Panasonic®

PROGRAMMABLE CONTROLLER

FP3/5

POSITIONING MODULE F-TYPE

Technical Manual

FP3/5 POSITIONING MODULE F-TYPE Technical Manual
ACG-M0029-1 '96.3

Matsushita Electric Works, Ltd.

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 safe.
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 abnormal exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assure in these specifications.
-Do not dismantle or remodel the product. It could lead to abnormal 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 might cause abnormal 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 might cause exothermic heat or smoke generation.
-Do not undertake construction (such as connection and disconnection) while the power supply is on.

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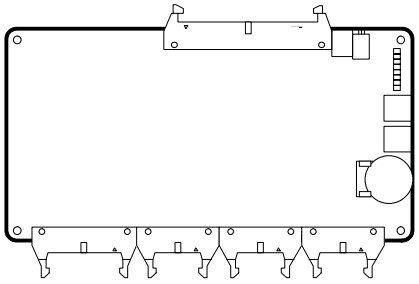
CHAPTER 1

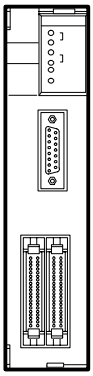
SYSTEM CONFIGURATION AND FEATURES

1-1. Features

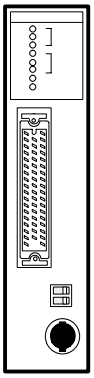
■ Positioning modules F-types (1-/2-/3-axis modules)



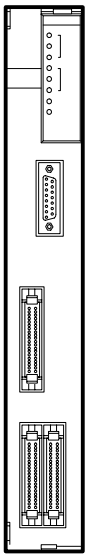
FP-C positioning board (Line-driver type)
1-axis board (AFC3434)
2-axis board (AFC3435)
3-axis board (AFC3436)



FP3 positioning unit (Transistor type)
1-axis unit (AFP3431)
2-axis unit (AFP3432)



FP3 positioning unit (Line-driver type)
1-axis unit (AFP3434)
2-axis unit (AFP3435)
3-axis unit (AFP3436)



FP5 positioning unit (Transistor type)
1-axis unit (AFP5434)
2-axis unit (AFP5435)
3-axis unit (AFP5436)

■ Applicable Positioning Module

Module \ CPU	FP-C	FP3	FP5	FP10S	FP10
FP-C positioning board	Available	———			
FP3 positioning unit	———	Available	———	Available	———
FP5 positioning unit	———		Available	———	Available

■ Highly precise positioning at up to 400 kpps

Positioning can be performed at high-speed, because the positioning module F-type lets you specify a high-speed instruction pulse.

■ Space saving 3-axis module available

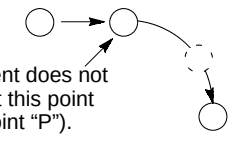
The 3-axis module can be located in one slot space, which saves space for controlling the motion for multiple axes.

■ Line-driver type for long-distance wiring (Max. 15 m/49.213 ft.)

■ Linear and circular interpolation functions (2-/3-axis modules)

These functions ensure smooth and continuous movement without stopping by using P point control of motion pattern.

Example: Positioning from linear to circular trace



■ Parameter and positioning point data setting from the CPU available

The following operations can be performed from the CPU:

- Starting of positioning, homing and JOG operations
- Setting parameter and positioning point data
- Reading and modifying the current position
- Changing the JOG speed

■ Home search function

The system can be set to automatic homing operation using this function.

■ 15 ms or less, quick start-up

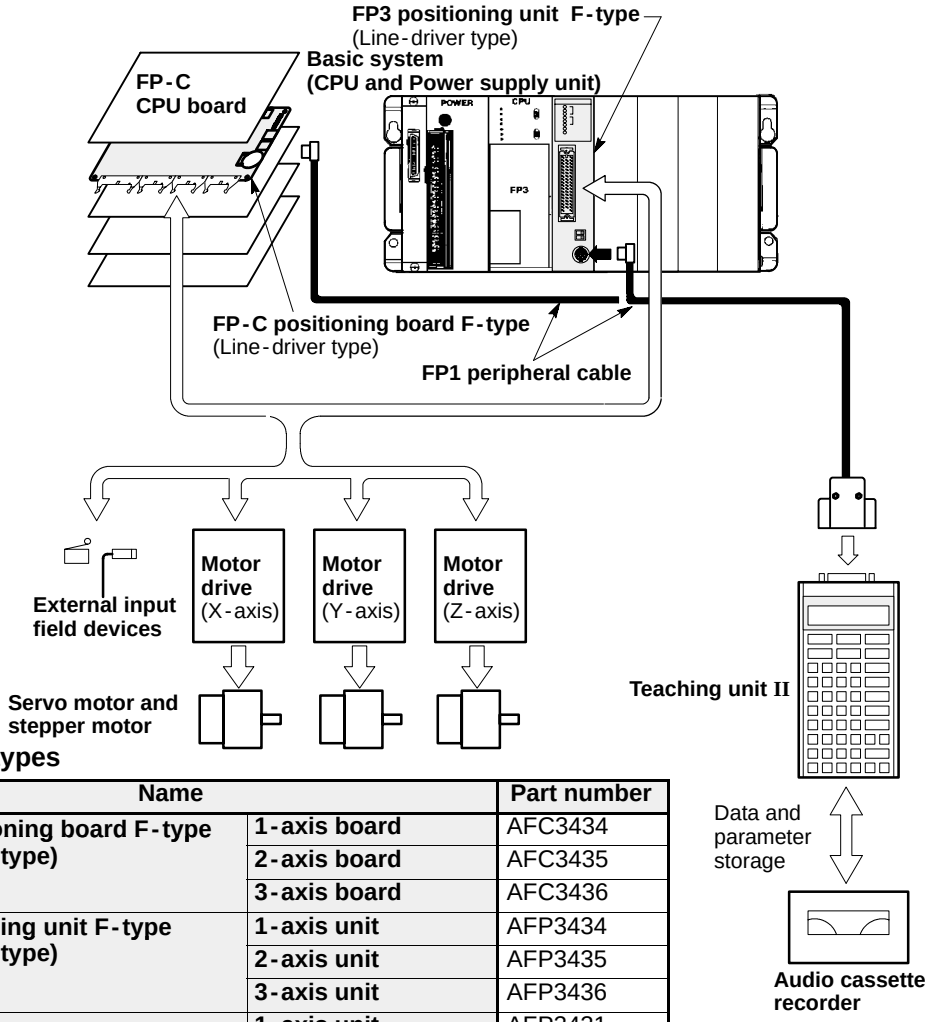
■ Easy-to-use teaching unit II

The hand-held terminal can customize and debug motion programs efficiently.

1-2. System Configuration

Mounted on a basic system of programmable controller, the positioning module stores positioning data, outputs pulses for the drive, and executes total positioning control to reduce the CPU load.
Once the parameters, motion span, speed and other data are set for each positioning point from a program in the CPU, the positioning operation can be started by turning the specific I/Os ON and OFF. The positioning module then outputs drive pulses for positioning according to the designated starting data number.
The positioning module parameters and data can also be set with the teaching unit II.

■ **Positioning system configuration** (Example: FP3 positioning unit F-type and FP-C positioning board F-type)



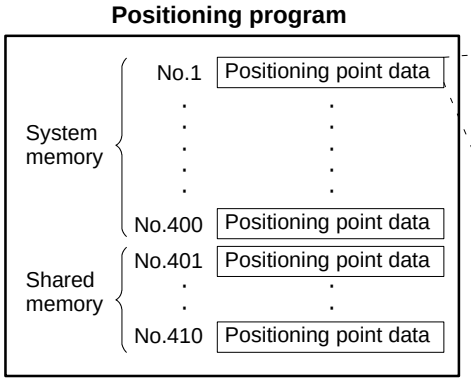
■ **Product types**

Name		Part number
FP-C positioning board F-type (Line-driver type)	**1-axis board**	AFC3434
	2-axis board	AFC3435
	3-axis board	AFC3436
FP3 positioning unit F-type (Line-driver type)	**1-axis unit**	AFP3434
	2-axis unit	AFP3435
	3-axis unit	AFP3436
FP3 positioning unit F-type (Transistor type)	**1-axis unit**	AFP3431
	2-axis unit	AFP3432
FP5 positioning unit F-type (Transistor type)	**1-axis unit**	AFP5434
	2-axis unit	AFP5435
	3-axis unit	AFP5436
FP1 peripheral cable (Cable needed for connection between teaching unit II and the line-driver type positioning module.)	**50 cm/19.685 in.**	AFP15205
	3 m/9.84 ft.	AFP1523
FP peripheral cable (Cable needed for connection between teaching unit II and the transistor type positioning module.)	**50 cm/19.685 in.**	AFP5520
	3 m/9.84 ft.	AFP5523
Teaching unit II		AFP5134

1-3. Function Outline

1. Positioning Program Composition (Up to 400 points of positioning point data can be stored)

A positioning program is composed of a set of positioning point data. Each set of positioning point data has information on the motion pattern, motion span, axis speed, acceleration/deceleration time, auxiliary code, and dwell time for each positioning point. Each set of positioning point data has a number.



Set of positioning point data

Item	Description
Motion pattern	Operation mode after positioning
Motion span	Target address of the motion control (absolute mode/incremental mode)
Axis speed	Axis speed for independent axis mode
Interpolation speed	Interpolation speed for simultaneous axis mode
Acceleration /deceleration time	Time to the set speed
Dwell time	Time lag from the end of the pulse output to in-position
Auxiliary code	Optional codes for the positioning point data

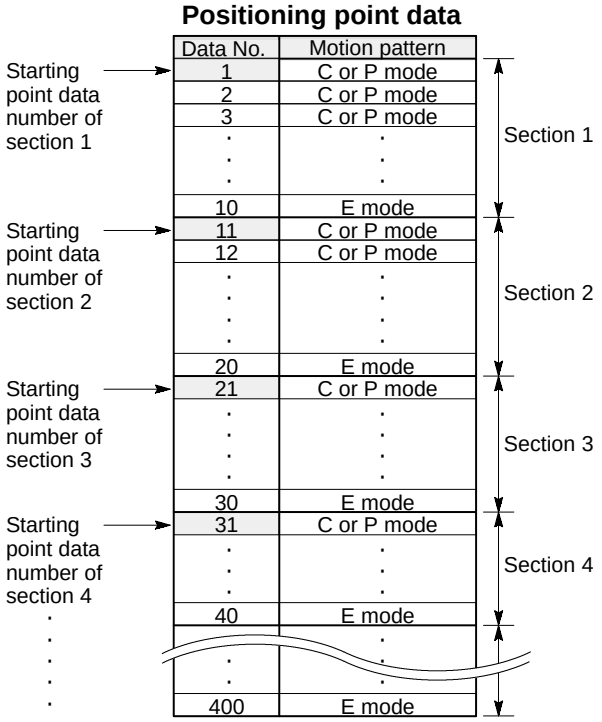
The positioning module F-type can store up to 400 sets of positioning point data per axis. Each set of positioning point data has a data number between 1 and 400. (See note below.) When the execution of a set of positioning point data is completed, successive positioning point data are executed according to the preset motion pattern.

Note:

· If you are using the positioning module with system ROM version SV 2.1 or later, positioning point data numbers from 401 to 410 are also available using its shared memory.

2. Dividing Positioning Point Data

The positioning module F-type has the ability to divide whole sets of positioning point data into some sections. One section ends its operation at the positioning point data set as end (E) point (in motion pattern data). The starting point for each section can be specified by setting the specific data number in the shared memory. After setting the starting point data number, you can perform the specified section. By dividing the whole data into some sections, you can easily control complicated positioning control by selecting combinations of sections.



3. Motion Patterns

By specifying the motion pattern for each set of positioning point data, operation after the completion of positioning can be selected from four control modes. The operation mode can be specified by using the letters “C”, “P”, “S” and “E” and for the “C”, “P” and “S” mode, the number is followed by the letter for specifying the next positioning point data number.

Motion pattern: CXXX, PXXX, SXXX, E
“XXX” means the next positioning point data number.
1 ≦ XXX ≦ 400
999: Return

- **CXXX (continuation point):**
  In this mode, the operation of the positioning module will pause once after the module finishes operation for the current set of positioning point data. After the module confirm its operation by itself, it continues operation from the next positioning point data.
- **PXXX (pass point):**
  In this mode, the operation of the positioning module will be performed without stopping. The module will smoothly go into operation from the next set of positioning point data after completion of one set of data.
- **SXXX (circular interpolation point):**
  In order for circular interpolation to be carried out, three point data are required. In this mode, the current position decided by the previous positioning point data, and the positions specified by it and the next and preceding set of positioning point data are used for making an arc.
- **E (end point):**
  In this mode, the positioning module stops positioning operation after it finishes the preset operation.

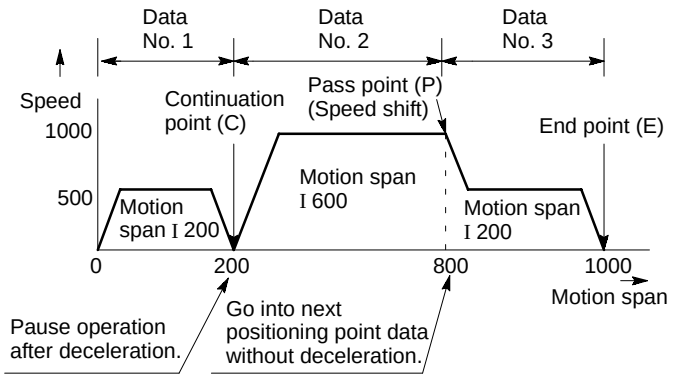
Notes:

- “XXX” added to the “C”, “P” and “S” means the positioning point data number for the next operation. When programming data using the teaching unit II, the one larger point data number is automatically set for “C”, “P” and “S” mode. And you need to set the number of the next positioning point data when programming data using the sequence program in the CPU. For details about the next point data settings, refer to page 6, “4. Positioning Point Data Jump and Return.”
- The positioning points “410 points (system memory: 400 points + shared memory: 10 points)” are available, if the system ROM version SV 2.1 or later is used.
- For details about positioning point data, refer to page 67, “4-4. Overview of Parameters and Positioning Point Data.”

■ Example: Motion pattern (C, P and E points)

Data No.	Motion pattern	Motion span	Axis speed
1	C2	I 200	500
2	P3	I 600	1000
3	E	I 200	500
.			
.			
. . . . . .			
400			

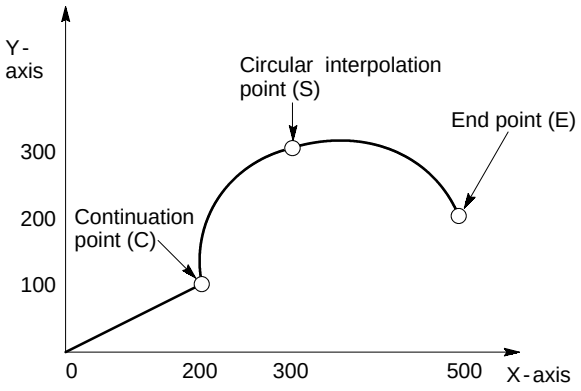
Operation chart



■ **Example: Motion pattern (C, S and E points)**

Data No.	X-axis		Y-axis	
	Motion pattern	Motion span	Motion pattern	Motion span
1	C2	A200	C2	A100
2	S3	A300	S3	A300
3	E	A500	E	A200
.				
.				
. . . . . .				
400				

Operation chart



Note:

· When the positioning module F-type is in the simultaneous mode, the same motion pattern must be used for the positioning point data on each axis.

4. Positioning Point Data Jump and Return

Usually positioning operations are performed in the order of smaller to larger point data numbers. However, in some cases, in order to execute the same motion option many times, you need to write the same positioning point data many times. In order to save such troublesome work, the positioning module F-type has the ability to jump to the next data for positioning at a-succeeding positioning point data in "C" and "P" motion pattern mode. By specifying the next positioning point data number, you can jump to the data with the specified number and setting a number 999 makes it possible to pass the motion to the original processing point.

Data No.	Motion pattern	
	X-axis	Y-axis
1	**C2**	C2
2	C3	**C13**
3	C4	**C4**
4	**C999**	C5
5		E
•		
•		
•		
•		
10	C11	C11
11	C12	C12
12	C13	C13
13	**C1**	**C14**
14	**E**	C15
15		**C999'**

- When data number 10 on the X-axis is started, the positioning module F-type will execute data numbers 10 to 13, then jump to data number 1, execute 1 to 4, and return to data number 14 to complete the positioning operation.
- When data number 1 on the Y-axis is started, the positioning module F-type will execute data numbers 1 and 2, then jump to data number 13, execute 13 to 15, and return to data number 3 and execute 3 to 5 to complete the positioning operation.

——→ : Jump

- - - -→ : Return

Notes:

· "XXX" added to the "C", "P" and "S" means the positioning point data number for the next operation. When programming data using teaching unit II, the one larger point data number is automatically set for "C", "P" and "S" mode. And you need to set the number of the next positioning point data when programming data using the sequence program in the CPU.

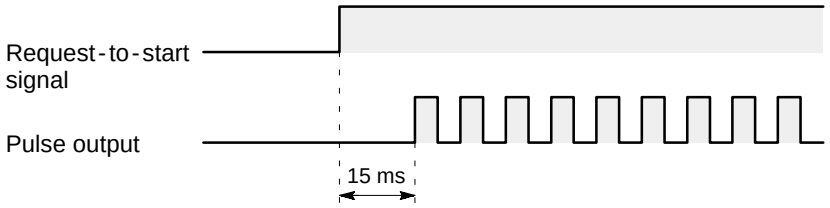
· For details about positioning point data, refer to page 67, "4-4. Overview of Parameters and Positioning Point Data."

· No more than 10 jump and return operation sets can be performed from the start point to the end point.

5. Quick-start

In quick-start mode, the positioning module F-type can output positioning pulses within 15 ms after the request-to-start signal. Using this function, you can start the positioning operation in a shorter time than when using conventional positioning modules.
Before selecting quick-start mode, be sure to perform a test for quick-start operation for checking the positioning point data used for quick-start operation.

Timing chart



Note:

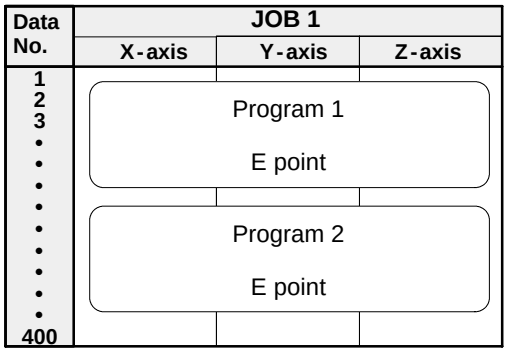
· For details about the quick-start function, refer to page 127, “18. Start Mode.”

6. Axis Mode

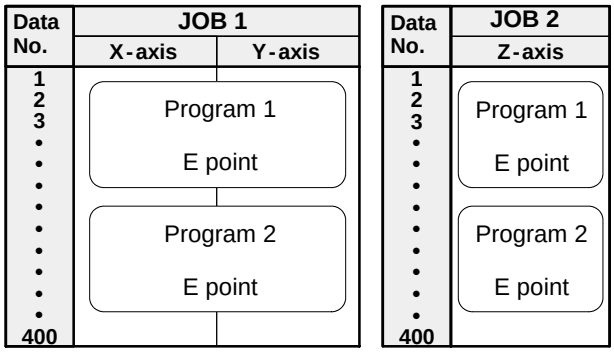
For the positioning module F-type, 1-axis, 2-axis and 3-axis modules are available. For controlling with a 2- or 3-axis module, simultaneous control modes are available in addition to independent mode. In simultaneous control mode, in order to synchronize the start-up and control timing of multiple axes, multiple axes are controlled in one unit as “JOB.” Depending on the axis mode you select, the JOB numbering allocation differs using “JOB 1”, “JOB 2” and “JOB 3” as shown in the example below:

■ **Example: JOB number allocation for 3-axis module**

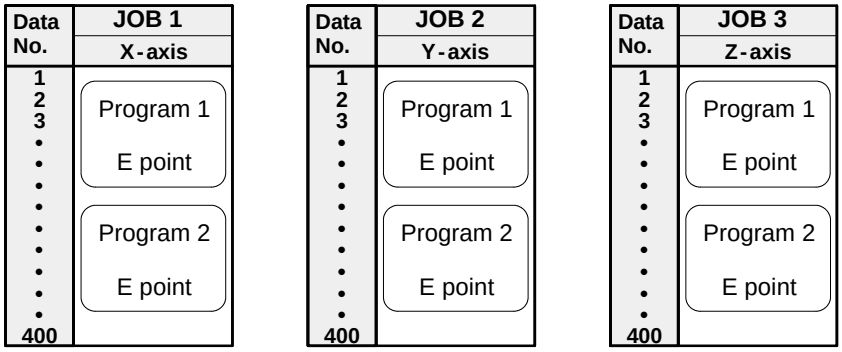
• Simultaneous 3-axis mode



• Simultaneous 2-axis mode (See note on page 8.)



• Independent mode

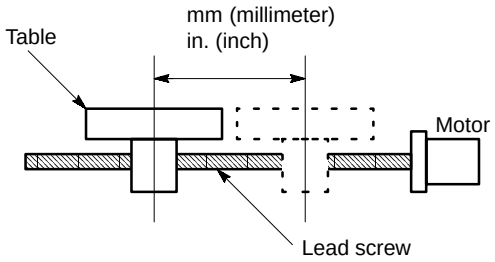


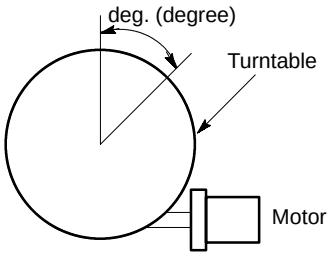
Notes:

- If you select simultaneous 2-axis mode on a 3-axis module, X- and Y-axis are used for synchronized operation.
- Even in simultaneous 3-axis mode, circular interpolation is performed based on the interpolation of X- and Y-axis and the Z-axis just moves in a spiral in accordance to the movement of the X- and Y-axis. Therefore, if you set 3 points so as to make X- and Y-axis a straight line, you cannot use these three points for making arc form.
- Within the same JOB, you should use the same pulse-conversion formula and movement unit for each axis.
- Even in the simultaneous mode, homing and JOG operations are performed independently.
- If 2- or 3-axis modules are operating in independent mode, parameters and data for the 2- or 3-axis module cannot be read or written. When an error occurs in one independent axis, the operation for all other axes will stop at the same time.

7. Unit Conversion for Motion Span

In addition to pulse motion span setting, positioning module F-type has motion span conversion function. This enables you to use actual positioning span data for program, such as in millimeters, inches or degrees, instead of using pulses by setting conversion value per pulse as a parameter conversion rate. Once the parameter for conversion rate is specified, program with actual movement distances or angles for lead screws of turntables can be made without concern for the pitches or deceleration ratios of the lead screw or the actual angle of the turntable as shown in the figures below:





Notes:

- If the unit conversion is changed, each positioning point data and other parameters concerning position and speed must be revised according to the new conversion rate setting.
- Within the same JOB, you should use the same pulse-conversion formula and movement unit for each axis.

8. Installation Flexibility

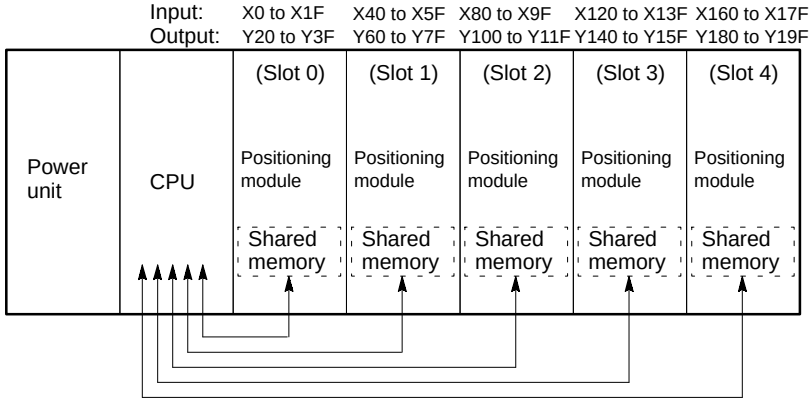
Besides 1-axis modules, 2- and 3-axis modules are also available for the positioning module F-type and this lets you control multiple axes with a small mounting space. In addition, since the positioning module F-type can be installed on any slot position on the master and expansion backplane, you can install as many modules as each system can control, each with its own I/O slot number and power supply.

9. Easy Control with I/O and Shared Memory

- When an positioning module F-type is installed, some I/O points (X external input relays and Y external output relays) are allocated for it, in the same way as for input, output and intelligent modules, depending on the type of modules. For example:
  - 1-axis modules (AFC3434, AFP3431, AFP3434 and AFP5434): 32 points (16SX and 16SY)
  - 2-axis modules (AFC3435, AFP3432, AFP3435 and AFP5435): 64 points (32SX and 32SY)
  - 3-axis modules (AFC3436, AFP3436 and AFP5436): 64 points (32SX and 32SY)
- These I/O points are used for communication between the CPU and a positioning module F-type:
  - X external input relays: CPU uses them for receiving report from the positioning module F-type
  - Y external output relays: CPU uses them for triggering functions of the positioning module F-type
- The other communications, such as positioning point data exchanges, between the CPU and the positioning module F-type are performed using the shared memory of the positioning module F-type. The CPU can access the shared memory by executing the **F150 (READ)/P150 (PREAD)** and **F151 (WRT)/P151 (PWRT)** instructions. Using the I/O and shared memory communication systems explained above, one CPU can control multiple axes thus reducing the CPU load.

■ **Example:**

- I/O allocation when 3-axis positioning modules F-type are installed on the master backplane



Communication between the CPU and the positioning module F-type
is executed by **F150 (READ)/P150 (PREAD)** or **F151 (WRT)/P151 (PWRT)** instructions.

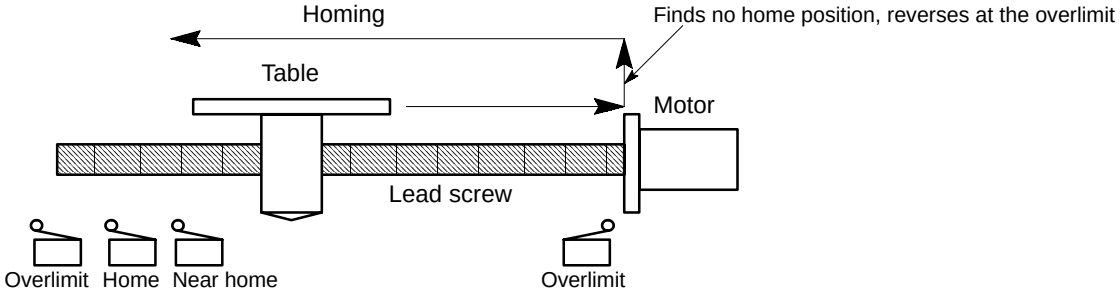
10. Homing Function

The positioning module F-type has two types of home positions for controlling the positioning operation.

- **Hardware home position:** Usually referred to as the “home” position.
  The home position is defined as the absolute starting point of the positioning hardware device and is used as the standard point for the positioning operation.

- **Software home position:** “Software home” is the starting position decided for your control convenience. It is specified by measuring the distance from the home (hardware home) position and it is handled at the “0” coordinate position in the positioning program.

Since the positioning module F-type has four (hardware) homing modes, you can select the ideal homing method for your positioning devices (limit switches and encoders) and their configuration. Additionally, the module also has a software homing function which lets you return to the software home position only by turning ON the software home request signal.
No matter where homing operation starts, a work always comes to home position in the direction specified in the parameter (positive or negative) and stops. Therefore, the stopping position will be stable using any home search method.



Note:

· For details about the homing methods and homing searching methods, refer to page 58, “4. Homing Function.”

11. Auxiliary Codes

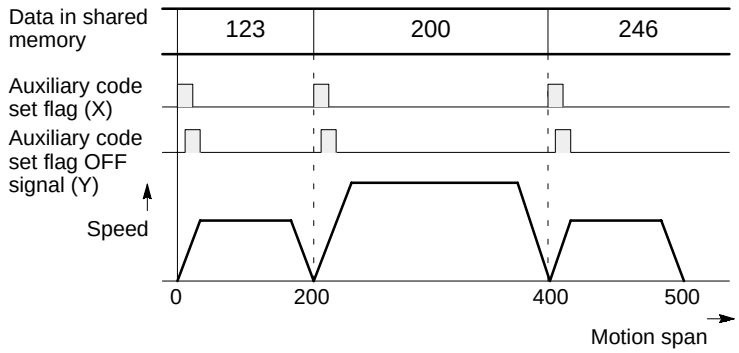
In order to take the positioning timing into the CPU, the positioning module F-type has an in-position/complete-to-test signal function. The in-position/complete-to-test signal can report the end of each positioning point data operation which has been set as a “C”, “P” or “E” motion pattern. However, this is not enough to know what kind of positioning operation is performed. In order to know that, the positioning module F-type has an auxiliary code function. The auxiliary code function will help you to check the current positioning control process by sending the preset code at some positioning point data to the shared memory. The available number of auxiliary codes is 255 (from 1 to 255) and the reporting timing can be selected from two modes.

- **Start (W) mode:** The module sends the auxiliary code to its shared memory at the moment it executes that positioning point data.
- **End (A) mode:** The module sends the auxiliary code to its shared memory after the positioning module executes that positioning point data.

In both modes, each time the auxiliary code is sent to the shared memory, the “auxiliary code set flag” is set to ON to inform the CPU about the sending of a new auxiliary code. Once set in the shared memory, the auxiliary code is maintained until a new one is sent. And the “auxiliary code set flag” can be turned OFF by turning the “auxiliary code set flag OFF signal” ON in the ladder program in the CPU. When no auxiliary code function is used for positioning data, be sure to set A0 to the auxiliary code area.

Data No.	Motion pattern	Motion span	Auxiliary code
1	C2	A200	W123
2	C3	A400	W200
3	E	A500	W246
.			
.			
. **.** **.** **.** **.** **.**			
400			

Operation chart



Note:

· For details about the auxiliary code function, refer to page 75, “4-5. Overview of Handshake Communications.”

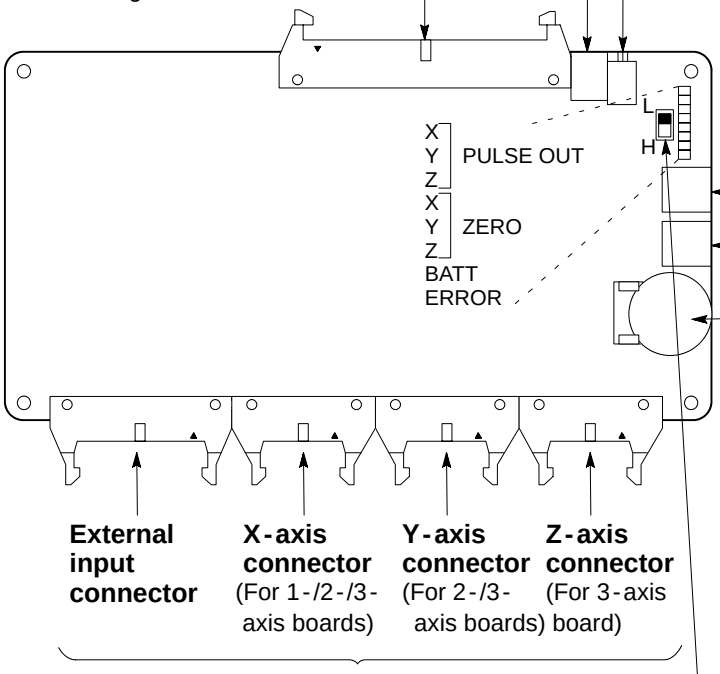
CHAPTER 2

SPECIFICATIONS

2-1. Part Terminology and Functions

1. FP-C Positioning Board (Line-driver Type)

(Illustration: 3-axis board)



Slot number selector
Set the slot number for additional boards.

Bus connector
Connects to the FP-C CPU board using CPU bus cable.

Mode selector

SW1:
Baud rate selector for RS422 and RS232C ports.
Set to ON to select 9,600 bps and OFF to select 19,200 bps.
Set to OFF when the teaching unit II is connected to the RS422 port.

SW2:
Unused. Set to OFF.

Operation monitor LEDs

PULSE OUT (X, Y, Z):
Used to monitor pulse output. Flashes when pulse output is turned ON or OFF.

ZERO (X, Y, Z):
Light with home input from external drive or field device.

BATT:
Used for memory backup.
Flashes when battery voltage drops.

ERROR:
Flashes when the positioning board has any error except a watchdog error.
Lights when a watchdog error occurs in the CPU.

RS422 port
Used to connect the teaching unit II.

RS232C port
Use this port for the programming tools (personal computer).

Backup battery holder
Holder for the backup lithium battery.
See page 32 for details on connecting a backup battery and page 229 for details on backup battery replacement.

External input connector

X-axis connector (For 1-/2-/3-axis boards)

Y-axis connector (For 2-/3-axis boards)

Z-axis connector (For 3-axis board)

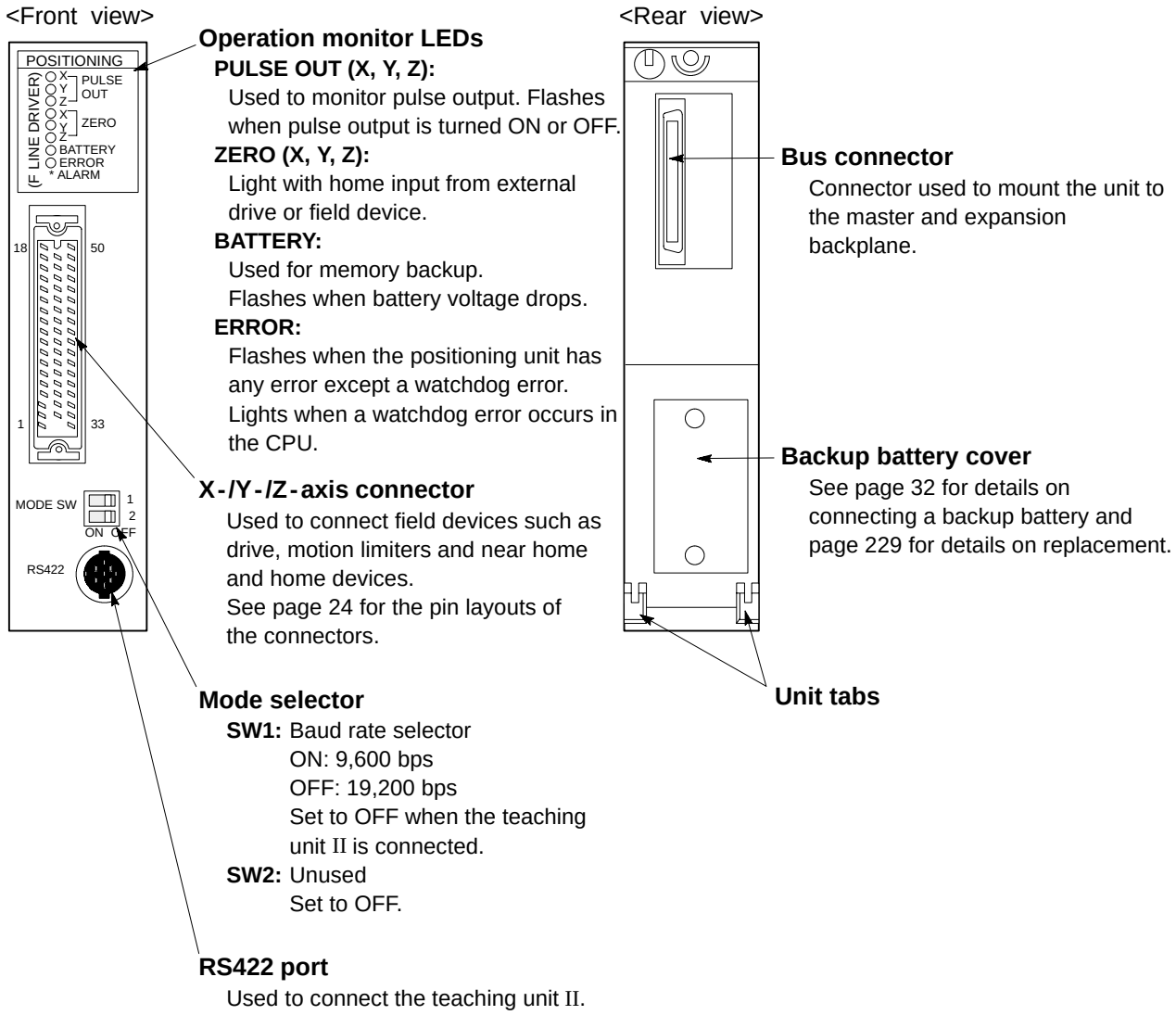
Used to connect field devices such as drive, motion limiters and near home and home devices.
See page 21 for the pin layouts of connector.

Be sure to set the switch to the L side.

2. FP3 Positioning Unit (Line-driver and Transistor Types)

1) Line-driver Type

(Illustration: 3-axis unit)



Operation monitor LEDs

PULSE OUT (X, Y, Z):
Used to monitor pulse output. Flashes when pulse output is turned ON or OFF.

ZERO (X, Y, Z):
Light with home input from external drive or field device.

BATTERY:
Used for memory backup.
Flashes when battery voltage drops.

ERROR:
Flashes when the positioning unit has any error except a watchdog error.
Lights when a watchdog error occurs in the CPU.

X-/Y-/Z-axis connector
Used to connect field devices such as drive, motion limiters and near home and home devices.
See page 24 for the pin layouts of the connectors.

Mode selector

SW1: Baud rate selector
ON: 9,600 bps
OFF: 19,200 bps
Set to OFF when the teaching unit II is connected.

SW2: Unused
Set to OFF.

RS422 port
Used to connect the teaching unit II.

Bus connector
Connector used to mount the unit to the master and expansion backplane.

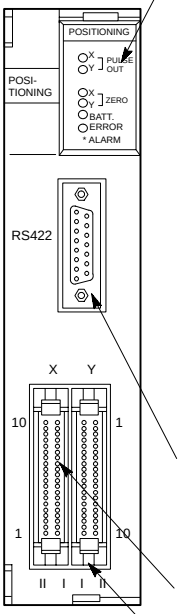
Backup battery cover
See page 32 for details on connecting a backup battery and page 229 for details on replacement.

Unit tabs

2) Transistor Type

(Illustration: 2-axis unit)

<Front view>



Operation monitor LEDs

PULSE OUT (X, Y):
Used to monitor pulse output. Flashes when pulse output is turned ON or OFF.

ZERO (X, Y):
Light with home input from external drive or field device.

BATT:
Used for memory backup.
Flashes when battery voltage drops.

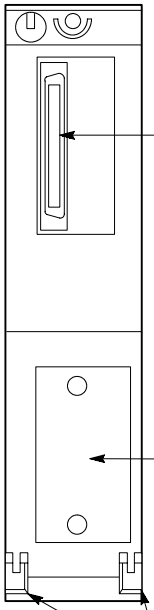
ERROR:
Flashes when the positioning unit has any error except a watchdog error.
Lights when a watchdog error occurs in the CPU.

RS422 port
Used to connect the teaching unit II.
(Baud rate: 19,200 bps fixed)

X-axis connector
(For 1-axis and 2-axis units)

Y-axis connector
(Only for 2-axis unit)
Used to connect field devices such as drive, motion limiters and near home and home devices.
See page 26 for the pin layouts of the connectors.

<Rear view>



Bus connector
Connector used to mount the unit to the master and expansion backplane.

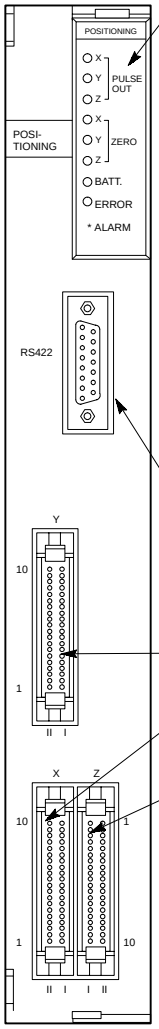
Backup battery cover
See page 32 for details on connecting a backup battery and page 229 for details on replacement.

Unit tabs

3. FP5 Positioning Unit (Transistor Type)

(Illustration: 3-axis unit)

<Front view>



Operation monitor LEDs

PULSE OUT (X, Y, Z):
Used to monitor pulse output. Flashes when pulse output is turned ON or OFF.

ZERO (X, Y, Z):
Light with home input from external drive or field device.

BATT:
Used for memory backup.
Flashes when battery voltage drops.

ERROR:
Flashes when the positioning unit has any error except a watchdog error.
Lights when a watchdog error occurs in the CPU.

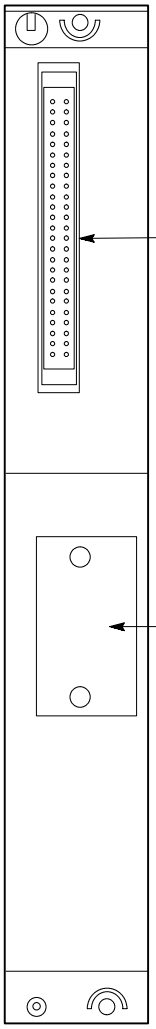
RS422 port
Used to connect the teaching unit II.
(Baud rate: 19,200 bps fixed)

Y-axis connector
(For 2-axis and 3-axis units)

X-axis connector
(For 1-axis, 2-axis, and 3-axis units)

Z-axis connector
(Only for 3-axis unit)
Used to connect field devices such as drive, motion limiters and near home and home devices.
See page 27 for the pin layouts of the connectors.

<Rear view>



Bus connector
Connector used to mount the unit to the master and expansion backplane

Backup battery cover
See page 32 for details on connecting a backup battery and page 229 for details on replacement.

2-2. Specifications

1. General Specifications

Item	Description
Ambient temperature	0° C to 55° C/32° F to 131° F
Ambient humidity	30 % to 85 % RH (non-condensing)
Storage temperature	-20° C to 70° C/-4° F to 158° F
Storage humidity	30 % to 85 % RH (non-condensing)
Vibration resistance	10 Hz to 55 Hz, 1 cycle/min: double amplitude of 0.75 mm/0.030 in., 10 min on 3 axes
Shock resistance	98 m/s^2 or more, 4 times on 3 axes
Noise immunity	1,000 Vp-p with pulse width, 50 ns or 1 μs (based on in-house measurements)
Operating condition	Free from corrosive gases and excessive dust

2. Performance Specifications

Item		Description		
Type		**1-axis module**	**2-axis module**	**3-axis module**
Part number	**FP-C board**	AFC3434	AFC3435	AFC3436
	FP3 unit	AFP3431 AFP3434	AFP3432 AFP3435	AFP3436
	FP5 unit	AFP5434	AFP5435	AFP5436
I/O occupation		32 points (16SX and 16SY)	64 points (32SX and 32SY)	
Limitations on the module location		Available for all of the slots in the master and expansion backplane		
Number of axes		1-axis (independent) Axis mode: Independent 1-axis	2 axes (simultaneous or independent) Axis mode: - Simultaneous 2-axis - Independent 2-axis	3 axes (simultaneous or independent) Axis combinations can be designed by axis mode parameters as: - Simultaneous 3-axis - Simultaneous 2-axis and independent 1-axis - Independent 3-axis (When circular interpolation is done using X- and Y-axis in the simultaneous 3-axis mode, Z-axis moves sychronized with the movement of X- and Y-axis.)
Interpolation method		Not available	Linear and circular interpolation (Interpolation speed is specified by the long-axis speed and tracking speed of parameter.)	
Control method		PTP (point-to-point)	PTP (point-to-point) and CP (continuous path)	
Positioning points (*1)		Max. 410 points per axis (using teaching unit II or CPU program)		
Memory backup		Min. 5,000 hours using lithium battery Min. 15 min using unit's capacitor		
External terminals		Pulse output 1, pulse output 2, deviation counter reset output, power supply for pulse output (5 V DC to 12 V DC or 24 V DC), drive error input, home input, near home input, overlimit input		
Internal current consumption (at 5 V DC) (*2)	**FP-C board**	AFC3434: 350 mA	AFC3435: 350 mA	AFC3436: 400 mA
	FP3 unit	AFP3431: 350 mA AFP3434: 350 mA	AFP3432: 400 mA AFP3435: 350 mA	AFP3436: 400 mA
	FP5 unit	AFP5434: 350 mA	AFP5435: 400 mA	AFP5436: 450 mA

Notes:

- (*1): The positioning points "410 points (system memory: 400 points + shared memory: 10 points)" are available, if system ROM version SV 2.1 or later is used.
- (*2): The current consumption of each positioning module F-type increases by 350 mA when the teaching unit II is connected.

Item		Description		
Type		1-axis module	2-axis module	3-axis module
Approx. weight	FP-C board	AFC3434: 200 g/7.055 oz.	AFC3435: 215 g/7.584 oz.	AFC3436: 230 g/8.113 oz.
	FP3 unit	AFP3431: 345 g/12.170 oz. AFP3434: 410 g/14.463 oz.	AFP3432: 360 g/12.699 oz. AFP3435: 425 g/14.992 oz.	AFP3436: 440 g/15.521 oz.
	FP5 unit	AFP5434: 610 g/21.518 oz.	AFP5435: 625 g/22.047 oz.	AFP5436: 640 g/22.576 oz.
Positioning drive function	Positioning command	Both increment (I) and absolute (A) Equivalent to ±8,388,607 pulses max. ±83,886.07 mm (with a conversion unit of 0.01 mm per pulse) ±8,388.607 inches (with a conversion unit of 0.001 inch per pulse) ±8,388.607 degrees (with a conversion unit of 0.001 degree per pulse)		
	Speed command	Equivalent to 400,000 pps max. ±4,000 mm per second (with a conversion unit of 0.01 mm per pulse) ±400 inches per second (with a conversion unit of 0.001 inch per pulse) ±400 degrees per second (with a conversion unit of 0.001 degree per pulse)		
	Acceleration and deceleration	64 to 4,999 ms [0 to 4,999 ms (*1)]		
	Auxiliary code	1 to 255 per JOB in start mode (W) and end mode (A). (Auxiliary code stored in shared memory.)		
	Backlash correction	Available		
	Error correction	Available		
	Quick-start	15 ms or less in independent and simultaneous modes. (*2)		
Homing function	Homing method	Home searching method (using near home and overlimit inputs)		
	Stopping method	1. Near home ON method (using near home and home inputs) 2. Near home OFF method (using near home and home inputs) 3. Near home ON/OFF method (using near home input) 4. Limit search method (using limit and home inputs) (*3)		
Software homing function		Homing to 0 position from the actual position		
JOG function		Using teaching unit II: - JOG forward and JOG reverse for each independent axis - JOG forward and JOG reverse for simultaneous X- and Y-axis Using CPU program: - JOG forward and JOG reverse for simultaneous 3 axes - JOG speed control		
Teaching function		Absolute motion span can be stored by specifying data number after JOG operation		
Auxiliary functions		Auxiliary code, I/F logic selection, homing position offset and pulse output selection (pulse train and sign or CW and CCW)		
Data storage function		Parameters and positioning data can be saved to or loaded from cassette tape by connecting a cassette tape recorder to the teaching unit II. Verification is also possible between the module and tape recorder.		
Other functions		Data/parameter settings, actual position read, actual position change, memory clear and self-diagnostic function		

Notes:

- (*1): This acceleration and deceleration range is possible, if system ROM version SV 2.0 or later is used. However, values in the range of 0 to 63 ms are approximate.
- (*2): If the quick-start function is used, it takes 15 ms maximum for the positioning module to start outputting pulses after a request-to-start signal is turned ON by the CPU.
- (*3): The limit search method for stopping is available for the FP-C positioning board only.

3. External Power Supply Capacity

Type	Operating voltage	Power supply capacity		
		1-axis module	2-axis module	3-axis module
Line-driver type	5 V DC	40 mA	80 mA	120 mA
	12 V DC	30 mA	50 mA	80 mA
	24 V DC	20 mA	30 mA	40 mA
Transistor type	5 V DC	20 mA	30 mA	40 mA
	12 V DC	20 mA	40 mA	60 mA
	24 V DC	20 mA	40 mA	60 mA

4. I/O Specifications

Item		Specification	
Output (*1) • Pulse output 1 • Pulse output 2	Output type	Line-driver output Equivalent AM26C31	
Output • Pulse output 1 • Pulse output 2	Output type	Transistor open collector (Output duty ratio : 50 ± 10 %)	
	Output voltage range	4.75 to 26.4 V DC	
	Load current range	2 to 15 mA	
	ON voltage	0.6 V or less	
Output • Deviation counter reset	Output type	Transistor open collector	
	Output voltage range	4.75 to 26.4 V DC	
	Load current range	10 mA or less	
	ON voltage	0.8 V or less for FP-C positioning board	
		0.6 V or less for FP3/FP5 positioning unit	
Input • Near home • Overlimit • Drive error • External input • Home (*2)	Input voltage range	4.75 to 26.4 V DC	
	ON voltage	3.5 V or less	Input impedance : 2.5 kΩ or more
	OFF voltage	2.5 V or more	
	Pulse width	5 ms or more (home input pulse width: 1.5 ms or more)	

Notes:

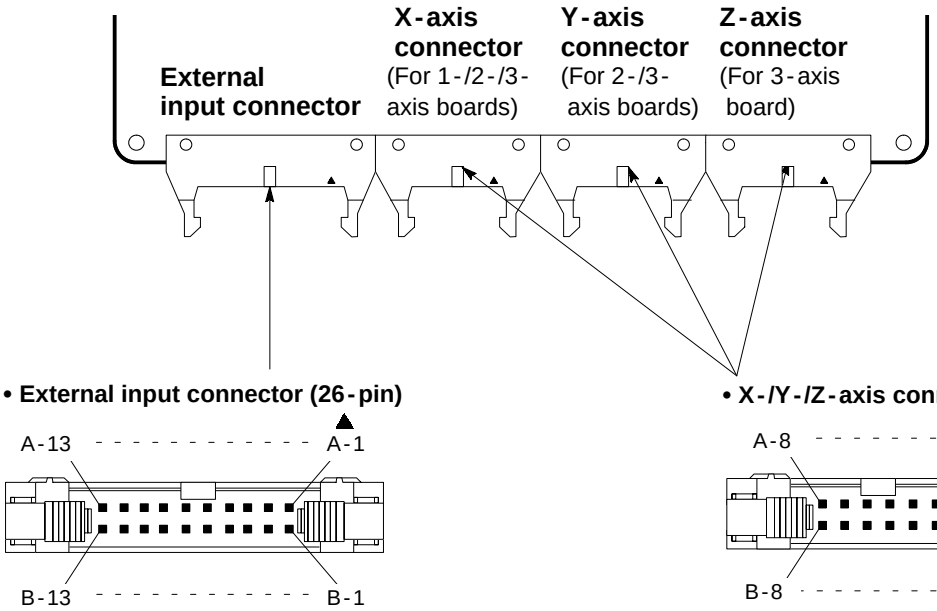
- (*1): Line-driver output is available only with the line-driver type.
- (*2): The line-driver type incorporates a line-driver input terminal.

5. Pin Layout of Connectors and Internal Circuits

1) FP-C Positioning Board (Line-driver Type)

■ Pin layouts

FP-C positioning board (Line-driver type)

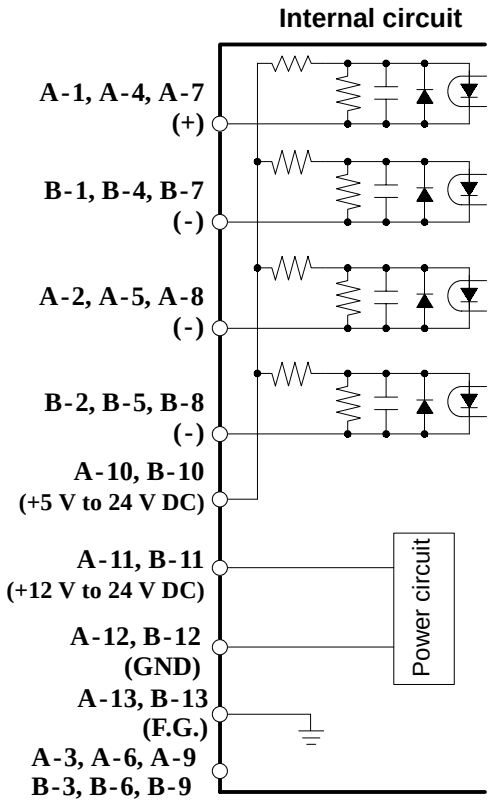


No.	Name	No.	Name
A-13	Frame ground	B-13	Frame ground
A-12	Ground for external power supply	B-12	Ground for external power supply
A-11	External power supply (12 V to 24 V DC)	B-11	External power supply (12 V to 24 V DC)
A-10	Common for input (5 V to 24 V DC)	B-10	Common for input (5 V to 24 V DC)
A-9	———	B-9	———
A-8	Near home (-) of Z-axis	B-8	Drive error (-) of Z-axis
A-7	Overlimit (+) of Z-axis	B-7	Overlimit (-) of Z-axis
A-6	———	B-6	———
A-5	Near home (-) of Y-axis	B-5	Drive error (-) of Y-axis
A-4	Overlimit (+) of Y-axis	B-4	Overlimit (-) of Y-axis
A-3	———	B-3	———
A-2	Near home (-) of X-axis	B-2	Drive error (-) of X-axis
A-1	Overlimit (+) of X-axis	B-1	Overlimit (-) of X-axis

No.	Name	No.	Name
A-8	Common for output (GND)	B-8	Common for output (GND)
A-7	———	B-7	Deviation counter reset output
A-6	———	B-6	Pulse output 2 [Transistor output (+)]
A-5	———	B-5	Pulse output 1 [Transistor output (+)]
A-4	Home (Z-phase) (5 V to 24 V DC)	B-4	Home (Z-phase) (common)
A-3	Home (Z-phase) [Line-driver (+)]	B-3	Home (Z-phase) (common)
A-2	Pulse output 2 [Line-driver (+)]	B-2	Pulse output 2 [Line-driver (-)]
A-1	Pulse output 1 [Line-driver (+)]	B-1	Pulse output 1 [Line-driver (-)]

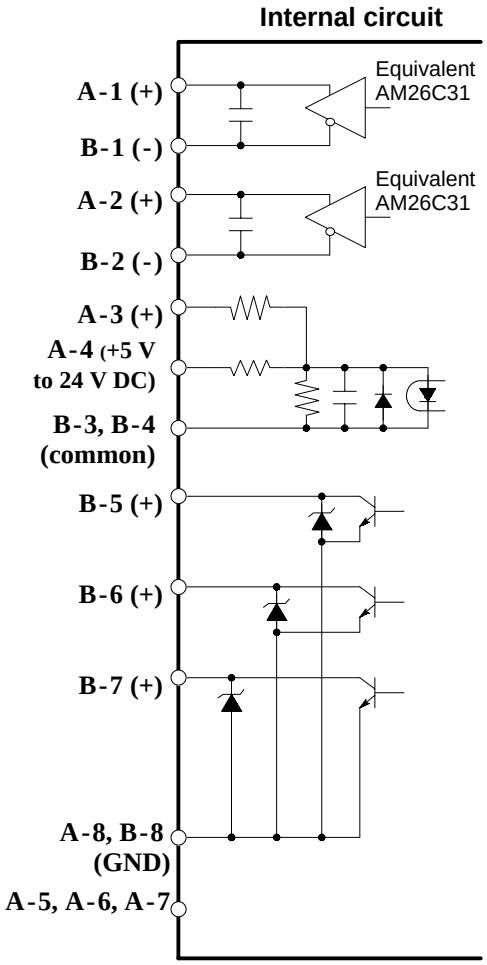
■ Internal circuit and pin numbers (FP-C Line-driver type)

• External input connector (26-pin)



Pin No.			Name	Description
X-axis	Y-axis	Z-axis		
A-1	A-4	A-7	Overlimit (+)	Connect this hardware limit input to limit switch (+).
B-1	B-4	B-7	Overlimit (-)	Connect this hardware limit input to limit switch (-).
A-2	A-5	A-8	Near home (-)	This signal detects the timing to reduce the speed of the positioning board to the near home speed just prior to a home signal.
B-2	B-5	B-8	Drive error (-)	Inputs an error output, such as drive deviation counter over or full torque.
A-10, B-10			Common for input (+5 V to 24 V DC)	Common terminal for input External input power supply +5 V to 24 V DC
A-11, B-11			External power supply	Power supply for external I/O circuit (+12 V to 24 V DC)
A-12, B-12				Ground for external I/O circuit (GND)
A-13, B-13			Frame ground	Frame ground terminal
A-3, A-6, A-9, B-3, B-6, B-9			_____	Not used Do not connect.

• X-/Y-/Z-axis connector (16-pin)

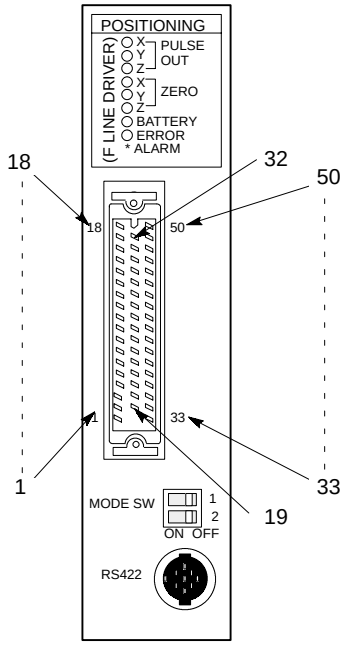


Pin No. X-/Y-/Z-axis	Name	Description
A-1, B-1	Pulse output 1 (Line-driver output)	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
A-2, B-2	Pulse output 2 (Line-driver output)	Directional output signals or position- pulses are output with pulse out mode parameter setting.
A-3	Home input	Home input (for line-driver, +Z)
A-4		Home input (+5 V to 24 V DC)
B-3, B-4		Common for home input (0 V, for -Z)
B-5	Pulse output 1 [Transistor output (+)]	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
B-6	Pulse output 2 [Transistor output (+)]	Directional output signals or position- pulses are output with pulse out mode parameter setting.
B-7	Deviation counter reset output (+)	Output when any error except a cassette tape error occurs, and output continues until the positioning board is reset. Output for approximately 1.5 to 2.4 ms when power is supplied to the positioning board. Output for approximately 1 ms when a homing operation is completed.
A-8, B-8	Common for output (GND)	Common terminal for output (Line-driver/transistor output common ground)
A-5, A-6, A-7	_____	Not used Do not connect.

2) FP3 Positioning Unit (Line-driver Type)

■ Pin layouts

FP3 positioning unit
(Line-driver type)



X-axis

No.	Name
18	Pulse output 1 [Line-driver output (-)]
17	Pulse output 1 [Line-driver output (+)]
16	Pulse output 2 [Line-driver output (-)]
15	Pulse output 2 [Line-driver output (+)]
14	Pulse output 1 [Transistor output (+)]
13	Pulse output 2 [Transistor output (+)]
12	Deviation counter reset output (+)
11	Common for output (GND)
10	Home (Z-phase) (+5 V to 24 V DC)
9	Home (Z-phase) [Line-driver (+)]
8	Home (Z-phase) (common)
7	Near home (-)
6	Overlimit (-)
5	Drive error (-)
4	Ground for external power supply (GND)
3	Ground for external power supply (GND)
2	Frame ground (F.G.)
1	Frame ground (F.G.)

Y-axis

No.	Name
32	Pulse output 1 [Line-driver output (-)]
31	Pulse output 1 [Line-driver output (+)]
30	Pulse output 2 [Line-driver output (-)]
29	Pulse output 2 [Line-driver output (+)]
28	Pulse output 1 [Transistor output (+)]
27	Pulse output 2 [Transistor output (+)]
26	Deviation counter reset output (+)
25	Common for output (GND)
24	Home (Z-phase) (+5 V to 24 V DC)
23	Home (Z-phase) [Line-driver (+)]
22	Home (Z-phase) (common)
21	Near home (-)
20	Overlimit (-)
19	Drive error (-)

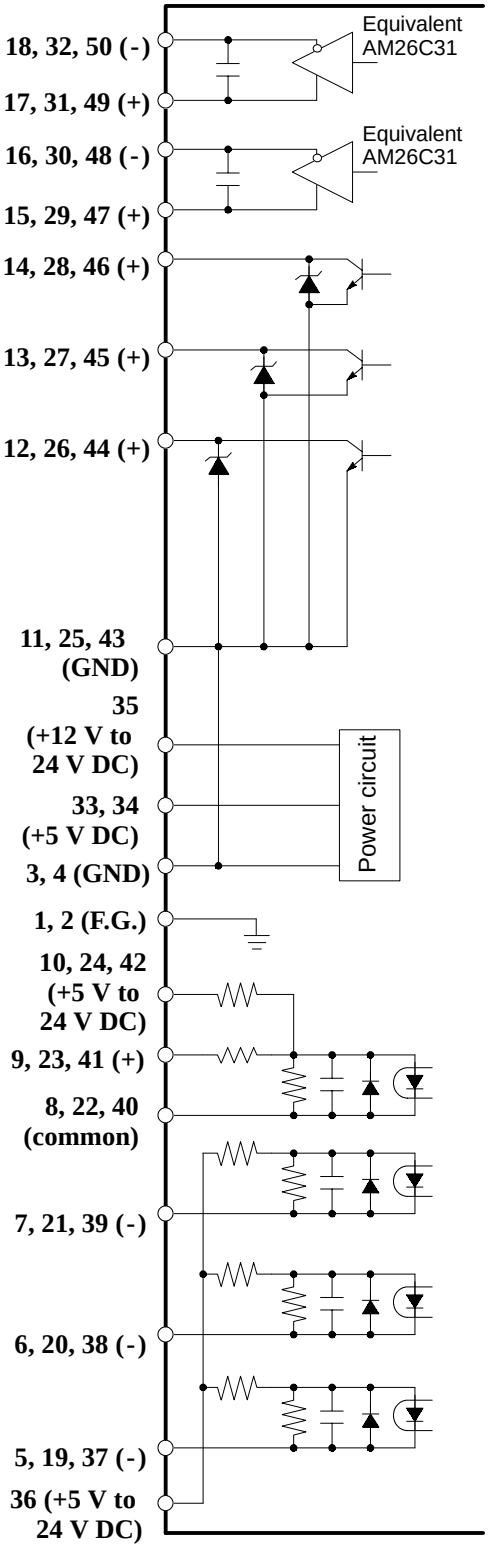
Z-axis

No.	Name
50	Pulse output 1 [Line-driver output (-)]
49	Pulse output 1 [Line-driver output (+)]
48	Pulse output 2 [Line-driver output (-)]
47	Pulse output 2 [Line-driver output (+)]
46	Pulse output 1 [Transistor output (+)]
45	Pulse output 2 [Transistor output (+)]
44	Deviation counter reset output (+)
43	Common for output (GND)
42	Home (Z-phase) (+5 V to 24 V DC)
41	Home (Z-phase) [Line-driver (+)]
40	Home (Z-phase) (common)
39	Near home (-)
38	Overlimit (-)
37	Drive error (-)
36	Common for input (+5 V to 24 V DC)
35	External power supply (+12 V to 24 V DC)
34	External power supply (+5 V DC)
33	External power supply (+5 V DC)

Note:

· Be sure not to connect any field devices to the terminals not used when using 1-axis or 2-axis module.

■ Internal circuit and pin numbers (FP3 Line-driver type)



Pin No.			Name	Description
X-axis	Y-axis	Z-axis		
18	32	50	Pulse output 1 (Line-driver output)	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
17	31	49		
16	30	48	Pulse output 2 (Line-driver output)	Directional output signals or position- pulses are output with pulse out mode parameter setting.
15	29	47		
14	28	46	Pulse output 1 (Transistor output)	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
13	27	45	Pulse output 2 (Transistor output)	Directional output signals or position- pulses are output with pulse out mode parameter setting.
12	26	44	Deviation counter reset output	Output when any error except a cassette tape error occurs, and output continues until the positioning unit is reset. Output for approximately 1.5 to 2.4 ms when power is supplied to the positioning unit. Output for approximately 1 ms when a homing operation is completed.
11, 25, 43			Common for output	Common terminal for output (Line-driver transistor output common ground)
35			External power supply (*1)	Power supply for external I/O circuit (+12 V to 24 V DC)
33, 34				Power supply for external I/O circuit (+5 V DC)
3, 4				Ground for external I/O circuit (GND)
1, 2			Frame ground	Frame ground terminal
10	24	42	Home input	Home input (+5 V to 24 V DC)
9	23	41		Home input (for line-driver, +Z)
8	22	40		Common for home input (0 V, for -Z)
7	21	39	Near home input	This signal detects the timing to reduce the speed of the positioning unit to the near home speed just prior to a home signal.
6	20	38	Overlimit input	Connect this hardware limit input to maximum (+) and minimum (-) limit switches.
5	19	37	Drive error input	Inputs an error output, such as driver deviation counter over or full torque.
36			Common for input	Common terminal for input External input power supply (+5 V to 24 V DC)

Note:

- (*1): For the external power supply, connect either +12 V to 24 V DC or +5 V DC (only one).

3) FP3 Positioning Unit (Transistor Type)

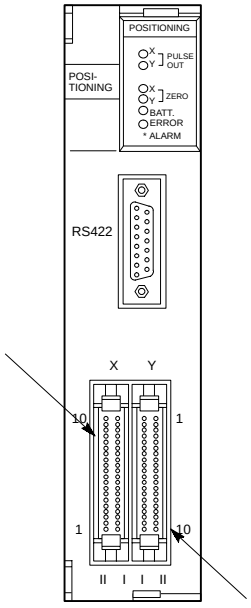
■ Pin layouts

X-axis connectors

Pin No.	Name	Pin No.	Name
II-10	Frame ground (F.G.)	I-10	Frame ground (F.G.)
II-9	Overlimit (+)	I-9	Overlimit (-)
II-8	Near home (+)	I-8	Near home (-)
II-7	Home (+)	I-7	Home (-)
II-6	Drive error (+)	I-6	Drive error (-)
II-5	External power supply (+5 V to 12 V DC)	I-5	Ground for external power supply (GND)
II-4	External power supply (24 V DC)	I-4	Ground for external power supply (GND)
II-3	Deviation counter reset output (+)	I-3	Deviation counter reset output (-)
II-2	Pulse output 2 (+)	I-2	Ground for pulse output 2 (GND)
II-1	Pulse output 1 (+)	I-1	Ground for pulse output 1 (GND)

II I

FP3 positioning unit (Transistor type)



Y-axis connectors

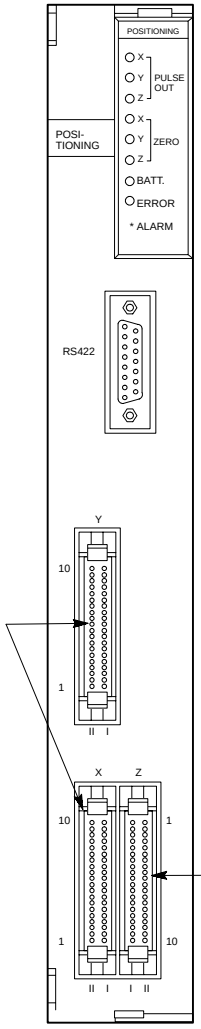
Pin No.	Name	Pin No.	Name
I-1	Ground for pulse output 1 (GND)	II-1	Pulse output 1 (+)
I-2	Ground for pulse output 2 (GND)	II-2	Pulse output 2 (+)
I-3	Deviation counter reset output (-)	II-3	Deviation counter reset output (+)
I-4	Ground for external power supply (GND)	II-4	External power supply (24 V DC)
I-5	Ground for external power supply (GND)	II-5	External power supply (+5 V to 12 V DC)
I-6	Drive error (-)	II-6	Drive error (+)
I-7	Home (-)	II-7	Home (+)
I-8	Near home (-)	II-8	Near home (+)
I-9	Overlimit (-)	II-9	Overlimit (+)
I-10	Frame ground (F.G.)	II-10	Frame ground (F.G.)

I II

4) FP5 Positioning Unit (Transistor Type)

■ Pin layouts

FP5 positioning unit (Transistor type)



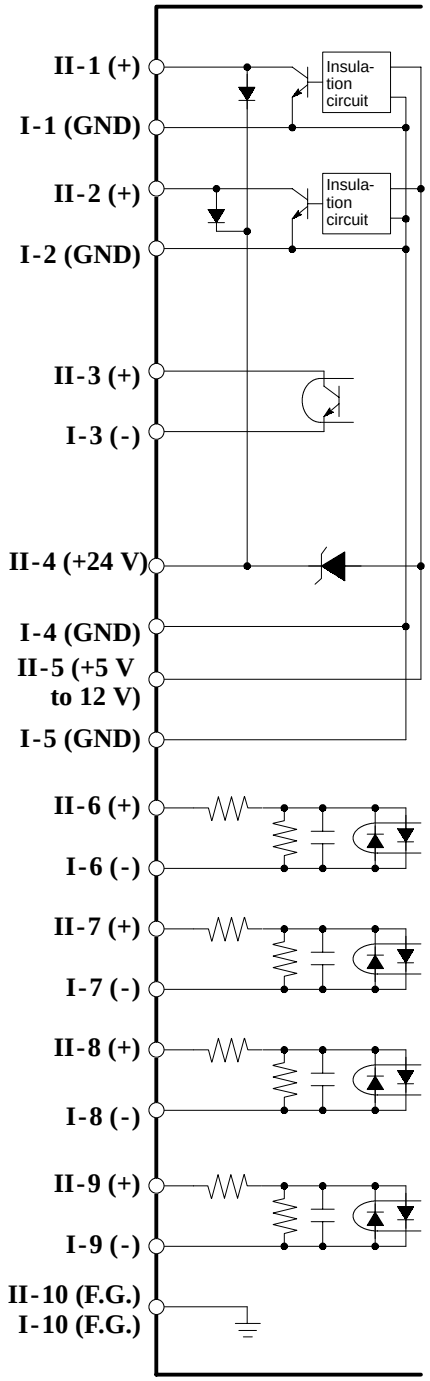
X-axis and Y-axis connectors

Pin No.	Name	Pin No.	Name
II-10	Frame ground (F.G.)	I-10	Frame ground (F.G.)
II-9	Overlimit (+)	I-9	Overlimit (-)
II-8	Near home (+)	I-8	Near home (-)
II-7	Home (+)	I-7	Home (-)
II-6	Drive error (+)	I-6	Drive error (-)
II-5	External power supply (+5 V to 12 V DC)	I-5	Ground for external power supply (GND)
II-4	External power supply (24 V DC)	I-4	Ground for external power supply (GND)
II-3	Deviation counter reset output (+)	I-3	Deviation counter reset output (-)
II-2	Pulse output 2 (+)	I-2	Ground for pulse output 2 (GND)
II-1	Pulse output 1 (+)	I-1	Ground for pulse output 1 (GND)
II		I	

Z-axis connectors

Pin No.	Name	Pin No.	Name
I-1	Ground for pulse output 1 (GND)	II-1	Pulse output 1 (+)
I-2	Ground for pulse output 2 (GND)	II-2	Pulse output 2 (+)
I-3	Deviation counter reset output (-)	II-3	Deviation counter reset output (+)
I-4	Ground for external power supply (GND)	II-4	External power supply (24 V DC)
I-5	Ground for external power supply (GND)	II-5	External power supply (+5 V to 12 V DC)
I-6	Drive error (-)	II-6	Drive error (+)
I-7	Home (-)	II-7	Home (+)
I-8	Near home (-)	II-8	Near home (+)
I-9	Overlimit (-)	II-9	Overlimit (+)
I-10	Frame ground (F.G.)	II-10	Frame ground (F.G.)
I		II	

■ Internal circuit and pin numbers (FP3/FP5 Transistor type)



Pin No.	Name	Description
II-1	Pulse output 1	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
I-1		
II-2	Pulse output 2	Directional output signals or position- pulses are output with pulse out mode parameter setting.
I-2		
II-3	Deviation counter reset output	Output when any error except a cassette tape error occurs, and output continues until the positioning unit is reset. Output for approximately 1.5 to 2.4 ms when power is supplied to the positioning unit. Output for approximately 1 ms when a homing operation is completed.
I-3		
II-4	External power supply (*1)	Power supply for pulse output (+24 V DC)
I-4		Ground for pulse output (GND)
II-5		Power supply for pulse output (+5 V to 12 V DC)
I-5		Ground for pulse output (GND)
II-6	Drive error input	Inputs an error output, such as drive deviation counter over or full torque.
I-6		
II-7	Home input	Connects to a home switch for hardware home operation, or the Z-phase of an encoder.
I-7		
II-8	Near home input	This signal detects the timing to reduce the speed of the positioning unit to the near home speed just prior to a home signal.
I-8		
II-9	Overlimit input	Connect this hardware limit input to maximum (+) and minimum (-) limit switches.
I-9		
II-10	Frame ground	Frame ground terminal
I-10		

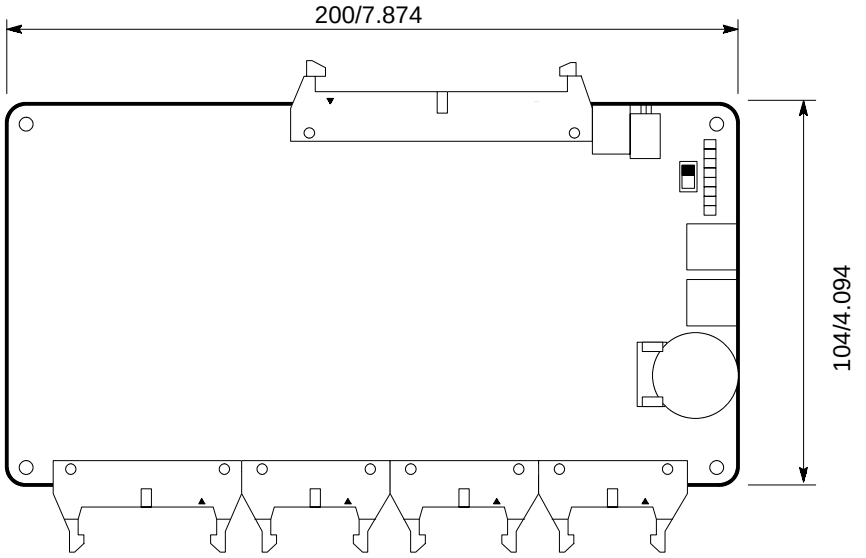
Note:

· (*1): For the external power supply, connect either 24 V DC or +5 V to 12 V DC (only one).

6. Dimensions

■ FP-C positioning board F-type (Line-driver type)

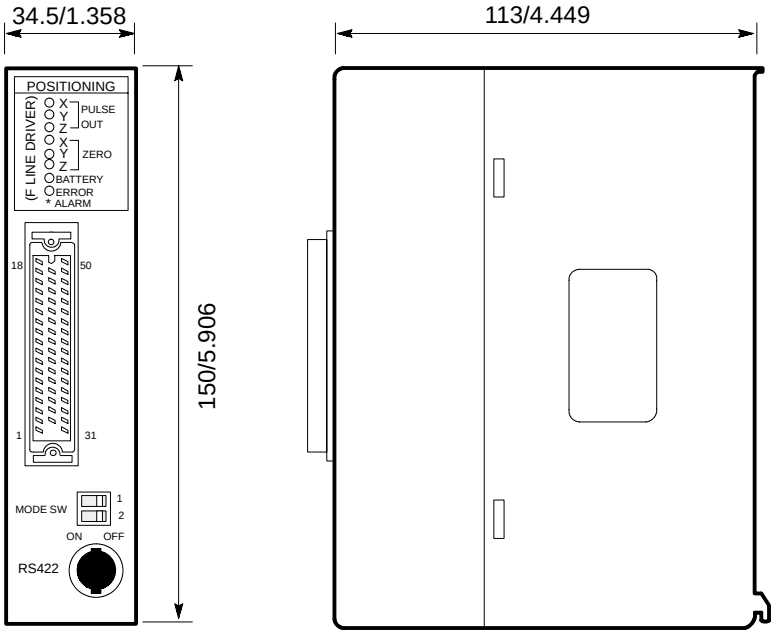
[1-axis board (AFC3434), 2-axis board (AFC3435) and 3-axis board (AFC3436)]



(unit: mm/in.)

■ FP3 positioning unit F-type (Line-driver type)

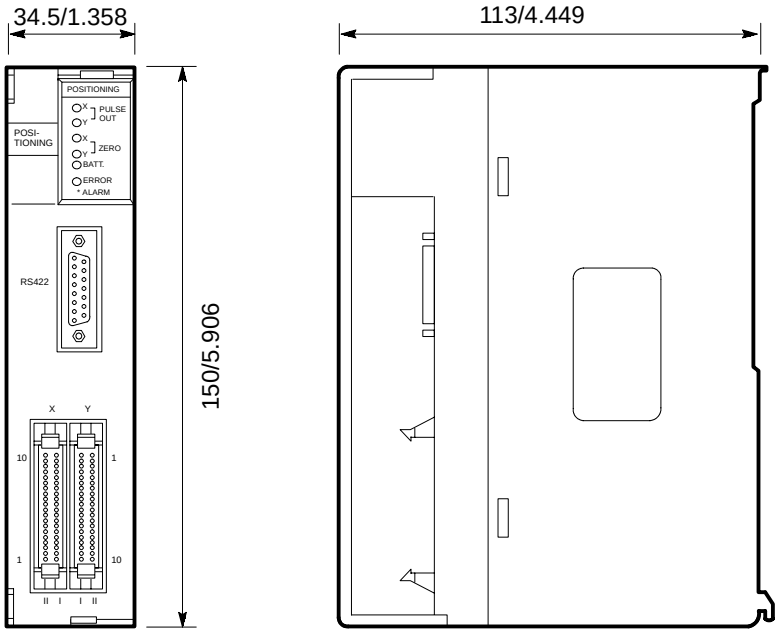
[1-axis unit (AFP3434), 2-axis unit (AFP3435) and 3-axis unit (AFP3436)]



(unit: mm/in.)

■ FP3 positioning unit F-type (Transistor type)

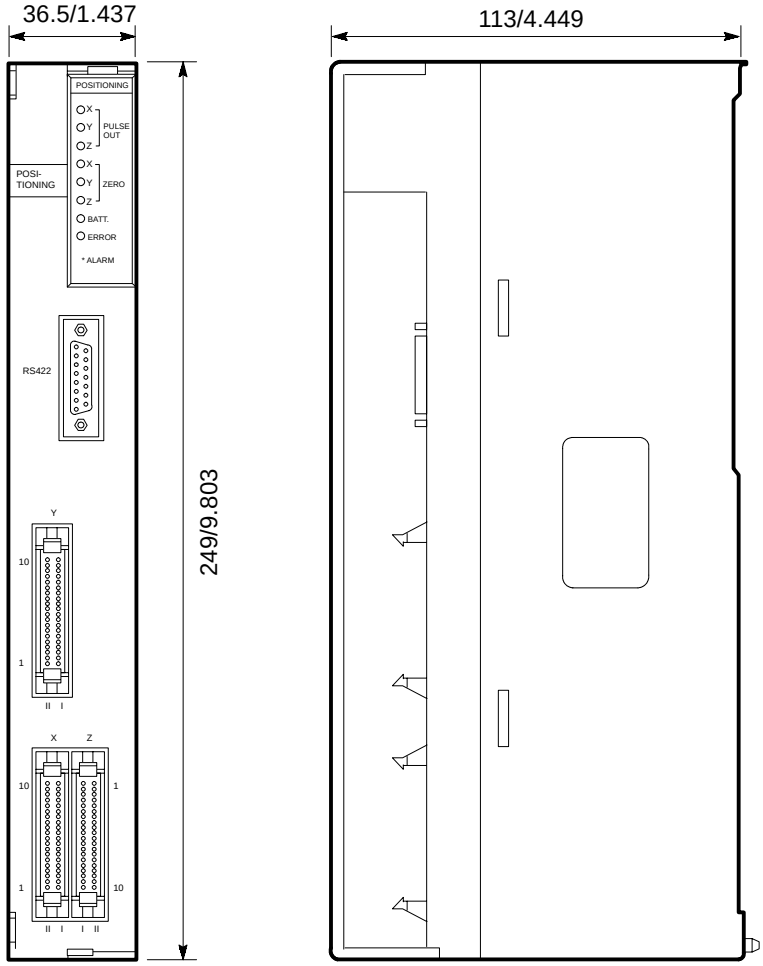
[1-axis unit (AFP3431) and 2-axis unit (AFP3432)]



(unit: mm/in.)

■ FP5 positioning unit F-type (Transistor type)

[1-axis unit (AFP5434), 2-axis unit (AFP5435) and 3-axis unit (AFP5436)]



(unit: mm/in.)

CHAPTER 3

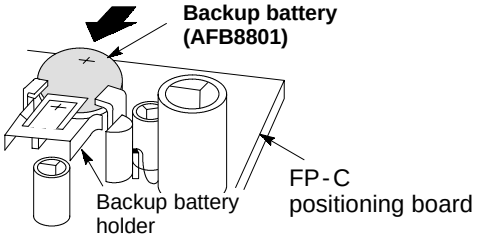
INSTALLATION AND WIRING

3-1. Installation

1. Connecting a Backup Battery

1) FP-C Positioning Board

Insert the backup battery in the backup battery holder as shown in the drawing. Before inserting the backup battery, check that nothing is attached to the + and - surfaces.



Using backup battery

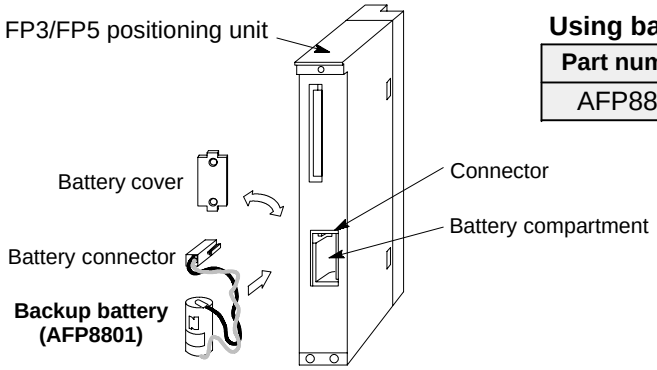
Part number	Description
AFB8801	Lithium battery, CR2032 type or equivalent

Notes:

- Use only the designated battery. An incorrect battery may cause the positioning module to be damaged or to malfunction.
- See page 228, “8-4. Replacement of Backup Battery” for details on replacement of the backup battery.

2) FP3/FP5 Positioning Unit

A battery is provided with the positioning unit. Remove the battery cover on the rear panel of the positioning unit to connect the battery connector to the connector in the battery compartment. Then insert the battery into the battery compartment and replace the battery cover.



Using backup battery

Part number	Description
AFP8801	Lithium battery

2. Installation Environment

■ Notes on usage

- The positioning module F-type should be used within the following conditions.
  - At ambient temperatures of 0° C to 55° C (32° F to 131° F).
  - At ambient humidity of 35 % to 85 % RH.
- It should be used in a place where it will not be exposed to:
  - Sudden temperature changes causing dew condensation.
  - Inflammable or corrosive gas.
  - Excessive airborne dust or iron particles.
  - Benzine, paint thinner, alcohol, other organic solvents or strong alkaline solutions of ammonia or caustic soda.
  - Excessive vibration or shock.
  - Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that generates high switching surges.
  - Water splashes.
  - Direct sunlight.

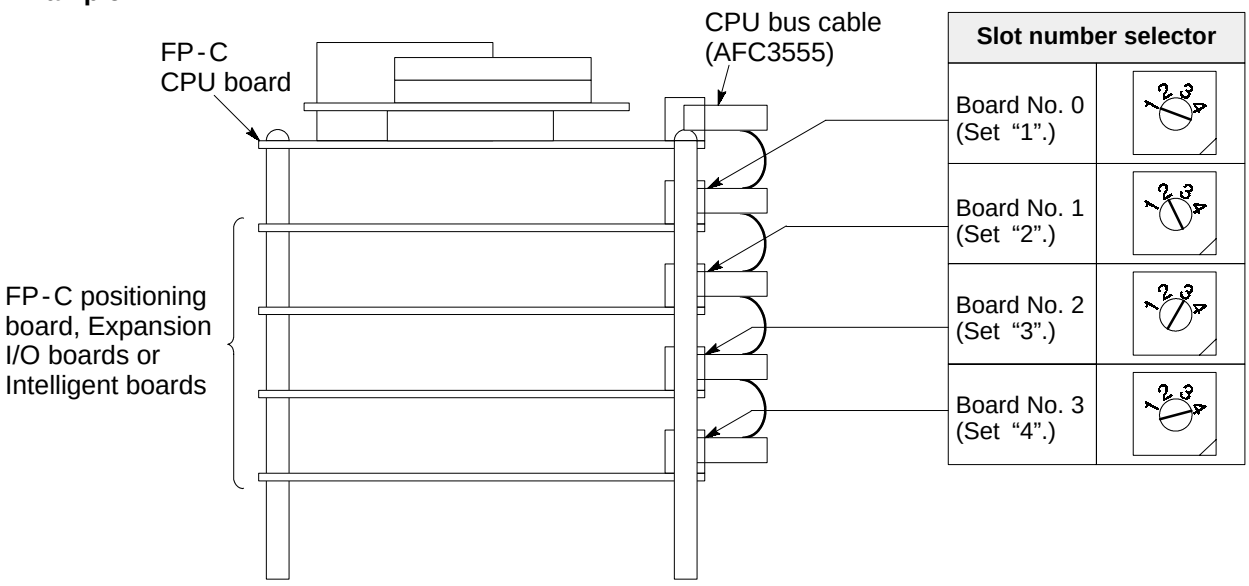
3. Installation Method

1) FP-C Positioning Board

■ Stacking the FP-C positioning board

- A total of 4 boards (expansion I/O boards and intelligent boards) can be stacked under the FP-C CPU board.
- Connect the FP-C positioning board and expansion/intelligent boards to the FP-C CPU board using the CPU bus cable.
- When you connect the FP-C positioning board, expansion and intelligent boards to the FP-C CPU board, you need to assign the board numbers for additional boards using the slot number selector. The selector is located at the side of the bus connector.

<Example>



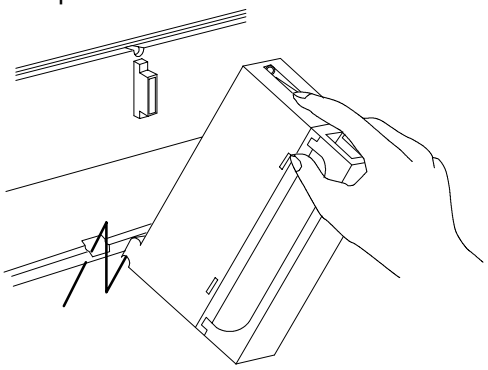
Notes:

- See the "FP-C Data sheet" for mounting of stacking board and notes on installation.
- Be sure to turn all power OFF before installing or removing boards.
- Do not touch any electronic parts or connector terminals when handling boards. When it is necessary to touch a board, first touch and hold a grounded metal object to discharge any static electricity.
- When assigning the slot numbers, be careful not to allocate same number to two or more boards.

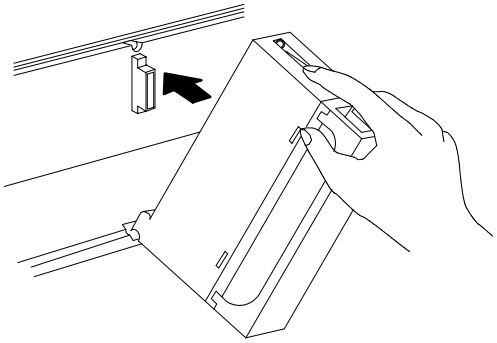
2) FP3/FP5 Positioning Unit

■ FP3

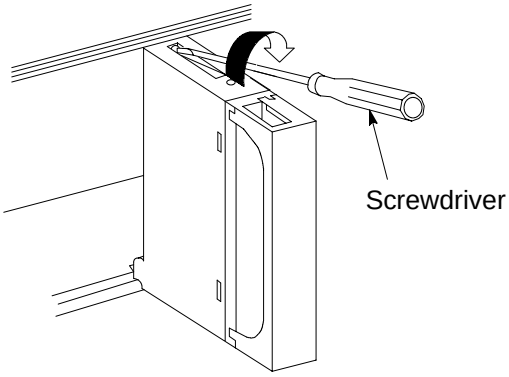
1. Insert the two unit tabs into the holes on the backplane.



2. Push the unit in the direction of the arrow to mount it to the backplane.

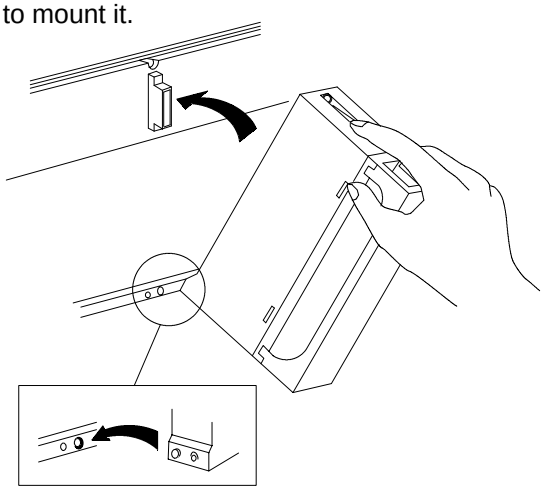


3. After mounting the unit to the backplane, tighten the mounting screw at the top.

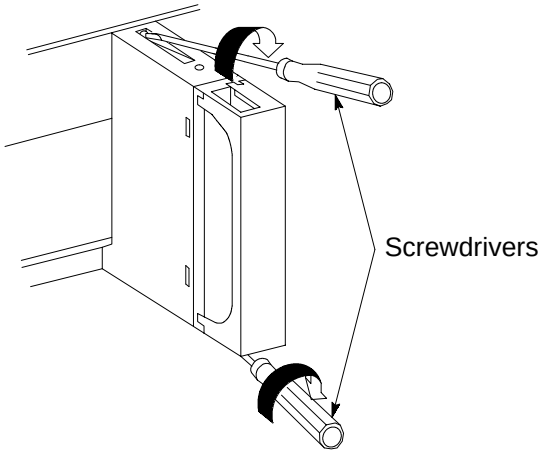


■ FP5

1. Fit the unit tab into the hole on the backplane, and push the unit in the direction of the arrow to mount it.



2. After mounting the unit to the backplane, tighten the mounting screws at both top and bottom.



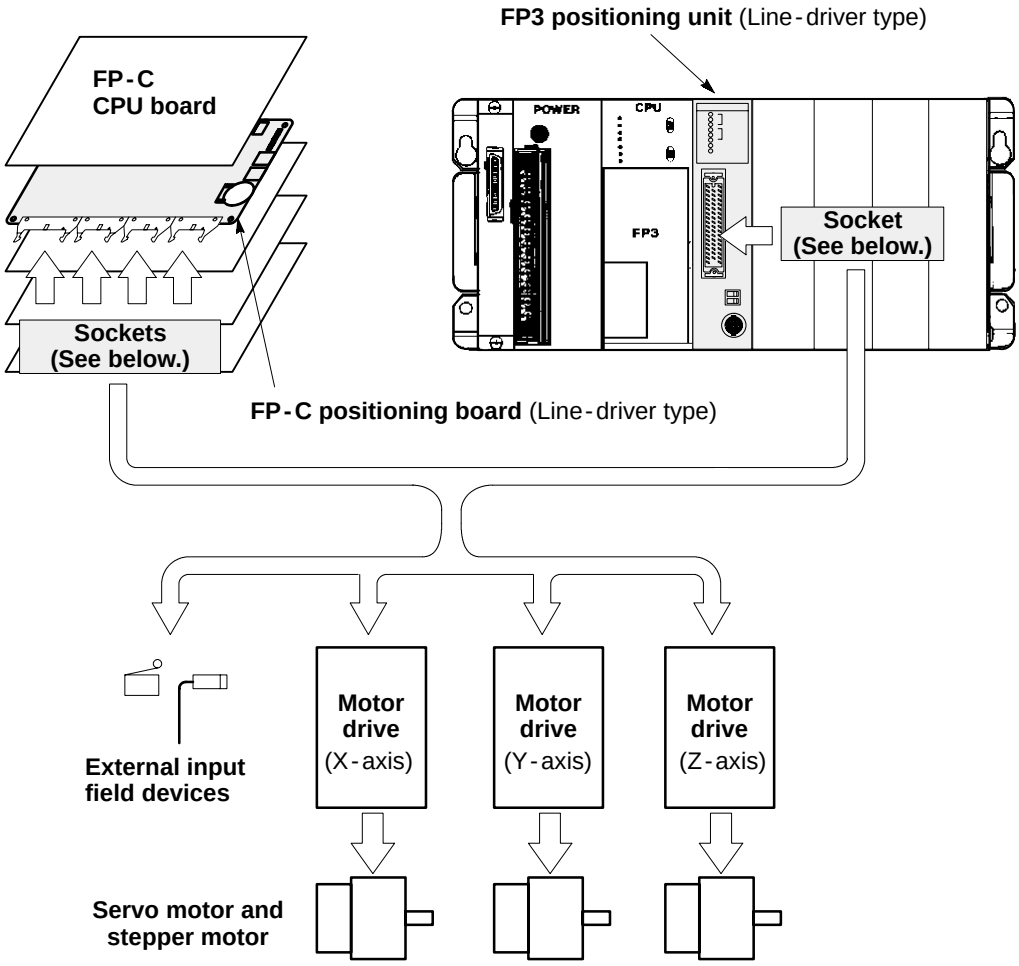
Notes:

- Be sure to turn all power OFF before installing or removing the unit.
- Before installing the unit, remove the connector cover on the backplane.
- Do not touch any electronic parts or connector terminals when handling the unit. When it is necessary to touch a unit, first touch and hold a grounded metal object to discharge any static electricity.

3-2. Wiring

1. Wiring for X-axis, Y-axis, Z-axis and External Input Connectors

■ **Example: FP3 positioning unit and FP-C positioning board**



■ **Product types of using socket**

FP-C positioning board (Line-driver type)

Connector	Number of pins	Socket	Description
X-axis, Y-axis and Z-axis connectors	16	AXW3161421A	Socket set product with semi-cover, Matsushita Electric Works, Ltd.
External input connector	26	AXW3261421A	

FP3 positioning unit (Line-driver type)

Connector	Number of pins	Socket	Description
X-/Y-/Z-axis connector	50	MR-50LH	Soldering type, HONDA TSUSHIN KOGYO CO., LTD.

FP3 and FP5 positioning unit (Transistor type)

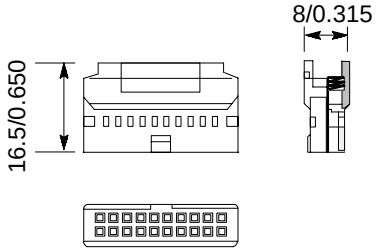
Connector	Number of pins	Housing	Cover		Contact (5 in line)
			Semi-cover	Hood cover	
X-axis, Y-axis and Z-axis connectors	20	AXW1204A	AXW62001A	AXW62002A	AXW7221 for AWG #22 and #24 of the loose cable

2. Socket for Connectors

1) FP-C Positioning Board (Line-driver Type)

- Socket for FP-C positioning board (line-driver type) ..... Included with the module
- Use the cable-press socket for external input connector (26 pins) and X-/Y-/Z-axis connectors (16 pins) as follows.

■ Dimension of housing with semi-cover



(unit: mm/in.)

