Deceleration stop</td>
<td>DCL</td>
<td>When turned ON in the user program, operations currently running are interrupted, and decelerate to a stop.</td>
</tr>
<tr>
<td>Y_7</td>
<td>Pulser input enabled</td>
<td>PEN</td>
<td>When turned ON in the user program, pulser input is enabled (valid only while on).</td>
</tr>
<tr>
<td>Y_8</td>
<td>JOG positioning start</td>
<td>JGST</td>
<td>ON during JOG positioning operation.</td>
</tr>
<tr>
<td>Y_9</td>
<td>JOG positioning start</td>
<td>TIM</td>
<td>ON at the timing of the positioning start after JOG operation, (when JOG positioning is confirmed.)</td>
</tr>
<tr>
<td>Y_A</td>
<td>—</td>
<td>—</td>
<td>Y10A</td>
</tr>
<tr>
<td>Y_B</td>
<td>—</td>
<td>—</td>
<td>Y10B</td>
</tr>
<tr>
<td>Y_C</td>
<td>—</td>
<td>—</td>
<td>Y10C</td>
</tr>
<tr>
<td>Y_D</td>
<td>—</td>
<td>—</td>
<td>Y10D</td>
</tr>
<tr>
<td>Y_E</td>
<td>—</td>
<td>—</td>
<td>Y10E</td>
</tr>
<tr>
<td>Y_F</td>
<td>Error clear</td>
<td>ECLR</td>
<td>If an error occurs, the error is canceled when this is turned ON in the user program.</td>
</tr>
</tbody>
</table>
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 > Cyclyd 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

\[
\begin{array}{c}
\text{R0} \\
\text{[ F1 DMV, H0, DT 0 ]}
\end{array}
\]

Control code

\[
\begin{array}{c}
\text{[ F1 DMV, K 500, DT 2 ]}
\text{[ F1 DMV, K 1000, DT 4 ]}
\text{[ F1 DMV, K 100, DT 6 ]}
\text{[ F1 DMV, K 10000, DT 8 ]}
\text{[ F151 WRT, K1, DT0, K10, H100 ]}
\end{array}
\]

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

Max. value = +2,147,483,647
+2,147,483,646
+2,147,483,645
...
-2,147,483,646
-2,147,483,647
Min. value = -2,147,483,648

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

<table>
<thead>
<tr>
<th>Address of shared memory (hexadecimal)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st. axis</td>
<td>2nd. axis</td>
</tr>
<tr>
<td>10Ah</td>
<td>11Ah</td>
</tr>
<tr>
<td>10Bh</td>
<td>11Bh</td>
</tr>
</tbody>
</table>

Elapsed value count (absolute value)
Signed 32-bit
-2,147,483,648 to +2,147,483,647
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.

```
R0 | F150 READ, ; S1 : S2 ; n ; D ;
```

- This is the positioning unit in slot No. 0, from which elapsed value data H10A to H10B for the first axis are read into DT100 to DT101.

**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.

<table>
<thead>
<tr>
<th>Address of shared memory (hexadecimal)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st. axis</td>
<td>2nd. axis</td>
</tr>
<tr>
<td>10Ah</td>
<td>11Ah</td>
</tr>
<tr>
<td>10Bh</td>
<td>11Bh</td>
</tr>
</tbody>
</table>

**Program example**
Reads the elapsed value into the optional data register.

```
[ F150 READ, K0, H10A, K2, DT100 ]
```
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.

\[
\text{F151 (WRT)}
\]

\[
\begin{array}{c}
\text{R0} \\
\text{F151} \\
\text{WRT} \\
\text{K0} \\
\text{DT100} \\
\text{K2} \\
\text{H10A} \\
\end{array}
\]

Specifies the positioning unit of slot No. 0

Write the two-word contents of data registers DT100 to DT101
to the shared memory addresses H10A to H10B

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.

<table>
<thead>
<tr>
<th>Address of shared memory (hexadecimal)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st. axis</td>
<td>2nd. axis</td>
</tr>
<tr>
<td>10Ah</td>
<td>11Ah</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:

Elapsed values should be written while the operation is stopped.

Program example

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

\[
\begin{array}{c}
\text{R0} \\
\text{F151} \text{ WRT} \\
\text{K0} \text{ DT100} \\
\text{K2} \text{ H10A} \\
\end{array}
\]

\[
\begin{array}{c}
\text{F1} \text{ DMV} \\
\text{K0} \\
\text{DT 100} \\
\end{array}
\]

\[
\begin{array}{c}
\text{F151} \text{ WRT} \\
\text{K0} \\
\text{DT 100} \\
\text{K2} \text{ H10A} \\
\end{array}
\]
Chapter 5

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

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

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

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

### Program

![Program Diagram](image)

**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**

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<tr>
<td>Target speed (pps)</td>
<td>K10000</td>
<td>K1 to K4,000,000 Set a value larger than the startup speed.</td>
</tr>
<tr>
<td>Acceleration/deceleration time (ms)</td>
<td>K100</td>
<td>K0 to K32,767</td>
</tr>
<tr>
<td>Position command value (pulse)</td>
<td>K-10000</td>
<td>K-2,147,483,648 to K2,147,483,647</td>
</tr>
</tbody>
</table>

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

**Program**

![Program diagram]

**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

<table>
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<tr>
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</thead>
<tbody>
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<td>H81 Note: &lt;Absolute method, Linear acceleration/deceleration&gt;</td>
<td>Refer to page 16-7.</td>
</tr>
<tr>
<td>Startup speed (pps)</td>
<td>K500</td>
<td>K0 to K4,000,000</td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td>K10000</td>
<td>K1 to K4,000,000 Set a value larger than the startup speed</td>
</tr>
<tr>
<td>Acceleration/deceleration time (ms)</td>
<td>K100</td>
<td>K0 to K32,767</td>
</tr>
<tr>
<td>Position command value (pulse)</td>
<td>K25000</td>
<td>K – 2,147,483,648 to K2,147,483,647</td>
</tr>
</tbody>
</table>

