Panasonic

Technical Instructions (Overall)

MINAS-BL GP series

- Thank you very much for your purchase of Panasonic product.
- Please read this instruction manual carefully for proper use.
- In particular, be sure to read Safety precautions (P.2 to 5) before use for safety.
- Keep this manual with care after reading, and read as necessary.
- This product is for industrial equipment. Don't use this product at general household.

• Label of safety precaution is affixed to the product.

Be sure to give this Instruction manual to an end user.

<Contents>

Safety precautions Important

The following explanations are for things that must be observed in order to prevent harm to people and damage to property.

- Misuses that could result in harm or damage are shown as follows, classified according to the degree of potential harm or damage.

⚠ **Danger**	Indicates great possibility of death or serious injury.
⚠ **Caution**	Indicates the possibility of injury or property damage.

- The following indications show things that must be observed.

⃠	Indicates something that must not be done.
❗	Indicates something that must be done.

⚠ DANGER

Do not touch the rotating part of the motor while operating.

⃠ The failure could result in injuries.

Do not touch the motor, amplifier, and external regenerative resistor, since they become hot.

⃠ The failure could result in burns.

Do not expose the cables to sharp objects, excessive pressing or pinching forces, and heavy loads.

⃠ The failure could result in electric shocks, damages, or malfunction.

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

⃠ The failure could result in fire.

Do not climb or stand on the brushless equipment.

⃠ The failure could result in electric shocks, injuries, damages, or malfunction.

Do not put your hands in the brushless amplifier.

⃠ The failure could result in burns, or electric shocks.

Do not place inflammable matter near the motor, amplifier and external regenerative resistor.

⃠ The failure could result in fire.

Do not connect the cable (U, V and W) of the brushless motor directly to the commercial power source.

⃠ The failure could result in fire, malfunction or damage.

Ground the earth of the brushless motor and brushless amplifier.

❗ The failure could result in electric shocks.

An over-current protection, earth leakage breaker, over temperature protecter and emergency stop device must be installed.

❗ The failure could result in electric shocks, injuries, or fire.

Install an external emergency stop device to shut down the main power source in any emergency.

❗ The failure could result in electric shocks, injuries, fire, damages or malfunction.

Install the product properly to avoid personal accidents or fire in case of an earthquake.

❗ The failure could result in electric shocks, injuries, or fire.

Make sure to secure the safety after the earthquake.

❗ The failure could result in electric shocks, injuries, or fire.

Only persons who are trained and qualified to work with or on electrical equipment are permitted to operate or maintain this equipment.

❗ The failure could result in electric shocks.

Mount the brushless motor, brushless amplifier and external regenerative resistor on incombustible material such as metal.

❗ The failure could result in electric shocks, injuries, or fire.

Safety precautions Important

Transportation, wiring and checking must be performed with power source turned off and after making sure that there is no risk of electric shock.

The failure could result in electric shocks or injuries.

Arrange the phase sequense of the motor and wiring of the CS sensor.

The failure could result in injuries, damages, or malfunction.

⚠ CAUTION

Do not approach to the equipment after recovery from the power failure because they may restart suddenly.

The failure could result in injuries.

Do not drive the motor from the external power.

The failure could result in fire.

Do not hold the cables or motor shaft when transporting the motor.

The failure could result in injuries.

Never start and stop the motor by magnet contactor which is provide on the main line.

The failure could result in damages.

Do not frequently turn on and off the master power source.

The failure could result in malfunction.

Do not place any obstacle that blocks ventilation around the brushless amplifier and the motor.

The failure could result in burns or fire.

Do not subject the brushless amplifier, motor or shaft to high impact.

The failure could result in malfunction.

Do not block the heat dissipation hole.

The failure could result in electric shocks, or fire.

Do not modify, dismantle or repair the product.

The failure could result in electric shocks, injuries, or fire.

Be sure to turn off power when not using it for a prolonged time.

The failure could result in injuries due to unintentional operation.

If trip occurs, remove the causes of the trip and secure the safety before restarting.

The failure could result in injuries.

Maintenance and check must be performed by an expert.

The failure could result in injuries and electric shock.

Execute the trial-operations with the motor fixed and a load unconnected.
Connect a load to the motor after the successful trial-operations.

The failure could result in injuries.

Conduct proper installation according to product weight or rated output.

The failure could result in injuries, or damages.

Use the specified voltage on the product.

The failure could result in electric shocks, injuries, or fire.

Use the motor and amplifier with the specified combination.

The failure could result in fire.

Install a safety device against idling or locking of gear head, and leakage of grease.

The failure could result in injuries, damages, and contaminations.

Ambient temperature of installed motor and amplifier should be under permittable one.

The failure could result in damages.

This product should be treated as an industrial waste when it is disposed.

Introduction/ Checking the model

After unpacking

- Make sure that the model is what you have ordered.
- Check whether the product has been damaged or not during transportation.

If any deficiency should be found,
contact the dealer store where you bought this product.

Checking the model of Amplifier, Motor and Gear head

This amplifier is designed for use in combination with a motor to be specified by us.
Check a name of series, rated output, voltage specifications you wish to use
To prevent damages or malfunctions, you must not use any other combinations than those listed below.

Standard

Shaft type	Voltage	Out put	Amplifier Type	Applicable Motor	Applicable Gear head
Pinion shaft	Single phase AC100 to 120 V	50 W	MBEG5A1BCP	MBMU5AZAB	MB8G □ BV * Reduction ratio: 5 to 50
		90 W	MBEG9A1BCP	MBMU9A1AB	MB9G □ BV * Reduction ratio: 5 to 50
		130 W	MBEG1E1BCP	MBMU1E1AB	
	Single phase/ 3-phase AC200 to 240 V	50 W	MBEG5A5BCP	MBMU5AZAB	MB8G □ BV * Reduction ratio: 5 to 50
		90 W	MBEG9A5BCP	MBMU9A2AB	MB9G □ BV * Reduction ratio: 5 to 50
		130 W	MBEG1E5BCP	MBMU1E2AB	

* A figure representing reduction ration in □
e.g.) Part number of MB8G type gear head with reduction ratio 10 is MB8G10BV.

For special-purpose motor

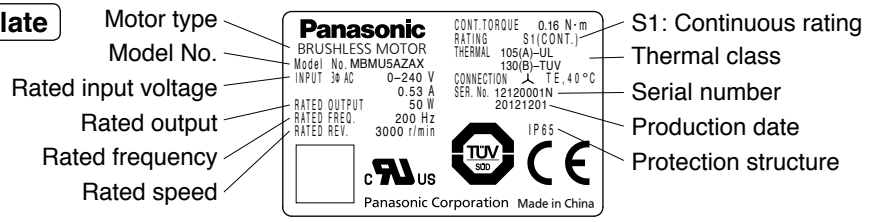
Voltage	Out put	Amplifier Type	Applicable Motor
Single phase AC100 to 120 V	50 W	MBEG5A1BCP	MBMU5AZ ○ *
	90 W	MBEG9A1BCP	MBMU9A1 ○ *
	130 W	MBEG1E1BCP	MBMU1E1 ○ *
Single phase/ 3-phase AC200 to 240 V	50 W	MBEG5A5BCP	MBMU5AZ ○ *
	90 W	MBEG9A5BCP	MBMU9A2 ○ *
	130 W	MBEG1E5BCP	MBMU1E2 ○ *

The mark " ○ " following the motor model number indicates the motor shaft specification.

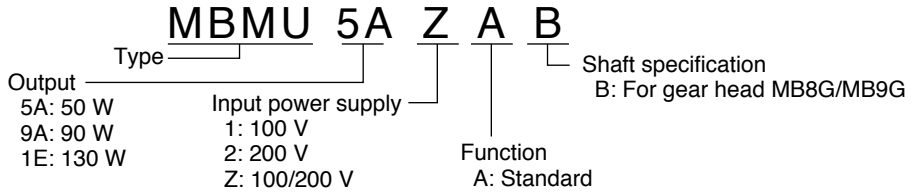
Checking the model

Checking the model of brushless motor

Nameplate



Model designation



Serial number

Example) Ser. No. 12 12 0001 ∗

- 12: Year of production (Lower 2 digits of AD year)
- 12: Month of production
- 0001: Consecutive number

The motor manufactured in Dec. 2012 is given the Serial number 0001.

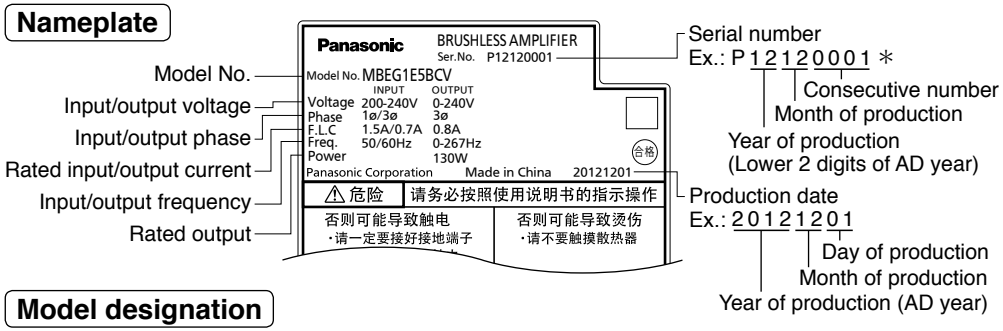
Production date

Example) 2012 12 01

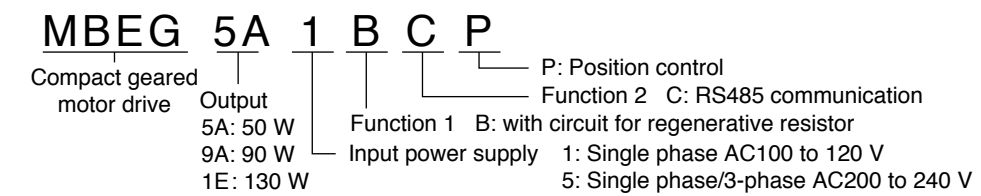
- 2012: Year of production (AD year)
- 12: Month of production
- 01: Day of production

Checking the model of brushless amplifier

Nameplate



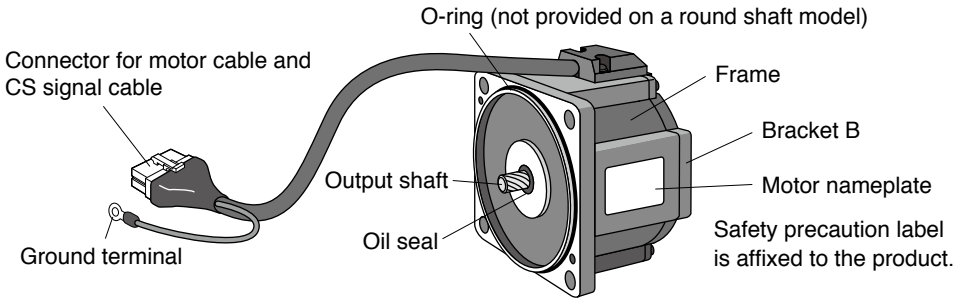
Model designation



Name of part

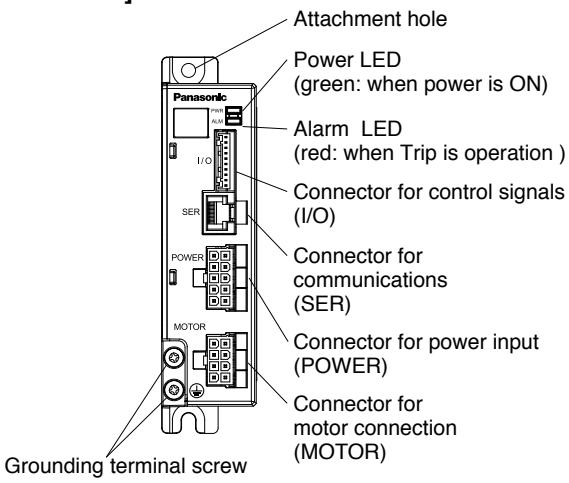
Name of part

Brushless motor

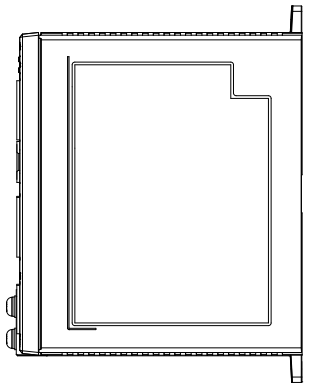


Brushless amplifier

[Front view]



[Side view]



Safety precaution label
is affixed to the product.

Installation

Install the brushless motor and brushless amplifier properly for preventing failure and accident.

Transport

- Use caution enough in transporting the unit to prevent injury by drop or fall, and avoid damage to the equipment.

Storage

- Keep the unit indoors in a clean and dry place free from vibration with little change of temperature.
- In keeping a gear head alone, direct the output shaft down.
  (Otherwise, grease leaking is possible.)

Location

- Location gives great influence upon the life of brushless motor and brushless amplifier, therefore choose a place in conformance with the conditions below:
  (1) Indoors where the motor is not subjected to rain water and direct sun beam.
  (2) Do not use the motor in corrosive atmosphere such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, sulfur, gas chloride, gas sulfide, acid, alkali, and salt, in the atmosphere of combustible gas, or in the vicinity of flammables.
  (3) Place not exposed to grinding liquid, oil mist, iron powder, and cutting particle.
  (4) Well-ventilated place with little moisture, oil, or inundation, and place far from heat source such as a furnace.
  (5) Place easy to check and clean
  (6) Place free from vibration
  (7) Do not use the unit in an enclosed environment. Enclosing may raise the temperature of motor (amplifier), and shorten their life.