■ Product types

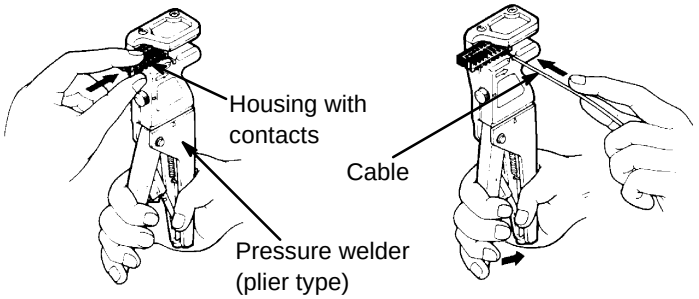
· Socket set product (semi-cover and housing with contacts)

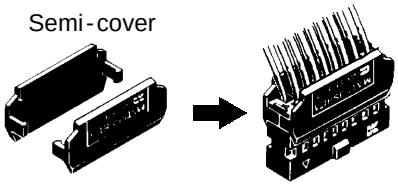
Item	Part number
Socket for external input connector (26 pins)	AXW3261421A
Socket for X-/Y-/Z-axis connector (16 pins)	AXW3161421A

■ Socket assembly method

Procedure

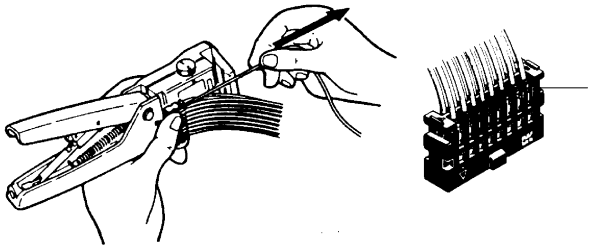
1. Insert the housing with contacts into a pressure welder (plier type).
2. Firmly insert the covered loose cable into the end and squeeze the handles of the welder.
3. After inserting all the cables, mount the semi-cover and finish the socket assembly.





Note:

· If there is a wiring mistake or the cable is incorrectly pressure-connected, the contact puller pin on the welder can be used to remove the contact.

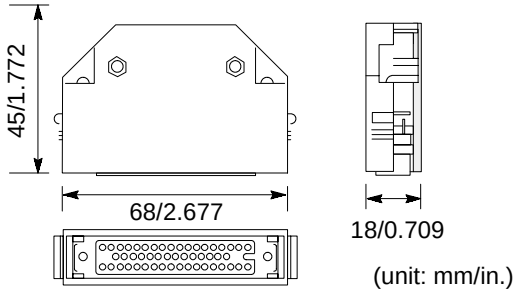


Item	Part number	Description
Pressure welder	AXY51000	Plier type pressure welder for loose wires

2) FP3 Positioning Unit (Line-driver Type)

- Socket for FP3 positioning unit (line-driver type) ..... Included with the module
- Use the socket for X-/Y-/Z-axis connector (50 pins) as follows.

■ Dimension of socket



(unit: mm/in.)

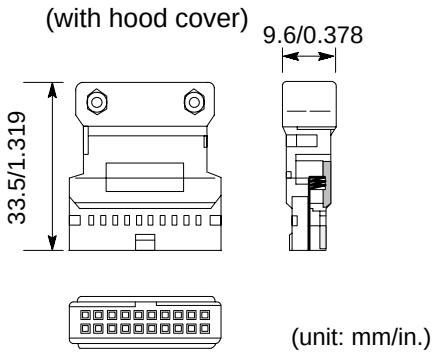
■ Product types

Item	Description
Socket	MR-50LH (soldering type), HONDA TSUSHIN KOGYO CO., LTD.
Applicable loose cable	Shielded twisted pair cable

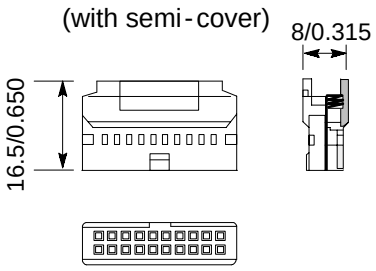
3) FP3/FP5 Positioning Unit (Transistor Type)

- Socket for FP3/FP5 positioning unit (transistor type) ..... Not included with the module
- Use the cable-press socket for X-/Y-/Z-axis connectors (20 pins) as follows.
- See page 38 for the socket assembly method.

■ Dimension of housing with cover



(unit: mm/in.)



(unit: mm/in.)

■ Product types

· Individual parts (housing, cover and contact)

Item	Number of pins	Housing	Cover		Contact (5 in line)
			Hood cover	Semi-cover	
FP3/FP5 Positioning unit (Transistor type) X-/Y-/Z-axis connector	20	AXW1204A	AXW62002A	AXW62001A	AXW7221 for AWG #22 and #24 of the loose cable

· Applicable cables

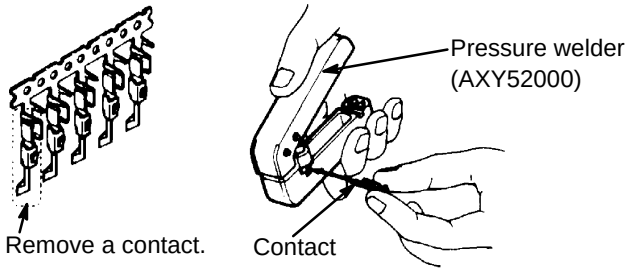
Number	Cross-section area	External figure	Rated current	Remark
AWG #22	0.3 mm^2	1.1 to 1.5 dia.	3 A	AWG #22: 12 wires per 0.18 should be used.
AWG #24	0.2 mm^2			

■ Socket assembly method

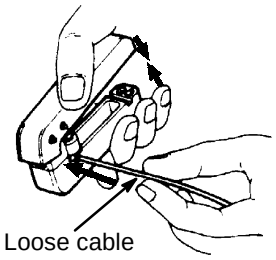
• The following describes how to assemble the cable-press socket for loose wires.

Procedure

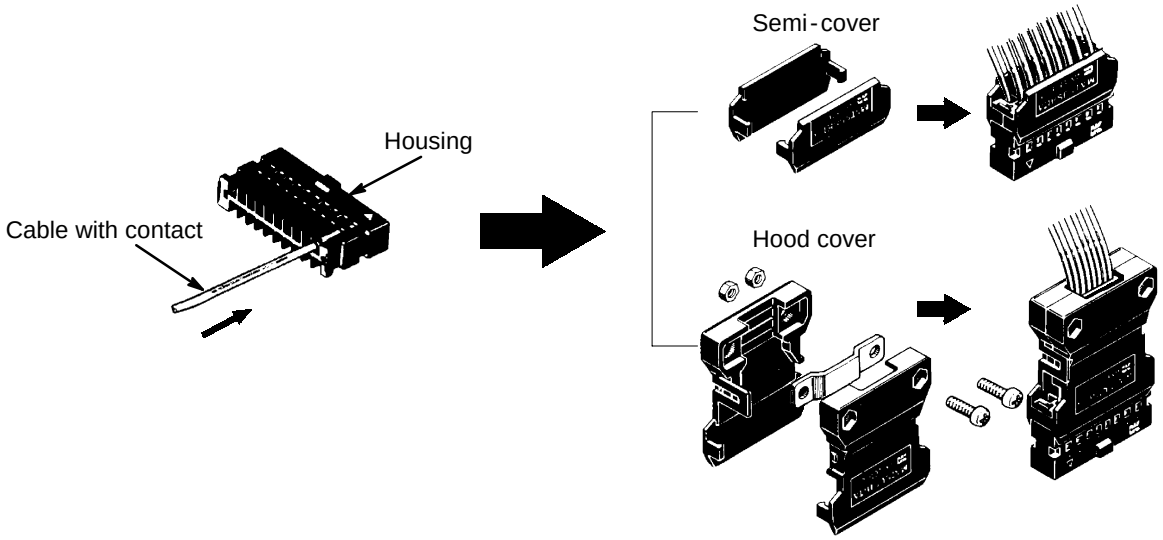
1. Insert the removed contact into a pressure welder.



2. Firmly insert the covered loose cable into the end and lightly squeeze the welder.

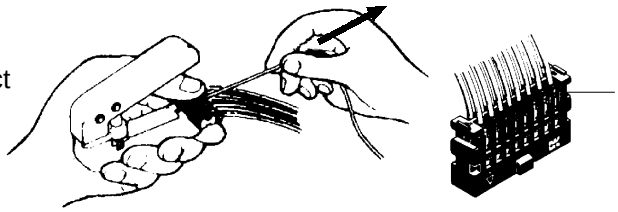


3. Insert the cables with contacts into the housing.
   After inserting all the cables, mount the semi/hood cover and finish the socket assembly.



Note:

· If there is a wiring mistake or the cable is incorrectly pressure-connected, the contact puller pin on the welder can be used to remove the contact.

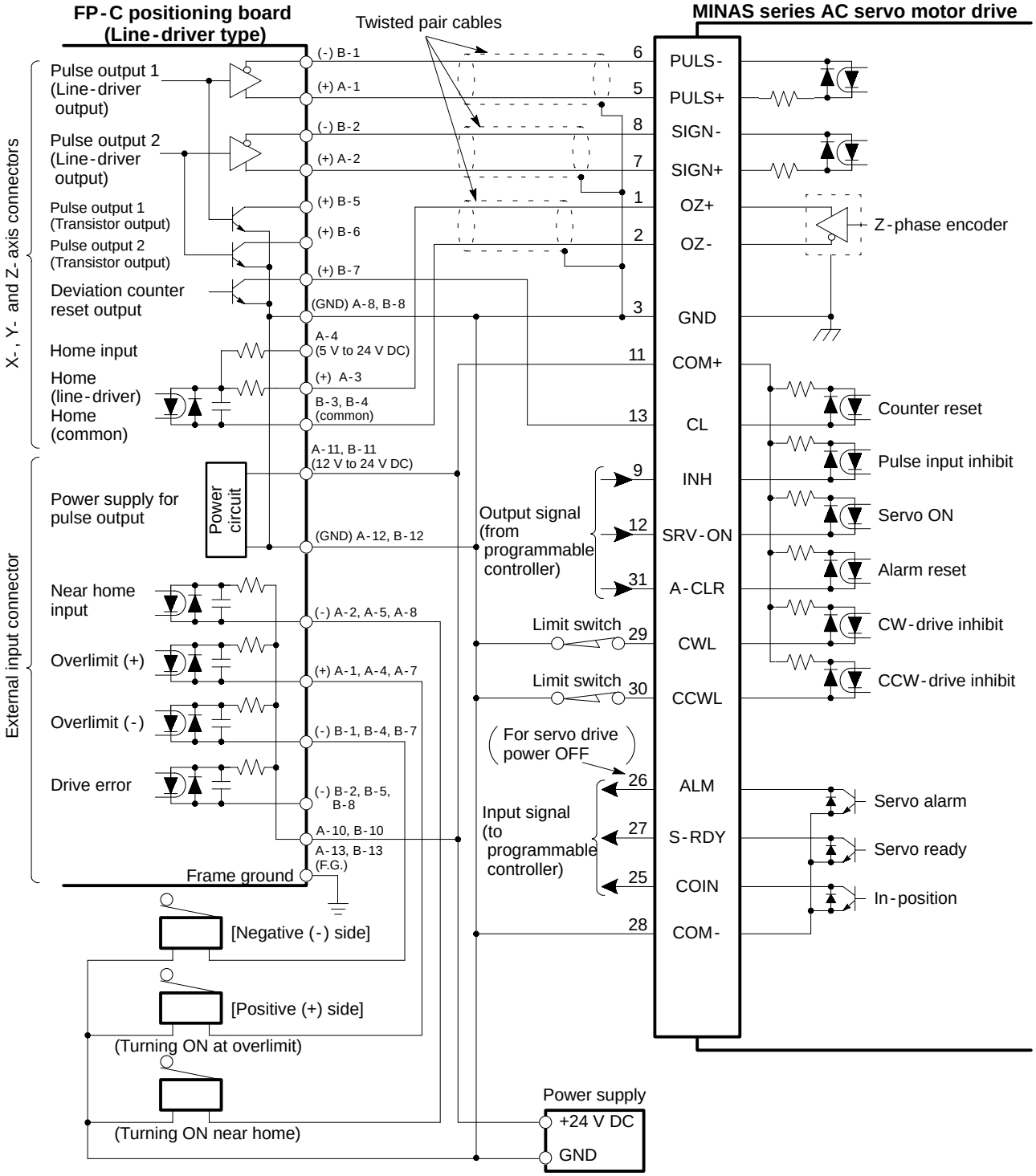


Item	Part number	Description
Pressure welder	AXY52000	Stapler type pressure welder for loose wires

3. Wiring Examples

1) MINAS Series AC Servo Motor Drive (Matsushita Electric Industrial Co., Ltd.)

■ FP-C positioning board (Line-driver type)



■ Parameter setting for positioning board and MINAS series AC servo motor drive wiring

· FP-C positioning board

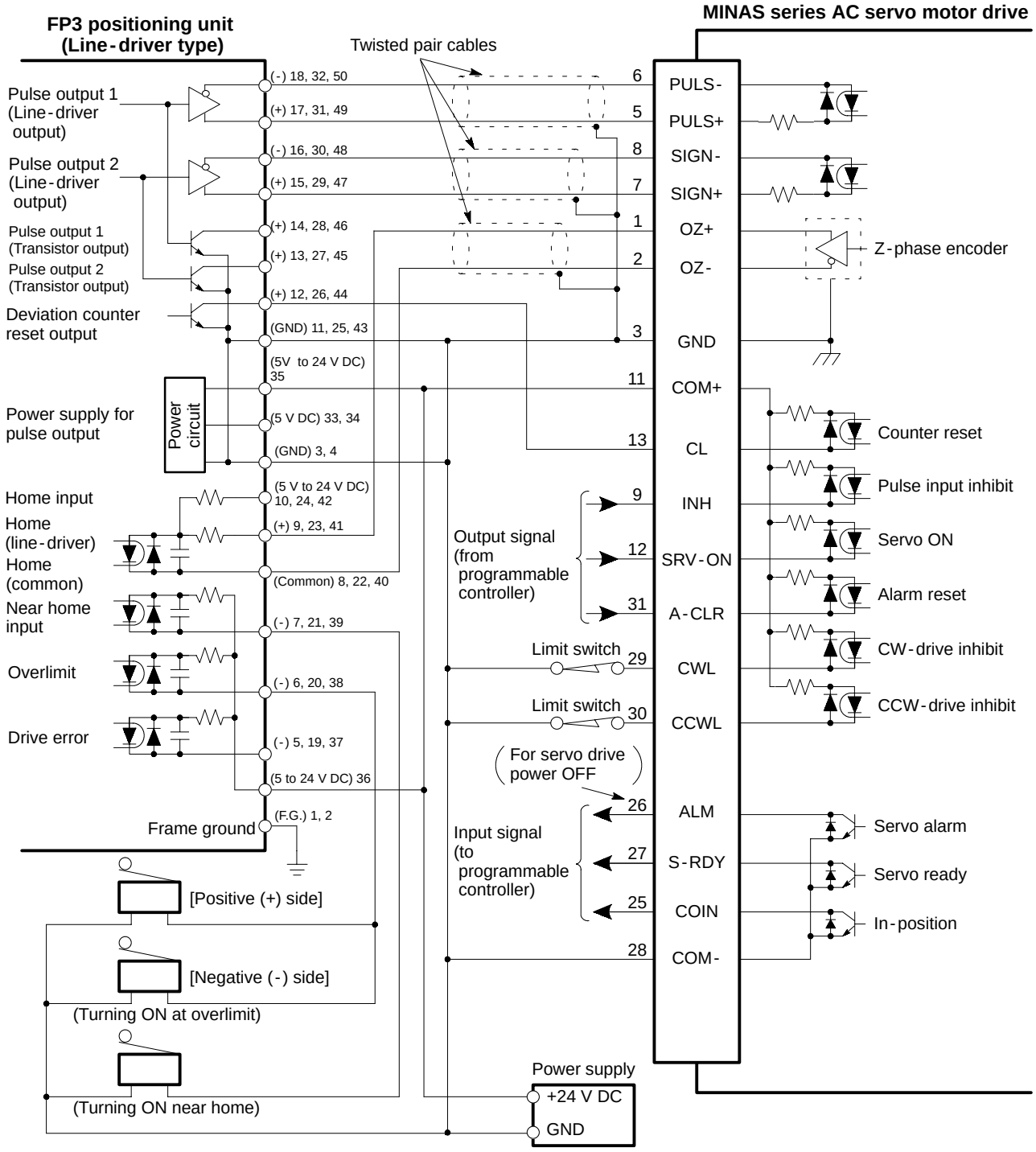
Item		Description
1	Pulse output mode	1: CW and CCW
20	Interface logic	100010 (H34)

* For details about the other parameters setting, refer to the each manual.

· MINAS series AC servo motor drive

Item		Description
02	Control mode	0: Positioning control
0D	Reverse mode for pulse output	0: Non-reverse (B, Z)
28	Reverse mode for command pulse	0: Non-reverse
29	Pulse input mode	1: CW and CCW

■ FP3 positioning unit (Line-driver type)



■ Parameter setting for positioning unit and MINAS series AC servo motor drive wiring

· FP3/FP5 positioning unit

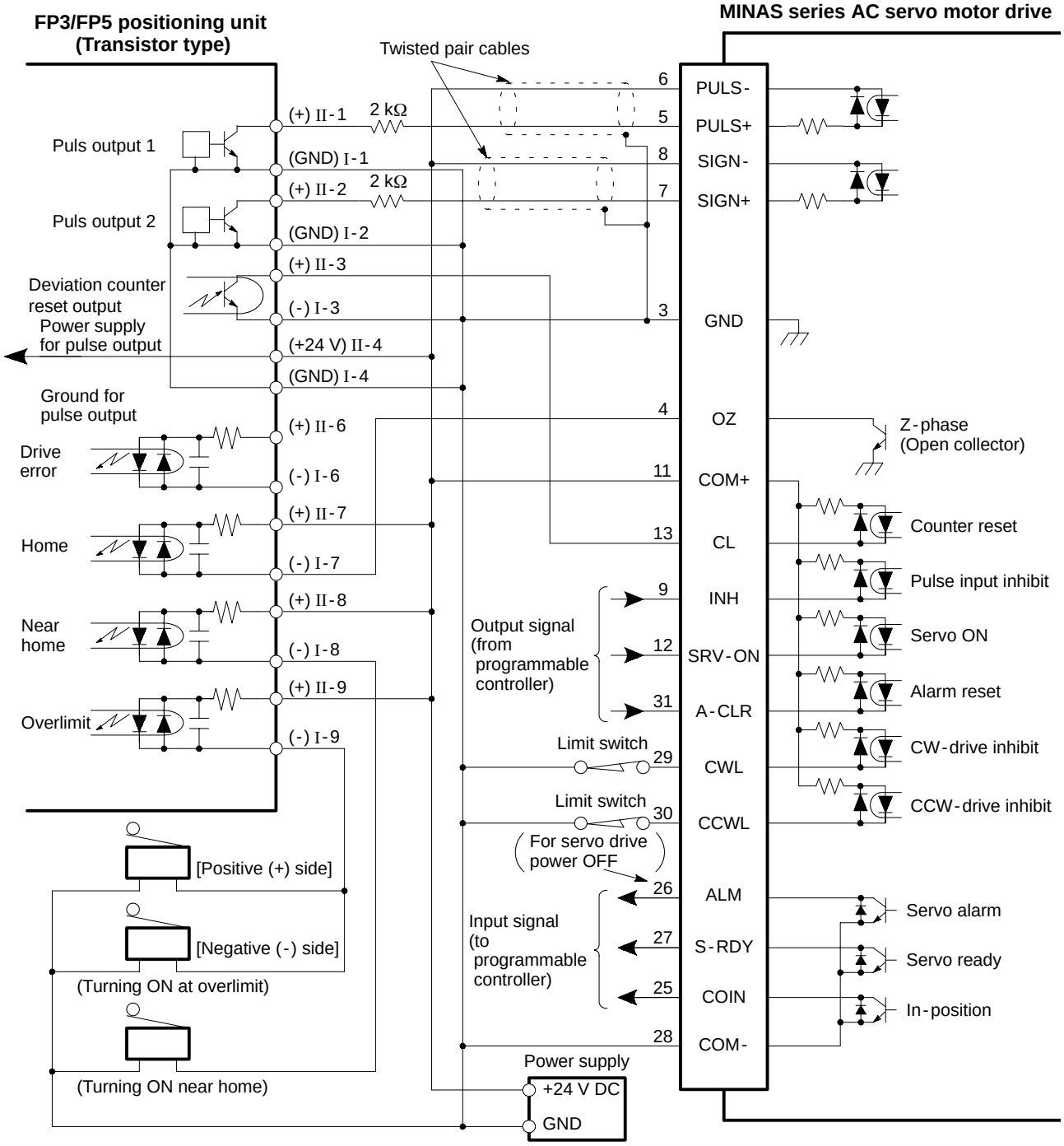
Item		Description
1	**Pulse output mode**	1: CW and CCW
20	**Interface logic**	100010 (H34)

* For details about the other parameters setting, refer to the each manual.

· MINAS series AC servo motor drive

Item		Description
02	**Control mode**	0: Positioning control
0D	**Reverse mode for pulse output**	0: Non-reverse (B, Z)
28	**Reverse mode for command pulse**	0: Non-reverse
29	**Pulse input mode**	1: CW and CCW

■ FP3/FP5 positioning unit (Transistor type)



■ Parameter setting for positioning unit and MINAS series AC servo motor drive wiring

· FP3/FP5 positioning unit

Item		Description
1	Pulse output mode	1: CW and CCW
20	Interface logic	100010 (H34)

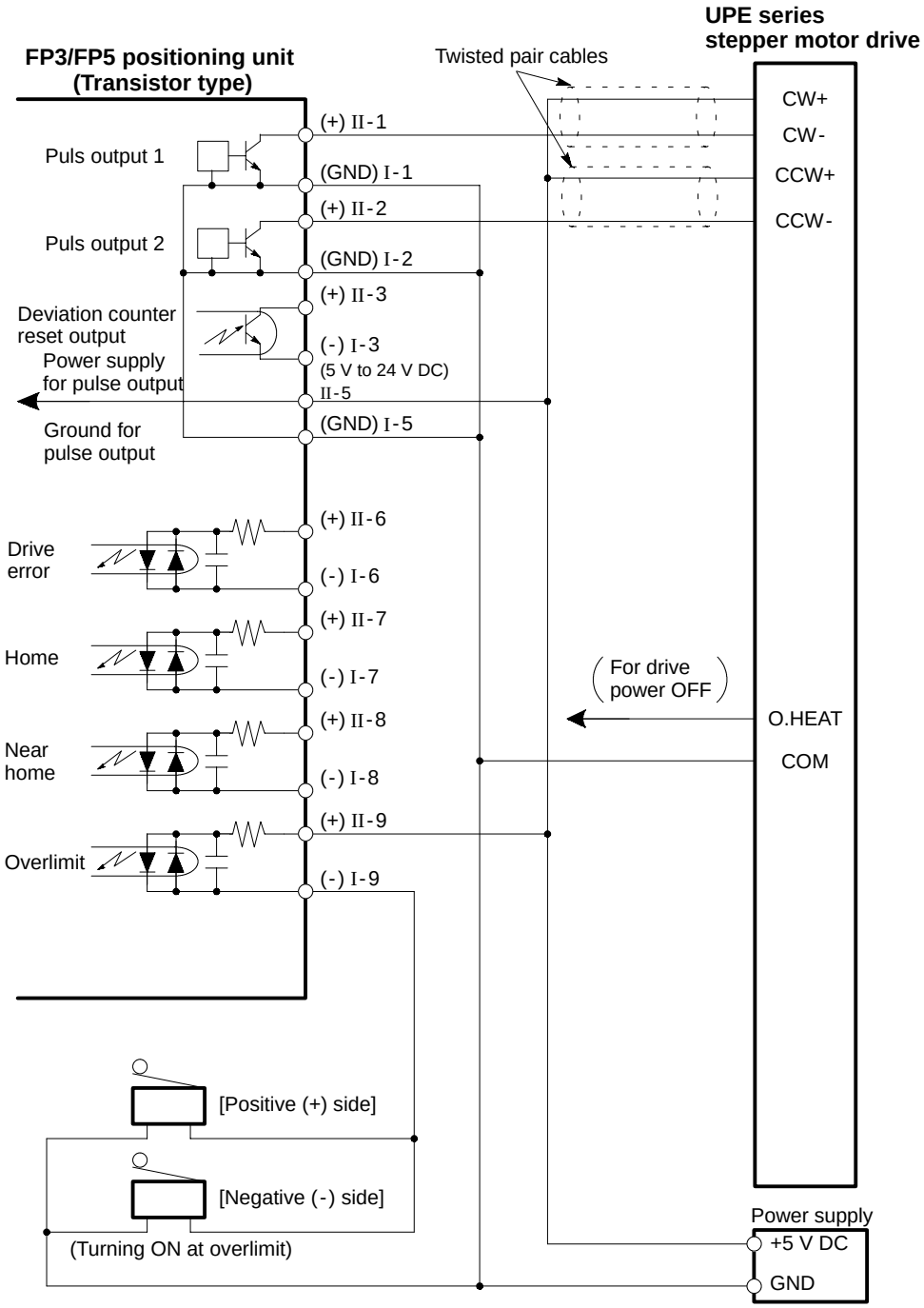
* For details about the other parameters setting, refer to the each manual.

· MINAS series AC servo motor drive

Item		Description
02	Control mode	0: Positioning control
0D	Reverse mode for pulse output	0: Non-reverse (B, Z)
28	Reverse mode for command pulse	0: Non-reverse
29	Pulse input mode	1: CW and CCW

2) UPE Series Stepper Motor Drive (Oriental Motor Co., Ltd.)

■ FP3/FP5 positioning unit (Transistor type)



■ Setting for positioning unit and UPE series stepper motor drive wiring

· Parameter setting of FP3/FP5 positioning unit

Item		Description
1	**Pulse output mode**	1: CW and CCW
20	**Interface logic**	100010 (H34)

- **Pulse input mode selector setting of UPE series stepper motor drive**

  Set to “2P” to select “CW and CCW” mode.

* For details about the other setting, refer to the each manual.

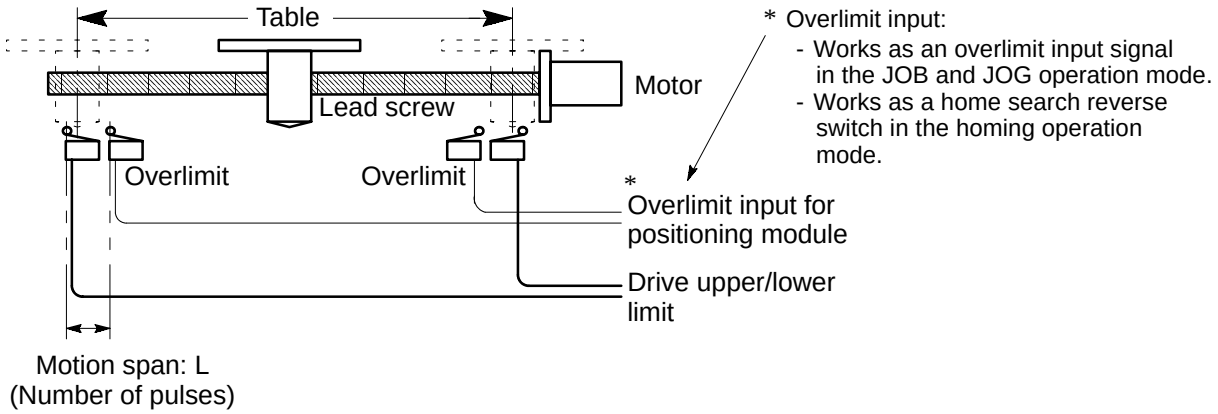
4. Notes on Wiring

1) Wiring

- The positioning module and drives should have an exclusive external power supply (24 V DC, etc.). Do not use the power supply for those modules to drive noise-generating devices such as relays, magnets and solenoids.
- Provide a surge absorption circuit for coils, such as relays, magnets and solenoids.
- Do not connect the ground (0 V) of the 24 V power supply for the positioning modules and drives with the ground of other power supplies (relay driving power supply, etc.).
- Install a noise filter between the DC power supply for the positioning module and drives and the AC power supply.
  - Install an insulating transformer, if possible.
  - Install the noise filter, 24 V power supply unit, positioning module and drivers as close to each other as possible.
  - Separate the wiring of the primary and secondary sides, and use different wire routes.
  - Use a thick, short wire to ground the noise filter.
- The wires of the power line (AC line, motor cable, etc.), DC lines and signal lines should be separated from one another with a distance of 30 cm or more. Never tie them together or route them in the same duct.
- When a servo motor/drive is used, it is recommended that you use a line-driver type positioning module and connect the line-driver output.
- Never bundle the signal lines together.
- Never use the flat cables for connection to field devices.
- It is recommended that you use shielded twisted pair cables for the signal lines (especially for pulse instructions) between the positioning module and drives. The shielded wires should be processed (frame ground connection, etc.) at the drive side.
- Use a shielded twisted pair cable for each signal line. If a servo drive is connected to the positioning module, the shield of the signal line connected to the servo drive must be grounded on the drive side.
- Do not wire the signal line connected to the drive operated by the positioning module near or along power lines or high-voltage lines.

2) Wiring the Drive

- Install the upper and lower limit switches of the drive operated by the positionig module horizontally outside the overlimit switches as shown in the following illustration. The span between each limit switch and the adjacent overlimit switch must be more than the deceleration stop span of the system.

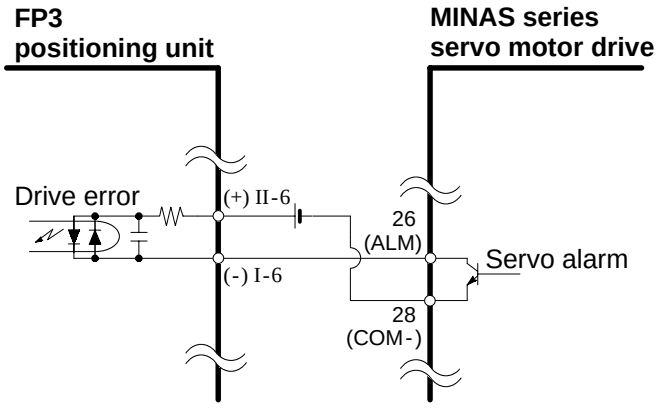


$$\text{Motion span: L (Number of pulses)} \geqq \underbrace{\left(\frac{1}{2000} \times \text{Home return speed (high) (pulse/s)} \times \text{Acceleration/deceleration time (ms)}\right)}_{\text{Number of pulses required for deceleration}} + \underbrace{\left(\frac{1}{50} \times \text{Home return speed (high) (pulse/s)}\right)}_{\text{Number of pulses required from the limit switch turning ON until the beginning of deceleration}}$$

- Although the drive alarm output can be connected to the drive error input of the positioning module, it is safer to use an alarm output that cuts OFF the power supplied to the drive.

■ **Example:**

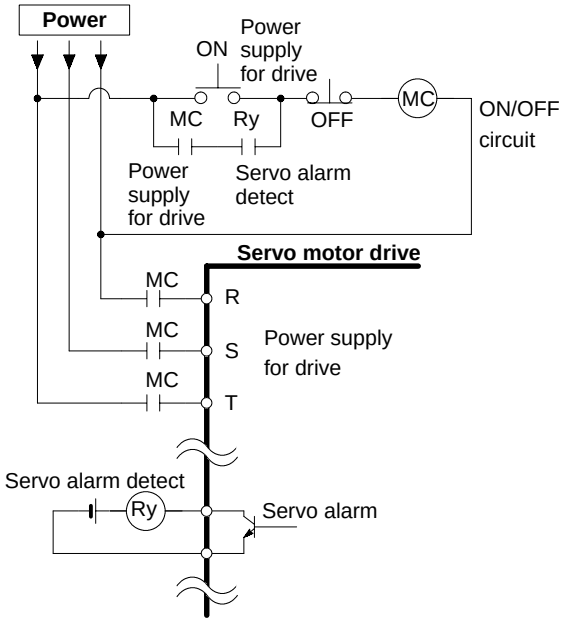
Connection to the drive error input of the FP3 positioning unit



■ **Example:**

Cutting the drive power

See the operating manual of the drive for details.

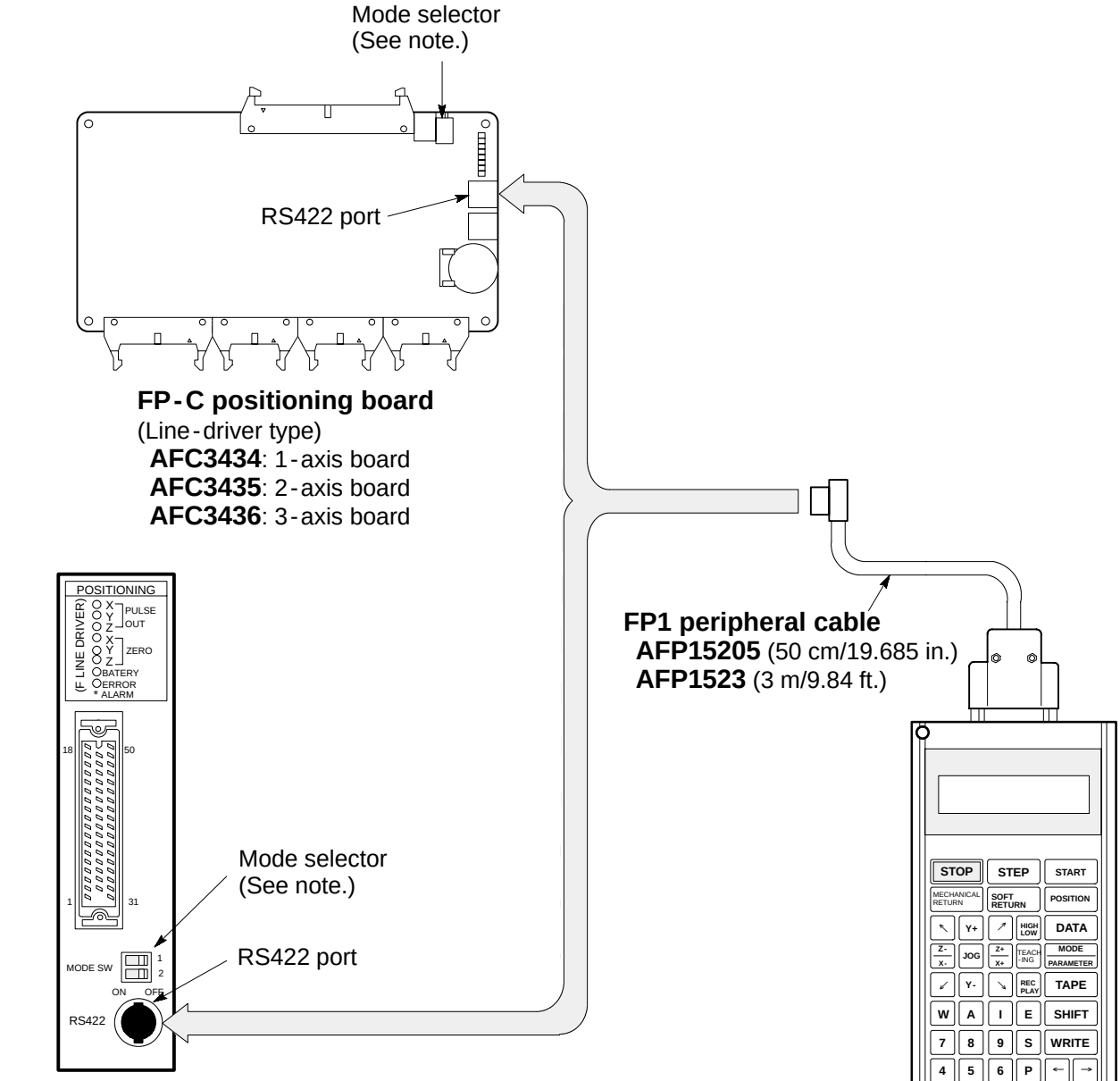


5. Connecting the Teaching Unit II

The teaching unit II makes it easy to set the parameters and positioning point data of the positioning module. To set the positioning module by trial operation without the teaching unit II requires data rewriting and position monitoring. The JOG and return home operations of the teaching unit II ensure smoother trial operation. See the "Teaching Unit II Operation Manual" for details.

1) FP-C Positioning Board and FP3 Positioning Unit (Line-driver Type)

- The teaching unit II is connected to the RS422 port on the FP-C positioning board and FP3 positioning unit by a FP1 peripheral cable.

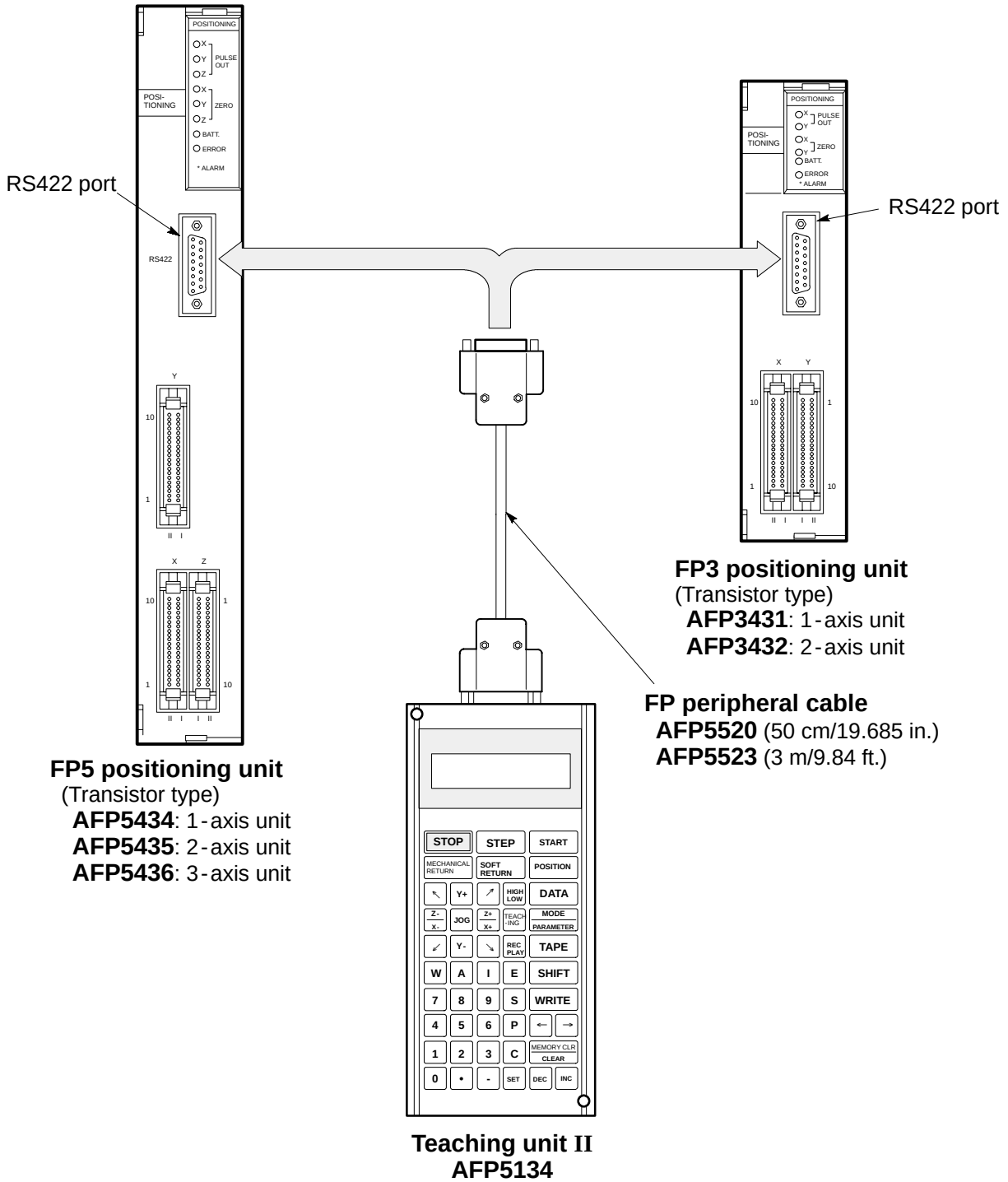


Note:

- Mode selector setting
  - SW1: Baud rate selector
    Set to ON to select 9,600 bps and OFF to select 19,200 bps.
    Set to OFF when the teaching unit II is connected.
  - SW2: Unused. Set to OFF.

2) FP3/FP5 Positioning Unit (Transistor Type)

- The teaching unit II is connected to the RS422 port on the FP3/FP5 positioning unit by a FP peripheral cable.



CHAPTER 4

POSITIONING MODULE F-TYPE SETUP PROCEDURES

4-1. Before Turning ON the Power

After wiring the field devices to the programmable controllers, be sure to check the items below before turning ON the power to the programmable controller.

- Module installation conditions:
  - Do the modules installed match the device lists specified in the system design stage?
  - Are the module fixing screws properly tightened?
  - Are the module dust-protection labels detached?

- Board number setting conditions:
  - Are the board numbers for the expansion backplane set correctly for FP3/FP5/FP10S/FP10?
  - Are the board number for the I/O and intelligent boards set correctly for FP-C?

- Expansion and bus cable conditions:
  - Are the expansion cables properly fixed?
  - Are the bus cables for FP-C properly connected?

- Power supply conditions:
  - Does supplied voltage meet the specifications of the programmable controller?
  - Is the voltage selection jumper correctly set?
  - Are the power supply cables properly fixed?
  - Is the wire size correct?

- Wiring conditions:
  - Are the terminal block fixing screws properly fixed?
  - Are the connectors properly fixed?
  - Are the wires and signal names for the terminals correct?
  - Is the wire size correct?

- CPU conditions:
  - Is the mode selector set to the PROG. mode?
  - Are the ROM/RAM specifications correct?
  - Is the battery connector firmly connected?

- Other conditions:
  - Be sure to check for all other conditions that may cause an accident including the field device conditions before turning ON the power.

4-2. Procedures for Programming the Positioning Module F-type

Before you start programming the positioning module, be sure to check all procedures by referring to the following flowchart:

Turn ON the power of the system and set the CPU to PROG. mode.

- Check the operation monitor LEDs of the positioning module F-type.
- For details about the operation monitor LEDs, refer to page 53, “1. Operation Monitor LEDs.”

Re-allocate the I/O using the I/O allocating function of the NPST-GR Software if you want.

- If you want to change the I/O allocation of the programmable controller, re-allocate using the NPST-GR Software Ver. 3.
- For details about the arbitrary I/O allocation, refer to the “NPST-GR SOFTWARE Ver. 3 Manual.”

Connect the teaching unit II to the positioning module F-type.

- For connection between the teaching unit II and each module, use the following cables:
  - FP peripheral cable (AFP5520) for FP3 transistor types (AFP3431 and AFP3432) and for FP5 transistor types (AFP5434, AFP5435 and AFP5436).
  - FP1 peripheral cable (AFP15205) for FP-C line-driver types (AFC3434, AFC3435 and AFC3436) and for FP3 line-driver types (AFP3434, AFP3435 and AFP3436).
- For details about the connection between teaching unit II and the positioning module F-type, refer to page 45, “5. Connecting the Teaching Unit II.”

Set the mode of the positioning module to LOCAL mode.

Initial screen

- Select “2: LOCAL” mode using the ← and → keys.
- Press the WRITE key.
- For details about the modes of the positioning module, refer to page 54, “2. RUN and LOCAL Modes.”
- For details about the operation of the teaching unit II, refer to the “TEACHING UNIT II Operation Manual.”

(Next page)

Clear the system memory of the positioning module F-type using the teaching unit II.

- Do this in order to prevent the positioning module from operating unexpectedly with unknown data.
- For details about the operation of the teaching unit II, refer to the "TEACHING UNIT II Operation Manual."

Set the parameters for each axis provisionally in order to check the actual position using JOG operation.

- According to the positioning field devices you use, be sure to set the following parameters provisionally.
  "Pulse output mode", "axis mode", "unit setting", "conversion rate", "home return speed (high and low)", "homing method" and "interface logics." If you change "unit setting" and "conversion rate", be sure to change also speed, position and distance parameters.
- For details about how to set parameters using the teaching unit II, refer to the "TEACHING UNIT II Operation Manual."
- For details about the JOG operation, refer to page 56, "3. JOG Operation."
- For details about the parameters, refer to page 67, "1. Overview of Parameters" and page 108, "5-2. Explanation of Each Parameter Item."
- For details about the homing operation, refer to page 58, "4. Homing Function" and "CHAPTER 5. SETTING PARAMETERS."

Check the current parameter settings and finalize all parameters performing JOG and homing operation.

- Perform JOG and homing operations in order to check if the parameters which were provisionally set are ideal for the motion control. After getting actual data from such trial operations, finalize the parameters according to the positioning field devices you use.
- The parameters to be finalized are:
  "pulse output mode", "axis mode", "unit setting", "conversion rate", "speed limit", "software limit (positive)", "software limit (negative)", "base speed", "interpolation speed setting mode", "backlash compensation", "error compensation", "home offset address", "home return speed (high)", "home return speed (low)", "homing method" and "interface logics."
- For details about how to set parameters using the teaching unit II, refer to the "TEACHING UNIT II Operation Manual."
- If an error occurs in the JOG and homing operation, an error code will be displayed on the screen of the teaching unit II. For details about the error contents, refer to page 226, "8-3. Error Codes."
- For details about the parameters, refer to page 67, "1. Overview of Parameters" and page 108, "5-2. Explanation of Each Parameter Item."
- Be sure to write down the finalized parameter settings after setting. They may be used in the CPU's programming stage for positioning control.

(Next page)

Set the positioning point data confirming the actual motion with the JOG operation.

- For each positioning point data, you need to specify the following data: "motion pattern", "motion span", "axis speed", "acceleration/deceleration time", "dwell time", "auxiliary code", and "interpolation speed."
- You can set the absolute address of motion span using the JOG operation and the teaching function of the teaching unit II. Using this function, you can easily set the motion span to confirm the actual motion.
- For details about the positioning point data, refer to page 71, "2. Overview of Positioning Point Data", and page 141, "6-2. Explanation of Each Positioning Point Data Item."
- If an error occurs in the positioning point data setting operation, an error code will be displayed on the screen of the teaching unit II. For details about the error contents, refer to page 226, "8-3. Error Codes."
- For details about the positioning point data settings and the teaching function using the teaching unit II, refer to the "TEACHING UNIT II Operation Manual."
- Be sure to write down the finalized positioning point data after setting. They may be used in the CPU's programming stage for positioning control.

Change the mode of the positioning module F-type to the RUN using the teaching unit II.

- Press the MODE/PARAMETER key while holding down the SHIFT key.

Initial screen

```
SET UP READY
1: RUN   2: LOCAL
```

- Select "1: RUN" mode with the ← and → keys.
- Press the WRITE key.
- For details about the mode of the positioning module, refer to page 54, "2. RUN and LOCAL Modes."
- For details about the operation of the teaching unit II, refer to the "TEACHING UNIT II Operation Manual."

(Next page)

Make the CPU's program for positioning control using the NPST-GR Software.

- To control the module with the programmable controller, you need to make a program in the CPU. The communication between the CPU and the module is performed using the following methods:
  - I/O handshake communication:
    X external input relays allocated for the module are used to feed the status of the positioning module F-type into the CPU. The CPU's program indicates the operation to the modules and field devices turning the Y external output relays allocated for the module ON or OFF.
  - Memory handshake communication:
    The memory handshake communication is performed using the shared memory of the positioning module F-type. The access to the shared memory is controlled by a CPU program which executes the **F150 (READ)**/**P150 (PREAD)** and **F151 (WRT)**/**P151 (PWRT)** instructions. Combined with I/O handshake communication, it reads data from and writes data to the shared memory.
- In the program for the motion control, the following sections are considered.
  - Parameter set/read program section
  - Positioning point data set/read program section
  - Positioning operation start program section
  - Homing and software homing program section
  - JOG operation program section
  - Actual position read/change program section
  - Auxiliary code read/process program section
  - Error code read/error clear program section
- For details about the handshake communications between CPU and the positioning module F-type, refer to page 75, "4-5. Overview of Handshake Communications."
- For details about the programming method for each program section, refer to "CHAPTER 7. PROGRAMMING FOR MOTION CONTROL."
- If an error occurs in the positioning point data setting operation, an error code will be displayed on the screen of the teaching unit II. For details about the error contents, refer to page 226, "8-3. Error Codes."
- It is recommended that you make program sections also for setting the parameters and positioning point data, even if they have already been set with the teaching unit II. Since the positioning modules F-type only have RAM backup system memory, the positioning point data and parameters which have been set by the teaching unit II may be lost when the backup battery power is lost.

END

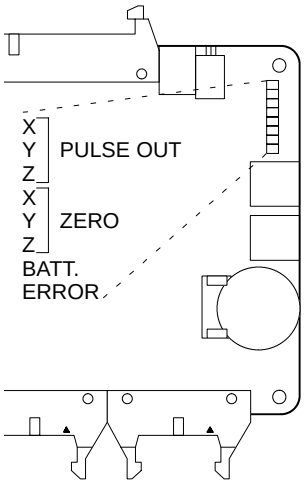
4-3. Key Functions for Setting Up the Positioning Module F-type

A variety of functions are available for the positioning module F-type in order to perform motion control smoothly. In this section, the key functions used for setting up the positioning module F-type are explained. For details about the other functions of the module, please refer to chapters 5 through 8.

1. Operation Monitor LEDs

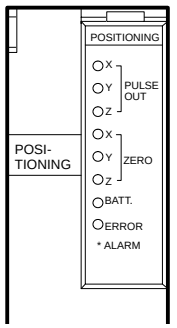
When power is supplied to the programmable controller, the status of the operation monitor LEDs is as shown below:

■ FP-C positioning board F-type

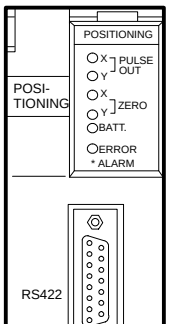


Initial LEDs status
- PULSE OUT LED: OFF
- ZERO LED: ON or OFF
- BATT. LED: OFF
- ERROR LED: OFF

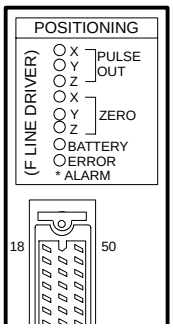
■ FP3 and FP5 positioning unit F-type



FP5 positioning unit (Transistor type)



FP3 positioning unit (Transistor type)



FP3 positioning unit (Line-driver type)

Initial LEDs status
- PULSE OUT LED: OFF
- ZERO LED: ON or OFF
- BATT. LED: OFF
- ERROR LED: OFF

When an error occurs in the positioning module F-type or in its operation, the LED status changes as shown below:
- ERROR LED is ON:
  A hardware abnormality in the positioning module F-type has been detected.
- ERROR LED is flashing:
  An operation error has occurred in the movement, in the data writing from CPU's program and teaching unit II, in the parameters and positioning point data settings from CPU's program and teaching unit II, in the communications between teaching unit II and the module, in the start-up methods.
- BATT. LED is flashing:
  The voltage of the backup battery dropped in the positioning module F-type. Replace the battery with a new one as soon as possible. The backup battery for the positioning module F-type can maintain its RAM data for approximately one month after this LED starts flashing.

Note:

· For details about the error conditions and steps to take when an error occurs, refer to page 226, "8-3. Error Codes."

2. RUN and LOCAL Modes

Two control modes are available for controlling the positioning module F-type.

- RUN mode: Usually used for controlling the motion after setting up the positioning module F-type. In this mode, the module is controlled by the sequence program in the CPU.

- LOCAL mode: Usually used in the setup stage for the parameters and trial operation. The module is controlled by the teaching unit II connected to it.

In the initial condition, the positioning module F-type is in neither RUN nor LOCAL mode. In order to select the control mode at this time:

- Setting to RUN mode: Use the teaching unit II or turn ON the request-to-run signal with a CPU program.

- Setting to LOCAL mode: Use the teaching unit II.

Note:

· In order to change the control mode from LOCAL to RUN, use the teaching unit II. It is impossible to change with a CPU program.

■ Controlling the module in each operation mode

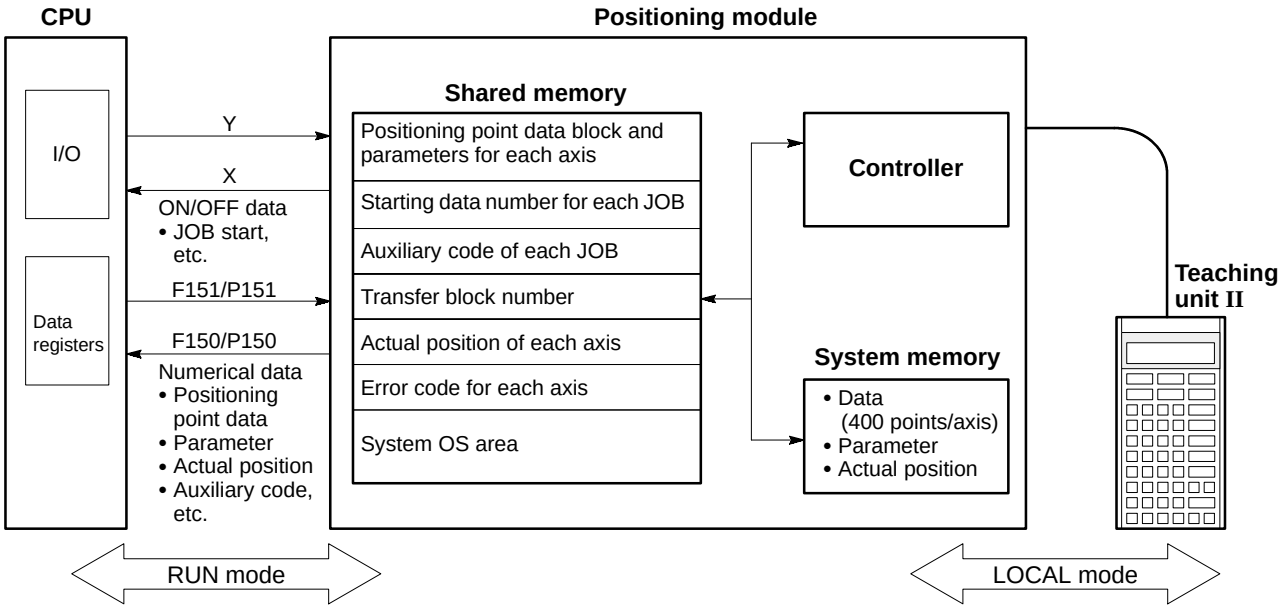
RUN mode:

In RUN mode, the positioning module is controlled by a CPU program with I/O and memory handshake communication.

- For I/O handshake communication, X external input relays and Y external output relays allocated for the module are used. The X external input relays are used for reporting module condition to the CPU and the Y external output relays are used for receiving instructions from the CPU.
- For memory handshake communication, the communication is performed by executing **F150 (READ)/P150 (PREAD)** and **F151 (WRT)/P151 (PWRT)** instructions in the CPU. The **F150 (READ)/P150 (PREAD)** instructions enable the CPU to read data in the shared memory of the positioning module and the **F151 (WRT)/P151 (PWRT)** instructions enable the CPU to set data in the shared memory of the module.

LOCAL mode:

In LOCAL mode, the positioning module is controlled by the teaching unit II. By simple key operations, you can perform motion control, such as JOG operation, data settings, homing function, etc.
In this mode, the handshake communication used in RUN mode operations is ignored.



Notes:

- For details about handshake communication, refer to page 75, “4-5. Overview of Handshake Communications” and “CHAPTER 7. PROGRAMMING FOR MOTION CONTROL.”
- For details about the teaching unit II, refer to the “TEACHING UNIT II Operation Manual.”

3. JOG Operation

JOG operation is used for setting up the positioning control or trial operation after the setup stage. By using JOG operation, you can count the actual number of pulses required for the motion while tracing the movement. This can help you to set the positioning point data at the setup or correction stage. The positioning module F-type can perform JOG operations using the CPU program or the teaching unit II. Thus you can use JOG operation both in RUN and LOCAL modes according to your requirements.

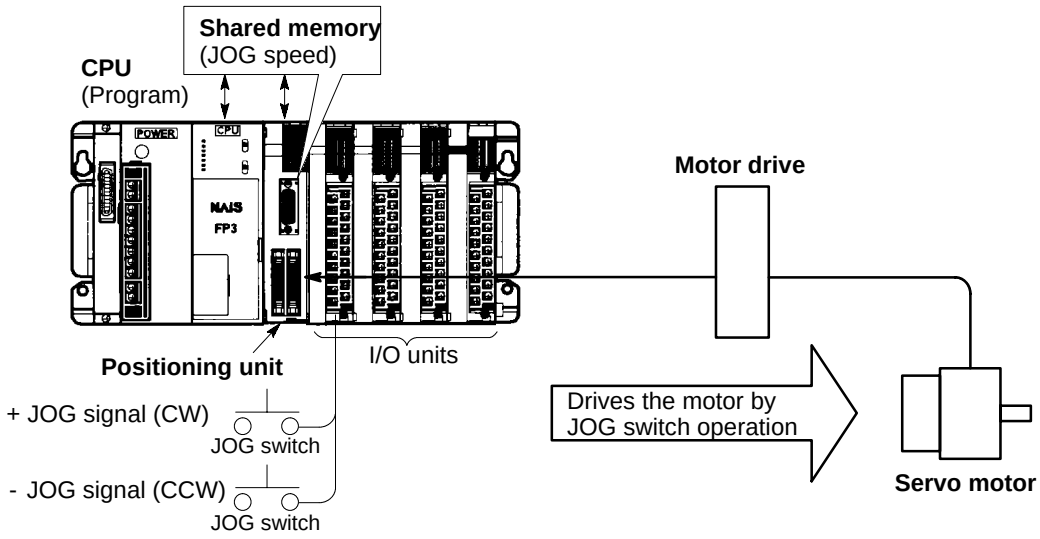
The positioning module F-type has useful options including:

- Forward or reverse JOG selection
- JOG speed value changes (Real time value change also available in RUN mode.)
- High or low JOG speed selection from teaching unit II using “home return speed (high and low)” set in the parameters

JOG operation is carried out by,

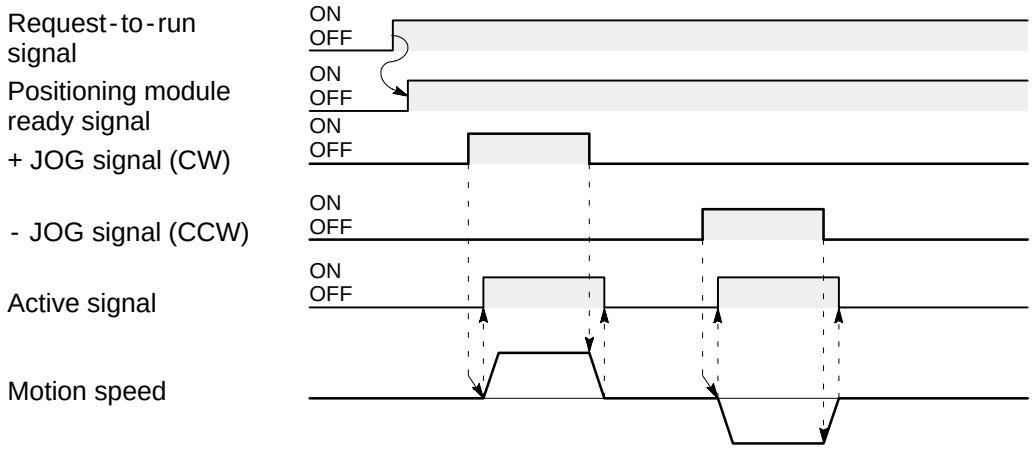
- Using the teaching unit II in LOCAL mode:

  Press the JOG key to enter the JOG operation mode.
- Using a CPU program in RUN mode:
  Turning ON or OFF the JOG switches while referring to the figure and time chart below.



■ Time chart

- JOG operation is possible only when the JOG forward point or JOG reverse point is ON.



Notes:

- During JOG operation, “software limits (negative and positive)” set in the parameter setting stage are not valid. In addition, even when the limit over signal is ON, pulses can be output during JOG operation.
- The “home return speed low”, which will be set in the parameter setting stage, is set as the initial JOG speed when the power is turned ON. Since an unknown value may be stored as the “home return speed” in the parameters when the power is first tuned ON, be sure to change the JOG speed for each axis in the shared memory before starting JOG operation.
- Before using high or low JOG speed selection, be sure to set parameters for “home return speed (high and low)” properly.
- JOG operations for each axis are always performed independently even if the axis mode is set as simultaneous 2- or 3-axis mode.
- For details about the teaching unit II, refer to the “TEACHING UNIT II Operation Manual.”
- For details about the CPU’s program section of JOG operation and JOG speed settings in RUN mode, refer to “CHAPTER 7. PROGRAMMING FOR MOTION CONTROL.”

4. Homing Function

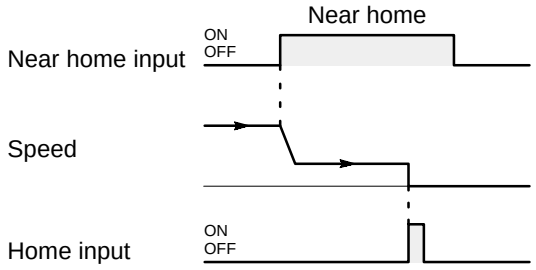
Homing operation is the key function for performing motion control. When controlling the motion of the machines, returning to the home position is required as the initial operation immediately after turning ON the power. If this operation is not performed, the programmable controller cannot find the standard point for positioning and the motion control cannot be performed correctly.
The positioning module F-type supports four types of homing methods for various types of field devices. Furthermore, the near home search function makes it possible for the field device to return to the home position regardless of its start-up position.

1) Homing Methods

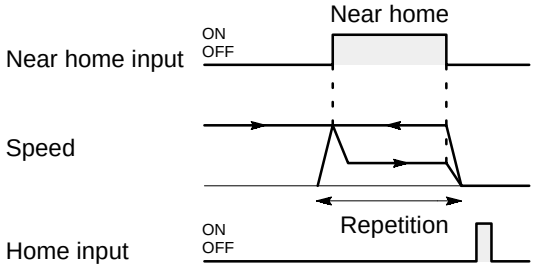
The following homing methods are available using the “home return speed (low and high)” parameter setting.

■ Near home ON method:

The speed drops when the near home switch turns ON, and operation stops at the first home (Z-phase) input.

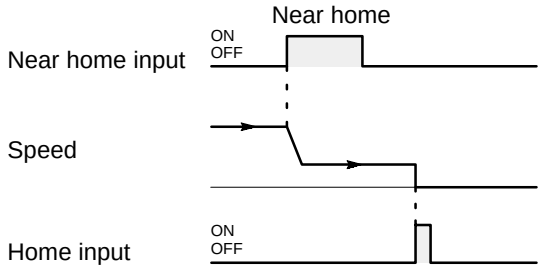


If no home is found after the near home switch turns ON, the operation decelerates and stops when the near home switch turns OFF, then reverses rapidly to the near home switch and repeats the same process.



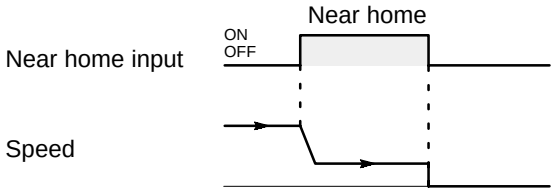
■ Near home OFF method:

The speed drops when the near home switch turns ON, and operation stops at the first home (Z-phase) input found after the near home switch turns OFF.



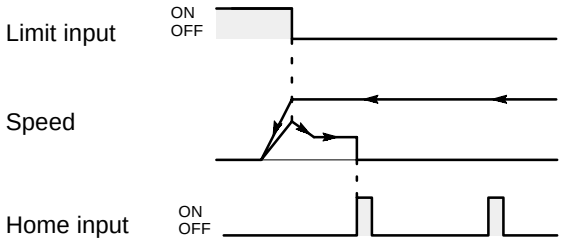
■ Near home ON/OFF method:

The speed drops when the near home switch turns ON, and operation stops when the near home switch turns OFF.



■ Limit search method:

Operation starts in the direction opposite to the preset homing direction. At the limit position opposite to the homing direction, the movement is reversed and the speed drops. Operation stops at the first home (Z-phase) input found after the direction is reversed.



Notes:

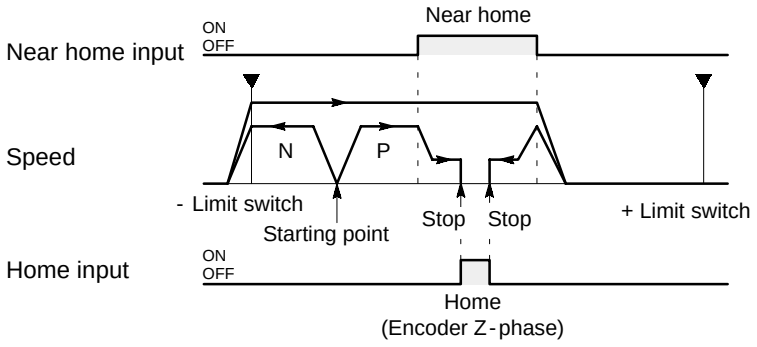
- For details about the parameter settings of the homing method and of home return speed (low and high), refer to page 67, “1. Overview of Parameters” and “CHAPTER 5. SETTING PARAMETERS.”
- For details about the CPU program for homing operation, refer to “CHAPTER 7. PROGRAMMING FOR MOTION CONTROL.”
- The limit search method is available for the FP-C positioning board only.

2) Home Searching Methods

In this section, home searching methods are explained using the examples when the homing method is set to the near home ON method.
For the other homing methods (near home OFF, near home ON/OFF and limit search methods), the home searching movement is performed in the same way as for the near home ON method.
In home searching operations, the module starts home search operation in the direction set in the parameter, and the movement may differ depending on the starting position.
No matter where the homing operation starts, a work always comes to home position in the direction specified in the parameter (positive or negative) and stops. Therefore, the stopping position will be stable using any home search method.

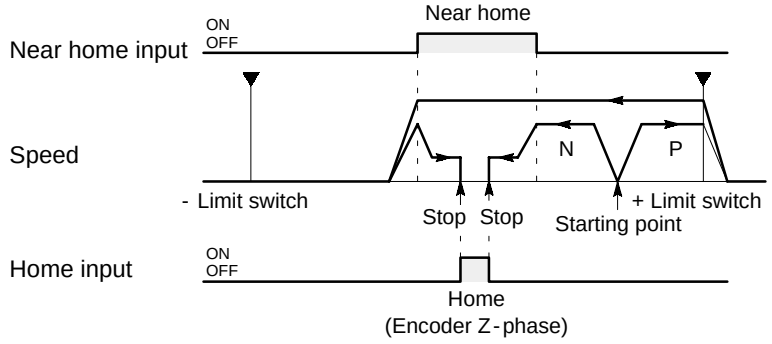
■ Homing from the position between the near home and the "- limit switch" position:

When homing operation is started between the near home and the "- limit switch" position, the homing operation is performed as shown below.



■ Homing from the position between the near home and the "+ limit switch" position:

When homing operation is started between the near home and the "+ limit switch" position, the homing operation is performed as shown below.

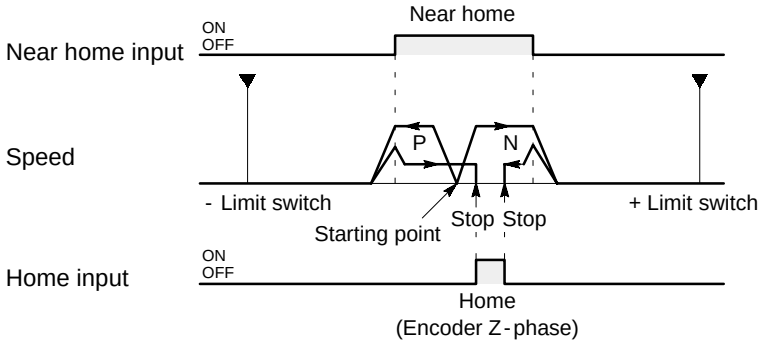


Notes:

- For details about the parameter settings for the home searching direction, refer to page 67, "1. Overview of Parameters" and "CHAPTER 5. SETTING PARAMETERS."
- Symbol legend
  P: P means that the + (positive) homing direction was specified in the parameter.
  N: N means that the - (negative) homing direction was specified in the parameter.

■ **Homing from the near home input ON position:**

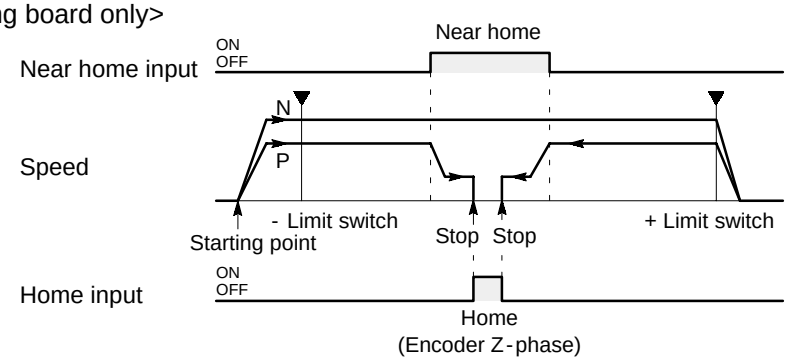
When homing operation is started at the near home input ON position, the homing operation is performed as shown below.



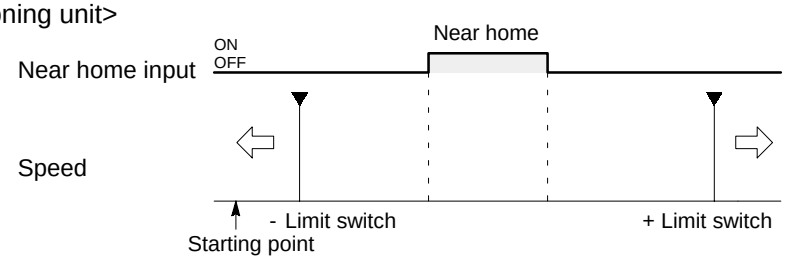
■ **Homing from the position outside the "- limit switch" and "+ limit switch" position:**

When homing operation is started outside the limits, the homing operation is performed as shown below.

<FP-C positioning board only>



<FP3/FP5 positioning unit>



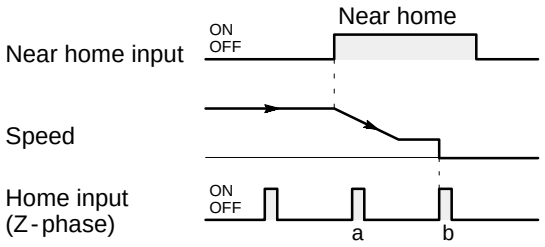
Homing can never start from outside the limit switch.
Use JOG operation to place the starting point within the limit switch, and try homing operation again.

Notes:

- For details about the parameter settings for the home searching direction, refer to page 67, "1. Overview of Parameters" and "CHAPTER 5. SETTING PARAMETERS."
- Symbol legend
  P: P means that the + (positive) homing direction was specified in the parameter.
  N: N means that the - (negative) homing direction was specified in the parameter.

3) Cautions for Stopping at Correct Position

When using the near home ON or near home OFF method, an error, such as the home stopping position not being stable, may occur depending on the setting condition.
During the homing operation, the module will change its moving speed from home return speed high to low when the near home signal turns ON. Then, it stops at the home position according to the homing method set in the parameter. However, if the home signal turns ON before the homing speed drops low enough for stopping, the module cannot stop the operation at the correct stopping position.
In the figure below, the motion must stop at point "a" but it stops at "b" point.

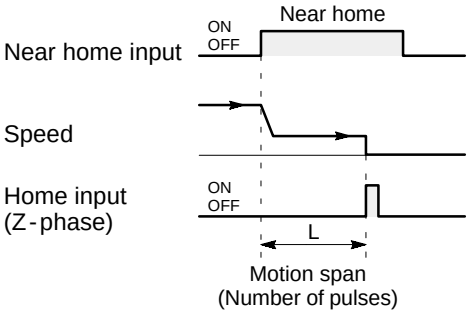


Note:

· If such an error occurs, adjust the position of the near home switch, or re-install the encoder so that the Z-phase signal turns ON at the appropriate position. It may also help to change the acceleration/deceleration time set in the parameters. For details about the motion span, home return speed (high) and acceleration/deceleration time, refer to the following explanations.

■ **For near home ON method**

If the near home ON method is set for homing, the homing speed will drop when the near home switch turns ON, and operation will stop at the first home signal. However, the stopping position may not be stable if the home input is detected without the homing speed dropping fully after the near home switch turns ON. Therefore, the distance between the near home and the home position must be made large enough for the homing speed drop to take the motion span into consideration. Since the acceleration/deceleration time will also affect the homing operation, be sure to set it taking homing operation not only other positioning control.

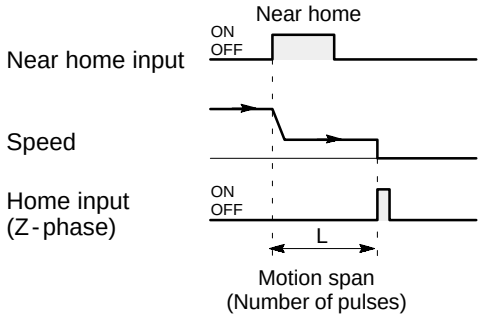


Motion span: L (Number of pulses) $\geqq$ $\left(\frac{1}{2000} \times \text{Home return high-speed (pulse/s)} \times \text{Acceleration/deceleration time (ms)} \right)$ (Number of pulses required for deceleration)

$+ \left(\frac{1}{50} \times \text{Home return high-speed (pulse/s)} \right)$ (Number of pulses required from the near home switch turning ON until the beginning of deceleration)

■ For near home OFF method

For the near home OFF method, the homing speed will drop when the near home switch turns OFF, and operation will stop positioning at the first home signal. However, the stopping position may not be stable if the home input is detected without the homing speed dropping fully after the near home switch turns ON. Therefore, the distance between the near home and the home position must be made large enough for the homing speed drop to take the motion span into consideration. Since the acceleration/deceleration time will also affect the homing operation, be sure to set it taking homing operation not only other positioning control.



Motion span: L (Number of pulses) $\geqq \left(\frac{1}{2000} \times \text{Home return high-speed (pulse/s)} \times \text{Acceleration/deceleration time (ms)} \right)$

Number of pulses required for deceleration

$+ \left(\frac{1}{50} \times \text{Home return high-speed (pulse/s)} \right)$

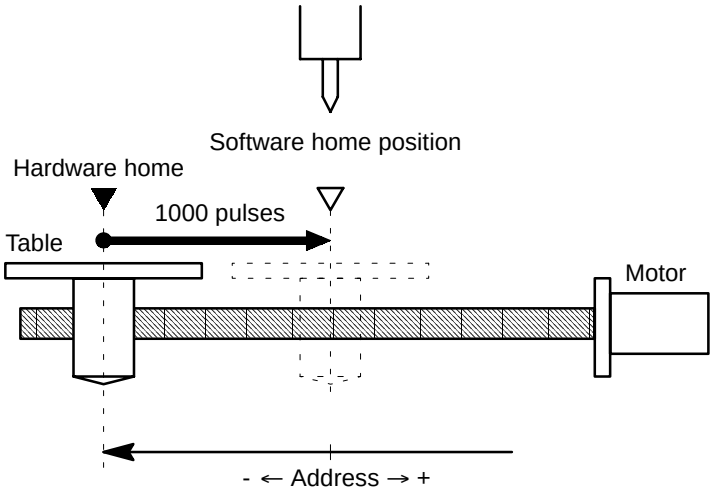
Number of pulses required from the near home switch turning ON until the beginning of deceleration

5. Software Homing Function

Software home is used as the “0” position in the positioning coordinates and all settings for the positioning point data are decided from the software home position. The positioning module F-type has a function to return to the software home position just by turning ON the specified signal in the program.

1) Software Home Position

The software home position is decided by setting the “home offset” parameter. In the home offset parameter, set the hardware home address by taking the software home address as the “0” coordinate position.
In the figure below, “- 1,000” is set as the home address parameter.



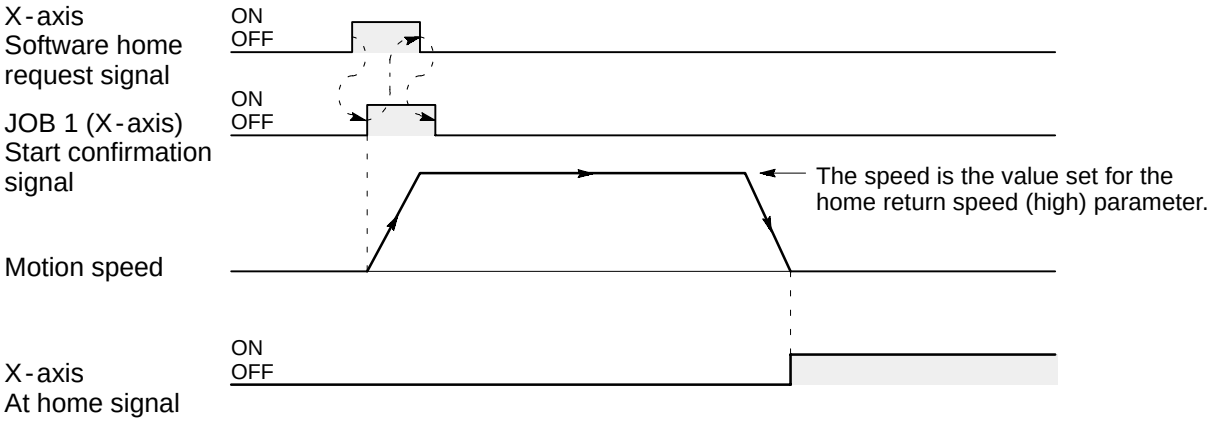
Note:

- For details about how to set the parameters, refer to page 67, “1. Overview of Parameters” and “CHAPTER 5. SETTING PARAMETERS.”

2) Software Homing Operation

The positioning module F-type has a function to return to the software home position using the "home return speed (high)" parameter.

- Use the teaching unit II in LOCAL mode:
  Press the SOFT RETURN key to enter the software home mode.
- Using a CPU program in RUN mode:
  Turn the software home request signal ON and OFF while referring to the time chart below.

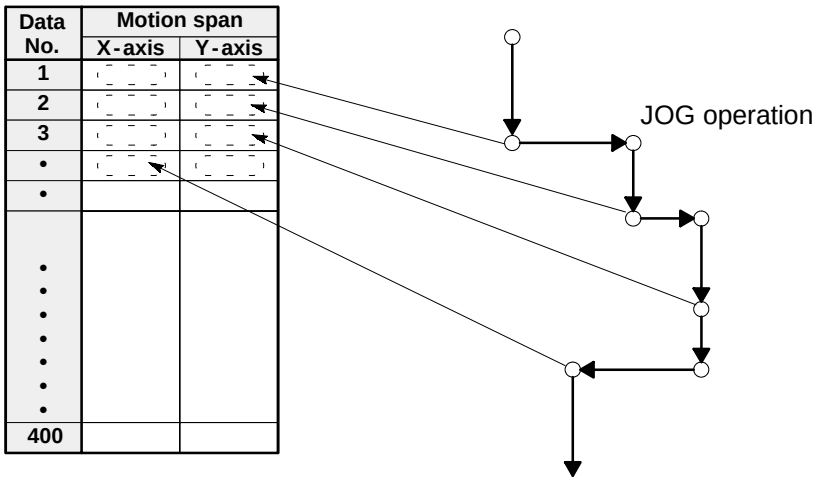


Notes:

- For details about the parameter settings for home return speed (high), refer to page 67, "1. Overview of Parameters" and "CHAPTER 5. SETTING PARAMETERS."
- For details about the operation of teaching unit II, refer to the "TEACHING UNIT II Operation Manual."
- For details about the CPU program for software homing operation, refer to "CHAPTER 7. PROGRAMMING FOR MOTION CONTROL."

6. Teaching Function

You can easily set the motion span for each positioning point data by registering the actual position as absolute position coordinates using the JOG operation in LOCAL mode. This lets you enter complicated positioning point data settings simply by monitoring the actual operation as follows.



Note:

- For details about the teaching function using the teaching unit II, refer to the “TEACHING UNIT II Operation Manual.”

4-4. Overview of Parameters and Positioning Point Data

1. Overview of Parameters

The parameters are basic variables for controlling motion with the positioning module F-type. Each parameter item should be set according to the specifications of the drive and servo motor connected and the characteristics of the drive system. Two methods are available for setting the parameters of the module.

- Using the teaching unit II
- Using CPU program

In this section, the outline of the parameters is explained based on using the teaching unit II.

Notes:

- It is recommended that you make a program for setting the parameters after finalizing them since the positioning module F-type has battery backup RAM for system memory.
- When setting parameters, decimal numbers such as 0.01 or 0.001 are used for some parameters. Since the CPU does not usually handle integers, a special technique for handling data is required for setting the parameters with a CPU program. For details about the setting methods, refer to "CHAPTER 5. SETTING PARAMETERS," and "CHAPTER 7. PROGRAMMING FOR MOTION CONTROL."
- For details about the teaching unit II, refer to the "TEACHING UNIT II Operation Manual."

1) List of Parameters

Most parameters should be set individually for each axis. However, "axis mode", "interpolation speed setting mode", "start mode", "homing method", and "interface logics" parameters are used for all axes. For details about the explanation of each parameter item, refer to "CHAPTER 5. SETTING PARAMETERS."
When setting the speed, position and distance for the parameters, be sure to check the "unit setting" and "conversion rate." The "unit setting" and "conversion rate" parameters will affect all of the settings.
The numbers in parentheses in the parameter item column express the parameter selection codes when using the teaching unit II.

Parameter item	Description	Default value	Setting range
Pulse output mode (1)	This selects the pulse output control mode using pulse output terminals 1 and 2.	1 (CW and CCW)	0: Pulse train and sign 1: CW and CCW
Axis mode (2)	This specifies whether axes are handled independently or simultaneously.	0 (Independent)	0: Independent 1: Simultaneous 2-axis 2: Simultaneous 3-axis
Unit setting (3) (*1)	This specifies which unit you use for parameters and positioning point data.	0 (Pulse)	0: Pulse 1: mm 2: inch 3: degree
Conversion rate (4) (*1)	This specifies the rate for converting pulses into the units set.	1	1: in "pulse units" 0.0001 to 0.1: in mm units 0.00001 to 0.001: in inch or degree units

Note:

- (*1): In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

Parameter item	Description	Default value	Setting range
Speed limit (5) (*1)	This specifies the maximum speed available for the positioning module using the conversion rate.	400000	$0 \leqq \frac{\text{Speed limit}}{\text{Conversion rate}} \leqq 400000$
Software limit (+) (6) (*1)	This specifies the positive limit, which does not actually exist, inside the hardware limit switches using the conversion rate.	8388607	$0 \leqq \frac{\text{Software limit (+)}}{\text{Conversion rate}} \leqq 8388607$
Software limit (-) (7) (*1)	This specifies the negative limit, which does not actually exist, inside the hardware limit switches using the conversion rate.	- 8388607	$-8388607 \leqq \frac{\text{Software limit (-)}}{\text{Conversion rate}} \leqq 0$
Base speed (8) (*1)	This specifies the base speed which is used for the starting and stopping stages of the stepper motor.	0	$0 \leqq \text{Base speed} \leqq$ Axis speed or Interpolation speed
Interpolation speed setting mode (9)	This selects the interpolation speed based on the long-axis or tracking speed.	1 (Tracking speed)	0: Long-axis speed 1: Tracking speed
Backlash compensation (10) (*1)	This specifies the correction value to compensate for the gap in the ball screw and the speed reducer using the conversion rate.	0	$0 \leqq \frac{\text{Backlash compensation}}{\text{Conversion rate}} \leqq 255$
Error compensation (11) (*1)	This specifies the value for correcting the deviation caused by indivisible rate setting or by pitch errors when mm, inch or degree units are used.	0	0: in “pulse units” ±1.0000: in mm units ±1.00000: in inch or degree units
In-position time (12)	This specifies the in-position ON signal duration.	300 (ms)	1 to 2,000 (ms)
Homing direction (13)	This specifies the direction for homing operation.	1 (Negative direction)	0: Positive direction 1: Negative direction
Home offset address (14) (*1)	This specifies the address of the hardware home address from the software home.	0	Software limit (-) ≦ Home offset address ≦ Software limit (+)
Home return speed (high) (15) (*1)	This specifies the higher speed for homing operation. This is also used for JOG and software home operations.	50000	Home return speed (low) ≦ Home return speed (high) ≦ Speed limit
Home return speed (low) (16) (*1)	This specifies the lower speed for homing operation. This is also used for JOG operation.	100	

Note:

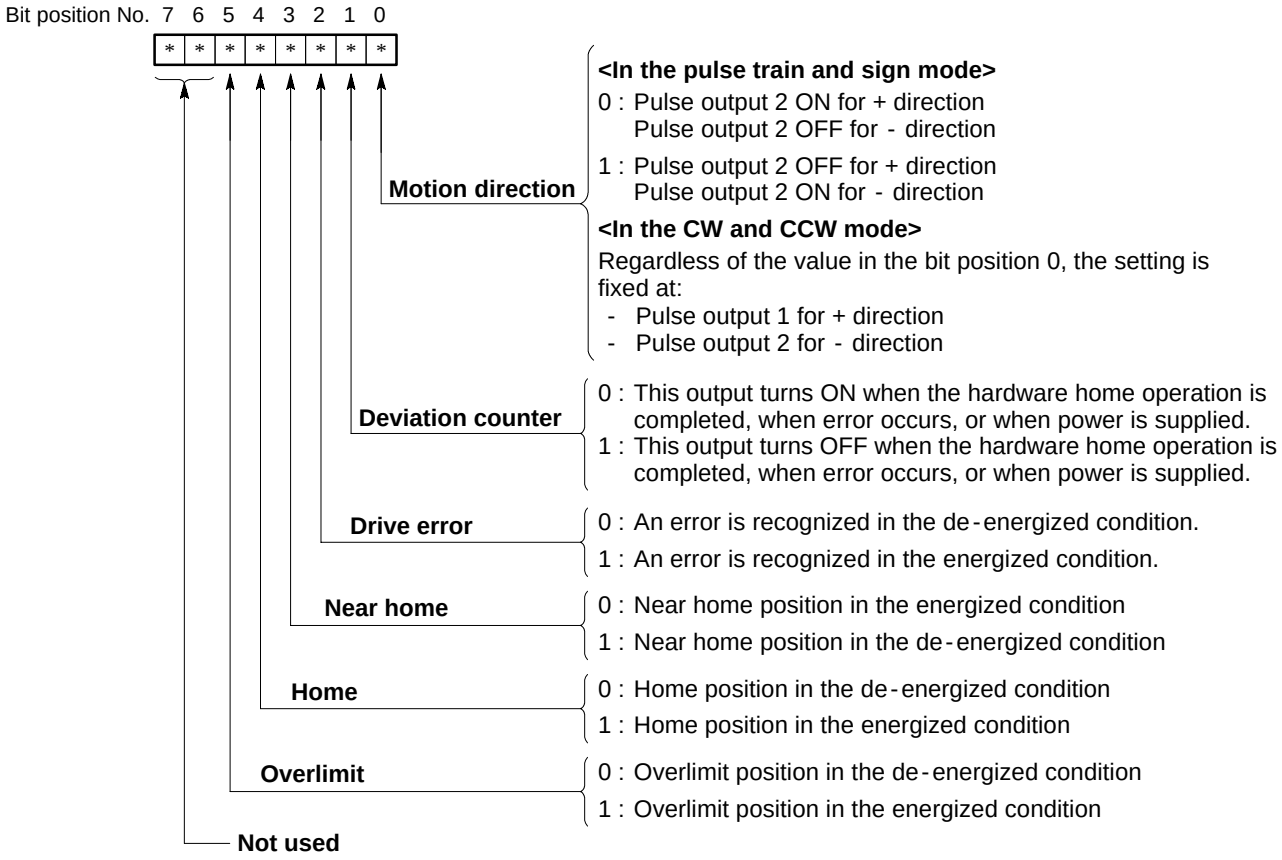
· (*1): In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

Parameter item	Description	Default value	Setting range
Acceleration/ deceleration time (17)	This specifies the time for acceleration and deceleration speed for homing and JOG operations.	1000 (ms)	64 to 4999 (ms)
Start mode (18)	This specifies the start mode from the four available modes.	0 (Immediate normal-start)	0: Immediate normal-start 1: Normal-start after homing 2: Quick-start 3: Test for quick-start
Homing method (19)	This specifies the homing method from the four available methods.	0 (Near home ON)	0: Near home ON 1: Near home OFF 2: Near home ON/OFF 3: Limit search (*2)
Interface logics (20)	This specifies the interface logic setting “0” or “1” in the specified bit position.	00000000	See explanation below.

Note:

· (*2): The limit search method is available for the FP-C positioning board only.

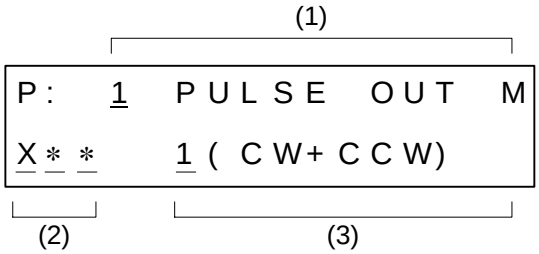
■ Explanation of the interface logic settings



2) How to Set Parameters Using Teaching Unit II

- The parameter screen is selected by pressing the MODE/PARAMETER key in LOCAL mode.
- The key input is not accepted during positioning operation, home return, or during execution of cassette load, save, or verify operations.

■ Initial screen



<Display>

_ . . Indicates the cursor positions
(The cursor is positioned at the "(1) Item selection field" in the initial screen.)
(1) . . Item selection field
(2) . . Write axis selection field
(3) . . Parameter value selection field

<Selection fields>

(1) Item selection field
- The numeric display field where the cursor is positioned indicates the item number.
- The contents of the item are displayed to the right of the item number.
- Item numbers 1 to 20 can be selected by moving the cursor to the item number and pressing the INC or DEC keys. An item can also be specified directly by pressing the number keys 1 to 20 followed by the WRITE key.
- When the cursor is in the "(3) Parameter value selection field", the item number can also be selected using the SET + INC and SET + DEC keys.

(2) Write axis selection field
- Selects the write axis for the parameter value.
- Move the cursor to the position of the axis to be set or cleared. When the WRITE key is pressed, the letter (X, Y, or Z) for the axis is displayed and the axis is selected. When the MEMORY CLR/CLEAR key is pressed, an asterisk (*) is displayed and the axis selection is cleared. (See table below.)
- When the selected write axis is changed, the parameter value of the axis is read and displayed in the "(3) Parameter value selection field."
- If multiple axes are selected, the parameter values are displayed in the order of X-Y-Z.

■ Write axis selection field display example

Procedure ↓

Item	1-axis module	2-axis module	3-axis module
Initial display	X	X*	X**
Y-axis selection	-	XY	XY*
Z-axis selection	-	-	XYZ
X-axis clear	*	*Y	*YZ
Y-axis clear	-	**	**Z
Z-axis clear	-	-	***

- The "(3) Parameter value selection field" is cleared when all write axes are cleared.

(3) Parameter value selection field

- Enter a numeric value and press the WRITE key. The data is written for the axis selected in the "(2) field" and the item selected in the "(1) field."
- If the entry is incorrect, press the MEMORY CLR / CLEAR key to return to the previous display.
- Numeric values which exceed the allowed tolerance can be entered. However, the entry is not accepted when the WRITE key is pressed, and the previous value is restored.

2. Overview of Positioning Point Data

The positioning module F-type has 400 positioning point data settings available for each axis. Each setting contains information necessary for positioning operation including motion pattern, motion span and axis speed. Two methods are available for setting the positioning point data of the module.

- Using the teaching unit II
- Using a CPU program

In this section, the outline of the positioning point data is explained based on using the teaching unit II.

Notes:

- It is recommended that you make a program for setting the positioning point data after finalizing them since the positioning module F-type has battery backup RAM for system memory.
- When setting positioning point data, decimal numbers such as 0.1 or 0.001 are used for some items. Since the CPU does not usually handle integers, a special technique for handling data is required for setting positioning point data with a CPU program. For details about the setting methods, refer to "CHAPTER 6. SETTING POSITIONING POINT DATA," and "CHAPTER 7. PROGRAMMING FOR MOTION CONTROL."
- For details about the teaching unit II, refer to the "TEACHING UNIT II Operation Manual."

1) Contents of Positioning Point Data

Seven items are available for each positioning point data item. Each positioning point data item should be specified according to your field device specifications and to the parameter set beforehand. For details about the explanation of each positioning point data item, refer to "CHAPTER 6. SETTING POSITIONING POINT DATA."
The numbers in parentheses in the positioning point data item column express the positioning point data selection codes when using the teaching unit II.

Positioning point data item	Description	Default value	Setting range
Motion pattern (1)	This specifies the motion patterns and point data number for next execution. When setting only motion pattern code, the "C", "P" or "S" is input from the teaching unit II, the data with 1 larger than its own data number is automatically set. (When setting by a CPU program, be sure to set also the next processing data number.) For "S" codes, the next processing data number should be 1 larger than its own data number.	E (End point)	CXXX: Continuation point PXXX: Pass point SXXX: Circular interpolation point E: End point "XXX" means the positioning point data number for next execution: 1 ≦ XXX ≦ 400 (*1) when "XXX" = 999, return to the original procedures before jump operation.
Motion span (2) (*2)	This specifies the direction of next motion and its span by setting the absolute address or span from the actual position with sign.	I0 (Not move)	A******** : Absolute address I******** : Increment span Software limit (-) ≦ ******** / Conversion unit ≦ Software limit (+)
Axis speed (3) (*2) (*3)	This specifies the axis speed for independent axis mode.	0	Base speed ≦ Axis speed ≦ Speed limit
Interpolation speed (4) (*2) (*3)	This specifies the interpolation speed for simultaneous axis mode.	0	Base speed ≦ Interpolation speed ≦ Speed limit
Acceleration/ deceleration time (5)	This specifies the acceleration and deceleration times to reach the specified speed or to stop the movement.	300 (ms)	64 to 4,999 (ms) (*4)
Dwell time (6)	This specifies the time lag from the end of the pulse output until when the in-position/complete-to-test signal turns ON.	0	0 to 499 (× 10 ms)
Auxiliary code (7)	This specifies optional codes for the positioning point data. The code set here can be monitored in the shared memory in the timing of the start or end of its execution. You can know which data is executing by monitoring this.	A0 (Auxiliary code not used)	AXXX : End mode WXXX : Start mode 0 ≦ "XXX" ≦ 255 A0: Auxiliary code not used.

Notes:

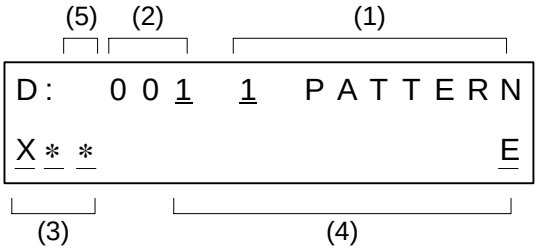
- (*1): The poisitioning points "410 points (system memory: 400 points + shared memory: 10 points)" are available, if the system ROM version SV 2.1 or later is used.
- (*2): In order to prevent malfunction, be sure to set all values for motion span, axis speed and interpolation speed setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.
- (*3): When using the teaching unit II, the axis speed is not displayed in simultaneous axis mode and interpolation speed is not displayed in independent axis mode.
- (*4): Positioning modules F-type with a system ROM version SV 2.0 or later can be set in the range of 0 to 4,999 ms. However, settings in the range of 0 to 63 ms cannot correctly be set.

2) How to Set Positioning Point Data Using the Teaching Unit II

- The positioning point data screen is selected by pushing the DATA key in LOCAL mode.
- The key is not accepted during positioning operation, home return, or during execution of cassette load, save, or verify operations.

