5

PARAMETERS

5 PARAMETERS

5.1 Parameter configuration

Various parameters are used to set up the mechanical system and adjust the characteristics and accuracy of servo.

The parameters are saved in the electrically erasable programmable read-only memory (EEPROM) and are not lost even when the power is turned off.

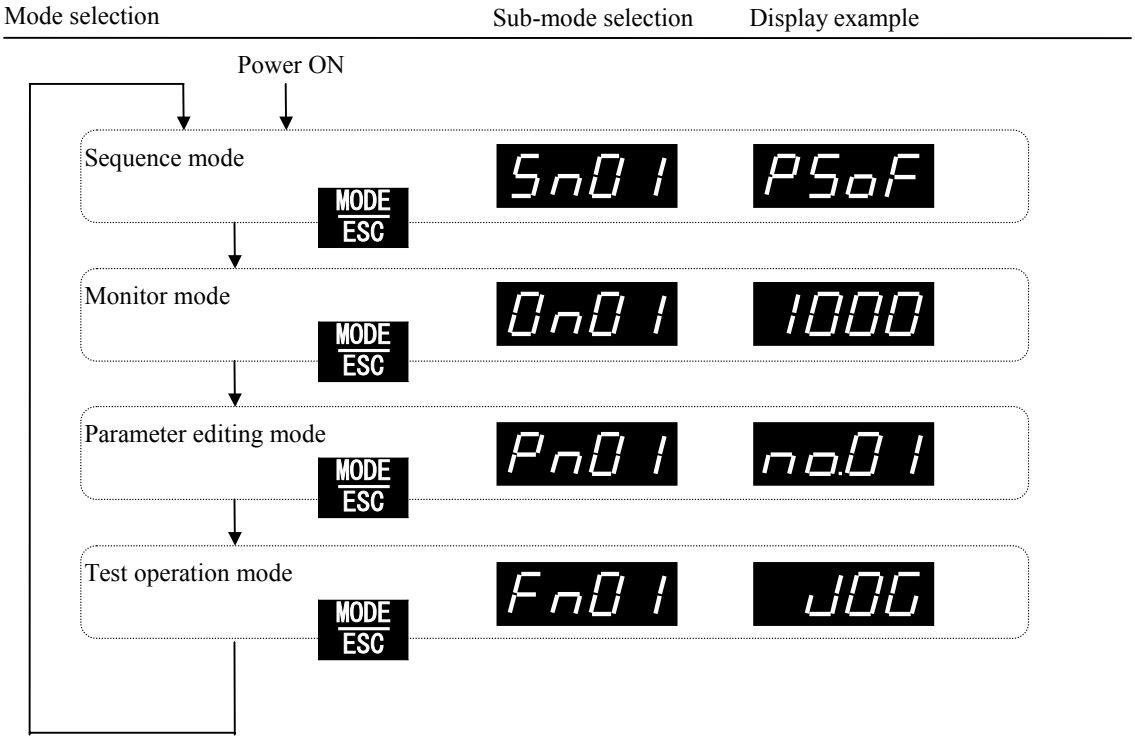
Parameters marked “Power” in the “Change” field in the parameter list become valid after the power supply is turned off and on again. (Check that the keypad panel (7-segment LED display) is unlit when the power is turned off.)

■ Parameter editing method

There are two parameter editing methods: through keypad panel operation and through PC loader operation.

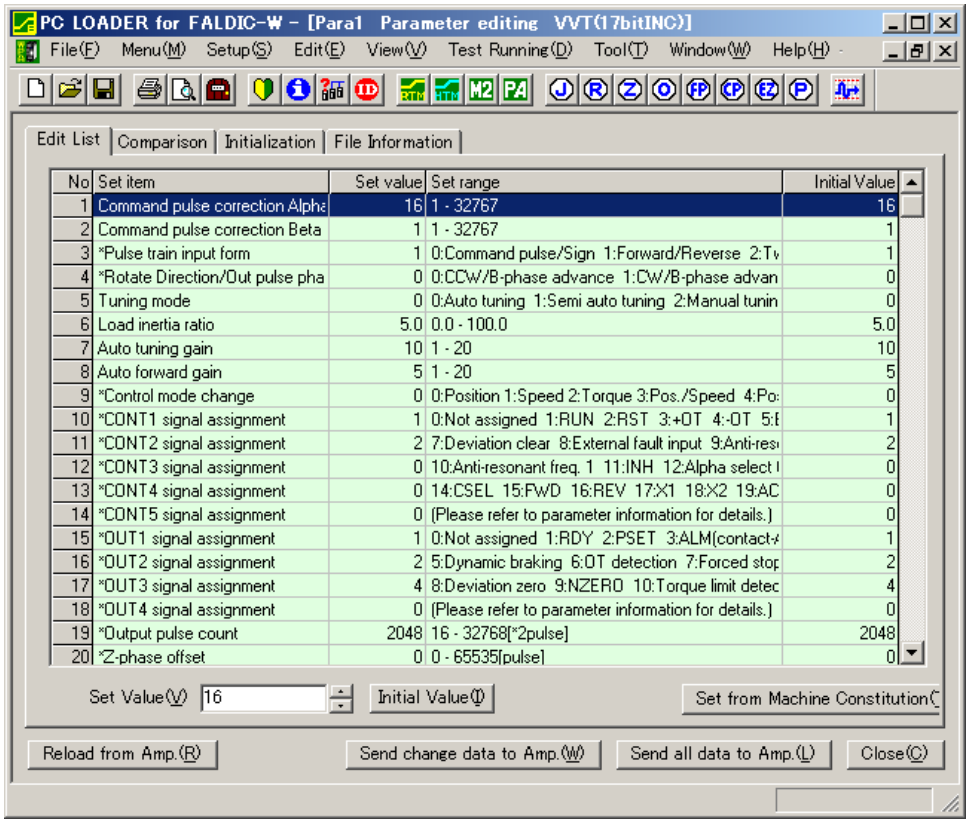
5.1.1 Parameter editing through keypad operation

Press the MODE/ESC key to select the parameter editing mode and press the ∨ or ∧ key to select the desired parameter number.



5.1.2 Parameter editing through PC loader

Use the PC loader to edit parameters.



5.2 List of parameters

■Parameter list (1)

No.	Name	Control mode			Reference page
		Position	Speed	Torque	
01	Command pulse compensation α	O	-	-	5-9
02	Command pulse compensation ß				
03	Pulse string input type	O	-	-	5-11
04	Rotation direction switching/output pulse phase switching	O	O	O	5-13
05	Tuning mode	O	O	-	5-14
06	Load inertia ratio	O	O	-	5-15
07	Auto tuning gain	O	O	-	5-16
08	Auto forward gain	O	-	-	5-17
09	Control mode switching	O	O	O	5-18
10	CONT 1 signal allocation	O	O	O	5-20
11	CONT 2 signal allocation				
12	CONT 3 signal allocation				
13	CONT 4 signal allocation				
14	CONT 5 signal allocation				
15	OUT 1 signal allocation	O	O	O	5-42
16	OUT 2 signal allocation				
17	OUT 3 signal allocation				
18	OUT 4 signal allocation				
19	No. of output pulses	O	O	O	5-53
20	Z phase offset	O	O	O	5-54
21	Zero deviation width	O	-	-	5-55
22	Deviation limit width	O	-	-	5-56
23	Zero speed width	O	O	O	5-56
24	Positioning end judgment time	O	-	-	5-57
25	Maximum current limit value	O	O	O	5-57
26	Alarm detection for undervoltage	O	O	O	5-58
27	Operation for undervoltage	-	O	-	5-58
28	For adjustment by manufacturer	-	-	-	5-59
29	Parameter write-protection	O	O	O	5-59
30	Initial display of the keypad	O	O	O	5-60
31	Manual feed speed 1 (and test operation)	O	O	-	5-61
32	Manual feed speed 2	O	O	-	
33	Manual feed speed 3	O	O	-	
34	Maximum rotating speed	O	O	O	5-61
35	Acceleration time 1 (and test operation)	O	O	-	5-62
36	Deceleration time 1 (and test operation)	O	O	-	
37	Acceleration time 2	O	O	-	
38	Deceleration time 2	O	O	-	
39	Zero clamp level	O	O		5-63
40	Position controller gain 1	O	-	-	5-66
41	Speed response 1	O	O	-	
42	Speed controller integration time 1	O	O	-	
43	S-curve time constant	O	O	-	5-68
44	Feed forward gain	O	-	-	5-68
45	Feed forward filter time constant	O	-	-	5-66
46	Torque filter time constant	O	O	-	
47	Speed setting filter	O	O	-	5-69
48	Gain switching factor	O	O	-	5-70
49	Gain switching level	O	O	-	
50	Gain switching time constant	O	O	-	

■Parameter list (2)

No.	Name	Control mode			Reference page
		Position	Speed	Torque	
51	Position controller gain 2	O	-	-	5-70
52	Speed response 2	O	O	-	
53	Speed controller integration time 2	O	O	-	
54	Torque setting filter	-	-	O	5-71
55	Command follow-up control selection	O	-	-	5-71
56	Notch filter 1 frequency	O	O	-	5-72
57	Notch filter 1 damping				
58	Notch filter 2 frequency				
59	Notch filter 2 damping				
60	Anti-resonance frequency 0	O	-	-	5-73
61	Anti-resonance frequency 1				
62	Anti-resonance frequency 2				
63	Anti-resonance frequency 3				
64 to 69	Not used	-	-	-	-
70	Analog command gain	O	O	O	5-74
71	Analog command offset				
72	Motion sequence selection for dynamic brake unit connection	O	O	O	5-76
73	Brake operation time	O	O	O	5-76
74	CONT normally ON 1	O	O	O	5-77
75	CONT normally ON 2				
76	CONT normally ON 3				
77	CONT normally ON 4				
78	Command pulse compensation α 1	O	-	-	5-78
79	Command pulse compensation α 2				
80	Command pulse compensation α 3				
81	Parameter storage in RAM	O	O	O	5-78
82	Station number	O	O	O	5-79
83	Baud rate				
84	Easy tuning: Travel setting	O	O	O	5-79
85	Easy tuning: Speed setting				
86	Easy tuning: Timer setting				
87	Monitor 1 signal allocation	O	O	O	5-80
88	Monitor 2 signal allocation				
89	Monitor 1 scale				
90	Monitor 1 offset				
91	Monitor 2 scale				
92	Monitor 2 offset				
93	Not used	-	-	-	-
94	For adjustment by manufacturer	-	-	-	-
95	For adjustment by manufacturer	-	-	-	5-82
96	For adjustment by manufacturer				
97	For adjustment by manufacturer				
98 to 99	Not used	-	-	-	-

■FALDIC-W parameter list (1)

No.	Name	Setting range	Initial value	Change
01	Command pulse compensation α	1 - 32767 (increments of 1)	16	Always
02	Command pulse compensation ß	1 - 32767 (increments of 1)	1	Always
03	Pulse string input type	0: Command pulse/command symbol 1: Forward/reverse rotation pulse 2: 90 degree phase difference 2 signal	1	Power
04	Rotation direction switching/output pulse phase switching	0: Positive direction forward rotation (CCW)/B phase advance 1: Positive direction reverse rotation (CW)/B phase advance 2: Positive direction forward rotation (CCW)/A phase advance 3: Positive direction reverse rotation (CW)/A phase advance	0	Power
05	Tuning mode	0: Auto tuning 1: Semi-auto tuning 2: Manual tuning	0	Always
06	Load inertia ratio	GYS type: 0.0 - 100.0 times (increments of 0.1) GYG type: 0.0 - 30.0 times (increments of 0.1)	5.0 (1.0)	Always
07	Auto tuning gain	1 - 20 (increments of 1)	10	Always
08	Auto forward gain	1 - 20 (increments of 1)	5	Always
09	Control mode switching	0: Position 1: Speed 2: Torque 3: Position⇔Speed 4: Position⇔Torque 5: Speed⇔Torque	0	Power
10	CONT 1 signal allocation	0 - 21 (increments of 1) 0: Not specified 1: Servo ON [RUN] 2: Reset [RST] 3: +OT 4: -OT 5: Emergency stop [EMG] 6: P motion 7: Deviation clear 8: External regenerative resistor overheating 9: Anti-resonance frequency selection 0 10: Anti-resonance frequency selection 1 11: Command pulse inhibition 12: Command pulse a selection 0 13: Command pulse a selection 1 14: Control mode switching 15: Manual forward rotation [FWD] 16: Manual reverse rotation [REV] 17: Multistep speed 1 [x1] 18: Multistep speed 2 [x2] 19: Acceleration/deceleration time selection 20: Current limiting regulator ON 21: Coasting [BX]	1[RUN]	Power
11	CONT 2 signal allocation		2[RST]	Power
12	CONT 3 signal allocation		0	Power
13	CONT 4 signal allocation		0	Power
14	CONT 5 signal allocation		0	Power
15	OUT 1 signal allocation	0 - 10 (increments of 1) 0: Not specified 1: Ready [RDY] 2: Positioning end [PSET] 3: Alarm detection: a contact 4: Alarm detection: b contact 5: Dynamic braking 6: OT detection 7: Forced stop detection 8: Zero deviation 9: Zero speed 10: Current limit detection 11: Brake timing	1[RDY]	Power
16	OUT 2 signal allocation		2[PSET]	Power
17	OUT 3 signal allocation		4[ALMb]	Power
18	OUT 4 signal allocation		0	Power
19	No. of output pulses	16 - 32768 [pulse] (increments of 1)	2048	Power
20	Z phase offset	0 - 65535 [×2 pulse] (increments of 1)	0	Power
21	Zero deviation width	1 - 2000 [pulse] (increments of 1)	400	Always
22	Deviation limit width	10 - 65535 [×100 pulse] (increments of 1)	20000	Always
23	Zero speed width	10 - Maximum rotation speed [r/min] (increments of 1)	50	Always
24	Positioning end judgment time	0.000 - 1.000 sec (increments of 0.001)	0.000	Always
25	Maximum current limit value	0 - 300% (increments of 1)	300	Always
26	Alarm detection for undervoltage	0: Not detected, 1: Detected	1	Power
27	Operation for undervoltage	0: Sudden deceleration and stop, 1: Coasting	0	Power
28	For adjustment by manufacturer	-	-	-
29	Parameter write-protection	0: Rewritable, 1: Write protected	0	Always
30	Initial display of the keypad	0 - 20 (increments of 1)	0	Power

* Values in ( ) are the initial values of the GYG motor.

■FALDIC-W parameter list (2)

No.	Name	Setting range	Initial value	Change
31	Manual feed speed 1 (and test operation)	0.1 - Maximum rotation speed [r/min] (increments of 0.1)	100.0	Always
32	Manual feed speed 2	0.1 - Maximum rotation speed [r/min] (increments of 0.1)	500.0	Always
33	Manual feed speed 3	0.1 - Maximum rotation speed [r/min] (increments of 0.1)	1000.0	Always
34	Maximum rotation speed	0.1 - Maximum rotation speed [r/min] (increments of 0.1)	5000.0 (3000.0)	Always
35	Acceleration time 1 (and test operation)	0.000 - 9.999 sec. (increments of 0.001)	0.100	Always
36	Deceleration time 1 (and test operation)	0.000 - 9.999 sec. (increments of 0.001)	0.100	Always
37	Acceleration time 2	0.000 - 9.999 sec. (increments of 0.001)	0.500	Always
38	Deceleration time 2	0.000 - 9.999 sec. (increments of 0.001)	0.500	Always
39	Zero clamp level	0.0 - 500.0[r/min] (increments of 0.1)	0.0	Always
40	Position controller gain 1	1 - 1000[rad/sec] (increments of 1)	*1	Always
41	Speed response 1	1 - 1000[Hz] (increments of 1)	*1	Always
42	Speed controller integration time 1	1.0 - 1000.0[msec] (increments of 0.1)	*1	Always
43	S-curve time constant	0.0 - 100.0[msec] (increments of 0.1)	2.0	Always
44	Feed forward gain	0.000 - 1.500 (increments of 0.001)	0.000	Always
45	Feed forward filter time constant	0.0 - 250.0[msec] (increments of 0.1)	*1	Always
46	Torque filter time constant	0.00 - 20.00[msec] (increments of 0.01)	*1	Always
47	Speed setting filter	0.00 - 20.00[msec] (increments of 0.01)	0.00	Always
48	Gain switching factor	0: Position deviation (×10), 1: Feedback speed, 2: Command speed	1	Always
49	Gain switching level	1 - 1000 (increments of 1)	50	Always
50	Gain switching time constant	0 - 100[msec] (increments of 1)	10	Always
51	Position controller gain 2	30 - 200% (increments of 1)	100	Always
52	Speed response 2	30 - 200% (increments of 1)	100	Always
53	Speed controller integration time 2	30 - 200% (increments of 1)	100	Always
54	Torque setting filter	0.000 - 9.999[sec] (increments of 0.001)	0.000	Always
55	Command follow-up control selection	0: None, 1: Command follow-up control, 2: Command follow-up control (compensated for while stopped)	0	Powre
56	Notch filter 1 frequency	10 - 200[×10Hz] (increments of 1)	200	Always
57	Notch filter 1 damping	0 - 40[dB] (increments of 1)	0	Always
58	Notch filter 2 frequency	10 - 200[×10Hz] (increments of 1)	200	Always
59	Notch filter 2 damping	0 - 40[dB] (increments of 1)	0	Always
60	Anti-resonance frequency 0	5.0 - 200.0[Hz] (increments of 0.1)	200.0	Always
61	Anti-resonance frequency 1	5.0 - 200.0[Hz] (increments of 0.1)	200.0	Always
62	Anti-resonance frequency 2	5.0 - 200.0[Hz] (increments of 0.1)	200.0	Always
63	Anti-resonance frequency 3	5.0 - 200.0[Hz] (increments of 0.1)	200.0	Always

* Values in ( ) are the initial values of the GYG motor.

*1. Indicates the value immediately after parameter initialization is executed. The value is automatically updated if “auto tuning” or “semi-auto tuning” is selected with parameter #5.

■FALDIC-W parameter list (3)

No.	Name	Setting range	Initial value	Change
64 to 69	Not used	-	0	-
70	Analog command gain	±0.10 - ±1.50 (increments of 0.01)	1.00	Always
71	Analog command offset	-2000 - +2000	(Set before shipment)	Always
72	Operation sequence selection for dynamic brake unit connection	0: DB invalid for OT detection/RUN = DB invalid for OFF 1: DB valid for OT detection/RUN = DB invalid for OFF 2: DB invalid for OT detection/RUN = DB valid for OFF 3: DB valid for OT detection/RUN = DB valid for OFF	0	Powre
73	Brake operation time	0.00 - 9.99 [sec] (increments of 0.01) Base shutoff delay time at RUN = OFF	0.00	Always
74	CONT normally valid 1	0 - 21	0	Powre
75	CONT normally valid 2		0	Powre
76	CONT normally valid 3		0	Powre
77	CONT normally valid 4		0	Powre
78	Command pulse compensation α 1	1 - 32767 (increments of 1)	1	Always
79	Command pulse compensation α 2		1	Always
80	Command pulse compensation α 3		1	Always
81	Parameter storage in RAM	0: Not specified, 1 - 99 (increments of 1)	0	Powre
82	Station number	1 - 31	1	Powre
83	Baud rate	0: 38400 [bps], 1: 19200 [bps], 3: 9600 [bps]	0	Powre
84	Easy tuning: Travel setting	0.5 - 200.0［rev］ (increments of 0.1)	2.0	Always
85	Easy tuning: Speed setting	10.0 - Maximum rotation speed [r/min] (increments of 0.1)	500.0	Always
86	Easy tuning: Timer setting	0.01 - 5.00[sec] (increments of 0.01)	0.50	Always
87	Monitor 1 signal allocation	1: Speed command, 2: Speed feedback, 3: Torque command, 4: Position deviation, 5: Position deviation (extension), 6: Pulse frequency	2	Always
88	Monitor 2 signal allocation		3	Always
89	Monitor 1 scale	±2.0 - ±100.0[V] (increments of 0.1)	7.0	Always
90	Monitor 1 offset	-50 - +50 (increments of 1)	0	Always
91	Monitor 2 scale	±2.0 - ±100.0[V] (increments of 0.1)	6.0	Always
92	Monitor 2 offset	-50 - +50 (increments of 1)	0	Always
93	Not used	-	0	-
94	For adjustment by manufacturer	-	Adjustment value	-
95	For adjustment by manufacturer	-	Adjustment value	-
96	For adjustment by manufacturer	-	Adjustment value	-
97	For adjustment by manufacturer	-	Adjustment value	-
98 to 99	Not used	-	0	-

5.3 Explanation of parameter

The parameters are described in the order of the parameter number.