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

### Program

```
  X2 | (DF) | R2 |
  |    |    |    |
  R2 | [ F1 DMV, H, 81, DT, 0 ] |
    | [ F1 DMV, K, 500, DT, 2 ] |
    | [ F1 DMV, K, 10000, DT, 4 ] |
    | [ F1 DMV, K, 100, DT, 6 ] |
    | [ F1 DMV, K, 25000, DT, 8 ] |
    | [ F151 WRT, K0, DT0, K10, H100 ] |

This specifies the positioning unit in slot No. 0, from which the 10-word contents from data registers DT0 to DT9 are written to the shared memory addresses H100 to H109
```

**Starting condition**

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

Shared memory writing
```

**E point control initiated for 1st axis**

**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 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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Direction</th>
<th>Limit status</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>When E point control is turned ON</td>
<td>Forward</td>
<td>Over limit input (+) ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (-) ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td>During E point control operation</td>
<td>Forward</td>
<td>Over limit input (+) ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (-) ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
</tbody>
</table>
Automatic Acceleration / Deceleration Control (E Point Control: Single-Speed Acceleration / Deceleration)
Chapter 7

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

<table>
<thead>
<tr>
<th>Control parameter setting content</th>
<th>Set values in sample program example</th>
<th>Range of acceptable settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control code</td>
<td></td>
<td>H80 Note: Increment method, Linear acceleration/deceleration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The same as left</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The same as left</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Refer to page 16-7</td>
</tr>
<tr>
<td>Startup speed (pps)</td>
<td></td>
<td>K500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The same as left</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The same as left</td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td></td>
<td>K5000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K20000</td>
</tr>
<tr>
<td>Acceleration/deceleration time(m/s)</td>
<td></td>
<td>K100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K500</td>
</tr>
<tr>
<td>Position command value (pulse)</td>
<td></td>
<td>K5000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K15000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K60000</td>
</tr>
</tbody>
</table>

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

Program

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

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

![Pulse output diagram](image)
Shared memory settings

<table>
<thead>
<tr>
<th>Control parameter setting content</th>
<th>Set values in sample program example</th>
<th>Range of acceptable settings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st speed</td>
<td>2nd speed</td>
</tr>
<tr>
<td>Control code</td>
<td>H80</td>
<td>The same as left</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Startup speed (pps)</td>
<td>K500</td>
<td>The same as left</td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td>K5000</td>
<td>K20000</td>
</tr>
<tr>
<td>Acceleration/ deceleration time</td>
<td>K100</td>
<td>K100</td>
</tr>
<tr>
<td>Position command value (pulse)</td>
<td>K-5000</td>
<td>K-15000</td>
</tr>
</tbody>
</table>

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

[Diagram showing pulse output characteristics and control flags]
Shared memory settings

<table>
<thead>
<tr>
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</tr>
<tr>
<td>Startup speed (pps)</td>
<td>K500 The same as left</td>
<td>K0 to K4,000,000</td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td>K5000 K20000 K500</td>
<td>The target speed for the first speed should be set to a value larger than the startup speed.</td>
</tr>
<tr>
<td>Acceleration/deceleration time (ms)</td>
<td>K100 K100 K500</td>
<td>K0 to K3,767</td>
</tr>
<tr>
<td>Position command value (pulse)</td>
<td>K10000 K25000 K31000</td>
<td>K-2,147,483,648 to K2,147,483,647</td>
</tr>
</tbody>
</table>

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

Program

![Program code](image)

**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.

<table>
<thead>
<tr>
<th>Data for section I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Control code</td>
</tr>
<tr>
<td>2. Startup speed</td>
</tr>
<tr>
<td>3. Target speed</td>
</tr>
<tr>
<td>4. Acceleration/deceleration time</td>
</tr>
<tr>
<td>5. Position command value</td>
</tr>
</tbody>
</table>

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_O)**
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

7.4.1 Precautions Concerning the Set Value Change Confirmation Flag X_A

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.

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

- H 80 Control code
- K 500 Startup speed fs [pps]
- K 10000 Target speed ft [pps]
- K 100 Acceleration/deceleration time Ac [ms]

f [pps]

10000

500

Forward

Reverse

Deceleration begins at the point when the flag goes OFF

Forward JOG start
CPU → Y103 (JGF)

Reverse JOG start
CPU → Y104 (JGR)

Pulse output busy flag
CPU → X100 (BUSY)

Pulse output done flag
CPU → X101 (EDP)

Elapsed value (Fe)

Count

8-2
### Shared memory settings

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

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

### Program

```
X0  X100  R0
+-----+-----+-----+-----+-----+-----+-----+-----+
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |

R0  F1  DMV  H  80  DT  0
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |

F1  DMV  K  500  DT  2
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |

F1  DMV  K  10000  DT  4
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |

F1  DMV  K  100  DT  6
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |

F151  WRT  K0  DT0  K8  H100
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |
```

This specifies the positioning unit in slot no. 0, from which the 8-word contacts from data registers DT0 to DT7 are written to the shared memory addresses H100 to H107.

### 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.
Shared memory settings

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

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

Program

```
[Diagram showing the program with labels]
```

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.

Data for JOG operation

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.

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

2. Time from the JOG speed of the low-speed specification to the JOG speed of the high-speed specification
   Acceleration/deceleration time = \frac{10000[pps] - 5000[pps]}{90[pps/ms]} = \text{Approx. 55.6}[ms]

3. Time from the JOG speed of the high-speed specification to when pulse output stops
   Acceleration/deceleration time = \frac{10000[pps] - 500[pps]}{90[pps/ms]} = \text{Approx. 105.6}[ms]

For the sake of expediency, “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.
Sample Program

```plaintext
X0 X100 (DF) R0
X1 X100 (DF)
X2 R0 [ F1 DMV, K 5000, DT 4 ] Target speed (Low-speed)
X2 R0 [ F1 DMV, K 10000, DT 4 ] Target speed (High-speed)
R0 [ F1 DMV, H 80, DT 0 ] Control code
[ F1 DMV, K 500, DT 2 ] Startup speed
[ F1 DMV, K 100, DT 6 ] Acceleration/deceleration time
[ F151 WRT, K0, DTO, K8, H100 ] Shared memory writing