■ Initial screen

The initial screen displays the contents of data number 1 for item 1 (MOTION PATTERN).



<Display>

_ . . Indicates the cursor positions
(The cursor is positioned at the "(1) Data item selection field" in the initial screen.)
(1) . . Data item selection field
(2) . . Positioning point data number selection field
(3) . . Write axis selection field
(4) . . Data value selection field
(5) . . Block write display field

<Selection fields>

(1) Data item selection field
- The numeric display field where the cursor is positioned indicates the item number (1 to 7).
- The contents of the item are displayed to the right of the item number.
- Item numbers 1 to 7 can be selected by moving the cursor to the "(1) Data item selection field" and pressing the INC or DEC key. An item can also be specified directly by pressing the number keys 1 to 7 followed by the WRITE key.
- When the cursor is in the "(4) Data value selection field", the item number can also be selected using the SET + INC and SET + DEC keys.

(2) Positioning point data number selection field
- Indicates the data number corresponding to the position.
- The data number can be selected by moving the cursor to the "(2) Positioning point data number selection field" and pressing the INC or DEC key. The data number can also be specified directly by pressing the number keys followed by the WRITE key.
- When the cursor is in the "(4) Data value selection field", the positioning point data number can also be selected using the INC and DEC keys.

(3) Write axis selection field

- Selects the write axis for the data value.
- Move the cursor to the position of the axis to be set or cleared. When the WRITE key is pressed, the letter (X, Y, or Z) for the axis is displayed and the axis is selected. When the MEMORY CLR / CLEAR key is pressed, an asterisk (*) is displayed and the axis selection is cleared. (See table below.)
- When the selected write axis is changed, the data value of the axis is read and displayed in the "(4) Data value selection field."
- If multiple axes are selected, the data values are displayed in the order of X-Y-Z.

■ **Write axis selection field display example (when the axis mode of parameter is independent)**

Procedure ↓

Item	1-axis module	2-axis module	3-axis module
Initial display	X	X*	X**
Y-axis selection	-	XY	XY*
Z-axis selection	-	-	XYZ
X-axis clear	*	*Y	*YZ
Y-axis clear	-	**	**Z
Z-axis clear	-	-	***

- The "(4) Data value selection field" is cleared when all write axes are cleared.

- When the axis mode is independent, the interpolation speed in data item 4 is meaningless, and the "(3) Write axis selection field" becomes "***." (Data write is not necessary.)
- When the axis mode is set for simultaneous 2-axis or simultaneous 3-axis mode, "XY" or "XYZ" is displayed in lowercase in the "(3) Write axis selection field", and the axes are cleared or set simultaneously. However for item 2 (motion span), the write axes XYZ are displayed in upper case, and even in simultaneous axis mode, the axes are set independently.
- When the axis mode is simultaneous 2-axis or simultaneous 3-axis mode, the positioning point data selection code 3 (axis speed) is meaningless, and the "(3) Write axis selection field" becomes "***." (Data write is not necessary.)

(4) Data value selection field

- Move the cursor to "field (4)" and enter a numeric value followed by the WRITE key. The item data selected in "field (1)" is written for the axis selected in "field (3)" and the data number selected in "field (2)."
- If the entry is incorrect, press the MEMORY CLR / CLEAR key to return to the previous value.

(5) Block write display field

- For example, when the data for positioning point data selection code 5 (acceleration / deceleration time) is the same for data numbers 1 to 10, the data can be written in a block. First input the data for the item and move the cursor to the "(2) Positioning point data number selection field." After selecting No. 1, press the SET key and input No. 10 followed by the WRITE key. Data numbers 1 to 10 will be written in a block. When the SET key is pressed, an arrow (→) is displayed in the "(5) Block write display field." The procedure is the same for the other positioning point data items.

4-5. Overview of Handshake Communications

In RUN mode, the positioning module F-type is controlled by the CPU using two types of handshake communication.

- **I/O handshake communication**: X external input relays and Y external output relays allocated for it are used for communication. CPU controls operation of the module by turning ON or OFF the Y external output relays referring to the status of the X external input relays.
- **Memory handshake communication**: Shared memory of the module is used for communication. The CPU controls operation of the module by writing and reading parameters or data with the **F150 (READ)/P150 (PREAD)** and **F151 (WRT)/P151 (PWRT)** instructions.

In RUN mode, the CPU controls the positioning operation of the module by combining two handshake communications.

1. I/O Handshake Communications

In the I/O handshake communications, the I/O allocated for the positioning module F-type are used. I/O allocation for each module are:

- For 1-axis module: 16 X external input relays and 16 Y external output relays
- For 2-axis module: 32 X external input relays and 32 Y external output relays
- For 3-axis module: 32 X external input relays and 32 Y external output relays

1) I/O Allocation for Each Module

The specifications of I/O points for each module are described below:

■ **I/O specifications for the 1-axis module (when the module is installed at the slot 0 position)**

Positioning module → CPU (X) specifications			CPU → Positioning module (Y) specifications		
Address	**Description**		**Address**	**Description**	
X0	Positioning module ready signal		**Y10**	Request-to-run signal	
X1	Error signal		**Y11**	Request-to-read signal (System memory → Shared memory)	
X2	RUN/LOCAL signal		**Y12**	Request-to-write signal (Shared memory → System memory)	
X3	Complete-to-read signal (System memory → Shared memory)		**Y13**	JOB1 operation	Request-to-start signal
X4	Complete-to-write signal (Shared memory → System memory)		**Y14**	X-axis operation	Request-to-home signal
X5	JOB1 operation	In-position/complete-to-test signal	**Y15**		Software home request signal
X6	X-axis operation	At home signal	**Y16**	JOB1 operation	Request-to-stop signal
X7	JOB1 operation	Active signal	**Y17**	X-axis operation	JOG forward request signal
X8		Start confirmation signal	**Y18**		JOG reverse request signal
X9		Auxiliary code set flag	**Y19**	JOB1 operation	Auxiliary code set flag OFF signal
XA to XF	Not used		**Y1A to Y1F**	Not used	

■ **I/O specifications for the 2-axis module (when the module is installed at the slot 0 position)**

Positioning module → CPU (X) specifications			CPU → Positioning module (Y) specifications		
Address	**Description**		**Address**	**Description**	
X0	Positioning module ready signal		**Y20**	Request-to-run signal	
X1	Error signal		**Y21**	Request-to-read signal (System memory → Shared memory)	
X2	RUN/LOCAL signal		**Y22**	Request-to-write signal (Shared memory → System memory)	
X3	Complete-to-read signal (System memory → Shared memory)		**Y23**	JOB1 operation	Request-to-start signal
X4	Complete-to-write signal (Shared memory → System memory)		**Y24**	X-axis operation	Request-to-home signal
X5	JOB1 operation	In-position/complete-to-test signal	**Y25**		Software home request signal
X6	X-axis operation	At home signal	**Y26**	JOB1 operation	Request-to-stop signal
X7	JOB1 operation	Active signal	**Y27**	X-axis operation	JOG forward request signal
X8		Start confirmation signal	**Y28**		JOG reverse request signal
X9		Auxiliary code set flag	**Y29**	JOB1 operation	Auxiliary code set flag OFF signal
XA	JOB2 operation	In-position/complete-to-test signal	**Y2A**	JOB2 operation	Request-to-start signal
XB	Y-axis operation	At home signal	**Y2B**	Y-axis operation	Request-to-home signal
XC	JOB2 operation	Active signal	**Y2C**		Software home request signal
XD		Start confirmation signal	**Y2D**	JOB2 operation	Request-to-stop signal
XE		Auxiliary code set flag	**Y2E**	Y-axis operation	JOG forward request signal
XF to X1F	Not used		**Y2F**		JOG reverse request signal
			Y30	JOB2 operation	Auxiliary code set flag OFF signal
			Y31 to Y3F	Not used	

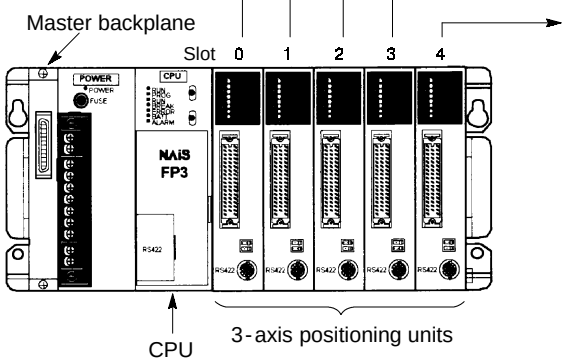
■ **I/O specifications for the 3-axis module (when the module is installed at the slot 0 position)**

Positioning module → CPU (X) specifications			CPU → Positioning module (Y) specifications		
Address	**Description**		**Address**	**Description**	
X0	Positioning module ready signal		**Y20**	Request-to-run signal	
X1	Error signal		**Y21**	Request-to-read signal (System memory → Shared memory)	
X2	RUN/LOCAL signal		**Y22**	Request-to-write signal (Shared memory → System memory)	
X3	Complete-to-read signal (System memory → Shared memory)		**Y23**	JOB1 operation	Request-to-start signal
X4	Complete-to-write signal (Shared memory → System memory)		**Y24**	X-axis operation	Request-to-home signal
X5	JOB1 operation	In-position/complete-to-test signal	**Y25**		Software home request signal
X6	X-axis operation	At home signal	**Y26**	JOB1 operation	Request-to-stop signal
X7	JOB1 operation	Active signal	**Y27**	X-axis operation	JOG forward request signal
X8		Start confirmation signal	**Y28**		JOG reverse request signal
X9		Auxiliary code set flag	**Y29**	JOB1 operation	Auxiliary code set flag OFF signal
XA	JOB2 operation	In-position/complete-to-test signal	**Y2A**	JOB2 operation	Request-to-start signal
XB	Y-axis operation	At home signal	**Y2B**	Y-axis operation	Request-to-home signal
XC	JOB2 operation	Active signal	**Y2C**		Software home request signal
XD		Start confirmation signal	**Y2D**	JOB2 operation	Request-to-stop signal
XE		Auxiliary code set flag	**Y2E**	Y-axis operation	JOG forward request signal
XF	JOB3 operation	In-position/complete-to-test signal	**Y2F**		JOG reverse request signal
X10	Z-axis operation	At home signal	**Y30**	JOB2 operation	Auxiliary code set flag OFF signal
X11	JOB3 operation	Active signal	**Y31**	JOB3 operation	Request-to-start signal
X12		Start confirmation signal	**Y32**	Z-axis operation	Request-to-home signal
X13		Auxiliary code set flag	**Y33**		Software home request signal
X14 to X1F	Not used		**Y34**	JOB3 operation	Request-to-stop signal
			Y35	Z-axis operation	JOG forward request signal
			Y36		JOG reverse request signal
			Y37	JOB3 operation	Auxiliary code set flag OFF signal
			Y38 to Y3F	Not used	

■ I/O allocation examples

• When installing five 3-axis units on the 5-slot master backplane

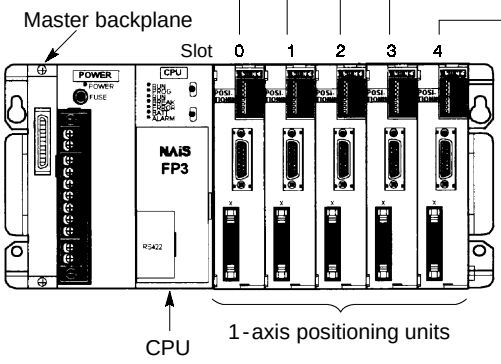
Slot number	I/O allocation	
	Input	Output
Slot 0	X0 to X13 (X14 to X1F: Not used)	Y20 to Y37 (Y38 to Y3F: Not used)
Slot 1	X40 to X53 (X54 to X5F: Not used)	Y60 to Y77 (Y78 to Y7F: Not used)
Slot 2	X80 to X93 (X94 to X9F: Not used)	Y100 to Y117 (Y118 to Y11F: Not used)
Slot 3	X120 to X133 (X134 to X13F: Not used)	Y140 to Y157 (Y158 to Y15F: Not used)
Slot 4	X160 to X173 (X174 to X17F: Not used)	Y180 to Y197 (Y198 to Y19F: Not used)



Input data (Positioning unit → CPU)		Output data (CPU → Positioning unit)	
Input allocation (X)	Description	Output allocation (Y)	Description
X0, 40, 80, 120, 160	Positioning module ready signal	Y20, 60, 100, 140, 180	Request-to-run signal
X1, 41, 81, 121, 161	Error signal	Y21, 61, 101, 141, 181	Request-to-read signal (System memory → Shared memory)
X2, 42, 82, 122, 162	RUN/LOCAL signal		
X3, 43, 83, 123, 163	Complete-to-read signal (System memory → Shared memory)	Y22, 62, 102, 142, 182	Request-to-write signal (Shared memory → System memory)
X4, 44, 84, 124, 164	Complete-to-write signal (Shared memory → System memory)	Y23, 63, 103, 143, 183	Request-to-start signal
		Y24, 64, 104, 144, 184	Request-to-home signal
X5, 45, 85, 125, 165	In-position/complete-to-test signal	Y25, 65, 105, 145, 185	Software home request signal
X6, 46, 86, 126, 166	At home signal	Y26, 66, 106, 146, 186	Request-to-stop signal
X7, 47, 87, 127, 167	Active signal	Y27, 67, 107, 147, 187	JOG forward request signal
X8, 48, 88, 128, 168	Start confirmation signal	Y28, 68, 108, 148, 188	JOG reverse request signal
X9, 49, 89, 129, 169	Auxiliary code set flag	Y29, 69, 109, 149, 189	Auxiliary code set flag OFF signal
XA, 4A, 8A, 12A, 16A	In-position/complete-to-test signal	Y2A, 6A, 10A, 14A, 18A	Request-to-start signal
XB, 4B, 8B, 12B, 16B	At home signal	Y2B, 6B, 10B, 14B, 18B	Request-to-home signal
XC, 4C, 8C, 12C, 16C	Active signal	Y2C, 6C, 10C, 14C, 18C	Software home request signal
XD, 4D, 8D, 12D, 16D	Start confirmation signal	Y2D, 6D, 10D, 14D, 18D	Request-to-stop signal
XE, 4E, 8E, 12E, 16E	Auxiliary code set flag	Y2E, 6E, 10E, 14E, 18E	JOG forward request signal
XF, 4F, 8F, 12F, 16F	In-position/complete-to-test signal	Y2F, 6F, 10F, 14F, 18F	JOG reverse request signal
X10, 50, 90, 130, 170	At home signal	Y30, 70, 110, 150, 190	Auxiliary code set flag OFF signal
X11, 51, 91, 131, 171	Active signal	Y31, 71, 111, 151, 191	Request-to-start signal
X12, 52, 92, 132, 172	Start confirmation signal	Y32, 72, 112, 152, 192	Request-to-home signal
X13, 53, 93, 133, 173	Auxiliary code set flag	Y33, 73, 113, 153, 193	Software home request signal
		Y34, 74, 114, 154, 194	Request-to-stop signal
		Y35, 75, 115, 155, 195	JOG forward request signal
		Y36, 76, 116, 156, 196	JOG reverse request signal
		Y37, 77, 117, 157, 197	Auxiliary code set flag OFF signal

• When installing five 1-axis units on the 5-slot master backplane

Slot number	I/O allocation	
	Input	Output
Slot 0	X0 to X9 (XA to XF: Not used)	Y10 to Y19 (Y1A to Y1F: Not used)
Slot 1	X20 to X29 (X2A to X2F: Not used)	Y30 to Y39 (Y3A to Y3F: Not used)
Slot 2	X40 to X49 (X4A to X4F: Not used)	Y50 to Y59 (Y5A to Y5F: Not used)
Slot 3	X60 to X69 (X6A to X6F: Not used)	Y70 to Y79 (Y7A to Y7F: Not used)
Slot 4	X80 to X89 (X8A to X8F: Not used)	Y90 to Y99 (Y9A to Y9F: Not used)



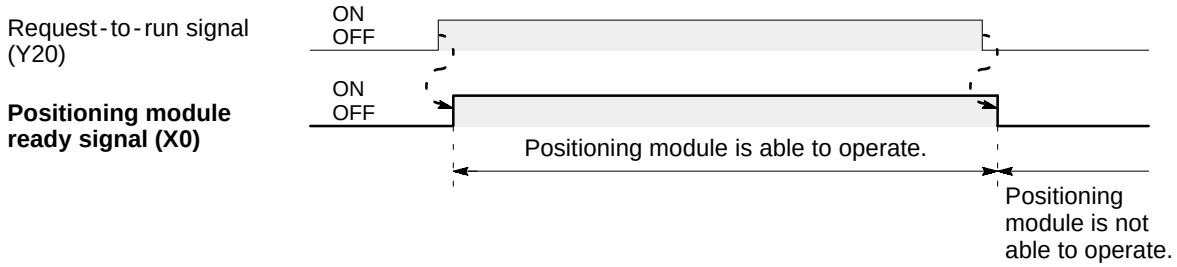
Input data (Positioning unit → CPU)		Output data (CPU → Positioning unit)	
Input allocation (X)	**Description**	**Output allocation (Y)**	**Description**
X0, 20, 40, 60, 80	Positioning module ready signal	Y10, 30, 50, 70, 90	Request-to-run signal
X1, 21, 41, 61, 81	Error signal	Y11, 31, 51, 71, 91	Request-to-read signal (System memory → Shared memory)
X2, 22, 42, 62, 82	RUN/LOCAL signal		
X3, 23, 43, 63, 83	Complete-to-read signal (System memory → Shared memory)	Y12, 32, 52, 72, 92	Request-to-write signal (Shared memory → System memory)
X4, 24, 44, 64, 84	Complete-to-write signal (Shared memory → System memory)	Y13, 33, 53, 73, 93	Request-to-start signal
		Y14, 34, 54, 74, 94	Request-to-home signal
X5, 25, 45, 65, 85	In-position/complete-to-test signal	Y15, 35, 55, 75, 95	Software home request signal
X6, 26, 46, 66, 86	At home signal	Y16, 36, 56, 76, 96	Request-to-stop signal
X7, 27, 47, 67, 87	Active signal	Y17, 37, 57, 77, 97	JOG forward request signal
X8, 28, 48, 68, 88	Start confirmation signal	Y18, 38, 58, 78, 98	JOG reverse request signal
X9, 29, 49, 69, 89	Auxiliary code set flag	Y19, 39, 59, 79, 99	Auxiliary code set flag OFF signal

2) "X" Input Signal Specifications (Positioning Module → CPU)

In LOCAL mode, the "X" input signals other than "positioning module ready signal" are available for the CPU. The input address of the signal in parentheses expresses the input allocation when a 2-axis module is installed in the slot 0 position.

■ Positioning module ready signal (X0)

The "positioning module ready signal" turns ON when the positioning module becomes ready to run after turning ON the "request-to-run signal" in RUN mode. The "positioning module ready signal" turns OFF when the "request-to-run signal" is turned OFF or when an error occurs. The positioning module can be controlled by the CPU while the "positioning module ready signal" is in the ON state.



■ Error signal (X1)

The "error signal" turns ON when an error occurs in the positioning module F-type. It turns OFF when error clear operation is performed after the cause of the error is removed.

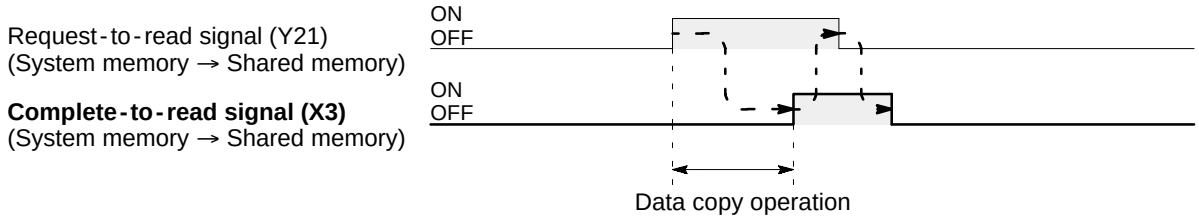
- Error clear operation from CPU:
  Turn OFF the "request-to-run signal" and set "0" to the error code area in the shared memory executing the **F151 (WRT)**/**P151 (PWRT)** instruction. Then, turn ON the "request-to-run signal" again.
- Error clear operation from the teaching unit II:
  Press the MEMORY CLR / CLEAR key.

■ RUN/LOCAL signal (X2)

The "RUN/LOCAL signal" is ON while the positioning module F-type is in LOCAL mode. And it is OFF while the module is in RUN mode.

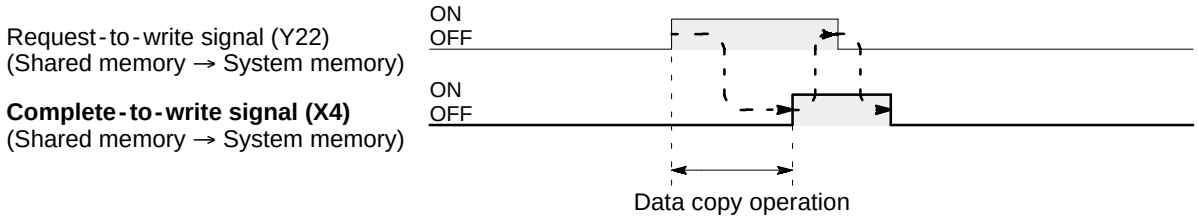
■ Complete-to-read signal (X3) (System memory → Shared memory)

The "complete-to-read signal" turns ON when the data copy operation from the system memory to the shared memory, which had been triggered by the "request-to-read signal", is completed. The "complete-to-read signal" turns OFF when the "request-to-read signal" is turned OFF.



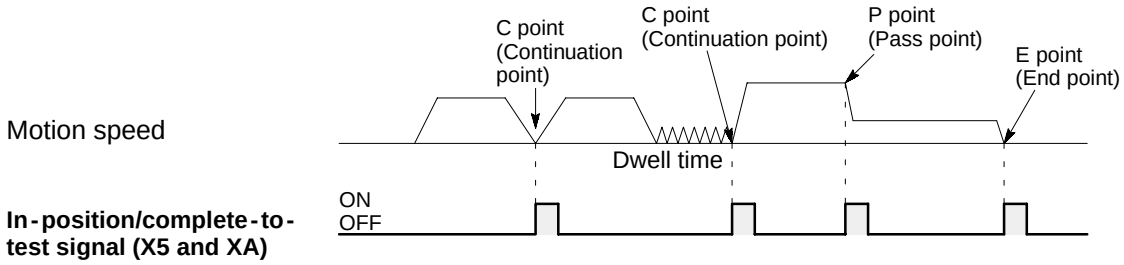
■ **Complete-to-write signal (X4)** (Shared memory → System memory)

The "complete-to-write signal" turns ON when the data copy operation from the shared memory to the system memory, which had been triggered by the "request-to-write signal" is completed. The "complete-to-write signal" turns OFF when the "request-to-write signal" is turned OFF.



■ **In-position/complete-to-test signal (X5 and XA)**

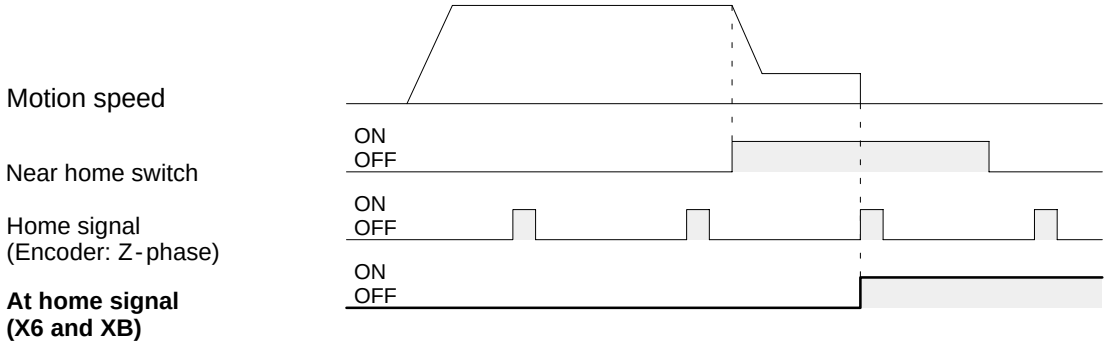
The "in-position/complete-to-test signal" turns ON when one positioning point data included the dwell time is executed or when the test check operation is performed. The duration of its ON time can be specified by the parameter in the range of 1 to 2,000 ms.



In case of the positioning point data with the "S" motion pattern, no "in-position/complete-to-test signal" turns ON. During the test check operation, the in-position/complete-to-test signal turns ON only when the operation comes to the end point (E point) positioning point data.

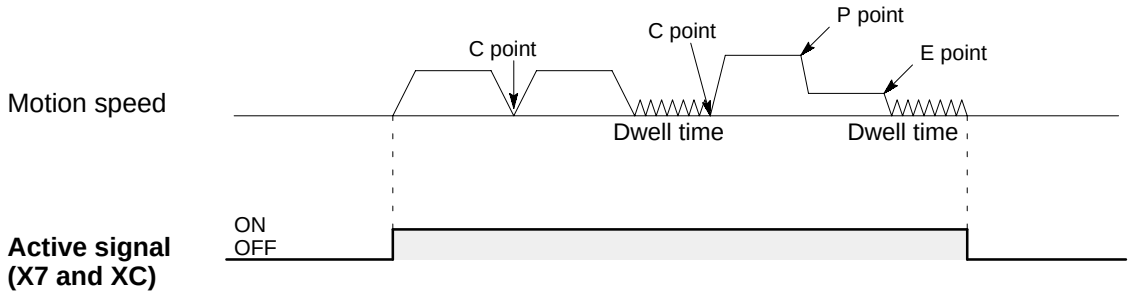
■ **At home signal (X6 and XB)**

The "at home signal" turns ON when the homing operation, triggered by the "request-to-home signal" or "software home request signal", is completed. The "at home signal" is used for both hardware and software homing operation. However, even if the module passes the software home position during hardware homing operation, it does not turn ON. In the same way, if the module passes the hardware home position during software homing operation, it does not turn ON. The "at home signal" is turned OFF when the module moves from the home position.



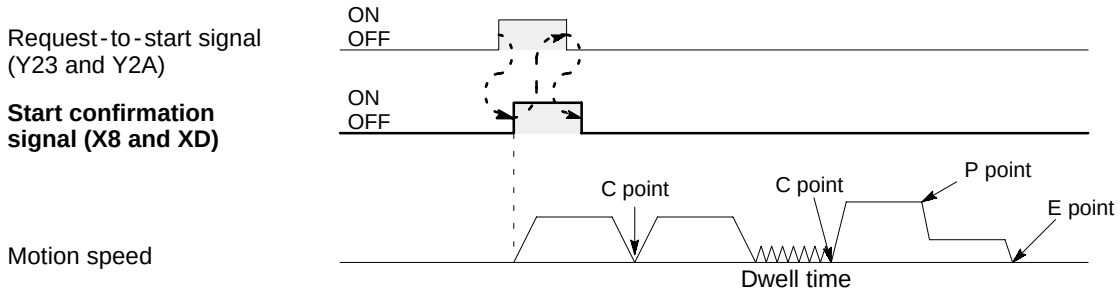
■ Active signal (X7 and XC)

The “active signal” turns ON while the pulses are output from the module during positioning operation and JOG operation including the dwell time. It is turned OFF when the pulse output operation including dwell time is finished.



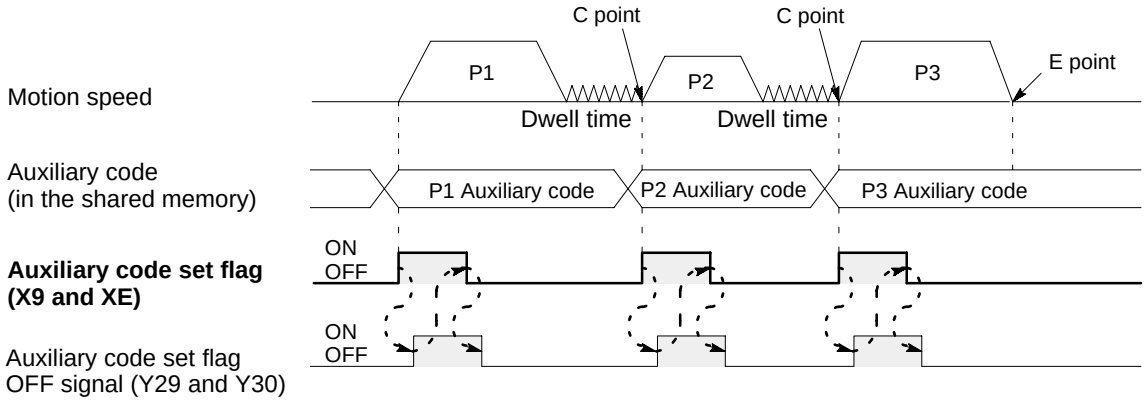
■ Start confirmation signal (X8 and XD)

The “start confirmation signal” turns ON when the module starts outputting pulses after turning ON the “request-to-start signal”, “request-to-home signal” or “software home request signal.” The “start confirmation signal” turns OFF when the “request-to-start signal” is turned OFF.



■ Auxiliary code set flag (X9 and XE)

The “auxiliary code set flag” turns ON at the time a new auxiliary code is set in the shared memory. The “auxiliary code set flag” turns OFF by turning ON the “auxiliary code set flag OFF signal.”

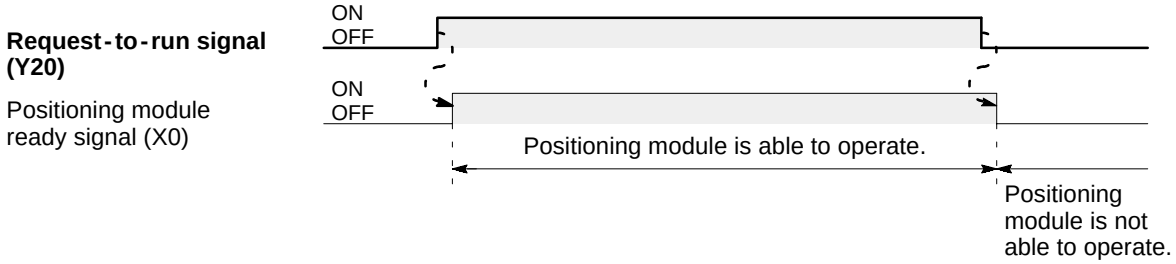


3) "Y" Output Signal Specifications (CPU → Positioning Module)

In LOCAL mode, the "auxiliary code set flag OFF signal" is available for the CPU. Be sure to note that all other output signals but for "auxiliary code set flag OFF signal" cannot be effective until the "positioning module ready signal" is turned ON by the "request-to-run signal."
The output address in the parentheses of signal expresses the output allocation when a 2-axis module is installed in the slot 0 position.

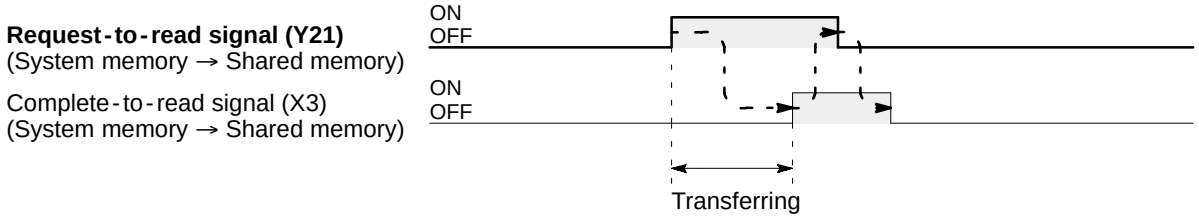
■ Request-to-run signal (Y20)

The "request-to-run signal" is used to make the module controllable with a CPU program. Turning it ON will turn the "positioning module ready signal" ON. After the "positioning module ready signal" turns ON, the module can be controlled by a CPU program. It should stay ON while you control the module with a CPU program. Without turning ON the "request-to-run signal", all other output signals apart from "auxiliary code set flag OFF signal" do not become effective. Therefore, it is also used to stop the operation of the module by turning it OFF.



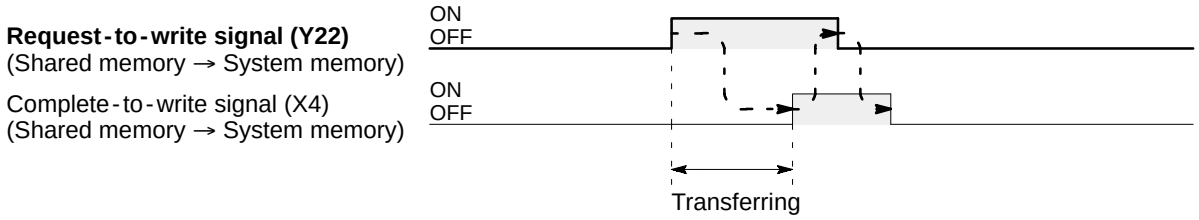
■ Request-to-read signal (Y21) (System memory → Shared memory)

The "request-to-read signal" is used to transfer the data stored in the system memory of the module into its shared memory. When the data is successfully transferred into the shared memory, the "complete-to-read signal" turns ON. Be sure to program to turn OFF the "request-to-read signal" at the leading edge of the "complete-to-read signal."



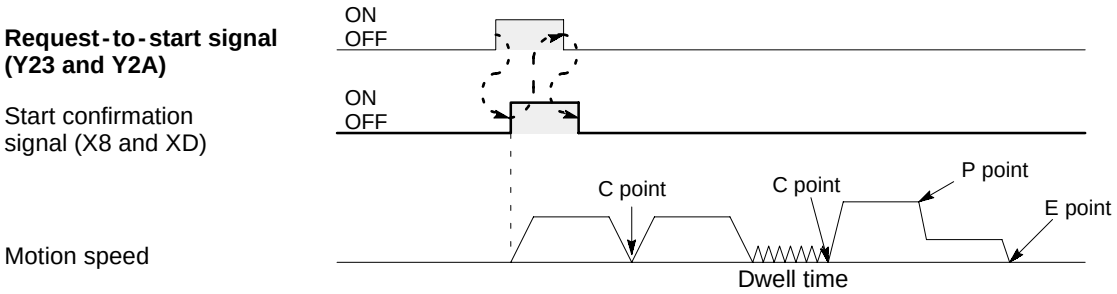
■ Request-to-write signal (Y22) (Shared memory → System memory)

The "request-to-write signal" is used to transfer the data set in the shared memory of the module into its system memory. When the data is successfully transferred into the system memory, the "complete-to-write signal" turns ON. Be sure to program to turn OFF the "request-to-write signal" at the leading edge of the "complete-to-write signal."



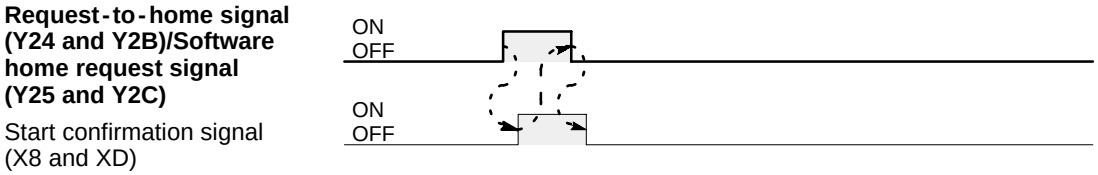
■ Request-to-start signal (Y23 and Y2A)

The “request-to-start signal” is used to start the positioning operation. When the JOB is started, the “start confirmation signal” turns ON. Be sure to program to turn OFF the “request-to-start signal” at the leading edge of the “start confirmation signal.”



■ Request-to-home signal (Y24 and Y2B)/Software home request signal (Y25 and Y2C)

The “request-to-home signal” is used to start the hardware homing operation. The “software home request signal” is used to start the software homing operation. When the hardware or software homing operation is started, the “start confirmation signal” turns ON. Be sure to program to turn OFF the “request-to-home signal” at the leading edge of the “start confirmation signal.”

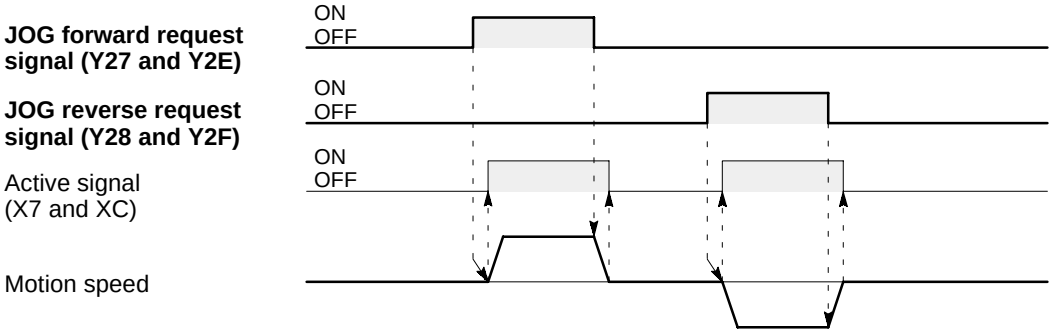


■ Request-to-stop signal (Y26 and Y2D)

The “request-to-stop signal” is used to stop the positioning operation. Be sure to program to turn OFF the “request-to-stop signal” at the trailing edge of the “active signal.” During hardware, software homing operation or JOG operation, even if the “request-to-stop signal” turns ON, these operations cannot be stopped.

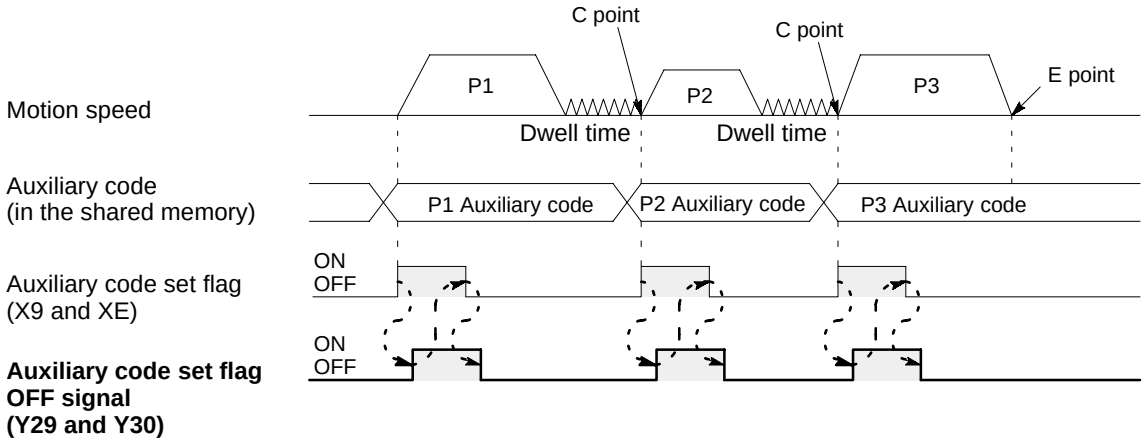
■ JOG forward request signal (Y27 and Y2E)/JOG reverse request signal (Y28 and Y2F)

The “JOG forward request signal” is used to operate the JOG operation in the positive direction. The “JOG reverse request signal” is used to operate the JOG operation in the negative direction. The JOG operation is stopped by turning OFF the “JOG forward request signal” and “JOG reverse request signal.”



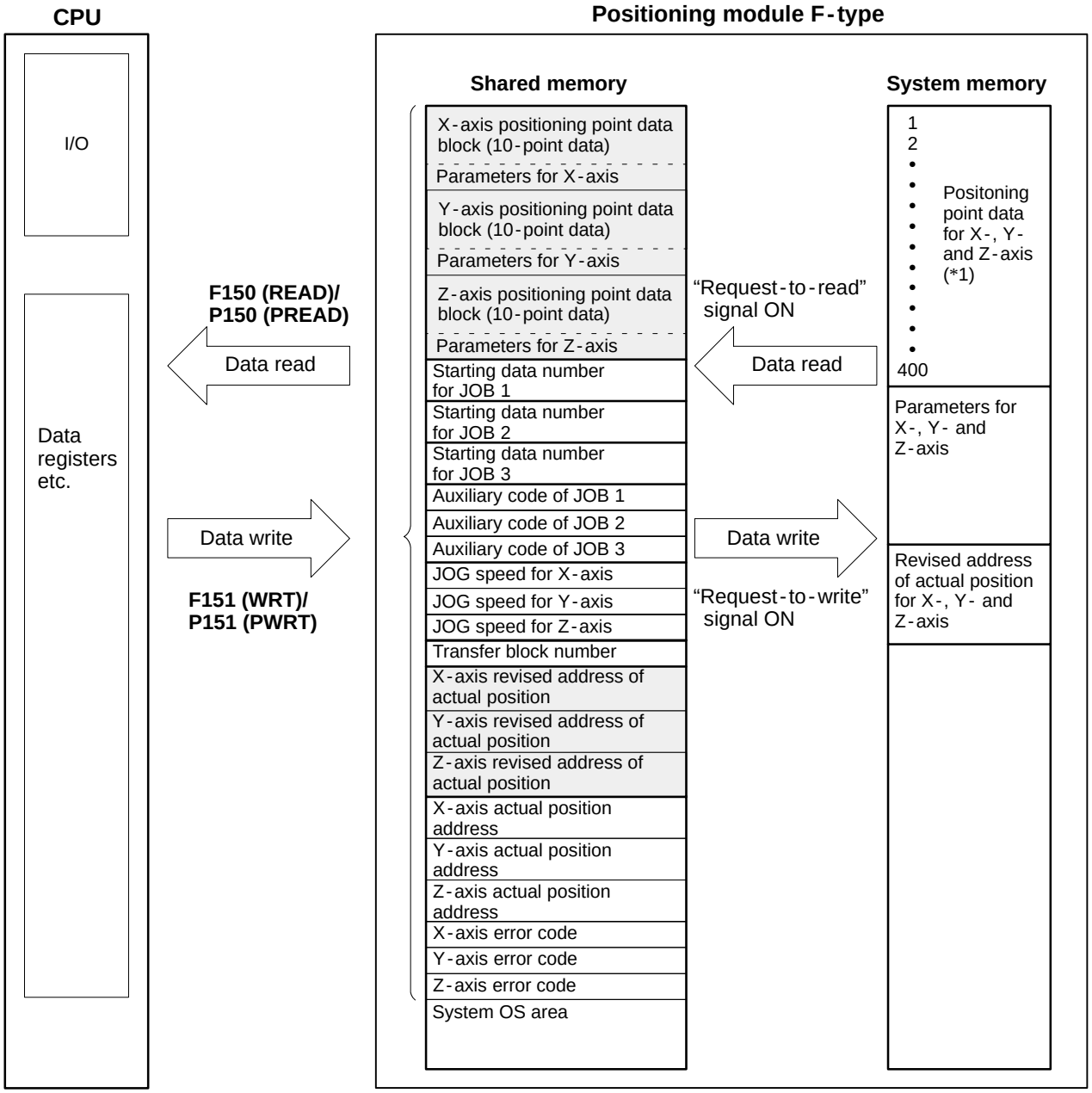
■ Auxiliary code set flag OFF signal (Y29 and Y30)

The “auxiliary code set flag OFF signal” is used to turn OFF the “auxiliary code set flag.” Be sure to program to turn OFF the “auxiliary code set flag OFF signal” at the trailing edge of the “auxiliary code set flag.”



2. Memory Handshake Communications

In order to control the positioning module with the CPU program, it is necessary to take many kinds of data into the CPU and to set many kinds of data into the module. The memory handshake communications enable the CPU to read data from and write data into the shared memory of the module by executing the **F150 (READ)**/ **P150 (PREAD)** and **F151 (WRT)**/**P151 (PWRT)** instructions in the CPU program. Combined with I/O handshake communication, the data exchange between the CPU and the module is performed as shown in the figure below.



Note:

- (*1): The positioning points "410 points (system memory: 400 points + shared memory: 10 points)" are available, if the system ROM version SV 2.1 or later is used.

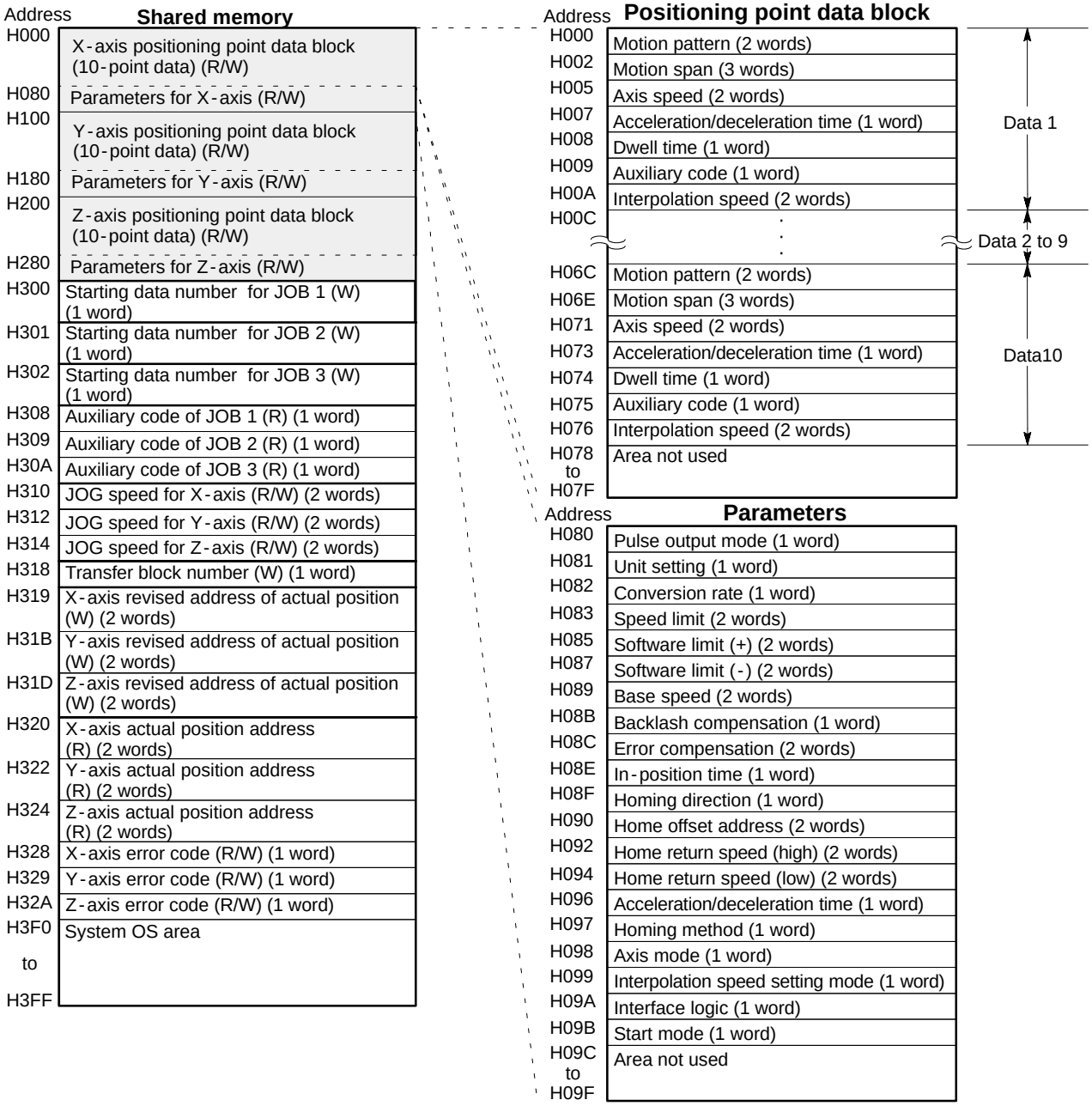
Notes:

- The positioning module F-type is controlled using the data in the system memory and shared memory. However, some areas of the shared memory are used for the tentative buffer for data exchange between CPU and system memory as:
  - positioning point data for each axis (shaded area)
  - parameters for each axis (shaded area)
  - revised address of actual position for each axis (shaded area)

  These areas in the shared memory are used as buffer for exchanging data between CPU and system memory. Their data exchange are controlled by turning ON or OFF the "request-to-read" and "request-to-write" signals with setting the specified transfer block number.
- Be sure not to access the system OS area of the shared memory using the **F151 (WRT)/P151 (PWRT)** instructions.

1) Shared Memory Overview

In the shared memory of the positioning module, addresses are allocated in word units using the hexadecimal numbers starting from H000 to H3FF and each word of the module has its own characteristics as follows.



Notes:

- The symbols “R” and “W” in the blanks indicate the characteristics of each area.
  - (R): The CPU can only read the data in the area by executing the **F150 (READ)**/**P150 (PREAD)** instructions.
  - (W): The CPU can only write the data to the area by executing the **F151 (WRT)**/**P151 (PWRT)** instructions.
  - (R/W): The CPU can read and write the data by executing the **F150 (READ)**/**P150 (PREAD)** and **F151 (WRT)**/**P151 (PWRT)** instructions.
- The communication between the shared memory and the system memory is performed by turning ON and OFF the “request-to-read” and the “request-to-write” signals. During active condition of the module, the data cannot be exchanged between the shared memory and the system memory.
- The type of data transferred to or from the system memory is controlled by the transfer block number setting in the shared memory. For details about the transfer block number specifications, refer to page 89, “2) Specifications of the Shared Memory.”
- Since some data handled in the positioning module have unique numbering system, it is necessary to use a special technique for writing data to the module and for judging data read from the module using a CPU program. For details, refer to page 257, “9-6. Handling Method for Unique One-word and Two-word Data Formats.”

2) Specifications of the Shared Memory

When controlling the positioning module with a CPU program, it is necessary to write data to and to read data from the shared memory according to the specifications for each area. In this section, the specifications for each data area are explained.

■ Parameters area in the shared memory (read and write operation available)

Address			Parameter item	Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis			
H080	**H180**	**H280**	Pulse output mode	Pulse output method for control the field device using output terminals	K0: pulse train and sign K1: CW and CCW (Decimal constant)
H081	**H181**	**H281**	Unit setting	Type of unit used for parameters and point data setting	K0: pulse K1: mm K2: inch K3: degree (Decimal constant)
H082	**H182**	**H282**	Conversion rate	Rate for converting pulse into the unit set in the unit setting parameter.	1: in pulse unit 0.0001 to 0.1: in mm unit 0.00001 to 0.001: in inch or degree unit (Unique one-word data format)
H083	**H183**	**H283**	Speed limit	Maximum speed available for the control	$0 \leqq \frac{\text{Speed limit}}{\text{Conversion rate}} \leqq 400000$ (Unique two-word data format)
H084	**H184**	**H284**			
H085	**H185**	**H285**	Software limit (+)	Positive limit address inside the hardware limit switch	$0 \leqq \frac{\text{Software limit (+)}}{\text{Conversion rate}} \leqq 8388607$ (Unique two-word data format)
H086	**H186**	**H286**			
H087	**H187**	**H287**	Software limit (-)	Negative limit address inside the hardware limit switch	$-8388607 \leqq \frac{\text{Software limit (-)}}{\text{Conversion rate}} \leqq 0$ (Unique two-word data format)
H088	**H188**	**H288**			
H089	**H189**	**H289**	Base speed	Base speed used for starting and stopping stage of the stepper motor	$0 \leqq \text{Base speed} \leqq \text{Axis speed or Interpolation speed}$ (Unique two-word data format)
H08A	**H18A**	**H28A**			
H08B	**H18B**	**H28B**	Backlash compensation	Value for correcting backlash caused by the gap of ball screw and speed reducer	$0 \leqq \frac{\text{Backlash compensation}}{\text{Conversion rate}} \leqq 255$ (Unique one-word data format)
H08C	**H18C**	**H28C**	Error compensation	Value for correcting error caused by the indivisible rate setting or by pitch error in the mm, inch or degree unit selection	0: in pulse unit ±1.0000: in mm unit ±1.00000: in inch or degree unit (Unique two-word data format)
H08D	**H18D**	**H28D**			

Address			Parameter item	Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis			
H08E	**H18E**	**H28E**	In-position time	ON duration of the in-position signal in ms units	K1 to K2000 (Decimal constant)
H08F	**H18F**	**H28F**	Homing direction	Direction of homing and software homing operation	K0: Positive direction K1: Negative direction (Decimal constant)
H090	**H190**	**H290**	Home offset	The address of the hardware home from the software home position	Software limit (-) ≦ Home offset address ≦ Software limit (+) (Unique two-word data format)
H091	**H191**	**H291**			
H092	**H192**	**H292**	Home return speed (high)	Higher speed used for homing operation (optionally used for software homing and JOG operation)	Home return speed (low) ≦ Home return speed (high) ≦ Speed limit (Unique two-word data format)
H093	**H193**	**H293**			
H094	**H194**	**H294**	Home return speed (low)	Lower speed used for homing operation (optionally used for JOG operation)	
H095	**H195**	**H295**			
H096	**H196**	**H296**	Acceleration/ deceleration time	Acceleration and deceleration time for starting and stopping of homing and JOG operation in ms units	K64 to K4999 (Decimal constant)
H097	**Not used**		Homing method	Control method for homing operation	K0: Near home ON K1: Near home OFF K2: Near home ON/OFF K3: Limit search (*1) (Decimal constant)
H098	**Not used**		Axis mode	Axis mode for selecting independent or simultaneous mode	K0: Independent K1: Simultaneous 2-axis K2: Simultaneous 3-axis (Decimal constant)
H099	**Not used**		Interpolation speed setting mode	Speed mode selection for the interpolation operation	K0: Long-axis speed K1: Tracking speed (Decimal constant)
H09A	**Not used**		Interface logic	Interface logic for selecting the field device specifications	Set 0 or 1 to each bit from bit position 0 to 5. Bit positions 6 and higher are ignored. (Bit setting or hexadecimal constant)
H09B	**Not used**		Start mode	Starting method for executing the positioning point data	K0: Immediate normal-start K1: Normal-start after homing K2: Quick-start K3: Test for quick-start (Decimal constant)

Notes:

- (*1): The limit search method is available for the FP-C positioning board only.
- For details about the parameters, refer to “CHAPTER 5. SETTING PARAMETERS.”
- For details about the handling method for unique one-word and two-word data formats, refer to page 257, “9-6. Handling Method for Unique One-word and Two-word Data Formats.”

■ **Positioning point data area in the shared memory (read and write operation available)**

Data number	Address			Positioning point data item	Setting item	Setting range (Transferring format)
	X-axis	Y-axis	Z-axis			
Data 1	**H000**	**H100**	**H200**	Motion pattern	Positioning point data number for next execution	K1 to K400 or K999 (Decimal constant)
	H001	**H101**	**H201**		Motion pattern code using ASCII code	C: H43, P: H50, S: H53, E: H45 (ASCII HEX code)
	H002	**H102**	**H202**	Motion span	Motion span from the software home (absolute address) or pre-executed position (incremental span)	Software limit (-) ≦ Motion span ≦ Software limit (+) (Unique two-word data format)
	H003	**H103**	**H203**			
	H004	**H104**	**H204**		Addressing method selection code using ASCII code	A: H41, I: H49 (ASCII HEX code)
	H005	**H105**	**H205**	Axis speed	Axis speed used for the independent control mode	Base speed ≦ Axis speed ≦ Speed limit (Unique two-word data format)
	H006	**H106**	**H206**			
	H007	**H107**	**H207**	Acceleration/ deceleration time	Acceleration and deceleration time for starting and stopping in ms units.	K64 to K4999 (*1) (Decimal constant)
	H008	**H108**	**H208**	Dwell time	Time lag from the end of pulse output to the in-position/complete-to-test signal ON in 10 ms units	K0 to K499 (Decimal constant)
	H009	**H109**	**H209**	Auxiliary code	Optional code for recognizing the executing status using the combination of ASCII code and number	Higher byte (mode setting) A: H41, W: H57 (ASCII HEX code) Lower byte (number code) K0 to K255 (Decimal constant)
	H00A	**Not used**		Interpolation speed	Interpolation speed for simultaneous control mode	Base speed ≦ Interpolation speed ≦ Speed limit (Unique two-word data format)
	H00B	**Not used**				
Data 2	**H00C**	**H10C**	**H20C**	Motion pattern	Refer to the descriptions for data 1.	
	H00D	**H10D**	**H20D**			
	H00E	**H10E**	**H20E**	Motion span		
	H00F	**H10F**	**H20F**			
	H010	**H110**	**H210**			
	H011	**H111**	**H211**	Axis speed		
	H012	**H112**	**H212**			
	H013	**H113**	**H213**	Acceleration/ deceleration time		
	H014	**H114**	**H214**	Dwell time		
	H015	**H115**	**H215**	Auxiliary code		
	H016	**Not used**		Interpolation speed		
	H017	**Not used**				

Note:

- (*1): Positioning modules F-type with system ROM version SV 2.0 or later can be set in the range of K0 to K4999. However, settings in the range of K0 to K63 cannot correctly set.

Data number	Address			Positioning point data item	Setting item	Setting range (Transferring format)
	X-axis	Y-axis	Z-axis			
Data 3	**H018**	**H118**	**H218**	Motion pattern	Refer to the descriptions for data 1.	
	H019	**H119**	**H219**			
	H01A	**H11A**	**H21A**	Motion span		
	H01B	**H11B**	**H21B**			
	H01C	**H11C**	**H21C**			
	H01D	**H11D**	**H21D**	Axis speed		
	H01E	**H11E**	**H21E**			
	H01F	**H11F**	**H21F**	Acceleration/ deceleration time		
	H020	**H120**	**H220**	Dwell time		
	H021	**H121**	**H221**	Auxiliary code		
	H022	**Not used**		Interpolation speed		
	H023	**Not used**				
Data 4	**H024**	**H124**	**H224**	Motion pattern	Refer to the descriptions for data 1.	
	H025	**H125**	**H225**			
	H026	**H126**	**H226**	Motion span		
	H027	**H127**	**H227**			
	H028	**H128**	**H228**			
	H029	**H129**	**H229**	Axis speed		
	H02A	**H12A**	**H22A**			
	H02B	**H12B**	**H22B**	Acceleration/ deceleration time		
	H02C	**H12C**	**H22C**	Dwell time		
	H02D	**H12D**	**H22D**	Auxiliary code		
	H02E	**Not used**		Interpolation speed		
	H02F	**Not used**				
Data 5	**H030**	**H130**	**H230**	Motion pattern	Refer to the descriptions for data 1.	
	H031	**H131**	**H231**			
	H032	**H132**	**H232**	Motion span		
	H033	**H133**	**H233**			
	H034	**H134**	**H234**			
	H035	**H135**	**H235**	Axis speed		
	H036	**H136**	**H236**			
	H037	**H137**	**H237**	Acceleration/ deceleration time		
	H038	**H138**	**H238**	Dwell time		
	H039	**H139**	**H239**	Auxiliary code		
	H03A	**Not used**		Interpolation speed		
	H03B	**Not used**				

Data number	Address			Positioning point data item	Setting item	Setting range (Transferring format)
	X-axis	Y-axis	Z-axis			
Data 6	**H03C**	**H13C**	**H23C**	Motion pattern	Refer to the descriptions for data 1.	
	H03D	**H13D**	**H23D**			
	H03E	**H13E**	**H23E**	Motion span		
	H03F	**H13F**	**H23F**			
	H040	**H140**	**H240**			
	H041	**H141**	**H241**	Axis speed		
	H042	**H142**	**H242**			
	H043	**H143**	**H243**	Acceleration/ deceleration time		
	H044	**H144**	**H244**	Dwell time		
	H045	**H145**	**H245**	Auxiliary code		
	H046	**Not used**		Interpolation speed		
	H047	**Not used**				
Data 7	**H048**	**H148**	**H248**	Motion pattern	Refer to the descriptions for data 1.	
	H049	**H149**	**H249**			
	H04A	**H14A**	**H24A**	Motion span		
	H04B	**H14B**	**H24B**			
	H04C	**H14C**	**H24C**			
	H04D	**H14D**	**H24D**	Axis speed		
	H04E	**H14E**	**H24E**			
	H04F	**H14F**	**H24F**	Acceleration/ deceleration time		
	H050	**H150**	**H250**	Dwell time		
	H051	**H151**	**H251**	Auxiliary code		
	H052	**Not used**		Interpolation speed		
	H053	**Not used**				
Data 8	**H054**	**H154**	**H254**	Motion pattern	Refer to the descriptions for data 1.	
	H055	**H155**	**H255**			
	H056	**H156**	**H256**	Motion span		
	H057	**H157**	**H257**			
	H058	**H158**	**H258**			
	H059	**H159**	**H259**	Axis speed		
	H05A	**H15A**	**H25A**			
	H05B	**H15B**	**H25B**	Acceleration/ deceleration time		
	H05C	**H15C**	**H25C**	Dwell time		
	H05D	**H15D**	**H25D**	Auxiliary code		
	H05E	**Not used**		Interpolation speed		
	H05F	**Not used**				

Data number	Address			Positioning point data item	Setting item	Setting range (Transferring format)
	X-axis	Y-axis	Z-axis			
Data 9	**H060**	**H160**	**H260**	Motion pattern	Refer to the descriptions for data 1.	
	H061	**H161**	**H261**			
	H062	**H162**	**H262**	Motion span		
	H063	**H163**	**H263**			
	H064	**H164**	**H264**			
	H065	**H165**	**H265**	Axis speed		
	H066	**H166**	**H266**			
	H067	**H167**	**H267**	Acceleration/ deceleration time		
	H068	**H168**	**H268**	Dwell time		
	H069	**H169**	**H269**	Auxiliary code		
	H06A	**Not used**		Interpolation speed		
	H06B	**Not used**				
Data 10	**H06C**	**H16C**	**H26C**	Motion pattern	Refer to the descriptions for data 1.	
	H06D	**H16D**	**H26D**			
	H06E	**H16E**	**H26E**	Motion span		
	H06F	**H16F**	**H26F**			
	H070	**H170**	**H270**			
	H071	**H171**	**H271**	Axis speed		
	H072	**H172**	**H272**			
	H073	**H173**	**H273**	Acceleration/ deceleration time		
	H074	**H174**	**H274**	Dwell time		
	H075	**H175**	**H275**	Auxiliary code		
	H076	**Not used**		Interpolation speed		
	H077	**Not used**				

Notes:

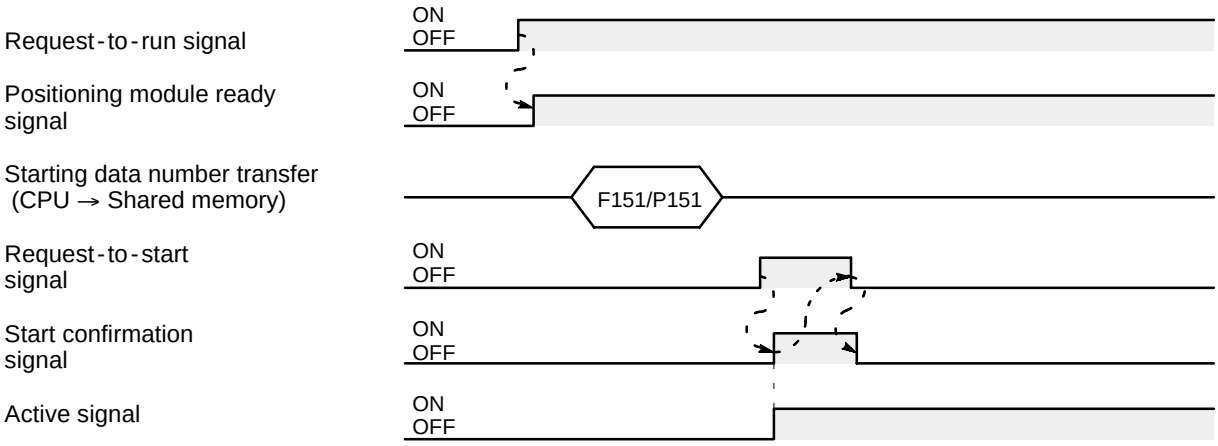
- For details about the positioning point data, refer to “CHAPTER 6. SETTING POSITIONING POINT DATA.”
- For details about the handling method for unique one-word and two-word data formats, refer to page 257, “9-6. Handling Method for Unique One-word and Two-word Data Formats.”

■ **Starting positioning point data number area in the shared memory (write operation only)**

The positioning module F-type has a function to select the starting positioning point data. By setting the starting positioning point data number for each JOB before turning ON the "request-to-start" signal, you can start the motion control from the specified positioning point data.

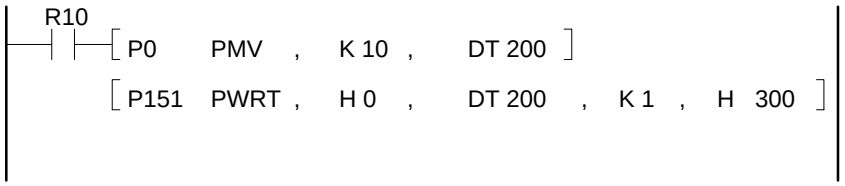
Address in shared memory			Setting item	Setting range (Transferring format)
JOB1	JOB2	JOB3		
H300	H301	H302	Starting positioning point data number used for motion control	K1 to K400 (Decimal constant)

[Time chart]



[Program example]

For setting the starting from positioning point data number 10 (slot 0 position)



Note:

- For details about the positioning operation start program, refer to page 197, "7-4. Positioning Operation Start Program."

■ Auxiliary code area in the shared memory (read operation only)

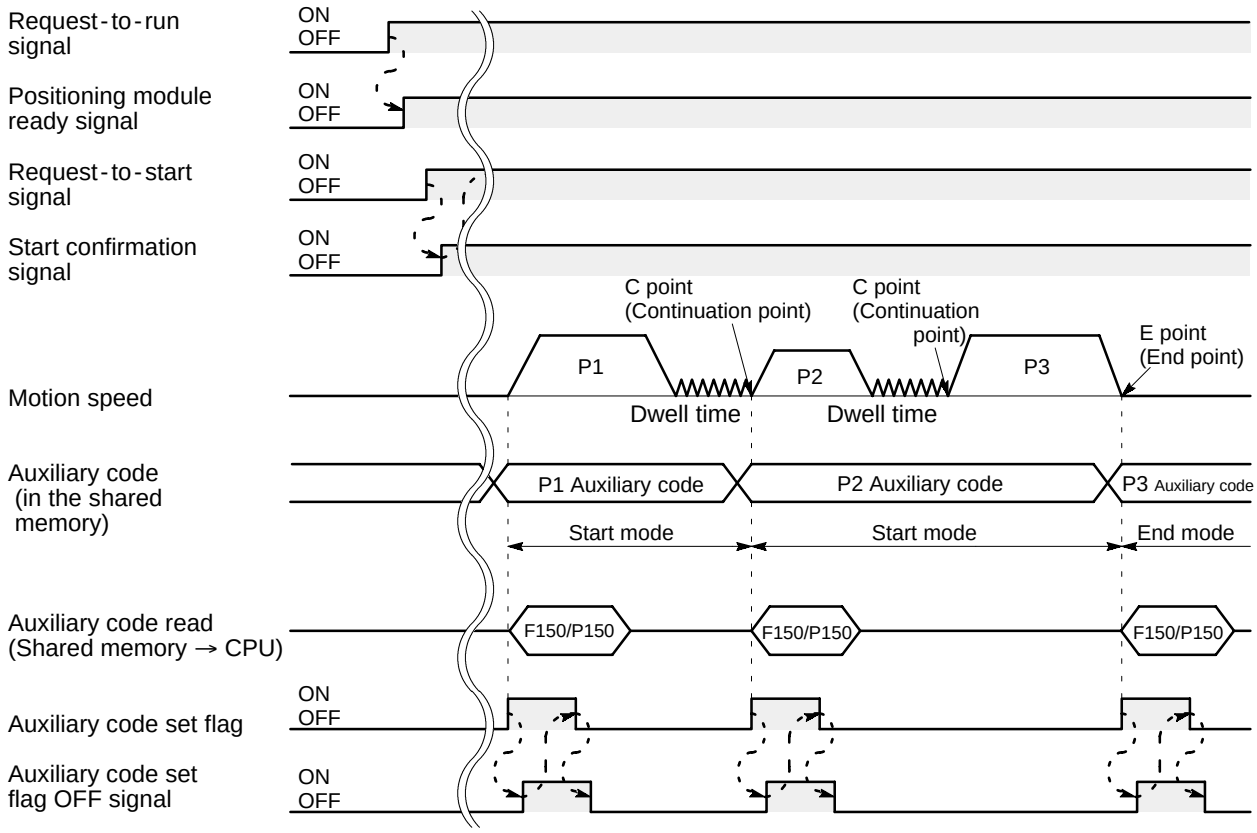
The positioning module F-type has a function to set optional codes for some positioning point data in order to inform the CPU about which positioning point data it is executing. The preset code is set in the shared memory as follows:

- in the start mode: when execution of the specified positioning point data is started
- in the end mode: after the specified positioning operation is finished

Address in shared memory			Read-out item	Data range (Transferring format)
JOB1	JOB2	JOB3		
H308	H309	H30A	Optional code set for positioning point data number	K0 to K255 (Judging the data in decimal format is recommended.)

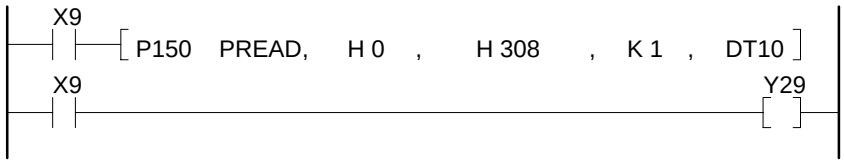
Each time a new auxiliary code is set in the area, the "auxiliary code set flag" turns ON. By transferring the data using this flag, you can take the code into the CPU memory.

[Time chart]



[Program example]

For reading a auxiliary code for JOB1 each time a new auxiliary code is set in the shared memory (slot 0 position)



Note:

· For details about the auxiliary code set and read programs, refer to page 204, "7-8. Auxiliary Code Read and Process Program."

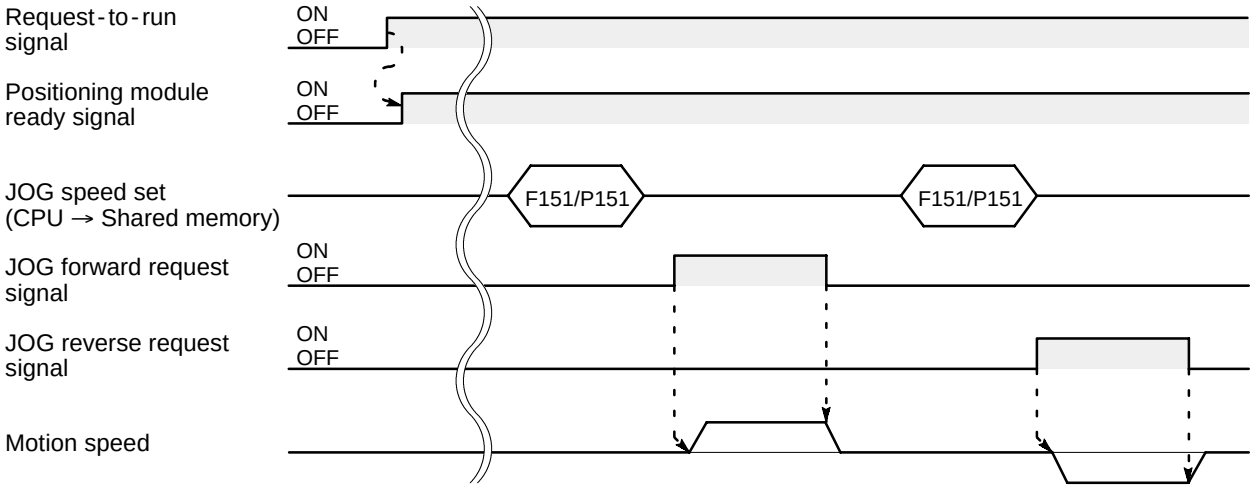
■ **JOG speed area in the shared memory (read and write operation available)**

The positioning module F-type has a function to output pulses for setup or trial operation purposes. The speed for the JOG operation is controlled by the speed set in the area.

Address in shared memory			Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis		
H310	H312	H314	Speed for the JOG operation	0 < JOG speed ≦ Speed limit (Unique two-word data format)
H311	H313	H315		

When the power is turned ON, the home return speed (low) in the parameter is set here.

[Time chart]



[Program example]

Usually the JOG speed data is expressed using two words.

$A \times 10^{-n}$

Address	H311								H310							
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16			
Data																
	15 • • 12				11 • • 8				7 • • 4				3 • • 0			
	n				A											

- When setting 1000, the data is handled as 1000×10^{-0}.

```
R10
 ┤ ├─[ P1    PDMV ,  K 1000 ,   DT 210 ]
   [ P6    PDGT ,  K 0    ,   H  210 ,  DT 211 ]
   [ P151  PWRT ,  H 0    ,   DT 210 ,  K 2 ,  H 310 ]
```

(A: K 1000, n: K 0)

- When reading JOG speed of X-axis (slot 0 position)

```
R20
 ┤ ├─[ P150  PREAD,  H 0  ,   H 310 ,  K 2 ,  DT 220 ]
```

Note:

· For details about the JOG operation, JOG speed set and JOG speed change programs, refer to page 200, "7-6. JOG Operation Program."

If you separate “n” and “A” parts for easy monitoring, use the following methods.
(n to DT5, A to DT6 and DT7):

```
R20
 |  |
 |  |--[ P1   PDMV , DT 220   , DT 6   ]
 |  |--[ P0   PMV  , H    0   , DT 5   ]
 |  |--[ P6   PDGT , DT 221   , H 012  , DT 5 ]
 |  |--[ P6   PDGT , H    0   , H 210  , DT 7 ]
```

■ **Transfer block number area in the shared memory (write operation only)**

In the shared memory, some areas are used for the tentative buffer for data exchange between the CPU and system memory as follows:

- positioning point data for each axis
- parameters for each axis
- revised address of actual position for each axis

The transfer block number area is used for specifying the data exchanged between the shared memory and the system memory when turning the “request-to-read” and “request-to-write” signals ON and OFF.

Address in shared memory	Setting item	Setting range (Transferring format)
H318	Code for selecting the data exchanged between the shared memory and the system memory	K0 to K47 (Decimal constant)

Specifications of transfer block number

Transfer block number	Data block selected	Action from CPU
0	Parameters for all axes	Read and write
1	Positioning point data block from number 1 to 10 for all axes	Read and write
2	Positioning point data block from number 11 to 20 for all axes	Read and write
3	Positioning point data block from number 21 to 30 for all axes	Read and write
⋮	⋮	⋮
39	Positioning point data block from number 381 to 390 for all axes	Read and write
40	Positioning point data block from number 391 to 400 for all axes	Read and write
41	Revised address of actual position for X-axis	Write only
42	Revised address of actual position for Y-axis	Write only
43	Revised address of actual position for X- and Y-axis	Write only
44	Revised address of actual position for Z-axis	Write only
45	Revised address of actual position for X- and Z-axis	Write only
46	Revised address of actual position for Y- and Z-axis	Write only
47	Revised address of actual position for X-, Y- and Z-axis	Write only

Note:

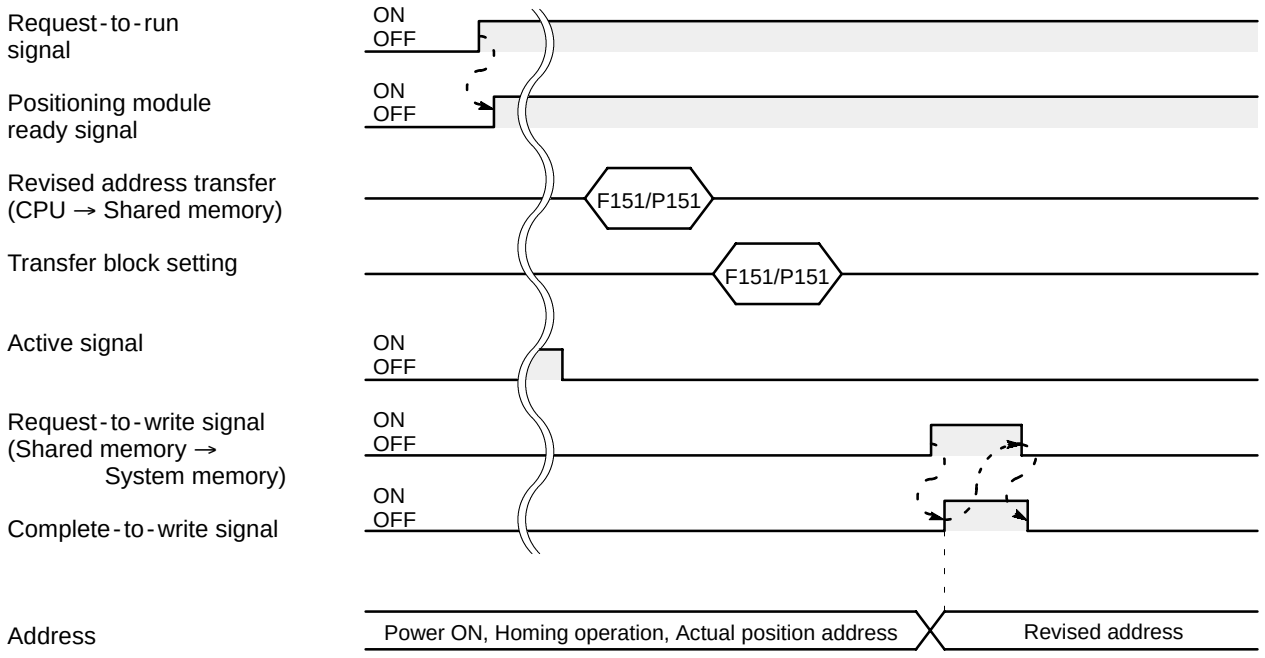
· During pulse output by the module (active state), it is impossible to exchange data between the shared memory and the system memory. Execute the operation after confirming the “in-position/complete-to-test signal.”

■ **Revised address of actual position area in the shared memory (write operation only)**

The positioning module F-type has a function to change the address for the actual position. The revised address is used temporarily until the next homing or software homing operation. The revised address set in the shared memory becomes effective only after transferring it into the system memory by turning ON the request-to-write signal.

Address in shared memory			Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis		
H319	H31B	H31D	New address for the actual position for temporary use	Software limit (-) ≦ Revised address ≦ Software limit (+) (Unique two-word data format)
H31A	H31C	H31E		

[Time chart]



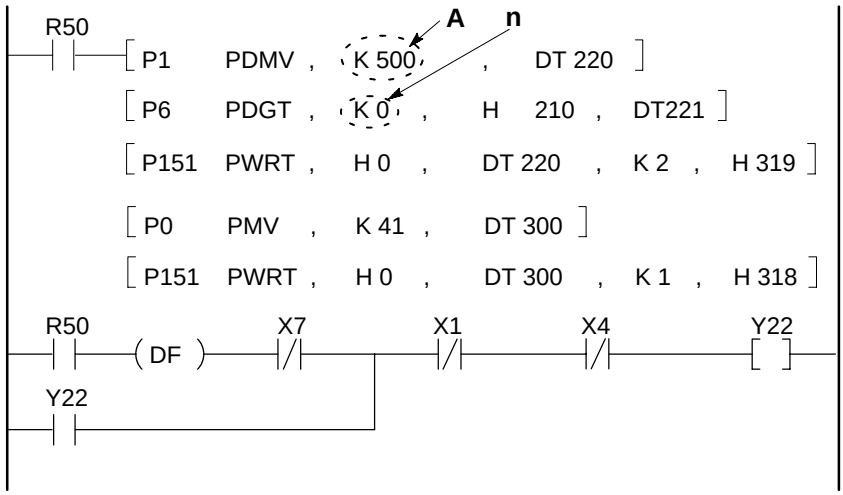
[Program example]

For changing the current position address for X-axis to 500 (slot 0 position)
When writing the unique two-word data from CPU to the shared memory, use the following formula:

$A \times 10^{-n}$

Address	H31A								H319							
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16			
Data																
	n				A											

When setting 500, 500×10^{-0} (A = 500, n = 0)



Note:

· For details about the actual position change programs, refer to page 202, “7-7. Actual Position Read and Change Programs.”

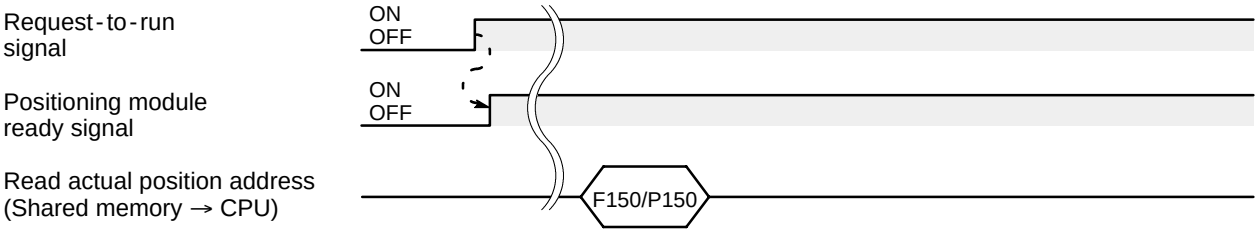
■ Actual position address area in the shared memory (read operation only)

The positioning module F-type has function to take actual position address into the CPU. The actual position address can be taken into the CPU by executing **F150 (READ)/P150 (PREAD)** instructions.

Address in shared memory			Read-out item	Data range (Transferring format)
X-axis	Y-axis	Z-axis		
H320	H322	H324	Actual position address for taking it into the CPU	Software limit (-) ≦ Actual position ≦ Software limit (+) (Unique two-word data format)
H321	H323	H325		

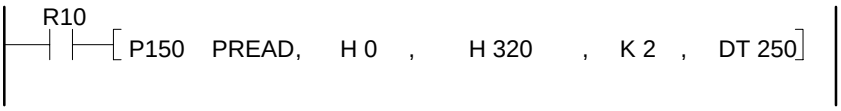
When the power is turned ON, the error occurs and K0 is set here.

[Time chart]



[Program example]

For reading the actual position of X-axis (slot 0 position)



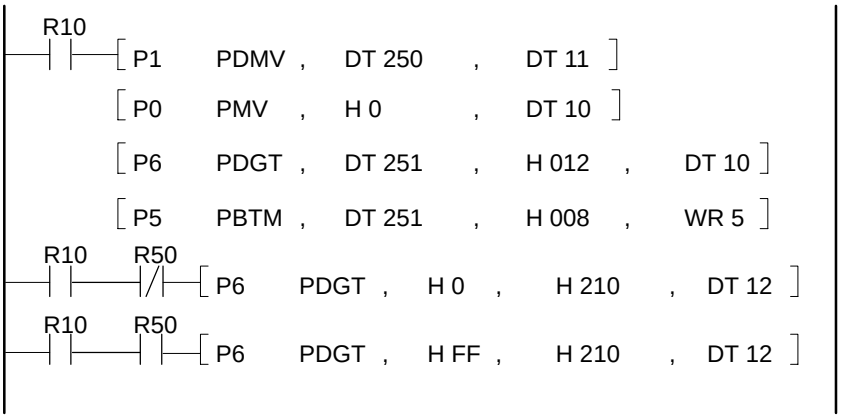
Usually the address data is expressed using two words.

$A \times 10^{-n}$

Address	H321								H320							
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16			
	15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data																

n A

If you separate “n” and “A” parts for easy monitoring, use the following methods.
(n to DT10, A to DT11 and DT12)



Note:

- For details about the actual position read programs, refer to page 202, “7-7. Actual Position Read and Change Programs.”

■ Error code area in the shared memory (read and write operation available)

The positioning module F-type has a self-diagnostic function. In this area, the error code is stored when an error occurs in hexadecimal code. After removing the cause of the error, setting “0” to this area can clear the error condition.
The error signal warns of the occurrence of an error.

Address in shared memory			Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis		
H328	H329	H32A	When used for read-out, an error code for checking the module. When used for error clearing, H0 should be set.	For read-out: hexadecimal error code For error clearing: H0

Note:

- For details about the error codes, refer to page 205, “7-9. Error Code Read and Error Clear Programs” and page 226, “8-3. Error Codes.”

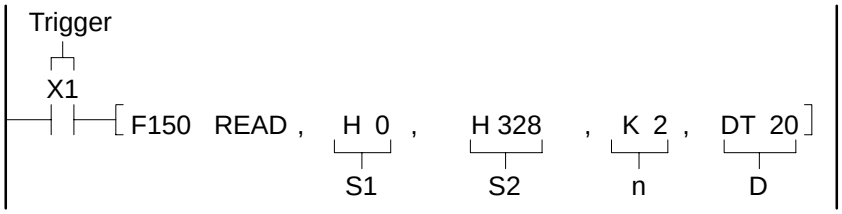
3) Explanation of the F150 (READ)/P150 (PREAD) and F151 (WRT)/P151 (PWRT) Instructions

The **F150 (READ)**/**P150 (PREAD)** and **F151 (WRT)**/**P151 (PWRT)** instructions are used to exchange data between the CPU and the shared memory of the intelligent modules.
The **F150 (READ)**/**P150 (PREAD)** instructions are used for reading data from the shared memory in a positioning module F-type and the **F151 (WRT)**/**P151 (PWRT)** instructions are used for writing the data to the shared memory in a positioning module.
Here, the outline of the instructions are explained using the examples for accessing the shared memory of the positioning module F-type.

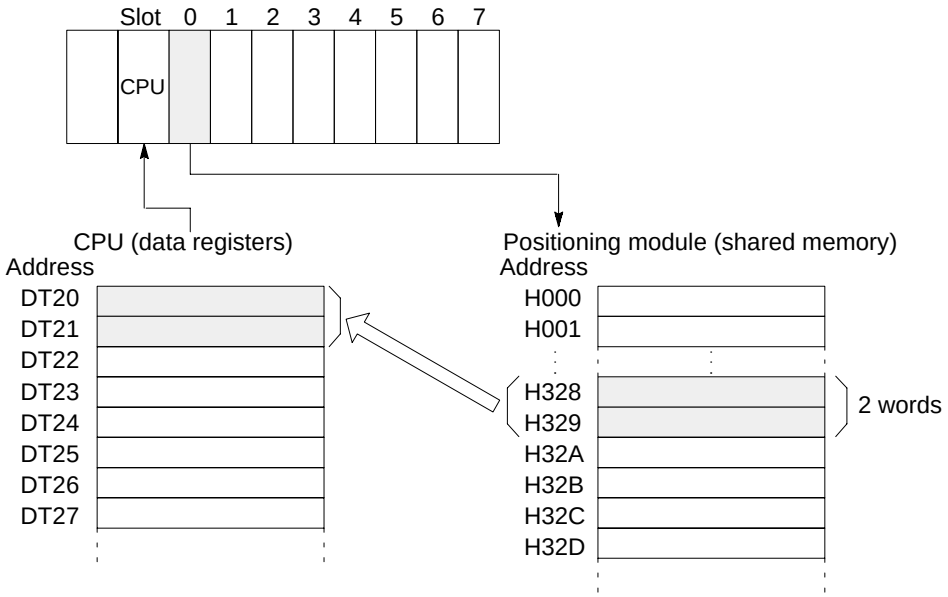
■ **F150 (READ)/P150 (PREAD) instructions:**

The instructions enable the CPU to read data from the shared memory in an intelligent module.
[The **P150 (PREAD)** instruction is executed only when the leading edge of the trigger is detected.]

[Program example]



- **Explanation of example:**
  The CPU reads the data stored in H328 and H329 (error codes for X- and Y-axis) the shared memory of the positioning module (in slot 0 position) and stores them into the DT20 and DT21 when X1 (error signal) turns ON.

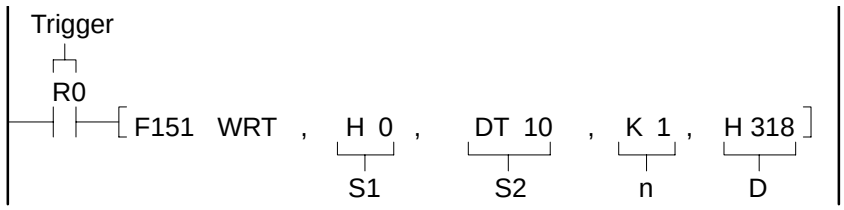


- **Explanation of S1, S2, n and D**
  - **S1**: Slot position is specified (hexadecimal or decimal constant)
  - **S2**: Starting address for the source data in the shared memory of the positioning module (hexadecimal or decimal constant)
  - **n**: Number of words for reading (hexadecimal or decimal constant)
  - **D**: Starting data address for storing data read from the shared memory (WY, WR, WL, SV, EV, DT, LD and FL)

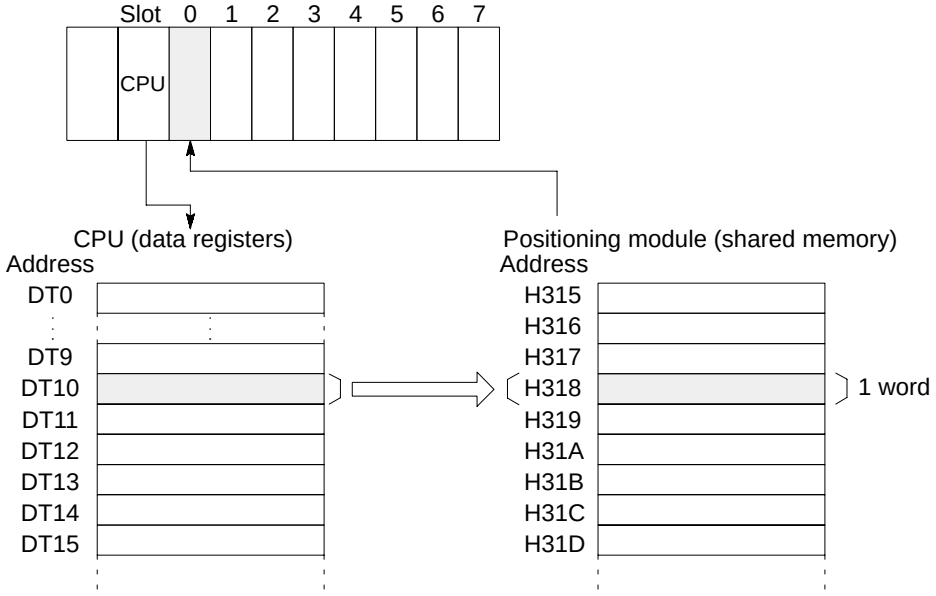
■ **F151 (WRT)/P151 (PWRT) instructions:**

These instructions enable the CPU to write data to the shared memory in an intelligent module.
[The **P150 (PREAD)** instruction is executed only when the leading edge of the trigger is detected.]

[Program example]



- **Explanation of example:**
  The CPU writes the data stored in DT10 to H318 (transfer block number area) in the shared memory of the positioning module (in slot 0 position) when R0 turns ON.



- **Explanation of S1, S2, n and D**
  - **S1**: Slot position is specified (hexadecimal or decimal constant)
  - **S2**: Starting address for the source data in the CPU
    (WX, WY, WR, WL, SV, EV, DT, LD and FL)
  - **n**: Number of words for writing (hexadecimal or decimal constant)
  - **D**: Starting address of the shared memory (destination) (hexadecimal or decimal constant)

CHAPTER 5

SETTING PARAMETERS

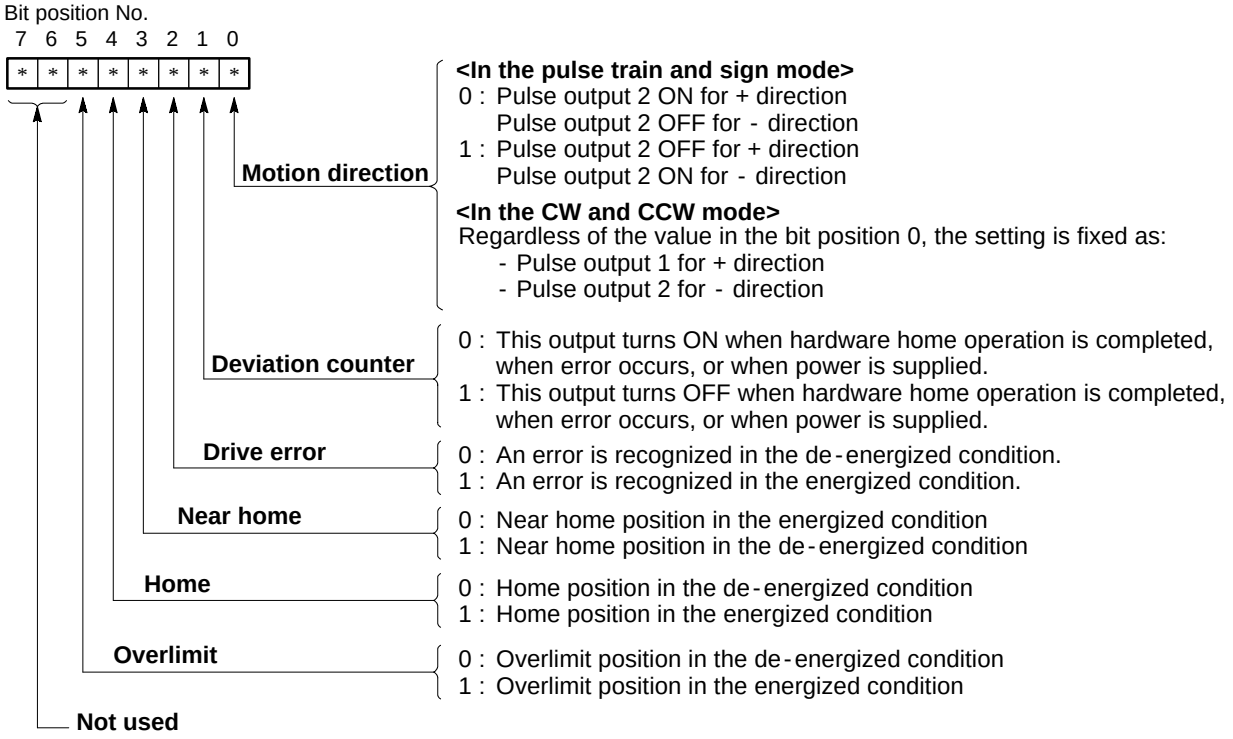
5-1. List of Parameters

The parameters are basic variables for controlling motion with the positioning module F-type. Each parameter item should be set according to the specifications of the drive and servo motor in connection and characteristics of the drive system. For details about each parameter item, refer to the explanations on the page described in the rightmost column.

