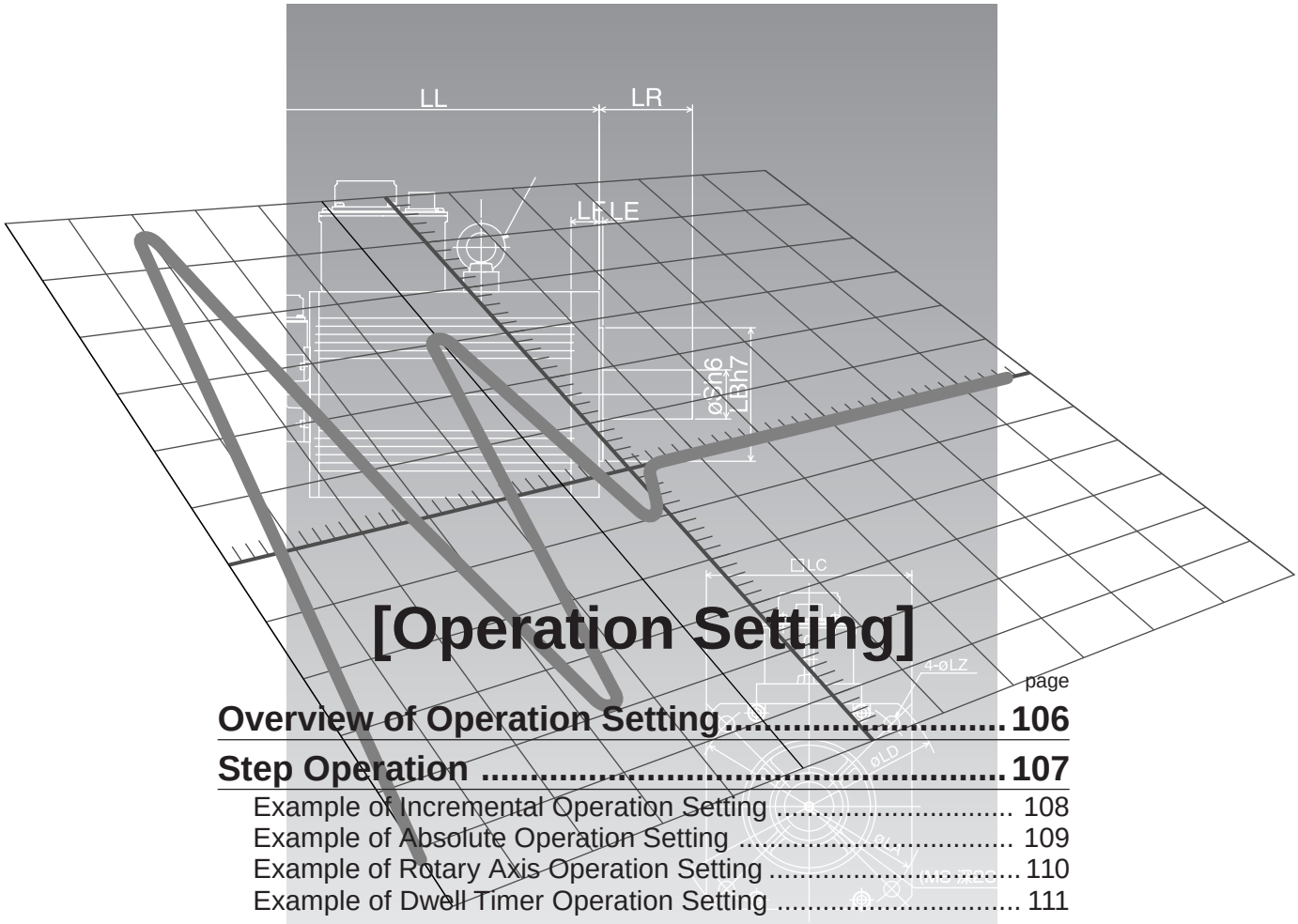


[Operation Setting]

Overview of Operation Setting

In MINAS A4P, the following operations can be performed.

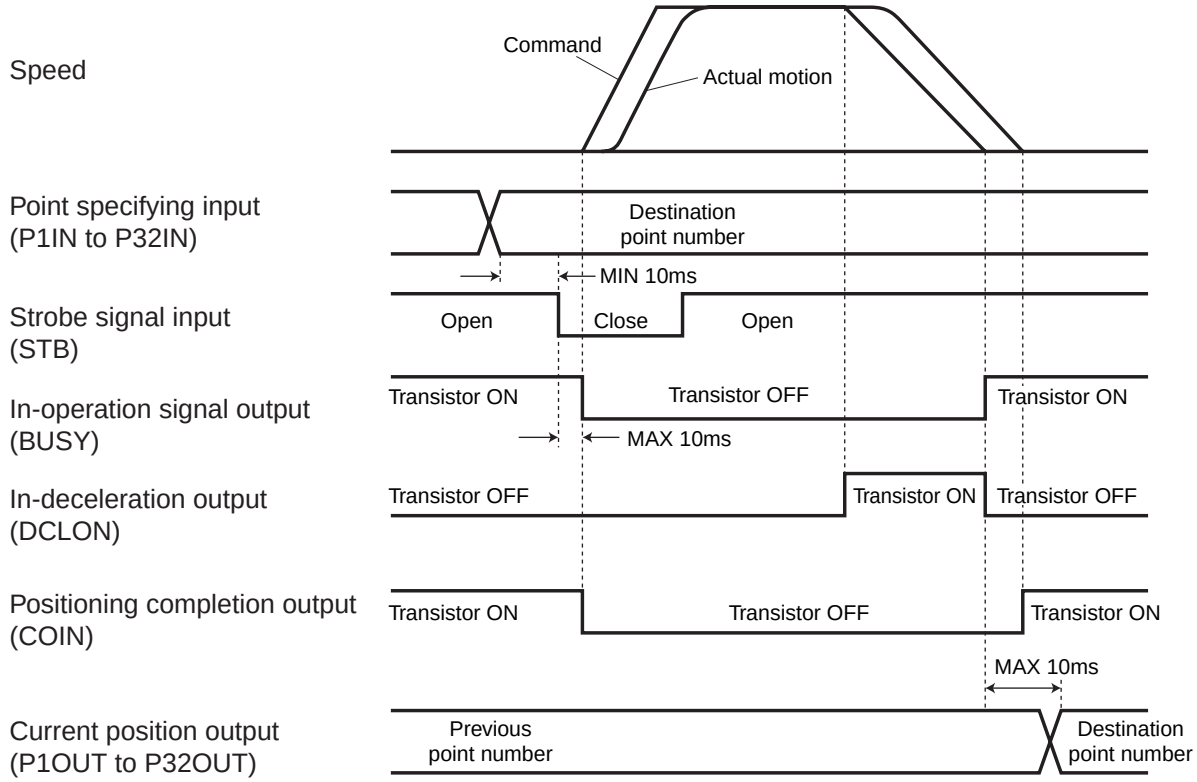
Step operation P.107	The most basic operation. Specify a point number set in advance when performing the operation. The four types of modes are available, i.e., an incremental operation, absolute operation, rotary axis operation and dwell timer (waiting time).
Jog operation P.112	The motor can be moved in a positive direction or negative direction independently. This is useful for teaching or adjustment.
Homing operation P.114	An operation to detect a home position which is the base of operation. The eight types of homing operations can be performed in A4P. Homing must be completed before performing the step operation etc. Also, homing can be disabled by setting a certain parameter.
Emergency stop/ deceleration-and-stop operation P.125	An active operation can be interrupted and canceled. Emergency stop: An operation stops in a deceleration time specified by a special parameter. Deceleration-and-stop: An operation stops in a deceleration time specified in an operation mode before the start of deceleration.
Temporary stop operation P.126	Active operation can be stopped temporarily and restarted.
Block operation P.127	Several step operations can be performed at a time. The two types of block operations below can be executed. Continuous block operation: Several step operations can be performed continuously. Once an operation starts, the operation continues to a specified point number. Combined block operation: A step operation is performed according to combined several point numbers. This is useful when you want to change the speed during a step operation.
Sequential operation P.130	A point number increments by 1 automatically whenever an operation command is given. A step operation can be performed easily only by turning the STB signal on/off.
S-shaped acceleration/ deceleration operation P.131	An operation can be performed smoothly by executing the start and end of acceleration/deceleration gradually.

<Notice>

- For how to set a step data or parameters, “Hot To Use Console” on page 80.
- When setting the step parameters using “PANATERM®”, speed = V1 to V6, deceleration = A1 to A4 and deceleration = D1 to D4 are shown. This instruction manual describes speed = VEL1 to VEL16, deceleration = ACC1 to ACC4 and deceleration = DEC1 to DEC4.

Step Operation

Positioning can be performed to a specified point by the step operation.
The four types of modes are available, i.e., an incremental operation, absolute operation, rotary axis operation and dwell timer (waiting time).



Procedure		Description
(1)	Setting of step parameters	Set the step parameters referring to the example of each operation setting since page 108.
(2)	Execution of homing	Perform the homing referring to “Homing Operation” on page 114. Any step operation is unacceptable if homing is not completed. This operation is not required if the absolute mode and homing are disabled.
(3)	Designation of operation point number	Specify an operation point number in the point specifying input (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8).
(4)	Start of step operation	By connecting (closing) the open strobe signal input (STB: CN X5 Pin 24) to COM- when 10 ms has passed after inputting the point specifying input (P1IN to P32IN), an operation starts according to a set value of a point number specified in procedure (3).
(5)	Check of operation command execution	Check whether a driver is executed by an operation command. If the driver is executed, open the strobe signal input (STB) again. If a transistor of the in-operation signal output (BUSY: CN X5 Pin 28) turns OFF, an operation is in the execution. Even if an operation completes when the strobe signal (STB) does not return to the OPEN state, the in-operation signal output (BUSY) remains turning OFF.
(6)	Check of completion of operation command execution	Check the completion of operation command execution with the in-operation signal output (BUSY). If a transistor of the signal returns from OFF to ON, the operation is completed.
(7)	Check of current position output	Check an operation point number executed by the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) after checking the operation command execution. The current position output (P1OUT to P32OUT) is updated within 10 ms after a transistor of the in-operation signal output (BUSY) turns ON.

* Positioning completion output/in-deceleration output (COIN/DCLON: CN X5 Pin 27)
In SV.Pr64 (output signal selection), you can select COIN or DCLON to be output. For the timing of tuning the transistor ON/OFF, refer to the diagram above.

Step Operation

Caution

1) If a set value of speed, acceleration or deceleration at a specified point is “0”, an operation trips due to undefined data error protection (error code No. 69) and stops according to an operation at alarm occurrence.
2) If the current position (–2147483647 to 2147483647) overflows when absolute movement is performed continuously in the same direction, an operation trips due to current position overflow error protection (error code No. 70) and stops according to an operation at alarm occurrence. This error can be disabled by 16.Pr51 (Wrap around permission). In this case, however, an absolute position cannot be guaranteed. If you disable the wrap around, use the incremental operation only.
3) If the over-travel inhibit input is enabled in an operating direction during a step operation, an operation trips due to over-travel inhibit detection error protection (error code No. 71) and stops according to an operation at alarm occurrence. In SV.Pr55 (Over-travel inhibit input operation setting), you can specify whether or not to trip an operation.
4) When the motor has exceeded a maximum travel specified by 32.Pr01 (Setting of maximum movement in plus direction) and 32.Pr02 (Setting of maximum movement in minus direction) during a step operation, an operation stops due to maximum travel limit error protection (error code No. 72) and stops according to an operation at alarm occurrence.
5) When the servo driver has tripped, a step operation cannot be executed again unless you input an Alarm Clear command once and then execute the homing. However, the absolute mode and homing are disabled, the step operation can be executed without performing the homing operation.
6) If a motor operation completes although the strobe signal input (STB: CN X5 Pin 24) does not return to the OPEN state after the in-operation signal output (BUSY: CN X5 Pin 28) turns OFF, the in-operation signal output (BUSY) is still in the OFF state. When the in-operation signal output (BUSY) has turned OFF, be sure to return the strobe signal input (STB) to the OPEN state.
7) Any step operation is unacceptable when the in-operation signal output (BUSY) turns OFF (a previous command is being executed).

Step Operation Mode

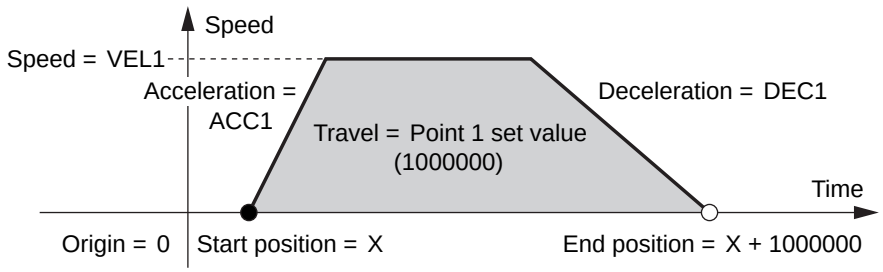
For a positioning operation in this servo driver, you can select any of the four types of operation modes. For the details of each operation mode, refer to the relevant page.

Operation mode	Description	Relevant page
Incremental operation (Incremental)	Operates regarding a set value as relative travel from a current position.	P.108
Absolute operation (Absolute)	Operates regarding a set value as an absolute position of a target.	P.109
Rotary axis operation (Rotary)	Operates regarding a set value as an absolute position per rotation.	P.110
Dwell timer operation (Dwell time)	Operates regarding a set value as a waiting time.	P.111

* A step data can be set in the point numbers 1 (01h) to 60 (3Ch). For details, refer to the table in “Overview of Point specifying Input” on page 45.
* Do not use the rotary axis operation (Rotary) mode together with the incremental operation (Incremental) or absolute operation (Absolute). Wrap around according to the command position and the number of pulses per rotation at the current position cannot be performed appropriately.

Example of Incremental Operation Setting

In the incremental operation, the motor operates regarding a set value as relative travel from a current position.



• Setting of 16-bit positioning parameter

	16.Pr* *	Parameter name
VEL1	00	Positioning setting first speed
ACC1	10	Positioning acceleration setting 1st
DEC1	12	Positioning deceleration setting 1st

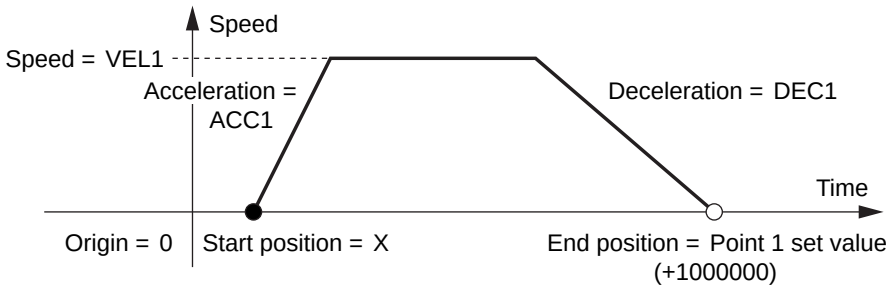
1. Set the 16-bit positioning parameter in the table above to any value and specify the step parameter as shown below.
2. Perform homing. (Refer to “Homing” on page 114.)
3. Specify the point 1 when the servo turns on and connect the strobe signal input (STB: CN X5 Pin 24) to COM–. Then, an operation starts.

• Setting of step parameter

No.	Operation mode	Position/Waiting time	Speed	Acceleration	Deceleration	Block
01	Incremental operation (Incremental)	1000000	VEL1	ACC1	DEC1	Single

Example of Absolute Operation Setting

In the absolute operation, the motor operates regarding a set value as absolute position based on origin = “0”. The chart below shows an example to specify the point 1 to the absolute operation for movement.



• Setting of 16-bit positioning parameter

	16.Pr* *	Parameter name
VEL1	00	Positioning setting first speed
ACC1	10	Positioning acceleration setting 1st
DEC1	12	Positioning deceleration setting 1st

1. Set the 16-bit positioning parameter in the table above and specify the step parameter as shown below.
2. Perform homing. (Refer to “Homing” on page 114.)
3. Specify the point 1 when the servo turns on and connect the strobe signal input (STB: CN X5 Pin 24) to COM–. Then, an operation starts.

• Setting of step parameter

No.	Operation mode	Position/Waiting time	Speed	Acceleration	Deceleration	Block
01	Absolute operation (Absolute)	1000000	VEL1	ACC1	DEC1	Single

Caution

1) Wrap around

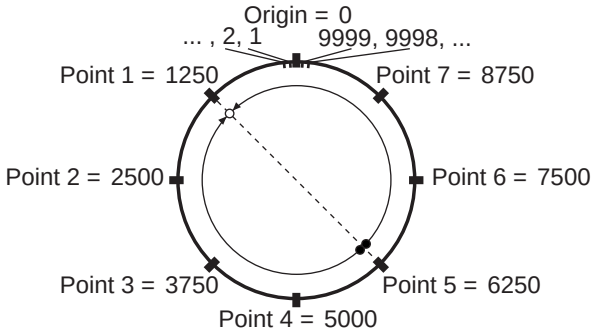
If 16.Pr51 (wrap around accepted) is set to “1”, although an error does not occur when wrap around happens, an absolute position cannot be guaranteed. If you will combine the absolute operation mode and incremental operation mode with each other, take care not to cause the wrap around or do not use the absolute operation.

Step Operation

Example of Rotary Axis Operation Setting

If the rotary axis operation is specified, the shaft moves in a direction nearest from the current position to a target position of a step parameter that the rotary axis operation (rotary) has been specified regarding 32.Pr03 (Movement per rotation in rotation coordinates) as 360 degrees.
A current position of running motor is automatically limited in a range between 0 and [travel per rotation at a rotary coordinate –1] as shown below.