This specifies the positioning unit in slot No. 0, from which
the 8-word contacts from data registers DTO to DTO7
are written to the shared memory addresses H100 to H107.
X0 X100 (DF) Y103
Y103 [ ] Forward JOG start
X1 X100 (DF) R1 Y104
Y104 [ ] Reverse JOG start
X0 (DF) R1
X1 (DF)
X3 (DF) [ F0 MV, K 0, I 0 ]
[ F6 DGT, WX0, H 0, I 0 ]
[ F30 *, I 0, K 2, I 0 ] Data number is read
[ F150 READ, H 0, H10A, K 2, I 0 DT100 ] Index pointer calculation
[ ] Shared memory writing

This specifies the positioning unit in slot No. 0, from which
the 2-word contacts of shared memory address elapsed value
area H10A and H10B
are read to the data register specified by IO + 100.
X8 R4 [ ] E point control start condition
R4 [ F6 DGT, WX0, H 1, I 0 ]
[ F30 *, I 0, K 2, I 0 ] Teaching data
[ F1 DMV, H100, DT 100, DT 8 ] (position command value) Read out
[ F1 DMV, H 81, DT 0 ] Control code
[ F1 DMV, K 500, DT 2 ] Startup speed
[ F1 DMV, K 10000, DT 4 ] Target speed
[ F1 DMV, K 100, DT 6 ] Acceleration/deceleration time
[ F151 WRT, K0, DTO, K10, H100 ] Shared memory writing
[ ] E point control start

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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Direction</th>
<th>Limit status</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>When JOG operation is</td>
<td>Forward</td>
<td>Over limit input (+):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td>turned ON</td>
<td>Reverse</td>
<td>Over limit input (-):ON</td>
<td>Table to move.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over limit input (+):ON</td>
<td>Table to move.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over limit input (-):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td>During JOG operation</td>
<td>Forward</td>
<td>Over limit input (+):ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (-):ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
</tbody>
</table>
8.7 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.
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

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

**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

```
X0           R0
(DF)         [ ]

R0          [ F1 DMV, H 80, DT 0 ]
            [ F1 DMV, K 500, DT 2 ]
            [ F1 DMV, K 10000, DT 4 ]
            [ F1 DMV, K 100, DT 6 ]
            [ F1 DMV, K 10000, DT 8 ]
            [ F151 WRT, K0, DT0, K10, H100 ]

This specifies the positioning unit in slot No. 0, from which
the 10 - word contacts from data registers DT0 to DT9
are written to the shared memory addresses H100 to H109

R0          Y108
< ED >      [ ]
```

Starting condition

Control code

Startup speed

Target speed

Acceleration/deceleration time

Position command value

Shared memory writing

Starting JOG positioning operation for the 1st. axis
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.
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

<table>
<thead>
<tr>
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</thead>
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<td>Control code</td>
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</tr>
<tr>
<td>Startup speed (pps)</td>
<td>K500</td>
<td>K0 to K4,000,000</td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td>K10000</td>
<td>K1 to K4,000,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set a value larger than the startup speed.</td>
</tr>
<tr>
<td>Acceleration/deceleration time(ms)</td>
<td>K100</td>
<td>K0 to 32,767</td>
</tr>
<tr>
<td>Position command value (pulse)</td>
<td>K-10000  Note 2:</td>
<td>K - 2,147,483,648 to K2,147,483,647</td>
</tr>
</tbody>
</table>

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

```
X1  (DF)  R1
[ F1 DMV , H 80 , DT 0 ]  [ ]
[ F1 DMV , K 500 , DT 2 ]  [ ]
[ F1 DMV , K 10000 , DT 4 ]  [ ]
[ F1 DMV , K 100 , DT 6 ]  [ ]
[ F1 DMV , K -10000 , DT 8 ]  [ ]
[ F151 WRT , K0 , DT0 , K10 , H100 ]  [ ]
```

Starting condition

Control code

Startup speed

Target speed

Acceleration/deceleration time

Position command value

Shared memory writing

This specifies the positioning unit in slot No. 0, from which the 10 - word contacts from data registers D0 to 9 are written to the shared memory addresses H100 to H109

R1  Y108

([ ])

(ED)

Starts JOG positioning operation for the 1st. axis
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.

![Diagram of JOG positioning operation](image)
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

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

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_0)
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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Direction</th>
<th>Limit status</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>When JOG positioning operation is turned ON</td>
<td>Forward</td>
<td>Over limit input (+):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over limit input (-):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (+):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over limit input (-):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td>During JOG positioning operation</td>
<td>Forward</td>
<td>Over limit input (+):ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (-):ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
</tbody>
</table>
9.5 Special Mention

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

The FP Positioning unit performs the process in the very high speed, so that it starts counting the number of the output pulses within 15µs 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

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 setting)
- 1004 Y100 Control code
- 1006 K 500 Start speed % [pos]
- 1008 K 10000 Target speed [pos]
- 1009 X 100 Acceleration/acceleration time Ac [ms]

Direction of increasing elapsed value

CPU—Y102 (CORG)
External—X107 (DCOG)
Home input—X106 (C3SG)
Deviation counter clear output—External
Pulse output busy flag—CPU—X100 (C3UG)
Home return done—CPU—X108 (C3UG)
Elapsed value (Pos)
Shared memory settings

<table>
<thead>
<tr>
<th>Control parameter setting content</th>
<th>Set values in sample program example</th>
<th>Range of acceptable settings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control code</strong></td>
<td>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</td>
<td>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.)</td>
</tr>
<tr>
<td><strong>Startup speed (pps)</strong></td>
<td>K500</td>
<td>K1 to K4,000,000</td>
</tr>
<tr>
<td><strong>Target speed (pps)</strong></td>
<td>K10000</td>
<td>K1 to K4,000,000</td>
</tr>
<tr>
<td><strong>Acceleration/deceleration time (ms)</strong></td>
<td>K100</td>
<td>K0 to K32,767</td>
</tr>
</tbody>
</table>

Note: Home search function is valid.

