Panasonic

Instruction Manual

AC Servo Motor and Driver

MINAS A4P Series

- Thank you for buying and using Panasonic AC Servo Motor and Driver, MINAS A4P Series.
- Read through this Instruction Manual for proper use, especially read "Precautions for Safety" (P.8 to 11) without fail for safety purpose.
- Keep this Manual at an easily accessible place so as to be referred anytime as necessary.
- This product is for industrial equipment. Don't use this product at general household.

DV0P4490

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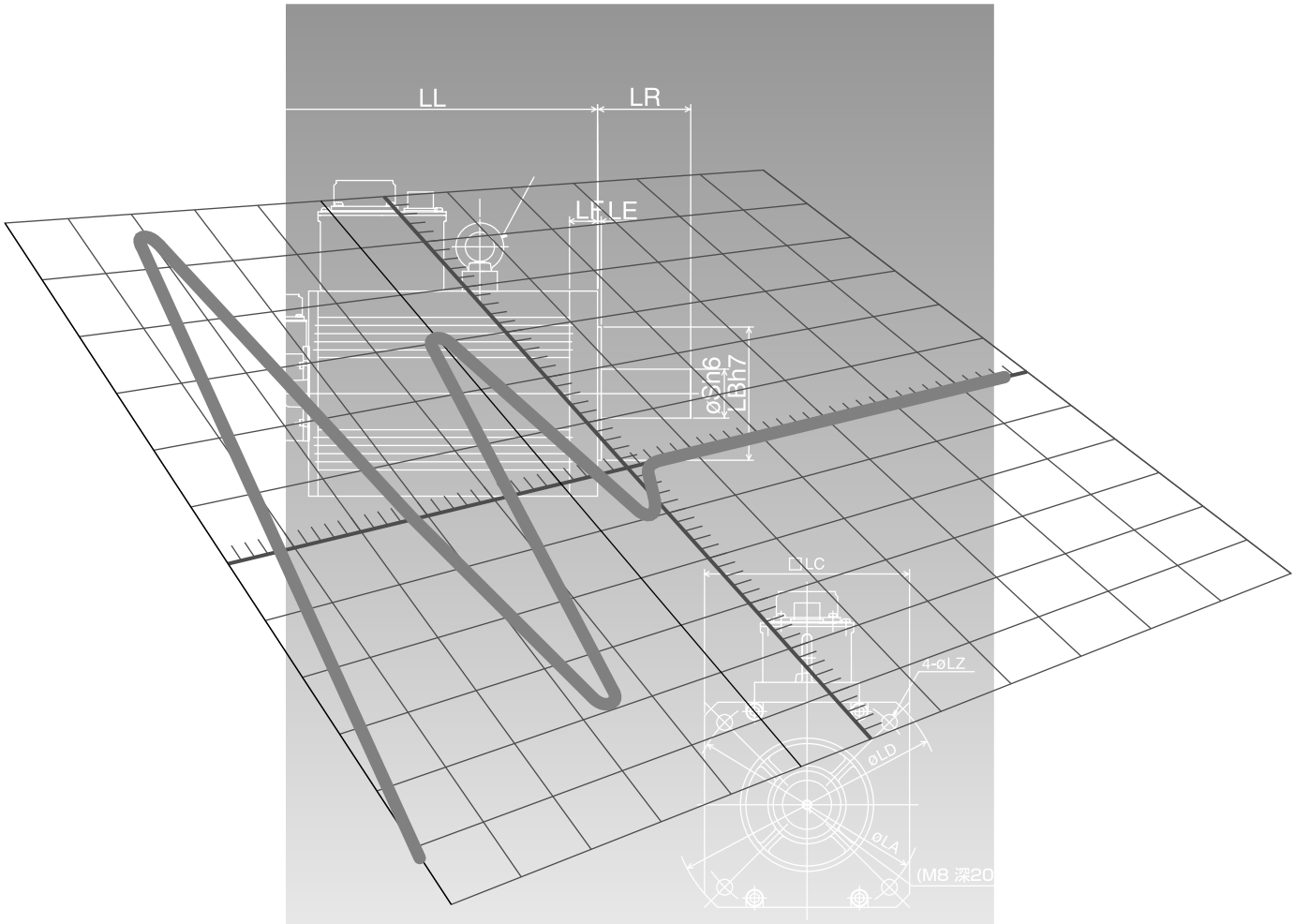


[Before Using the Products]

Safety Precautions Observe the Following Instructions Without Fail

Observe the following precautions in order to avoid damages on the machinery and injuries to the operators and other personnel during the operation.

- **In this document, the following symbols are used to indicate the level of damages or injuries which might be incurred by the misoperation ignoring the precautions.**

⚠ **DANGER**	Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
⚠ **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, will result in minor injury or property damage.

- **The following symbols represent "MUST NOT" or "MUST" operations which you have to observe. (Note that there are other symbols as well.)**

⃠	Represents "MUST NOT" operation which is inhibited.
❗	Represents "MUST" operation which has to be executed.

⚠ DANGER

Do not subject the Product to water, corrosive or flammable gases, and combustibles.

⃠ Failure to observe this instruction could result in fire.

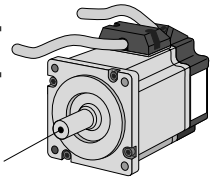
Do not subject the cables to excessive force, heavy object, or pinching force, nor damage the cables.

⃠ Failure to observe this instruction could result in electrical shocks, damages and breakdowns.

Do not put your hands in the servo driver.

⃠ Failure to observe this instruction could result in burn and electrical shocks.

Do not touch the rotating portion of the motor while it is running.



⃠ Failure to observe this instruction could result in injuries.

Do not drive the motor with external power.

⃠ Failure to observe this instruction could result in fire.

Do not touch the motor, servo driver and external regenerative resistor of the driver, since they become very hot.

⃠ Failure to observe this instruction could result in burns.

⚠ DANGER

Do not place combustibles near by the motor, driver and regenerative resistor.

Failure to observe this instruction could result in fire.

Do not place the console close to a heating unit such as a heater or a large wire wound resistor.

Failure to observe this instruction could result in fire and breakdowns.

Ground the earth terminal of the motor and driver without fail.

Failure to observe this instruction could result in electrical shocks.

Install an overcurrent protection, earth leakage breaker, over-temperature protection and emergency stop apparatus without fail.

Failure to observe this instruction could result in electrical shocks, injuries and fire.

Install an emergency stop circuit externally so that you can stop the operation and shut off the power immediately.

Failure to observe this instruction could result in injuries, electrical shocks, fire, breakdowns and damages.

Turn off the power and wait for a longer time than the specified time, before transporting, wiring and inspecting the driver.

Failure to observe this instruction could result in electrical shocks.

Install and mount the Product and machinery securely to prevent any possible fire or accidents incurred by earthquake.

Failure to observe this instruction could result in electrical shocks, injuries and fire.

Turn off the power and make it sure that there is no risk of electrical shocks before transporting, wiring and inspecting the motor.

Failure to observe this instruction could result in electrical shocks.

Check and confirm the safety of the operation after the earthquake.

Failure to observe this instruction could result in electrical shocks, injuries and fire.

Wiring has to be carried out by the qualified and authorized specialist.

Failure to observe this instruction could result in electrical shocks.

Mount the motor, driver and regenerative resistor on incombustible material such as metal.

Failure to observe this instruction could result in fire.

Make the correct phase sequence of the motor and correct wiring of the encoder.

Failure to observe this instruction could result in injuries breakdowns and damages.

Safety Precautions Observe the Following Instructions Without Fail

⚠ CAUTION

Do not hold the motor cable or motor shaft during the transportation.

Failure to observe this instruction could result in injuries.

Do not block the heat dissipating holes or put the foreign particles into them.

Failure to observe this instruction could result in electrical shocks and fire.

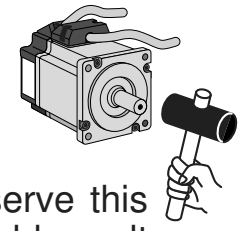
Never run or stop the motor with the electro-magnetic contactor installed in the main power side.

Failure to observe this instruction could result in breakdowns.

Do not step on the Product nor place the heavy object on them.

Failure to observe this instruction could result in electrical shocks, injuries, breakdowns and damages.

Do not give strong impact shock to the motor shaft.



Failure to observe this instruction could result in breakdowns.

Do not turn on and off the main power of the driver repeatedly.

Failure to observe this instruction could result in breakdowns.

Do not approach to the machine since it may suddenly restart after the power resumption.
Design the machine to secure the safety for the operator even at a sudden restart.

Failure to observe this instruction could result in injuries.

Do not make an extreme gain adjustment or change of the drive.
Do not keep the machine running/operating unstably.

Failure to observe this instruction could result in injuries.

Do not use the built-in brake as a "Braking" to stop the moving load.

Failure to observe this instruction could result in injuries and breakdowns.

Do not give strong impact shock to the Product.

Failure to observe this instruction could result in breakdowns.

Do not modify, disassemble nor repair the Product.

Failure to observe this instruction could result in fire, electrical shocks and injuries.

Do not pull the cables with excessive force.

Failure to observe this instruction could result in breakdowns.

⚠ CAUTION

Use the motor and the driver in the specified combination.

Failure to observe this instruction could result in fire.

Make a wiring correctly and securely.

Failure to observe this instruction could result in fire and electrical shocks.

Use the eye bolt of the motor for transportation of the motor only, and never use this for transportation of the machine.

Failure to observe this instruction could result in injuries and breakdowns.

Observe the specified mounting method and direction.

Failure to observe this instruction could result in breakdowns.

Make an appropriate mounting of the Product matching to its wight and output rating.

Failure to observe this instruction could result in injuries and breakdowns.

Observe the specified voltage.

Failure to observe this instruction could result in electrical shocks, injuries and fire.

Keep the ambient temperature below the permissible temperature for the motor and driver.

Failure to observe this instruction could result in breakdowns.

Execute the trial run without connecting the motor to the machine system and fix the motor. After checking the operation, connect to the machine system again.

Failure to observe this instruction could result in injuries.

Connect the brake control relay to the relay which is to shut off at emergency stop in series.

Failure to observe this instruction could result in injuries and breakdowns.

When any error occurs, remove the cause and release the error after securing the safety, then restart.

Failure to observe this instruction could result in injuries.

When you dispose the batteries, observe any applicable regulations or laws after insulating them with tape.

This Product shall be treated as Industrial Waste when you dispose.

Maintenance and Inspection

• Routine maintenance and inspection of the driver and motor are essential for the proper and safe operation.

Notes on Maintenance and Inspection

1) Turn on and turn off should be done by operators or inspectors themselves.
2) Internal circuit of the driver is kept charged with high voltage for a while even after power-off. Turn off the power and allow 15 minutes or longer after LED display of the front panel has gone off, before performing maintenance and inspection.
3) Disconnect all of the connection to the driver when performing megger test (Insulation resistance measurement) to the driver, otherwise it could result in breakdown of the driver.

Inspection Items and Cycles

General and normal running condition

Ambient conditions : 30˚C (annual average), load factor of 80% or lower, operating hours of 20 hours or less per day.

Perform the daily and periodical inspection as per the items below.

Type	Cycles	Items to be inspected
Daily inspection	Daily	• Ambient temperature, humidity, speck, dust or foreign object • Abnormal vibration and noise • Main circuit voltage • Odor • Lint or other particles at air holes • Cleanness at front portion of the driver and connecter • Damage of the cables • Loose connection or misalignment between the motor and machine or equipment • Pinching of foreign object at the load
Periodical inspection	Annual	• Loose tightening • Trace of overheat • Damage of the terminals

<Note> Inspection cycle may change when the running conditions of the above change.

Guideline for Parts Replacement

Use the table below for a reference. Parts replacement cycle varies depending on the actual operating conditions. Defective parts should be replaced or repaired when any error have occurred.

Prohibited	**Disassembling for inspection and repair should be carried out only by authorized dealers or service company.**

Product	Component	Standard replacement cycles (hour)	Note
Driver	Smoothing capacitor	Approx. 5 years	These hours or cycles are reference. When you experience any error, replacement is required even before this standard replacement cycle.
	Cooling fan	2 to 3 years (10,000 to 30,000 hours)	
	Aluminum electrolytic capacitor (on PCB)	Approx. 5 years	
	Rush current preventive relay	Approx. 100,000 times (depending on working condition)	
	Rush current preventive resistor	Approx. 20,000 times (depending on working condition)	
Motor	Bearing	3 to 5 years (20,000 to 30,000 hours)	
	Oil seal	5000 hours	
	Encoder	3 to 5 years (20,000 to 30,000 hours)	
	Battery for absolute encoder	Life time varies depending on working conditions. Refer to the instruction manual attached to the battery for absolute encoder.	
Motor with gear reducer	Gear reducer	10,000 hours	

Introduction

Outline

MINAS-A4P Series is a servo motor and driver of I/O command type. A4P Series is based on the high-performance servo driver MINAS-A4 Series, which achieved response frequency of 1kHz, real-time auto-gain tuning function and damping control, and contains the NC function which can perform positioning more easily.
A maximum of 60 setting points can be set for (1) moving distance, (2) maximum rotation speed in a moving section, (3) acceleration time and (4) deceleration time in each moving section and positioning can be performed by an external contact input. Moreover, in combination with a motor equipped with a 17-bit absolute encoder, positioning can be performed at an absolute position and a homing operation is not required.
A4P Series have also improved the user-friendliness by offering some optional components, e.g., a console which enables you to monitor the rotation speed display, set up parameters, perform teaching (setup of target position) and copy parameters, and a waveform graphic display to show a operating waveform and the communication software "PANATERM®" available for frequency measurement to measure machine resonance point.
Read this document with care and exploit the versatile functions of A4P Series to full extent.

Cautions

1) Any part or whole of this document shall not be reproduced without written permission from us.
2) Contents of this document are subject to change without notice.

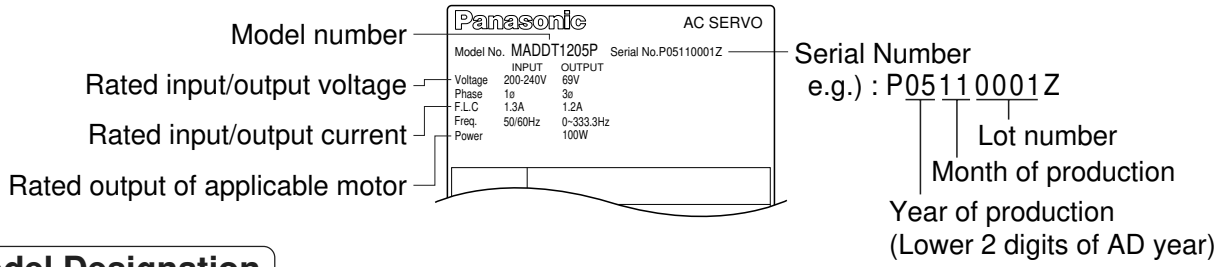
On Opening the Product Package

- Make sure that the model is what you have ordered.
- Check if the product is damaged or not during transportation.
- Check if the instruction manual is attached or not.
- Check if the power connector and motor connecters (CN X1 and CN X2 connectors) are attached or not (A to D-frame).

Contact to a dealer if you find any failures.

Check of the Driver Model

Contents of Name Plate



Model Designation

M A D D T 1 2 0 5 P ∗ ∗

1 to 4 — Frame-size symbol
5 to 6 — Max. current rating of power device
7 — Power supply
8 to 9 — Current detector rating
10 — Interface specification I/O command type
11, 12 — Special specifications (letters and numbers)

Symbol	Frame
MADD	A4-series, A-frame
MBDD	A4-series, B-frame
MCDD	A4-series, C-frame
MDDD	A4-series, D-frame
MEDD	A4-series, E-frame
MFDD	A4-series, F-frame

Symbol	Current rating
T1	10A
T2	15A
T3	30A
T5	50A
T7	70A
TA	100A
TB	150A

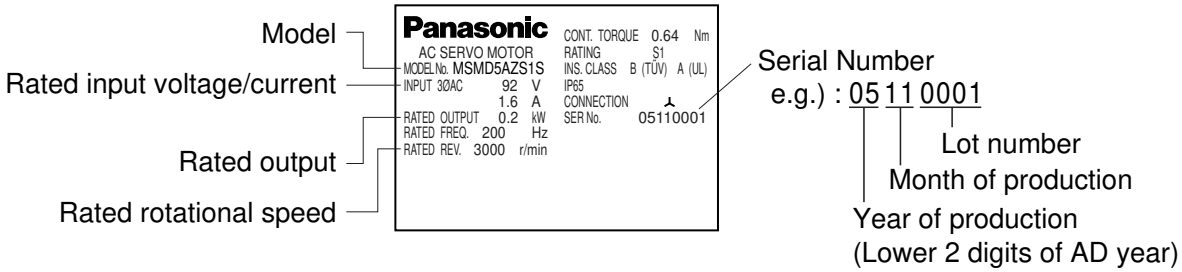
Symbol	Specifications
1	Single phase, 100V
2	Single phase, 200V
3	3-phase, 200V
5	Single/3-phase, 200V

Symbol	Current rating
05	5A
07	7.5A
10	10A
15	15A
20	20A

Symbol	Current rating
30	30A
40	40A
64	64A
90	90A
A2	120A

Check of the Motor Model

Contents of Name Plate



Model Designation

M S M D 5 A Z S 1 S ∗∗

1 to 4 | 5 to 6 | 7 | 8 | 9 | 10 | 11 to 12

Special specifications (letters and numbers)

Motor structure

Design order
1: Standard

Voltage specifications

Symbol	Specifications
1	100 V
2	200 V
Z	100/200 common (50W only)

Motor rated output

Symbol	Output	Symbol	Output
5A	50W	15	1.5kW
01	100W	20	2.0kW
02	200W	25	2.5kW
04	400W	30	3.0kW
05	500W	40	4.0kW
08	750W	45	4.5kW
09	900W	50	5.0kW
10	1.0kW		

Symbol	Type
MAMA	Ultra low inertia (100W to 750W)
MQMA	Low inertia (100W to 400W)
MSMD	Low inertia (50W to 750W)
MSMA	Low inertia (1.0kW to 5.0kW)
MDMA	Middle inertia (1.0kW to 5.0kW)
MHMA	High inertia (500W to 5.0kW)
MFMA	Middle inertia (400W to 4.5kW)
MGMA	Middle inertia (900W to 4.5kW)

Rotary encoder specifications

Symbol	Specifications			
	Format	Pulse count	Resolution	Wire count
P	Incremental	2500P/r	10,000	5-wire
S	Absolute/Incremental common	17bit	131,072	7-wire

Motor structure

MSMD, MQMA

Symbol	Shaft		Holding brake		Oil seal	
	Round	Key way	Without	With	Without	With*1
A	●		●		●	
B	●			●	●	
S		● *2	●		●	
T		● *2		●	●	

*1 The product with oil seal is a special order product.
*2 Key way with center tap.

Products are standard stock items or build to order items. For details, inquire of the dealer.

MAMA

Symbol	Shaft		Holding brake		Oil seal	
	Round	Key way	Without	With	Without	With
A	●		●		●	
B	●			●	●	
E		●	●		●	
F		●		●	●	

MSMA, MDMA, MFMA, MGMA, MHMA

Symbol	Shaft		Holding brake		Oil seal	
	Round	Key way	Without	With	Without	With
C	●		●			●
D	●			●		●
G		●	●			●
H		●		●		●

Introduction

Check of the Combination of the Driver and the Motor

This drive is designed to be used in a combination with the motor which are specified by us.
Check the series name of the motor, rated output torque, voltage specifications and encoder specifications.

Incremental Specifications, 2500P/r

<Remarks> Do not use in other combinations than those listed below.

Power supply	Applicable motor				Applicable driver	
	Motor series	Rated rotational speed	Model	Rated output	Model	Frame
Single phase, 200V	MAMA Ultra low inertia	5000r/min	MAMA012P1*	100W	MADDT1207P	A-frame
			MAMA022P1*	200W	MBDDT2210P	B-frame
3-phase, 200V			MAMA042P1*	400W	MCDDT3520P	C-frame
			MAMA082P1*	750W	MDDDT5540P	D-frame
Single phase, 100V	MAMA Low inertia	3000r/min	MQMA011P1*	100W	MADDT1107P	A-frame
			MQMA021P1*	200W	MBDDT2110P	B-frame
			MQMA041P1*	400W	MCDDT3120P	C-frame
Single phase, 200V			MQMA012P1*	100W	MADDT1205P	A-frame
			MQMA022P1*	200W	MADDT1207P	A-frame
			MQMA042P1*	400W	MBDDT2210P	B-frame
Single phase, 100V	MSMD Low inertia	3000r/min	MSMD5AZP1*	50W	MADDT1105P	A-frame
			MSMD011P1*	100W	MADDT1107P	
			MSMD021P1*	200W	MBDDT2110P	B-frame
			MSMD041P1*	400W	MCDDT3120P	C-frame
Single phase, 200V			MSMD5AZP1*	50W	MADDT1205P	A-frame
			MSMD012P1*	100W		
			MSMD022P1*	200W	MADDT1207P	
			MSMD042P1*	400W	MBDDT2210P	B-frame
Single/3-phase, 200V			MSMD082P1*	750W	MCDDT3520P	C-frame
	MSMA Low inertia	3000r/min	MSMA102P1*	1.0kW	MDDDT5540P	D-frame
			MSMA152P1*	1.5kW		
3-phase, 200V			MSMA202P1*	2.0kW	MEDDT7364P	E-frame
			MSMA302P1*	3.0kW	MFDDTA390P	F-frame
			MSMA402P1*	4.0kW	MFDDTB3A2P	
			MSMA502P1*	5.0kW		
Single/3-phase, 200V	MDMA Middle inertia	2000r/min	MDMA102P1*	1.0kW	MDDDT3530P	D-frame
			MDMA152P1*	1.5kW	MDDDT5540P	
3-phase, 200V			MDMA202P1*	2.0kW	MEDDT7364P	E-frame
			MDMA302P1*	3.0kW	MFDDTA390P	F-frame
			MDMA402P1*	4.0kW	MFDDTB3A2P	
			MDMA502P1*	5.0kW		
Single/3-phase, 200V	MHMA High inertia	2000r/min	MHMA052P1*	500W	MCDDT3520P	C-frame
			MHMA102P1*	1.0kW	MDDDT3530P	D-frame
			MHMA152P1*	1.5kW	MDDDT5540P	
3-phase, 200V			MHMA202P1*	2.0kW	MEDDT7364P	E-frame
			MHMA302P1*	3.0kW	MFDDTA390P	F-frame
			MHMA402P1*	4.0kW	MFDDTB3A2P	
			MHMA502P1*	5.0kW		
Single/3-phase, 200V	MFMA Middle inertia	2000r/min	MFMA042P1*	400W	MCDDT3520P	C-frame
			MFMA152P1*	1.5kW	MDDDT5540P	D-frame
3-phase, 200V			MFMA252P1*	2.5kW	MEDDT7364P	E-frame
			MFMA452P1*	4.5kW	MFDDTB3A2P	F-frame
Single/3-phase, 200V	MGMA Middle inertia	1000r/min	MGMA092P1*	900W	MDDDT5540P	D-frame
3-phase, 200V			MGMA202P1*	2.0kW	MFDDTA390P	F-frame
			MGMA302P1*	3.0kW	MFDDTB3A2P	
			MGMA452P1*	4.5kW		

<Note>
Suffix of " * " in the applicable motor model represents the motor structure.

Absolute/Incremental Specifications, 17-bit

<Remarks> Do not use in other combinations than those listed below.

Power supply	Applicable motor				Applicable driver	
	Motor series	Rated rotational speed	Model	Rated output	Model	Frame
Single phase, 200V	MAMA Ultra low inertia	5000r/min	MAMA012S1*	100W	MADDT1207P	A-frame
			MAMA022S1*	200W	MBDDT2210P	B-frame
3-phase, 200V			MAMA042S1*	400W	MCDDT3520P	C-frame
			MAMA082S1*	750W	MDDDT5540P	D-frame
Single phase, 100V	MAMA Low inertia	3000r/min	MQMA011S1*	100W	MADDT1107P	A-frame
			MQMA021S1*	200W	MBDDT2110P	B-frame
			MQMA041S1*	400W	MCDDT3120P	C-frame
Single phase, 200V			MQMA012S1*	100W	MADDT1205P	A-frame
			MQMA022S1*	200W	MADDT1207P	A-frame
			MQMA042S1*	400W	MBDDT2210P	B-frame
Single phase, 100V	MSMD Low inertia	3000r/min	MSMD5AZS1*	50W	MADDT1105P	A-frame
			MSMD011S1*	100W	MADDT1107P	
			MSMD021S1*	200W	MBDDT2110P	B-frame
			MSMD041S1*	400W	MCDDT3120P	C-frame
Single phase, 200V			MSMD5AZS1*	50W	MADDT1205P	A-frame
			MSMD012S1*	100W		
			MSMD022S1*	200W	MADDT1207P	
			MSMD042S1*	400W	MBDDT2210P	B-frame
Single/3-phase, 200V			MSMD082S1*	750W	MCDDT3520P	C-frame
	MSMA Low inertia	3000r/min	MSMA102S1*	1.0kW	MDDDT5540P	D-frame
			MSMA152S1*	1.5kW		
3-phase, 200V			MSMA202S1*	2.0kW	MEDDT7364P	E-frame
			MSMA302S1*	3.0kW	MFDDTA390P	F-frame
			MSMA402S1*	4.0kW	MFDDTB3A2P	
			MSMA502S1*	5.0kW		
Single/3-phase, 200V	MDMA Middle inertia	2000r/min	MDMA102S1*	1.0kW	MDDDT3530P	D-frame
			MDMA152S1*	1.5kW	MDDDT5540P	
3-phase, 200V			MDMA202S1*	2.0kW	MEDDT7364P	E-frame
			MDMA302S1*	3.0kW	MFDDTA390P	F-frame
			MDMA402S1*	4.0kW	MFDDTB3A2P	
			MDMA502S1*	5.0kW		
Single/3-phase, 200V	MHMA High inertia	2000r/min	MHMA052S1*	500W	MCDDT3520P	C-frame
			MHMA102S1*	1.0kW	MDDDT3530P	D-frame
			MHMA152S1*	1.5kW	MDDDT5540P	
3-phase, 200V			MHMA202S1*	2.0kW	MEDDT7364P	E-frame
			MHMA302S1*	3.0kW	MFDDTA390P	F-frame
			MHMA402S1*	4.0kW	MFDDTB3A2P	
			MHMA502S1*	5.0kW		
Single/3-phase, 200V	MFMA Middle inertia	2000r/min	MFMA042S1*	400W	MCDDT3520P	C-frame
			MFMA152S1*	1.5kW	MDDDT5540P	D-frame
3-phase, 200V			MFMA252S1*	2.5kW	MEDDT7364P	E-frame
			MFMA452S1*	4.5kW	MFDDTB3A2P	F-frame
Single/3-phase, 200V	MGMA Middle inertia	1000r/min	MGMA092S1*	900W	MDDDT5540P	D-frame
3-phase, 200V			MGMA202S1*	2.0kW	MFDDTA390P	F-frame
			MGMA302S1*	3.0kW	MFDDTB3A2P	
			MGMA452S1*	4.5kW		

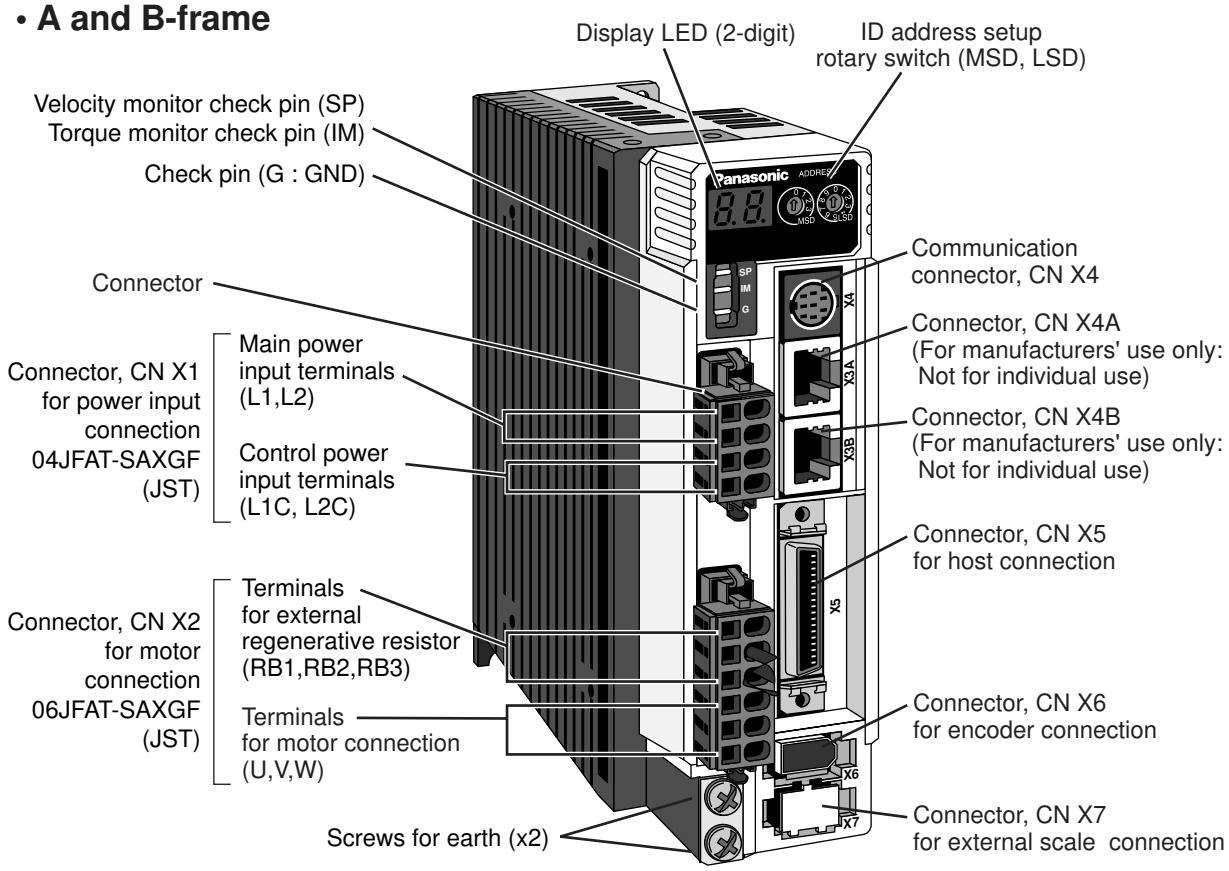
<Notes>

1) Suffix of " * " in the applicable motor model represents the motor structure.
2) Default of the driver is set for the incremental encoder specifications.
   When you use in absolute, make the following operations.
   a) Install a battery for absolute encoder. (refer to P.190, "Options" of Supplement.)
   b) Switch the parameter SV.Pr0B (Absolute encoder setup) from "1 (default)" to "0".
3) No wiring for back up battery is required when you use the absolute 17-bit encoder in incremental.

Parts Description

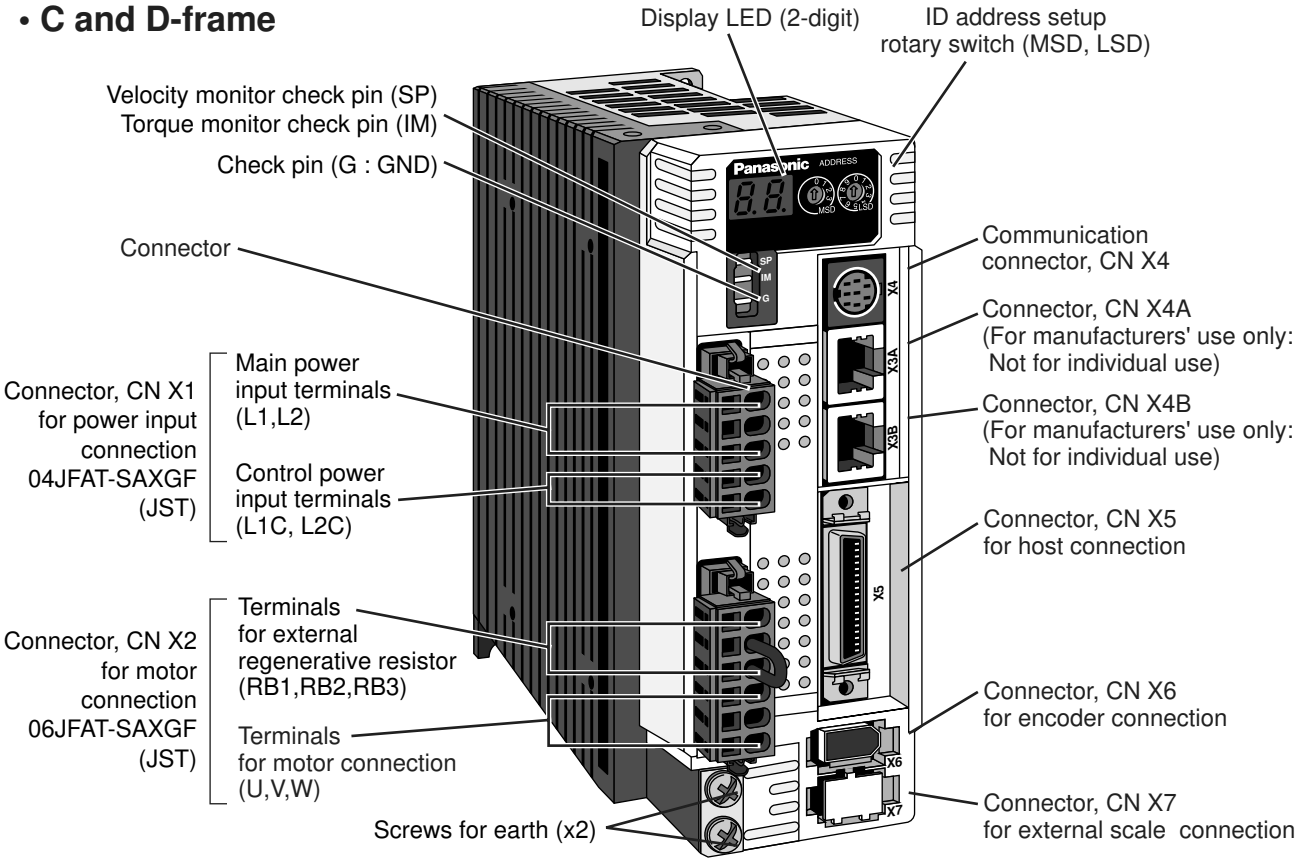
Driver

• A and B-frame



e.g.) : MADDT1207P (Single phase, 200V, 200W : A-frame)

• C and D-frame

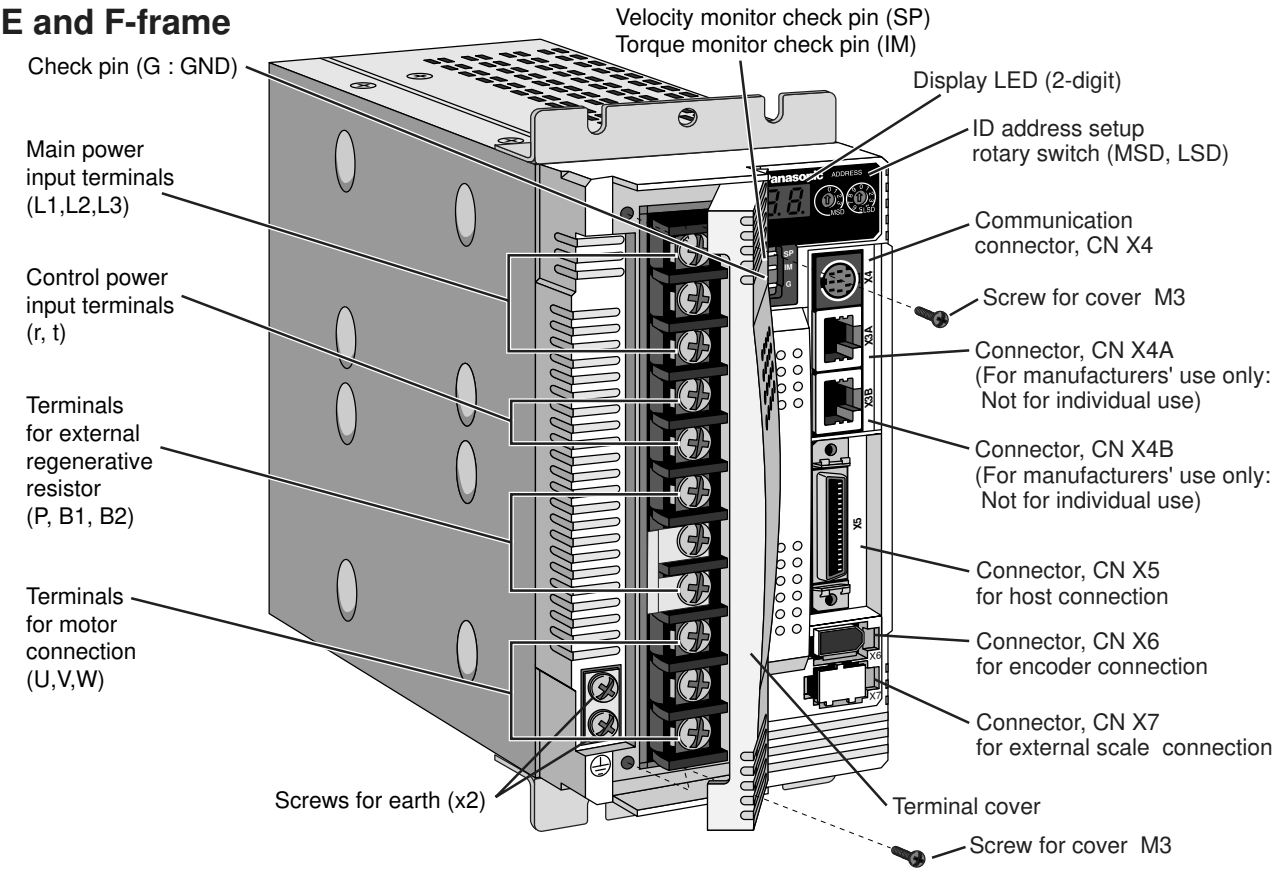


e.g.) : MCDDT3520P (Single/3-phase, 200V, 750W : C-frame)

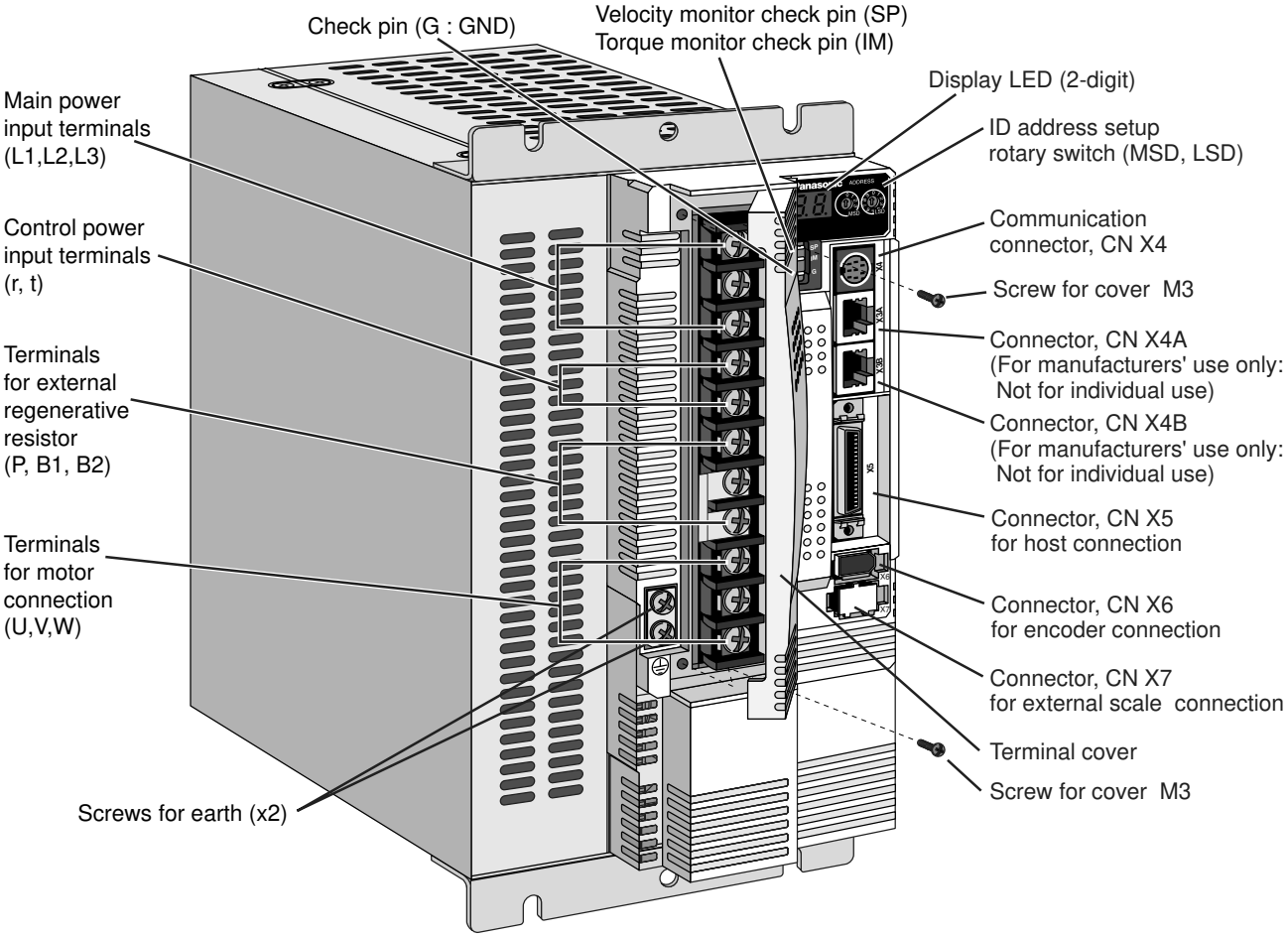
<Note>

X1 and X2 are attached in A to D-frame driver.

• E and F-frame



e.g.) : MEDDT7364P (3-phase, 200V, 2.0kW : E-frame)



e.g.) : MFDDTB3A2P (3-phase, 200V, 5.0kW : F-frame)

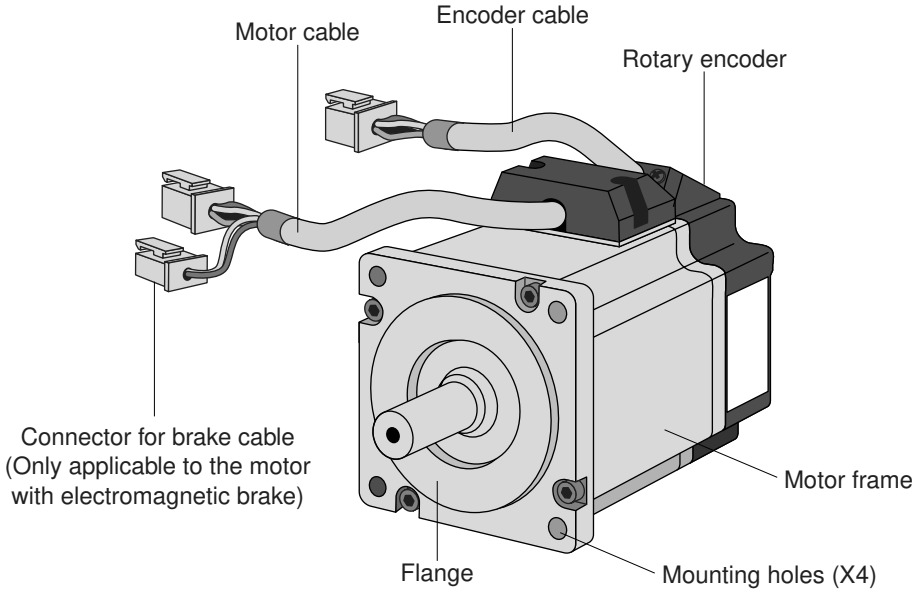
<Note>

For details of each model, refer to "Dimensions " (P.192 to 194) of Supplement.