Caution in installing gear head

Install a device that will ensure safety operation of the system even if the following failures should occur on the life end of gear head: idling by damaged teeth, locking by bite, grease leakage, and the like.

- As for application such as on a lifter or the like device, install a device for preventing drop by damaged teeth.
- As for application such as opening and closing of door, install a release device against locking by gear biting.
- As for food or textile equipment, install an oil pan for measures against grease leakage.
- Do not install an encoder, sensor, contact, etc., in the proximity of gear head. Or otherwise, protect such devices against grease leakage.
- In order to prevent unexpected accident, be sure to perform daily check.

Environmental condition

Item		Condition
Ambient temperature	Brushless motor	–10 °C to 40 °C (free from freezing) *1
	Brushless amplifier	0 °C to 50 °C (free from freezing) *1
	Digital key pad (Option)	
Ambient humidity		20% to 85% RH (free from condensation)
Storage temperature		At normal temperature and normal humidity *2
Protection structure	Brushless motor	IP65 (Excluding shaft pass-through section and lead wire connector) • This motor meets test requirements specified in EN standards (EN60529 and EN60034-5). This motor cannot be used for an application that requires long term waterproof performance, such as the case where the motor is always washed with water.
	Brushless amplifier	Equivalent to IP20
	Digital key pad (Option)	
Vibration		Not greater than 4.9 m/s^2 (10 to 60 Hz)
Altitude		Not greater than 1000 m

*1 Ambient temperature is measured at a distance of 5 cm from the product.

*2 Temperature which is acceptable for a short time, such as during transportation, is –20 °C to 60 °C (free from freezing).

Installation of brushless motor

• Oil and water protection

(1) Direct down the lead of cable as far as possible.

(2) Avoid use in such an environment where the motor is always exposed to oil and water.

(3) Avoid use with cable immersed in oil or water.

• Stress to cable

(1) Make sure that stress is not applied to the lead or connection of cable due to bending or dead weight.

(2) In installation where the motor moves, fix the cable of motor, and house the extension cable connected to it in the cable bear to reduce stress by bending as small as possible.

(3) Allow the bending radius of cable as large as possible.

Installation of brushless amplifier

The amplifier is a vertical placement type. Install it vertically and provide at least 10 cm space around it for ventilation.

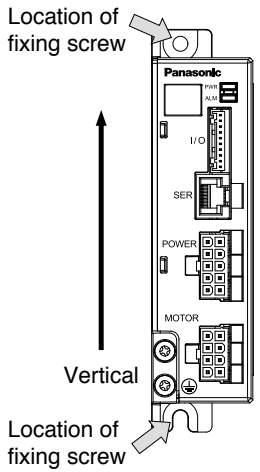
(1) When installing with screw

Determine the fastening torque of the fixing screw based on the strength of the screw and material of the mounting surface, to ensure secure and safe installation.

Example) To install to steel plate with steel screw (M4):
1.35 to 1.65 N·m

(2) When installing to DIN rail

The DIN rail mounting unit is available as option.
For details, refer to P.106.

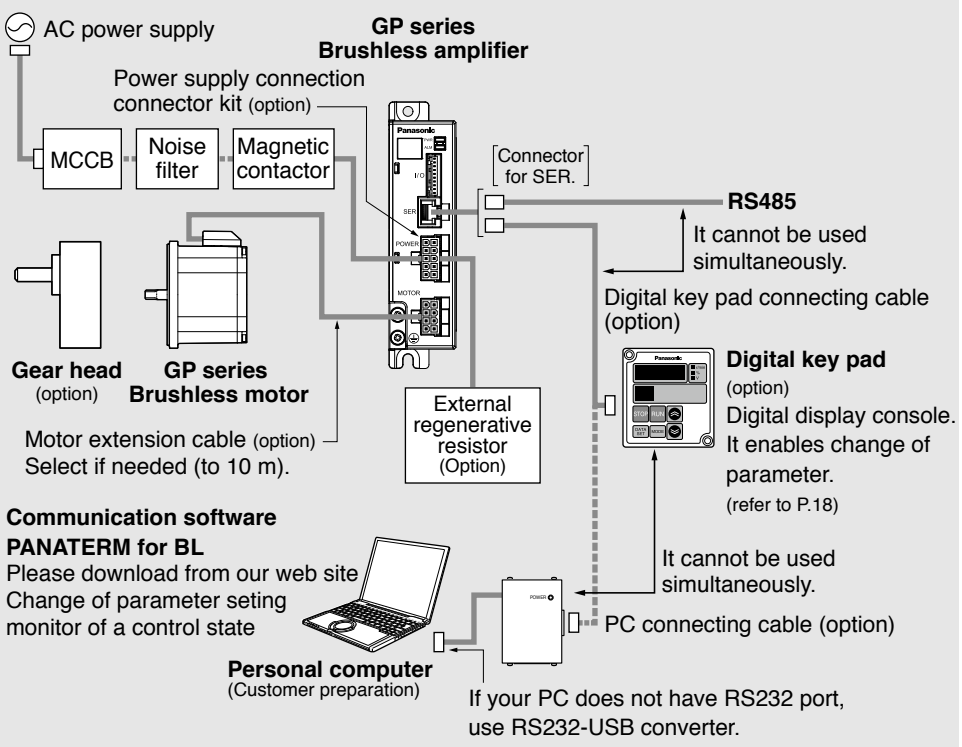


Cautions for Proper Use

(1) Because the control circuit is sensitive to temperature and impact, read this instruction manual carefully for proper installation.

(2) The brushless amplifier switches the power element at a high speed to control the motor. When the motor runs, leaking current will increase, which may activate the leakage breaker. If this is the case, use a leakage breaker provided with measure against high frequency for inverter.

System configuration/ general wiring diagram



- Wiring work shall be performed by qualified electric engineering technician.
- Do not turn on power before finishing wiring, to avoid risk of electric shock.
- For details of options (sold separately), see P.102.

Wiring equipment

- Recommended noise filter

Voltage	Optional part number (option)	Manufacturer's part No.	Manufacturer
Single phase 100, 200 V	DV0P4170	SUP-EK5-ER-6	OKAYA ELECTRIC IND. CO., LTD.
3-phase	DV0PM20042	3SUP-HU10-ER-6	

- Selection of Molded Case Circuit Breaker (MCCB), magnetic contactor, and electric wire (wiring within equipment) (refer to P.91 “Conformance to EC directive and UL standard” for compatibility with overseas standard.)

Voltage	Capacity (W)	MCCB (rated current)	Magnetic contactor rated current (contact structure)	Electric wire (mm^2) (Wiring within equipment)	
				Main circuit/ Grounding wire	Control circuit
Single phase 100V	50 to 130	5 A	20 A (3P+1a)	0.5 (AWG20)	0.13 (AWG26)
Single phase 200V	50 to 130	5 A	20 A (3P+1a)	0.5 (AWG20)	0.13 (AWG26)
3-phase 200V	50 to 130	5 A	20 A (3P+1a)	0.5 (AWG20)	0.13 (AWG26)

■ **Be sure to ground the grounding terminal.**

In wiring to power supply (outside of equipment) from MCCB, use an electric wire of 1.6 mm diameter (2.0 mm^2) or more both for main circuit and grounding. Apply grounding class D (100 Ω or below) for grounding. Do not tighten the ground wires together, please tighten them individually.

- **Selection of relay**

  As for use for control circuit such as control input terminal, use a relay for small signal (minimum guarantee current 1 mA or less) for preventing poor contact.

  <Reference example>

  Panasonic: DS type, NK type, HC type, OMRON: G2A type

- **Control Circuit Switch**

  When using a switch instead of relay, use one for minute current in order to prevent poor contact.

  <Example>

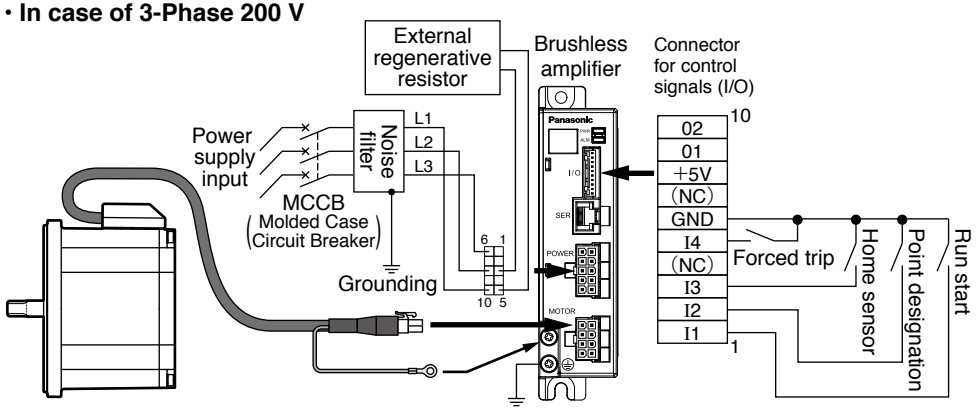
  Nihon Kaiheiki Ind.Co.,Ltd: M-2012J-G

Wiring

Wiring

Standard wiring diagram

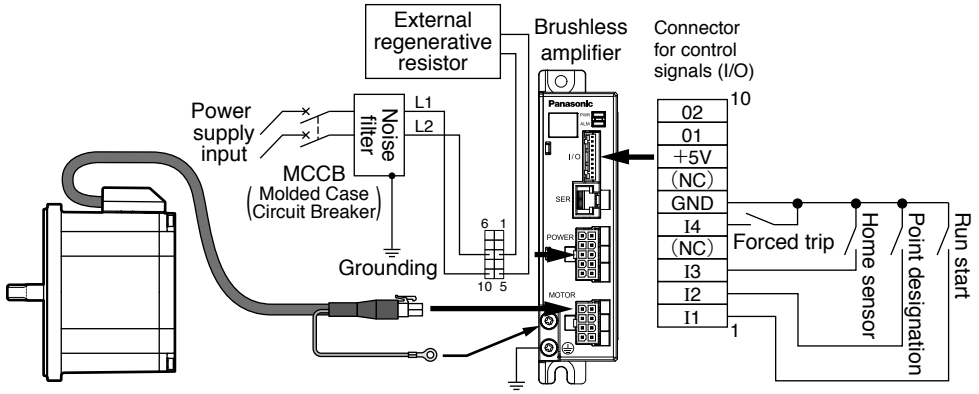
• In case of 3-Phase 200 V



Be sure to ground the grounding terminal.

In wiring to power supply (outside of equipment) from MCCB, use an electric wire of 1.6 mm diameter (2.0 mm^2) or more both for main circuit and grounding.
Apply grounding class D (100 Ω or below) for grounding.
Do not tighten the ground wires together, but connect them individually.
Fastening torque of earth screws to be 0.49 to 0.98 N·m.

• In case of single phase 100, 200 V



Be sure to ground the grounding terminal.

In wiring to power supply (outside of equipment) from MCCB, use an electric wire of 1.6 mm diameter (2.0 mm^2) or more both for main circuit and grounding.
Apply grounding class D (100 Ω or below) for grounding.
Do not tighten the ground wires together, but connect them individually.
Fastening torque of earth screws to be 0.49 to 0.98 N·m.

Function of terminal

Connector for power supply (POWER)

Connector on amplifier side: Part No. 5569-10A1-210 (Molex Inc.) or equivalent.
(mating connector: Housing 5557-10R-210, Terminal 5556PBTL)

Terminal number	Terminal symbol	Terminal name	Terminal explanation
3	B	Terminal for external regenerative resistor	Please connect external regenerative resistor of an option if needed. External regenerative resistor name: 100 V type DV0P2890 (50 Ω) 200 V type DV0PM20068 (200 Ω)
5	P		
6	L3	Terminal for power supply input	Connect the terminal to commercial power supply conforming to voltage specification. When you use single phase, connect the main power between L1 and L2 terminals.
8	L2		
10	L1		
1,2,4,7,9	NC	—	Do not connect anything.

Wiring

Connector for control signals (I/O)

Connector on amplifier side: Parts No. S10B-PASK-2 (J.S.TMfg.,Co.,Ltd.) or equivalent.
(mating connector: Representative Housing PAP-10V-S,
Terminal SPHD-001T-P0.5 or SPHD-002T-P0.5)

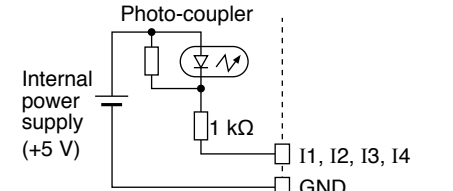
Terminal number	Terminal symbol	Terminal name	Default	Terminal explanation	function selection	logic selection
1	I1*1	Signal input 1	Run start	In turning on signal, short between "I1" and "GND".*2	Pr50	Pr54
2	I2*1	Signal input 2	Point designation	In turning on signal, short between "I2" and "GND".*2	Pr51	Pr55
3	I3*1	Signal input 3	Home sensor	In turning on signal, short between "I3" and "GND".*2	Pr52	Pr56
4	(NC)	—	—	Do not connect anything.	—	—
5	I4*1	Signal input 4	Forced trip	In turning on signal, short between "I4" and "GND".*2	Pr53	Pr57
6	GND	Control ground	—	Common ground terminal for control signal.	—	—
7	(NC)	—	—	Do not connect anything.	—	—
8	+5V	Power supply	—	Set 50 mA or below	—	—
9	01*1	Signal output 1	Trip output	Open collector output. Open collector Vce max: DC30 V, Ic max: 50 mA	Pr5C	Pr5E
10	02*1	Signal output 2	In-motion signal	Open collector output. Open collector Vce max; DC 30 V, Ic max; 50 mA	Pr5d	Pr5F

*1 Function of input/output can be changed by the Digital key pad or PANATERM for BL.