- If travel per rotation at a rotary coordinate is set to “10000”



• Setting of 32-bit positioning parameter

32.Pr* *	Parameter name	Input value
03	Movement per rotation in rotation coordinates	10000

• Setting of step parameter

No.	Operation mode	Position/Waiting time	Speed	Acceleration	Deceleration	Block
01	Rotary axis operation (Rotary)	1250	VEL1	ACC1	DEC1	Single
02	Rotary axis operation (Rotary)	2500	VEL1	ACC1	DEC1	Single
03	Rotary axis operation (Rotary)	3750	VEL1	ACC1	DEC1	Single
04	Rotary axis operation (Rotary)	5000	VEL1	ACC1	DEC1	Single
05	Rotary axis operation (Rotary)	6250	VEL1	ACC1	DEC1	Single
06	Rotary axis operation (Rotary)	7500	VEL1	ACC1	DEC1	Single
07	Rotary axis operation (Rotary)	8750	VEL1	ACC1	DEC1	Single

Caution

1) Control mode

The rotary axis operation is enabled only for the position control (SV.Pr02 = 0). If the rotary axis operation is specified for the full-closed control (SV.Pr02 = 6), an error code No. 69 (undefined data error protection) is shown.

2) Restrictions on parameter

If the rotary axis operation is used, the restrictions below are imposed to the parameters not to exceed the limitation of the current position.

PrNo.	Name	Set value	Description
SV.Pr0B	Absolute encoder set up	1	The rotary axis operation requires homing. If “0” or “2” is set, an error code No. 69 (undefined data error protection) is shown when the rotary shaft operation starts.
16.Pr37	Home complete type	1	Be sure to set “1” if you use the home offset function.
16.Pr38	Homing skip	0	The rotary axis operation requires homing.
16.Pr54	Block operation type	0	The combined block operation cannot be used.
32.Pr00	Home offset		For 16.Pr37 = 0, set “0”. For 16.Pr37 = 0, set a value in a range between 0 and [movement per rotation at a rotary coordinate - 1] .
32.Pr03	Setting of maximum movement in plus direction	2 to 1073741824	For any invalid value out of specified range, an error code No. 69 (undefined data error protection) is shown when the positioning operation starts.
32.Pr01	Setting of maximum movement in minus direction	0	A maximum travel limitation error protection cannot be used for the rotary axis operation.
32.Pr02	Movement per rotation in rotation coordinates		

3) Setting of step data

- Do not use the rotary axis operation (Rotary) mode together with the incremental operation (Incremental) or absolute operation (Absolute).
- If a step data set value specified for the rotary axis operation is out of a range between 0 and [movement per rotation at a rotary coordinate –1] , an error code No. 69 (undefined data error protection) is shown.

4) Jog operation

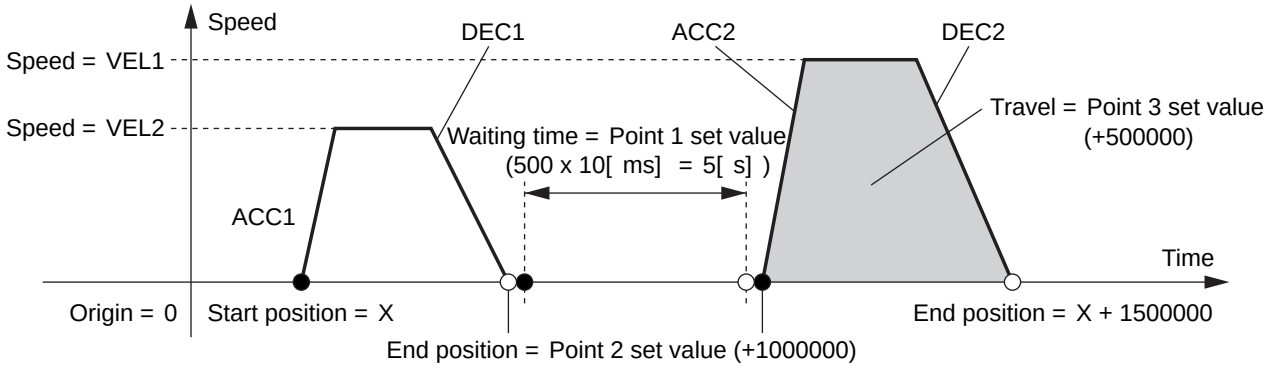
If you use the motor in the rotary axis operation, do not perform the jog operation after homing completes. The motor may exceed limitation of the current position. If you perform the jog operation by mistake, execute the homing again.

5) Servo off

Also if the servo has turned off when the motor is used in the rotary axis operation, the motor may exceed limitation of the current position. Be sure to execute the homing again after the servo turns on.

Example of Dwell Timer Operation Setting

In the dwell timer operation, the motor operates regarding a set value as waiting time. The dwell time operation is not used independently. This operation is used as waiting time between the points in the block operation.
The chart below shows an example to set the point 1 in the dwell timer after the absolute operation at the point 2 and perform the relative travel at the point 3 after a specified time has passed.



• Setting of 16-bit positioning parameter

	16.Pr* *	Parameter name
VEL1, VEL2	00, 01	Positioning setting first speed, second speed
ACC1, ACC2	10, 14	Positioning acceleration setting 1st, 2nd
DEC1, DEC2	12, 16	Positioning deceleration setting 1st, 2nd

1. Set the 16-bit positioning parameter in the table above to any value and specify the step parameter as shown below.
2. Perform homing. (Refer to “Homing Operation” on page 114.)
3. Specify the point 1 after the point 2 operation has completed and connect the strobe signal input (STB: CN X5 Pin 24) to COM–. Then, a waiting time operation starts. When a waiting time has passed, the in-operation signal output (BUSY: CN X5 Pin 28) turns on and the next point 3 operation can be specified.

• Setting of step parameter

No.	Operation mode	Position/Waiting time	Speed	Acceleration	Deceleration	Block
01	Dwell timer operation (Dwell time)	500	VEL1	ACC1	DEC1	Single
02	Absolute operation (Absolute)	1000000	VEL1	ACC1	DEC1	Single
03	Incremental operation (Incremental)	500000	VEL2	ACC2	DEC2	Single

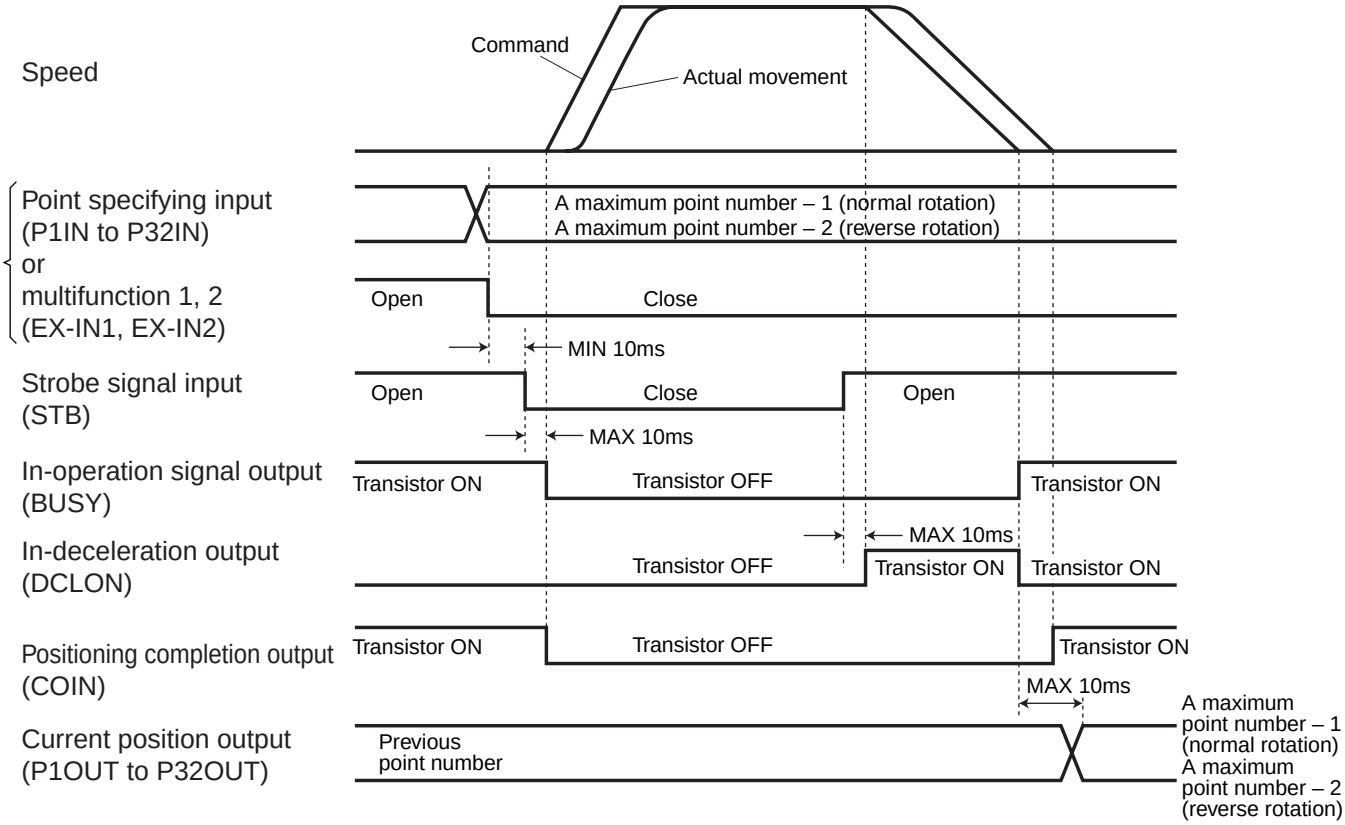
Caution

1) If a waiting time set value (unit: 10 ms) is larger than 214748364, the waiting time is a maximum of 214748364 x 10 ms.
2) To interrupt the dwell timer operation, input emergency stop or deceleration-and-stop signal assigned by the multi function input (EX-IN1 and EX-IN2: CN X5 Pin 22 and 25).

Jog Operation

Jog Operation

The motor can be moved in a positive direction or negative direction independently.



Procedure		Description
(1)	Setting of parameters related to jog operation	Specify the parameters 16.Pr No. 40 to No. 45 related to the jog operation. For details, refer to “List of Parameters Related to Jog Operation” on page 113.
(2)	Start of jog operation	There are two ways of starting the jog operation. 1) Point specifying input (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8) To start the operation, specify a maximum point - 1 for high-speed normal rotation jog or a maximum point -2 for high-speed reverse rotation jog and, after 10 ms has passed, connect the strobe signal input (STB: CN X5 Pin 24) to COM- (i.e., close the opened connection). * The maximum point number depends on a set value of SV.Pr57 (selection of number of input points). 2) Multi function input 1 and 2 (EX-IN1 and EX-IN2: CN X5 Pin 22 and 25) To start the operation, specify the high-speed normal rotation jog or high-speed reverse rotation jog by SV.Pr5A (multi function input 1 signal selection) or SV.Pr5C (multi function input 2 signal selection), input the multi function input 1 or 2 and, after 10 ms has passed, connect the strobe signal input (STB: CN X5 Pin 24) to COM– (i.e., close the opened connection).
(3)	Check of command execution	When the in-operation signal output (BUSY: CN X5 Pin 28) turns OFF, an operation becomes ready to be executed.
(4)	Stop of jog operation	When you make the strobe signal input (STB) open, an operation decelerates and stops. While the contact of the strobe signal input is closed, the jog operation continues.
(5)	Check of completion of operation command execution	Check the completion of operation command execution through the in-operation signal output (BUSY). When a transistor of the signal has returned from OFF into ON, this means that the operation has completed.
(6)	Check of current position output	Check an operation point executed by the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) after checking the operation command execution. The current position output (P1OUT to P32OUT) is updated within 10 ms after a transistor of the in-operation signal output (BUSY) has returned to ON.

* Positioning completion output/in-deceleration output (COIN/DCLON: CN X5 Pin 27)
In SV.Pr64 (output signal selection), you can select COIN or DCLON to be output. For the timing of tuning the transistor ON/OFF, refer to the diagram above.

• Parameters related to jog operation

Set the parameters below when performing the jog operation.

16.Pr* *	Description
40	Specify the speed of low-speed jog operation (0 to 6000 r/min). Use this parameter only when performing the jog operation from the console (optional). For details, refer to page 90.
41	Specify the speed of high-speed jog operation (0 to 6000 r/min). For the jog operation by point specifying or multi function input (refer to procedure (2) on page 112), specify the jog speed using this parameter.
42	Specify the acceleration for the jog operation. Available acceleration time is in a range between 0 and 3000 r/min.
43	Specify the S-shaped acceleration for the jog operation. Specify the S-shaped control time during acceleration time (0 to 1000 r/min). For details, refer to page 131.
44	Specify the deceleration for the jog operation. Available acceleration time is in a range between 3000 and 0 r/min.
45	Specify the S-shaped deceleration for the jog operation. Specify the S-shaped control time during deceleration time (0 to 1000 r/min). For details, refer to page 131.

Caution

1) If any of the set values of the parameters below is “0”, an operation trips due to undefined data error protection (error code No. 69) and stops according to an operation at alarm occurrence.
   - 16.Pr40 (Jog speed (low))
   - 16.Pr41 (Jog speed (high))
   - 16.Pr42 (Jog operation acceleration setting)
   - 16.Pr44 (Jog operation deceleration setting)
2) If the current position (–2147483647 to 2147483647) overflows when the jog operation is performed continuously in the same direction, an operation trips due to current position overflow error protection (error code No. 70) and stops according to an operation at alarm occurrence. This error can be disabled by 16.Pr51 (wrap around permission). In this case, however, an absolute position cannot be guaranteed. If you disable the wrap around, use the incremental operation only.
3) If the over-travel inhibit input is enabled in an operating direction during the jog operation after homing has completed, an operation trips due to over-travel inhibit detection error protection (error code No. 71) and stops according to an operation at alarm occurrence. In the SV.Pr55 (Over-travel inhibit input operation setting), you can specify whether or not to trip the deceleration operation. However, if the over-travel inhibit input in the operating direction is enabled during the jog operation before homing completes, an error does not occur although the motor complies with the deceleration pattern of SV.Pr55.
4) When the motor has exceeded a maximum travel specified by 32.Pr01 (Setting of maximum movement in plus direction) and 32.Pr02 (Setting of maximum movement in minus direction) during the jog operation after homing has completed, an operation stops due to maximum travel limit error protection (error code No. 72) and stops according to an operation at alarm occurrence. However, the maximum travel limit error protection does not work during the jog operation before homing completes.
5) For the jog operation by an external signal, high-speed normal rotation jog operation and high-speed reverse rotation jog operation only can be executed. (If the console is used, low-speed normal rotation jog operation and low-speed reverse rotation jog operation also can be performed.)
6) Even if you specify the high-speed normal rotation jog and high-speed reverse rotation jog in the multi function input (EX-IN1 and EX-IN2) and turn ON the strobe signal input (STB) when both of EX-IN1 and EX-IN2 turns ON, the motor does not work.
7) If the jog operation is stopped by a stop command (emergency stop, deceleration-and-stop or temporary stop), the current position output (P1OUT to P3OUT) is not updated.

Homing Operation

Homing Operation

To start a step operation after turning the power supply on, you need to execute the homing to detect a home position as the base. Homing must be completed in advance. According to your intended purpose, select one mode in the “Homing Mode List” below and execute it.
For A) below, homing is not required because the homing is completed when the power supply turns on.

A) Homing is completed when the power supply turns on

- “0” or “2” is set to SV.Pr0B (absolute encoder setting) using an absolute encoder or absolute external scale.
  When homing is executed for this setting, an absolute position corresponding to the hone position is stored in EEPROM of the driver. If the absolute position when homing has been executed last is set to the hone position, no homing is required.
  For details, refer to “Absolute System” on page 136.
- If “1” (homing not required) is set to 16.Pr38 (Homing skip)
  For this setting, set a motor position when the power supply turn on to “32.Pr00 (Home offset) set value”.

B) Homing is not completed

- After the power supply turns on, excluding the case A) above
  Execute the homing. Then, the homing is completed.
- When an alarm is given, excluding the case A) above
  If the setting (the case A) above) that the homing is required when the power supply turns on is not satisfied, the homing has not yet been completed when an alarm has been given.
  In this case, eliminate the cause of the alarm, clear the alarm and execute the homing. Then, the homing can be completed.
- When the homing starts
  The homing is not completed even if the homing starts. When the homing finishes normally, the homing is completed. If the homing is interrupted due to input of an operation stop (emergency stop, temporary stop or deceleration-and-stop), servo off, trip, etc., the homing is not completed. Retry the homing from the beginning.
- When the normal auto-tuning or frequency characteristics measurement is executed
  Even if the normal auto-tuning is executed by a console or “PANATERM®” or the frequency characteristics measurement is executed by “PANATERM®”, the homing is not completed. Execute the homing again. Otherwise, for the setting A) above, the homing can be completed by turning the power supply on again.