Parts Description

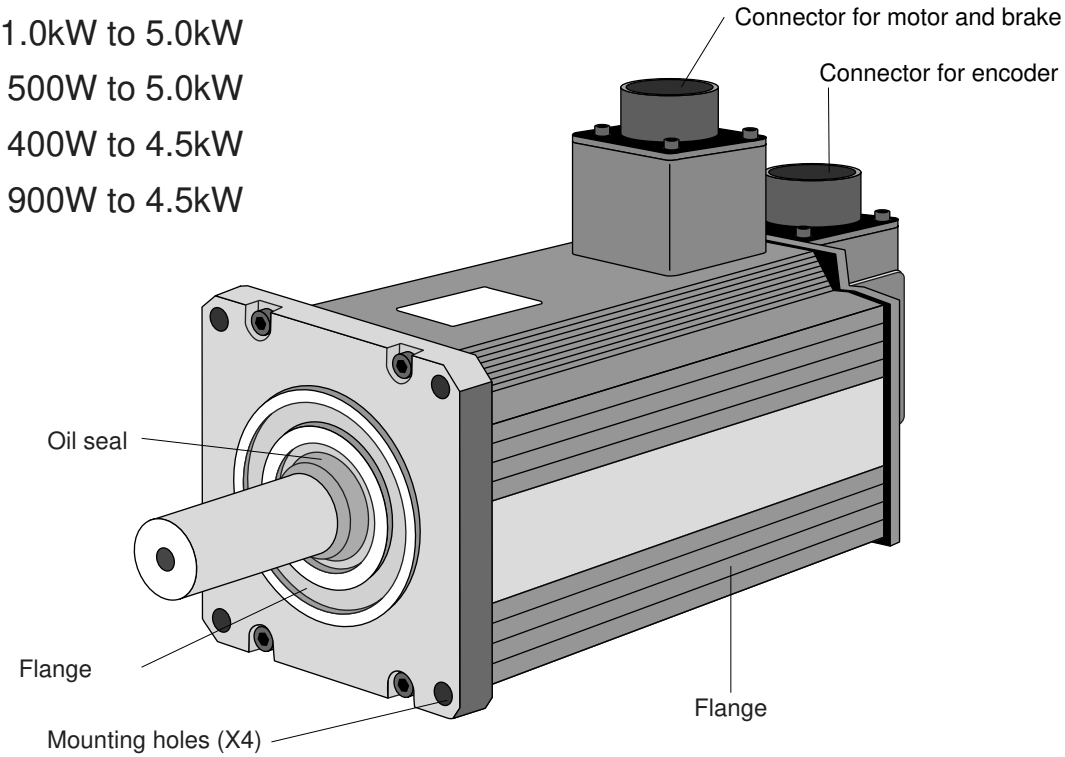
Motor

- MSMD 50W to 750W
- MAMA 100W to 750W
- MQMA 100W to 400W



e.g.) : Low inertia type (MSMD series, 50W)

- MSMA 1.0kW to 5.0kW
- MDMA 1.0kW to 5.0kW
- MHMA 500W to 5.0kW
- MFMA 400W to 4.5kW
- MGMA 900W to 4.5kW

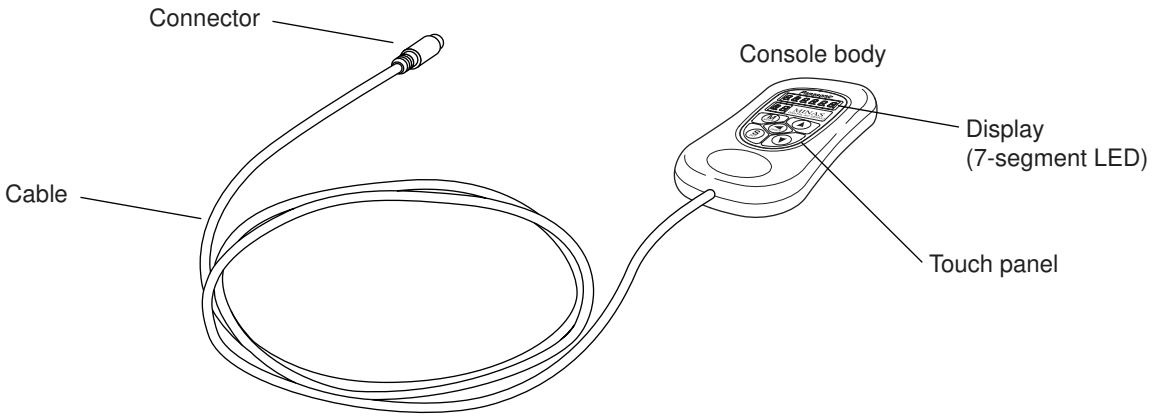


e.g.) : Middle inertia type (MDMA series, 1.0kW)

<Note>
For details of each model, refer to "Dimensions " (P.195 to P.209) of Supplement.

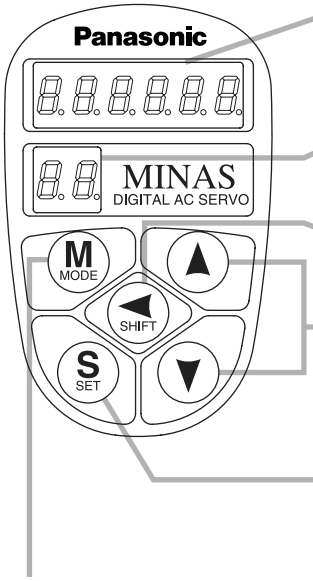
Console

Main Body



<Note>
Console is an option (Part No.: DV0P4420).

Display/Touch panel



Display LED (6-digit)
All of LED will flash when error occurs, and switch to error display screen.

Display LED (in 2 digits)
Parameter No. is displayed at parameter setup mode. Point No. is displayed at teaching mode.

SHIFT Button
Press this to shift the digit for data change.

▲▼ Button
Press these to change data or execute selected action of parameter.
Numerical value increases by pressing ,▲,
decreases by pressing ▼.

SET Button
Press this to shift each mode which is selected by mode switching button to EXECUTION display.

Mode Switching Button Press this to switch 7 kinds of mode.

1) Monitor mode
2) Teaching mode
   - Target position settings established by teaching
   - Test operation
3) Parameter setup mode
4) EEPROM write mode
5) Normal auto-gain tuning mode
6) Auxiliary function mode
   - Alarm clear
   - Absolute encoder clear
7) Copy mode
   - Copying of parameters from the driver to the console.
   - Copying of parameters from the console to the driver.

The data for the parameters is set after the mode has been switched to the parameter setup mode. For details on operation, refer to the instruction manual provided with the console.

How to Install

Install the driver and the motor properly to avoid a breakdown or an accident.

Driver

Installation Place

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

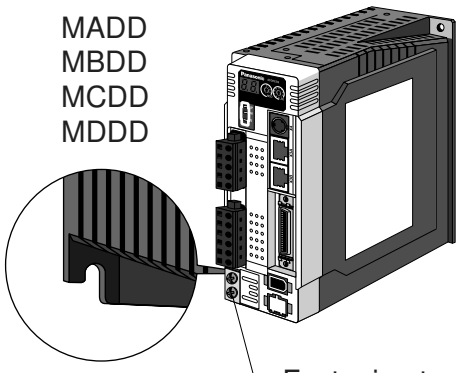
Environmental Conditions

Item	Condition
Ambient temperature	0˚C to 55˚C (free from freezing)
Ambient humidity	Less than 90% RH (free from condensation)
Storage temperature	–20˚C to 80˚C (free from freezing)
Storage humidity	Less than 90% RH (free from condensation)
Vibration	Lower than 5.9m/S^2 (0.6G), 10 to 60Hz
Altitude	Lower than 1000m

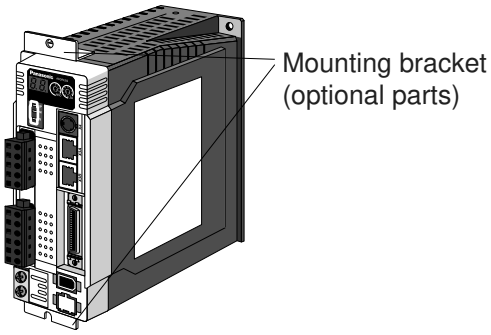
How to Install

1) Rack-mount type. Install in vertical position, and reserve enough space around the servo driver for ventilation. Base mount type (rear mount) is standard (A to D-frame)
2) Use the optional mounting bracket when you want to change the mounting face.

A to D-frame

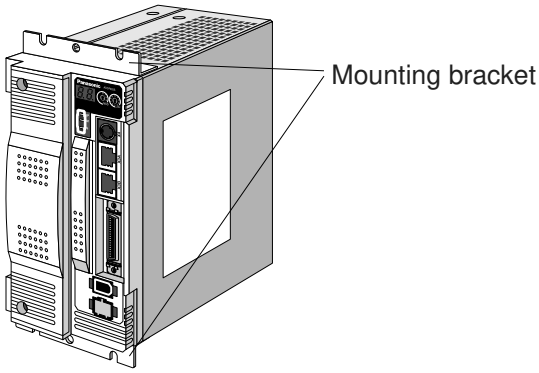


e.g.) In case of C-frame



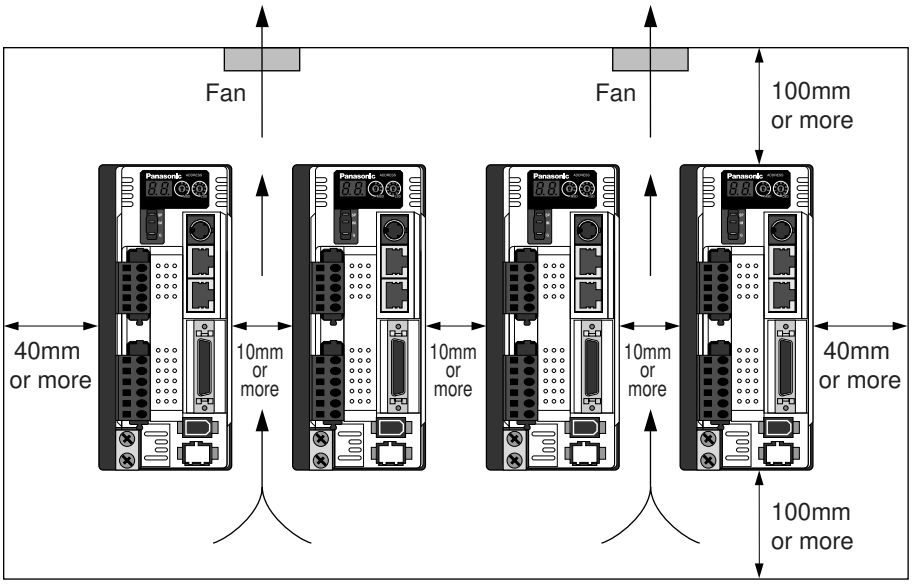
Fastening torque of earth screws (M4) to be 0.39 to 0.59N·m.

E and F-frame



Mounting Direction and Spacing

- Reserve enough surrounding space for effective cooling.
- Install fans to provide uniform distribution of temperature in the control panel.
- Observe the environmental conditions of the control panel described in the next page.



<Note>

It is recommended to use the conductive paint when you make your own mounting bracket, or repaint after peeling off the paint on the machine for installing the products, in order to make noise countermeasure.

Caution on Installation

We have been making the best effort to ensure the highest quality, however, application of exceptionally large external noise disturbance and static electricity, or failure in input power, wiring and components may result in unexpected action. It is highly recommended that you make a fail-safe design and secure the safety in the operative range.

There might be a chance of smoke generation due to the failure of these products. Pay an extra attention when you apply these products in a clean room environment.

How to Install

Motor

Installation Place

Since the conditions of location affect a lot to the motor life, select a place which meets the conditions below.

1) Indoors, where the products are not subjected to rain or direct sun beam. The products are not water-proof.
2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas, grinding oil, oil mist, iron powder or chips and etc.
3) Where the motor is free from grinding oil, oil mist, iron powder or chips.
4) Well-ventilated and humid and dust-free place, far apart from the heat source such as a furnace.
5) Easy-to-access place for inspection and cleaning.
6) Vibration-free place.
7) Avoid enclosed place. Motor may gets hot in those enclosure and shorten the motor life.

Environmental Conditions

Item		Condition
Ambient temperature		0˚C to 40˚C (free from freezing) *1
Ambient humidity		Less than 85% RH (free from condensation)
Storage temperature		–20˚C to 80˚C (free from freezing) *2
Storage humidity		Less than 85% RH (free from condensation)
Vibration	Motor only	Lower than 49m/s^2 (5G) at running, 24.5m/s^2 (2.5G) at stall
Impact	Motor only	Lower than 98m/s^2 (10G)
Enclosure rating	Motor only	IP65 (except rotating portion of output shaft and lead wire end) • These motors conform to the test conditions specified in EN standards (EN60529, EN60034-5). Do not use these motors in application where water proof performance is required such as continuous wash-down operation.

*1 Ambient temperature to be measured at 5cm away from the motor.
*2 Permissible temperature for short duration such as transportation.

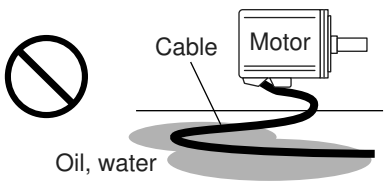
How to Install

You can mount the motor either horizontally or vertically as long as you observe the followings.

1) Horizontal mounting
   • Mount the motor with cable outlet facing downward for water/oil countermeasure.
2) Vertical mounting
   • Use the motor with oil seal (non-standard) when mounting the motor with gear reducer to prevent the reducer oil/grease from entering to the motor.
3) For mounting dimensions, refer to P.195 to 209 "Dimensions".

Oil/Water Protection

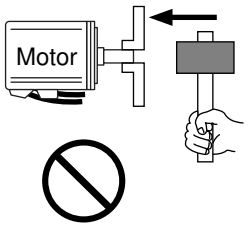
1) Don't submerge the motor cable to water or oil.
2) Install the motor with the cable outlet facing downward.
3) Avoid a place where the motor is subjected to oil or water.
4) Use the motor with an oil seal when used with the gear reducer, so that the oil may not enter to the motor through shaft.



Stress to Cables

1) Avoid a stress application to the cable outlet and connecting portion by bending or self-weight.
2) Especially in an application where the motor itself travels, fix the attached cable and contain the extension junction cable into the bearer so that the stress by bending can be minimized.
3) Take the cable bending radius as large as possible. (Minimum R20mm)

Permissible Load to Output Shaft



1) Design the mechanical system so that the applied radial load and/or thrust load to the motor shaft at installation and at normal operation can meet the permissible value specified to each model.
2) Pay an extra attention when you use a rigid coupling. (Excess bending load may damage the shaft or deteriorate the bearing life.
3) Use a flexible coupling with high stiffness designed exclusively for servo application in order to make a radial thrust caused by micro misalignment smaller than the permissible value.
4) For permissible load of each model, refer to P.210, "List of Permissible Load to Output Shaft" of Supplement.

Notes on Installation

1) Do not apply direct impact to the shaft by hammer while attaching/detaching a coupling to and from the motor shaft.
   (Or it may damage the encoder mounted on the other side of the shaft.)
2) Make a full alignment. (incomplete alignment may cause vibration and damage the bearing.)
3) If the motor shaft is not electrically grounded, it may cause electrolytic corrosion to the bearing depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Check and verification by customer is required.

How to Install

Console

Installation Place

1) Indoors, where the products are not subjected to rain or direct sun beam. The products are not water-proof.
2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas, grinding oil, oil mist, iron powder or chips and etc.
3) Well-ventilated and low humidity and dust-free place.
4) Easy-to-access place for inspection and cleaning

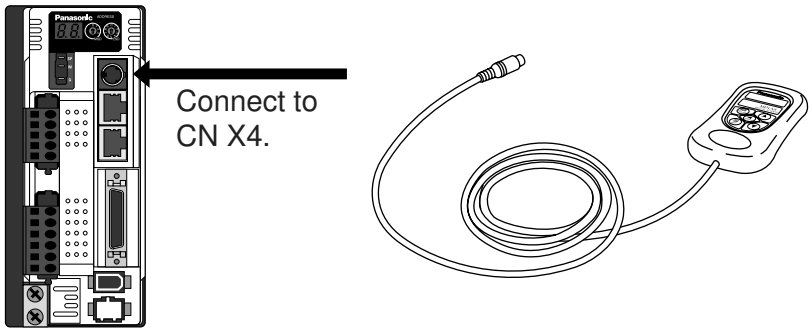
Environmental Conditions

Item	Condition
Ambient temperature	0˚C to 55˚C (free from freezing)
Ambient humidity	Less than 90% RH (free from condensation)
Storage temperature	–20˚C to 80˚C (free from freezing)
Storage humidity	Less than 90% RH (free from condensation)
Vibration	Lower than 5.9m/s^2 (0.6G), 10 to 60Hz
Impact	Conform to JISC0044 (Free fall test, 1m for 2 directions, 2 cycles)
Altitude	Lower than 1000m

<Cautions>

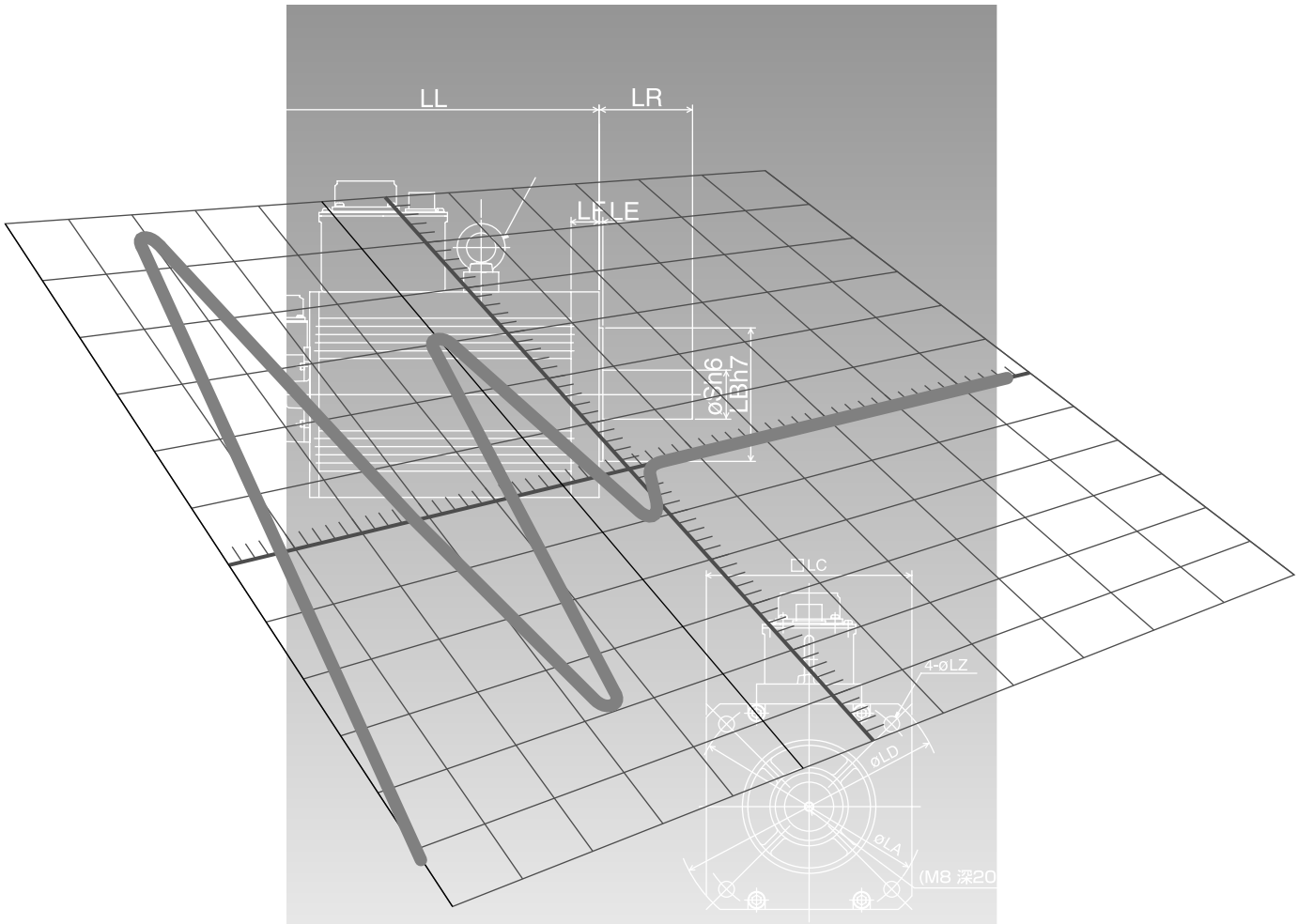
- Do not give strong impact to the products.
- Do not drop the products.
- Do not pull the cables with excess force.
- Avoid the place near to the heat source such as a heater or a large winding resistor.

How to Connect



<Remarks>

- Connect the console connector securely to CN X4 connector of the driver
- Never pull the cable to plug in or plug out.



[Preparation]

System Configuration and Wiring

Overall Wiring (Connecting Example of C-frame, 3-phase)

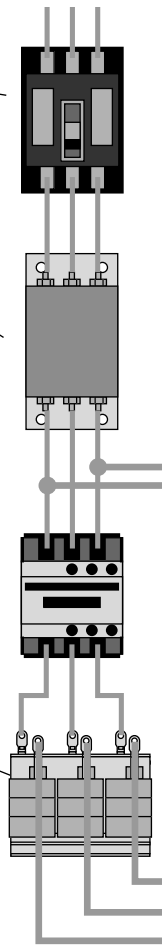
• Wiring of the Main Circuit (see P.34, 35.)

Circuit Breaker (NFB) (see P.32, 33 and 177.)
Use the circuit breaker matching capacity of the power source to protect the power lines.

Noise Filter (NF) (see P.177 , 178.)
Prevents external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

Magnetic Contactor (MC) (see P.32, 33.)
Turns on/off the main power of the servo driver.
Use a surge absorber together with this.
- **Never start nor stop the servo motor with this Magnetic Contactor.**

Reactor (L) (see P.189.)
Reduces harmonic current of the main power.



- **Connection to the Connector, CN X1**
(connection to input power)
<Remarks>
Before turning the power supply on, check whether the input voltage is correct.

L1 (Pin-5)
L2 (Pin-4)
L3 (Pin-3)
L1C (Pin-2)
L2C (Pin-1)

Pin RB1 (6-pin), RB2 (4-pin), and RB3 (5-pin)

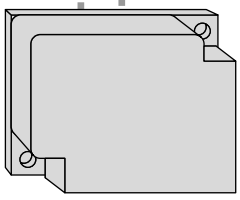
RB2 and RB3 to be kept shorted for normal operation.

- **When the capacity shortage of the regenerative resister is found, disconnect a shorting bar between RB2 and RB3,** then connect **the external regenerative resister between RB1 and RB2.**
(Note that no regenerative resister is equipped in Frame A and B type. **Install an external regenerative resister on incombustible material, such as metal.** Follow the same wiring connection as the above.)
- When you connect an external regenerative resister, set up SV.Pr6C to 1 or 2.

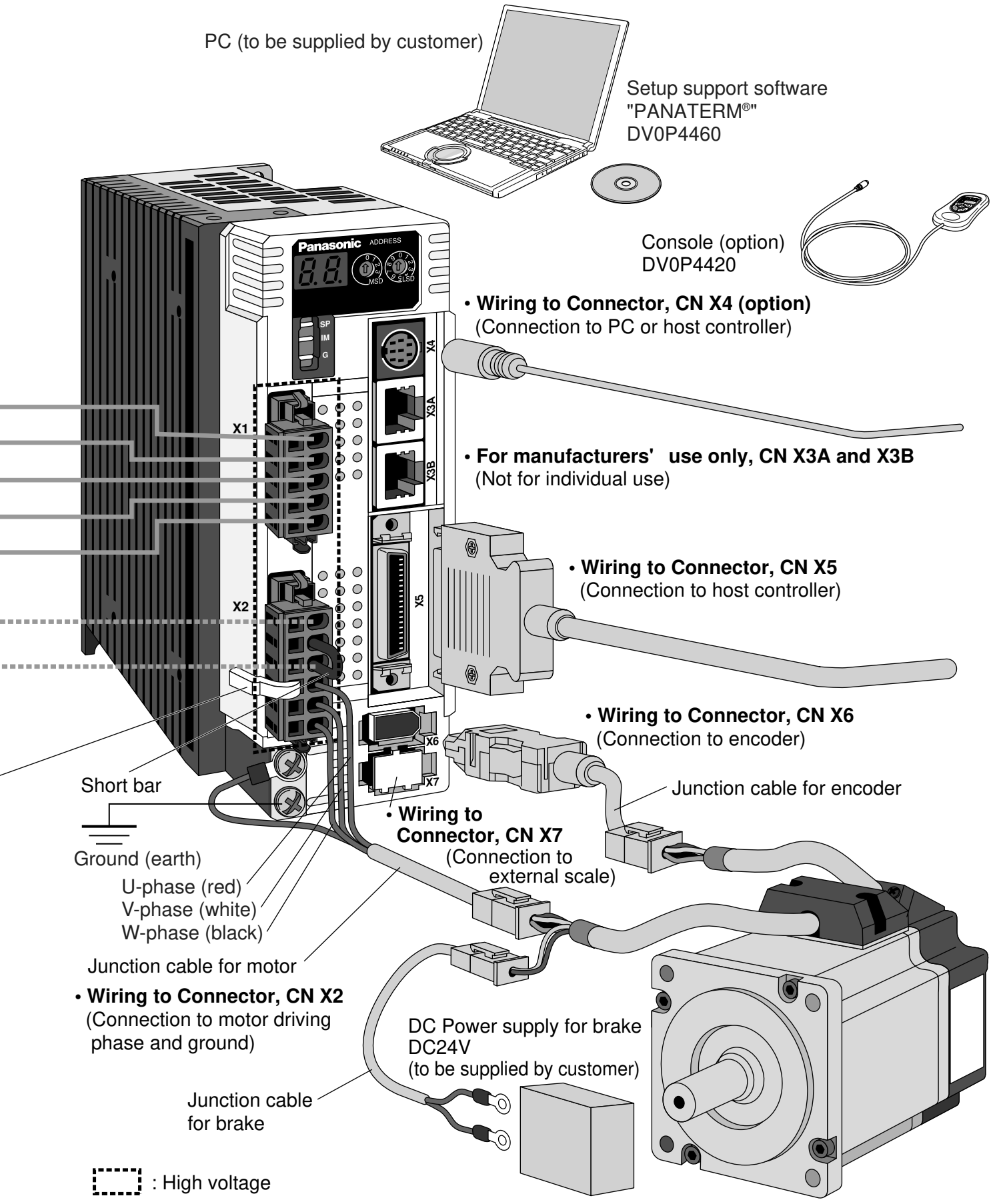
- **Connection to the Connector, CN X2**
(connection to external components)

RB1 (Pin-6)
RB2 (Pin-4)

Handle lever
Use this for connector connection. Store this after connection for other occasions.
(see page for connection.)



Regenerative resistor (optional)
<Remarks>
- When you use an external regenerative resister, install an external protective apparatus, such as thermal fuse without fail.
- Thermal fuse and thermostat are built in to the regenerative resistor (Option). If the thermal fuse is activated, it will not resume.


PC (to be supplied by customer)
Setup support software
"PANATERM®"
DV0P4460
Console (option)
DV0P4420
• Wiring to Connector, CN X4 (option)
(Connection to PC or host controller)
• For manufacturers' use only, CN X3A and X3B
(Not for individual use)
• Wiring to Connector, CN X5
(Connection to host controller)
• Wiring to Connector, CN X6
(Connection to encoder)
Junction cable for encoder
Short bar
Ground (earth)
U-phase (red)
V-phase (white)
W-phase (black)
• Wiring to Connector, CN X7
(Connection to external scale)
Junction cable for motor
• Wiring to Connector, CN X2
(Connection to motor driving phase and ground)
DC Power supply for brake
DC24V
(to be supplied by customer)
Junction cable for brake
: High voltage
Panasonic
ADDRESS
MSD
LSD
SP
IM
G
X1
X2
X3A
X3B
X4
X5
X6
X7

System Configuration and Wiring

Overall Wiring (Connecting Example of E-frame)

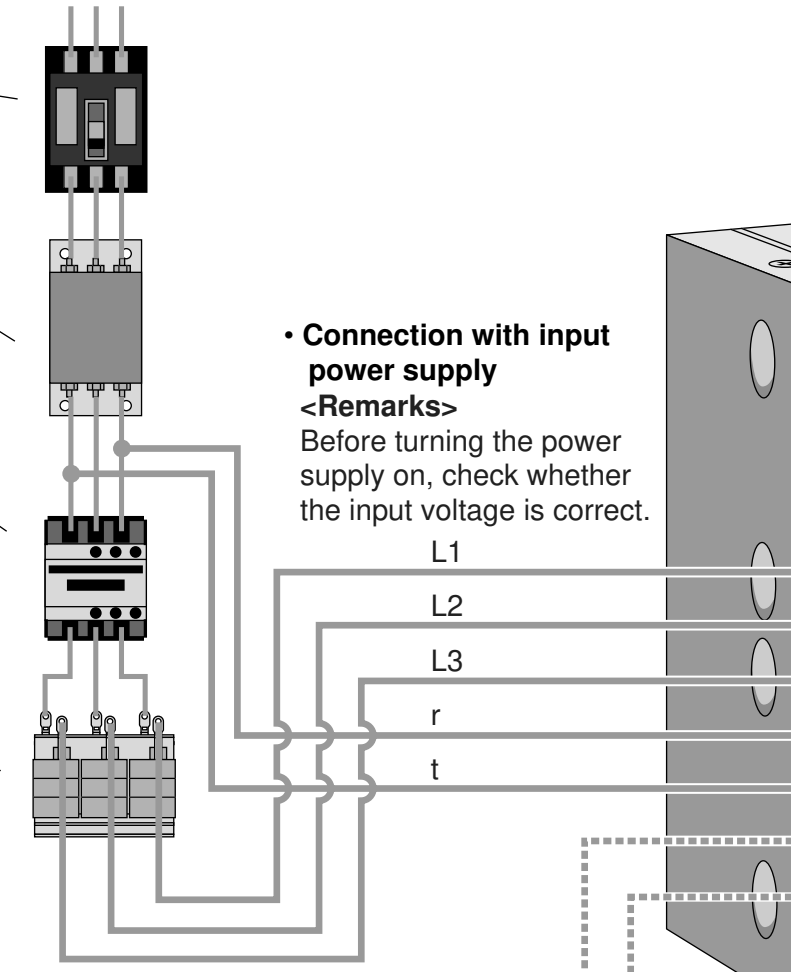
• Wiring of the Main Circuit (see P.36, 37.)

Circuit Breaker (NFB) (see P.32, 33 and 177.)
Use the circuit breaker matching capacity of the power source to protect the power lines.

Noise Filter (NF) (see P.177 , 178.)
Prevents external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

Magnetic Contactor (MC) (see P.32, 33.)
Turns on/off the main power of the servo driver.
Use a surge absorber together with this.
- **Never start nor stop the servo motor with this Magnetic Contactor.**

Reactor (L) (see P.189.)
Reduces harmonic current of the main power.

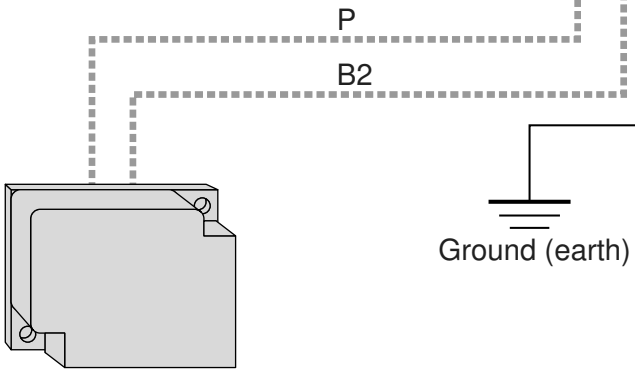


• Connection with input power supply
<Remarks>
Before turning the power supply on, check whether the input voltage is correct.

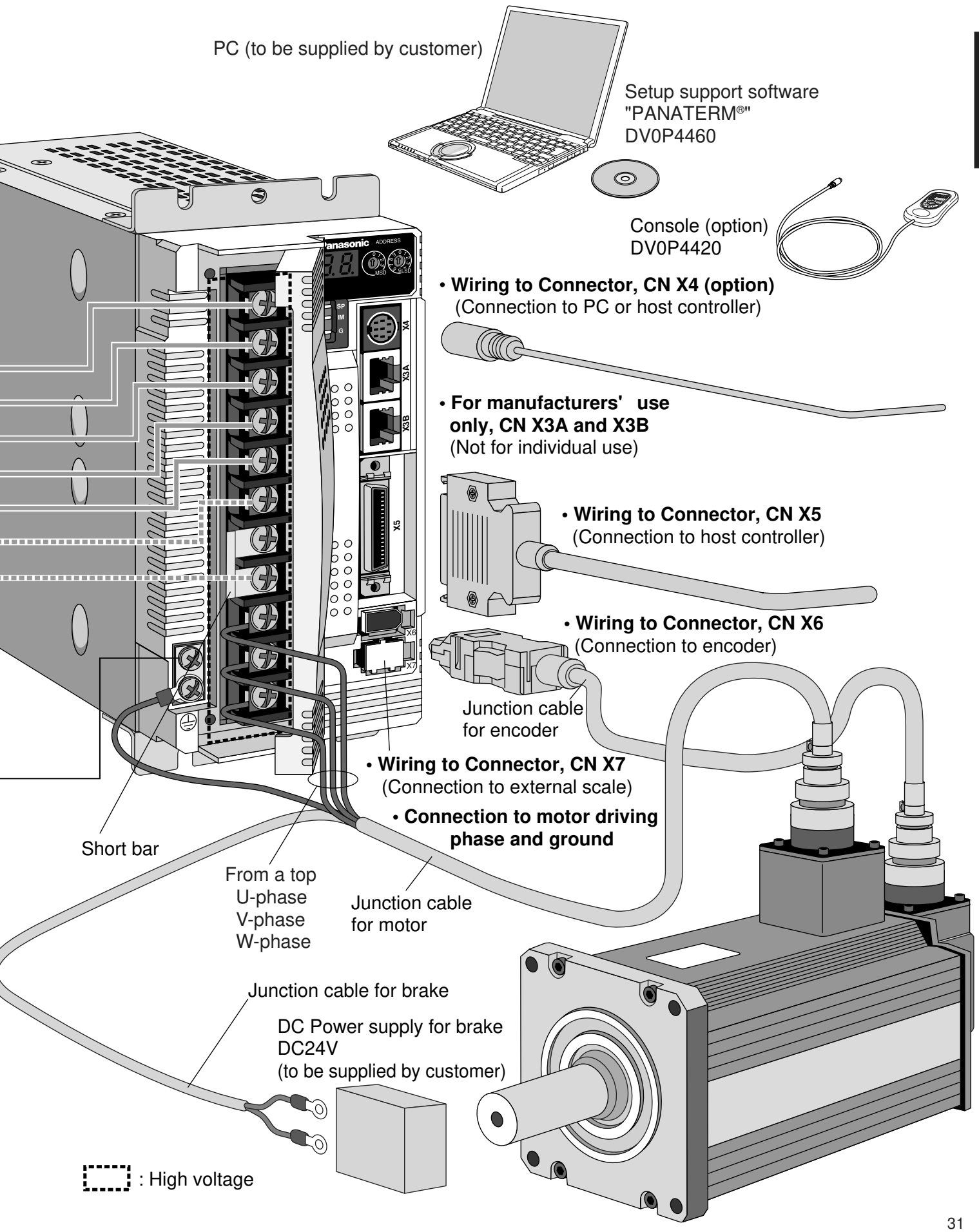
Pin P, B1 and B2...
B1 and B2 to be kept shorted for normal operation.

- **When the capacity shortage of the regenerative resister is found, disconnect a short bar between B1 and B2,** then connect **the external regenerative resister** between P and B2.
  Install an external regenerative resister on incombustible material, such as metal. Follow the same wiring connection as the above.
- When you connect an external regenerative resister, set up SV.Pr6C to 1 or 2.

• Connection to external components

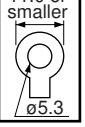


Regenerative resistor (optional)
<Remarks>
When you use an external regenerative resister, install an external protective apparatus, such as thermal fuse without fail.
Thermal fuse and thermostat are built in to the regenerative resistor (Option). If the thermal fuse is activated, it will not resume.


PC (to be supplied by customer)
Setup support software
"PANATERM®"
DV0P4460
Console (option)
DV0P4420
• Wiring to Connector, CN X4 (option)
(Connection to PC or host controller)
• For manufacturers' use only, CN X3A and X3B
(Not for individual use)
• Wiring to Connector, CN X5
(Connection to host controller)
• Wiring to Connector, CN X6
(Connection to encoder)
Junction cable for encoder
• Wiring to Connector, CN X7
(Connection to external scale)
• Connection to motor driving phase and ground
Short bar
From a top
U-phase
V-phase
W-phase
Junction cable for motor
Junction cable for brake
DC Power supply for brake
DC24V
(to be supplied by customer)
: High voltage

System Configuration and Wiring

Driver and List of Applicable Peripheral Equipments

Driver	Applicable motor	Voltage	Rated output	Required Power (at the rated load)	Circuit breaker (rated current)	Noise filter	Surge absorber	Noise filter for signal	Magnetic contactor	Cable diameter (main circuit)	Cable diameter (control circuit)	Connection
MADD	MSMD	Single phase, 100V	50W –100W	approx. 0.4kVA	10A	DV0P4170	DV0P4190	DV0P1460	BMFT61041N (3P+1a)	0.75 to 2.0mm² AWG 14 to 18	0.75mm² AWG18	Connection to exclusive connector
	MQMA		100W	approx. 0.4kVA								
	MSMD	Single phase, 200V	50W –200W	approx. 0.5kVA					BMFT61542N (3P+1a)			
	MQMA		100W	approx. 0.3kVA								
			200W	approx. 0.5kVA								
	MAMA		100W	approx. 0.3kVA								
MBDD	MSMD	Single phase, 100V	200W	approx. 0.5kVA					BMFT61041N (3P+1a)			
	MQMA											
	MSMD	Single phase, 200V	400W	approx. 0.9kVA					BMFT61542N (3P+1a)			
	MQMA											
	MAMA		200W	approx. 0.5kVA								
MCDD	MQMA	Single phase, 100V	400W	approx. 0.9kVA		DV0P4180			BMFT61541N (3P+1a)			
	MSMD	Single/ 3- phase, 200V	750W	approx. 1.3kVA	15A				BMFT61542N (3P+1a)			
	MAMA		400W	approx. 0.9kVA								
	MFMA											
	MHMA		500W	approx. 1.1kVA								
MDDD	MAMA	Single/ 3- phase, 200V	750W	approx. 1.6kVA		DV0P4220	DV0P1450		BMFT61842N (3P+1a)	2.0mm² AWG14		
	MDMA		1.0kW	approx. 1.8kVA								
	MHMA											
	MGMA		900W	approx. 1.8kVA	20A							
	MSMA		1.0kW	approx. 1.8kVA								
	MHMA		1.5kW	approx. 2.3kVA								
	MDMA											
	MSMA											
	MFMA											
MEDD	MDMA	3- phase, 200V	2.0kW	approx. 3.3kVA	30A				BMF6352N (3P+2a2b)	2.0mm² AWG14		Terminal block M5 11.0 or smaller 
	MSMA											
	MHMA											
	MFMA		2.5kW	approx. 3.8kVA						3.5mm² AWG12		

Driver	Applicable motor	Voltage	Rated output	Required Power (at the rated load)	Circuit breaker (rated current)	Noise filter	Surge absorber	Noise filter for signal	Magnetic contactor	Cable diameter (main circuit)	Cable diameter (control circuit)	Connection
MFDD	MGMA	3- phase, 200V	2.0kW	approx. 3.8kVA	50A	DV0P3410	DV0P1450	DV0P1460	BMF6352N (3P+2a2b)	3.5mm² AWG12	0.75mm² AWG18	Terminal block M5 
	MDMA		3.0kW	approx. 4.5kVA								
	MHMA											
	MSMA											
	MGMA											
	MDMA		4.0kW	approx. 6kVA					BMF6652N (3P+2a2b)	5.3mm² AWG10		
	MHMA											
	MSMA											
	MFMA		4.5kW	approx. 6.8kVA								
	MGMA			approx. 7.5kVA								
	MDMA		5.0kW	approx. 7.5kVA								
	MHMA											
	MSMA											

- Select a single and 3-phase common specifications according to the power source.
- Manufacturer of circuit breaker and magnetic contactor : Matsushita Electric Works.
  To comply to EC Directives, install a circuit breaker between the power and the noise filter without fail, and the circuit breaker should conform to IEC Standards and UL recognized (Listed and Ⓤ marked).
  5000Arms, 240V is the maximum capacity to be delivered to the circuit of 750W or larger model when the maximum current value of the circuit breaker is limited to 20A.
- For details of noise filters, refer to P.177, 178, "Noise Filter" and P.179, "Driver and List of Applicable Peripheral Equipments (EC Directives)" of Supplement.

<Remarks>

- Select and use the circuit breaker and noise filter with matching capacity to those of the power source, considering the load conditions as well.
- Terminal block and protective earth terminal
  Use a copper conductor cable with temperature rating of 60˚C or higher.
  Protective earth terminal is M4 for A to D-frame, and M5 for E and F-frame.
  Larger tightening torque of the screw than the max. value (M4 : 1.2 N·m, M5 : 2.0 N·m) may damage the terminal block.
- Earth cable diameter should be 2.0mm² (AWG14) or larger for 50W to 2.0kW model, and 3.5mm² (AWG12) or larger for 2.5kW to 4.0kW, and 5.3mm² (AWG10) or larger for 4.5kW to 5kW model.
- Use the attached exclusive connectors for A to D-frame, and maintain the peeled off length of 8 to 9mm.
- Tightening torque of the screws for connector (CN X5) for the connection to the host to be 0.3 to 0.35 N·m.
  Larger tightening torque than these may damage the connector at the driver side.

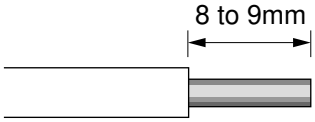
System Configuration and Wiring

Wiring of the Main Circuit (A to D-frame)

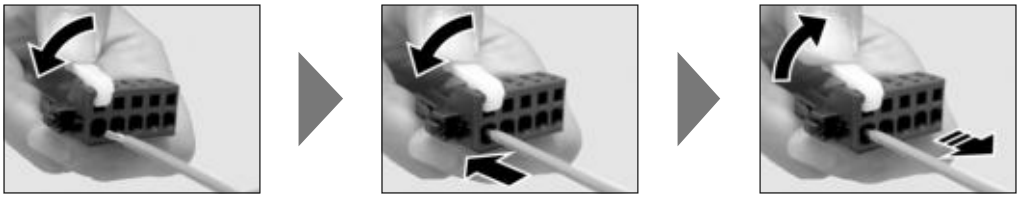
- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.

Tips on Wiring

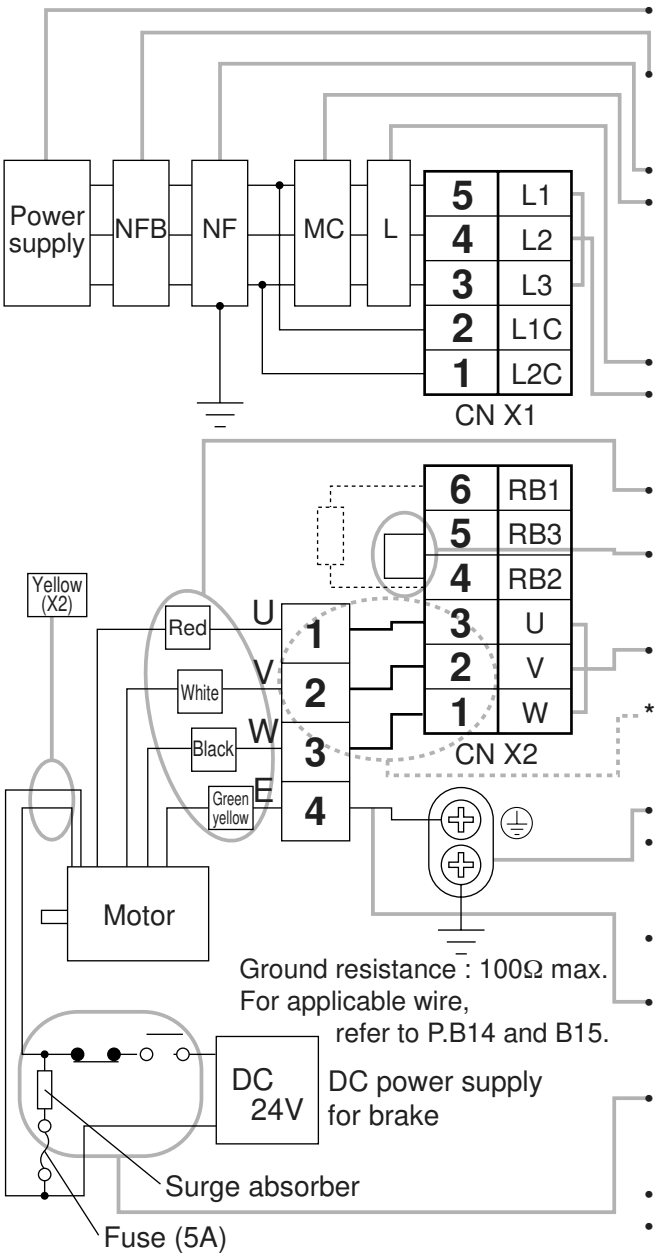
1) Peel off the insulation cover of the cable.
(Observe the dimension as the right fig. shows.)



2) Insert the cable to the connector detached from the driver. (See P.37 for details.)



3) Connect the wired connector to the driver.