Parameter item	Shared memory address			Default value	Setting range	Reference
	X-axis	Y-axis	Z-axis			
Pulse output mode (1)	H080	H180	H280	1 (CW and CCW)	0: Pulse train and sign 1: CW and CCW	Page 109
Axis mode (2)	H098	Not used		0 (Independent)	0: Independent 1: Simultaneous 2-axis 2: Simultaneous 3-axis	Page 110
Unit setting (3) (*1)	H081	H181	H281	0 (Pulse)	0: Pulse 1: mm 2: inch 3: degree	Page 112
Conversion rate (4) (*1)	H082	H182	H282	1	1: in "pulse units" 0.0001 to 0.1: in mm units 0.00001 to 0.001: in inch or degree units	Page 113
Speed limit (5) (*1)	H083 H084	H183 H184	H283 H284	400000	$0 \leqq \frac{\text{Speed limit}}{\text{Conversion rate}} \leqq 400000$	Page 114
Software limit (+) (6) (*1)	H085 H086	H185 H186	H285 H286	8388607	$0 \leqq \frac{\text{Software limit (+)}}{\text{Conversion rate}} \leqq 8388607$	Page 115
Software limit (-) (7) (*1)	H087 H088	H187 H188	H287 H288	- 8388607	$-8388607 \leqq \frac{\text{Software limit (-)}}{\text{Conversion rate}} \leqq 0$	Page 116
Base speed (8) (*1)	H089 H08A	H189 H18A	H289 H28A	0	$0 \leqq \text{Base speed} \leqq$ Axis speed or Interpolation speed	Page 117
Interpolation speed setting mode (9)	H099	Not used		1 (Tracking speed)	0: Long-axis speed 1: Tracking speed	Page 118
Backlash compensation (10) (*1)	H08B	H18B	H28B	0	$0 \leqq \frac{\text{Backlash compensation}}{\text{Conversion rate}} \leqq 255$	Page 119
Error compensation (11) (*1)	H08C H08D	H18C H18D	H28C H28D	0	0: in "pulse unit" ±1.0000: in mm unit ±1.00000: in inch or degree unit	Page 120
In-position time (12)	H08E	H18E	H28E	300 (ms)	1 to 2,000 (ms)	Page 121
Homing direction (13)	H08F	H18F	H28F	1 (Negative direction)	0: Positive direction 1: Negative direction	Page 122
Home offset address (14) (*1)	H090 H091	H190 H191	H290 H291	0	Software limit (-) $\leqq$ Home offset address $\leqq$ Software limit (+)	Page 123

Parameter item	Shared memory address			Default value	Setting range	Reference
	X-axis	Y-axis	Z-axis			
Home return speed (high) (15) (*1)	H092 H093	H192 H193	H292 H293	50000	Home return speed (low) ≦ Home return speed (high) ≦ Speed limit	Page 124
Home return speed (low) (16) (*1)	H094 H095	H194 H195	H294 H295	100		Page 125
Acceleration/ deceleration time (17)	H096	H196	H296	1000 (ms)	64 to 4999 (ms)	Page 126
Start mode (18)	H09B	Not used		0 (Immediate normal-start)	0: Immediate normal-start 1: Normal-start after homing 2: Quick-start 3: Test for quick-start	Page 127
Homing method (19)	H097	Not used		0 (Near home ON)	0: Near home ON 1: Near home OFF 2: Near home ON/OFF 3: Limit search (*2)	Page 130
Interface logic (20)	H09A	Not used		00000000	See explanation below.	Page 132

■ Explanation of the interface logic settings



Notes:

- The numbers in the parentheses in the parameter item column indicate the parameter selection codes when the teaching unit II is used.
- (*1): In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.
- (*2): The limit search method is available for the FP-C positioning board only.

5-2. Explanation of Each Parameter Item

Details about each parameter are explained by emphasizing the setting parameters from the CPU (using I/O and memory handshake communication). If you want to set parameters in LOCAL mode with the teaching unit II, refer to page 70, “2) How to Set Parameters Using Teaching Unit II.” In each parameter explanation, the program example explains the data setting method supposing that the parameters for the X-axis are once set in data registers starting from DT100 as shown in the table below. However, be sure to note that the value in the examples do not always correspond to the actual settings. Be sure to confirm the actual settings according to the specifications of field devices.

Parameter item (Parameter selection code when using the teaching unit II)	Shared memory address for X-axis	Provisional storage address for data registers
Pulse output mode (1)	H080	DT100
Axis mode (2)	H098	DT124
Unit setting (3)	H081	DT101
Conversion rate (4)	H082	DT102
Speed limit (5)	H083	DT103
	H084	DT104
Software limit (+) (6)	H085	DT105
	H086	DT106
Software limit (-) (7)	H087	DT107
	H088	DT108
Base speed (8)	H089	DT109
	H08A	DT110
Interpolation speed setting mode (9)	H099	DT125
Backlash compensation (10)	H08B	DT111
Error compensation (11)	H08C	DT112
	H08D	DT113
In-position time (12)	H08E	DT114
Homing direction (13)	H08F	DT115
Home offset address (14)	H090	DT116
	H091	DT117
Home return speed (high) (15)	H092	DT118
	H093	DT119
Home return speed (low) (16)	H094	DT120
	H095	DT121
Acceleration/deceleration time (17)	H096	DT122
Start mode (18)	H09B	DT127
Homing method (19)	H097	DT123
Interface logic (20)	H09A	DT126

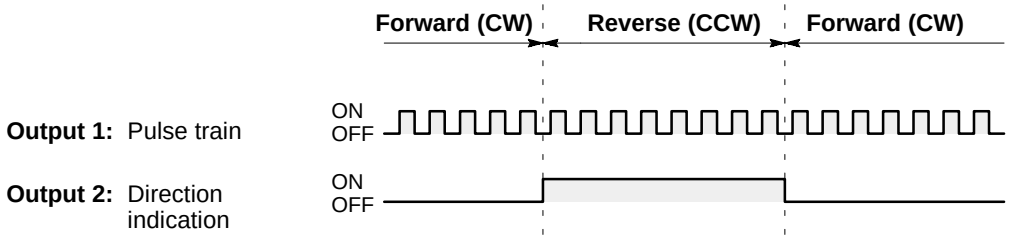
1. Pulse Output Mode

This parameter specifies which of the two output methods is required for the drive, from:
- pulse train and sign mode (setting: K0)
- CW and CCW mode (setting: K1)

■ Time chart

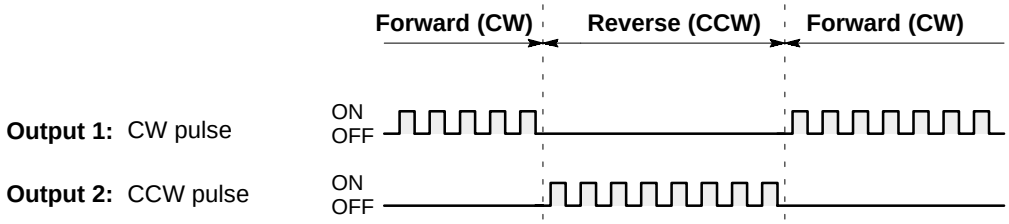
- Pulse train and sign mode

(Setting: K0)



- CW and CCW mode

(Setting: K1)



■ Settings

Selection	Set value
Pulse train and sign mode	K0
CW and CCW mode	K1

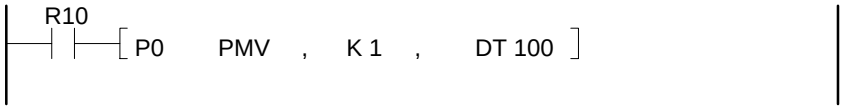
■ Shared memory addresses

The shared memory addresses for the pulse output mode parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H080	H180	H280

■ Program example

"CW and CCW mode" is selected and the parameter setting is provisionally set in DT100.



Note:

· For details about the program of pulse output mode, refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

2. Axis Mode

This parameter specifies which of the three JOB grouping modes is required for controlling devices, from:
- independent mode (setting: K0)
- simultaneous 2-axis mode (setting: K1)
- simultaneous 3-axis mode (setting: K2)

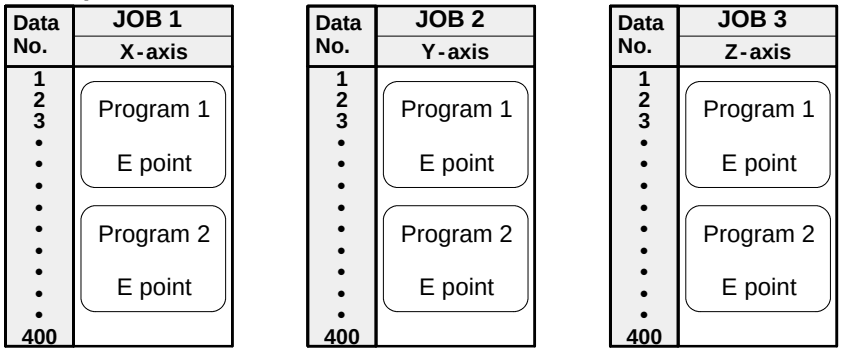
By selecting “axis mode”, the control method for each axis is selected for the synchronized or independent motion.

■ Axis combination for JOB control

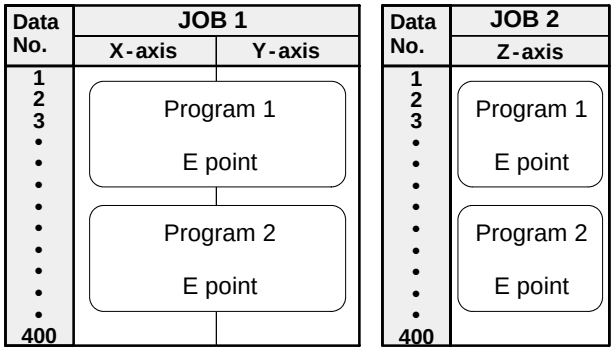
Axis mode	1-axis module		2-axis module		3-axis module	
Independent	JOB1	X-axis	JOB1 JOB2	X-axis Y-axis	JOB1 JOB2 JOB3	X-axis Y-axis Z-axis
Simultaneous 2-axis	———	———————	JOB1	X- and Y-axis	JOB1 JOB2	X- and Y-axis Z-axis
Simultaneous 3-axis	———	———————	———	———————	JOB1	X-, Y- and Z-axis

[Examples when using a 3-axis module]

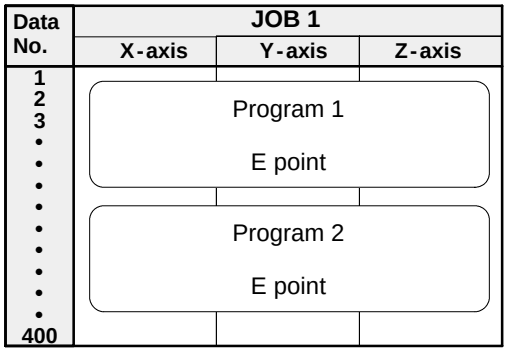
• Independent mode



• Simultaneous 2-axis mode (See note.)



• Simultaneous 3-axis mode



Notes:

- If you select simultaneous 2-axis mode on the 3-axis module, X- and Y-axis are used for synchronized operation.
- Even in the simultaneous 3-axis mode, circular interpolation is performed based on the interpolation of the X- and Y-axis and the Z-axis just moves in a spiral in accordance to the movement of the X- and Y-axis. Therefore, if you set 3 points so as to make X- and Y-axis a straight line, you cannot use these three points for making arc form.
- In the same JOB, you should use the same pulse-conversion formula and movement unit for each axis.
- Even in the simultaneous mode, the operation is independently performed for homing and JOG operations.
- If one of 2- or 3-axis is operating in independent mode, parameters and data for the 2- or 3-axis module cannot be read or written. When an error occurs in one independent axis, the operation for all other axes will stop at the same time.

■ **Settings**

Selection	Set value
Independent mode	K0
Simultaneous 2-axis mode	K1
Simultaneous 3-axis mode	K2

■ **Shared memory addresses**

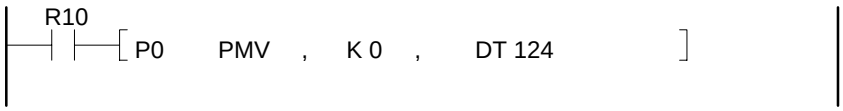
The shared memory addresses for the axis mode parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H098	Not used	

For the axis mode, only the parameter for the X-axis is used.

■ **Program example**

The “independent mode” is selected and the parameter setting is provisionally set in DT124.



Note:

- For details about the program of axis mode, refer to page 134, “5-3. Transferring Parameter Set Values” and page 169, “7-2. Parameter Set and Read Programs.”

3. Unit Setting

This parameter specifies what type of unit is used for the motion control from:
- pulse units (setting: K0)
- mm units (setting: K1)
- inch units (setting: K2)
- degree units (setting: K3)

By selecting “unit setting”, all the setting for parameters and for positioning point data are controlled with the specified unit. You also need to set the conversion rate per pulse with the “conversion rate” parameter. When using simultaneous mode in “axis mode”, be sure to use the same units and conversion rate for the synchronized axes.

■ Settings

Selection	Set value
Pulse units	K0
mm units	K1
inch units	K2
degree units	K3

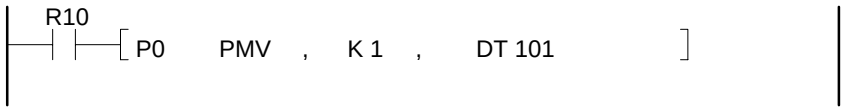
■ Shared memory addresses

The shared memory addresses for the unit setting parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H081	H181	H281

■ Program example

The “mm” is selected and the parameter setting is provisionally set in DT101.



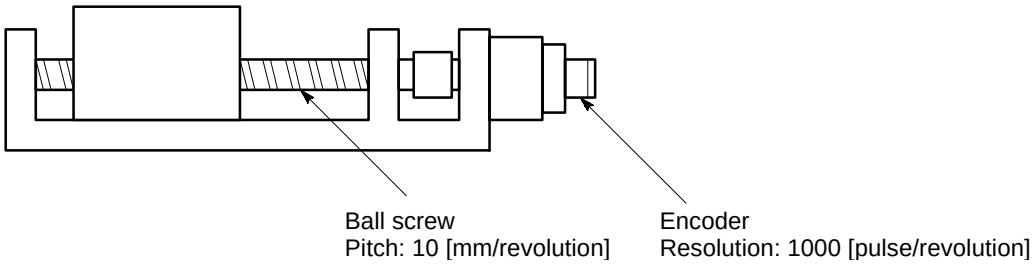
Notes:

- In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.
- For details about the program of unit setting, refer to page 134, “5-3. Transferring Parameter Set Values” and page 169, “7-2. Parameter Set and Read Programs.”

4. Conversion Rate

This parameter specifies the rate for converting pulses into the unit specified in the "unit setting" parameter. When using simultaneous mode in "axis mode", be sure to use the same unit and conversion rate for the synchronized axes.

$$\text{Conversion rate} = \frac{10\ [\text{mm/revolution}]}{1000\ [\text{pulse/revolution}]} = 0.01\ [\text{mm/pulse}]$$



Note:

- In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Settings

Selection in the "unit setting" parameter	Set value
Pulse units	1
mm units	0.0001 to 0.01
inch or degree units	0.00001 to 0.001

■ Shared memory addresses

The shared memory addresses for the conversion rate parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H082	H182	H282

■ Construction of data

Data in H082, H182 and H282 are expressed using a unique one-word format based on the following formula:

$A \times 10^{-n}$

The values in "A" and "n" are expressed as follows:

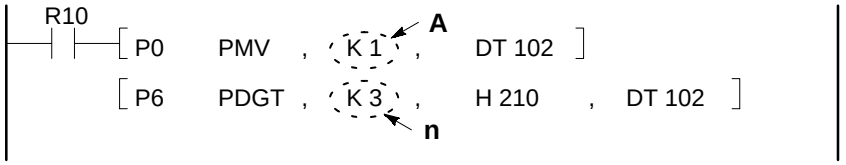
Example: setting $0.001 = 1 \times 10^{-3}$ for X-axis (H082)

Bit position	15 • • 12	11 • • 8	7 • • 4	3 • • 0
H082	0 0 0 0	0 0 1 1	0 0 0 0	0 0 0 1

n A

■ Program example

"mm" is selected in the unit setting parameter and the conversion rate of "0.001" is provisionally set in DT102.



Note:

- For details about the program of conversion rate, refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

5. Speed Limit

This parameter specifies the maximum speed available for motion control. When specifying the speed limit, be sure to take the conversion rate set for each axis into consideration.

Note:

- In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Setting range

$$0 \leqq \frac{\text{Speed limit}}{\text{Conversion rate}} \leqq 400,000$$

■ Shared memory addresses

The shared memory addresses for the speed limit parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H083 H084	H183 H184	H283 H284

■ Construction of data

Data in H083 and H084, H183 and H184, and H283 and H284 are expressed using a unique two-word format based on the following formula:

$A \times 10^{-n}$

The values in "A" and "n" are expressed as follows:

Example: setting $350 = 350 \times 10^{-0}$ for X-axis (H083 and H084)

Shared memory address	H084																H083															
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	1	1	0
					n				A																							

■ Program example

The speed limit of "350 mm/s" for the X-axis is provisionally set in DT103 and DT104.

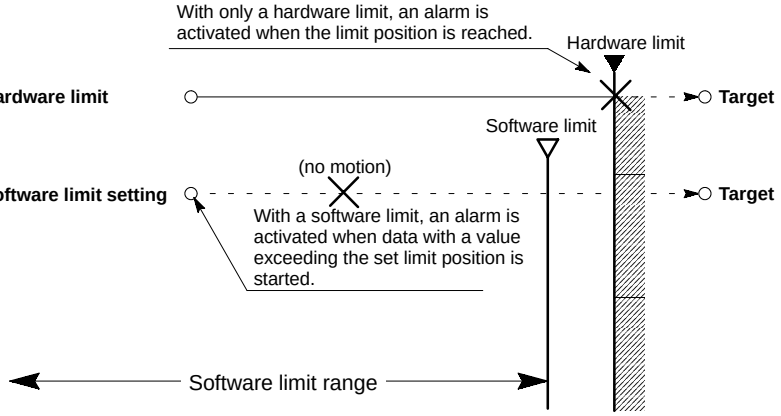
```
R10
 |  |--[ P1   PDMV , K 350 , DT 103 ]
                      A
 |      [ P6   PDGT , K 0 ,  H 210  ,  DT 104 ]
                      n
```

Note:

- For details about the program of speed limit, refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

6. Software Limit (+)

This parameter specifies the software limit in the positive direction available for the motion control. When specifying the software limit (+), be sure to take the conversion rate set for each axis and the home offset address into consideration.



Notes:

- The software limit is ignored during JOG operation and hardware homing.
- Using a module with a system ROM version SV 2.0 or later, the positioning module is set for no software limit if you set "0" for both positive and negative software limits.
- This setting can be effectively used to control a shaft rotating in one direction with no hardware limit.
- In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Setting range

$$0 \leqq \frac{\text{Software limit (+)}}{\text{Conversion rate}} \leqq 8,388,607$$

■ Shared memory addresses

The shared memory addresses for the software limit (+) parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H085 H086	H185 H186	H285 H286

■ Construction of data

Data in H085 and H086, H185 and H186, and H285 and H286 are expressed using a unique two-word format based on the following formula:

$A \times 10^{-n}$

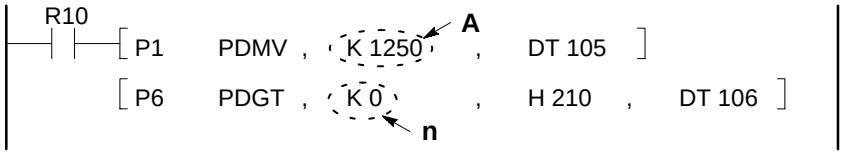
The values in "A" and "n" are expressed as follows:

Example: setting 1,250 = 1,250 × 10^{-0} for X-axis (H085 and H086)

Shared memory address	H086																H085															
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0
					n				A																							

■ Program example

The software limit (+) of "1,250 mm" for X-axis is provisionally set in DT105 and DT106.



Note:

- For details about the program of software limit (+), refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

7. Software Limit (-)

This parameter specifies the software limit in the negative direction available for the motion control. When specifying the software limit (-), be sure to take the conversion rate set for each axis and the home offset address into consideration. For details about the explanation, refer to page 115, "6. Software Limit (+)."

■ Settings range

$$-8,388,607 \leqq \frac{\text{Software limit (–)}}{\text{Conversion rate}} \leqq 0$$

Notes:

- The software limit is ignored during JOG operation and hardware homing.
- Using a module with a system ROM version SV 2.0 or later, the positioning module is set for no software limit if you set "0" for both positive and negative software limits.
- This setting can be effectively used to control a shaft rotating in one direction with no hardware limit.
- In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Shared memory addresses

The shared memory addresses for the software limit (-) parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H087 H088	H187 H188	H287 H288

■ Construction of data

Data in H087 and H088, H187 and H188, and H287 and H288 are expressed using a unique two-word format based on the following formula:

$A \times 10^{-n}$

The values in "A" and "n" are expressed as follows:

Example: setting - 1,250 = - 1,250 × 10^{-0} for X-axis (H087 and H088)

Shared memory address	H088																H087													
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	1	1	1	1	0
	n								A																					

■ Program example

The software limit (-) of "- 1,250 mm" for the X-axis is provisionally set in DT107 and DT108.

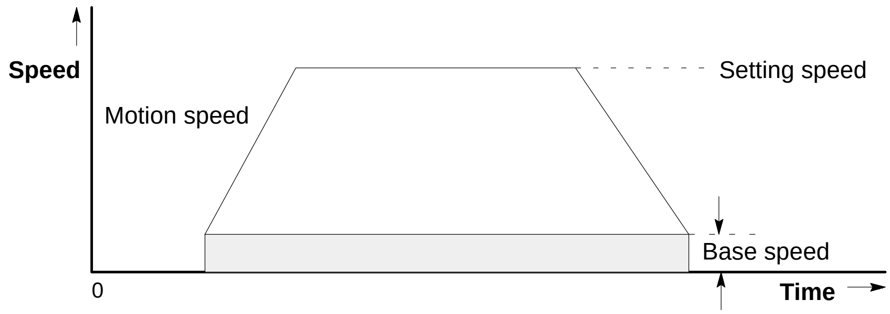
```
R10
 |  |
 |  [ P1   PDMV , K -1250 , DT 107 ]
 |                  A
 |  [ P6   PDGT , K 0     , H 210 , DT 108 ]
 |                n
```

Note:

- For details about the program of software limit (-), refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

8. Base Speed

This parameter specifies the base speed used for controlling a stepper motor. When controlling a stepper motor, accelerating and decelerating within a short time may cause misoperation of the motion control. In order to reduce this kind of unfriendliness, a stepper motor usually has a function to accept pulses at a fixed speed in its starting and stopping stages. The fixed speed used in the starting and stopping stages is called the “base speed.” When specifying the base speed, be sure to take the conversion rate set for each axis into consideration.



■ Setting range

0 ≦ Base speed ≦ Axis speed or Interpolation speed

Notes:

- When performing a circular interpolation operation in simultaneous mode, the base speed setting will be ignored.
- In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Shared memory addresses

The shared memory addresses for the base speed parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H089 H08A	H189 H18A	H289 H28A

■ Construction of data

Data in H089 and H08A, H189 and H18A, and H289 and H28A are expressed using a unique two-word format based on the following formula:

$A \times 10^{-n}$

The value in “A” and “n” are expressed as follows:

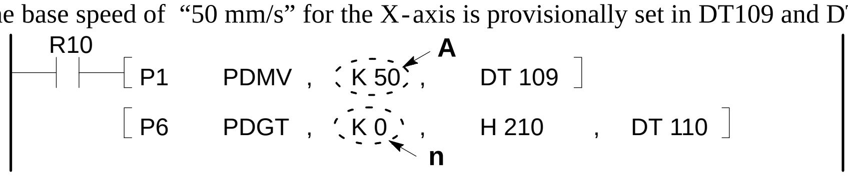
Example: setting 50 = 50 × 10^{-0} for X-axis (H089 and H08A)

Shared memory address	H08A																H089															
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0

n (bits 31 to 24)   A (bits 23 to 0)

■ Program example

The base speed of “50 mm/s” for the X-axis is provisionally set in DT109 and DT110.



Note:

- For details about the program of base speed, refer to page 134, “5-3. Transferring Parameter Set Values” and page 169, “7-2. Parameter Set and Read Programs.”

9. Interpolation Speed Setting Mode

In the simultaneous mode, the axes move according to the interpolation speed set in the positioning point data. This parameter specifies the method of controlling speed in the positioning point data for:

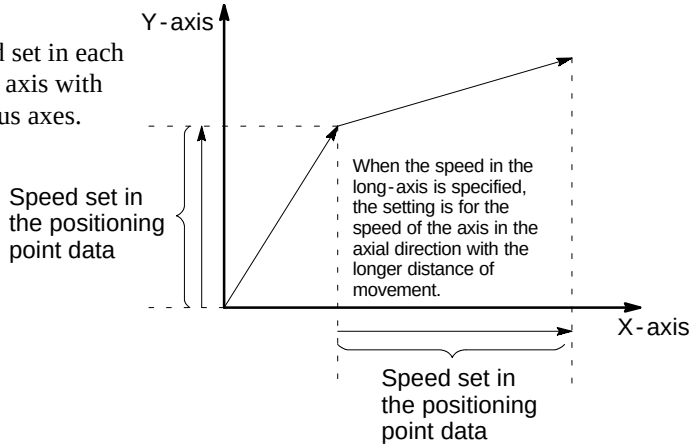
- long-axis speed (setting: K0)
- tracking speed (setting: K1)

Note:

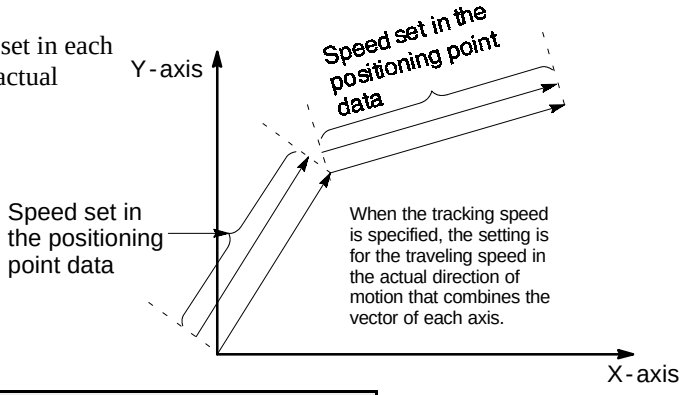
· When circular interpolation will be used, select the tracking speed mode.

■ Explanation of speed setting mode

- **Long-axis speed mode:**
  If this mode is selected, the interpolation speed set in each positioning point data denotes the speed of the axis with longest movement span among the simultaneous axes.



- **Tracking speed mode:**
  If this mode is selected, the interpolation speed set in each positioning point data denotes the speed of the actual movement.



■ Settings

Selection	Set value
Long-axis speed mode	K0
Tracking speed mode	K1

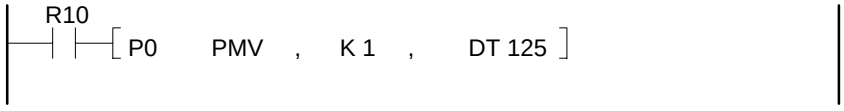
■ Shared memory addresses

The shared memory addresses for the interpolation speed setting mode parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H099	Not used	

■ Program example

The tracking speed mode of "K1" is provisionally set in DT125.



Note:

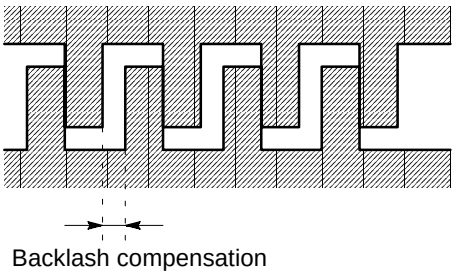
· For details about the program of interpolation speed setting mode, refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

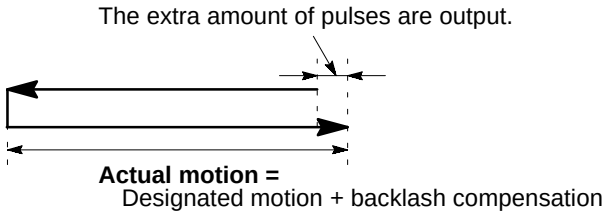
10. Backlash Compensation

This parameter specifies the backlash compensation used for correcting the gap of the ball screw and speed reducer. When the backlash compensation value is set, the extra amount of pulses specified is output when the operating direction is switched in order to compensate for the gap caused by hardware. When specifying the backlash compensation, be sure to take the conversion rate set for each axis into consideration. Be sure to perform the homing operation to use this function effectively. Setting of backlash compensation is invalid for the linear and circular interpolation control.

Note:

· In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.





■ Setting range

$$0 \leqq \frac{\text{Backlash compensation}}{\text{Conversion rate}} \leqq 255$$

■ Shared memory addresses

The shared memory addresses for the backlash compensation parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H08B	H18B	H28B

■ Construction of data

Data in H08B, H18B and H28B are expressed using a unique one-word format based on the following formula:

$A \times 10^{-n}$

The values in “A” and “n” are expressed as follows:

Example: setting $0 = 0 \times 10^{-0}$ for X-axis (H08B)

Bit position	15 • • 12	11 • • 8	7 • • 4	3 • • 0
H08B	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0

n A

■ Program example

The backlash compensation of “0 mm” is provisionally set in DT111.

```
R10
 |  |--[ P0   PMV  , K 0 , DT 111 ]
                      A
 |     [ P6   PDGT , K 0 , H 210 , DT 111 ]
                      n
```

Note:

· For details about the program of backlash compensation, refer to page 134, “5-3. Transferring Parameter Set Values” and page 169, “7-2. Parameter Set and Read Programs.”

11. Error Compensation

This parameter specifies the error compensation used for correcting the gap caused by calculation using the conversion rate. The error per 100 mm, 100 inches or 100 degrees is set in this parameter. When specifying the error compensation, be sure to take the conversion rate set for each axis into consideration. Be sure to adjust the backlash gap by setting the backlash compensation parameter before measuring the error. If you find an actual motion span of 50.05 mm when outputting pulses for 50 mm movement, calculate the error as:

$$\text{Error} = (50.05 - 50) \times \frac{100\ \text{mm}}{50\ \text{mm}} = 0.1\ \text{mm}$$

Note:

· In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Setting range

- in pulse mode: K0
- in “mm” mode: - 1.0000 to + 1.0000 (mm)
- in “inch” or “degree” mode: - 1.00000 to + 1.00000 (inch/degree)

■ Shared memory addresses

The shared memory addresses for the error compensation parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H08C H08D	H18C H18D	H28C H28D

■ Construction of data

Data in H08C and H08D, H18C and H18D, and H28C and H28D are expressed using a unique two-word format based on the following formula:

$A \times 10^{-n}$

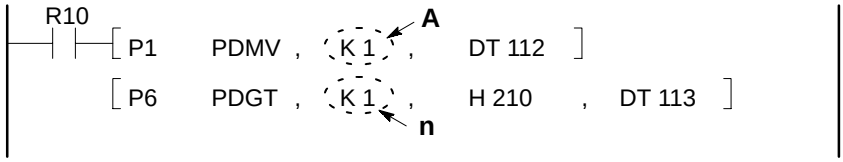
The values in “A” and “n” are expressed as follows:

Example: setting 0.1 mm = 1×10^{-1} for X-axis (H08C and H08D)

Shared memory address	H08D																H08C															
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
								n								A																

■ Program example

The error compensation of “0.1 mm” for the X-axis is provisionally set in DT112 and DT113.



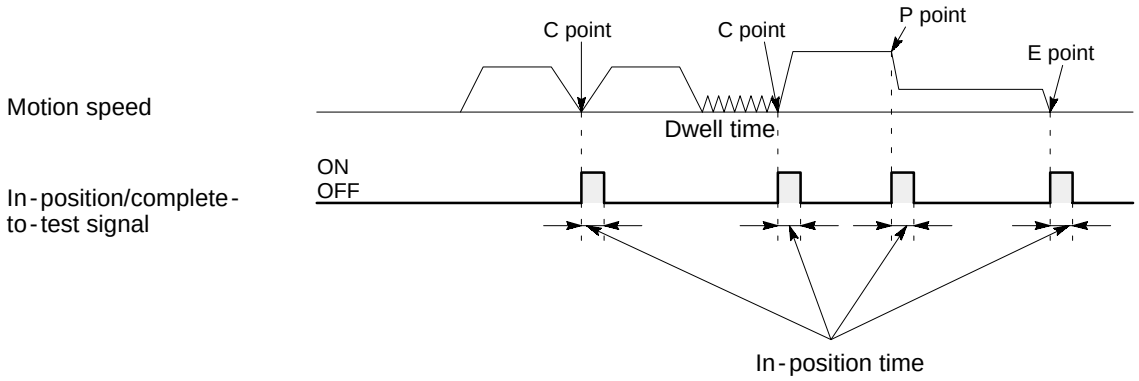
Note:

· For details about the program of error compensation, refer to page 134, “5-3. Transferring Parameter Set Values” and page 169, “7-2. Parameter Set and Read Programs.”

12. In-position Time

This specifies the duration that the in-position/complete-to-test signal is ON. The in-position/complete-to-test signal turns ON when each positioning point data specified with “C”, “P” and “E” is finished.

■ Time chart



■ Setting range

1 (ms) ≦ In-position time ≦ 2,000 (ms)

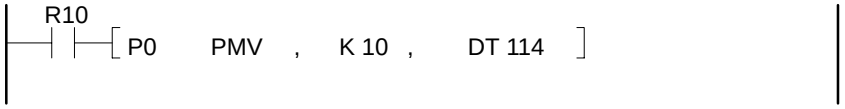
■ Shared memory addresses

The shared memory addresses for the in-position time parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H08E	H18E	H28E

■ Program example

The in-position time of “10 ms” is provisionally set in DT114.



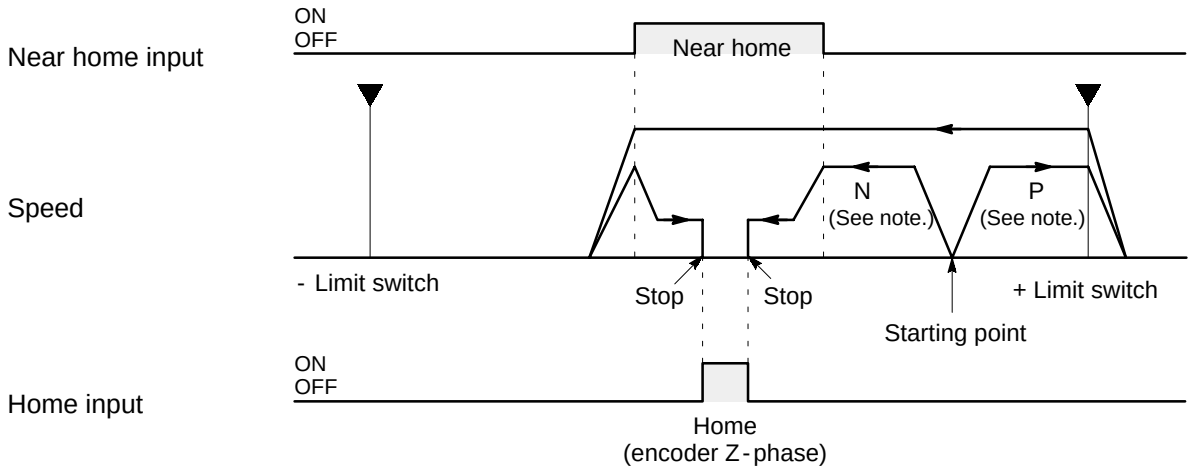
Note:

- For details about the program of in-position time, refer to page 134, “5-3. Transferring Parameter Set Values” and page 169, “7-2. Parameter Set and Read Programs.”

13. Homing Direction

This parameter specifies the initial direction when hardware homing operation is performed. Be sure to take the software home position, set by the home offset address, into consideration when setting the homing direction.

■ Movement



Notes:

- **P:** "P" means the positive direction.
- **N:** "N" means the negative direction.

■ Settings

Selection in the "homing direction" parameter	Set value
Positive direction	K0
Negative direction	K1

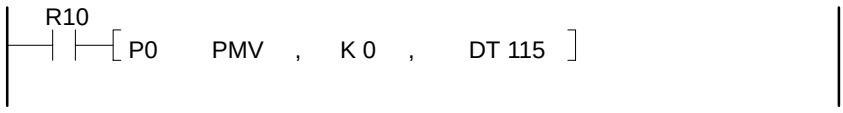
■ Shared memory addresses

The shared memory addresses for the homing direction parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H08F	H18F	H28F

■ Program example

The "positive direction" is selected in the homing direction parameter and "K0" is provisionally set in DT115.

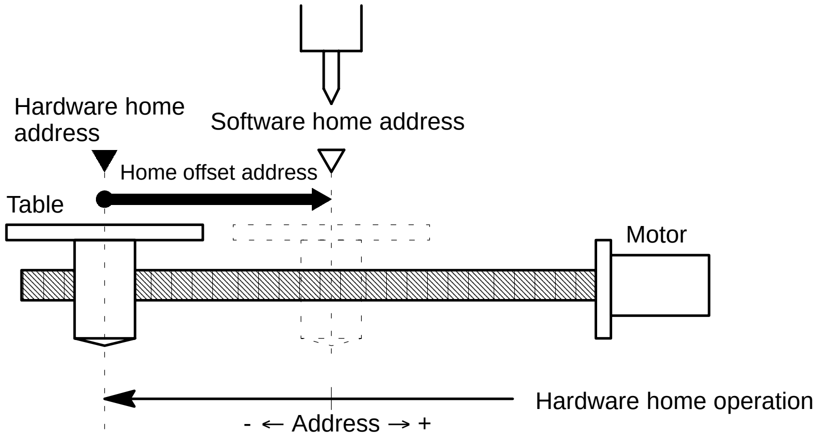


Note:

- For details about the program of homing direction, refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

14. Home Offset Address

This parameter specifies the software home by specifying the hardware home address from the software home position. This setting become effective after the at-home signal turns ON. This setting is useful for using the same coordinate system in making a program. When specifying the home offset address, be sure to take the conversion rate set for each axis into consideration.



Note:

- In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Setting range

Software limit (-) ≦ Home offset address ≦ Software limit (+)

■ Shared memory addresses

The shared memory addresses for the home offset address parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H090 H091	H190 H191	H290 H291

■ Construction of data

Data in H090 and H091, H190 and H191, and H290 and H291 are expressed using a unique two-word format based on the following formula:

$A \times 10^{-n}$

The values in "A" and "n" are expressed as follows:

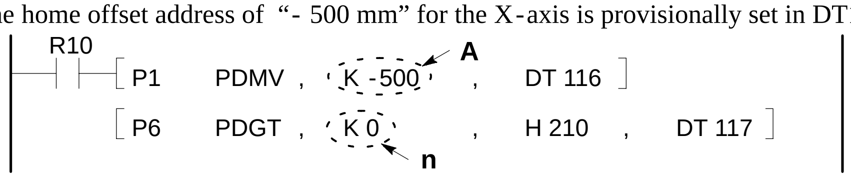
Example: setting - 500 mm = - 500 $\times 10^{-0}$ for X-axis (H090 and H091)

Shared memory address	H091																H090															
Bit position	31	•	•	28	27	•	•	24	23	•	•	20	19	•	•	16	15	•	•	12	11	•	•	8	7	•	•	4	3	•	•	0
Data	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	0	0

n (bits 31–24); A (bits 23–0)

■ Program example

The home offset address of "- 500 mm" for the X-axis is provisionally set in DT116 and DT117.



Note:

- For details about the program of home offset address, refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

15. Home Return Speed (High)

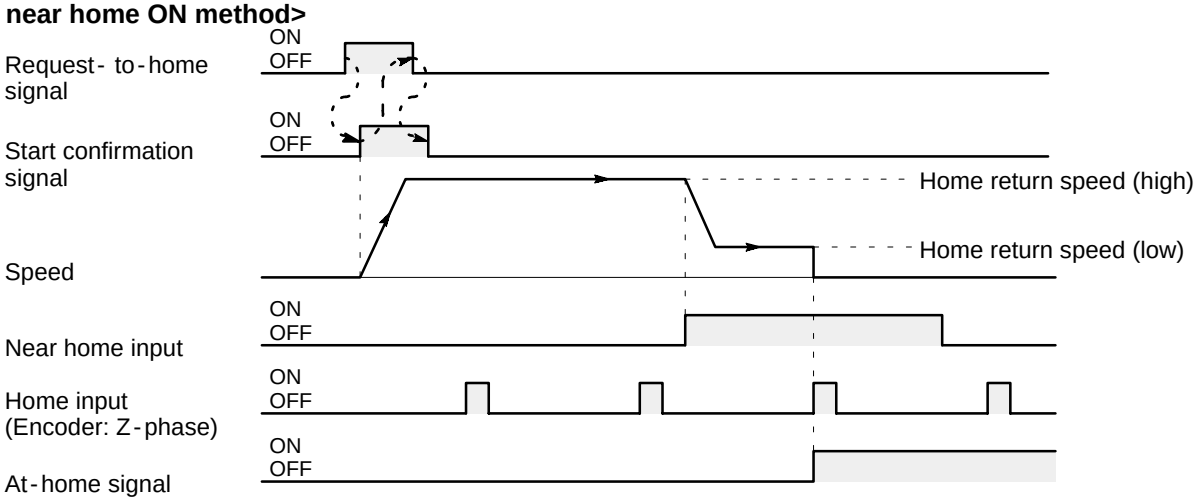
This parameter specifies the home return speed (high) used for home return operation up to the near home detection. This is also used for software home operation and JOG operation at high-speed. When specifying the home return speed (high), be sure to take the conversion rate set for each axis into consideration.

Note:

- In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Time chart

<In near home ON method>



■ Setting range

Home return speed (low) ≦ Home return speed (high) ≦ Speed limit

■ Shared memory addresses

The shared memory addresses for the home return speed (high) parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H092 H093	H192 H193	H292 H293

■ Construction of data

Data in H092 and H093, H192 and H193, and H292 and H293 are expressed using a unique two-word format based on the following formula:

$A \times 10^{-n}$

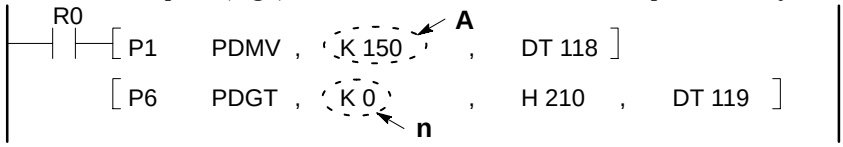
The values in "A" and "n" are expressed as follows:

Example: setting 150 mm/s = 150×10^{-0} for X-axis (H092 and H093)

Shared memory address	H093																H092															
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0
	n								A																							

■ Program example

The home return speed (high) of "150 mm/s" for the X-axis is provisionally set in DT118 and DT119.



Note:

- For details about the program of home return speed (high), refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

16. Home Return Speed (Low)

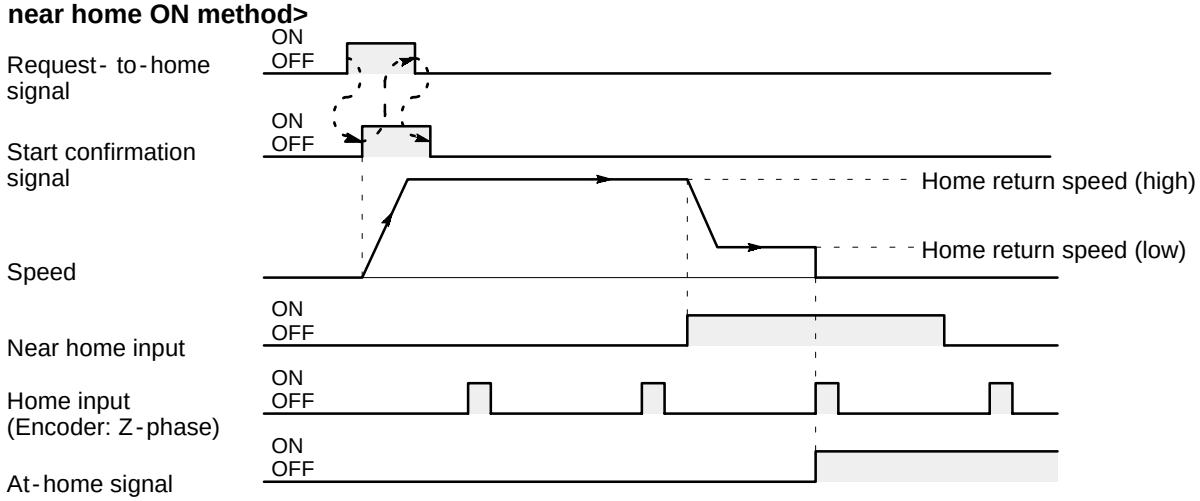
This parameter specifies the home return speed (low) used for home return operation from the near home detection. This is also used for JOG operation at low-speed. When specifying the home return speed (low), be sure to take the conversion rate set for each axis into consideration.

Note:

- In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Time chart

<In near home ON method>



■ Settings range

Home return speed (low) ≦ Home return speed (high)

■ Shared memory addresses

The shared memory addresses for the home return speed (low) parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H094 H095	H194 H195	H294 H295

■ Construction of data

Data in H094 and H095, H194 and H195, and H294 and H295 are expressed using a unique two-word format based on the following formula:

$A \times 10^{-n}$

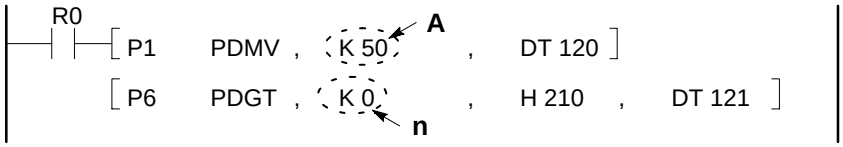
The values in "A" and "n" are expressed as follows:

Example: setting 50 mm/s = 50×10^{-0} for X-axis (H094 and H095)

Shared memory address	H095																H094															
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0
	n								A																							

■ Program example

The home return speed (low) of "50 mm/s" for the X-axis is provisionally set in DT120 and DT121.



Note:

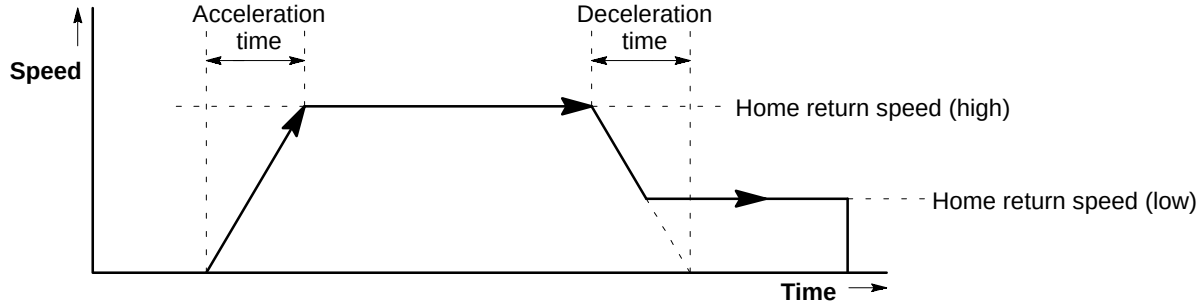
- For details about the program of home return speed (low), refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

17. Acceleration/Deceleration Time

This specifies the time required for reaching the preset speed during of home return and JOG operation.
If the setting is too short, the fast rising and falling speed of the motor may generate overcurrent in the drive.
Therefore, be sure to set an appropriate time according to the characteristics of the motor.

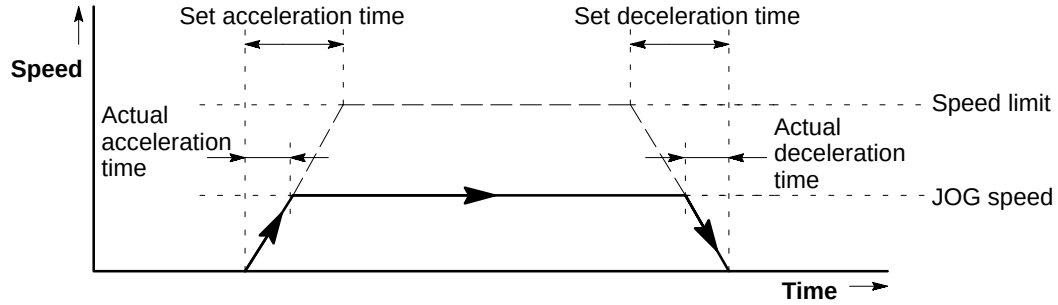
■ Time chart

- Home return operation



The set acceleration/deceleration time is the same as the actual acceleration/deceleration time.

- JOG operation



The set acceleration/deceleration time is different from the actual acceleration/deceleration time.

■ Settings range

64 (ms) ≦ Acceleration/deceleration time ≦ 4,999 (ms)

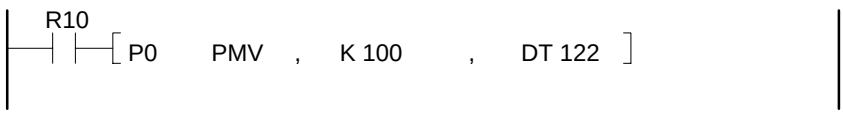
■ Shared memory addresses

The shared memory addresses for the acceleration/deceleration time parameter are:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H096	H196	H296

■ Program example

The acceleration/deceleration time of "100 ms" is provisionally set in DT122.



Note:

· For details about the program of acceleration/deceleration time, refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

18. Start Mode

This specifies the mode for starting the motion control from:
- immediate normal-start (setting: K0)
- normal-start after homing (setting: K1)
- quick-start (setting: K2)
- test for quick-start (setting: K3)

■ **Explanation of each mode**

Start mode	Description
Immediate normal-start	The motion control starts from the actual position without homing. If the software homing operation is not done after the power-up, the operation is performed regarding work position at the power-up as 0 address. You can change this address by using the actual position change or homing functions. Internal processing time for the start-up is normally required.
Normal-start after homing	The motion control starts from the home position after homing operation. Internal processing time for the start-up is normally required.
Quick-start	The motion control starts from the actual position. The internal processing time for the start-up is less than 15 ms. Before selecting quick-start mode, be sure to perform a test for quick-start for checking the positioning point data used for quick-start operation and for memorizing data in the system. For details about the quick-start, refer to page 128, “1) Explanation of Quick-start Operation” in this section.
Test for quick-start	This mode is used for checking and memorizing the positioning point data for quick-start operation. Therefore, be sure to perform the data setting for the parameters in this mode before performing the quick-start operation. If the quick-start operation is performed without performing this test, an error may occur. In this mode, actual pulses are not output. After checking and memorizing data, the in-position/complete-to-test signal turns ON during in-position time. For details about the test for quick-start, refer to page 128, “1) Explanation of Quick-start Operation” in this section.

■ **Settings**

Mode selection	Set value
Immediate normal-start	K0
Normal-start after homing	K1
Quick-start	K2
Test for quick-start	K3

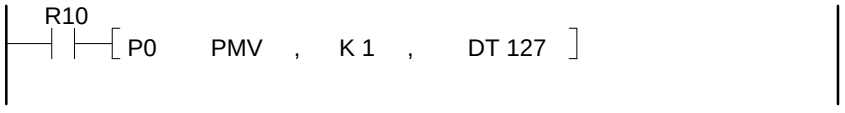
■ **Shared memory address**

The shared memory address for the start mode parameter is:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H09B	Not used	

■ **Program example**

The normal-start after homing mode of “K1” is provisionally set in DT127.



Note:

- For details about the program of start mode, refer to page 134, “5-3. Transferring Parameter Set Values” and page 169, “7-2. Parameter Set and Read Programs.”

1) Explanation of Quick-start Operation

In order to also meet high-speed operation requirements, the positioning module F-type has a quick-start mode option. Using quick-start mode, you can start outputting drive pulses within 15 ms of pre-processing time. (The pre-processing time is the duration from receipt of the “request-to-start signal” to actual drive pulse output.) The pre-processing time required between normal-start and quick-start mode is:

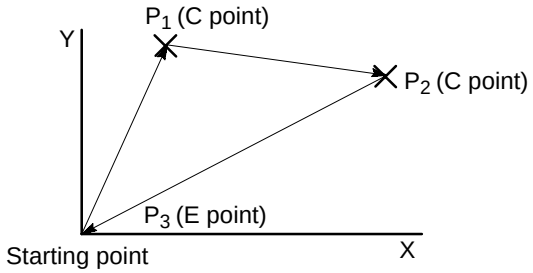
- **In normal-start mode**
  When specifying E point data in independent axis mode: Approx. 50 ms
  When specifying E point data in simultaneous axis mode: Approx. 100 ms
  The pre-processing time may increase if you specify a positioning point data with a “C”, “P” or “S” motion pattern.
- **In quick-start mode**
  When specifying E point data both in independent and simultaneous axis mode: 15 ms or less

2) Limitations for Quick-start Operation

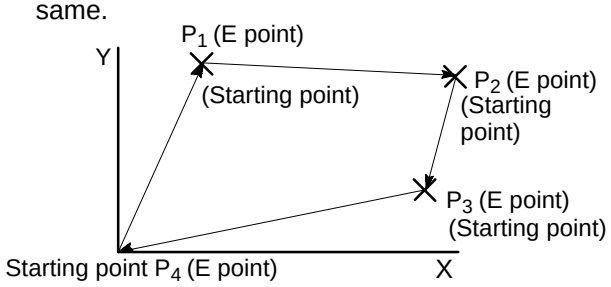
When quick-start or test for quick-start mode is selected, some functions available for the normal-start operation are limited as follows:

- Positioning point data, parameters other than the start mode parameter, and actual position addresses cannot be revised in the quick-start and test for quick-start modes.
- Homing, software homing and JOG operation cannot be performed in the quick-start and test for quick-start modes.
- For the quick-start operation, no more than 10 motions (from the starting positioning point data to the “E” point) can be controlled. (That is, more than 10 motions cannot be memorized by the test for quick-start.) In order to control multiple motions in the quick-start operation, the following motions should be started from the “E” point of a preceding position as shown below.

· The starting point and end point are the same.



· The end point and the next starting point are the same.



- Since the starting position address is also memorized at the time of test for quick-start, an error occurs if you turn ON the request-to-start signal after placing a work piece at different address. Be sure to set a work piece at the address used when quick-start operation before performing the test for quick-start.
- In the test for quick-start mode, pulses for motion control are not output. Additionally, the auxiliary code set flag is not turned ON.

■ **How to control with quick-start mode**

Turn ON the power of the system.

↓

Set parameters and positioning point data.

↓

Set a work piece at the address used for quick-start operation.

↓

Set the start positioning point data for quick-start.

↓

Perform test for quick-start setting “K3.”
(Turn ON the request-to-start signal.)

↓

- Since the starting position address is also memorized at the time of the test for quick-start in quick-start mode, an error occurs if you turn ON the request-to-start signal after placing a work piece at a different address. Be sure to set a work piece at the address used for quick-start operation before performing the test for quick-start.
- Up to 10 motions (from a starting point to “E” point data) can be memorized by executing the test for quick-start operations 10 times when the following motions are started from the “E” point of a preceding position.
- The data memorized for quick-start operation will be cleared once the start mode is changed to normal-start modes (immediate normal-start or normal-start after homing) or once the power of the system turns OFF. Therefore, if this happens, be sure to perform the test for quick-start again.

↓

In-position/complete-to-test signal turns ON.

↓

Perform quick-start operation setting “K2.”
(Turn ON the request-to-start signal after setting the start positioning point data number.)

↓

Pulse output starts within 15 ms.

Notes:

- For the correct movement of the quick-start, some spare time should be required before turning ON the request-to-start signal:
  - When starting a motion with less than 10 positioning point data: 0.1 s or more after the start positioning point data number setting.
  - When starting a motion with 10 or more positioning point data: 0.6 s or more after the start positioning point data number setting.
- When starting the same motion many times, the spare times described above are not required.

19. Homing Method

This specifies the homing method for the motion control from:
- near home ON method (setting: K0)
- near home OFF method (setting: K1)
- near home ON/OFF method (setting: K2)
- limit search method (setting: K3)

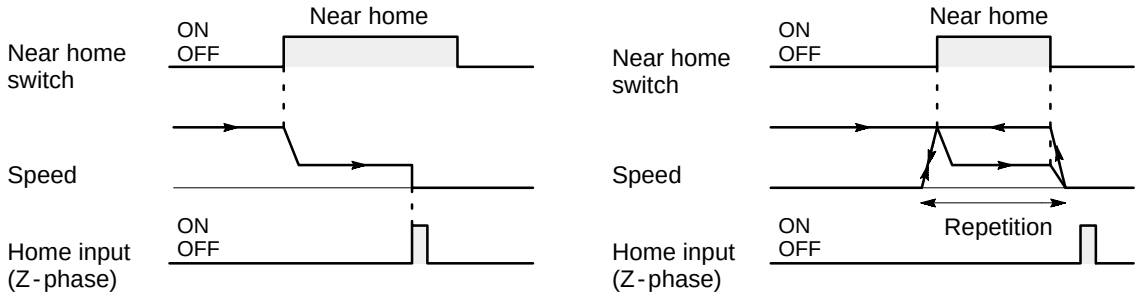
Note:

· The limit search method is available for the FP-C positioning board only.

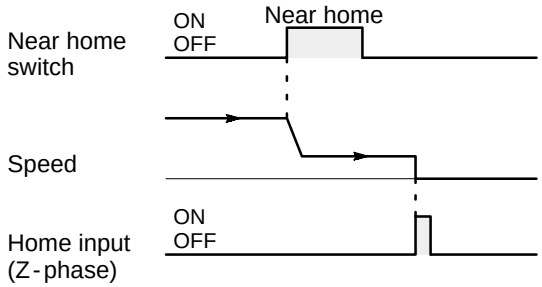
■ Operation of each homing method

- **Near home ON method:**
  The speed drops when the near home switch turns ON and operation stops at the first home (Z-phase) input.

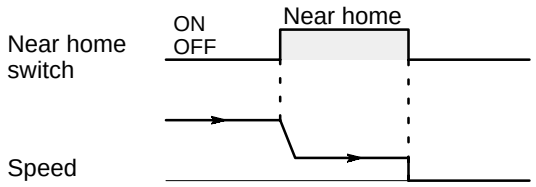
If no home is found after the near home switch turns ON, the operation decelerates and stops when the near home switch turns OFF, then reverses rapidly to the near home switch and repeats the same process.



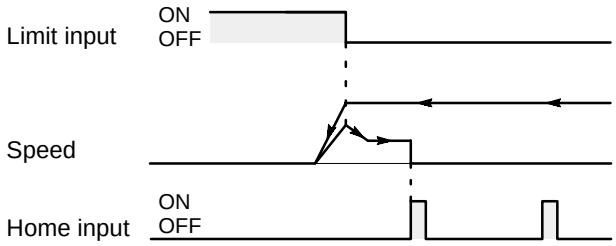
- **Near home OFF method:**
  The speed drops when the near home switch turns ON and operation stops at the first home (Z-phase) input found after the near home switch is turned OFF.



- **Near home ON/OFF method:**
  The speed drops when the near home switch turns ON and operation stops when the near home switch turns OFF.



- **Limit search method:** (available for the FP-C positioning board only)
  Operation starts to the direction opposite to the preset homing direction. At the limit position opposite to the homing direction, the movement is revised and the speed drops. Operation stops at the first home (Z-phase) input found after the direction is reversed.



■ Settings

Selection	Set value
Near home ON method	K0
Near home OFF method	K1
Near home ON/OFF method	K2
Limit search method	K3

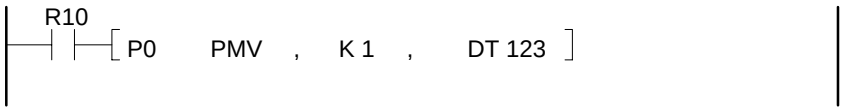
■ Shared memory address

The shared memory address for the homing method parameter is:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H097	Not used	

■ Program example

The near home OFF method of "K1" is provisionally set in DT123.



Note:

· For details about the program of homing method, refer to page 134, "5-3. Transferring Parameter Set Values" and page 169, "7-2. Parameter Set and Read Programs."

20. Interface Logic

This parameter specifies the specifications of the module's interface according to the specifications of the other parameters and field drive. The items specified in this parameters are:

- Motion direction specifications (using bit position 0)
- Deviation counter specifications (using bit position 1)
- Drive error specifications (using bit position 2)
- Near home specifications (using bit position 3)
- Home specifications (using bit position 4)
- Overlimit specifications (using bit position 5)

Bit positions 6 or higher are not used for the settings. Be sure to set bit positions 6 to 15 to "0".

■ Explanation and settings

Interface logic item (bit position)	Default value	Description
Motion direction (bit position 0)	0	This bit selects the specifications for the pulse output terminals according to the pulse output mode you selected in the parameter. - When "pulse train and sign mode" is selected. 0: Pulse output 2 ON for + direction Pulse output 2 OFF for - direction 1: Pulse output 2 OFF for + direction Pulse output 2 ON for - direction - When "CW and CCW mode" is selected. Regardless of the value in the bit position 0, the settings are fixed at: - Pulse output 1 for + direction - Pulse output 2 for - direction
Deviation counter (bit position 1)	0	This bit selects the specifications for the deviation counter reset output condition from: 0: Output turns ON when hardware home operation is completed, when error occurs, or when power is supplied. 1: Output turns OFF when hardware home operation is completed, when error occurs, or when power is supplied.
Drive error (bit position 2)	0	This bit selects the specifications for the drive error input condition from: 0: An error is recognized in the de-energized condition. 1: An error is recognized in the energized condition.
Near home (bit position 3)	0	This bit selects the specifications for the near home input condition from: 0: Near home position in the energized condition. 1: Near home position in the de-energized condition.
Home (bit position 4)	0	This bit selects the specifications for the home input condition from: 0: Home position in the de-energized condition. 1: Home position in the energized condition.
Overlimit (bit position 5)	0	This bit selects the specifications for the overlimit input condition from: 0: Overlimit position in the de-energized condition. 1: Overlimit position in the energized condition.

■ Shared memory address

The shared memory address for the interface logic parameter is:

Axis	X-axis	Y-axis	Z-axis
Address in the shared memory	H09A	Not used	

■ Construction of data

Specifications for the H09A are as follows:

[Example]

Bit position	15 • • 12	11 • • 8	7 • • 4	3 • • 0
H09A	0 0 0 0	0 0 0 0	0 0 0 0	1 0 0 1

Be sure to set 0 bit positions 6 to 15.

Pulse output 1 is used for + direction in CW and CCW mode (regardless of the value in the bit position 0).

The deviation counter reset output turns ON when hardware home operation is completed, when error occurs, or when power is supplied. (bit position 1 = 0).

The error is detected when error input is de-energized (bit position 2 = 0).

The near home is detected when near home input is de-energized (bit position 3 = 1).

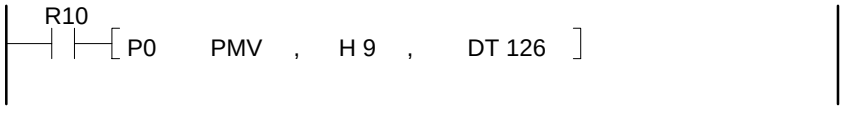
The home is detected when home input is de-energized (bit position 4 = 0).

The overlimit is detected when overlimit input is de-energized (bit position 5 = 0).

■ Program example

The interface logic “H0009” is provisionally set in DT126 with the following specifications:

- Pulse output 1 is used for + direction in CW and CCW mode (regardless of the value in the bit position 0).
- The deviation counter reset output turns ON when hardware home operation is completed, when error occurs, or when power is supplied (bit position 1 = 0).
- The error is detected when error input is de-energized (bit position 2 = 0).
- The near home is detected when near home input is de-energized (bit position 3 = 1).
- The home is detected when home input is de-energized (bit position 4 = 0).
- The overlimit is detected when overlimit input is de-energized (bit position 5 = 0).



Note:

· For details about the program of interface logic, refer to page 134, “5-3. Transferring Parameter Set Values” and page 169, “7-2. Parameter Set and Read Programs.”

5-3. Transferring Parameter Set Values

If the positioning module F-type is in LOCAL mode in the trial operation stage, parameters set by the teaching unit II become effective soon after the setting. For parameter settings using the teaching unit II, refer to page 70, “2) How to Set Parameters Using Teaching Unit II” or to the “TEACHING UNIT II Operation Manual.”
In the actual motion control with the programmable controller, it is necessary to control it in RUN mode using the CPU program. In this case, it is recommended that you make a program to transfer all parameters and positioning point data from the CPU in order to make sure of control. Therefore, the method for transferring parameters set provisionally in registers of the CPU is explained with the data set in “5-2. Explanation of Each Parameter Item.”

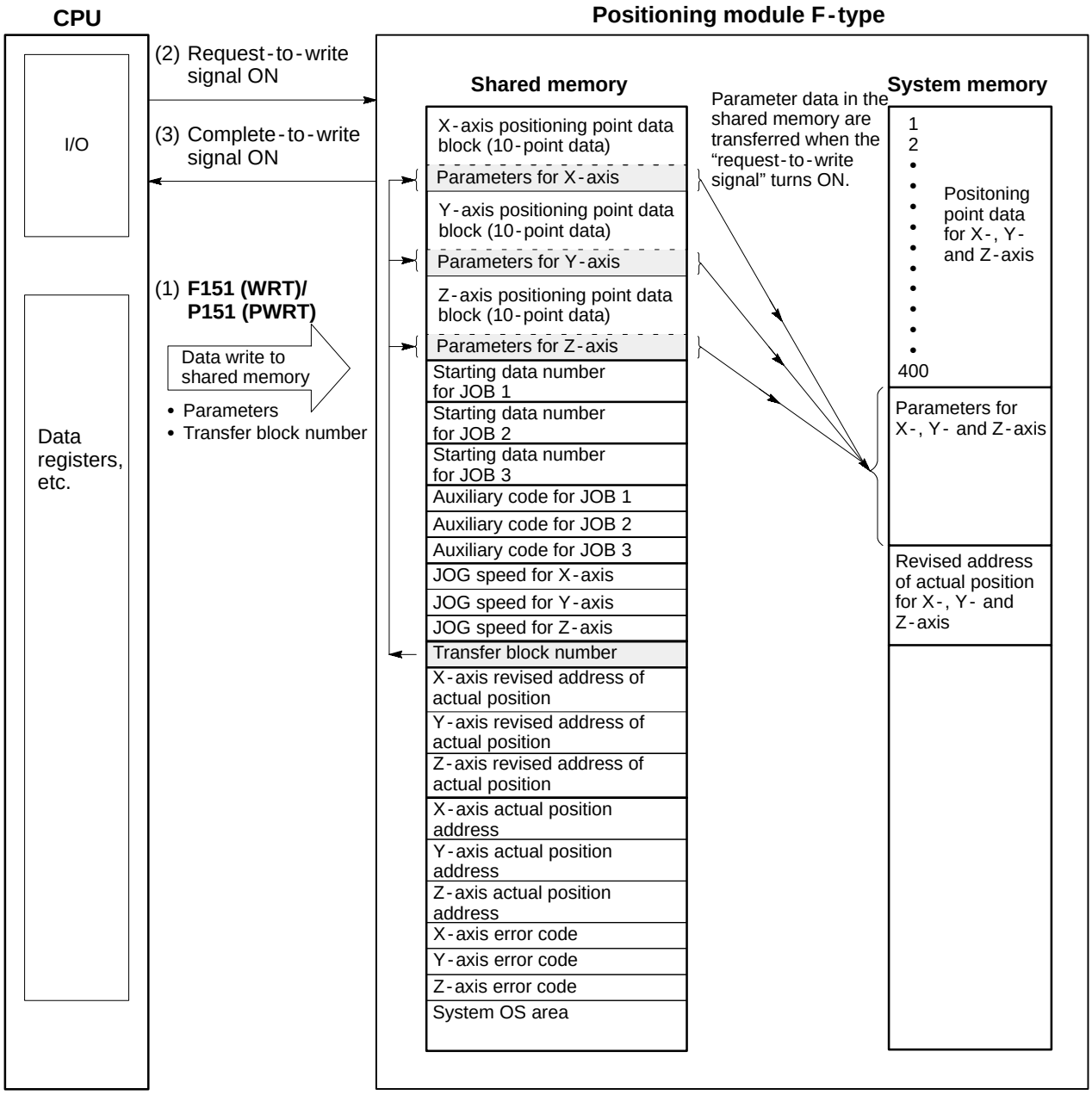
■ Conditions

- Type of module: 1-axis module
- Module’s position: Slot 0 position
- Axis controlled: X-axis
- Provisional registers in the CPU: DT100 to DT127
- Settings and allocation: See table below.

Parameter item	Settings	Provisional storage address for data registers	Shared memory address for X-axis
Pulse output mode	K1	DT100	H080
Axis mode	K0	DT124	H098
Unit setting	K1	DT101	H081
Conversion rate	0.001	DT102	H082
Speed limit	350.000	DT103 DT104	H083 H084
Software limit (+)	1,250.000	DT105 DT106	H085 H086
Software limit (-)	-1,250.000	DT107 DT108	H087 H088
Base speed	50.000	DT109 DT110	H089 H08A
Interpolation speed setting mode	K1	DT125	H099
Backlash compensation	0.000	DT111	H08B
Error compensation	0.1	DT112 DT113	H08C H08D
In-position time	10	DT114	H08E
Homing direction	K0	DT115	H08F
Home offset address	-500.000	DT116 DT117	H090 H091
Home return speed (high)	150.000	DT118 DT119	H092 H093
Home return speed (low)	50.000	DT120 DT121	H094 H095
Acceleration/deceleration time	100	DT122	H096
Start mode	K1	DT127	H09B
Homing method	K1	DT123	H097
Interface logic	H9	DT126	H09A

1) Outline of Parameter Setting in RUN Mode

For setting parameters with a CPU program, procedures using the I/O and memory handshake communication are required as shown below.



■ Procedure

Turn ON the “request-to-run signal.”

↓

Provisionally set parameters in registers of the CPU.

↓

Transfer the contents of the registers into the shared memory of the module using the **F151 (WRT)**/ **P151 (PWRT)** instructions.

↓

Provisionally set the transfer block number “K0” in a register and then transfer it to the address H318 of the shared memory using the **F151 (WRT)/P151 (PWRT)** instructions.

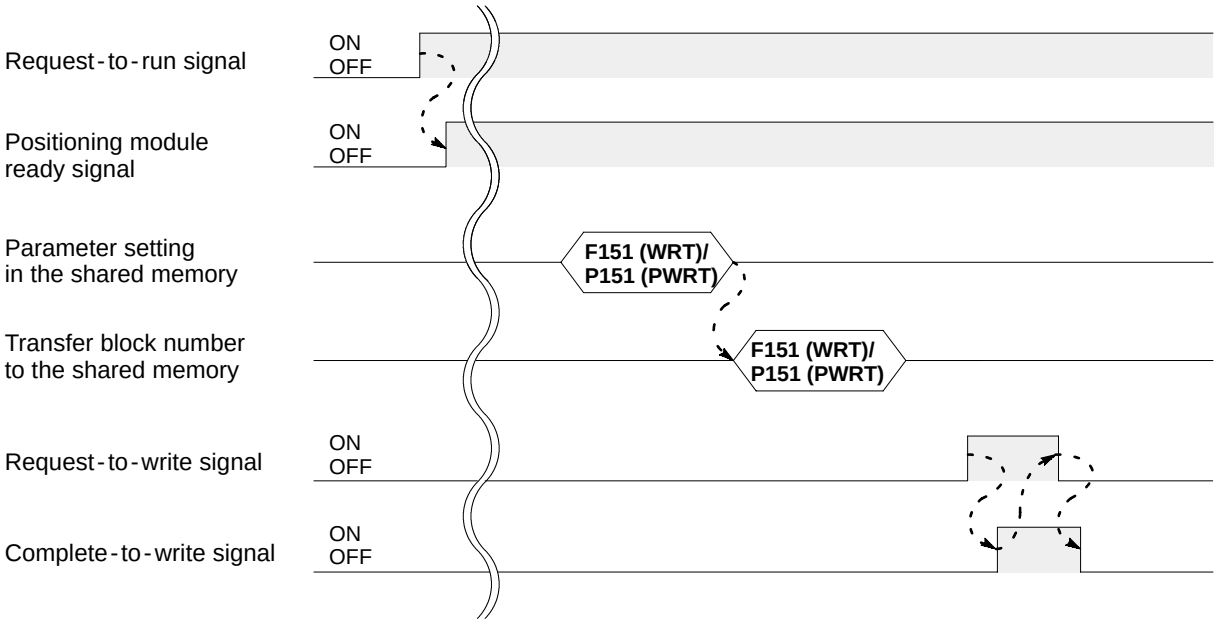
↓

After confirming that the “positioning module ready signal” is turned ON, turn ON the “request-to-write signal.”

↓

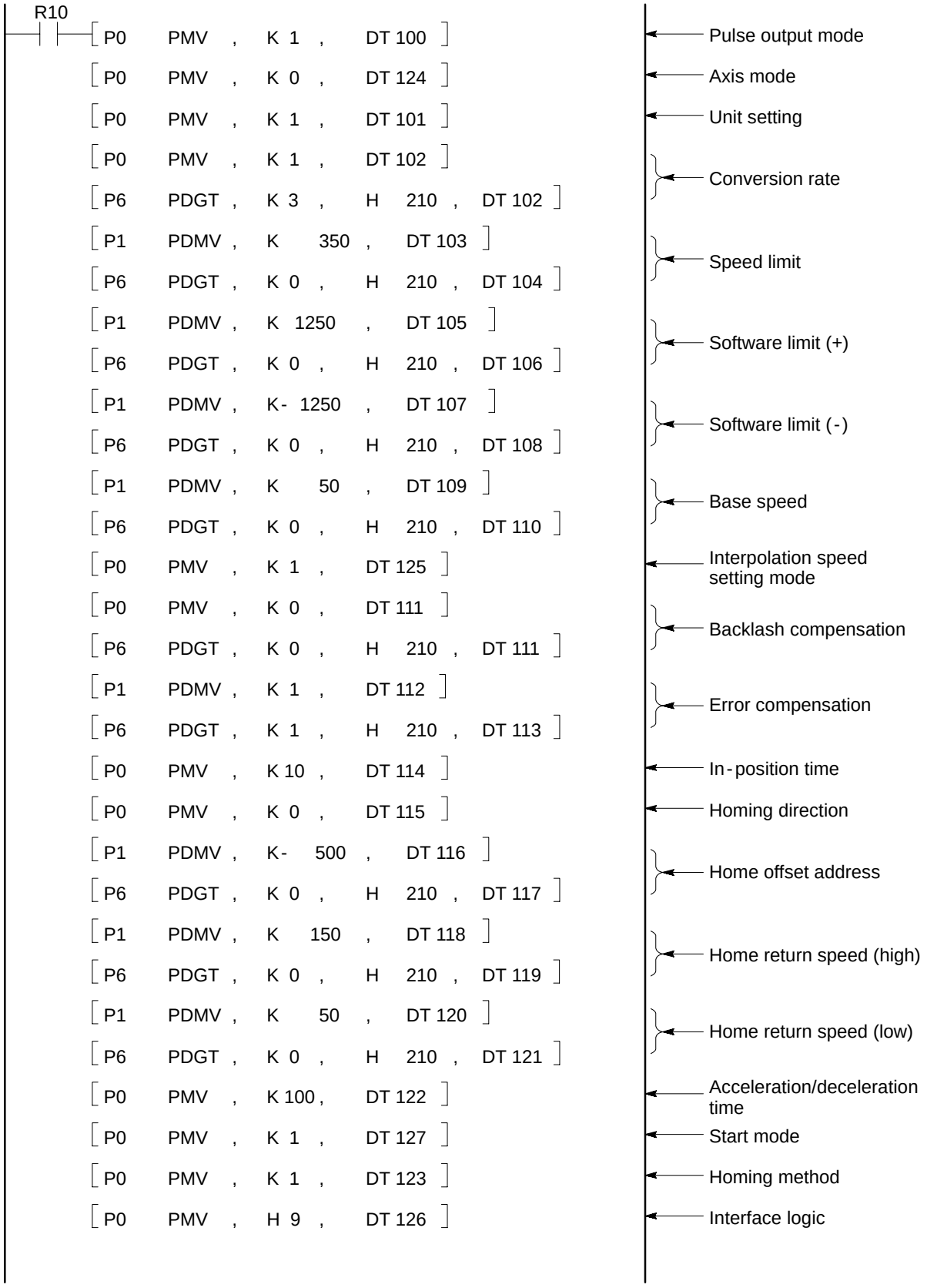
After confirming that the “complete-to-write signal” is turned OFF, perform the JOG or other operations.

■ Time chart



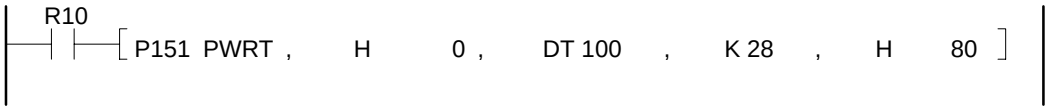
2) Program Example for Provisional Data Storage in CPU

- Provisional registers in the CPU: DT100 to DT127



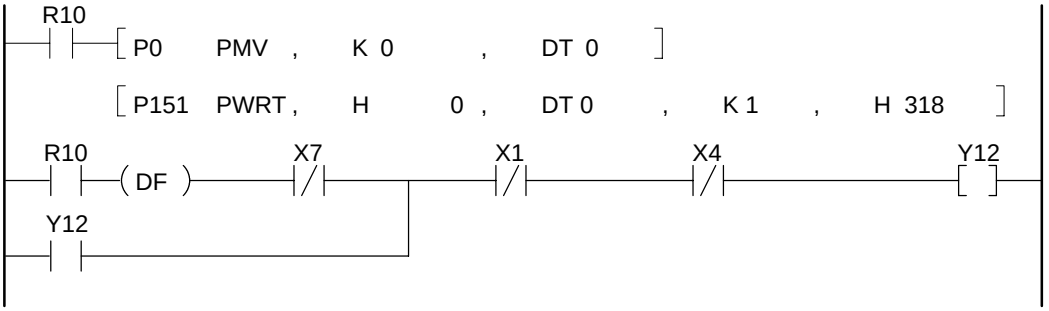
3) Program Example for Sending Data in the Shared Memory

- Module position: Slot 0 position
- Parameters for X-axis: H080 to H09B (28 words)



4) Program Example for Transferring Shared Memory Data to the System Memory

- Request-to-write signal (Shared memory → System memory): Y12
- Complete-to-write signal (Shared memory → System memory): X4
- Transfer block number for parameters: K0



Note:

· For details about the parameter set and read programs, refer to page 169, “7-2. Parameter Set and Read Programs.”

CHAPTER 6

SETTING POSITIONING POINT DATA

6-1. List of Positioning Point Data

The positioning point data are variables for specifying each motion of the positioning module F-type.
A maximum of 400 points data are available for each axis. Each positioning point data contains 7 information items which are necessary for the motion control including motion pattern, motion span and axis speed.
For details about each item, refer to the explanations on the page described in the rightmost column.

Positioning point data item	Setting item	Setting range	Reference
Motion pattern (1)	Next positioning point data number	K1 to K400 or K999 (Decimal constant)	Page 142
	Motion pattern code	C (continuation point): H43 P (pass point): H50 S (circular interpolation point): H53 E (end point) : H45	
Motion span (2) (*1)	Motion span from the software home (absolute address) or from pre-executed position (incremental span)	In "A" mode: - Software limit (-) ≦ Motion span ≦ Software limit (+) In "I" mode: - Software limit (-) ≦ Motion span + Actual address ≦ Software limit (+) (Unique two-word data format)	Page 144
	Addressing code	A (absolute address): H41 I (incremental span): H49	
Axis speed (3) (*1) (*2)	Speed of each axis in independent mode	Base speed ≦ Axis speed ≦ Speed limit (Unique two-word data format)	Page 146
Interpolation speed (4) (*1) (*2)	Interpolation speed in simultaneous mode	Base speed ≦ Interpolation speed ≦ Speed limit (Unique two-word data format)	Page 147
Acceleration/ deceleration time (5)	Time required for acceleration/deceleration for operation	K64 to K4999 (ms) (*3) (Decimal constant)	Page 148
Dwell time (6)	Time lag from the end of pulse	K0 to K499 (× 10 ms) (Decimal constant)	Page 149
Auxiliary code (7)	Operational code for recognizing the execution status	Higher order byte: - A (end mode): H41 - W (start mode): H57 Lower order byte: - K1 to K255 (*4) (Decimal constant)	Page 150

Notes:

- The numbers in brackets in the positioning point data item column indicate the positioning point data selection codes when the teaching unit II is used.
- (*1): In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.
- (*2): When using the teaching unit II, axis speed is not displayed in simultaneous axis mode and interpolation speed is not displayed in independent axis mode.
- (*3): Positioning modules F-type with system ROM version SV 2.0 or later can be set in the range of 0 to 4,999 ms. However, settings in the range of 0 to 63 ms cannot correctly set.
- (*4): If the auxiliary code of "A0" is set, no auxiliary code is set in the shared memory.
- For details about the positioning point data area in the shared memory, refer to page 249.

6-2. Explanation of Each Positioning Point Data Item

Details about each positioning point data item are explained by emphasizing the setting of a positioning point data from the CPU (using I/O and memory handshake communication). If you want to set positioning point data in LOCAL mode with the teaching unit II, refer to page 73, "2) How to Set Positioning Point Data Using the Teaching Unit II." In each positioning point data item explanation, the program example explains the data setting method when 10 positioning point data for the X-axis have been set in data registers starting from DT200 as shown in the table below. However, since the values in the examples do not always correspond to the actual settings, be sure to confirm the actual settings according to actual motion.

Offset data number	Positioning point data item	Shared memory address for X-axis	Provisional storage address for data registers	Reference
1	**Motion pattern**	H000 H001	DT200 DT201	Section 1
	Motion span	H002 H003 H004	DT202 DT203 DT204	Section 2
	Axis speed	H005 H006	DT205 DT206	Section 3
	Interpolation speed	H00A H00B	DT210 DT211	Section 4
	Acceleration/deceleration time	H007	DT207	Section 5
	Dwell time	H008	DT208	Section 6
	Auxiliary code	H009	DT209	Section 7
2	**Same items as data number 1**	H00C to H017	DT212 to DT223	———
3	**Same items as data number 1**	H018 to H023	DT224 to DT235	———
4	**Same items as data number 1**	H024 to H02F	DT236 to DT247	———
5	**Same items as data number 1**	H030 to H03B	DT248 to DT259	———
6	**Same items as data number 1**	H03C to H047	DT260 to DT271	———
7	**Same items as data number 1**	H048 to H053	DT272 to DT283	———
8	**Same items as data number 1**	H054 to H05F	DT284 to DT295	———
9	**Same items as data number 1**	H060 to H06B	DT296 to DT307	———
10	**Same items as data number 1**	H06C to H077	DT308 to DT319	———

1. Motion Pattern

The motion pattern data is used to specify the motion after executing the positioning point data. The operation mode can be selected from four patterns by specifying the next positioning point data number for execution as follows:

- C× × ×: Continuation mode with next positioning point data number
- P× × ×: Pass mode with next positioning point data number
- S× × ×: Circular interpolation mode with next positioning point data number
- E: End mode

■ Setting explanation

• Next positioning point data number

The next positioning point data number should be specified when a continuation (C), pass (P), or circular interpolation (S) is selected. The number specified here is:

- In the range of K1 to K400 for specifying the next data number
- K999 for going back to the unique procedures when jump operation is used.

Notes:

· When a continuation (C) or pass (P) mode is selected, the next data number can freely be selected in the range of K1 to K400.
· When a circular interpolation mode (S) is used, the number should be one larger than the present data number.

• Motion pattern code

Motion pattern	Explanation	Motion pattern code	
		Letter	ASCII code for set letter (For RUN mode setting)
Continuation mode	If this mode is selected, operation pauses at a time after deceleration in order to confirm the motion span. Then it moves to the next positioning point data.	C	H43
Pass mode	If this mode is selected, operation goes into the next positioning point data without deceleration.	P	H50
Circular interpolation mode	This mode is used as a auxiliary point when the circular interpolation is used.	S	H53
End mode	If this mode is selected, series of positioning operation will end after executing the positioning point data.	E	H45

■ Shared memory address

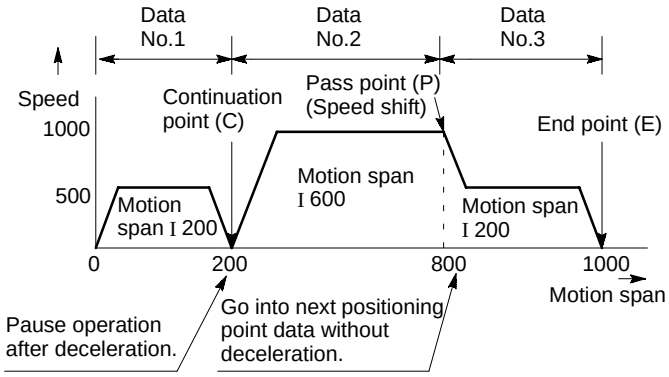
Offset data number		X-axis	Y-axis	Z-axis	Offset data number		X-axis	Y-axis	Z-axis
1	Next data number	H000	H100	H200	6	Next data number	H03C	H13C	H23C
	Motion pattern code	H001	H101	H201		Motion pattern code	H03D	H13D	H23D
2	Next data number	H00C	H10C	H20C	7	Next data number	H048	H148	H248
	Motion pattern code	H00D	H10D	H20D		Motion pattern code	H049	H149	H249
3	Next data number	H018	H118	H218	8	Next data number	H054	H154	H254
	Motion pattern code	H019	H119	H219		Motion pattern code	H055	H155	H255
4	Next data number	H024	H124	H224	9	Next data number	H060	H160	H260
	Motion pattern code	H025	H125	H225		Motion pattern code	H061	H161	H261
5	Next data number	H030	H130	H230	10	Next data number	H06C	H16C	H26C
	Motion pattern code	H031	H131	H231		Motion pattern code	H06D	H16D	H26D

■ Operation examples

• Operation using C, P and E codes

Data No.	Motion pattern	Motion span	Axis speed
1	C2	I 200	500
2	P3	I 600	1000
3	E	I 200	500
.			
.			
. . . . . .			
400			

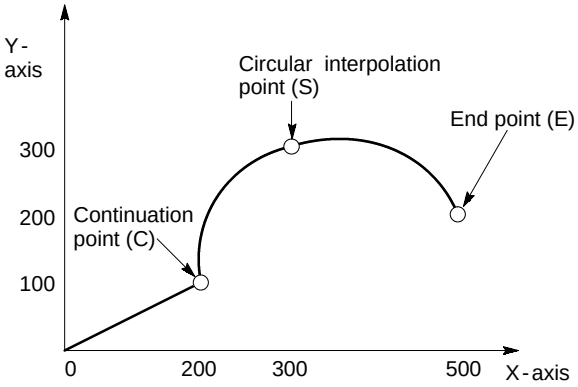
Operation chart



• Operation using C, S and E codes

Data No.	X-axis		Y-axis	
	Motion pattern	Motion span	Motion pattern	Motion span
1	C2	A200	C2	A100
2	S3	A300	S3	A300
3	E	A500	E	A200
.				
.				
. . . . . .				
400				

Operation chart

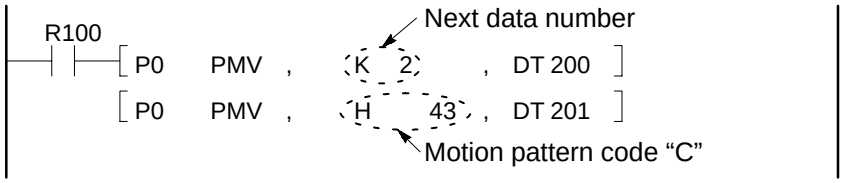


Note:

· When the positioning module F-type is in simultaneous mode, the same motion pattern must be used for the positioning point data on each axis.

■ Program example

The "C2" is set as the motion pattern item for data number 1 for the X-axis.
Provisional storage: DT200 and DT201



Note:

· For details about the motion pattern setting program, refer to page 153, "6-3. Transferring Positioning Point Data" and page 174, "7-3. Positioning Point Data Set and Read Programs."

2. Motion Span

The motion span is used to specify the target address of the motion control. The motion span is specified using one of the following two modes:

- A********: Absolute address specification method
- I********: Incremental motion specification method

******** means the value for setting the absolute address or incremental movement span.

■ Setting explanation

• Motion span value

The motion span value is specified using a unique two-word data according to the mode selected:

- Absolute mode:
  Software limit (-) ≦ Motion span value ≦ Software limit (+)
- Incremental mode:
  Software limit (-) ≦ Motion span value + Actual address ≦ Software limit (+)

• Motion span code

Motion span mode	Explanation	Motion span code	
		Letter	ASCII code of set letter (For RUN mode setting)
Absolute mode	If this mode is selected, the operation moves to the specified address. The absolute address denotes the distance from the software home position. (If the software homing operation is not done after the power-up, the operation is performed regarding work position at the power-up as 0 address.)	A	H41
Incremental mode	If this mode is selected, the operation moves the specified value from the actual position.	I	H49

■ Shared memory address

Offset data number		X-axis	Y-axis	Z-axis	Offset data number		X-axis	Y-axis	Z-axis
1	**Motion span**	H002 H003	H102 H103	H202 H203	**6**	**Motion span**	H03E H03F	H13E H13F	H23E H23F
	Motion span code	H004	H104	H204		**Motion span code**	H040	H140	H240
2	**Motion span**	H00E H00F	H10E H10F	H20E H20F	**7**	**Motion span**	H04A H04B	H14A H14B	H24A H24B
	Motion span code	H010	H110	H210		**Motion span code**	H04C	H14C	H24C
3	**Motion span**	H01A H01B	H11A H11B	H21A H21B	**8**	**Motion span**	H056 H057	H156 H157	H256 H257
	Motion span code	H01C	H11C	H21C		**Motion span code**	H058	H158	H258
4	**Motion span**	H026 H027	H126 H127	H226 H227	**9**	**Motion span**	H062 H063	H162 H163	H262 H263
	Motion span code	H028	H128	H228		**Motion span code**	H064	H164	H264
5	**Motion span**	H032 H033	H132 H133	H232 H233	**10**	**Motion span**	H06E H06F	H16E H16F	H26E H26F
	Motion span code	H034	H134	H234		**Motion span code**	H070	H170	H270

■ Construction of data

• Motion span value

Data for the motion span value is set using a unique two-word format based on the following formula:

$A \times 10^{-n}$

The values in "A" and "n" are expressed as follows:

Example: Setting $500 = 500 \times 10^{-0}$ for the X-axis (H002 and H003)

Shared memory address	H003																H002															
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0
	n								A																							

Note:

· In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

• Motion span code

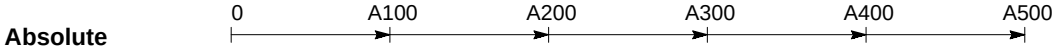
Data for the motion span code is set using the ASCII code of "A" or "I."

A: H41

I : H49

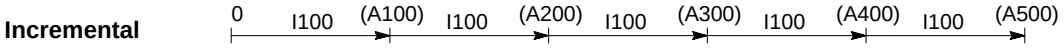
■ Operation examples

• Absolute mode example



(The amount of motion to each target position is specified with the software home position as the reference point.)

• Incremental mode example

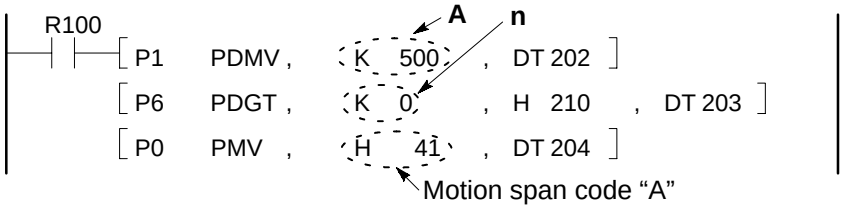


(The amount of motion to each target position is specified with the actual position as the reference point.)

■ Program example

"A500" is set as the motion span item for data number 1 for the X-axis.

Provisional storage: DT202, DT203 and DT204



Note:

· For details about the motion span setting program, refer to page 153, "6-3. Transferring Positioning Point Data" and page 174, "7-3. Positioning Point Data Set and Read Programs."

3. Axis Speed

The axis speed is used for setting the motion speed of an axis when independent mode is selected.

■ Setting range

The axis speed is specified using a unique two-word format so that:
Base speed ≦ Axis speed ≦ Speed limit

Note:

· Speed limit and base speed are specified in the parameters.

■ Shared memory address

Offset data number	X-axis	Y-axis	Z-axis	Offset data number	X-axis	Y-axis	Z-axis
1	H005 H006	H105 H106	H205 H206	**6**	H041 H042	H141 H142	H241 H242
2	H011 H012	H111 H112	H211 H212	**7**	H04D H04E	H14D H14E	H24D H24E
3	H01D H01E	H11D H11E	H21D H21E	**8**	H059 H05A	H159 H15A	H259 H25A
4	H029 H02A	H129 H12A	H229 H22A	**9**	H065 H066	H165 H166	H265 H266
5	H035 H036	H135 H136	H235 H236	**10**	H071 H072	H171 H172	H271 H272

■ Construction of data

Data for the axis speed is set using a unique two-word format based on the following formula:
$A \times 10^{-n}$
The values in "A" and "n" are expressed as follows:

Example: Setting $600 = 600 \times 10^{-0}$ for X-axis (H005 and H006)

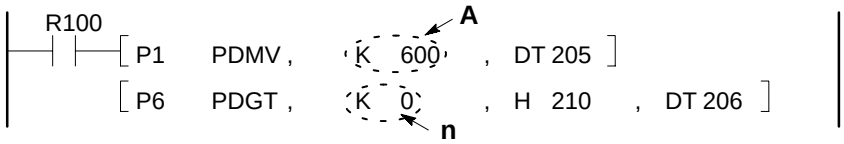
Shared memory address	H006																H005															
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0
	n								A																							

Note:

· In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Program example

"600" is set as the axis speed item for data number 1 for the X-axis.
Provisional storage: DT205 and DT206



Note:

· For details about the axis speed setting program, refer to page 153, "6-3. Transferring Positioning Point Data" and page 174, "7-3. Positioning Point Data Set and Read Programs."

4. Interpolation Speed

The interpolation speed is used for setting the motion speed of the movement when simultaneous mode is selected.

Note:

· The interpolation speed setting mode is specified in the parameter. For details about the setting, refer to page 118, "9. Interpolation Speed Setting Mode."

■ Setting range

The interpolation speed is specified using a unique two-word format so that:
Base speed ≦ Interpolation speed ≦ Speed limit

Note:

· Speed limit and base speed are specified in the parameters.

■ Shared memory address

Offset data number	X-axis	Y-axis	Z-axis	Offset data number	X-axis	Y-axis	Z-axis
1	H00A H00B	Not used		**6**	H046 H047	Not used	
2	H016 H017	Not used		**7**	H052 H053	Not used	
3	H022 H023	Not used		**8**	H05E H05F	Not used	
4	H02E H02F	Not used		**9**	H06A H06B	Not used	
5	H03A H03B	Not used		**10**	H076 H077	Not used	

■ Construction of data

Data for the interpolation speed is set using a unique two-word format based on the following formula:
$A \times 10^{-n}$
The values in "A" and "n" are expressed as follows:
Example: Setting $400 = 400 \times 10^{-0}$ for the X-axis (H00A and H00B)

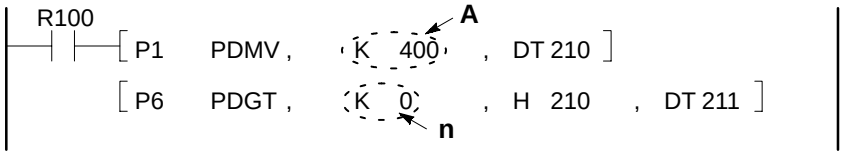
Shared memory address	H00B																H00A											
Bit position	31 • • 28				27 • • 24				23 • • 20				19 • • 16				15 • • 12				11 • • 8				7 • • 4				3 • • 0			
Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0
					n								A																			

Note:

· In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.

■ Program example

"400" is set as the interpolation speed item for data number 1 for the X-axis.
Provisional storage: DT210 and DT211



Note:

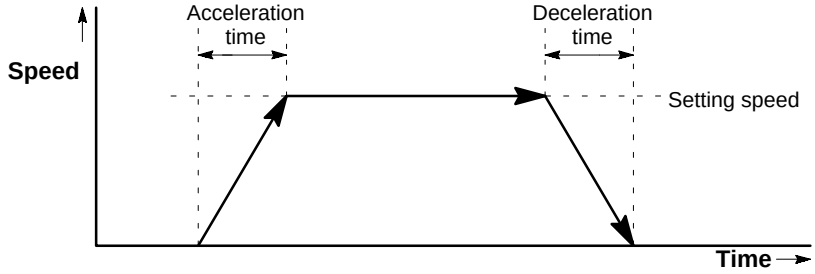
· For details about the interpolation speed setting program, refer to page 153, "6-3. Transferring Positioning Point Data" and page 174, "7-3. Positioning Point Data Set and Read Programs."