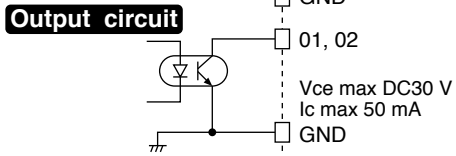
*2 Maximum rated voltage: –0.5 to 5.5V.

- Connector for control signals pin number is 1, 2, ... 10 in the order from grounding terminal side.
- Permissible length for control signal cable is 5m or less.

Input circuit



Output circuit



Connector for motor connection (MOTOR)

Connector on amplifier side: Parts No. 5569-08A1-210 (Molex Inc.) or equivalent.
(mating connector: Housing 5557-08R-210, Terminal 5556PBTL)

Terminal number	Terminal symbol	Terminal name	Terminal explanation
1	U	Motor U phase	Connect motor wire U, V and W.
2	V	Motor V phase	
3	W	Motor W phase	
4	5VS	High voltage 5 V	Not isolated from commercial power source. Use care to avoid electric shock and grounding fault.
5	CS1	CS signal 1	
6	CS2	CS signal 2	
7	CS3	CS signal 3	
8	GNDS	High voltage GND	

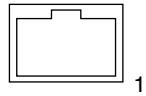
- High voltage is applied to motor wire and CS signal line; Use caution for avoiding electric shock.
- Use a motor extension cable (option) for extending motor wire.
- No.4 to 8 terminals of option cable are shielded, But the shield material is not grounded. please do not ground the shield material in order to avoid malfunctions or damages.

Connector for communications (SER)

Modular jack: 85503-0001 (Molex Inc.) or equivalent (RJ45)

Terminal number	Terminal symbol	Terminal explanation
1	—	Do not connect anything.
2	+5V	DC5 V power supply for Digital key pad
3	SOT	Interface for Digital key pad or PANATERM for BL
4	SIN	
5	RS485+	For connect RS485+
6	RS485–	For connest RS485–
7	GND	Power supply GNG for Digital key pad
8	SCK	Interface for Digital key pad

- Connection of Digital key pad of an option is possible. Digital key pad connecting cable of an option (DV0P383**) is required.
- The terminal number of a modular jack is the below figure



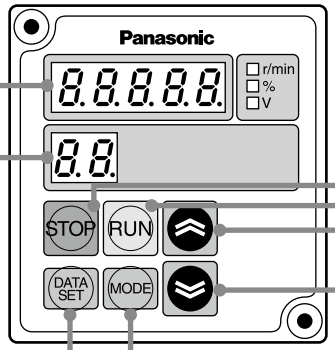
How to use Digital key pad (option)

Function of Digital key pad

- Monitoring of rotation speed (actual speed) and load factor, etc.
- Display detail of trip, and trip history. Trip reset by pressing ▲ and ▼ .
- Parameter setting, initialization, and copying function.
- Teaching function (Target point (positioning point) can be set by actually starting the motor.)
  - ■ When using Digital key pad, the Digital key pad connection cable (DV0P383**/ option) is required.

Using the Digital key pad

- When power is turned on, rotation speed (actual speed) r/min is displayed in monitor mode (changeable by Pr7A).
- Displayed value is an index. Do not use the Digital key pad for a measuring instrument.



5-digit LED

■ **In monitor mode**
Displays rotation speed (actual speed), commanded speed, present position, trip history, and the like.
■ **In parameter editing**
Displays a parameter setting value.
■ **In teaching**
Displays present position of motor.
• [. . . . .] is displayed for indicating a negative value.

2-digit LED

■ **In monitor mode**
The left value (position of 10) indicates an operation command signal status.
([0]: Stand still, [ ]: Commanding)
The right value (position of 1) indicates a rotation direction and operation status.
([F]: Operating in direction +*, [r]: Operating in direction –*, [_]: Stand still, [0]: Motor is free)
■ **In parameter editing**
Displays the number of parameter.
■ **In teaching**
Displays the point number of parameter.
• Rotation direction is changed by Pr23.
Direction + ([F]): CCW rotation when viewed from motor output shaft (default).

STOP Switch

When [STOP] switch is pressed, the setting change warning [CAU] (CAU) is displayed, and the motor is stopped and tripped.

RUN Switch

■ **In monitor mode**
When this switch is pressed for about 4 seconds, system shifts to teaching mode.
■ **In teaching**
When homing is not completed, homing operation is executed by pressing this switch for about 4 seconds in teaching mode.

▲ ▼ Switch

■ **In monitor mode**
Trip reset can be executed by pressing ▲ and ▼ at the same time.
■ **In parameter editing**
This switch allows selection of parameter, and setting and changing of details.
Parameter changes continuously while this switch is held down.
■ **In teaching**
When homing is completed, teaching operation (motor drive) is enabled by the switch ▲ and ▼ .

MODE Switch

■ **In monitor mode**
Switch for changing monitor mode. Whenever this switch is pressed, the mode changes in this sequence:
Rotation speed (actual speed) → Internal DC voltage (voltage of smoothing capacitor in power supply) → Load factor → Torque → Commanded speed → Present position (lower 5 digits) → Present position (shaft rotation number) → Rotation speed (actual speed) → ....
■ **In parameter editing, and in teaching**
System shifts to monitor mode. (Setting is not saved in EEPROM.)

DATA SET Switch

■ **In monitor mode**
System shifts to parameter number mode.
■ **In parameter editing**
This switch is for changing parameter number mode and parameter setting mode, and for saving parameter setting in EEPROM.
■ **In teaching**
This switch is for changing point number mode and teaching mode, and for saving setting in EEPROM (nonvolatile memory built in the amplifier).

How to use Digital key pad (option)

Description of various modes

Monitor mode	Displays rotation speed (actual speed), commanded speed, internal DC voltage, load factor, torque, and present position on 5-digit LED. This mode is set when power is turned on. Control changes to this mode when MODE switch is pressed in parameter number mode, parameter setting mode, point number mode, and point setting mode.
Parameter number mode	Displays a parameter number (00 to 7F) in flashing. Control changes to this mode when DATA SET switch is pressed in parameter number mode. Parameter number can be changed and selected by ▲ and ▼ switch.
Parameter setting mode	Displays the detail of parameter (setting) in flashing. Control changes to this mode when DATA SET switch is pressed in monitor mode. Change setting by ▲ and ▼ switch. When DATA SET switch is pressed after change of setting, it is saved in EEPROM.
Point number mode	Displays a parameter number (01 to 04) in flashing. Control shifts to this mode when RUN switch is pressed for 4 seconds in monitor mode. Point number can be changed and selected by ▲ and ▼ switch.
Teaching mode	Displays the present position of motor (distance from home) **in flashing**. (If homing is not completed, ----- is displayed. • When present position is greater than 99999, 99999 is displayed. • When present position is smaller than -99999, -99999 is displayed. Ex. 1) When present position is 123456, only lower 4 digits 3456 are displayed. Ex. 2) When present position is -20, -20 is displayed. Control shifts to this mode when DATA SET switch is pressed in point number mode. When ▲ or ▼ switch is pressed after completion of homing, the motor can be operated. If homing is not completed yet, homing operation is started when RUN switch is pressed for 4 seconds. When DATA SET switch is pressed, the present position is set in parameter as a point setting, and saved in EEPROM

<Information>

Present position is the distance from the home, indicated in pulses (288 pulses/rotation).

Operation of the Digital key pad

Basic operations

Power-on — Displays monitored details set by Pr7A (see P.45).

Monitor mode

• Changes display on 5-digit LED with **MODE** switch.

MODE | **DATA SET**

Parameter number mode

Displays the contents of displayed parameter (setting).

Displays parameter number.
• Number is changed by ▲ and ▼ switch.
• Exit this mode with **MODE** switch (returns to monitor).

DATA SET | **MODE** | **DATA SET** | **DATA SET**

Trip detail display mode

When trip occurs, trip display mode is set by **MODE** switch.

• Trip can be reset by pressing ▲ and ▼ switch at the same time.
Display shifts to monitor screen after resetting.
• Shifts to parameter number made when DATA SET switch is pressed.

Parameter setting mode

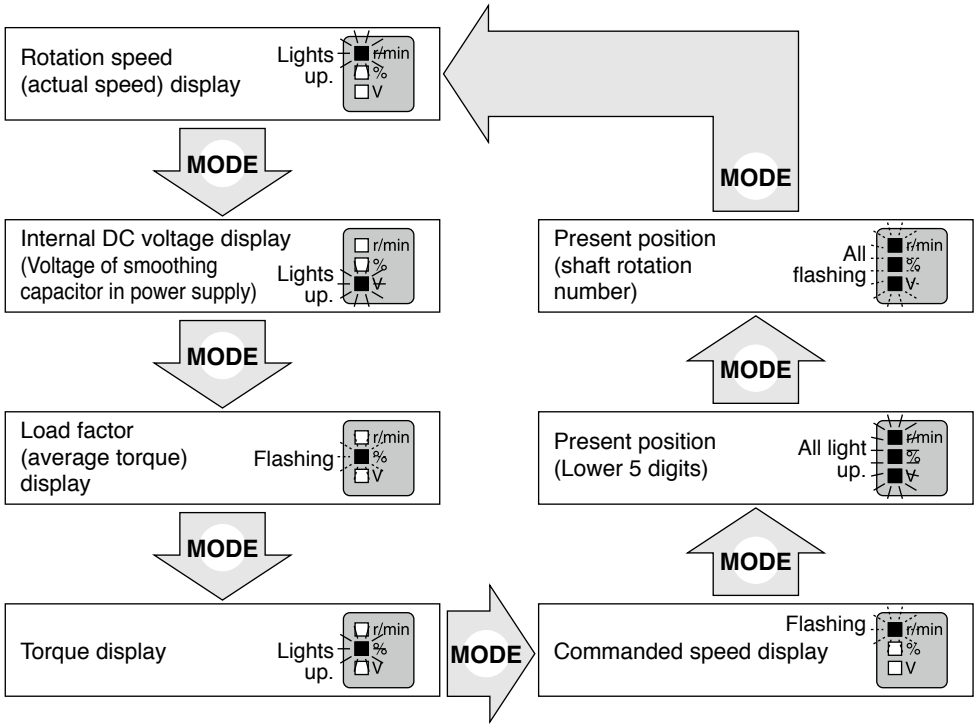
• Value is changed by ▲ and ▼ switch. (Such value is effective on the spot.)
• Value is written in EEPROM by DATA SET switch.
• Exit this mode with **MODE** switch without writing in EEPROM.

Trip reset | **MODE**

How to use Digital key pad (option)

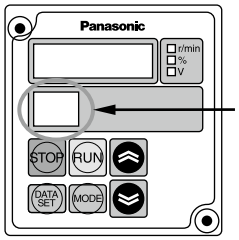
Monitor mode

Monitor display item can be changed after power is turned on and when monitor mode display is on. (See P.45 for setting of Pr7A.)



Display of present position

- When homing is not completed, is [- - - - -] displayed.
- When present position is greater than 99999, [8888] is displayed.
  When present position is smaller than –99999, [8888] is displayed.
  Ex. 1) When present position is 123456, only lower 4 digits [3456] are displayed.
  Ex. 2) When present position is –20, [. . .20.] is displayed.

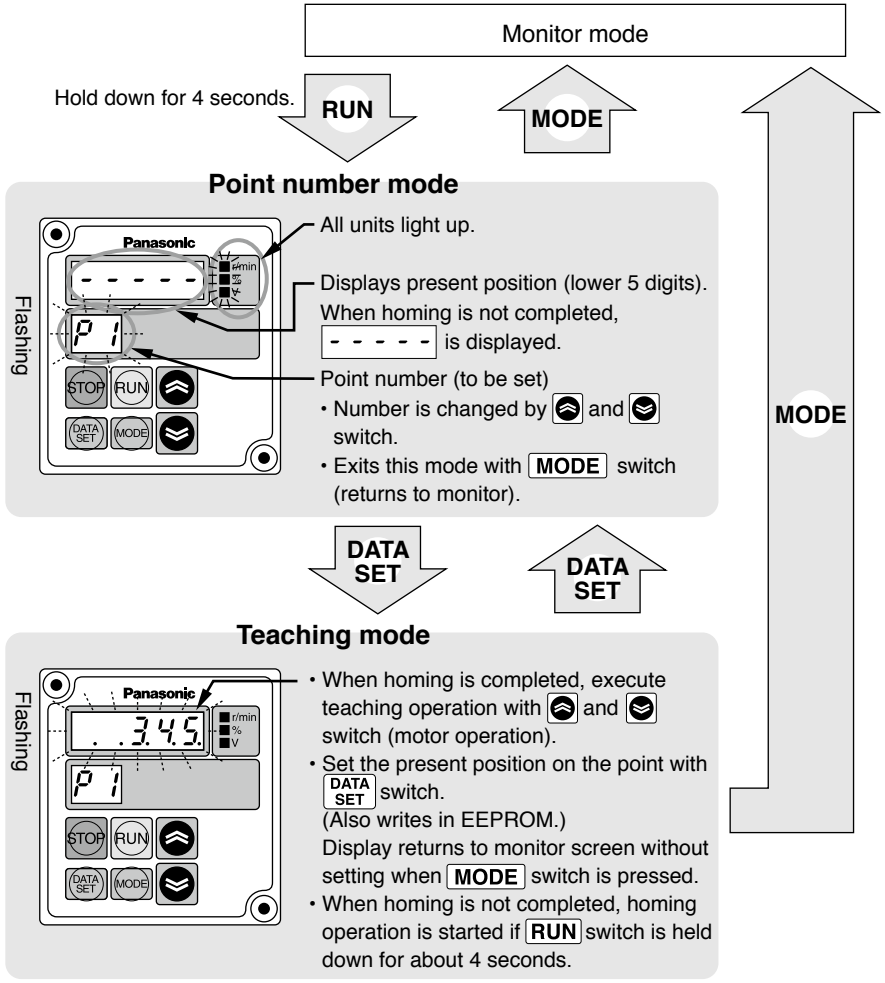


Left (position of 10)
... Displays command status.
[0]: Stand still
[ ]: In Motion (BUSY)

Right (position of 1)
... Displays rotation direction.
[r]: Running in – direction.
[F]: Running in + direction.
[_]: Stand still
[0]: Motor is free.