- Check the name plate of the driver for power specifications.
- Provide a circuit breaker, or a leakage breaker. The leakage breaker to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.
- Provide a noise filter without fail.
- Provide a surge absorber to a coil of the Magnetic Contactor. **Never start/stop the motor with this Magnetic Contactor.**
  Connect a fuse in series with the surge absorber. Ask the manufacturer of the Magnetic Contactor for the fuse rating.
- Provide an AC Reactor.
- **Connect L1 and L1C, and L3 and L2C at single phase use (100V and 200V), and don' t use L2.**

- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- Don't disconnect the shorting cable between RB2 and RB3 (C and D frame type). Disconnect this only when the external regenerative register is used.
- **Avoid shorting and ground fault. Don' t connect the main power.**

***Connect pin 3 of the connector on the driver side with pin 1 of the connector on the motor side.**

- **Earth-ground this.**
- Connect the protective earth terminal (⏚) of the driver and the protective earth (earth plate) of the control panel without fail to prevent electrical shock.
- Don't co-clamp the earth wires to the protective earth terminal (⏚) . Two terminals are provided.
- **Don' t connect the earth cable to other inserting slot, nor make them touch.**

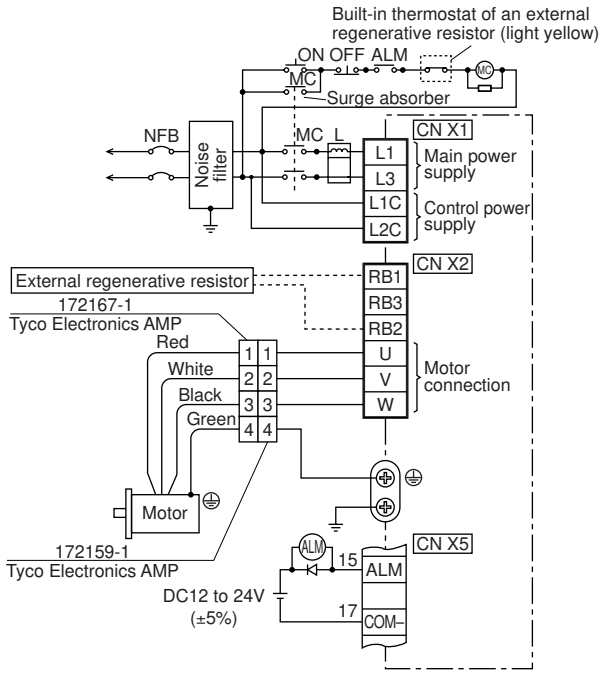
- Compose a duplex Brake Control Circuit so that the brake can also be activated by an external emergency stop signal.
- The Electromagnetic Brake has no polarity.
- For the capacity of the electromagnetic brake and how to use it, refer to P.50, "Specifications of Built-in Holding Brake".
- Provide a surge absorber.
  Connect a 5A fuse in series with the surge absorber.

Wiring Diagram

Compose the circuit so that the main circuit power will be shut off when an error occurs.

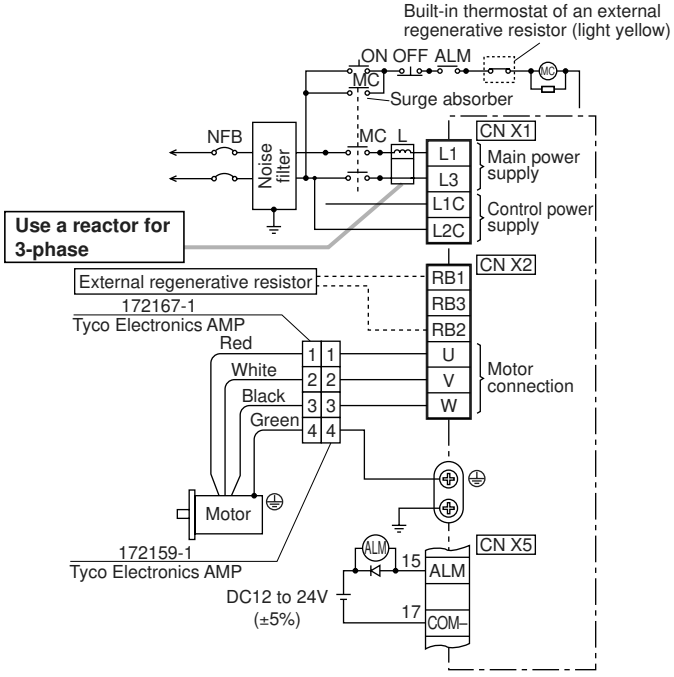
In Case of Single Phase, 100V (A and B-frame)

Power supply Single phase, 100V $^{+10\%}_{-15\%}$ to 115V $^{+10\%}_{-15\%}$



In Case of Single Phase, 200V (A and B-frame)

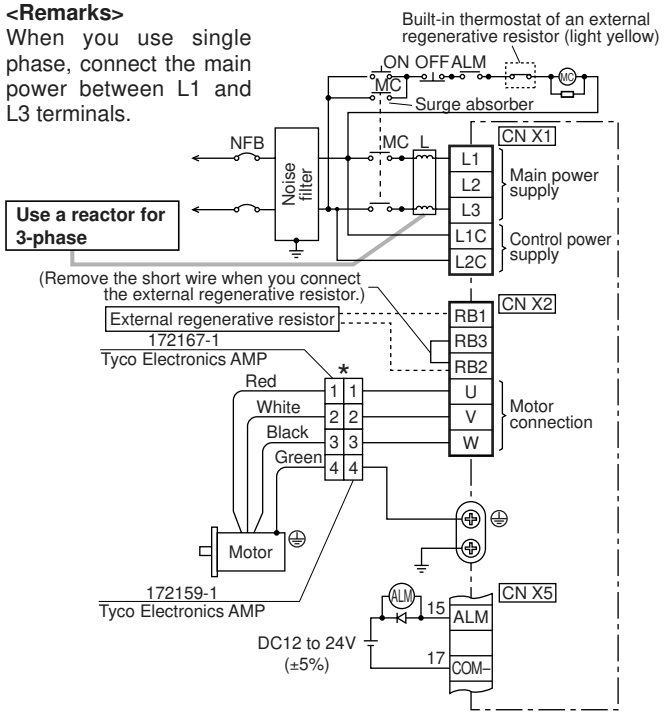
Power supply Single phase, 200V $^{+10\%}_{-15\%}$ to 240V $^{+10\%}_{-15\%}$



In Case of Single Phase, 200V (C and D-frame)

Power supply Single phase, 200V $^{+10\%}_{-15\%}$ to 240V $^{+10\%}_{-15\%}$

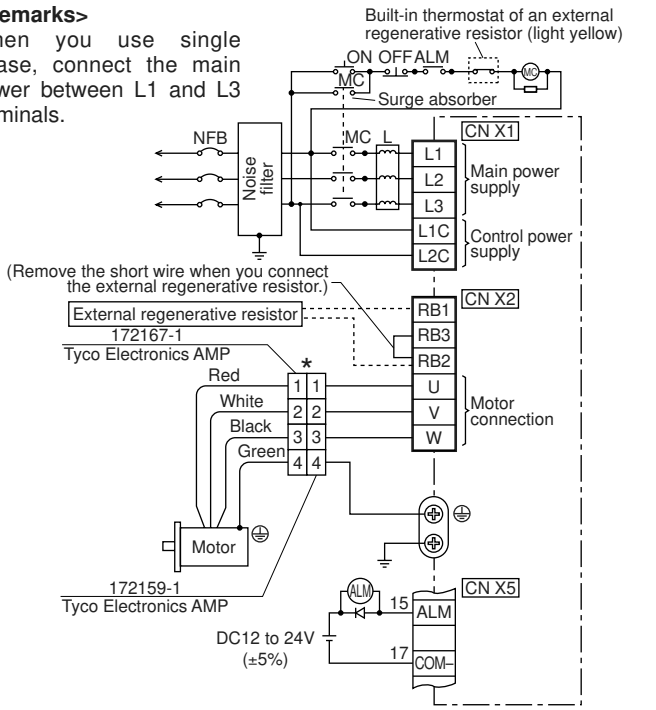
<Remarks>
When you use single phase, connect the main power between L1 and L3 terminals.



In Case of 3-Phase, 200V (C and D-frame)

Power supply 3-phase, 200V $^{+10\%}_{-15\%}$ to 240V $^{+10\%}_{-15\%}$

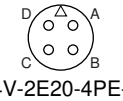
<Remarks>
When you use single phase, connect the main power between L1 and L3 terminals.



* When you use motor model of MSMA, MDMA, MFMA, MHMA and MGMA, use the connections as the below table shows.

[Motor portion]
Connector : by Japan Aviation Electronics Ind.

<Remark>
Do not connect anything to NC.

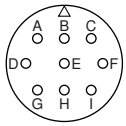


JL04V-2E20-4PE-B-R
JL04HV-2E22-22PE-B-R

PIN No.	Application
A	U-phase
B	V-phase
C	W-phase
D	Ground

JL04V-2E20-18PE-B-R

PIN No.	Application
G	Brake
H	Brake
A	NC
F	U-phase
I	V-phase
B	W-phase
E	Ground
D	Ground
C	NC



JL04V-2E24-11PE-B-R

PIN No.	Application
A	Brake
B	Brake
C	NC
D	U-phase
E	V-phase
F	W-phase
G	Ground
H	Ground
I	NC

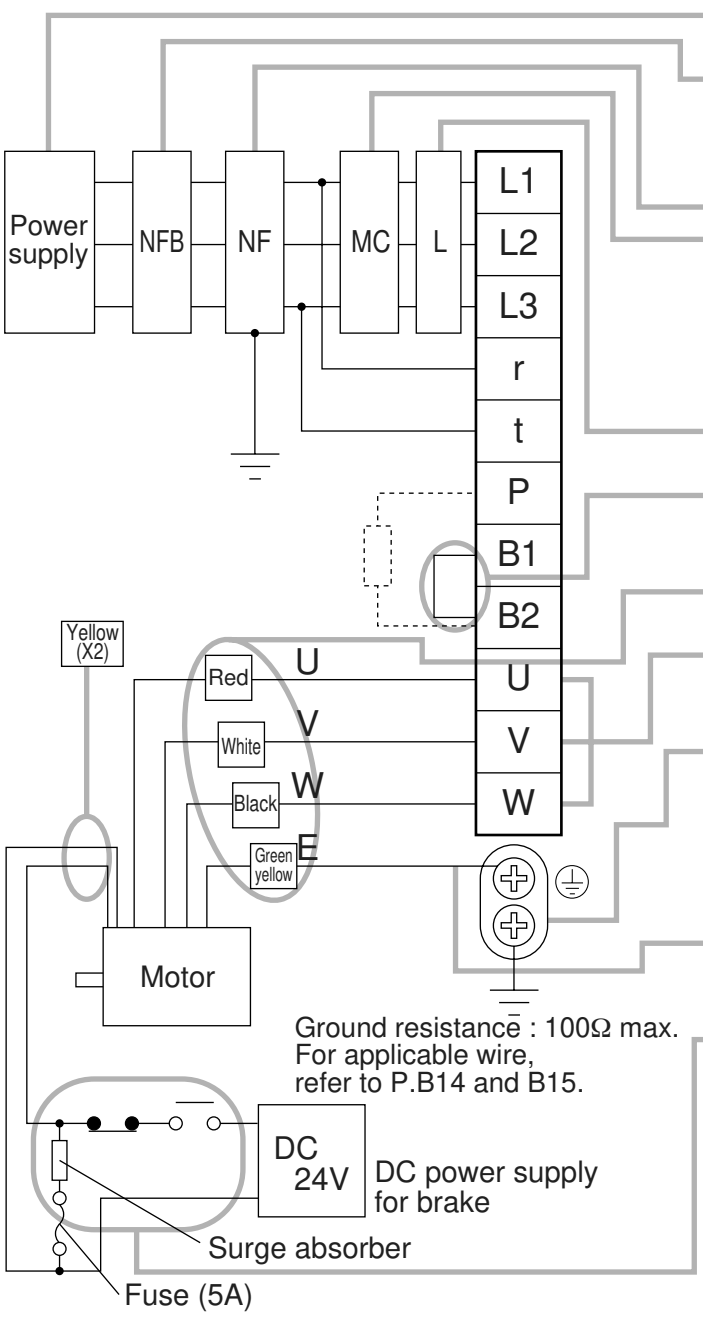
System Configuration and Wiring

Wiring of the Main Circuit (E and F-frame)

- Wiring should be performed by a specialist or an authorized personnel.
- Do not turn on the power until the wiring is completed.

Tips on Wiring

1) Take off the cover fixing screws, and detach the terminal cover.
2) Make wiring
   Use clamp type terminals of round shape with insulation cover for wiring to the terminal block. For cable diameter and size, rater to "Driver and List of Applicable Peripheral Equipments" (P.B14 and B15).
3) Attach the terminal cover, and fix with screws.
   Fastening torque of cover fixed screw in less than 0.2 N•m.



- Check the name plate of the driver for power specifications.
- Provide a circuit breaker, or a leakage breaker. The leakage breaker to be the one designed for "Inverter" and is equipped with countermeasures for harmonics.
- Provide a noise filter without fail.
- Provide a surge absorber to a coil of the Magnetic Contactor. **Never start/stop the motor with this Magnetic Contactor.**
  Connect a fuse in series with the surge absorber. Ask the manufacturer of the Magnetic Contactor for the fuse rating.
- Provide an AC Reactor.

- Don't disconnect the short bar between B1 and B2. Disconnect this only when an external regenerative register is used.
- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U,V,W).
- **Avoid shorting and ground fault.**
  Don' t connect the main power.

- **Earth-ground this.**
- Connect the protective earth terminal (⏚) of the driver and the protective earth (earth plate) of the control panel without fail to prevent electrical shock.
- Don't co-clamp the earth wires to the protective earth terminal (⏚) . Two terminals are provided.
- **Don' t connect the earth cable to other inserting slot, nor make them touch.**

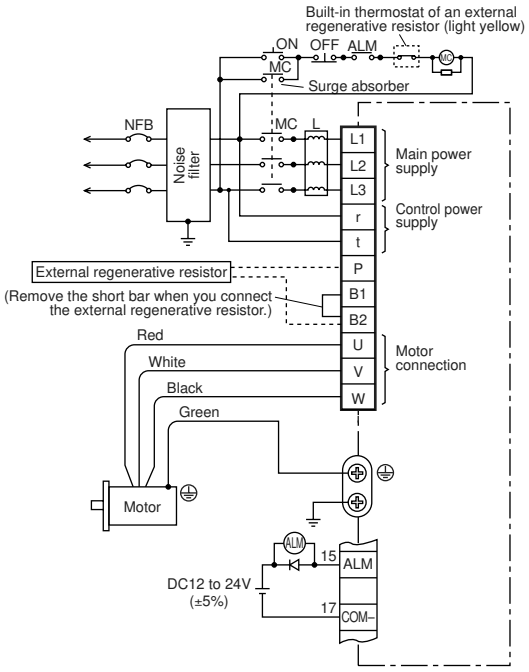
- Compose a duplex Brake Control Circuit so that the brake can also be activated by an external emergency stop signal.
- The Electromagnetic Brake has no polarity.
- For the capacity of the electromagnetic brake and how to use it, refer to P.50, "Specifications of Built-in Holding Brake".
- Provide a surge absorber.
  Connect a 5A fuse in series with the surge absorber.

Wiring Diagram

Compose the circuit so that the main circuit power will be shut off when an error occurs.

In Case of 3-Phase, 200V (E and F-frame)

Power supply 3-phase, 200V $^{+10\%}_{-15\%}$ to 230V $^{+10\%}_{-15\%}$



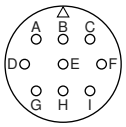
[Motor portion]
Connector : by Japan Aviation Electronics Ind.

JL04V-2E20-4PE-B-R
JL04HV-2E22-22PE-B-R

PIN No.	Application
A	U-phase
B	V-phase
C	W-phase
D	Ground

JL04V-2E20-18PE-B-R

PIN No.	Application
G	Brake
H	Brake
A	NC
F	U-phase
I	V-phase
B	W-phase
E	Ground
D	Ground
C	NC



JL04V-2E24-11PE-B-R

PIN No.	Application
A	Brake
B	Brake
C	NC
D	U-phase
E	V-phase
F	W-phase
G	Ground
H	Ground
I	NC

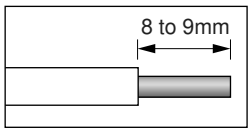
<Remark>
Do not connect anything to NC.

Wiring method to connector (A to D-frame)

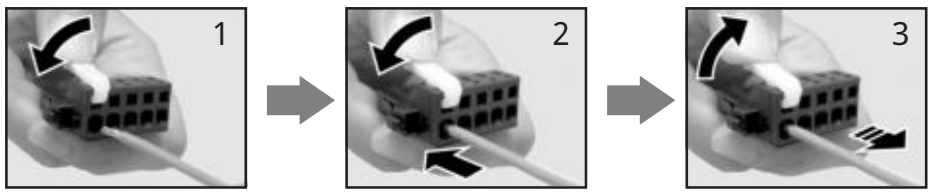
• Follow the procedures below for the wiring connection to the Connector CN X1 and X2.

How to connect

1. Peel off the insulation cover of the cable. (see the right fig for exact length for peeling.)
2. Insert the cable to the connecter in the following 2 methods.
   (a) Using the attached Handle Lever
   (b) Using a screw driver (blade width of 3.0 to 3.5 mm)



(a) Using handle lever



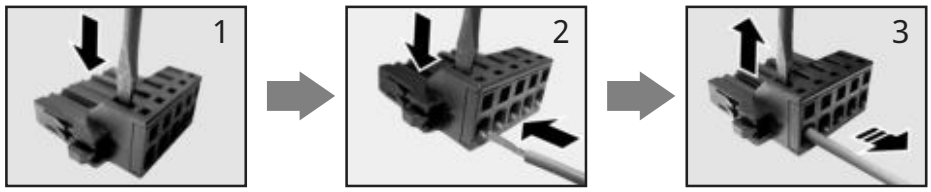
Attach the handle lever to the handling slot on the upper portion. Press down the lever to push down the spring.

Insert the peeled cable while pressing down the lever, until it hits the insertion slot (round hole).

Release the lever.

* You can pull out the cable by pushing down the spring as the above.

(b) Using screw driver



Press the screw driver to the handling slot on the upper portion to push down the spring.

Insert the peeled cable while pressing down the screw driver, until it hits the insertion slot (round hole).

Release the screw driver.

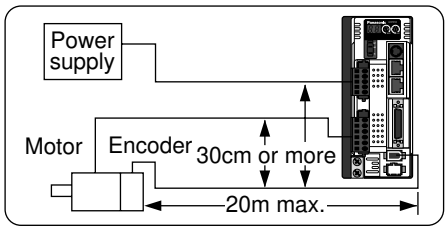
* You can pull out the cable by pushing down the spring as the above.

<CAUTION>
- Peel off the cable with exact length (8 to 9 mm).
- Take off the connector from the Servo Driver before making connection.
- Insert one cable into each one of cable insertion slot.
- Pay attention to injury by screw driver.

System Configuration and Wiring

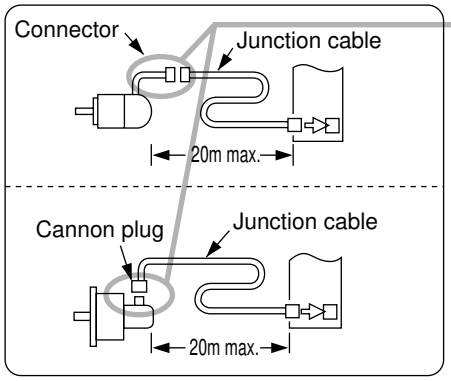
Wiring to the Connector, CN X6 (Connection to Encoder)

Tips on Wiring



◦Maximum cable length between the driver and the motor to be 20m. Consult with a dealer or distributor if you want to use the longer cable than 20m. (Refer to the back cover.)

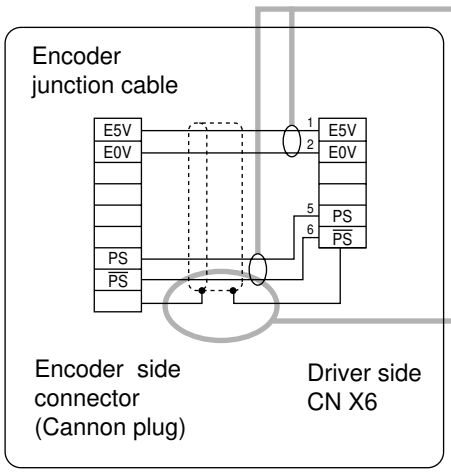
◦Keep this wiring away from the main circuit by 30 cm or more. Don't guide this wiring through the same duct with the main, nor bind them together.



◦Encoder outlets are different by the motors, flyer leads + connecter and cannon plug type.

◦When you make your own encoder junction cable (for connectors, refer to P.186, "Options (Connector Kit for Motor and Encoder connection)" of Supplement.

1) Refer to the Wiring Diagram below.
2) Cable to be : Shielded twisted pair cable with core diameter of 0.18mm^2 or larger (AWG24), and with higher bending resistance.

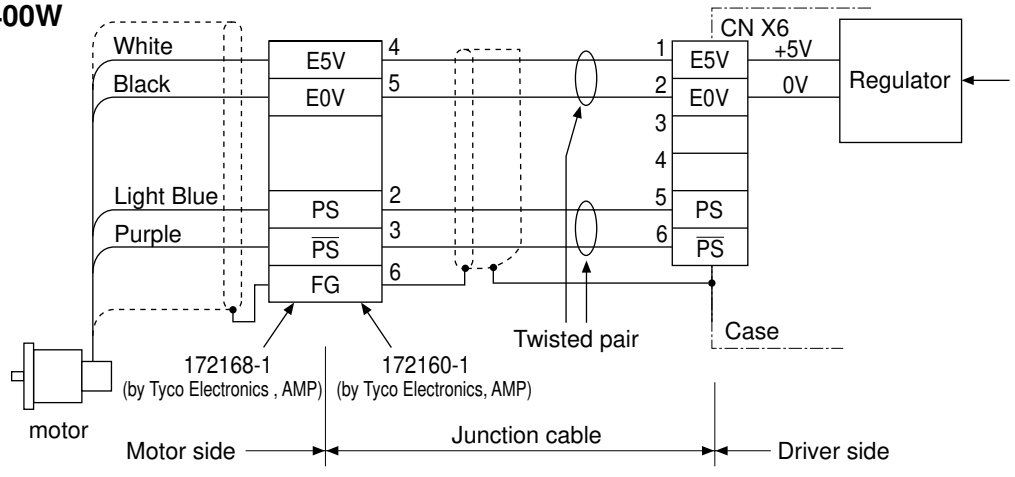


3) Use twisted pair cable for corresponding signal/power wiring.
4) Shielding treatment
   • Shield wall of the driver side : Connect to Pin-20 (FG) of CN X6.
   • Shield wall of the motor side :
   Tyco Electronics AMP
   In case of 9-pin (17-bit absolute/incremental encoder) : Connect to pin-3.
   In case of 6-pin (2500P/r incremental encoder) : Connect to pin-6.
   In case of cannon plug, connect to Pin-J.
5) Connect nothing to the empty terminals of each connector and Cannon Plug.

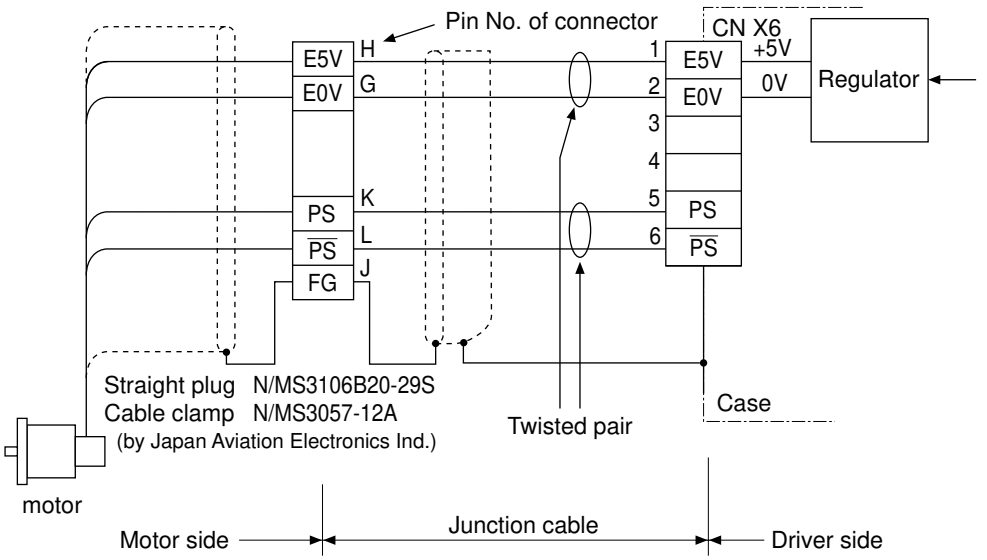
Wiring Diagram

In case of 2500P/r incremental encoder

- **MSMD 50W to 750W**
- **MAMA 100W to 750W**
- **MQMA 100W to 400W**



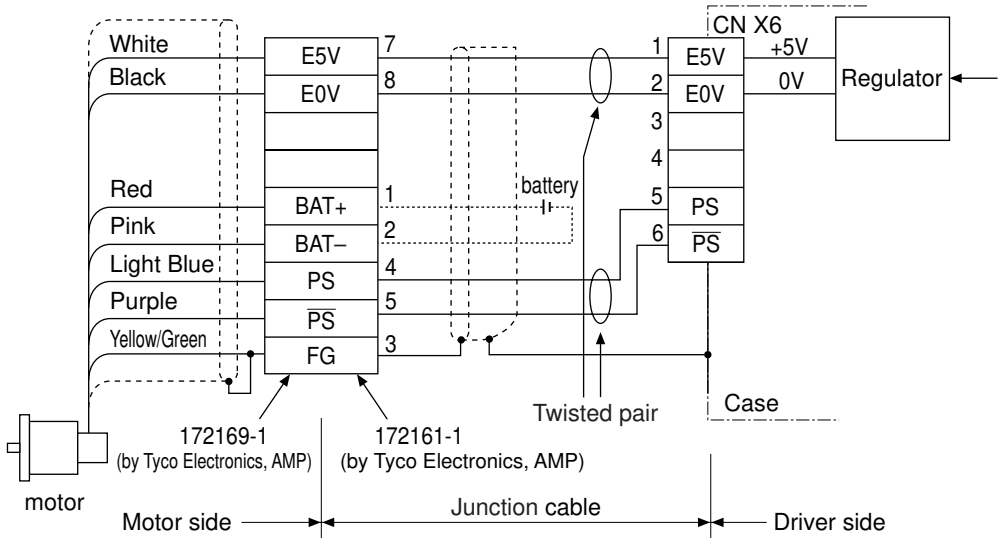
- **MSMA 1kW to 5kW**
- **MDMA 1kW to 5kW**
- **MHMA 500W to 5kW**
- **MFMA 400W to 4.5kW**
- **MGMA 900W to 4.5kW**



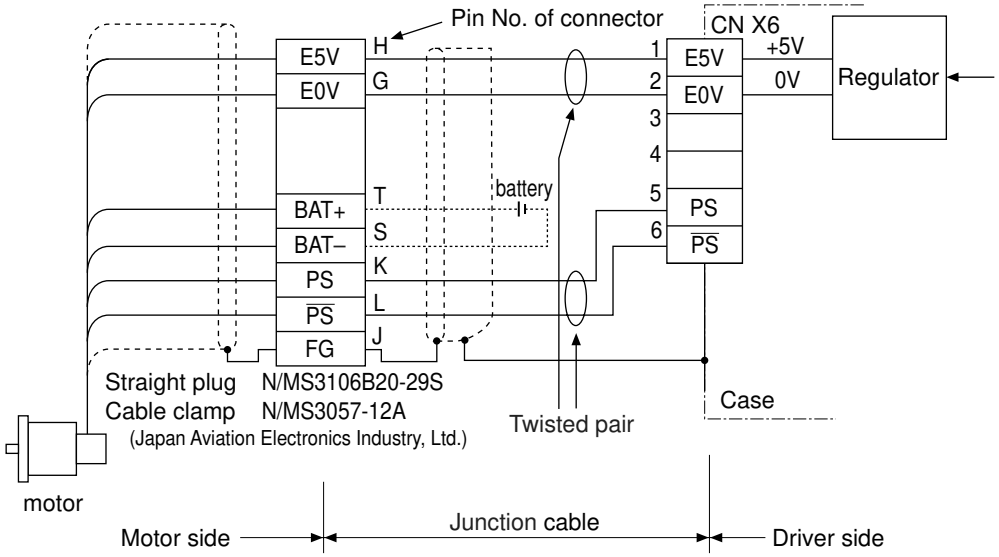
Wiring Diagram

In case of 17-bit absolute/incremental encoder

- **MSMD 50W to 750W**
- **MAMA 100W to 750W**
- **MQMA 100W to 400W**



- **MSMA 1kW to 5kW**
- **MDMA 1kW to 5kW**
- **MHMA 500W to 5kW**
- **MFMA 400W to 4.5kW**
- **MQMA 900W to 4.5kW**



System Configuration and Wiring

Wiring to the Connector, CN X7 (Connection to External Scale)

Power supply for the external scale shall be prepared by customer, or use the following power supply output for the external scale (250mA or less).

Application	Connector PinNo.	Content
Power supply output for external scale	1	EX5V
	2	EX0V
I/F of external scale signals (serial signal)	5	EXPS
	6	$\overline{\text{EXPS}}$
Frame ground	Case	FG

<Note>
EXOV of the external scale power supply output is connected to the control circuit ground which is connected to the Connecter, CN X5.
<Remark>
Do not connect anything to other Pin numbers descried in the above table (Pin-3 and 4).

Cautions

(1) Following external scale can be used for full-closed control.
- AT500 series by Mitutoyo (Resolution 0.05[μm] , max. speed 2[m/s])
- ST771 by Mitutoyo (Resolution 0.5[μm] , max. speed 2[m/s])

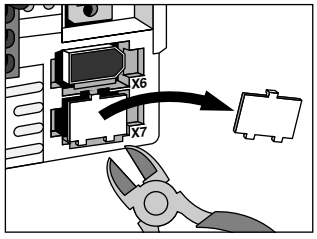
(2) **Recommended external scale ratio is 1/20<External scale ratio<20**

If you set up the external scale ratio to smaller value than 50/position loop gain (SV.Pr10 and 18), you may not be able to control per 1 pulse unit. Setup of larger scale ratio may result in larger noise.

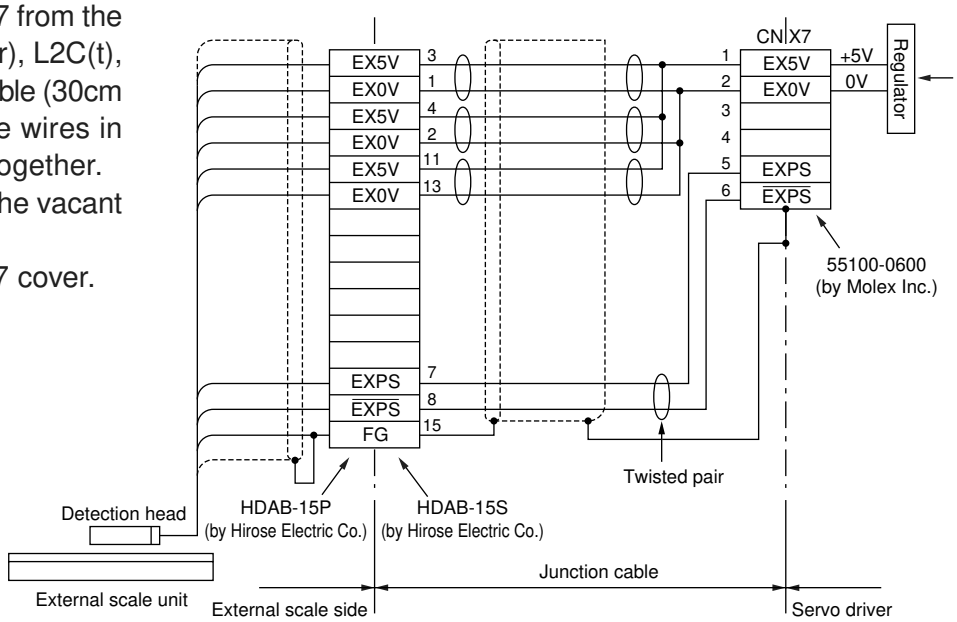
Wiring to the External Scale, Connector, CN X7

Wire the signals from the external scale to the external scale connector, CN X7.

1) Cable for the external scale to be the twisted pair with bundle shielding and to having the twisted core wire with diameter of 0.18mm^2.
2) Cable length to be max. 20m. Double wiring for 5V power supply is recommended when the wiring length is long to reduce the voltage drop effect.
3) Connect the outer film of the shield wire of the external scale to the shield of the junction cable. Also connect the outer film of the shield wire to the shell (FG) of CN X7 of the driver without fail.
4) Separate the wiring to CN X7 from the power line (L1, L2, L3, L1C(r), L2C(t), U, V. W, ⏚) as much as possible (30cm or more). Do not pass these wires in the same duct, nor bundle together.
5) Do not connect anything to the vacant pins of CN X7.
6) Cut away the driver's CN X7 cover.

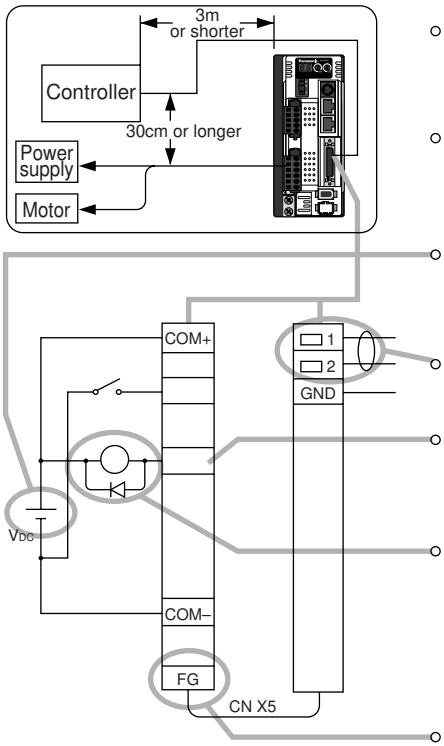


Please cut it out with nippers etc.



Wiring to the Connector, CN X5 (Connection to Host Controller)

• Tips on wiring



- Peripheral apparatus such as host controller should be located within 3m.
- Separate the main circuit at least 30cm away.
  Don't pass them in the same duct, nor bind them together.
- Power supply for control signals (V_{CC}) between COM+ and COM– (V_{DC}) should be prepared by customer.
- Use shield twisted pair for the wiring of encoder signal output.
- Don't apply more than 24V to the control signal output terminals, nor run 50mA or more to them.
- When the relay is directly driven by the control output signals, install a diode in parallel with a relay, and in the direction as the Fig. shows. The driver might be damaged without a diode installment, or by reverse direction.
- Frame ground (FG) is connected to the earth terminal inside of the driver.

• For detailed information, refer to P.42 to 47.

• Specifications of the Connector, CN X5

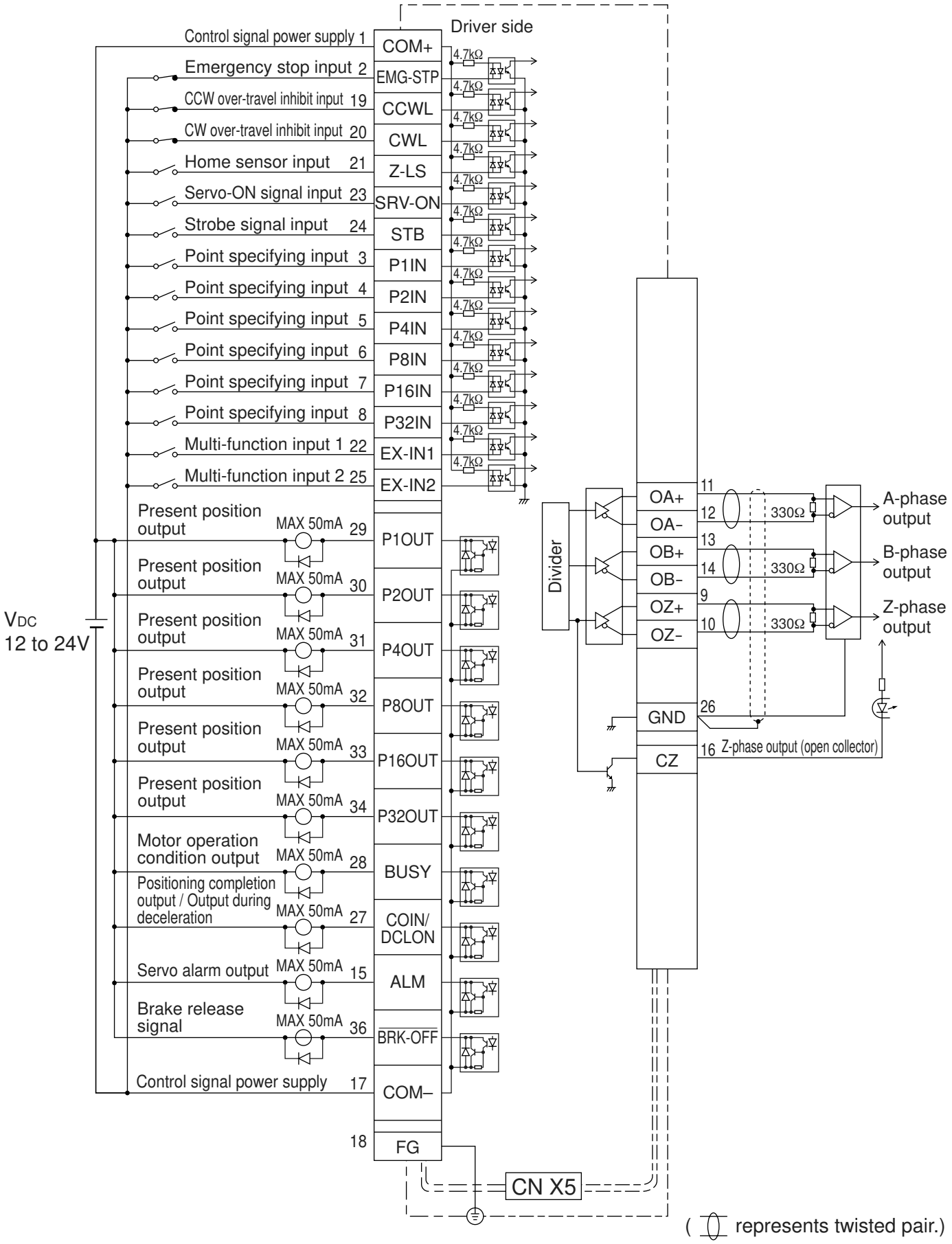
Connector at driver side	Connecter to be prepared by customer		Manufacturer
	Part name	Part No.	
52986-3679	Connecter (soldering type)	54306-3611 or 54306-3619 (lead-free)	Molex Inc.
	Connector cover	54331-0361	
	or		
	Connecter (soldering type)	10136-3000VE	Sumitomo 3M
	Connector cover	10336-52A0-008	

<Note>
For details, refer to P.185, "Options" of Supplement.

<Remarks>
- Tightening torque of the screws for connector (CN X5) for the connection to the host to be 0.3 to 0.35N·m. Larger tightening torque than these may damage the connector at the driver side.

System Configuration and Wiring

Wiring for Connector CN X5

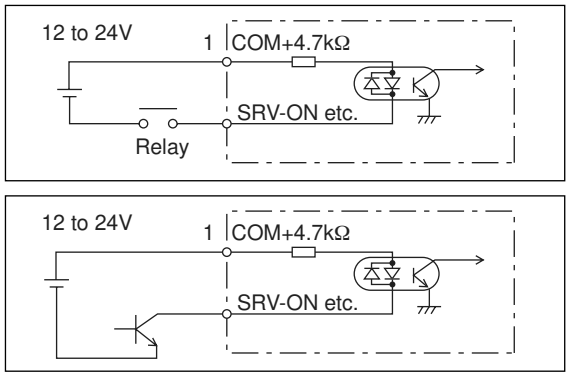


Interface Circuit

Input Circuit

SI Connection to sequence input signals

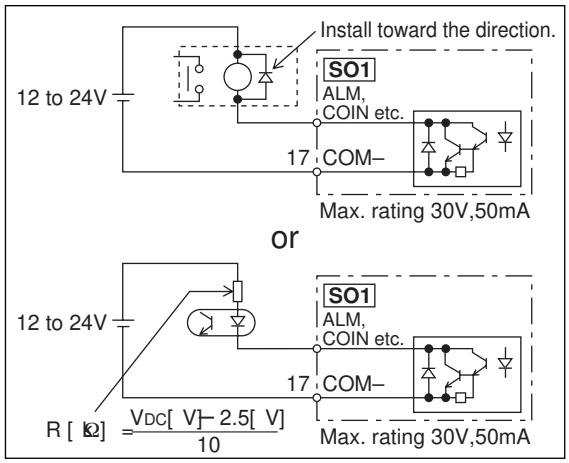
- Connect to contacts of switches and relays, or open collector output transistors.
- When you use contact inputs, use the switches and relays for micro current to avoid contact failure.
- Make the lower limit voltage of the power supply (12 to 24V) as 11.4V or more in order to secure the primary current for photo-couplers.



Output Circuit

SO1 Sequence output circuit

- The output circuit is composed of open collector transistor outputs in the Darlington connection, and connect to relays or photo-couplers.
- There exists collector to emitter voltage, V_{CE} (SAT) of approx. 1V at transistor-ON, due to the Darlington connection of the output or. Note that normal TTL IC cannot be directly connected since it does not meet VIL.
- There are two types of output, one which emitter side of the output transistor is independent and is connectable individually, and the one which is common to – side of the control power supply (COM–).
- If a recommended primary current value of the photo-coupler is 10mA, decide the resistor value using the formula of the right Fig.

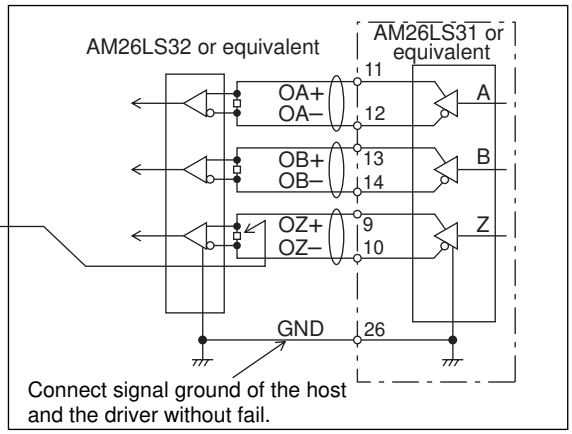


For the recommended primary current value, refer to the data sheet of apparatus or photo-coupler to be used.

PO1 Line driver (Differential output) output

- Feeds out the divided encoder outputs (A, B and Z-phase) in differential through each line driver.
- At the host side, receive these in line receiver. Install a terminal resistor (approx. 330Ω) between line receiver inputs without fail.
- These outputs are not insulated.

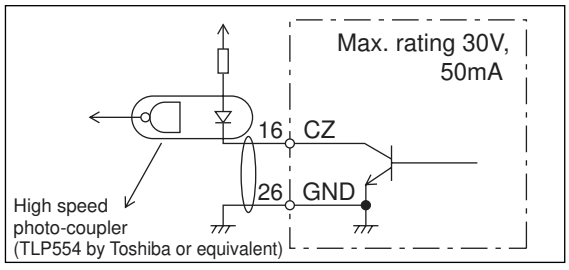
⏚ represents twisted pair.



PO2 Open collector output

- Feeds out the Z-phase signal among the encoder signals in open collector. This output is not insulated.
- Receive this output with high-speed photo couplers at the host side, since the pulse width of the Z-phase signal is narrow.

⏚ represents twisted pair.



List of Signal for Connector CN X5

Common input signals

Application	Code	Connector pin No.	Function
Control signal power supply	COM+	1	• Connected to the ⊕ terminal of an external DC power supply (12 to 24 V) • Use a 12 V (±5%) to 24 V (±5%) power supply.
	COM–	17	• Connected to the ⊖ terminal of an external DC power supply (12 to 24 V). • The power supply capacity differs depending on the configuration of the input/output circuits used. A capacity of more than 0.5A is recommended.
Emergency stop input	EMG-STP	2	• When connection with COM– is opened, emergency stop input error (error code No.39) occurs, and the circuit trips. • Tripping can be reset using an alarm clear input initiated by specifying point 0 or assigning the multi-function inputs (EX-IN1, EX-IN2).
Point specifying input	P1IN	3	• Specify an operation point number when operation command is input. • The number at which operation point can be specified depends on the number of points set by SV.Pr57. • SV.Pr58 can be used for setting input logic. When the point described below is specified, special operation is performed. 1)Specify point 0, and input a strobe signal, then alarm is cleared. 2)Specify the maximum point number specified in SV.Pr57, and input a strobe signal, then system returns to the home position. 3)Specify the maximum point number specified in SV.Pr57 –1 and input a strobe signal, then high-speed normal rotation jog is performed. 4)Specify the maximum point number specified in SV.Pr57 –2 and input a strobe signal, then high-speed reverse rotation jog is performed.
	P2IN	4	
	P4IN	5	
	P8IN	6	
	P16IN	7	
	P32IN	8	
CCW over-travel inhibit input	CCWL	19	• CCW drive prohibition input (CCWL). • Connect so as to open COM– connection when movable part of the equipment exceeds the movable range in CCW direction. • When this input is open, operation command in CCW direction is not issued. (Torque is generated) • SV.Pr53, 54, and 55 enable for setting of valid/invalid, input logic, and operation.
CW over-travel inhibit input	CWL	20	• CW drive prohibition input (CWL). • Connect so as to open COM– connection when movable part of the equipment exceeds the movable range in CW direction. • When this input is open, operation command in CW direction is not issued. (Torque is generated) • SV.Pr53, 54, and 55 enable setting of valid/invalid, input logic, and operation.
Home sensor input	Z-LS	21	• Connect so as to close the home sensor input when system is in the vicinity of home position (default). SV.Pr56 can be used for setting input logic. • Connected to the home sensor signal.
Servo-ON signal input	SRV-ON	23	• Connect so as to close the home sensor input when system is in the vicinity of home position. Pr56 can be used for setting input logic. • When servo driver is connected to COM– of control signal power supply, it is set in servo-ON condition. • When connection to COM– is opened, servo-OFF condition is set, and energization of motor is cut off. • Dynamic brake operation and deviation counter clearing operation in servo-OFF condition can be chosen by SV.Pr69 (sequence at servo-off). • SV.Pr5D enable setting of valid/invalid. **<Notes>** 1)When shifting from servo-OFF to servo-ON, make sure that the motor is stopped. 2)After shifting to servo-ON, allow 100ms or more before giving an instruction. 3)Frequent repeating of servo-ON/OFF may damage the dynamic brake circuit contained in servo driver. Avoid such a use.