Homing Mode List

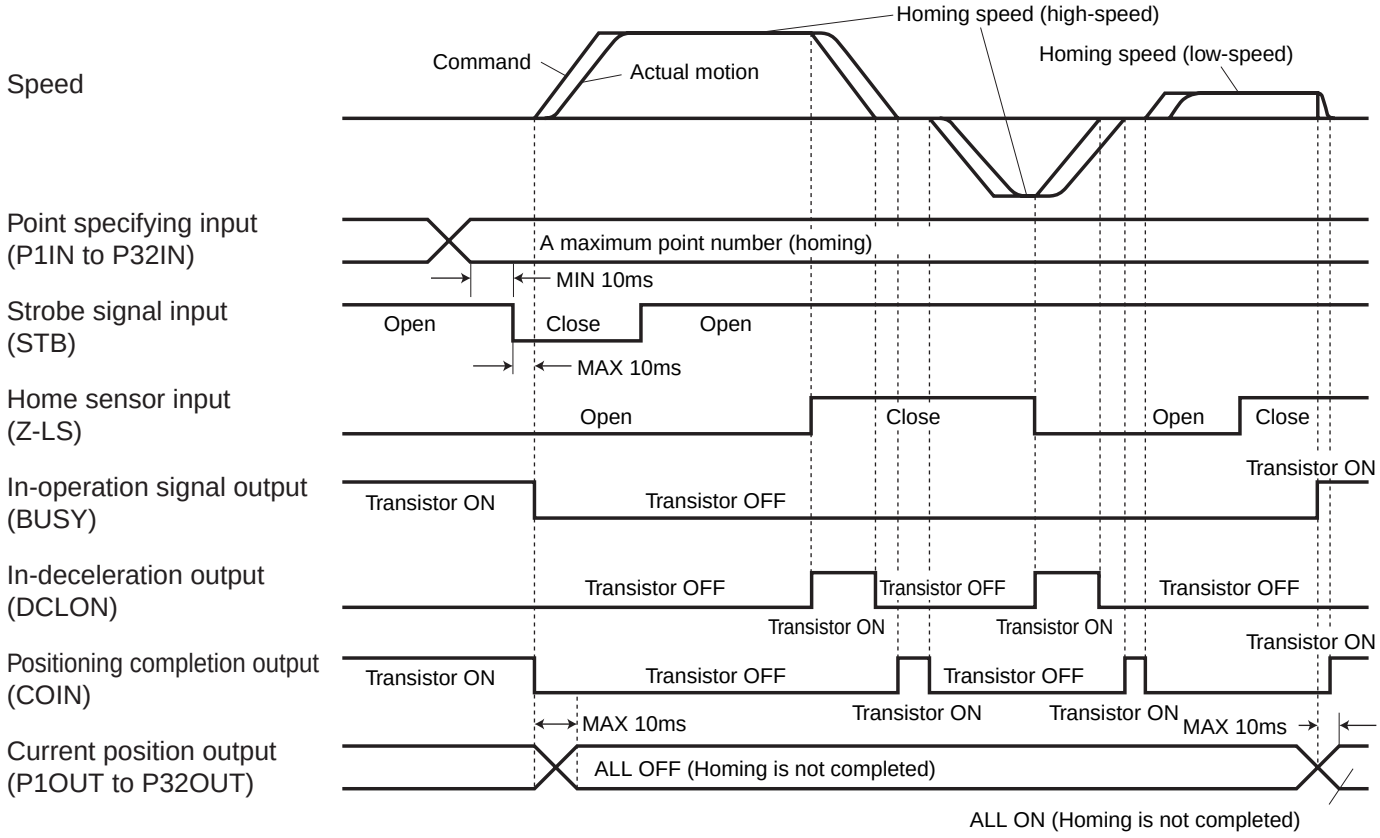
The table below lists the available homing modes selected by combining 16.Pr36 (Homing type) and control mode (SV.Pr02) with each other. For the details of each mode, refer to the relevant page (page 116 to page 123).

Operation	16-bit positioning parameter No. 36 (Homing type setting)	Positioning control	Full-closed control	Relevant page
Home sensor + Z phase (based on the front end)	0	○	×	P.116
Home sensor (based on the front end)	1	○	○	P.117
Home sensor + Z phase (based on the rear end)	2	○	×	P.118
Limit sensor + Z phase	3	○	×	P.120
Limit sensor	4	○	○	P.121
Z phase homing	5	○	×	P.122
Bumping homing	6	○	○	P.122
Data set	7	○	○	P.123

Caution

In the table above, “○” means “Available” and “×” means “Unavailable (error code No. 68 (homing error protection) is shown)”.

A chart of I/O signal timing during homing and an operating procedure are shown as an example of the case that 16.Pr36 (Homing type) is “0” (Home sensor + Z phase (based on the front end)). The same procedure is performed also in any other homing mode.



Procedure		Description
(1)	Setting of parameters related to homing operation	Specify 16.Pr30 (homing speed (high-speed)), 16.Pr31 (homing speed (low-speed)), 16.Pr33 (homing acceleration setting), 16.Pr34 (homing deceleration setting) and 16.Pr35 (homing direction setting).
(2)	Designation of point number	Specify a maximum point number depending on SV.Pr57 (selection of number of input points), using the point specifying input (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8).
(3)	Start of homing operation	By connecting (closing) the open strobe signal input (STB: CN X5 Pin 24) to COM– when 10 ms has passed after inputting the point specifying input (P1IN to P32IN), an operation starts according to a set value of a point number specified in procedure (3).
(4)	Check of operation command execution	Check whether a driver is executed by an operation command. If the driver is executed, open the strobe signal input (STB) again. If a transistor of the in-operation signal output (BUSY: CN X5 Pin 28) turns OFF, an operation is in the execution. Even if an operation completes when the strobe signal (STB) does not return to the OPEN state, the in-operation signal output (BUSY) remains OFF.
(5)	Check of completion of operation command execution	Check the completion of operation command execution with the in-operation signal output (BUSY). If a transistor of the signal returns from OFF to ON, the operation is completed.
(6)	Check of current position output	Check that the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) is “ALL ON” (homing has been completed) after checking the operation command execution. The current position output (P1OUT to P32OUT) is updated within 10 ms after a transistor of the in-operation signal output (BUSY) turns ON.

* Positioning completion output/in-deceleration output (COIN/DCLON: CN X5 Pin 27)
  In SV.Pr64 (output signal selection), you can select COIN or DCLON to be output. For the timing of tuning the transistor ON/OFF, refer to the diagram above.

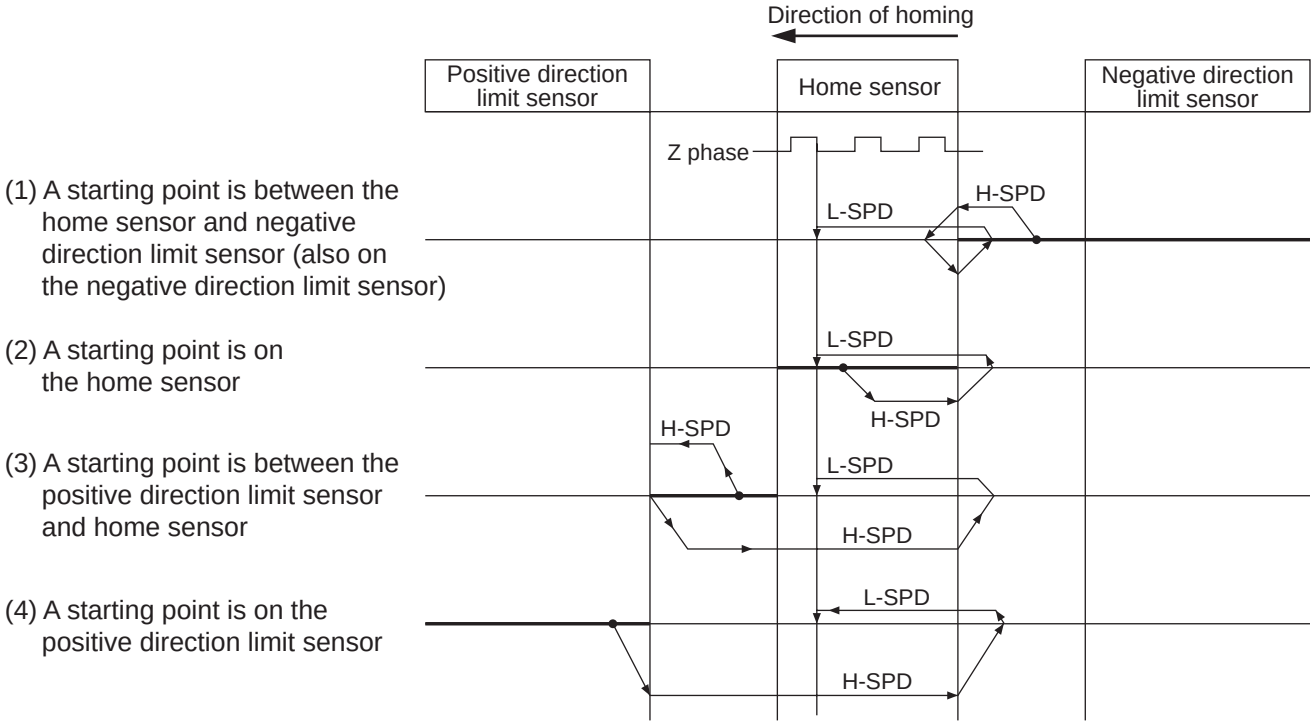
Caution

Because a command position and current position are preset at the instant when a home position has been detected, COIN turns ON momentarily and the motor overruns a little and returns. Then, COIN turns OFF/ON according to the positional deviation.

Homing Operation

Home Sensor + Z Phase (based on the front end)

Example: Z phase count = 3 at an operation in a positive direction



Detect the home sensor (at the front end) in a direction of homing by 16.Pr30 (Homing speed (high)), get out of the home sensor area once and detect the home sensor (at the front end) by 16.Pr31 (Homing speed (low)) again. After that, count the Z phase specified times by 16.Pr3B (Homing Z-phase count setting) and define that point as a home position.

• Parameters related to this operation

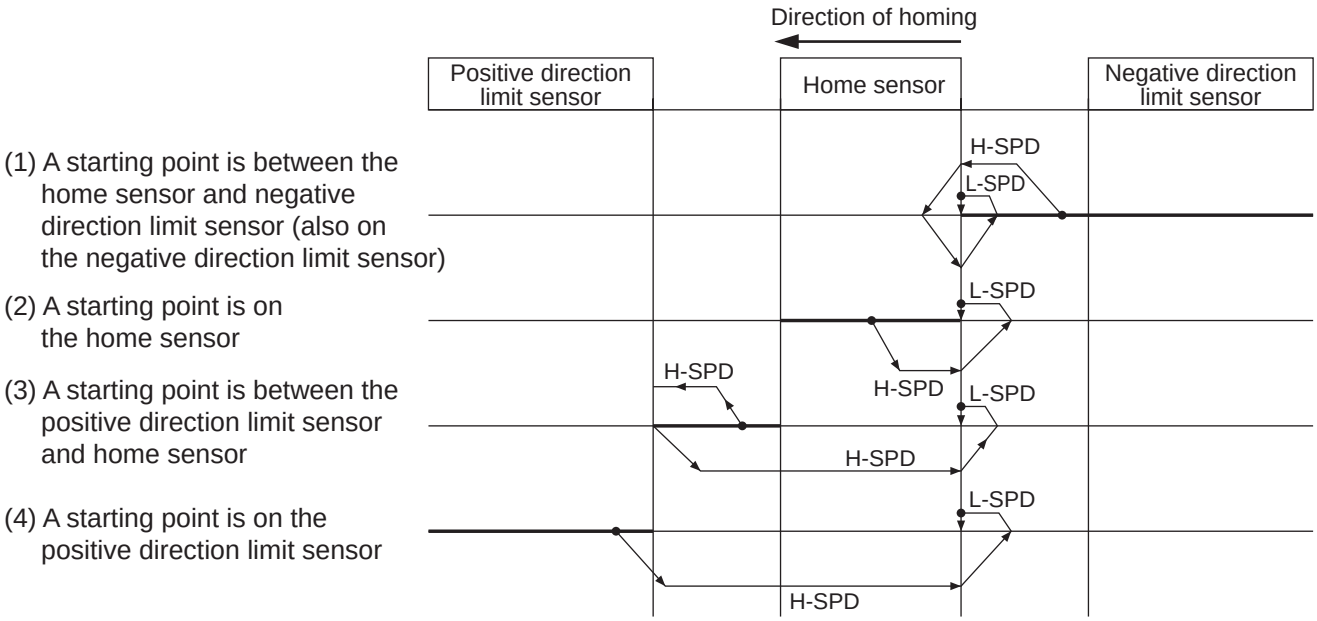
Parameter number		Description
16.Pr**	30	Specify the high speed for the homing operation (0 to 6000 r/min).
	31	Specify the low speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing operation in a range between 0 to 3000 r/min.
	34	Specify the deceleration for the homing operation in a range between 3000 to 0 r/min.
	35	Specify an operating direction for the homing. (0: positive direction, 1: negative direction)
	36	Specify a type of homing. ([0] : Home sensor + Z phase (based on the front end))
	37	Specify whether or not to perform the home offset operation. (0: Not perform, 1: Perform) For the home offset operation, refer to page 124.
	3B	Specify the Z phase that an operation stops. ([3] (the 3rd Z phase) in this example)
32.Pr**	01	Specify the home offset (–2147483647 to 2147483647 pulses). If the home offset is not required, specify “0”.

Caution

1) If any of the set values of the parameters below is “0”, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • 16.Pr30 (Homing speed (high))
   • 16.Pr31 (Homing speed (low))
   • 16.Pr33 (Homing acceleration setting)
   • 16.Pr34 (Homing deceleration setting)

2) Also, if the over-travel inhibit input is enabled in an operating direction under any of the conditions below during homing, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   - After the reversal due to detection of a limit sensor in a direction of homing, the change in the home sensor ON into OFF could not be detected and a limit sensor in the reverse direction, not in a direction of homing, has been detected.
   - A limit sensor in a traveling direction has been detected during detection of specified count of Z phase How to decelerate at the detection of a limit sensor depends on the settings of SV.Pr55 (Over-travel inhibit input operation setting). (For a set value = 0 or 2, deceleration-and-stop. For a set value = 1 or 3, stop in the deceleration time “0”.)
3) We would like to ask you to design so that a sensor signal does not vary (beyond the sensor signal width) when the motor is decelerating after it detects the home sensor or limit sensor.
4) We would like to ask you to design so that the Z phase of the motor does not turn on near the Z phase detection start position (L-SPD in the home sensor area in a figure shown at the previous page). The number of Z phase counts may vary. A position where the Z phase is counted specified times is defined as the home position, even if the position is out of the home sensor area during Z phase count.

Home Sensor (based on the front end)



Detect the home sensor (at the front end) in a direction of homing by 16.Pr30 (Homing speed (high)), get out of the home sensor area once, detect the home sensor (at the front end) by 16.Pr31 (Homing speed (low)) again and define that point as a home position.

• Parameters related to this operation

Parameter number		Description
16.Pr**	30	Specify the high speed for the homing operation (0 to 6000 r/min).
	31	Specify the low speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing operation in a range between 0 to 3000 r/min.
	34	Specify the deceleration for the homing operation in a range between 3000 to 0 r/min.
	35	Specify an operating direction for the homing. (0: positive direction, 1: negative direction)
	36	Specify a type of homing. ([1] : Home sensor (based on the front end))
	37	Specify whether or not to perform the home offset operation. (0: Not perform, 1: Perform) For the home offset operation, refer to page 124.
32.Pr**	01	Specify the home offset (–2147483647 to 2147483647 pulses). If the home offset is not required, specify “0”.

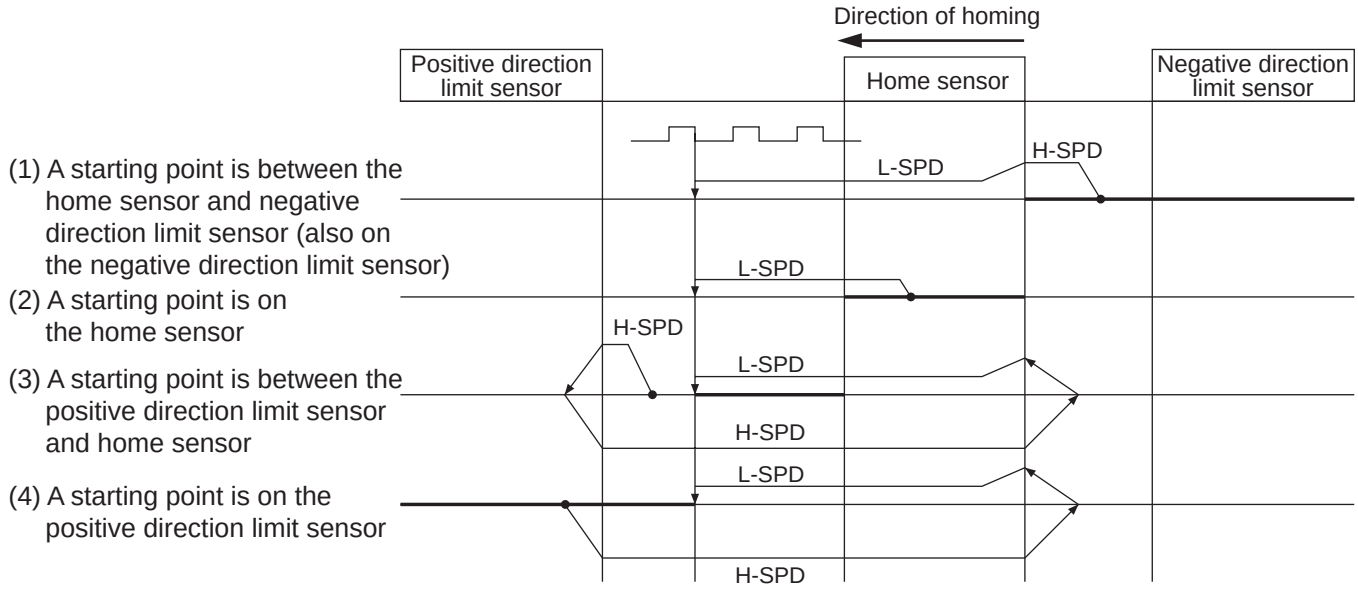
Homing Operation

Caution

1) If any of the set values of the parameters below is “0”, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   - 16.Pr30 (Homing speed (high))
   - 16.Pr31 (Homing speed (low))
   - 16.Pr33 (Homing acceleration setting)
   - 16.Pr34 (Homing deceleration setting)
2) Also, if the over-travel inhibit input is enabled in an operating direction under any of the conditions below during homing, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   - After the reversal due to detection of a limit sensor in a direction of homing, the change in the home sensor ON into OFF could not be detected and a limit sensor in the reverse direction, not in a direction of homing, has been detected.
     How to decelerate at the detection of a limit sensor depends on the settings of SV.Pr55 (Over-travel inhibit input operation setting). (For a set value = 0 or 2, deceleration-and-stop. For a set value = 1 or 3, stop in the deceleration time “0”.)
3) We would like to ask you to design so that a sensor signal does not vary (beyond the sensor signal width) when the motor is decelerating after it detects the home sensor or limit sensor.
4) In this system, delay time of a maximum of 2 ms is caused when detecting the home sensor (front end) at the • part and, therefore, the home position varies to the extent of a maximum of homing speed (low) multiplied by 2 (ms).