Teaching function

This motor allows two target position setting methods, one of which is setting by parameter value, and the other is setting target position by actually operating the motor by use of teaching function.
In order to use teaching function, press [RUN] switch for 4 seconds or longer on the monitor mode display screen, then control shifts to point number mode of teaching function.



[Caution]

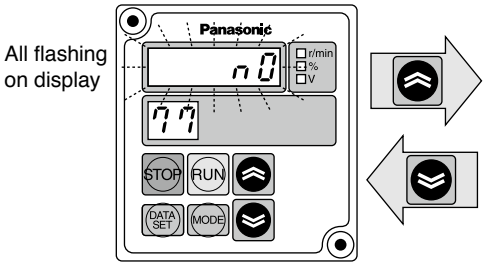
- In teaching mode, displayed present position is set as target position.
- Set the point coordinate setting to absolute travel. (Pr02, 0A, 12, and 1A).
  When the point coordinate setting is set to relative travel, stop position is different between teaching setting and actual operation.
- In point number mode and teaching mode, operation instruction by I/O or RS485 is not accepted.

How to use Digital key pad (option)

Parameter copy function

Parameter copy function (Digital key pad ⟷ Brushless amplifier) can be used by Pr77.

- **Initializing the data of the Digital key pad**
  EEPROM installed onboard the Digital key pad is initialized (data cleared). When reading is disabled, or when data transfer fails during copying, execute "Data initialization of the Digital key pad". Normally, it is not required.



- **Reading parameters**
  Parameter of Brushless amplifier is read and saved in EEPROM of the Digital key pad. Read parameter is retained even when the Digital key pad is separated from the Brushless amplifier.
- **Writing parameters**
  Parameter information saved in the Digital key pad is written to the Brushless amplifier. (Saved in EEPROM of Brushless amplifier)

<Information>

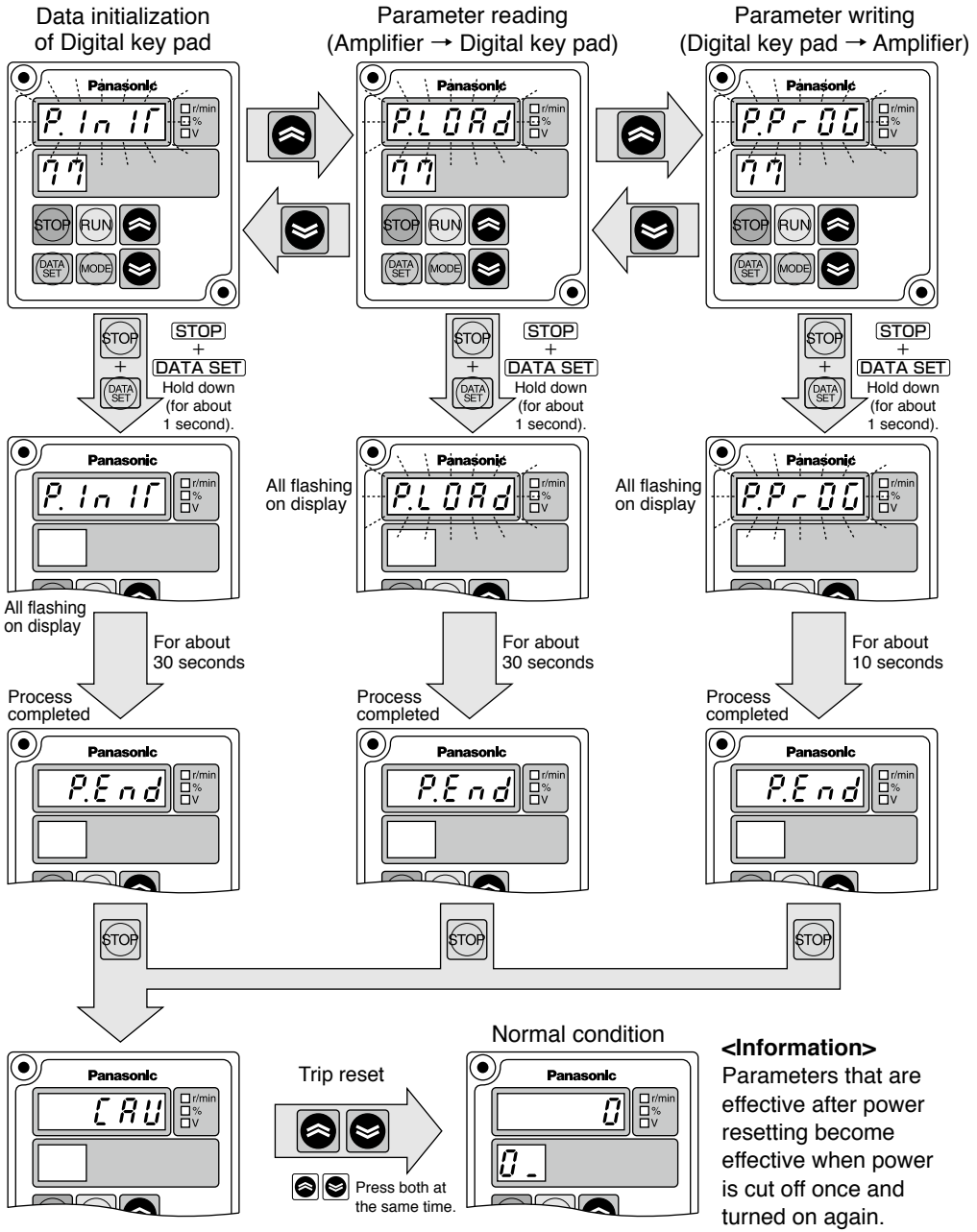
- **Error in copying parameters**
  P.Err1: Data trouble was found during copying
  → Press **STOP** switch for clearing, and then copy the parameter again. If data trouble is still found, initialize the Digital key pad and try again.

  P.Err2: Copy error
  → This error occurs in the attempt to copy data between products with different function. Press **STOP** switch to cancel the error.

  Although parameters can be copied between the same models with different output, parameters should be copied between the same outputs in principle.

<Note>

Do not turn off power or disconnect the connection cable of Digital key pad during operation such as "Initializing data of Digital key pad", "Reading parameter into Digital key pad", "Writing parameter to brushless amplifier", etc.



Test run

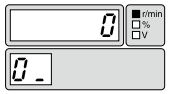
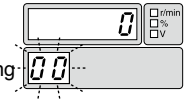
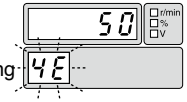
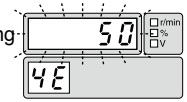
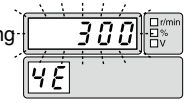
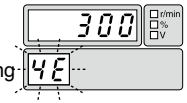
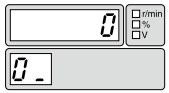
Inspection before Test run

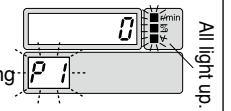
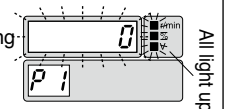
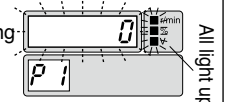
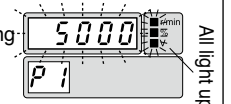
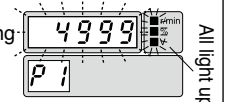
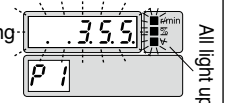
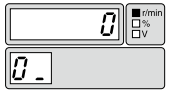
1) Make sure that all wiring is correct.
2) Make sure that input power supply conforms to rating.

Test run

Procedure for test run using the Digital key pad is as follows:
Shown here is the case of running at 300r/min in direction CW or CCW by use of teaching function.
First execute the following work for safe operation.

[1] Ensure that the motor alone can be operated.
[2] Turn on power and follow the steps below for test run.

Description of operation	Operation panel	
	Switch	LED display
1.Turn on power		
2.Set the action Pr4E (Setting of teaching speed)	Press DATA SET	 Flashing
	Press ▲▲ and choose parameter 4E (teaching speed). (Initial setting: 50)	 Flashing
	Press DATA SET	 Flashing
	Press ▲▲ change the teaching speed to 300.	 Flashing
	Press DATA SET	 Flashing
3.Return to monitor mode.	Press MODE	

Description of operation	Operation panel	
	Switch	LED display
4.Teaching operation	Press RUN for 4 seconds	 Flashing All light up.
	Press DATA SET	 Flashing All light up.
	▲▲ When ▲▲ is pressed in this condition, the motor rotates in + direction* and 5-digit LED indicates position coordinates.	 Flashing All light up.
	▲▲ When ▲▲ is released, the motor stops. (LED display "5000" is an example, which shows the present position of the motor.)	 Flashing All light up.
	▼▼ When ▼▼ is pressed after the motor has stopped, the motor rotates in one direction.	 Flashing All light up.
	▼▼ When ▼▼ is released, the motor stops. (LED display ". . 3.5.5." indicates that the present position is –355.)	 Flashing All light up.
5.Exit	MODE When exiting the mode without setting data, press **MODE** switch to return to monitor mode.	

Checkpoint in Test run

[1] Check whether the motor rotates smoothly. Check for abnormal noise and vibration.
[2] Check whether the motor is accelerated and decelerated smoothly.
[3] Make sure that the direction of motor rotation is correct.

* Rotation direction + represents CCW on the motor shaft in default setting. (Can be changed by Pr23 coordinate system setting.)
Rotation direction of gear head output shaft may sometimes be reversed due to reduction gear ratio when gear head is installed.
(See the table of permissible shaft torque on P.29. Rotation direction is described.)

Checking load and use condition

Check the use condition for extended use of the product. Particular use conditions may lead to heating or damage to the shaft. Fully check use conditions, and use the motor in a permissible range.

Standard life

Standard life is 10,000 hours for the motor equipped with gear head (MB8G and MB9G). (Standard life of sealing performance of oil seal is 5,000 hours.)
Standard life refers to design life for operation 8 hours per day (service factor: Sf = 1.0) at a normal temperature and humidity, under uniform load (permissible shaft torque of gear head and rated torque of motor).

* Standard life in the case of 3000 to 4000 r/min rotation speed of the motor, please calculated by the following formula.

Standard life (hours) = 10000 (h) × 3000 (r/min) / rotation speed (r/min)

<Information>

Repeated forward/reverse operation with motor shaft rotation angle below 45 degrees causes fretting of bearing (partial wear due to bearing out of grease), and is not advisable. It does not apply if operation is available to rotate the motor shaft above 45 degrees at an appropriate interval more than once a day.)
Oscillation due to inappropriate setting of gain, also causes fretting.
Note that gear head shaft is also subject to this restriction.

Service factor (Sf)

$$\text{Life expectancy} = \frac{\text{Standard life}}{\text{Service factor (Sf)}}$$

Service factor (Sf) varies with impact of load and operation time. The table below shows how the service factor value depends on load condition.

Type of load	Typical load	Service factor		
		5 hours/day	8hours/day	24hours/day
Constant	Belt conveyor, One-directional rotation	1.0	1.0	1.5
Light-impact	Start/Stop, Cam-drive	1.2	1.5	2.0
Medium-impact	Instant FWD/REV, Instant stop	1.5	2.0	2.5
Heavy-impact	Frequent medium-impact	2.5	3.0	3.5

Permissible torque

The required gear head allowable shaft torque T_A can be determined based on the service factor and actual load torque T_1.

$T_A = T_1 \times Sf$

Select a gear head/motor so that the required torque (continuous value) is equal to or lower than the allowable shaft torque shown in the table below.