Application	Code	Connector pin No.	Function
Strobe signal input	STB	24	• When this is connected to COM– of the control signal power supply, the servo driver starts the movement to the specified point. • When 10ms or more has passed after setting specified point input, connect the strobe signal input (STB) to COM–. It is possible that the servo driver is unable to read specified point input properly. • Input STB signal 10ms or longer. Also, reset STB signal to opened condition after receiving BUSY signal from the servo driver in order to ensure that STB signal is received reliably.
Multi-function input 1	EX-IN1	22	Function can be selected and set by Pr5A and 5C out of the options below. Instantaneous stop, temporary stop, deceleration stop, high-speed normal rotation jog, high-speed reverse rotation jog, and alarm clearing Input logic can be set by SV.Pr59 and 5B.
Multi-function input 2	EX-IN2	25	

Overview of Point Spesifying Input

Operation instruction is specified by use of signal for point specifying input (P1IN to P32IN).
See the table below for the relation between point specifying input and operation instruction.
In order to execute an instruction, determine the kind of instruction by P1IN to P32IN, and then input a strobe signal.

<Remarks>
Because down of the signal wires during moving operation or exceptionally larger external noise disturbance may result in unexpected action, the protective equipments like limit sensors or emergency stop input must be installed before using.

Ex) When SV.Pr57 = 3 (6 bits) is set

Point No.	P32IN	P16IN	P8IN	P4IN	P2IN	P1IN	Description
0 (00H)	H	H	H	H	H	H	Alarm clearing instruction
1 (01H)	H	H	H	H	H	L	Moves to step parameter 1.
2 (02H)	H	H	H	H	L	H	Moves to step parameter 2.
3 (03H)	H	H	H	H	L	L	Moves to step parameter 3.
4 (04H)	H	H	H	L	H	H	Moves to step parameter 4.
5 (05H)	H	H	H	L	H	L	Moves to step parameter 5.
6 (06H)	H	H	H	L	L	H	Moves to step parameter 6.
7 (07H)	H	H	H	L	L	L	Moves to step parameter 7.
8 (08H)	H	H	L	H	H	H	Moves to step parameter 8.
9 (09H)	H	H	L	H	H	L	Moves to step parameter 9.
10 (0AH)	H	H	L	H	L	H	Moves to step parameter 10.
⋮							⋮
59 (3BH)	L	L	L	H	L	L	Moves to step parameter 59.
60 (3CH)	L	L	L	L	H	H	Moves to step parameter 60.
61 (3DH)	L	L	L	L	H	L	High-speed jog operation (negative)
62 (3EH)	L	L	L	L	L	H	High-speed jog operation (positive)
63 (3FH)	L	L	L	L	L	L	Homing instruction

<Notes>
- H indicates the opened contact condition and L the closed contact condition.
- The number of point inputs can be set by SV.Pr57.
- The logic of point input can be changed by SV.Pr58.
  The table above describes the case where SV.Pr58 is "1: Point input valid by closed connection with COM–".
  In the case of "0: Point input valid by opened connection with COM–", "H" and "L" are reversed.
- Point number of "High-speed jog operation (negative)", "High-speed jog operation (positive)", and "Homing instruction" depends on the setting of SV.Pr57.

Common output signals and their functions

Application	Code	Connector pin No.	Function
Servo alarm output	ALM	15	Output signal indicating that the alarm is on. Output transistor turns on in normal condition, and output transistor turns off when alarm is on.
Positioning completion output/ Output during deceleration	COIN/ DCLON	27	• This output signal can be used by choosing positioning completion output (COIN) or output during deceleration (DCLON) by SV.Pr64. COIN: When the amount of position deviation pulse is within the range set by SV.Pr60 (In-position range), the transistor turns on. However, while the operation command is being processed, it will not turn ON even inside the positioning completion range. DCLON: Transistor turns ON while the motor is decelerating. However, the signal is not output when the motor has stopped because the deceleration time is zero.
Motor operation condition output	BUSY	28	• Transistor turns OFF while the servo driver is processing operation command. **<Notes>** When an operation command has been started by the strobe signal input (STB), the motor operation status output remains OFF until the strobe signal input is set to the opened condition.
Present position output	P1OUT	29	• Outputs the present motor position (point number) when the step operation is completed. • All the transistors are OFF (point 0) when the power is turned on. However, when the absolute mode is established or when the 16.Pr38 is set to 1 (homing is invalid), the maximum point number set in the SV.Pr57 (Selecting the number of input points) is output. • Upon completion of homing, the maximum point number set in the SV.Pr57 (Selecting the number of input points) is output. • During high-speed normal rotation jog operations, the maximum point number set in the SV.Pr57 (Selecting the number of input points) minus 1 is output after the motor has stopped. • During high-speed reverse rotation jog operations, the maximum point number set in the SV.Pr57 (Selecting the number of input points) minus 2 is output after the motor has stopped. When an alarm has occurred, all the transistors are set OFF. **<Note>** When an operation has been aborted because of servo OFF, instantaneous stop or deceleration stop, the last status is held as the current position output. To obtain the correct output, move to the reference position (home point, absolute position command point).
	P2OUT	30	
	P4OUT	31	
	P8OUT	32	
	P16OUT	33	
	P32OUT	34	
Brake release output	BRK-OFF	36	• Defines the timing signal to activate the electromagnetic brake for the motor. When the electromagnetic brake is released, the output transistor turns ON. • Output timing of this signal can be set by SV.Pr6A (Mechanical brake delay at motor standstill) and SV.Pr6B (Mechanical brake delay at motor in motion).

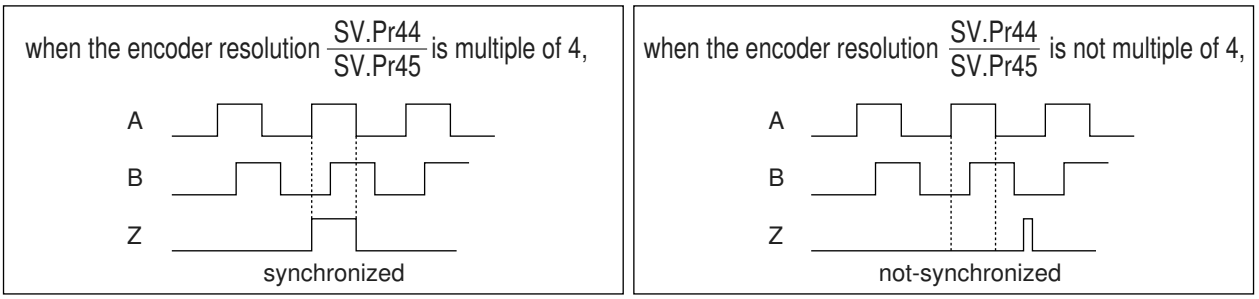
Output signal (pulse train) and function

Application	Code	Connector pin No.	Function
A-phase output	OA+	11	• Division-processed encoder signal or external scale signal (A/B-phase) is output in differential mode. (RS422) • SV.Pr44 (numerator of output pulse ratio) and SV.Pr45 (denominator of output pulse ratio) can be used to set the division ratio. • SV.Pr46 (pulse output logic inversion) can be used to select the logic relation of phase B with regard to the pulse of phase A, and its output source. • Ground of line driver of the output circuit is connected to signal ground (GND); not insulated. • The maximum output frequency is 4 Mpps (after being multiplied by 4).
	OA–	12	
B-phase output	OB+	13	
	OB–	14	
Z-phase output	OZ+	9	
	OZ–	10	
Z-phase output	CZ	16	• Open collector output of Z-phase signal. • Emitter side of the transistor of the output circuit is connected to signal ground (GND); not insulated.

<Note>

• When the output source is the encoder

• If the encoder resolution X $\frac{\text{SV.Pr44}}{\text{SV.Pr45}}$ is multiple of 4, Z-phase will be fed out synchronizing with A-phase.
In other case, the Z-phase width will be equal to the encoder resolution, and will not synchronize with A-phase because of narrower width than that of A-phase.



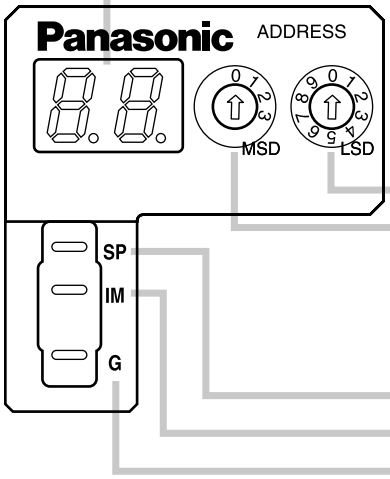
• In case of the 5-wire, 2500P/r incremental encoder, the signal sequence might not follow the above fig. until the first Z-phase is fed out. When you use the pulse output as the control signal, rotate the motor one revolution or more to make sure that the Z-phase is fed out at least once before using.

Others

Application	Code	Connector pin No.	Function
Frame ground	FG	18	• Internally connected to the ground terminal inside the servo driver.
Signal ground	GND	26	• Signal ground • Internally insulated from the control signal power supply (COM–) inside the servo driver.

Setup with the Front Panel

Composition of Touch Panel and Display



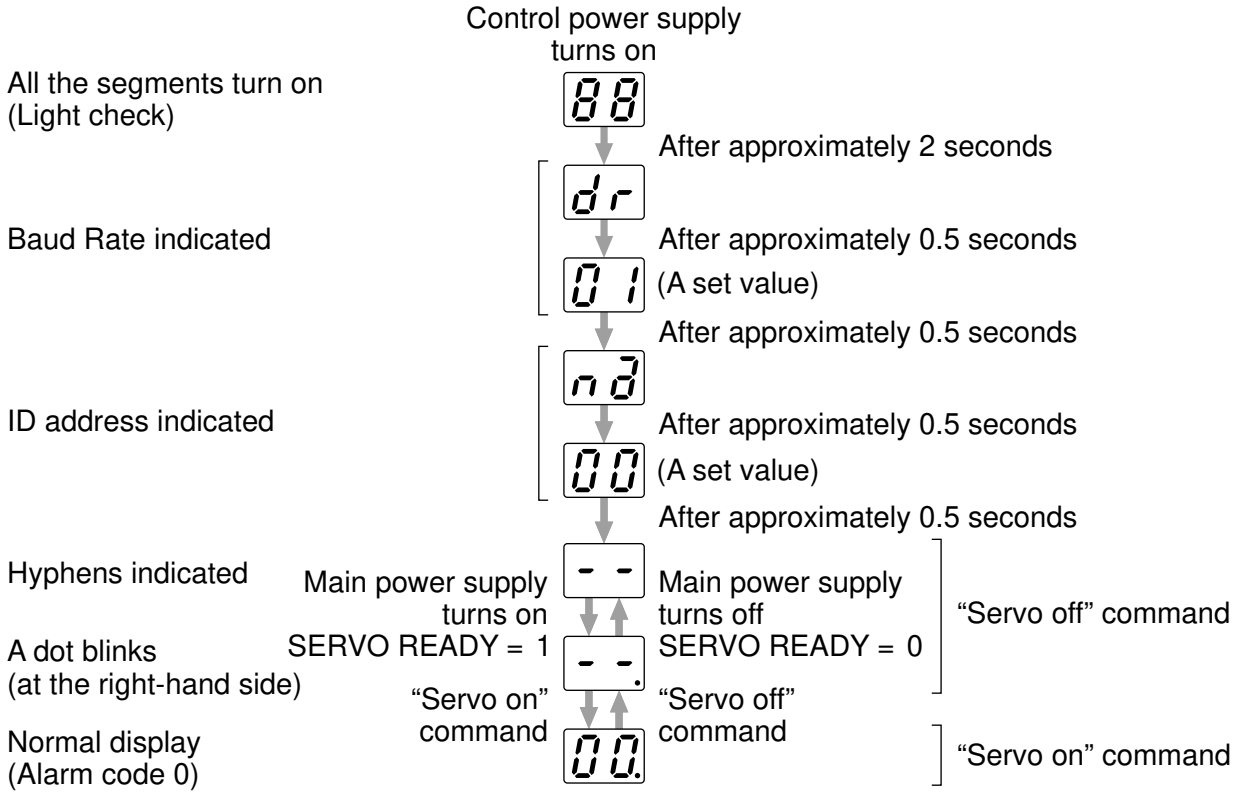
Display LED (2 digits)
In the case of an error, the alarm code will flash.
In the case of a warning, the warning code (about 2 seconds) will alternate at about 4 seconds intervals with 00.

ID address setup rotary switch
LSD : Lower-shifting (Default : 0)
MSD : Upper-shifting (Default : 0)
For manufacturers' use only.
(Not for individual use)

Output signal (Analog signal)
Speed monitor output
Torque monitor output
Signal ground

Initial Status of the Front Panel Display (7-Segment LED)

When an alarm has been given, an alarm code of two-digit decimal number blinks on the front panel display (7-segment LED) of this servo driver. When no alarm is given, the display shows as follows:



• When an alarm has been given

16 An alarm code blinks.
(In the case of overflow)

• When a warning has been given

A warning code and normal state are shown in turn

16. ⇄ 00.

Warning code (Approximately 2 seconds)
Normal display (Approximately 4 seconds)

Output Signals (Analog) and Their Functions

<table>
<tr><th>Application</th><th>Code</th><th>Function</th></tr>
<tr><td>Speed monitor signal output</td><td>SP</td><td>• The content of the output signal varies depending on SV.Pr07 (Speed monitor (IM) selection).
• You can set up the scaling with SV.Pr07 value.
<table>
<tr><th>SV.Pr07</th><th>Control mode</th><th>Function</th></tr>
<tr><td>0 to 4</td><td>Motor speed</td><td>• Feeds out the voltage in proportion to the motor speed with polarity.
+ : rotates to CCW
– : rotates to CW</td></tr>
<tr><td>5 to 9</td><td>Command speed</td><td>• Feeds out the voltage in proportion to the command speed with polarity.
+ : rotates to CCW
– : rotates to CW</td></tr>
</table></td></tr>
<tr><td>Torque monitor signal output</td><td>IM</td><td>• The content of output signal varies depending on SV.Pr08 (Torque monitor (IM) selection).
• You can set up the scaling with SV.Pr08 value.
<table>
<tr><th>SV.Pr08</th><th>Control mode</th><th>Function</th></tr>
<tr><td>0, 11,12</td><td>Torque command</td><td>• Feeds out the voltage in proportion to the motor torque command with polarity.
+ : generates CCW torque
– : generates CW torque</td></tr>
<tr><td>1 – 5</td><td>Positional deviation</td><td>• Feeds out the voltage in proportion to the positional deviation pulse counts with polarity.
+ : positional command to CCW of motor position
– : positional command to CW of motor position</td></tr>
</table></td></tr>
</table>

Built-in Holding Brake

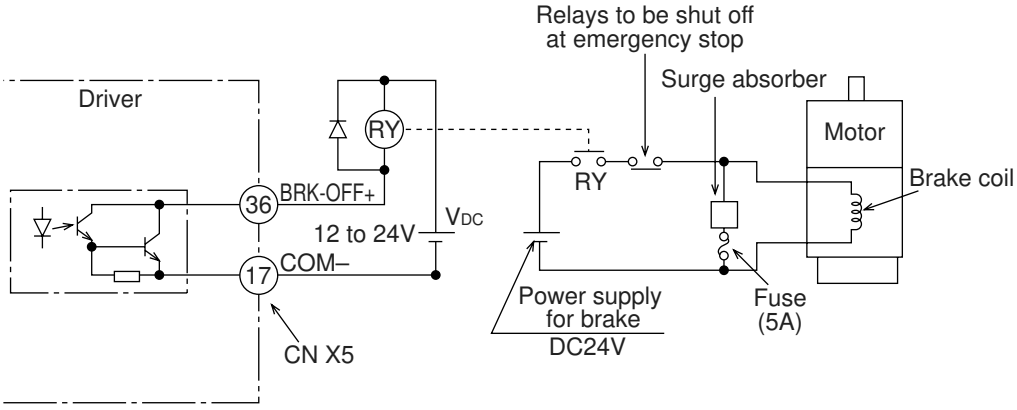
In the applications where the motor drives the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling by gravity while the power to the servo is shut off.

<Caution>

Use this built-in brake for "Holding" purpose only, that is to hold the stalling status. Never use this for "Brake" purpose to stop the load in motion.

Connecting Example

The following shows the example when the brake is controlled by using the brake release output signal (BRK-OFF) of the driver.



<Notes, Cautions>

1. The brake coil has no polarity.
2. Power supply for the brake to be provided by customer. Do not co-use the power supply for the brake and for the control signals (V_{DC}).
3. Install a surge absorber as the above Fig. shows to suppress surge voltage generated by ON/OFF action of the relay (RY). When you use a diode, note that the time from the brake release to brake engagement is slower than that of the case of using a surge absorber.
4. For a surge absorber, refer to P.191, "Recommended Components"of Supplement.
5. Recommended components are specified to measure the brake releasing time.
   Reactance of the cable varies depending on the cable length, and it might generate surge voltage.
   Select a surge absorber so that relay coil voltage (max. rating : 30V, 50mA) and terminal voltage may not exceed the rating.

Output Timing of BRK-OFF Signal

- For the brake release timing at power-on, or braking timing at Servo-OFF/Servo-Alarm while the motor is in motion, refer to P.133, 135, "Timing Chart".
- With the parameter, SV.Pr6B (Setup of mechanical brake action while the motor is in motion), you can set up a time between when the motor enters to a free-run from energized status and when BRK-OFF signal turns off (brake will be engaged), when the Servo-OFF or alarm occurs while the motor is in motion.

<Notes>

1. The lining sound of the brake (chattering and etc.) might be generated while running the motor with built-in brake, however this does not affect any functionality.
2. Magnetic flux might be generated through the motor shaft while the brake coil is energized (brake is open). Pay an extra attention when magnetic sensors are used nearby the motor.

Specifications of Built-in Holding Brake

Motor series	Motor output	Static friction torque N·m	Rotor inertia X10^{-4} kg·m^2	Engaging time ms	Releasing time ms*	Exciting current DC A (at cool-off)	Releasing voltage	Permissible work (J) per one braking	Permissible total work x 10^{3}J
MSMD MAMA	50W, 100W	0.29 or more	0.002	35 or less	10 or less	0.25	DC2V or more	39.2	4.9
	200W, 400W	1.27 or more	0.018	50 or less		0.30		137	44.1
	750W	2.45 or more	0.075	70 or less	20 or less	0.35		196	147
MQMA	100W	0.29 or more	0.03	50 or less	15 or less	0.29	DC1V or more	137	44.1
	200W, 400W	1.27 or more	0.09	60 or less		0.41		196	147
MSMA	1.0kW	4.9 or more	0.25	50 or less	15 or less (100)	0.74	DC2V or more	392	196
	1.5kW, 2.0kW	7.8 or more	0.33			0.81			490
	3.0kW	11.8 or more		80 or less					
	4.0kW, 5.0kW	16.1 or more	1.35	110 or less	50 or less (130)	0.90		1470	2156
MDMA	1.0kW	4.9 or more	1.35	80 or less	70 or less (200)	0.59		588	780
	1.5kW, 2.0kW	13.7 or more		100 or less	50 or less (130)	0.79		1176	1470
	3.0kW	16.1 or more		110 or less		0.90		1470	2156
	4.0kW	21.5 or more	4.25	90 or less	35 or less (150)	1.10		1078	2450
	5.0kW	24.5 or more	4.7	80 or less	25 or less (200)	1.30		1372	2940
MHMA	500W, 1.0kW	4.9 or more	1.35		70 or less (200)	0.59		588	784
	1.5kW	13.7 or more		100 or less	50 or less (130)	0.79		1176	1470
	2.0kW to 5.0kW	24.5 or more	4.7	80 or less	25 or less (200)	1.30		1372	2940
MFMA	400W	4.9 or more	1.35		70 or less (200)	0.59		588	784
	1.5kW	7.8 or more	4.7		35 or less (150)	0.83		1372	2940
	2.5kW	21.6 or more	8.75	150 or less	100 or less (450)	0.75		1470	1470
	4.5kW	31.4 or more							2156
MGMA	900W	13.7 or more	1.35	100 or less	50 or less (130)	0.79		1176	1470
	2.0kW	24.5 or more	4.7	80 or less	25 or less (200)	1.3		1372	2940
	3.0kW, 4.5kW	58.8 or more		150 or less	50 or less (130)	1.4			

- Excitation voltage is DC24±10%.
- * Values represent the ones with DC-cutoff using a surge absorber for holding brake.
  Values in ( ) represent those measured by using a diode (V03C by Renesas Technology Corp.)
- Above values (except static friction torque, releasing voltage and excitation current) represent typical values.
- Backlash of the built-in holding brake is kept ±1˚ or smaller at ex-factory point.
- Permissible angular acceleration : 30000rad/s^2 for MAMA series
  10000rad/s^2 for MSMD, MQMA, MSMA, MDMA, MHMA, MFMA and MGMA series
- Service life of the number of acceleration/deceleration with the above permissible angular acceleration is more than 10 million times.
  (Life end is defined as when the brake backlash drastically changes.)

Dynamic Brake

This driver is equipped with a dynamic brake for emergency stop.
Pay a special attention to the followings.

<Caution>

1. Dynamic brake is only for emergency stop.

**Do not start/stop the motor by turning on/off the Servo-ON signal (SRV-ON).
Or it may damage the dynamic brake circuit of the driver.**

The motor becomes a dynamo when driven externally, and shorting current runs while this dynamic brake is activated and might cause smoking or fire.

2. Dynamic brake is a short-duration rating, and designed for only emergency stop. Allow approx. 3 minutes pause when the dynamic brake is activated during high-speed running.
(Over-current protection (error code No. 14) may be activated when the dynamic brake circuit inside the F-frame driver has overheated.)

• You can activate the dynamic brake in the following cases.
1) When the main power is turned off
2) At Servo-OFF
3) When one of the protective function is activated.

In the above cases from 1) to 3), you can select either activation of the dynamic brake or making the motor free-run during deceleration or after the stop, with parameter.
Note that when the control power is off, the dynamic brake will be kept activated.

1) Setup of driving condition from deceleration to after stop by main power-off (SV.Pr67)

Sequence at main power-off (SV.Pr67) Setup value of SV.Pr67	Driving condition: during deceleration	Driving condition: after stalling	Contents of deviation counter
0	D B	D B	Clear
1	Free-run	D B	Clear
2	D B	Free-run	Clear
3	Free-run	Free-run	Clear
4	D B	D B	Hold
5	Free-run	D B	Hold
6	D B	Free-run	Hold
7	Free-run	Free-run	Hold
8	Emergency stop	D B	Clear
9	Emergency stop	Free-run	Clear

Torque limit value at emergency stop will be that of SV.Pr6E (Emergency stop torque set up) when the setup value is 8 or 9.

2) Setup of driving condition from deceleration to after stop by Servo-OFF (SV.Pr69)

Sequence at main Servo-OFF (SV.Pr69)	Driving condition		Contents of deviation counter
	During deceleration	after stalling	
Setup value of SV.Pr69 ↓ 0	D B	D B	Clear
1	Free-run	D B	Clear
2	D B	Free-run	Clear
3	Free-run	Free-run	Clear
4	D B	D B	Hold
5	Free-run	D B	Hold
6	D B	Free-run	Hold
7	Free-run	Free-run	Hold
8	Emergency stop	D B	Clear
9	Emergency stop	Free-run	Clear

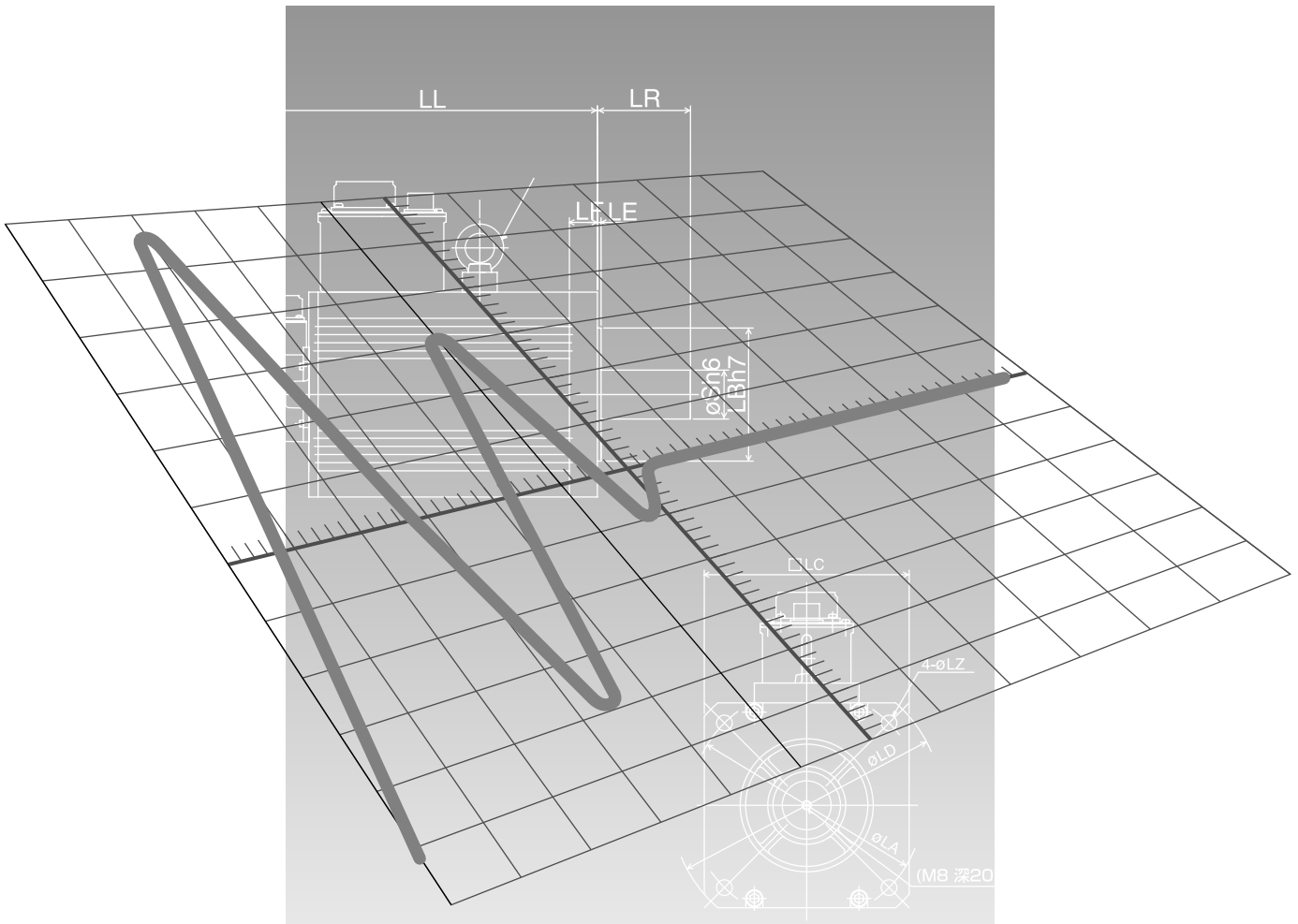
Torque limit value at emergency stop will be that of SV.Pr6E (Emergency stop torque set up) when the setup value is 8 or 9.

3) Setup of driving condition from deceleration to after stop by activation of protective function (SV.Pr68)

Sequence at main Servo-OFF (SV.Pr68)	Driving condition		Contents of deviation counter
	During deceleration	after stalling	
Setup value of SV.Pr68 ↓ 0	D B	D B	Hold
1	Free-run	D B	Hold
2	D B	Free-run	Hold
3	Free-run	Free-run	Hold

Deviation counter at activation of protective function will be cleared at alarm-clear.

MEMO



[Setting]

Parameter Setup

Outline of Parameter

This driver is equipped with various parameters to set up its characteristics and functions. This section describes the outline of each parameter. Read and comprehend very well so that you can adjust this driver in optimum condition for your running requirements.

<Remarks>
The parameter numbers not be mentioned in this section are not for individual use but for manufacturers' use. Do not change these parameters from the default setting.

How to Set

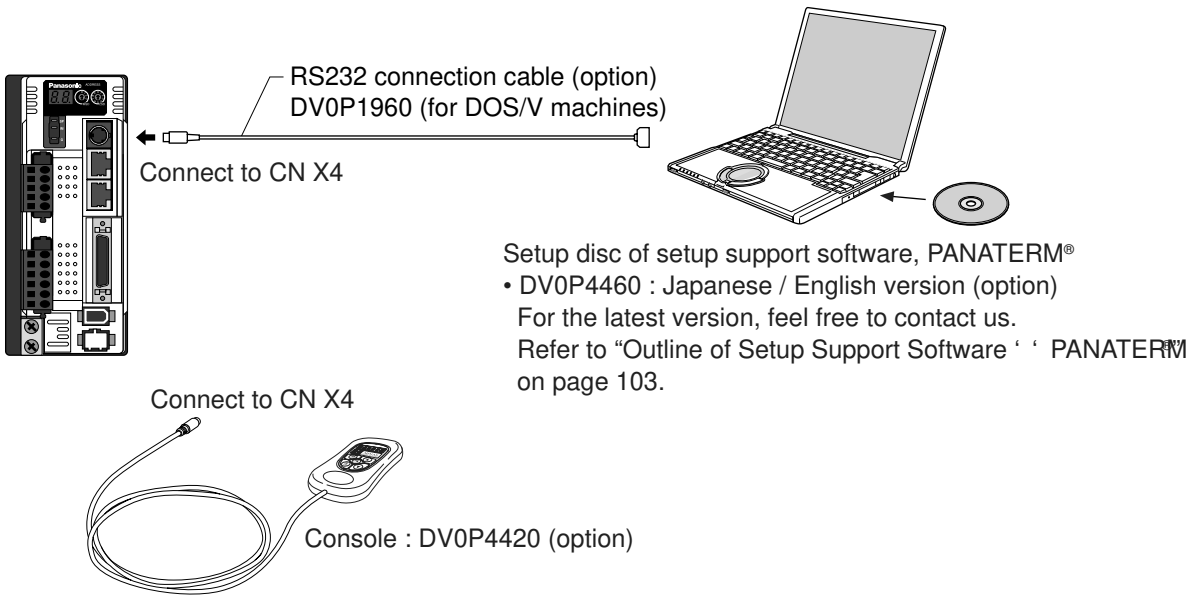
• You can refer and set up the parameter with either one of the following.
1) Console (DV0P4420, option)
2) Combination of the setup support software, "PANATERM®" (Option, DV0P4460: Japanese / English version) and PC.

<Note>
For setup of the parameters on PC screen, refer to the instruction manual of the "PANATERM®".

Outline of PANATERM®

With the PANATERM®, you can execute the followings.
1) Setup and storage of parameters, and writing to the memory (EEPROM).
2) Monitoring of I/O and pulse input and load factor.
3) Display of the present alarm and reference of the error history.
4) Data measurement of the wave-form graphic and bringing of the stored data.
5) Normal auto-gain tuning
6) Frequency characteristic measurement of the machine system.

How to Connect



<Remarks>
• Connect the console connector to the connector, CN X4 of the driver securely.
• Do not pull the cable to insert/unplug.

Composition of Parameters

• Servo parameter

Group		Servo parameter No.	Outline
Servo parameter	Function selection	01 to 03, 07,08,0B, 0C,0F	You can select a control mode, and set up a baud rate.
	Adjustment	10 to 1E, 27 to 2E	You can set up servo gains (1st and 2nd) of position, velocity, integration, etc, and time constants of various filters.
		20 to 26, 2F	Parameters related to Real Time Auto-Gain Tuning. You can set up a mode and select a mechanical stiffness.
		30 to 35	You can set up parameters related to gain switching(1st ⟷ 2nd)
	Position Control	44 to 46, 4C, 4D	You can set up dividing of encoder output pulse.
	Input signals	53 to 5D	You can set up the logic of input signals and the number of point input.
		5E to 5F	You can set up a torque limit of torque command.
	Sequence	60, 64, 65, 67 to 6E	You can set up detecting conditions of output signals, such as positioning-completion. You can also set up a deceleration/stop action at main power-off, at alarm output and at servo-off, and clear condition of the deviation counter.
		70, 72, 73	You can set up actions of protective functions.
	Full-Closed Control	78 to 7C	You can set up dividing of external scale.

• 16-bit positioning parameter

Group		16-bit positioning parameter No.	Outline
16-bit positioning parameter	Motor speed Acceleration and	00 to 0F	You can set speed data of step operation.
	Deceleration	10 to 1F	You can set acceleration and deceleration data of step operation.
	Homing	30 to 3B	You can set data for homing.
	Jog operation	40 to 45	You can set data for jog operation.
	Others	48 to 54	You can set data for teaching or operation direction and so on.

• 32-bit positioning parameter

Group	32-bit positioning parameter No.	Outline
32-bit positioning parameter	00 to 03	You can set data for offset or maximum movement.

• Step parameter

Group		Outline
Step parameter	Operation mode	Specifying the positioning procedure. ABS (absolute position), INC (relative position), Rotary (rotation coordinates), and Dwell time (standby time)
	Position/waiting time	Inputting the coordinate data for positioning. When dwell time is selected in operation mode, set the standby time.
	Speed	Selecting a speed selection number in positioning. Setting the speed by 16-bit positioning parameter.
	Acceleration	Selecting an acceleration speed selecting number in positioning. Setting the speed by 16-bit positioning parameter.
	Deceleration	Selecting a deceleration speed selecting number in positioning. Setting the speed by 16-bit positioning parameter.
	Block	Choosing either single operation or block operation.

• In this document, following symbols represent each mode.

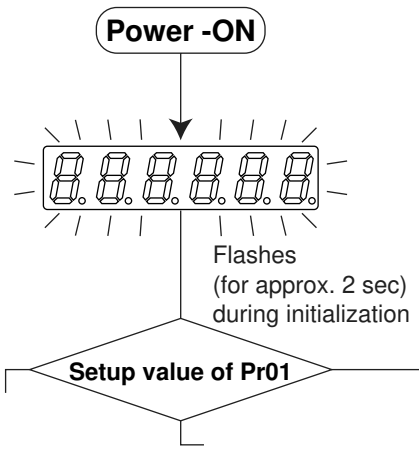
Symbol	Control mode	Setup value of servo parameter No.02
P	Position control	0
F	Full-Closed control	6

Parameter Setup

List of Servo Parameter

Parameters for Functional Selection

Standard default : < >

<table>
<tr><th>Servo PrNo.</th><th>Title</th><th>Setup range</th><th>Function/Content</th></tr>
<tr><td>01
*</td><td>7-segment LED status for console, initial condition display</td><td>0 to 15
<1></td><td>You can select the type of data to be displayed on the console LED (7 segment) at the initial status after power-on.
 

For details of display, refer to the technical reference or instruction manual of the console.
<table>
<tr><th>Setup value</th><th>Content</th></tr>
<tr><td>0</td><td>Positional deviation</td></tr>
<tr><td><1></td><td>Motor rotational speed</td></tr>
<tr><td>2</td><td>Torque output</td></tr>
<tr><td>3</td><td>Control mode</td></tr>
<tr><td>4</td><td>I/O signal status</td></tr>
<tr><td>5</td><td>Error factor/history</td></tr>
<tr><td>6</td><td>Software version</td></tr>
<tr><td>7</td><td>Alarm</td></tr>
<tr><td>8</td><td>Regenerative load factor</td></tr>
<tr><td>9</td><td>Over-load factor</td></tr>
<tr><td>10</td><td>Inertia ratio</td></tr>
<tr><td>11</td><td>Sum of feedback pulses</td></tr>
<tr><td>12</td><td>Sum of command pulses</td></tr>
<tr><td>13</td><td>External scale deviation</td></tr>
<tr><td>14</td><td>Sum of external scale feedback pulses</td></tr>
<tr><td>15</td><td>Motor automatic recognizing function</td></tr>
</table></td></tr>
<tr><td>02
*</td><td>Control mode</td><td>0, 6
<0></td><td>You can set up the control mode to be used.
<table>
<tr><th>Setup value of SV.Pr.02</th><th>Control mode</th><th>Symbol</th></tr>
<tr><td><0></td><td>Position</td><td>P</td></tr>
<tr><td>6</td><td>Full-closed</td><td>F</td></tr>
</table></td></tr>
<tr><td>03</td><td>Torque limit selection</td><td>0 to 3
<1></td><td>You can set up the torque limiting method for CCW/CW direction.
<table>
<tr><th>Setup value</th><th>CCW</th><th>CW</th></tr>
<tr><td>0, <1></td><td colspan="2">Pr5E is a limit value for both CCW and CW direction</td></tr>
<tr><td>2, 3</td><td>Set with SV.Pr5E</td><td>Set with SV.Pr5F</td></tr>
</table></td></tr>
<tr><td>07</td><td>Speed monitor (SP) selection</td><td>0 to 9
<3></td><td>You can set up the content of analog speed monitor signal output (SP : CN X5, Pin43) and the relation between the output voltage level and the speed.
<table>
<tr><th>Setup value</th><th>Signal of SP</th><th>Relation between the output voltage level and the speed</th></tr>
<tr><td>0</td><td rowspan="5">Motor actual speed</td><td>6V / 47 r/min</td></tr>
<tr><td>1</td><td>6V / 188 r/min</td></tr>
<tr><td>2</td><td>6V / 750 r/min</td></tr>
<tr><td><3></td><td>6V / 3000 r/min</td></tr>
<tr><td>4</td><td>1.5V / 3000 r/min</td></tr>
<tr><td>5</td><td rowspan="5">Command speed</td><td>6V / 47 r/min</td></tr>
<tr><td>6</td><td>6V / 188 r/min</td></tr>
<tr><td>7</td><td>6V / 750 r/min</td></tr>
<tr><td>8</td><td>6V / 3000 r/min</td></tr>
<tr><td>9</td><td>1.5V / 3000 r/min</td></tr>
</table></td></tr>
</table>

<Notes>

- For servo parameters which No. have a suffix of "*", changed contents will be validated when you turn on the control power.
- Parameters which default values have a suffix of "*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.151, "Release of Automatic Gain Adjusting Function" of Adjustment.

Standard default : < >

<table>
<tr><th>Servo PrNo.</th><th>Title</th><th>Setup range</th><th>Function/Content</th></tr>
<tr><td>08</td><td>Torque monitor (IM) selection</td><td>0 to 12
<0></td><td>You can set up the content of the analog torque monitor of the signal output (IM : CN X5, Pin-42), and the relation between the output voltage level and torque or deviation pulse counts.
<table>
<tr><th>Setup value</th><th>Signal of IM</th><th>Relation between the output voltage level and torque or deviation pulse counts</th></tr>
<tr><td><0></td><td>Torque command</td><td>3V/rated (100%) torque</td></tr>
<tr><td>1</td><td rowspan="5">Position deviation</td><td>3V / 31Pulse</td></tr>
<tr><td>2</td><td>3V / 125Pulse</td></tr>
<tr><td>3</td><td>3V / 500Pulse</td></tr>
<tr><td>4</td><td>3V / 2000Pulse</td></tr>
<tr><td>5</td><td>3V / 8000Pulse</td></tr>
<tr><td>6</td><td rowspan="5">Full-closed deviation</td><td>3V / 31Pulse</td></tr>
<tr><td>7</td><td>3V / 125Pulse</td></tr>
<tr><td>8</td><td>3V / 500Pulse</td></tr>
<tr><td>9</td><td>3V / 2000Pulse</td></tr>
<tr><td>10</td><td>3V / 8000Pulse</td></tr>
<tr><td>11</td><td rowspan="2">Torque command</td><td>3V / 200% torque</td></tr>
<tr><td>12</td><td>3V / 400% torque</td></tr>
</table></td></tr>
<tr><td>0B
*</td><td>Absolute encoder set up</td><td>0 to 2
<1></td><td>You can set up the using method of 17-bit absolute encoder.
<table>
<tr><th>Setup value</th><th>Content</th></tr>
<tr><td>0</td><td>Use as an absolute encoder.</td></tr>
<tr><td><1></td><td>Use as an incremental encoder.</td></tr>
<tr><td>2</td><td>Use as an absolute encoder, but ignore the multi-turn counter over.</td></tr>
</table>
<Caution>
This parameter will be invalidated when 5-wire, 2500P/r incremental encoder is used.</td></tr>
<tr><td>0C
*</td><td>Baud rate of RS232</td><td>0 to 5
<2></td><td>You can set up the communication speed of RS232. • Error of baud rate is ±0.5%.
<table>
<tr><th>Setup value</th><th>Baud rate</th></tr>
<tr><td>0</td><td>2400bps</td></tr>
<tr><td>1</td><td>4800bps</td></tr>
<tr><td><2></td><td>9600bps</td></tr>
</table>
<table>
<tr><th>Setup value</th><th>Baud rate</th></tr>
<tr><td>3</td><td>19200bps</td></tr>
<tr><td>4</td><td>38400bps</td></tr>
<tr><td>5</td><td>57600bps</td></tr>
</table>
<Caution>
If the console is used specify the set value 2 (9600 bps).</td></tr>
<tr><td>0F</td><td>Node address</td><td>–
(display only)</td><td>Shows the axis number set by a rotary switch at the front panel of the driver. The axis number cannot be changed.</td></tr>
</table>

Parameters for Adjustment of Time Constants of Gains and Filters

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
10	1st position loop gain	0 to 3000 A to C-frame:<63>* D to F-frame:<32>*	1/s	You can determine the response of the positional control system. Higher the gain of position loop you set, faster the positioning time you can obtain. Note that too high setup may cause oscillation.
11	1st velocity loop gain	1 to 3500 A to C-frame:<35>* D to F-frame:<18>*	Hz	You can determine the response of the velocity loop. In order to increase the response of overall servo system by setting high position loop gain, you need higher setup of this velocity loop gain as well. However, too high setup may cause oscillation. **<Caution>** When the inertia ratio of SV.Pr20 is set correctly, the setup unit of SV.Pr11 becomes (Hz).
12	1st velocity loop integration time constant	1 to 1000 A to C-frame:<16>* D to F-frame:<31>*	ms	You can set up the integration time constant of velocity loop. Smaller the setup, faster you can dog-in deviation at stall to 0. The integration will be maintained by setting to "999". The integration effect will be lost by setting to "1000".

Parameter Setup

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
13	1st speed detection filter	0 to 5 <0>*	–	You can set up the time constant of the low pass filter (LPF) after the speed detection, in 6 steps. Higher the setup, larger the time constant you can obtain so that you can decrease the motor noise, however, response becomes slow. Use with a default value of 0 in normal operation. This setting is invalid if SV.Pr27 (Velocity observer) is enabled.
14	1st torque filter time constant	0 – 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	You can set up the time constant of the 1st delay filter inserted in the torque command portion. You might expect suppression of oscillation caused by distortion resonance.
15	Velocity feed forward	–2000 to 2000 <300>*	0.1%	You can set up the velocity feed forward volume at position control. Use when high-speed response is required.
16	Feed forward filter time constant	0 to 6400 <50>*	0.01ms	You can set up the time constant of 1st delay filter inserted in velocity feed forward portion.
18	2nd position loop gain	0 to 3000 A to C-frame:<73>* D to F-frame:<38>*	1/s	Set when performing optimum tuning using the gain switching function. Set the second loop gain for position control.
19	2nd velocity loop gain	1 to 3500 A to C-frame:<35>* D to F-frame:<18>*	Hz	Set when performing optimum tuning using the gain switching function. When SV.Pr20 (Inertia ratio) has been set correctly, the set time is “Hz”.
1A	2nd velocity loop integration time constant	1 to 1000 <1000>*	ms	Set when performing optimum tuning using the gain switching function. When using in a vertical axis, to keep the integration value, set “999”. To disable the integration, set “1000”.
1B	2nd speed detection filter	0 to 5 <0>*	–	Set when performing optimum tuning using the gain switching function. If you increase the value, the motor noise reduces. This setting is disabled if the instantaneous speed observer is enabled (SV.Pr27 = 1).
1C	2nd torque filter time constant	0 to 2500 A to C-frame:<65>* D to F-frame:<126>*	0.01ms	Set when performing optimum tuning using the gain switching function. Set the time constant of 1st delay filter of the torque command.
1D	1st notch frequency	100 to 1500 <1500>	Hz	Specify the frequency of the 1st resonance suppressing notch filter. Use it according to the machine resonance frequency. If this parameter is set to “1500”, the notch filter function is disabled. **<Note>** This parameter may be changed depending on the adaptive filter settings.
1E	1st notch width selection	0 to 4 <2>	–	You can set up the notch filter width of the 1st resonance suppressing filter in 5 steps. Higher the setup, larger the notch width you can obtain. **<Note>** This parameter may be changed depending on the adaptive filter operation. If it is combined with the adaptive filter, use the 2nd notch filter.
27 (P)	Velocity observer	0 to 1 <0>*	–	With a high stiffness machine, you can achieve both high response and reduction of vibration at stall, by using this instantaneous speed observer. **Setup value** / **Instantaneous speed observer setup** <0>* / Invalid 1 / Valid You need to set up the inertia ratio of SV.Pr20 correctly to use this function. If you set up SV.Pr21, real-time auto-gain tuning mode setup, to other than 0 (valid), SV.Pr27 becomes 0 (invalid).
28	2nd notch frequency	100 to 1500 <1500>	Hz	You can set up the 2nd notch width of the resonance suppressing filter in 5 steps. The notch filter function is invalidated by setting up this parameter to "1500".