Home sensor + Z phase (based on the rear end)

Example: Z phase count = 3 at an operation in a positive direction



Detect the home sensor (at the front end) in a direction of homing by 16.Pr30 (Homing speed (high)), decelerate to 16.Pr31 (Homing speed (low)), detect the home sensor (at the rear end) turning off, count the Z phase specified times by 16.Pr3B (Homing Z phase count setting) and define that point as a home position.

• Parameters related to this operation

Parameter number		Description
16.Pr**	30	Specify the high speed for the homing operation (0 to 6000 r/min).
	31	Specify the low speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing operation in a range between 0 to 3000 r/min.
	34	Specify the deceleration for the homing operation in a range between 3000 to 0 r/min.
	35	Specify an operating direction for the homing. (0: positive direction, 1: negative direction)
	36	Specify a type of homing. ([2] : Home sensor + Z phase (based on the rear end))
	37	Specify whether or not to perform the home offset operation. (0: Not perform, 1: Perform) For the home offset operation, refer to page 124.
	3B	Specify the Z phase that an operation stops. ([3] (the 3rd Z phase) in this example)
32.Pr**	01	Specify the home offset (–2147483647 to 2147483647 pulses). If the home offset is not required, specify “0”.

Caution

1) If any of the set values of the parameters below is “0”, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • 16.Pr30 (Homing speed (high))
   • 16.Pr31 (Homing speed (low))
   • 16.Pr33 (Homing acceleration setting)
   • 16.Pr34 (Homing deceleration setting)
2) Also, if the over-travel inhibit input is enabled in an operating direction under any of the conditions below during homing, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • After the reversal due to detection of a limit sensor in a direction of homing, the change in the home sensor ON into OFF could not be detected and a limit sensor in the reverse direction, not in a direction of homing, has been detected.
   • A limit sensor in a traveling direction has been detected during detection of the home sensor at the rear end
   • A limit sensor in a traveling direction has been detected during detection of specified count of Z phase
   How to decelerate at the detection of a limit sensor depends on the settings of the servo parameter No. 55 (over-travel inhibit input operation setting). (For a set value = 0 or 2, deceleration-and-stop. For a set value = 1 or 3, stop in the deceleration time “0”.)
3) We would like to ask you to design so that a sensor signal does not vary (beyond the sensor signal width) when the motor is decelerating after it detects the home sensor or limit sensor.
4) We would like to ask you to design so that the Z phase of the motor does not turn on near the Z phase detection start position (L-SPD out of the home sensor area in a figure shown above). The number of Z phase counts may vary. A position where the Z phase is counted specified times is defined as the home position, even if the position is out of the home sensor area during Z phase count.

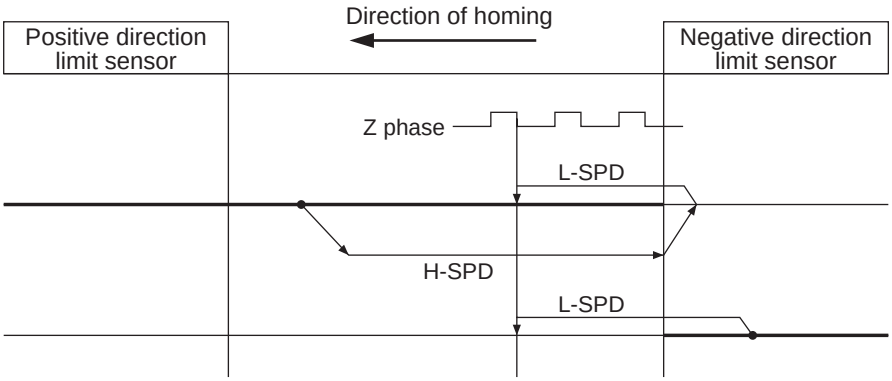
Homing Operation

Limit Sensor + Z phase

Example: Z phase count = 3 at an operation in a positive direction

(1) A starting point is at any place other than on the negative limit sensor

(2) A starting point is on the negative limit sensor



Detect the home sensor and the limit sensor in a reverse direction, not in a direction of homing, by 16.Pr30 (Homing speed (high)), decelerate, and stop. After that, detect the limit sensor turning off in a direction of homing by 16.Pr31 (Homing speed (low)), count the Z phase specified times by 16.Pr3B (homing Z phase count setting) and define that point as a home position.

• Parameters related to this operation

Parameter number		Description
16.Pr**	30	Specify the high speed for the homing operation (0 to 6000 r/min).
	31	Specify the low speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing operation in a range between 0 to 3000 r/min.
	34	Specify the deceleration for the homing operation in a range between 3000 to 0 r/min.
	35	Specify an operating direction for the homing. (0: positive direction, 1: negative direction)
	36	Specify a type of homing. ([3] : Limit sensor + Z phase)
	37	Specify whether or not to perform the home offset operation. (0: Not perform, 1: Perform) For the home offset operation, refer to page 124.
	3B	Specify the Z phase that an operation stops. ([3] (the 3rd Z phase) in this example)
32.Pr**	01	Specify the home offset (–2147483647 to 2147483647 pulses). If the home offset is not required, specify “0”.

Caution

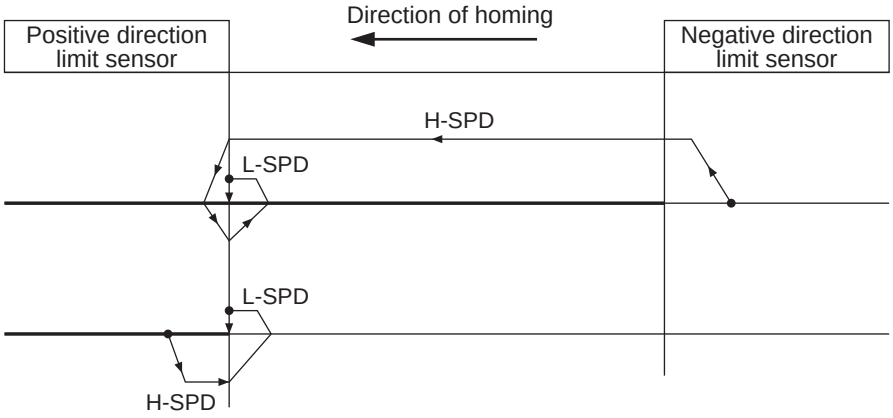
1) If any of the set values of the parameters below is “0”, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • 16.Pr30 (Homing speed (high))
   • 16.Pr31 (Homing speed (low))
   • 16.Pr33 (Homing acceleration setting)
   • 16.Pr34 (Homing deceleration setting)
2) Also, if the over-travel inhibit input is enabled in an operating direction under any of the conditions below during homing, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • A limit sensor in a traveling direction has been detected during detection of specified count of Z phase How to decelerate at the detection of a limit sensor depends on the settings of SV.Pr55 (Over-travel inhibit input operation setting). (For a set value = 0 or 2, deceleration-and-stop. For a set value = 1 or 3, stop in the deceleration time “0”.)
3) We would like to ask you to design so that a sensor signal does not vary (beyond the sensor signal width) when the motor is decelerating after it detects the limit sensor.
4) We would like to ask you to design so that the Z phase of the motor does not turn on near the Z phase detection start position (L-SPD out of the negative limit sensor area in a figure shown above). The number of Z phase counts may vary.

Limit Sensor

Example: An operation in a positive direction

(1) A starting point is at any place other than on the positive limit sensor

(2) A starting point is on the positive limit sensor



Detect the limit sensor in a direction of homing by 16.Pr30 (Homing speed (high)), decelerate and stop. After that, get out of the limit sensor area once, detect the limit sensor turning off by 16.Pr31 (Homing speed (low)) and define that point as a home position.

• Parameters related to this operation

Parameter number		Description
16.Pr**	30	Specify the high speed for the homing operation (0 to 6000 r/min).
	31	Specify the low speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing operation in a range between 0 to 3000 r/min.
	34	Specify the deceleration for the homing operation in a range between 3000 to 0 r/min.
	35	Specify an operating direction for the homing. (0: positive direction, 1: negative direction)
	36	Specify a type of homing. ([4] : Limit sensor)
	37	Specify whether or not to perform the home offset operation. (0: Not perform, 1: Perform) For the home offset operation, refer to page 124.
32.Pr**	01	Specify the home offset (–2147483647 to 2147483647 pulses). If the home offset is not required, specify “0”.

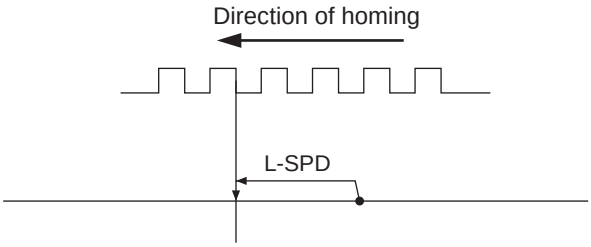
Caution

1) If any of the set values of the parameters below is “0”, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • 16.Pr30 (Homing speed (high))
   • 16.Pr31 (Homing speed (low))
   • 16.Pr33 (Homing acceleration setting)
   • 16.Pr34 (Homing deceleration setting)
2) Also, if the over-travel inhibit input is enabled in an operating direction under any of the conditions below during homing, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • After the reversal due to detection of a limit sensor in a direction of homing, a limit sensor in the reverse direction, not in a direction of homing, has been detected.
   How to decelerate at the detection of a limit sensor depends on the settings of SV.Pr55 (Over-travel inhibit input operation setting). (For a set value = 0 or 2, deceleration-and-stop. For a set value = 1 or 3, stop in the deceleration time “0”.)
3) We would like to ask you to design so that a sensor signal does not vary (beyond the sensor signal width) when the motor is decelerating after it detects the limit sensor.
4) In this system, delay time of a maximum of 2 ms is caused when detecting the limit sensor at the • part and, therefore, the home position varies to the extent of a maximum of homing speed (low) multiplied by 2 (ms).

Homing Operation

Z Phase Homing

Example: Z phase count = 3 at an operation in a positive direction



Count the Z phase specified times by 16.Pr3B (homing Z phase count setting) while moving in a direction of homing according to 16.Pr31 (Homing speed (low)) and define that point as a home position.

• Parameters related to this operation

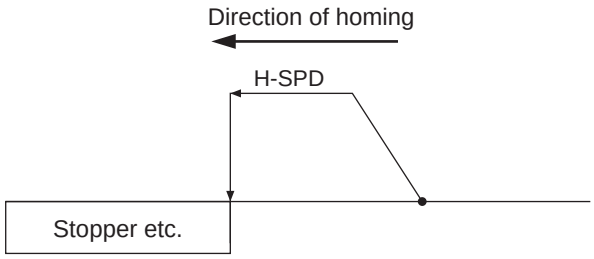
Parameter number		Description
16.Pr**	31	Specify the low speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing operation in a range between 0 to 3000 r/min.
	34	Specify the deceleration for the homing operation in a range between 3000 to 0 r/min.
	35	Specify an operating direction for the homing. (0: positive direction, 1: negative direction)
	36	Specify a type of homing. ([5] : Z phase homing)
	37	Specify whether or not to perform the home offset operation. (0: Not perform, 1: Perform) For the home offset operation, refer to page 124.
	3B	Specify the Z phase that an operation stops. ([3] (the 3rd Z phase) in this example)
32.Pr**	01	Specify the home offset (–2147483647 to 2147483647 pulses). If the home offset is not required, specify “0”.

Caution

1) If any of the set values of the parameters below is “0”, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   - 16.Pr31 (Homing speed (low))
   - 16.Pr33 (Homing acceleration setting)
   - 16.Pr34 (Homing deceleration setting)
2) Also, if the over-travel inhibit input is enabled in an operating direction under any of the conditions below during homing, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   - A limit sensor in a traveling direction has been detected during detection of specified count of Z phase How to decelerate at the detection of a limit sensor depends on the settings of SV.Pr55 (Over-travel inhibit input operation setting). (For a set value = 0 or 2, deceleration-and-stop. For a set value = 1 or 3, stop in the deceleration time “0”.)
3) If a start position of homing is near the Z phase output position, the number of Z phase counts may vary.

Bumping Homing

Example: An operation in a positive direction



The motor moves in a direction of homing according to 16.Pr30 (Homing speed (high)). During the homing, the motor output torque limit becomes 16.Pr3A (Torque limit for bumping homing). When the state the motor output torque is limited by the hit & stop torque limit has been kept for a period specified by 16.Pr39 (Bumping detection time), define that point as a home position

• Parameters related to this operation

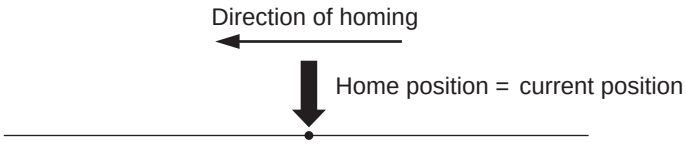
Parameter number		Description
16.Pr**	30	Specify the high speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing operation in a range between 0 to 3000 r/min.
	34	Specify the deceleration for the homing operation in a range between 3000 to 0 r/min.
	35	Specify an operating direction for the homing. (0: positive direction, 1: negative direction)
	36	Specify a type of homing. ([6] : Bumping Homing)
	37	Specify whether or not to perform the home offset operation. (0: Not perform, 1: Perform) For the home offset operation, refer to page 124.
	39	Specify the bumping detection time (0 to 10000 ms).
	3A	Specify the torque limit for the bumping homing (0 to 100%).
32.Pr**	01	Specify the home offset (–2147483647 to 2147483647 pulses). If the home offset is not required, specify “0”.

Caution

1) If any of the set values of the parameters below is “0”, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • 16.Pr30 (Homing speed (high))
   • 16.Pr33 (Homing acceleration setting)
   • 16.Pr34 (Homing deceleration setting)
2) Also, if the over-travel inhibit input is enabled in an operating direction under any of the conditions below during homing, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • A limit sensor has turned on at the startup.
   • A limit sensor in a traveling direction has been detected during detection of bumping.
   How to decelerate at the detection of a limit sensor depends on the settings of SV.Pr55 (Over-travel inhibit input operation setting). (For a set value = 0 or 2, deceleration-and-stop. For a set value = 1 or 3, stop in the deceleration time “0”.)
3) If a set value of 16.Pr39 (Bumping detection time) and 16.Pr3A (Torque limit for bumping homing) is small, the bumping may not be detected exactly.

Data Set

Example:



A current position is defined as a home position. If the motor is moved to any position by JOG and homing of data set system is executed, that place is defined as a home position and the homing is completed.

• Parameters related to this operation

Parameter number		Description
16.Pr**	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing operation in a range between 0 to 3000 r/min. (This is required only when performing an offset operation.)
	34	Specify the deceleration for the homing operation in a range between 3000 to 0 r/min. (This is required only when performing an offset operation.)
	36	Specify a type of homing. ([7] : Data set)
	37	Specify whether or not to perform the home offset operation. (0: Not perform, 1: Perform) For the home offset operation, refer to page 124.
32.Pr**	01	Specify the home offset (–2147483647 to 2147483647 pulses). If the home offset is not required, specify “0”.

Homing Operation

Homing Offset Operation

The home offset at the completion of homing can be specified by 32.Pr00 (Home offset). Specify the travel from a machine home position (homing completion position) to the “0” position as the home offset.

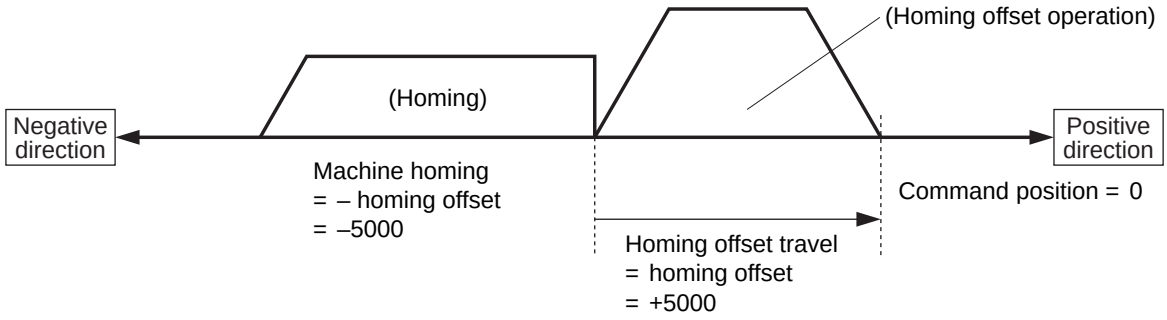
- 16.Pr37 (Home complete type) is set to “0”
  The motor stops at the machine home position when the homing has completed and, at the same time, a command position is set to [- home offset] .
- 16.Pr37 (Home complete type) is set to “1”
  After the motor stops at a machine home position, preset a command position = [- home offset] . Then, perform a step operation for the home offset at a speed specified by 16.Pr32 (Homing offset speed). In this case, the command position after the home offset operation completes becomes “0”

Caution

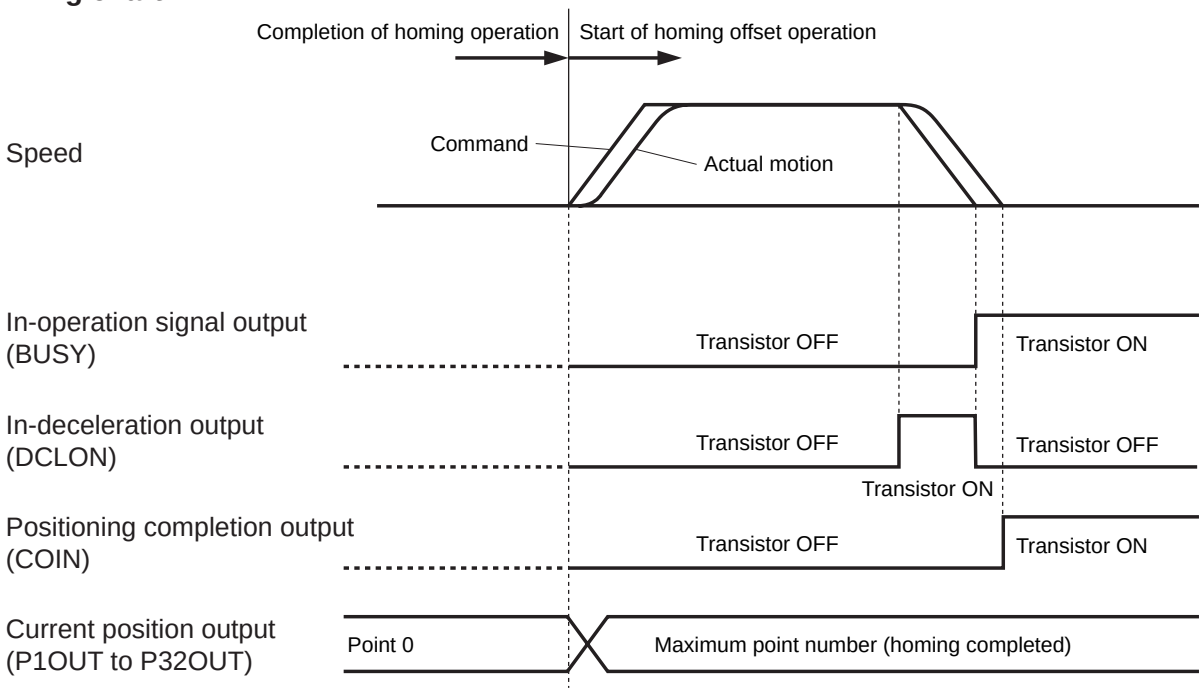
1) If 16.Pr32 (Homing offset speed), 16.Pr33 (Homing acceleration setting) and 16.Pr34 (Homing deceleration setting) are “0”, an operation trips due to the error code No. 69 (undefined data error protection) and stops according to an operation at alarm occurrence.
2) Do not set [- home offset] out of a maximum travel limit range. The error code No. 72 (maximum travel limit error protection) may be shown.
3) Set the home offset appropriately so that a position of [command position = 0] is not in the over-travel inhibit input range. The home offset may not be completed.