• Motor rotation speed: 3000 r/min or less. Unit: N·m

Model name	Reduction ratio	5	10	15	20	30	50
MBMU5AZAB ／ MB8G□BV		0.71	1.4	2.2	2.8	4.0	6.8
MBMU9A○AB ／ MB9G□BV		1.2	2.5	3.6	4.9	7.0	11.6
MBMU1E○AB ／ MB9G□BV		1.9	3.7	5.6	7.4	10.7	17.7

• Motor rotation speed: 3000 to 4000 r/min or less. Unit: N·m

Model name	Reduction ratio	5	10	15	20	30	50
MBMU5AZAB ／ MB8G□BV		0.53	1.1	1.7	2.1	3.0	5.1
MBMU9A○AB ／ MB9G□BV		0.90	1.9	2.7	3.7	5.3	8.7
MBMU1E1AB(100 V)／ MB9G□BV		1.1	2.1	3.3	4.3	6.2	10.3
MBMU1E2AB(200 V)／ MB9G□BV		1.4	2.8	4.2	5.6	8.0	13.3

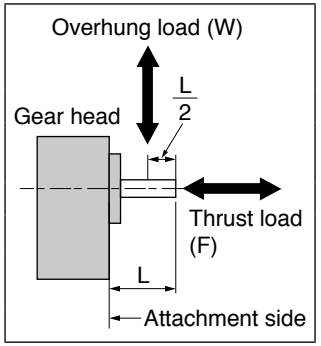
* Direction of rotation: ▭ represents that the direction is same as that of motor; otherwise opposite to that of motor

• ○ in the part name of motor represents either 1 or 2 which indicates supply voltage.
• □ in the part name of gear head represents a figure which indicates reduction ratio.

Shaft permissible load

The load should not cause the limits shown in the table below to be exceeded.

Gear head size	Model name	Permissible overhung load (W)	Permissible thrust load (F)
□80 mm	MB8G5BV	245 N	98 N
	MB8G10BV, MB8G15BV MB8G20BV	343 N	
	MB8G30BV, MB8G50BV	539 N	
□90 mm	MB9G5BV	294 N	147 N
	MB9G10BV, MB9G15BV MB9G20BV	490 N	
	MB9G30BV, MB9G50BV	637 N	



Permissible load inertia moment

Unit : $\times 10^{-4}$kg·m^2

Model name	Reduction ratio	5	10	15	20	30	50
MBMU5AZAB ／ MB8G□BV		3.42	13.8	30.6	55.8	127	342
MBMU9A○AB ／ MB9G□BV MBMU1E○AB ／ MB9G□BV		16.4	67.6	142	257	589	1684

<Information>

• ○ in the part name of motor represents either 1 or 2 which indicates supply voltage.
• □ in the part name of gear head represents a figure which indicates reduction ratio.

Assembling of gear head

Assembling of gear head

• Preparation for assembling

[1] Gear head applicable to the motor described in this instruction manual is MB8G □ BV (for 50W) and MB9G □ BV (for 90 W and 130 W). Never use a combination of gear heads other than applicable ones. Failure to observe this instruction will result in malfunction.

[2] Make sure that O-ring is attached to the bottom of spigot joint.
When the gear head is assembled with O-ring floating, it may result in grease leakage.

[3] When grease adheres to the end surface of gear head, wipe off clean.
If the gear head is assembled with grease adhered, it may cause grease to exude.

• Assembling

[1] Direct the motor pinion upward, and make sure that the relation between direction of motor lead wire and output shaft matches with the equipment.

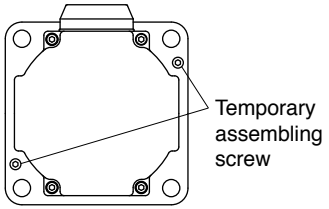
[2] Turn the motor pinion finely clockwise and counterclockwise for assembling, ensuring that the tip of motor pinion does not hit the tooth of gear head.

<Information>

MB type gear head is provided with temporary assembling screw (two hexagon socket head bolt). Before installing the equipment, assemble the motor and gear head temporarily, which will ensure stable installation of the equipment. In installing to the equipment, be sure to use four “mounting screws” attached to the gear head for secure installation.

[Recommended tightening torque for temporary assembling]

Size	Gear head type	Screw size	Tightening torque	Screw length
80 mm sq.	MB8G	M2.6	0.5 N·m	12 mm
90 mm sq.	MB9G	M3	0.8 N·m	

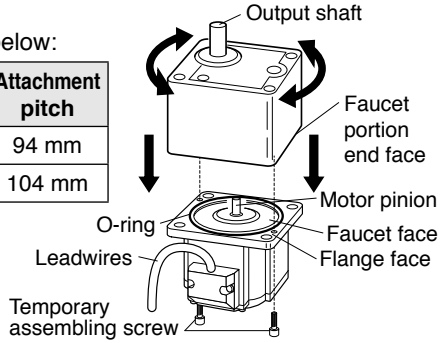


[3] When installing the motor and gear head to the mating equipment, use “mounting screws” attached to the gear head, tighten them sufficiently to eliminate clearance between the motor flange surface and gear head spigot joint while paying attention to bite of O-ring.

Recommended tightening torque is shown below:

Size	Gear head type	Screw size	Tightening torque	Attachment pitch
80 mm sq.	MB8G	M6	2.9 N·m	94 mm
90 mm sq.	MB9G	M8	7.8 N·m	104 mm

- Assemble with motor pinion faced up.
- Outward direction of motor leadwire can be aligned with any one of 4 sides of gear head with an output shaft at a different position.



Maintenance/ Inspections

Maintenance/ Inspections

Routine maintenance and inspection are essential for proper and satisfactory operation of the motor.

Maintenance/ Inspection item

Maintenance/ Check item	Inspection procedure	Condition
Input voltage	Voltmeter	Must be within ±10% of rating.
Input current	Ammeter	Must be within rated input current described on nameplate.
Insulation resistance	Insulation resistance tester	The resistance of motor should be 1 MΩ or higher when tested with a 500 V megger. Measuring position: Between power input line (L1, L2,L3) and grounding wire Brushless motor: Across phase (U, V, W) and ground terminals
Noise	Hearing	Noise level must not be different from the usual level. In addition, abnormal noise such as rumbling noise must not be heard.
Vibration	By hand	Free from abnormal vibration.
Grease leakage	Visual check	Check that circumference of the motor and gear head are free from oil and grease. If grease leakage will cause problem, use grease sealing cover.
Installation bolt	Torque wrench	Check for loosening of bolt, and tighten additionally as necessary.
Use environment	By sight	Check the ambient temperature and humidity, and make sure that dirt, dust, or foreign substance is not found. Check the waste thread etc don’t attached to the windhole of brushless amplifier.

Caution

- Power-on/off operations should be done by the operators themselves for ensuring safety in checking.
- Do not touch the motor while it is running or immediately after it stops because it gets hot and stays hot for a while after power has been turned off.
- When testing the insulation resistance of the brushless amplifier with the megger, disconnect the amplifier from all associated devices. Performing megger testing without first disconnecting these devices will cause failure.

**When disassembly, troubleshooting, etc., is needed,
be sure to contact our service department or the sales agent of purchase.**

Protective function

What is protective function?

- Brushless motors, brushless amplifier MINAS-BL GP series have various protective functions. When they are activated, the motor stops under a tripping state, which turns off (opens) trip output. (Factory default)
- Trip detail is displayed only when the Digital key pad (option) is connected.
- State of trip and corrective actions

  In tripped state, display of trip details appears on the 7-segment LED of the Digital key pad and the motor does not work.

  Check the detail of trip, remove the cause, and clear the trip.

How to clear trip

When the motor is tripped, remove the cause, and clear by any of the setting procedures below:

[1] Turn off power, and turn on power after 10 seconds. (Power resetting)

[2] Press both ◓ and ◒ switch of Digital key pad simultaneously in trip detail display mode.

[3] Input the trip reset signal about 100ms or longer (when 10: Trip reset is set in Pr50 to 53).

[4] When Pr58 is “1”, input the operation start signal (run start signal, sequential run start signal, jog signal, and homing start signal) about 1 second or longer.

[5] Operation of communication software “PANATERM for BL” (download from our web site) also enables clearing of trip.

<Information>

- When protective functions marked with “ * ” operate in the list of protective functions described on the next page and after, trip reset by the procedure [1] shown above. (Trip cannot be cleared by the procedure, [2], [3], [4], and [5].)
- Setting change warning CAU (CAU) and Digital key pad communication error E_Cn (E_Cn) are not saved in trip history.
- Undervoltage error E-LU (E-LV) is not saved in trip history when power is turned off normally. It is saved only in instantaneous stop. (It is saved in trip history only when undervoltage state is established once and then voltage is recovered to normal state.)

List of protective functions

Display on the Digital key pad	Trip number (RS485)	Protective function	Causes	Countermeasure
E-LU	2	Undervoltage error (E-LV)	The motor trips when internal DC voltage (voltage of smoothing capacitor of power supply) is below specified value. Product of 100 V: Approx DC100 V Product of 200 V: Approx DC200 V	Investigate the condition of wiring and power supply.
E-OU	3	Overvoltage error (E-OV)	The motor trips when internal DC voltage (voltage of smoothing function of power supply) rises and exceeds specified value. Product of 100 V: Approx DC200 V Product of 200 V: Approx DC400 V	It is possible that deceleration time is too short. Set longer deceleration time. Not compatible with continuous lowering operation.
LED flashes	—	Overload warning (Electronic thermal)	When load factor exceeds specified value, the electronic thermal relay operates and monitor display flashes. It is an alarm fo 50 to 130 W: 100%	Reduce the load. Check the load factor in monitor mode.
THr	4	Overload error (Electronic thermal relay) (THr)	The motor trips when motor torque is output continuously above specified value. 50 to 130 W: 115%	Investigate the cause of overload, and reduce the load, change the operating pattern by making acceleration and deceleration time longer, or apply design to increase the capacity of motor.
E-OS	5	Overspeed error (E-OS)	The motor trips when rotation speed (actual speed) exceeds specified value. Approx 6000 r/min	Ensure that the actual speed does not exceed rated rotation speed, such as overshooting by unmatching between load and gain.
E-POS	6	Position error (E-POS)	The motor trips when position error (difference between command position and actual position) is greater than Pr39 × 8 [pulses].	Check the parameter again and adjust gain.
E-PO	7	* Position error counter overflow (E-PO)	The motor trips when the position error exceeds 8388607 [pulse].	Check the parameter again and adjust gain.

When any of protective functions marked with “ * ” operates, trip reset by the procedure of [1] on P.32.

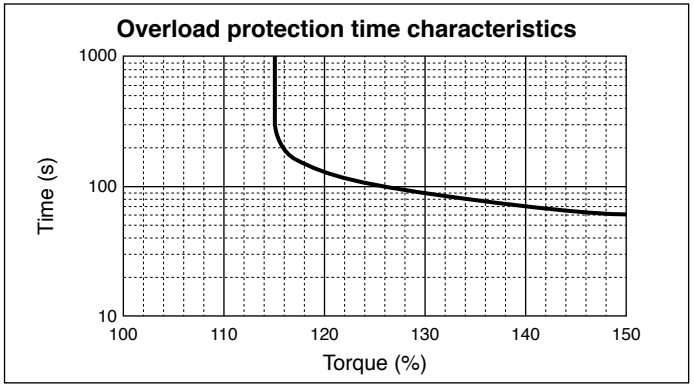
Protective function

Display on the Digital key pad	Trip number (RS485)	Protective function	Causes	Countermeasure
E-OC	8	* Overcurrent error (E-OC)	The motor trips when the motor current exceeds specified current.	[1] Excessive acceleration/ deceleration setting is possible. Set longer acceleration/ deceleration time. [2] Failure of internal circuit is possible.
E-OH	9	Overheat error (E-OH)	The motor trips when the temperature in control section rises above specified value. Approx 105 °C	Check the ambient temperature and cooling condition of motor. Check the load factor. If the ambient temperature is low enough, and the protection occurs soon after power-on, failure is possible.
E-OL	10	External forced trip (E-OL)	The motor trips when external forced trip input turns on.	Turn off external forced trip input, and reset tripping.
CAU	11	Setting change warning (CAU)	It occurs when parameter copying function on Digital key pad is completed normally. Also,when STOP key on Digital key pad is pressed, the motor trips and stops.	It is not abnormal. Execute trip reset.
E-485	12	RS485 communication error (E-485)	The motor trips when communication error of RS485 communication function occurs.	Check for noise problem in the vicinity. (See "Information – Communication" on P.68 for detail.)
E-rU	20	Command execution error (E-rU)	The motor trips when data is abnormal in executing an operation instruction (setting speed is 0, and travel distance is 32767 rotations or more).	Check the setting of parameter.
E-HO	21	Homing error (E-HO)	The motor trips when homing speed is 0, or when home cannot be detected although the motor shaft rotates more than parameter (Pr43) in homing operation, or when setting of sensor is abnormal	Investigate the setting of parameter, home sensor, and wiring of home sensor.
E-OF	22	* Present position overflow error (E-OF)	The motor trips after homing is completed, if present position exceeds ±32767 rotations.	Check the setting of parameter. (It can be made ineffective by Pr4A.)

When any of protective functions marked with " * " operates, trip reset by the procedure of [1] on P.32.

Display on the Digital key pad	Trip number (RS485)	Protective function	Causes	Countermeasure
E-LT	23	Hardware limit error (E-LT)	The motor trips after homing is completed, if hardware limit sensor is detected.	Check the installation of sensor, and setting of parameter.
E_Cn	—	Digital key pad communication error (E_Cn)	It occurs when the Digital key pad and motor cannot communicate normally. (This is a trouble on Digital key pad side. It does not affect motor operation.)	It can be cleared by reconnecting the Digital key pad. Make sure that Digital key pad and motor are connected normally.
E-UPr	90	* User parameter error (E-UPr)	Parameter data saved in EEPROM is abnormal.	Check all parameters again and set them again. If this protection works frequently, failure is possible.
E-SPr	91	* System parameter error (E-SPr)	Internal parameter data saved in EEPROM is abnormal.	Failure is possible.
E-CS	1	* Sensor error (E-CS)	The motor trips when trouble of CS sensor signal is detected.	[1] Malfunction due to external noise is possible. Investigate for noise source in the vicinity and eliminate such source. [2] Internal circuit may be in failure.
Err	Other numbers	* System error (Err)	The motor trips when trouble of control microcomputer is detected.	
-----	0	Normal condition	—	—

When any of protective functions marked with " * " operates, trip reset by the procedure of [1] on P.32.