PnO1 / no.01 – no02

Parameter #01 and #02

No.	Name	Setting range	Initial value	Change
01	Command pulse correction α	1 to 32767 (in 1 increments)	16	Always
02	Command pulse correction ß	1 to 32767 (in 1 increments)	1	Always

* It is only valid for position control.

These parameters are used to convert the travel distance per each command pulse into a unit quantity that is used by the electronic gear.
Calculate in the following equation.

■ Calculation formula for command pulse correction α and β

$$\frac{\text{(Mechanical system travel distance per revolution of servomotor)}}{\text{(131072 pulses/rotation)}} \times \frac{\text{(Command pulse correction } \alpha\text{)}}{\text{(Command pulse correction ß)}} = \text{(Unit quantity)*}$$

* "Unit quantity" is a value such as "1," "0.1," "0.01," and "0.001."

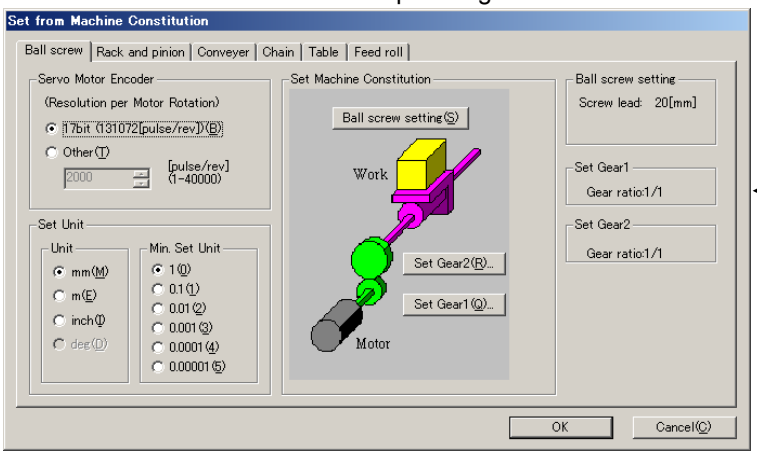
$$\frac{\text{(Command pulse correction } \alpha\text{)}}{\text{(Command pulse correction ß)}} = \frac{\text{(131072 pulses/rotation)}}{\text{(Mechanical system travel distance per revolution of servomotor)}} \times \text{(Unit quantity)}$$

Reduce the fraction so that command pulse correction α and β become integers within 32767.

■ Setting from PC loader

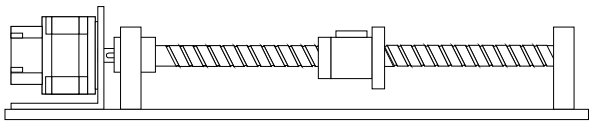
Use the “α and β setting from mechanical configuration” button in the parameter editing screen of the PC loader to automatically specify command pulse correction values α and β.

< α / β setting screen>



Data are automatically set by simply entering the machine specifications.
Because settings are given for each component of the machine, entry is simply.

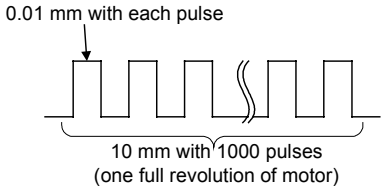
To couple 10-mm-lead screw to the output shaft of the servomotor with a setting unit of 1/100



$$\frac{\text{(Mechanical system travel distance per revolution of servomotor)}}{\text{(131072 pulses/rotation)}} \times \frac{\text{(Command pulse correction } \alpha\text{)}}{\text{(Command pulse correction } \beta\text{)}} = \text{(Unit quantity)}$$

$$\frac{10\text{ mm}}{\text{(131072 pulses/rotation)}} \times \frac{\text{(Command pulse correction } \alpha\text{)}}{\text{(Command pulse correction } \beta\text{)}} = 1/100$$

Hence command pulse correction α becomes “16384” and command pulse correction β becomes “125.” With the above settings, the mechanical system travel distance per each pulse in the pulse string becomes 0.01 mm.



Hint The pi (π) included in the mechanical system travel distance per each revolution of the servomotor can be approximated with “355 / 113.”

The number of output pulses has nothing to do with command pulse correction. According to the setting of parameter #19, two signals with phase-B-advanced 90-degree phase difference are output when the motor shaft rotates in the forward direction.

PnO1 / no.03

Parameter #03

No.	Name	Setting range	Initial value	Change
03	Pulse string input form	0: Command pulse / command sign, 1: Forward / reverse rotation pulse, 2: Two signals with 90-degree phase difference	1	Power

* It is only valid for position control.

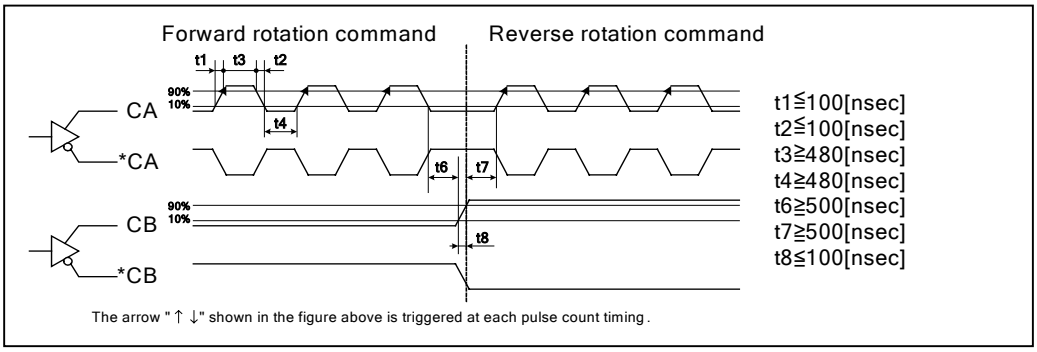
The form of the signal added to the pulse string input terminal can be selected.

The form of pulse strings added to the [CA], [*CA], [CB] and [*CB] pulse string input terminals of the servo amplifier can be specified. The maximum input frequency is 1.0MHz.

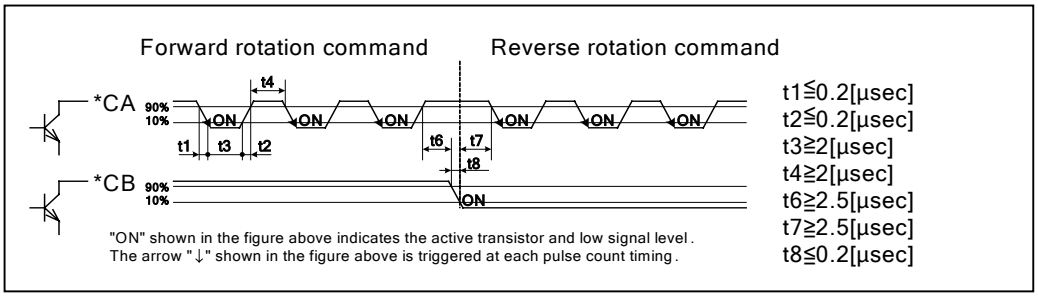
■ Command pulse/command sign (Setting of parameter 03: 0)

The rotation amount is indicated with the command pulse while the direction of rotation is indicated with the command sign.

• Differential input



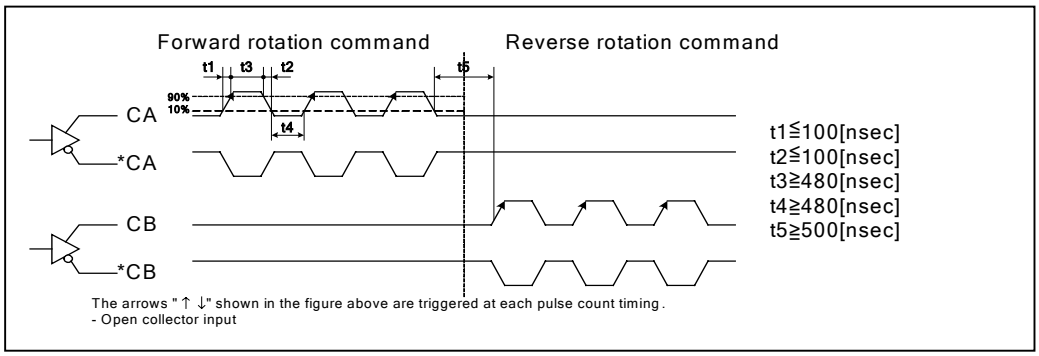
• Open collector input



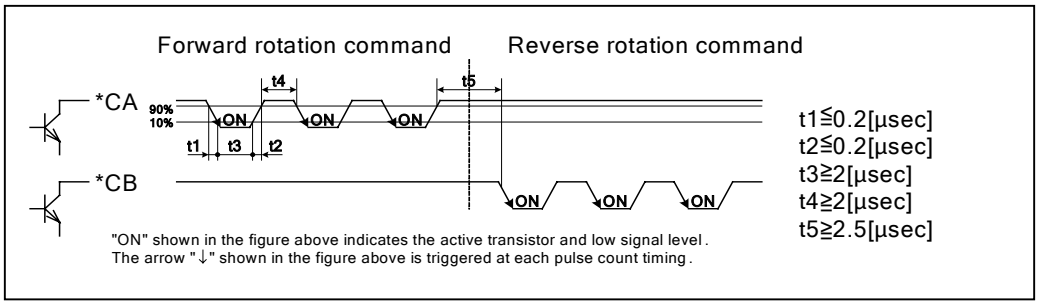
■ Forward / reverse rotation pulse (Setting of parameter 03: 1)

The forward rotation pulse indicates the rotation amount in the positive direction, while the reverse pulse indicates that in the reverse direction.

• Differential input



• Open collector input

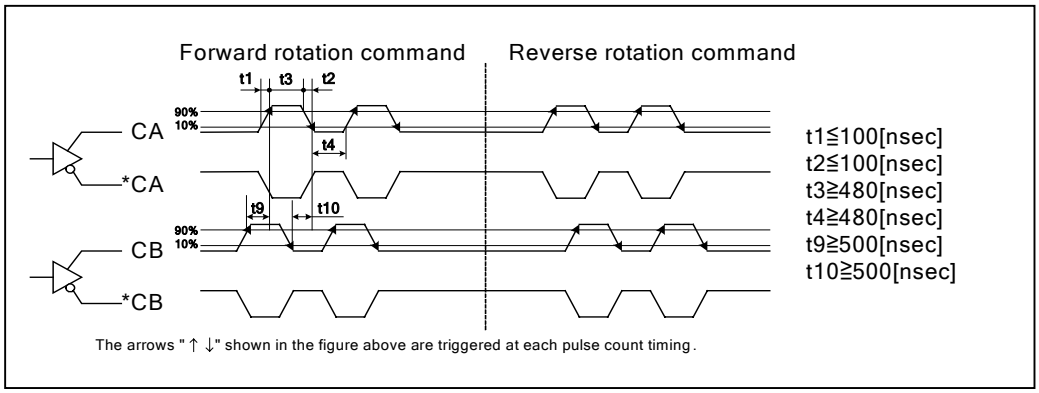


■ Two signals with 90-degree phase difference (Setting of parameter 03: 2)

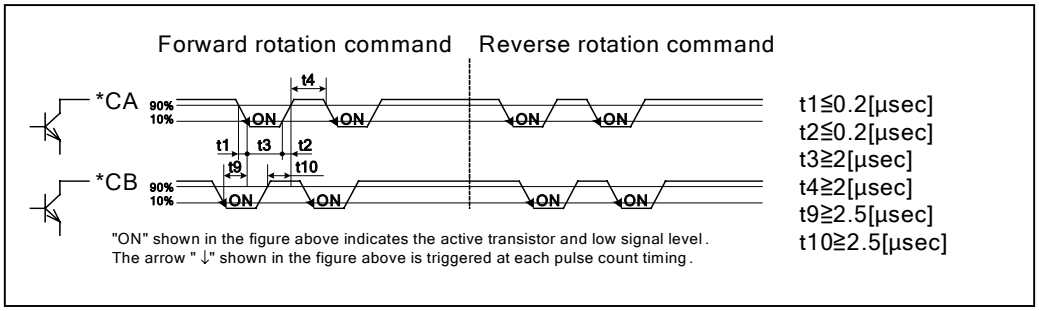
The phase-A and phase-B signals indicate the direction of rotation and rotation amount, respectively.

Each edge in the phase-A or phase-B signal corresponds to one pulse.

• Differential input



• Open collector input



PnO1 / no.04

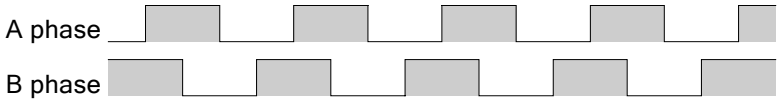
Parameter #04

No.	Name	Setting range	Initial value	Change
04	Rotation direction switching/output pulse switching for rotation in CCW direction	0: Positive direction forward rotation (CCW)/B phase advance 1: Positive direction reverse rotation (CW)/B phase advance 2: Positive direction forward rotation (CCW)/A phase advance 3: Positive direction reverse rotation (CW)/A phase advance	0	Power

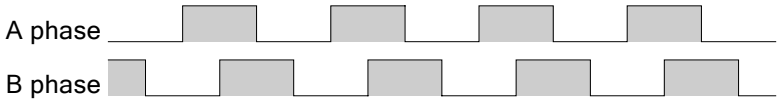
Set the servomotor rotation direction and the output pulse phase to the direction the machine is moving.

The rotation direction when the forward rotation pulse and the command signal are the H level or the 90 degree phase difference 2 signal with input of B phase advance pulse string is the positive direction.
To switch the output pulse phase, select the phase when the servomotor is rotating counterclockwise (CCW).

- When the reference value is 0 or 1

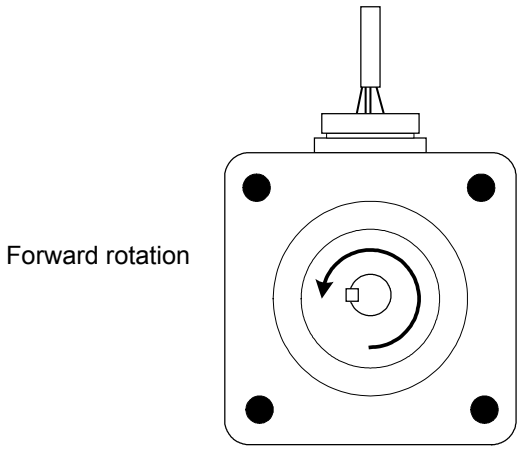


- When the reference value is 2 or 3



■ Forward/reverse rotation

Counterclockwise rotation (CCW) when the servomotor output shaft is viewed from the front is forward rotation. Clockwise rotation (CW) is reverse rotation.



Parameter #05

No.	Name	Setting range	Initial value	Change
05	Tuning mode	0: Auto tuning, 1: Semi-auto tuning, 2: Manual tuning	0	Always

* It is valid for position control and speed control.

Select the tuning method of the servo amplifier.

■ Auto tuning (Setting of basic setting parameter 05: 0)

This is the factory setting of the servo amplifier.
The inertia ratio of the machine is always assumed inside the amplifier in this mode to automatically set the optimum gain.
Set 0 for easy tuning.

■ Semi-auto tuning (Setting of parameter 05: 1)

Use this mode when the inertia ratio of the machine cannot be assumed correctly inside the amplifier.

■ Manual tuning (Setting of parameter 05: 2)

Use this option when adjustment fails in the auto tuning and semi-auto tuning modes.

Parameters that must be set or those automatically adjusted in each tuning mode are as follows.

No.	Name	Tuning mode		
		0: Auto	1: Semi-auto	2: Manual
06	Load inertia ratio	-	O	O
07	Auto tuning gain	O	O	×
40	Position controller gain 1	-	-	O
41	Speed response 1	-	-	O
42	Speed controller integration time 1	-	-	O
45	Feed forward filter time constant	-	-	O
46	Torque filter time constant	-	-	O

* O : Parameter that must be set
- : Parameter that may not be set (The value is automatically calculated inside the amplifier and the result is reflected on the parameter.)
× : The parameter has no effect even if it is set.

Refer to Chapter 6 for detailed description of tuning.

PnO1 / no.06

Parameter #06

No.	Name	Setting range	Initial value	Change
06	Load initial ratio	GYS motor: 0.0 - 100.0 times (in 0.1 increments) GYG motor: 0.0 - 30.0 times (in 0.1 increments)	5.0 (1.0)	Always

* It is valid for position control and speed control.

Values in ( ) are the initial values of the GYG motor.

Specify the moment of inertia of the load (moment of inertia of load converted to motor shaft) exerted on the motor shaft in the mechanical system, in the ratio to the moment of inertia of the motor.

$$\text{Load inertial ratio} = \frac{\text{(Moment of inertia of load converted to motor shaft)}}{\text{(Moment of inertia of motor)}}$$

This parameter must be specified in some tuning modes (basic parameter 05).

No.	Name	Tuning mode		
		0: Auto	1: Semi-auto	2: Manual
06	Load inertia ratio	Automatically refreshed at every 10 minutes	O	O

O:Parameter that must be set

■ How to specify the load inertia ratio

There are the following two setting methods.

1) Setting the value monitored at the keypad panel

Use monitor mode On 12 at the keypad panel to monitor.

Use the monitored value as a setting.

* If the value fluctuates, set the average value.

If fluctuation is considerable and the maximum-to-minimum ratio exceeds two, use the setting method described below.

2) Setting the calculated value

Calculate the load inertial moment and specify the result.

The calculation formula for obtaining the moment of inertia is described in appendix.

* Capacity selection software can be used for automatic calculation.

The capacity selection software can be downloaded free of charge from Fuji Electric's home page.

http://www.fujielectric.co.jp/fcs/jpn/f/f_info.html

PnO1 / no.07

Parameter #07

No.	Name	Setting range	Initial value	Change
07	Auto tuning gain	1 to 20 (in 1 increments)	10	Always

* It is valid for position control and speed control.

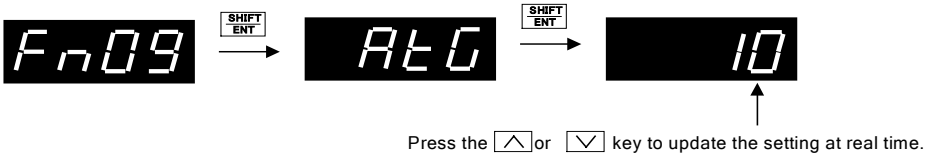
Specify the response of the servomotor used in the auto tuning or semi-auto tuning mode.
Specify a larger value to reduce the command follow-up time and positioning setting time, but too large a value cause the motor to vibrate.
* There is no need to set the parameter in the manual tuning mode.

■ Setting method

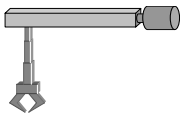
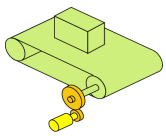
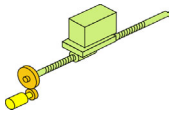
There are two setting methods

1) Setting parameter using PC loader and keypad panel (parameter setting mode)
After the parameter is established, the setting content is updated.

2) Setting through auto tuning gain setting from keypad panel (in test operation mode)
The setting is updated at real time when the value is changed.



■ Approximate measure for setting

Configuration of machine	Auto tuning gain (approximate)
Large transfer machine	1 to 6
Arm robot 	5 to 10
Belt drive 	7 to 13
Ball screw mechanism 	10 to 15
Inserting, mounting or bonding machine	13 to 20

* If the gain cannot be increased up to the value specified as an approximate measure, there may be mechanical resonance. Use a notch filter to suppress mechanical resonance. → Refer to page 5-72.