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
29	2nd notch width selection	0 to 4 <2>	–	You can set up the notch width of 2nd resonance suppressing filter in 5 steps. Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.
2A	2nd notch depth selection	0 to 99 <0>	–	You can set up the 2nd notch depth of the resonance suppressing filter. Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.
2B	1st vibration suppression frequency	0 to 2000 <0>	0.1Hz	You can set up the 1st vibration suppression frequency of the damping control which suppress vibration at the load edge. The driver measures vibration at load edge. Setup unit is 0.1[Hz] . The setup frequency is 10.0 to 200.0[Hz] . Setup of 0 to 99 becomes invalid. Refer to P.161, "Damping control" as well before using this parameter.
2C	1st vibration suppression filter	–200 to 2000 <0>	0.1Hz	While you set up SV.Pr2B (1st vibration suppression frequency), set this up to smaller value when torque saturation occurs, and to larger value when you need faster action.Use with the setup of 0 in normal operation. Refer to P.161, "Damping control" of Adjustment . **<Caution>** Setup is also limited by 10.0[Hz] – SV.Pr2B≦ SV.Pr2C≦ SV.Pr2B
2D	2nd vibration suppression frequency	0 to 2000 <0>	0.1Hz	You can set up the 2nd vibration suppression frequency of the damping control which suppress vibration at the load edge. The driver measures vibration at the load edge. Setup unit is 0.1 [Hz] . Setup frequency is 10.0 to 200.0 [Hz] . Setup of 0-99 becomes invalid. Refer to P.161, "Damping control" of Adjustment as well before using this parameter.
2E	2nd vibration suppression filter	–200 to 2000 <0>	0.1Hz	While you set up SV.Pr2D (2nd vibration suppression frequency), set this up to smaller value when torque saturation occurs, and to larger value when you need faster action. Use with the setup of 0 in normal operation. Refer to P.161, "Damping control" of Adjustment . **<Caution>** Setup is also limited by 10.0[Hz] – SV.Pr2D≦ SV.Pr2E ≦ SV.Pr2D

Parameters for Auto-Gain Tuning

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
20	Inertia ratio	0 to 10000 <250>*	%	You can set up the ratio of the load inertia against the rotor (of the motor) inertia. SV.Pr20 = (load inertia/rotor inertia) X 100 [%] When you execute the normal auto-gain tuning, the load inertial will be automatically estimated after the preset action, and this result will be reflected in this parameter. The inertia ratio will be estimated at all time while the real-time auto-gain tuning is valid, and its result will be saved to EEPROM every 30 min. **<Caution>** If the inertia ratio is correctly set, the setup unit of SV.Pr11 and SV.Pr19 becomes (Hz). When the inertia ratio of SV.Pr20 is larger than the actual, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of SV.Pr20 is smaller than the actual, the setup unit of the velocity loop gain becomes smaller.

<Notes>

- Anything marked with “(P)” on the servo parameter number (Servo PrNo.) can be used only for the “position control”.
- Parameters which default values have a suffix of "*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.151, "Release of Automatic Gain Adjusting Function" of Adjustment.

Standard default : < >

<table>
<tr><th>Servo PrNo.</th><th>Title</th><th>Setup range</th><th>Unit</th><th>Function/Content</th></tr>
<tr><td>21</td><td>Real time auto tuning set up</td><td>0 to 7
<1></td><td>–</td><td>You can set up the action mode of the real-time auto-gain tuning.
With higher setup such as 3 or 6, the driver respond quickly to the change of the inertia during operation, however it might cause an unstable operation. Use 1 or 4 for normal operation.For the vertical axis application, use with the setup of 4 to 6.
When vibration occurs at gain switching, set up this to "7".
<table>
<tr><th>Setup value</th><th>Real-time auto-gain tuning</th><th>Varying degree of load inertia in motion</th></tr>
<tr><td>0</td><td>Invalid</td><td>–</td></tr>
<tr><td><1></td><td rowspan="3">Normal mode</td><td>Little change</td></tr>
<tr><td>2</td><td>Gradual change</td></tr>
<tr><td>3</td><td>Rapid change</td></tr>
<tr><td>4</td><td rowspan="3">Vertical axis mode</td><td>Little change</td></tr>
<tr><td>5</td><td>Gradual change</td></tr>
<tr><td>6</td><td>Rapid change</td></tr>
<tr><td>7</td><td>No gain switching</td><td>Little change</td></tr>
</table></td></tr>
<tr><td>22</td><td>Machine stiffness at auto tuning</td><td>0 to 15
A to C-frame:
<4>
D to F-frame:
<1></td><td>–</td><td>You can set up the machine stiffness in 16 steps while the real-time auto-gain tuning is valid.
low←machine stiffness→high
low← servo gain →high
SV.Pr22 | 0, 1- - - - - - - - - - - - 14, 15
low← response →high
<Caution>
When you change the setup value rapidly, the gain changes rapidly as well, and this may give impact to the machine. Increase the setup gradually watching the movement of the machine.</td></tr>
<tr><td>23</td><td>Adaptive filter mode</td><td>0 to 2
<1></td><td>–</td><td>You can set up the action of the adaptive filter.
<table>
<tr><th>Setup value</th><th>Content</th></tr>
<tr><td>0</td><td>Invalid</td></tr>
<tr><td><1></td><td>Valid</td></tr>
<tr><td>2</td><td>Hold (holds the adaptive filter frequency when this setup is changed to 2.)</td></tr>
</table></td></tr>
<tr><td>24</td><td>Vibration suppression filter switching selection</td><td>0 to 2
<0></td><td>–</td><td>You can select the switching method when you use the vibration suppression filter.
<table>
<tr><th>Setup value</th><th>Content</th></tr>
<tr><td><0>, 1</td><td>No switching (both of 1st and 2nd are valid.)</td></tr>
<tr><td>2</td><td>You can switch with the position command direction.
CCW : 1st damping filter selection (SV.Pr2B, 2C).
CW : 2nd damping filter selection (SV.Pr2D, 2E).</td></tr>
</table></td></tr>
<tr><td>25</td><td>Normal auto tuning motion setup</td><td>0 to 7
<0></td><td>–</td><td>You can set up the action pattern at the normal mode auto-gain tuning.
<table>
<tr><th>Setup value</th><th>Number of revolution</th><th>Rotational direction</th></tr>
<tr><td><0></td><td rowspan="4">2 [revolution]</td><td>CCW → CW</td></tr>
<tr><td>1</td><td>CW → CCW</td></tr>
<tr><td>2</td><td>CCW → CCW</td></tr>
<tr><td>3</td><td>CW → CW</td></tr>
<tr><td>4</td><td rowspan="4">1 [revolution]</td><td>CCW → CW</td></tr>
<tr><td>5</td><td>CW → CCW</td></tr>
<tr><td>6</td><td>CCW → CCW</td></tr>
<tr><td>7</td><td>CW → CW</td></tr>
</table>
e.g.) When the setup is 0, the motor turns 2 revolutions to CCW and 2 revolutions to CW.</td></tr>
</table>

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
26	Software limit set up	0 to 1000 <10>	0.1 revolution	You can set up the movable range of the motor against the position command input range. When the motor movement exceeds the setup value, software limit protection of Err.34 will be triggered. This parameter is invalid with setup value of 0.
2F	Adaptive filter frequency	0 to 64 <0>	–	Displays the table No. corresponding to the adaptive filter frequency. (Refer to P.147 of Adjustment.) This parameter will be automatically set and cannot be changed while the adaptive filter is valid. (when SV.Pr23 (Adaptive filter mode) is other than 0.) **Setup value** / **Filter mode** <0> to 4 : Filter is invalid. 5 to 48 : Filter is valid. 49 to 64 : Filter validity changes according to SV.Pr22. This parameter will be saved to EEPROM every 30 minutes while the adaptive filter is valid, and when the adaptive filter is valid at the next power-on, the adaptive action starts taking the saved data in EEPROM as an initial value. **<Caution>** When you need to clear this parameter to reset the adaptive action while the action is not normal, invalidate the adaptive filter (SV.Pr23, "Adaptive filter mode" to 0) once, then validate again. Refer to P.151, "Release of Automatic Gain Adjusting Function" of Adjustment as well.

Parameters for Adjustment (2nd Gain Switching Function)

Standard default : < >

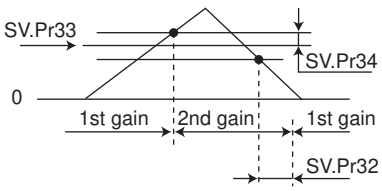
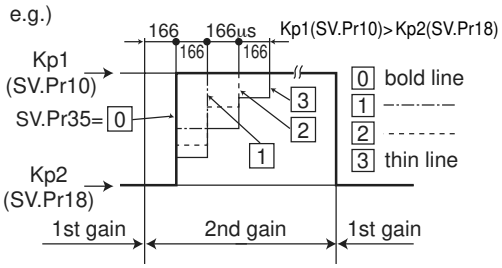
Servo PrNo.	Title	Setup range	Unit	Function/Content
30	2nd gain action set up	0 to 1 <1>*	–	Set when performing optimum tuning using the gain switching function. Setup value / **Gain selection/switching** 0 : 1st gain (SV.Pr10 to 14) <1>* : 1st (SV.Pr10 to 14) / 2nd gain (SV.Pr18 to 1C)
31	1st control switching mode	0 to 10 <10>*	–	Set a trigger to switch a gain. Setup value / **Gain switching condition** 0 : Fixed to the 1st gain. 1 : Fixed to the 2nd gain. 2 : Unavailable 3 : Toque command variation 4 *1 : Speed command variation 5 *1 : Speed command 6 *1 : Positional deviation 7 *1 : Positional command 8 *1 : Positioning is not completed 9 *1 : Speed <10>* *1 : Position command + speed *1 For the switching level and the timing, refer to P.155, "Gain Switching Function" of Adjustment.
32	1st control switching delay time	0 to 10000 <30>*	x 166μs	Set a time from the detection of trigger to actual gain switching when the 2nd gain is switched into the 1st gain, if SV.Pr31 (1st control switching mode) is between 3 and 10.
33	1st control switching level	0 to 20000 <50>*	–	You can set up the switching (judging) level of the 1st and the 2nd gains, while SV.Pr31 is set to 3, 5, 6. 9 and 10. Unit varies depending on the setup of SV.Pr31 (1st control switching mode)

<Notes>

- Parameters which default values have a suffix of "*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.151, "Release of Automatic Gain Adjusting Function" of Adjustment.

Parameter Setup

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
34	1st control switching hysteresis	0 to 20000 <33> *	–	You can set up hysteresis width to be implemented above/below the judging level which is set up with SV.Pr33. Unit varies depending on the setup of SV.Pr31 (1st control switching mode). Definitions of SV.Pr32 (Delay), SV.Pr33 (Level) and SV.Pr34 (Hysteresis) are explained in the fig. below.  **<Caution>** The setup of SV.Pr33 (Level) and SV.Pr34 (Hysteresis) are valid as absolute values (positive/negative).
35	Position loop gain switching time	0 – 10000 <20> *	(setup value +1) x 166μs	You can setup the step-by-step switching time to the position loop gain only at gain switching while the 1st and the 2nd gain switching is valid.  **<Caution>** The switching time is only valid when switching from small position gain to large position gain.

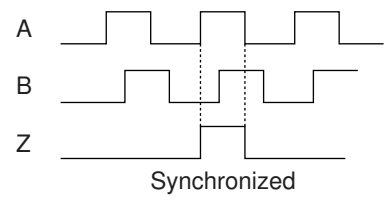
Parameters for Position Control

Standard default : < >

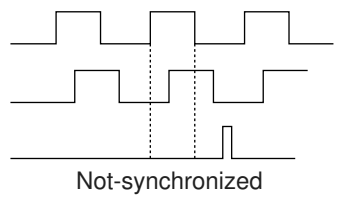
Servo PrNo.	Title	Setup range	Function/Content
44 *	Numerator of output pulse ratio	1 to 32767 <10000>	You can set up the pulse counts to be fed out from the pulse output (X5 0A+ : Pin-21, 0A- : Pin-22, 0B+ : Pin-48, 0B- : Pin-49).
45 *	Denominator of output pulse ratio	0 to 32767 <10000>	**• In the case that the encoder pulse is output (When the control mode is the position control mode and SV.Pr46 = 0, 1).** • SV.Pr45= 0 : You can set up the output pulse counts per one motor revolution for each OA and OB with the SV.Pr44 setup. Therefore the pulse output resolution after quadruple can be obtained from the formula below. The pulse output resolution per one revolution = SV.Pr44 (Numerator of output pulse ratio) X 4 • SV.Pr45≠0 : The pulse output resolution per one revolution can be divided by any ration according to the formula below. $\text{Pulse output resolution per one revolution} \frac{\text{SV.Pr44 (Numerator of output pulse ratio)}}{\text{SV.Pr45 (Denominator of output pulse ratio)}} \times \text{Encoder resolution}$ **<Cautions>** • The encoder resolution is 131072 [P/r] for the 17-bit absolute encoder, and 10000 [P/r] for the 5-wire 2500P/r incremental encoder. • The pulse output resolution per one revolution cannot be greater than the encoder resolution. (In the above setup, the pulse output resolution equals to the encoder resolution.) • Z-phase is fed out once per one revolution of the motor. When the pulse output resolution obtained from the above formula is multiple of 4, Z-phase synchronizes with A-phase. In other case, the Z-phase width equals to output with the encoder resolution, and becomes narrower than A-phase, hence does not synchronize with A-phase.

(Continue to the next page.)

Standard default : < >

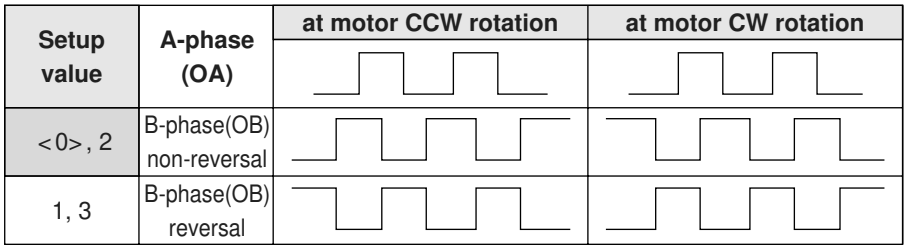
<table>
<tr><th>Servo PrNo.</th><th>Title</th><th>Setup range</th><th>Function/Content</th></tr>
<tr><td>44
*</td><td>Numerator of output pulse ratio</td><td>1 to 32767
<10000></td><td rowspan="2">when encoder resolution x $\frac{SV.Pr44}{SV.Pr45}$ is multiple of 4
 

Synchronized

when encoder resolution x $\frac{SV.Pr44}{SV.Pr45}$ is not multiple of 4
 

Not-synchronized

• In the case the external scale pulse is output (When the control mode is the full-closed control mode and SV.Pr46 = 2, 3).
• SV.Pr45= 0 :
No division will be executed.
• SV.Pr45≠0 :
The pulse output resolution per one revolution can be divided by any ration according to the formula below.
Pulse output resolution per one revolution = $\frac{\text{SV.Pr45 (Denominator of output pulse ratio)}}{\text{SV.Pr44 (Numerator of output pulse ratio)}}$ x The pulse of external scale output resolution one resolution

<Cautions>
• The setting of SV.Pr44> SV.Pr45 is invalid. (For the setting above, no division will be executed.)
• Z-phase of the external scale is not reproduced.</td></tr>
<tr><td>45
*</td><td>Denominator of output pulse ratio</td><td>0 to 32767
<10000></td></tr>
<tr><td>46
*</td><td>Pulse output logic inversion</td><td>0 to 3
<0></td><td>You can set up the B-phase logic and the output source of the pulse output (X5 OB+ : Pin-48, OB– : Pin-49). With this parameter, you can reverse the phase relation between the A-phase pulse and the B-phase pulse by reversing the B-phase logic.
 

<table><tr><th>SV.Pr46</th><th>B-phase logic</th><th>Output source</th></tr><tr><td><0></td><td>Non-reversal</td><td>Encoder position</td></tr><tr><td>1</td><td>Reversal</td><td>Encoder position</td></tr><tr><td>2 *1</td><td>Non-reversal</td><td>External scale position</td></tr><tr><td>3 *1</td><td>Reversal</td><td>External scale position</td></tr></table>
*1 The output source of SV.Pr46= 2, 3 is valid only at full-closed control.</td></tr>
</table>

<Notes>

- For servo parameters which No. have a suffix of "*", changed contents will be validated when you turn on the control power.
- Parameters which default values have a suffix of "*" will be automatically set up during real time auto-gain tuning. When you change manually, invalidate the real-time auto-gain tuning first then set, referring to P.151, "Release of Automatic Gain Adjusting Function" of Adjustment.

Parameter Setup

Standard default : < >

Servo PrNo.	Title	Setup range	Function/Content
4C	Smoothing filter	0 to 7 <1>	You can set the time constant of the primary delay firter covering the internal command pulse in 8 steps.
4D *	FIR filter set up	0 to 31 <0>	You can set up the moving average times of the FIR filter covering the internal command pulse. (Setup value + 1) become average travel times.

Setup value	Time constant
0	No filter function
<1>	Time constant small
↓	↓
7	Time constant large

Parameters for Input Signals

Standard default : < >

Servo PrNo.	Title	Setup range	Function/Content
53	Over-travel inhibit input valid	0 to 1 <1>	Specify whether to enable or disable the CW/CCW over-travel inhibit input (CWL: CN X5 Pin 20, CCWL: CN X5 Pin 19).
54	Over-travel inhibit input logic	0 to 1 <0>	Set the logic of the CW/CCW over-travel inhibit input (CWL: CN X5 Pin 20, CCWL: CN X5 Pin 19).
55	Over-travel inhibit input operation setting	0 to3 <1>	Select an operation when the CW/CCW over-travel inhibit input (CWL: CN X5 Pin 20, CCWL: CN X5 Pin 19) has been made. An operation is not tripped before homing has completed, even if “0” or “1” is selected.
56	Home sensor input logic	0 to 1 <1>	Set the logic of the Home sensor input (Z-LS: CN X5 Pin 21).
57 *	Selecting the number of input points	0 to 3 <2>	Select the number of point specifying inputs (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8). The number of present position outputs (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) also becomes the same as that of selected point specifying input.

Setup value	Description
53	Specify whether to enable or disable the CW/CCW over-travel inhibit input (CWL: CN X5 Pin 20, CCWL: CN X5 Pin 19).
0	Disable
<1>	Enable

Setup value	Description
54	Set the logic of the CW/CCW over-travel inhibit input (CWL: CN X5 Pin 20, CCWL: CN X5 Pin 19).
<0>	Over-travel is inhibited by opening the connection to COM–.
1	Over-travel is inhibited by closing the connection to COM–.

Setup value	Description
55	Select an operation when the CW/CCW over-travel inhibit input (CWL: CN X5 Pin 20, CCWL: CN X5 Pin 19) has been made. An operation is not tripped before homing has completed, even if “0” or “1” is selected.
0	An operation decelerates, stops and trips after the stop.
<1>	An operation stops in deceleration time “0” and trips after the stop.
2	An operation decelerates and stops, but it does not trip after the stop.
3	An operation stops in deceleration time “0”, but it does not trip after the stop.

Setup value	Description
56	Set the logic of the Home sensor input (Z-LS: CN X5 Pin 21).
0	Home sensor input is enabled by opening the connection to COM–.
<1>	Home sensor input is enabled by closing the connection to COM–.

Setup value	Description	
57	Select the number of point specifying inputs (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8). The number of present position outputs (P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34) also becomes the same as that of selected point specifying input.	
0	3 bits	P1IN to P4IN: CN X5 Pin 3, 4 and 5, and P1OUT to P4OUT: CN X5 Pin 29, 30 and 31 only are enabled. The number of positioning points is 4 and a maximum number of points is 7.
1	4 bits	P1IN to P8IN: CN X5 Pin 3, 4, 5 and 6, and P1OUT to P8OUT: CN X5 Pin 29, 30, 31 and 32 only are enabled. The number of positioning points is 12 and a maximum number of points is 15.
<2>	5 bits	P1IN to P16IN: CN X5 Pin 3, 4, 5, 6 and 7, and P1OUT to P16OUT: CN X5 Pin 29, 30, 31, 32 and 33 only are enabled. The number of positioning points is 28 and a maximum number of points is 31.
3	6 bits	P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8, and P1OUT to P32OUT: CN X5 Pin 29, 30, 31, 32, 33 and 34 only are enabled. The number of positioning points is 60 and a maximum number of points is 63.

<Notes>

- For servo parameters which No. have a suffix of "*", changed contents will be validated when you turn on the control power.

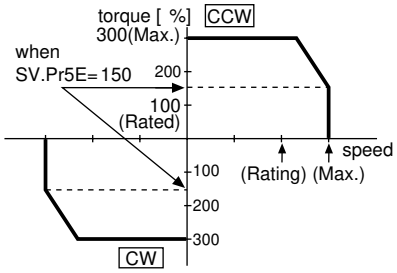
Standard default : < >

<table>
<tr><th>Servo PrNo.</th><th>Title</th><th>Setup range</th><th>Function/Content</th></tr>
<tr><td>58</td><td>Point specifying input logic setting</td><td>0 to 1
<1></td><td>Set the logic of the point specifying inputs (P1IN to P32IN: CN X5 Pin 3, 4, 5, 6, 7 and 8).
<table>
<tr><th>Setup value</th><th>Description</th></tr>
<tr><td>0</td><td>Point specifying inputs are enabled by opening the connection to COM–.</td></tr>
<tr><td><1></td><td>Point specifying inputs are enabled by closing the connection to COM–.</td></tr>
</table></td></tr>
<tr><td>59</td><td>Multi-function input 1 Signal logic</td><td>0 to 1
<1></td><td>Set the logic of the multi function input 1 (EX-IN1: CN X5 Pin 22).
<table>
<tr><th>Setup value</th><th>Description</th></tr>
<tr><td>0</td><td>Input is enabled by opening the connection to COM–.</td></tr>
<tr><td><1></td><td>Input is enabled by closing the connection to COM–.</td></tr>
</table></td></tr>
<tr><td>5A
*</td><td>Multi-function input 1 Signal selection</td><td>0 to 6
<0></td><td>Set the function of the multi function input 1 (EX-IN2: CN X5 Pin 22).
<table>
<tr><th>Setup value</th><th>Description</th></tr>
<tr><td><0></td><td>Disabled (regardless of the logic setting in SV.Pr59).</td></tr>
<tr><td>1</td><td>Immediate stop</td></tr>
<tr><td>2</td><td>Temporary stop</td></tr>
<tr><td>3</td><td>Deceleration and stop</td></tr>
<tr><td>4</td><td>High-speed normal rotation jog</td></tr>
<tr><td>5</td><td>High-speed reverse rotation jog</td></tr>
<tr><td>6</td><td>Alarm is cleared.</td></tr>
</table></td></tr>
<tr><td>5B</td><td>Multi-function input 2 Signal logic</td><td>0 to 1
<1></td><td>Set the logic of the multi function input 2 (EX-IN2: CN X5 Pin 25).
<table>
<tr><th>Setup value</th><th>Description</th></tr>
<tr><td>0</td><td>Input is enabled by opening the connection to COM–.</td></tr>
<tr><td><1></td><td>Input is enabled by closing the connection to COM–.</td></tr>
</table></td></tr>
<tr><td>5C
*</td><td>Multi-function input 2 Signal selection</td><td>0 to 6
<0></td><td>Set the function of the multi function input 2 (EX-IN2: CN X5 Pin 25).
<table>
<tr><th>Setup value</th><th>Description</th></tr>
<tr><td><0></td><td>Disabled (regardless of the logic setting in SV.Pr5B).</td></tr>
<tr><td>1</td><td>Immediate stop</td></tr>
<tr><td>2</td><td>Temporary stop</td></tr>
<tr><td>3</td><td>Deceleration and stop</td></tr>
<tr><td>4</td><td>High-speed normal rotation jog</td></tr>
<tr><td>5</td><td>High-speed reverse rotation jog</td></tr>
<tr><td>6</td><td>Alarm is cleared.</td></tr>
</table>
<Note>
The setting of the multi function input 1 and that of the multi function input 2 must be different from each other. Moreover, if high-speed normal rotation jog and high-speed reverse rotation jog are assigned to the input 1 and input 2, respectively, the motor does not work when those turn on simultaneously.</td></tr>
<tr><td>5D</td><td>Servo-ON input valid</td><td>0 to 1
<1></td><td>Specify whether to enable or disable the servo-on input (SRV-ON: CN X5 Pin 23).
<table>
<tr><th>Setup value</th><th>Description</th></tr>
<tr><td>0</td><td>Disable:
A servo turns on after the power supply turns on, regardless of the state of servo-on input (SRV-ON: CN X5 Pin 23).</td></tr>
<tr><td><1></td><td>Enable:
A servo turns on when the servo-on input (SRV-ON: CN X5 Pin 23) has been input after the power supply turns on.</td></tr>
</table></td></tr>
</table>

Parameter Setup

Parameters for Velocity and Torque Limit

Standard default : < >

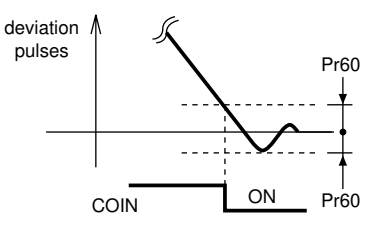
Servo PrNo.	Title	Setup range	Unit	Function/Content
5E	1st torque limit	0 to 500 <500> *2	%	You can set up the limit value of the motor output torque (SV.Pr5E : 1st torque, SV.Pr5F : 2nd torque). For the torque limit selection, refer to SV.Pr03 (Torque limit selection). This torque limit function limits the max. motor torque inside of the driver with parameter setup. In normal operation, this driver permits approx. 3 times larger torque than the rated torque instantaneously. If this 3 times bigger torque causes any trouble to the load (machine) strength, you can use this function to limit the max. torque. • Setup value is to be given in % against the rated torque. • Right fig. shows example of 150% setup with SV.Pr03=1. • SV.Pr5E limits the max. torque for both CCW and CW directions.  **<Caution>** You cannot set up a larger value to this parameter than the default setup value of "Max. output torque setup" of System parameter (which you cannot change through operation with PANATERM® or panel). Default value varies depending on the combination of the motor and the driver. For details, refer to P.78, "Setup of Torque Limit " of Preparation.
5F	2nd torque limit	0 to 500 <500> *2	%	

<Note>

• For parameters which default. has a suffix of "*2", value varies depending on the combination of the driver and the motor.

Parameters for Sequence

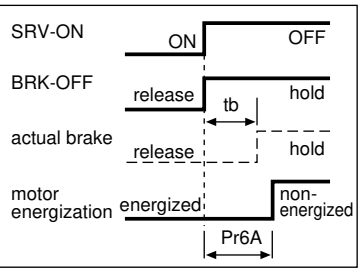
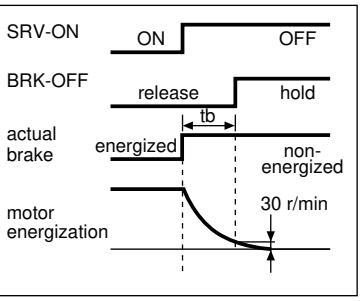
Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
60	In-position range	0 to 32767 <131>	Pulse	You can set up the timing to feed out the positioning complete signal (COIN : CN X5, Pin-27). The positioning complete signal (COIN) will be fed out when the deviation counter pulse counts fall within ± (the setup value), after the position command entry is completed. The setup unit should be the encoder pulse counts at the position control and the external scale pulse counts at the full-closed control. • Basic unit of deviation pulse is encoder "resolution", and varies per the encoder as below. (1) 17-bit encoder : 2^{17} = 131072 (2) 2500P/r encoder : 4 X 2500 = 10000 **<Cautions>** 1. If you set up too small value to SV.Pr60, the time until the COIN signal is fed might become longer, or cause chattering at output. 2. The setup of "Positioning complete range" does not give any effect to the final positioning accuracy. 

Standard default : < >

<table>
<tr><th>Servo PrNo.</th><th>Title</th><th>Setup range</th><th>Unit</th><th>Function/Content</th></tr>
<tr><td>64</td><td>Output signal selection</td><td>0 to 1
<0></td><td>–</td><td>Set the function of the positioning completion output/in-deceleration output pin (COIN/DCLON: CN X5 Pin 27).
<table>
<tr><th>Setup value</th><th>Description</th></tr>
<tr><td><0></td><td>COIN (Positioning completion output)</td></tr>
<tr><td>1</td><td>DCLON (In-deceleration output)</td></tr>
</table></td></tr>
<tr><td>65</td><td>Undervoltage error response at main power-off</td><td>0 to 1
<1></td><td>–</td><td>You can select whether or not to activate Err13 (Main power supply under-voltage protection) function while the main power shutoff continues for the setup of Pr6D (Main power-off detection time).
<table>
<tr><th>Setup value</th><th>Action of main power low voltage protection</th></tr>
<tr><td>0</td><td>Turns the servo off according to SV.Pr67 (Error response at main power-off).</td></tr>
<tr><td><1></td><td>When the main power is shut off during Servo-ON, the driver will trip due to Err13 (Main power supply under-voltage protection).</td></tr>
</table>
<Caution>
This parameter is invalid when SV.Pr6D (Main power-off detection time)=1000. Err13 (Main power supply under-voltage protection) is triggered when setup of SV.Pr6D is long and P-N voltage of the main converter falls below the specified value before detecting the main power shutoff, regardless of the SV.Pr65 setup.</td></tr>
<tr><td>67</td><td>Error response at main power-off</td><td>0 to 9
<0></td><td>–</td><td>When SV.Pr65 (Undervoltage error response at main power-off) is 0, you can set up,
1) the action during deceleration and after stalling
2) the clearing of deviation counter content
after the main power is shut off.
<table>
<tr><th rowspan="2">Setup value</th><th colspan="2">Action</th><th rowspan="2">Deviation counter content</th></tr>
<tr><th>During deceleration</th><th>After stalling</th></tr>
<tr><td><0></td><td>DB</td><td>DB</td><td>Clear</td></tr>
<tr><td>1</td><td>Free-run</td><td>DB</td><td>Clear</td></tr>
<tr><td>2</td><td>DB</td><td>Free-run</td><td>Clear</td></tr>
<tr><td>3</td><td>Free-run</td><td>Free-run</td><td>Clear</td></tr>
<tr><td>4</td><td>DB</td><td>DB</td><td>Hold</td></tr>
<tr><td>5</td><td>Free-run</td><td>DB</td><td>Hold</td></tr>
<tr><td>6</td><td>DB</td><td>Free-run</td><td>Hold</td></tr>
<tr><td>7</td><td>Free-run</td><td>Free-run</td><td>Hold</td></tr>
<tr><td>8</td><td>Emergency stop</td><td>DB</td><td>Clear</td></tr>
<tr><td>9</td><td>Emergency stop</td><td>Free-run</td><td>Clear</td></tr>
</table>
(DB: Dynamic Brake action)
<Caution>
In case of the setup value of 8 or 9, torque limit during deceleration will be limited by the setup value of SV.Pr6E (Emergency stop torque set up).</td></tr>
<tr><td>68</td><td>Error response action</td><td>0 to 3
<0></td><td>–</td><td>You can set up the action during deceleration or after stalling when some error occurs while either one of the protective functions of the driver is triggered.
<table>
<tr><th rowspan="2">Setup value</th><th colspan="2">Action</th><th rowspan="2">Deviation counter content</th></tr>
<tr><th>During deceleration</th><th>After stalling</th></tr>
<tr><td><0></td><td>DB</td><td>DB</td><td>Hold</td></tr>
<tr><td>1</td><td>Free-run</td><td>DB</td><td>Hold</td></tr>
<tr><td>2</td><td>DB</td><td>Free-run</td><td>Hold</td></tr>
<tr><td>3</td><td>Free-run</td><td>Free-run</td><td>Hold</td></tr>
</table>
(DB: Dynamic Brake action)
<Caution>
The content of the deviation counter will be cleared when clearing the alarm.</td></tr>
</table>

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
69	Sequence at Servo-OFF	0 to 9 <0>	–	You can set up, 1) the running condition during deceleration and after stalling 2) the clear treatment of deviation counter is set up. After the servo-ON signal input is turned off (SRV-ON : CN X5, Pin-23 shifting from ON to OFF). The relation between the setup value of SV.Pr69 and the action/deviation counter clearance is same as that of SV.Pr67 (Error response at main power-off). Refer to P.135, "Timing Chart"-Servo-ON/OFF action while the motor is at stall" of Operation Setting as well.
6A	Mechanical brake delay at motor standstill	0 to 100 <0>	2ms	You can set up the time from when the brake release signal (BRK-OFF : CN X5, Pin-10 and 11) turns off to when the motor is de-energized (Servo-free), when the motor turns to Servo-OFF while the motor is at stall. • Set up to prevent a micro-travel/ drop of the motor (work) due to the action delay time (tb) of the brake • After setting up SV.Pr6a ≧ tb, then compose the sequence so as the driver turns to Servo-OFF after the brake is actually activated.  Refer to P.135, "Timing Chart"-Servo-ON/OFF Action While the Motor Is at Stall" of Operation Setting as well.
6B	Mechanical brake delay at motor in motion	0 to 100 <0>	2ms	You can set up time from when detecting the off of Servo-ON input signal (SRV-ON : CN X5, Pin-29) is to when external brake release signal (BRK-OFF : CN X5, Pin-10 and 11) turns off, while the motor turns to servo off during the motor in motion. • Set up to prevent the brake deterioration due to the motor running. • At Servo-OFF during the motor is running, tb of the right fig. will be a shorter one of either SV.Pr6B setup time, or time lapse till the motor speed falls below 30r/min.  Refer to P.135, "Timing Chart"-Servo-ON/OFF action while the motor is in motion" of Operation Setting as well.

<Notes>

• For servo parameters which No. have a suffix of "*", changed contents will be validated when you turn on the control power.

Standard default : < >

<table>
<tr><th>Servo PrNo.</th><th>Title</th><th>Setup range</th><th>Unit</th><th>Function/Content</th></tr>
<tr><td>6C
*</td><td>External regenerative resistor set up</td><td>0 to 3
for
A, B-frame
<3>
for
C to F-frame
<0></td><td>–</td><td>With this parameter, you can select either to use the built-in regenerative resistor of the driver, or to separate this built-in regenerative resistor and externally install the regenerative resistor (between RB1 and RB2 of Connector CN X2 in case of A to D-frame, between P and B2 of terminal block in case of E, F-frame).
<table>
<tr><th>Setup value</th><th>Regenerative resistor to be used</th><th>Regenerative processing and regenerative resistor overload</th></tr>
<tr><td><0>
(C, D, E and F-frame)</td><td>Built-in resistor</td><td>Regenerative processing circuit will be activated and regenerative resistor overload protection will be triggered according to the built-in resistor (approx. 1% duty).</td></tr>
<tr><td>1</td><td>External resistor</td><td>The driver trips due to regenerative overload protection (Err18), when regenerative processing circuit is activated and its active ratio exceeds 10%,</td></tr>
<tr><td>2</td><td>External resistor</td><td>Regenerative processing circuit is activated, but no regenerative over-load protection is triggered.</td></tr>
<tr><td><3>
(A, B-frame)</td><td>No resistor</td><td>Both regenerative processing circuit and regenerative protection are not activated, and built-in capacitor handles all regenerative power.</td></tr>
</table>
<Remarks>
Install an external protection such as thermal fuse when you use the external regenerative resistor.
Otherwise, the regenerative resistor might be heated up abnormally and result in burnout, regardless of validation or invalidation of regenerative over-road protection.
<Caution>
When you use the built-in regenerative resistor, never to set up other value than 0. Don't touch the external regenerative resistor.
External regenerative resistor gets very hot, and might cause burning.</td></tr>
<tr><td>6D
*</td><td>Main power-off detection time</td><td>35 to 1000
<35></td><td>2ms</td><td>You can set up the time to detect the shutoff while the main power is kept shut off continuously.
The main power off detection is invalid when you set up this to 1000.</td></tr>
<tr><td>6E</td><td>Emergency stop torque set up</td><td>0 to 500
<0></td><td>%</td><td>You can set up the torque limit in case of emergency stop as below.
• During deceleration with the setup of 8 or 9 of SV.Pr67 (Error response at main power-off)
• During deceleration with the setup of 8 or 9 of SV.Pr69 (Sequence at Servo-OFF)
Normal torque limit is used by setting this to 0.
<Caution>
The stop is not due to the emergency stop input (EMG-STP: CN X5 Pin 2).</td></tr>
</table>

Parameters for Protective function

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
70	Position deviation error level	0 to 32767 <25000>	256 x pulse	• You can set up the excess range of position deviation. • Set up with the encoder pulse counts at the position control and with the external scale pulse counts at the full-closed control. • Err24 (Position deviation excess protection) becomes invalid when you set up this to 0.
72	Overload level	0 to 500 <0>	%	• You can set up the over-load level. The overload level becomes 115 [%] by setting up this to 0. • Use this with 0 setup in normal operation. Set up other value only when you need to lower the over-load level. • The setup value of this parameter is limited by 115[%] of the motor rating.

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
73	Setup of over-speed level	0 to 20000 <0>	r/min	• You can set up the over-speed level. The over-speed level becomes 1.2 times of the motor max. speed by setting up this to 0. • Use this with 0 setup in normal operation. Set up other value only when you need to lower the over-speed level. • The setup value of this parameter is limited by 1.2 times of the motor max. speed. **<Caution>** The detection error against the setup value is ±3 [r/min] in case of the 7-wire absolute encoder, and ±36 [r/min] in case of the 5-wire incremental encoder.

Parameters for Full-Closed Control

Standard default : < >

Servo PrNo.	Title	Setup range	Unit	Function/Content
78 * (F)	Numerator of external scale ratio	0 to 32767 <10000>	–	You can setup the ratio between the encoder resolution and the external scale resolution at full-closed control. $\frac{\text{Encoder resolution per one motor revolution}}{\text{External scale resolution per one motor revolution}} = \frac{\text{SV.Pr78 X } 2^{\text{SV.Pr79}}}{\text{SV.Pr7A}}$ • SV.Pr78= 0 Numerator equals to encoder resolution, and you can setup the external scale resolution per one motor revolution with SV.Pr7A. • SV.Pr78 ≠ 0, Setup the ratio between the external scale resolution and the encoder resolution per one motor revolution according to the above formula. **<Caution>** • Upper limit of numerator value after calculation is 131072. Setup exceeding this value will be invalidated, and 131702 will be the actual numerator. • The actual calculation of numerator is “numerator of external scale division (SV.Pr78) x 2 to the nth power (a set value of SV.Pr79)”.
79 * (F)	Multiplier of numerator of external scale ratio	0 to 17 <0>	–	
7A * (F)	Denominator of external scale ratio	1 to 32767 <10000>	–	
7B * (F)	Hybrid deviation error level	1 to 10000 <100>	16 x external scale pulse	• You can setup the permissible gap (hybrid deviation) between the present motor position and the present external scale position.
7C * (F)	External scale direction	0 to 1 <0>	–	You can set up the logic of the absolute data of the external scale. **Setup value** / **Content** 0 – Serial data will increase when the detection head travels to the right viewed from the mounting side. (+ count) 1 – Serial data will decrease when the detection head travels to the right viewed from the mounting side. (– count) **<Caution>** Unlike 16.Pr50 (setup of operating direction), this parameter depends on the mounting direction of external scale. Please note that the full-closed control cannot be executed appropriately in a reverse setting.

<Notes>

- Anything marked with “(F)” on the servo parameter number (Servo PrNo.) can be used only for the “Full-Closed Control”.
- For servo parameters which No. have a suffix of "*", changed contents will be validated when you turn on the control power.

List of 16-bit Positioning Parameters

Parameters for Motor speed

Standard default : < >

16-bit positioning PrNo.	Title	Setup range	Unit	Function/Content
00	1st speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 1 has been selected.
01	2nd speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 2 has been selected.
02	3rd speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 3 has been selected.
03	4th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 4 has been selected.
04	5th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 5 has been selected.
05	6th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 6 has been selected.
06	7th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 7 has been selected.
07	8th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 8 has been selected.
08	9th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 9 has been selected.
09	10th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 10 has been selected.
0A	11th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 11 has been selected.
0B	12th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 12 has been selected.
0C	13th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 13 has been selected.
0D	14th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 14 has been selected.
0E	15th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 15 has been selected.
0F	16th speed	0 to 6000 <0>	r/min	Specify a speed when Speed Selection 16 has been selected.

Parameters for Acceleration and Deceleration

Standard default : < >

16-bit positioning PrNo.	Title	Setup range	Unit	Function/Content
10	1st acceleration	0 to 10000 <0>	ms	Specify acceleration when Acceleration Selection 1 has been selected. Specify an acceleration time in a range between 0 to 3000 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual acceleration time.
11	1st S-shaped acceleration	0 to 1000 <0>	ms	Specify S-shaped acceleration when Acceleration Selection 1 has been selected. Specify the S-shaped acceleration during acceleration time. For details, refer to page 131. If “0” is specified, the linear acceleration time is enabled.
12	1st deceleration	0 to 10000 <0>	ms	Specify deceleration when Deceleration Selection 1 has been selected. Specify a deceleration time in a range between 3000 to 0 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual deceleration time.
13	1st S-shaped deceleration	0 to 1000 <0>	ms	Specify S-shaped deceleration when Deceleration Selection 1 has been selected. Specify the S-shaped deceleration during deceleration time. For details, refer to page 131. If the S-shaped deceleration is set to “0”, the linear deceleration time is enabled.
14	2 nd acceleration	0 to 10000 <0>	ms	Specify acceleration when Acceleration Selection 2 has been selected. Specify an acceleration time in a range between 0 to 3000 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual acceleration time.

Standard default : < >

16-bit positioning PrNo.	Title	Setup range	Unit	Function/Content
15	2nd S-shaped acceleration	0 to 1000 <0>	ms	Specify S-shaped acceleration when Acceleration Selection 2 has been selected. Specify the S-shaped acceleration during acceleration time. For details, refer to page 131. If “0” is specified, the linear acceleration time is enabled.
16	2nd deceleration	0 to 10000 <0>	ms	Specify deceleration when Deceleration Selection 2 has been selected. Specify a deceleration time in a range between 3000 to 0 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual deceleration time.
17	2nd S-shaped deceleration	0 to 1000 <0>	ms	Specify S-shaped deceleration when Deceleration Selection 2 has been selected. Specify the S-shaped deceleration during deceleration time. For details, refer to page 131. If the S-shaped deceleration is set to “0”, the linear deceleration time is enabled.
18	3rd acceleration	0 to 10000 <0>	ms	Specify acceleration when Acceleration Selection 3 has been selected. Specify an acceleration time in a range between 0 to 3000 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual acceleration time.
19	3rd S-shaped acceleration	0 to 1000 <0>	ms	Specify S-shaped acceleration when Acceleration Selection 3 has been selected. Specify the S-shaped acceleration during acceleration time. For details, refer to page 131. If “0” is specified, the linear acceleration time is enabled.
1A	3rd deceleration	0 to 10000 <0>	ms	Specify deceleration when Deceleration Selection 3 has been selected. Specify a deceleration time in a range between 3000 to 0 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual deceleration time.
1B	3rd S-shaped deceleration	0 to 1000 <0>	ms	Specify S-shaped deceleration when Deceleration Selection 3 has been selected. Specify the S-shaped deceleration during deceleration time. For details, refer to page 131. If the S-shaped deceleration is set to “0”, the linear deceleration time is enabled.
1C	4th acceleration	0 to 10000 <0>	ms	Specify acceleration when Acceleration Selection 4 has been selected. Specify an acceleration time in a range between 0 to 3000 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual acceleration time.
1D	4th S-shaped acceleration	0 to 1000 <0>	ms	Specify S-shaped acceleration when Acceleration Selection 4 has been selected. Specify the S-shaped acceleration during acceleration time. For details, refer to page 131. If “0” is specified, the linear acceleration time is enabled.
1E	4th deceleration	0 to 10000 <0>	ms	Specify deceleration when Deceleration Selection 4 has been selected. Specify a deceleration time in a range between 3000 to 0 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual deceleration time.
1F	4th S-shaped deceleration	0 to 1000 <0>	ms	Specify S-shaped deceleration when Deceleration Selection 4 has been selected. Specify the S-shaped deceleration during deceleration time. For details, refer to page 131. If the S-shaped deceleration is set to “0”, the linear deceleration time is enabled.

Parameters for Homing

Standard default : < >

16-bit positioning PrNo.	Title	Setup range	Unit	Function/Content
30	Homing speed (fast)	0 to 6000 <0>	r/min	Specify a high operation speed for the homing.
31	Homing speed (slow)	0 to 6000 <0>	r/min	Specify a low operation speed for the homing.
32	Homing offset speed	0 to 6000 <0>	r/min	Specify a speed used for an offset operation for the homing.
33	Homing acceleration	0 to 10000 <0>	ms	Specify acceleration for the homing. Specify an acceleration time in a range between 0 to 3000 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual acceleration time.
34	Homing deceleration	0 to 10000 <0>	ms	Specify deceleration for the homing. Specify a deceleration time in a range between 3000 to 0 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual deceleration time.

<Notes>

- For 16-bit positioning parameters which No. have a suffix of "*", changed contents will be validated when you turn on the control power.