Protective function

Troubleshooting

If any trouble should be found, follow the steps below to determine the fault.
If you cannot find out the cause, we recommend that you use the Digital key pad (option) or communication software “PANATERM for BL” (download from our web site) to check the detail of trip. If the motor or amplifier is in failure, or any part is damaged, or in another case of malfunction, contact the Panasonic partner where you bought the product.

Phenomenon	Detail of checking	Countermeasure
Motor does not rotate	Is any error in wiring.	Apply proper wiring.
	Check whether protective function is activated.	Check for tripping with Digital key pad. Turn off power once, and turn on again. Reset tripping.
	Check whether power LED (green) is lighted up.	If the LED is off when power is input to the amplifier, failure is possible. Contact us for repair.
	Check whether the voltage of power input line is normal.	Check the supply voltage and voltage described on amplifier nameplate.
	Check whether run start signal is input.	Check wiring.
	Homing is not executed yet.	First set the parameter for homing operation and execute homing operation.
	Check whether target position of each point of parameter is set.	Set the target position.
Motor stops during the run.	Check whether protective function is activated.	Overload on the motor is possible. Reduce the load, increase the capacity of motor, or increase the gear reduction ratio.
Motor stops during deceleration.	Check whether the inertia of load is too large.	Regenerative overload error was activated. Make the inertia smaller. Once turn off power and turn on again for clearing trip. Increase the deceleration time with Digital key pad.

Phenomenon	Detail of checking	Countermeasure
Large vibration or noise.	Output shaft of motor (gear head) and shaft of load are not aligned.	Check the connection between the output shaft of motor (gear head) and the load.
	Motor and gear head are not assembled correctly.	Check the assembling condition between motor and gear head, and their combination, and assemble them properly.
	Damage to gear head or bearing.	Contact us for repair.
	Gain is not adjusted properly.	Gain must be adjusted. Lower the setting.
Motor rotates reversely.	Check whether the setting of rotation direction (parameter) is wrong. Rotation direction of motor and that of gear head output shaft are reverse with some gear reduction ratio of gear head.	Check the setting of parameter. Check the gear reduction ratio. Check the rotation direction. See the list of permissible shaft torque on P.29.
Rotation speed is unstable during operation (actual speed).	Check whether the load fluctuates greatly.	Reduce the fluctuation of load. Increase the capacity of motor. Increase the gear reduction ratio.
Positioning accuracy is not precise.	Check whether the setting of parameter is wrong.	Adjust the parameter of target position of each point.
		Check the parameter of coordinate setting (relative and absolute).
Home position shifts.	Chattering of home sensor	Check wiring.
	Homing speed is too fast.	Reduce the setting speed with parameter.
Motor is too hot.	Start and stop are repeated frequently.	Check by display of load factor. Use within 80% is recommended.
Parameter does not change.	Check whether parameters are changed which are effective after resetting.	Turn off power once, and turn on again for resetting. See the list of parameters.
Rotation speed (actual speed) and target position are not as expected.	Check whether the setting of parameter is wrong.	Check the detail of parameter setting. See the list of parameters.
Rotation of motor is abnormal	Check the combination of motor and amplifier.	Use the motor and amplifier with the specified combination.

Parameter

Overview of parameter

Brushless amplifier of this series has various parameters that are used for adjusting or setting the features or functions of the motor. This section describes the purpose and function of these parameters. Ensure a full understanding of the parameters to achieve optimum operating performance.

List of parameters

Parameter No. (Pr□□)		Name of parameter	Effective after power resetting	Setting range	Default	Description	
00	The 1st point	The 1st target position (rotation number)		–16384 to 16383	0	Setting unit [rotation number]	You can set travel distance in rotation numbers and pulses. (288 pulses per rotation)
01		The 1st target position (Pulse)		–288 to 288	0	Setting unit [pulse]	
02		The 1st coordinate setting		0,1	1	You can select positioning system to the 1st point. **0**: Relative travel, **1**: Absolute travel	
03		The 1st setting speed		0 to 4000	2000	You can set the speed moving to the 1st point. Setting unit [r/min]	
04		The 1st acceleration time		1 to 30000	200	You can set time taken for reaching the 1st setting speed. Setting unit [ms]	
05		The 1st deceleration time		1 to 30000	200	You can set time taken from the 1st setting speed to stop. Setting unit [ms]	
06		The 1st block setting		0 to 2	0	**0**: Normal operation **1**: Continuous block operation (1st point → 2nd point) **2**: Combined block operation (1st point + 2nd point)	
07		The 1st block timer setting		0 to 30000	0	Enabled when you set Pr06 to "1". Start commanding of 2nd point after this setting time elapses and command of 1st point is completed. Enabled in unit of 2 ms. (If you set to 1, this is rounded down and recognized as 0.) Setting unit [ms]	
08	The 2nd point	The 2nd target position (rotation number)		–16384 to 16383	0	Setting unit [rotation number]	You can set travel distance in rotation numbers and pulses. (288 pulses per rotation)
09		The 2nd target position (Pulse)		–288 to 288	0	Setting unit [pulse]	
0A		The 2nd coordinate setting		0,1	1	You can select positioning system to the 2nd point. **0**: Relative travel, **1**: Absolute travel	
0b		The 2nd setting speed		0 to 4000	2000	You can set the speed moving to the 2nd point. Setting unit [r/min]	

Parameter No. (Pr□□)		Name of parameter	Effective after power resetting	Setting range	Default	Description	
0C	The 2nd point	The 2nd acceleration time		1 to 30000	200	You can set time taken for reaching the 2nd setting speed. Setting unit [ms]	
0d		The 2nd deceleration time		1 to 30000	200	You can set time taken from the 2nd setting speed to stop. Setting unit [ms]	
0E		The 2nd block setting		0, 1	0	**0**: Normal operation **1**: Continuous block operation (2nd point → 3rd point)	
0F		The 2nd block timer setting		0 to 30000	0	Enabled when you set Pr0E to "1". Start commanding of 3rd point after this setting time elapses and command of 2nd point is completed. Enabled in unit of 2 ms. Setting unit [ms]	
10	The 3rd point	The 3rd target position (rotation number)		–16384 to 16383	0	Setting unit [rotation number]	You can set travel distance in rotation numbers and pulses. (288 pulses per rotation)
11		The 3rd target position (Pulse)		–288 to 288	0	Setting unit [pulse]	
12		The 3rd coordinate setting		0, 1	1	You can select positioning system to the 3rd point. **0**: Relative travel, **1**: Absolute travel	
13		The 3rd setting speed		0 to 4000	2000	You can set the speed moving to the 3rd point. Setting unit [r/min]	
14		The 3rd acceleration time		1 to 30000	200	You can set time taken for reaching the 3rd setting speed. Setting unit [ms]	
15		The 3rd deceleration time		1 to 30000	200	You can set time taken from the 3rd setting speed to stop. Setting unit [ms]	
16		The 3rd block setting		0 to 2	0	**0**: Normal operation **1**: Continuous block operation (3rd point → 4th point) **2**: Combined block operation (3rd point + 4th point)	
17		The 3rd block timer setting		0 to 30000	0	Enabled when you set Pr16 to "1". Start commanding of 4th point after this setting time elapses and command of 3rd point is completed. Enabled in unit of 2 ms. Setting unit [ms]	
18	The 4th point	The 4th target position (rotation number)		–16384 to 16383	0	Setting unit [rotation number]	You can set travel distance in rotation numbers and pulses. (288 pulses per rotation)
19		The 4th target position (Pulse)		–288 to 288	0	Setting unit [pulse]	
1A		The 4th coordinate setting		0,1	1	You can select positioning system to the 4th point. **0**: Relative travel, **1**: Absolute travel	

Parameter

Parameter No. (Pr□□)	Name of parameter		Effective after power resetting	Setting range	Default	Description
1b	The 4th point	The 4th setting speed		0 to 4000	2000	You can set the speed moving to the 4th point. Setting unit [r/min]
1C		The 4th acceleration time		1 to 30000	200	You can set time taken for reaching the 4th setting speed. Setting unit [ms]
1d		The 4th deceleration time		1 to 30000	200	You can set time taken from the 4th setting speed to stop. Setting unit [ms]
1E		The 4th block setting		0, 1	0	**0**: Normal operation **1**: Continuous block operation (4th point → 1st point)
1F		The 4th block timer setting		0 to 30000	0	Enabled when you set Pr1E to "1". Start commanding of 1st point after this setting time elapses and command of 4th point is completed. Enabled in unit of 2 ms. Setting unit [ms]
20	Acceleration mode			0, 1	0	You can select running pattern in acceleration. **0**: Linear **1**: S-Pattern (Setting common to all points)
21	Deceleration mode			0, 1	0	You can select running pattern in deceleration. **0**: Linear **1**: S-Pattern (Setting common to all points)
22	Sequential run maximum point number			1 to 4	4	You can set the maximum point number for positioning by use of sequential run signal.
23	Coordinate system setting		○	0, 1	0	**0**: CCW rotation in + direction **1**: CW rotation in + direction
28	Position loop gain (the 1st gain)			0 to 100	5	You can determine the response of position control. You need not change it normally. When it is increased, the response is improved, which is likely to cause oscillation. (The 1st gain: When gain switching is used, the 1st gain is the gain at stop.)
29	Velocity loop gain (the 1st gain)			0 to 10000	1000	You can determine the response of velocity loop. You need not change it normally. When it is increased, the response is improved, which is likely to cause oscillation.
2A	Velocity loop integration gain (the 1st gain)			0 to 10000	500	You can determine the rigidity of velocity loop. You need not change it normally. When it is increased, the rigidity is improved, which is likely to cause oscillation.
2b	Velocity feed forward gain (the 1st gain)			0 to 100	0	Set it to 0 in normal use. This is the function to forward (add) position command to speed command.When the setting is increased, the position error is decreased and response improved, which makes overshoot large. Setting unit [%]

Parameter No. (Pr□□)	Name of parameter	Effective after power resetting	Setting range	Default	Description
2C	Speed detection filter (the 1st gain)		5 to 20	13	Use the default setting normally. You can set the time constant of low-pass filter of speed feedback. When the setting is made smaller, the gain can be made larger and response improved, which increases operation noise.
2d	Velocity feed forward time constant (Common to the 1st/2nd gain)		0 to 500	0	Set it at 0 in normal use. This is a filter in velocity feed forward section. When the setting is made larger, the time constant is made larger. Setting unit [ms]
2E	Torque limit setting (the 1st gain)		50 to 150	150	Output torque of motor is limited. Set it in [%] with reference to rated torque. (Torque value has no precision because torque is not controlled. Use it as an index.)
2F	Torque filter time constant (Common to the 1st/2nd gain)		0 to 500	0	You can set the time constant of primary delay filter of torque instruction. You need not change it normally. You can suppress oscillation due to insufficient rigidity of load. Setting unit [ms]
30	The 2nd position loop gain (the 2nd gain)		0 to 100	5	You can determine the response of position control. (The 2nd gain: When using gain switching, the 2nd gain is the gain in running.)
31	The 2nd velocity loop gain (the 2nd gain)		0 to 10000	1000	You can determine the response of velocity loop.
32	The 2nd velocity loop integration gain (the 2nd gain)		0 to 10000	500	You can determine the rigidity of velocity loop.
33	The 2nd velocity feed forward gain (the 2nd gain)		0 to 100	0	Set it at 0 in normal use. Setting unit [%]
34	The 2nd speed detection filter (the 2nd gain)		5 to 20	13	Use the default setting normally. You can set the time constant of low-pass filter in speed feedback.
35	The 2nd torque limit setting (The 2nd gain)		50 to 150	150	Output torque of the motor is limited. Set it in [%] with reference to rated torque. (Torque value has no precision because torque is not controlled. Use it as an index.)
36	Gain switching mode selection		0 to 2	0	**0**: Fixed at the 1st gain **1**: Fixed at the 2nd gain **2**: Automatic switching (In running = the 2nd gain, In standstill = the 1st gain)

Parameter

Parameter No. (Pr□□)	Name of parameter	Effective after power resetting	Setting range	Default	Description
37	Gain switching time		0 to 10000	50	When the gain switching mode is set to automatic switching, after the output of instruction, the 2nd gain (in running) changes to the 1st gain (in standstill) when time setting has elapsed. Setting unit [ms]
38	In-position range		0 to 16383	20	In-position signal is turned on when position error (difference between command position and actual position) is below setting. Setting unit [pulse]
39	Position error set-up		0 to 16383	144	Position error occurs when the value of position error (difference between command position and actual position) is larger than this parameter × 8 as well as parameter 3A is effective. Setting unit [pulse]
3A	Position error invalidation		0, 1	0	**0**: Effective **1**: Ineffective (Motor does not trip but keeps on operating.)
3E	Run-command selection	○	0, 1	0	You can select the run-command method with this parameter. **0**: Command through I/O **1**: Command through RS485 (Command through I/O will be disabled except trip and sensor input)
40	Homing mode		0 to 5	0	Select homing method. **0**: Home sensor homing 1 **1**: Home sensor homing 2 **2**: Limit sensor homing **3**: Bumping homing **4**: Home resetting **5**: Home sensor homing 3
41	Homing direction		0, 1	0	You can set the detection direction of home. **0**: Detecting in + direction **1**: Detecting in – direction
42	Homing speed		0 to 4000	200	You can set the speed in homing action. Setting unit [r/min]
43	Homing limit		0 to 16383	0	When the home cannot be detected although the motor travel distance has exceeded setting, homing error is found. (Ineffective at 0) Setting unit [rotation number]
44	Homing acceleration/ deceleration time		1 to 30000	200	You can set time taken for reaching the homing speed. Setting unit [ms]
45	Bumping torque detection value		50 to 150	50	You can limit the output torque of motor when returning to bumping home. You can set it in [%] with reference to the rated torque.