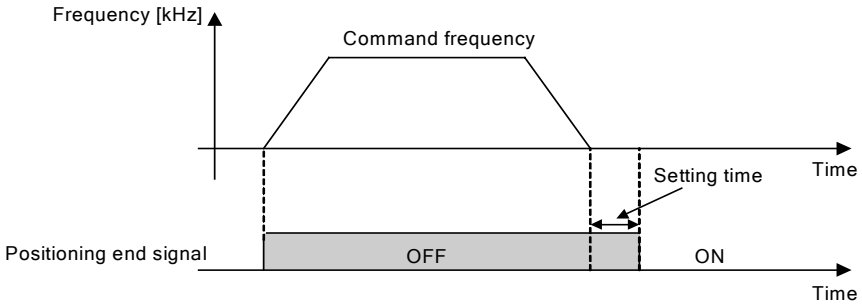
PnO1 / no.08

Parameter #08

No.	Name	Setting range	Initial value	Change
08	Auto forward gain	1 - 20 (in 1 increments)	5	Always

* It is only valid for position control.

This reduces the positioning setting time for auto/semi-auto tuning.
The larger this value is, the shorter the positioning setting time is. It is effective to reduce the tact time.



With adjustment of the auto forward gain, the following parameters are automatically adjusted.

No.	Name	Setting range	Initial value	Change
45	Feed forward filter time constant	0.0 - 250.0 [msec] (in 0.1 increments)	Initial value	Always

* Precautions for adjustment of auto forward gain

1) Make adjustment after adjustment of the auto tuning gain (standard parameter # 7).
2) Minimize the command pulse compensation (guideline value below).

$$\frac{\text{Command pulse compensation } \alpha \text{ (parameter \# 1)}}{\text{Command pulse compensation } \beta \text{ (parameter \# 2)}} \leqq 30$$

<When the parameters below are set, the auto forward gain is invalid.>

- The tuning (parameter # 5) reference value is "2 (manual)".
- The command following control selection (parameter # 55) reference value is "1" or "2".

Parameter #55

No.	Name	Setting range	Initial value	Change
55	Command following control selection	0: None, 1: Command following control, 2: Command following control (compensated during stop)	0	Power

PnO1 / no.09

Parameter #09

No.	Name	Setting range	Initial value	Change
09	Control mode switching	0: Position, 1: Speed 2: Torque, 3: Position⇔Speed 4: Position⇔Torque, 5: Speed⇔Torque	0	Power

The RYC-VVT control function is of 3 types.

- Position control

  Rotation of the servomotor output shaft is controlled (pulse string input).

- Speed control

  The rotation speed of the servomotor output shaft is controlled.

- Torque control

  Torque of the servomotor output shaft is controlled.

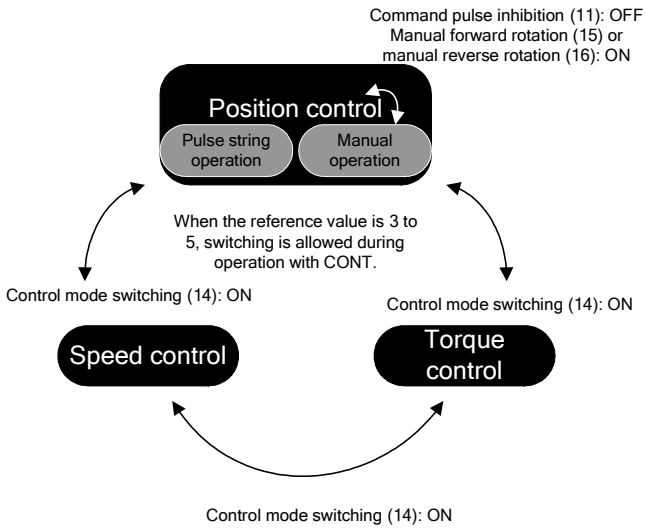
■ Switching method to each control mode

With parameter 09, whether the control mode is fixed or the control mode is switched by CONT signal allocation control mode switching (14) can be selected.

Position⇔Speed, Position⇔Torque and Speed⇔Torque can be switched at any time.

Basic setting parameter 09

Parameter reference value	Control mode	
	Control mode switching = OFF	Control mode switching = ON
0	Position control (fixed)	
1	Speed control (fixed)	
2	Torque control (fixed)	
3	Position control	Speed control
4	Position control	Torque control
5	Speed control	Torque control

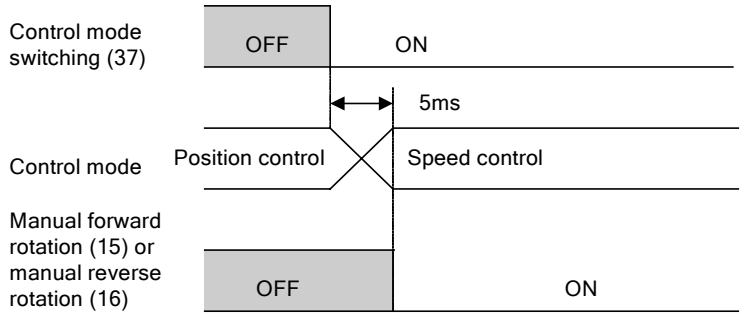


■ Transition time to each control mode

The transition time to each control mode is 5 [ms].

Enter the switch signal and enter the following command 5 [ms] later.

Ex.) Position control → Switching to speed control



■ Position control

It is applicable to the pulse string operation, multistep speed operation (3rd speed) and analog speed command input operation. When command pulse inhibition (27) is ON, it is inhibited.

■ Speed control

It is applicable to the multistep speed operation (3rd speed) and analog speed command input operation.

■ Torque control

It is applicable to the analog torque command input operation.

Parameters are described in the order of the parameter number.

PnO1 / no.10 – no.14

Parameters #10 through #14

No.	Name	Setting range	Initial value	Change
10	CONT 1 signal allocation	0 to 21 (in 1 increments) 0: Not specified 1: Servo ON (RUN) 2: Reset [RST] 3: + overtravel 4: - overtravel 5: Emergency stop [EMG] 6: P-action 7: Deviation clearance 8: External regenerative resistor overheat 9: Anti-resonance frequency selection 0 10: Anti-resonance frequency selection 1 11: Command pulse inhibition 12: Command pulse α selection 0 13: Command pulse α selection 1 14: Control mode switching 15: Manual forward rotation [FWD] 16: Manual reverse rotation [REV] 17: Multistep speed 1 [x1] 18: Multistep speed 2 [x2] 19: Acceleration/deceleration time selection 20: Current limiting regulator ON 21: Coasting [BX]	1 [RUN]	Power
11	CONT 2 signal allocation		2 [RST]	Power
12	CONT 3 signal allocation		0	Power
13	CONT 4 signal allocation		0	Power
14	CONT 5 signal allocation		0	Power

PnO1 / no.15 – no.18

Parameters #15 and #18

No.	Name	Setting range	Initial value	Change
15	OUT 1 signal allocation	0 to 11 (in 1 increments) 0: Not specified 1: Ready [RDY] 2: Positioning end [PSET] 3: Alarm detection: a-contact 4: Alarm detection: b-contact 5: Dynamic brake 6: Overtravel detection 7: Forced stop detection 8: Zero deviation 9: Zero speed 10: Current limit detection 11: Brake timing	1 [RDY]	Power
16	OUT 2 signal allocation		2 [PSET]	Power
17	OUT 3 signal allocation		4 [ALMb]	Power
18	OUT 4 signal allocation		0	Power

The following functions can be assigned to sequence input/output terminals.

■ CONT signal allocation number

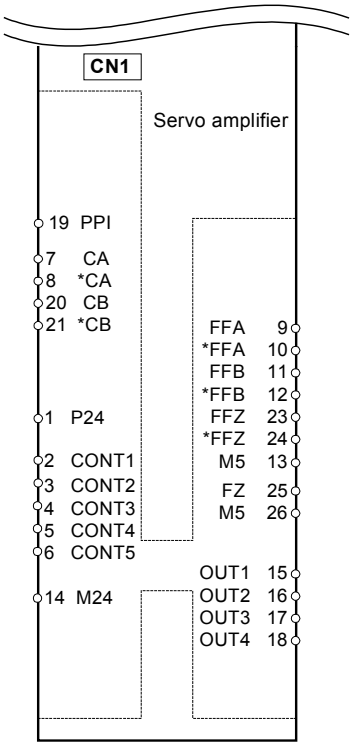
Setting	Name		Page
0	Not specified		–
1	Servo ON	[RUN]	5-22
2	Reset	[RST]	5-23
3	+ overtravel	[+OT]	5-24
4	- overtravel	[-OT]	
5	Forced stop	[EMG]	5-26
6	P-action		5-28
7	Deviation clearance		5-29
8	External regenerative resistor overheat		5-30
9	Anti-resonance frequency selection 0		5-31
10	Anti-resonance frequency selection 1		
11	Command pulse inhibition		5-32
12	Command pulse α selection 0		5-34
13	Command pulse α selection 1		
14	Control mode switching		5-35
15	Manual forward rotation	[FWD]	5-36
16	Manual reverse rotation	[REV]	
17	Multistep speed 1	[x1]	5-38
18	Multistep speed 2	[x2]	
19	Acceleration/deceleration time selection		5-39
20	Current limiting regulator ON		5-40
21	Coasting	[BX]	5-41

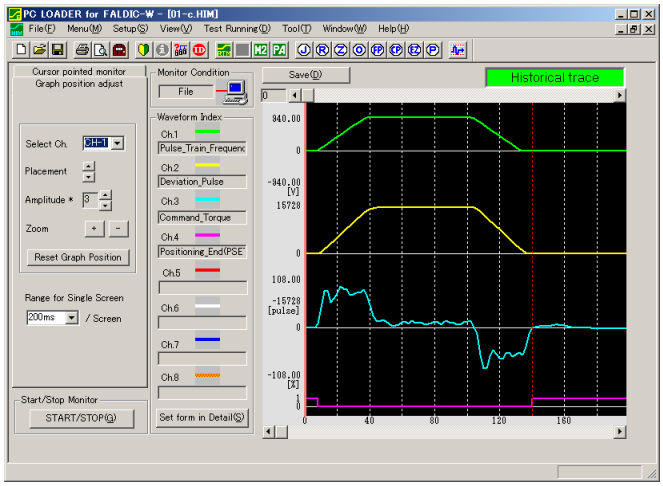
■ OUT signal allocation number

Setting	Name	Page
0	Not specified	–
1	Ready	5-42
2	Positioning end	5-43
3	Alarm detection: a-contact	5-46
4	Alarm detection: b-contact	
5	Dynamic brake	5-47
6	Overtravel detection	5-24
7	Forced stop detection	5-26
8	Zero deviation	5-48
9	Zero speed	5-49
10	Current limit detection	5-40
11	Brake timing	5-50

■ Each sequence input/output signal can be monitored in the trace screen of the PC loader.

Terminal allocation of connector 1 (CN1) of servo amplifier and trace screen of PC loader





(1) Servo on [RUN]

This signal makes the servomotor ready to rotate.

Sequence input signal	Operation command [RUN]... Assigned to CONT 1 with factory setting

■ Function

The servomotor is ready to rotate while the servo on [RUN] signal remains active.
The servomotor does not rotate if motor power is supplied but the servo on signal is turned off.
If the signal is turned off during rotation, the servomotor decelerates at its maximum performance and, after the stopping point (with rotation speed being within the zero speed width specified at parameter #21), the servomotor coasts to stop.
There is no retaining torque after the servomotor is stopped.
When the servo on [RUN] remains inactive, all rotation commands are ignored.
The servomotor is ready to rotate when the servo on [RUN] is active without alarm detection with active + overtravel, - overtravel and forced stop [EMG] signals.

If the servo on [RUN] signal is active and other signals are turned off, the servomotor is stopped.

■ Parameter setting

To assign the servo on [RUN] signal to a sequence input terminal, specify the corresponding value (“1”) to the system setting parameter.
If the signal is not assigned to sequence input terminals, the signal is assumed to be active at any time.

■ Reference

For the forced stop signal, refer to page 5-26.

(2) Reset [RST]

Alarm detection of the servo amplifier is reset.

Sequence input signal	Reset [RST] ... Assigned to CONT 2 with factory setting

■ Function

The sequence input signal resets the alarm detected at the servo amplifier.
Alarm detection is reset upon the activating edge of the reset [RST] signal.

■ Alarm that can be reset by alarm reset

Indication	Description
OC1	Overcurrent 1
OC2	Overcurrent 2
OS	Overspeed
Ou	Overvoltage
rH2	Regenerative transistor overheat
EC	Encoder communication alarm
OL	Overload
Lu	Undervoltage
rH1	Regenerative resistance overheat
OF	Deviation limit
AH	Amplifier overheat

■ Alarm that is reset by rebooting

Indication	Description
Et	Encoder trouble
Ct	Control power alarm
dE	Memory alarm
Cnt	CONT duplication

■ Parameter setting

To assign the reset [RST] signal to a sequence input terminal, specify the corresponding value (“2”) to the parameter.
If this signal is not assigned to the sequence input terminals, the signal is assumed to be inactive at any time.

■ Reference

Alarm detection can be reset in any of the following methods.

1) Activating edge of reset [RST] sequence input signal
2) ENT key operation upon alarm reset [FnO4] in test operation mode
3) Simultaneous depression of ∧ and ∨ keys upon alarm detection [SnO2] (for more than 1 second)
4) Power off and on

The alarm history can be initialized through ENT key operation at alarm history initialization [FnO5] in the test operation mode.

(3) Overtravel and overtravel detection

Movement of the machine can be forcibly stopped upon a signal from a limit switch or the like.

Sequence input/output signal	Overtravel / overtravel detection

■ Function

+OT (3)/-OT (4)

These are input signals from limit switches for the prevention of overtravel (OT) at the end of the moving stroke of the machine.

When the input signal is turned off, the servomotor decelerates to stop at its maximum performance while ignoring the rotation command in the detected direction. Only pulse string inputs in the direction opposite to the detecting direction and manual feed (forward/reverse rotation command) in the test operation mode are executed. (b-contact)

If over-travel is detected, the position deviation is cleared.

■ Parameter setting

To assign the +OT signal to a sequence input terminal, specify the corresponding value (“3”) to the parameter. For -OT signal, specify “4.”

These signals are assumed to be active at any time if they are not assigned to the sequence input terminals.

To assign OT detection to a sequence output terminal, specify the corresponding value (“6”) to the system setting parameter.

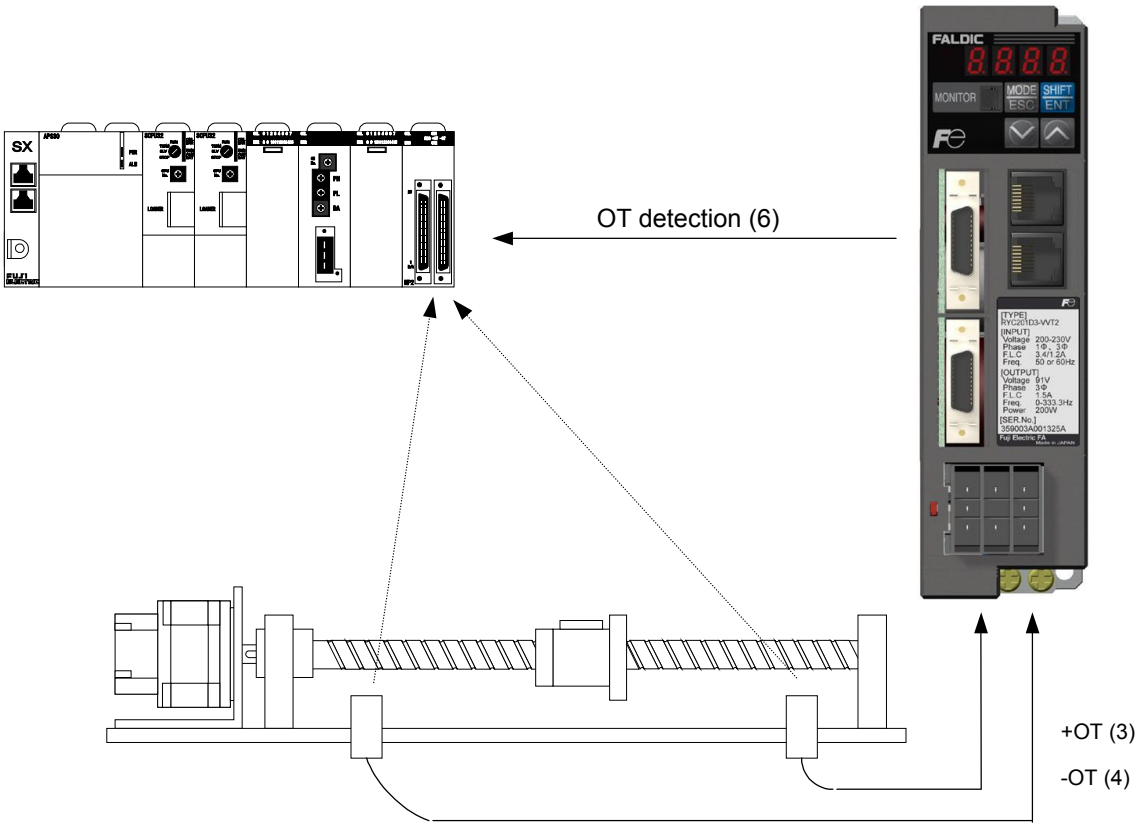
■ Reference

(1) Detecting direction

The +OT signal is detected while the servomotor rotates in the positive direction. The positive direction is the direction specified in basic setting parameter #4. The servomotor is not stopped even if the +OT signal is detected during rotation in the negative direction.

(2) OT detection (6)

This sequence output signal is turned on when +OT (3) or -OT (4) sequence input is turned off.


SX
FALDIC
MONITOR
MODE
SHIFT
ESC
ENT
OT detection (6)
+OT (3)
-OT (4)

(4) Forced stop and forced stop detection

This signal supplied at the sequence input terminal stops the servomotor forcibly.

Sequence input/output signal	Forced stop/forced stop detection

■ Function

(1) Forced stop (Valid for position control/speed control)

The servomotor is forcibly stopped (with a b-contact) while the forced stop (5) signal is turned off.

This signal is valid in all control states and it is executed at the highest priority. Because safety and detection speeds are generally important for forced stop (5), the signal is directly connected to the servo amplifier.

Usually a self-locking pushbutton switch (command switch) on the operation panel is connected.

If forced stop is detected, the position deviation is cleared.

(2) Forced stop detection

When the forced stop (5) signal is turned off, the forced stop detection (7) signal is turned on to notify external devices of the event.

■ Parameter setting

To assign forced stop to a sequence input terminal, specify the corresponding value (“5”) to the parameter.

If this signal is not assigned to the sequence input terminals, the signal is assumed to be active at any time.

When detection of forced stop is allocated to the sequence output terminal, set value (7) applicable to the parameter.

■ Reference

(1) Ready [RDY]

Assign the forced stop (5) signal to a sequence input terminal to turn on the ready [RDY] signal upon activation of the servo on [RUN] and forced stop signals, readying the output shaft of the servomotor to rotate.

(2) State of forced stop

If forced stop (5) is inactive and servo on [RUN] is active, the servomotor is stopped with the zero speed command state.

Activate forced stop to ready the servomotor for operation.

Deactivate the servo on [RUN] signal to coast to stop.

(3) Rotation command

While the forced stop signal remains inactive, all rotation commands are ignored.

(5) P-action

Proportional band control is adopted as a control method of the servo amplifier.

Sequence input signal	P-action

■ Function

Activate this signal while the servo on [RUN] signal is active with the motor shaft being mechanically locked.

If P-action is activated during rotation of the servomotor, position control becomes unstable. Do not activate the signal while the servomotor rotates.

■ Parameter setting

To assign P-action to a sequence input terminal, specify the corresponding value ("6") to the parameter.
The signal is assumed to be inactive at any time if it is not assigned to the sequence input terminals

Hint

If the brake is handled with servo locked, an overload alarm ("OL") is detected.
This is because the servo performs PI control to generate a torque and restore the original position even upon small deviation. Therefore activate P-action without fail, using an external signal, when the brake is applied.

(6) Deviation clearance

Difference (position deviation) between the command position and feedback position is reduced to zero.

Sequence input signal	Deviation clearance

■ Function

While this signal remains active, the difference (position devition) between the command position and feedback position is reduced to zero. The feedback position is made the command position.

■ Parameter setting

To assign deviation clearance to a sequence input terminal, specify the corresponding value (“7”) to the parameter.

■ Reference

While the deviation clearance signal is activated, all rotation commands are ignored.
If the deviation clearance signal is turned on during rotation of the servomotor, pulse command, manual forward rotation [FWD] of the test operation mode and other commands are ignored, to cause the servomotor to be stopped.

Deviation accumulated at a stopper can be zeroed to avoid movement caused by the offsetting of deviation upon a released load.