Standard default : < >

16-bit positioning PrNo.	Title	Setup range	Unit	Function/Content
35	Homing direction	0 to 1 <0>	–	Specify an operating direction of homing. Setup value: <0> Detects a home position in a positive direction. 1 Detects a home position in a negative direction.
36	Homing type	0 to 7 <0>	–	Select how to perform the homing. <0> Home sensor + Z phase (based on the front end) 1 Home sensor (based on the front end) 2 Home sensor + Z phase (based on the rear end) 3 Limit sensor + Z phase 4 Limit sensor 5 Z phase homing 6 Bumping homing 7 Data set
37	Home complete type	0 to 1 <0>	–	Select an operation when homing has completed. <0> Set a current position to "- home offset" when the machine has returned to its home position. 1 The machine moves according to the home offset when homing has completed.
38 *	Homing skip	0 to 1 <0>	–	If "1" is specified, a step operation can be performed without homing. In this case, a position when the power supply has turned on is defined as a home position. <0> Homing required 1 Homing not required **<Note>** If the absolute mode (17-bit absolute encoder is used and SV.Pr08 (absolute encoder setting) is 0.2) is enabled, "Homing not required" is specified regardless of this parameter.
39	Bumping detection time	0 to 10000 <0>	ms	Specify home position recognition time for bumping homing.
3A	Torque limit for bumping homing	0 to 100 <0>	%	Specify a homing torque limit for bumping homing.
3B	Homing Z-phase count setting	0 to 100 <0>	–	Specify a Z phase at which the machine stops if the machine stops at the Z phase when returning to its home position. If "0" is specified, the machine stops at the first Z phase. (The same operation when "1" is specified.)

Parameters for Jog operation

Standard default : < >

16-bit positioning PrNo.	Title	Setup range	Unit	Function/Content
40	Jog speed (low)	0 to 6000 <0>	r/min	Specify a speed for a low-speed jog operation. **<Note>** A low-speed jog can be started only from the console. For a jog operation with a specified point, a set value for a high-speed jog is used.
41	Jog speed (high)	0 to 6000 <0>	r/min	Specify a speed for a high-speed jog operation.
42	Acceleration setting in jog operation	0 to 10000 <0>	ms	Specify acceleration for a jog operation. Specify an acceleration time in a range between 0 to 3000 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual acceleration time.
43	Setting of S-shaped acceleration in jog operation	0 to 1000 <0>	ms	Specify S-shaped acceleration for a jog operation. Specify the S-shaped control time during acceleration time. For details, refer to page 131. If "0" is specified, the linear acceleration control is enabled.

Standard default : < >

16-bit positioning PrNo.	Title	Setup range	Unit	Function/Content
44	Setting of deceleration in jog operation	0 to 10000 <0>	ms	Specify deceleration for a jog operation. Specify a deceleration time in a range between 3000 to 0 [r/min] . * There is a maximum of 10% difference between a calculation value in the setup and the actual deceleration time.
45	Setting of S-shaped deceleration in jog operation	0 to 1000 <0>	ms	Specify S-shaped deceleration for a jog operation. Specify the S-shaped control time during deceleration time. For details, refer to page 131. If “0” is specified, the linear deceleration control is enabled.

Other Parameters

Standard default : < >

16-bit positioning PrNo.	Title	Setup range	Unit	Function/Content
48	Teaching movement amount setting	0 to 32767 <0>	Pulse	Specify the number of pulses for movement at every pressing an operation key when teaching a position data using the console.
49	Instantaneous stop deceleration time	0 to 10000 <0>	ms	Specify a deceleration time when an immediate stop command assigned to the multi function input pin has been input. Specify a deceleration time in a range between 3000 to 0 [r/min] . For “0”, the speed command changes into a step shape. * There is a maximum of 10% difference between a calculation value in the setup and the actual deceleration time.
50 *	Operation direction setting	0 to 1 <1>	–	Specify a relation between a positive/negative direction of point position data and command position monitor and a CW/CCW rotation direction. Setup value: 0 — CCW is a negative direction and CW is a positive direction. <1> — CCW is a positive direction and CW is a negative direction. If “0” is specified, a sign of the command pulse sum shown on the monitor screen of the console or “PANATERM®” is reversed. However, for a value of the feedback pulse sum, CCW is a positive direction always.
51 *	Wrap around permission	0 to 1 <0>	–	Select an operation when a current position has overflowed. <0> — An alarm is given and a trip is caused (Error code No. 70). 1 — No alarm is given and an operation continues. **<Note>** If “1” is specified to this parameter, although an error does not occur when wrap around happens, an absolute position cannot be guaranteed. If wrap around is disabled, use the system in a relative position only.
52 *	Sequential operation setting	0 to 1 <0>	–	Specify whether to enable or disable a sequential operation. For the details of sequential operation, refer to page 130. <0> — Disable a sequential operation. 1 — Enable a sequential operation.
53	Sequential operation maximum point number	0 to 60 <0>	–	Specify a maximum point number for a sequential operation. This is enabled only when a sequential operation is enabled (16.Pr52 = 1). If “0” is specified, this is the same with “1”
54 *	Block operation type	0 to 1 <0>	–	Specify a type of block operation. For the details of block operation, refer to page 125. <0> — Continuous block operation. 1 — Combined block operation. **<Note>** If “1” is specified, the S-shaped acceleration/deceleration becomes unavailable.

<Notes>

- For 16-bit positioning parameters which No. have a suffix of "*", changed contents will be validated when you turn on the control power.

List of 32-bit Positioning Parameters

Standard default : < >

32-bit positioning PrNo.	Title	Setup range	Unit	Function/Content
00 *	Home offset	–2147483647 to 2147483647 <0>	Pulse	Specify the home offset when homing has completed. For details, refer to page 124.
01 *	Setting of maximum movement in plus direction	0 to 2147483647 <0>	Pulse	Specify a maximum travel in a positive direction. If “0” is specified, a positive direction error code No. 72 (maximum travel limit error protection) is disabled. The error code No. 72 is shown when a command position has become larger than this parameter value during a step operation or jog operation after homing has completed. **<Note>** When homing has not yet completed or 16.Pr51 (wraparound accepted) is “1”, the error code No. 72 is disabled. Also, the error code No. 72 is not detected when an operation stops.
02 *	Setting of maximum movement in minus direction	–2147483648 to 0 <0>	Pulse	Specify a maximum travel in a negative direction. If “0” is specified, a negative direction error code No. 72 (maximum travel limit error protection) is disabled. The error code No. 72 is shown when a command position has become smaller than this parameter value during a step operation or jog operation after homing has completed. **<Note>** When homing has not yet completed or 16.Pr51 (wraparound accepted) is “1”, the error code No. 72 is disabled. Also, the error code No. 72 is not detected when an operation stops.
03 *	Movement per rotation in rotation coordinates	0 to 2147483647 <0>	Pulse	Specify a travel (the number of pulses) per rotation in a step operation when a rotary axis is specified (operation mode: Rotary). An available range is between 2 and 1073741824. If any value out of this range is specified, an error code No. 69 (undefined data error protection) is shown when an operation starts.

List of Step Parameters

Standard default : < >

Step PrNo.	Title	Setup range		Unit	Function/Content
		PANATERM display	Console display		
01H to 3CH	Operation mode	ABS/INC/Rotary/ Dwelltime <INC>	AbS/inc/rot/d_t <inc>	–	Specify how to position. Absolute operation (ABS, Abs), incremental operation (INC, Inc), rotary axis operation (Rotary, rot), dwell timer operation (Dwell time, d_t).
	Position/waiting time	–2147483648 to 2147483647 <0>	–2147483648 to 2147483647 <0>	Pulse /10ms	Input a coordinate data for positioning. If “Dwelltime” is selected as an operation mode, specify a waiting time.
	Speed	V1 to V16 <V1>	VEL1 to VEL16 <VEL1>	–	Select a speed selection number for positioning. Specify a speed by 16-bit positioning parameter.
	Acceleration	A1 to A4 <A1>	Acc1 to Acc4 <Acc1>	–	Select a acceleration selection number for positioning. Specify a speed by 16-bit positioning parameter.
	Deceleration	D1 to D4 <D1>	dEc1 to dEc4 <dEc1>	–	Select a deceleration selection number for positioning. Specify a speed by 16-bit positioning parameter.
	Block	Single/Block <Single>	SinGLE/BLoc <SinGLE>	–	Select a single operation or block operation.

Setup of Torque Limit

Torque limit setup range is 0 to 300 and default is 300 except the combinations of the motor and the driver listed in the table below.

Frame	Model No.	Applicable motor	Max. value of SV.Pr5E,5F
A-frame	MADDCT1105P	MSMD5AZP1*	300
		MSMD5AZS1*	300
	MADDT1107P	MSMD011P1*	300
		MSMD011S1*	300
		MQMA011P1*	300
		MQMA011S1*	300
	MADDT1205P	MSMD5AZP1*	300
		MSMD5AZS1*	300
		MSMD012P1*	300
		MSMD012S1*	300
		MQMA012P1*	300
		MQMA012S1*	300
	MADDT1207P	MSMD022P1*	300
		MSMD022S1*	300
		MAMA012P1*	500
		MAMA012S1*	500
		MQMA022P1*	300
		MQMA022S1*	300
B-frame	MBDDT2110P	MSMD021P1*	300
		MSMD021S1*	300
		MQMA021P1*	300
		MQMA021S1*	300
	MBDDT2210P	MSMD042P1*	300
		MSMD042S1*	300
		MAMA022P1*	500
		MAMA022S1*	500
		MQMA042P1*	300
		MQMA042S1*	300
C-frame	MCDDT3120P	MSMD041P1*	300
		MSMD041S1*	300
		MQMA041P1*	300
		MQMA041S1*	300
	MCDDT3520P	MSMD082P1*	300
		MSMD082S1*	300
		MAMA042P1*	500
		MAMA042S1*	500
D-frame	MDDDT3530P	MFMA042P1*	300
		MFMA042S1*	300
		MHMA052P1*	255
		MHMA052S1*	255
		MDMA102P1*	300
		MDMA102S1*	300
		MHMA102P1*	300
		MHMA102S1*	300
	MDDDT5540P	MGMA092P1*	225
		MGMA092S1*	225
D-frame	MDDDT5540P	MSMA102P1*	300
		MSMA102S1*	300
		MHMA152P1*	300
		MHMA152S1*	300
		MDMA152P1*	300
		MDMA152S1*	300
		MSMA152P1*	300
		MSMA152S1*	300
		MFMA152P1*	300
		MFMA152S1*	300
		MAMA082P1*	500
		MAMA082S1*	500
		MDMA202P1*	300
		MDMA202S1*	300
E-frame	MEDDT7364P	MSMA202P1*	300
		MSMA202S1*	300
		MHMA202P1*	300
		MHMA202S1*	300
		MFMA252P1*	300
		MFMA252S1*	300
		MGMA202P1*	230
		MGMA202S1*	230
F-frame	MFDDTA390P	MDMA302P1*	300
		MDMA302S1*	300
		MHMA302P1*	300
		MHMA302S1*	300
		MSMA302P1*	300
		MSMA302S1*	300
		MGMA302P1*	235
		MGMA302S1*	235
	MFDDTB3A2P	MDMA402P1*	300
		MDMA402S1*	300
		MHMA402P1*	300
		MHMA402S1*	300
		MSMA402P1*	300
		MSMA402S1*	300
		MFMA452P1*	300
		MFMA452S1*	300
		MGMA452P1*	255
		MGMA452S1*	255
		MDMA502P1*	300
		MDMA502S1*	300
		MHMA502P1*	300
		MHMA502S1*	300
		MSMA502P1*	300
		MSMA502S1*	300

- The above limit applies to SV.Pr5E, 1st torque limit setup, SV.Pr5F, 2nd torque limit setup and SV.Pr6E, Torque setup at emergency stop.

<Caution>

When you change the motor model, above max. value may change as well. Check and reset the setup values of SV.Pr5E, SV.Pr5F and SV.Pr6E.

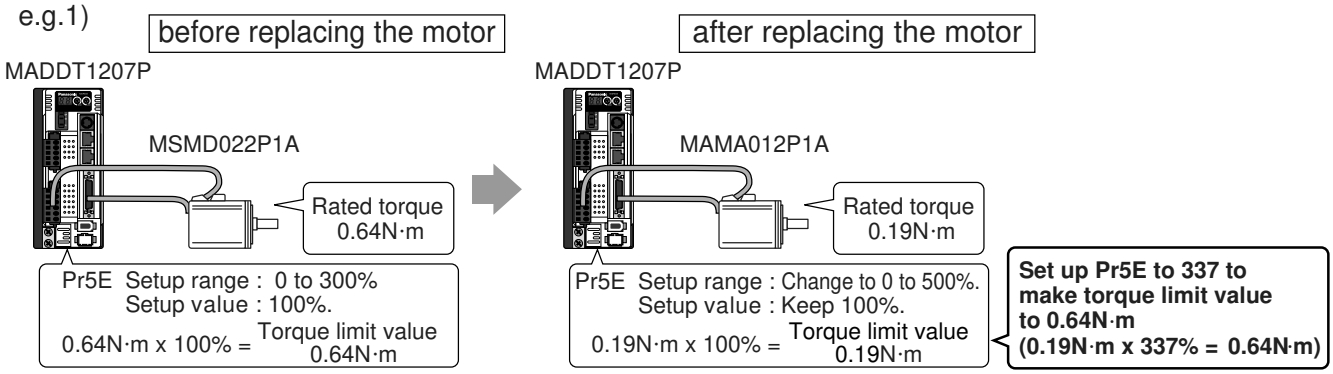
Cautions on Replacing the Motor

As stated above, torque limit setup range might change when you replace the combination of the motor and the driver. Pay attention to the followings.

1. When the motor torque is limited,

When you replace the motor series or to the different wattage motor, you need to reset the torque limit setup because the rated toque of the motor is different from the previous motor. (see e.g.1)

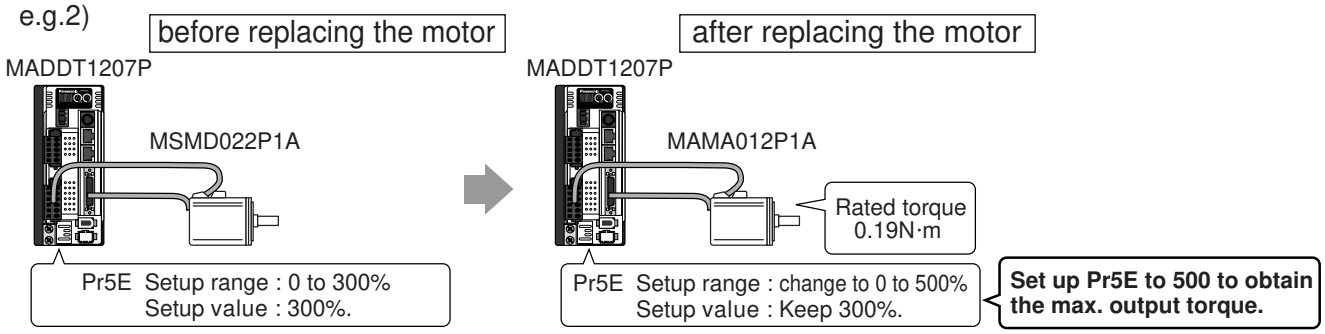
e.g.1)



2. When you want to obtain the max. motor torque,

You need to reset the torque limiting setup to the upper limit, because the upper limit value might be different from the previous motor. (see e.g.2)

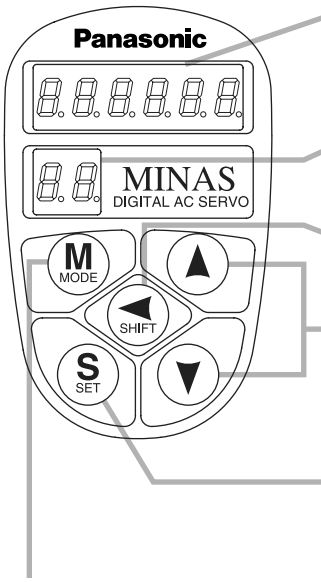
e.g.2)



How to Use the Console

Setup with the Console

Composition of Display/Touch panel



Display LED (6-digit)
All of LED will flash when error occurs, and switch to error display screen.

Display LED (in 2 digits)
Parameter No. is displayed at parameter setup mode. Point No. is displayed at teaching mode.

SHIFT Button
Press this to shift the digit for data change.

▲ ▼ Button
Press these to change data or execute selected action of parameter.
Numerical value increases by pressing , ▲,
decreases by pressing ▼.

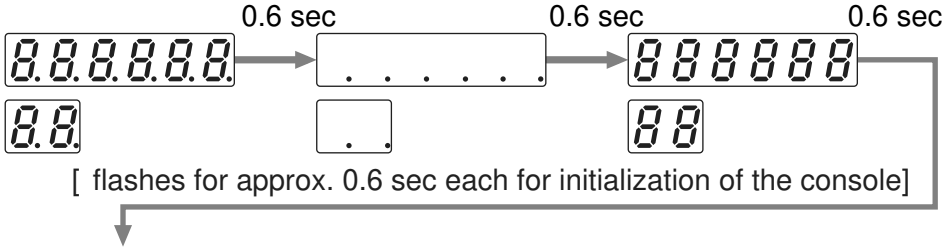
SET Button
Press this to shift each mode which is selected by mode switching button to EXECUTION display.

Mode Switching Button Press this to switch 7 kinds of mode.

1) Monitor mode
2) Teaching mode
   - Target position settings established by teaching
   - Test operation
3) Parameter setup mode
4) EEPROM write mode
5) Normal auto-gain tuning mode
6) Auxiliary function mode
   - Alarm clear
   - Absolute encoder clear
7) Copy mode
   - Copying of parameters from the driver to the console.
   - Copying of parameters from the console to the driver.

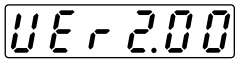
Initial Status of the Console Display (7 Segment LED)

Turn on the power of the driver while inserting the console connector to the driver main body, or inserting the console connector to CN X4 connector.

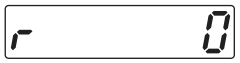


[flashes for approx. 0.6 sec each for initialization of the console]

• In case of communication with RS232 only

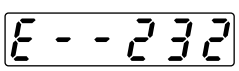

… Displays version No. of micro computer of the console.
(Displayed figures vary depending on the version)

1 sec


… Initial display of LED
(Determined by the setup of SV.Pr01, "Initial Status of LED".)

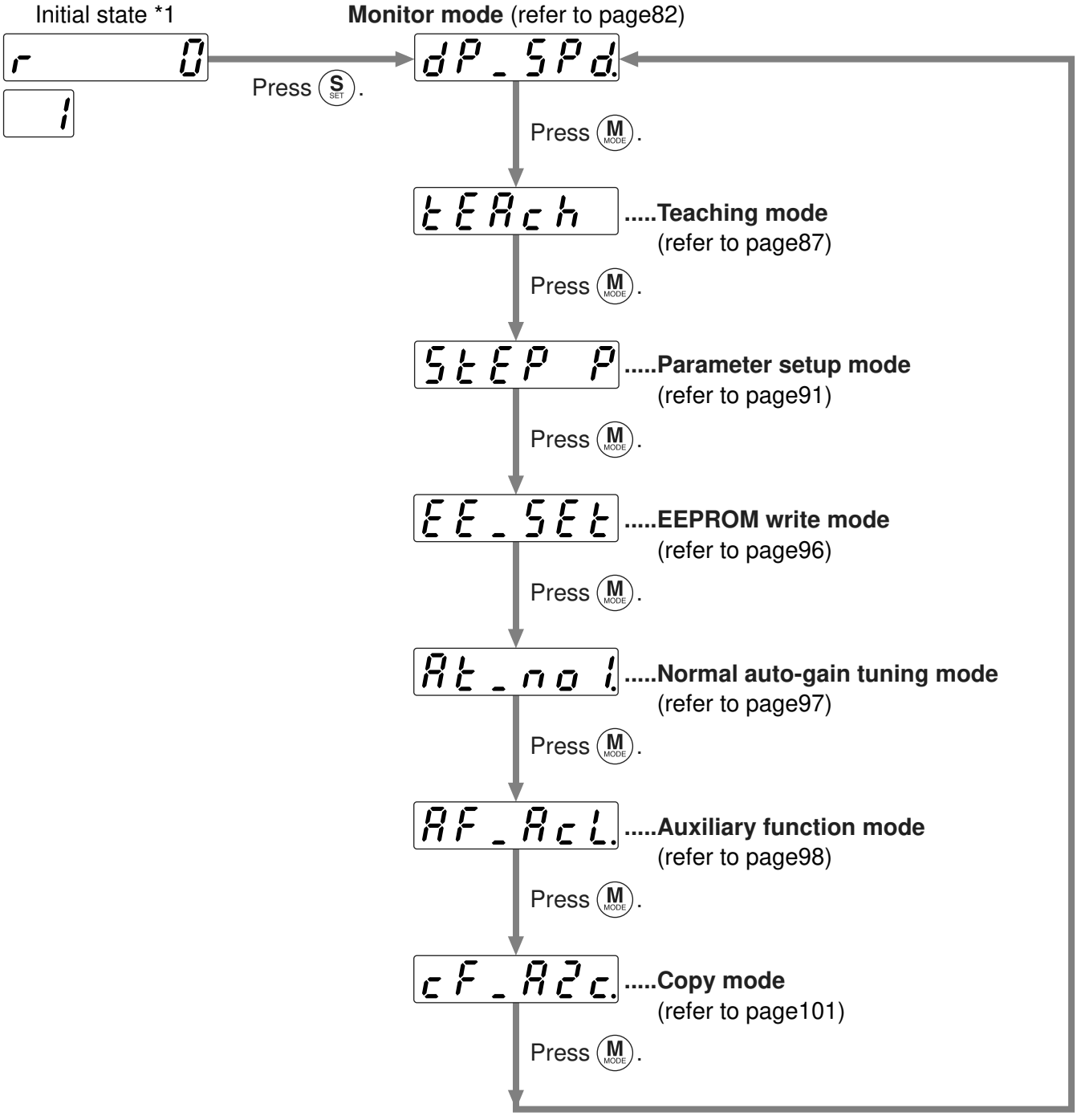
• Release of RS232 communication error

When RS232 communication error occurs as the Fig, below shows, release it by pressing (S SET) and (◀ SHIFT) at the same time.



Mode Change

The modes below are available in this console. To switch a mode, press (S SET) once in the initial state to enter the **SELECTION display** screen and press (M MODE).



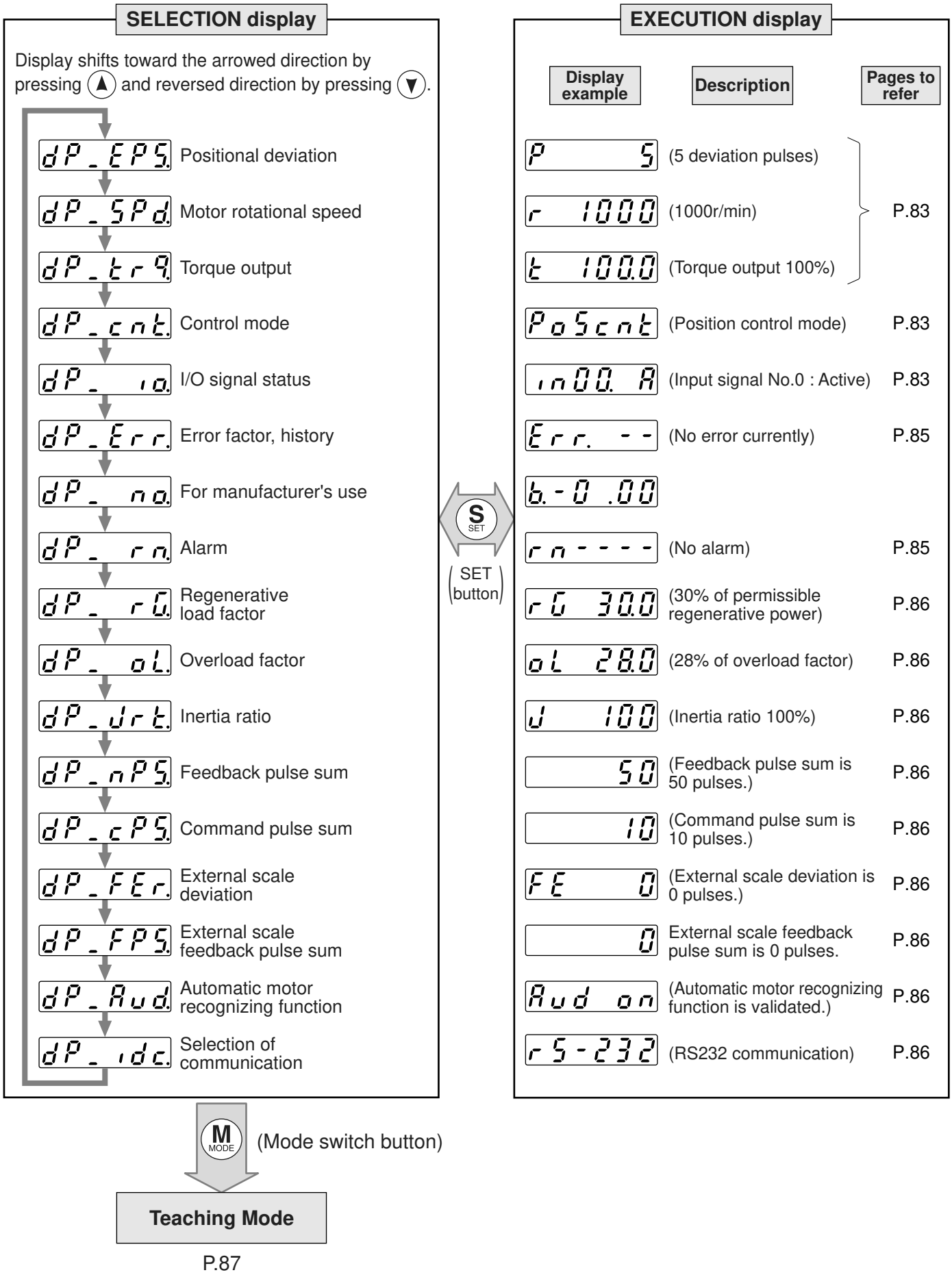
Show a target mode to be executed, select it by the (▲)(▼) button and press (S SET) to enter the **EXECUTION display** screen.

<Note>

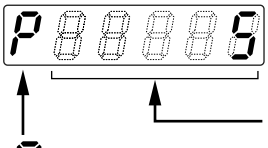
*1: Depends on the settings of the initial LED state of SV.Pr01.

How to Use the Console

Monitor Mode



Display of Position Deviation, Motor Rotational Speed and Torque Output



P .....Positional deviation (cumulative pulse counts of deviation counter)
- – display : generates rotational torque of CW direction (viewed from shaft end)
  no display : generates rotational torque of CCW direction (viewed from shaft end)

r .....Rotational speed of the motor unit [r/min]
- – display : CW rotation, no display : CCW rotation

t .....Torque command unit [%] (100 for rated torque)
- – display : CW rotation, no display : CCW rotation

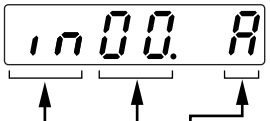
<Note>
" + " is not displayed on LED, but only " - " appears.

Display of Control Mode

PoScnt .....Position control mode FcLcnt .....Full-closed control mode

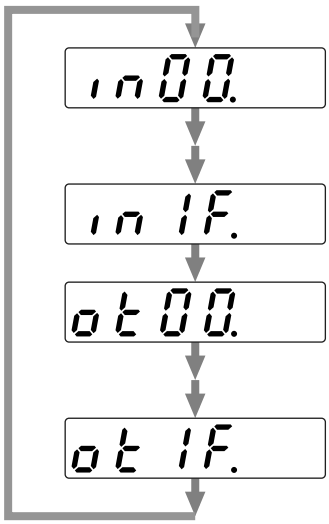
Display of I/O Signal Status

Displays the control input and output signal to be connected to CN X5 connector.



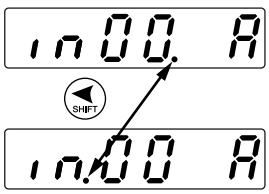
Select the signal No. to be monitored by pressing ▲▼.

Transition when pressing ▲.

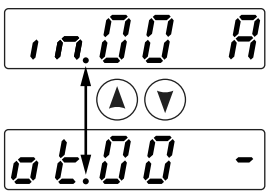


<Note>

- Shift the flashing decimal point with SHIFT.



- The other way to change signal No. at I/O selection mode Signal selection mode.



• Signal No. and its title

Input signal		
Signal No.	Title	Symbol
00	Servo-ON	SRV-ON
01	(For manufacturer's use)	
02	CW over-travel inhibit input	CWL
03	CCW over-travel inhibit input	CCWL
04	(For manufacturer's use)	
05	(For manufacturer's use)	
06	(For manufacturer's use)	
07	Multi-function input 1	EX-IN1
08	Multi-function input 2	EX-IN2
09	(For manufacturer's use)	
0A	(For manufacturer's use)	
0B	Home sensor input	Z-LS
0C	(For manufacturer's use)	
0D	(For manufacturer's use)	
0E	Emergency stop input	EMG-STP
0F	(For manufacturer's use)	
10	(For manufacturer's use)	
11	(For manufacturer's use)	
12	(For manufacturer's use)	
13	(For manufacturer's use)	
14	(For manufacturer's use)	
15	(For manufacturer's use)	
16	Point specifying input	P1IN
17	Point specifying input	P2IN
18	Point specifying input	P4IN
19	Point specifying input	P8IN
1A	Point specifying input	P16IN
1B	Point specifying input	P32IN
1C	Strobe signal input	STB-IN
1D	(For manufacturer's use)	
1E	(For manufacturer's use)	
1F	(For manufacturer's use)	

Output signal		
Signal No.	Title	Symbol
00	(For manufacturer's use)	
01	Servo alarm output	ALM
02	Positioning completion output/Output during deceleration	COIN/DCLON
03	Brake release output	BRK-OFF
04	(For manufacturer's use)	
05	(For manufacturer's use)	
06	(For manufacturer's use)	
07	Motor operation condition output	BUSY
08	(For manufacturer's use)	
09	(For manufacturer's use)	
0A	(For manufacturer's use)	
0B	(For manufacturer's use)	
0C	(For manufacturer's use)	
0D	(For manufacturer's use)	
0E	(For manufacturer's use)	
0F	(For manufacturer's use)	
10	Present position output	P1OUT
11	Present position output	P2OUT
12	Present position output	P4OUT
13	Present position output	P8OUT
14	Present position output	P16OUT
15	Present position output	P32OUT
16	(For manufacturer's use)	
17	(For manufacturer's use)	
18	(For manufacturer's use)	
19	(For manufacturer's use)	
1A	(For manufacturer's use)	
1B	(For manufacturer's use)	
1C	(For manufacturer's use)	
1D	(For manufacturer's use)	
1E	(For manufacturer's use)	
1F	(For manufacturer's use)	

*For details of Signal, refer to P.42 to 47.

• Point Number Conversion Table

The console shows the point numbers in the specified point input (No. 16 to 1B) and the current position output (No. 10 to 15) for the of I/O signal state. The point number is expressed in a six-digit binary number. Convert the point number from the I/O signal state referring to the table below.
The console shows [A] or [-] below when SV.Pr58 is “1”. If SV.Pr58 is “0”, interchange [A] and [-] with each other.

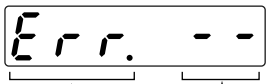
Input signal No.	1B	1A	19	18	17	16
Output signal No.	15	14	13	12	11	10
Point No.	P32	P16	P8	P4	P2	P1
0	–	–	–	–	–	–
1	–	–	–	–	–	A
2	–	–	–	–	A	–
3	–	–	–	–	A	A
4	–	–	–	A	–	–
5	–	–	–	A	–	A
6	–	–	–	A	A	–
7	–	–	–	A	A	A
8	–	–	A	–	–	–
9	–	–	A	–	–	A
10	–	–	A	–	A	–
11	–	–	A	–	A	A
12	–	–	A	A	–	–
13	–	–	A	A	–	A
14	–	–	A	A	A	–
15	–	–	A	A	A	A
16	–	A	–	–	–	–
17	–	A	–	–	–	A
18	–	A	–	–	A	–
19	–	A	–	–	A	A
20	–	A	–	A	–	–
21	–	A	–	A	–	A
22	–	A	–	A	A	–
23	–	A	–	A	A	A
24	–	A	A	–	–	–
25	–	A	A	–	–	A
26	–	A	A	–	A	–
27	–	A	A	–	A	A
28	–	A	A	A	–	–
29	–	A	A	A	–	A
30	–	A	A	A	A	–
31	–	A	A	A	A	A

Input signal No.	1B	1A	19	18	17	16
Output signal No.	15	14	13	12	11	10
Point No.	P32	P16	P8	P4	P2	P1
32	A	–	–	–	–	–
33	A	–	–	–	–	A
34	A	–	–	–	A	–
35	A	–	–	–	A	A
36	A	–	–	A	–	–
37	A	–	–	A	–	A
38	A	–	–	A	A	–
39	A	–	–	A	A	A
40	A	–	A	–	–	–
41	A	–	A	–	–	A
42	A	–	A	–	A	–
43	A	–	A	–	A	A
44	A	–	A	A	–	–
45	A	–	A	A	–	A
46	A	–	A	A	A	–
47	A	–	A	A	A	A
48	A	A	–	–	–	–
49	A	A	–	–	–	A
50	A	A	–	–	A	–
51	A	A	–	–	A	A
52	A	A	–	A	–	–
53	A	A	–	A	–	A
54	A	A	–	A	A	–
55	A	A	–	A	A	A
56	A	A	A	–	–	–
57	A	A	A	–	–	A
58	A	A	A	–	A	–
59	A	A	A	–	A	A
60	A	A	A	A	–	–
61	A	A	A	A	–	A
62	A	A	A	A	A	–
63	A	A	A	A	A	A

<Notice>

- [-] shows the OPEN state and [A] shows the CLOSED state.
- The number of point inputs can be specified in SV.Pr57.
- The logic of point input can be changed in SV.Pr58.
  The table above shows the case of "1: Point input is enabled by closing the connection to COM–".
  [A] and [-] are interchanged with each other in the case of "0: Point input is enabled by opening the connection to COM–".
- A point of "High-speed jog operation (negative direction)", "High-speed jog operation (positive direction)" and "Homing command" depends on the settings of SV.Pr57.

Reference of Error Factor and History



Error code No.
(- - appears if no error occurs)

Err. .....Present error

E-0. .....History 0 (latest error)

E 13. .....History 13 (oldest error)

- You can refer the last 14 error factors (including present one).
  Press ▲ ▼ to select the factor to be referred.

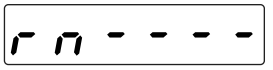
<Note>

- Following errors are not included in the history.
  - 11: Control power supply under-voltage protection
  - 13: Main power supply under-voltage protection
  - 36: EEPROM parameter error protection
  - 37: EEPROM check code error protection
  - 39: Emergency stop input error protection
  - 93: External scale auto recognition error protection
  - 95: Motor auto recognition error protection
- When one of the errors which are listed in error history occurs, this error and history o shows the same error No.
- When error occurs, the display flashes.

<Notice>

For the relation between an error code number and an error, refer to "Protective Function" in [When in Trouble] on page 164.

Alarm Display



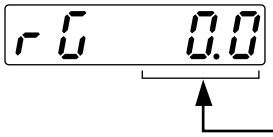
- ·····no alarm

·····Alarm occurrence

- **Over-load alarm** :
  Turns on when the load reaches 85% or more of alarm trigger level of over-load protection.
- **Over-regeneration alarm** :
  Turns on when regenerative load reaches more than 85% of alarm trigger level of regenerative load protection. Alarm trigger level is defined as 10% of regenerative resister working ratio, when Pr6C "Selection of external regenerative resister " is 1.
- **Battery alarm**
- **Fun-lock alarm**

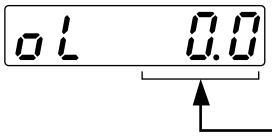
How to Use the Console

Display of Regenerative Load Factor



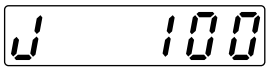
Shows regenerative resistance load factor in percentage assuming that an operation level of regenerative protection is 100%.
This is valid when SV.Pr6C is 0 or 1.

Display of Over-load Factor



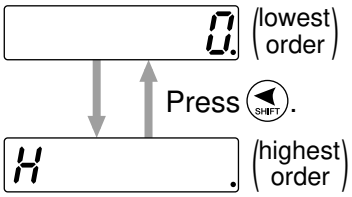
Displays the ratio (%) against the rated load.
Refer to P.170, "Overload Protection Time Characteristics" of When in Trouble.

Display of Inertia Ratio



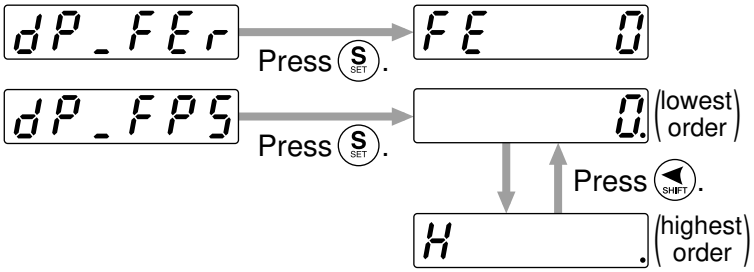
Displays the inertia ratio (%) .
Value of SV.Pr20 (Inertia ratio) will be displayed as it is.

Display of Feedback Pulse Sum, Command Pulse Sum



Total sum of pulses after control power-ON.
The display range is from –2147483647 to 2147483647.
An overflow occurs if the result is outside the display range.
Sum of pulses shown can be reset to " 0" by pressing (SET) for approximately 5 seconds or more.

Display of External Scale Deviation, External Scale Feedback Pulse Sum

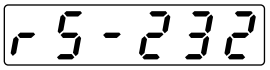


* Not available to the models that do not support external scale.

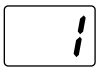
Automatic Motor Recognizing Function

Automatic recognition is valid. (This is always shown.)

Switching of the Driver to be Communicated



RS232 communication



....."1" is always shown.

Teaching Mode

Overview of Teaching Mode

In the teaching mode, you can operate the motor actually using this console, set a target position and execute a test operation, e.g., step operation, jog operation, etc.

Operation at SELECTION display

Press (S SET) once and (M MODE) once in the initial LED state

to show tEAch for the teaching mode.

To change the mode, press (▲) or (▼).

Test mode: tESt

Press (S SET).

StEP ...**Step operation** (refer to page 89). Moving to a selected point number.

Press (M MODE).

JoG ...**Jog operation** (refer to page 90). The motor rotates while pressing (▲) (▼) after pressing (S SET).

orG ...**Homing operation** (refer to page 90). Returning to a home position.

StEP

<Note>

- **When operating the motor, check the safety, e.g., whether the wiring is correct, whether the servo motor is fixed, etc.**
- **When a trouble, e.g., cable breakage, has occurred during a motor operation, the servo driver overruns a maximum of approximately 1s. Check the safety fully.**

Teaching Mode Setup

Operate the motor and set a target position.

Operation at EXECUTION display

Teaching mode display

Show tEAch and press (S SET).

EXECUTION display

0. Then, a current position is shown (lowest order).

Press (◀ SHIFT).

H A current position (highest order)

* The data is shown on the two screens because of a large number of displayed digits.

* If “Error” is shown, it may be caused by any of the factors below.

- Homing is not completed. • The servo turns off. • Operation by I/O etc.
- 16.Pr51 (wrap around permission) is set to “1”.

How to Use the Console

When you press (▲), the motor rotates by specified travel in a positive direction.
When you press (▼), the motor rotates by specified travel in a negative direction.
The travel can be set by 16.Pr48 (teaching travel setting).
The rotation speed can be set by16.Pr40 (jog speed [low]).
When you press (M MODE) during movement, the motor decelerates and stops.

When you keep on pressing (▲), the motor rotates continuously in a positive direction while pressing it.
When you keep on pressing (▼), the motor rotates continuously in a negative direction while pressing it.
The rotation speed can be set by16.Pr40 (jog speed [low]).
When you press (M MODE) during rotation, the rotation speed changes to a jog speed (high speed).

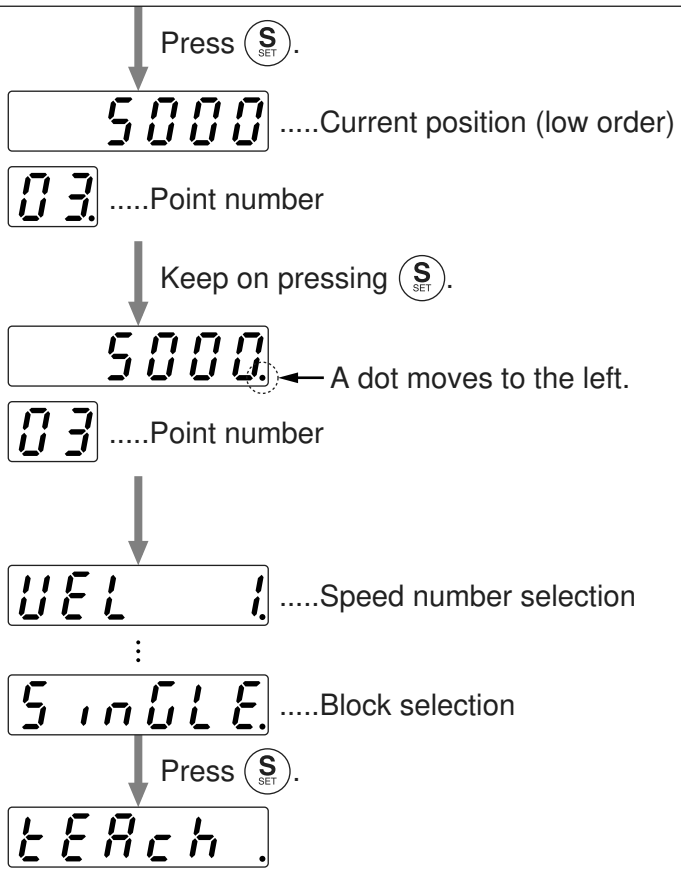
When you keep on pressing (▲) + (M MODE), the motor rotates continuously in a positive direction while pressing it.
When you keep on pressing (▼) + (M MODE), the motor rotates continuously in a negative direction while pressing it.
The rotation speed can be set by16.Pr41 (jog speed [high]).
When you press (M MODE) during rotation, the rotation speed changes to a jog speed (low speed).

Definition of positive or negative direction of rotation depends on the setting of 16.Pr50 (operating direction setting).
"Error" is shown when execution is made during an operation by I/O etc.
When you press (S SET), teaching is completed and you will be moved to the parameter number selection.
If you do not want to store a current position in a parameter, press (M MODE) after finishing teaching.

- **Parameter number selection**
  To store a current position, set a relevant point number using (◀ SHIFT), (▲) and/or (▼).

- **Target position setting**
  Select a point number and keep on pressing (S SET). A current position is set in a selected parameter and you will be moved to the speed number selection.

- **Step parameter setting**
  For the setting of the speed number selection – block selection, refer to "Step Parameters" on page 92.



* When you press (M MODE) during parameter setting, any parameter in process is not changed and tEAch shown again.
* When you set a target position by teaching, an operation mode fixed to the absolute value mode.
* If you set a target position manually when the servo turns off or main power supply turns off, set SV.Pr67 and SV.Pr69 to "Deviation counter clear".
* When you have set the parameters, write the parameters into EEPROM. If you turn the power supply off before writing the parameters into EEPROM, those parameters are cleared.

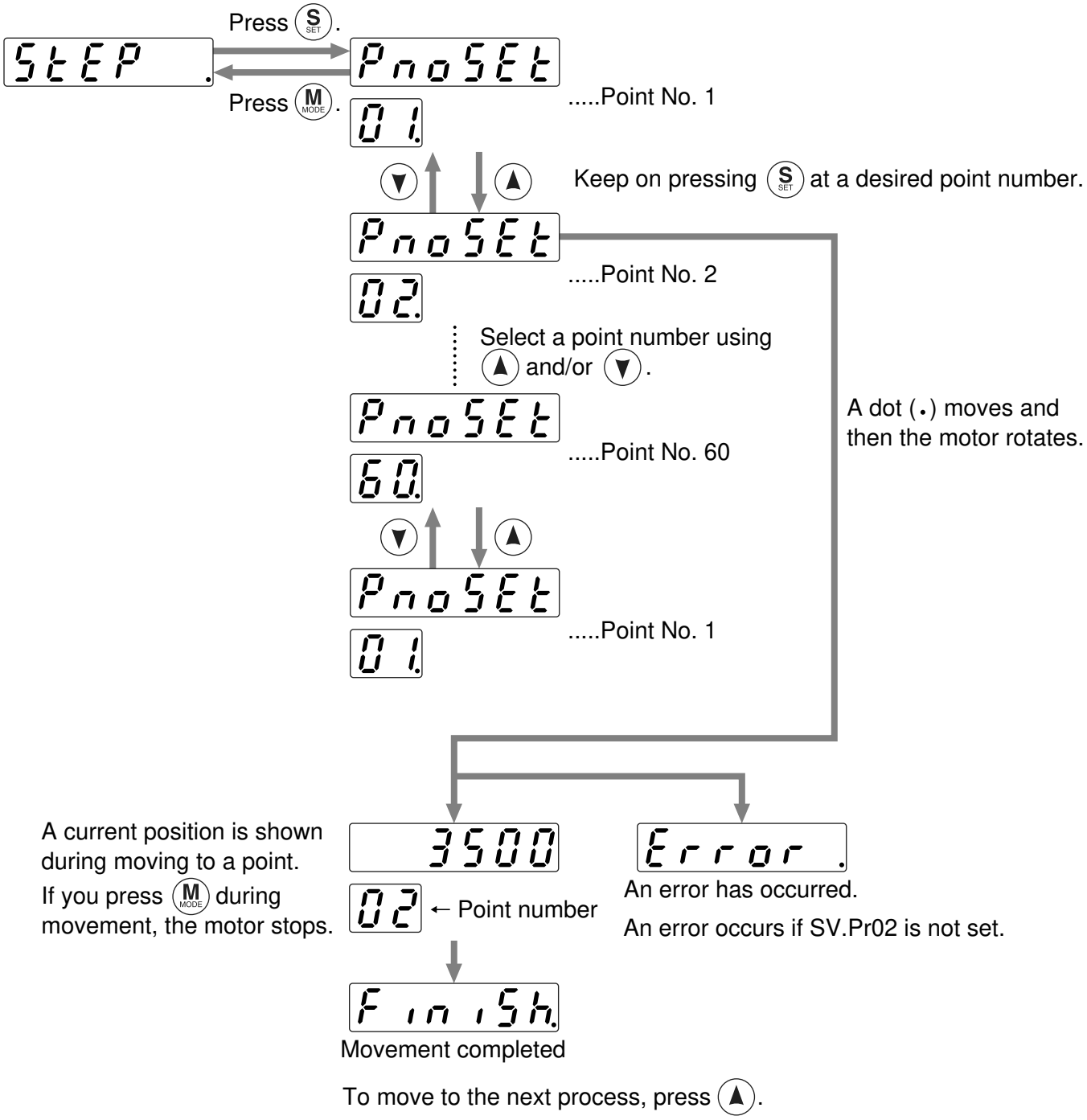
Test Mode

• Step operation

An operation is performed at a position of a selected point number.