*** Example of homing offset**

• Homing offset is set to “ +5000”

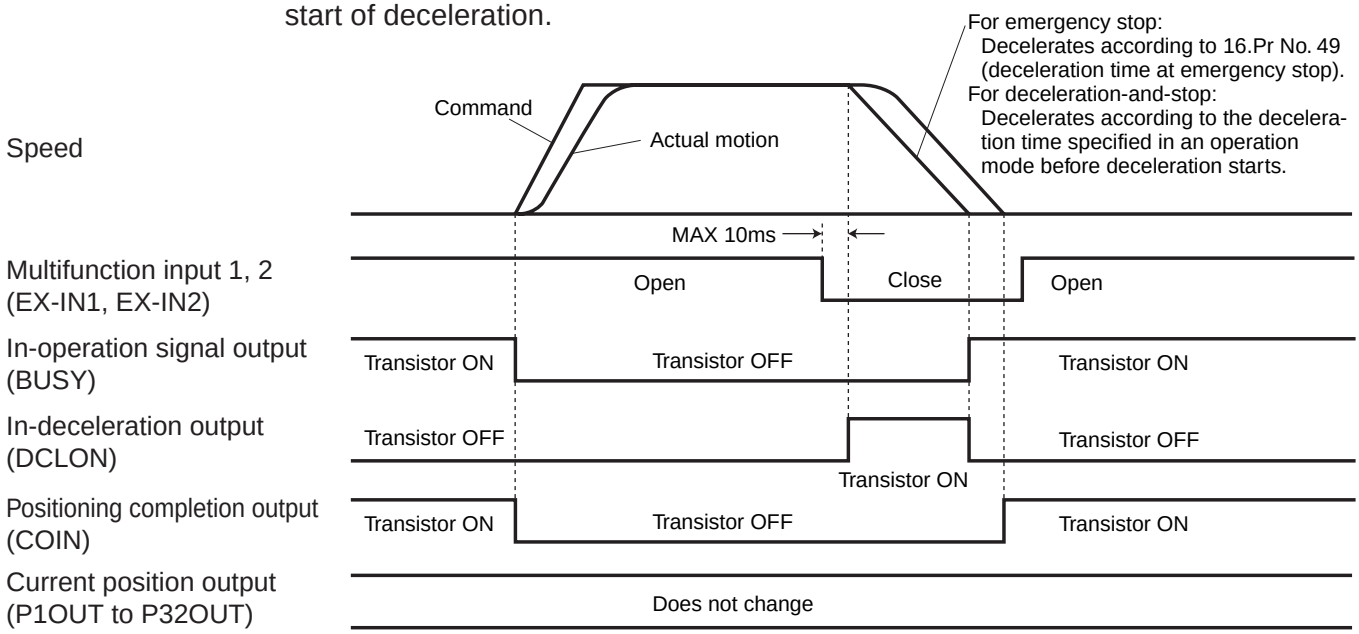


• Timing chart



Emergency Stop Operation/Deceleration-and-Stop Operation

An active operation can be interrupted and canceled.
Emergency stop : An operation stops in a deceleration time specified by a special parameter.
Deceleration-and-stop : An operation stops in a deceleration time specified in an operation mode before the start of deceleration.



Procedure		Description
(1)	Assignment of emergency stop/deceleration-and-stop	Assign the emergency stop or deceleration-and-stop to the multifunction input 1 (EX-IN1: CN X5 Pin 22) or multifunction input 2 (EX-IN2: CN X5 Pin 25) by SV.Pr5A (multi function input 1 signal selection) or SV.Pr5C (multi function input 2 signal selection).
(2)	Start of emergency stop/deceleration-and-stop	By connecting (closing) the open multi function input 1/2, to which the emergency stop or deceleration-and-stop is assigned, into COM– when the motor is running, an active operation is canceled and a stop operation starts. The signal logic can be changed by SV.Pr59 (multi function input 1 signal logic) or SV.Pr5B (multi function input 2 signal logic). • For emergency stop: An operation decelerates according to 16.Pr49 (deceleration time at emergency stop). If a set value is "0", an operation stop in the deceleration time "0". • For deceleration-and-stop: An operation stops in a deceleration time specified in an operation mode at the start of deceleration.
(3)	Stop confirmation	When a stop operation has completed, a transistor of the in-operation signal output (BUSY: CN X5 Pin 28) turns ON again. Then, the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) keeps the state before the deceleration.

* Positioning completion output/in-deceleration output (COIN/DCLON: CN X5 Pin 27)
In SV.Pr64 (output signal selection), you can select COIN or DCLON to be output. For the timing of turning the transistor ON/OFF, refer to the diagram above.

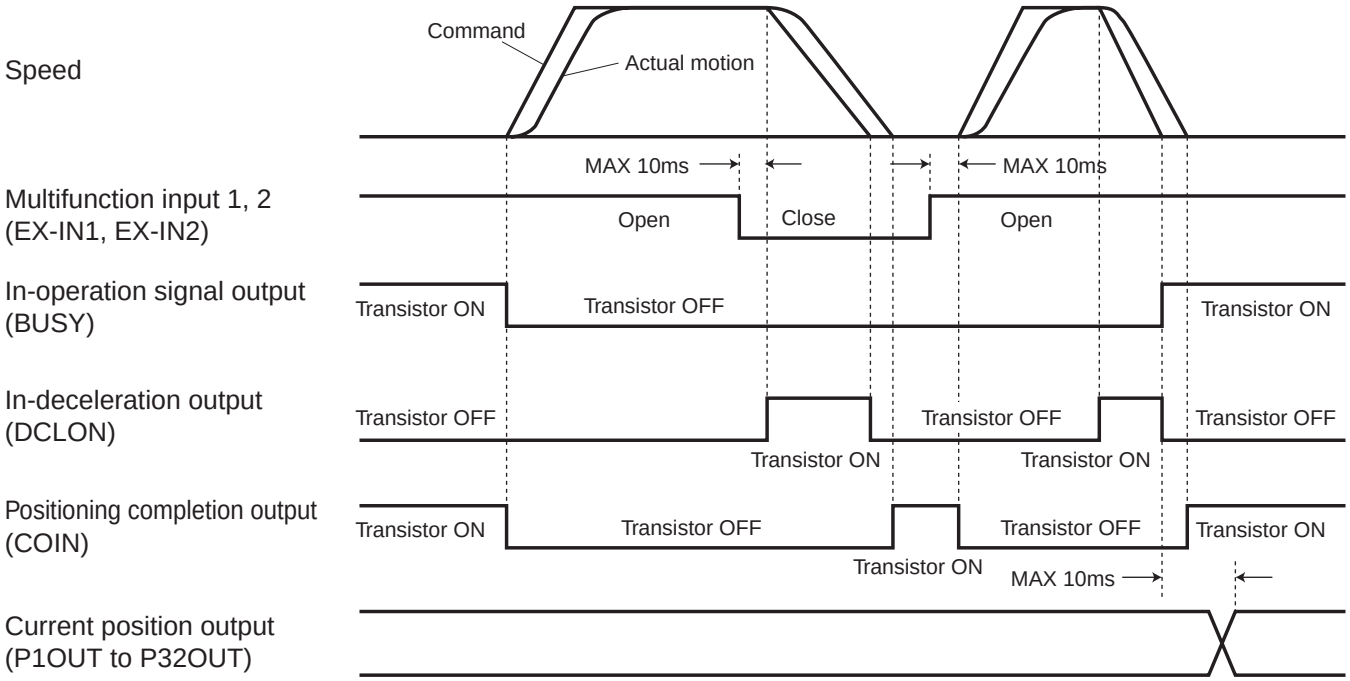
Caution

1) Even if the multifunction input 1/2 (EX-IN1/EX-IN2) is returned to the OPEN state, the deceleration is not canceled and the stop operation continues. Return the multi function input to the previous state after the emergency stop or deceleration-and-stop, specify a point just like as a normal step operation and connect (close) the open strobe signal input (STB: CN X5 Pin 24) to COM–. Then, movement to the point starts.
2) When you input a stop signal during a homing operation, retry the homing operation from the beginning.
3) If the emergency stop and deceleration-and-stop are assigned to the multifunction input 1 and 2 (EX-IN1 and EX-IN2), respectively, and those are input simultaneously, the higher priority is given to the emergency stop.
4) If the emergency stop is input during deceleration by the deceleration-and-stop, an operation stops in the deceleration time "0".
5) When the emergency stop or deceleration-and-stop is input, the start of step operation, jog operation and homing operation (strobe signal input (STB) ON) is ignored.

Temporary Stop Operation

Temporary Stop Operation

An active operation can be stopped temporarily and restarted.



Procedure		Description
(1)	Assignment of temporary stop	Assign the temporary stop to the multi function input 1 (EX-IN1: CN X5 Pin 22) or multi function input 2 (EX-IN2: CN X5 Pin 25) by SV.Pr5A (multi function input 1 signal selection) or SV.Pr5C (multi function input 2 signal selection).
(2)	Start of temporary stop	By connecting (closing) the open multi function input 1 or multi function input 2, to which the temporary stop is assigned, into COM- when the motor is running, an active operation is stopped temporarily. Then, the deceleration operation complies with the settings specified in an operation mode at the start of deceleration.
(3)	Check of stop by temporary stop	Even if the stop operation is completed, a transistor of the in-operation signal output (BUSY: CN X5 Pin 28) remains OFF. Therefore, if the stop must be checked, check it with the positioning completion output (COIN: CN X5 Pin 27).
(4)	Cancellation of temporary stop and restart of operation	An operation can be restarted by opening again the multi function input 1 or multi function input 2 to which the temporary stop is assigned. After the restart, check the completion of operation etc. in the same procedure as a step operation.

* Positioning completion output/in-deceleration output (COIN/DCLON: CN X5 Pin 27)
In SV.Pr64 (output signal selection), you can select COIN or DCLON to be output. For the timing of tuning the transistor ON/OFF, refer to the diagram above.

Caution

1) The temporary stop operation is enabled only for the step operation. The temporary stop operation works like the deceleration-and-stop for the jog operation and homing operation and any operation before the temporary operation is canceled.
2) When you input a temporary stop signal during a homing operation, retry the homing operation from the beginning.
3) If the emergency stop or deceleration-and-stop is input during the temporary stop, the temporary stop is terminated forcibly. An operation cannot be restarted even if the input of the temporary stop is canceled.
4) If the emergency stop is input during deceleration by the temporary stop, an operation stops in the deceleration time “0”.
5) If the temporary stop is input and the temporary stop is canceled during the motor deceleration, an operation stops once and then restarts.
6) If the temporary stop is input at the start of step operation command, the step operation is held although the command is accepted. After that, the step operation which was held starts when the temporary stop has been canceled. The start (strobe signal input (STB) ON) of the jog operation/homing operation in temporary stop is ignored.

Block Operation

Overview of Block Operation

This servo driver can perform the two types of block operations, i.e., continuous block operation and combined block operation. These operations can be switched by 16.Pr54 (block operation type setting).

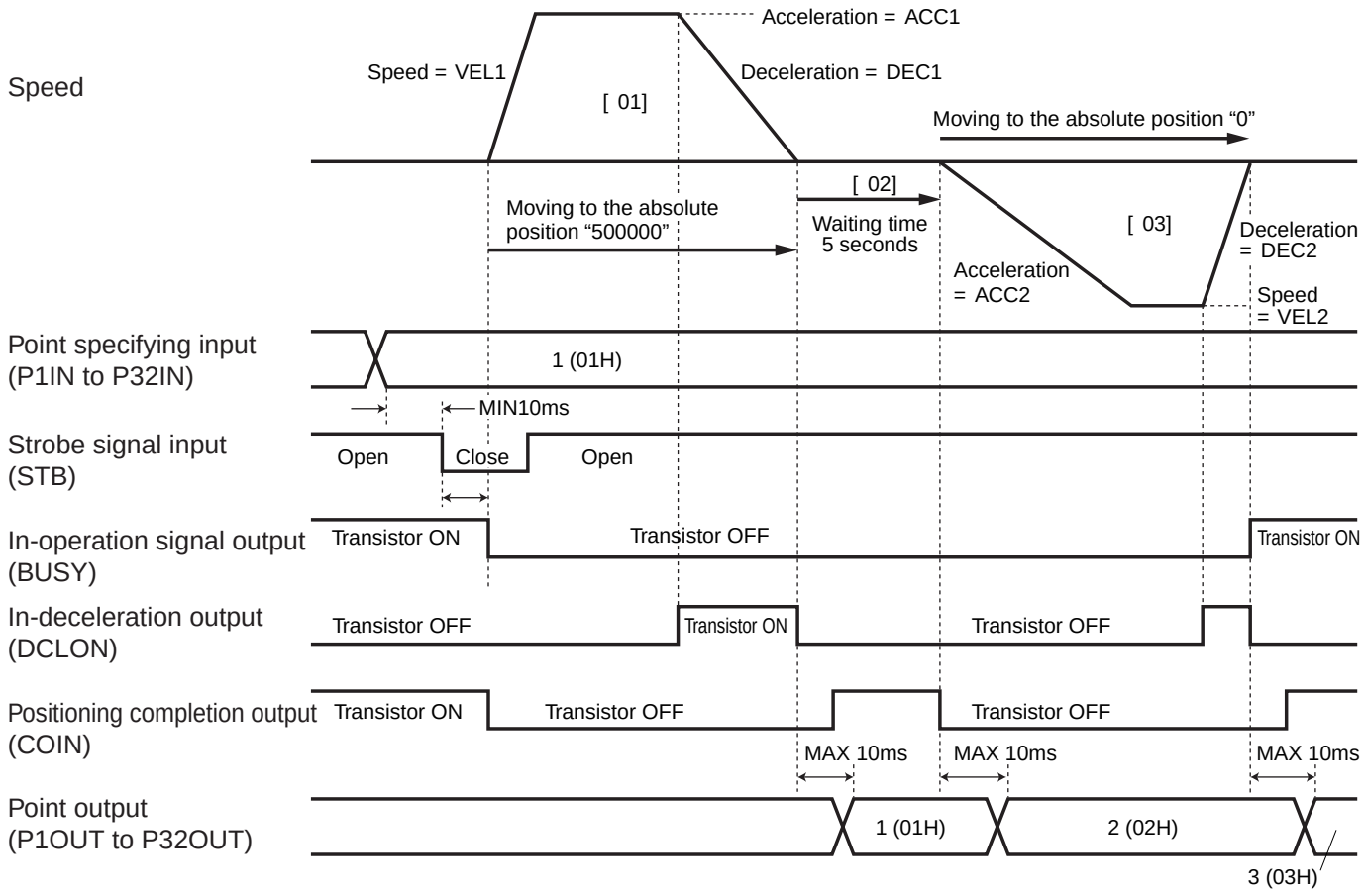
Continuous block operation : Several step operations can be performed continuously. Once an operation starts, the operation continues to a specified point number.

Combined block operation : A step operation is performed according to combined several point numbers. This is useful when you want to change the speed during a step operation.

16.Pr54 (block operation type setting)	Description
0	Continuous block operation
1	Combined block operation

Continuous Block Operation

If 16.Pr54 (block operation type setting) is “0” (continuous block operation) and the block setting of the point number specified by point specifying input (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8) is “Block”, the step operation is performed continuously in order from the specified point number to the block number of “Single” block setting.



Continuous block operation procedure (example)

1. Set a 16-bit positioning parameter and step parameter. (Refer to “Parameters Used in this Operation Example” on page 128.)
2. Execute the homing. (Refer to “Homing Operation” on page 114.)
3. Specify the point 1 when the servo turns on and input the strobe signal input (STB: CN X5 Pin 24). Then, an operation is performed continuously, e.g., [01] -> [02] [03] .

Block Operation

• **Parameters Used in this Operation Example**

16-bit positioning parameter

16.Pr**□	Symbol in diagram□	Description□
54	–	Specify a type of block operation. ([0] for the continuous block operation)
01	VEL1	Specify the first speed (0 to 6000 r/min)
02	VEL2	Specify the second speed (0 to 6000 r/min)
10	ACC1	Specify the first acceleration speed (0 to 10000 ms) Specify in the acceleration speed in a range between 0 and 3000 r/min.
14	ACC2	Specify the second acceleration speed (0 to 10000 ms) Specify in the acceleration speed in a range between 0 and 3000 r/min.
12	DEC1	Specify the first deceleration speed (0 to 10000 ms) Specify in the deceleration speed in a range between 3000 and 0 r/min.
16	DEC2	Specify the second deceleration speed (0 to 10000 ms) Specify in the deceleration speed in a range between 3000 and 0 r/min.