(7) Regenerative resistor overheat

Connect the thermistor signal of the external regenerative resistor (option) to this signal. When this signal is OFF with the regenerative resistor overheating alarm, the servomotor is forcibly stopped.

Sequence input signal	Regenerative resistor overheat

■ Function

The servomotor is forcibly stopped (with a b-contact) while the regenerative resistor overheat signal is inactive.

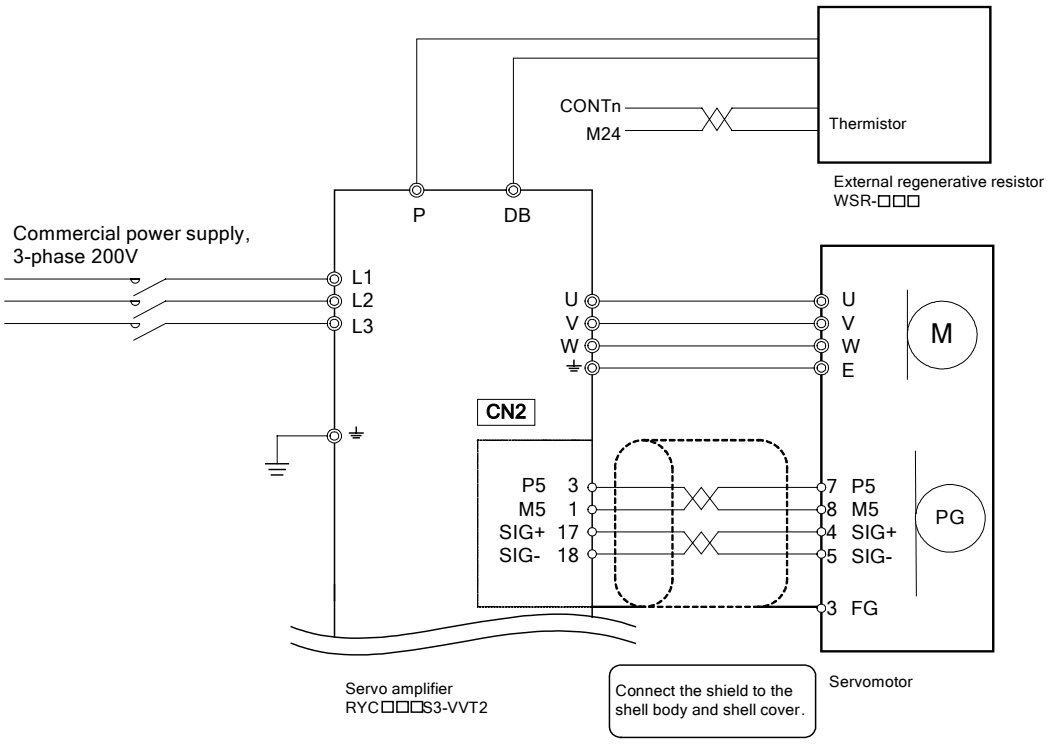
If this signal is deactivated during rotation, the servomotor decelerates by its maximum performance to stop (within the zero speed width (parameter #23)), and then it coasts to stop.

No holding torque generates after the servomotor is stopped.

■ Parameter setting

To assign regenerative resistor overheat to a sequence input terminal, specify the corresponding value ("8") to the parameter.

The signal is assumed to be active at any time if it is not assigned to the sequence input terminals.



(8) Anti-resonance frequency selection 0/1

Set any of the four anti-resonance frequencies.

Sequence input signal	Anti-resonance frequency selection 0/1

■ Function

Select any of the four anti-resonance frequencies by setting two ON/OFF bits.

Anti-resonance frequency selection 1	Anti-resonance frequency selection 0	Anti-resonance frequency
OFF	OFF	Parameter #60*
OFF	ON	Parameter #61
ON	OFF	Parameter #62
ON	ON	Parameter #63

* The signal is assumed to be inactive at any time if it is not assigned to sequence input signals.
In this case, parameter #60 (anti-resonance frequency 0) becomes always valid.
To make anti-resonance frequencies invalid, set the anti-resonance frequency at 200.0Hz (factory shipment value).

■ Parameter setting

To assign anti-resonance frequency 0 or 1 to a sequence input terminal, specify the corresponding value (“9”) or (“10”) to the parameter.

■ Reference

For details of the anti-resonance frequency, refer to Chapter 7.

(9) Command pulse inhibition

Pulse string input ON/OFF for position control is selected.

Sequence input signal	Command pulse inhibition

■ Function

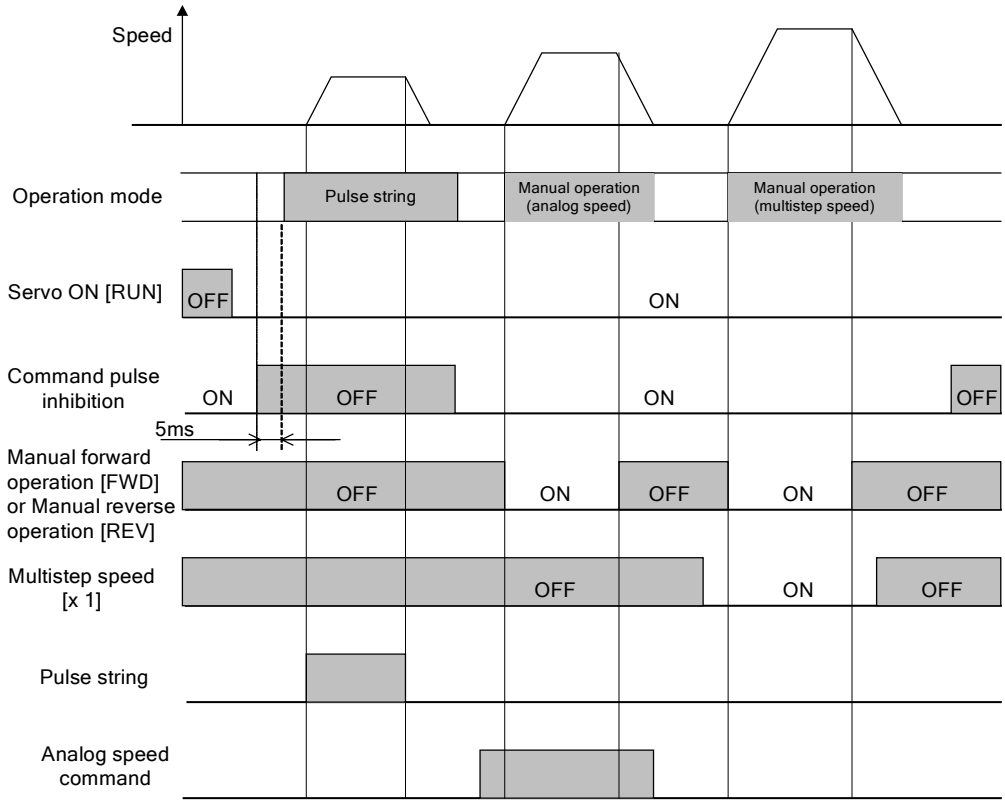
While the command pulse inhibition signal (11) is ON, manual operation of the servo amplifier is valid.
It is used for manual forward operation [FWD] (15) or manual reverse operation [REV] (16) during position control. Switching between the pulse string operation and the manual operation is performed.

* When this signal is not allocated to the sequence input signal, it is considered to normally be OFF. Therefore, when servo ON [RUN] (1) is turned ON, the pulse string input is always ON.

■ Parameter setting

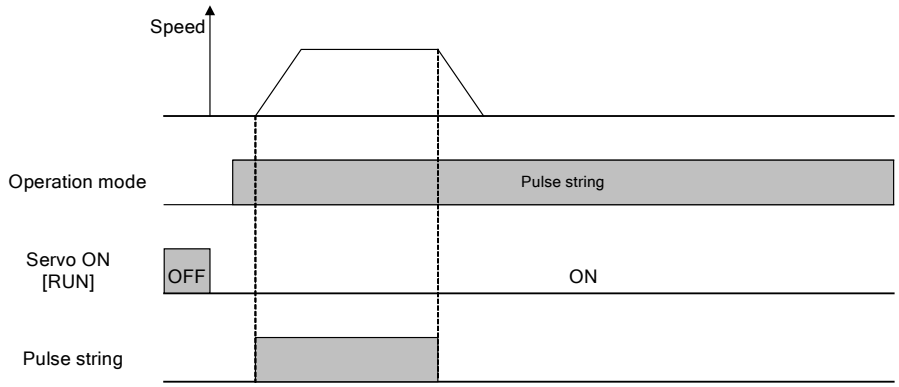
To allocate the command pulse inhibition to the sequence input terminal, set value (11) applicable to the parameter.

■ For pulse string operation and manual operation



■ When only pulse string operation is performed

Allocation of the command pulse inhibition (11) is not required as shown below:



(10) Command pulse compensation α selection 0/1

Multiplying power of the machine movement is changed.

Sequence input signal	Command pulse compensation α selection 0/1

■ Function

By switching the command pulse compensation α0 (12) or command pulse compensation α1 (13), either one of 4 command pulse compensation values is selected.

■ Command pulse compensation

Command pulse compensation α selection 1	Command pulse compensation α selection 0	Pulse compensation value
OFF	OFF	Parameter #1
OFF	ON	Parameter #78
ON	OFF	Parameter #79
ON	ON	Parameter #80

■ Parameter setting

To allocate the command pulse compensation α0 or command pulse compensation α1 to the sequence input terminal, set value (12) or (13) applicable to the parameter.

(11) Control mode switching

Control mode is switched.

Sequence input signal	Control mode switching

■ Function

With ON/OFF of control mode switching (14), the control mode is switched.
Control mode switching is only valid when 3, 4 and 5 are set for parameter #09.

■ Control mode (parameter #09)

Parameter #09

Parameter reference value	Control mode switching	Control mode	
		Control mode switching = OFF	Control mode switching = ON
0	Invalid	Position control (fixed)	
1	Invalid	Speed control (fixed)	
2	Invalid	Torque control (fixed)	
3	Valid	Position control	Speed control
4	Valid	Position control	Torque control
5	Valid	Speed control	Torque control

■ Parameter setting

To allocate the control mode switching to the sequence input terminal, set value (14) applicable to the parameter.

■ Reference

Refer to parameter #09 for details of the control mode.

(12) Forward rotation command [FWD]/Reverse rotation command [REV]

It is the signal to rotate the servomotor.

Sequence input signal	Forward rotation command [FWD]/Reverse rotation command [REV]

■ Function

While the forward rotation command [FWD] (reverse rotation command [REV]) is ON, the servomotor rotates in the positive (negative) direction. When it is ON, acceleration starts. When it is OFF, deceleration starts.

(1) Speed control

The motor rotates at the voltage of the analog speed command input [Vref] terminal and at the speed selected from multistep speed [X1] and [X2].

(2) Position control

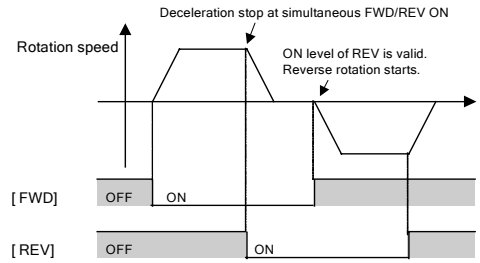
It is the same as speed control. The motor starts rotation when the forward rotation command [FWD] (reverse rotation command [REV]) is at the ON edge. If other [REV] or [FWD] signal is ON during rotation, it is ignored.

(3) Torque control

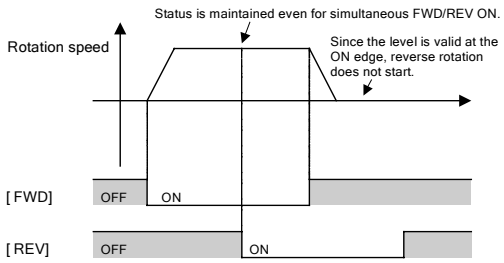
Torque is output from the servomotor shaft according to the torque command voltage.

Control mode	FWD/REV signal	Simultaneous FWD/REV ON
Speed control	ON level	Deceleration stop
Position control	ON edge	Motion immediately before simultaneous ON is maintained.
Torque control	ON level	Deceleration stop

Speed control **Torque control**



Position control



■ Parameter setting

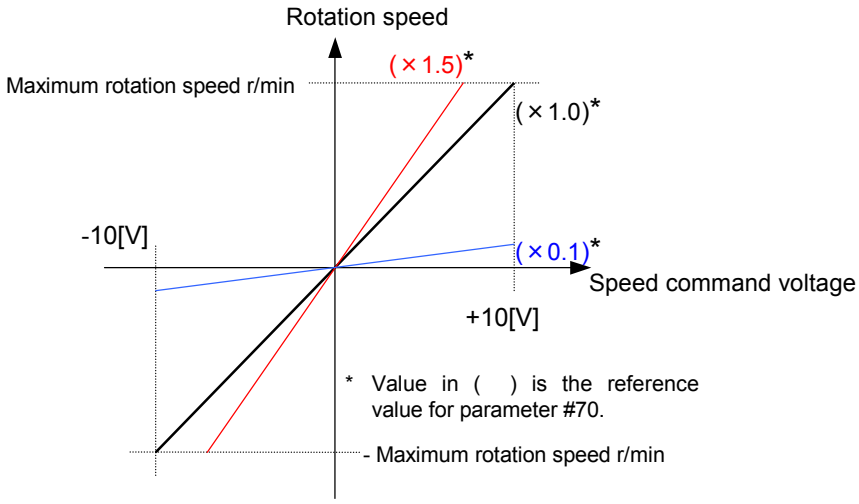
To allocate the forward rotation command [FWD] signal to the sequence input terminal, set value (15) applicable to the parameter. ((16) for the reverse rotation command.)
When this signal is not allocated to the sequence input terminal, it is considered to normally be OFF.

■ Reference

(1) Gain of analog speed command input [Vref] terminal (for speed command)

The motor shipped from the factory rotates at the maximum rotation speed [r/min] (Note 1) of the motor in the forward rotation direction for the speed command voltage of + 10 [V].

When parameter #70 is set, the rotation speed ratio for the speed command voltage can be changed. When the reference value for parameter #70 is 0.1, the rotation speed can be (Maximum rotation speed x 0.1) [r/min] for the speed command voltage of +10 [V].

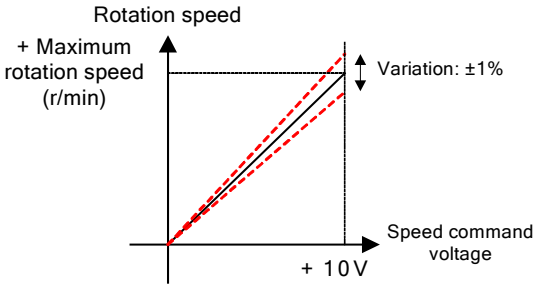


Note 1) The actual rotation speed of the motor has a tolerance of ±10 [V]/± Maximum rotation speed ±1% [r/min] due to variation of individual servo amplifiers and servomotors.

To make a fine adjustment of the rotation speed, adjust parameter #70 above.

GYS motor ±10V / ±5000±1%[r/min]

GYG motor ±10V / ±3000±1%[r/min]



(2) Resolution of analog speed command input voltage

The analog speed command input voltage [Vref] terminal has a resolution of 14 bits in full scale.

(13) Multistep speed 1 [X1]/2 [X2]

The setting speed for manual operation is selected.

Sequence input signal	Multistep speed 1 [X1]/2 [X2]

■ Function

By switching of multistep speed 1 [X1]/2 [X2] signal, either one of 4 command pulse compensation values is selected.

Selection of multistep speed

X2	X1	Rotation speed
OFF	OFF	Analog speed command input [Vref] terminal
OFF	ON	Standard parameter #31
ON	OFF	Standard parameter #32
ON	ON	Standard parameter #33

(1) Speed control

The motor rotates at the voltage of the analog speed command input [Vref] terminal and at the speed selected in multistep speed [X1] and [X2].

(2) Position control

It is the same as speed control.

■ Parameter setting

To allocate the multistep speed 1 [X1] and 2 [X2] to the sequence input terminal, set value (17) or (18) applicable to the parameter.

(14) Acceleration/deceleration time selection

Acceleration/deceleration time in manual operation is selected.

Sequence input signal	Acceleration/deceleration time selection

■ Function

By switching the acceleration/deceleration time selection signals, either one of 2 acceleration/deceleration times is selected.

The acceleration time and the deceleration time of the servomotor are determined according to parameters #35 to 38. The acceleration time can be set separate from the deceleration time.

The acceleration time is not dependent on the rotation direction, and is on parameter #35 (#37). Parameters #35 and 37 can be switched with the acceleration/deceleration time selection signal.

Acceleration/deceleration time

Acceleration/ deceleration selection	Acceleration time	Deceleration time
OFF	Parameter 35	Parameter 36
ON	Parameter 37	Parameter 38

■ Parameter setting

To allocate the acceleration/deceleration time selection signal to the sequence input terminal, set value (19) applicable to the parameter. When this signal is not allocated to the sequence input terminal, it is considered to normally be OFF.

(15) Current limit valid/current limit detection

The maximum output torque of the servomotor can be limited.

Sequence input/output signal	Current limit valid/current limit detection

■ Function

(1) Current limit valid

While the current limit valid (20) signal is ON, the output torque of the servomotor can be limited. The torque limit value can be set in the range from 0 to 300 at the increments of 1 [%] to parameter #25. The maximum output torque is set as 100[%] rated torque.

Current limit is always valid for all control types.
When the output torque is limited during acceleration or deceleration, the acceleration/deceleration time in parameter setting may not be observed.

(2) Current limit detection

This signal is ON while the output torque of the servomotor has reached the torque limit value.
The output of current limit detection (10) is valid for all control types.

■ Parameter setting

To allocate the current limit valid signal to the sequence input terminal, set value (20) applicable to the parameter.
When the current limit valid (20) signal is not allocated to the sequence input terminal, the reference value for parameter 25 is always valid.

To allocate the current limit detection signal to the sequence input terminal, set value (10) applicable to the parameter.

(16) Coasting [BX]

The servomotor is forcibly set to coasting.

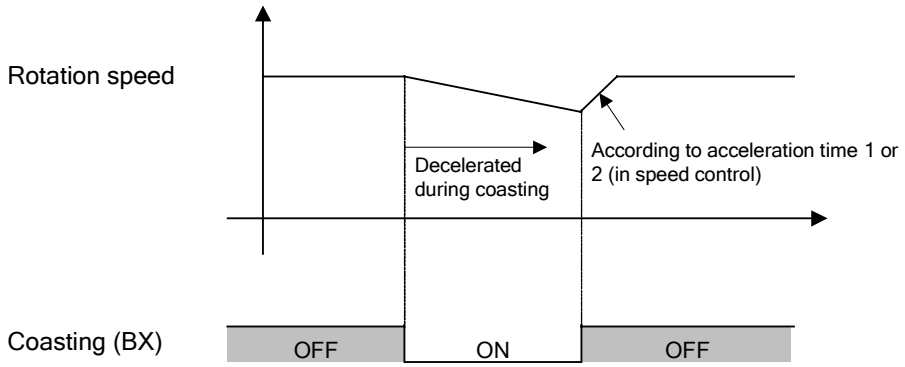
Sequence input signal	Coasting [BX]

■ Function

While the coasting (BX) signal is ON, the servo amplifier output is shutoff and the servomotor is coasting. The output shaft of the servomotor is decelerated (accelerated) with the load torque.
The coasting signal is valid for all control status (position control, speed control and torque control).

It is safe that this signal is not used for moving the machine in the vertical direction.

While the signal is ON during position control, the servomotor is coasting. When positioning control is performed with the pulse string, the number of output pulses on the upper level controller does not match the rotation of the servomotor.
During speed control and torque control, the servomotor is coasting as is. If the coasting signal is turned OFF during deceleration, the command speed or the command torque is output.



■ Parameter setting

To allocate the coasting signal to the sequence input terminal, set value (21) applicable to the parameter.

■ Reference

Coasting is a valid signal by priority in all control modes.

(17) Ready [RDY]

The signal is activated when the motor is ready to rotate.

Sequence output signal	Ready [RDY]...Assigned to OUT 1 with shipment setting

■ Function

The signal is activated when the following conditions are satisfied:

1) Servo ON [RUN] (1) signal ON
2) Active forced stop [EMG] (5) signal*
3) Inactive alarm detection: a-contact (3) signal (Or active alarm detection: b-contact (4) signal)
4) Active external regenerative resistor overheat (8) signal*
5) Source voltage above 150V
6) Coasting [BX] (21) signal OFF

* Conditions 2) and 4) are ignored if the corresponding signal is not assigned to the CONT terminals.