* Execute homing completely before performing a step operation.

An example of an operation to move to the point No. 2 is shown below.



How to Use the Console

• Jog operation

The motor can be operated by the jog operation.

...A current position is shown during an operation.

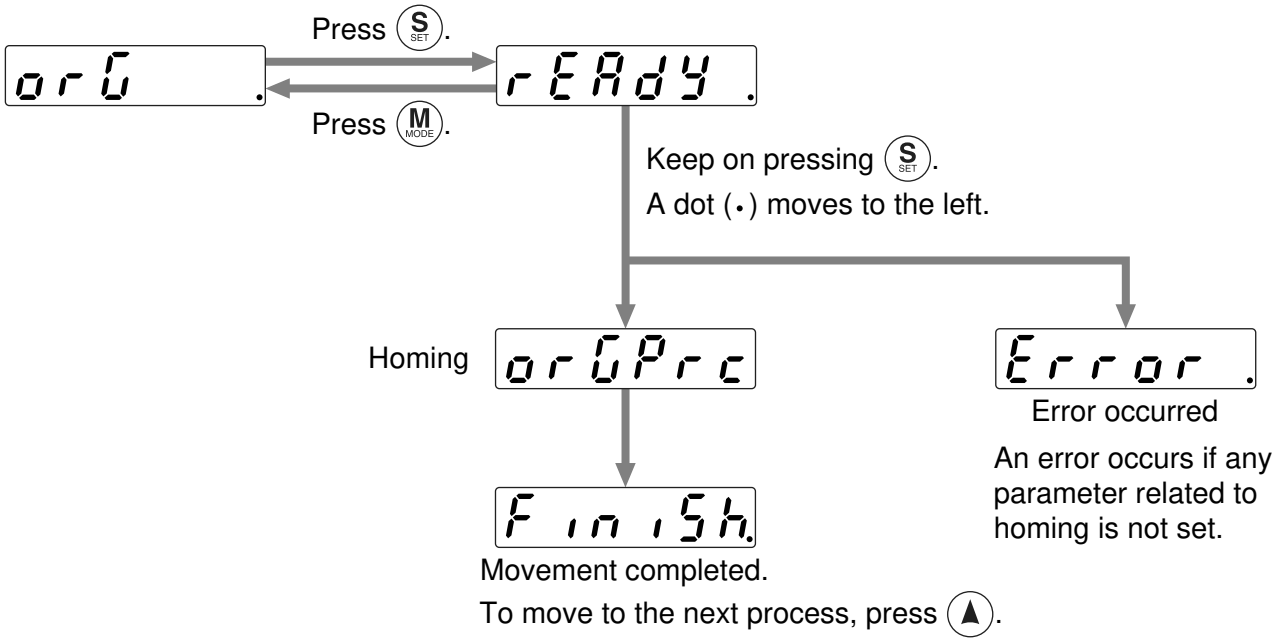
When you keep on pressing ▲, the motor rotates continuously in a positive direction while pressing it.
When you keep on pressing ▼, the motor rotates continuously in a negative direction while pressing it.
The rotation speed can be set by 16.Pr40 (jog speed [low]).
When you press M MODE during rotation, the rotation speed changes to a jog speed (low).

When you keep on pressing ▲ + M MODE, the motor rotates continuously in a positive direction while pressing it.
When you keep on pressing ▼ + M MODE, the motor rotates continuously in a negative direction while pressing it.
The rotation speed can be set by 16.Pr41 (jog speed [high]).
When you press M MODE during rotation, the rotation speed changes to a jog speed (high).

* Definition of positive or negative direction of rotation depends on the setting of 16.Pr50 (operating direction setting).
* If “Error” is shown, it may be caused by any of the factors below.
  • The servo turns off.
  • Operation by I/O etc.

• Homing

Homing is performed as follows.



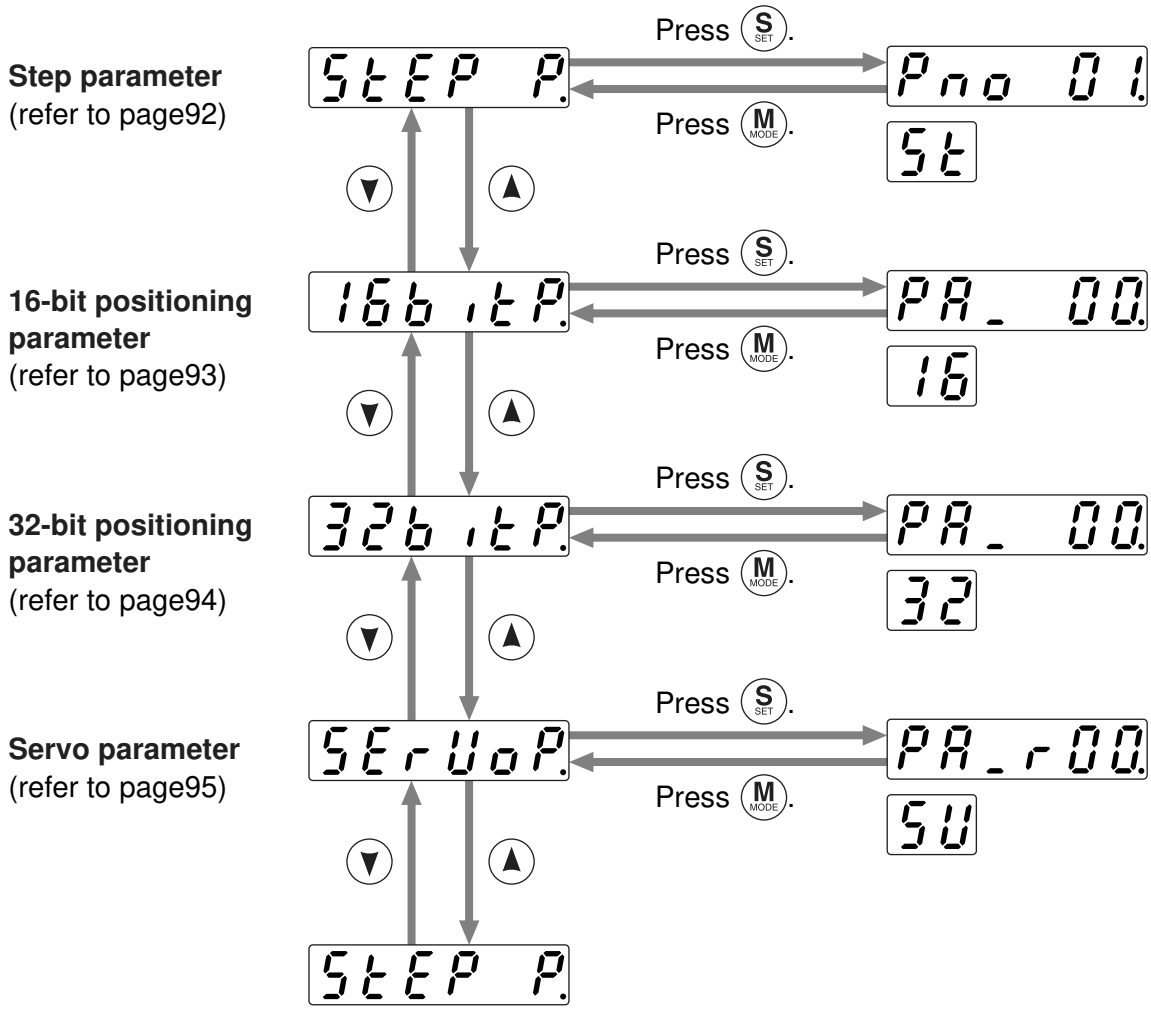
Parameter setup mode

Set the servo driver parameters.
The parameters are classified as follows:

- Step parameter (ST.Pr)
- 16-bit positioning parameter (16.Pr)
- 32-bit positioning parameter (32.Pr)
- Servo parameter (SV.Pr)

Structure of Parameter Setup Mode

When you press (S SET) once and (M MODE) twice in the initial LED state, the step parameter display shows StEP P.
Select a target parameter using (▼) and/or (▲).

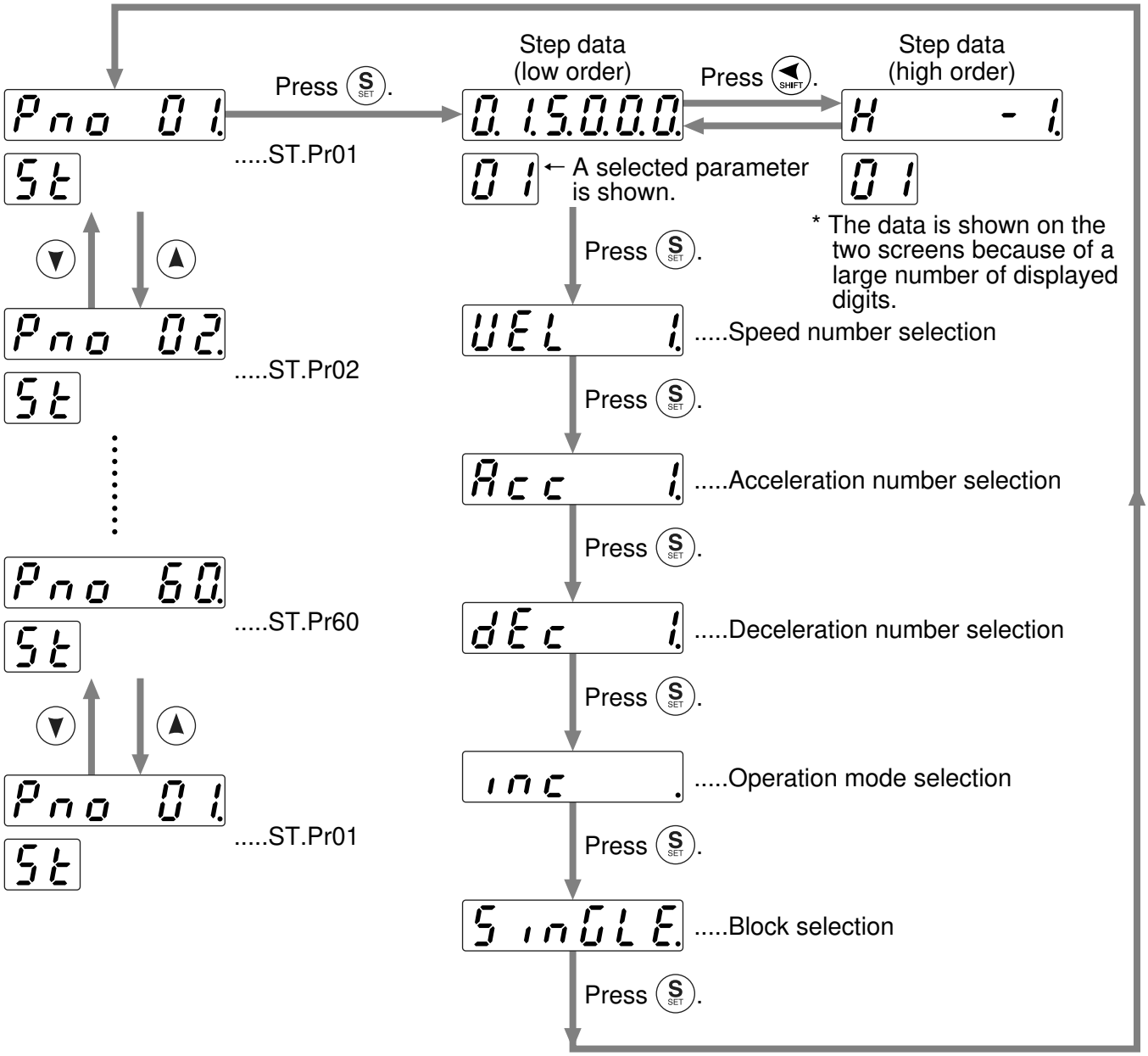


How to Use the Console

Step Parameter

Step parameter can be set.

* An example to set in ST.Pr1 is shown below.



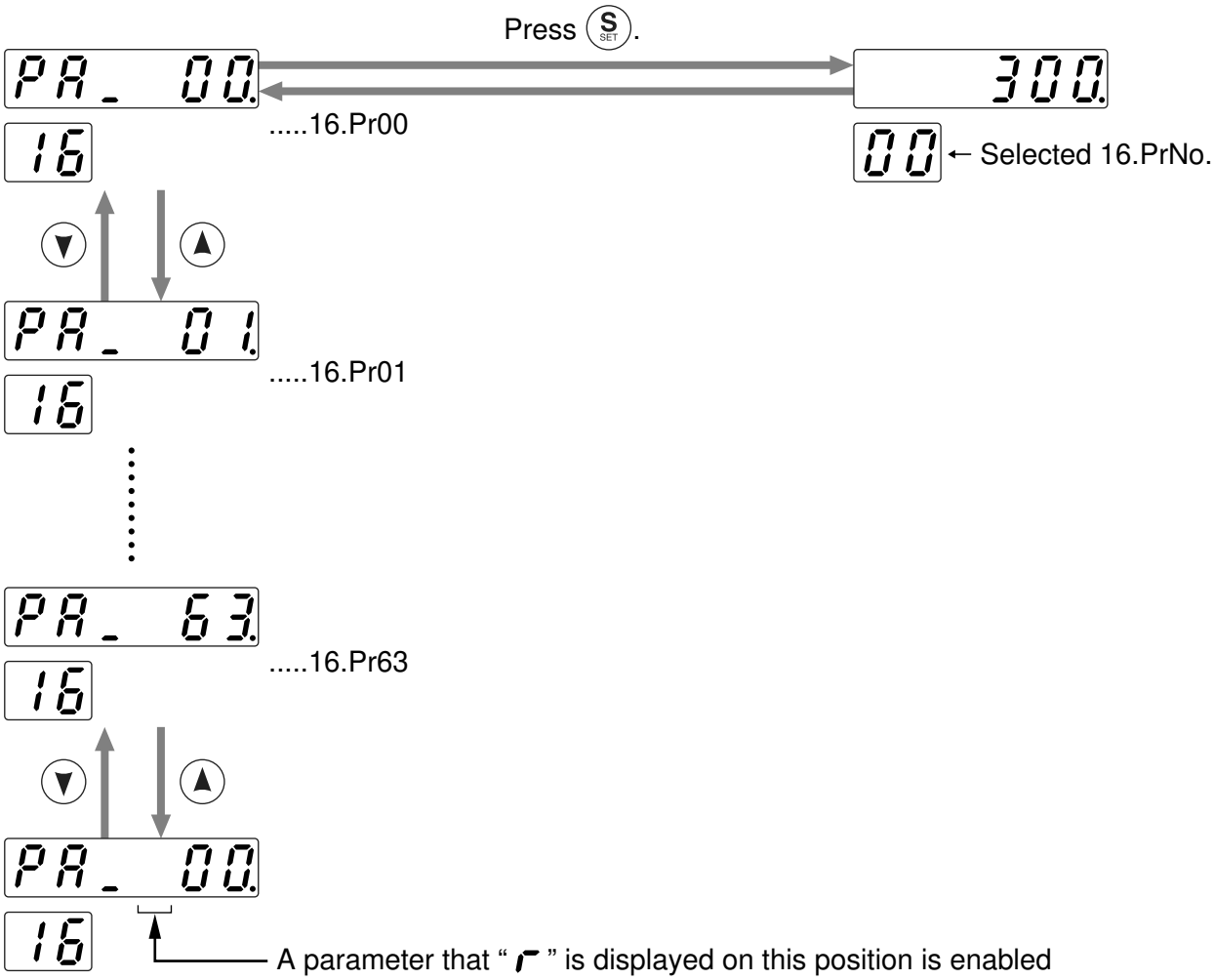
<Notice>

Select an input digit (a dot blinks) by the [SHIFT] key and a parameter by the [UP] /[DOWN] key.
The step data is shown on the two screens because of a large number of displayed digits.
If the parameter is a negative value, a dot lights.
When you press the [SET] key, the parameter is modified.

* When you press M MODE during parameter setting, any parameter in process is not changed and “No.” display is shown again.
* When you have set the parameters, write the parameters into EEPROM. If you turn the power supply off before writing the parameters into EEPROM, those parameters are cleared.

16-Bit Positioning Parameter

16-bit positioning parameter can be set.



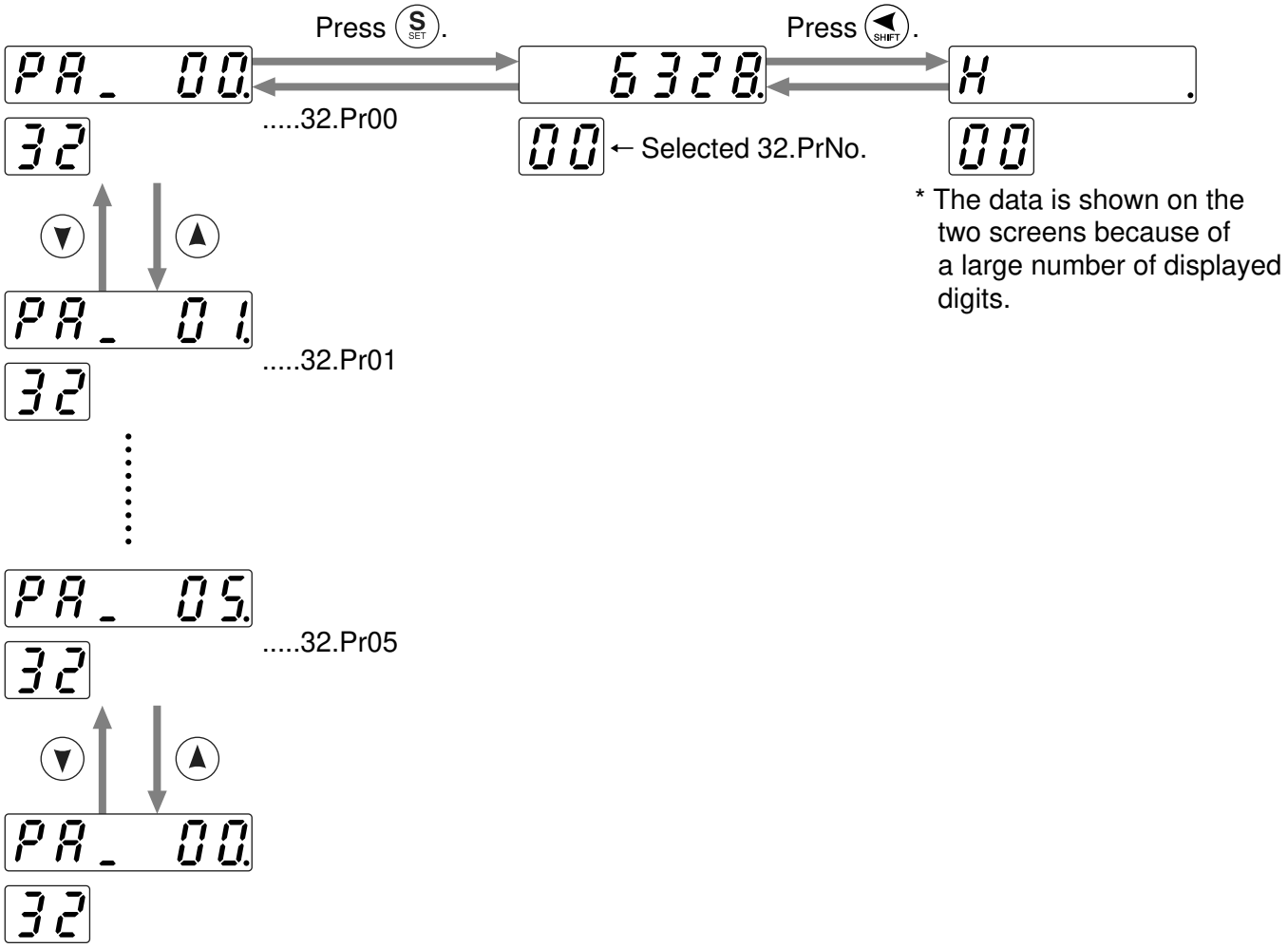
<Notice>
Select an input digit (a dot blinks) by the [SHIFT] key and a parameter by the [UP] /[DOWN] key. When you press the [SET] key, the parameter is modified.

* When you press M during parameter setting, any parameter in process is not changed and "No." display is shown again.
* When you have set the parameters, write the parameters into EEPROM. If you turn the power supply off before writing the parameters into EEPROM, those parameters are cleared.

How to Use the Console

32-Bit Positioning Parameter

32-bit positioning parameter can be set.



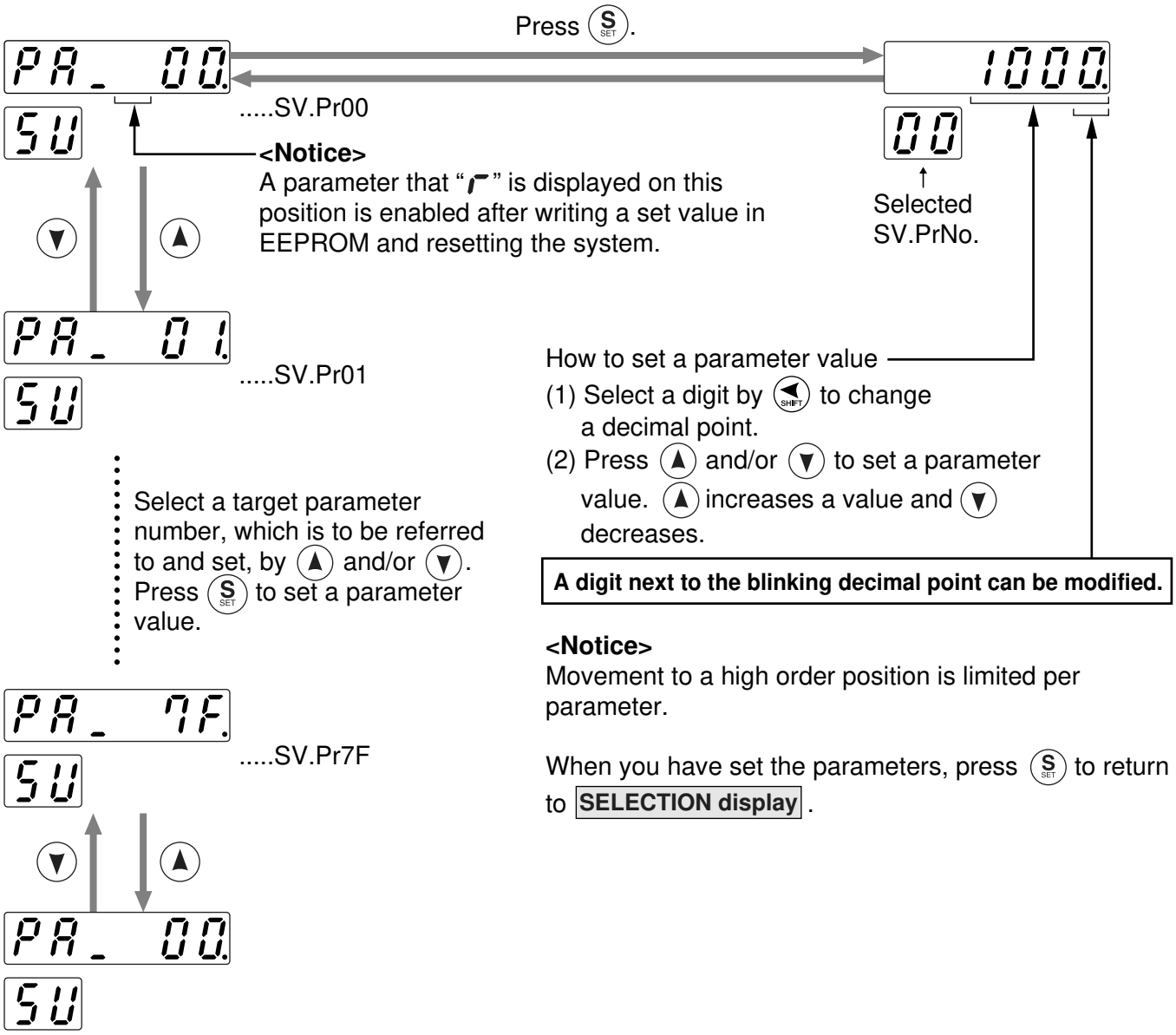
<Notice>

Select an input digit (a dot blinks) by the [SHIFT] key and a parameter by the [UP] /[DOWN] key.
The 32-bit positioning parameter is shown on the two screens because of a large number of displayed digits.
If the parameter is a negative value, a dot lights.
When you press the [SET] key, the parameter is modified.

* When you press M MODE during parameter setting, any parameter in process is not changed and “No.” display is shown again.
* When you have set the parameters, write the parameters into EEPROM. If you turn the power supply off before writing the parameters into EEPROM, those parameters are cleared.

Servo Parameter

Servo parameter can be set. For the details of parameter, refer to “Parameter Setup” on page 56.



<Notice>
Movement to a high order position is limited per parameter.

When you have set the parameters, press S to return to **SELECTION display** .

<Remarks>
When you change a parameter value and press S, the change is reflected in the control. Modify gradually a value of parameter (especially, velocity loop gain, position loop gain, etc.) which exerts an influence on the motor operation, not changing it extremely at a time.

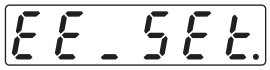
* When you have set the parameters, write the parameters into EEPROM. If you turn the power supply off before writing the parameters into EEPROM, those parameters are cleared.

How to Use the Console

EEPROM Write Mode

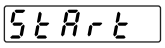
EEPROM Writing

Operation at SELECTION display

Starting from the initial LED status, press (M MODE) three time after pressing (S SET), then brings the display of EEPROM Writing Mode, 

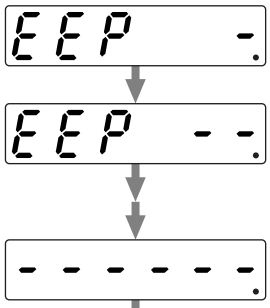
Operation at EXECUTION display

Press (S SET) to make EXECUTION DISPLAY to 

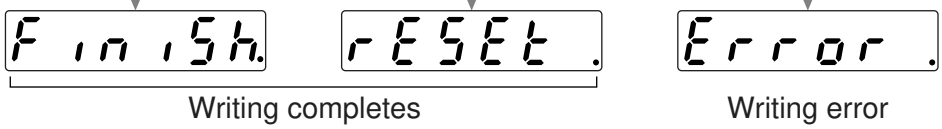
Keep pressing (▲) until the display changes to 

when you execute writing.

" - " increases while keep pressing (▲) (for approx. 5sec) as the right fig. shows.

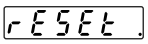


Starts writing. 

Finishes writing 

Writing completes — Writing error

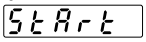
To move to the next process, press (▲).

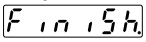
- When you change the parameters which contents become valid after resetting, 

will be displayed after finishing wiring. Turn off the control power once to reset.

Note 1) When writing error occurs, make writing again. If the writing error repeats many times, this might be a failure.

Note 2) Don't turn off the power during EEPROM writing. Incorrect data might be written. If this happens, set up all of parameters again, and re-write after checking the data.

Note 3) Between 

and 

, take care not to pull out a console connector from a servo driver main unit. If the connector is pulled out accidentally, insert the connector again and retry from the beginning.

<Notice>

When you have set the parameters, write the parameters into EEPROM. If you turn the power supply off before writing the parameters into EEPROM, those parameters are cleared.

Auto-Gain Tuning Mode

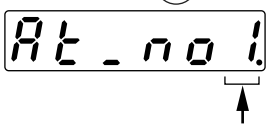
Normal Mode Auto-Gain Tuning Screen

<Remarks>

- For details of normal auto-gain tuning, refer to P.148, "Normal Auto-Gain Tuning" of Adjustment. Pay a special attention to applicable range and cautions.
- The motor will be driven in a preset pattern by the driver in normal auto-gain tuning mode. You can change this pattern with SV.Pr25 (Normal auto tuning motion setup), however, shift the load to where the operation in this pattern may not cause any trouble, then execute this tuning.
- Depending on the load, oscillation may occur after the tuning. In order to secure the safety, use the protective functions of SV.Pr26 (Software limit set up), SV.Pr70 (Position deviation error level) or SV.Pr73 (Overspeed level).

Operation at SELECTION display

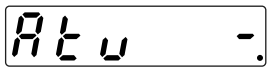
Starting from the initial LED status, press (M MODE) four time after pressing (S SET), then brings the display of normal auto-gain tuning, then press (▲) (▼) to select the machine stiffness No.



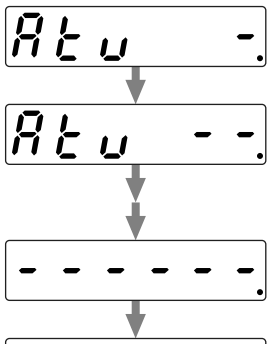
machine stiffness No.
(1 to 9, A (10) to F (15))

<Note>
For machine stiffness No., refer to P.148.

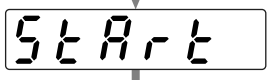
Operation at EXECUTION display

Press (S SET) to make EXECUTION DISPLAY to 

After inhibiting command input, and during Servo-On status,keep pressing (▲) until Console (LED) display changes to StArt .



" - " increases by pressing (▲) (approx. 5sec) as the left fig. shows.

Starting of the motor 

Tuning finishes. 

Tuning completes　　Tuning error

<Note>
To prevent the loss of gain value due to the power shutdown, write into EEPROM.

When you have finished the tuning, press (S SET) to return to **SELECTION display**.

<Remarks>

Don' t disconnect the console from the driver between StArt **and** Finish. .

Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

<Note> If the following status occurs during the tuning action, the tuning error occurs.

(1) During the tuning action, 1) when an error occurs, 2) when turned to Servo-OFF, 3) even the deviation counter is cleared and 4) when the tuning is actuated close to the limit switch.
(2) When the output torque is saturated because the inertia or load is too large.
(3) When the tuning can not be executed well causing oscillation.

If the tuning error occurs, value of each gain returns to the previous value before the tuning. The driver does not trip except error occurrence. Depending on the load, the driver might oscillate without becoming tuning error. (not showing Error .) Extra attention should be paid to secure the safety.

How to Use the Console

Auxiliary Function Mode

The console has two auxiliary functions.

(1) Alarm Clear

A protection function works and a motor stop (motor trip) can be canceled.

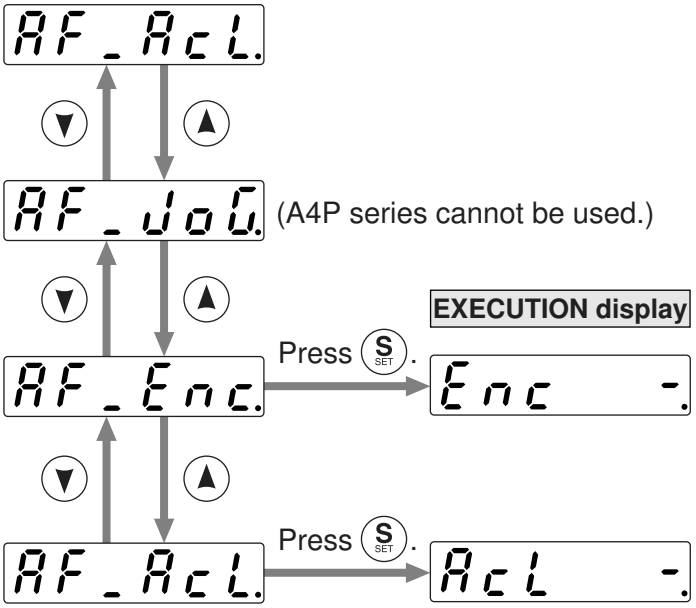
(2) Absolute encoder clear

A value of absolute encoder is cleared.

Structure of Auxiliary Function Mode

Operation at SELECTION display

Starting from the initial LED status, Press (M MODE) five time after pressing (S SET), then brings the display of Auxiliary Function Mode,

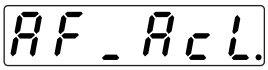


Select a desired function using (▲) and/or (▼) and press (S SET) to change into [EXECUTION] display.

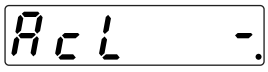
Alarm Clear Screen

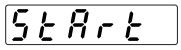
Protective function will be activated and release the motor stall status (error status).

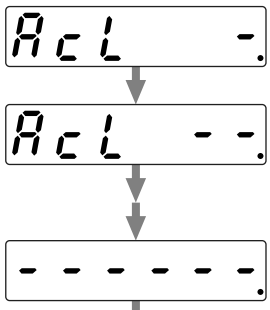
Operation at SELECTION display

Starting from the initial LED status,
Press (M MODE) five time after pressing (S SET),
then press (▲) (▼) to make a display to 

Operation at EXECUTION display

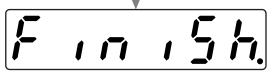
Press (S SET) to call for
EXECUTION display of 

Keep pressing (▲) until the console (LED)
changes to 

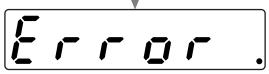


" - " increases by pressing (▲)
(approx. 5sec) as the right fig. shows.

Alarm clear starts. 

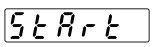
Clearing finishes. 

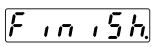
Alarm clear completes



Clear is not finished.
Release the error by resetting the power.

When you have set the alarm clear, press (S SET) to return to **SELECTION display**.

<Remarks>
Don't disconnect the console from the driver between 

and 

.
Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

How to Use the Console

Clearing of Absolute Encoder

Only applicable to the system which uses absolute encoder. You can clear the alarm and multi-turn data of the absolute encoder.

Operation at SELECTION display

Press (M MODE) five time after pressing (S SET), to setup auxiliary function mode, then with (▲) (▼) , make a display to AF_Enc

Operation at EXECUTION display

Press (S SET) to call for EXECUTION DISPLAY of Enc -.

Then keep pressing (▲) until the display of Console (LED) changes to StArt

Enc -. → Enc - -. → - - - - - -

" - " increases by pressing (▲) (approx. 5sec) as the left fig. shows.

Clearing of absolute encoder starts StArt

Clearing finishes

- FinISh. — Clearing of absolute encoder completes
- Error . — Error occurs (When non-applicable encoder is connected)

A incremental encoder or any unsupported encoder other than an absolute encoder may be connected. Reset the power supply and clear the error.

When you have cleared the absolute encoder, press (S SET) to return to **SELECTION display** .

<Remarks>

Don' t disconnect the console from the driver between StArt **to** FinISh **.**

Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

<Notice>

If an error code No. 40 is shown on the console immediately after purchase, clear the absolute encoder through the console.

Copying Function (Console Only)

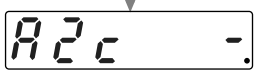
Copying of Parameters from the Driver to the Console

Operation at SELECTION display

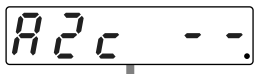
Starting from initial LED status, Press (M MODE) six time after pressing (S SET), then press (▲) (▼), to make a display to

Operation at EXECUTION display

Press (S SET) to call for EXECUTION DISPLAY of

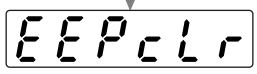


Keep pressing (▲) until the console display (LED) changes to EEPclr.

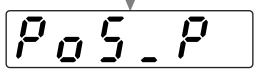


" - " increases by pressing (▲) (approx. 3sec) as the left fig. shows.

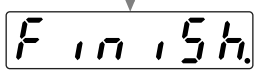
Initialization of EEPROM of the console starts.



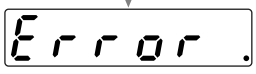
The positioning parameter is copied from the servo driver into the console and the positioning parameter is written into EEPROM (console).



The servo parameter and driver type code are copied from the servo driver into the console and the driver type code of the servo parameter is written into EEPROM (console).



Copying completes normally.



Error display

<Remarks>
If error is displayed, repeat the procedures from the beginning.
Press (S SET) for releasing error.

To move to the next process, press (▲).

When you have finished the copy, press (S SET) to return to **SELECTION display**.

<Remarks>
Don' t disconnect the console from the driver between EEPclr **to** SrU_P **.**
Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

<Note>
If the error display repeats frequently, check the broken cable, disconnection of the connector, misoperation due to noise or failure of console.

How to Use the Console

Copying of Parameters from the Console to the Driver

Operation at SELECTION display

Starting from initial LED status,Press (M MODE) six time after pressing (S SET), then press (▲) (▼)
to make a display to

Operation at EXECUTION display

Press (S SET) to call for
EXECUTION DISPLAY of

Keep pressing (▲) until
the console display (LED)
change.

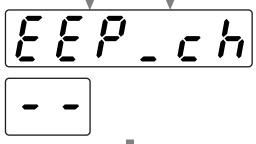
" - " increases by
pressing (▲) (approx. 3sec)
as the left fig. shows.

If a type code stored in EEPROM (console)
and another type code of servo driver are
different from each other.

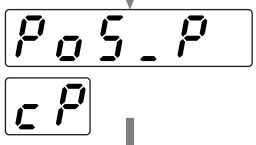
Press (M MODE).

When you keep on pressing (◀ SHIFT),
a dot (.) moves to the left.

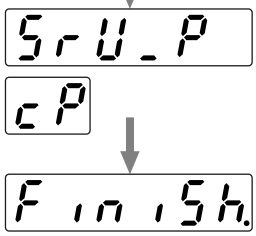
Check whether or not to
transfer the read parameter
to the servo driver.



The positioning parameter is
copied from the console into the
servo driver.

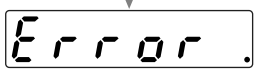


The servo parameter is copied
from the console into the servo
driver and the driver type code of
the servo parameter is written into
EEPROM (console).



Copying completes normally.

To move to the next process, press (▲).



Error display

<Remarks>
If error is displayed,
repeat the procedures
from the beginning.

When you have finished the copy, press (S SET) to return to **SELECTION display**.

<Remarks>
Don' t disconnect the console from the driver between EEP_ch **to** SrU_P **.**
Should the connector is pulled out, insert it again and repeat the procedures from the beginning.

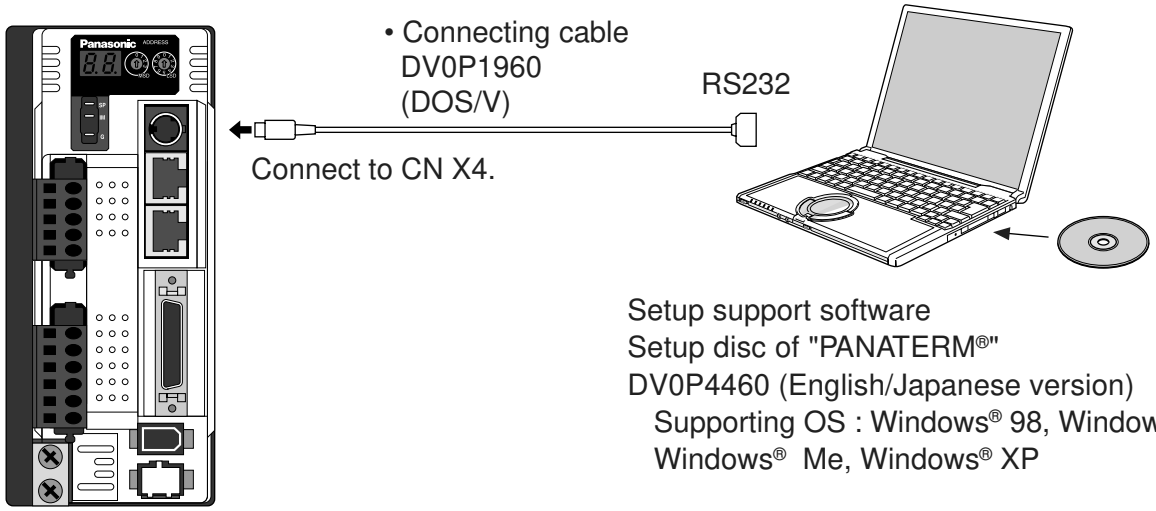
<Note>
If the error display repeats frequently, check the broken cable, disconnection of the connector, misoperation due to noise or failure of console.

Outline of Setup Support Software, "PANATERM®" [Setting]

Outline of PANATERM®

With the PANATERM®, you can execute the followings.
(1) Setup and storage of parameters, and writing to the memory (EEPROM).
(2) Monitoring of I/O and pulse input and load factor.
(3) Display of the present alarm and reference of the error history.
(4) Data measurement of the wave-form graphic and bringing of the stored data.
(5) Normal auto-gain tuning
(6) Frequency characteristic measurement of the machine system.

How to Connect



Setup support software
Setup disc of "PANATERM®"
DV0P4460 (English/Japanese version)
Supporting OS : Windows® 98, Windows® 2000, Windows® Me, Windows® XP

Install the "PANATERM®" to Hard Disc

<Cautions/Notes>
1. 15MB capacity of hard disc is required. OS to be Window® 98, Windows® 2000, Windows® Me or Windows® XP.
2. Install the "PANATERM®" to a hard disc, using the setup disc according to the procedures below to log on.

Procedure of install

1) Turn on the power of the computer to log on the supporting OS. (Exit the existing logged on software.)
2) Insert the setup disc of the "PANATERM®" to CD-ROM drive.
3) When a window has opened automatically, click a name of file required.
   * If a window has not opened automatically, execute the target setup file through the Explorer.
4) Operate according to the guidance of the setup program file.
5) Click [OK] on the installation verification window to start the setup.
6) Exit all applications and log on Windows® again.
   "PANATERM®" will be added on program menu when you log on again.

Outline of Setup Support Software, "PANATERM®"

Log on of the "PANATERM®" .

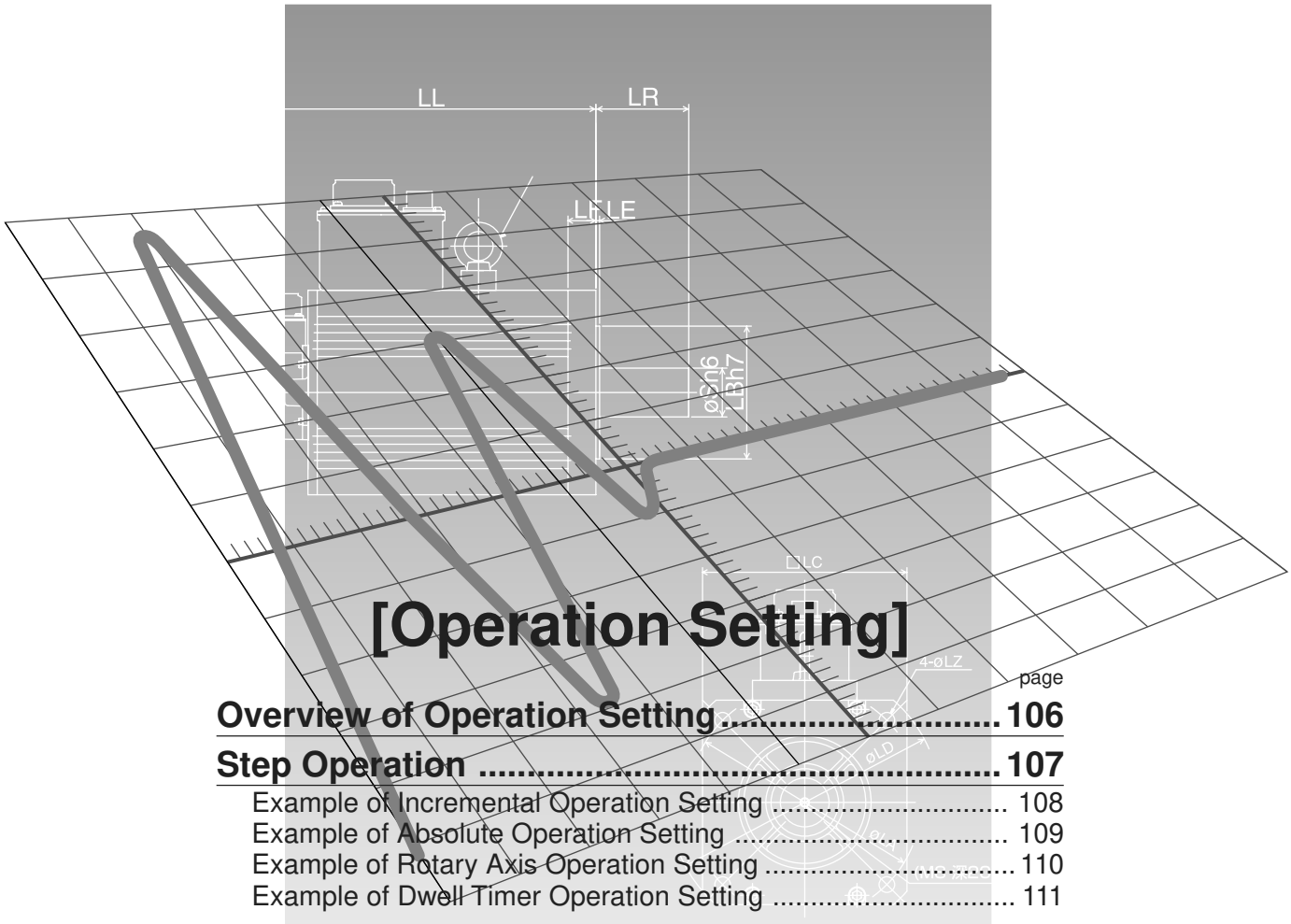
<Cautions/Notes>

1. Once the "PANATERM®" is installed in the hard disc, you do not need to install every time you log on.
2. Connect the driver to a power supply, the motor and encoder before you log on.
   Refer to the instruction manual of supporting OS for start.