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

Program

```
X9   \[\text{\textless DF\textgreater}\] R9
R9   \[F1\text{ DMV , H D0 , DT O }\] \[\text{\textless \textless Condition of home return\textless}\]
     \[F1\text{ DMV , K 500 , DT 2}\] \[\text{\textless Control code\textless}\]
     \[F1\text{ DMV , K 10000 , DT 4}\] \[\text{\textless Target speed\textless}\]
     \[F1\text{ DMV , K 100 , DT 6}\] \[\text{\textless Acceleration/deceleration time\textless}\]
     \[F151\text{ WRT , K0 , DTO K8 , H100}\] \[\text{\textless Shared memory\textless}\]
     \[\text{This specifies the positioning unit in slot No. 0, from which the 8-word contents from data registers DTO to DT7}\]
     \[\text{are written to the shared memory addresses H100 to H107}\]
     \[\text{\textless \textless \textless Shared memory\textless}\]
     \[R9\text{ Y102}\] \[\text{\\\textless Home return start\textless}\]
```

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.
## Shared memory settings

<table>
<thead>
<tr>
<th>Control parameter setting content</th>
<th>Set values in sample program example</th>
<th>Range of acceptable settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control code</td>
<td>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</td>
<td>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.)</td>
</tr>
<tr>
<td>Startup speed (pps)</td>
<td>K500</td>
<td>K1 to K4,000,000</td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td>K10000</td>
<td>K1 to K4,000,000 Specify a value larger than the startup speed.</td>
</tr>
<tr>
<td>Acceleration/deceleration time(ms)</td>
<td>K100</td>
<td>K0 to K32,767</td>
</tr>
</tbody>
</table>

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

### Program

![Program Diagram]

- 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.

### 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 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 setting)

<table>
<thead>
<tr>
<th>Code</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100H</td>
<td>H 00</td>
<td>Control code</td>
</tr>
<tr>
<td>102H</td>
<td>K 500</td>
<td>Startup speed [fps]</td>
</tr>
<tr>
<td>104H</td>
<td>K 1000</td>
<td>Target speed [fps]</td>
</tr>
<tr>
<td>106H</td>
<td>H 100</td>
<td>Acceleration/deceleration time [ms]</td>
</tr>
</tbody>
</table>

The signal logic following detection of the near home flag does not affect operation.

Pulse width of about 1 ms (Can be changed to 10 ms using the control code.)

When home return is done, count value becomes 0.
Shared memory settings

<table>
<thead>
<tr>
<th>Control parameter setting content</th>
<th>Set values in sample program example</th>
<th>Range of acceptable settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control code</td>
<td>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</td>
<td>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.)</td>
</tr>
<tr>
<td>Startup speed (pps)</td>
<td>K500</td>
<td>K1 to K4,000,000</td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td>K10000</td>
<td>K1 to K4,000,000 Specify a value larger than the startup speed.</td>
</tr>
<tr>
<td>Acceleration/deceleration time(ms)</td>
<td>K100</td>
<td>K0 to K32,767</td>
</tr>
</tbody>
</table>

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

Program

```
X9 | (DF) |
R9 |

| [ F1 DMV , H 90 , DT 0 ] |
| [ F1 DMV , K 500 , DT 2 ] |
| [ F1 DMV , K 10000 , DT 4 ] |
| [ F1 DMV , K 100 , DT 6 ] |
| [ F151 WRT , K0 , DT0 , K8 , H100 ] |

This specifies the positioning unit in slot No. 0, from which the 8-word contents from data registers DT0 to DT7 are written to the shared memory addresses H100 to H107

R9 |

| Y102 |

< ED >
```

---

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)

<table>
<thead>
<tr>
<th>10h</th>
<th>H</th>
<th>Control code</th>
</tr>
</thead>
<tbody>
<tr>
<td>11h</td>
<td>K</td>
<td>Startup speed [fps]</td>
</tr>
<tr>
<td>12h</td>
<td>K</td>
<td>Target speed [fps]</td>
</tr>
<tr>
<td>14h</td>
<td>K</td>
<td>Acceleration/deceleration time [ms]</td>
</tr>
</tbody>
</table>

Direction of increasing elapsed value

- CPU: X103 (OCR5)
- External: X107 (OCR5)
- Deviation counter clear output
- Deviation counter clear output
- Pulse output busy flag
- Home return done
- Elapsed value (Pe)

Home return start
Near home input
Home input
Deviation counter clear output
Pulse output busy flag
Home return done

When home return is done, the count value becomes 0.

The signal logic following detection of the near home flag does not affect operation.

Pulse width of about 1 ms.

(Can be changed to 10 ms using the control code.)
Shared memory settings

<table>
<thead>
<tr>
<th>Control parameter setting content</th>
<th>Set values in sample program example</th>
<th>Range of acceptable settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control code</td>
<td>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</td>
<td>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.)</td>
</tr>
<tr>
<td>Startup speed (pps)</td>
<td>K500 K1 to K4,000,000</td>
<td></td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td>K10000 K1 to K4,000,000</td>
<td></td>
</tr>
<tr>
<td>Acceleration/deceleration time (ms)</td>
<td>K100 K0 to K32,767</td>
<td></td>
</tr>
</tbody>
</table>

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

Program

```
XA                   RA
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( DF )</td>
<td>[</td>
</tr>
<tr>
<td>F1 DMV , H 94 , DT 0</td>
<td>[</td>
</tr>
<tr>
<td>F1 DMV , K 500 , DT 2</td>
<td>[</td>
</tr>
<tr>
<td>F1 DMV , K 10000 , DT 4</td>
<td>[</td>
</tr>
<tr>
<td>F1 DMV , K 100 , DT 6</td>
<td>[</td>
</tr>
<tr>
<td>F151 WRT , K0 , DT0 , K8 , H100</td>
<td>]</td>
</tr>
</tbody>
</table>

This specifies the positioning unit in slot No. 9, from which the 8-word contents from data registers DT0 to DT7 are written to the shared memory addresses H100 to H107.
```

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.
10.3 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

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)

<table>
<thead>
<tr>
<th>Address</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100h</td>
<td>H</td>
<td>Control code</td>
</tr>
<tr>
<td>101h</td>
<td>K</td>
<td>Startup speed fs [pps]</td>
</tr>
<tr>
<td>102h</td>
<td>K</td>
<td>Target speed ft [pps]</td>
</tr>
<tr>
<td>103h</td>
<td>K</td>
<td>Acceleration/deceleration time Ac [ms]</td>
</tr>
</tbody>
</table>

Small signal pieces of the waveform

Note:

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

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** (ORGS)
- **Near home input** (DOG)
- **Home input** (ZSG)
- **Deviation counter clear output**
- **Pulse output busy flag** (BUSY)
- **Home return done** (ORGE)
- **Pulse output done flag** (EDP)
**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 cannot 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 one 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.