Step parameter

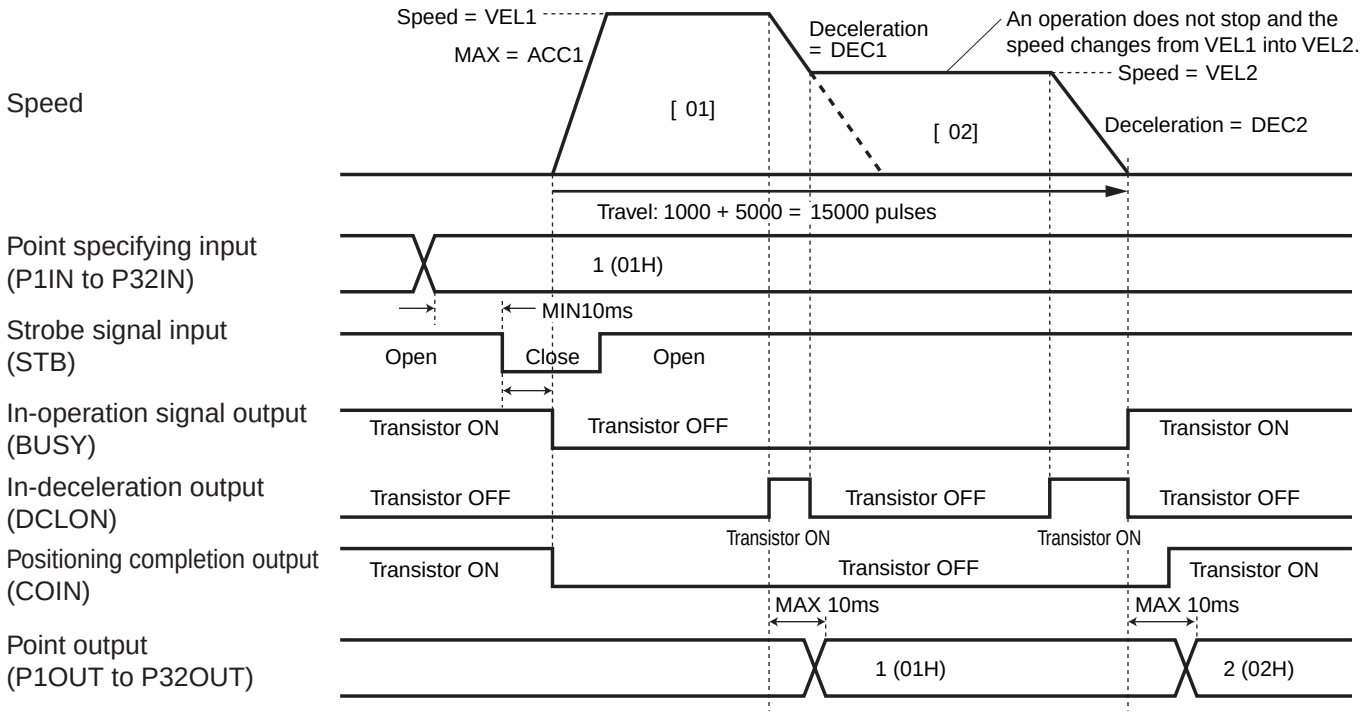
ST.Pr**	Operation mode	Position/Waiting time	Speed	Acceleration	Deceleration	Block
01	Absolute operation (Absolute)	500000	VEL1	ACC1	DEC1	Block
02	Dwell timer operation (Dwell time)	500	VEL1	ACC1	DEC1	Block
03	Absolute operation (Absolute)	0	VEL2	ACC2	DEC2	Single

Caution

1) A maximum point number (specified by the settings of SV.Pr57 (selection of number of input points)) is treated as the “Single” operation, regardless of the block setting.
2) The change into the last point number (point “10” in this example) of the in-operation signal output (BUSY: CN X5 Pin 28) and the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) is made only when the last step operation of the continuous block operation has completed and the strobe signal input (STB: CN X5 Pin 24) is in the OPEN state. Be sure to make the strobe signal input (STB) open after the in-operation signal output (BUSY) turns OFF.

Combined Block Operation

If the block setting of a point number specified by the point specifying input (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8) is “Block” when 16.Pr54 (block operation type setting) is “1” (combined block operation), the operation which consists of combined step operations from a specified point number to the “Single” point number specified by the block setting.



Combined block operation procedure (example)

1. Set a 16-bit positioning parameter and step parameter. (Refer to “Parameters Used in this Operation Example” below.)
2. Execute the homing. (Refer to “Homing Operation” on page 114.)
3. Specify the point 1 when the servo turns on and input the strobe signal input (STB: CN X5 Pin 24). Then, an operation is performed without stopping, e.g., [01] >–[02] .

• **Parameters Used in this Operation Example**

16-bit positioning parameter

16.Pr**□	Symbol in diagram□	Description□
54	–	Specify a type of block operation. ([1] for the combined block operation)
01	VEL1	Specify the first speed. (0 to 6000 r/min)
02	VEL2	Specify the second speed. (0 to 6000 r/min)
10	ACC1	Specify the acceleration speed. (0 to 10000 ms) Specify in the acceleration speed in a range between 0 and 3000 r/min. The acceleration speed at the combined points must be all the same.
12	DEC1	Specify the deceleration speed. (0 to 10000 ms) Specify in the deceleration speed in a range between 3000 and 0 r/min. The deceleration speed at the combined points must be all the same.

Step parameter

ST.Pr**	Operation mode	Position/Waiting time	Speed	Acceleration	Deceleration	Block
01	Incremental operation (Incremental)	10000	VEL1	ACC1	DEC1	Block
02	Incremental operation (Incremental)	5000	VEL2	ACC1	DEC1	Single

Caution

1) A combined operation up to a maximum point number (specified by the settings of SV.Pr57 (selection of number of input points)) available as a step operation can be performed. However, the maximum point number is treated as the “Single” operation, regardless of the block setting.
2) If the block setting of the next point number is “Dwell time”, an operation works like the continuous block operation (refer to page 127).
3) Do not specify “Rotary” as an operation mode. The combined block operation is unavailable in the rotary axis operation.
4) During the combined block operation, the linear acceleration/deceleration only is enabled and the S-shaped acceleration/deceleration is ignored. The deceleration speed at the combined points must be all the same.
5) If a step operation in a reverse traveling direction is defined as a combined block operation by the “Block” designation, the motor moves to the first point by step, stops once, moves back and then starts an operation to the next point.
6) The change into the last point number (point “10” in this example) of the in-operation signal output (BUSY: CN X5 Pin 28) and the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) is made only when the last step operation of the combined block operation has completed and the strobe signal input (STB: CN X5 Pin 24) is in the OPEN state. Be sure to make the strobe signal input (STB) open after the in-operation signal output (BUSY) turns OFF.

Sequential Operation

Sequential Operation

The sequential operation can be performed by setting 16.Pr52 (sequential operation setting) to “1”. When the sequential operation is set, execute a step operation by incrementing a point number by 1 at every inputting the strobe signal input (STB: CN X5 Pin 24) when the servo turns on, not using the point specifying input (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8).

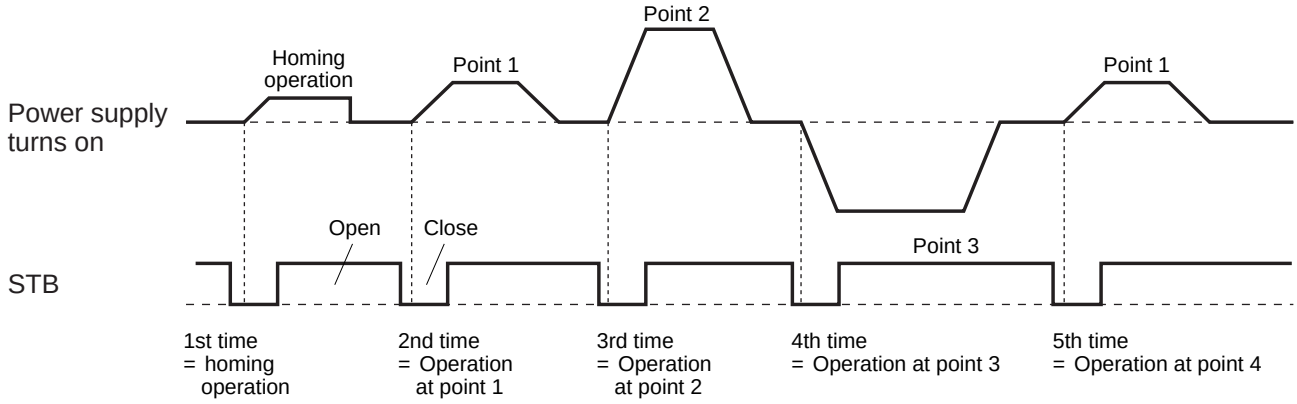
• Homing operation at sequential operation

1) 16.Pr38 (homing disabling setting) is “0” (homing required) and an operation mode is not the absolute mode (SV.Pr0B (absolute encoder setting) is “1”).
   => Homing is executed by the first strobe signal input (STB) after the power supply turns on. A sequential operation is performed beginning with the point 1 after the next strobe signal.
2) 16.Pr38 (homing disabling setting) is “1” (homing not required) and an operation mode is the absolute mode (SV.Pr0B (absolute encoder setting) is “0” or “2”).
   => A sequential operation is performed beginning with the point 1 when the first strobe signal is input, because homing is not required.

A maximum point number of the sequential operation can be set by 16.Pr53 (a maximum point number of sequential operation). After a step operation of the maximum point number is executed, the operation returns to the point 1. In the sequential operation, the maximum point number can be specified in a range between 1 and 60, because the setting of SV.Pr57 (selection of number of input points) is disabled.

Example of Operation

16.Pr52 (sequential operation setting) = 1 (enabled)
16.Pr53 (a maximum point number of sequential operation) = 3



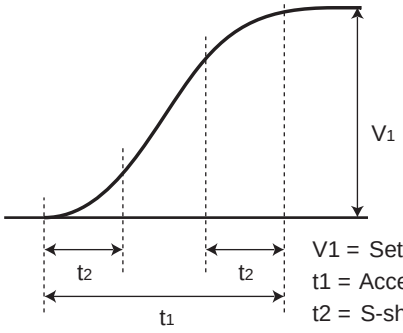
Procedure		Description
(1)	Setting of parameter	Set 16.Pr52 (sequential operation setting) to “1” and necessary positioning parameters to 16.Pr53 (a maximum point number of sequential operation), “homing operation” and “step operation”.
(2)	Power reset	Turn the servo on after the power supply turns on again.
(3)	Execution of homing operation	Close the first open strobe signal input (STB). Then, homing is executed.
(4)	Designation of operation point number	After that, an operation is performed in order at every inputting the strobe signal input (STB), e.g., point 1 -> point 2 -> point 3 -> point 1 -> point 2 -> ...

Caution

1) When setting the sequential operation, an operation command (step operation, homing, jog operation or Alarm Clear) cannot be executed by the point specifying input (P1IN to P32IN). However, the Alarm Clear can be specified by assignment of the multifunction input 1/2 (EX-IN1/EX-IN2: CN X5 Pin 22/25).
2) A block operation is unavailable when the sequential operation is set.

S-shaped Acceleration/Deceleration Function

This servo driver can perform the S-shaped acceleration/deceleration at the acceleration/deceleration. Set the S-shaped acceleration/deceleration in the time to reach the acceleration at the linear acceleration/deceleration in 16-bit positioning parameter “Positioning S-shaped acceleration/deceleration setting 1st to 4th” and “S-shaped acceleration/deceleration at jog operation”.

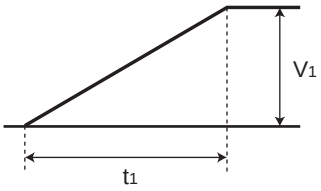


V1 = Set speed (16.Pr00)
t1 = Acceleration time
t2 = S-shaped acceleration time (16.Pr11)

16-bit positioning parameter “Positioning S-shaped acceleration/deceleration setting 1st to 4th” is for input of a value of acceleration time in a range between 0 and 3000 r/min. So, specify as shown below.

<Note>
The examples 1 to 3 below explain the acceleration and apply also to the deceleration.

Example 1:
Linear acceleration (t2 = 0)

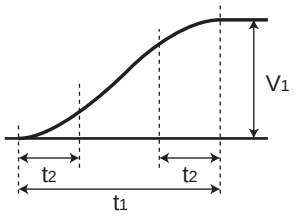


In order to set: V_1 = 2000r/min, t_1 = 100ms

$$16.Pr10 = t_1 \times \frac{3000}{V_1}$$
$$= 100ms \times \frac{3000}{2000}$$
$$= 150ms$$

16.Pr00	1st speed	2000
16.Pr10	1st acceleration	150
16.Pr11	1st S-shaped acceleration	0

Example 2:
S-shaped section less than 50% ($t2 < \frac{t_1}{2}$)

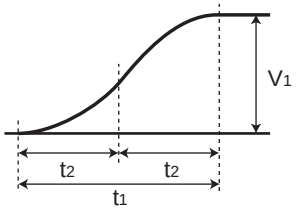


In order to set: V_1 = 2000r/min, t_1 = 100ms, t_2 = 30ms

$$16.Pr10 = (t_1 - t_2) \times \frac{3000}{V_1}$$
$$= 70ms \times \frac{3000}{2000}$$
$$= 105ms$$

16.Pr00	1st speed	2000
16.Pr10	1st acceleration	105
16.Pr11	1st S-shaped acceleration	30

Example 3:
S-shaped section 50% ($t2 = \frac{t_1}{2}$)



In order to set: V_1 = 2000r/min, t_1 = 100ms, t_2 = 50ms

$$16.Pr10 = (t_1 - t_2) \times \frac{3000}{V_1}$$
$$= 50ms \times \frac{3000}{2000}$$
$$= 75ms$$

16.Pr00	1st speed	2000
16.Pr10	1st acceleration	75
16.Pr11	1st S-shaped acceleration	50

Caution

1) Change during a motor step operation applies at the next step operation.
2) When a combined block operation is used (16.Pr54 (Block operation type) = 1), all the operations are performed in the linear acceleration/deceleration, regardless of the S-shaped acceleration/deceleration setting.
3) If the S-shaped acceleration/deceleration setting is “0”, the linear acceleration/deceleration applies.
4) Also if a value of the S-shaped acceleration/deceleration setting is out of an available range, the linear acceleration/deceleration applies.
5) If a deceleration command or travel during the S-shaped acceleration/deceleration is small, smooth S-shaped characteristics may not be obtained.
6) The calculation above shows a theoretical value. Actual S-shaped acceleration/deceleration may cause an error in the setting.

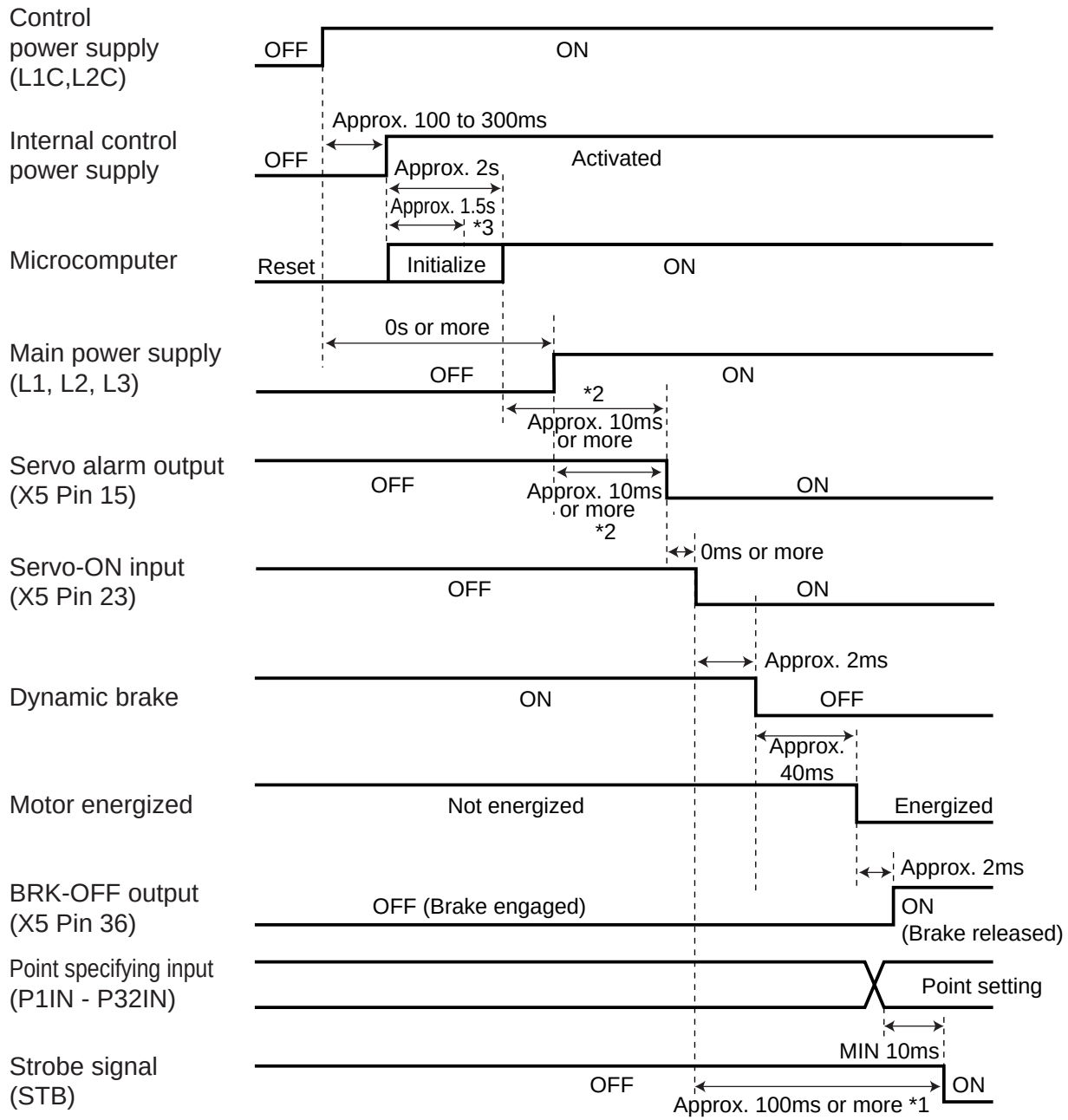
• Available set range of S-shaped acceleration/deceleration (decimals omitted)

2500 p/r encoder	S-shaped acceleration/deceleration setting [ms] ≦ (127950 ÷ acceleration/deceleration setting [ms]) – 1
17-bit encoder	S-shaped acceleration/deceleration setting [ms] ≦ 1677066.24 ÷ acceleration/deceleration setting [ms]) – 1

Example of calculation: 2500 p/r encoder
For acceleration/deceleration setting = 1000 [ms] , an available set range of S-shaped acceleration/deceleration is:
S-shaped acceleration/deceleration setting [ms] ≦ (127950 ÷ 1000) – 1 ≦ 126.950 [ms]
Therefore, for the S-shaped acceleration/deceleration setting of 127 [ms] or more, the linear acceleration/deceleration is enabled.