The host controller recognizes the ready [RDY] signal to check if the servomotor is ready to rotate.

■ Parameter setting

To allocate the ready [RDY] signal to the sequence input terminal, set value (1) applicable to the parameter.

(18) Positioning end [PSET]

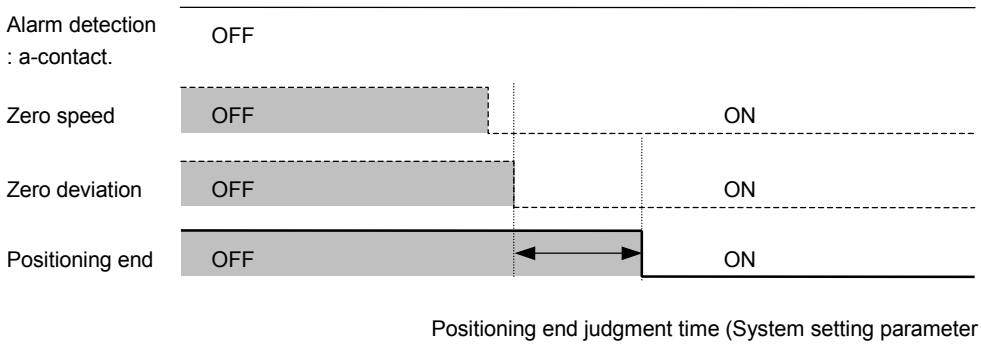
Use the signal to check that the positioning action has been completed.

Sequence output signal	Positioning end [PSET]...Assigned to OUT 2 with shipment setting

■ Function

The signal is active when the following conditions are satisfied.

1) There is no alarm.
2) The rotation speed is within the zero speed width specified at parameter #23.
3) The deviation amount is within zero deviation width specified at parameter #21.
4) The above conditions remain arranged for the positioning end judgment time specified at parameter #24.



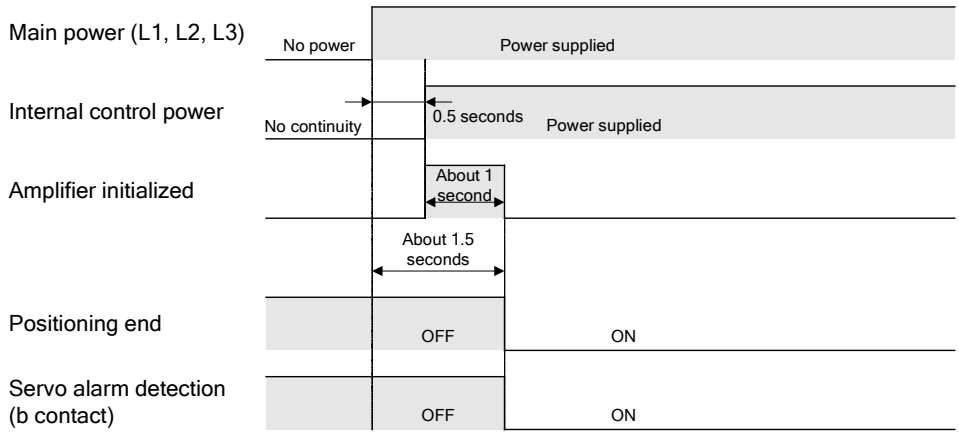
■ Parameter setting

To allocate the positioning end [PSET] signal to the sequence input terminal, set value (2) applicable to the parameter.

■ Reference

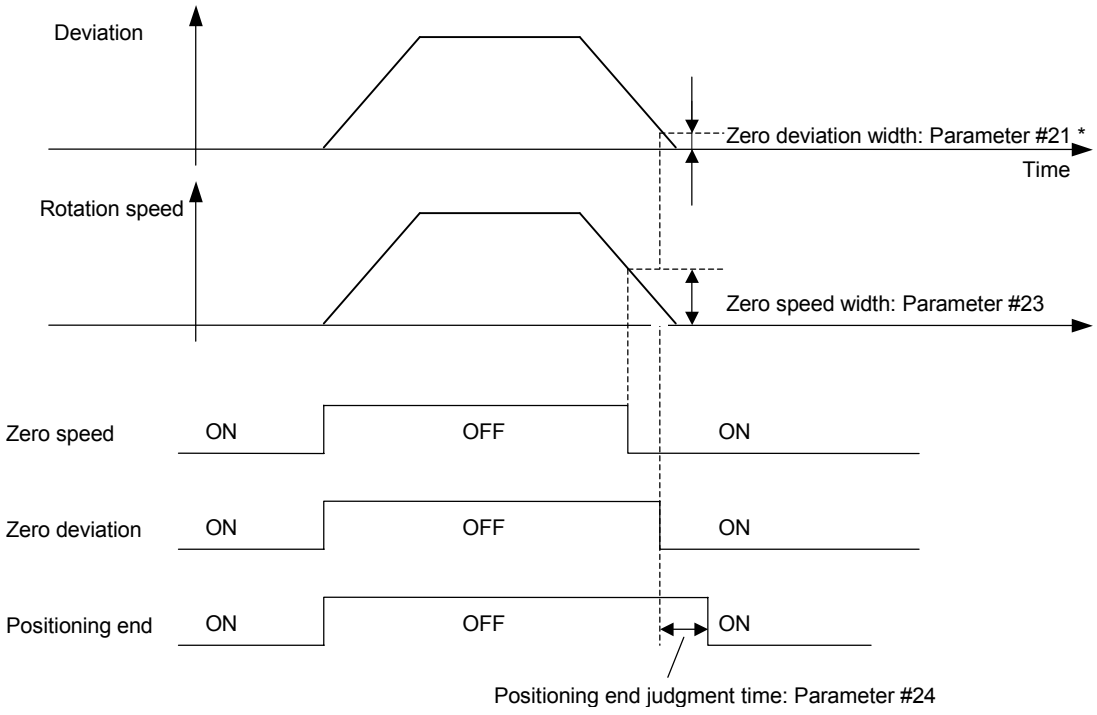
(1) When the power is supplied

It takes about 1.5 seconds from the power supply to defined position control of the servo amplifier. The positioning end signal is ON 1.5 seconds after the power is supplied.



(2) Position control

When the difference (deviation) between the command position (pulse string input) and the feedback position is zero deviation width (parameter 21) or less and the rotation speed is zero speed width (parameter 23) or less, the signal is ON.



* The unit uses encoder pulses (131072 pulses).

For details, refer to page 5-55.

(3) Positioning end (PSET) output for alarm detection

Positioning end (PSET) for alarm detection

Factor	Deceleration method	Positioning end signal	Remark
Servo ON [RUN] OFF	Forced zero speed - Base OFF	ON during stop	Ready [RDY] signal OFF
Forced stop [EMG] OFF	Forced zero speed	OFF	ON when forced stop is reset.
+OT, -OT detection	Forced zero speed - Servo lock	ON during stop	Rotation is available with pulse string, forward rotation command and reverse rotation command.
Alarm detection (minor failure)	Forced zero speed - Base OFF	OFF when alarm is detected.	ON when alarm is reset.
Alarm detection (major failure)	Base OFF	OFF when alarm is detected.	ON when alarm is reset.

Note) Minor failure - Deviation limit (OF), regenerative resistor overheating (rH1), amplifier overheating (AH), undervoltage (Lv)

Major failure - Failure detection other than minor failure
Forced zero speed - Decelerated at the maximum capacity of the servomotor.
Base OFF - No drive power on the servomotor (coasting).

(19) Alarm detection: a-contact (b-contact)

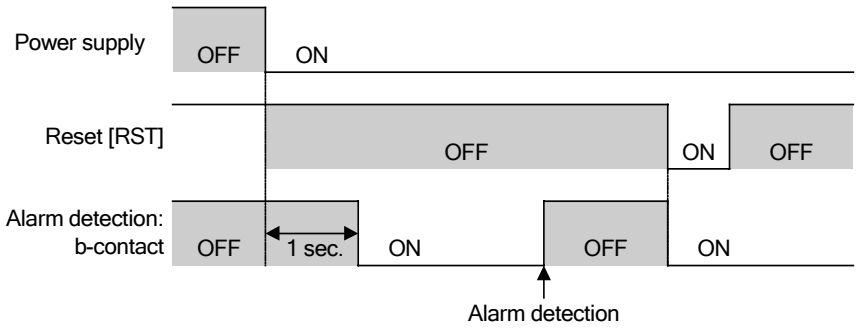
The servo amplifier detects the action (alarm) of protection function to activate (desactivate)* the signal.

Sequence output signal	Alarm detection: a-contact Alarm detection: b-contact ... Assigned to OUT 3 with shipment setting

■ Function

The signal is activated (deactivated*) and is held at the servo amplifier when the servo amplifier detects an alarm. After the cause of the alarm is removed, the signal is deactivated (activated*) upon the activating edge of the reset signal [RST] so that operation is resumed.
The host controller recognizes the alarm detection signal to check for an alarm.
* Description in parentheses ( ) is for b-contact alarm detection.

<Precaution for usage of b-contact alarm detection>



Make sure that the signal is inactive for about one second after the power is turned on.

■ Parameter setting

To assign a- or b-contact alarm detection to the sequence output terminal, specify the corresponding value (“3” or “4”) to the parameter.

(20) Dynamic brake

This signal is ON when the servo amplifier detects a specific alarm *.

Sequence output signal	Dynamic brake

■ Function

This signal is ON when the servo amplifier detects a specific alarm * that cannot drive the servomotor, and the signal is maintained until input of the alarm reset signal.
When the dynamic brake is applied, three phases of the synchronous motor are short-circuited to generate power. After the output shaft of the servomotor is stopped, no braking force generates.

The output terminal of the dynamic brake is +30VDC, 50mA. Because the electromagnetic contact cannot be driven directly, use a general relay or solid-state contactor (SSC).

■ Parameter setting

To assign the dynamic brake to the sequence output terminal, specify the corresponding value ("5") to the parameter.

■ Reference

- Specific alarm
  The motion changes to coasting at the same time the alarm is detected.

Indication	Description
OC 1	Overcurrent 1
OC2	Overcurrent 2
OS	Overspeed
Ou	Overvoltage
Et	Encoder trouble
Ct	Control power alarm
dE	Memory alarm
rH2	Regenerative transistor overheat
EC	Encoder communication alarm
Cnt	CONT duplication
OL	Overload

* At occurrence of the alarm, only overload motion is decelerated at the maximum capacity. When the signal stops, the servomotor is coasting.

(21) Zero deviation

This can confirm that the servomotor has almost reached the command position.

Sequence output signal	Zero deviation

■ Function

The signal is ON when the difference (position deviation) between the current command position and the current feedback position is within the reference value for parameter #21.

The zero deviation signal is valid at the position control mode.

The signal is always ON in control status (torque control, etc.) other than the position control.
Reference value level for parameter #21 is not related to positioning accuracy.

■ Parameter setting

To allocate the zero deviation signal to the sequence input terminal, set value (8) applicable to the parameter.

(22) Zero speed

This signal is ON when the rotation speed of the servomotor is almost 0 (zero).

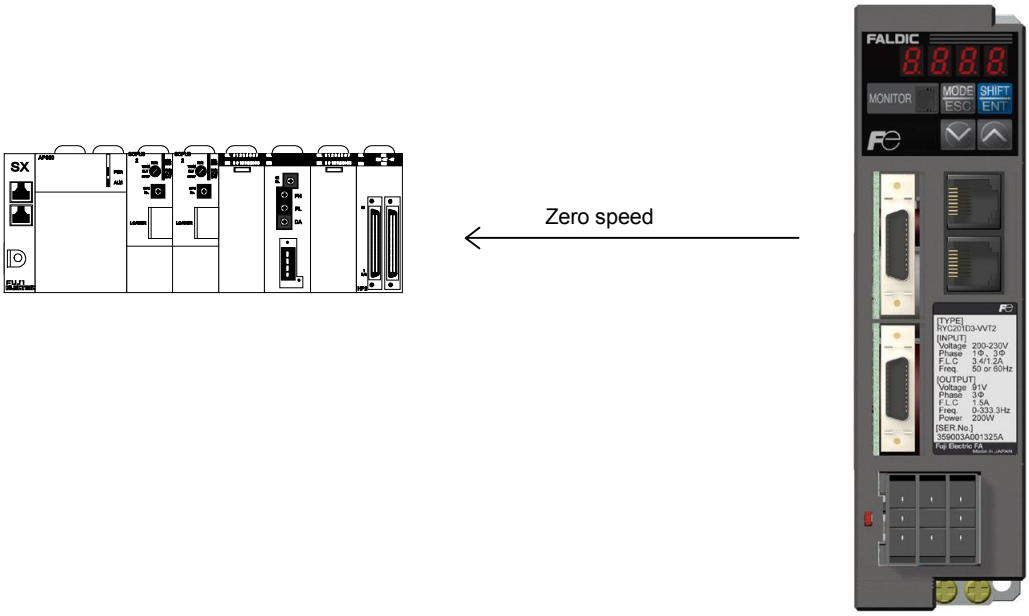
Sequence output signal	Zero speed

■ Function

This signal is ON when the actual rotation speed of the servomotor is reference value or less for parameter #23.

■ Parameter setting

To allocate the zero speed signal to the sequence input terminal, set value (9) applicable to the parameter.



(23) Brake timing

This is the timing signal to automatically turn the servomotor brake ON/OFF.

Sequence output signal	Brake timing

■ Function

The timing signal that automatically excites/releases the servomotor brake is output according to the rotation command for the servo amplifier.

■ Parameter setting

To allocate the brake timing output signal to the sequence input terminal, set value (11) applicable to the parameter.

When this signal is not allocated to the sequence input terminal, it is considered to normally be OFF.

■ Reference

(1) Brake timing

The procedures to set the brake timing signal to the sequence output terminal are as follows:

1) Setting of sequence output terminal

Set value (11) applicable to brake timing to either one of parameters #15 to 18. If [11] is set to #15, the OUT1 terminal is the brake timing output.

2) Brake operation time

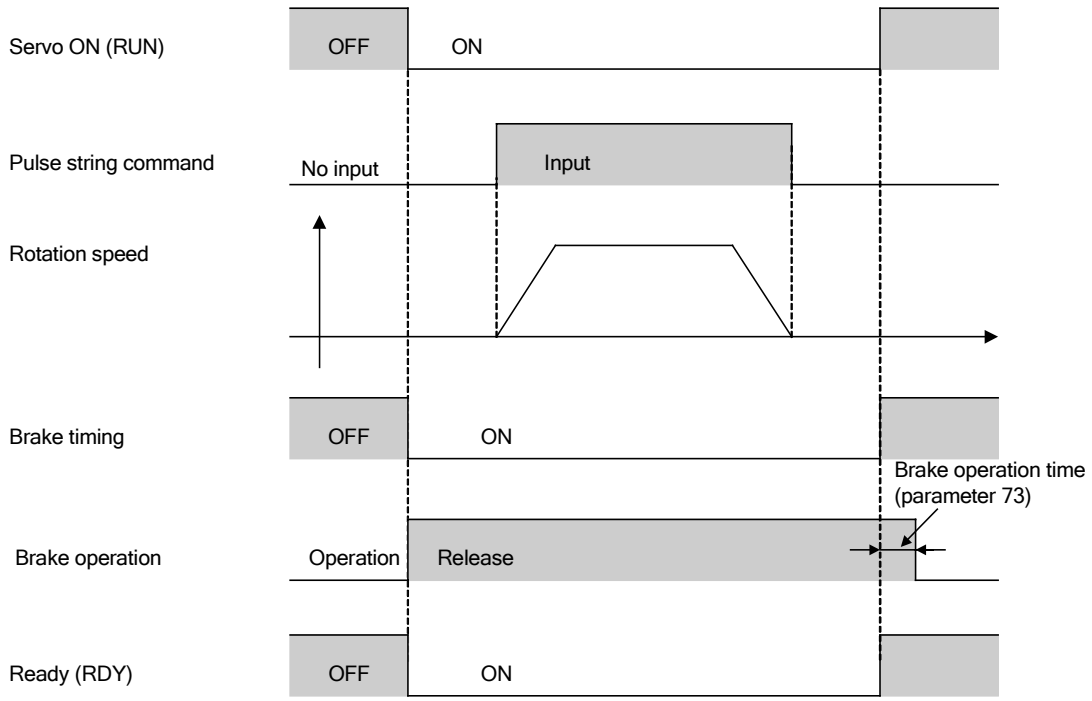
Add the scan time for parameter 10 [V] (programmable logic controller) and the response time of external relay, electromagnetic contactor and brake to the operation time of the external brake.

Brake operation time: Time setting from output OFF of the servo amplifier to actual operation of the external brake

Parameter #73

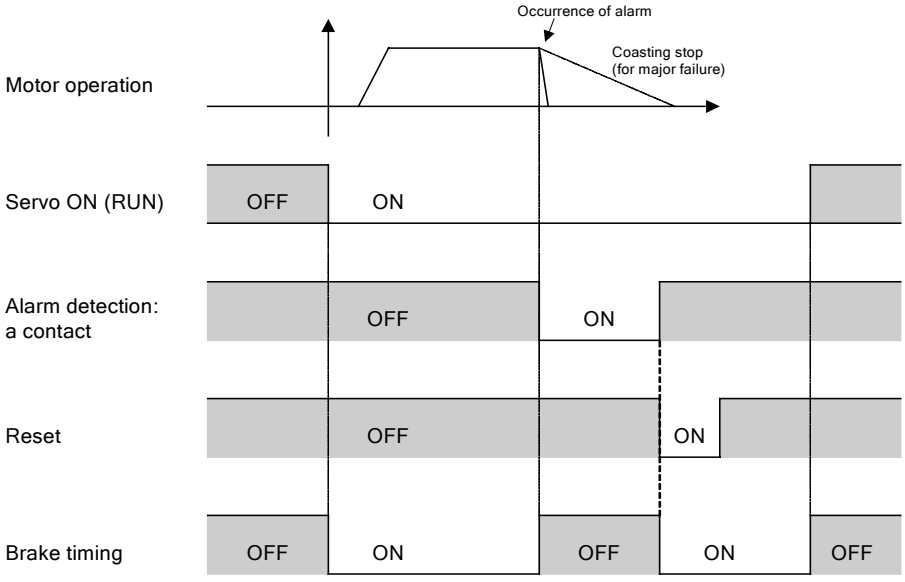
No.	Description	Setting range	Initial value	Change
73	Brake operation time	0.01 - 9.99 sec. (in 0.01 increments)	0.00	Always

(2) Brake timing chart

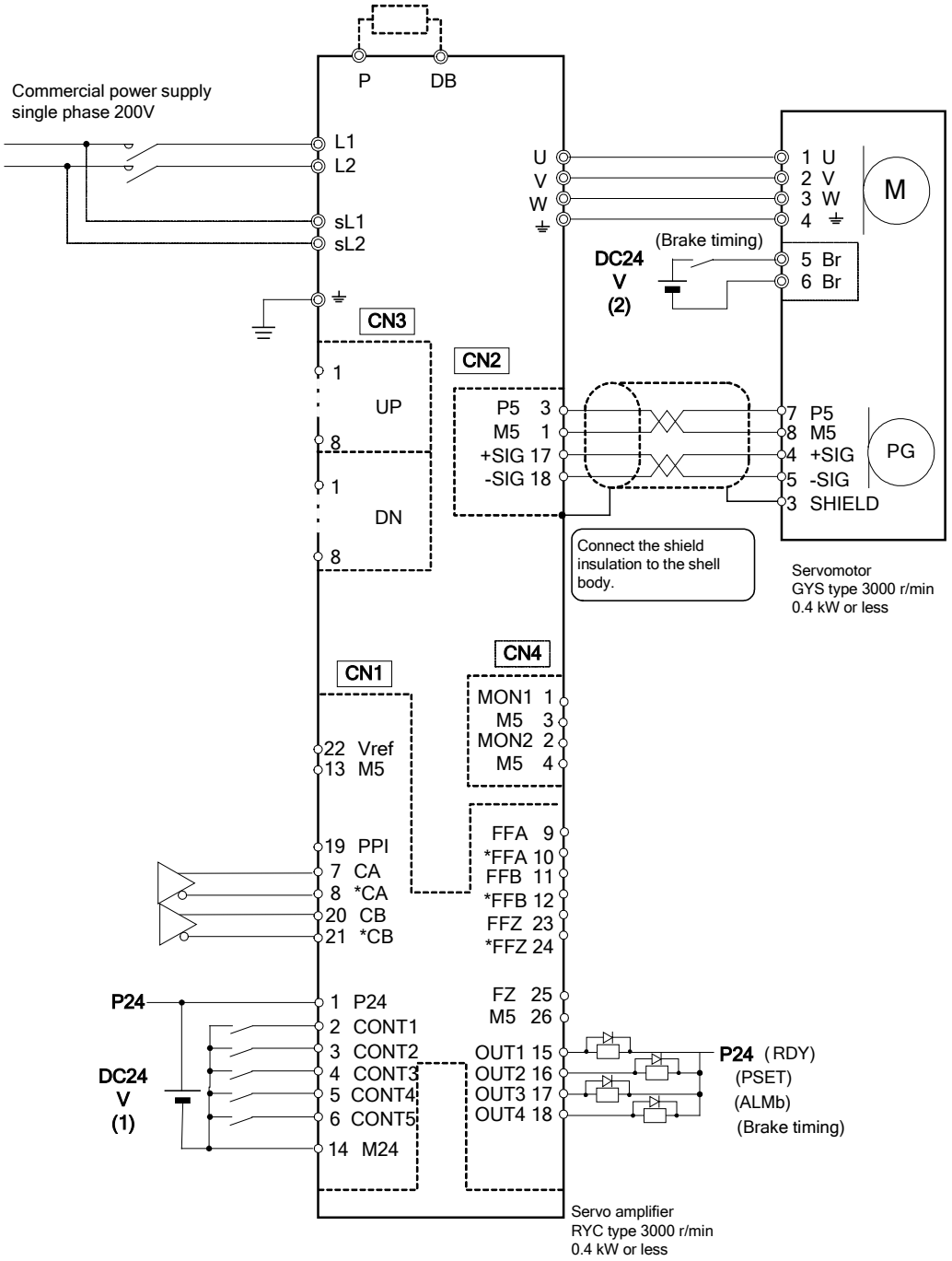


(3) Timing chart for alarm detection

If an alarm is detected, the brake is immediately activated without waiting for stoppage.
The brake is used for retention. Operation of the brake during rotation may shorten the life of the brake.
Avoid repeated operation.