Procedure of log on

1) Turn on the power of the computer and log on the supporting OS.
2) Turn on the power of the driver.
3) Click the start bottom of the supporting OS.
   (Refer to the instruction manual of supporting OS for start.)
4) Select the "PANATERM®" with program ► and click.
5) The screen turns to "PANATERM®" after showing opening splash for approx. 2sec.

For more detailed information for operation and functions of the "PANATERM®", refer to the instruction manual of the Setup Support Software, "PANATERM®".



[Operation Setting]

Overview of Operation Setting

In MINAS A4P, the following operations can be performed.

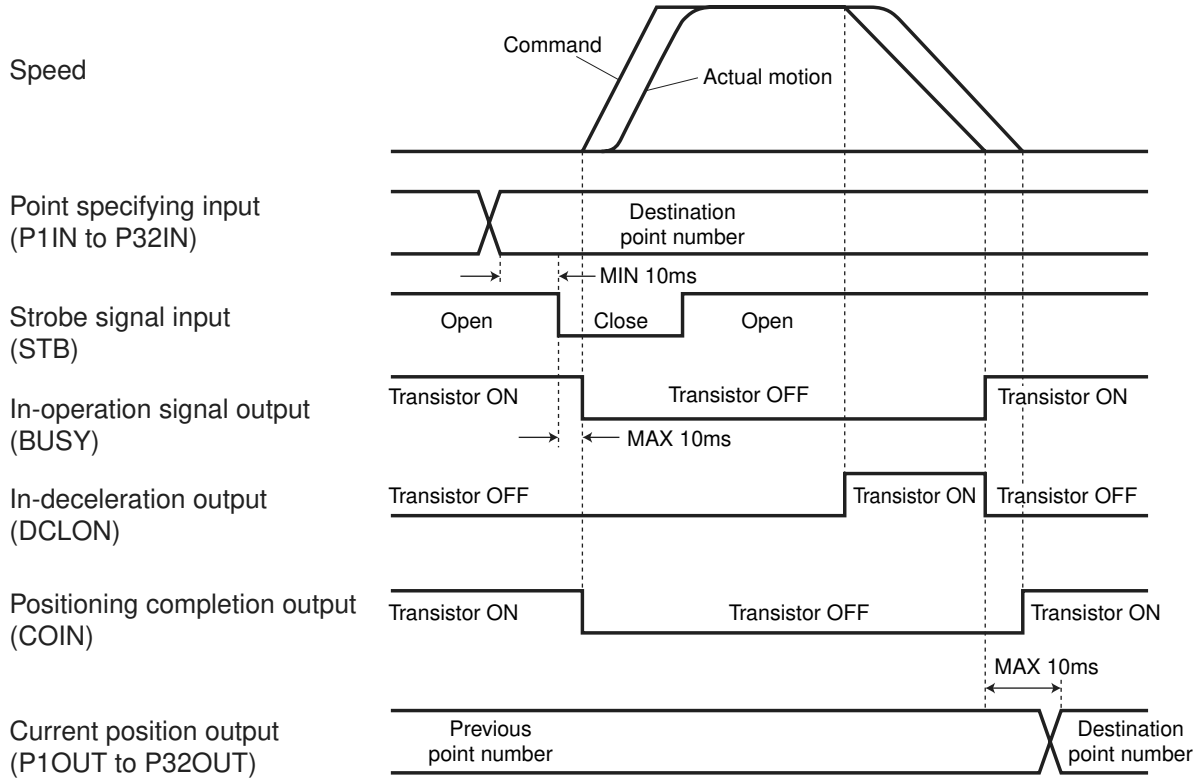
Step operation P.107	The most basic operation. Specify a point number set in advance when performing the operation. The four types of modes are available, i.e., an incremental operation, absolute operation, rotary axis operation and dwell timer (waiting time).
Jog operation P.112	The motor can be moved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

<Notice>

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

Step Operation

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



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

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

Step Operation

Caution

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

Step Operation Mode

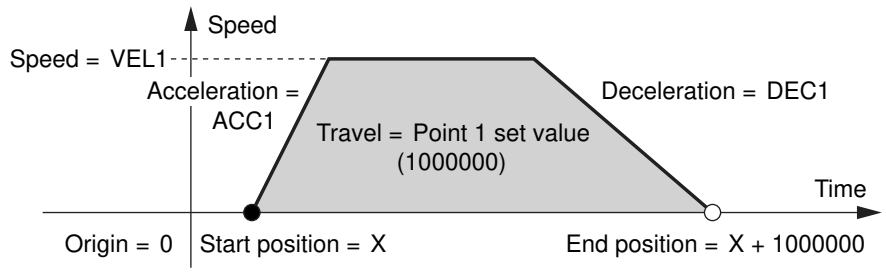
For a positioning operation in this servo driver, you can select any of the four types of operation modes. For the details of each operation mode, refer to the relevant page.

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

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

Example of Incremental Operation Setting

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



• **Setting of 16-bit positioning parameter**

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

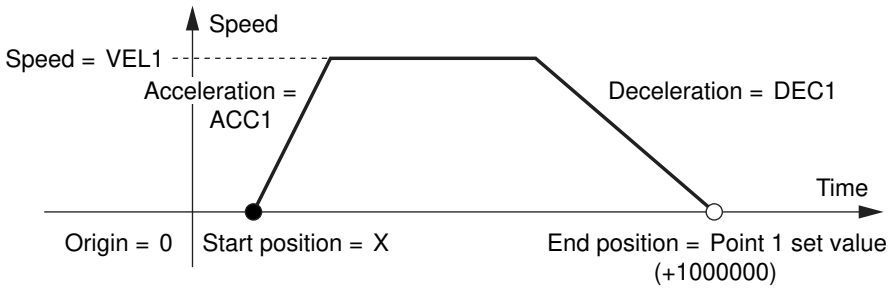
1. Set the 16-bit positioning parameter in the table above to any value and specify the step parameter as shown below.
2. Perform homing. (Refer to “Homing” on page 114.)
3. Specify the point 1 when the servo turns on and connect the strobe signal input (STB: CN X5 Pin 24) to COM–. Then, an operation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

• **Setting of step parameter**

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

Example of Absolute Operation Setting

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



• **Setting of 16-bit positioning parameter**

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

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

• **Setting of step parameter**

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

Caution

1) Wrap around

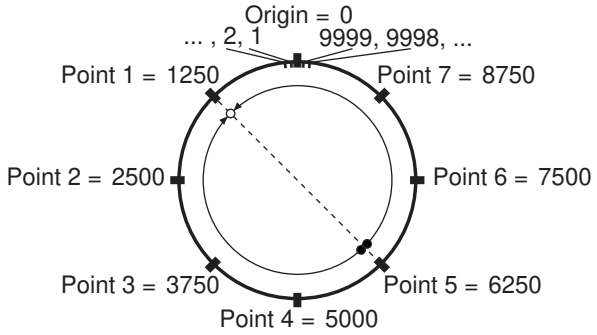
If 16.Pr51 (wrap around accepted) is set to “1”, although an error does not occur when wrap around happens, an absolute position cannot be guaranteed. If you will combine the absolute operation mode and incremental operation mode with each other, take care not to cause the wrap around or do not use the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

Step Operation

Example of Rotary Axis Operation Setting

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

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



• Setting of 32-bit positioning parameter

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

• Setting of step parameter

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

Caution

1) Control mode

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

2) Restrictions on parameter

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

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

3) Setting of step data

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

4) Jog operation

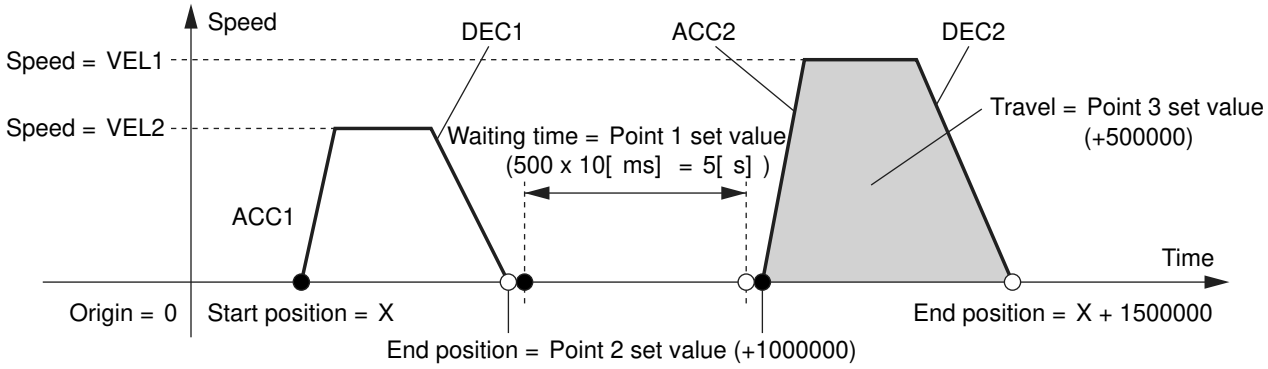
If you use the motor in the rotary axis operation, do not perform the jog operation after homing completes. The motor may exceed limitation of the current position. If you perform the jog operation by mistake, execute the homing again.

5) Servo off

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

Example of Dwell Timer Operation Setting

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



• Setting of 16-bit positioning parameter

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

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

• Setting of step parameter

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

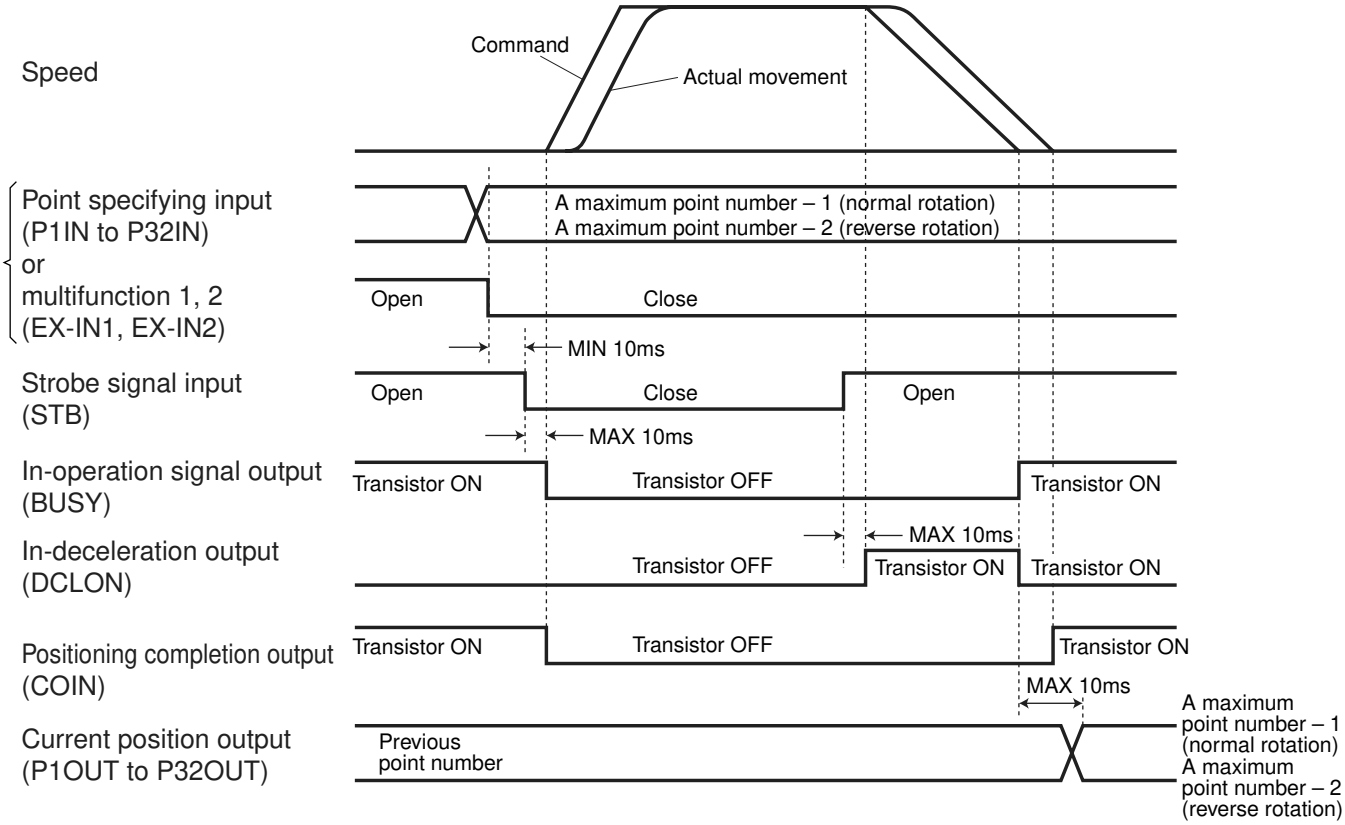
Caution

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

Jog Operation

Jog Operation

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



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

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

• **Parameters related to jog operation**

Set the parameters below when performing the jog operation.

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

Caution

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

Homing Operation

Homing Operation

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

A) Homing is completed when the power supply turns on

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

B) Homing is not completed

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

Homing Mode List

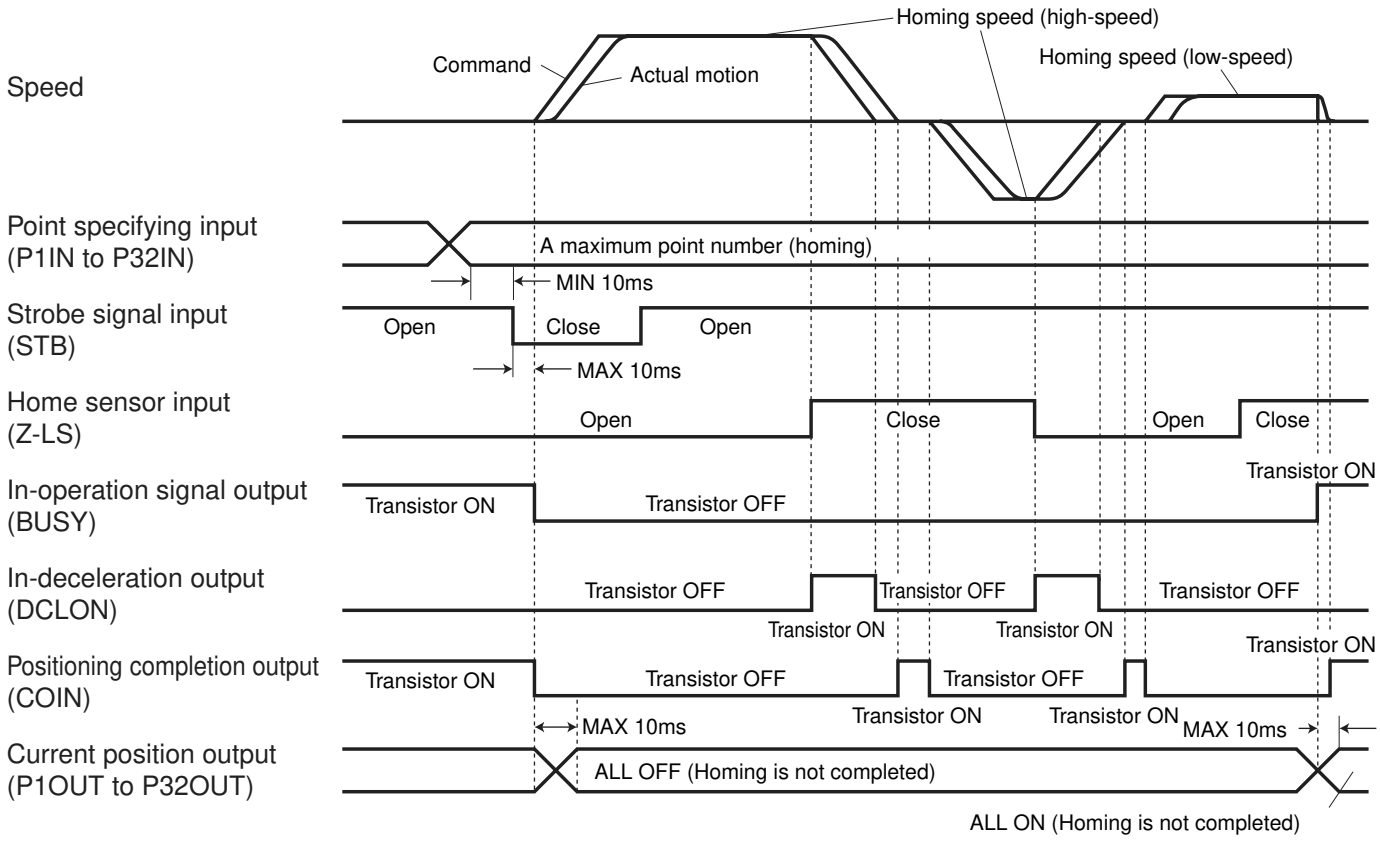
The table below lists the available homing modes selected by combining 16.Pr36 (Homing type) and control mode (SV.Pr02) with each other. For the details of each mode, refer to the relevant page (page 116 to page 123).

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

Caution

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

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



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

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

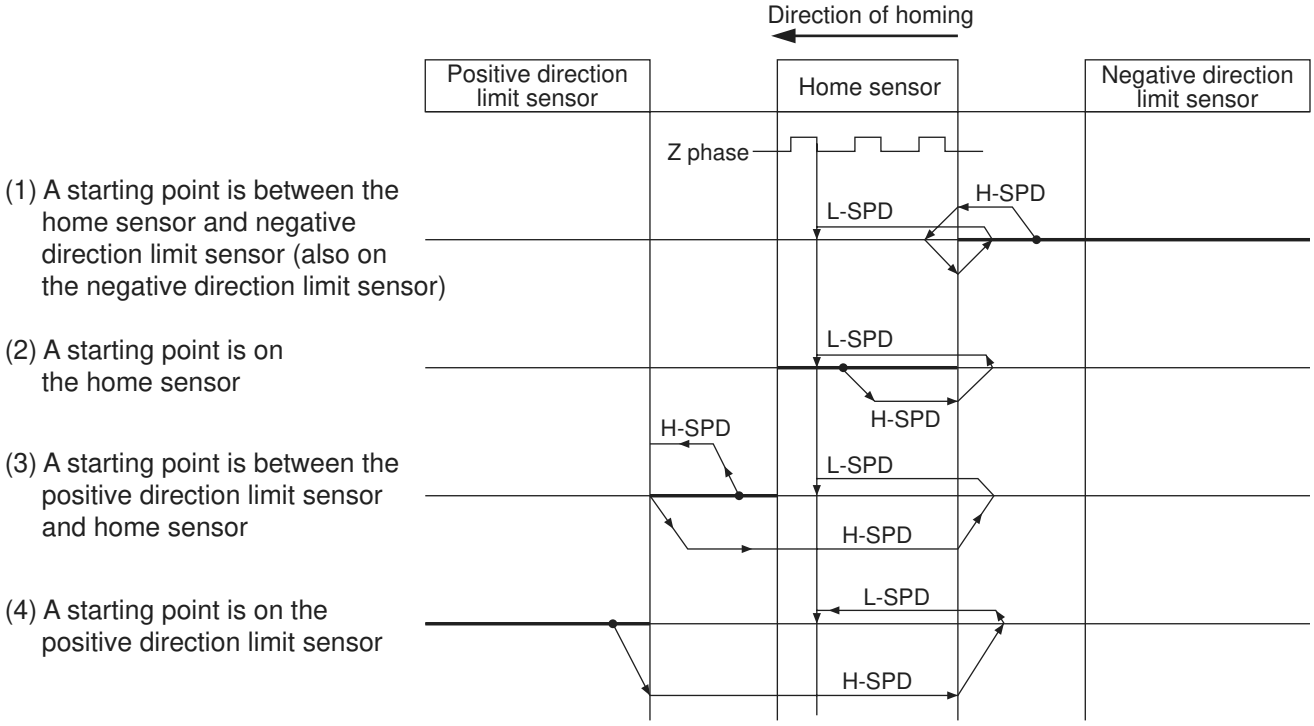
Caution

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

Homing Operation

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

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



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

• Parameters related to this operation

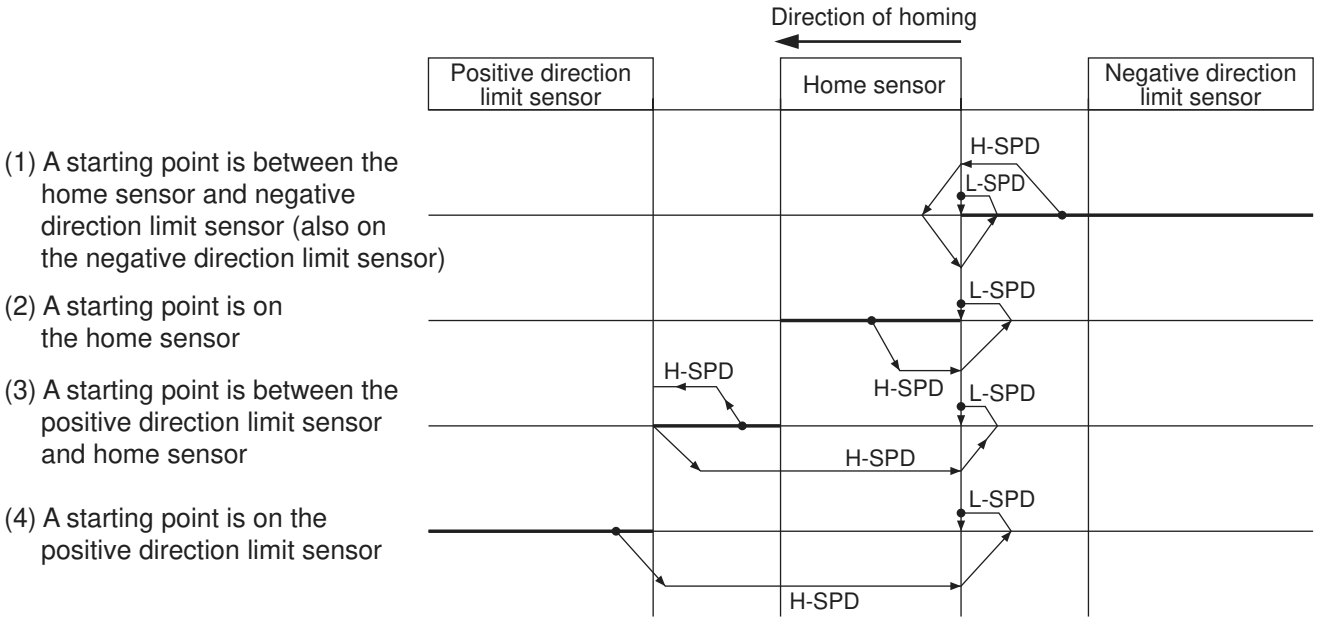
Parameter number		Description
16.Pr**	30	Specify the high speed for the homing operation (0 to 6000 r/min).
	31	Specify the low speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation,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

Caution

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

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

Home Sensor (based on the front end)



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

- **Parameters related to this operation**

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

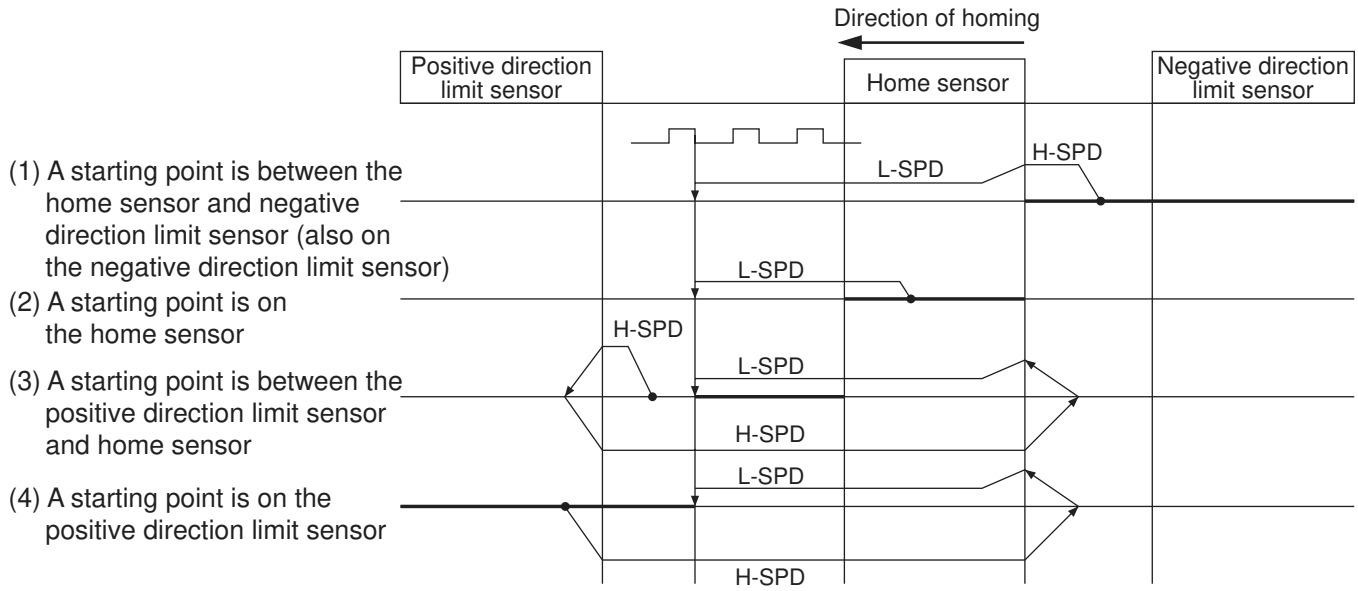
Homing Operation

Caution

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

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

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



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

• Parameters related to this operation

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

Caution

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

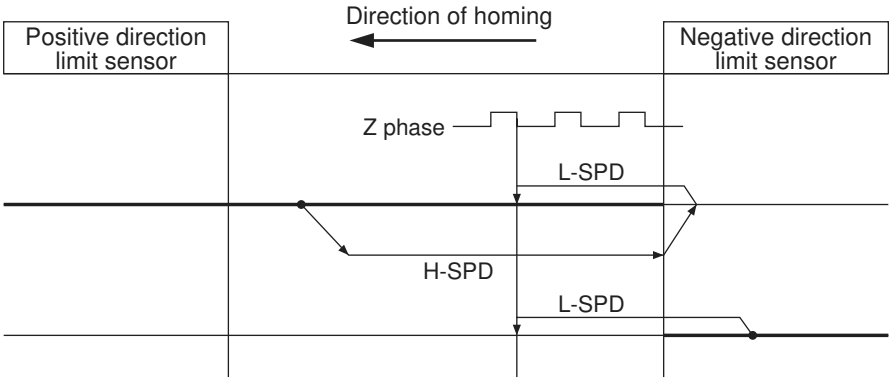
Homing Operation

Limit Sensor + Z phase

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

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

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



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

• Parameters related to this operation

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

Caution

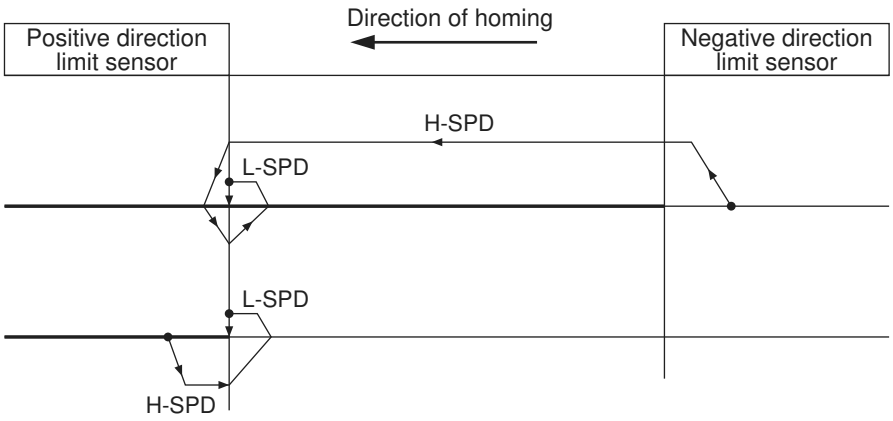
1) If any of the set values of the parameters below is “0”, an operation trips due to homing error protection (error code No. 68) and stops according to an operation at alarm occurrence.
   • 16.Pr30 (Homing speed (high))
   • 16.Pr31 (Homing speed (low))
   • 16.Pr33 (Homing acceleration setting)
 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

Limit Sensor

Example: An operation in a positive direction

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

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



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

• Parameters related to this operation

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

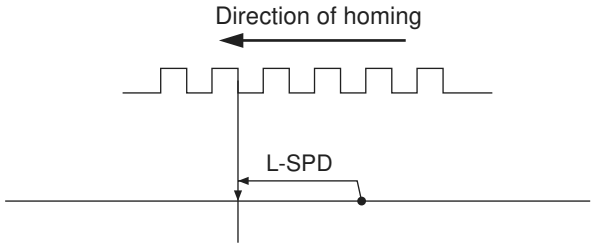
Caution

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

Homing Operation

Z Phase Homing

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



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

• Parameters related to this operation

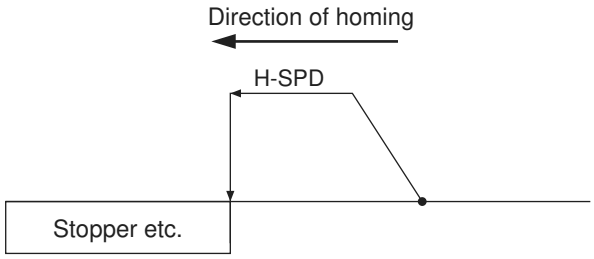
Parameter number		Description
16.Pr**	31	Specify the low speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing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

Caution

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

Bumping Homing

Example: An operation in a positive direction



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

• Parameters related to this operation

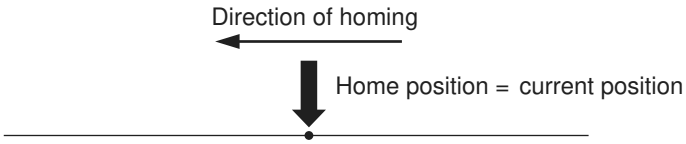
Parameter number		Description
16.Pr**	30	Specify the high speed for the homing operation (0 to 6000 r/min).
	32	Specify the offset operation speed if the home offset operation is performed (0 to 6000 r/min). For the home offset operation, refer to page 124.
	33	Specify the acceleration for the homing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

Caution

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

Data Set

Example:



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

• Parameters related to this operation

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

Homing Operation

Homing Offset Operation

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

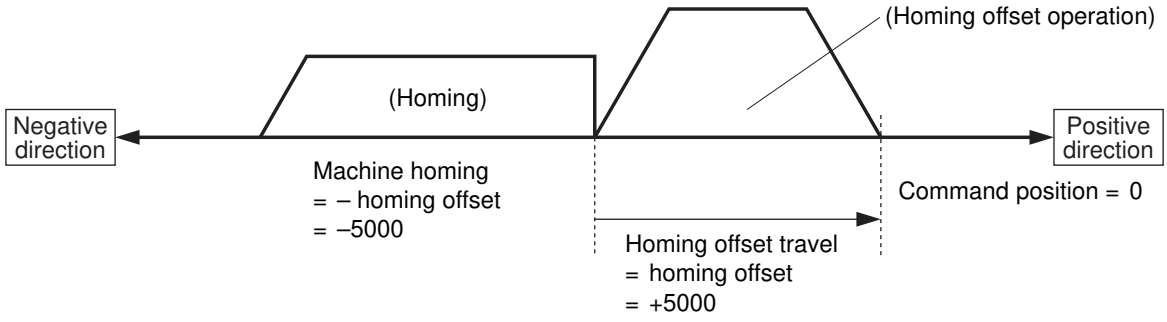
- 16.Pr37 (Home complete type) is set to “0”
  The motor stops at the machine home position when the homing has completed and, at the same time, a command position is set to [- home offset] .
- 16.Pr37 (Home complete type) is set to “1”
  After the motor stops at a machine home position, preset a command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

Caution

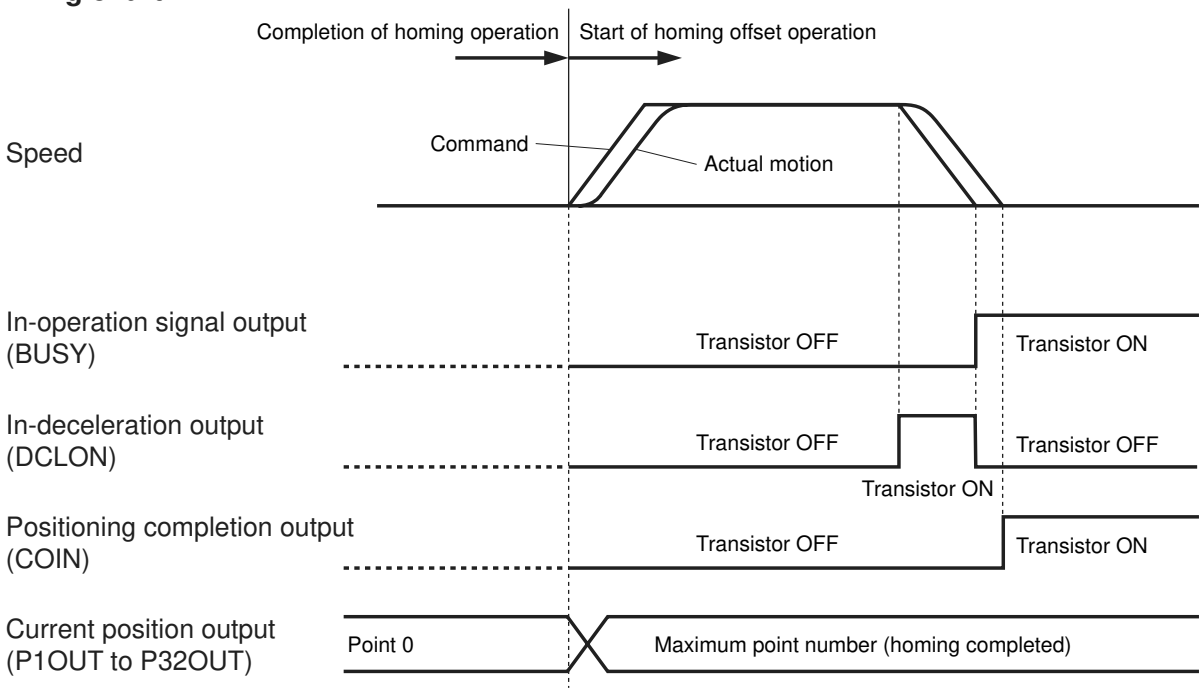
1) If 16.Pr32 (Homing offset speed), 16.Pr33 (Homing acceleration setting) and 16.Pr34 (Homing deceleration setting) are “0”, an operation trips due to the error code No. 69 (undefined data error protection) and stops according to an operation at alarm occurrence.
2) Do not set [- home offset] out of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

*** Example of homing offset**

• Homing offset is set to “ +5000”

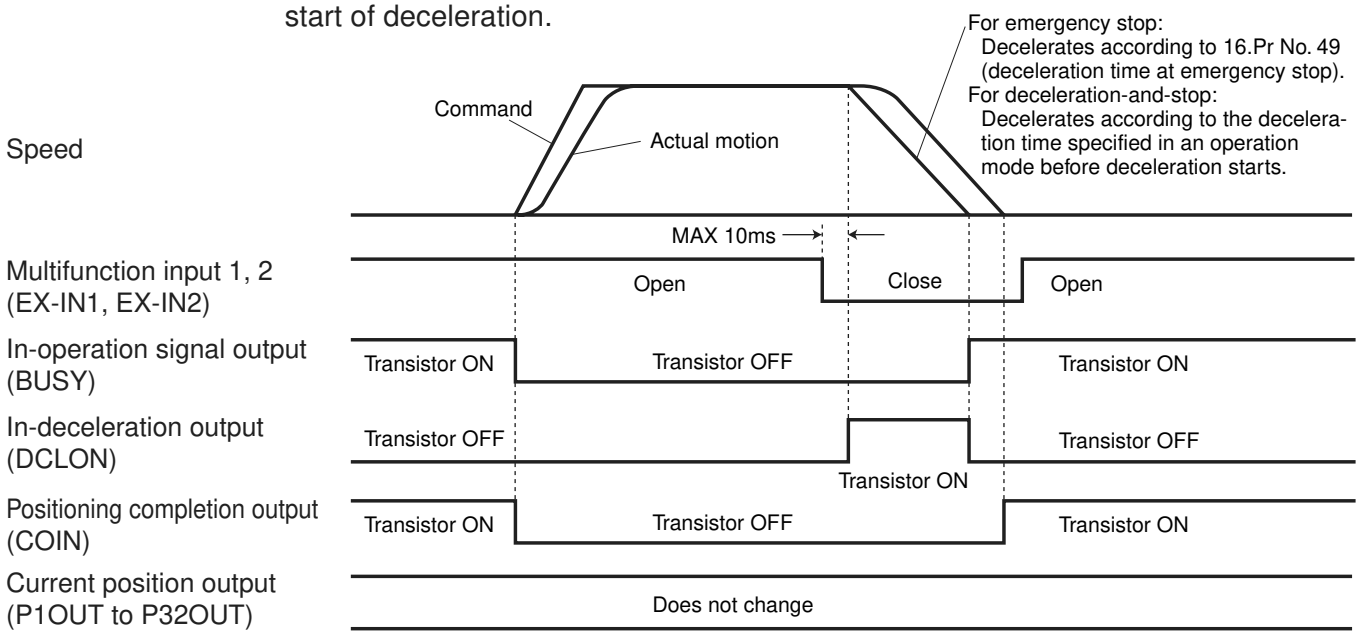


• Timing chart



Emergency Stop Operation/Deceleration-and-Stop Operation

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



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

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

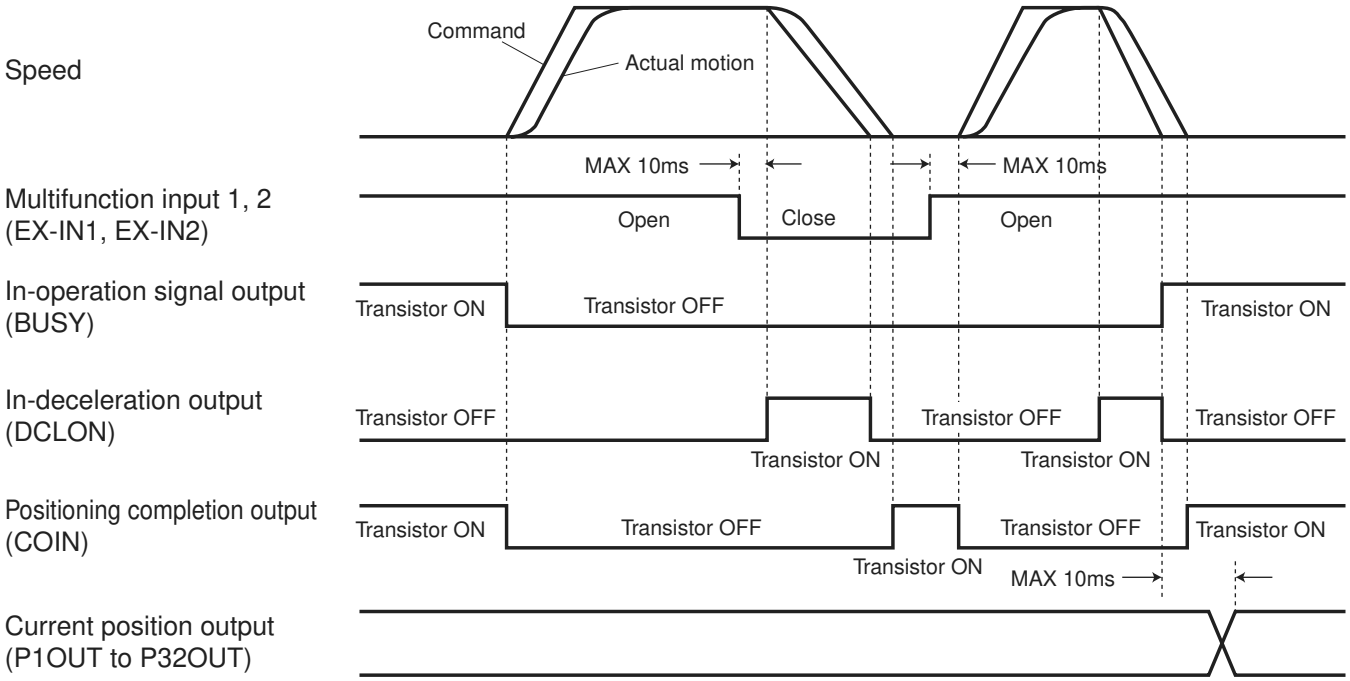
Caution

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

Temporary Stop Operation

Temporary Stop Operation

An active operation can be stopped temporarily and restarted.



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

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

Caution

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

Block Operation

Overview of Block Operation

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

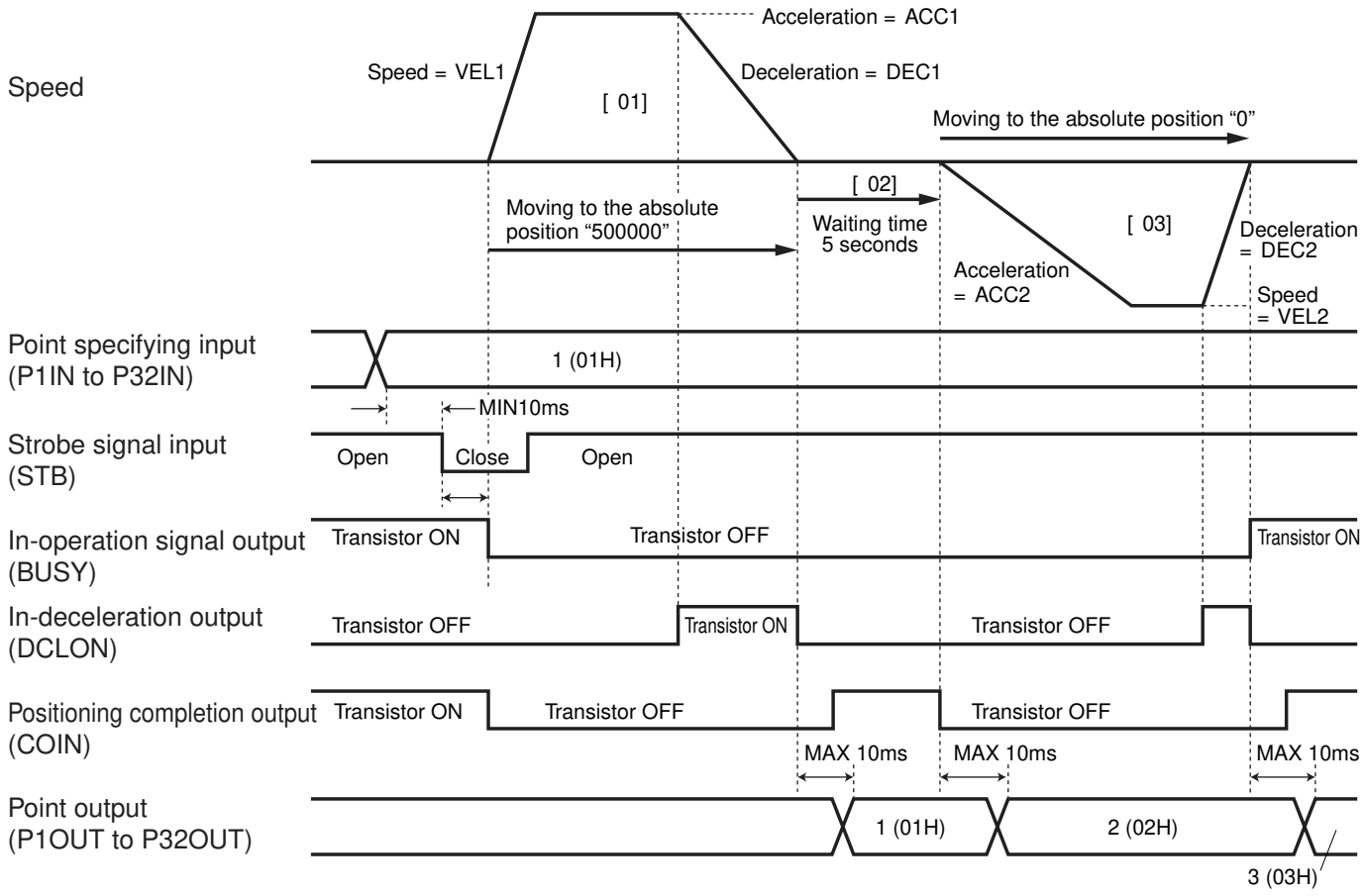
Continuous block operation : Several step operations can be performed continuously. Once an operation starts, the operation continues to a specified point number.

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

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

Continuous Block Operation

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



Continuous block operation procedure (example)

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