Parameter No. (Pr□□)	Name of parameter	Effective after power resetting	Setting range	Default	Description
46	Bumping detection time		0 to 15000	100	You can set the detection time of bumping toque in returning to bumping home. Setting unit [ms]
47	Home offset		–16384 to 16383	0	You can set the offset from home detection position. When the home has been detected, set a value of plus and minus opposite to the desired travel direction as an offset. (When you set –100, the position traveling 100 pulses in +direction on the coordinate system is set as an home.) Setting unit [pulse]
48	Homing function	○	0 to 2	1	**0**: Required **1**: Not required (Position when power is turned on is the home.) **2**: When homing is not completed yet, homing operation is executed by positioning start signal.
49	Homing selection when motor is free		0, 1	0	**0**: When homing is unavailable after motor-free state is reset (when trip occurs, after trip is reset), positioning operation is enabled. **1**: When motor is free (trip occurs), homing is required again. Note) When Pr48 is 1, setting of this parameter is ineffective.
4A	Present position overflow permission		0, 1	0	You can set operation when the present position counter of motor has overflowed (exceeded ±32767 rotations). **0**: Prohibited (motor trip) **1**: Permitted (no motor trip) Set it to 1 for operation to allow the motor to rotate in one direction without change.
4b	Jog speed		0 to 4000	100	You can set the operation speed in jog operation. Setting unit [r/min]
4C	Jog acceleration time		1 to 30000	200	You can set time taken for reaching jog speed. Setting unit [ms]
4d	Jog deceleration time		1 to 30000	200	You can set time taken from jog speed until stopping. Setting unit [ms]
4E	Teaching speed		0 to 4000	50	You can set speed used in applying teaching function of Digital key pad. Acceleration and deceleration time is the same as jog operation. Setting unit [r/min]

Parameter

Parameter No. (Pr□□)	Name of parameter	Effective after power resetting	Setting range	Default	Description
50	I1 function selection	○	0 to 15	8	You can assign functions to I1 through I4. **0**: Forced trip **1**: Instantaneous stop, **2**: Deceleration stop **3**: Homing start*, **4**: Forward jog* **5**: Reverse jog*, **6**: Point designation 1* **7**: Point designation 2*, **8**: Run start* **9**: Sequential run start*, **10**: Trip reset **11**: Home sensor, **12**: Limit in + direction **13**: Limit in – direction **14**: Direction switching* **15**: Motor-free *) When Pr3E is 1, this function is effective for I/O input for giving priority to RS485.
51	I2 function selection	○	0 to 15	6	
52	I3 function selection	○	0 to 15	11	
53	I4 function selection	○	0 to 15	0	
54	I1 Input logic selection	○	0, 1	0	**0**: Normal logic (Input is effective (ON) when connected to GND.) **1**: Reverse rotation logic (Input is effective (ON) when OPEN (open)) Set the reverse rotation logic to the input desired to be operated on wiring break side such as forced trip (emergency stop input).
55	I2 Input logic selection	○	0, 1	0	
56	I3 Input logic selection	○	0, 1	0	
57	I4 Input logic selection	○	0, 1	0	
58	Trip reset function enable		0, 1	1	**0**: Disable **1**: Enable (Operation start signal longer than 1 second enables execution of trip reset.)
59	Deceleration time in instantaneous stop		0 to 30000	0	Set the deceleration time in executing instantaneous stop. Setting unit [ms]
5C	01 function selection		0 to 5	0	You can assign functions to 01 and 02. **0**: Trip output, 1: In-position, **2**: In-motion signal (BUSY) **3**: Homing completion, **4**: Overload detection **5**: Torque under restriction
5d	02 function selection		0 to 5	2	
5E	01 output polarity selection		0, 1	0	**0**: Normal logic (Output transistor ON at enabled, OFF at disabled) **1**: Reversed logic (Output transistor OFF at enabled, ON at disabled) When only trip output is normal logic, output transistor is off in tripping, and output transistor is on in no tripping.
5F	02 output polarity selection		0, 1	0	
60	RS485 device number	○	128 to 159	129	See P.70.
61	RS485 communication speed	○	0 to 2	2	
62	RS485 communication standard	○	0 to 11	4	

Parameter No. (Pr□□)	Name of parameter	Effective after power resetting	Setting range	Default	Description
63	RS485 communication response time	○	10 to 1000	10	See P.70.
64	RS485 retry times of communication	○	0 to 9	9	
65	RS485 protocol Timeout	○	1 to 255	2	
6A	Trip history clear		nO (0) YES (1)	nO (0)	When "YES (1)" is set, trip history (Pr6b to 6F) is cleared. Trip history is also cleared when 1 is set on "PANATERM for BL" (download from our web site).
6b	Trip history 1		–	–	Display the latest trip.
6C	Trip history 2		–	–	Display the 2nd latest trip.
6d	Trip history 3		–	–	Display the 3rd latest trip.
6E	Trip history 4		–	–	Display the 4th latest trip.
6F	Trip history 5		–	–	Display the 5th latest trip.
77	Parameter copy function		nO P.InIT P.LOAd PPrOG	nO	This function is only available with use of the Digital key pad. See P.24.
7A	Monitor mode switching		0 to 6	0	You can choose monitor screen to be displayed first when the Digital key pad is connected. **0**: Rotation speed (actual speed), **1**: Torque **2**: Load factor **3**: Command speed **4**: Internal DC voltage **5**: Present position (lower 5 digits) **6**: Present position (rotation number)
7b	Numerator of command pulse ratio	○	1 to 20000	1	You can set the division multiplier ratio of travel distance. Change of this parameter does not affect operation speed of motor. You can set numerator : denominator = 100:1 to 1:100.
7C	Denominator of command pulse ratio	○	1 to 20000	1	
7F	For manufacturer use		–	–	It cannot be changed.

<Information>

- Pr6b, 6C, 6d, 6E, 6F, and 7F are read-only parameters. They cannot be changed.
- Parameters marked with ○ in the column of "effective after power resetting" become effective when power is turned off once and turned on again after about 10 seconds. They are not made effective just by changing.

List of parameters

List of parameters

Figures displayed on the 7 segment display of the Digital key pad are shown below.

Alphanumeric	LED display
A	A
B	b
C	C
D	d
E	E
F	F
G	G
H	H
I	I
K	k
L	L
N	n
O	O
P	P
Q	q
R	r

Alphanumeric	LED display
S	S
T	t
U	U
V	U
Y	y
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

• Example of LED display

nO	nO
P.PrOG	P.PrOG

Detail of parameters

Detail of parameters

Operation setting

• Positioning operation

This Brushless amplifier can save positioning information for a maximum of 4 points (the 1st to the 4th point), and allows operation by use of I/O interface. Travel distance, speed setting, acceleration time, deceleration time, and coordinate (relative travel/absolute travel) can be set for each point. Further, setting block operations allows operation to change speed setting and position allowing continuous movements of position to position with a single operation
command.

Homing must be completed for executing positioning operation. (It is possible to make homing unnecessary by Pr48.) If operation command run such as operation start is input without homing completed, the run command is ignored. If limit sensor is detected after completion of homing, hardware limit error E-LT (E-LT) is found. Travel distance is the addition of rotation number and pulse of motor shaft. One rotation of motor shaft corresponds to 288 [pulses], therefore the travel distance is the rotation number x 288 + pulse [pulses].

e.g.) When 1 [rotations] and 144 [pulses] are set at the target position, the travel distance is 432 pulses, this represents a travel distance of 1.5 rotations. Negative values can also be set on the pulse/value. When 2 [rotations] – 144 [pulses] is set, it also represents the same travel distance of 1.5 rotations.

Single positioning command allows up to 32767 rotations at the maximum on the motor shaft. When operation command is above 32767 rotations + 1 pulse, command execution error E-rU (E-rU) is found.

This Brushless amplifier is provided with two types of positioning instruction function, i.e. point designation run and sequential run. Operation to a designated point is executed by point designation run. In sequential run, point number is automatically updated (such as 1 → 2 → 3 → 1 ...) whenever an run signal is input.

[1] Point designation run (using run start signal and point designation signal)

Set Pr50 to 53 as follows and assign the function of signal input. Of signal inputs 1 to 4 (I1 to I4), set the parameter used for run start at “8”, the input used for point designation 1 at “6”, and the input parameter used for point designation 2 at “7”. When point designation is not assigned to signal input, such signal is always considered to be off. (For example, when the 3rd and 4th point are not designated, it is not required to assign point designation 2.) When run start is input after designation of point, the motor moves to any desired point.

Point designation 2 \ Point designation 1	OFF	ON
OFF	Runs to the 1st point.	Runs to the 2nd point.
ON	Runs to the 3rd point.	Runs to the 4th point.

[2] Sequential run (using sequential run start signal)

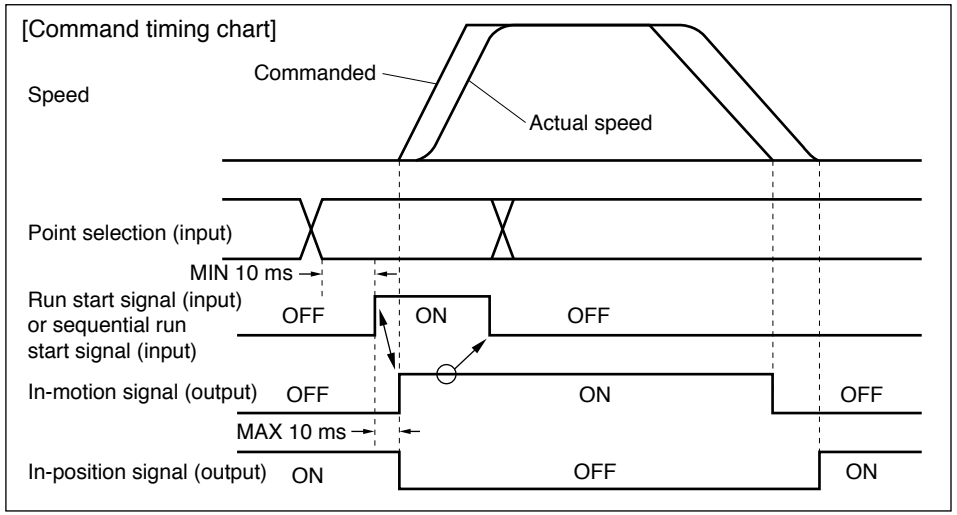
Set Pr50 to 53 as follows, and assign the function of signal input.

Of signal inputs 1 to 4 (I1 to I4), set the input parameter used for run start at "9" (sequential run start).

Positioning point number is incremented by one whenever the sequential run start signal is turned on. (When homing is completed, the initial run start point is always the 1st point.)

The maximum of run point can be set by Pr22.

e.g.) When Pr22 is 3, the motor runs in the order: the 1st point → the 2nd point → the 3rd point → the 1st point → ... whenever run command is input.



(1) Choose a point number for point designation run. Point designation is not required (made ineffective) in sequential operation.

(2) Set the run start signal at (ON (Default setting: ON when shorted to GND)). It activates operation.

(3) Make sure that in-motion signal (BUSY) is on, and then return the run start signal to off. (Assign the function of in-motion signal to signal output 01 or 02 by Pr5E and 5F.) Alternatively, turn on the run start signal, and turn it off in 20msec. Changing the next point designation number for positioning operation at this point causes no problem.

(4) When positioning operation is completed, in-motion signal (BUSY) returns to off. (If the run start signal is not off, positioning when operation is completed, in-motion signal still remains on.) In-position signal, after completion of command output, turns on when position error (difference between command position and actually reached position) is below setting of Pr38.

- Operation instruction can be given to the motor only when in-motion signal is off.

• Block operation

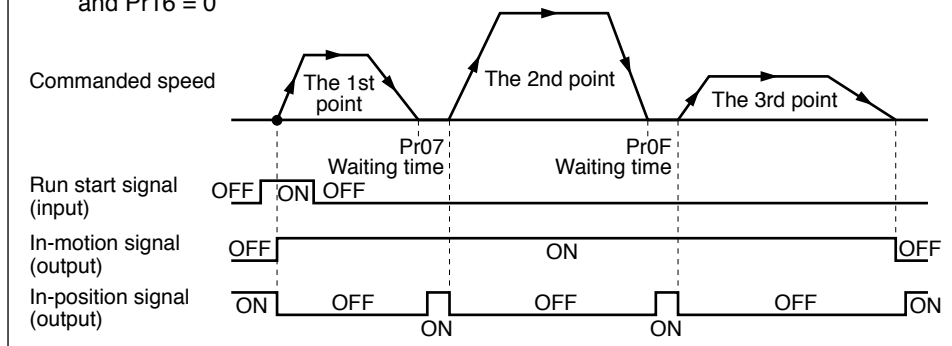
This motor allows continuous positioning to more than one point by single operation instruction (continuous block operation) or changing the speed setting on the way of operation (combined block operation) when block operation is set.