5. Acceleration/Deceleration Time

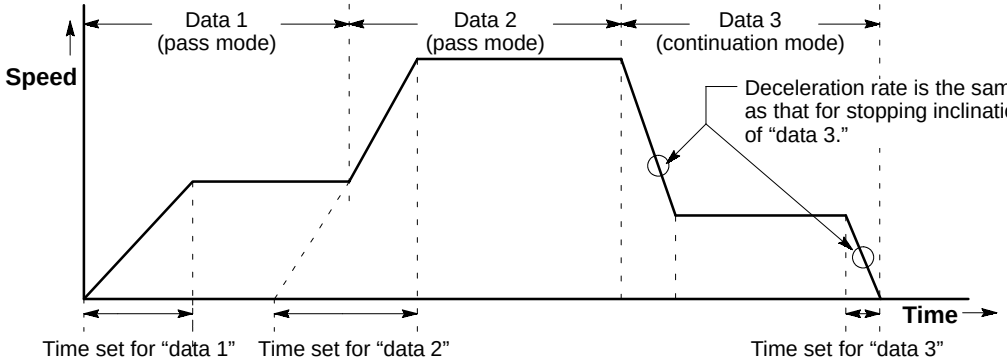
The acceleration/deceleration time is used for setting the time required for reaching the speed at the time of starting and ending the positioning point data operation.
If the setting is too short, the fast rising and falling speed of the motor may generate overcurrent in the drive. Therefore, be sure to set an appropriate time according to the characteristics of the motor.

■ Time chart

• When starting and ending speed is 0



• When starting and ending speed is not 0
When the starting and ending speed of the data is not 0, such as after the pass point, the acceleration and deceleration are performed using the inlination of acceleration from 0 and of deceleration to 0.



■ Setting range

The acceleration/deceleration time is specified as:
64 (ms) ≦ Acceleration/deceleration time ≦ 4,999 (ms)
(Positioning modules F-type with a system ROM version SV 2.0 or later can be set in the range of 0 to 4,999 ms. However, settings in the range of 0 to 63 ms cannot correctly be set.)

■ Shared memory address

Offset data number	X-axis	Y-axis	Z-axis	Offset data number	X-axis	Y-axis	Z-axis
1	H007	H107	H207	**6**	H043	H143	H243
2	H013	H113	H213	**7**	H04F	H14F	H24F
3	H01F	H11F	H21F	**8**	H05B	H15B	H25B
4	H02B	H12B	H22B	**9**	H067	H167	H267
5	H037	H137	H237	**10**	H073	H173	H273

■ Program example

“500” (ms) is set as the acceleration/deceleration time item for data number 1 for the X-axis.
Provisional storage: DT207

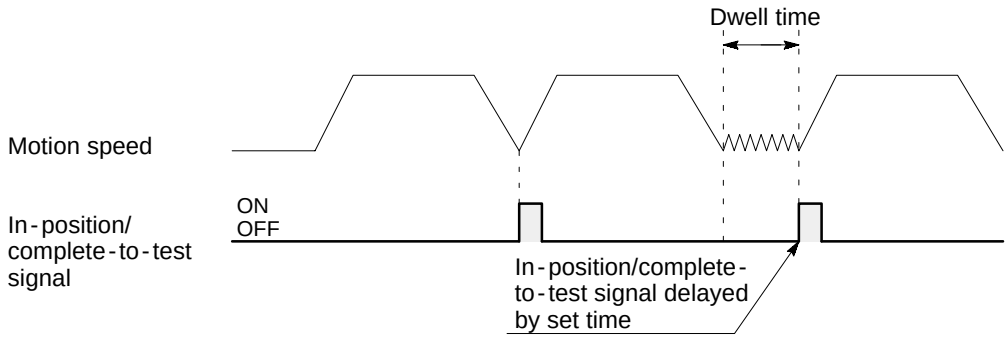
Note:

· For details about the acceleration/deceleration time setting program, refer to page 153, “6-3. Transferring Positioning Point Data” and page 174, “7-3. Positioning Point Data Set and Read Programs.”

6. Dwell Time

The dwell time can specify the time from when the pulse output is completed to when the in-position/complete-to-test signal turns ON. It is used when some time is required from the stopping of an operation to the starting of the next operation.

■ Time chart



■ Setting range

The dwell time is specified as:
0 (× 10 ms) ≦ Dwell time (× 10 ms) ≦ 499 (× 10 ms)

■ Shared memory address

Offset data number	X-axis	Y-axis	Z-axis	Offset data number	X-axis	Y-axis	Z-axis
1	H008	H108	H208	**6**	H044	H144	H244
2	H014	H114	H214	**7**	H050	H150	H250
3	H020	H120	H220	**8**	H05C	H15C	H25C
4	H02C	H12C	H22C	**9**	H068	H168	H268
5	H038	H138	H238	**10**	H074	H174	H274

■ Program example

"20 (× 10 ms)" is set as the dwell time item for data number 1 for the X-axis.
Provisional storage: DT208

Note:

- For details about the dwell time setting program, refer to page 153, "6-3. Transferring Positioning Point Data" and page 174, "7-3. Positioning Point Data Set and Read Programs."

7. Auxiliary Codes

Auxiliary codes are used as a user-significant flag for recognizing the operation of the data. Up to 256 codes can be specified using a auxiliary mode letter "A" or "W" as:

- A × × × (End mode): The auxiliary code is set in the auxiliary code area of shared memory at the same time of the operation end timing (start confirmation signal ON timing).
- W × × × (Start mode): The auxiliary code is set in the auxiliary code area of shared memory at the same time of the operation start timing.

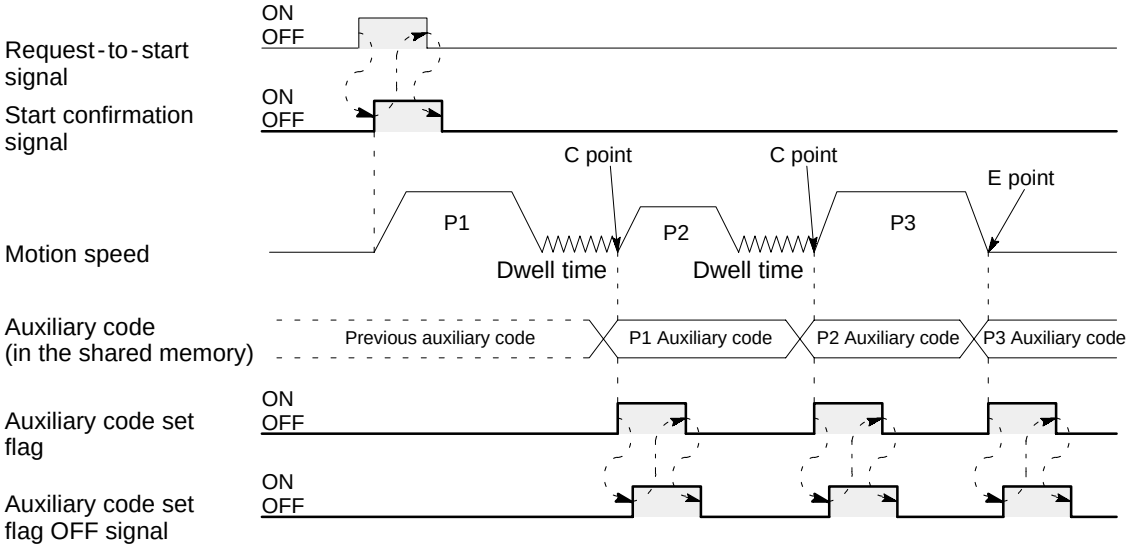
1 ≦ × × × ≦ 255 available for each axis

Notes:

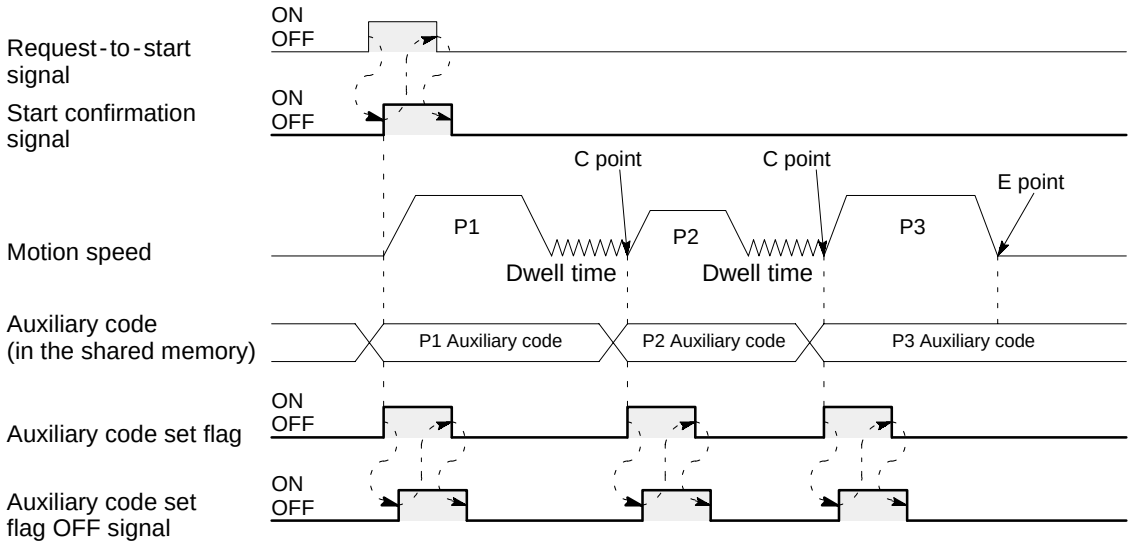
- Be sure to set auxiliary codes not so that they do overlap themselves.
- Even if the mode is different, the number cannot be overlapped.
- An "auxiliary code set flag" and an "auxiliary code set flag OFF signal" are prepared in order to notify of an auxiliary code setting or to reset this signal. For details about the flags, refer to page 75, "4-5. Overview of Handshake Communications."
- The auxiliary area for each JOB is allocated in the shared memory at the following addresses:
  - JOB1: H308.
  - JOB2: H309.
  - JOB3: H30A.

■ Time chart

• End (A) mode operation



• Start (W) mode operation



Note:

· Auxiliary codes can be set for the C, P and E points. However, auxiliary code will not be generated at the S point even if a setting is made.

■ Setting explanation

• Auxiliary code set mode

Auxiliary code set mode	Explanation	Auxiliary code set mode	
		Letter	ASCII code of set letter
End mode	If this mode is selected, the auxiliary code is set when the operation of the positioning point data is finished. (If the dwell time is specified, the code is set in the shared memory after that time.)	A	H41
Start mode	If this mode is selected, the auxiliary code is set in the shared memory at the beginning of operation.	W	H57

• Auxiliary code numbers
255 codes from 1 to 255 is available for setting auxiliary codes.

Notes:

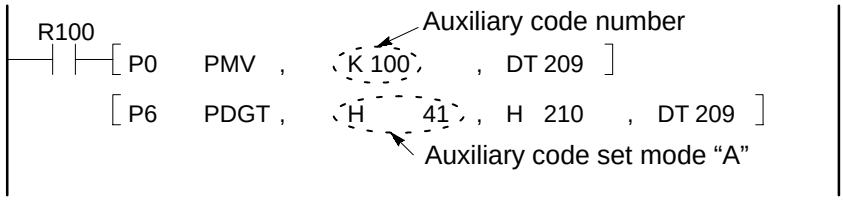
· If the different auxiliary codes are set for X and other axes in simultaneous mode, the code for the X-axis has the priority.
· If code “A0” is set, an auxiliary code is not used for that JOB.
· Note that the same number cannot be used for the other positioning point data even if the auxiliary code set mode is different.

■ **Shared memory address**

Offset data number	X-axis	Y-axis	Z-axis	Offset data number	X-axis	Y-axis	Z-axis
1	H009	H109	H209	**6**	H045	H145	H245
2	H015	H115	H215	**7**	H051	H151	H251
3	H021	H121	H221	**8**	H05D	H15D	H25D
4	H02D	H12D	H22D	**9**	H069	H169	H269
5	H039	H139	H239	**10**	H075	H175	H275

■ **Program example**

"A100" is set as the auxiliary code for data number 1 for the X-axis.
Provisional storage: DT209



Note:

- For details about the auxiliary code setting program, refer to page 153, "6-3. Transferring Positioning Point Data" and page 174, "7-3. Positioning Point Data Set and Read Programs."

6-3. Transferring Positioning Point Data

If the positioning module F-type is in LOCAL mode in the trial operation stage, positioning point data set by the teaching unit II becomes effective soon after the setting. For the positioning point data settings with the teaching unit II, refer to page 73, "2) How to Set Positioning Point Data Using the Teaching Unit II." or to the "TEACHING UNIT II Operation Manual."
In actual motion control with a programmable controller, you must carry out control in RUN mode using a CPU program. In this case, it is recommended that you make a program to transfer all positioning point data from the CPU in order to make sure of control. Therefore, the method for transferring positioning point data provisionally set in registers of the CPU is explained along with data setting in "6-2. Explanation of Each Positioning Point Data Item."

■ Conditions

- Type of module: 1-axis module
- Module's position: Slot 0 position
- Axis controlled: X-axis (independent mode)
- Provisional registers in the CPU: DT200 to DT319
- Settings and allocation: See table below.

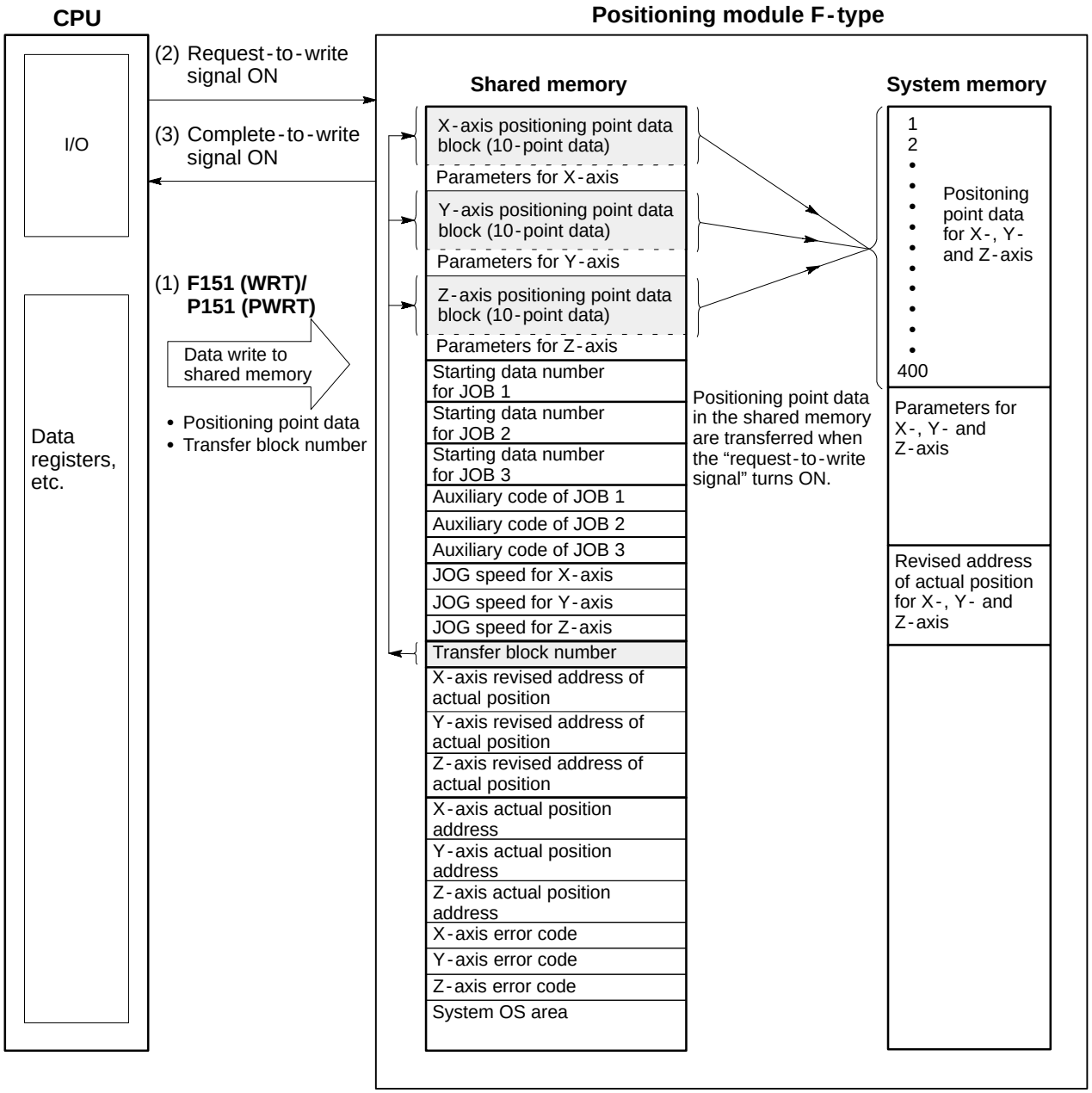
Offset data number	Positioning point data item	Settings	Provisional storage address for data registers	Shared memory address for X-axis
1	**Motion pattern**	C2	DT200 DT201	H000 H001
	Motion span	A500	DT202 DT203 DT204	H002 H003 H004
	Axis speed	600	DT205 DT206	H005 H006
	Interpolation speed (*1)	400	DT210 DT211	H00A H00B
	Acceleration/deceleration time	500	DT207	H007
	Dwell time	20	DT208	H008
	Auxiliary code	A100	DT209	H009
2	**Same items as data number 1**	-	DT212 to DT223	H00C to H017
3	**Same items as data number 1**	-	DT224 to DT235	H018 to H023
4	**Same items as data number 1**	-	DT236 to DT247	H024 to H02F
5	**Same items as data number 1**	-	DT248 to DT259	H030 to H03B
6	**Same items as data number 1**	-	DT260 to DT271	H03C to H047
7	**Same items as data number 1**	-	DT272 to DT283	H048 to H053
8	**Same items as data number 1**	-	DT284 to DT295	H054 to H05F
9	**Same items as data number 1**	-	DT296 to DT307	H060 to H06B
10	**Same items as data number 1**	-	DT308 to DT319	H06C to H077

Note:

· (*1): Even if the interpolation speed is set, the set value is ignored in independent mode.

1) Outline of Positioning Point Data Setting in RUN Mode

The procedures using I/O and memory handshake communications required as shown below for setting positioning point data with a CPU program.



■ Procedure

Turn ON the “request-to-run signal.”

↓

Provisionally set positioning point data in registers of the CPU.

↓

Transfer the contents of the registers into the shared memory of the module using the **F151 (WRT)**/ **P151 (PWRT)** instructions.

↓

Provisionally set the transfer block number in the range of “K1 to K40” in a register and then transfer it to address H318 of the shared memory using the **F151 (WRT)**/**P151 (PWRT)** instructions.

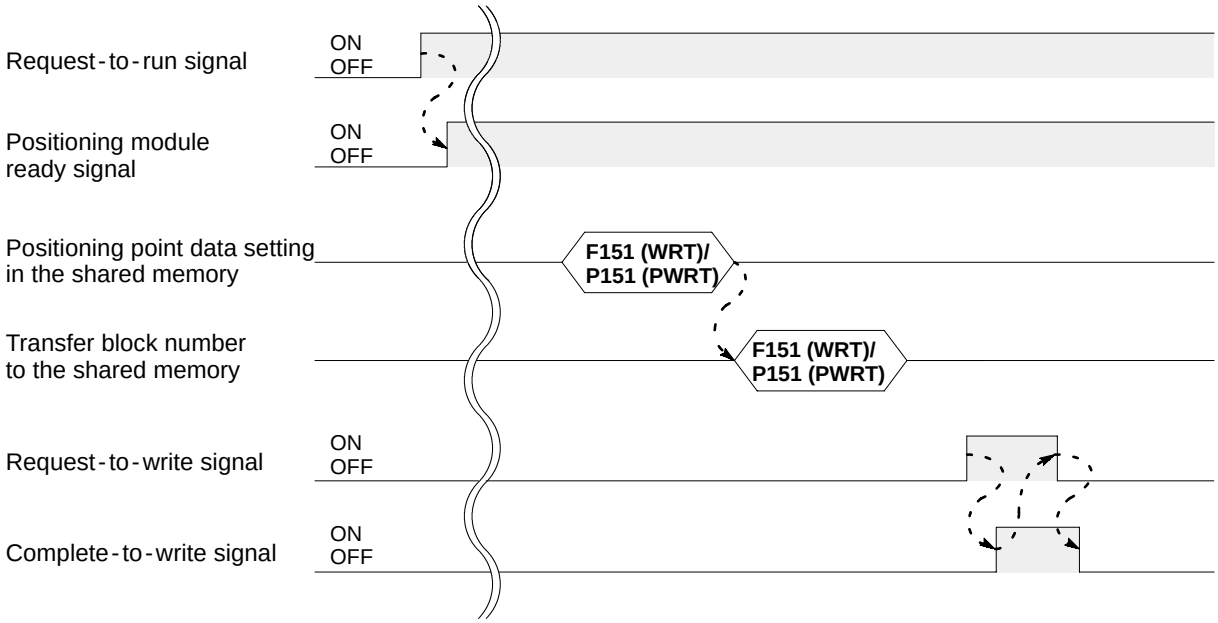
↓

After confirming that the “positioning module ready signal” is turned ON, turn ON the “request-to-write signal.”

↓

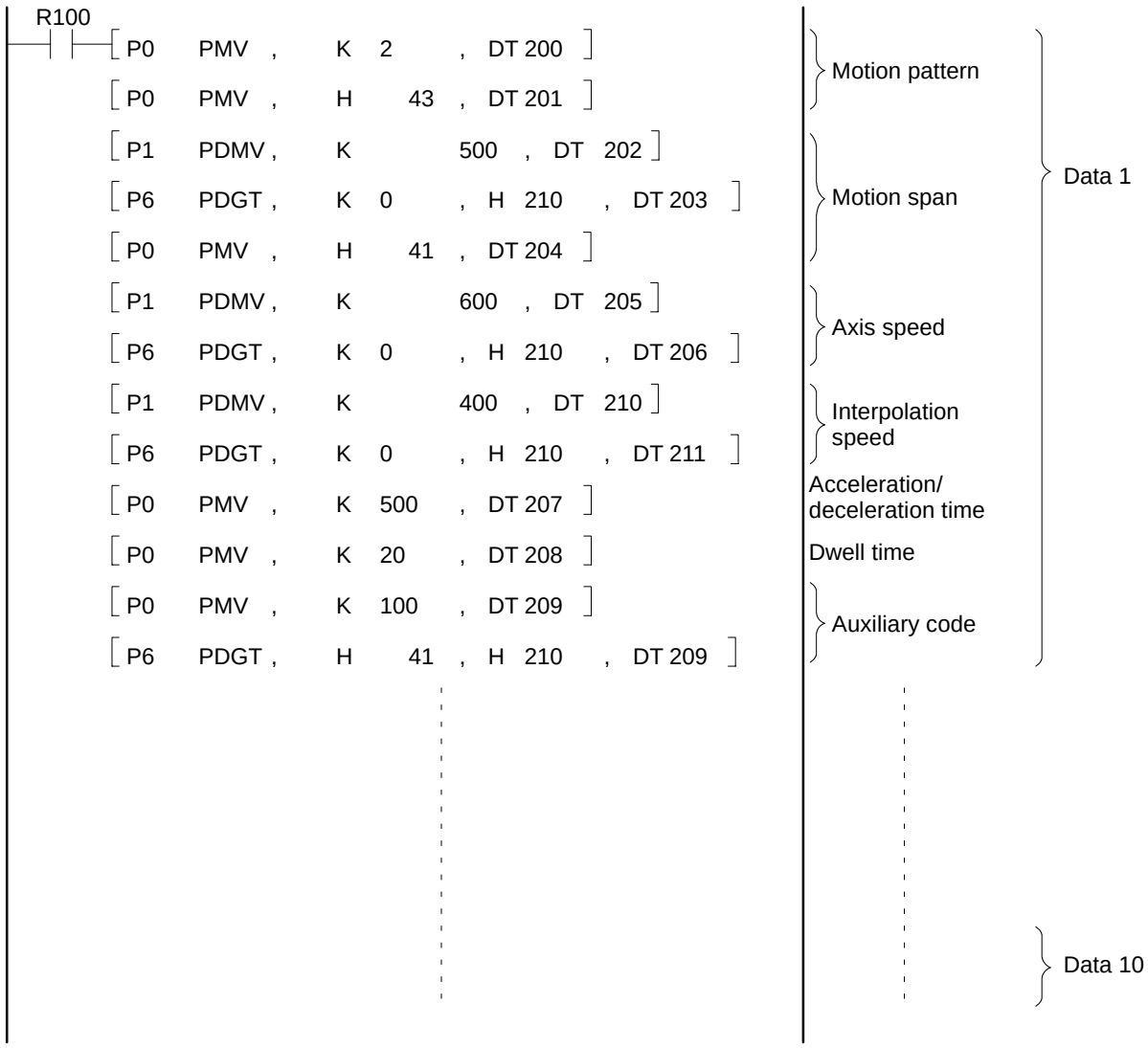
After confirming that the “complete-to-write signal” is turned OFF, perform the JOG or other operations.

■ Time chart



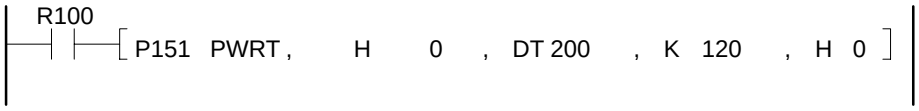
2) Program Example for Provisional Data Storage in CPU

- Provisional registers in the CPU: DT200 to DT319



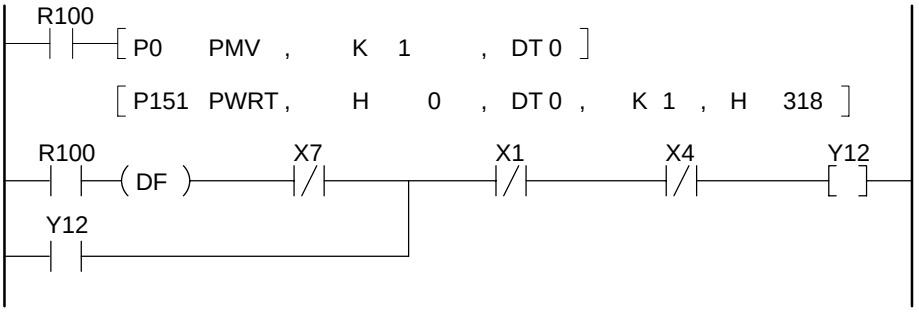
3) Program Example for Sending Data in the Shared Memory

- Modules position: Slot 0 position
- Positioning point data for X-axis: H000 to H077 (120 words)



4) Program Example for Transferring Shared Memory Data to the System Memory

- Request-to-write signal (Shared memory → System memory): Y12
- Complete-to-write signal (Shared memory → System memory): X4
- Transfer block number for positioning point data: K1



Note:

· For details about the positioning point data set and read programs, refer to page 174, “7-3. Positioning Point Data Set and Read Programs.”

6-4. Motion Pattern and Program Composition

A positioning program consists of the axis mode and positioning point data. The positioning module F-type in PTP (point-to-point) operation allows speed control, interpolation control, and constant speed control to be carried out. The composition of the positioning programs and motion patterns are explained with examples in this section.

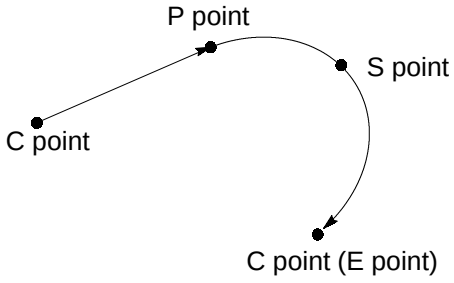
■ Sample operation

Operation / Axis mode	PTP (point-to-point)	Speed shift	Linear interpolation	Circular interpolation	Constant speed control in a continuous path
Independent	○—○ Example 1				
	○—○ Example 2 ○ Example 3 (CXXX jump, C999 return)				
	○ Example 4				
Simultaneous 2-axis			○—○	○	○ Example 5
Simultaneous 3-axis	○—○		○ Example 7	○	○ Example 6

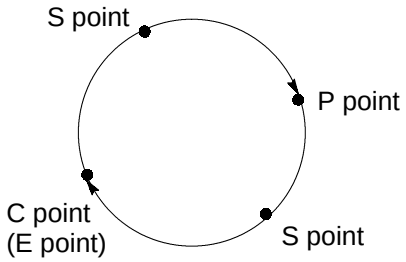
■ Notes on constant speed control in a continuous path

- Smooth operation are possible with the P (pass) point designation in the following control operations between line and circle.

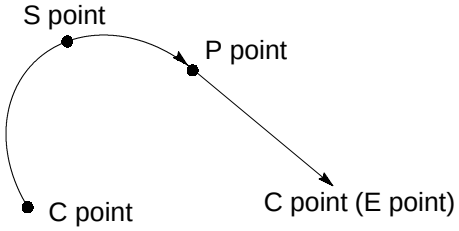
<Linear → Circular>



<Circular → Circular>



<Circular → Linear>



C point: Continuation point
P point: Pass point
S point: Circular interpolation point
E point: End point

- The P (pass) mode of motion pattern has a continuous path error as shown in the following formula.

$$\textbf{Path error (pulses)} = \frac{\text{Constant control speed (kpps)}^{*} \times 1.2\ (\text{ms})}{2}$$

*** Constant control speed** (interpolation speed)

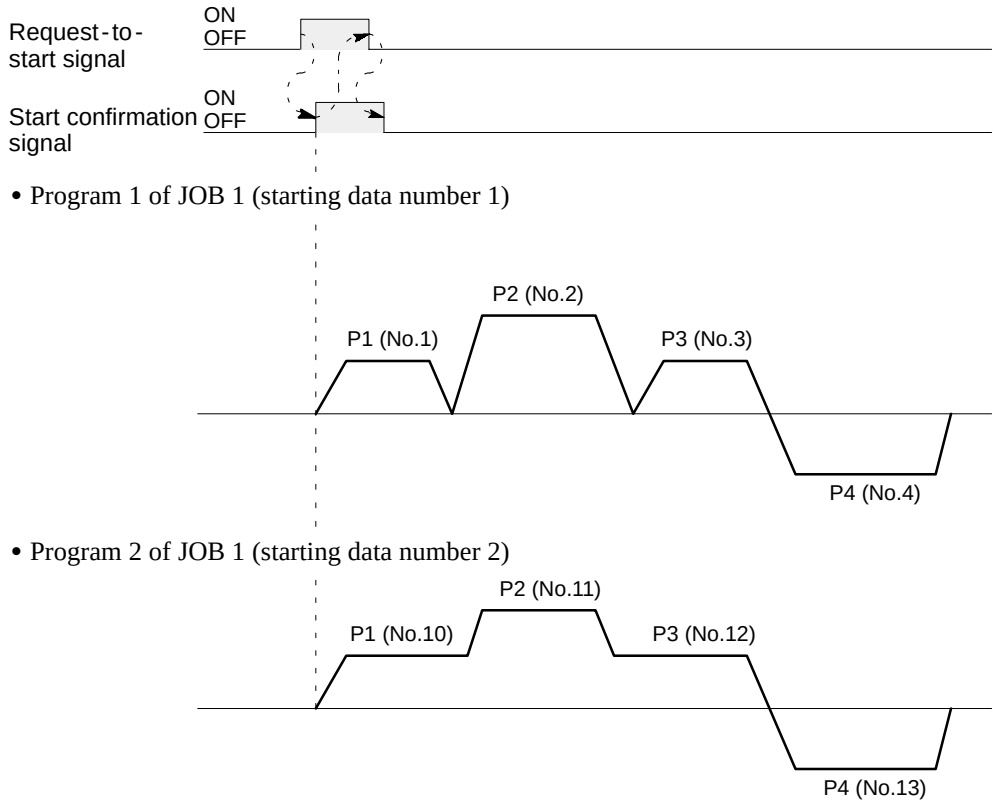
Tracking speed is used for circular interpolation.
Tracking speed or long-axis speed is used for linear interpolation.

■ Example 1: PTP control and speed shift in independent mode (X-axis only)

Program composition

Data No.	JOB 1 X-axis
1	Program 1
2	
3	
4	
•	
•	
•	
•	
•	
•	
10	Program 2
11	
12	
13	

Time chart



Content of data settings

Program 1

Data No.	JOB 1 X	JOB 2 Y	JOB 3 Z	Positioning point	Description
1	C2	-	-	P1	X-axis PTP (point-to-point) control
2	C3	-	-	P2	
3	C4	-	-	P3	
4	E	-	-	P4	
•					
•					
•					
•					
10	P11	-	-	P1	X-axis speed shift P (pass) point control without stop
11	P12	-	-	P2	
12	C13	-	-	P3	
13	E	-	-	P4	

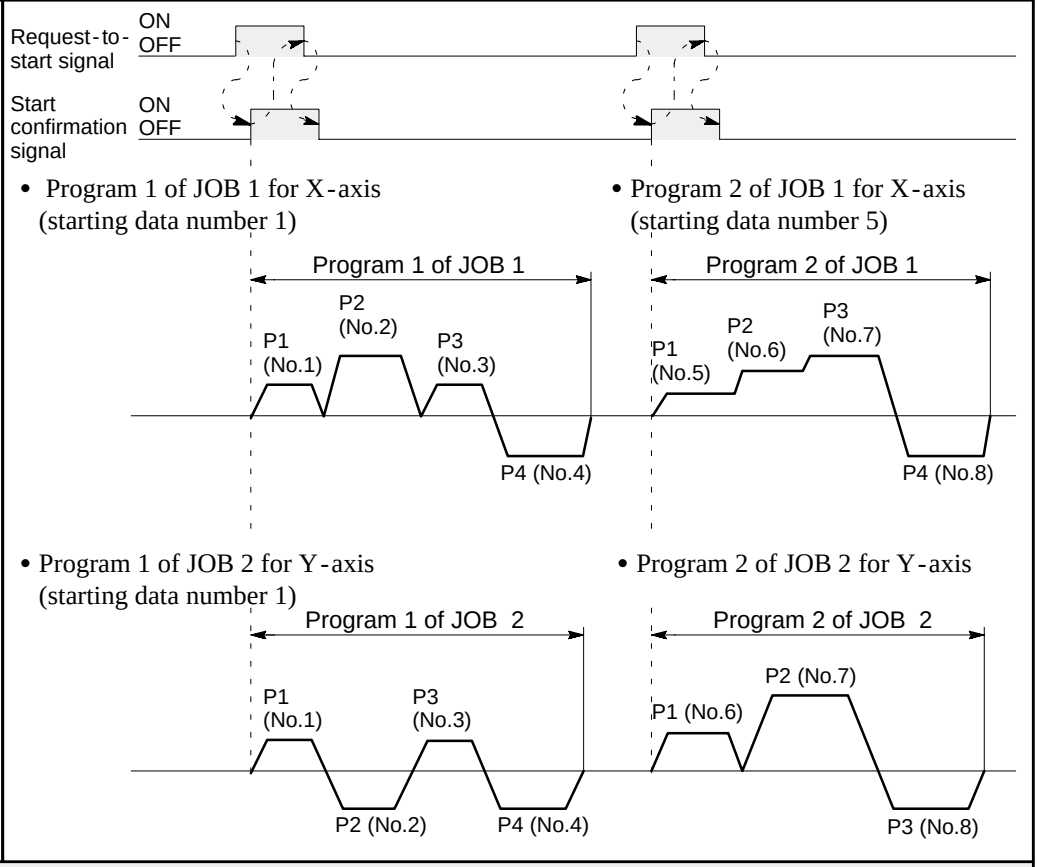
Program 2

■ Example 2: PTP control and speed shift in independent mode (X- and Y-axis)

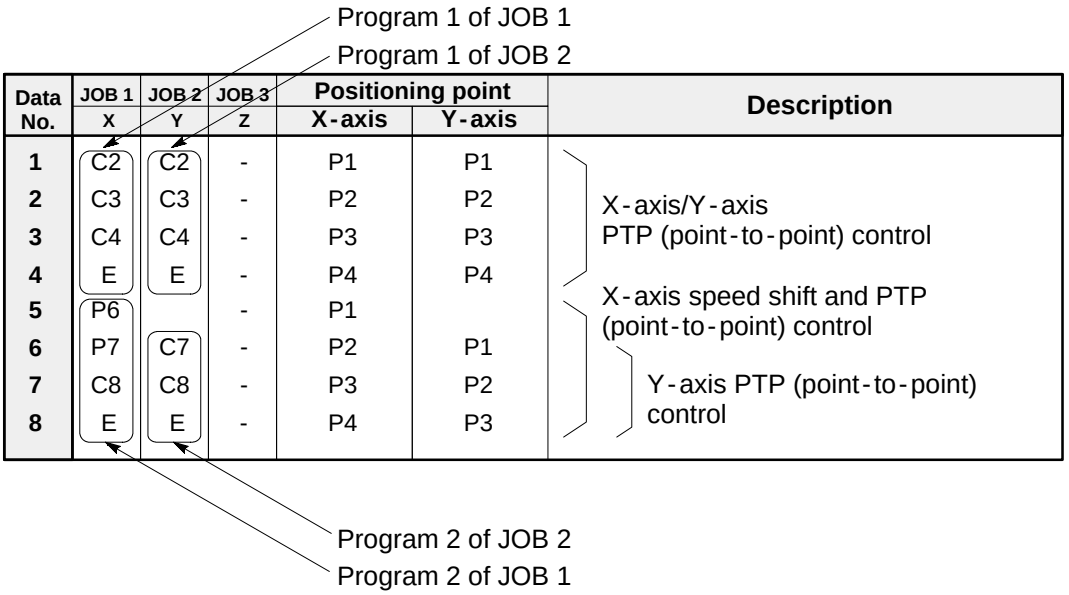
Program composition

Data No.	JOB 1 X-axis	JOB 2 Y-axis
1	Program 1	Program 1
2		
3		
4		
5	Program 2	
6		Program 2
7		
8		

Time chart



Content of data settings



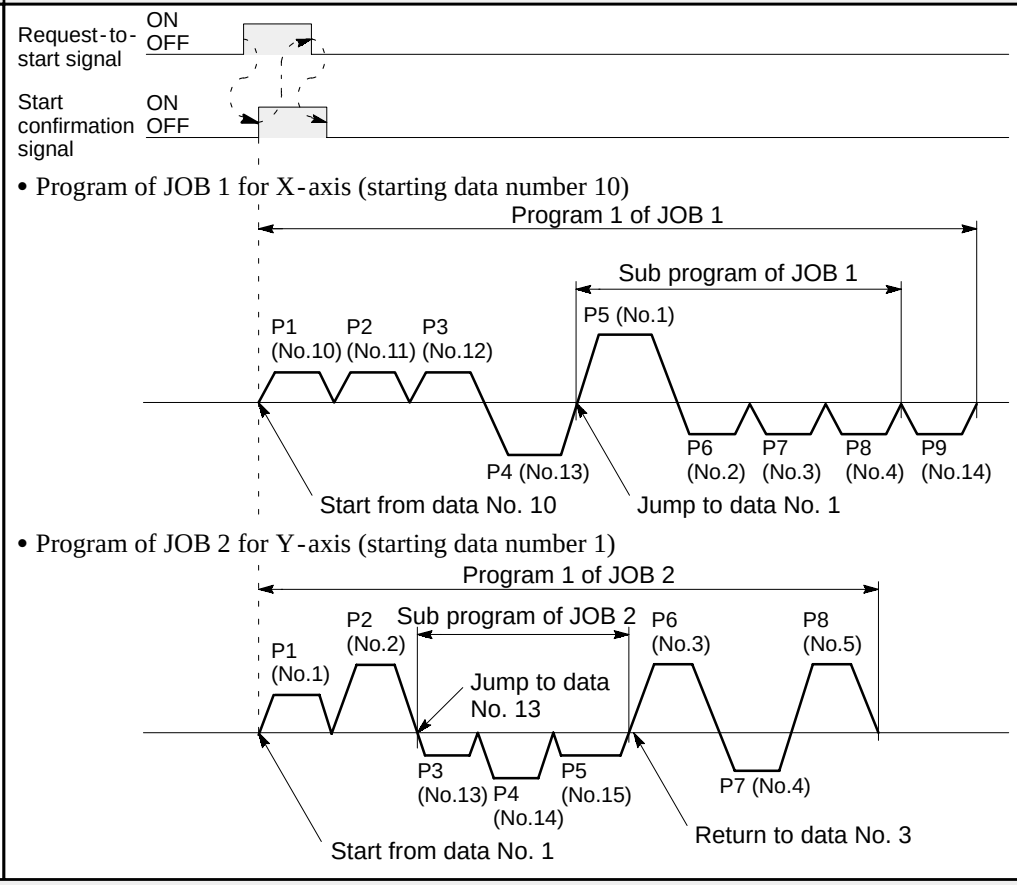
Data No.	JOB 1 X	JOB 2 Y	JOB 3 Z	Positioning point X-axis	Positioning point Y-axis	Description
1	C2	C2	-	P1	P1	X-axis/Y-axis PTP (point-to-point) control
2	C3	C3	-	P2	P2	
3	C4	C4	-	P3	P3	
4	E	E	-	P4	P4	
5	P6		-	P1		X-axis speed shift and PTP (point-to-point) control
6	P7	C7	-	P2	P1	
7	C8	C8	-	P3	P2	Y-axis PTP (point-to-point) control
8	E	E	-	P4	P3	

■ Example 3: PTP control and data jump in independent mode (X- and Y-axis)

Program composition

Data No.	JOB 1 X-axis	JOB 2 Y-axis
1	Sub program	Program 1
2		
3		
4		
5		
•		
•		
•		
•		
•		
10	Program 1	
11		
12		
13		Sub program
14		
15		
16		

Time chart



Content of data settings

Sub program of JOB 1
Program 1 of JOB 2

Data No.	JOB 1 X	JOB 2 Y	JOB 3 Z	Positioning point X-axis	Positioning point Y-axis	Description
1	C2	C2	-	P5	P1	Start program 1 of JOB 2
2	C3	C13	-	P6	P2	Jump to data No. 13 of JOB 2
3	C4	C4	-	P7	P6	
4	C999	C5	-	P8	P7	Return to data No. 14 of JOB 1
5		E	-		P8	End program 1 of JOB 2
•	Jump	Jump	-			
•			-			
•	Return	Return	-			
•			-			
10	C11		-			
11	C12		-	P1		Start program 1 of JOB 1
12	C13		-	P2		
13	C1	C14	-	P3	P3	Jump to data No. 1 of JOB 1
14	E	C15	-	P4	P4	End program 1 of JOB 1
15		C999	-		P5	Return to data No. 3 of JOB 2

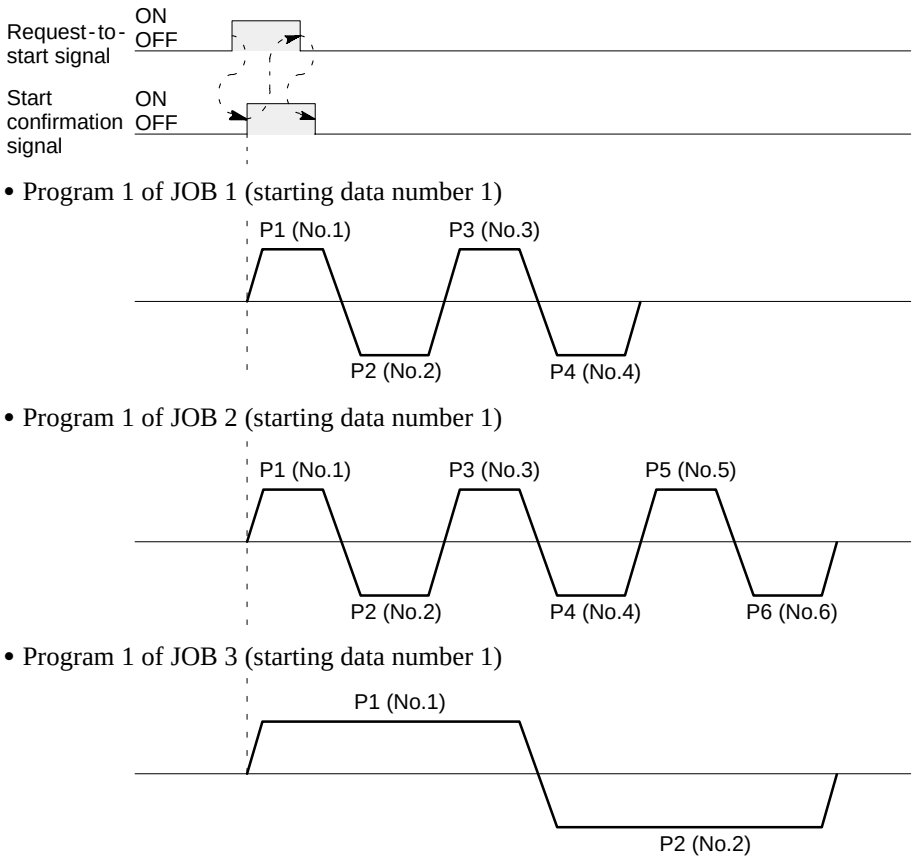
Sub program of JOB 2
Program 1 of JOB 1

■ Example 4: PTP control in independent mode (X-, Y- and Z-axis)

Program composition

Data No.	JOB 1 X-axis	JOB 2 Y-axis	JOB 3 Z-axis
1	Program 1	Program 1	Program 1
2			
3			
4			
5			
6			
7			
8			

Time chart



Content of data settings

Data No.	JOB 1 X	JOB 2 Y	JOB 3 Z	Positioning point X-axis	Positioning point Y-axis	Positioning point Z-axis	Description
1	C2	C2	C2	P1	P1	P1	
2	C3	C3	E	P2	P2	P2	
3	C4	C4		P3	P3		
4	E	C5		P4	P4		
5		C6			P5		
6		E			P6		
7							
8							

Program 1 of JOB 3
Program 1 of JOB 2
Program 1 of JOB 1

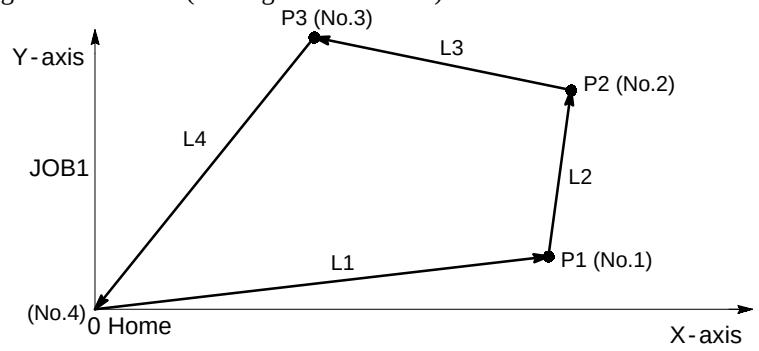
■ Example 5: Interpolation control (linear and circular) and constant speed control in simultaneous 2-axis mode (X- and Y-axis)

Program composition

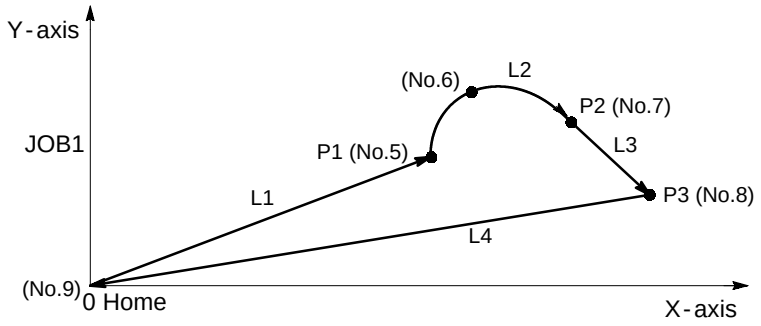
Data No.	JOB 1 X-axis	JOB 1 Y-axis
1	Program 1	
2		
3		
4		
5	Program 2	
6		
7		
8		

Operation chart

• Program 1 of JOB 1 (starting data number 1)



• Program 2 of JOB 1 (starting data number 5)



Content of data settings

Program 1

Data No.	JOB 1 X	JOB 1 Y	JOB 3 Z	Positioning point	Description		
1	C2	C2	-	P1	Move to P1	L1: Linear interpolation	PTP control
2	C3	C3	-	P2	Move to P2	L2: Linear interpolation	
3	C4	C4	-	P3	Move to P3	L3: Linear interpolation	
4	E	E	-	0	Move to home (0)	L4: Linear interpolation	
5	C6	C6	-	P1	Move to P1	L1: Linear interpolation	Constant speed control between L2 and L3
6	S7	S7	-		Circular interpolation point	L2: Circular interpolation	
7	P8	P8	-	P2	Move to P2		
8	C9	C9	-	P3	Move to P3	L3: Linear interpolation	
9	E	E	-	0	Move to home (0)	L4: Linear interpolation	

Program 2

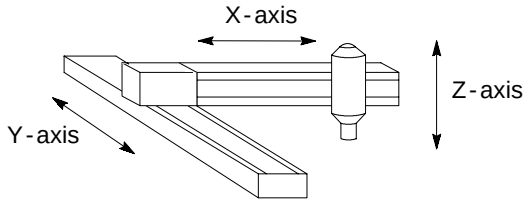
■ Example 6: Interpolation control (linear and circular) and constant speed control in simultaneous 3-axis mode (X-, Y- and Z-axis)

Program composition

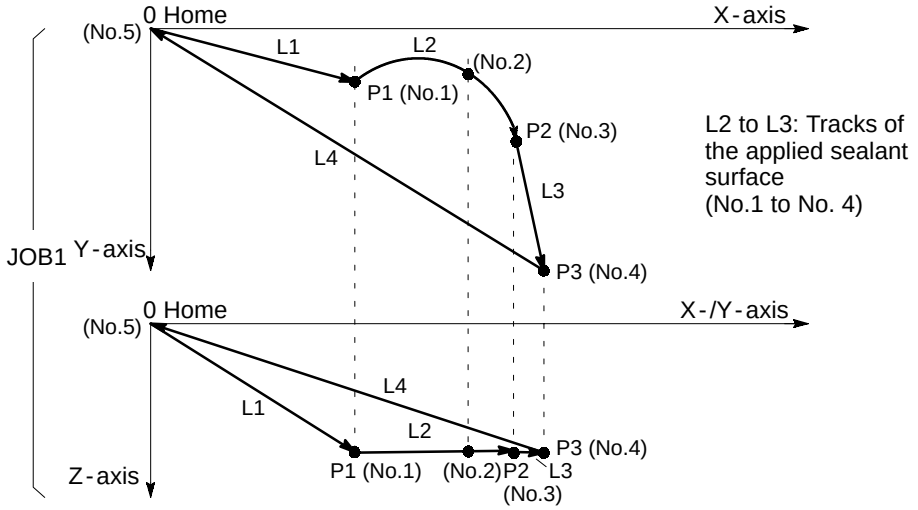
Data No.	JOB 1 X	JOB 1 Y	JOB 1 Z
1	Program 1		
2			
3			
4			
5			

Operation chart

Example: Applying sealant



• Program 1 of JOB 1 (starting data number 1)



Content of data settings

Data No.	JOB 1 X	JOB 1 Y	JOB 1 Z	Positioning point	Description
1	C2	C2	C2	P1	Move to P1 — X, Y, Z: Linear interpolation - PTP control
2	S3	S3	S3		Circular interpolation point — L2: Circular interpolation
3	P4	P4	P4	P2	Move to P2
4	C5	C5	C5	P3	Move to P3 — L3: Linear interpolation (Constant speed control between L2 and L3)
5	E	E	E	0	Move to home (0) — X, Y, Z: Linear interpolation - PTP control
6					
7					
8					
9					

Program 1

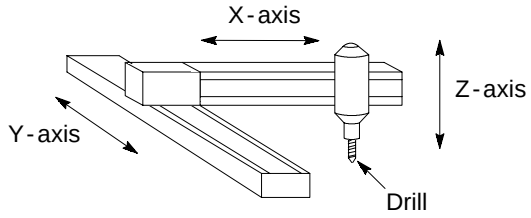
■ Example 7: Linear interpolation control in simultaneous 3-axis mode (X-, Y- and Z-axis)

Program composition

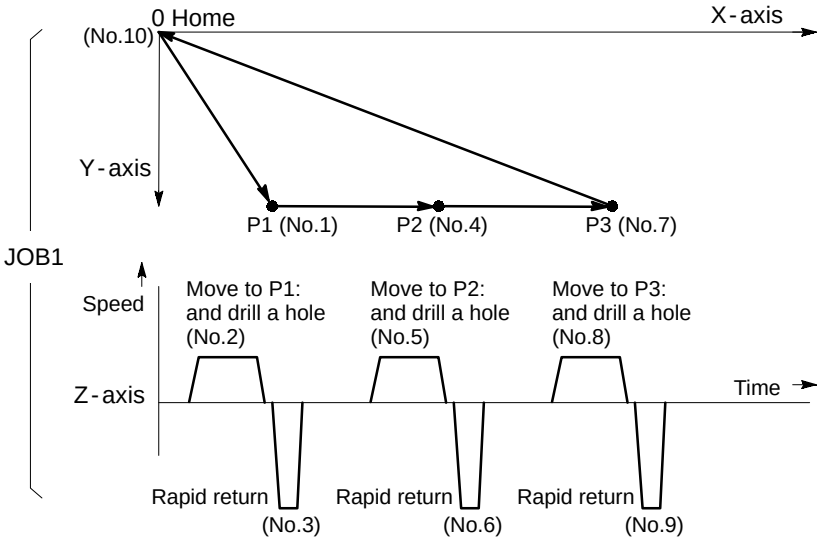
Data No.	JOB 1 X	JOB 1 Y	JOB 1 Z
1	Program 1		
2			
3			
4			
5			
6			
7			
8			
9			
10			

Operation chart

Example: Drilling



• Program 1 of JOB 1 (starting data number 1)



Content of data settings

Data No.	JOB 1 X	JOB 1 Y	JOB 1 Z	Positioning point	Description
1	C2	C2	C2	P1	Move to P1 Linear interpolation - PTP control
2	C3	C3	C3		Work 1 (drill a hole at P1)
3	C4	C4	C4		(Return the drill rapidly)
4	C5	C5	C5	P2	Move to P2 Linear interpolation - PTP control
5	C6	C6	C6		Work 2 (drill a hole at P2)
6	C7	C7	C7		(Return the drill rapidly)
7	C8	C8	C8	P3	Move to P3 Linear interpolation - PTP control
8	C9	C9	C9		Work 3 (drill a hole at P3)
9	C10	C10	C10		(Return the drill rapidly)
10	E	E	E	0	Move to home (0) Linear interpolation - PTP control

Program 1

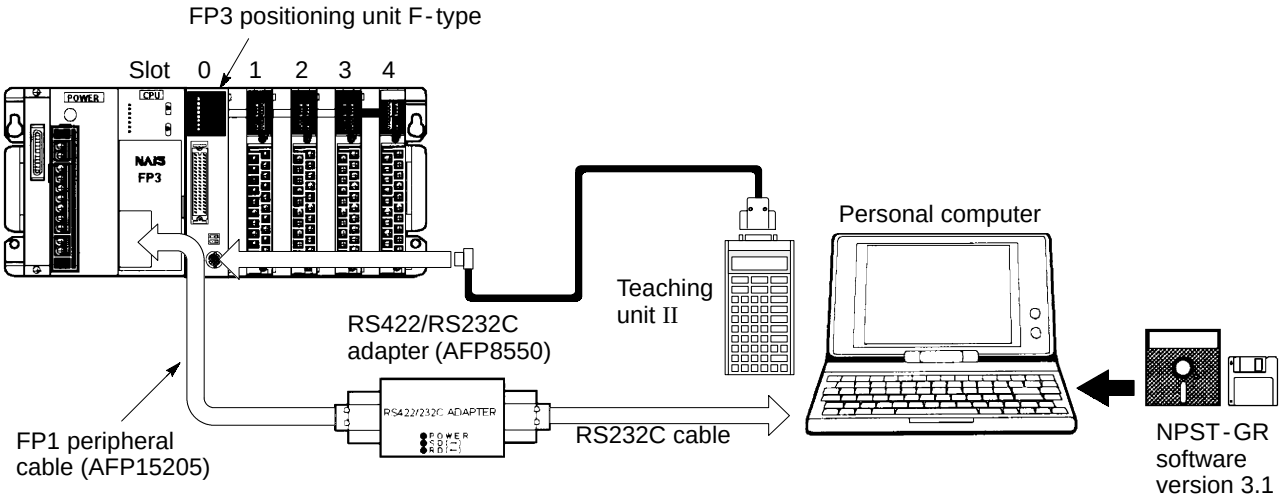
CHAPTER 7

PROGRAMMING FOR MOTION CONTROL

7-1. Preparation for Programming

The positioning module F-type can be installed in any slot of the backplane.
For the convenience of understanding, the programs in this chanpter will be explained using the following conditions.

- CPU: FP3
- Module position: Slot 0 position
- I/O allocated: 1-axis module (16 SX and 16 SY: X0 to XF and Y10 to Y1F),
  2- and 3-axis module (32 SX and 32 SY: X0 to X1F and Y20 to Y3F)
- Programming tool: NPST-GR software version 3.1
- Programming peripherals: FP1 peripheral cable (AFP15205), RS422/RS232C adapter (AFP8550), a commercially available RS232C cable and a personal computer



Notes:

- For details about module installation, refer to page 33, “3. Installation Method.”
- For information on the I/O connectors and wiring, refer to page 21, “5. Pin Layout of Connectors and Internal Circuits,” and to page 35, “3-2. Wiring.”
- When turning ON the power to the system for the first time after installation, you must check the operation monitor LEDs while referring to page 53, “1. Operation Monitor LEDs.”
- When power is supplied to the positioning module at the first time, be sure to clear the memory away using the teaching unit II. For details about the memory clear operation, refer to the “TEACHING UNIT II Operation Manual.”
- For details about the specifications for a commercially available RS232C cable, refer to the “FP3/FP10S HARDWARE Technical Manual.”
- For details about the NPST-GR compatible personal computer is:
  - IBM PC AT or 100% compatible type with a i80486 CPU or later
  - Approx. 2 MB or more hard disk space
  - One disk drive for 3.5-in 2HD floppies formatted at 1.44 MB or 5.25-in 2HD floppies formatted at 1.2 MB
  - 580 KB or more free main (conventional) memory
  - 800 KB or more EMS
  - VGA display
  - RS232C port (COM1 or COM2)
  - PC-DOS or MS-DOS version 5.0 or later

7-2. Parameter Set and Read Programs

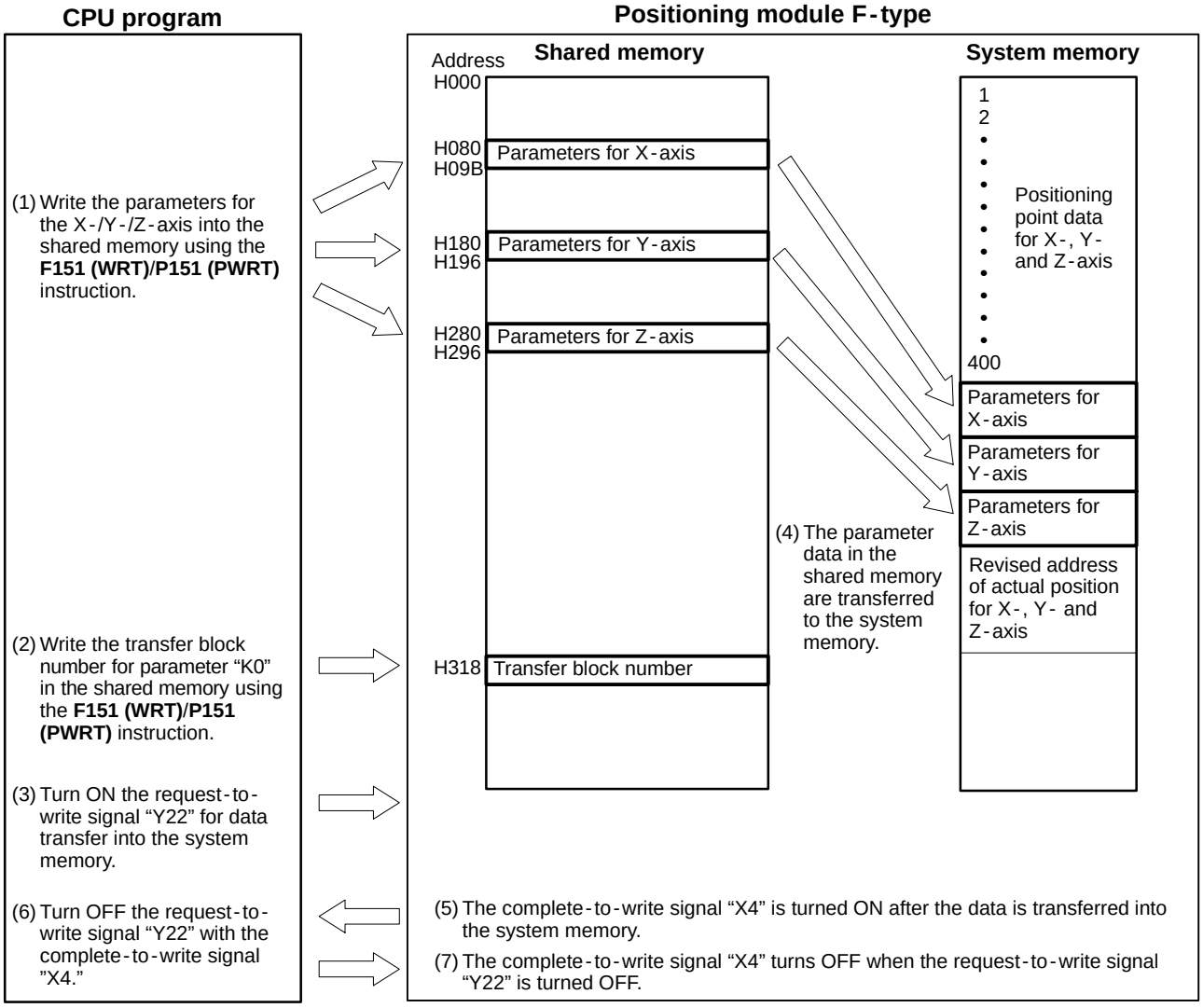
1. Setting Parameters

The parameters can be set to the system memory of the positioning module F-type with CPU program by the following procedures.

■ Parameter setting procedures

Procedures are explained using the 3-axis module in the 0 slot position.

(1) Write the parameters for X-/Y-/Z-axis to the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
↓
(2) Write the transfer block number for parameter "K0" to the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
↓
(3) Turn the request-to-write signal "Y22" ON for transferring the parameters set in the shared memory to the system memory.
↓
(4) The parameter data in the shared memory are transferred to the system memory.
↓
(5) The complete-to-write signal "X4" turns ON after the data is transferred into the system memory.
↓
(6) Turn OFF the request-to-write signal "Y22" with the complete-to-write signal "X4."
↓
(7) The complete-to-write signal "X4" turns OFF when the request-to-write signal "Y22" is turned OFF.



Notes:

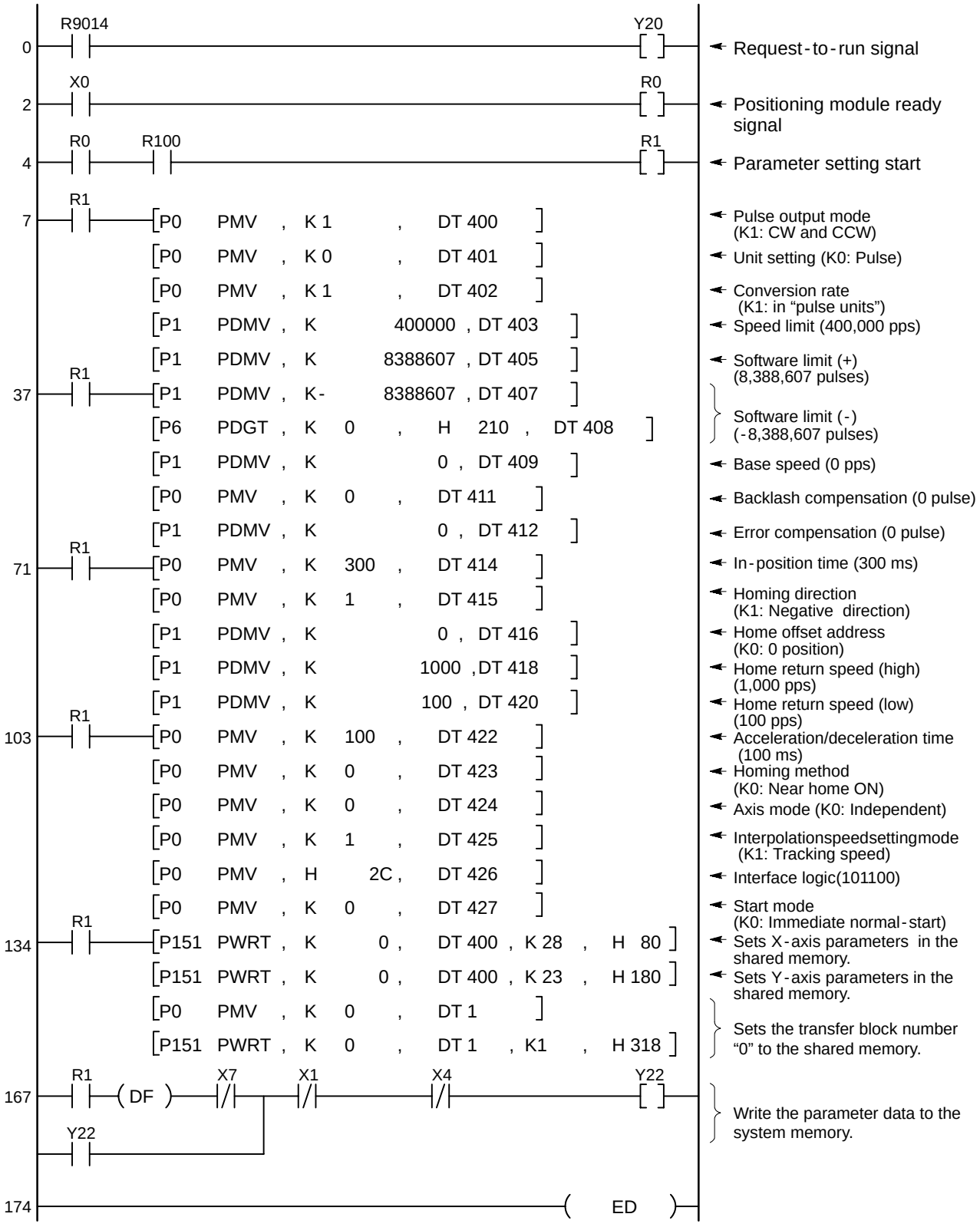
- It is impossible to transfer the data into the system memory while the positioning module is in the operating condition (outputting pulses).
- If you go into the JOG or homing operation soon after the parameter settings, be sure to make a program so that an interval of 200 ms or more is kept after the complete-to-write signal is turned ON.

■ Program example

Condition: 2-axis module in the slot 0 position

Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y22: Request-to-write signal
  - X4: Complete-to-write signal
  - R100: Parameter setting start trigger from the field device
- Shared memory of the positioning module
  - H080 to H09B: Parameters for X-axis
  - H180 to H19B: Parameters for Y-axis
  - H318: Transfer block number area



Note:

- For details about each parameter item, refer to page 108, "5-2. Explanation of Each Parameter Item."

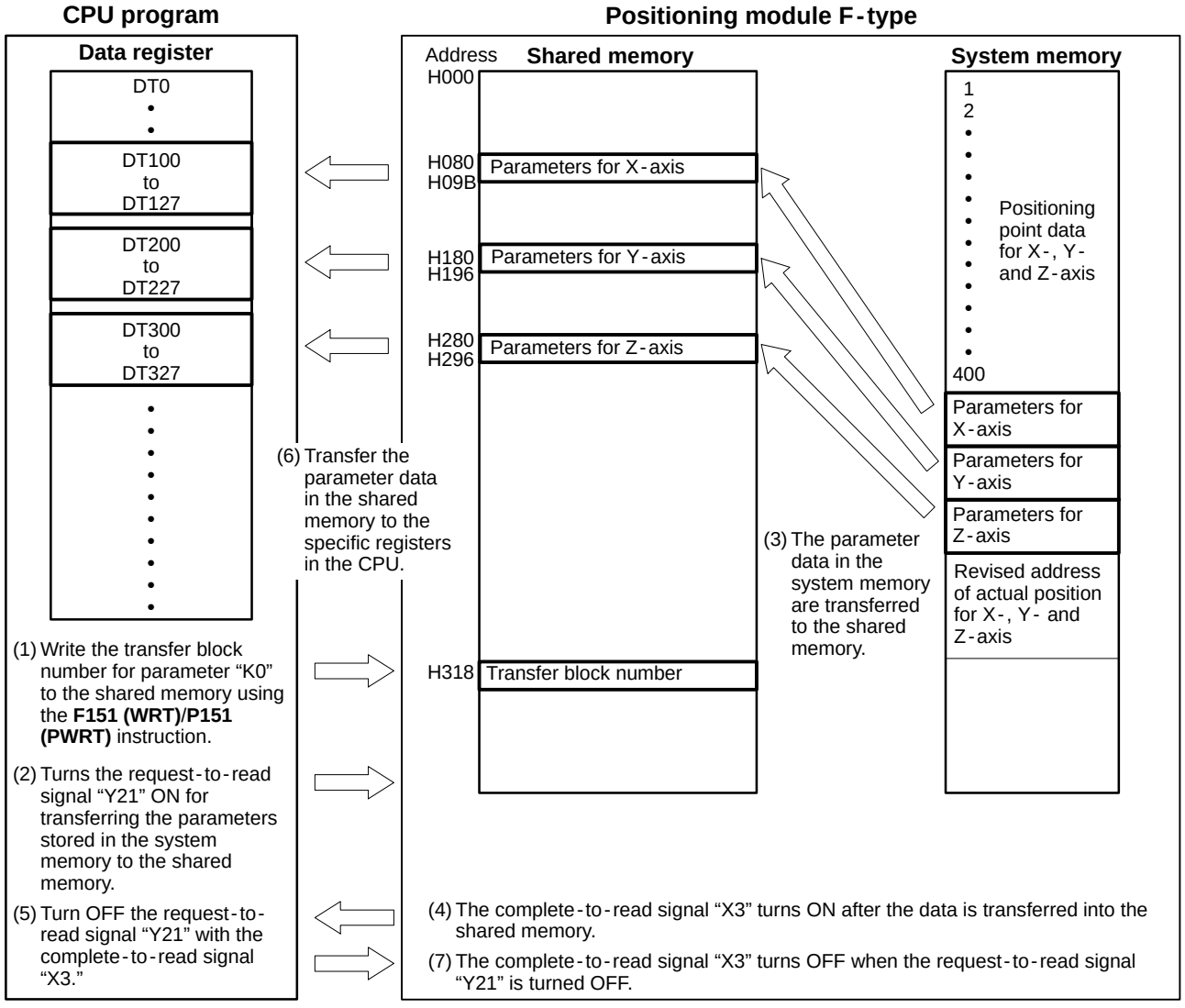
2. Reading Parameters

The parameters can be read from the system memory of the positioning module F-type to the CPU program in the following procedures.

■ Parameter reading procedures

Procedures are explained using the 3-axis module in the 0 slot position.

(1) Write the transfer block number for parameter “K0” to the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
↓
(2) Turns the request-to-read signal “Y21” ON for transferring the parameters stored in the system memory to the shared memory.
↓
(3) The parameter data in the system memory are transferred to the shared memory.
↓
(4) The complete-to-read signal “X3” turns ON after the data is transferred into the shared memory.
↓
(5) Turn OFF the request-to-read signal “Y21” with the complete-to-read signal “X3.”
↓
(6) Transfer the parameter data in the shared memory to the specific registers in the CPU.
↓
(7) The complete-to-read signal “X3” turns OFF when the request-to-read signal “Y21” is turned OFF.



Note:

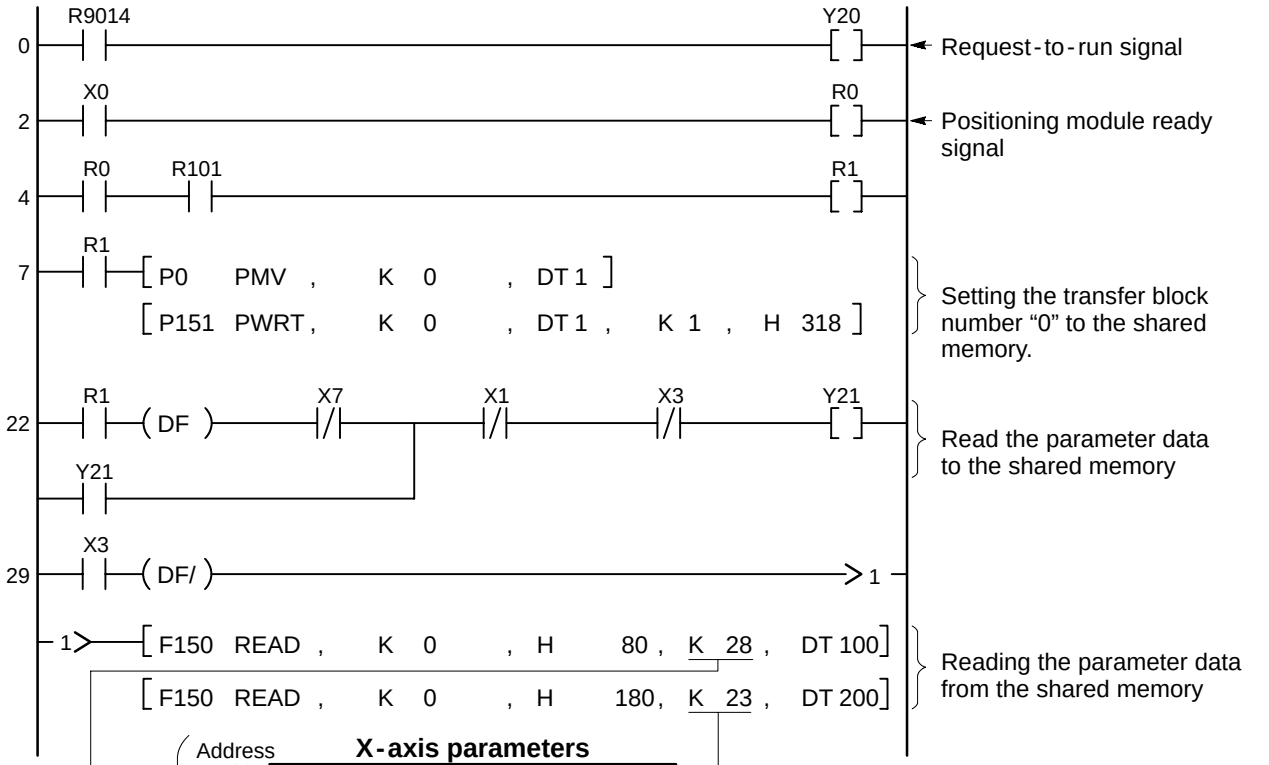
· It is impossible to transfer the data from the system memory while the positioning module is in the operating condition (outputting pulses).

■ Program example

Condition: 2-axis module in the slot 0 position

Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y21: Request-to-read signal
  - X3: Complete-to-read signal
  - R101: Parameter reading start trigger from the field device
- Shared memory of the positioning module
  - H080 to H09B: Parameters for X-axis
  - H180 to H19B: Parameters for Y-axis
  - H318: Transfer block number area



X-axis parameters

Address	
H080	Pulse output mode (1 word)
H081	Unit setting (1 word)
H082	Conversion rate (1 word)
H083	Speed limit (2 words)
H085	Software limit (+) (2 words)
H087	Software limit (-) (2 words)
H089	Base speed (2 words)
H08B	Backlash compensation (1 word)
H08C	Error compensation (2 words)
H08E	In-position time (1 word)
H08F	Homing direction (1 word)
H090	Home offset address (2 words)
H092	Home return speed (high) (2 words)
H094	Home return speed (low) (2 words)
H096	Acceleration/deceleration time (1 word)
H097	Homing method (1 word)
H098	Axis mode (1 word)
H099	Interpolation speed setting mode (1 word)
H09A	Interface logic (1 word)
H09B	Start mode (1 word)

28 words

23 words

Y-axis parameters

Address	
H180	Pulse output mode (1 word)
H181	Unit setting (1 word)
H182	Conversion rate (1 word)
H183	Speed limit (2 words)
H185	Software limit (+) (2 words)
H187	Software limit (-) (2 words)
H189	Base speed (2 words)
H18B	Backlash compensation (1 word)
H18C	Error compensation (2 words)
H18E	In-position time (1 word)
H18F	Homing direction (1 word)
H190	Home offset address (2 words)
H192	Home return speed (high) (2 words)
H194	Home return speed (low) (2 words)
H196	Acceleration/deceleration time (1 word)

7-3. Positioning Point Data Set and Read Programs

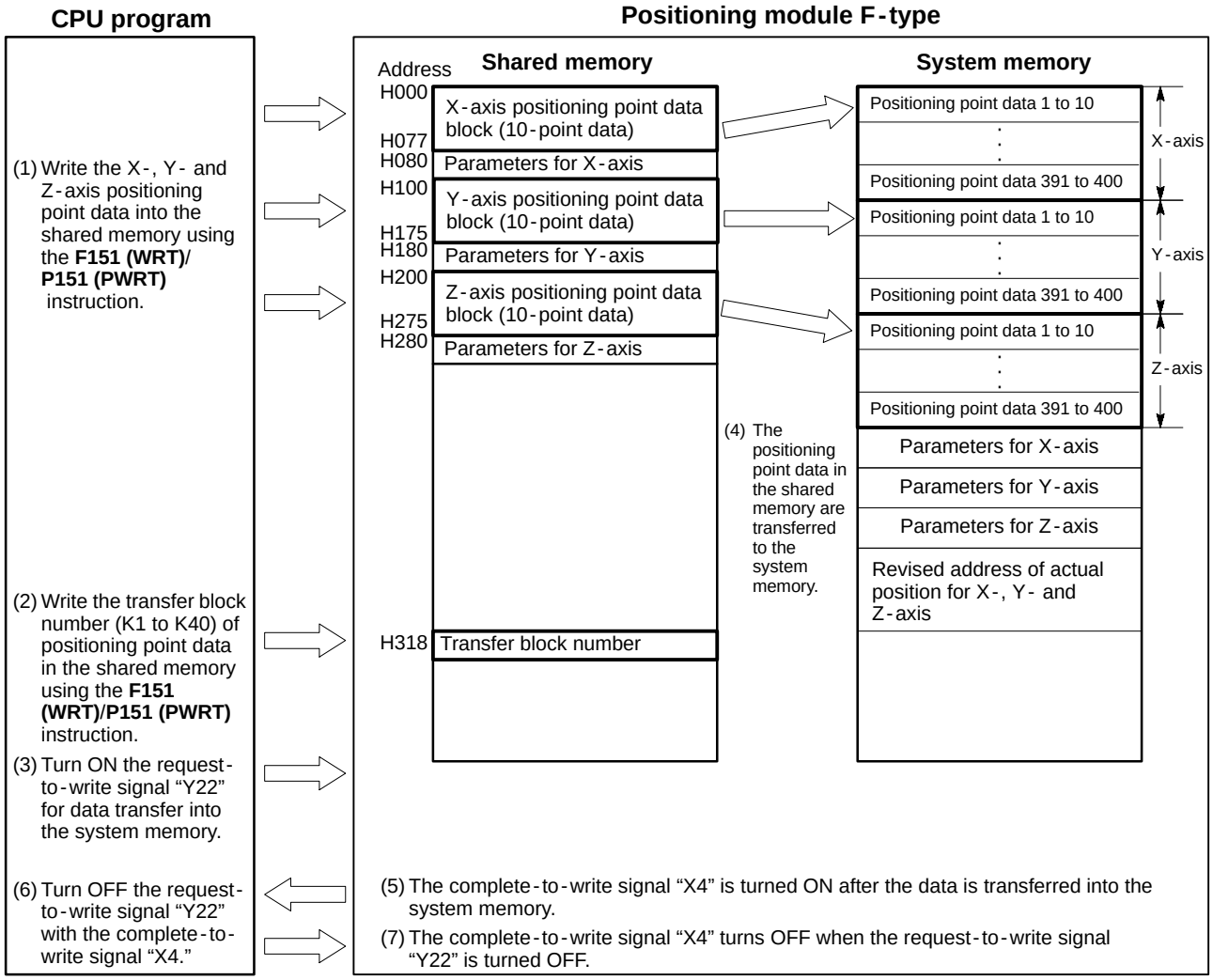
1. Setting Positioning Point Data

The positioning point data can be set to the system memory of the positioning module F-type with a CPU program by the following procedures.

■ Positioning point data setting procedures

Procedures are explained using the 3-axis module in the 0 slot position.

(1) Write the X-, Y- and Z-axis positioning point data to the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
↓
(2) Write the transfer block number (K1 to K40) for positioning point data to the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
↓
(3) Turn the request-to-write signal "Y22" ON for transferring the positioning point data set in the shared memory to the system memory.
↓
(4) The positioning point data in the shared memory are transferred to the system memory.
↓
(5) The complete-to-write signal "X4" turns ON after the data is transferred into the system memory.
↓
(6) Turn OFF the request-to-write signal "Y22" with the complete-to-write signal "X4."
↓
(7) The complete-to-write signal "X4" turns OFF when the request-to-write signal "Y22" is turned OFF.



Notes:

- It is impossible to transfer the data into the system memory while the positioning module is in the operating condition (outputting pulses).
- When transferring positioning point data, a block of positioning point data (10 data in a group) for 3 axes is transferred into the system memory at a time. Therefore, if you want to revise a part of a data block (i.e. less than 10 data or only X-axis data of the 3-axis module), be sure to read the data once from the system memory to the shared memory and then set the revised data to the shared memory.
- For details about the partial revision of positioning point data, refer to page 194, "4. Changing Positioning Point Data."

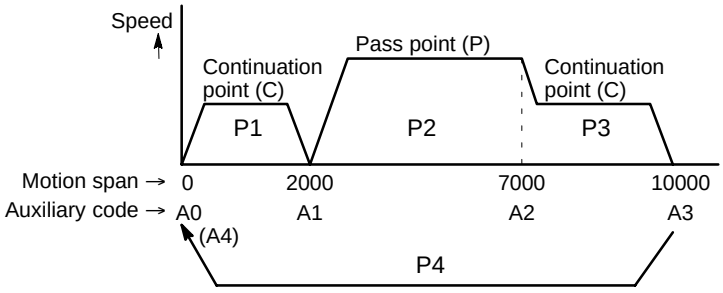
■ Content of data settings

Input data according to the following positioning point data table.

Positioning point	Data No	Motion pattern		Motion span		Axis speed		Interpolation speed		Acceleration/ deceleration time		Dwell time		Auxiliary code	
		X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
P1	1	C2	C2	I+2000	I+3000	3000	3000	0	0	300	300	0	0	A1	A1
P2	2	P3	P3	I+5000	I+3000	5000	5000	0	0	300	300	0	0	A2	A2
P3	3	C4	C4	I+3000	I+4000	3000	3000	0	0	300	300	0	0	A3	A3
P4	4	E	E	I-10000	I-10000	5000	5000	0	0	300	300	0	0	A4	A4
Remarks		———		———		———		Same as the default value		Same as the default value		Same as the default value		———	

■ Operation chart

The example shown is for an X-axis operation.



After positioning at P3, returns to home position.

■ Program example

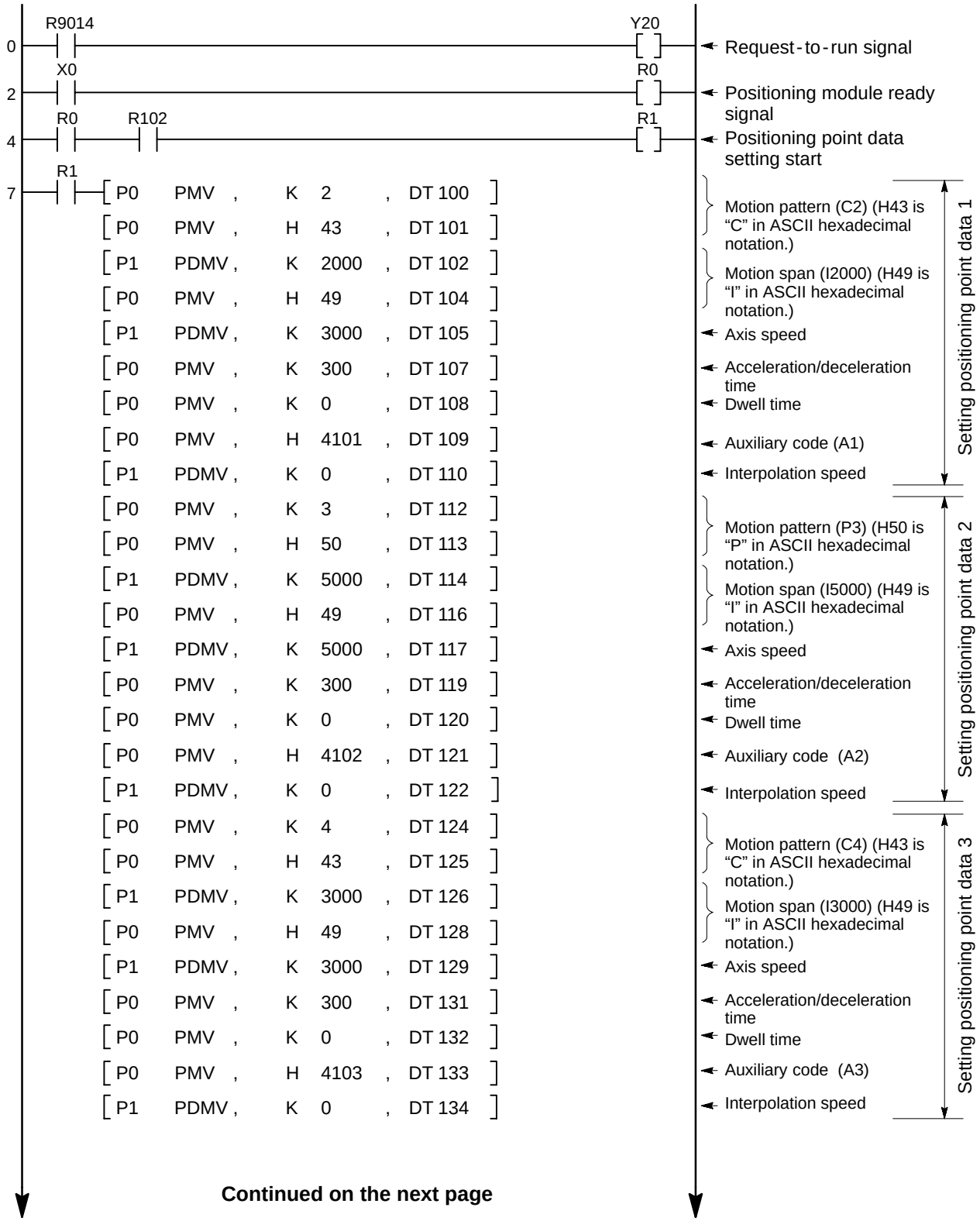
Condition: 2-axis module in the slot 0 position

Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y22: Request-to-write signal
  - X4: Complete-to-write signal
  - R102: Positioning point data setting start trigger from the field device
- Shared memory of the positioning module
  - H000 to H077: X-axis positioning point data block
  - H100 to H177: Y-axis positioning point data block
  - H318: Transfer block number area

When R102 turns ON, four positioning point data are provisionally set in data registers DT100 to DT147 and their contents are transferred to the X- and Y-axis positioning point data block in the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction. Then, transfer block number "K1", (specifying the positioning point data numbers 1 to 10 for X-, Y- and Z-axis) is set in the transfer block area.

Then, the request-to-write signal turns ON for transferring the data in the shared memory to the system memory. After confirming the end of write operation with the complete-to-write signal, the request-to-write signal is turned OFF.



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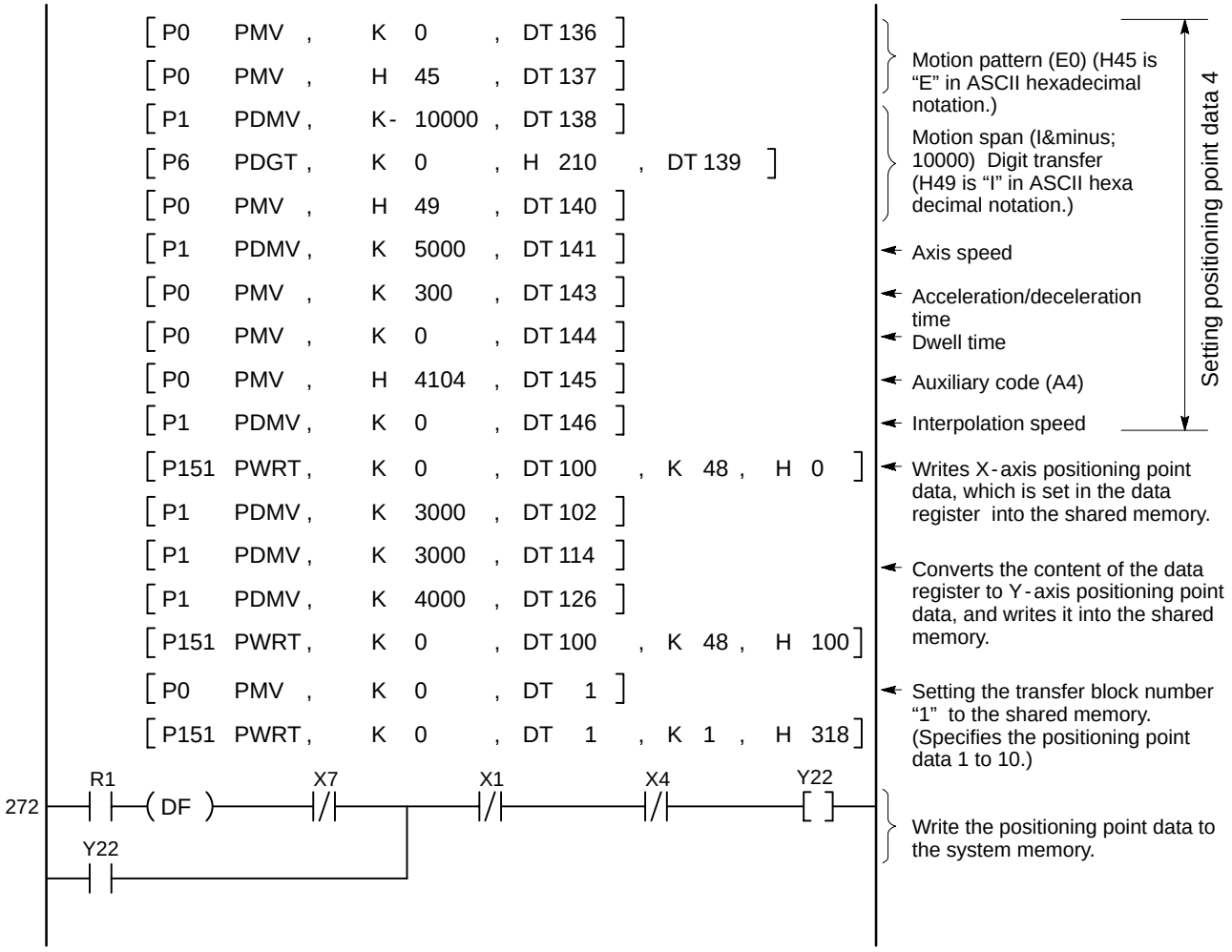


Note:

- For details about each positioning point data item, refer to page 141, "6-2. Explanation of Each Positioning Point Data Item."

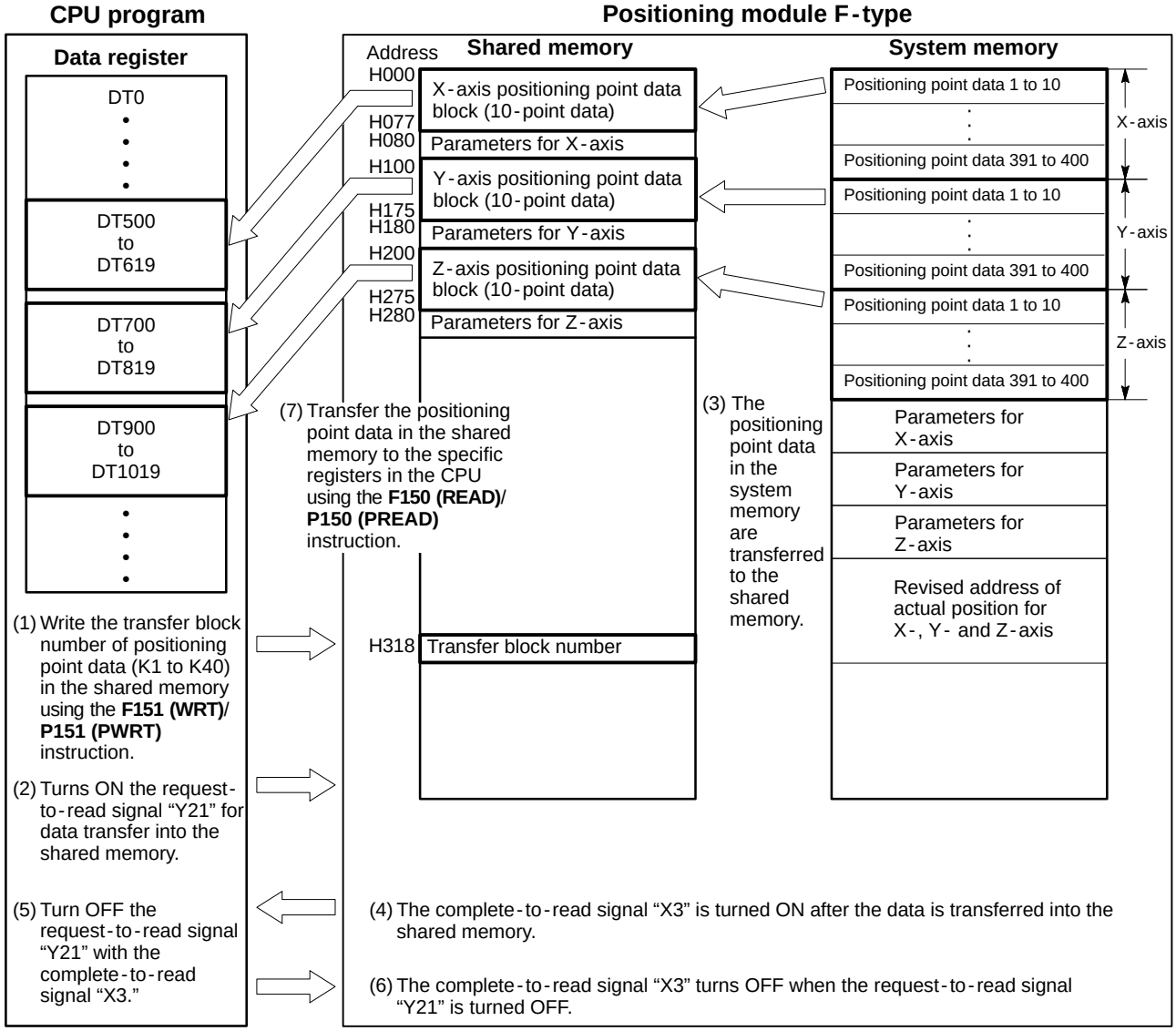
2. Reading Positioning Point Data

The positioning point data can be read from the system memory of the positioning module F-type to the CPU program in the following procedures.