■ Connection example of brake timing signal (0.4 [kW] or less)



* Prepare DC24V separately for the sequence input/output power source (1) and the motor brake power source (2).

* Set 11 (brake timing) to parameter #18 (CONT4 allocation).

PnO1 / no.19

Parameter #19

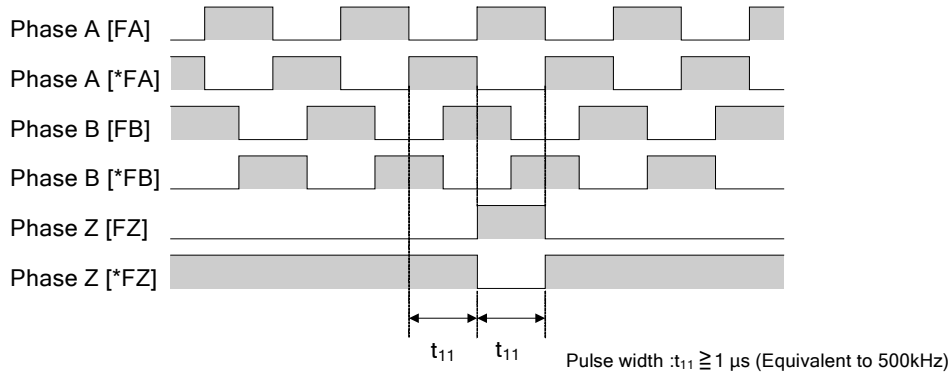
No.	Name	Setting range	Initial value	Change
19	Output pulse count	16 to 32768 [pulse] (in 1 increments)	2048	Power

Specify the number of pulses output per each revolution of the servomotor.

The output form is two signals having 90-degree phase difference.
When the servomotor output shaft is rotating forward, B phase advance signal is output. By setting the rotation direction switching (parameter #4), the phase sequence can be changed.

- When the parameter # 4 reference value is 1 or 2, the signal is B phase advance for counterclockwise rotation.
- When the parameter # 4 reference value is 1 or 2, the signal is A phase advance for counterclockwise rotation.

The number of pulses output from the frequency dividing output terminals ([FA], [*FA], [FB], [*FB] and [*FZ] terminals) of the servo amplifier can be specified.



The phase-A and phase-B signals are 50% duty.
A single pulse of the phase-Z signal is output in each revolution. The output width depends on the number of output pulses.
The phase-A and phase-Z signals are synchronized with each other.
Use about 500kHz output frequency. There is no limit in the output frequency of the servo amplifier.
There is no relationship between the position of the output shaft of the servomotor and the phase-Z signal.

Hint

Number of output pulses during rotation at 5000 [r/min] with an output pulse count setting of 3000

$$\frac{3000[\text{pulse/rev}]}{60} \times 5000[\text{r/min}] = 250000[\text{Hz}]$$

The number of output pulses exceeds 2.7 [MHz] with maximum 32768 [pulses/rev] and 5000 [r/min].

PnO1 / no.20

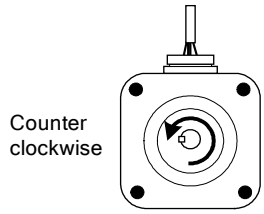
Parameter #20

No.	Name	Setting range	Initial value	Change
20	Phase-Z offset	0 to 65535[×2 pulses] (in 1 increments)	0	Power

Specify the parameter to change the output position of the phase-Z signal.

There is a counterclockwise delay in the output position of the phase-Z signal by the number of pulses specified in parameter #20.
This parameter has no relations with the direction of rotation switch (parameter #4).

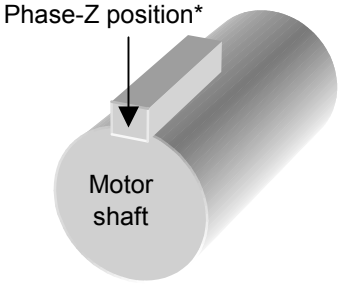
$$\frac{\text{(Phase-Z offset [×2 pulses])}}{\text{65536 pulses/rev}} = \text{Z [rev]}$$



There is a counterclockwise delay in the output position of the phase-Z signal by Z revolutions.

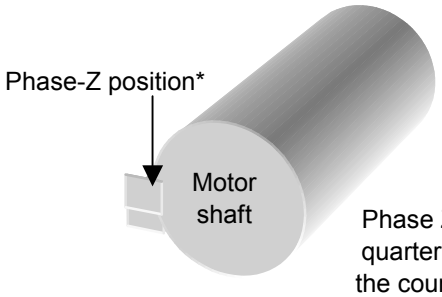
■ Output position of phase-Z signal

・When the phase-Z offset is “0”



・When phase-Z offset is “16384”

$$\frac{\text{16384×2 pulses}}{\text{131072 pulses/rev}} = \frac{1}{4}\text{[rev]}$$



Phase Z is late by a quarter revolution in the counterclockwise direction.

*The position of the key is not phase Z. The position of the key is assumed to be phase Z for explanation.

■ Reference

Adjustment of the phase-Z position can be made in the test operation mode of the keypad panel so that the current position becomes the position where the phase-Z signal is issued.
Refer to page 8-24.

Precaution for detection of phase-Z signal for origin returning action

When the rotation speed is 100 [r/min] or less and the motor shaft rotation angle is advanced (released) 372°(machine angle) from the home position return limit switch (home position LS), perform the home position return operation.
If the angle is not released 372°or more, the motor may rotate another one turn when the home position return is completed.

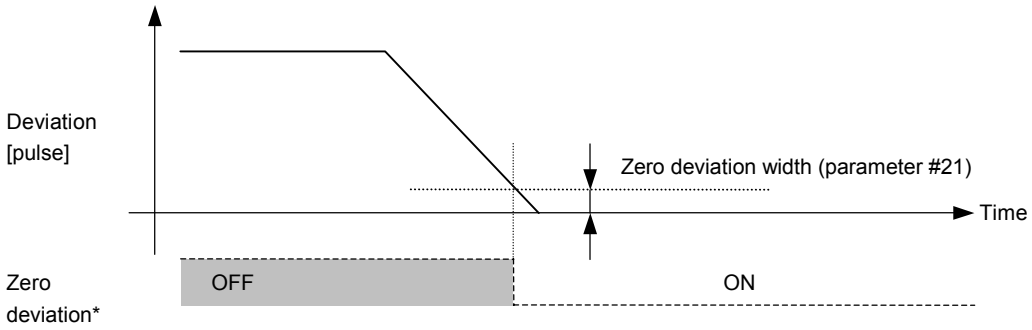
PnO1 / no.21

Parameter #21

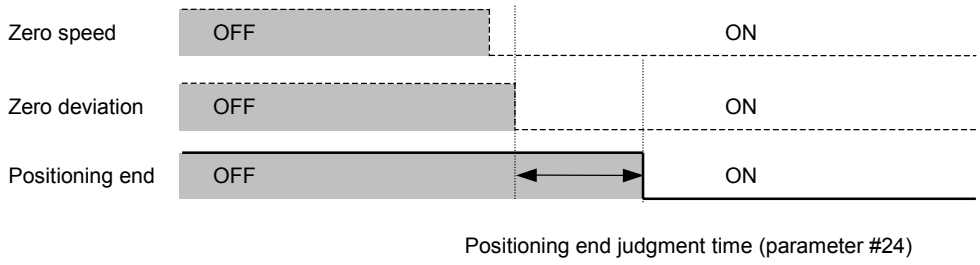
No.	Name	Setting range	Initial value	Change
21	Zero deviation width	1 to 20000 [pulse] (in 1 increments)	400	Always

* It is only valid for position control.

Specify the width of the zone where the zero deviation signal is activated* in the number of encoder pulses.
The unit is equivalent to the number of encoder feedback pulses (not command pulses).



If both the zero deviation signal (parameter #21) and zero speed signal (parameter #23) remain active in the positioning end judgment time specified in parameter #24, the positioning end signal is activated.



Hint When the precision of ±10 [μm] is desired for a machine with ball screw fastening and the lead of 10 [mm].

$$\frac{131072[\text{pulse/rev}]}{\text{Movement per rotation [m]}} \times (\text{Required precision [m]}) = \text{Zero deviation width [pulse]}$$

$$\frac{131072[\text{pulse/rev}]}{10\times10^{-3}\ [\text{m}]} \times (10\times10^{-6}\ [\text{m}]) = 131.072 \approx 131\ [\text{pulse}]$$

Set [131] to zero deviation width (parameter #21).

PnO1 / no.22

Parameter #22

No.	Name	Setting range	Initial value	Change
22	Deviation limit width	10 to 65535 [× 100 pulse] (in 1 increments)	20000	Always

* It is only valid for position control.

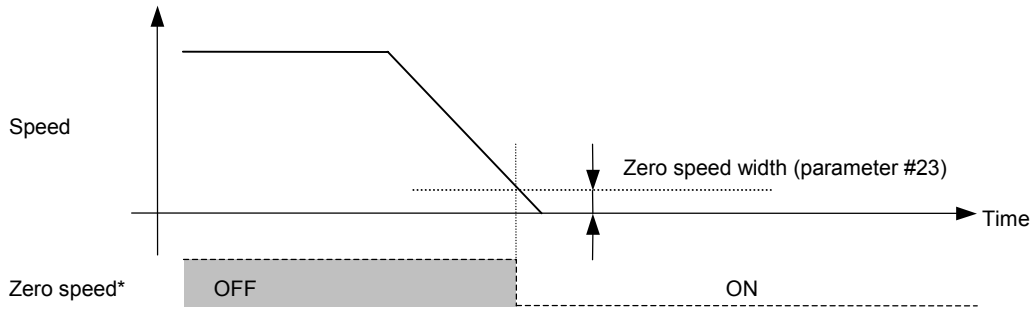
Specify the number of pulses for detecting the deviation limit (for alarm detection) in the number of encoder feedback pulses (not command pulses).
The initial setting is "20000," so that deviation is detected at 2000000 pulses.
With the initial setting, deviation is detected if the difference between the command position and feedback position is equivalent to about 15.2 revolutions of the servomotor shaft.
The deviation limit width is provided for alarm detection.

PnO1 / no.23

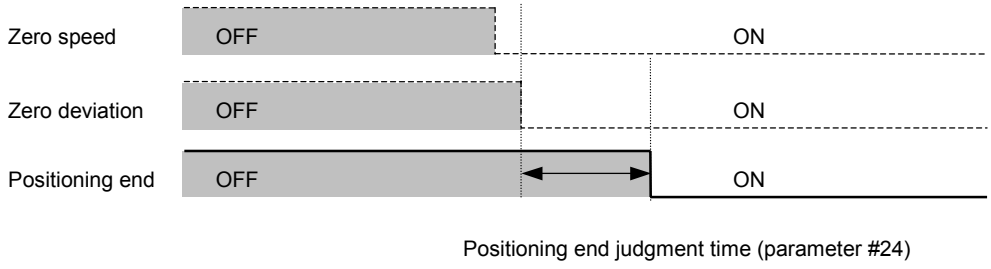
Parameter #23

No.	Name	Setting range	Initial value	Change
23	Zero speed width	10 to 5000 [r/min] (in 1 increments)	50	Always

Use the parameter to judge if the servomotor is stopped. Specify the width where the zero speed signal is activated*.



If the zero deviation signal (parameter #21) and zero speed signal (parameter #23) remain active in the positioning completion judgment time specified in parameter #24, the positioning end signal is activated.



PnO1 / no.24

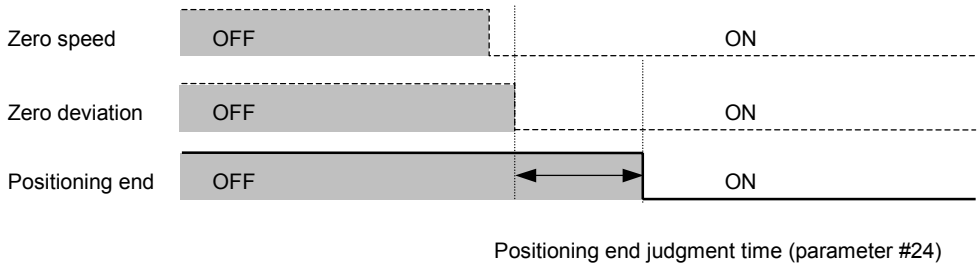
Parameter #24

No.	Name	Setting range	Initial value	Change
24	Positioning end judgment time	0.000 to 1.000 sec. (in 0.001 increments)	0.000	Always

* It is only valid for position control.

Specify the time for judgment of the end of positioning.

If the zero deviation signal (parameter #21) and zero speed signal (parameter #23) remain active in the positioning end judgment time (parameter #24), the positioning end signal is activated.



PnO1 / no.25

Parameter #25

No.	Name	Setting range	Initial value	Change
25	Max. current limit	0 to 300 % (in 1 increments)	300	Always

Specify the output torque limit of the servomotor.
This setting is specified as shown in the table below according to the sequence input signal torque limit (20) setting.

Allocation of current limit signal		Description of operation
No		Normally ON (parameter #25 reference value)
Yes	OFF	Maximum torque
	ON	ON (parameter #25 reference value)

PnO1 / no.26

Parameter #26

No.	Name	Setting range	Initial value	Change
26	Undervoltage alarm detection	0: No detection, 1: Detection	1	Power

Specify whether or not alarm detection is made upon detection of undervoltage in the power supply under active servo on [RUN].

PnO1 / no.27

Parameter #27

No.	Name	Setting range	Initial value	Change
27	Operation for undervoltage	0: Sudden deceleration and stop 1: Coasting	0	Power

* It is only valid for speed control.

While the servo on (RUN) signal is ON, the servomotor operation is specified for detection of undervoltage of the power supply.

Parameter #27

Setting range	Operation for detection of undervoltage
0: Sudden deceleration and stop	The system decelerates and stops at the maximum capacity of the servo amplifier.
1: Coasting	The system decelerates (accelerates) with the load torque for coasting.

PnO1 / no.28

Parameter #28

No.	Name	Setting range	Initial value	Change
28	For adjustment by manufacturer	-	Adjustment value	-

This parameter is for adjustment by manufacturer. Do not change it.

PnO1 / no.29

Parameter #29

No.	Name	Setting range	Initial value	Change
29	Parameter write-protection	0: Write-enable, 1: Write-protected	0	Always

Parameter editing is prohibited.
Even if write-protection is selected with parameter #29, parameter #29 can be edited.

PnO1 / no.30

Parameter #30

No.	Name	Setting range	Initial value	Change
30	Initial display of the keypad	0 to 20 (in 1 increments)	0	Power

Specify the initial display of the keypad immediately after the power is supplied.

Parameter #30

Setting	Description	Display
0	Operation mode	SnO1
1	Current alarm	SnO2
2	Alarm history	SnO3
3	Station No. setting	SnO4

Setting	Description	Display
4	Feedback speed	OnO1
5	Command speed	OnO2
6	Average torque	OnO3
7	Current feedback position	OnO4
8	Current command position	OnO5
9	Position deviation	OnO6
10	Feedback cumulative pulse	OnO7
11	Command cumulative pulse	OnO8
12	Peak torque	OnO9
13	Input voltage	On 10
14	Input/output signal	On 11
15	Load inertia ratio	On 12
16	OL thermal value	On 13
17	Regenerative resistor thermal value	On 14
18	Pulse string input frequency	On 15
19	DC link voltage (maximum value)	On 16
20	DC link voltage (minimum value)	On 17

Refer to Chapter 8 Keypad for details of each display.

PnO1 / no.31 – no33

Parameters #31 to 33

No.	Name	Setting range	Initial value	Change
31	Manual feed speed 1 (and test operation)	0.1 - (Maximum rotation speed) [r/min] (in 0.1 increments)	100.0	Always
32	Manual feed speed 2	0.1 - (Maximum rotation speed) [r/min] (in 0.1 increments)	500.0	Always
33	Manual feed speed 3	0.1 - (Maximum rotation speed) [r/min] (in 0.1 increments)	1000.0	Always

* It is valid for position control and speed control.

The rotation speed of the forward rotation command [FWD] (reverse rotation command [REV]) signal can be specified.
ON/OFF combination of X1 and X2 signals can change the rotation speed.

The rotation speed can be changed during operation of the servomotor. It is not related to the parameter sequence and the degree of the reference value.

Selection of multistep speed

X2	X1	Rotation speed
OFF	OFF	Analog speed command input [Vref] terminal
OFF	ON	Standard parameter #31
ON	OFF	Standard parameter #32
ON	ON	Standard parameter #33

PnO1 / no.34

Parameter #34

No.	Name	Setting range	Initial value	Change
34	Maximum rotation speed	0.1 - (Maximum rotation speed) [r/min] (in 0.1 increments)	5000.0 (3000.0)	Always

* Value in ( ) is the initial value of the GYG motor.

Set the upper limit of the servomotor rotation speed specified with the parameter and the analog speed command input.
During torque control, the difference between the reference value and the actual rotation speed of the servomotor is about 100 [r/min].
(It is because speed control is not performed.)
The setting of the maximum rotation speed is not valid for position control of the pulse string input.

* The initial value of the GYS motor is 5000.0 [r/min].
* The initial value of the GYG motor is 3000.0 [r/min].

PnO1 / no.35 – no.38

Parameters #35 to 38

No.	Name	Setting range	Initial value	Change
35	Acceleration time 1	0.000 - 9.999 sec. (in 0.001 increments)	0.100	Always
36	Deceleration time 1	0.000 - 9.999 sec. (in 0.001 increments)	0.100	Always
37	Acceleration time 2	0.000 - 9.999 sec. (in 0.001 increments)	0.500	Always
38	Deceleration time 2	0.000 - 9.999 sec. (in 0.001 increments)	0.500	Always

* It is valid for position control and speed control.

Acceleration/deceleration time of the servomotor can be set.