Note:
The near home input should be ON for the time more than the deceleration time. The operation of the near home input will not be affected by the signal logic change after the near home input is detected.

Reference (Key Points):
- Practical application of input logic. Reverse the logic of the near home input and the home input.
- When the switch is ON, the near home input is to be ON.
- When the switch is OFF, the home input is to be ON.
- One switch is to be connected with the home input and the near home input.
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)**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Direction</th>
<th>Limit status</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>When Home return is turned ON</td>
<td>Forward</td>
<td>Over limit input (+):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (+):ON</td>
<td>Table to move</td>
</tr>
<tr>
<td></td>
<td>Forward</td>
<td>Over limit input (-):ON</td>
<td>Table to move</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (-):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td>During Home return operation</td>
<td>Forward</td>
<td>Over limit input (+):ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (-):ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
</tbody>
</table>

**Home Return (with home search)**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Direction</th>
<th>Limit status</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>When Home return is turned ON</td>
<td>Forward</td>
<td>Over limit input (+):ON</td>
<td>Table to move</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (+):ON</td>
<td>Table to move</td>
</tr>
<tr>
<td></td>
<td>Forward</td>
<td>Over limit input (-):ON</td>
<td>Table to move</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (-):ON</td>
<td>Table to move</td>
</tr>
<tr>
<td>During Home return operation</td>
<td>Forward</td>
<td>Over limit input (+):ON</td>
<td>Automatic-reverse operation</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input (-):ON</td>
<td>Automatic-reverse operation</td>
</tr>
</tbody>
</table>
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

The time from the home input to the pulse output stop during the home return (home search)
The FP Σ Positioning unit performs the process in the very high speed, so that it starts counting the
number of the output pulses within 1µs 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.
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 setting)

- 100h H 80 Control code
- 10Ch 42h
- 104h K 1000 Target speed (pps)

A phase
B phase
Shared memory settings

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

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

Program

```
xb                                      RB
  |                                     |
  [ F1 DMV , H 80 , DT 0 ]               |
  [ F151 WRT , KO , DT0 , K2 , H100 ]    |
This specifies the positioning unit in slot No. 0, from which
the 2-word contents from data registers DT0 to DT1
are written to the shared memory addresses H100 to H101

[ F1 DMV , K 1000 , DT 4 ]               |
[ F151 WRT , KO , DT4 , K2 , H104 ]      |
This specifies the positioning unit in slot No. 0, from which
the 2-word contents from data registers DT4 to DT5
are written to the shared memory addresses H104 to H105

RB                                      Y107
  |                                     |
  ( ED )                                 |
```

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

- Control code
  - H: 280
  - K: 5000
- Target speed [pps]
  - 5000

- Direction of increasing elapsed value
  - Direction of decreasing elapsed value

- Pulser input enabled
- CPU: Y107 (PEN)
- Pulse output done flag
- CPU: X101 (EDP)
- External—Pulse input A phase
- External—Pulse input B phase
- External—Pulse output A phase
- External—Pulse output B phase

Pulser forward
- A phase
- B phase

Pulser reverse
- A phase
- B phase
**Shared memory settings**

<table>
<thead>
<tr>
<th>Control parameter setting content</th>
<th>Set values in sample program example</th>
<th>Range of acceptable settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control code</td>
<td>H280 Note: Multiplication ratio:×5 multiple</td>
<td>Refer to page 16-7.</td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td>K10000</td>
<td>K1 to K4,000,000</td>
</tr>
</tbody>
</table>

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

**Program**

```
X0
RC

RC
F1 DMV, H 280, DT 0
F151 WRT, K0, DT0, K2, H100

This specifies the positioning unit in slot No. 0, from which the 2-word contents from data registers DT0 to DT1 are written to the shared memory addresses H100 to H101

F1 DMV, K 5000, DT 4
F151 WRT, K0, DT4, K2, H104

This specifies the positioning unit in slot No. 0, from which the 2-word contents from data registers DT4 to DT5 are written to the shared memory addresses H104 to H105

RC
Y107

(ED)
```

**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.

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 Pulser Input Operation

**Pulser 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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Direction</th>
<th>Limit status</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>When Pulser input operation is turned ON</td>
<td>Forward</td>
<td>Over limit input(+):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input(+):ON</td>
<td>Table to move.</td>
</tr>
<tr>
<td></td>
<td>Forward</td>
<td>Over limit input(-):ON</td>
<td>Table to move.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input(-):ON</td>
<td>Table not to move, Limit error occurs.</td>
</tr>
<tr>
<td>During Pulser input operation</td>
<td>Forward</td>
<td>Over limit input(+):ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
<tr>
<td></td>
<td>Reverse</td>
<td>Over limit input(-):ON</td>
<td>Table stops, Limit error occurs.</td>
</tr>
</tbody>
</table>

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

```
R0013
F1 DMV , H 2000090 , DT 0
F1 DMV , K 500 , DT 2
F1 DMV , K 1000 , DT 4
F1 DMV , K 10 , DT 6
F151 WRT , K 0

R0
R1
Y57
Y5F
Y54

When the over limit input (+) and (-) is ON in resetting the over limit error, the moving unit executes JOG reverse and JOG forward operation, respectively.
```

11-10
11.5 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.
11.6 Types of Manual Pulse Generators That Can be Used