Timing Chart

Operation Timing after Power-ON



<Notes>

- The above chart shows the timing from AC power-ON to command input.
- Activate the external command input according to the above timing chart.

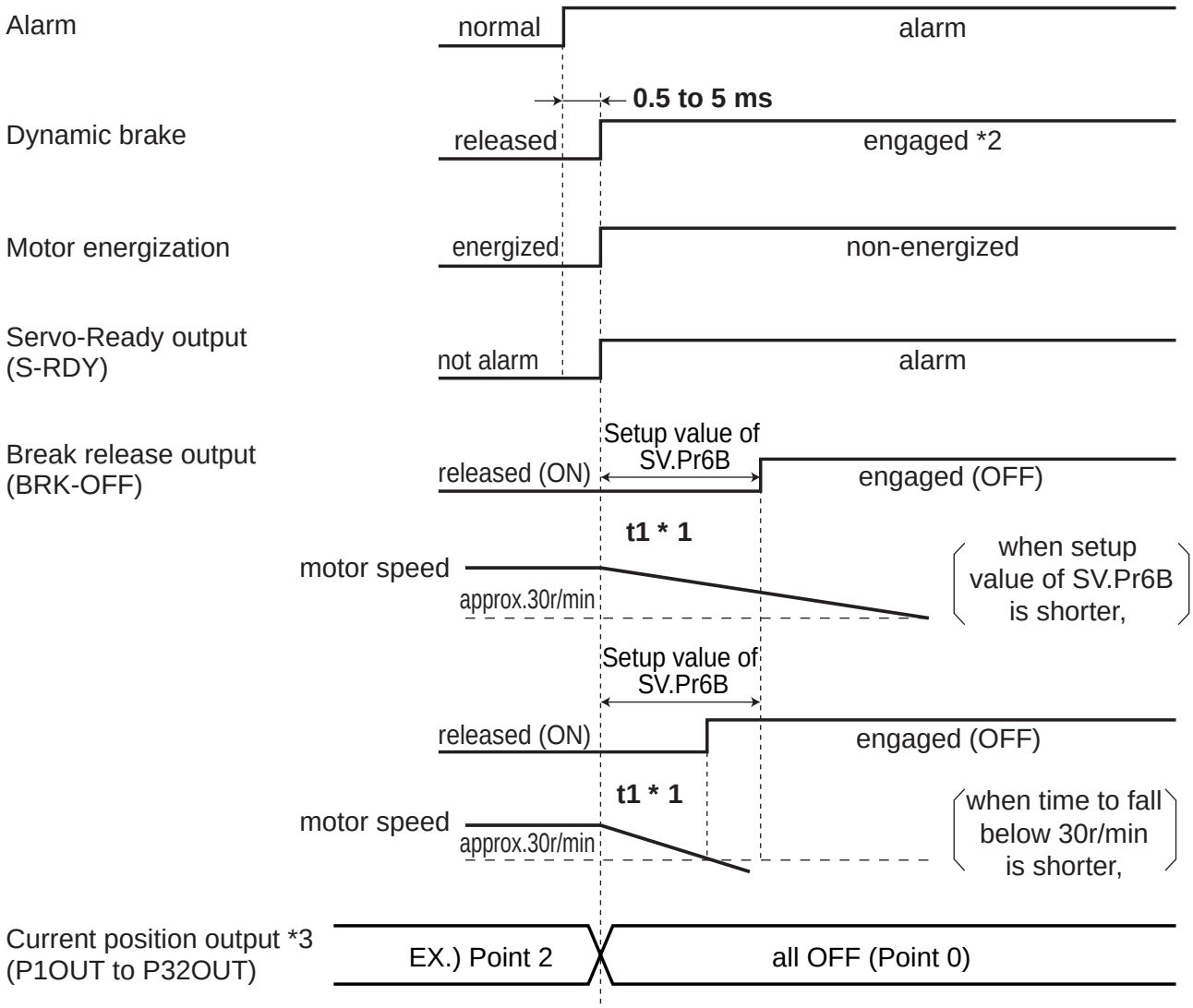
Caution

*1. In this term Servo-ON input (CN X5 SRV-ON:pin23) turns ON as a hard ware, but operation command can not be received.

*2. Servo alarm output (CN X5 ALM:pin15) turns ON when the microcomputer's initialization is completed, and the condition of no error is occurring. Servo-ON input turns ON after Servo alarm turns ON and the main power supply is activated sufficiently.

*** 3. After Internal control power supply , protective functions are active from approx. 1.5 sec after the start of initializing microcomputer. Please set the signals, especially for protective function, for example over-travel inhibit input (CWL,CCWL) or emergency stop input (EMG-STP), so as to decide their logic until this term.**

When an Error (Alarm) Has Occurred (at Servo-ON Command)



Caution

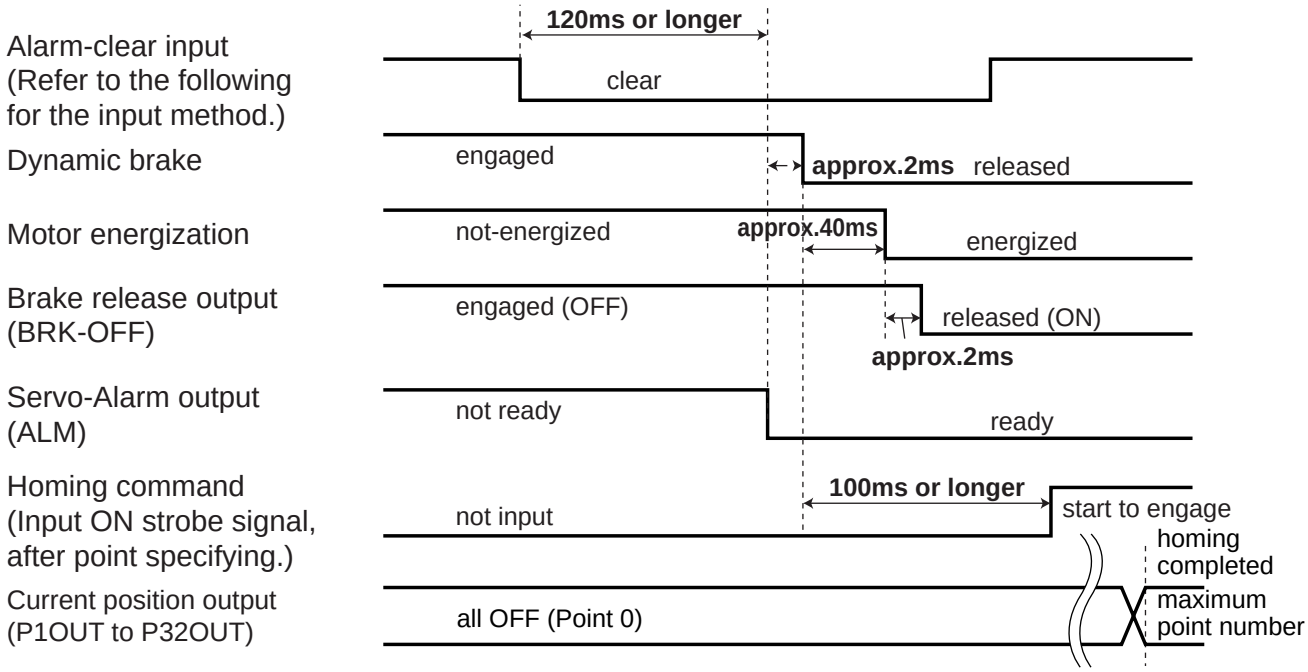
*1. t1 will be a shorter time of either the setup value of SV.Pr6B or elapsing time for the motor speed to fall below 30r/min.
t1 will be 0 when the motor is in stall regardless of the setup pf SV.Pr6A.

*2. For the action of dynamic brake at alarm occurrence, refer to an explanation of SV.Pr68, "Sequence at alarm ("Parameter setup" at each control mode) as well.

*3. When an alarm has been given, the homing is not completed. So, all the transistors of the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) turn OFF (point “0”).

Timing Chart

When an Alarm Has Been Cleared (at Servo-ON Command)



1) Alarm Clear can be input in the two ways below.

1. Point input (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8)

Specify the point “0” and, when 10 ms or more has passed, enable the strobe signal (STB: CN X5 Pin 24). Alarm Clear is started when the disabled strobe signal input has been enabled.

2. Multi function input (EX-IN1/EX-IN2: CN X5 Pin 22/25)

Assign the Alarm Clear to the multi function input 1 (EX-IN1: CN X5 Pin 22) or multi function input 2 (EX-IN2: CN X5 Pin 25) by SV.Pr5A (multi function input 1 signal selection) or SV.Pr5C (multi function input 2 signal selection) to enable the Alarm Clear.

Alarm Clear is started when the disabled strobe signal input has been enabled.

The signal logic of multi function input can be changed by SV.Pr59 (multi function input 1 signal logic) or SV.Pr5B (multi function input 2 signal logic).

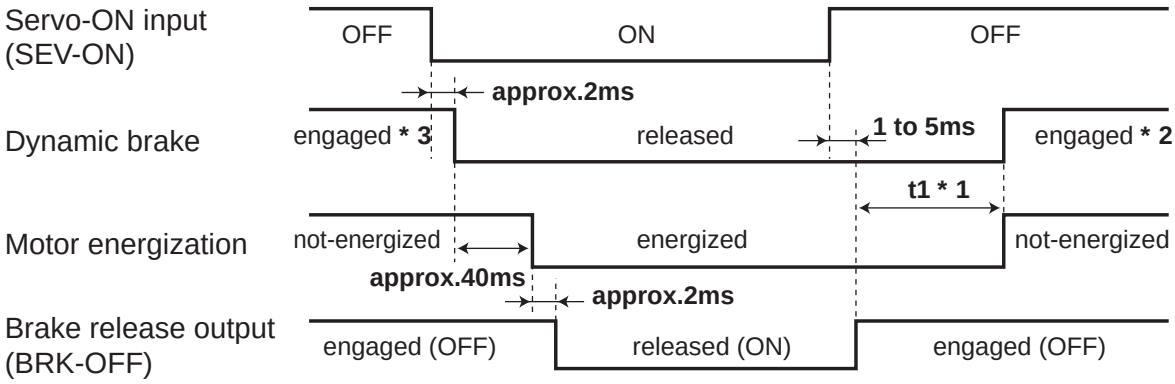
2) The servo driver power supply turns on again after an alarm is cleared.

A step operation can be performed by executing the homing.

When the homing has been completed, a transistor of the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) becomes a maximum point number decided by SV.Pr57 (selection of number of input points).

However, in the absolute mode or if the homing is not required, a transistor of the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) becomes a maximum point number decided by SV.Pr57 (selection of number of input points) immediately after Alarm Clear and the step operation can be performed.

Servo-ON/OFF Action While the Motor Is at Stall (Servo-Lock)

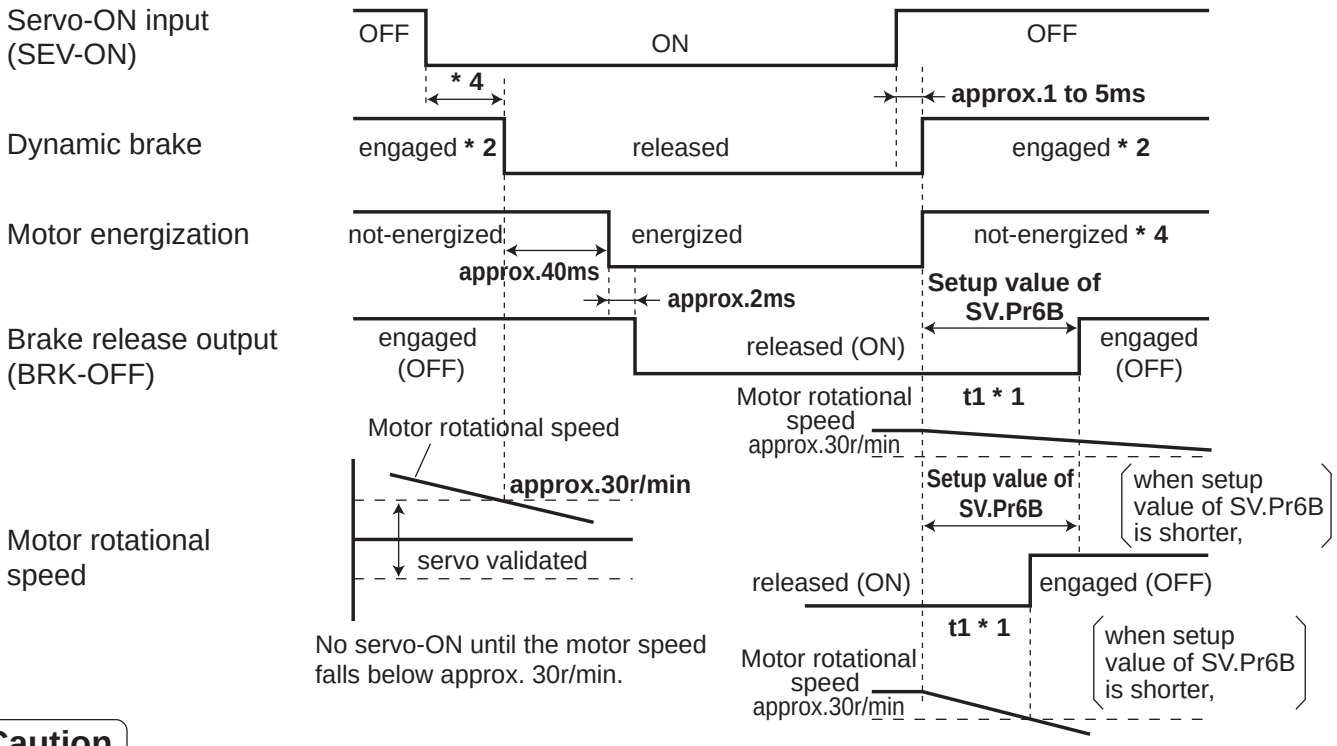


Caution

*1. t1 will be determined by SV.Pr6A setup value.
*2. For the dynamic brake action at Servo-OFF, refer to an explanation of SV.Pr69, "Sequence at Servo-OFF ("Parameter setup" at each control mode) as well.
*3. Servo-ON will not be activated until the motor speed falls below approx. 30r/min.
*4. Once the servo turns off, the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) is held to be unchanged until the next point operation is completed.

Servo-ON/OFF Action While the Motor Is in Motion

(Timing at emergency stop or trip. Do not repeat this sequence. During the normal operation, stop the motor, then make Servo-ON/OFF action.)



Caution

*1. t1 will be a shorter time of either the setup value of SV.Pr6B or elapsing time for the motor speed to fall below 30r/min.
*2. For a dynamic brake operation during servo off and a motor operation state during deceleration, refer to the explanation of SV.Pr69 (sequence at servo off) also.
*3. For the action of dynamic brake at alarm occurrence, refer to an explanation of Pt69, "Sequence at Servo-OFF ("Parameter setup" at each control mode) as well.
*4. Once the servo turns off, the current position output (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) is held to be unchanged until the next point operation is completed.

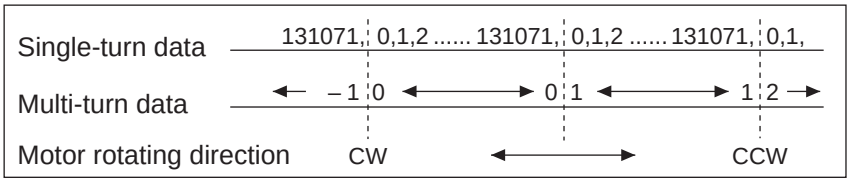
Absolute System

Overview of Absolute System

In a motor of the absolute encoder specifications or absolute/incremental specifications, an absolute system can be constructed by connecting a battery for an absolute encoder and changing the setting of SV.Pr0B (absolute encoder setting) from “1” (default setting) into “0” or “2”. In the absolute system, homing is not required after turning the power supply on.

Configuration of Absolute System

The data of an absolute encoder consists of single-turn data, which output an absolute position always within single turn, and multi-turn data which counts the number of turns. When a battery for the absolute encoder is connected, the multi-turn data can be held even if the power supply turns off. This allow to hold a home position set once, even after the power supply is reset. For the home position setting, “Setup (Initialization) of Absolute Encoder” on page 138.



Battery (for Backup) Installation

First Installation of the Battery

After installing and connecting the back-up battery to the motor, execute an absolute encoder setup. Refer to P.138, "Setup (initialization) of Absolute Encoder ".
It is recommended to perform ON/OFF action once a day after installing the battery for refreshing the battery.
A battery error might occur due to voltage delay of the battery if you fail to carry out the battery refreshment.