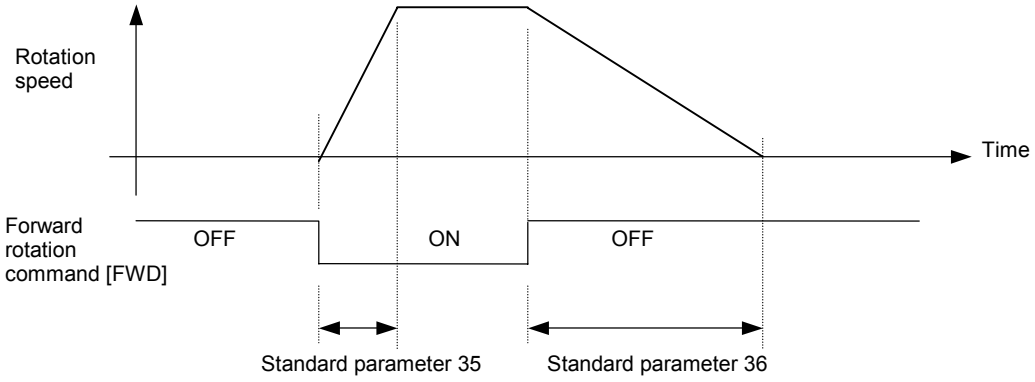
It is valid for all acceleration/deceleration during speed control and position control (excluding the pulse string input).
The time setting is from 0 (zero) to 2000 [r/min].
Acceleration time 2 and deceleration time 2 are valid while the acceleration/deceleration time selection signal is ON. ON/OFF of the acceleration/deceleration time selection is always ON. The acceleration time/deceleration time is changed in a similar manner.

The acceleration/deceleration time selection signal is the control allocation signal of the parameter.

External selection of acceleration/deceleration time

Acceleration/deceleration time selection (19)	Acceleration time	Deceleration time
OFF	Parameter 35	Parameter 36
ON	Parameter 37	Parameter 38

Acceleration time 1 can be set separate to deceleration time 1. Only the deceleration time can be increased. Deceleration time can be used depending on load including movement of a carrier.



When the analog speed command voltage is output with the upper level control unit and the feedback from the dividing output of the servo amplifier is used for position control, set the acceleration time and the deceleration time to 0.000 sec.

PnO1 / no.39

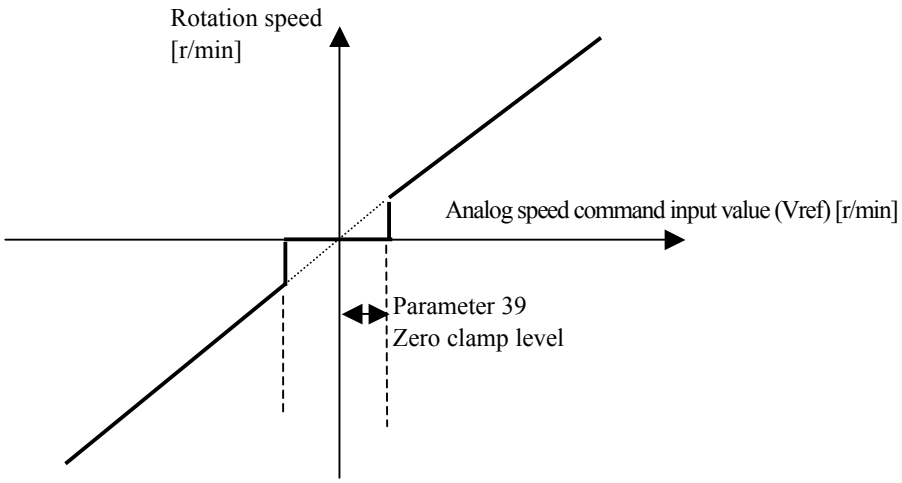
Parameter #39

No.	Name	Setting range	Initial value	Change
39	Zero clamp level	0.0 - 500.0 [r/min] (in 0.1 increments)	0.0	Always

* It is valid for position control and speed control.

This sets the rotation speed of the servomotor in zero clamp.

When the analog speed command of position control and speed control is input, this signal is valid.
When the speed command value of the analog speed command input (Vref) terminal is zero clamp level or less, the rotation speed is zero clamped. Drift of the analog speed command input value is prevented near zero.



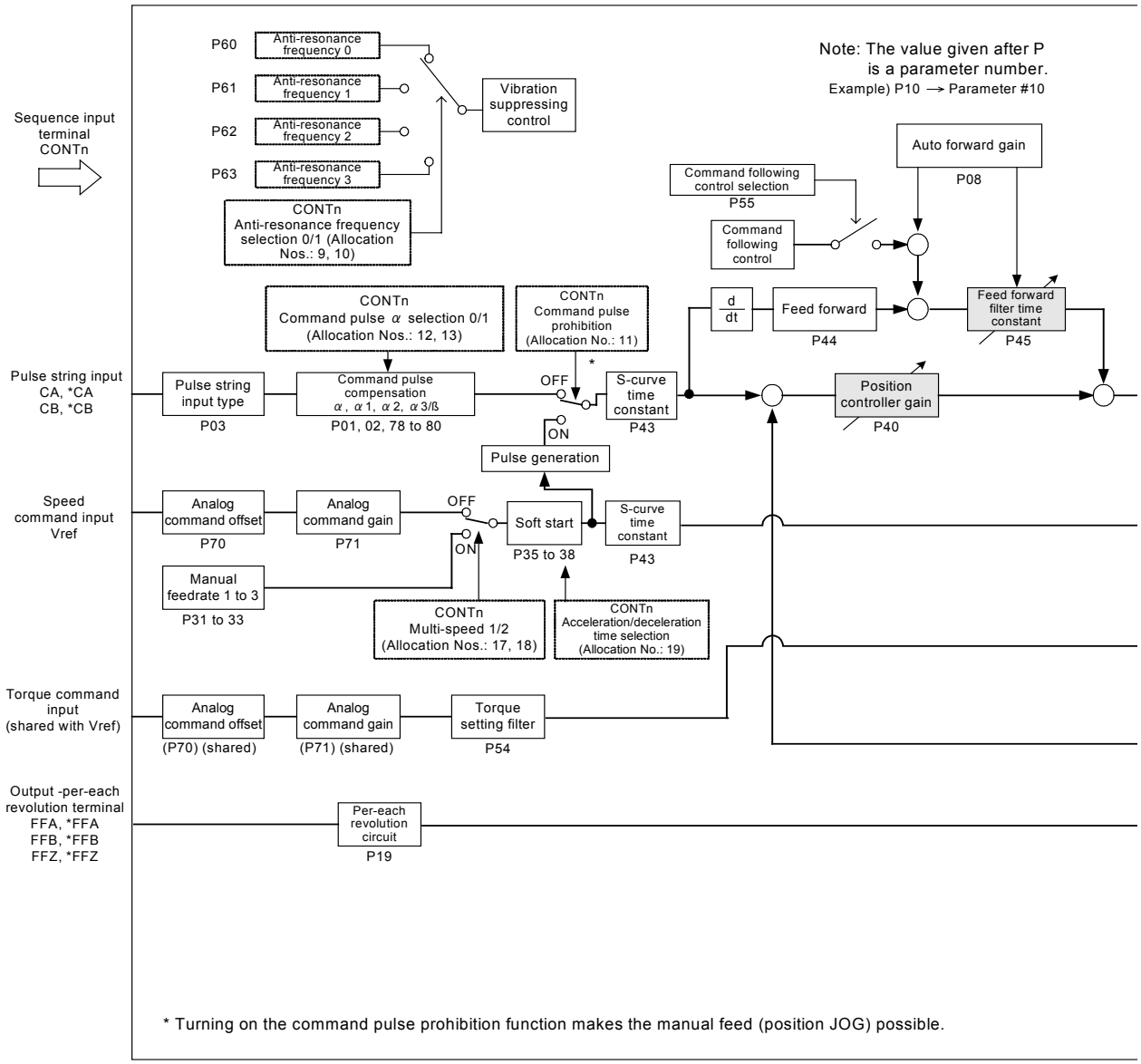
Note For analog voltage around the reference value, the command may fluctuate between "zero" and "reference value," resulting in an unstable motor shaft.

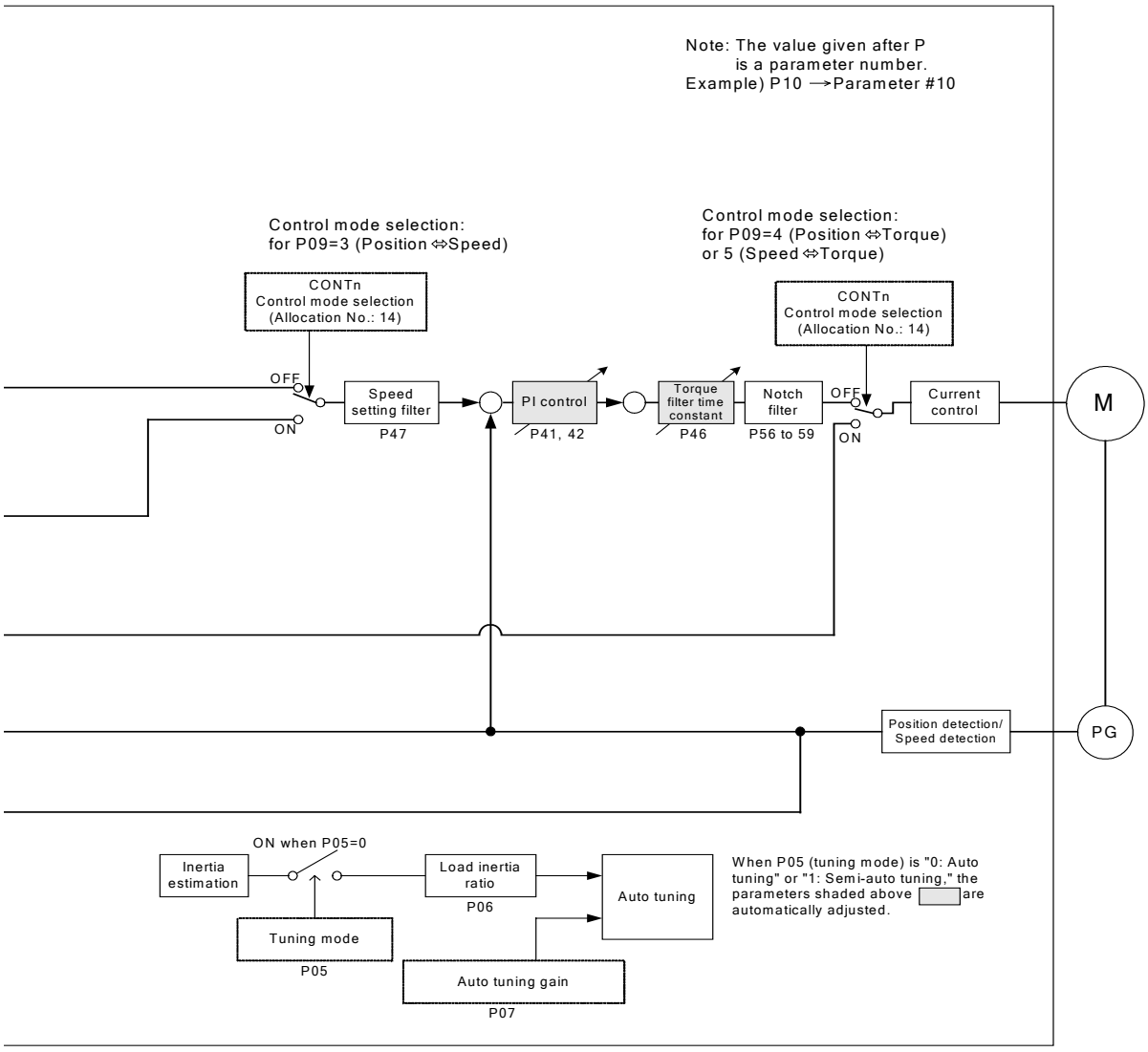
Control system settings

Control system setting parameters are described in the order of the parameter number.

■Control block diagram

The control block diagram of FALDIC-W Series is shown.




Note: The value given after P
is a parameter number.
Example) P10 →Parameter #10
Control mode selection:
for P09=3 (Position ⇔Speed)
Control mode selection:
for P09=4 (Position ⇔Torque)
or 5 (Speed ⇔Torque)
CONTn
Control mode selection
(Allocation No.: 14)
CONTn
Control mode selection
(Allocation No.: 14)
OFF
ON
Speed setting filter
P47
PI control
P41, 42
Torque filter time constant
P46
Notch filter
P56 to 59
OFF
ON
Current control
M
Position detection/ Speed detection
PG
ON when P05=0
Inertia estimation
Load inertia ratio
P06
Auto tuning
Tuning mode
P05
Auto tuning gain
P07
When P05 (tuning mode) is "0: Auto tuning" or "1: Semi-auto tuning," the parameters shaded above are automatically adjusted.

PnO1 / no.40 – no.42

Parameters #40 through #42

No.	Name	Setting range	Initial value	Change
40	Position controller gain 1	1 to 1000 [rad/sec] (in 1 increments)	77	Always
41	Speed response 1	1 to 1000 [Hz] (in 1 increments)	57	Always
42	Speed controller integration time 1	1.0 to 1000.0 [msec] (in 0.1 increments)	25.9	Always

* The initial value is for the GYS motor.

PnO1 / no.45 – no.46

Parameters #45 and #46

No.	Name	Setting range	Initial value	Change
45	Feed forward filter time constant	0.0 to 250.0 [msec] (in 0.1 increments)	12.9	Always
46	Torque filter time constant	0.00 to 20.00 [msec] (in 0.01 increments)	0.31	Always

* The initial value is for the GYS motor.

* It is valid for position control and speed control.
  No. 40 and No. 45 are only valid for position control.

These parameters are automatically updated when “auto tuning” or “semi-auto tuning” is selected at basic setting parameter #5.
Specify them when “manual tuning” is selected.

No.	Name	Tuning mode		
		0: Auto	1: Semi-auto	2: Manual
06	Load inertia ratio	-	O	O
07	Auto tuning gain	O	O	X
40	Position controller gain 1	-	-	O
41	Speed response 1	-	-	O
42	Speed controller integration time 1	-	-	O
45	Feed forward filter time constant	-	-	O
46	Torque filter time constant	-	-	O

* O : Parameter which must be set
- : Parameter which may not be set (The value is automatically calculated inside the amplifier and the result is reflected on the parameter.)
X : The parameter has no effect even if it is set.

■ Position controller gain 1 (Parameter 40)

This parameter determines the response of the position control loop. A larger setting improves the response to the position command, while too large a setting is likely to generate overshoot.

■ Speed response 1 (Parameter 41)

This parameter determines the response of the speed control loop. A larger setting improves the response of the servomotor, while too large a setting may cause the mechanical system to vibrate.

■ Speed controller integration time 1 (Parameter 42)

This parameter determines the response of the speed control loop. A smaller setting improves the response of the servomotor, while too small a setting may cause the mechanical system to vibrate.

■ Feed forward filter time constant (Parameter 45)

This parameter filters feed forward action of the position control loop.
A smaller setting improves the response while it may cause torque shock.

■ Torque filter time constant (Parameter 46)

This parameter filters the torque command.
A larger setting suppresses resonance of the machine while stability in the control may be undermined.

PnO1 / no.43

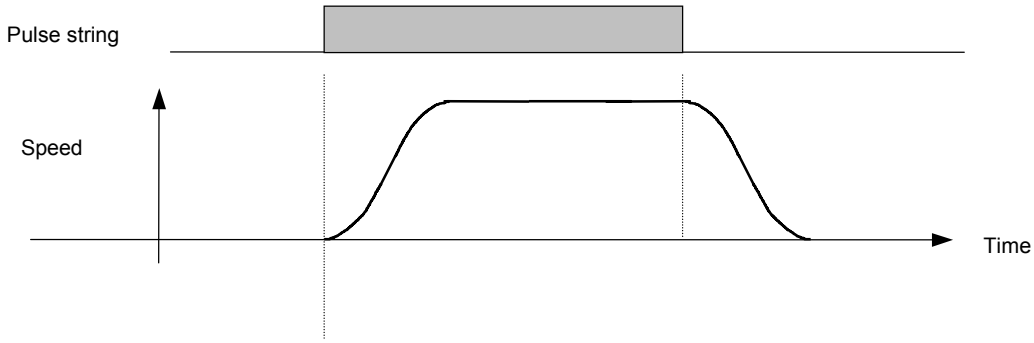
Parameter #43

No.	Name	Setting range	Initial value	Change
43	S-curve time constant	0.0 to 100.0 [msec] (in 0.1 increments)	2.0	Always

* It is valid for position control and speed control.

The servomotor can be accelerated or decelerated moderately in the S-curve pattern.
If the pulse string input is given at a constant frequency, the servomotor accelerates or decelerates at the time constant of the set time.

Smooth acceleration and deceleration are obtained even if the host controller does not allow linear acceleration.



* Specify the parameter without fail if the dumping control function (parameters #60 through #63) are used.
Refer to section 7.1 “Vibration control.”

PnO1 / no.44

Parameter #44

No.	Name	Setting range	Initial value	Change
44	Feed forward gain	0.000 to 1.500 (in 0.001 increments)	0.000	Always

* It is only valid for position control.

This parameter functions if parameter #60 (command following control selection) is set at “0 (none).” Specify the parameter in a poorly rigid machine or a mechanical system having a large load inertia ratio, to increase the response.
Specify a value between 0.100 and 0.500 to obtain a preferable result. A larger setting reduces position deviation (difference between position command and feedback position), resulting in a better response.

To perform synchronous operation between two axes, set “1.000.”

PnO1 / no.47

Parameter #47

No.	Name	Setting range	Initial value	Change
47	Speed setting filter	0.00 to 20.00 [msec] (in 0.01 increments)	0.00	Always

* It is valid for position control and speed control.

Specify the parameter to filter the speed command.

* No change is necessary in principle.

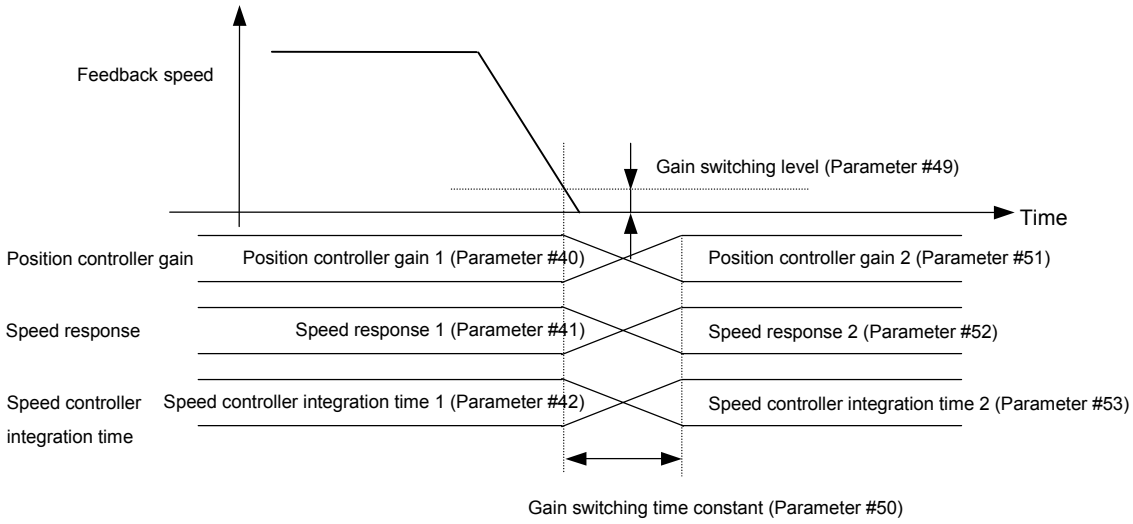
PnO1 / no.48 – no.53

Parameters #48 through #53

No.	Name	Setting range	Initial value	Change
48	Gain switching factor	0: Position deviation (x 10), 1: Feedback speed, 2: Command speed	1	Always
49	Gain switching level	1 to 1000 (in 1 increments)	50	Always
50	Gain switching time constant	0 to 100 [msec] (in 1 increments)	10	Always
51	Position controller gain 2	30 to 200 % (in 1 increments)	100	Always
52	Speed response 2	30 to 200 % (in 1 increments)	100	Always
53	Speed controller integration time 2	30 to 200 % (in 1 increments)	100	Always

* It is valid for position control and speed control.
  Only No. 51 is valid for position control.

The gain at the time of stopping is switched from the first gain (parameters #40 to #42) to the second gain (parameters #51 to #53).
Gain switching reduces the noise and vibration at the time of stopping.