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

Deceleration Stop and Forced Stop
12.1 Sample Program

12.1.1 In-progress Stopping, Emergency Stopping

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

12.4.1 Pulse Output Done Flag Status After a Stop

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

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.
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.
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.

```
R0010
R010

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;

<table>
<thead>
<tr>
<th>Axis</th>
<th>Shared memory address</th>
<th>Countable range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st.</td>
<td>H10F, 10E</td>
<td>Signed 32 bits</td>
</tr>
<tr>
<td>2nd.</td>
<td>H11F, 11E</td>
<td>-2,147,483,648 to +2,147,483,647</td>
</tr>
</tbody>
</table>

Feedback counter function control code table

<table>
<thead>
<tr>
<th>8 bits among higher 16 bits</th>
<th>0 (default)</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Rotation</td>
<td>Forward</td>
</tr>
<tr>
<td>1</td>
<td>Count</td>
<td>Available</td>
</tr>
<tr>
<td>1</td>
<td>2-phase</td>
<td>Reverse</td>
</tr>
<tr>
<td>0</td>
<td>Individual</td>
<td>Masked</td>
</tr>
</tbody>
</table>

0 = 0 Transfer multiple
1 = 1 Transfer multiple

Input mode: 0 = Input 1
1 = Input 2

2-phase input: 0 = X1
1 = X2

Direction distinction: 0 = X4
1 = - (2-phase)
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

![Diagram showing Forward and Reverse directions with Pulse input A and B waveforms and count value increment/decrement directions.]

**Individual input <reverse settings>**
Control code   Higher side H9

![Diagram showing Forward and Reverse directions with Pulse input A and B waveforms and count value increment/decrement directions.]

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

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.

![Diagram showing shared memory setting contents and output frequency over time](image_url)
Chapter 15

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 YΔ0 is turned on.
### Cases in which errors occur, and their contents

<table>
<thead>
<tr>
<th>Item</th>
<th>At startup setting</th>
<th>At setting change during operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative number</td>
<td>0</td>
</tr>
<tr>
<td>E point control</td>
<td>startup speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>target speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>Acceleration/deceleration time</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>position command value (Increment)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td></td>
<td>position command value (Absolute)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td>P point control</td>
<td>startup speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>target speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>Acceleration/deceleration time</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>position command value (Increment)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td></td>
<td>position command value (Absolute)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td>Home return</td>
<td>startup speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>target speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>Acceleration/deceleration time</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>position command value (Increment)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td></td>
<td>position command value (Absolute)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td>JOG operation</td>
<td>startup speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>target speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>Acceleration/deceleration time</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>position command value (Increment)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td></td>
<td>position command value (Absolute)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td>JOG positioning operation</td>
<td>startup speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>target speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>Acceleration/deceleration time</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>position command value (Increment)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td></td>
<td>position command value (Absolute)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td>Pulser input operation</td>
<td>startup speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>target speed</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>Acceleration/deceleration time</td>
<td>Error</td>
</tr>
<tr>
<td></td>
<td>position command value (Increment)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td></td>
<td>position command value (Absolute)</td>
<td>No applicable condition</td>
</tr>
<tr>
<td>Operation when above error occurs</td>
<td>Operation does not begin</td>
<td>Deceleration stop</td>
</tr>
</tbody>
</table>

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

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

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.
### 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

<table>
<thead>
<tr>
<th>Type of parameter</th>
<th>Allowable setting range</th>
<th>Program specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Startup speed (pps)</td>
<td>0 to +4,000,000 [pps]</td>
<td>K0 to K4,000,000</td>
</tr>
<tr>
<td>Target speed (pps)</td>
<td>+1 to +4,000,000 [pps]</td>
<td>K1 to K4,000,000</td>
</tr>
<tr>
<td>Acceleration/deceleration time (ms)</td>
<td>0 to +32,767 [ms]</td>
<td>K0 to 32,767</td>
</tr>
</tbody>
</table>

**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:

![Diagram showing XF and Y10F]

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