■ Positioning point data reading procedures

Procedures are explained using the 3-axis module in the 0 slot position.

(1) Write the transfer block number for positioning point data (K1 to K40) to the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
↓
(2) Turns the request-to-read signal "Y21" ON for transferring the positioning point data stored in the system memory to the shared memory.
↓
(3) The positioning point data in the system memory are transferred to the shared memory.
↓
(4) The complete-to-read signal "X3" turns ON after the data is transferred into the shared memory.
↓
(5) Turn OFF the request-to-read signal "Y21" with the complete-to-read signal "X3."
↓
(6) The complete-to-read signal "X3" turns OFF when the request-to-read signal "Y21" is turned OFF.
↓
(7) Transfer the positioning point data in the shared memory to the specific registers in the CPU using the **F150 (READ)/P150 (PREAD)** instruction.



Note:

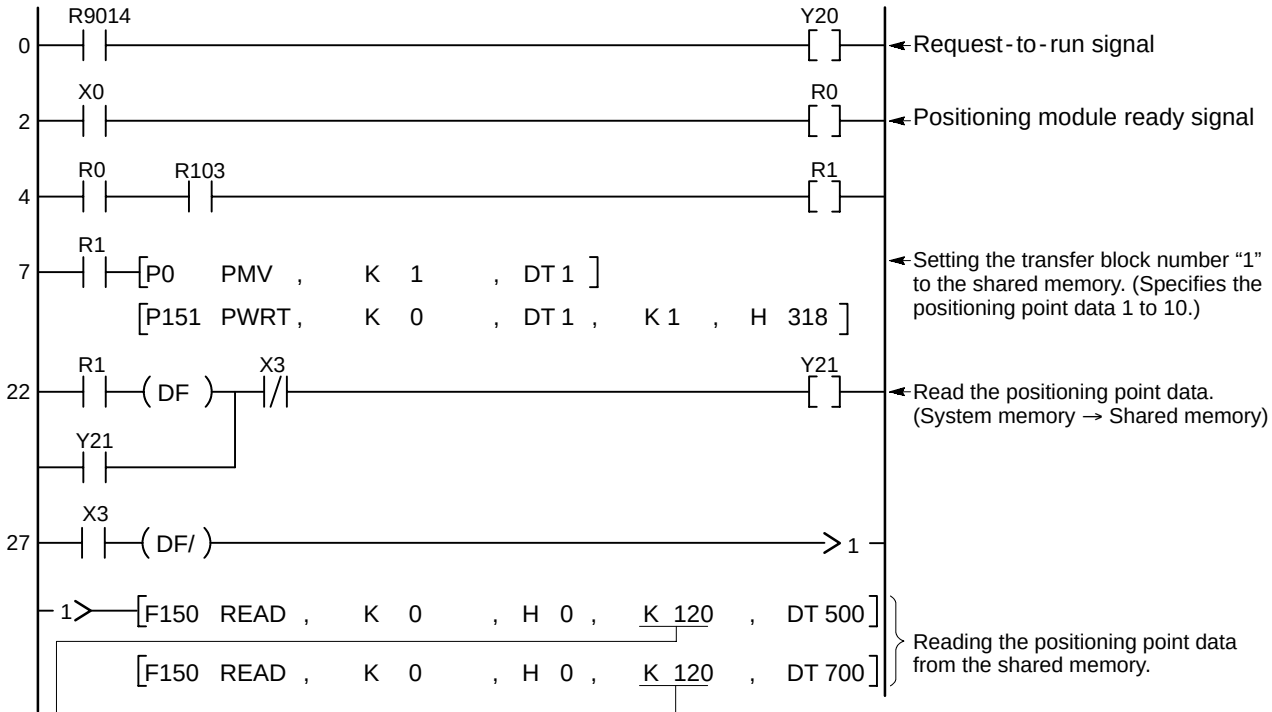
· It is impossible to transfer the data from the system memory while the positioning module is in the operating condition (outputting pulses).

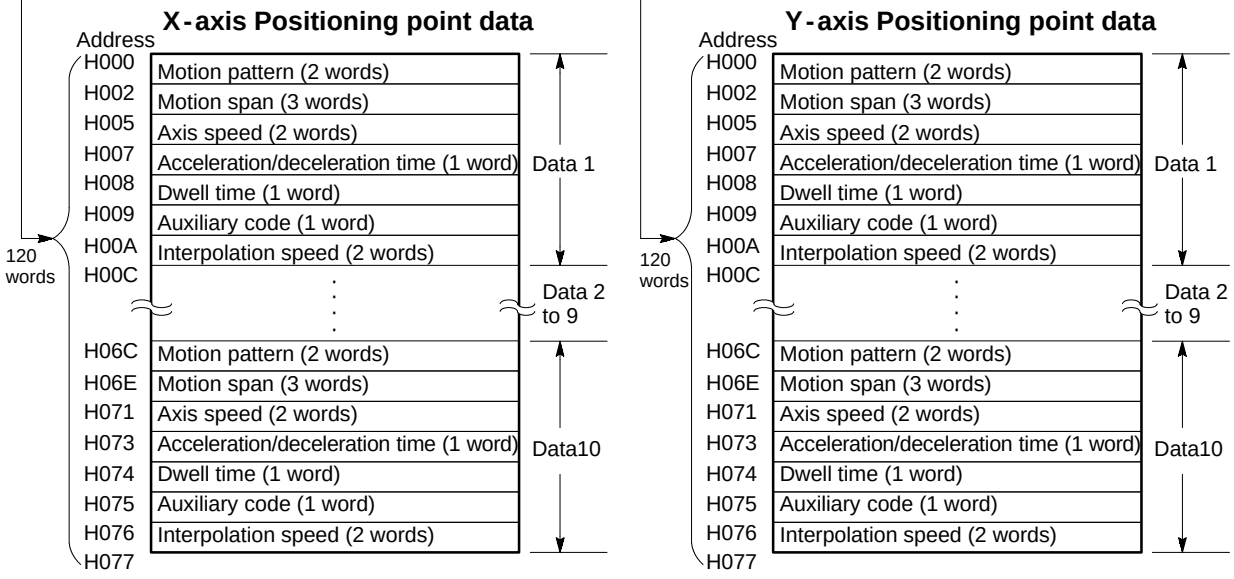
■ Program example

Condition: 2-axis module in the slot 0 position

Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y21: Request-to-read signal
  - X3: Complete-to-read signal
  - R103: Positioning point data reading start trigger from the field device
- Shared memory of the positioning module
  - H000 to H077: X-axis positioning point data block
  - H100 to H177: Y-axis positioning point data block
  - H318: Transfer block number area



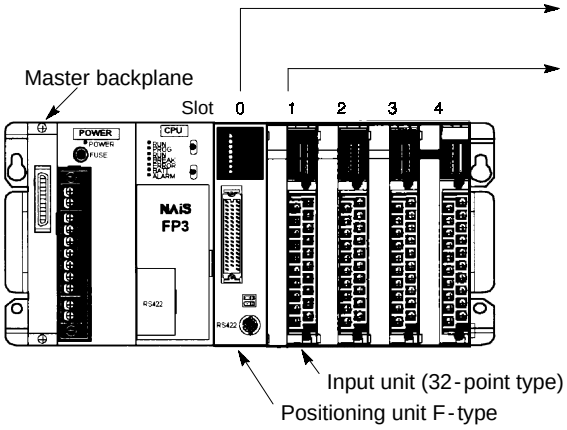


3. Overview of Positioning Point Data Program

Since positioning point data is read from the shared memory and written to the system memory in units of 10 points for each X-, Y- and Z-axis, if the number of the point data is more than 10, the transfer process must be repeated for each 10 points. (For example, if the number of data points is 43, the transfer process must be repeated 5 times.) In this section, the program for transferring data more than 10 points is explained.

1) System Configuration

The programs in this section are based on the presumption that positioning module F-type 1-axis unit is mounted in slot 0 position of the master backplane. If the positioning module is mounted in a different slot, it should be noted that the I/O point addresses allocated to the positioning module are different.



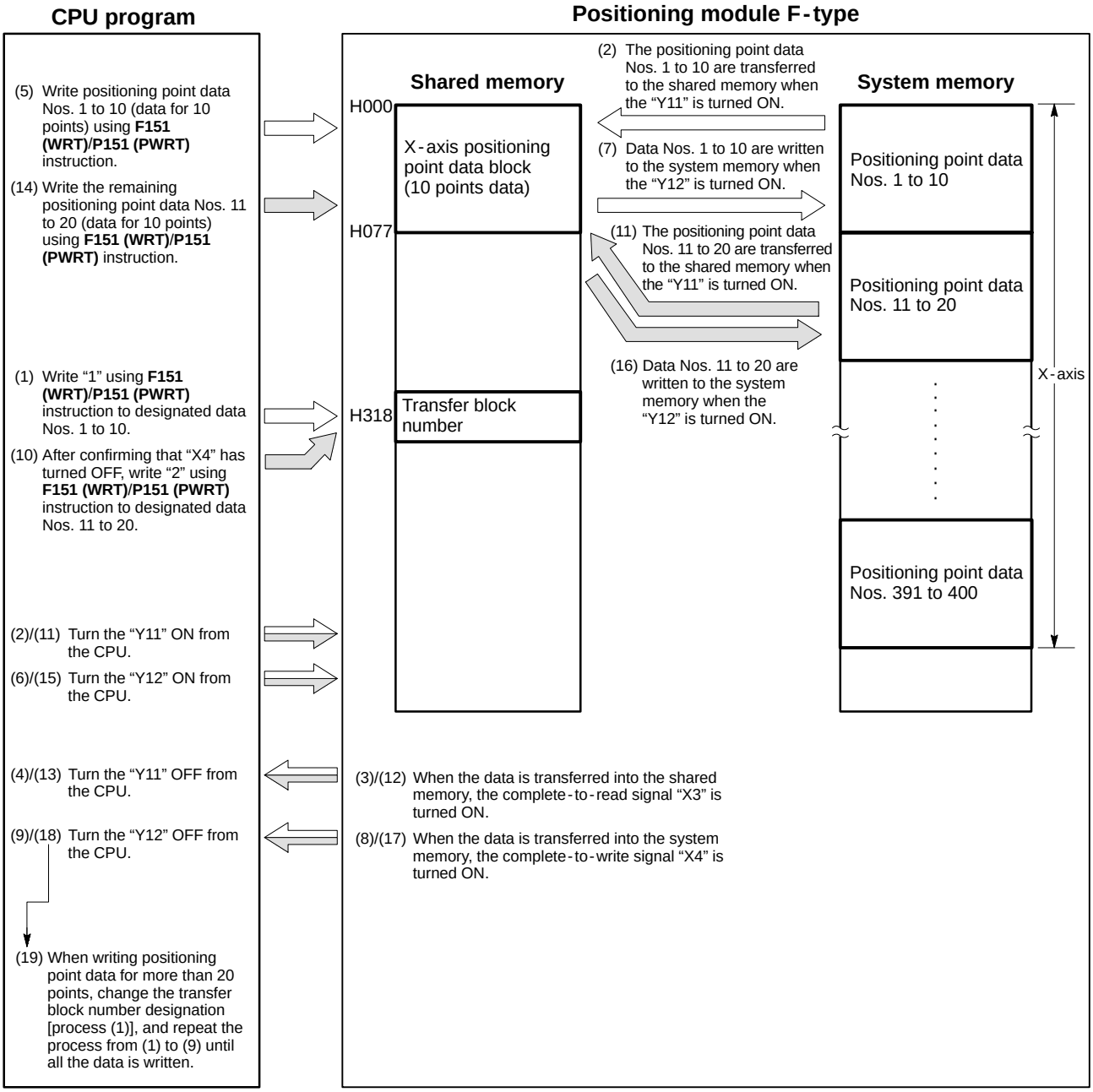
Slot number	I/O allocation	
	Input	Output
Slot 0	X0 to X9 (XA to XF: Not used)	Y10 to Y19 (Y1A to Y1F: Not used)
Slot 1	X20 (X21 to X3F: Not used)	———

■ **I/O allocation**

Input data (X)			Output data (Y)		
Address	**Description**		**Address**	**Description**	
X0	Positioning module ready signal		**Y10**	Request-to-run signal	
X1	Error signal		**Y11**	Request-to-read signal (System memory → Shared memory)	
X2	RUN/LOCAL signal		**Y12**	Request-to-write signal (Shared memory → System memory)	
X3	Complete-to-read signal (System memory → Shared memory)		**Y13**	JOB1 operation	Request-to-start signal
X4	Complete-to-write signal (Shared memory → System memory)		**Y14**	X-axis operation	Request-to-home signal
X5	JOB1 operation	In-position/complete-to-test signal	**Y15**		Software home request signal
X6	X-axis operation	At home signal	**Y16**	JOB1 operation	Request-to-stop signal
X7	JOB1 operation	Active signal	**Y17**	X-axis operation	JOG forward request signal
X8		Start confirmation signal	**Y18**		JOG reverse request signal
X9		Auxiliary code set flag	**Y19**	JOB1 operation	Auxiliary code set flag OFF signal
XA to XF	Not used		**Y1A to Y1F**	Not used	
X20	JOB operation start signal				
X21 to X3F	Not used				

2) Procedure

(1) Write “1” to the transfer block number using the **F151 (WRT)/P151 (PWRT)** instruction.
↓ (Designate data Nos. 1 to 10.)
(2) Turn the request-to-read signal “Y11” ON to read positioning point data Nos. 1 to 10 (data for 10 points) from
↓ the system memory to the shared memory.
(3) After the data is read out from system memory, the complete-to-read signal “X3” turns ON.
↓
(4) Turn OFF the request-to-read signal “Y11” with the “X3.”
↓
(5) After confirming that signal “X3” has turned OFF, write positioning point data Nos. 1 to 10 (data for 10 points)
↓ to the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
(6) Turn the request-to-write signal “Y12” ON.
↓
(7) Positioning point data Nos. 1 to 10 (data for 10 points) is written from the shared memory to the system memory.
↓
(8) After the data is written to the system memory, the complete-to-write signal “X4” turns ON.
↓
(9) Turn OFF the “Y12” with the “X4.”
↓
(10) After confirming that “X4” has turned OFF, write “2” to the transfer block number using the **F151 (WRT)/**
↓ **P151 (PWRT)** instruction. (Designate data Nos. 11 to 20.)
(11) Turn the “Y11” ON to read positioning point data Nos. 11 to 20 (data for 10 points) from the system memory to
↓ the shared memory.
(12) After the data is written to the shared memory, the “X3” turns ON.
↓
(13) Turn OFF the “Y11” with the “X3.”
↓
(14) After confirming that signal “X3” has turned OFF, write positioning point data Nos. 11 to 20 (data for 10 points)
↓ to the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
(15) Turn the “Y12” ON.
↓
(16) Positioning point data Nos. 11 to 20 (data for 10 points) is written from the shared memory to the system
↓ memory.
(17) After the data is written to the system memory, the “X4” turns ON.
↓
(18) Turn OFF the “Y12” with the “X4.”
↓
(19) After confirming that signal “X4” has turned OFF, to continue writing positioning point data, change the transfer
block number designation as described in (1), and repeat the process from (1) to (9).

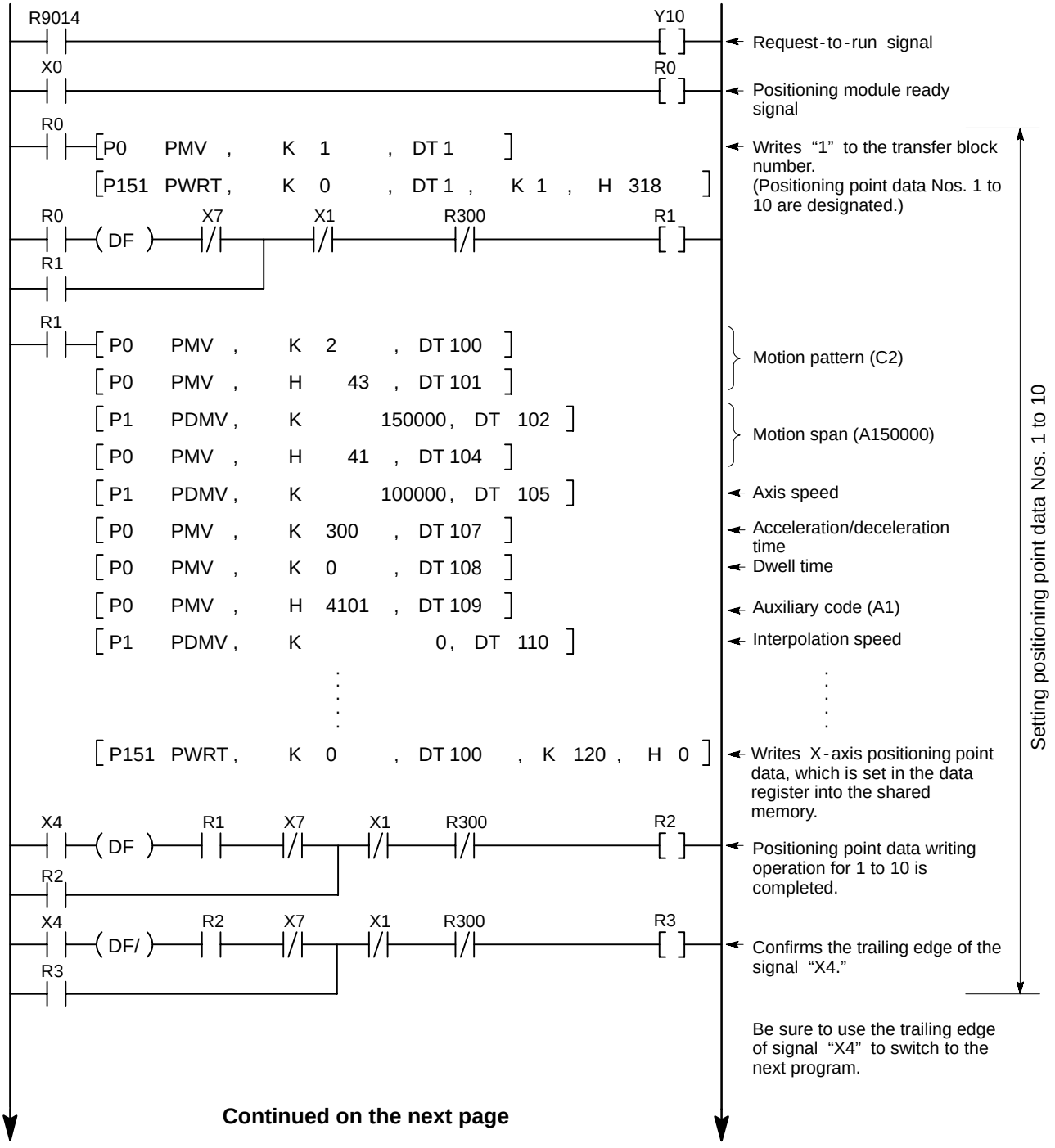

CPU program
Positioning module F-type
Shared memory
System memory
(5) Write positioning point data Nos. 1 to 10 (data for 10 points) using F151 (WRT)/P151 (PWRT) instruction.
(14) Write the remaining positioning point data Nos. 11 to 20 (data for 10 points) using F151 (WRT)/P151 (PWRT) instruction.
(1) Write "1" using F151 (WRT)/P151 (PWRT) instruction to designated data Nos. 1 to 10.
(10) After confirming that "X4" has turned OFF, write "2" using F151 (WRT)/P151 (PWRT) instruction to designated data Nos. 11 to 20.
(2)/(11) Turn the "Y11" ON from the CPU.
(6)/(15) Turn the "Y12" ON from the CPU.
(4)/(13) Turn the "Y11" OFF from the CPU.
(9)/(18) Turn the "Y12" OFF from the CPU.
(19) When writing positioning point data for more than 20 points, change the transfer block number designation [process (1)], and repeat the process from (1) to (9) until all the data is written.
H000
X-axis positioning point data block (10 points data)
H077
H318
Transfer block number
(2) The positioning point data Nos. 1 to 10 are transferred to the shared memory when the "Y11" is turned ON.
(7) Data Nos. 1 to 10 are written to the system memory when the "Y12" is turned ON.
(11) The positioning point data Nos. 11 to 20 are transferred to the shared memory when the "Y11" is turned ON.
(16) Data Nos. 11 to 20 are written to the system memory when the "Y12" is turned ON.
Positioning point data Nos. 1 to 10
Positioning point data Nos. 11 to 20
Positioning point data Nos. 391 to 400
X-axis
(3)/(12) When the data is transferred into the shared memory, the complete-to-read signal "X3" is turned ON.
(8)/(17) When the data is transferred into the system memory, the complete-to-write signal "X4" is turned ON.

3) Basic Program of Positioning Point Data (Positioning point data Nos. 1 to 400)

Condition:

- Type of module: FP3 positioning unit F-type, 1-axis module
- Module position: Slot 0 position

The following program is for writing positioning point data with a 1-axis module. However, by changing the I/O points, the program can be used for a 2-axis or 3-axis module. (For example, when the module is mounted in slot No. 0 of the master backplane, the request-to-run signal is Y10 for a 1-axis module, but Y20 for a 2-axis or 3-axis module.)



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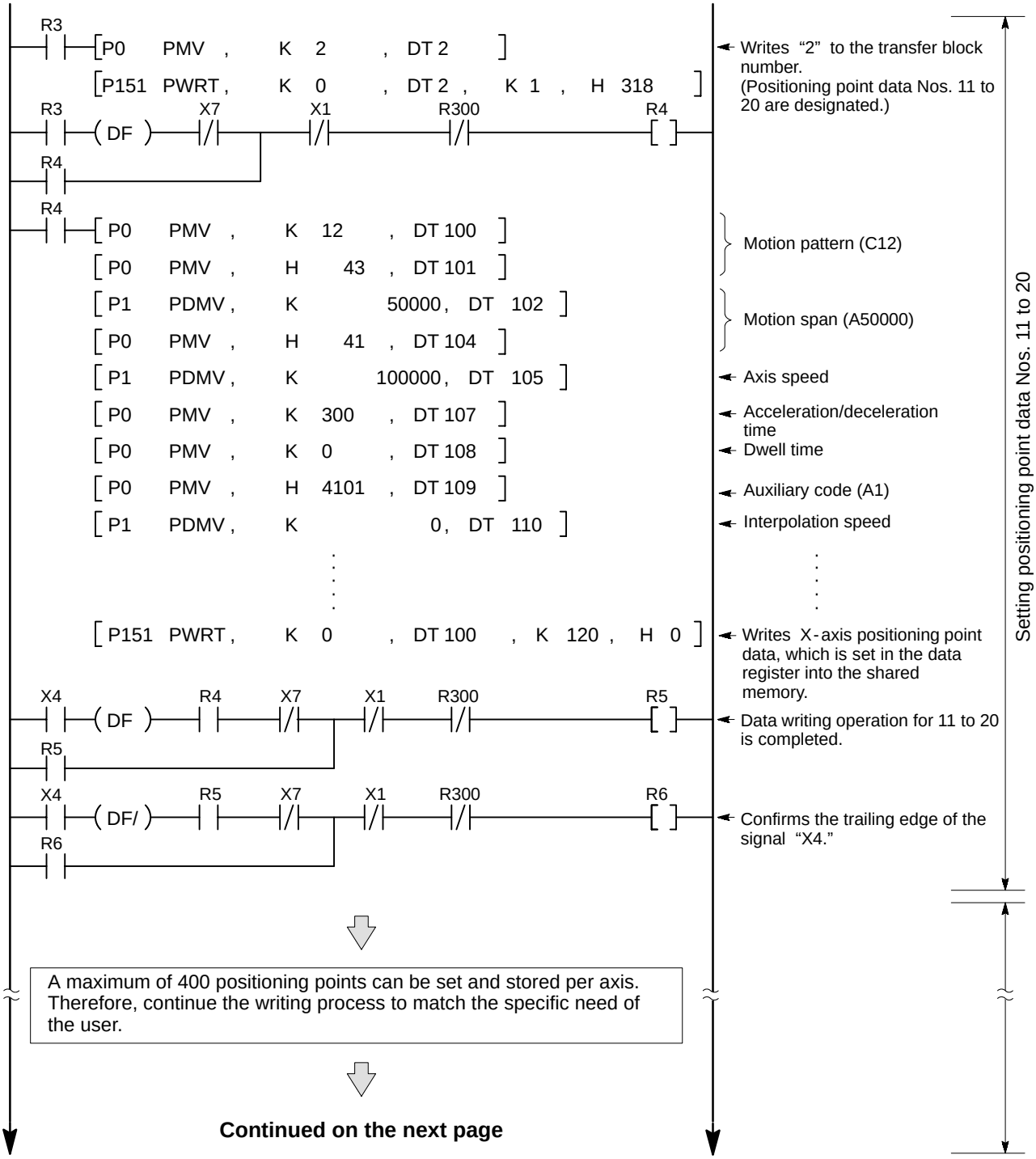

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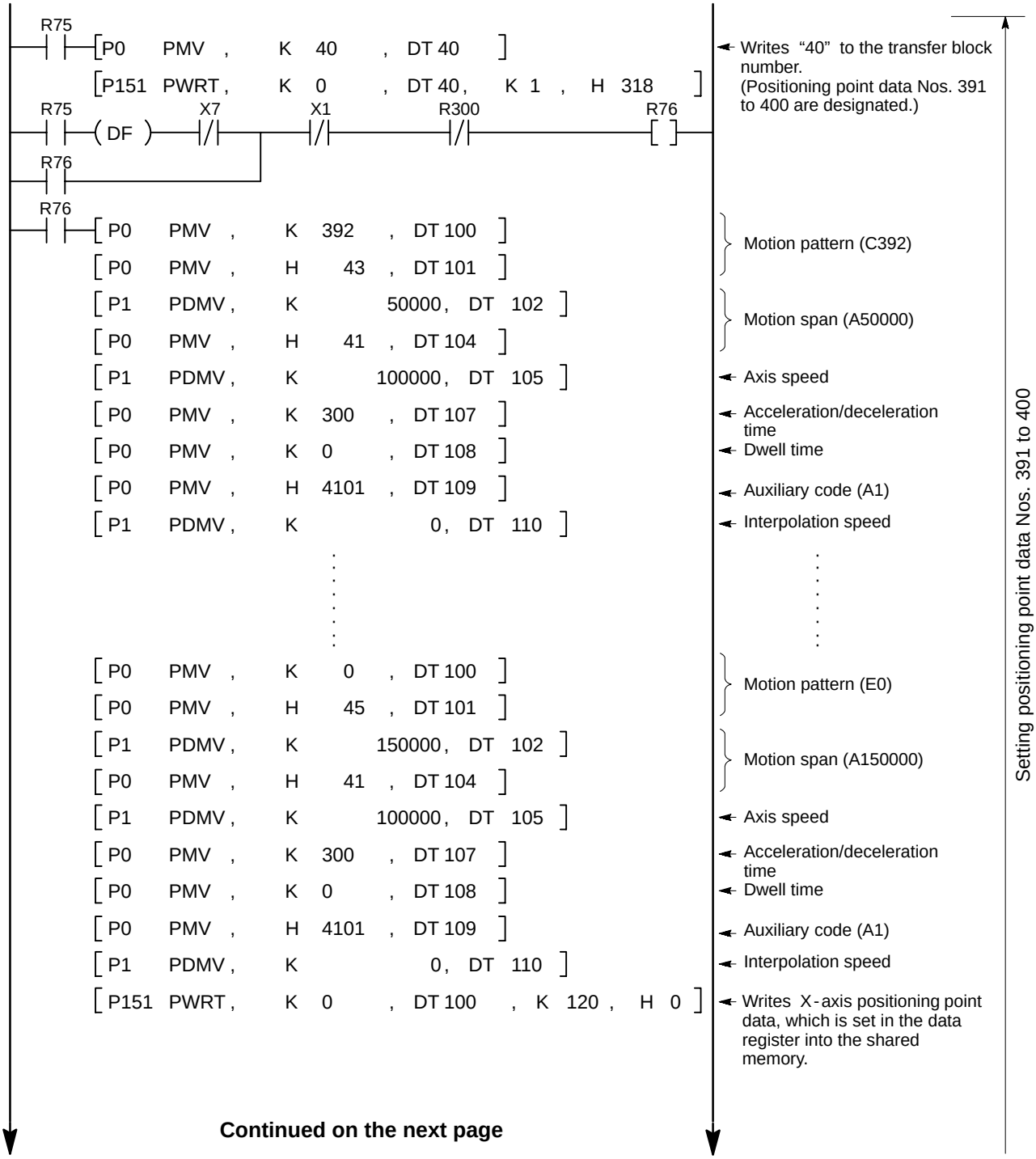

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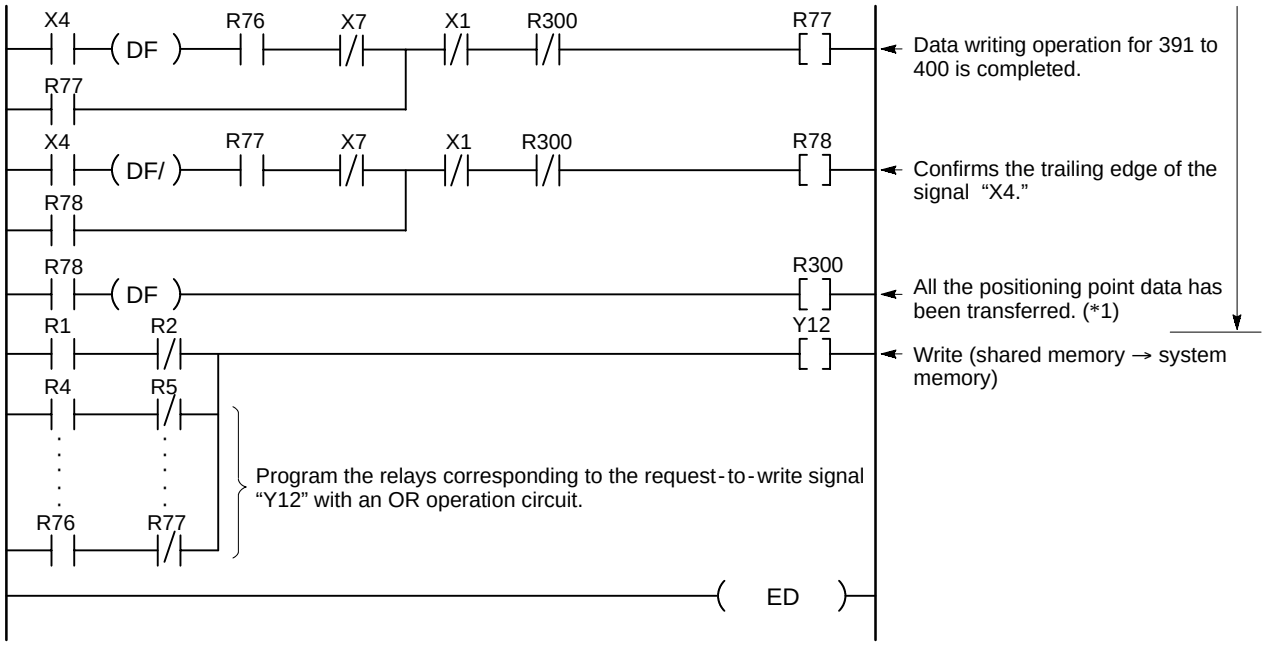


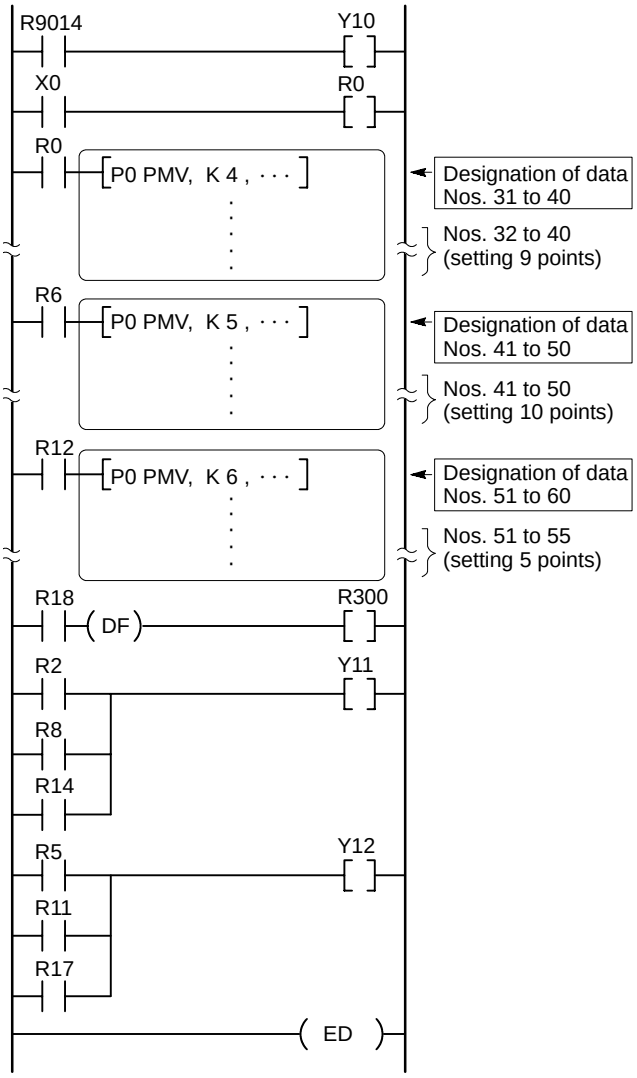
Note:

- (*1): Provide a circuit that clears the self-holding function at the end of the point data setting program (or at the end of other operations that are conducted after positioning point data setting by the program, such as homing).

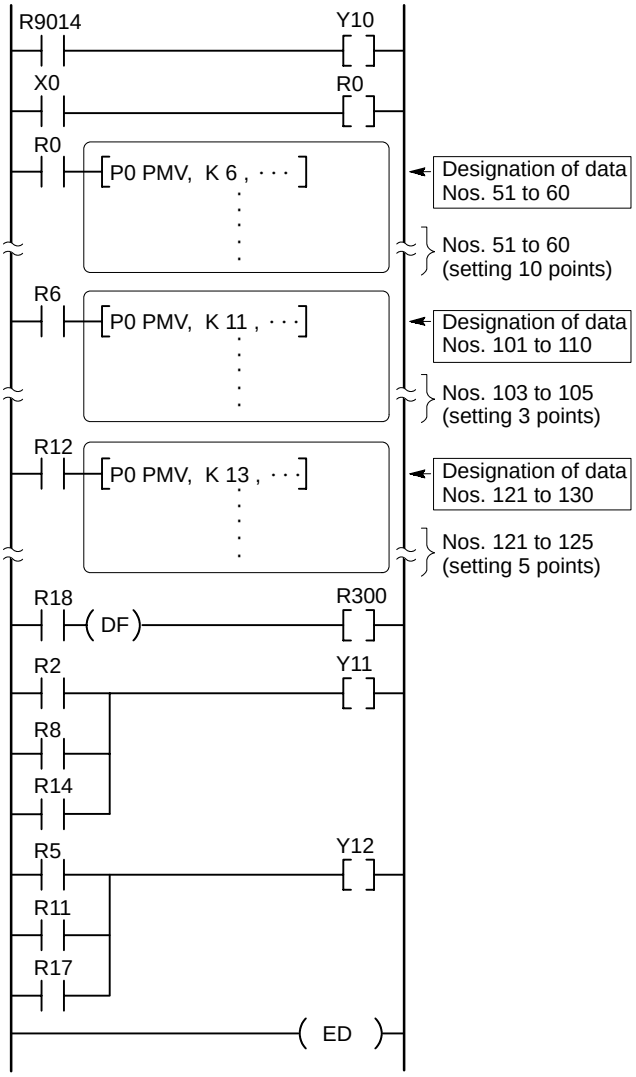
- The preceding program uses all positioning point data Nos. 1 to 400. Therefore, the transfer block number designation starts from "1" (Nos. 1 to 10). When only specific point data is set and written, designate the necessary number of transfer block numbers (one number for each 10 points) for the point data to be set, and write the data.

Examples:

- For writing 24 points (data Nos. 32 to 55)



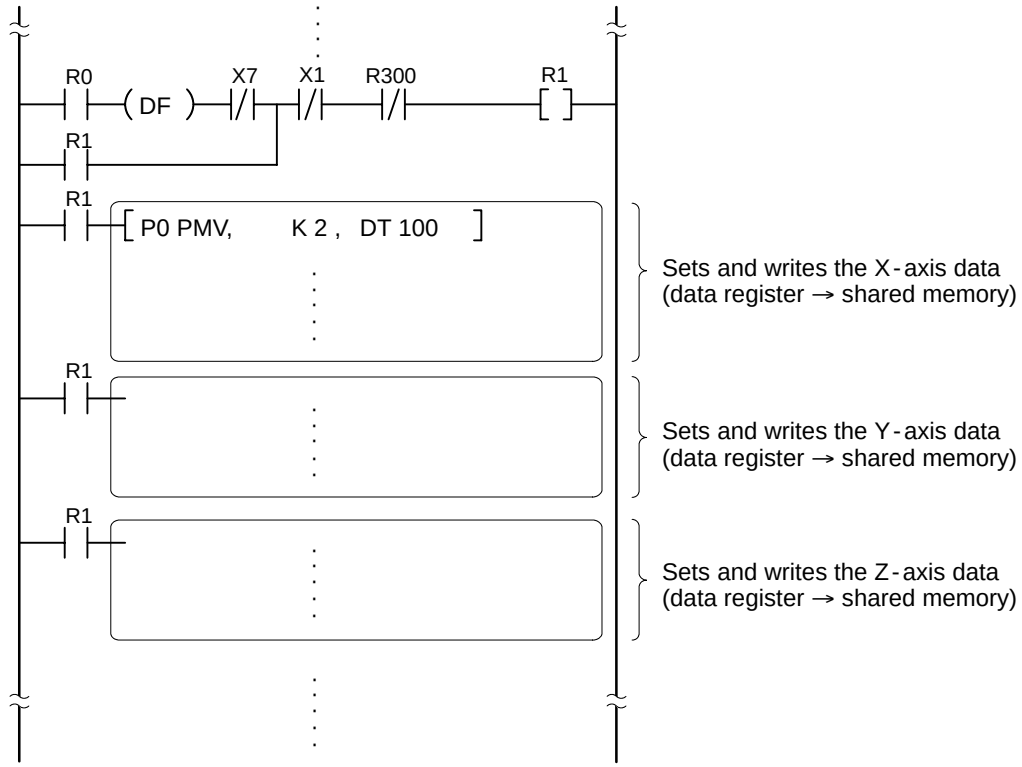
- For writing 10 points (Nos. 51 to 60), 3 points (Nos. 103 to 105), and 5 points (Nos. 121 to 125)



- When writing point data for the Y- and Z-axis together with the data for 10 points for the X-axis (only when using a 2-axis or 3-axis module), first set the X-axis data and use the write instruction (to the shared memory), then continuously set the Y- and Z-axis data and use the write instruction.

Example:

- For setting the X-, Y- and Z-axis data during the process [Setting and writing of positioning point data Nos. 1 to 10] in the program on page 183.



Note:

· Data setting can be more efficiently performed by changing the contents of the DT100 data registers used for the X-axis data setting to the data for the Y- and Z-axis, and writing it to the shared memory.

4) Sample Program of Positioning Point Data (15 points)

■ Program structure

This program transfers the positioning point data for 15 points as an example of transferring more than 10 points of data.

■ Procedures

(1) PROG → RUN mode
(2) Reads positioning point data Nos. 1 to 10 (system memory → shared memory)
(3) Sets and writes positioning point data Nos. 1 to 10 (shared memory → system memory)
(4) Reads positioning point data Nos. 11 to 20 (system memory → shared memory)
(5) Sets and writes positioning point data Nos. 11 to 15 (shared memory → system memory)

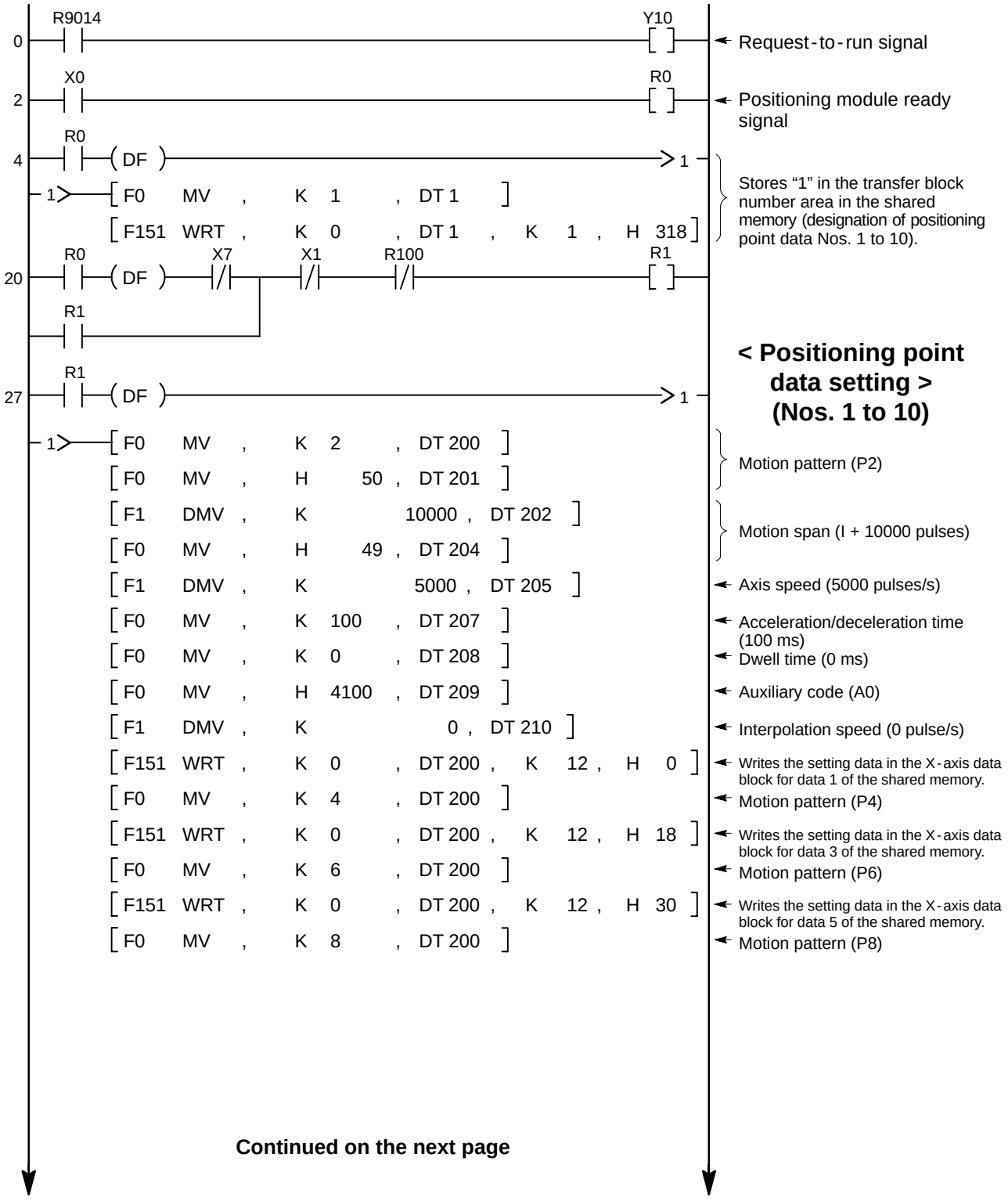
■ Content of positioning point data settings

Data No.	Motion pattern	Motion span	Axis speed	Acceleration/ deceleration time	Dwell time	Auxiliary code	Interpolation speed
1	P2	I + 10000	5000	100	0	A0	0
2	P3	I + 10000	20000	100	0	A0	0
3	P4	I + 10000	5000	100	0	A0	0
4	P5	I + 10000	20000	100	0	A0	0
5	P6	I + 10000	5000	100	0	A0	0
6	P7	I + 10000	20000	100	0	A0	0
7	P8	I + 10000	5000	100	0	A0	0
8	P9	I + 10000	20000	100	0	A0	0
9	P10	I + 10000	5000	100	0	A0	0
10	C11	I + 10000	20000	100	100	A0	0
11	P12	I - 20000	5000	200	0	A0	0
12	P13	I - 20000	10000	200	0	A0	0
13	P14	I - 20000	15000	200	0	A0	0
14	P15	I - 20000	20000	200	0	A0	0
15	E	I - 20000	30000	200	0	A0	0

■ Program example

Conditions:
- Type and position: 1-axis module in the slot 0 position
- Axis controlled: X-axis
- Provisional register in the CPU for positioning point data: DT200

Explanation of signals:
• CPU
- X0: Positioning module ready signal
- X1: Error signal
- X3: Complete-to-read signal
- X4: Complete-to-write signal
- Y10: Request-to-run signal
- Y11: Request-to-read signal
- Y12: Request-to-write signal



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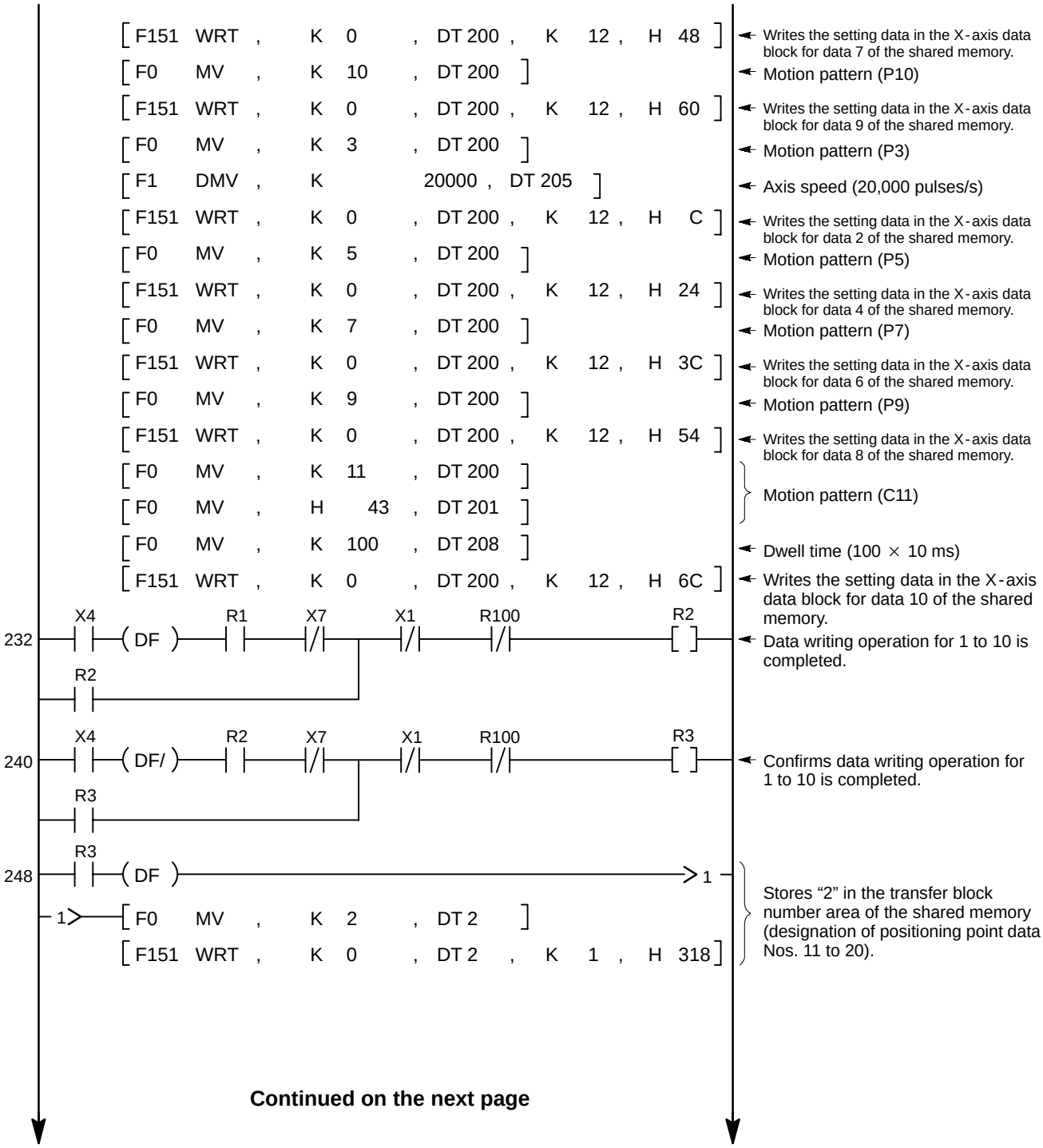

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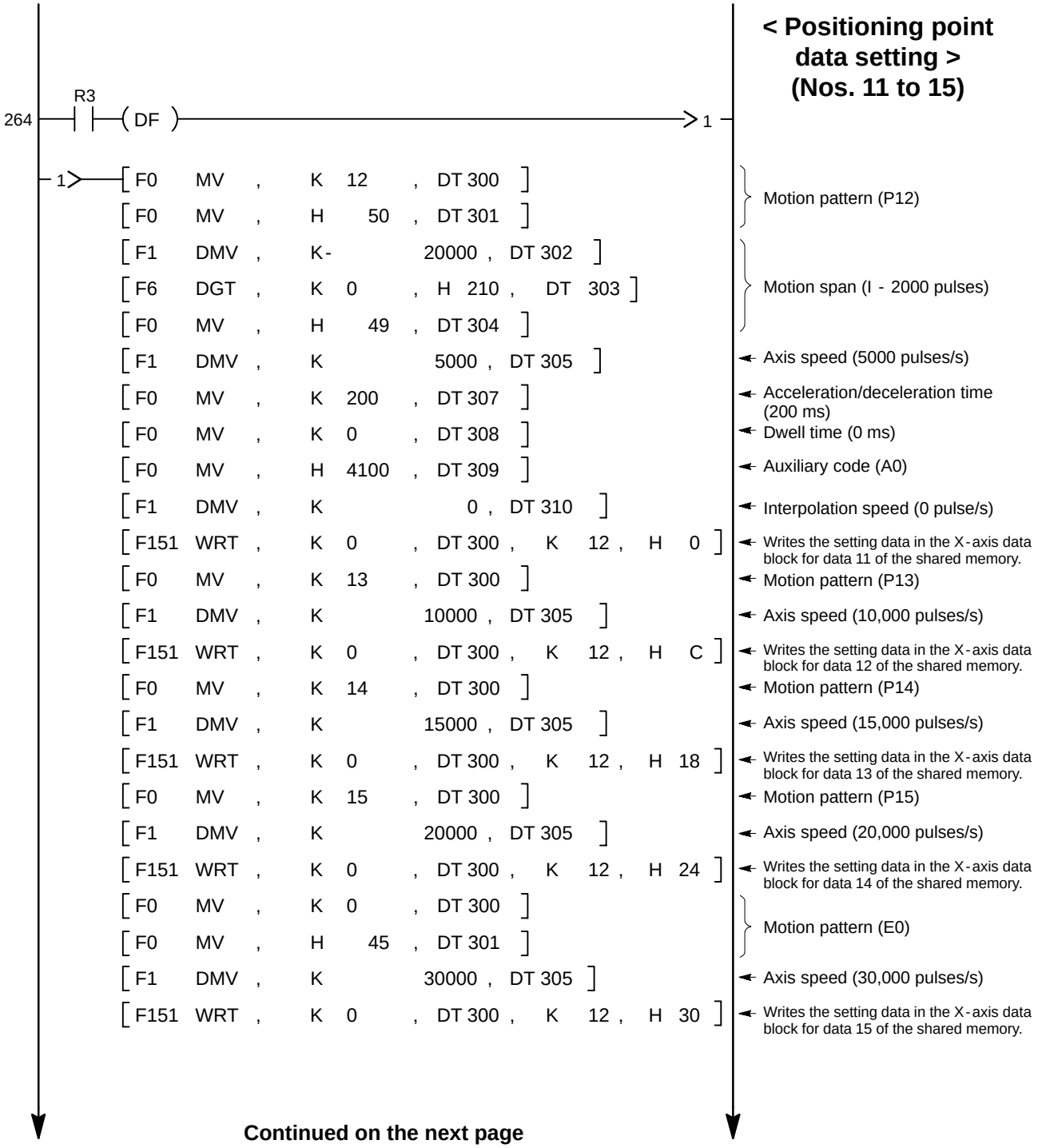

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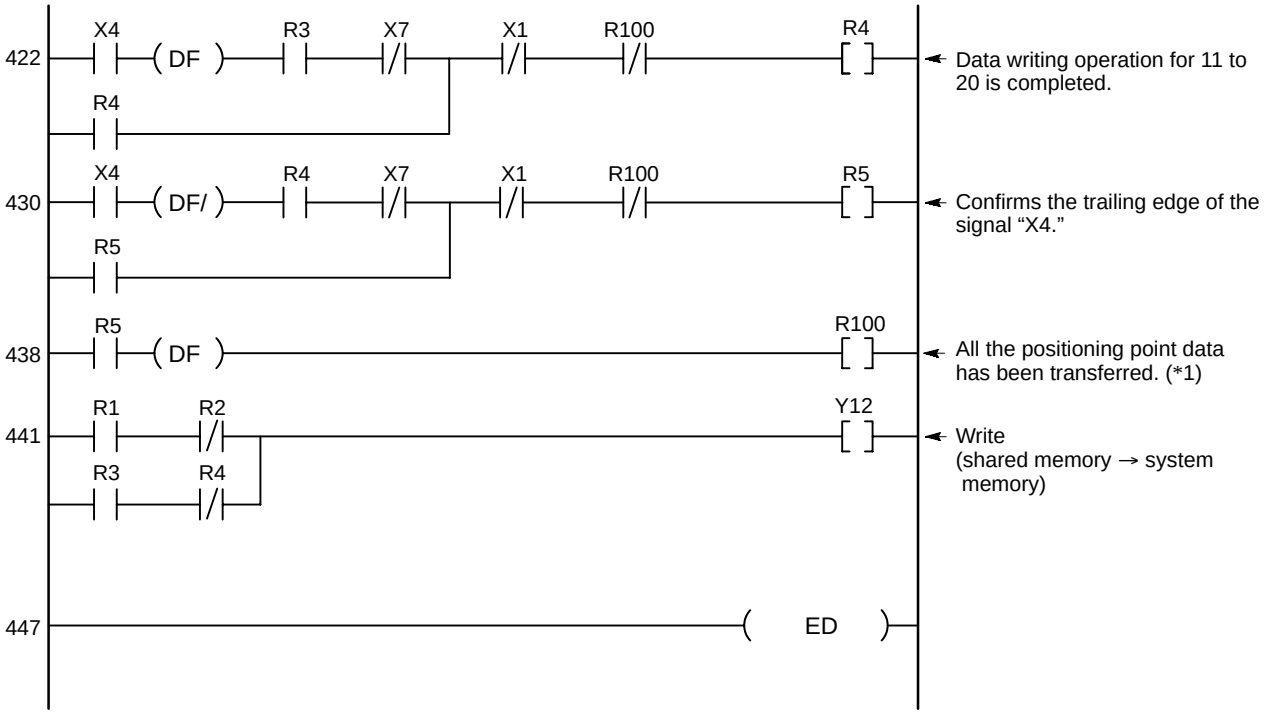


Note:

- (*1): Provide a circuit that clears the self-holding function at the end of the point data setting program (or at the end of other operations that are conducted after positioning point data setting by the program, such as homing).

4. Changing Positioning Point Data

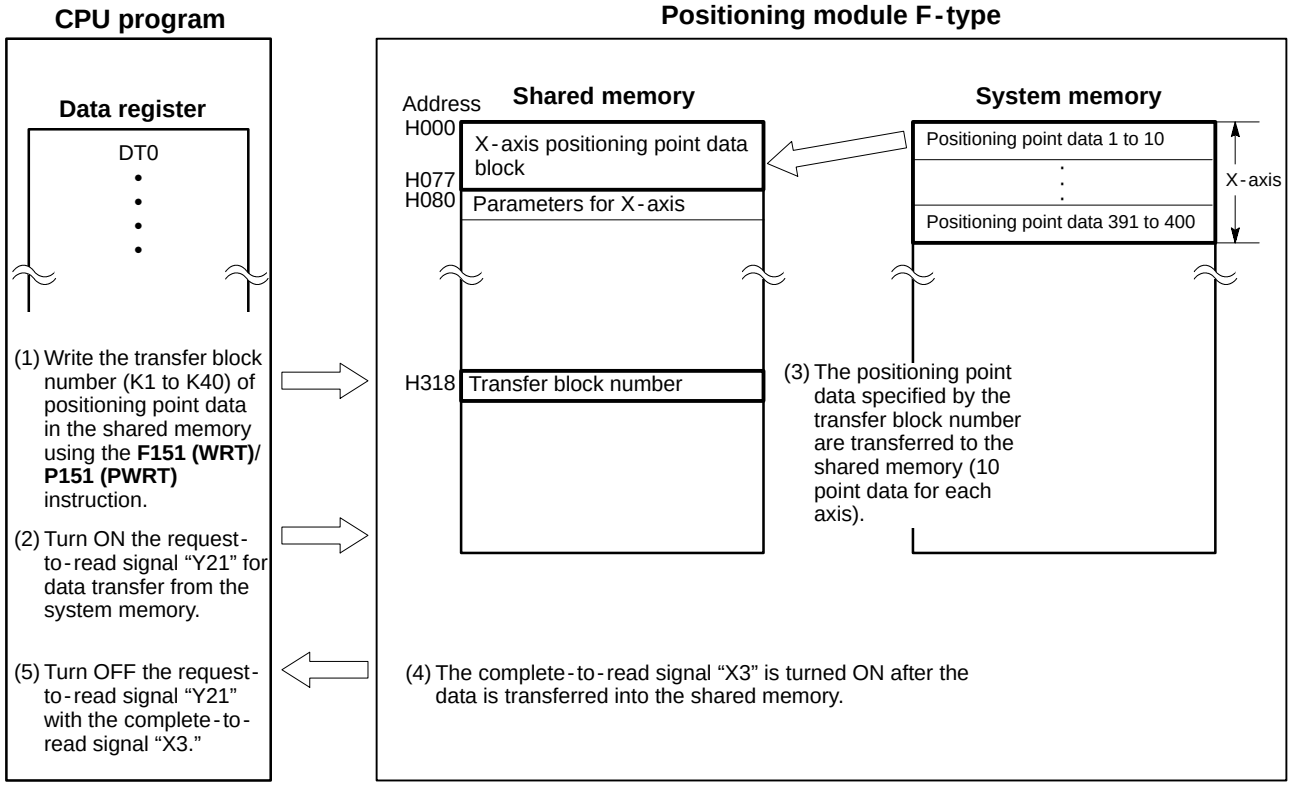
To make partial changes to the positioning point data in the system memory, first transfer the data in the system memory to the shared memory and write only the changes to into the shared memory.
Then, transfer the positioning point data block for the X-, Y- and Z-axis into the system memory.

■ Positioning point data setting procedures

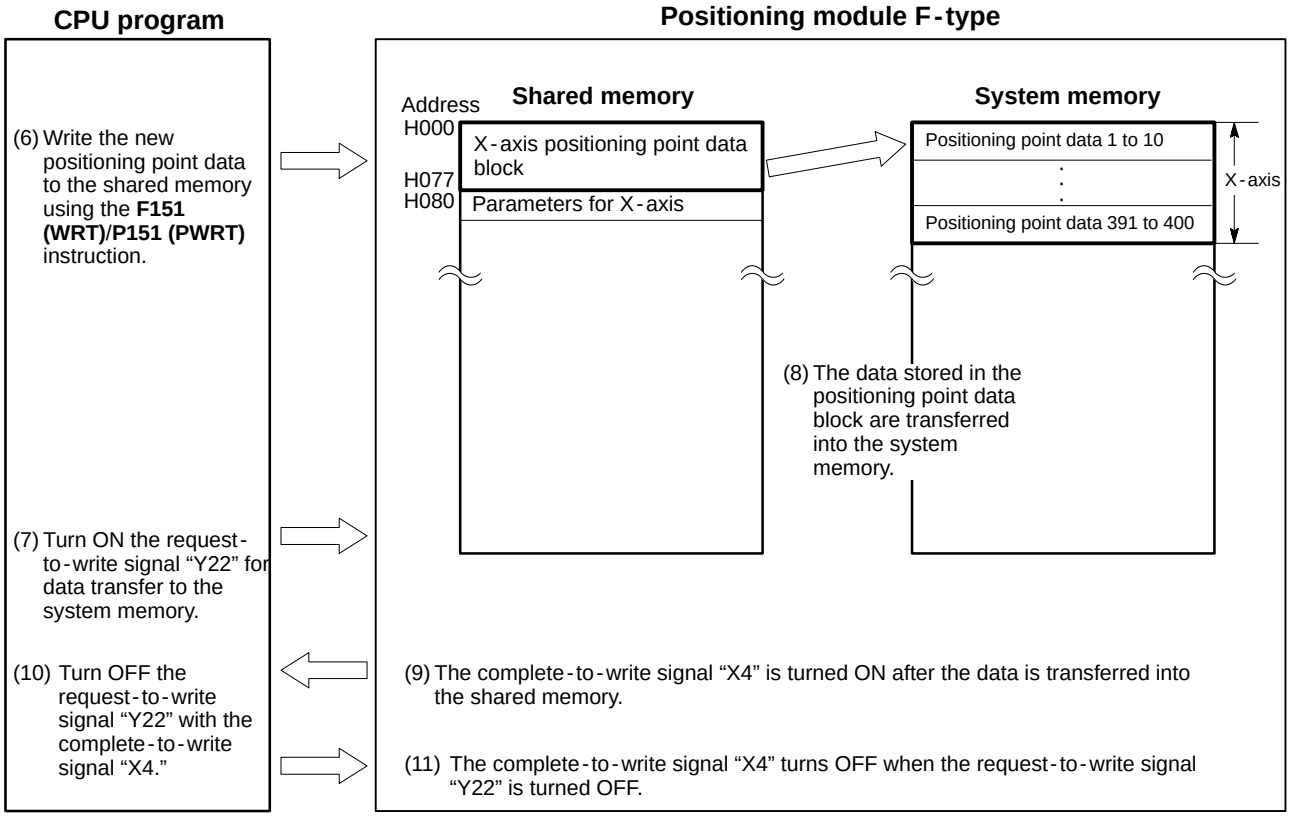
Procedures are explained using the 3-axis module in the 0 slot position.

(1) Write the transfer block number (K1 to K40) for positioning point data to the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
↓
(2) Turn the request-to-read signal "Y21" ON for transferring the positioning point data stored in the system memory to the shared memory.
↓
(3) The positioning point data specified by the transfer block number are transferred to the shared memory (10 point data for each axis).
↓
(4) The complete-to-read signal "X3" turns ON after the data is transferred into the system memory.
↓
(5) Turn OFF the request-to-read signal "Y21" with the complete-to-read signal "X3."
↓
(6) After confirming that signal "X3" has turned OFF, write the changes of the positioning point data into the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction.
↓
(7) Turn ON the request-to-write signal "Y22" for transferring the data into the system memory.
↓
(8) The data stored in the positioning point data blocks of 3 axes are transferred into the system memory.
↓
(9) The complete-to-write signal "X4" turns ON after the data is transferred into the system memory.
↓
(10) Turn OFF the request-to-write signal "Y22" with the complete-to-write signal "X4."
↓
(11) The complete-to-write signal "X4" turns OFF when the request-to-write signal "Y22" is turned OFF.

■ Reading positioning point data in the system memory to the shared memory



■ Revising positioning point data into the system memory



Note:

- While the positioning module is in the operating condition (outputting pulses), it is impossible to transfer the data into the system memory.

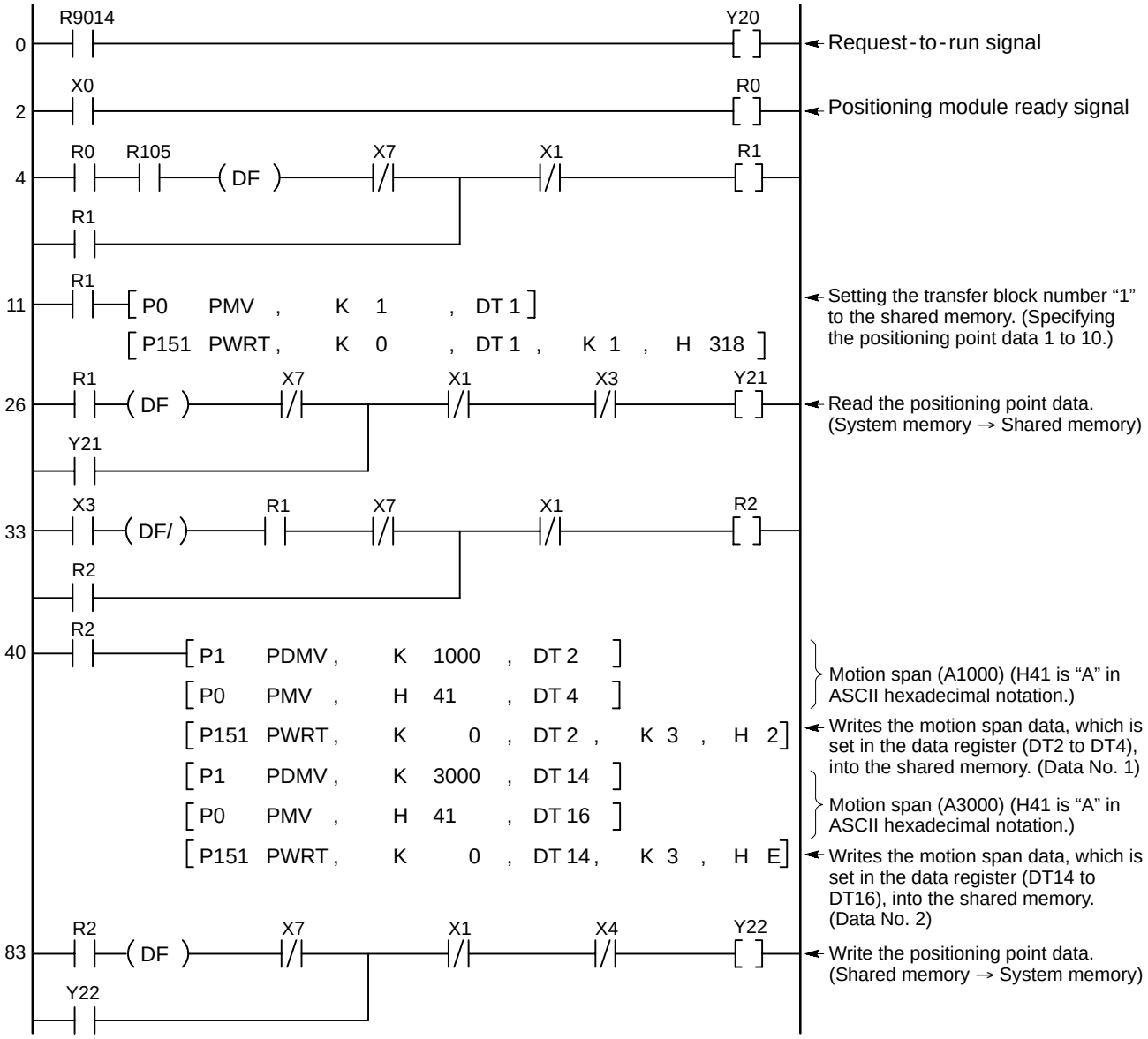
■ Program example

Condition: 2-axis module in the slot 0 position

Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y21: Request-to-read signal
  - X3: Complete-to-read signal
  - Y22: Request-to-write signal
  - X4: Complete-to-write signal
  - R105: Positioning point data read/write trigger from the field device
- Shared memory of the positioning module
  - H000 to H077: X-axis positioning point data block area
  - H100 to H177: Y-axis positioning point data block area
  - H318: Transfer block number area

When R105 turns ON, transfer block number “K1”, (specifying the positioning point data numbers 1 to 10 for X-, Y- and Z-axis) is set in the transfer block area. Then, the request-to-read signal turns ON for transferring the data in the system memory to the shared memory. After confirming the end of read operation with the complete-to-read signal, the request-to-read signal is turned OFF. Then, transfer the changes into the shared memory using the **F151 (WRT)/P151 (PWRT)** instruction. By turning the request-to-write signal ON, the data stored in the data blocks for the X- and Y-axis are transferred to the system memory. After confirming the end of write operation with the complete-to-write signal, the complete-to-write signal is turned OFF.



Note:

· For details about each positioning point data item, refer to page 141, “6-2. Explanation of Each Positioning Point Data Item.”

7-4. Positioning Operation Start Program

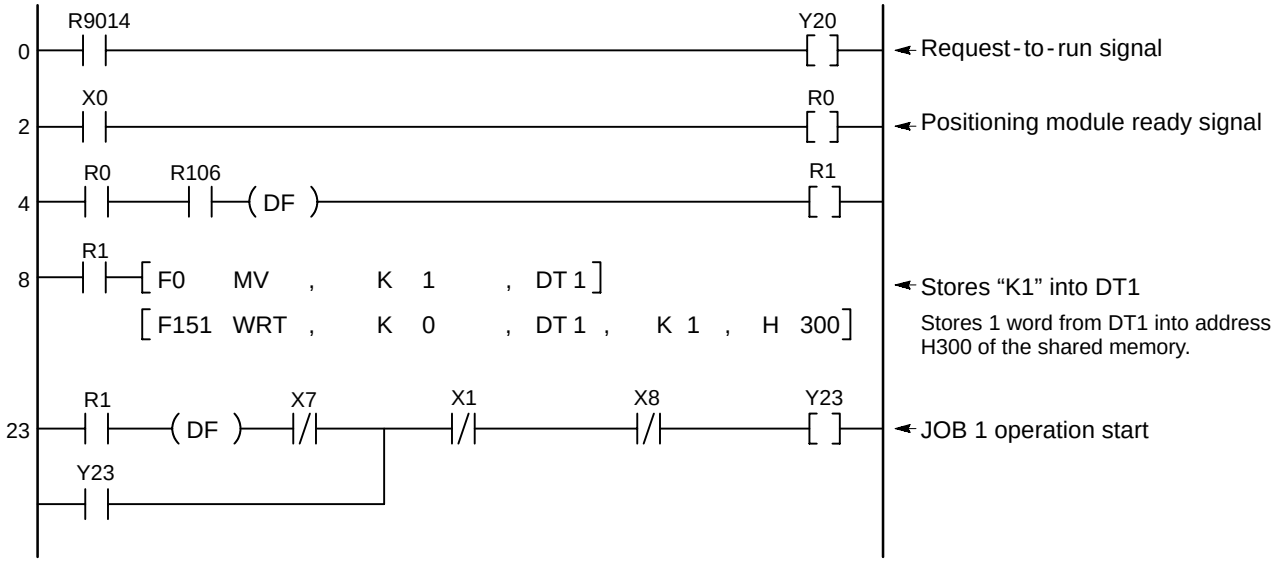
The positioning operation is executed according to the parameters and positioning point data entered by the procedure described in the previous sections. To start the positioning operation, set the starting positioning point data number for each JOB in the starting data number area of the shared memory, and turn the "request-to-start signal" ON. You can start the motion control from the specified positioning point data. When the motion control (JOB operation) is started, the "start confirmation signal" turns ON. Be sure to program to turns OFF the "request-to-start signal" at the leading edge of the "start confirmation signal."

■ Program example

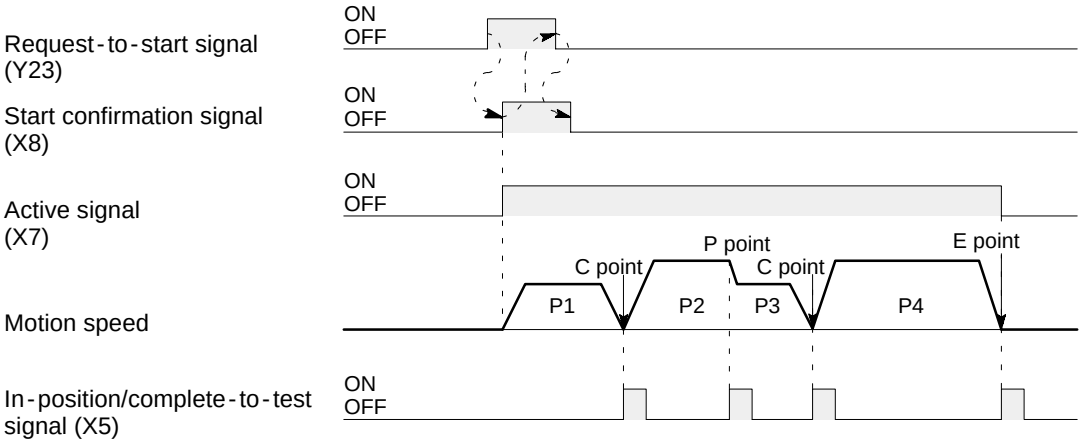
Condition: 2-axis module in the slot 0 position
For motion control of JOB1 starting from positioning point data number 1

Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y23: Request-to-start signal
  - X7: Active signal
  - X8: Start confirmation signal
  - X1: Error signal
  - R106: Positioning operation start trigger from the field device
- Shared memory of the positioning module
  - H300: Starting data number for JOB1
- R106: Positioning operation start contact



■ Operation time chart of JOB1



7-5. Homing and Software Homing Programs

1. Homing Program

The homing operation can be executed by turning the "request-to-home signal" ON. When the homing operation is started, the "start confirmation signal" turns ON. The "at home signal" turns ON when the homing operation, triggered by the "request-to-home signal" is completed.

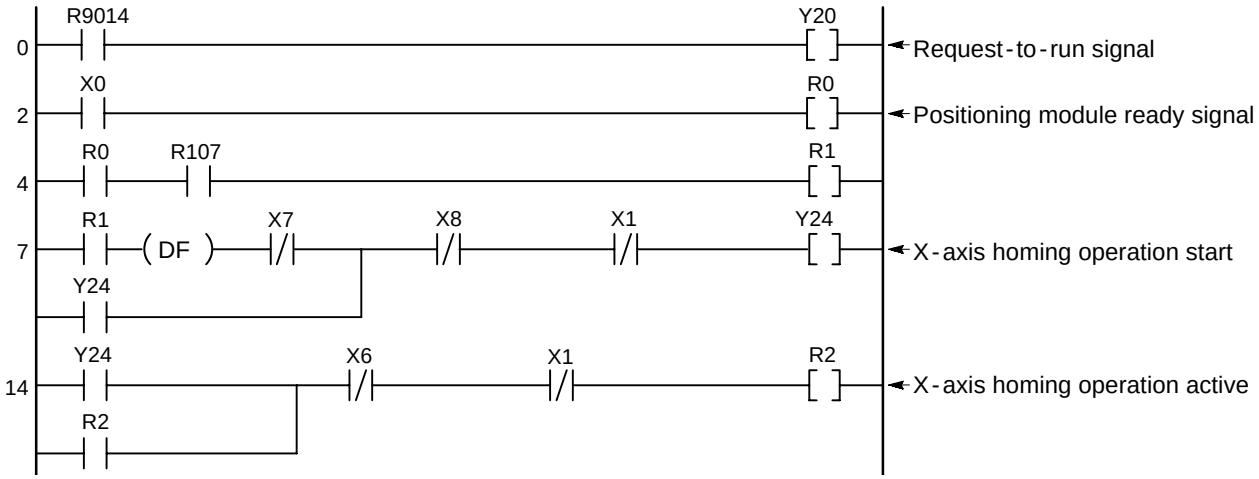
Notes:

- Even if the axis mode is set as simultaneous 2- or 3-axis mode, the homing operation for each axis is always performed independently.
- Be sure to program to turn OFF the "request-to-home signal" at the leading edge of the "start confirmation signal."
- The "at home signal" is turned OFF when the module moves from the home position.
- If the module passes the software home position during homing operation, the "at home signal" does not turn ON.

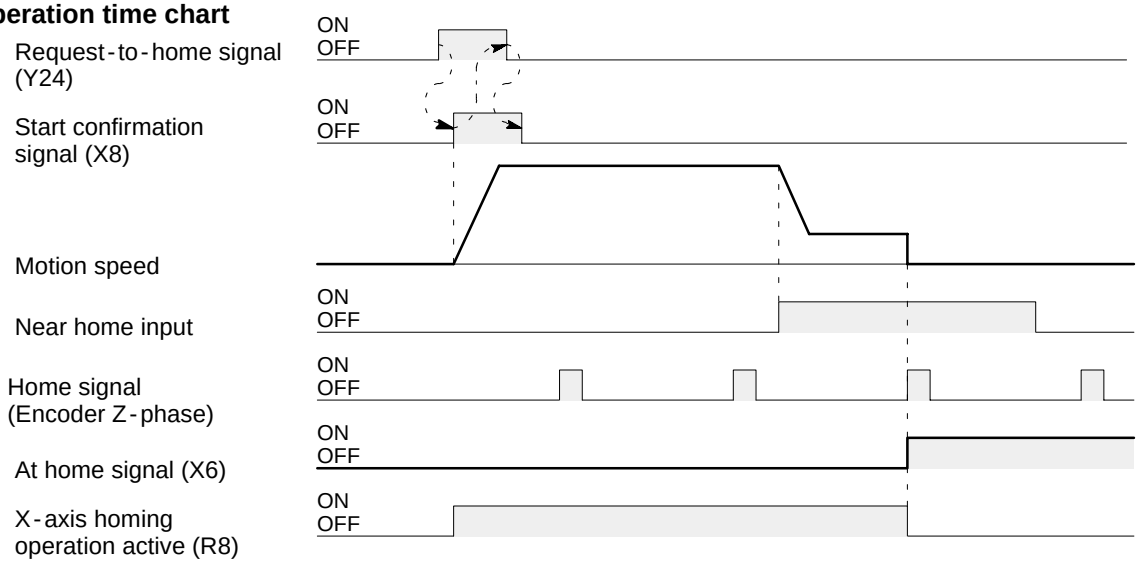
■ Program example

Condition: 2-axis module in the slot 0 position
Homing method: Near home ON method
Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y24: Request-to-home signal
  - R107: Homing start trigger from the field device
  - X8: Start confirmation signal
  - X1: Error signal
  - X6: At home signal



■ Operation time chart



2. Software Homing Program

Software homing operation can be executed by turning ON the “software home request signal.”
When the software homing operation is started, the “start confirmation signal” turns ON.
The “at home signal” turns ON when the software homing operation, triggered by the “software home request signal” is completed.

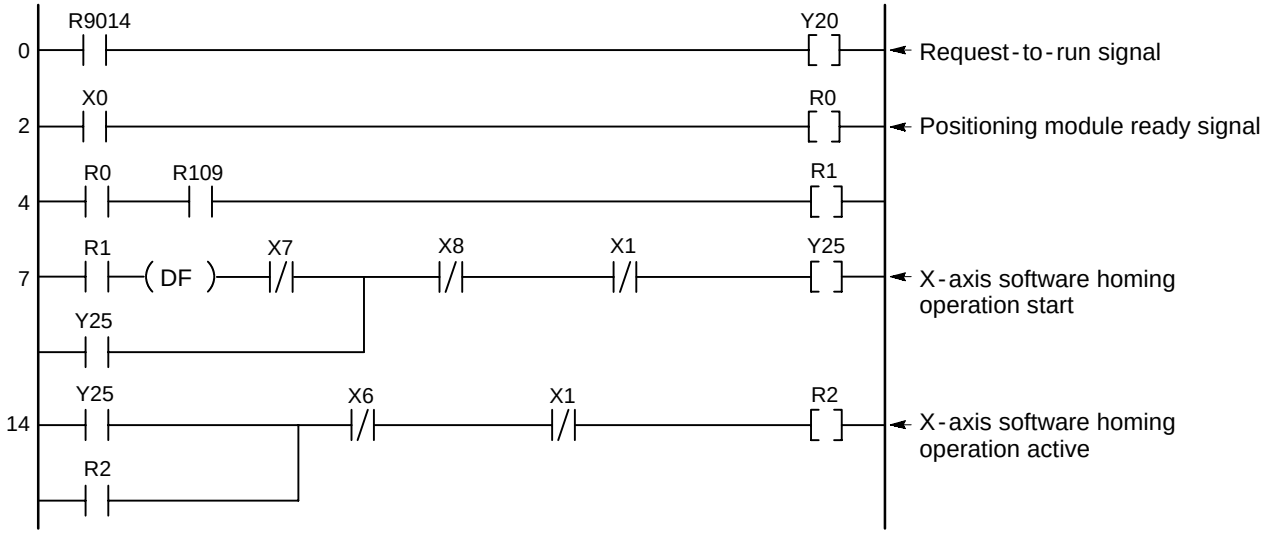
Notes:

- Even if the axis mode is set to simultaneous 2- or 3-axis mode, the software homing operation for each axis is always performed independently.
- Be sure to program to turn OFF the “software home request signal” at the leading edge of the “start confirmation signal.”
- The “at home signal” is turned OFF when the module moves from the home position.
- If the module passes the home position during software homing operation, the “at home signal” does not turn ON.

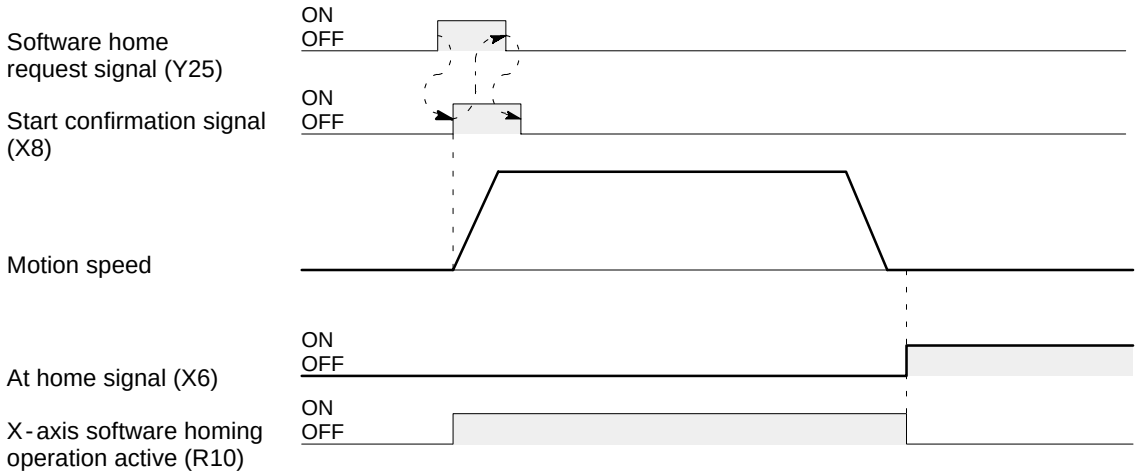
■ Program example

Condition: 2-axis module in the slot 0 position
Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y25: Software home request signal
  - R109: Software homing start trigger from the field device
  - X8: Start confirmation signal
  - X1: Error signal
  - X6: At home signal



■ Operation time chart



7-6. JOG Operation Program

The JOG operation is possible only when the JOG forward request signal or JOG reverse request signal turns ON. The JOG operation is stopped by turning OFF the "JOG forward request signal" and "JOG reverse request signal." The speed for JOG operation is controlled by the JOG speed data set in the JOG speed area of the shared memory.

■ Program example

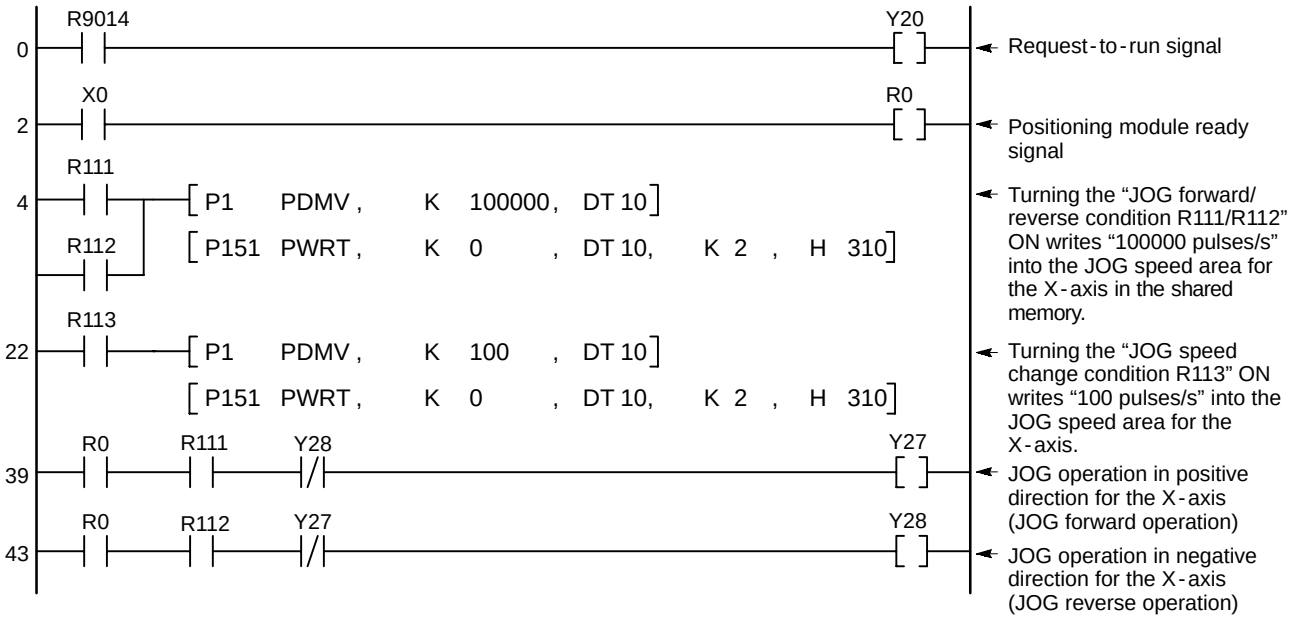
Condition: 2-axis module in the slot 0 position

Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y28: JOG reverse request signal
  - Y27: JOG forward request signal
  - R111: JOG forward trigger from the field device
  - R112: JOG reverse trigger from the field device
- Shared memory of the positioning module
  - H310: JOG speed for X-axis

Operation:

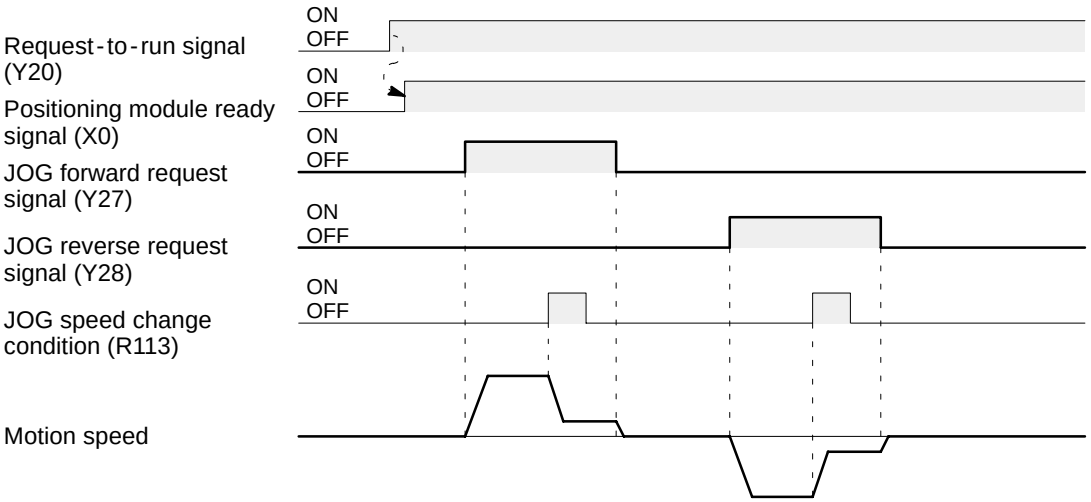
- When the JOG forward condition R111 or JOG reverse condition R112 turns ON, the JOG operation begins. In this program, when the JOG speed change condition R113 turns ON during JOG operation, the JOG speed is modified.



Notes:

- During JOG operation, "software limits (negative and positive)" set in the parameter setting stage are not valid. In addition, even when the limit over signal is ON, pulses can be output during JOG operation.
- "Home return speed low", which will be set in the parameter setting stage, is set as the initial JOG speed when the power is turned ON. Since an unknown value may be stored as the "home return speed" in the parameters at the first power ON, be sure to change the JOG speed for each axis in the shared memory before starting JOG operation.
- Before using high or low JOG speed selection of the teaching unit II's function, be sure to set parameters for "home return speed (high and low)" properly.
- JOG operation for each axis is always performed independently even if the axis mode is set to simultaneous 2- or 3-axis mode.

■ Operation time chart



7-7. Actual Position Read and Change Programs

1. Actual Position Read Program

The actual position address can be taken into the CPU by executing **F150 (READ)**/**P150 (PREAD)** instructions. The address is revised about every 0.5 second during positioning operation.

Note:

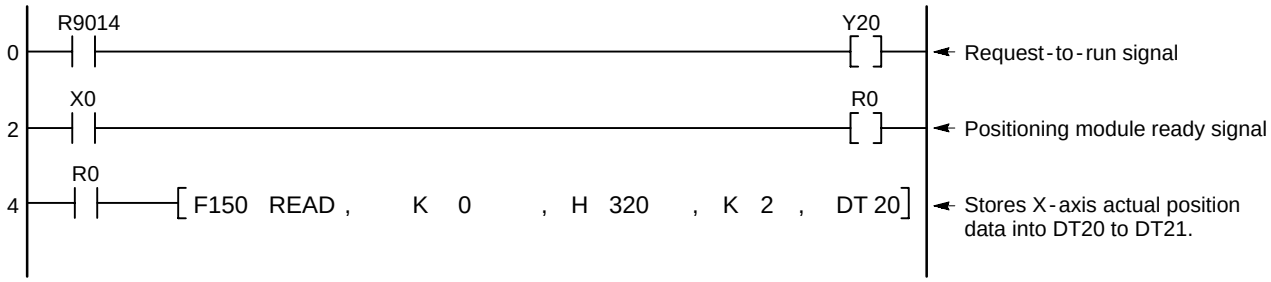
· During positioning (pulse output), the actual position address is revised at intervals of approximately 0.5 second. Therefore, if the actual position is continuously read using a normal ON relay (such as the R9010), please note that the position of the workpiece will differ slightly from the actual position data.

■ Program example

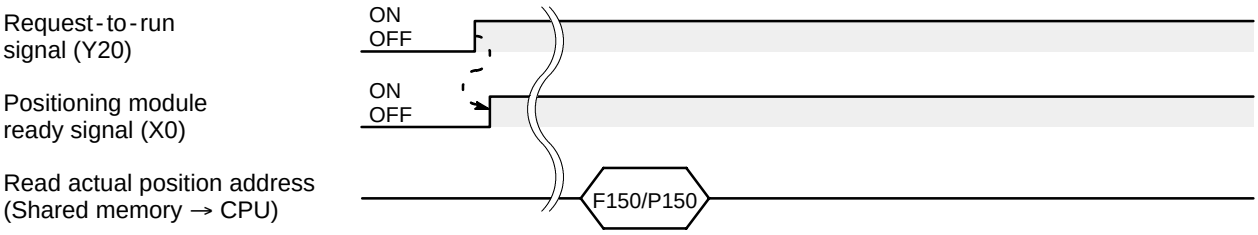
Condition: 2-axis module in the slot 0 position

Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
- Shared memory of the positioning module
  - H320: X-axis actual position address



■ Operation time chart



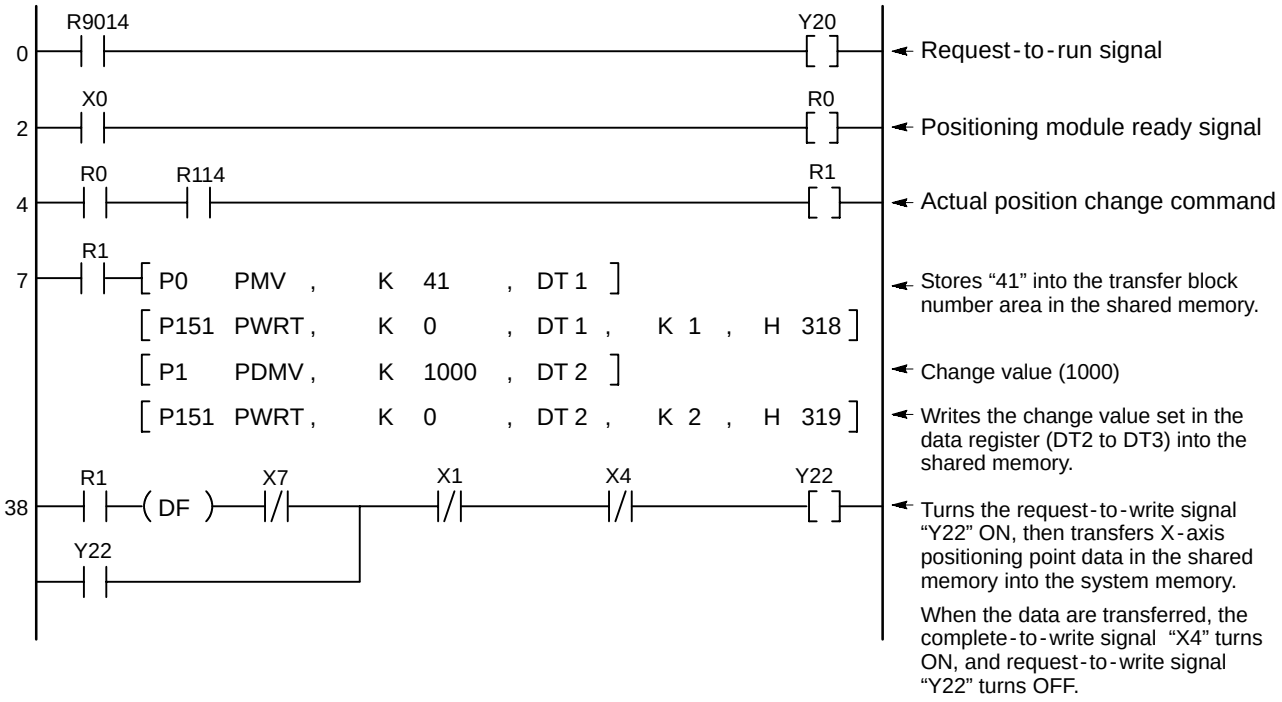
2. Actual Position Change Program

The positioning module F-type has function to change address for actual position by program. To do so, write the block number of the axis to the data change into the transfer block number area of the shared memory.
The revised address set in the shared memory become effective only after transferring it into the system memory by turning ON the request-to-write signal.