The settings of the second gain (parameters #51 to #53) are given in the ratio (%) to the first gain.

Example: When speed response 1 (parameter #41) is 100Hz

"100%" of speed response 2 (parameter #52) means 100Hz.

"80%" of speed response 2 (parameter #52) means 80Hz.

* The same rule applies to position controller gain 2 (parameter #51) and speed controller integration time 2 (parameter #53).

PnO1 / no.54

Parameter #54

No.	Name	Setting range	Initial value	Change
54	Torque setting filter	0.000 - 9.999 [sec] (in 0.001 increments)	0.000	Always

* It is only valid for torque control.

With this parameter, the input voltage of the analog torque command input [Vref] terminal can be filtered.

PnO1 / no.55

Parameter #55

No.	Name	Setting range	Initial value	Change
55	Command following control selection	0: None, 1: Command following control, 2: Command following control (with correction on stop)	0	Power

* It is only valid for position control.

Use the parameter to select the command following control mode where the mechanical system follows the command without delay to the pulse command.

Refer to section 7.2 “Command following control.”

PnO1 / no.56 – no.59

Parameters #56 through #59

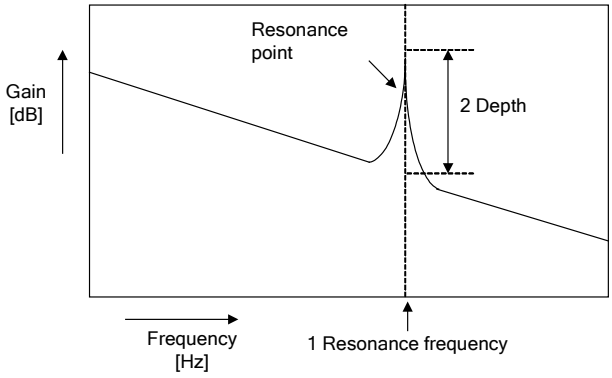
No.	Name	Setting range	Initial value	Change
56	Notch filter 1 frequency	10 to 200 [x 100 Hz] (in 1 increments)	200	Always
57	Notch filter 1 damping amount	0 to 40 [dB] (in 1 increments)	0	Always
58	Notch filter 2 frequency	10 to 200 [x 10Hz] (in 1 increments)	200	Always
59	Notch filter 2 damping amount	0 to 40 [dB] (in 1 increments)	0	Always

* It is valid for position control and speed control.

Specify to suppress resonance of the mechanical system.
Resonance can be suppressed at up to two points.

■ Notch filter setting method

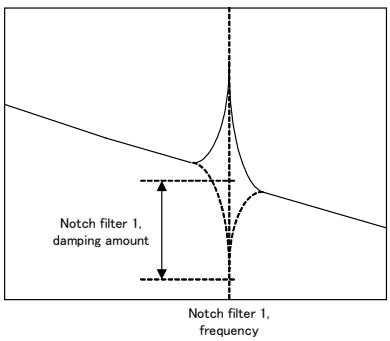
i) Use the servo analysis function of the PC loader (option) to determine the resonance point of the machine.



ii) Specify the resonance frequency and damping amount of the resonance point of the machine in parameters.

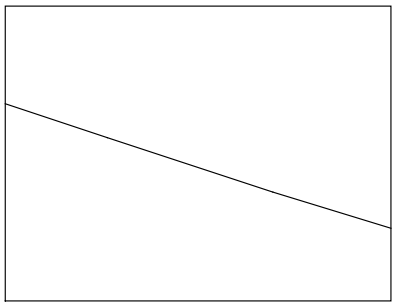
1 Resonance frequency → Parameter #56 (Notch filter 1 frequency)
2 Depth → Parameter #57 (Notch filter 1 damping amount)*

* Too deep a damping amount may undermine stability of the control. Avoid setting too large a value.



The notch filter functions at the resonance point as shown in the figure above.

Use the servo analysis function again.



The resonance point is eliminated due to the notch filter.

PnO1 / no.60 – no.63

Parameters #60 through #63

No.	Name	Setting range	Initial value	Change
60	Anti-resonance frequency 0	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
61	Anti-resonance frequency 1	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
62	Anti-resonance frequency 2	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
63	Anti-resonance frequency 3	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always

* It is only valid for position control.

Use these parameters to specify anti-resonance frequencies and suppress vibration of the workpiece (vibration suppressing control).
The vibration suppressing control function becomes invalid with 200.0Hz (factory setting).
Refer to section 7.1 “Vibration suppressing control.”

PnO1 / no.64 – no.69

Parameters #64 through #69

No.	Name	Setting range	Initial value	Change
64 to 69	Not used	-	0	-

These parameters are not used.

PnO1 / no.70 – no.71

Parameters #70 and 71

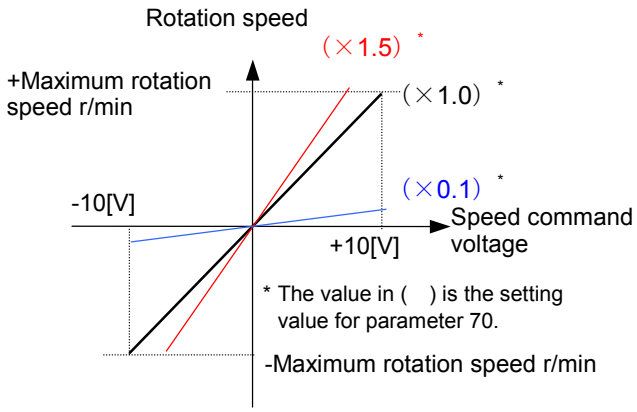
No.	Name	Setting range	Initial value	Change
70	Analog command gain	±0.10 - ±1.5 (in 0.01 increments)	1.0	Always
71	Analog command offset	-2000 - +2000	(Set before shipment)	Always

Gain and offset of the analog speed command input [Vref] can be adjusted.

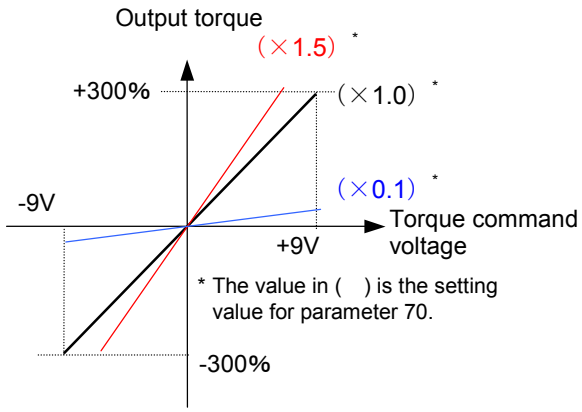
■ Analog command gain

The gain can be set in the range from ±0.10 to ±1.50 in increments of 0.01.
By adding the negative sign, the rotation direction will be reverse.

1) Speed control (speed command voltage)



2) Torque control (torque command voltage)



*) Relationship of rotation speed by speed command voltage and analog command gain. (GYS motor)

Analog command gain		Rotation speed [r/min]			
		1.5	1.0	0.5	0.1
Speed command voltage	10V	5000	5000	2500	500
	9V		4500	2250	450
	8V		4000	2000	400
	7V		3500	1750	350
	6V	4500	3000	1500	300
	5V	3750	2500	1250	250
	4V	3000	2000	1000	200
	3V	2250	1500	750	150
	2V	1500	1000	500	100
	1V	750	500	250	50

*) Relationship of output torque by torque command voltage and analog command gain.

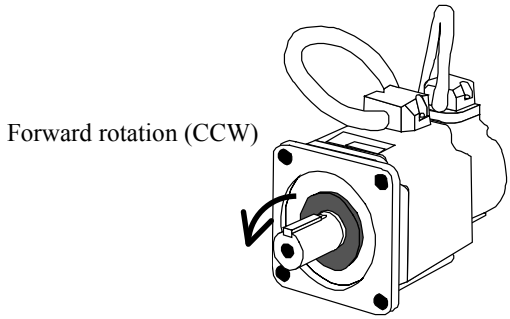
Analog command gain		Output torque [%]			
		1.5	1.0	0.5	0.1
Torque command voltage	9V	300	300	150	30
	8V		267	133	27
	7V		233	117	23
	6V		200	100	20
	5V	250	167	83	17
	4V	200	133	67	13
	3V	150	100	50	10
	2V	100	67	33	6.7
	1V	50	33	17	3.3

*) The relationship between the speed command voltage and the rotation direction is shown below (upon shipment from factory).

Speed command voltage	Rotation command	Rotation direction	Rotation speed [r/min]
+6.0V	FWD	CCW	3000
	REV	CW	
+1.0V	FWD	CCW	500
	REV	CW	
0V	FWD	-	0
	REV		
-5.0V	FWD	CW	2500
	REV	CCW	

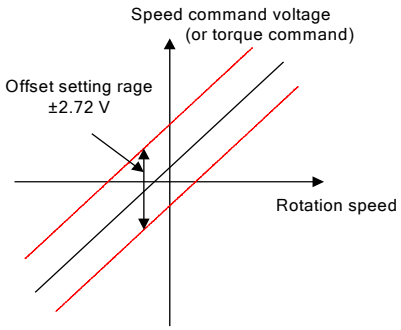
*) The relationship between the torque command voltage and the rotation direction is shown below (upon shipment from factory).

Torque command voltage	Rotation command	Rotation direction	Output torque
+6.0V	FWD	CCW	200%
	REV	CW	
+1.5V	FWD	CCW	50%
	REV	CW	
0V	FWD	-	0%
	REV		
-4.5V	FWD	CW	150%
	REV	CCW	



■ Analog command offset

It is set in the range from -2000 to 2000 in increments of 1.
Increment [1] is equivalent to [1.36 mV].
The setting range is from [-2.72V] to [2.72V].
The reference value set at factory before shipment is registered as the initial value.
Automatic offset adjustment is available in test operation mode of the keypad. FnO7
The value after adjustment is incorporated to parameter No. 70.



Hint

■ Resolution during speed control (speed command voltage)

14 bit resolution is available in full scale (-11.22 to +11.22 [V]). When the maximum rotation speed is 5000 [r/min] and 10V (speed command voltage), the resolution is (-5000 to +5000) [r/min]/214 × 11.22/10 = 0.67 [r/min]. (For GYS motor)

■ Resolution during torque control (torque command voltage)

14 bit resolution is available in full scale (-11.22 to +11.22 [V]). When the maximum torque is 300% and 9V (torque command voltage), the resolution is (-300 to +300) % /214 × 11.22/9 = 0.046% (rated torque 100%).

PnO1 / no.72

Parameter #72

No.	Name	Setting range	Initial value	Change
72	Operation sequence selection for dynamic brake unit connection	0: DB invalid for OT detection/RUN = DB invalid for OFF 1: DB valid for OT detection/RUN = DB invalid for OFF 2: DB invalid for OT detection/RUN = DB valid for OFF 3: DB valid for OT detection/RUN = DB valid for OFF	0	Power

It is set when the optional dynamic brake unit (soon to be released) is connected.

PnO1 / no.73

Parameter #73

No.	Name	Setting range	Initial value	Change
73	Brake operation time	0.00 - 9.99 [sec] (in 0.01 increments) Base shutoff delay time at RUN = OFF	0.00	Always

Set the operation time of the external brake.

Set the time from the servo ON (RUN) signal OFF of the servo amplifier to the base OFF status.

For detailed timing chart, refer to “4.4 Brake timing”.

PnO1 / no.74 – no.77

Parameters #74 to 77

No.	Name	Setting range	Initial value	Change
74	CONT normally ON 1	0 - 21 (in 1 increments)	0	Power
75	CONT normally ON 2	0 - 21 (in 1 increments)	0	Power
76	CONT normally ON 3	0 - 21 (in 1 increments)	0	Power
77	CONT normally ON 4	0 - 21 (in 1 increments)	0	Power

Any sequence input signal can always be ON.

Signals available for allocation are as follows:

1: Servo ON (RUN)

Operation command is normally ON.

11: Command pulse inhibition (INH)

Command pulse is normally inhibited.

This is set when only manual operation is performed during position control.

(It is not set for pulse string.)

15: Manual forward rotation command (FWD),

14: Manual reverse rotation command (REV)

It is normally ON during speed/torque control.

It is not normally ON during position control.

■ Recognition method of FWD/REV signal

Speed/torque control : Level

Position control : Edge

17: Multistep speed selection 1 (X1), 18: Multistep speed selection 2 (X2)

Specific multistep speed is ON.

Hint When this parameter is allocated to either one of control parameters #74 to 77, it is normally ON. Signals that allow the status to be normally ON are 4.

PnO1 / no.78 – no.80

Parameters #78 to 80

No.	Name	Setting range	Initial value	Change
78	Command pulse compensation α 1	1 - 32767 (in 1 increments)	1	Always
79	Command pulse compensation α 2	1 - 32767 (in 1 increments)	1	Always
80	Command pulse compensation α 3	1 - 32767 (in 1 increments)	1	Always

* It is only valid for position control.

With "Command pulse compensation α selection 0" and "Command pulse compensation α selection 1" allocated by the sequence signal, the value of the command pulse compensation α is changed.

Command pulse compensation α selection 1	Command pulse compensation α selection 0	Command pulse compensation α
OFF	OFF	Parameter #1
OFF	ON	Parameter #78
ON	OFF	Parameter #79
ON	ON	Parameter # 80

PnO1 / no.81

Parameter #81

No.	Name	Setting range	Initial value	Change
81	Parameter storage in RAM	0: Not specified, 1 - 99 (in 1 increments)	0	Power

Parameter settings are stored in EEPROM (electronically rewritable EPROM) for data storage during power shutoff.

* The maximum assured count of rewriting in EEPROM is 100,000 times.

With storage of parameters in RAM, data can be infinitely rewritten.
Specify the number of RAM storage to parameter #81.
The initial value is set for the parameter stored in RAM when the power is supplied.

List of parameters storable in RAM

No.	Description of parameter	No.	Description of parameter
1	Command pulse compensation α	37	Acceleration time 2
2	Command pulse compensation β	38	Deceleration time 2
25	Maximum current limit value	60	Anti-resonance frequency 1
31	Manual feed speed 1	61	Anti-resonance frequency 2
32	Manual feed speed 2	62	Anti-resonance frequency 3
33	Manual feed speed 3	63	Anti-resonance frequency 4
34	Maximum rotation speed	78	Command pulse compensation α 1
35	Acceleration time 1	79	Command pulse compensation α 2
36	Deceleration time 1	80	Command pulse compensation α 3

PnO1 / no.82 – no.83

Parameters #82 and 83

No.	Name	Setting range	Initial value	Change
82	Station No.	1 - 31 (in 1 increments)	1	Power
83	Baud rate	0 : 38400 [bps] , 1 : 19200 [bps] , 2 : 9600 [bps]	0	Power

■ Station No.

The station number of the servo amplifier is specified from 1 to 31 with the RS485 communication cable.

■ Baud rate

The baud rate is set with the RS485 communication cable.

PnO1 / no.84 – no.86

Parameters #84 to 86

No.	Name	Setting range	Initial value	Change
84	Easy tuning: Travel setting	0.5 - 200.0 [rev] (in 0.1 increments)	2.0	Always
85	Easy tuning: Speed setting	10.0 - Maximum rotation speed [r/min] (in 0.1 increments)	500.0	Always
86	Easy tuning: Timer setting	0.01 - 5.00 [sec] (in 0.01 increments)	0.50	Always

The parameters are set for easy tuning.

Refer to Chapter 6.

PnO1 / no.87 – no.92

Parameters #87 to 92

No.	Name	Setting range	Initial value	Change
87	Monitor 1 signal allocation	1: Speed command, 2: Speed feedback, 3: Torque command, 4: Position deviation, 5: Position deviation (extension), 6: Pulse frequency	2	Always
88	Monitor 2 signal allocation	1: Speed command, 2: Speed feedback, 3: Torque command, 4: Position deviation, 5: Position deviation (extension), 6: Pulse frequency	3	Always
89	Monitor 1 scale	± 2.0 - ± 100.0 [V] (in 0.1 increments)	7.0	Always
90	Monitor 1 offset	- 50 - +50 (in 1 increments)	0	Always
91	Monitor 2 scale	± 2.0 - ± 100.0 [V] (in 0.1 increments)	6.0	Always
92	Monitor 2 offset	- 50 - +50 (in 1 increments)	0	Always

* ±11.0 [V] or more is not output for monitor output.

Monitor 1 or monitor 2 terminal output can be selected.

Output description of monitor 1 [MON1] and monitor 2 [MON2] terminals can be selected.
All output types are common for position control, speed control and torque control.

■ Monitor 1/monitor 2 signal allocation

Details output to monitor 1 [MON1] and monitor 2 [MON2] terminals are set.

Parameters #87, 88/Monitor allocation

Output type	Details
1: Speed command	Speed command to the servomotor recognized by the servo amplifier.
2: Speed feedback	Actual rotation speed of the servomotor.
3: Torque command	Torque command to the servomotor recognized by the servo amplifier.
4: Position deviation	Difference (deviation) between position command and position feedback.
5: Position deviation (extension)	Difference (deviation) between position command and position feedback.
6: Pulse string frequency	Pulse string frequency input to the pulse string input terminal.

■ Monitor 1/monitor 2 scale

Full scale output to monitor 1 [MON1] and monitor 2 [MON2] terminals is set.

#89, 91/Monitor scale

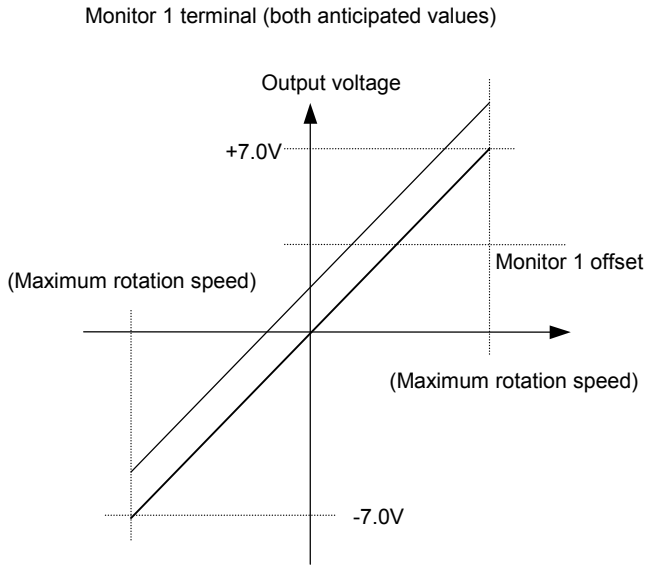
Output type	Monitor scale
1: Speed command	Output voltage for the maximum rotation speed.
2: Speed feedback	Output voltage for the maximum rotation speed.
3: Torque command	Output voltage for the maximum torque.
4: Position deviation	Output voltage for 8192 pulses.
5: Position deviation (extension)	Output voltage for 512 pulses.
6: Pulse string frequency	Output voltage for 1 MHz.

When negative sign is specified, polarity of the output voltage can be changed.
The settings to 100.0 [V] can be made, but voltage more than 11.0 [V] cannot be output.

■ Monitor 1/monitor 2 offset

The offset voltage of monitor 1 [MON1] and monitor 2 [MON2] terminals can be adjusted.
The setting range is -50 - 0 - 50 in increments of 1. The setting value has no unit.

■ Monitor 1 output type (speed feedback)



When the negative sign is specified by monitor 1 scale, polarity of the output voltage is reversed.

■ Resolution of monitor 1/monitor 2 output

The resolution is 12 bit (4096) in full scale (-12.5 to +12.5).

The resolution is (-12.5 to +12.5) [V]/212 = 6.1 [mV].

* The maximum/minimum output is ±11.0 [V] and the calculation of the resolution is ±12.5 [V].

PnO1 / no.93

Parameters #93

No.	Name	Setting range	Initial value	Change
93	Not used	-	0	-

These parameters are not used.

Parameters #94 to 97

No.	Name	Setting range	Initial value	Change
94	For adjustment by manufacturer	-	Adjusted value	-
95	For adjustment by manufacturer	-	Adjusted value	-
96	For adjustment by manufacturer	-	Adjusted value	-
97	For adjustment by manufacturer	-	Adjusted value	-

The parameters are for adjustment by manufacturer. Do not change them.

Parameters #98 and 99

No.	Name	Setting range	Initial value	Change
98 to 99	Not used	-	0	-

These parameters are not used.