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 witches 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.
16.1 Table of Performance Specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ambient operating</strong></td>
<td><strong>temperature</strong> 0 to +55 °C/32F to +131F</td>
</tr>
<tr>
<td><strong>Ambient storage</strong></td>
<td><strong>temperature</strong> -20 to +70 °C/ -4F to +158F</td>
</tr>
<tr>
<td><strong>Ambient operating</strong></td>
<td><strong>humidity</strong> 30 to 85 % RH (at25°C non-condensing)</td>
</tr>
<tr>
<td><strong>Ambient storage</strong></td>
<td><strong>humidity</strong> 30 to 85 % RH (at25°C non-condensing)</td>
</tr>
<tr>
<td><strong>Breakdown voltage</strong></td>
<td>500 V AC, 1 minute Between the various pins of the external connector and the ground</td>
</tr>
<tr>
<td><strong>Insulation resistance</strong></td>
<td>100MΩ or more (measured with 500 V DC testing) Between the various pins of the external connector and the ground</td>
</tr>
<tr>
<td><strong>Vibration resistance</strong></td>
<td>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)</td>
</tr>
<tr>
<td><strong>Shock resistance</strong></td>
<td>Shock of 98 m/s², 4 times in the X, Y, Z directions</td>
</tr>
<tr>
<td><strong>Noise immunity</strong></td>
<td>1,000 V[P-P] with pulse widths 50ns and 1µs (based on in-house measurements)</td>
</tr>
<tr>
<td><strong>Operating environment</strong></td>
<td>Free of corrosive gases and excessive dust</td>
</tr>
</tbody>
</table>

Specifications
## Performance specifications

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

*5) The power is supplied from the external to the unit connector.
## 16.2 Table of 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.

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

**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” (x 4) or “2 multiple setting” (x 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

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

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

*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.
<table>
<thead>
<tr>
<th>Flag</th>
<th>Name</th>
<th>Description</th>
<th>I/O flag number (*5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1st axis</td>
</tr>
<tr>
<td>Y_0</td>
<td>EST</td>
<td>When turned ON in the user program, E point control is initiated.</td>
<td>Y100</td>
</tr>
<tr>
<td>Y_1</td>
<td>PST</td>
<td>When turned ON in the user program, P point control is initiated.</td>
<td>Y101</td>
</tr>
<tr>
<td>Y_2</td>
<td>ORGS</td>
<td>When turned ON in the user program, Home return is initiated.</td>
<td>Y102</td>
</tr>
<tr>
<td>Y_3</td>
<td>JGF</td>
<td>When turned ON in the user program, Forward JOG is initiated.</td>
<td>Y103</td>
</tr>
<tr>
<td>Y_4</td>
<td>JGR</td>
<td>When turned ON in the user program, Reverse JOG is initiated.</td>
<td>Y104</td>
</tr>
<tr>
<td>Y_5</td>
<td>EMR</td>
<td>When turned ON in the user program, operations currently running are interrupted and forcibly terminated.</td>
<td>Y105</td>
</tr>
<tr>
<td>Y_6</td>
<td>DCL</td>
<td>When turned ON in the user program, operations currently running are interrupted, and decelerate to a stop.</td>
<td>Y106</td>
</tr>
<tr>
<td>Y_7</td>
<td>PEN</td>
<td>When turned ON in the user program, pulser input is enabled. (valid only while ON.)</td>
<td>Y107</td>
</tr>
<tr>
<td>Y_8</td>
<td>JGST</td>
<td>ON during the transfer from JOG operation to JOG positioning operation.</td>
<td>Y108</td>
</tr>
<tr>
<td>Y_9</td>
<td>TIM</td>
<td>ON when JOG positioning is started. (can be used to confirm if JOG positioning operation is ON.)</td>
<td>Y109</td>
</tr>
<tr>
<td>Y_A</td>
<td>-</td>
<td>-</td>
<td>Y10A</td>
</tr>
<tr>
<td>Y_B</td>
<td>-</td>
<td>-</td>
<td>Y10B</td>
</tr>
<tr>
<td>Y_C</td>
<td>-</td>
<td>-</td>
<td>Y10C</td>
</tr>
<tr>
<td>Y_D</td>
<td>-</td>
<td>-</td>
<td>Y10D</td>
</tr>
<tr>
<td>Y_E</td>
<td>-</td>
<td>-</td>
<td>Y10E</td>
</tr>
<tr>
<td>Y_F</td>
<td>ECLR</td>
<td>ON when to cancel an error.</td>
<td>Y10F</td>
</tr>
</tbody>
</table>
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)

(Unit: mm)
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

<table>
<thead>
<tr>
<th>Product name</th>
<th>Product number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Driver I/F Terminal II</td>
<td></td>
</tr>
<tr>
<td>1-axis type</td>
<td>AFP8503</td>
</tr>
<tr>
<td>2-axis type</td>
<td>AFP8504</td>
</tr>
</tbody>
</table>

-Positioning unit which can be used

<table>
<thead>
<tr>
<th>Product name</th>
<th>Product number</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP2 Positioning unit</td>
<td></td>
</tr>
<tr>
<td>Multifunction type</td>
<td></td>
</tr>
<tr>
<td>2-axis type</td>
<td>AFP2434</td>
</tr>
<tr>
<td>4-axis type</td>
<td>AFP2435</td>
</tr>
<tr>
<td>FPSigma Positioning unit</td>
<td></td>
</tr>
<tr>
<td>1-axis type</td>
<td>AFPG432</td>
</tr>
<tr>
<td>2-axis type</td>
<td>AFPG433</td>
</tr>
</tbody>
</table>

-Related products

<table>
<thead>
<tr>
<th>Product name</th>
<th>Product number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable for FP2 Positioning unit</td>
<td></td>
</tr>
<tr>
<td>0.5m</td>
<td>AFP85100</td>
</tr>
<tr>
<td>1m</td>
<td>AFP85101</td>
</tr>
<tr>
<td>Cable for MINAS A III series</td>
<td></td>
</tr>
<tr>
<td>1m</td>
<td>AFP85131</td>
</tr>
<tr>
<td>2m</td>
<td>AFP85132</td>
</tr>
<tr>
<td>Cable for MINAS S series</td>
<td></td>
</tr>
<tr>
<td>1m</td>
<td>AFP85141</td>
</tr>
<tr>
<td>2m</td>
<td>AFP85142</td>
</tr>
</tbody>
</table>

-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.

- 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

<table>
<thead>
<tr>
<th>Manufacture</th>
<th>Part No.</th>
<th>Size</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phoenix Contact Co.</td>
<td>AI 0.25-6BU</td>
<td>AWG#25-#22</td>
<td>0.18-0.33mm²</td>
</tr>
<tr>
<td></td>
<td>AI 0.34-6TQ</td>
<td>AWG#24-#22</td>
<td>0.20-0.37mm²</td>
</tr>
<tr>
<td></td>