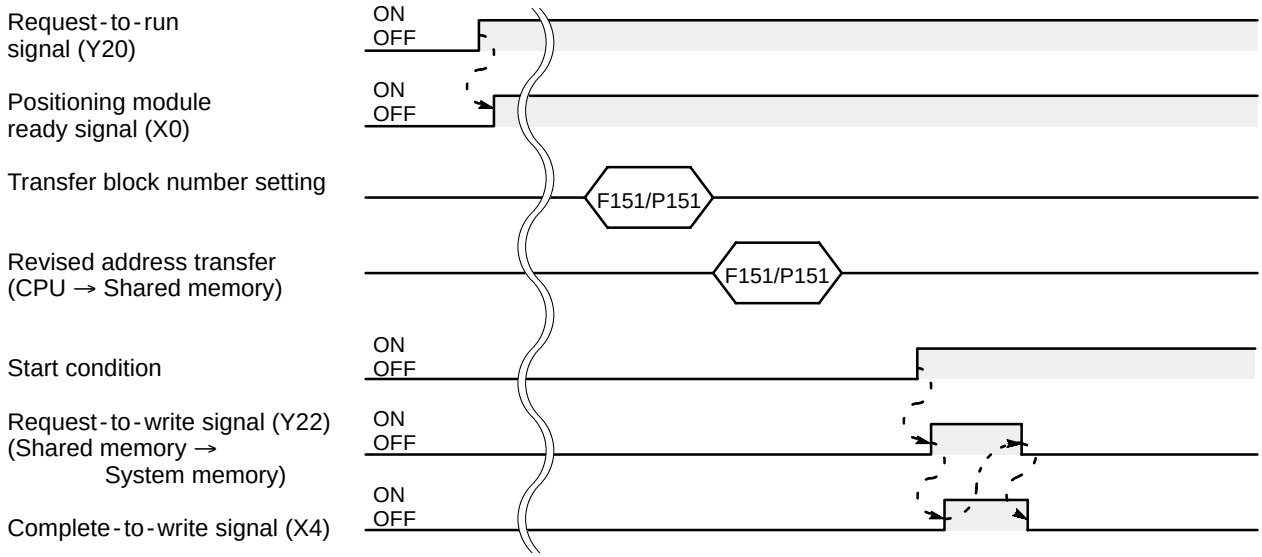
■ Program example

Condition: 2-axis module in the slot 0 position
Explanation of signals:

- CPU
  - Y20: Request-to-run signal
  - X0: Positioning module ready signal
  - Y22: Request-to-write signal
  - X4: Complete-to-write signal
  - R114: Actual position change trigger from the field device
- Shared memory of the positioning module
  - H318: Transfer block number area
  - H319: X-axis revised address of actual position



■ Operation time chart



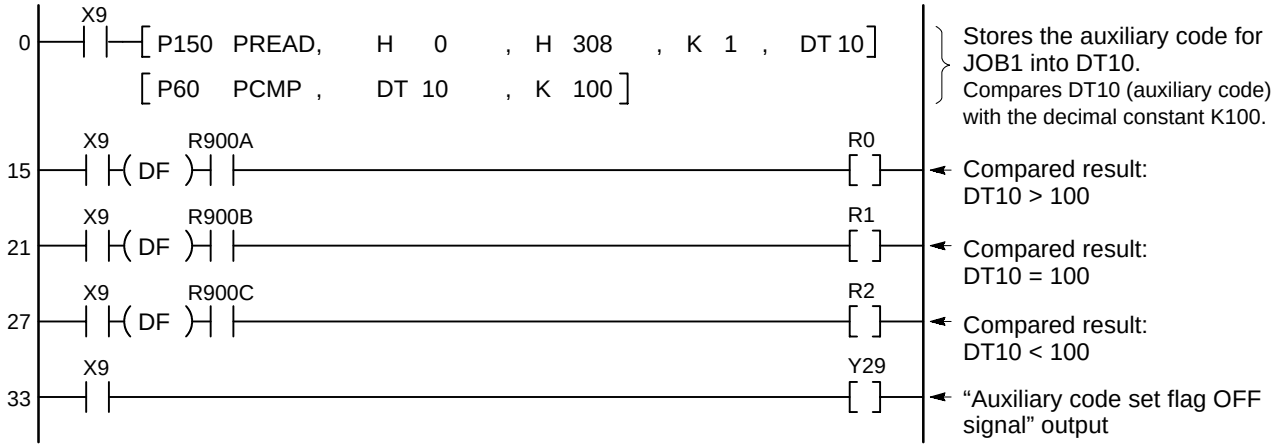
7-8. Auxiliary Code Read and Process Program

The auxiliary code is used as a user significant flag for recognizing the operation of the data.
The "auxiliary code set flag" turns ON when a new auxiliary code is set in the shared memory.
The auxiliary code is read at the leading edge of the "auxiliary code set flag." Turn the "auxiliary code set flag OFF signal" ON immediately after the auxiliary code is read and the program has recognized the operation.
The "auxiliary code set flag" turns OFF by turning ON the "auxiliary code set flag OFF signal."
Be sure to program to turn OFF the "auxiliary code set flag OFF signal" at the trailing edge of the "auxiliary code set flag."

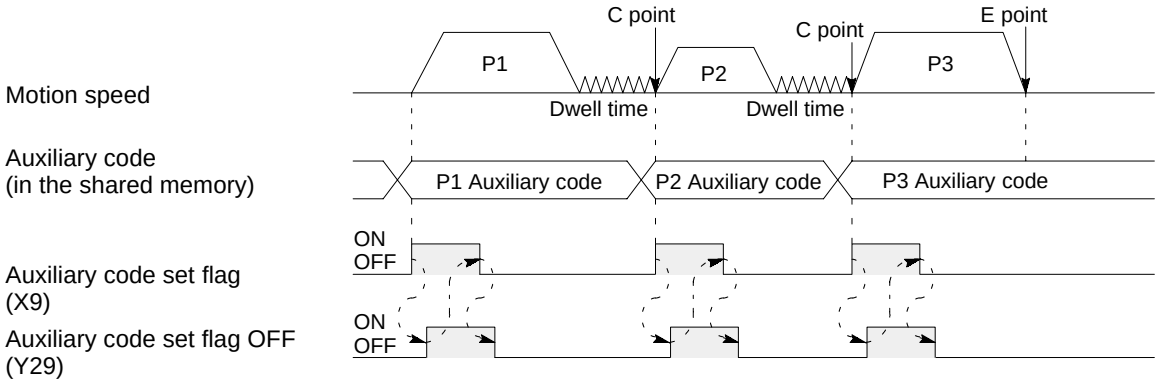
■ Program example

Condition: 2-axis module in the slot 0 position
For reading the auxiliary code of JOB1
Auxiliary code set mode: Start (W) mode
Explanation of signals:

- CPU
  - X9: Auxiliary code set flag
  - Y29: Auxiliary code set flag OFF signal
- Shared memory of the positioning module
  - H308: Auxiliary code area for JOB1



■ Operation time chart



Notes:

- In the above time chart, the auxiliary codes of all the positioning points are set to start (W) mode operation.
- In the above program example, internal relays R0, R1 and R2 turn ON only for one scan. For using the result in other parts of program, add a self-holding circuit.

7-9. Error Code Read and Error Clear Programs

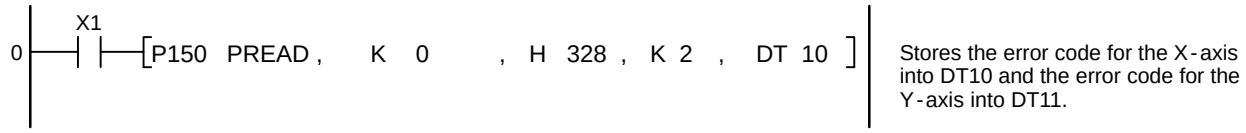
1. Error Code Read Program

When an error occurs in the positioning module, such as a malfunction in the start-up method and data writing or an error in the setting of parameters or positioning point data, the “error signal” turns ON, and a hexadecimal error code is written into shared memory according to the type of the error. The ladder program writes the error code into the CPU at the leading edge of the error signal.

■ Program example

Condition: 2-axis module in the slot 0 position
Explanation of signals:

- CPU
  - X1: Error signal (Error detected contact)
- Shared memory of the positioning module
  - H328: Error code area for X-axis



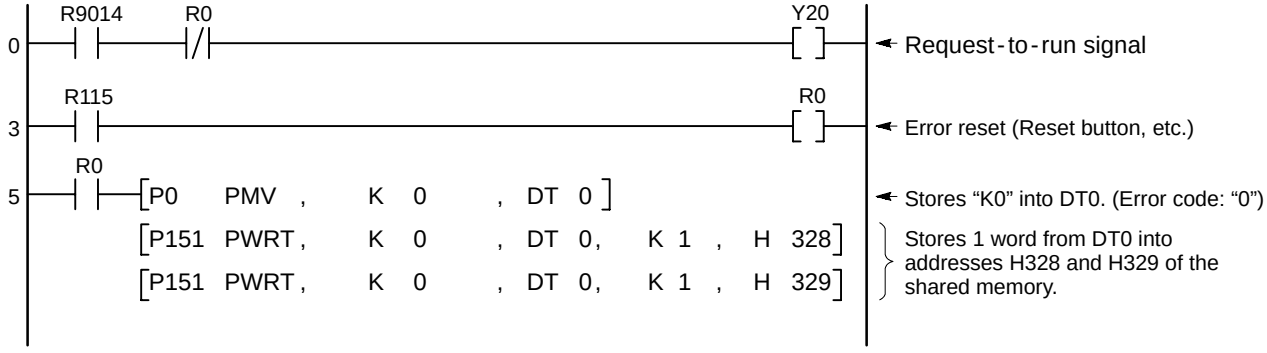
2. Error Clear Program

The “error signal” turns OFF when error clear operation is performed after the cause of the error is removed.
Turn OFF the “request-to-run signal” and set the error code area in the shared memory to “0” by executing the **F151 (WRT)/P151 (PWRT)** instruction. Then, turn ON the “request-to-run signal” again.
The positioning module is initialized and returns to normal operating condition.

■ Program example

Condition: 2-axis module in the slot 0 position
Explanation of signals:

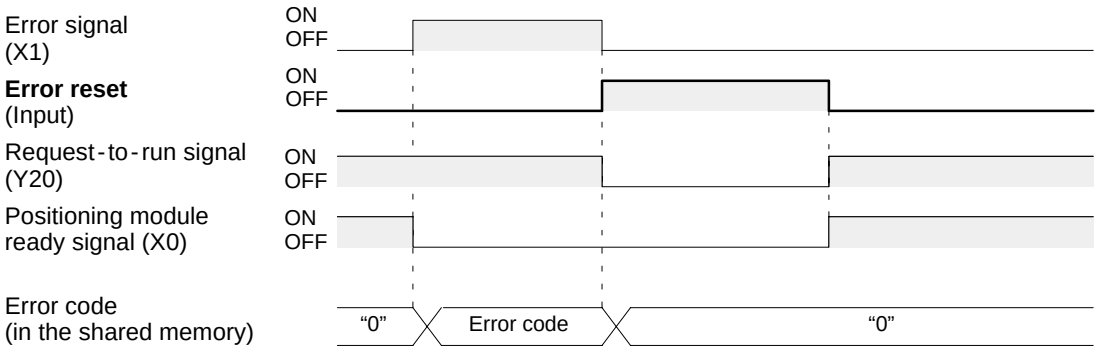
- CPU
  - Y20: Request-to-run signal
  - R115: Error reset trigger from the field device
- Shared memory of the positioning module
  - H328: Error code area for X-axis
  - H329: Error code area for Y-axis



Note:

· When using a 3-axis module, add the program to write “K0” into the error code area (address H32A) of the shared memory using DT0.

3. Operation Time Chart



4. Cautions When an Error Is Detected

When an error occurs in the positioning module, the following process occurs:

(1) The pulse output is stopped immediately (emergency stop).

↓

(2) The deviation counter reset signal is output.

↓

(3) The error code is set in the error code area.

↓

(4) The positioning module ready signal "X0" is turned OFF .

↓

(5) The error signal "X1" is turned ON.

↓

(6) The actual position data of the positioning module set to "0."

↓

(7) The error response is returned to the teaching unit II.

↓

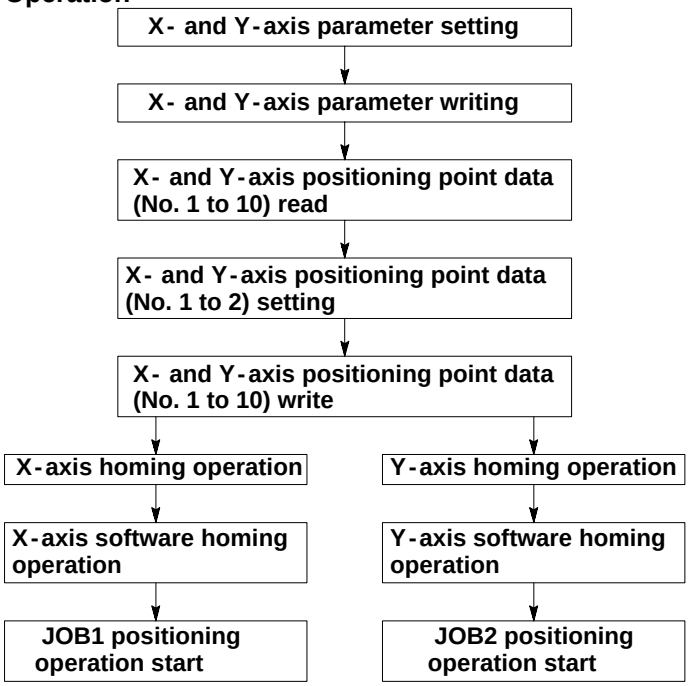
(8) The error LED flashes.

7-10. Integrated Program Example

1. Application Program for Writing Positioning Point Data (10 points or less)

As a summary of the various programs explained in this chapter, these programs are combined for continuous execution. When the CPU is set to RUN mode, this program executes a series of operations, from the setting of the parameters and positioning point data and the execution of the homing operation, to the positioning operation. Each process and operation timing is as shown below.

■ Operation



< Memory Handshake Communication >

Data register → shared memory

Shared memory → system memory

System memory → shared memory

Data register → shared memory

Shared memory → system memory

(The near home and home inputs are necessary to complete homing operation.)

■ Content of parameter settings

Item		X-axis	Y-axis
1	Pulse output mode	K1: CW and CCW	
2	Axis mode	K0: Independent	——
3	Unit setting	0: Pulse	
4	Conversion rate	1: in “pulse units”	
5	Speed limit	400,000 pulses/s	
6	Software limit (+)	8,388,607 pulses	
7	Software limit (-)	-8,388,607 pulses	
8	Base speed	0 pulse/s	
9	Interpolation speed setting mode	K1: Tracking speed	——
10	Backlash compensation	0 pulse	

Item		X-axis	Y-axis
11	Error compensation	0: in “pulse unit”	
12	In-position time	300 ms	
13	Homing direction	1: Negative direction	
14	Home offset address	2,000 pulses	
15	Home return speed (high)	1,000 pulses/s	
16	Home return speed (low)	100 pulses/s	
17	Acceleration/ deceleration time	300 ms	
18	Start mode	0: Immediate normal-start mode	——
19	Homing method	0: Near home ON	——
20	Interface logic	101100	——

■ Content of data settings

Data No.	Motion pattern		Motion span		Axis speed		Acceleration/ deceleration time		Dwell time		Auxiliary code		Interpolation speed	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
1	E	E	I-5,000	I-2,000	2,000	3,000	300	300	200×10	200×10	A0	A0	0	——

■ Program example

Conditions:

- Type and position: 2-axis module in the slot 0 position
- Axis controll: X- and Y-axis
- Provisional register in the CPU for parameter: DT100
- Provisional register in the CPU for positioning point data: DT200

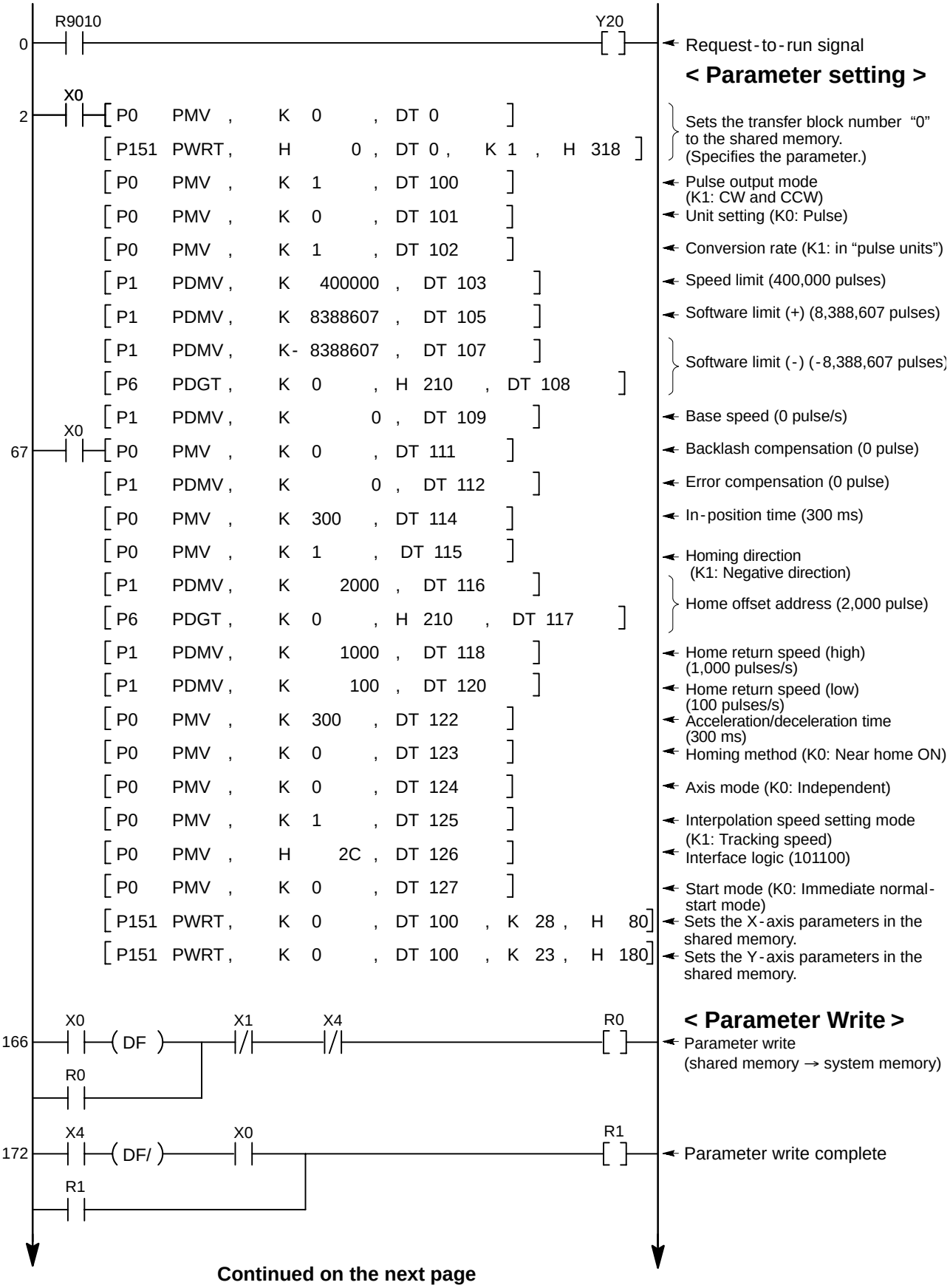
Explanation of signals:

• CPU

- Y20: Request-to-run signal
- X0: Positioning module ready signal
- X4: Complete-to-write signal
- X3: Complete-to-read signal
- Y24: Request-to-home signal for X-axis operation
- X8: Start confirmation signal for JOB1 operation
- Y2B: Request-to-home signal for Y-axis operation
- XD: Start confirmation signal for JOB2 operation
- X6: At home signal for X-axis operation
- XB: At home signal for Y-axis operation
- Y25: Software home request signal for X-axis operation
- Y2C: Software home request signal for Y-axis operation
- Y23: Request-to-start signal for JOB1 operation
- Y2A: Request-to-start signal for JOB2 operation
- Y21: Request-to-read signal
- Y22: Request-to-write signal

• Shared memory of the positioning module

- H318: Transfer block number area
- H80 to H09B: Parameters for X-axis
- H180 to H19B: Parameters for Y-axis
- H000 to H00B: X-axis positioning point data 1
- H100 to H10B: Y-axis positioning point data 1
- H300: Starting data number for JOB1
- H301: Starting data number for JOB2



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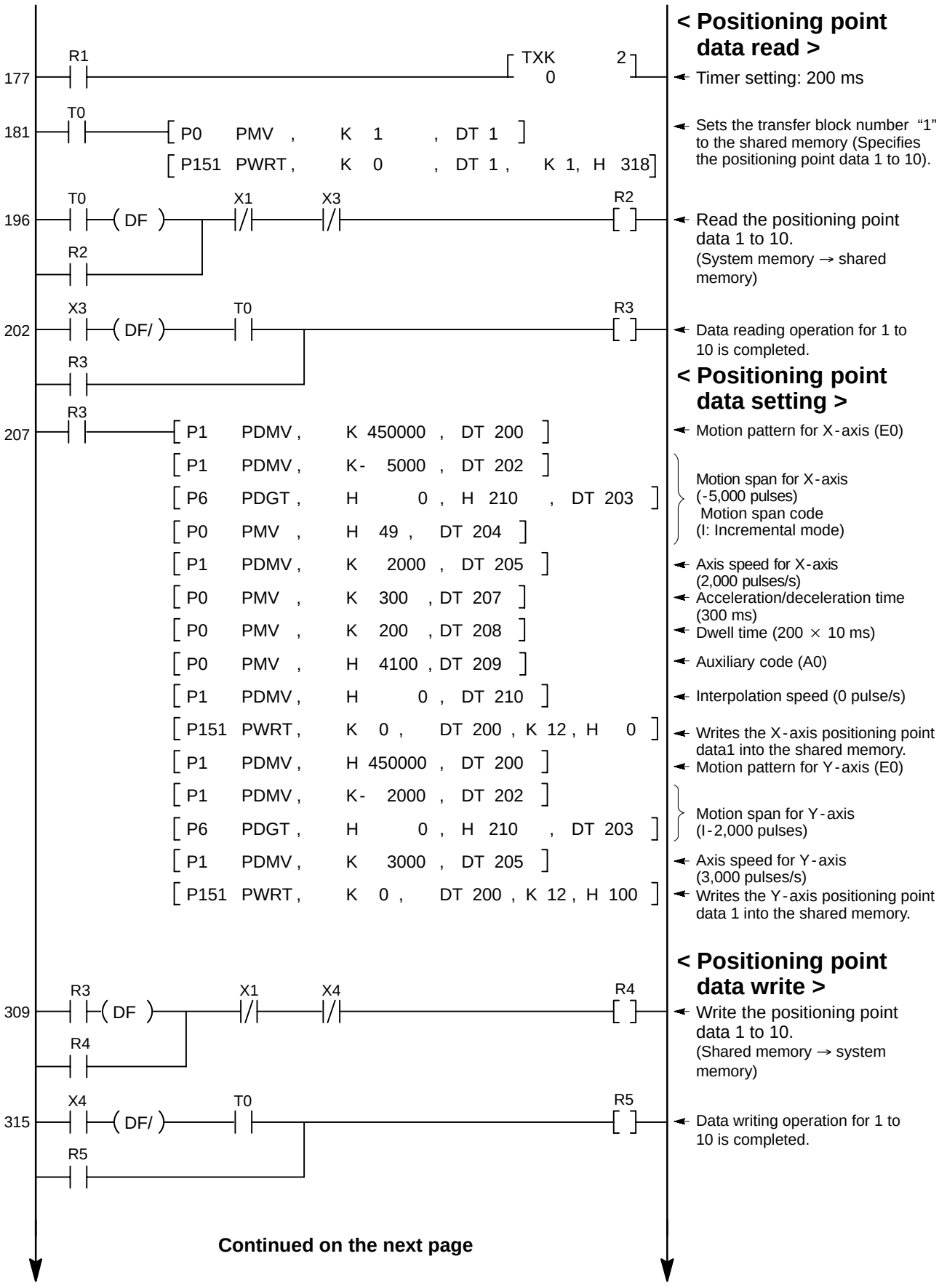
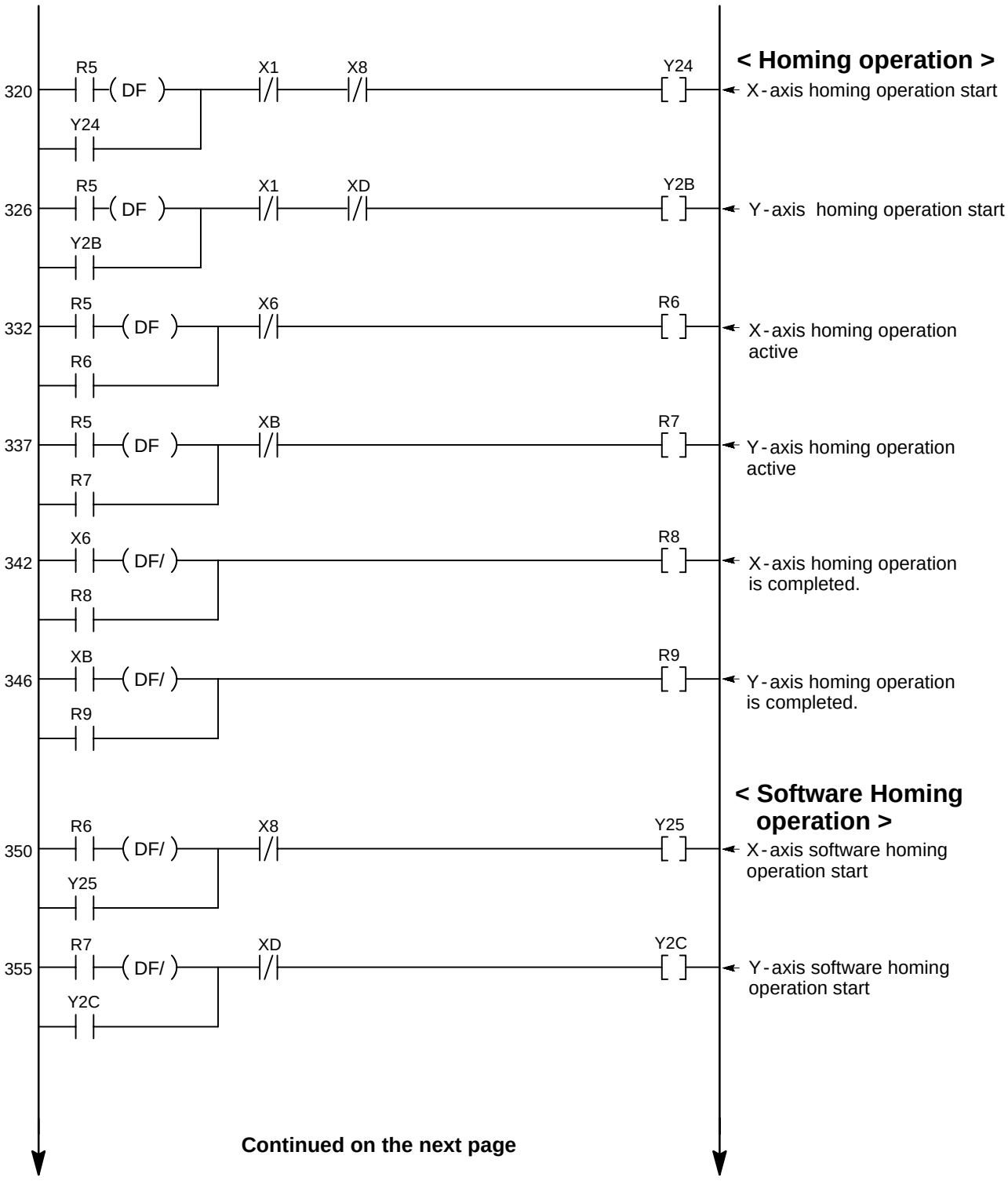
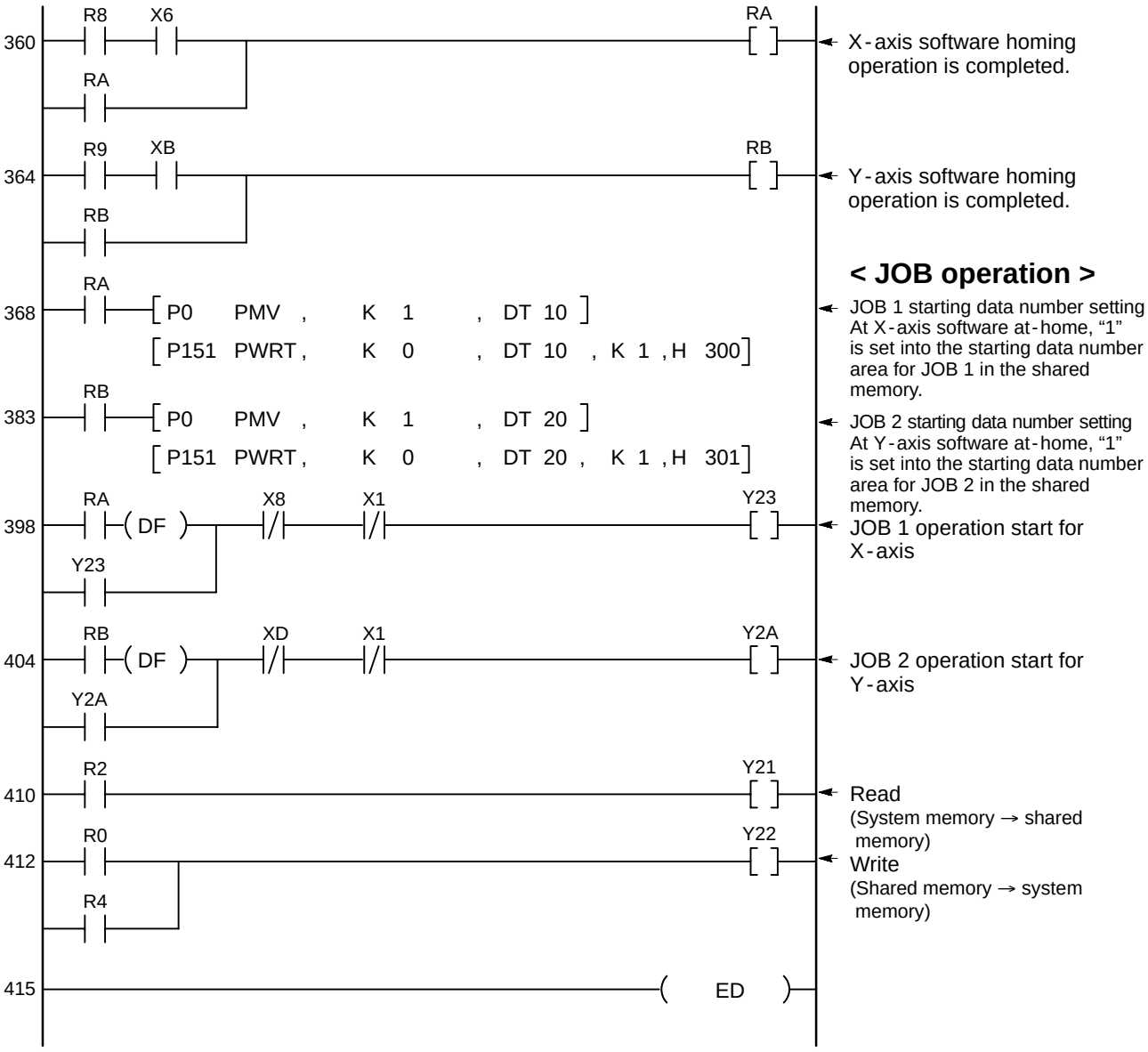


Continued on the next page


< Homing operation >
320
R5
DF
X1
X8
Y24
Y24
X-axis homing operation start
326
R5
DF
X1
XD
Y2B
Y2B
Y-axis homing operation start
332
R5
DF
X6
R6
R6
X-axis homing operation active
337
R5
DF
XB
R7
R7
Y-axis homing operation active
342
X6
DF/
R8
R8
X-axis homing operation is completed.
346
XB
DF/
R9
R9
Y-axis homing operation is completed.
< Software Homing operation >
350
R6
DF/
X8
Y25
Y25
X-axis software homing operation start
355
R7
DF/
XD
Y2C
Y2C
Y-axis software homing operation start
Continued on the next page


360
R8
X6
RA
RA
X-axis software homing operation is completed.
364
R9
XB
RB
RB
Y-axis software homing operation is completed.
< JOB operation >
368
RA
P0 PMV , K 1 , DT 10
P151 PWRT, K 0 , DT 10 , K 1 ,H 300
JOB 1 starting data number setting
At X-axis software at-home, "1" is set into the starting data number area for JOB 1 in the shared memory.
383
RB
P0 PMV , K 1 , DT 20
P151 PWRT, K 0 , DT 20 , K 1 ,H 301
JOB 2 starting data number setting
At Y-axis software at-home, "1" is set into the starting data number area for JOB 2 in the shared memory.
398
RA
DF
X8
X1
Y23
Y23
JOB 1 operation start for X-axis
404
RB
DF
XD
X1
Y2A
Y2A
JOB 2 operation start for Y-axis
410
R2
Y21
Read
(System memory → shared memory)
412
R0
R4
Y22
Write
(Shared memory → system memory)
415
ED

2. Application Program for Writing Positioning Point Data (more than 10 points)

■ Program structure

This program transfers the positioning point data for 15 points as an example of transferring more than 10 points of data. When the CPU is set to the RUN mode, it first sets the parameters and positioning point data, then executes homing and software homing operations consecutively, and starts positioning operation with a switch input.

■ Procedures

(1) PROG → RUN mode
(2) Sets and writes parameters (shared memory → system memory)
(3) Reads positioning point data Nos. 1 to 10 (system memory → shared memory)
(4) Sets and writes positioning point data Nos. 1 to 10 (shared memory → system memory)
(5) Reads positioning point data Nos. 11 to 20 (system memory → shared memory)
(6) Sets and writes positioning point data Nos. 11 to 15 (shared memory → system memory)
(7) Executes homing operation
(8) Executes software homing operation
(9) JOB operation start switch “X20” turns ON
(10) Executes positioning operation for JOB 1

■ Content of parameter settings

Item		X-axis
1	Pulse output mode	1: CW and CCW
2	Axis mode	K0: Independent
3	Unit setting	0: Pulse
4	Conversion rate	1: in “pulse units”
5	Speed limit	400,000 pulses/s
6	Software limit (+)	150,000 pulses
7	Software limit (-)	-45,000 pulses

Item		X-axis
8	Base speed	0 pulse/s
9	Interpolation speed setting mode	K1: Tracking speed
10	Backlash compensation	0 pulse
11	Error compensation	0 pulse
12	In-position time	300 ms
13	Homing direction	K1: Negative direction

Item		X-axis
14	Home offset address	-20,000 pulses
15	Home return speed (high)	50,000 pulses/s
16	Home return speed (low)	3000 pulses/s
17	Acceleration/ deceleration time	100 ms
18	Start mode	1: Normal-start after homing
19	Homing method	1: Near home OFF
20	Interface logic	110101

■ Content of positioning point data settings

Data No.	Motion pattern	Motion span	Axis speed	Acceleration/ deceleration time	Dwell time	Auxiliary code	Interpolation speed
1	P2	I + 10000	5000	100	0	A0	0
2	P3	I + 10000	20000	100	0	A0	0
3	P4	I + 10000	5000	100	0	A0	0
4	P5	I + 10000	20000	100	0	A0	0
5	P6	I + 10000	5000	100	0	A0	0
6	P7	I + 10000	20000	100	0	A0	0
7	P8	I + 10000	5000	100	0	A0	0
8	P9	I + 10000	20000	100	0	A0	0
9	P10	I + 10000	5000	100	0	A0	0
10	C11	I + 10000	20000	100	100	A0	0
11	P12	I - 20000	5000	200	0	A0	0
12	P13	I - 20000	10000	200	0	A0	0
13	P14	I - 20000	15000	200	0	A0	0
14	P15	I - 20000	20000	200	0	A0	0
15	E	I - 20000	30000	200	0	A0	0

■ Program example

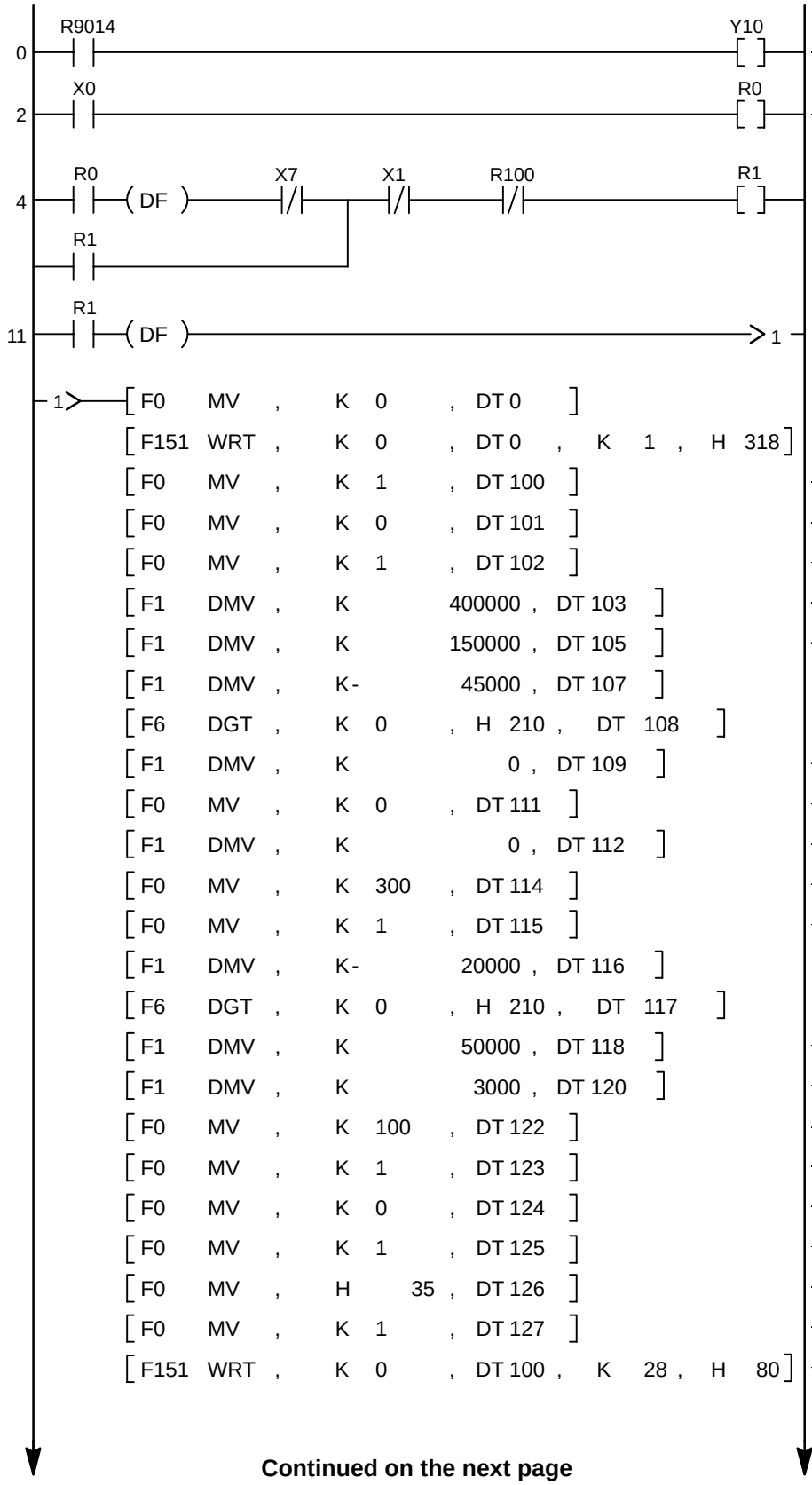
Conditions:

- Type and position: 1-axis module in the slot 0 position
- Axis controlled: X-axis
- Provisional register in the CPU for prameter: DT100
- Provisional register in the CPU for positioning point data: DT200

Explanation of signals:

• CPU

- X0: Positioning module ready signal
- X1: Error signal
- X3: Complete-to-read signal
- X4: Complete-to-write signal
- X6: At home signal for X-axis operation
- X7: Active signal for JOB 1 opeartion
- X8: Start confirmation signal for JOB1 operation
- X20: JOB operation start signal
- Y10: Request-to-run signal
- Y11: Request-to-read signal
- Y12: Request-to-write signal
- Y13: Request-to-start signal for JOB1 operation
- Y14: Request-to-home signal for X-axis operation
- Y15: Software home request signal for X-axis operation



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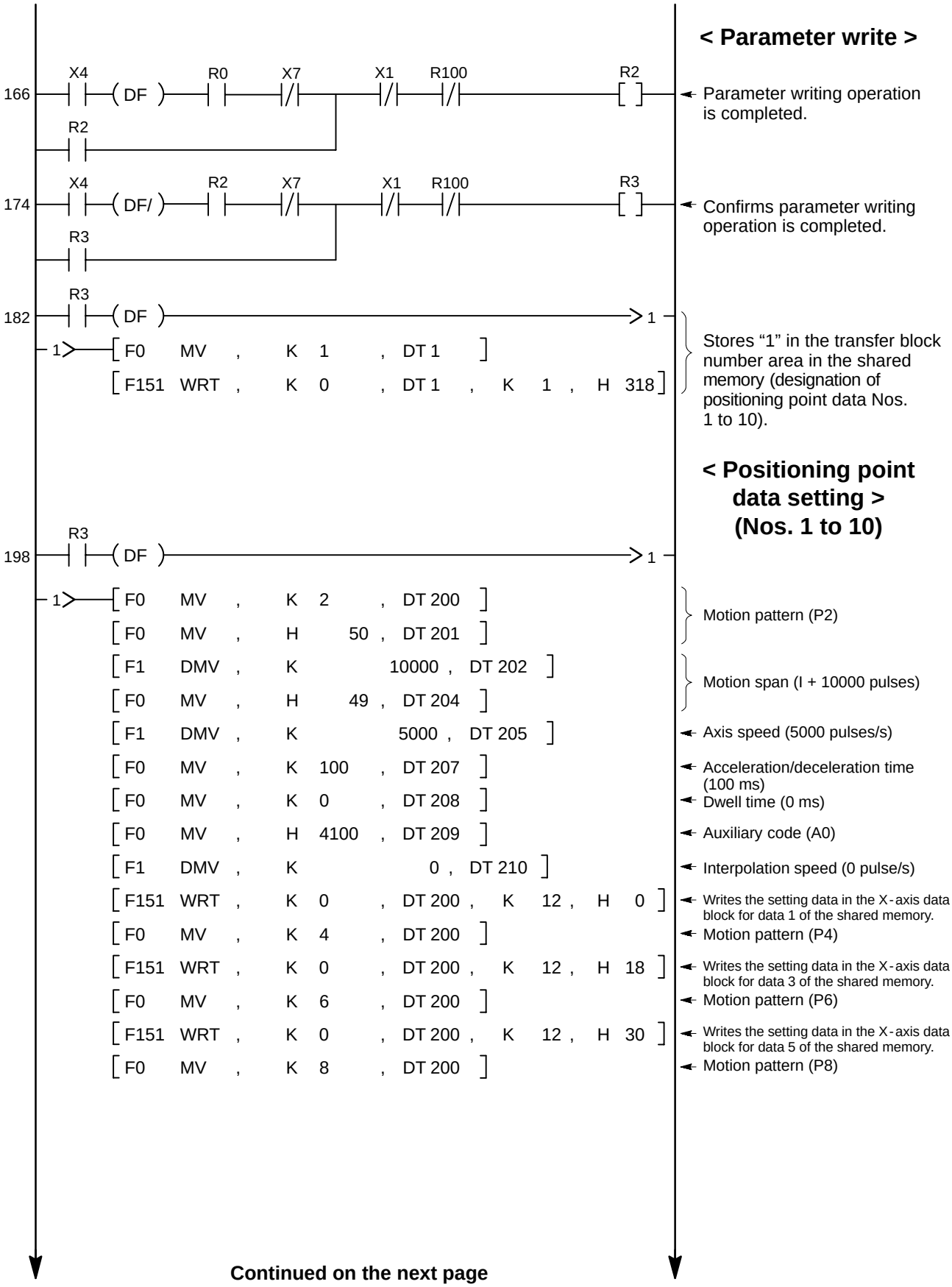

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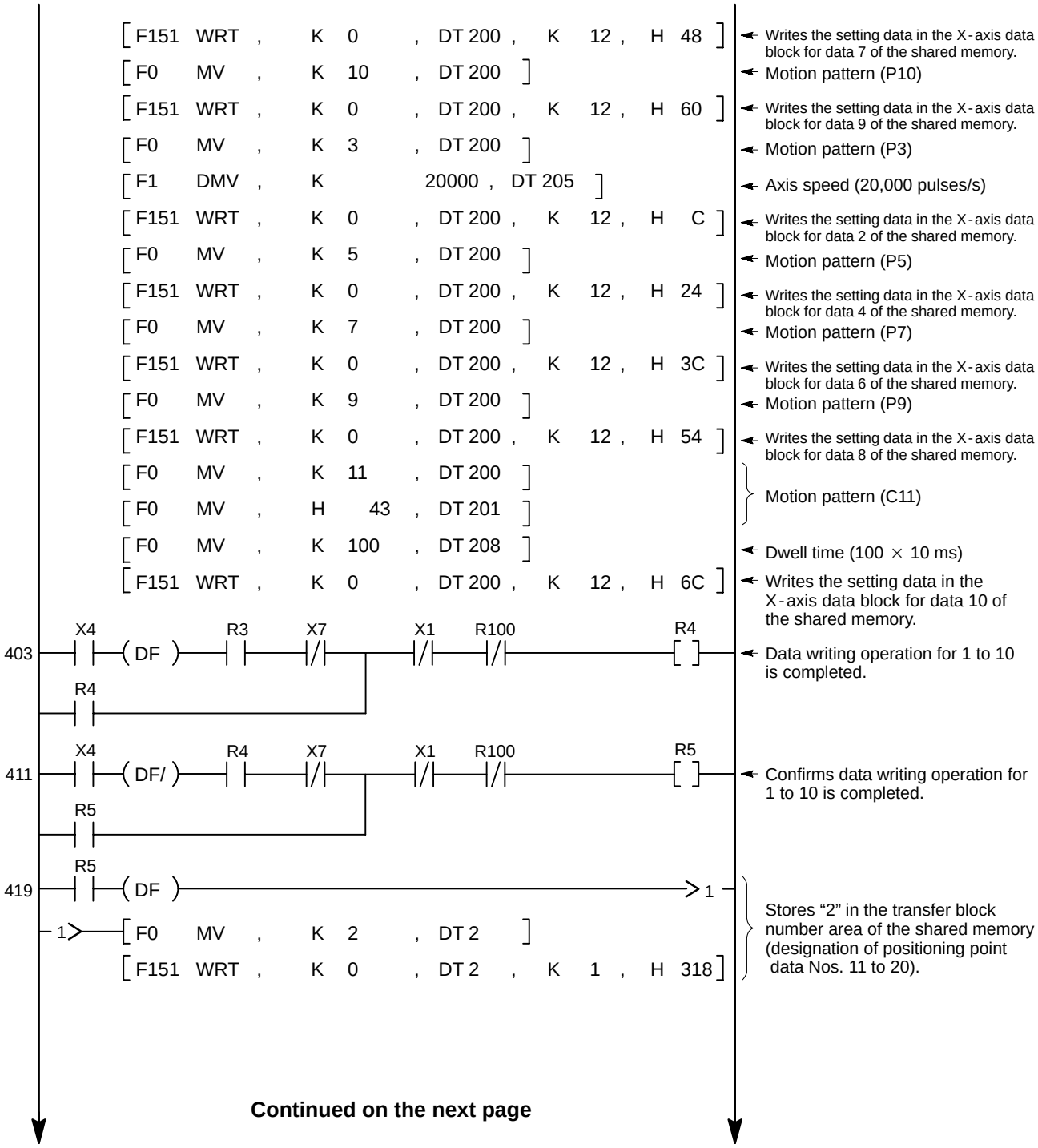

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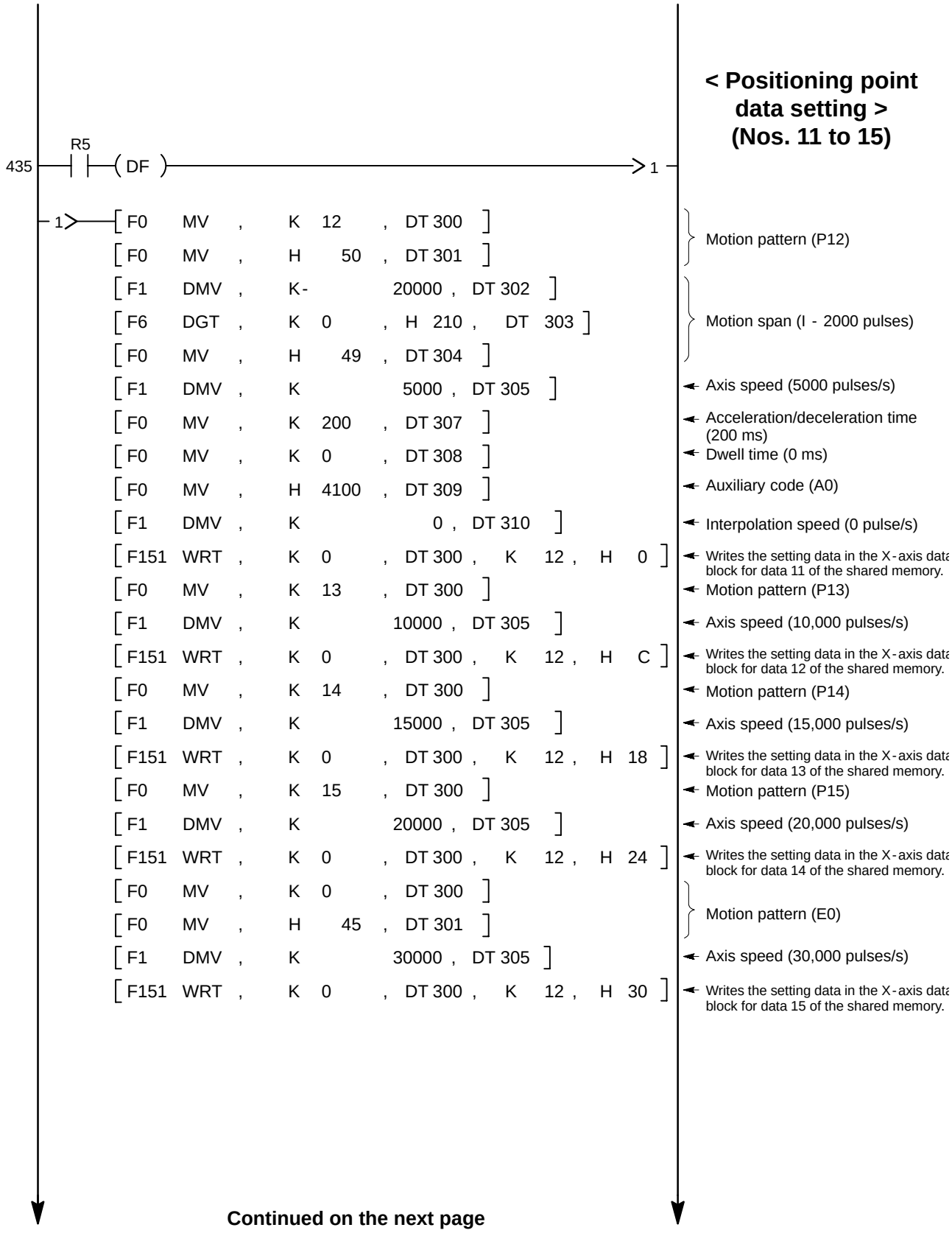

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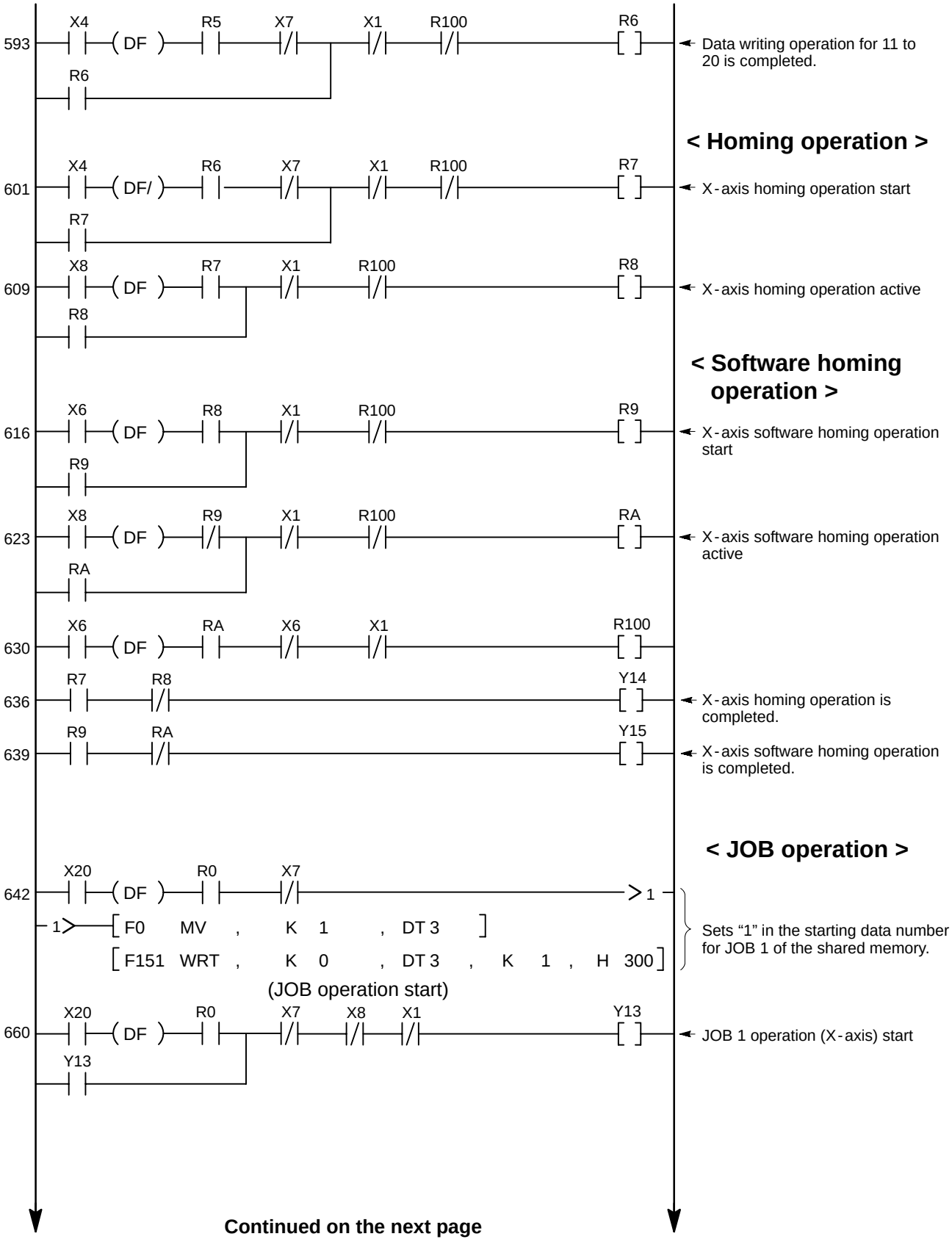

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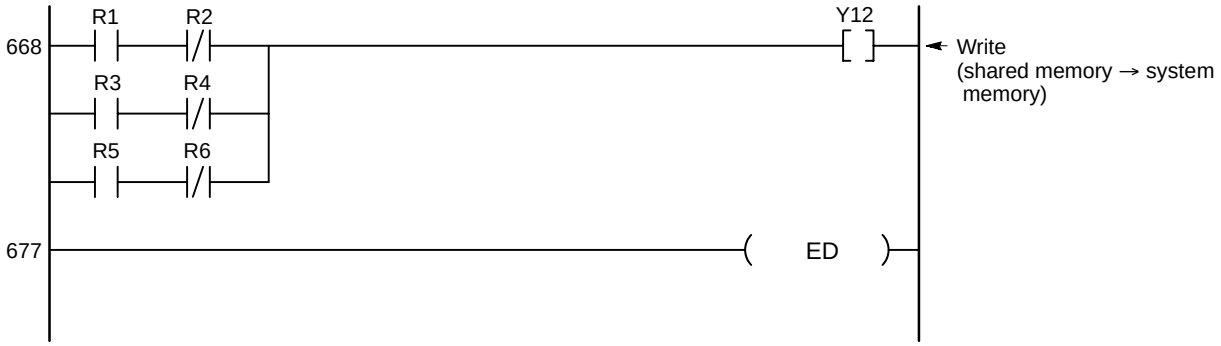

668
R1
R2
R3
R4
R5
R6
Y12
Write
(shared memory → system
memory)
677
ED

CHAPTER 8

TROUBLESHOOTING

8-1. Check Points for Troubleshooting

When something goes wrong with the FP-C/FP3/FP5/FP10S/FP10 system connected to the positioning module F-type, check the FP-C/FP3/FP5/FP10S/FP10 system using the troubleshooting flowchart in "8-2. Troubleshooting" on page 224.

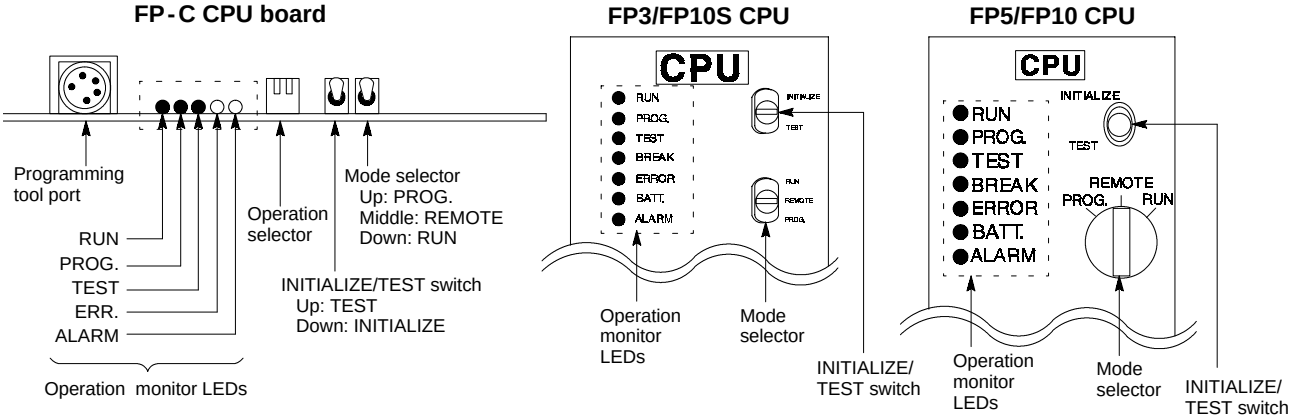
Be sure to check the entire system including peripheral devices, according to the following:

- Observe what is happening.
- Check for error repetition.
- Check the status of indicators.
- Check that power is properly supplied to the FP-C/FP3/FP5/FP10S/FP10 system.
- Check whether the trouble detected is in the FP-C/FP3/FP5/FP10S/FP10 system or in other field devices.
- Check whether there is a problem with the program or not.

1. Operation Monitor LEDs of the FP-C/FP3/FP5/FP10S/FP10 CPU

When something goes wrong with the FP-C/FP3/FP5/FP10S/FP10 system connected to the positioning module F-type, the status of the FP-C/FP3/FP5/FP10S/FP10 CPU should also be checked. The operating monitor LEDs of the FP-C/FP3/FP5/FP10S/FP10 CPU are helpful when checking.

Refer to the LED status table below.



LED status							Description	Program execution status	Condition
RUN LED	PROG. LED	TEST LED	BREAK LED (*1)	ERROR LED	BATT. LED (*1)	ALARM LED			
ON	OFF	OFF	OFF	OFF	Varies	OFF	Operation in RUN mode	Executing	Normal condition
OFF	ON	Varies	OFF	Varies	Varies	OFF	Operation in PROG. mode	Not-executing	
Flashes	OFF	Varies	OFF	Varies	Varies	OFF	Forced ON/OFF in RUN mode	Executing	
OFF	ON	Varies	OFF	Varies	Varies	OFF	Forced ON/OFF in PROG. mode	Not-executing	
ON	OFF	ON	ON	Varies	Varies	OFF	TEST/RUN (BREAK condition)	Not-executing	
ON	OFF	ON	OFF	Varies	Varies	OFF	TEST/RUN (operating condition)	Executing	
OFF	Varies	Varies	Varies	ON	Varies	OFF	Self-diagnostic error (stops)	Not-executing	Abnormal condition
ON	OFF	OFF	OFF	ON	Varies	OFF	Self-diagnostic error (continues)	Executing	
Varies	Varies	Varies	Varies	Varies	ON	OFF	CPU back-up voltage drops	Executing	
Varies	Varies	Varies	Varies	Varies	Varies	ON	System watchdog timer error	Not-executing	
OFF	Flashes	Varies	OFF	Varies	Varies	OFF	MEWNET-F slave waiting condition	Not-executing	

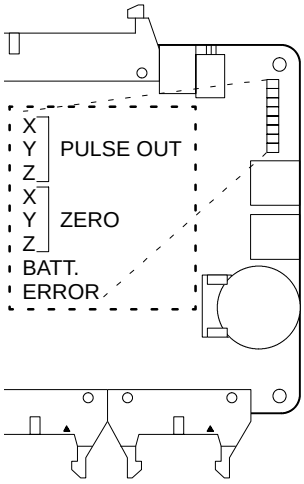
Note:

· (*1): A BREAK and BATT. LEDs are not available for FP-C.

2. Operation Monitor LEDs of the FP-C/FP3/FP5 Positioning Module F-type

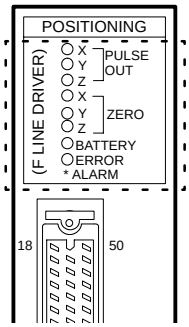
When an error occurs in the positioning module F-type or in its operation, the operation monitor LEDs of the FP-C/FP3/FP5 positioning module F-type are useful for checking the module. Please refer to description below when checking the system.

■ **FP-C positioning board F-type**

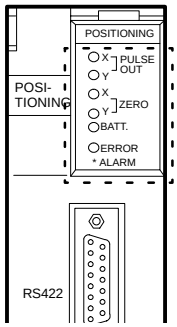


FP-C positioning board
(Line-driver type)

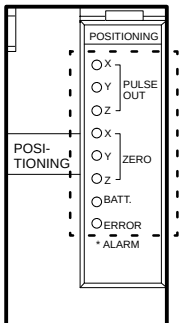
■ **FP3 and FP5 positioning unit F-type**



FP3 positioning unit
(Line-driver type)



FP3 positioning unit
(Transistor type)



FP5 positioning unit
(Transistor type)

Operation monitor LEDs

PULSE OUT (X, Y, Z) LEDs: Used to monitor pulse output.
- Flashes when pulse output is turned ON or OFF.

ZERO (X, Y, Z) LEDs: Light with home input from external drive or field device.

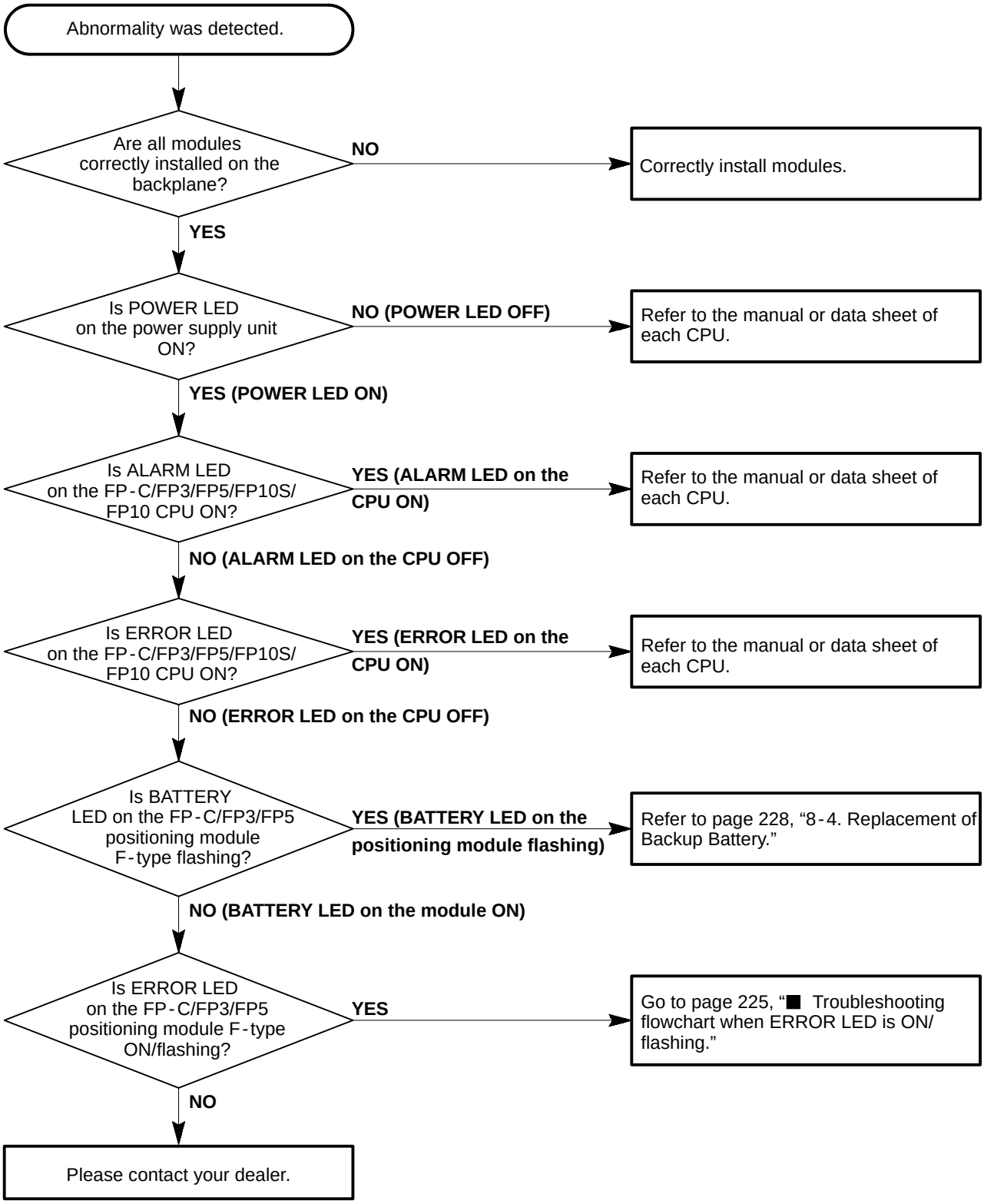
BATT. LED: Used for memory backup.
- Flashes when the voltage of the backup battery dropped in the positioning module F-type.
  Replace the battery with a new one as soon as possible.
  The backup battery for the positioning module F-type can maintain its RAM data for approximately one month after this LED starts flashing.

ERROR LED:
- ON when a hardware abnormality of the positioning module F-type is detected.
- Flashes when the operation error occurs in communication between the teaching unit II and the module, parameters and positioning point data settings, start-up methods, movement and data writing.

8-2. Troubleshooting

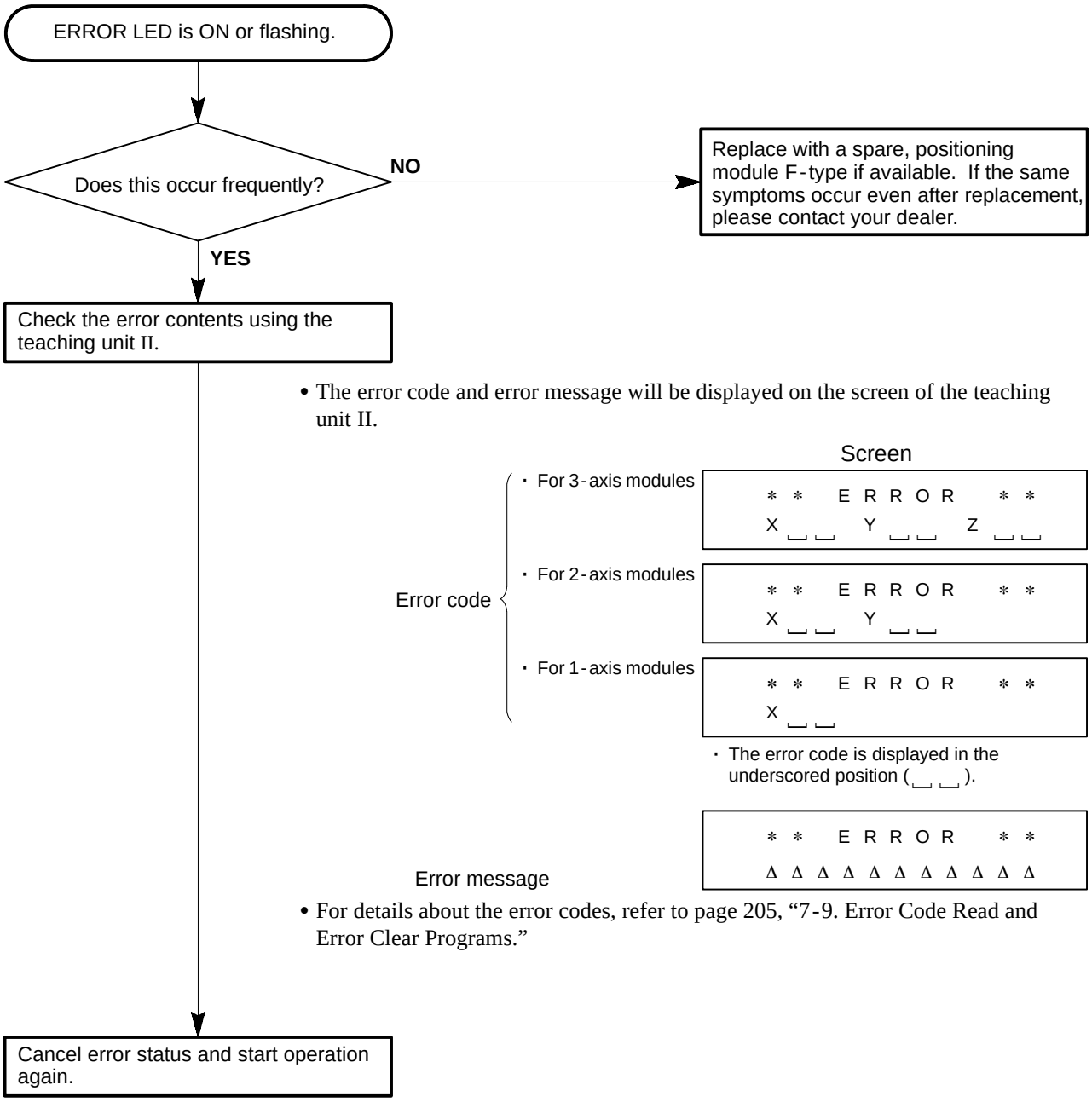
When something goes wrong with the FP-C/FP3/FP5/FP10S/FP10 system connected to the positioning module F-type, check the FP-C/FP3/FP5/FP10S/FP10 system while referring to the main troubleshooting flowchart below.

■ Main troubleshooting flowchart



■ Troubleshooting flowchart when ERROR LED is ON/flashing

- The ERROR LED on the FP-C/FP3/FP5 positioning module F-type is:
  - ON when a hardware abnormality of the positioning module F-type is detected.
  - Flashing when an operation error occurs in communication between the teaching unit II and the module, parameters and positioning point data settings, start-up methods, movement and data writing.



- The error code and error message will be displayed on the screen of the teaching unit II.

Screen

Error code

- For 3-axis modules: ＊＊ ERROR ＊＊ / X␣␣ Y␣␣ Z␣␣
- For 2-axis modules: ＊＊ ERROR ＊＊ / X␣␣ Y␣␣
- For 1-axis modules: ＊＊ ERROR ＊＊ / X␣␣

・ The error code is displayed in the underscored position (␣␣).

Error message: ＊＊ ERROR ＊＊ / Δ Δ Δ Δ Δ Δ Δ Δ Δ Δ Δ

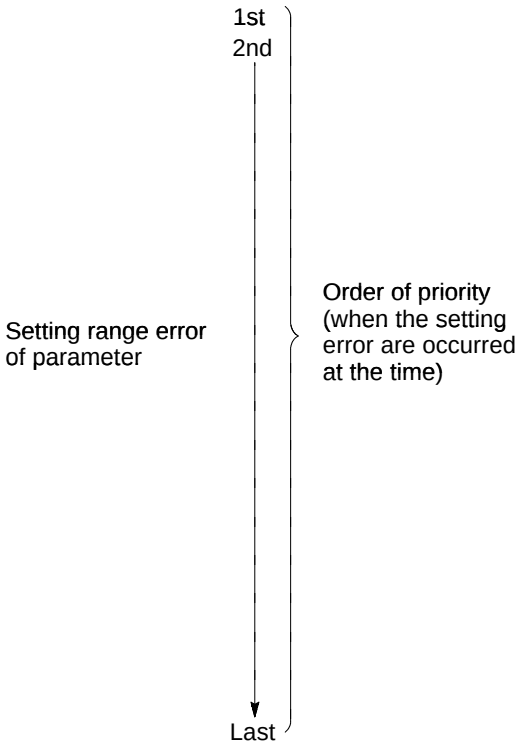
- For details about the error codes, refer to page 205, “7-9. Error Code Read and Error Clear Programs.”

- You can cancel the error status in the following ways:
  - Error clear operation from CPU:
    Turn OFF the “request-to-run signal” and set error code area in the shared memory to “0” by executing the **F151 (WRT)**/**P151 (PWRT)** instruction. Then, turn ON the “request-to-run signal” again.
    For details about the error codes, refer to page 205, “7-9. Error Code Read and Error Clear Programs.”
  - Error clear operation from the teaching unit II:
    Press the MEMORY CLR. / CLEAR key.

8-3. Error Codes

- When an error occurs in the positioning module, such as a malfunction in the start-up method and data writing or an error in the setting of parameters or positioning point data, the error detection contact turns ON, and an error code is written into shared memory according to the type of the error. The ladder program writes the error code into the CPU at the leading edge of the error signal.
- The error codes are read as a hexadecimal constant.
- See page 101 for the error code area in the shared memory of CPU.
- See page 205, “7-9. Error Code Read and Error Clear Programs” for error code read-out and error clear programs.

1. Error Codes

Error code (HEX value)	Error name	Description
01	SET UP error or PC CPU error	System start failure or watchdog error of CPU
02	Battery voltage error (*1)	The backup battery for the memory is either running low or disconnected.
10	Time check error (*2)	Time check over for the communication line
11	BCC error (*2)	BCC error occurred in the command data
12	Format error (*2)	The command message does not match the format.
21	Pulse output mode setting error	
22	Axis mode setting error	
23	Unit setting error	
24	Conversion rate setting error	
25	Speed limit setting error	
26	Software limit (+) setting error	
27	Software limit (-) setting error	
28	Base speed setting error	
29	Interpolation speed setting error	
30	Backlash compensation setting error	
31	Error compensation setting error	
32	In-position time setting error	
33	Homing direction setting error	
34	Home offset address setting error	
35	Home return high-speed setting error	
36	Home return low-speed setting error	
37	Acceleration/deceleration time setting error	
38	Start mode setting error	
39	Homing method setting error	
40	Interface logic setting error	

Notes:

- (*1): Only available for positioning modules F-type with a system ROM version of SV 2.0 or later. If an abnormality in the battery voltage is detected after the power is turned ON, error code “02” is set, but the error detection contact does not turn ON. Battery errors do not affect the positioning operation.
- (*2): An error name appears on the display when the teaching unit II is connected, but there is no effect on the positioning operation.

Error code (HEX value)	Name of error	Description
41	Motion pattern setting error	Setting range error of positioning point data
42	Motion span setting error	
43	Axis speed setting error	
44	Interpolation speed setting error	
45	Acceleration/deceleration time setting error	
46	Dwell time setting error	
47	Auxiliary code setting error	
50	JOB start number error	• In quick-start mode, a data No. other than test execution was selected. • The start No. current value selected for the quick-start mode is different from the value for the test run. • Exceeded 10 points per axis (30 points for 3 axes) during the test run.
51	Start mode error	Hardware homing operation was not completed in normal-start after homing mode.
52	Start mode error	JOG start, teaching mode, or home start was set in test for quick-start mode.
60	Overlimit switch error	Overlimit switch was turned ON.
61	Software overlimit error	Software limit will be exceeded with the next action.
62	Branch error	9 times or more branches were exceeded.
63	Return error	Program encountered “Return” without branch.
64	Drive error	Drive error input was active.
65	Speed change error	Cannot accelerate/decelerate at the speed change point.
66	Stop disable error	Insufficient distance for the current speed until stop during C and E points.
67	Circular interpolation error	Three points for circular interpolation are on one straight line.
68	Actual position change error	Setting range error Range: - 8,388,607 to + 8,388,607
70	Data write error (*1)	Data write was executed during test for quick-start mode.

Note:

· (*1): If the start mode is set to test for quick-start mode, parameters or positioning point data cannot be written and the memory cannot be cleared.

2. Error Messages

Situation	Name of error	Description
When using of audio cassette	**Tape error (TAPE)**	Audio cassette tape problem during playback
	Playback error (HEADDER)	Faulty search for header mark during playback, faulty cord connection
	Tape BCC error (TAPE BCC)	BCC error in the data during load, degraded cassette tape
	Verify error (VERIFY)	Memory contents differ during verification
	Type identity error (CONNECTION)	Different models used for writing and reading data
	Phase error (PHASE)	Faulty phase detection at the beginning of playback operation.

The error name is displayed on the LCD display when the teaching unit II is connected.

8-4. Replacement of Backup Battery

1. Replacement Period

- When the battery voltage drops, the BATT. LED on the FP-C/FP3/FP5 positioning module F-type flashes, and battery error code “02” is set in shared memory. Data backup is effective for about a month after the BATT. LED starts flashing, but it is recommended that you replace the battery as soon as the LED starts to flash.
- The battery voltage error does not turn the error detection contact ON. The battery error code setting function is provided only with system ROM version SV 2.0 or later.

1) Battery Life

Type	Rating	Typical life in actual use (at 25 °C/77 °F ambient temperature)
FP-C/FP3/FP5 positioning module	5,000 hours	Approx. 20,000 hours

2) Using Backup Battery

Type	Part number	Description
FP-C positioning board	AFB8801	Lithium battery, BR2032/CR2032 type or equivalent for all FP-M control boards
FP3/FP5 positioning unit	AFP8801	Lithium battery, for FP3/FP10S CPU

Caution:

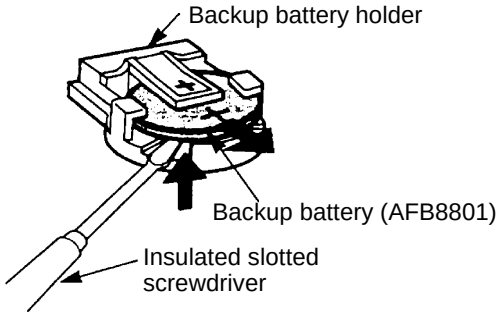
· Never throw the battery into a fire. Do not dispose of them in trash that will be incinerated.
· To prevent accidents such as bursting, fire or heat generation, never short, disassemble or charge the battery.

2. How to Replace the Battery

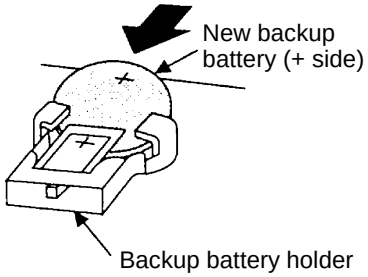
■ FP-C positioning board

Procedure

1) Turn OFF the power of the FP-C control board.
2) Lift the backup battery on the FP-C positioning board using an insulated slotted screwdriver as shown at the right.
3) Remove the backup battery from the backup battery holder as shown at the right.



4) With the + side facing up, insert the new backup battery into the backup battery holder by sliding it in sideways as shown at the right.
5) Turn ON the power of the FP-C control board.



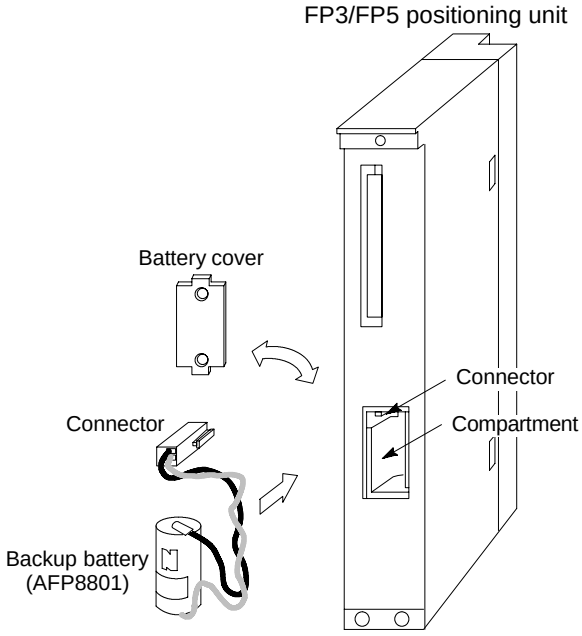
Notes:

- Before inserting the new battery, check that nothing is attached to the + and - surfaces.
- Complete replacement should be carried out within 10 min. after the power is turned OFF. If the power is not ON, turn it ON power and wait in this state for at least 30 min. before replacing the battery.

■ FP3/FP5 positioning unit

Procedure

1) Turn OFF the power.
2) Remove the FP3/FP5 positioning unit from the backplane.
3) Remove the battery cover.
4) Replace the battery with new one. (Battery part No. AFP8801)
5) Close the battery cover.
6) Mount the positioning unit onto the backplane.
7) Turn ON the power.



Note:

- Complete replacement should be carried out within 10 min. after the power is turned OFF. If the power is not ON, turn it ON power and wait in this state for at least 30 min. before replacing the battery.

CHAPTER 9

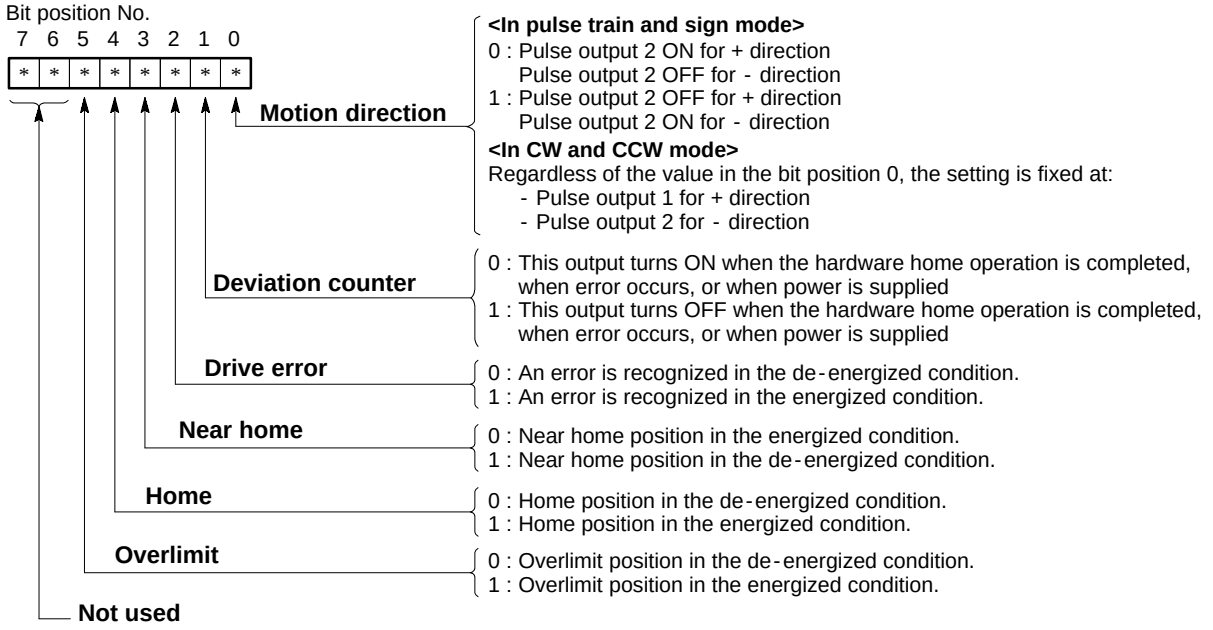
APPENDIX

9-1. List of Parameters

Parameter item	Description	Default value	Setting range
Pulse output mode (1)	This selects the pulse output control mode using pulse output terminals 1 and 2.	1 (CW and CCW)	0: Pulse train and sign 1: CW and CCW
Axis mode (2)	This specifies that axes are handled independently or simultaneously.	0 (Independent)	0: Independent 1: Simultaneous 2-axis 2: Simultaneous 3-axis
Unit setting (3) (*1)	This specifies which unit you use for parameters and positioning point data.	0 (Pulse)	0: Pulse 1: mm 2: inch 3: degree
Conversion rate (4) (*1)	This specifies the rate for converting pulse into the unit set.	1	1: in “pulse units” 0.0001 to 0.1: in mm units 0.00001 to 0.001: in inch or degree units
Speed limit (5) (*1)	This specifies the maximum speed available for the positioning module using the conversion rate.	400000	$0 \leqq \frac{\text{Speed limit}}{\text{Conversion rate}} \leqq 400000$
Software limit (+) (6) (*1)	This specifies the positive limit, which does not actually exist, inside the hardware limit switches using the conversion rate.	8388607	$0 \leqq \frac{\text{Software limit (+)}}{\text{Conversion rate}} \leqq 8388607$
Software limit (-) (7) (*1)	This specifies the negative limit, which does not actually exist, inside the hardware limit switches using the conversion rate.	- 8388607	$-8388607 \leqq \frac{\text{Software limit (-)}}{\text{Conversion rate}} \leqq 0$
Base speed (8) (*1)	This specifies base speed which is used for the starting and stopping stages of the stepper motor.	0	$0 \leqq \text{Base speed} \leqq \text{Axis speed or Interpolation speed}$
Interpolation speed setting mode (9)	This selects the interpolation speed is set based on the long-axis or tracking speed.	1 (Tracking speed)	0: Long-axis speed 1: Tracking speed
Backlash compensation (10) (*1)	This specifies the correction value to compensate for the gap of ball screw and speed reducer using the conversion rate.	0	$0 \leqq \frac{\text{Backlash compensation}}{\text{Conversion rate}} \leqq 255$
Error compensation (11) (*1)	This specifies the value for correcting the deviation caused by indivisible rate setting or by pitch error when mm, inch or degree unit is used.	0	0: in “pulse units” ±1.0000: in mm units ±1.00000: in inch or degree units
In-position time (12)	This specifies the in-position signal ON duration.	300 (ms)	1 to 2,000 (ms)
Homing direction (13)	This specifies the direction for homing operation.	1 (Negative direction)	0: Positive direction 1: Negative direction

Parameter item	Description	Default value	Setting range
Home offset address (14) (*1)	This specifies the address of the hardware home address from the software home.	0	Software limit (-) ≦ Home offset address ≦ Software limit (+)
Home return speed (high) (15) (*1)	This specifies the higher speed for homing operation. This is also used for JOG and software home operations.	50000	Home return speed (low) ≦ Home return speed (high) ≦ Speed limit
Home return speed (low) (16) (*1)	This specifies the lower speed for homing operation. This is also used for JOG operation.	100	
Acceleration/ deceleration time (17)	This specifies the time for acceleration and deceleration speed for homing and JOG operations.	1000 (ms)	64 to 4999 (ms)
Start mode (18)	This specifies the start mode from the four modes available.	0 (Immediate normal-start)	0: Immediate normal-start 1: Normal-start after homing 2: Quick-start 3: Test for quick-start
Homing method (19)	This specifies the homing method from the four methods available.	0 (Near home ON)	0: Near home ON 1: Near home OFF 2: Near home ON/OFF 3: Limit search (*2)
Interface logics (20)	This specifies the interface logics setting “0” or “1” in the specified bit position.	00000000	See explanation below.

■ Explanation of the interface logic settings



Notes:

- The numbers in parentheses in the parameter item column indicate the parameter selection codes when the teaching unit II is used.
- (*1): In order to prevent malfunction, be sure to set all values for speeds, limits, compensations and address setting in the same fraction digits as the unit setting when the unit setting parameter other than pulse unit (mm, inch or degree unit) is specified.
- (*2): The limit search method is available for the FP-C positioning board only.

9-2. List of Positioning Point Data

Positioning point data item	Description	Default value	Setting range
Motion pattern (1)	This specifies the motion patterns and point data number for next execution. When only motion pattern code, such as “C”, “P” or “S”, is input from the teaching unit II, the data which is 1 larger than its own data number is automatically set. (When setting by the CPU program, be sure to set also the next processing data number.) For the “S” code, the next processing data number should be 1 larger than its own data number.	E (End point)	CXXX: Continuation point PXXX: Pass point SXXX: Circular interpolation point E: End point “XXX” means the positioning point data number for next execution as: 1 ≦ XXX ≦ 400 when “XXX” = 999, return to the original procedures before jump operation.
Motion span (2)	This specifies the direction of next motion and its span by setting the absolute address or span from the actual position with sign.	I0 (Not move)	A ******** : Absolute address I******** : Increment span Software limit (-) ≦ ******** / Conversion unit ≦ Software limit (+)
Axis speed (3) (*1)	This specifies the axis speed for independent axis mode.	0	Base speed ≦ Axis speed ≦ Speed limit
Interpolation speed (4) (*1)	This specifies the interpolation speed for simultaneous axis mode.	0	Base speed ≦ Interpolation speed ≦ Speed limit
Acceleration/ deceleration time (5)	This specifies the acceleration and deceleration time to reach the specified speed or to stop the movement.	300 (ms)	64 to 4,999 (ms) (*2)
Dwell time (6)	This specifies the time lag from the end of the pulse output to the in-position/complete-to-test signal ON.	0	0 to 499 (× 10 ms)
Auxiliary code (7)	This specifies optional codes for the positioning point data. The code set here can be monitored in the shared memory in the timing of the start or end of its execution. You can know which data is executing by monitoring this.	A0 (Auxiliary code not used)	AXXX : End mode WXXX : Start mode 0 ≦ “XXX” ≦ 255 A0: Auxiliary code not used.

Notes:

- (*1): When using the teaching unit II, axis speed is not displayed in simultaneous axis mode and interpolation speed is not displayed in independent axis mode.
- (*2): Positioning modules F-type with system ROM version SV 2.0 or later can be set in the range of 0 to 4,999 ms. However, settings in the range of 0 to 63 ms cannot correctly be set.

9-3. Pin Layouts of Connector

1. FP3/FP5 (Transistor Type)

1) FP3 Positioning Unit (Transistor Type)

■ **Pin layouts**

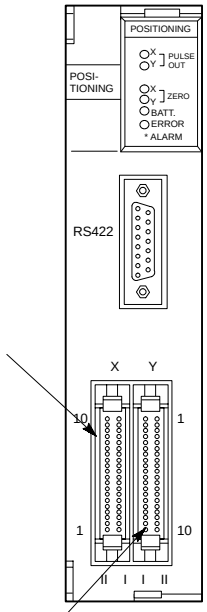
X-axis connectors

Pin No.	Name	Pin No.	Name
II-10	Frame ground (F.G.)	I-10	Frame ground (F.G.)
II-9	Overlimit (+)	I-9	Overlimit (-)
II-8	Near home (+)	I-8	Near home (-)
II-7	Home (+)	I-7	Home (-)
II-6	Drive error (+)	I-6	Drive error (-)
II-5	External power supply (+5 V to 12 V DC)	I-5	Ground for external power supply (GND)
II-4	External power supply (24 V DC)	I-4	Ground for external power supply (GND)
II-3	Deviation counter reset output (+)	I-3	Deviation counter reset output (-)
II-2	Pulse output 2 (+)	I-2	Ground for pulse output 2 (GND)
II-1	Pulse output 1 (+)	I-1	Ground for pulse output 1 (GND)
II		I	

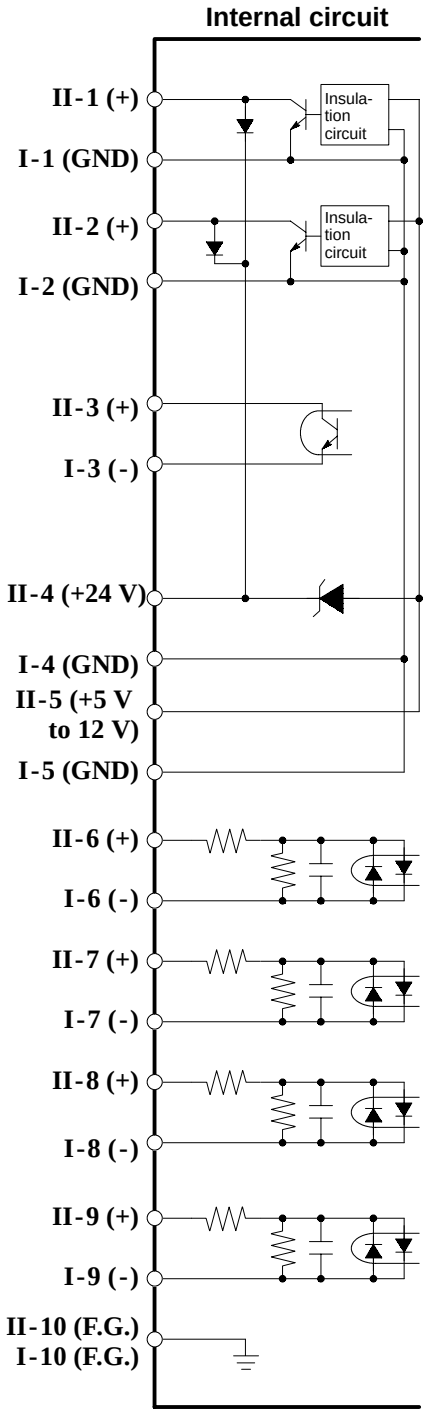
Y-axis connectors

Pin No.	Name	Pin No.	Name
I-1	Ground for pulse output 1 (GND)	II-1	Pulse output 1 (+)
I-2	Ground for pulse output 2 (GND)	II-2	Pulse output 2 (+)
I-3	Deviation counter reset output (-)	II-3	Deviation counter reset output (+)
I-4	Ground for external power supply (GND)	II-4	External power supply (24 V DC)
I-5	Ground for external power supply (GND)	II-5	External power supply (+5 V to 12 V DC)
I-6	Drive error (-)	II-6	Drive error (+)
I-7	Home (-)	II-7	Home (+)
I-8	Near home (-)	II-8	Near home (+)
I-9	Overlimit (-)	II-9	Overlimit (+)
I-10	Frame ground (F.G.)	II-10	Frame ground (F.G.)
I		II	

FP3 positioning unit (Transistor type)



■ **Internal circuit**



2) FP5 Positioning Unit (Transistor Type)

■ Pin layouts

X-axis and Y-axis connectors

Pin No.	Name	Pin No.	Name
II-10	Frame ground (F.G.)	I-10	Frame ground (F.G.)
II-9	Overlimit (+)	I-9	Overlimit (-)
II-8	Near home (+)	I-8	Near home (-)
II-7	Home (+)	I-7	Home (-)
II-6	Drive error (+)	I-6	Drive error (-)
II-5	External power supply (+5 V to 12 V DC)	I-5	Ground for external power supply (GND)
II-4	External power supply (24 V DC)	I-4	Ground for external power supply (GND)
II-3	Deviation counter reset output (+)	I-3	Deviation counter reset output (-)
II-2	Pulse output 2 (+)	I-2	Ground for pulse output 2 (GND)
II-1	Pulse output 1 (+)	I-1	Ground for pulse output 1 (GND)

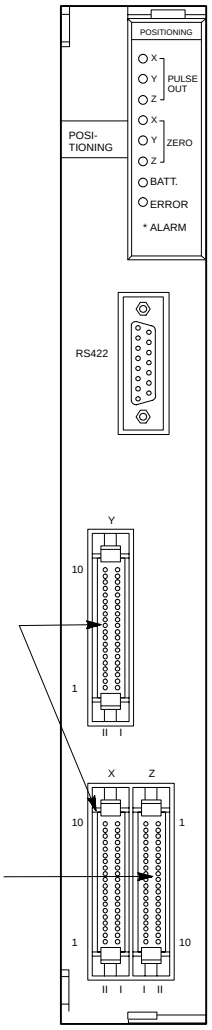
II I

Z-axis connectors

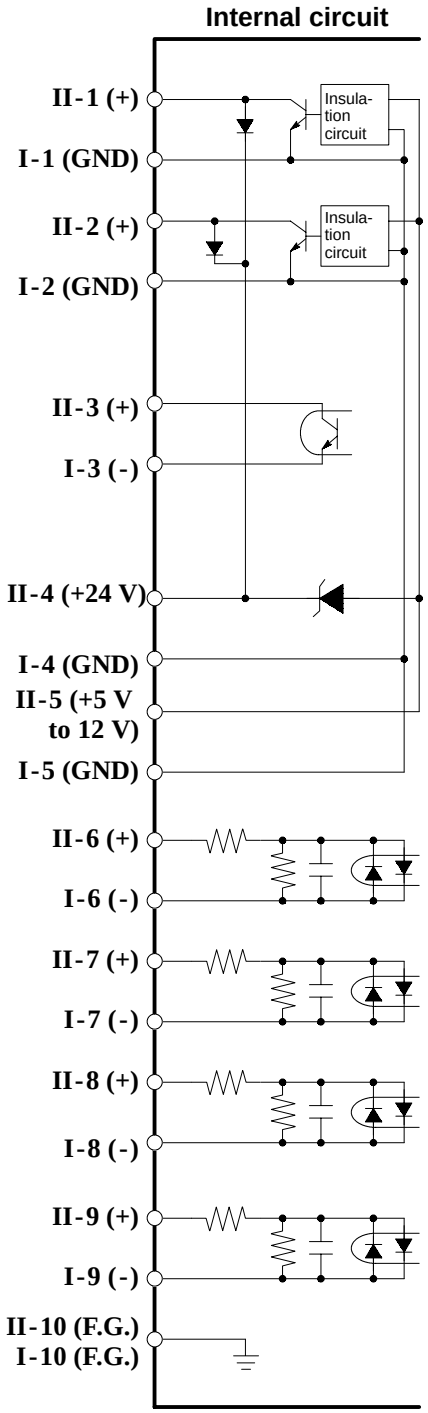
Pin No.	Name	Pin No.	Name
I-1	Ground for pulse output 1 (GND)	II-1	Pulse output 1 (+)
I-2	Ground for pulse output 2 (GND)	II-2	Pulse output 2 (+)
I-3	Deviation counter reset output (-)	II-3	Deviation counter reset output (+)
I-4	Ground for external power supply (GND)	II-4	External power supply (24 V DC)
I-5	Ground for external power supply (GND)	II-5	External power supply (+5 V to 12 V DC)
I-6	Drive error (-)	II-6	Drive error (+)
I-7	Home (-)	II-7	Home (+)
I-8	Near home (-)	II-8	Near home (+)
I-9	Overlimit (-)	II-9	Overlimit (+)
I-10	Frame ground (F.G.)	II-10	Frame ground (F.G.)