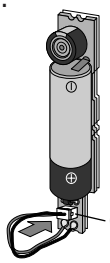
Replacement of the Battery

It is necessary to replace the battery for absolute encoder when battery alarm occurs.
Replace while turning on the control power. Data stored in the encoder might be lost when you replace the battery while the control power of the driver is off.
After replacing the battery, clear the battery alarm. Refer to P.99, "How to Clear the Battery Alarm".

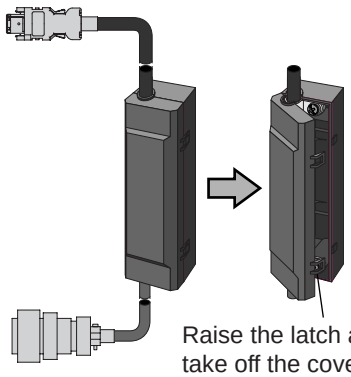
<Caution>
When you execute the absolute encoder with the console (refer to P.100 of Setting), all of error and multi-turn data will be cleared together with alarm, and you are required to execute “Setup (Initialization) of absolute encoder” (refer to P.138).

How to Replace the Battery

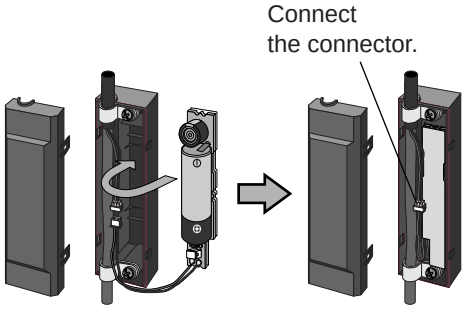
1) Refresh the new battery.
Connector with lead wire of the battery to CN601 and leave of 5 min. Pull out the connector from CN601 5 min after.



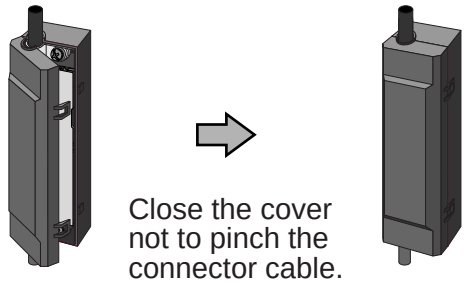
2) Take off the cover of the battery box.



3) Install the battery to the battery box.



4) Close the cover of the battery box.



Close the cover not to pinch the connector cable.

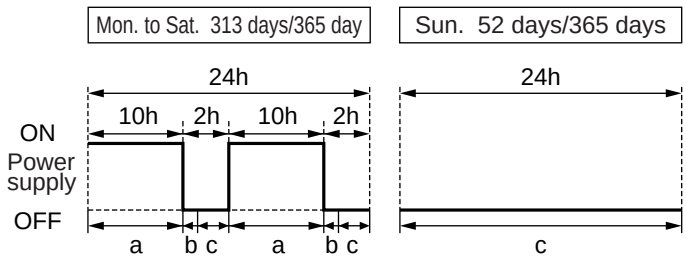
<Caution>
Use the following battery for absolute encoder.
Part No. : DV0P2990 (Lithium battery by Toshiba Battery Co., Ltd. ER6V, 3.6V 2000mAh)

<Cautions>

- Be absolutely sure to follow the precautions below since improper use of the battery can cause electrolyte to leak from the battery, giving rise to trouble where the product may become corroded, and/or the battery itself may rupture.
  1) Insert the battery with its "+" and "–" electrodes oriented correctly.
  2) Leaving a battery which has been used for a long period of time or a battery which is no longer usable sitting inside the product can cause electrolyte leakage and other trouble. For this reason, ensure that such a battery is replaced at an early date. (As a general guideline, it is recommended that the battery be replaced every two years.)
     - The electrolyte inside the battery is highly corrosive, and if it should leak out, it will not only corrode the surrounding parts but also give rise to the danger of short-circuiting since it is electrically conductive. For this reason, ensure that the battery is replaced periodically.
  3) Do not disassemble the battery or throw it into a fire.
     - Do not disassemble the battery since fragments of the interior parts may fly into your eyes, which is extremely dangerous. It is also dangerous to throw a battery into a fire or apply heat to it as doing so may cause it to rupture.
  4) Do not cause the battery to be short-circuited. Under no circumstances must the battery tube be peeled off.
     - It is dangerous for metal items to make contact with the "+" and "–" electrodes of the battery since such objects may cause a high current to flow all at once, which will not only reduce the battery performance but also generate considerable heat, possibly leading to the rupture of the battery.
  5) This battery is not rechargeable. Under no circumstances must any attempt be made to recharge it.
- The disposal of used batteries after they have been replaced may be subject to restrictions imposed by local governing authorities. In such cases, ensure that their disposal is in accordance with these restrictions.

<Reference>
Following example shows the life calculation of the back-up battery used in assumed robot operation. 2000[mAh] of battery capacity is used for calculation. Note that the following value is not a guaranteed value, but only represents a calculated value. The values below were calculated with only the current consumption factored in. The calculations do not factor in electrolyte leakage and other forms of battery deterioration.
Life time may be shortened depending on ambient condition.

1) 2 cycles/day



a : Current consumption in normal mode 3.6[μA]
b : Current consumption at power failure timer mode 280[μA]
* Power failure timer mode...Action mode in time period when the motor can respond to max. speed even the power is off (5sec).
c : Current consumption at power failure mode 110[μA]

Annual consumption capacity = (10h x a + 0.0014h x b + 2h x c) x 2 x 313 days + 24h x c x 52 days = 297.8[mAh])
Battery life = 2000[mAh] /297.8[mAh] = 6.7 (6.7159) [year]

2) 1 cycle/day

(2nd cycle of the above 1) is for rest.

Annual consumption capacity = (10h x a + 0.0014h x b + 14h x c) x 313 days + 24h x c x 52 days = 640.6[mAh])
Battery life = 2000[mAh] /630.6[mAh] = 3.1 (3.1715) [year]

Absolute System

When you make your own cable for 17-bit absolute encoder

When you make your own cable for 17-bit absolute encoder, connect the optional battery for absolute encoder, DV0P2060 or DV0P2990 as per the wiring diagram below. Connector of the battery for absolute encoder shall be provided by customer as well.

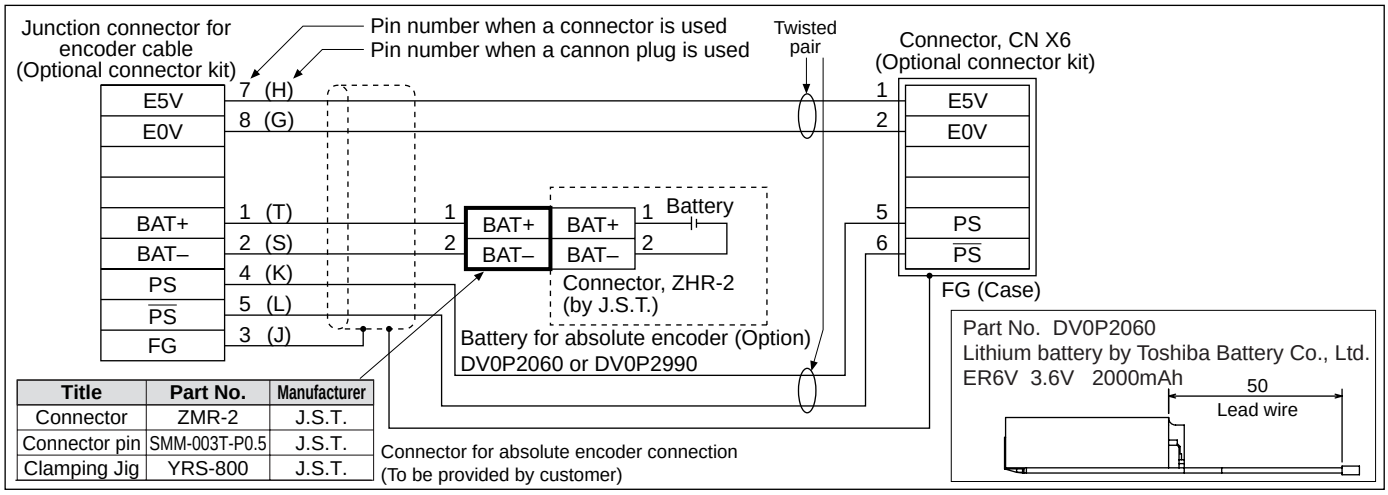
<Cautions>

Install and fix the battery securely. If the installation and fixing of the battery is not appropriate, it may cause the wire breakdown or damage of the battery.

Refer to the instruction manual of the battery for handling the battery.

- **Installation Place**
  1) Indoors, where the products are not subjected to rain or direct sun beam.
  2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas, grinding oil, oil mist, iron powder or chips and etc.
  3) Well-ventilated and humid and dust-free place.
  4) Vibration-free place

Wiring Diagram



Title	Part No.	Manufacturer
Connector	ZMR-2	J.S.T.
Connector pin	SMM-003T-P0.5	J.S.T.
Clamping Jig	YRS-800	J.S.T.

Setup (Initialization) of Absolute Encoder

Execute the setup of absolute encoder in the following cases.

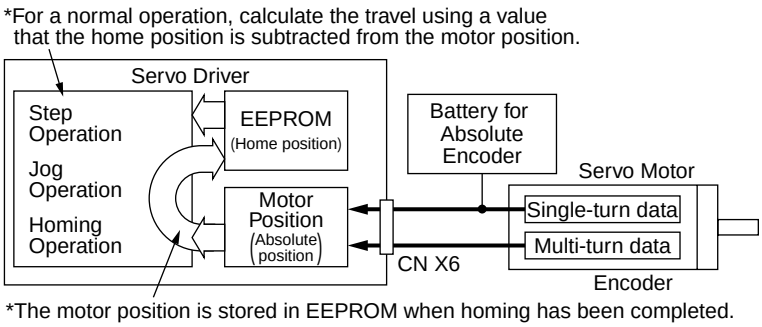
- Initial setup of the machine
- When absolute system down error protection (alarm No. 40) occurs
- When the encoder cable is pulled out

A home position can be set in the two ways below.

- **Normal homing**

  (Refer to "Homing Operation" on page 114.)

  Execute one of the eight types of homing operations and store that position in EEPROM as the position. Positioning is performed based on the stored position as the home position even after the power supply reset.



- **Define " 0" position of absolute encoder as a home position**

  Clear an absolute encoder so that a machine home position and the "0" position of absolute encoder can match with each other. By using a data of the absolute encoder after the power supply reset, positioning is performed based on the "0" position of absolute encoder as the home position.

  The absolute encoder is cleared through a console or "PANATERM®". A multi-turn data only is cleared by clearing the absolute encoder.

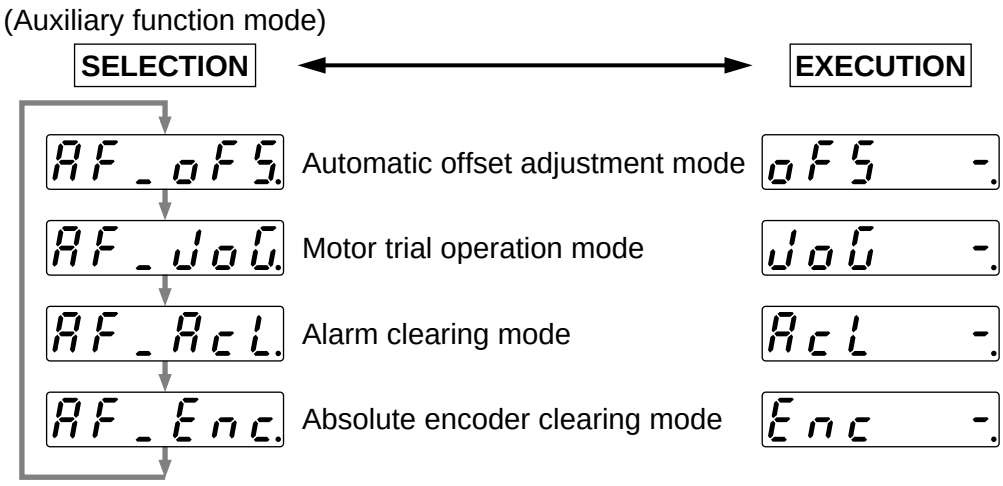
Clearing Absolute Encoder

• Using a console

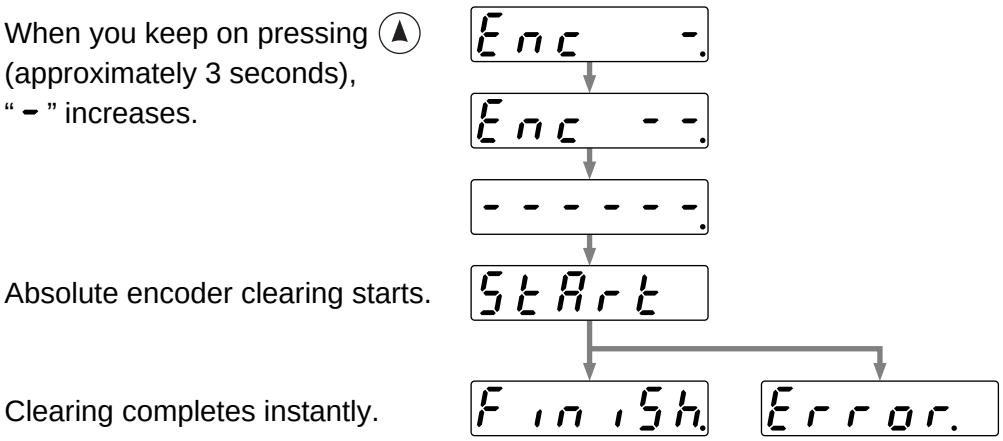
(1) Turn the power supply on and mount it to the machine when you find a position where a machine home position and single-turn data of the absolute encoder become “0”. (A position of single-turn data = “0” is a position where the Z phase is output, only when the pulse output division ratio is “1:1”.)

(2) After mounting it, turn it one quarter or one half turn counterclockwise. (If you perform clearing at a position where the Z phase is output, the home position may turn completely in the worst case. Turn it counterclockwise slightly from the Z phase output position when performing clearing.)

(3) Put the console in the auxiliary function mode and enable the EXECUTION display for “Absolute encoder clear mode”. (Refer to “Absolute Encoder Clearing Function” in “Settings” on page 100.)



(4) Operate the key as shown below in the EXECUTION display.



Note: For the incremental encoder, Error. display appears when absolute encoder clearing is executed.

(5) Turn the power supply off once and turn it on again.

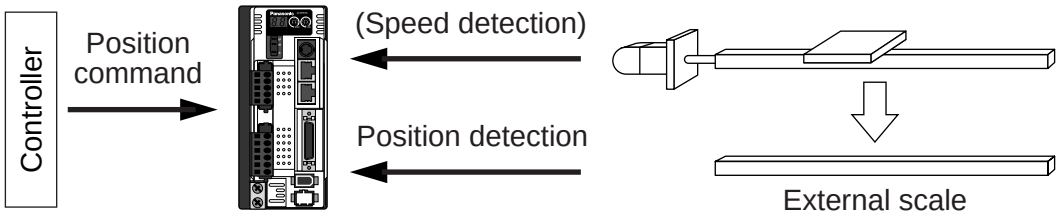
• Using the setup support software “ PANATERM® ”

Basically, the step (3) and (4) only are different from the procedure by the console. The absolute encoder is cleared when you open the monitor window, select the [Absolute encoder] tab and press the [Clear] button for the multi-turn data and encoder error. A digital value of single-turn data is shown on the same monitor window. So, you do not need to check the Z phase as stated in 1).

Outline of Full-Closed Control

What Is Full-Closed Control ?

In this full-closed control, you can make a position control by using a external scale mounted externally which detects the machine position directly and feeds it back.. With this control, you can control without being affected by the positional variation due to the ball screw error or temperature and you can expect to achieve a very high precision positioning in sub-micron order.



Preparation for full-closed control

1) Wire the external scale referring to “Wiring to CN X7” in “System Configuration and Wiring” on page 40.
2) Set SV.Pr02 (control mode setting) to “6” (full-closed control). (Change becomes enabled after turning the power supply on again.)
3) Specify each parameter according to “Cautions on Full-Closed Control” below.

Cautions on Full-Closed Control

A4P-series supports the external scale of a communication type. Execute the initial setup of parameters per the following procedures, then write into EEPROM and turn on the power again before using this function.

<How to make an initial setup of parameters related to external scale >

1) Turn on the power after checking the wiring.
2) Check the values (initial) feedback pulse sum and external scale feedback pulse sum with the console or with the setup support software, PANATERM®.
3) Move the work and check the travel from the initial values of the above 2).
4) If the travel of the feedback sum and the external scale feedback pulse sum are reversed in positive and negative, set up the reversal of external scale direction (SV.Pr7C) to 1.
5) Set up the external scale division ratio (SV.Pr78-7A) using the formula below,

$$\text{External scale division ratio} = \frac{\text{Total variation of external scale feedback pulse sum}}{\text{Total variation of feedback pulse sum}} = \frac{\text{SV.Pr78} \times 2^{\text{SV.Pr79}}}{\text{SV.Pr7A}}$$

We recommend $1/20 \leqq$ external scale division ratio $\leqq 20$.

If the external scale division ratio is set to a value smaller than 50/position loop gain (SV.Pr10, 18), control per pulse may not be performed. If the external scale division ratio is set to a larger value, an operating noise may become large.

* If the design value of the external scale division ratio is obtained, set up this value.

6) Set up appropriate value of hybrid deviation excess (SV.Pr7B) in 16 pulse unit of the external scale resolution, in order to avoid the damage to the machine.
   * A4P-series driver calculates the difference between the encoder position and the external scale position as hybrid deviation, and is used to prevent the machine runaway or damage in case of the external scale breakdown or when the motor and the load is disconnected.
   If the hybrid deviation excess range is too wide, detection of the breakdown or the disconnection will be delayed and error detection effect will be lost. If this is too narrow, it may detect the normal distortion between the motor and the machine under normal operation as an error.
   * When the external scale division ration is not correct, hybrid deviation excess error (Err25) may occur especially when the work travels long distance, even though the external scale and the motor position matches.
   In this case, widen the hybrid deviation excess range by matching the external scale division ratio to the closest value.