<td>AI 0.5-6WH</td>
<td>AWG#22-#20</td>
<td>0.32-0.56mm²</td>
</tr>
</tbody>
</table>

- Insalling the I/F terminal

- DIN rail installation
  (DIN EN50022 35 mm / 1.376 in width)

- Screw-in installation

<table>
<thead>
<tr>
<th>Type</th>
<th>Part number</th>
<th>L(mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-axis</td>
<td>AFP8503</td>
<td>106.0</td>
</tr>
<tr>
<td>2-axis</td>
<td>AFP8504</td>
<td>178.0</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>I/O No.</th>
<th>Description</th>
<th>I/O No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X100</td>
<td>Pulse output busy flag</td>
<td>R0</td>
<td>during home return operation</td>
</tr>
<tr>
<td>X101</td>
<td>Positioning done flag</td>
<td>R1</td>
<td>Home return command pulse</td>
</tr>
<tr>
<td>X108</td>
<td>Home return done flag</td>
<td>R8</td>
<td>Home return done pulse</td>
</tr>
<tr>
<td>X0</td>
<td>Positioning(1) operation start</td>
<td>R9</td>
<td>Home return completed and stored in memory</td>
</tr>
<tr>
<td>X1</td>
<td>Positioning(2) operation start</td>
<td>R10</td>
<td>during positioning (1) operation</td>
</tr>
<tr>
<td>X2</td>
<td>Home Return start</td>
<td>R11</td>
<td>Positioning (1) operation command pulse</td>
</tr>
<tr>
<td>X3</td>
<td>Forward JOG</td>
<td>R12</td>
<td>Positioning (1) completed and stored in memory</td>
</tr>
<tr>
<td>X4</td>
<td>Reverse JOG</td>
<td>R13</td>
<td>Positioning (1) done pulse</td>
</tr>
<tr>
<td>X5</td>
<td>Emergency stop</td>
<td>R20</td>
<td>during positioning (2) operation</td>
</tr>
<tr>
<td>Y100</td>
<td>E point control start</td>
<td>R21</td>
<td>Positioning (2) operation command pulse</td>
</tr>
<tr>
<td>Y102</td>
<td>Home return start</td>
<td>R22</td>
<td>Positioning (2) completed and stored in memory</td>
</tr>
<tr>
<td>Y103</td>
<td>Forward JOG</td>
<td>R23</td>
<td>Positioning (2) done pulse</td>
</tr>
<tr>
<td>Y104</td>
<td>Reverse JOG</td>
<td>R30</td>
<td>Forward JOG setting</td>
</tr>
<tr>
<td>Y105</td>
<td>Forced stop</td>
<td>R31</td>
<td>Reverse JOG setting</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Data</th>
<th>Linear component</th>
<th>X axis component</th>
<th>Y axis component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target position (absolute)</td>
<td>(X, Y)</td>
<td>X*</td>
<td>Y*</td>
</tr>
<tr>
<td>Current position (absolute)</td>
<td>(x, y)</td>
<td>x</td>
<td>y</td>
</tr>
<tr>
<td>Movement distance</td>
<td>L=\sqrt{(X-x)^2+(Y-y)^2}</td>
<td>Lx=X-x</td>
<td>Ly=Y-y</td>
</tr>
<tr>
<td>startup speed</td>
<td>VS*</td>
<td>Vsx=Vs \times \frac{</td>
<td>X-x</td>
</tr>
<tr>
<td>target speed</td>
<td>Vt*</td>
<td>Vtx=Vt \times \frac{</td>
<td>X-x</td>
</tr>
<tr>
<td>Acceleration/deceleration</td>
<td>Ac*</td>
<td>Acx=Ac</td>
<td>Acy=Ac</td>
</tr>
<tr>
<td>time</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
\[ L = \sqrt{X^2 + Y^2} \]
### Allocation of data registers

<table>
<thead>
<tr>
<th>Item</th>
<th>Data No.</th>
<th>Description</th>
<th>Calculation formula</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>User Setting area</strong></td>
<td>DT0</td>
<td>startup speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DT2</td>
<td>target speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DT4</td>
<td>Acceleration/deceleration time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DT6</td>
<td>Target position of X axis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DT8</td>
<td>Target position of Y axis</td>
<td></td>
</tr>
<tr>
<td><strong>Data register the program is using</strong></td>
<td>DT10</td>
<td>Current position of X axis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DT12</td>
<td>Current position of Y axis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DT14</td>
<td>Movement amount of X axis = absolute value of (target position of X axis – current position of X axis)</td>
<td>ABS(DT6 – DT10)</td>
</tr>
<tr>
<td></td>
<td>DT16</td>
<td>Movement amount of Y axis = absolute value of (target position of Y axis - current position of Y axis)</td>
<td>ABS(DT8 – DT12)</td>
</tr>
<tr>
<td></td>
<td>DT18</td>
<td>Movement amount of square of X axis</td>
<td>Square of (DT14)</td>
</tr>
<tr>
<td></td>
<td>DT20</td>
<td>Movement amount of square of Y axis</td>
<td>Square of (DT16)</td>
</tr>
<tr>
<td></td>
<td>DT22</td>
<td>Movement amount of square of X axis + movement amount of square of Y axis</td>
<td>DT18 + DT20</td>
</tr>
<tr>
<td></td>
<td>DT24</td>
<td>Linear movement amount</td>
<td>√DT22</td>
</tr>
<tr>
<td></td>
<td>DT26</td>
<td>Movement amount of X axis/Linear movement amount</td>
<td>DT14/DT24</td>
</tr>
<tr>
<td></td>
<td>DT28</td>
<td>Movement amount of Y axis/Linear movement amount</td>
<td>DT16/DT24</td>
</tr>
<tr>
<td></td>
<td>DT30</td>
<td>Control code of X axis</td>
<td>H1&lt;Absoute&gt;</td>
</tr>
<tr>
<td></td>
<td>DT32</td>
<td>Startup speed of X axis component</td>
<td>DT0*DT26</td>
</tr>
<tr>
<td></td>
<td>DT34</td>
<td>Target speed of X axis component</td>
<td>DT2*DT26</td>
</tr>
<tr>
<td></td>
<td>DT36</td>
<td>Acceleration/deceleration time</td>
<td>DT4</td>
</tr>
<tr>
<td></td>
<td>DT38</td>
<td>Target position of X axis</td>
<td>DT6</td>
</tr>
<tr>
<td></td>
<td>DT40</td>
<td>Control code of Y axis</td>
<td>H1&lt;Absoute&gt;</td>
</tr>
<tr>
<td></td>
<td>DT42</td>
<td>Startup speed of Y axis component</td>
<td>DT0*DT28</td>
</tr>
<tr>
<td></td>
<td>DT44</td>
<td>Target speed of Y axis component</td>
<td>DT2*DT28</td>
</tr>
<tr>
<td></td>
<td>DT46</td>
<td>Acceleration/deceleration time</td>
<td>DT4</td>
</tr>
<tr>
<td></td>
<td>DT48</td>
<td>Target position of Y axis</td>
<td>DT8</td>
</tr>
</tbody>
</table>
**Sample Program**

**FP Σ Positioning Unit**

**Program**

```
F1 DMV, K 500, DT 0 1
F1 DMV, K 1000, DT 2
F1 DMV, K 100, CT 4
F1 DMV, K 4000, DT 6
F1 DMV, K 3000, DT 8
```

**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

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