I II

FP5 positioning unit (Transistor type)



■ Internal circuit



3) Pin Numbers of FP3/FP5 Positioning Unit (Transistor Types)

Pin No.	Name	Description
II-1	Pulse output 1	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
I-1		
II-2	Pulse output 2	Directional output signals or position- pulses are output with pulse out mode parameter setting.
I-2		
II-3	Deviation counter reset output	Output when any error except a cassette tape error occurs, and output continues until the positioning unit is reset. Output for approximately 1.5 to 2.4 ms when power is supplied to the positioning unit. Output for approximately 1 ms when a hardware home operation is completed.
I-3		
II-4	External power supply (*1)	Power supply for pulse output (+24 V DC)
I-4		Ground for pulse output (GND)
II-5		Power supply for pulse output (+5 V to 12 V DC)
I-5		Ground for pulse output (GND)
II-6	Drive error input	Inputs an error output, such as drive deviation counter over or full torque.
I-6		
II-7	Home input	Connects to a home switch for hardware home operation, or the Z-phase of an encoder.
I-7		
II-8	Near home input	This signal detects the timing to reduce the speed of the positioning unit to the near home speed just prior to a home signal.
I-8		
II-9	Overlimit input	Connect this hardware limit input to maximum (+) and minimum (-) limit switches.
I-9		
II-10	Frame ground	Frame ground terminal
I-10		

Note:

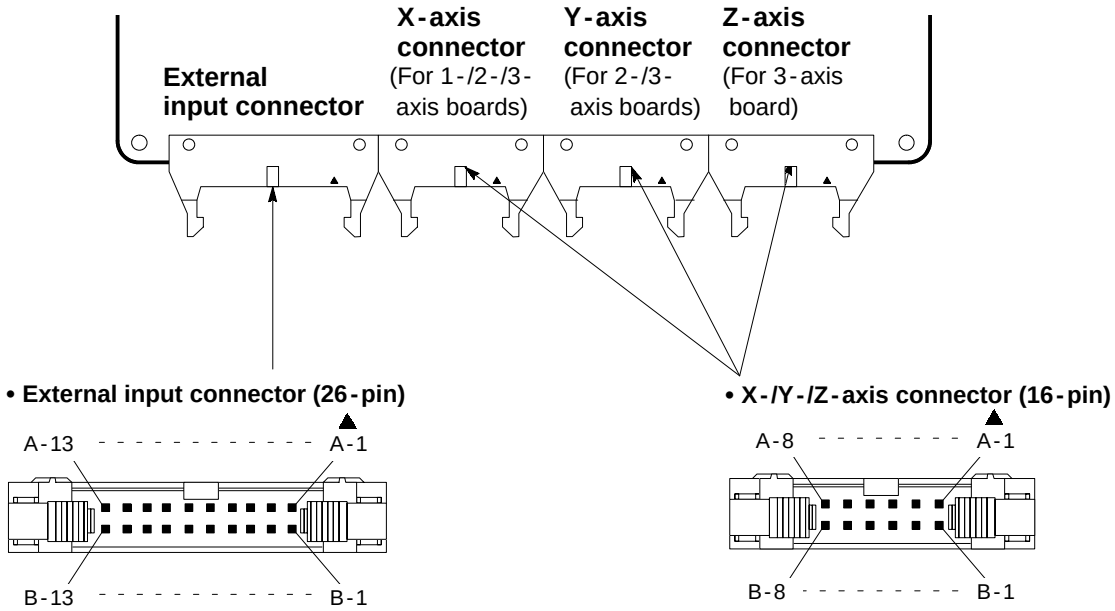
- (*1): For the external power supply, connect either 24 V DC or +5 V to 12 V DC (only one).

2. FP-C/FP3 (Line-driver Type)

1) FP-C Positioning Board (Line-driver Type)

■ Pin layouts

FP-C positioning board (Line-driver type)

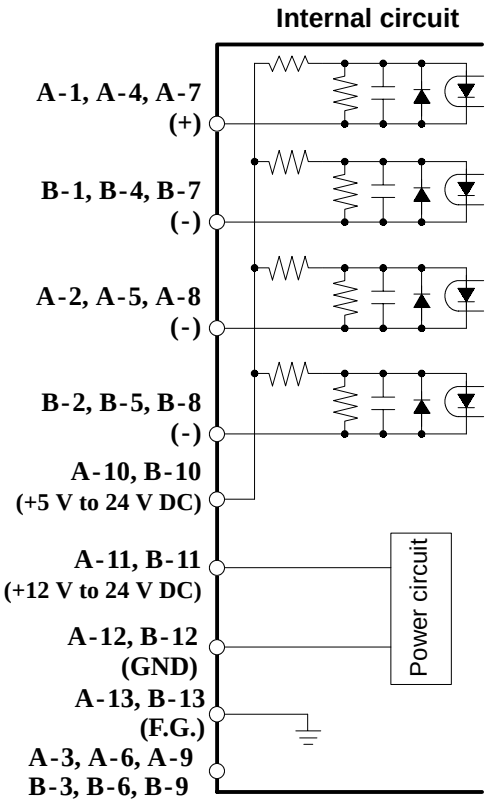


No.	Name	No.	Name
A-13	Frame ground	B-13	Frame ground
A-12	Ground for external power supply	B-12	Ground for external power supply
A-11	External power supply (12 V to 24 V DC)	B-11	External power supply (12 V to 24 V DC)
A-10	Common for input (5 V to 24 V DC)	B-10	Common for input (5 V to 24 V DC)
A-9	———	B-9	———
A-8	Near home (-) of Z-axis	B-8	Drive error (-) of Z-axis
A-7	Overlimit (+) of Z-axis	B-7	Overlimit (-) of Z-axis
A-6	———	B-6	———
A-5	Near home (-) of Y-axis	B-5	Drive error (-) of Y-axis
A-4	Overlimit (+) of Y-axis	B-4	Overlimit (-) of Y-axis
A-3	———	B-3	———
A-2	Near home (-) of X-axis	B-2	Drive error (-) of X-axis
A-1	Overlimit (+) of X-axis	B-1	Overlimit (-) of X-axis

No.	Name	No.	Name
A-8	Common for output (GND)	B-8	Common for output (GND)
A-7	———	B-7	Deviation counter reset output
A-6	———	B-6	Pulse output 2 [Transistor output (+)]
A-5	———	B-5	Pulse output 1 [Transistor output (+)]
A-4	Home (Z-phase) (5 V to 24 V DC)	B-4	Home (Z-phase) (common)
A-3	Home (Z-phase) [Line-driver (+)]	B-3	Home (Z-phase) (common)
A-2	Pulse output 2 [Line-driver (+)]	B-2	Pulse output 2 [Line-driver (-)]
A-1	Pulse output 1 [Line-driver (+)]	B-1	Pulse output 1 [Line-driver (-)]

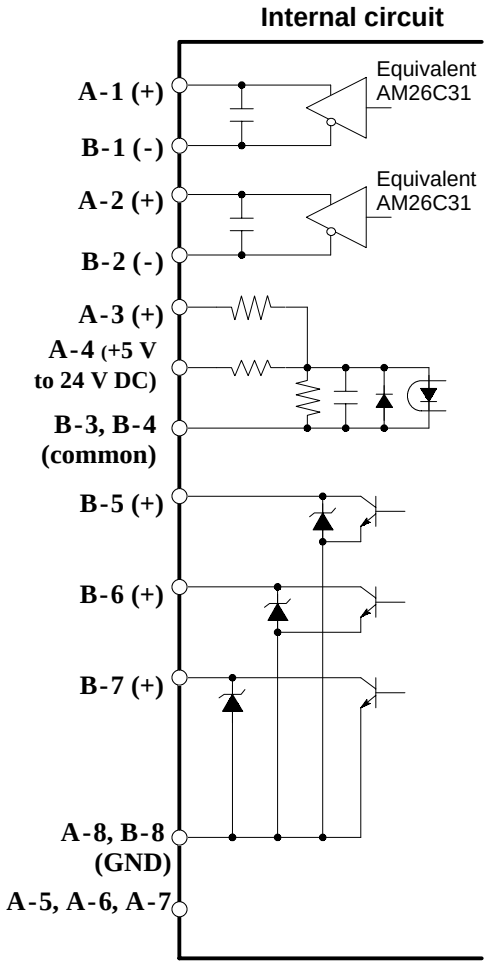
■ Internal circuit and pin numbers (FP-C Line-driver type)

• External input connector (26-pin)



Pin No.			Name	Description
X-axis	Y-axis	Z-axis		
A-1	A-4	A-7	Overlimit (+)	Connect this hardware limit input to limit switch (+).
B-1	B-4	B-7	Overlimit (-)	Connect this hardware limit input to limit switch (-).
A-2	A-5	A-8	Near home (-)	This signal detects the timing to reduce the speed of the positioning board to the near home speed just prior to a home signal.
B-2	B-5	B-8	Drive error (-)	Inputs an error output, such as drive deviation counter over or full torque.
A-10, B-10			Common for input (+5 V to 24 V DC)	Common terminal for input External input power supply +5 V to 24 V DC
A-11, B-11			External power supply	Power supply for external I/O circuit (+12 V to 24 V DC)
A-12, B-12				Ground for external I/O circuit (GND)
A-13, B-13			Frame ground	Frame ground terminal
A-3, A-6, A-9, B-3, B-6, B-9			_____	Not used Do not connect.

- **X-/Y-/Z-axis connector (16-pin)**

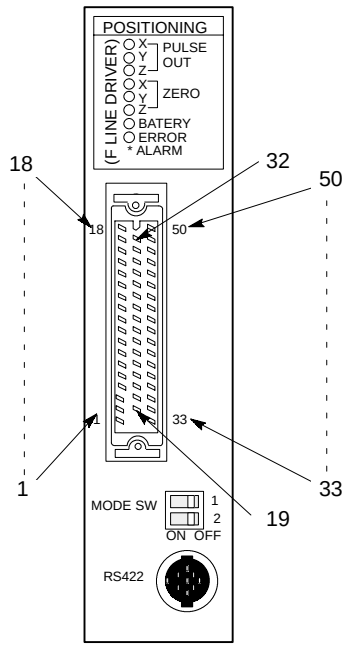


Pin No. X-/Y-/Z-axis	Name	Description
A-1, B-1	Pulse output 1 (Line-driver output)	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
A-2, B-2	Pulse output 2 (Line-driver output)	Directional output signals or position- pulses are output with pulse out mode parameter setting.
A-3	Home input	Home input (for line-driver, +Z)
A-4		Home input (+5 V to 24 V DC)
B-3, B-4		Common for home input (0 V, for -Z)
B-5	Pulse output 1 [Transistor output (+)]	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
B-6	Pulse output 2 [Transistor output (+)]	Directional output signals or position- pulses are output with pulse out mode parameter setting.
B-7	Deviation counter reset output (+)	Output when any error except a cassette tape error occurs, and output continues until the positioning board is reset. Output for approximately 1.5 to 2.4 ms when power is supplied to the positioning board. Output for approximately 1 ms when a hardware home operation is completed.
A-8, B-8	Common for output (GND)	Common terminal for output (Line-driver/transistor output common ground)
A-5, A-6, A-7	_____	Not used Do not connect.

2) FP3 Positioning Unit (Line-driver Type)

■ Pin layouts

FP3 positioning unit (Line-driver type)



X-axis

No.	Name
18	Pulse output 1 [Line-driver output (-)]
17	Pulse output 1 [Line-driver output (+)]
16	Pulse output 2 [Line-driver output (-)]
15	Pulse output 2 [Line-driver output (+)]
14	Pulse output 1 [Transistor output (+)]
13	Pulse output 2 [Transistor output (+)]
12	Deviation counter reset output (+)
11	Common for output (GND)
10	Home (Z-phase) (+5 V to 24 V DC)
9	Home (Z-phase) [Line-driver (+)]
8	Home (Z-phase) (common)
7	Near home (-)
6	Overlimit (-)
5	Drive error (-)
4	Ground for external power supply (GND)
3	Ground for external power supply (GND)
2	Frame ground (F.G.)
1	Frame ground (F.G.)

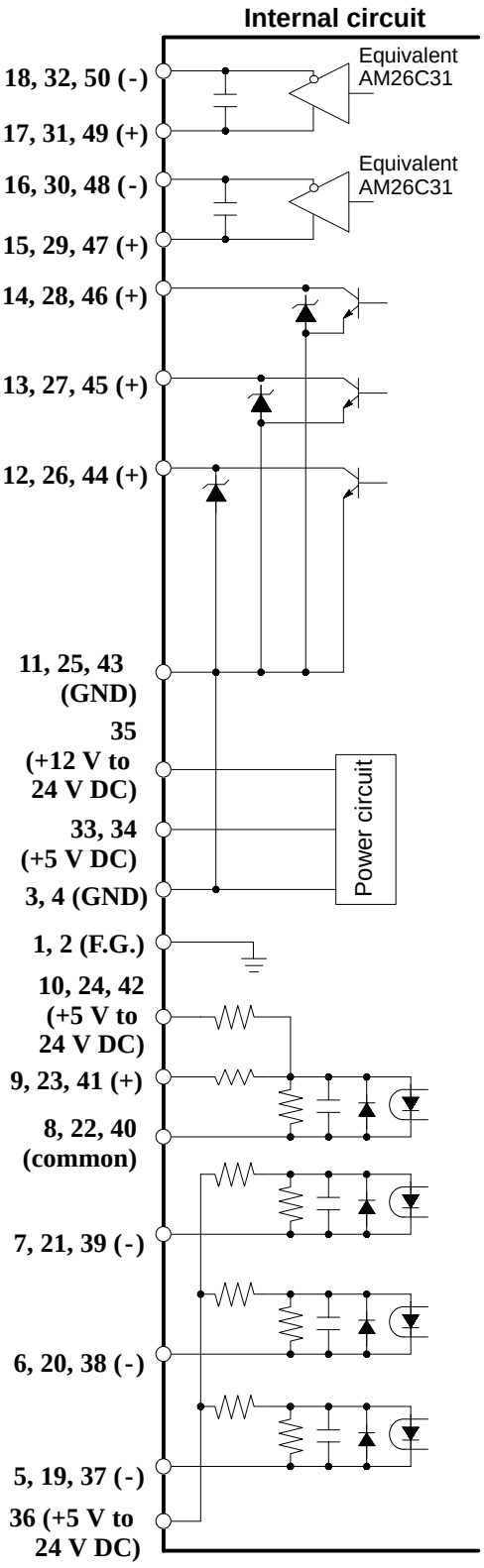
Y-axis

No.	Name
32	Pulse output 1 [Line-driver output (-)]
31	Pulse output 1 [Line-driver output (+)]
30	Pulse output 2 [Line-driver output (-)]
29	Pulse output 2 [Line-driver output (+)]
28	Pulse output 1 [Transistor output (+)]
27	Pulse output 2 [Transistor output (+)]
26	Deviation counter reset output (+)
25	Common for output (GND)
24	Home (Z-phase) (+5 V to 24 V DC)
23	Home (Z-phase) [Line-driver (+)]
22	Home (Z-phase) (common)
21	Near home (-)
20	Overlimit (-)
19	Drive error (-)

Z-axis

No.	Name
50	Pulse output 1 [Line-driver output (-)]
49	Pulse output 1 [Line-driver output (+)]
48	Pulse output 2 [Line-driver output (-)]
47	Pulse output 2 [Line-driver output (+)]
46	Pulse output 1 [Transistor output (+)]
45	Pulse output 2 [Transistor output (+)]
44	Deviation counter reset output (+)
43	Common for output (GND)
42	Home (Z-phase) (+5 V to 24 V DC)
41	Home (Z-phase) [Line-driver (+)]
40	Home (Z-phase) (common)
39	Near home (-)
38	Overlimit (-)
37	Drive error (-)
36	Common for input (+5 V to 24 V DC)
35	External power supply (+12 V to 24 V DC)
34	External power supply (+5 V DC)
33	External power supply (+5 V DC)

■ Internal circuit and pin numbers (FP3 Line-driver type)



Pin No. X-axis	Pin No. Y-axis	Pin No. Z-axis	Name	Description
18	32	50	Pulse output 1 (Line-driver output)	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
17	31	49		
16	30	48	Pulse output 2 (Line-driver output)	Directional output signals or position- pulses are output with pulse out mode parameter setting.
15	29	47		
14	28	46	Pulse output 1 (Transistor output)	Pulse trains or position+ pulses are output with pulse out mode parameter setting.
13	27	45	Pulse output 2 (Transistor output)	Directional output signals or position- pulses are output with pulse out mode parameter setting.
12	26	44	Deviation counter reset output	Output when any error except a cassette tape error occurs, and output continues until the positioning unit is reset. Output for approximately 1.5 to 2.4 ms when power is supplied to the positioning unit. Output for approximately 1 ms when a hardware home operation is completed.
11, 25, 43			Common for output	Common terminal for output (Line-driver transistor output common ground)
35			External power supply (*1)	Power supply for external I/O circuit (+12 V to 24 V DC)
33, 34				Power supply for external I/O circuit (+5 V DC)
3, 4				Ground for external I/O circuit (GND)
1, 2			Frame ground	Frame ground terminal
10	24	42	Home input	Home input (+5 V to 24 V DC)
9	23	41		Home input (for line-driver, +Z)
8	22	40		Common for home input (0 V, for -Z)
7	21	39	Near home input	This signal detects the timing to reduce the speed of the positioning unit to the near home speed just prior to a home signal.
6	20	38	Overlimit input	Connect this hardware limit input to maximum (+) and minimum (-) limit switches.
5	19	37	Drive error input	Inputs an error output, such as driver deviation counter over or full torque.
36			Common for input	Common terminal for input External input power supply +5 V to 24 V DC

Note:

· (*1): For the external power supply, connect either 24 V DC or +5 V to 12 V DC (only one).

9-4. I/O Allocation for Each Module

The specifications of I/O points for each module are described below:

■ **I/O specifications for 1-axis modules (when the module is installed at the slot 0 position)**

Positioning module → CPU (X) specifications			CPU → Positioning module (Y) specifications		
Address	**Description**		**Address**	**Description**	
X0	Positioning module ready signal		**Y10**	Request-to-run signal	
X1	Error signal		**Y11**	Request-to-read signal (System memory → Shared memory)	
X2	RUN/LOCAL signal		**Y12**	Request-to-write signal (Shared memory → System memory)	
X3	Complete-to-read signal (System memory → Shared memory)		**Y13**	JOB1 operation	Request-to-start signal
X4	Complete-to-write signal (Shared memory → System memory)		**Y14**	X-axis operation	Request-to-home signal
X5	JOB1 operation	In-position/complete-to-test signal	**Y15**		Software home request signal
X6	X-axis operation	At home signal	**Y16**	JOB1 operation	Request-to-stop signal
X7	JOB1 operation	Active signal	**Y17**	X-axis operation	JOG forward request signal
X8		Start confirmation signal	**Y18**		JOG reverse request signal
X9		Auxiliary code set flag	**Y19**	JOB1 operation	Auxiliary code set flag OFF signal
XA to XF	Not used		**Y1A to Y1F**	Not used	

■ **I/O specifications for 2-axis modules (when the module is installed at the slot 0 position)**

Positioning module → CPU (X) specifications			CPU → Positioning module (Y) specifications		
Address	**Description**		**Address**	**Description**	
X0	Positioning module ready signal		**Y20**	Request-to-run signal	
X1	Error signal		**Y21**	Request-to-read signal (System memory → Shared memory)	
X2	RUN/LOCAL signal		**Y22**	Request-to-write signal (Shared memory → System memory)	
X3	Complete-to-read signal (System memory → Shared memory)		**Y23**	JOB1 operation	Request-to-start signal
X4	Complete-to-write signal (Shared memory → System memory)		**Y24**	X-axis operation	Request-to-home signal
X5	JOB1 operation	In-position/complete-to-test signal	**Y25**		Software home request signal
X6	X-axis operation	At home signal	**Y26**	JOB1 operation	Request-to-stop signal
X7	JOB1 operation	Active signal	**Y27**	X-axis operation	JOG forward request signal
X8		Start confirmation signal	**Y28**		JOG reverse request signal
X9		Auxiliary code set flag	**Y29**	JOB1 operation	Auxiliary code set flag OFF signal
XA	JOB2 operation	In-position/complete-to-test signal	**Y2A**	JOB2 operation	Request-to-start signal
XB	Y-axis operation	At home signal	**Y2B**	Y-axis operation	Request-to-home signal
XC	JOB2 operation	Active signal	**Y2C**		Software home request signal
XD		Start confirmation signal	**Y2D**	JOB2 operation	Request-to-stop signal
XE		Auxiliary code set flag	**Y2E**	Y-axis operation	JOG forward request signal
XF to X1F	Not used		**Y2F**		JOG reverse request signal
			Y30	JOB2 operation	Auxiliary code set flag OFF signal
			Y31 to Y3F	Not used	

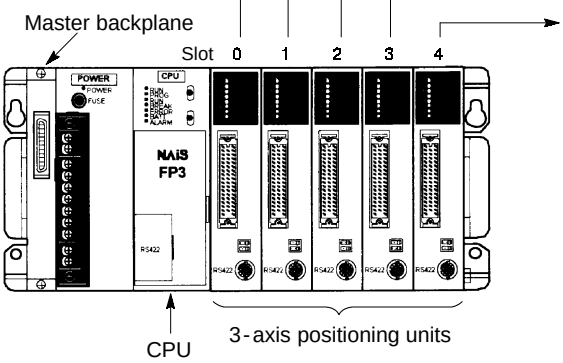
■ **I/O specifications for 3-axis modules (when the module is installed at the slot 0 position)**

Positioning module → CPU (X) specifications			CPU → Positioning module (Y) specifications		
Address	**Description**		**Address**	**Description**	
X0	Positioning module ready signal		**Y20**	Request-to-run signal	
X1	Error signal		**Y21**	Request-to-read signal (System memory → Shared memory)	
X2	RUN/LOCAL signal		**Y22**	Request-to-write signal (Shared memory → System memory)	
X3	Complete-to-read signal (System memory → Shared memory)		**Y23**	JOB1 operation	Request-to-start signal
X4	Complete-to-write signal (Shared memory → System memory)		**Y24**	X-axis operation	Request-to-home signal
X5	JOB1 operation	In-position/complete-to-test signal	**Y25**		Software home request signal
X6	X-axis operation	At home signal	**Y26**	JOB1 operation	Request-to-stop signal
X7	JOB1 operation	Active signal	**Y27**	X-axis operation	JOG forward request signal
X8		Start confirmation signal	**Y28**		JOG reverse request signal
X9		Auxiliary code set flag	**Y29**	JOB1 operation	Auxiliary code set flag OFF signal
XA	JOB2 operation	In-position/complete-to-test signal	**Y2A**	JOB2 operation	Request-to-start signal
XB	Y-axis operation	At home signal	**Y2B**	Y-axis operation	Request-to-home signal
XC	JOB2 operation	Active signal	**Y2C**		Software home request signal
XD		Start confirmation signal	**Y2D**	JOB2 operation	Request-to-stop signal
XE		Auxiliary code set flag	**Y2E**	Y-axis operation	JOG forward request signal
XF	JOB3 operation	In-position/complete-to-test signal	**Y2F**		JOG reverse request signal
X10	Z-axis operation	At home signal	**Y30**	JOB2 operation	Auxiliary code set flag OFF signal
X11	JOB3 operation	Active signal	**Y31**	JOB3 operation	Request-to-start signal
X12		Start confirmation signal	**Y32**	Z-axis operation	Request-to-home signal
X13		Auxiliary code set flag	**Y33**		Software home request signal
X14 to X1F	Not used		**Y34**	JOB3 operation	Request-to-stop signal
			Y35	Z-axis operation	JOG forward request signal
			Y36		JOG reverse request signal
			Y37	JOB3 operation	Auxiliary code set flag OFF signal
			Y38 to Y3F	Not used	

■ I/O allocation examples

• When installing five 3-axis units on a 5-slot master backplane

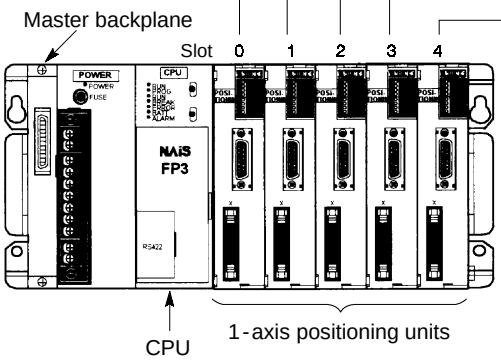
Slot number	I/O allocation	
	Input	Output
Slot 0	X0 to X13 (X14 to X1F: Not used)	Y20 to Y37 (Y38 to Y3F: Not used)
Slot 1	X40 to X53 (X54 to X5F: Not used)	Y60 to Y77 (Y78 to Y7F: Not used)
Slot 2	X80 to X93 (X94 to X9F: Not used)	Y100 to Y117 (Y118 to Y11F: Not used)
Slot 3	X120 to X133 (X134 to X13F: Not used)	Y140 to Y157 (Y158 to Y15F: Not used)
Slot 4	X160 to X173 (X174 to X17F: Not used)	Y180 to Y197 (Y198 to Y19F: Not used)



Input data (Positioning unit → CPU)		Output data (CPU → Positioning unit)	
Input allocation (X)	Description	Output allocation (Y)	Description
X0, 40, 80, 120, 160	Positioning module ready signal	Y20, 60, 100, 140, 180	Request-to-run signal
X1, 41, 81, 121, 161	Error signal	Y21, 61, 101, 141, 181	Request-to-read signal (System memory → Shared memory)
X2, 42, 82, 122, 162	RUN/LOCAL signal		
X3, 43, 83, 123, 163	Complete-to-read signal (System memory → Shared memory)	Y22, 62, 102, 142, 182	Request-to-write signal (Shared memory → System memory)
X4, 44, 84, 124, 164	Complete-to-write signal (Shared memory → System memory)	Y23, 63, 103, 143, 183	Request-to-start signal
		Y24, 64, 104, 144, 184	Request-to-home signal
X5, 45, 85, 125, 165	In-position/complete-to-test signal	Y25, 65, 105, 145, 185	Software home request signal
X6, 46, 86, 126, 166	At home signal	Y26, 66, 106, 146, 186	Request-to-stop signal
X7, 47, 87, 127, 167	Active signal	Y27, 67, 107, 147, 187	JOG forward request signal
X8, 48, 88, 128, 168	Start confirmation signal	Y28, 68, 108, 148, 188	JOG reverse request signal
X9, 49, 89, 129, 169	Auxiliary code set flag	Y29, 69, 109, 149, 189	Auxiliary code set flag OFF signal
XA, 4A, 8A, 12A, 16A	In-position/complete-to-test signal	Y2A, 6A, 10A, 14A, 18A	Request-to-start signal
XB, 4B, 8B, 12B, 16B	At home signal	Y2B, 6B, 10B, 14B, 18B	Request-to-home signal
XC, 4C, 8C, 12C, 16C	Active signal	Y2C, 6C, 10C, 14C, 18C	Software home request signal
XD, 4D, 8D, 12D, 16D	Start confirmation signal	Y2D, 6D, 10D, 14D, 18D	Request-to-stop signal
XE, 4E, 8E, 12E, 16E	Auxiliary code set flag	Y2E, 6E, 10E, 14E, 18E	JOG forward request signal
XF, 4F, 8F, 12F, 16F	In-position/complete-to-test signal	Y2F, 6F, 10F, 14F, 18F	JOG reverse request signal
X10, 50, 90, 130, 170	At home signal	Y30, 70, 110, 150, 190	Auxiliary code set flag OFF signal
X11, 51, 91, 131, 171	Active signal	Y31, 71, 111, 151, 191	Request-to-start signal
X12, 52, 92, 132, 172	Start confirmation signal	Y32, 72, 112, 152, 192	Request-to-home signal
X13, 53, 93, 133, 173	Auxiliary code set flag	Y33, 73, 113, 153, 193	Software home request signal
		Y34, 74, 114, 154, 194	Request-to-stop signal
		Y35, 75, 115, 155, 195	JOG forward request signal
		Y36, 76, 116, 156, 196	JOG reverse request signal
		Y37, 77, 117, 157, 197	Auxiliary code set flag OFF signal

• When installing five 1-axis units on a 5-slot master backplane

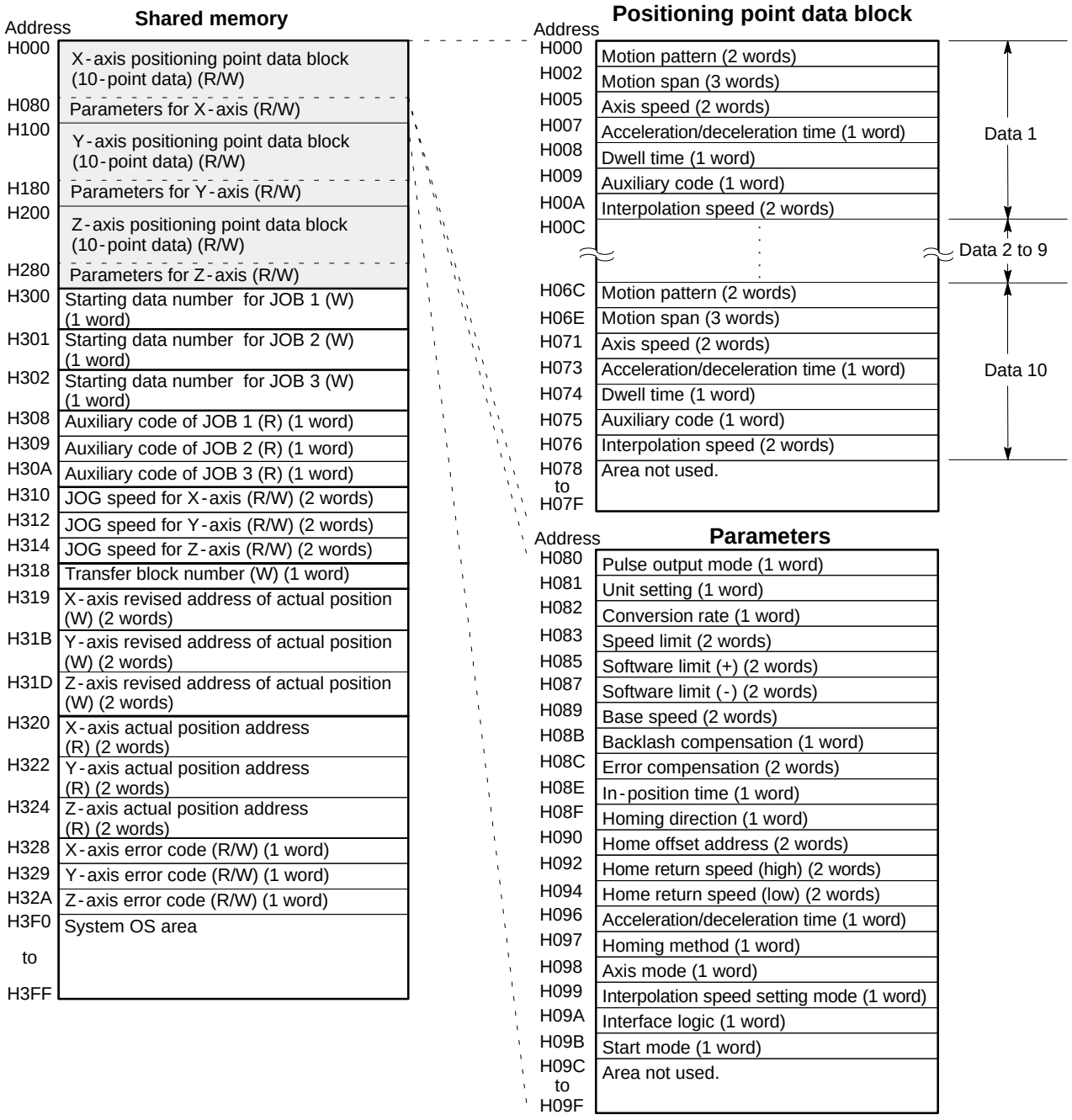
Slot number	I/O allocation	
	Input	Output
Slot 0	X0 to X9 (XA to XF: Not used)	Y10 to Y19 (Y1A to Y1F: Not used)
Slot 1	X20 to X29 (X2A to X2F: Not used)	Y30 to Y39 (Y3A to Y3F: Not used)
Slot 2	X40 to X49 (X4A to X4F: Not used)	Y50 to Y59 (Y5A to Y5F: Not used)
Slot 3	X60 to X69 (X6A to X6F: Not used)	Y70 to Y79 (Y7A to Y7F: Not used)
Slot 4	X80 to X89 (X8A to X8F: Not used)	Y90 to Y99 (Y9A to Y9F: Not used)



Input data (Positioning unit → CPU)		Output data (CPU → Positioning unit)	
Input allocation (X)	**Description**	**Output allocation (Y)**	**Description**
X0, 20, 40, 60, 80	Positioning module ready signal	Y10, 30, 50, 70, 90	Request-to-run signal
X1, 21, 41, 61, 81	Error signal	Y11, 31, 51, 71, 91	Request-to-read signal (System memory → Shared memory)
X2, 22, 42, 62, 82	RUN/LOCAL signal		
X3, 23, 43, 63, 83	Complete-to-read signal (System memory → Shared memory)	Y12, 32, 52, 72, 92	Request-to-write signal (Shared memory → System memory)
X4, 24, 44, 64, 84	Complete-to-write signal (Shared memory → System memory)	Y13, 33, 53, 73, 93	Request-to-start signal
		Y14, 34, 54, 74, 94	Request-to-home signal
X5, 25, 45, 65, 85	In-position/complete-to-test signal	Y15, 35, 55, 75, 95	Software home request signal
X6, 26, 46, 66, 86	At home signal	Y16, 36, 56, 76, 96	Request-to-stop signal
X7, 27, 47, 67, 87	Active signal	Y17, 37, 57, 77, 97	JOG forward request signal
X8, 28, 48, 68, 88	Start confirmation signal	Y18, 38, 58, 78, 98	JOG reverse request signal
X9, 29, 49, 69, 89	Auxiliary code set flag	Y19, 39, 59, 79, 99	Auxiliary code set flag OFF signal

9-5. Shared Memory

In the shared memory of the positioning module, addresses are allocated in word units using hexadecimal numbers starting from H000 to H3FF, and each word of the module has its own characteristics as follows.



■ **Positioning point data area in the shared memory (read and write operation available)**

Data number	Address			Positioning point data item	Setting item	Setting range (Transferring format)
	X-axis	Y-axis	Z-axis			
Data 1	**H000**	**H100**	**H200**	Motion pattern	Positioning point data number for next execution	K1 to K400 or K999 (Decimal constant)
	H001	**H101**	**H201**		Motion pattern code using ASCII code	C: H43, P: H50, S: H53, E: H45 (ASCII HEX code)
	H002	**H102**	**H202**	Motion span	Motion span from the software home (absolute address) or pre-executed position (incremental span)	Software limit (-) ≦ Motion span ≦ Software limit (+) (Unique two-word data format)
	H003	**H103**	**H203**			
	H004	**H104**	**H204**		Addressing method selection code using ASCII code	A: H41, I: H49 (ASCII HEX code)
	H005	**H105**	**H205**	Axis speed	Axis speed used for the independent control mode	Base speed ≦ Axis speed ≦ Speed limit (Unique two-word data format)
	H006	**H106**	**H206**			
	H007	**H107**	**H207**	Acceleration/ deceleration time	Acceleration and deceleration time for starting and stopping in ms units.	K64 to K4999 (*1) (Decimal constant)
	H008	**H108**	**H208**	Dwell time	Time lag from the end of pulse output to the in-position/complete-to-test signal ON in 10 ms units	K0 to K499 (Decimal constant)
	H009	**H109**	**H209**	Auxiliary code	Optional code for recognizing the executing status using the combination of ASCII code and number	Higher byte (mode setting) A: H41, W: H57 (ASCII HEX code) Lower byte (number code) K0 to K255 (Decimal constant)
	H00A	**Not used**		Interpolation speed	Interpolation speed for simultaneous control mode	Base speed ≦ Interpolation speed ≦ Speed limit (Unique two-word data format)
	H00B	**Not used**				
Data 2	**H00C**	**H10C**	**H20C**	Motion pattern	Refer to the descriptions for data 1.	
	H00D	**H10D**	**H20D**			
	H00E	**H10E**	**H20E**	Motion span		
	H00F	**H10F**	**H20F**			
	H010	**H110**	**H210**			
	H011	**H111**	**H211**	Axis speed		
	H012	**H112**	**H212**			
	H013	**H113**	**H213**	Acceleration/ deceleration time		
	H014	**H114**	**H214**	Dwell time		
	H015	**H115**	**H215**	Auxiliary code		
	H016	**Not used**		Interpolation speed		
	H017	**Not used**				

Note:

- (*1): For the positioning module F-type with a system ROM version SV 2.0 or later has ability to set in the range of K0 to K4999. However, the setting in the range of K0 to K63 cannot correctly be set.

Data number	Address			Positioning point data item	Setting item	Setting range (Transferring format)
	X-axis	Y-axis	Z-axis			
Data 3	**H018**	**H118**	**H218**	Motion pattern	Refer to the descriptions for data 1.	
	H019	**H119**	**H219**			
	H01A	**H11A**	**H21A**	Motion span		
	H01B	**H11B**	**H21B**			
	H01C	**H11C**	**H21C**			
	H01D	**H11D**	**H21D**	Axis speed		
	H01E	**H11E**	**H21E**			
	H01F	**H11F**	**H21F**	Acceleration/ deceleration time		
	H020	**H120**	**H220**	Dwell time		
	H021	**H121**	**H221**	Auxiliary code		
	H022	**Not used**		Interpolation speed		
	H023	**Not used**				
Data 4	**H024**	**H124**	**H224**	Motion pattern	Refer to the descriptions for data 1.	
	H025	**H125**	**H225**			
	H026	**H126**	**H226**	Motion span		
	H027	**H127**	**H227**			
	H028	**H128**	**H228**			
	H029	**H129**	**H229**	Axis speed		
	H02A	**H12A**	**H22A**			
	H02B	**H12B**	**H22B**	Acceleration/ deceleration time		
	H02C	**H12C**	**H22C**	Dwell time		
	H02D	**H12D**	**H22D**	Auxiliary code		
	H02E	**Not used**		Interpolation speed		
	H02F	**Not used**				
Data 5	**H030**	**H130**	**H230**	Motion pattern	Refer to the descriptions for data 1.	
	H031	**H131**	**H231**			
	H032	**H132**	**H232**	Motion span		
	H033	**H133**	**H233**			
	H034	**H134**	**H234**			
	H035	**H135**	**H235**	Axis speed		
	H036	**H136**	**H236**			
	H037	**H137**	**H237**	Acceleration/ deceleration time		
	H038	**H138**	**H238**	Dwell time		
	H039	**H139**	**H239**	Auxiliary code		
	H03A	**Not used**		Interpolation speed		
	H03B	**Not used**				

Data number	Address			Positioning point data item	Setting item	Setting range (Transferring format)
	X-axis	Y-axis	Z-axis			
Data 6	**H03C**	**H13C**	**H23C**	Motion pattern	Refer to the descriptions for data 1.	
	H03D	**H13D**	**H23D**			
	H03E	**H13E**	**H23E**	Motion span		
	H03F	**H13F**	**H23F**			
	H040	**H140**	**H240**			
	H041	**H141**	**H241**	Axis speed		
	H042	**H142**	**H242**			
	H043	**H143**	**H243**	Acceleration/ deceleration time		
	H044	**H144**	**H244**	Dwell time		
	H045	**H145**	**H245**	Auxiliary code		
	H046	**Not used**		Interpolation speed		
	H047	**Not used**				
Data 7	**H048**	**H148**	**H248**	Motion pattern	Refer to the descriptions for data 1.	
	H049	**H149**	**H249**			
	H04A	**H14A**	**H24A**	Motion span		
	H04B	**H14B**	**H24B**			
	H04C	**H14C**	**H24C**			
	H04D	**H14D**	**H24D**	Axis speed		
	H04E	**H14E**	**H24E**			
	H04F	**H14F**	**H24F**	Acceleration/ deceleration time		
	H050	**H150**	**H250**	Dwell time		
	H051	**H151**	**H251**	Auxiliary code		
	H052	**Not used**		Interpolation speed		
	H053	**Not used**				
Data 8	**H054**	**H154**	**H254**	Motion pattern	Refer to the descriptions for data 1.	
	H055	**H155**	**H255**			
	H056	**H156**	**H256**	Motion span		
	H057	**H157**	**H257**			
	H058	**H158**	**H258**			
	H059	**H159**	**H259**	Axis speed		
	H05A	**H15A**	**H25A**			
	H05B	**H15B**	**H25B**	Acceleration/ deceleration time		
	H05C	**H15C**	**H25C**	Dwell time		
	H05D	**H15D**	**H25D**	Auxiliary code		
	H05E	**Not used**		Interpolation speed		
	H05F	**Not used**				

Data number	Address			Positioning point data item	Setting item	Setting range (Transferring format)
	X-axis	Y-axis	Z-axis			
Data 9	**H060**	**H160**	**H260**	Motion pattern	Refer to the descriptions for data 1.	
	H061	**H161**	**H261**			
	H062	**H162**	**H262**	Motion span		
	H063	**H163**	**H263**			
	H064	**H164**	**H264**			
	H065	**H165**	**H265**	Axis speed		
	H066	**H166**	**H266**			
	H067	**H167**	**H267**	Acceleration/ deceleration time		
	H068	**H168**	**H268**	Dwell time		
	H069	**H169**	**H269**	Auxiliary code		
	H06A	**Not used**		Interpolation speed		
	H06B	**Not used**				
Data 10	**H06C**	**H16C**	**H26C**	Motion pattern	Refer to the descriptions for data 1.	
	H06D	**H16D**	**H26D**			
	H06E	**H16E**	**H26E**	Motion span		
	H06F	**H16F**	**H26F**			
	H070	**H170**	**H270**			
	H071	**H171**	**H271**	Axis speed		
	H072	**H172**	**H272**			
	H073	**H173**	**H273**	Acceleration/ deceleration time		
	H074	**H174**	**H274**	Dwell time		
	H075	**H175**	**H275**	Auxiliary code		
	H076	**Not used**		Interpolation speed		
	H077	**Not used**				

Notes:

- For details about the positioning point data, refer to “CHAPTER 6. SETTING POSITIONING POINT DATA.”
- For details about the handling method of unique one-word and two-word data formats, refer to page 257, “9-6. Handling Method for Unique One-word and Two-word Data Formats.”

■ **Parameters area in the shared memory (read and write operation available)**

Address			Parameter item	Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis			
H080	**H180**	**H280**	Pulse output mode	Pulse output method for control the field device using output terminals	K0: pulse train and sign K1: CW and CCW (Decimal constant)
H081	**H181**	**H281**	Unit setting	Type of unit used for parameters and point data setting	K0: pulse K1: mm K2: inch K3: degree (Decimal constant)
H082	**H182**	**H282**	Conversion rate	Rate for converting pulse into the unit set in the unit setting parameter.	1: in pulse units 0.0001 to 0.1: in mm units 0.00001 to 0.001: in inch or degree units (Unique one-word data format)
H083	**H183**	**H283**	Speed limit	Maximum speed available for the control	$0 \leqq \frac{\text{Speed limit}}{\text{Conversion rate}} \leqq 400000$ (Unique two-word data format)
H084	**H184**	**H284**			
H085	**H185**	**H285**	Software limit (+)	Positive limit address inside the hardware limit switch	$0 \leqq \frac{\text{Software limit (+)}}{\text{Conversion rate}} \leqq 8388607$ (Unique two-word data format)
H086	**H186**	**H286**			
H087	**H187**	**H287**	Software limit (-)	Negative limit address inside the hardware limit switch	$-8388607 \leqq \frac{\text{Software limit (-)}}{\text{Conversion rate}} \leqq 0$ (Unique two-word data format)
H088	**H188**	**H288**			
H089	**H189**	**H289**	Base speed	Base speed used for starting and stopping stages of the stepper motor	$0 \leqq \text{Base speed} \leqq \text{Axis speed or Interpolation speed}$ (Unique two-word data format)
H08A	**H18A**	**H28A**			
H08B	**H18B**	**H28B**	Backlash compensation	Value for correcting backlash caused by the gap of ball screw and speed reducer	$0 \leqq \frac{\text{Backlash compensation}}{\text{Conversion rate}} \leqq 255$ (Unique one-word data format)
H08C	**H18C**	**H28C**	Error compensation	Value for correcting deviation caused by the indivisible rate setting or by pitch error in the mm, inch or degree unit selection	0: in pulse units ±1.0000: in mm units ±1.00000: in inch or degree units (Unique two-word data format)
H08D	**H18D**	**H28D**			

Address			Parameter item	Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis			
H08E	**H18E**	**H28E**	In-position time	ON duration of the in-position signal in ms units	K1 to K2000 (Decimal constant)
H08F	**H18F**	**H28F**	Homing direction	Direction of homing and software homing operation	K0: Positive direction K1: Negative direction (Decimal constant)
H090	**H190**	**H290**	Home offset	The address of the hardware home from the software home position	Software limit (-) ≦ Home offset address ≦ Software limit (+) (Unique two-word data format)
H091	**H191**	**H291**			
H092	**H192**	**H292**	Home return speed (high)	Higher speed used for homing operation (optionally used for software homing and JOG operation)	Home return speed (low) ≦ Home return speed (high) ≦ Speed limit (Unique two-word data format)
H093	**H193**	**H293**			
H094	**H194**	**H294**	Home return speed (low)	Lower speed used for homing operation (optionally used for JOG operation)	
H095	**H195**	**H295**			
H096	**H196**	**H296**	Acceleration/ deceleration time	Acceleration and deceleration time for starting and stopping of homing and JOG operation in ms units	K64 to K4999 (Decimal constant)
H097	**Not used**		Homing method	Control method for homing operation	K0: Near home ON K1: Near home OFF K2: Near home ON/OFF K3: Limit search (*1) (Decimal constant)
H098	**Not used**		Axis mode	Axis mode for selecting independent or simultaneous mode	K0: Independent K1: Simultaneous 2-axis K2: Simultaneous 3-axis (Decimal constant)
H099	**Not used**		Interpolation speed setting mode	Speed mode selection for the interpolation operation	K0: Long-axis speed K1: Tracking speed (Decimal constant)
H09A	**Not used**		Interface logic	Interface logic for selecting the field device specifications	Set 0 or 1 to each bit from bit position 0 to 5. Bit positions 6 and higher are ignored. (Bit setting or hexadecimal constant)
H09B	**Not used**		Start mode	Starting method for executing the positioning point data	K0: Immediate normal-start K1: Normal-start after homing K2: Quick-start K3: Test for quick-start (Decimal constant)

Notes:

- (*1): The limit search method is available for the FP-C positioning board only.
- For details about the parameters, refer to “CHAPTER 5. SETTING PARAMETERS.”
- For details about the handling method of unique one-word and two-word data formats, refer to page 257, “9-6. Handling Method for Unique One-word and Two-word Data Formats.”

■ **Starting positioning point data number area in the shared memory (write operation only)**

Address in shared memory			Setting item	Setting range (Transferring format)
JOB1	JOB2	JOB3		
H300	H301	H302	Starting positioning point data number used for motion control	K1 to K400 (Decimal constant)

■ **Auxiliary code area in the shared memory (read operation only)**

Address in shared memory			Read-out item	Data range (Transferring format)
JOB1	JOB2	JOB3		
H308	H309	H30A	The optional code set for positioning point data number	K0 to K255 (Judging the data in decimal format is recommended.)

■ **JOG speed area in the shared memory (read and write operation available)**

Address in shared memory			Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis		
H310	H312	H314	The speed for the JOG operation	0 < JOG speed ≦ Speed limit (Unique two-word data format)
H311	H313	H315		

When the power is turned ON, the home return speed (low) in the parameter is set here.

■ **Transfer block number area in the shared memory (write operation only)**

Address in shared memory	Setting item	Setting range (Transferring format)
H318	Code for selecting the data exchanged between the shared memory and the system memory	K0 to K47 (Decimal constant)

Specifications of transfer block number

Transfer block number	Data block selected	Action from CPU
0	Parameters for all axes	read and write
1	Positioning point data block from number 1 to 10 for all axes	read and write
2	Positioning point data block from number 11 to 20 for all axes	read and write
⋮	⋮	⋮
40	Positioning point data block from number 391 to 400 for all axes	read and write
41	Revised address of actual position for X-axis	write only
42	Revised address of actual position for Y-axis	write only
43	Revised address of actual position for X- and Y-axis	write only
44	Revised address of actual position for Z-axis	write only
45	Revised address of actual position for X- and Z-axis	write only
46	Revised address of actual position for Y- and Z-axis	write only
47	Revised address of actual position for X-, Y- and Z-axis	write only

■ **Revised address of actual position area in the shared memory (write operation only)**

Address in shared memory			Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis		
H319	H31B	H31D	New address for the actual position for tentative use	Software limit (-) ≦ Revised address ≦ Software limit (+) (Unique two-word data format)
H31A	H31C	H31E		

When the power is turned ON, the home return speed (low) in the parameter is set here.

■ **Actual position address area in the shared memory (read operation only)**

Address in shared memory			Read-out item	Data range (Transferring format)
X-axis	Y-axis	Z-axis		
H320	H322	H324	Actual position address for taking it into the CPU	Software limit (-) ≦ Actual position ≦ Software limit (+) (Unique two-word data format)
H321	H323	H325		

When the power is turned ON, the home return speed (low) in the parameter is set here.

■ **Error code area in the shared memory (read and write operation available)**

Address in shared memory			Setting item	Setting range (Transferring format)
X-axis	Y-axis	Z-axis		
H328	H329	H32A	When used for read-out, an error code for checking the module should be set. When used for error clear, H0 should be set.	For read-out: hexadecimal error code For error clear: H0

9-6. Handling Method for Unique One-word and Two-word Data Formats

1. Data Using Unique Data Formats

The parameters and positioning point data using the unique one-/two-word data format are as follows:

- Data using unique one-word data format: Conversion rate, Backlash compensation
- Data using unique two-word data format: Speed limit, Software limit (+), Software limit (-), Base speed, Error compensation, Home offset address, Home return speed (high), Home return speed (low), Motion span, Axis speed, Interpolation speed

2. Types of Unique Data Format

1) Unique One-word Data

The preceding data using unique data formats are expressed using a unique one-word data format based on the formula:

$A \times 10^{-n}$

The values in "A" and "n" are expressed as follows:

• Unique one-word data format

Bit position	15 • • 12	11 • • 8	7 • • 4	3 • • 0
Data				

n A

■ **Example**

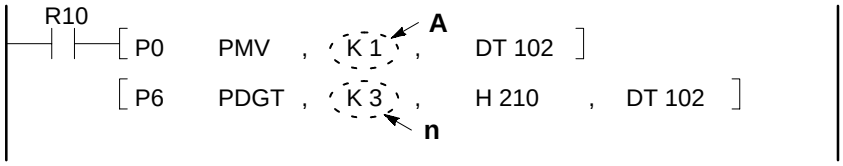
Conversion rate setting $0.001 = 1 \times 10^{-3}$ for X-axis (H082)

Shared memory address	H082			
Bit position	15 • • 12	11 • • 8	7 • • 4	3 • • 0
H082	0 0 0 0	0 0 1 1	0 0 0 0	0 0 0 1

n A

Program example

The "mm" is selected in the unit setting parameter and the conversion rate of "0.001" is provisionally set in DT102.



2) Unique Two-word Data

The preceding data using unique data formats are expressed using a unique two-word data format based on the formula:

$A \times 10^{-n}$

The values in "A" and "n" are expressed as follows:

• Unique two-word data format

Bit position	31 • • 28	27 • • 24	23 • • 20	19 • • 16	15 • • 12	11 • • 8	7 • • 4	3 • • 0
Data								

n A

■ Example

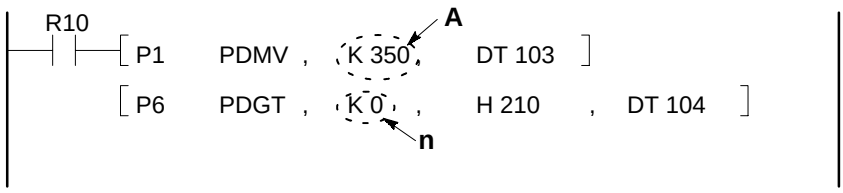
Speed limit value setting $350 = 350 \times 10^{-0}$ for X-axis (H083 and H084)

Shared memory address	H084				H083			
Bit position	31 • • 28	27 • • 24	23 • • 20	19 • • 16	15 • • 12	11 • • 8	7 • • 4	3 • • 0
Data	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 1	0 1 0 1	1 1 1 0

n A

Program example

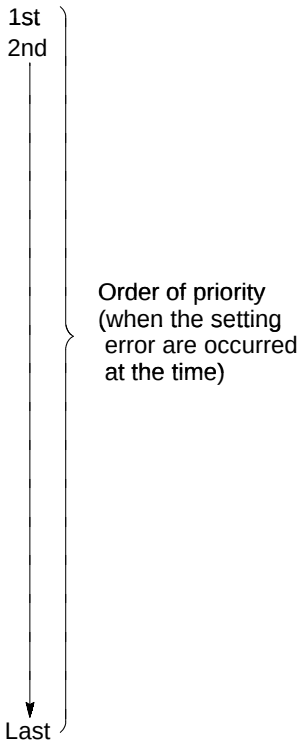
The speed limit of "350 mm/s" for the X-axis is provisionally set in DT103 and DT104.



9-7. Error Codes and Error Messages

1. Error Codes

Error code (HEX value)	Error name	Description
01	SET UP error or PC CPU error	System start failure or watchdog error of CPU
02	Battery voltage error (*1)	The backup battery for the memory is either running low or disconnected.
10	Time check error (*2)	Time check over for the communication line
11	BCC error (*2)	BCC error occurred in the command data
12	Format error (*2)	The command message does not match the format.
21	Pulse output mode setting error	Setting range error of parameter (1st, 2nd, ..., Last — Order of priority (when the setting error are occurred at the time))
22	Axis mode setting error	
23	Unit setting error	
24	Conversion rate setting error	
25	Speed limit setting error	
26	Software limit (+) setting error	
27	Software limit (-) setting error	
28	Base speed setting error	
29	Interpolation speed setting error	
30	Backlash compensation setting error	
31	Error compensation setting error	
32	In-position time setting error	
33	Homing direction setting error	
34	Home offset address setting error	
35	Home return high-speed setting error	
36	Home return low-speed setting error	
37	Acceleration/deceleration time setting error	
38	Start mode setting error	
39	Homing method setting error	
40	Interface logic setting error	
41	Motion pattern setting error	Setting range error of positioning point data
42	Motion span setting error	
43	Axis speed setting error	
44	Interpolation speed setting error	
45	Acceleration/deceleration time setting error	
46	Dwell time setting error	
47	Auxiliary code setting error	



Notes:

- (*1): Only available on the positioning modules F-type with system ROM version of SV 2.0 or later. If an abnormality in the battery voltage is detected after the power is turned ON, error code “02” is set, but the error detection contact does not turn ON. Battery errors do not affect the positioning operation.
- (*2): An error name appears on the display when the teaching unit II is connected, but there is no effect on the positioning operation.

Error code (HEX value)	Name of error	Description
50	JOB start number error	• In quick-start mode, a data No. other than test execution was selected. • The start No. current value selected for the quick-start mode is different from the value for the test run. • Exceeded 10 points per axis (30 points for 3 axes) during the test run.
51	Start mode error	Hardware homing operation was not completed in normal-start after homing mode.
52	Start mode error	JOG start, teaching mode, or home start was set in test for quick-start mode.
60	Overlimit switch error	Overlimit switch was turned ON.
61	Software overlimit error	Software limit will be exceeded with the next action.
62	Branch error	9 times or more branches were exceeded.
63	Return error	Program encountered “Return” without branch.
64	Drive error	Drive error input was active.
65	Speed change error	Cannot accelerate/decelerate at the speed change point.
66	Stop disable error	Insufficient distance for the current speed until stop during C and E points.
67	Circular interpolation error	Three points for circular interpolation are on one straight line.
68	Actual position change error	Setting range error Range: - 8,388,607 to + 8,388,607
70	Data write error (*1)	Data write was executed during test for quick-start mode.

Note:

· (*1): If the start mode is set to test for quick-start mode, parameters or positioning point data cannot be written and the memory cannot be cleared.

2. Error Messages

Situation	Name of error	Description
When using an audio cassette	**Tape error (TAPE)**	Audio cassette tape problem during playback
	Playback error (HEADDER)	Faulty search for header mark during playback, faulty cord connection
	Tape BCC error (TAPE BCC)	BCC error in the data during load, degraded cassette tape
	Verify error (VERIFY)	Memory contents differ during verification
	Type identity error (CONNECTION)	Different models used for writing and reading data
	Phase error (PHASE)	Faulty phase detection at the beginning of playback operation.

The error name is displayed on the LCD display when the teaching unit II is connected.

9-8. Comparison Tables

1. Positioning Modules F-type and E-type

Item		F-type	E-type
Positioning points		Max. 410 points per axis (using system ROM version SV 2.1 or later)	50 points per axis
Speed command		400,000 pps max.	200,000 pps max.
Interpolation method		Available (simultaneous 2 or 3 axes)	Not available
Memory backup		Using lithium battery and unit's capacitor	EEPROM (required to write) (Transfers into the system at power-ON.)
External connector		MIL type: for transistor type Soldering type: for line-driver type	Soldering type
Overlimit input		1 point per axis: for FP3/FP5 2 points per axis: for FP-C (+ and - directions)	2 points per axis (+ and - directions)
Home input		1 point per axis: for transistor type 2 points per axis: for line-driver type	2 points per axis (5 to 24 V input and line-driver)
Common for external input		Independent (common positive except home: for line-driver type)	Common positive except home
External input direction		Two-way (one-way: for line-driver type only)	One-way
Baud rate		19,200 bps (selectable 19,200/9,600 bps for line-driver type only)	Selectable 19,200/9,600 bps
ZERO operation LED		Used to display the home input state	Used to display the state of input LEDs
Parameters	**Item**	20 items (1 to 20)	21 items (1 to 21)
	Unit setting	Pulse, mm, inch, degree	Pulse
	Base speed	Less than speed limit	Less than 8,000 pps
	Home return speed (low)	Less than home return speed (high)	Less than 500 pps
	Start mode	Immediate normal-start, normal-start after homing, quick-start, test for quick-start	Immediate normal-start, normal-start after homing
	Homing method	Limit search method available (For FP-C only) Sets collectively for the unit.	Limit search method available (System ROM version SV 1.2 or later) Sets individually for each axis.
	Interface logic	6 bits setting (Sets collectively for the unit.)	7 bits setting (Sets individually for each axis.)
Interpolation speed data		Used	Not used
Positioning point data	**Motion pattern**	C, P and S mode with next positioning point data number and E mode	C and P mode without next positioning point data number and E mode
	Motion span	Using unique two-word data format	Using decimal constant
	Acceleration/ deceleration time	64 to 4,999 ms (For system ROM version SV 2.0 or later, 0 to 4,999 ms)	64 to 4,999 ms (For system ROM version SV 1.1 or later, 0 to 4,999 ms)
Transfer block number		0: Parameter 1 to 40: Positioning point data block 41 to 47: Revised address of actual position	0: Parameter 1 to 5: Positioning point data block 41 to 43: Revised address of actual position 48 to 50: Memory clear 51: EEPROM transfer
Actual position address data		Using unique two-word data format	Using decimal constant

Item	F-type	E-type
Turns the "request-to-run signal" OFF during operation (pulse output)	Slows down and stops without error	Stops short with error
JOB stop point	Makes the positioning operation (JOB operation) stop	Makes the positioning, homing and software homing operation stop
Acceleration/deceleration control	No limitation	At axis speed of 800 pps or less, does not accelerate/decelerate

2. FP-C Positioning Board and FP3/FP5 Positioning Unit

Item	FP-C positioning board (Line-driver type)	FP3 positioning unit (Transistor type)	FP3 Positioning unit (Line-driver type)	FP5 positioning unit (Transistor type)
Number of axes	1-, 2-, and 3-axis modules	1- and 2-axis modules	1-, 2-, and 3-axis modules	1-, 2-, and 3-axis modules
Pulse output type	Line-driver output and transistor output	Transistor output	Line-driver output and transistor output	Transistor output
X-/Y-/Z-axis connector	MIL type, 26-pin and 16-pin (pressure welding, crimping)	MIL type, 20-pin (pressure welding, crimping)	Soldered type, 50-pin	MIL type, 20-pin (pressure welding, crimping)
Socket for the connector	Included with the board	Not included with the unit	Included with the unit	Not included with the unit
RS422 port for teaching unit II	Small round connector	D-SUB connector, 15-pin	Small round connector	D-SUB connector, 15-pin
Peripheral cable for teaching unit II	• AFP15205 (50 cm/19.685 in.) • AFP1523 (3 m/9.84 ft.)	• AFP5520 (50 cm/19.685 in.) • AFP5523 (3 m/9.84 ft.)	• AFP15205 (50 cm/19.685 in.) • AFP1523 (3 m/9.84 ft.)	• AFP5520 (50 cm/19.685 in.) • AFP5523 (3 m/9.84 ft.)
Baud rate for teaching unit II communication	Selectable 19,200/9,600 bps	19,200 bps	Selectable 19,200/9,600 bps	19,200 bps
RS232C port for personal computer	Provided	None	None	None
Homing method	• Near home ON • Near home OFF • Near home ON/OFF • Limit search	• Near home ON • Near home OFF • Near home ON/OFF	• Near home ON • Near home OFF • Near home ON/OFF	• Near home ON • Near home OFF • Near home ON/OFF
Home input	2 inputs (5 to 24 V DC/ line-driver)	1 input (5 to 24 V DC)	2 inputs (5 to 24 V DC/ line-driver)	1 input (5 to 24 V DC)
Overlimit input	2 inputs (positive and negative sides)	1 input	1 input	1 input
External input power supply compatibility	12 to 24 V DC	Either 5 to 12 V DC or 24 V DC	Either 5 V DC or 12 to 24 V DC	Either 5 to 12 V DC or 24 V DC
Memory backup battery	Lithium battery (AFB8801)	Lithium battery (AFP8801)	Lithium battery (AFP8801)	Lithium battery (AFP8801)
Homing operation from outside the limit range	Possible	Not possible (starts only after being moved to the limit range by JOG operation)	Not possible (starts only after being moved to the limit range by JOG operation)	Not possible (starts only after being moved to the limit range by JOG operation)

3. Information on System ROM Versions

Version	Description
SV 2.0	• Expanded setting range for positioning acceleration/deceleration time: Changed from "64 to 4999" → "0 to 4999 msec" • Additional function for abnormal battery voltage detection: Setting of error code "02" in the shared memory • Addition of limit search method: When the software limit (+) and software limit (-) parameters are both "0", operation can be conducted without the restriction of the software limit.
SV 2.1	• Addition of positioning point data Nos. 401 to 410 (operating with shared memory data). • Compatible with the version read function of the teaching unit II

9-9. Registration Sheet (Please make copies and use)

1. Parameter

Parameter setting sheet Title:

No.	Item	Default value	X-axis	Y-axis	Z-axis
1	Pulse output mode 0: Pulse train and sign 1: CW and CCW	1			
2	Axis mode 0: Independent 1: Simultaneous 2-axis 2: Simultaneous 3-axis	0		———	———
3	Unit setting 0: pulse 1: mm 2: inch 3: degree	0			
4	Conversion rate	1			
5	Speed limit	400,000 pps			
6	Software limit (+)	+ 8,388,607 pulse			
7	Software limit (-)	- 8,388,607 pulse			
8	Base speed	0 pps			
9	Interpolation speed setting mode 0: Long-axis speed 1: Tracking speed	1		———	———
10	Backlash compensation	0 pulse			
11	Error compensation	0 pulse			
12	In-position time	300 ms			
13	Homing direction 0: Positive direction 1: Negative direction	1			
14	Home offset address	0 pulse			
15	Home return speed (high)	50,000 pps			
16	Home return speed (low)	100 pps			
17	Acceleration/deceleration time	1,000 ms			
18	Start mode 0: Immediate normal-start 1: Normal-start after homing 2: Quick-start 3: Test for quick-start	0		———	———
19	Homing method 0: Near home ON 1: Near home OFF 2: Near home ON/OFF 3: Limit search	0		———	———
20	Interface logic	000000		———	———

2. Positioning Point Data

Positioning point data setting sheet   Title: ______________________

Data No.	Motion pattern			Motion span			Axis speed			Acceleration/ deceleration time (ms)			Dwell time (× 10 ms)			Auxiliary code			Remark
	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	

9-10. Terminology

active open: One of connection opening methods for TCP/IP communication. To establish a virtual connection with another node, an active node must initiate an open call to a passive node.

address: An alphanumeric value that identifies where data is stored.

ambient temperature: The temperature of the air surrounding a system.

American Wire Gauge (AWG): A standard system used for designating the size of electrical conductors. Larger gauge numbers have smaller diameter.

AND: A Boolean operation that produces a logic “1” output if all inputs are “1”, and a logic “0” if any input is “0”.

ARP: Abbreviation for Address Resolution Protocol. This is used to transmit the Ethernet (physical) address, which is essential to Ethernet communication, by specifying the IP address. When communicating with a node address, whose Ethernet address is unknown, you only need to specify its IP address if the destination node has the ARP function.

ASCII: American Standard Code for Information Interchange. ASCII is normally used when alphanumeric (letters and decimal numbers) and control codes are sent as information to printers, etc. ASCII can be represented using 7 or 8 bits and is often expressed in a 2-digit hexadecimal form converted from specific binary expressions. ASCII expressed in 2-digit hexadecimals is called “ASCII HEX code”. For details about actual ASCII codes, refer to the table for ASCII.
[EXAMPLE] When a letter “M” is expressed in ASCII code:
7-bit ASCII : 1001101 (binary)
ASCII HEX code: 4D (hexadecimal)

asynchronous: Not synchronous. Repeated operations that take place in patterns unrelated over time.

AWG: See American Wire Gauge (AWG).

backplane: A printed circuit board located in the back of a chassis, that contains a data bus, power bus, and mating connectors for units. For FP3, FP5, FP10S and FP10 programmable controllers, two types of backplanes are available:
Master Backplane
Expansion Backplane

backup: A device that is kept available to replace something that may fail during operation.

baseband communication: A communication method which uses digital signals, without modulating them, in a complete bandwidth frequency.

battery backup: A battery or set of batteries that will provide power to the processor memory only when system power is lost. FP3 CPU, FP10S CPU, and S-RAM type IC cards have a battery backup system.

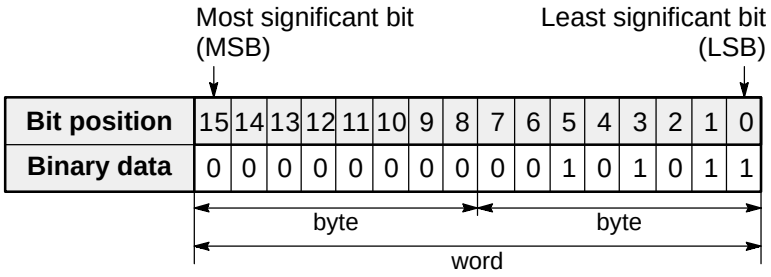
battery low: A condition that exists when the backup battery voltage drops low enough to require battery replacement. For FP3 CPU, FP10S CPU, S-RAM and S-RAM/Flash-EEPROM type IC cards, the ERROR LED turns ON.

baud: Formally defined as the shortest pulse width in data communication. However, usually used to refer to the number of binary bits transmitted per second (bps) during serial data communication.

BCC: See Block Check Code

BCD: See Binary Coded Decimal

binary: In general, programmable controllers work with binary numbers in one form or another to represent various codes or quantities. The binary number system uses the number 2 as the base and the only allowable symbols are “0” and “1”. There are no 2s, 3s, etc. Each digit of binary is called as “bit”. “Bit” means “binary digit”. A group of 8 bits is called a “byte” and a group of 16 bits (two bytes) is called a “word”.



The binary number “0000000000101011” is expressed in decimal as follows:

$1 \times 2^0 + 1 \times 2^1 + 0 \times 2^2 + 1 \times 2^3 + 0 \times 2^4 + 1 \times 2^5 + ... + 0 \times 2^{15}$

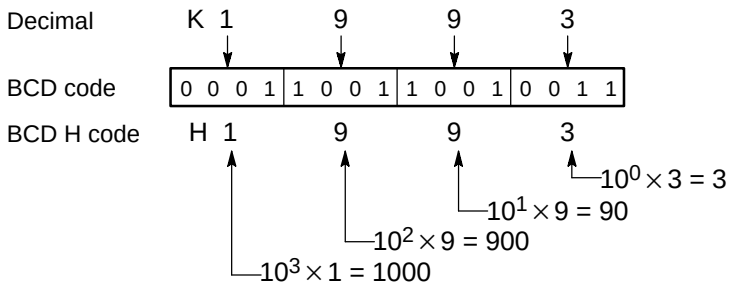
$= 1 + 2 + 0 + 8 + 0 + 32 + ... + 0$

$= 43$

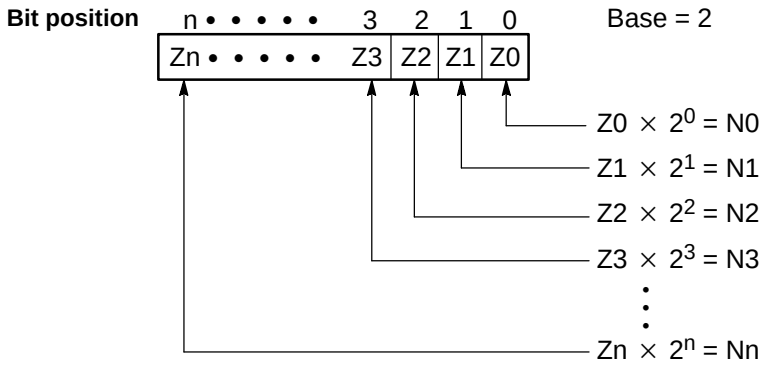
Binary Coded Decimal (BCD): One of the codes expressed in binary. BCD is a binary code in which each decimal digit from 0 to 9 is represented by four binary digits (bits). The four positions have a weighted value of 1, 2, 4, and 8, respectively, starting with the least significant bit. A thumbwheel switch is specified as a BCD device, and when connected to a programmable controller, each decimal digit requires four inputs.

BCD is usually expressed grouping four bits as one digit in the same way as the hexadecimal constant H. **When BCD is grouped in four bit units, the BCD is expressed by adding the prefix H to the data. Since the weight of each BCD H code is same as that of decimals, be sure to pay attention not to be confused with hexadecimal numbers when BCD H code is handled.**

Example: When K1993 (decimal) is expressed in BCD.



binary number system: A number system that uses two symbols, “0” and “1”. Each digit position has a weighted value of 1, 2, 4, 8, 16, 32, 64, and so on beginning with the least significant (right-most) digit.



The sum of N0 through Nn is the decimal equivalent of the number in base “2”.

Block Check Code (BCC): This code is used to detect errors in message transmissions. It is created by Exclusive ORing all of the codes from the header though the last text character, then translating the result (8-bit) data into two ASCII characters.

broadband communication: A communication method which modulates data, such as that for voice and video data transmission, into narrower bands for communication with different users.

buffer: A group of registers used for temporary data storage. This is used for data transmission and works effectively when there are transmission rate differences between sending and receiving devices.

bug: Software errors which will cause unexpected actions.

bus: Power distribution conductors.

Central Processing Unit: The Central Processing Unit is usually referred to as the CPU. The CPU controls system activities of the programmable controller.

character: A symbol such as a letter of the alphabet or decimal number. An ASCII character is most commonly used to express characters using binary.

complement: A logical operation that inverts a signal or bit. The complement of “1” is “0”, and the complement of “0” is “1”.

computer link: The term “computer link” means the link that functions between a programmable controller and a computer. In the computer link, a computer always initiates communication to a programmable controller and communication is performed using the MEWTOCOL-COM protocol for FP series programmable controllers. To perform computer link communication, you need to prepare a program in the computer that conforms to the MEWTOCOL-COM format. You do not have to make a program for the programmable controller.

connection: In data communication, a circuit between two data terminals.

CPU: See Central Processing Unit.

CRT: Abbreviation for cathode-ray tube.

data transfer: The data transfer function enables a programmable controller to send or get data to/from another programmable controller. This function is usually used between programmable controllers using the **F145 (SEND)/P145 (PSEND)** and **F146 (RECV)/P146 (PRECV)** instructions through the link modules. If you use this for communication with a computer, you need to prepare programs that conform to the MEWTOCOL-DAT format at the computer.

debug: Removing errors from a program.

decimal number system: The decimal number system uses the number 10 as the base and the allowable symbols are “0”, “1”, “2”, “3”, “4”, “5”, “6”, “7”, “8”, and “9”. Each digit position has a weighted value of 1, 10, 100, 1000, and so on, beginning with the least significant (right-most) digit.

duplex: See full-duplex.

EEPROM: Electrically Erasable Programmable Read Only Memory. EEPROM can be programmed and erased by electrical pulses.

EPROM: Erasable Programmable Read Only Memory. EPROM can be reprogrammed after being entirely erased with the use of an ultra-violet light source.

FIFO: See First-In-First-Out.

First-In-First-Out: The order that data is written in, and read from registers.

flag: A relay used to detect and remember certain events in the programmable controller. In FP series programmable controllers, some of the special internal relays are used as flags.

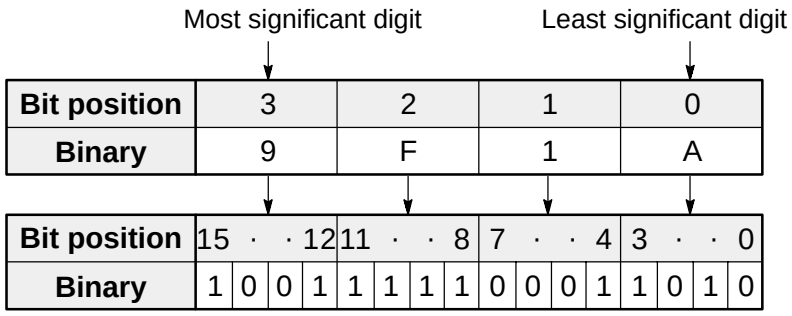
full-duplex: A communication link in which data can be transmitted and received at the same time.

half-duplex: A communication link in which transmission is limited to one direction at a time.

handshake communication: Data exchanges between two pieces of devices. For FP series programmable controllers, main signal exchanges between the CPU and the shared memory of intelligent units are referred to as handshake communication.

hexadecimal:

The hexadecimal number system uses 16 as the base. The allowable symbols are numbers 0 through 9 and letters A through F. The letters are substituted for numbers 10 to 15, respectively, to represent all 16 numbers in one digit. The binary number system can easily be represented in hexadecimal with 4 bit groups. In this manner, a very large binary number can be represented by a hexadecimal number with significantly fewer digits.



hold:

The memory area whose contents will not be lost or modified if operating power is lost or if the mode of the programmable controller is changed from RUN to PROG.

ICMP:

Abbreviation for Internet Control Message Protocol. This is used to transmit an error message in a network. The FP3/FP10S ET-LAN unit supports the echo reply option to the ping command.

interrupt:

The act of performing a more urgent task by putting off the presently executing task. FP series programmable controllers have three types of interrupts, as follows:
- input initiated interrupt
- high-speed counter initiated interrupt
- time initiated interrupt

I/O:

Abbreviation of Input/Output.

I/O update:

Taking the input data at the input interface into the memory for program execution and outputting the result of program execution to the output interface.

IP:

Abbreviation for Internet Protocol. IP is used to transmit data in datagram units to a destination node specified by an IP address. It provides functions such as the dividing and reassembling of communication data, and communication services between networks via a router.

ladder diagram:

A standard for representing relay-logic systems.

layer:

The conceptual service groups in a network architecture hierarchy. (e.g., transport layer, network layer, data link layer, and physical layer, etc.)
In FP series programmable controller networks, the word layer is regarded as a subnetwork which should be accessed via relay stations.

LCD:

Abbreviation for Liquid Crystal Display.

leading edge differential:

A programming technique to operate a bit only for one scan at the moment its input condition turns ON from the OFF state.

Least Significant Bit (LSB): The bit which represents the smallest value in a byte, word, or double-word.

Least Significant Digit (LSD): The digit which represents the smallest value in a number.

LED: Abbreviation for Light-Emitting Diode.

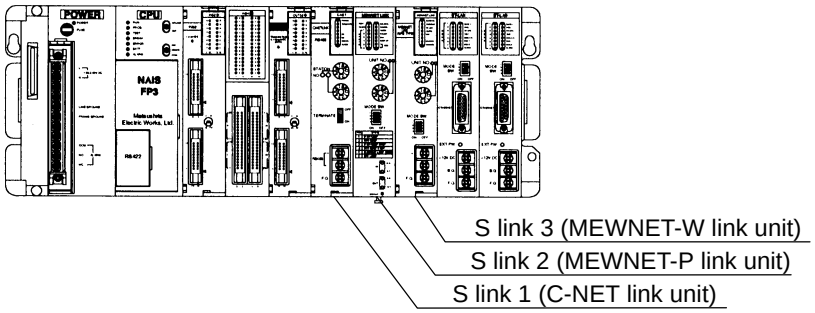
link module: Link modules available for the FP-C/FP3/FP5/FP10S/FP10 are classified into two types: those for the ”standard link system” and those for the ”high-level link system.” Modules for the ”standard link system” and ”high-level link system” are as follows:

- Modules for the standard link system:
  Computer communication modules, C-NET link module, MEWNET-P (Optical) link modules and MEWNET-W (Wire) link modules
- Modules for the high-level link system:
  ET-LAN modules and MEWNET-H link modules

link number: Link numbers are used to express the position of link modules separately for the standard and high-level link systems, starting from the link module at the smallest slot position, as follows:

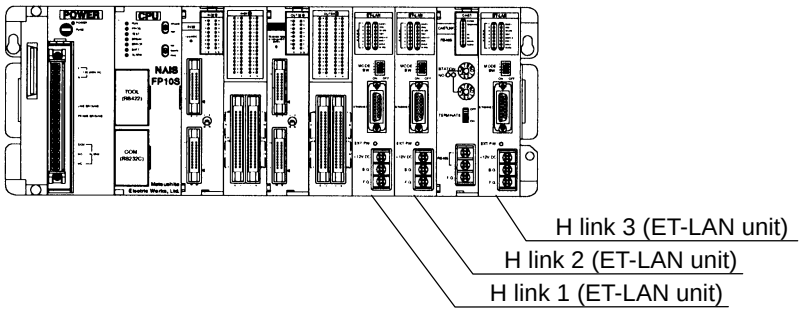
[Link number for standard link system]

- FP-C/FP3/FP5: “S link 1”, “S link 2” and “S link 3”
- FP10S/FP10: “S link 1”, “S link 2”, “S link 3”, “S link 4” and “S link 5”



[Link number for high-level link system]

- FP-C: No high-level link modules available for FP-C.
- FP3/FP5/FP10S/FP10: “H link 1”, “H link 2” and “H link 3”



malfunction: Incorrect function.

Master Control Relay: A relay which controls any series of programs with its operation. If the master control relay is de-energized, all of the contacts and devices controlled by the master control relay are de-energized.

MEWTOCOL-COM: A communication protocol for FP series programmable controllers that performs communication between a computer and programmable controllers.

modem: Abbreviation for MOdulator/DEModulator. The modem modulates digital signals and transmits them through a telephone line.

Most Significant Bit (MSB): The bit which represents the greatest value in a byte, word, or double-word.

Most Significant Digit (MSD): The digit which represents the greatest value in a number.

multidrop link: A communication link in which one host can communicate with two or more stations.

network: A group of nodes that use links to exchange information.

node: A communication station such as computer or programmable controller that is connected to a network.

noise: Random, unexpected electrical signals, that are caused by radio waves or by electrical or magnetic fields.

non-hold: The memory area whose contents will be lost or modified if operating power is lost or if the mode of the programmable controller is changed from RUN to PROG.

normally-closed contact: A contact which is closed when the coil of the relay is not activated.

normally-open contact: A contact which is open when the coil of the relay is not activated.

offline: Not being in continuous communication with another processor.

online: Being in continuous communication with another processor.

overflow: The act of exceeding the maximum limit in a registers capacity.

parity check: A check method for the number of 1s in a character when data communication is performed. The parity check is performed by calculating the number of ones in a character.

passive open: One of connection opening methods for TCP/IP communication. To establish a virtual connection with another node, an active node must initiate an open call to a passive node. When using Ethernet, there are two passive open methods, unpassive and fullpassive.

PC link:

The term “PC link” means one of the link functions between programmable controllers that use specified relays and data registers. In the PC link, you do not have to make a complicated program to enable communication. The PC link function is available separately for the standard link system and high-level link system as follows:

[PC link for standard link system]

In the standard link system, a maximum of two PC links are available per CPU using MEWNET-P or MEWNET-W link modules. The two PC links for the standard link system are called “PC link S0” and “PC link S1.” For each link communication, 1,024 link relay (L) points and 128 link data register (LD) words are used.

The PC link S0 and S1 allocations can be set using system register 46* as follows:

- When system register 46 is K0, PC link S0 is assigned for the module with the smaller slot number (module with a smaller S link number) of the two.
- When system register 46 is K1, PC link S0 is assigned for the module with the larger slot number (module with a larger S link number) of two.

* System register 46 is available for any FP-C/FP3/FP5 with CPU version V.4.4. or later and any FP10S/FP10.

[PC link for high-level link system]

In the high-level link system, a maximum of two PC links are available per CPU using MEWNET-H link modules. The two PC links for the high-level link systems are called “PC link H0” and “PC link H1.” For each link communication, you can assign relays and registers using setting tools.

The PC link H0 and H1 allocations are determined by the position of the MEWNET-H link modules. Between the two MEWNET-H link modules used for the PC link, PC link H0 is assigned for the module at the smaller slot number (module with the smaller H link number) of the two, and PC link H1 is assigned for the module at the larger slot number (module with the larger H link number).

peripheral device:

Devices that are connected to the programmable controller.

PLC:

Abbreviation for Programmable Logic Controller. See programmable controller.

potentiometer:

A simple transducer which works based on resistance change.

programmable controller:

A control device which can be programmed to control process or machine operations. A programmable controller is often referred to as a PLC when abbreviated.

RAM:

Random Access Memory. RAM provides an excellent means for easily creating and altering a program. Many of the FP series programmable controllers use RAM with battery backup for the application memory.

register:

A unit of memory for various types of data. A register is usually 16 bits wide.

repeater:

In an Ethernet LAN, a device that re-sends or relays a signal traveling along a LAN cable. It is used to overcome restrictions in segment length in the LAN.

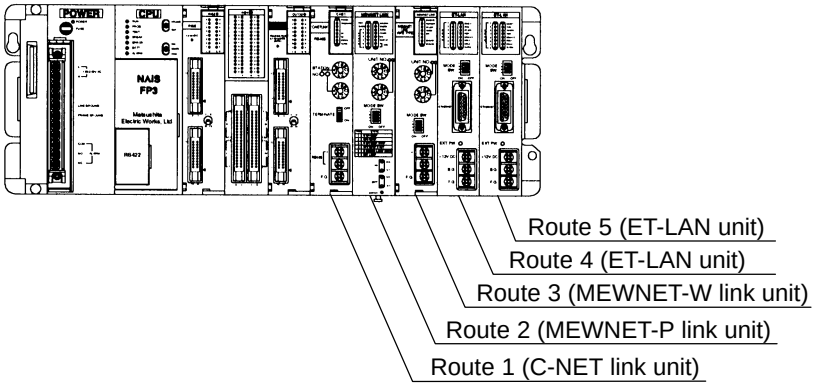
ROM:

Read Only Memory. See EEPROM and EPROM.

route number:

Route numbers are used to express the position of standard and high-level link modules together. The numbers are assigned starting from the link module at the smallest slot position as follows:

- FP-C: “route 1”, “route 2” and “route 3” only with 3 standard link modules.
  (For FP-C, no high-level link modules are available.)
- FP3/FP5: “route 1”, “route 2”, “route 3”, “route 4”, “route 5” and “route 6” including 3 standard and 3 high-level link modules.
- FP10S/FP10: “route 1”, “route 2”, “route 3”, “route 4”, “route 5”, “route 6”, “route 7” and “route 8” including 3 standard and 5 high-level link modules.



RS232C:

An EIA communication standard for data transmission media that is less than 15 m. Most common serial communication standard.

RS422:

An EIA communication standard for data transmission media.

rung:

Term for a ladder program. A rung refers to the programmed instructions that drive one output.

scan:

Time required to read all inputs, execute the program, and update local and remote information.

segment:

In a network, this refers to a piece of coaxial cable that is closed on both ends by a terminator. The segment length is the distance between terminators and varies depending on the type of network.

self-diagnostic function:

A function within the programmable controller which monitors operation and indicates any fault that is detected.

serial communication:

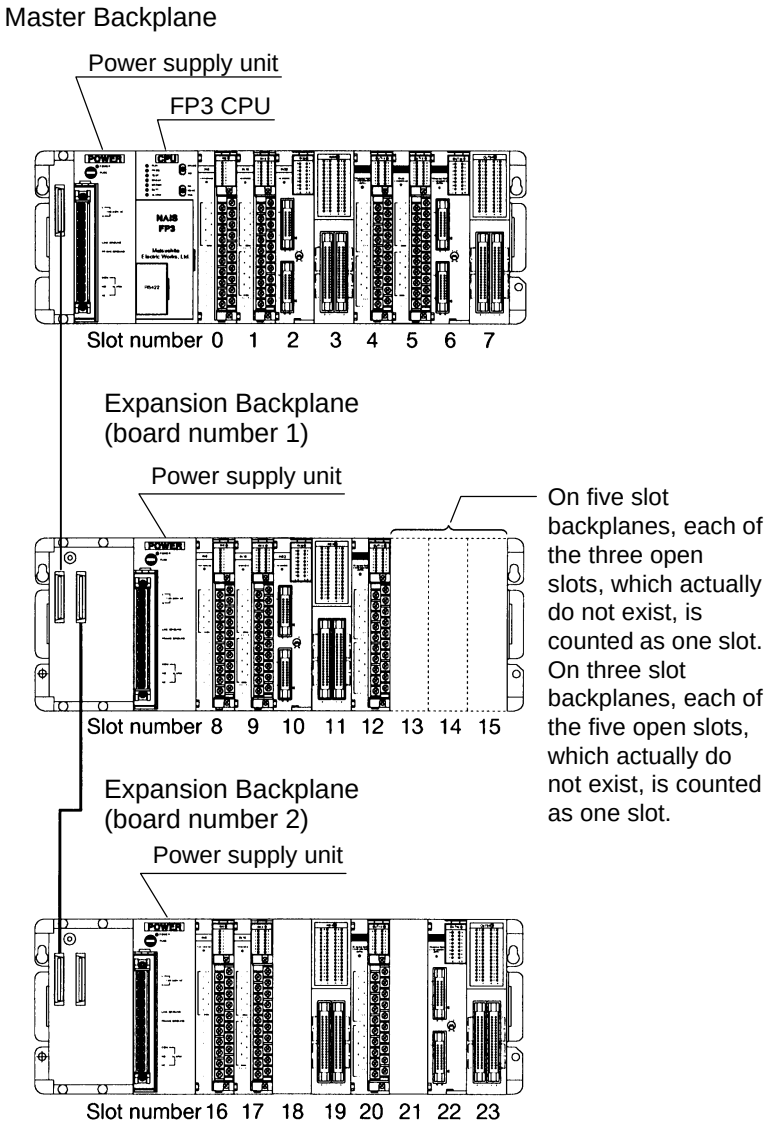
A communication style in which data is transmitted bit by bit serially.

shared memory:

Memory that can be accessed by two or more pieces of devices. In FP series programmable controllers, some intelligent modules have shared memory which can be accessed by both the CPU and the intelligent module.

slot number:

Slot numbers are used for expressing the position of modules except for the CPU and power supply module. The slot numbers are assigned for each module, starting from the module in the slot nearest to the CPU.
In the slot numbering system, all types of backplanes are regarded as the 8-slot type and the number is assigned in the order: CPU equipped master backplane, expansion backplane with board number 1, and then the expansion backplane with board number 2, starting from slot number 0.



stop bit:

The last bit when a character is transmitted.

subnet:

In TCP/IP communication, a part of a network specified by a part of the internet address.

system errors:

Errors resulting from the device or the environment.

system register:

The registers used only for system settings of the programmable controller.

TCP: Abbreviation for Transmission Control Protocol. This is a connection-based communication method. Since communication services including re-transmission, sequence and flow control for the communication data are provided, this protocol guarantees high communication reliability.

10 BASE 5 network: One of the CSMA/CD method networks which allows 10 Mbps baseband local area communication with a maximum segment length of 500 m. Usually referred to as Ethernet.

10 BASE T network: One of the CSMA/CD method networks which allows 10 Mbps baseband local area communication with twisted-pair cable.

10 BASE 2 network: One of the CSMA/CD method networks which allows 10 Mbps baseband local area communication with a maximum segment length of 200 m. Usually referred to as Cheapernet.

trailing edge differential: A programming technique to operate a bit only for one scan at the moment its input condition turns OFF from the ON state.

two's complement: A number system used to express positive and negative numbers in binary. In this system, the number becomes negative if the most significant bit of the data is "1". In FP series programmable controllers, numbers are expressed using the two's complement.

UDP: Abbreviation for User Diagram Protocol. This is a connectionless communication method. Since no re-transmission, sequence, or flow control for communication data is provided, support at the application level is required to guarantee communication reliability.

underflow: The act of going below the minimum limit in a register's capacity.

watchdog timer: A timer that monitors processing time of the programmable controller. If the program does not time out, the processor is assumed to be faulty.

word: A unit of bits which is usually executed at the same time. A word is composed of 16 bits.

9-11. Product Types

■ **Positioning modules and Teaching unit II**

Type		Part number
FP-C positioning board F-type (Line-driver type)	1-axis board	AFC3434
	2-axis board	AFC3435
	3-axis board	AFC3436
FP3 positioning unit F-type (Line-driver type)	1-axis unit	AFP3434
	2-axis unit	AFP3435
	3-axis unit	AFP3436
FP3 positioning unit F-type (Transistor type)	1-axis unit	AFP3431
	2-axis unit	AFP3432
FP5 positioning unit F-type (Transistor type)	1-axis unit	AFP5434
	2-axis unit	AFP5435
	3-axis unit	AFP5436
Teaching unit II (Programming tool of positioning module)		AFP5134

■ **Peripheral cables**

Type		Part number	Description
FP peripheral cable	**50 cm/19.685 in.**	AFP5520	Cable needed for connection between teaching unit II and the positioning module transistor type.
	3 m/9.84 ft.	AFP5523	
FP1 peripheral cable	**50 cm/19.685 in.**	AFP15205	Cable needed for connection between teaching unit II and the positioning module line-driver type.
	3 m/9.84 ft.	AFP1523	

■ Socket for connector of FP-C/FP3/FP5 positioning module

FP-C positioning board (line-driver type)

· Socket set product (semi-cover and housing with contacts)

Item	Part number
Socket for external input connector (26 pins)	AXW3261421A
Socket for X-/Y-/Z-axis connectors (16 pins)	AXW3161421A

· Applicable cables

Number	Cross section area	External figure	Rated current	Remark
AWG #22	0.3 mm^2	1.1 to 1.5 dia.	3 A	AWG #22: 12 wires per 0.18 should be used.
AWG #24	0.2 mm^2			

FP3 positioning unit (line-driver type)

· Socket

Item	Number of pins	Socket	Description
Socket for X-/Y-/Z-axis connector	50	MR-50LH	Soldering type, HONDA TSUSHIN KOGYO CO., LTD.

· Applicable cable

Item	Description
Applicable loose cable	Shielded twisted pair cable

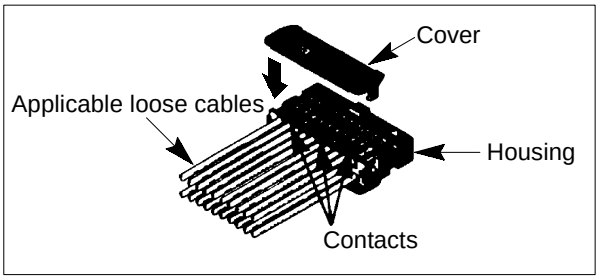
FP3/FP5 positioning unit (transistor type)

· Individual parts (housing, cover and contact)

Item	Number of pins	Housing	Cover		Contact (5 in line)
			Hood cover	Semi-cover	
Socket for X-/Y-/Z-axis connectors	20	AXW1204A	AXW62002A	AXW62001A	AXW7221 for AWG #22 and #24 of the loose cable

· Applicable cables

Number	Cross section area	External figure	Rated current	Remark
AWG #22	0.3 mm^2	1.1 to 1.5 dia.	3 A	AWG #22: 12 wires per 0.18 should be used.
AWG #24	0.2 mm^2			



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Matsushita Electric Works, Ltd.

Automation Controls Company

- Head Office: 1048, Kadoma, Kadoma-shi, Osaka 571-8686, Japan
- Telephone: +81-6-6908-1050
- Facsimile: +81-6-6908-5781

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