[1] Continuous block operation

Continuous block run is executed by setting the block setting parameter (Pr06, 0E, 16, and 1E) at "1", and giving run start command by any procedure.

When command output of point is completed, command output of the following points is started when set waiting time (Pr07, 0F, 17, and 1F) has elapsed.

e.g.) When run command is given to the 1st point by setting Pr06 = 1, Pr0E = 1, and Pr16 = 0



- When block setting parameters (Pr06, 0E, 16, and 1E) are all set to "1", single run start command allows the motor to keep moving in the order: the 1st point → the 2nd point → the 3rd point → the 4th point → the 1st point → ... until stop signal is input.
- Changing the value of Pr22 "Sequential run maximum point number" allows the motor to keep moving in the order: the 1st point → the 2nd point → the 3rd point → the 1st point → ... even when block setting parameters are all "1" (when Pr22 = 3).

[2] Combined block operation

When block setting parameter (Pr06 and 16) is set to "2", and run start command is given to the 1st or 3rd point in any procedure, combined block operation of the 1st point + 2nd point (or the 3rd point + the 4th point) is executed.

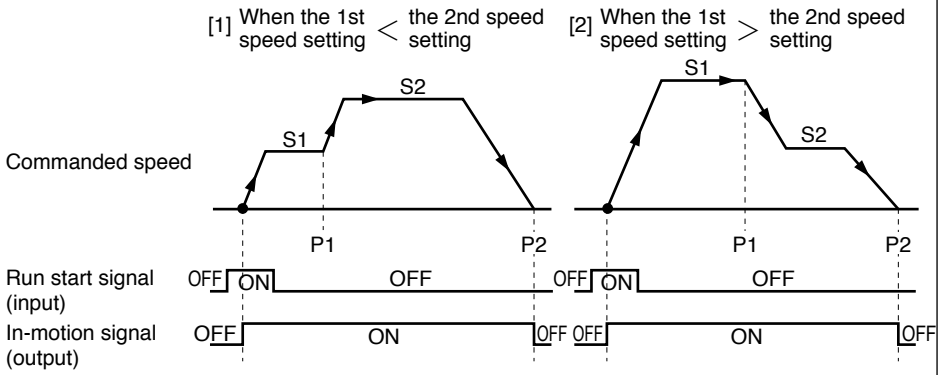
Positioning operation completion position in combined block operation is determined by the 2nd point (or the 4th point). Position for changing speed setting is determined by the 1st point (or the 3rd point).

Coordinate setting of each point can be either by relative travel or absolute travel.

When the 2nd point (or the 4th point) which is the positioning operation completion position is set by relative travel, coordinate is calculated by target position of the 1st point (or the 3rd point), and by run start position in the case of absolute travel.

When the 1st point (or the 3rd point) is set by absolute travel, if the motor passes the position designated by parameter, the motor speed changes to the speed set by the 2nd point (or the 4th point), and the motor runs to the target position. In relative travel, the motor runs by the speed designated at the 1st point (or the 3rd point) for the distance set by the 1st point (or the 3rd point) from run start, and then the motor speed changes to the speed designated at the 2nd point (or the 4th point) and the motor runs to the target position.

e.g.) When the 1st point and the 2nd point are set to combined block operation (Pr06 = 2)



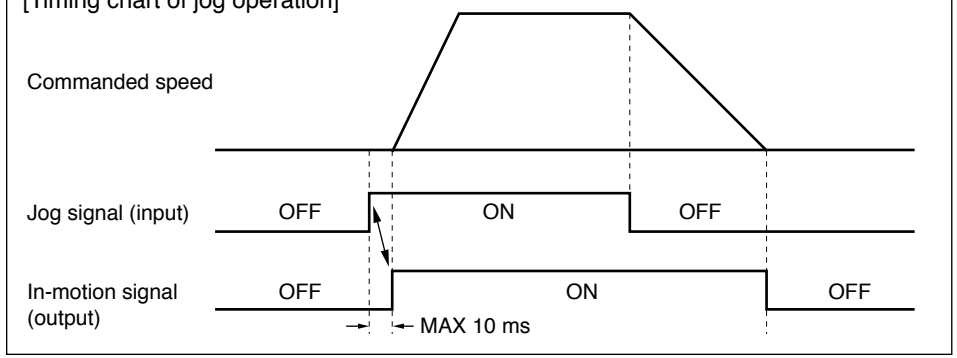
S1: The 1st speed setting set by the 1st point S2: The 2nd speed setting set by the 2nd point
P1: The 1st position P2: The 2nd position

- When the 1st point position > the 2nd point position (when the target position is closer than the position to change speed setting (P1)), the motor runs to the 2nd point position at the 1st speed setting and positioning operation is completed.
- When the motor run start position has already passed the position of the 1st point such as when the motor is stopped halfway (or when the operation direction to the 1st point is different from that to the 2nd point), the motor runs to the position of the 2nd point at the 2nd speed setting, and positioning operation is completed.
- During combined block operation, data of the 1st point is applied to the setting of acceleration and deceleration time. Setting at the 2nd point is made ineffective, and the motor operates with acceleration and deceleration time set at the 1st point.
- In combined block operation, acceleration and deceleration pattern is fixed to linearity. (It is the same when the motor runs to the target position at a constant speed.)
- In combined block operation (status where the 1st block setting is “2”), when the 2nd point positioning command is executed, command execution error E-rU (E-rU) is found.
- When using block setting “2” and “1” together, it is enabled by setting the block setting parameter at “1” and setting the block timer at the 2nd point. (Operation at the 3rd point is started after completion of combined block operation at the 1st point + the 2nd point.)

• Jog operation

The motor runs in one direction at a specified speed as long as the signal is on.
Jog operation is allowed even when homing is not completed.
Set Pr50 to 53 as follows, and assign the function of signal input.
Of signal inputs 1 to 4 (I1 to I4), set the input used for forward jog operation instruction at “4”, and the input used for reverse jog operation instruction at “5”.
The motor runs in specified direction as long as specified input signal is on.
When the input signal is turned off, the motor reduces its speed and stops.
See Pr4b to 4d for parameters relating to jog operation.

[Timing chart of jog operation]



(1) Change the jog start signal from contact-off to the status of connection to GND (on). It activates operation.
(2) When the jog start signal is returned to off, the motor starts speed reduction.
(3) When operation is completed, the transistor of in-motion signal (BUSY) returns to off.
- Operation instruction can be given to the motor only when in-motion signal is off.
- In jog operation, setting of Pr20 is applied to acceleration and deceleration pattern (linear and S-letter) as for acceleration. In deceleration, the pattern is linear irrespective of setting of Pr21.

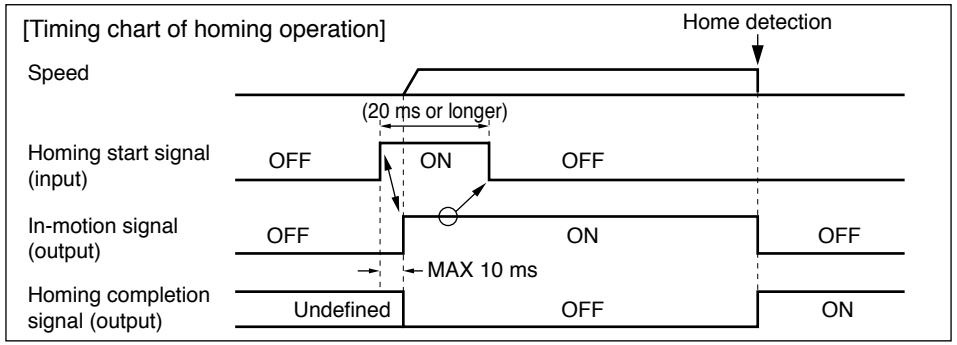
• Homing operation

In order to establish the reference position of motor, homing operation is always required for positioning operation.
In applications where homing operation is not required, set Pr48 at "1", then the position where power is turned on is assumed to be the home (0), by which positioning operation is enabled. After completion of homing, when the limit sensor in motor operation direction is detected, hardware limit error E-LT (E-LT) is found.
When you use the relative travel command in positioning, positioning might shift after the motor trip reset, or at positioning after turning the motor-free signal from OFF to ON. If you find any problem in such a use, set Pr49 at "1" to apply "homing operation required again when motor is free".

This motor support the following homing operation.

Parameter 40	Homing name	Description
0	Home sensor homing 1	Edge of home sensor is detected to be set to the home.
1	Home sensor homing 2	When the home sensor is on at the homing command, corresponding position is set to the home. In any other case, operation the same as home sensor homing 1 is executed.
5	Home sensor homing 3	When reversing is not desired in homing (only for rotation system)
2	Limit sensor homing	Edge of limit sensor is detected and set to the home.
3	Bumping homing	Mechanical end is detected and set to the home.
4	Home resetting	Present position is reset to be the home.

In order to execute homing operation, set Pr50 to 53 as follows to assign the function of signal input.
Assign one of signal inputs 1 to 4 (I1 to I4) to the input used for homing start signal. (Set Pr52 at "3" for I3.) Be sure to assign the function required for respective homing to the signal input. Unnecessary sensors (functions) need not be assigned if not required.
When Pr48 is set to "2", it is enabled to execute homing operation with run start signal (run start and sequential run start) when homing is not completed.
See Pr 40 to 49 for parameters relating to homing operation. Set the homing speed as low as possible in order to improve accuracy in homing.

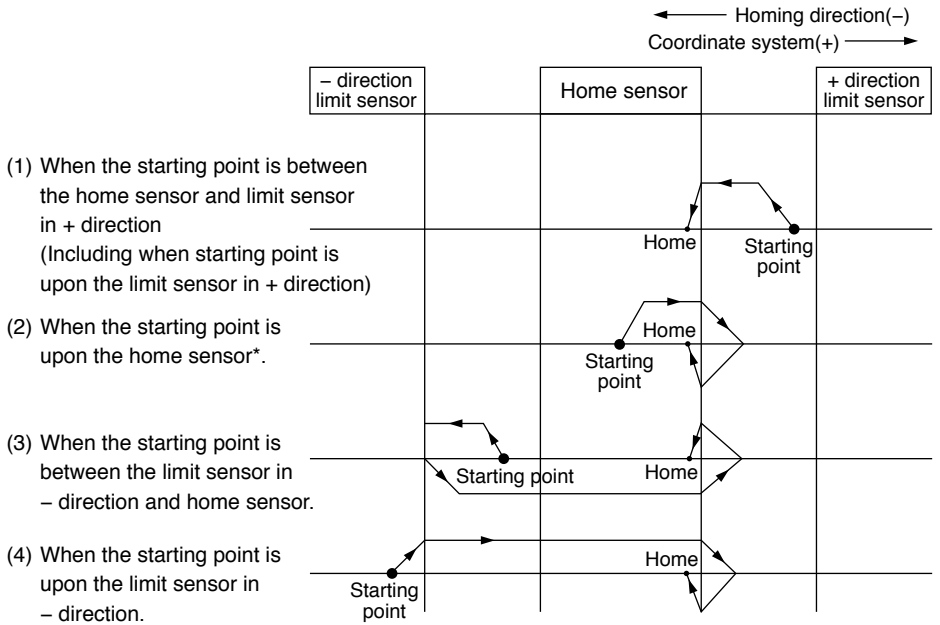


(1) Change the homing start signal (or run start signal (when Pr48 is 2)) from contactoff to the status of connection to GND (on). It activates operation. Even when homing has been completed, if homing is started, the homing completion signal turns off.
(2) Make sure that in-motion signal (BUSY) is on and return the homing start signal to open status. Alternatively, enable the homing operation return start signal for a minimum of 20msec.
(3) When operation is completed, in-motion signal (BUSY) returns to off. (If the homing start signal is not off, even when operation is completed, the in-motion signal is still on.) Also, when homing is completed normally, the homing completion signal turns on.

- Run signal can be given to the motor only when in-motion signal is off.
- In homing operation, setting of Pr20 is applied to acceleration and deceleration pattern (linear and S-shape) as for acceleration. In deceleration, the pattern is linear irrespective of setting of Pr21.

Home sensor homing 1 (Pr40 = 0), Home sensor homing 2 (Pr40 = 1)

e.g. 1: When "Pr41 Detects the homing direction in – direction" is set.

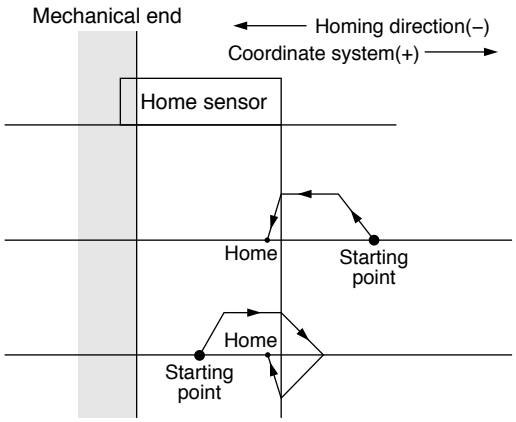


* In the case of home sensor homing 2, when homing operation is executed upon the home sensor of 2, the motor is not activated but the position is set to the home, and homing operation is completed.

e.g. 2: When homing consists of home sensor only.

(1) When the starting point is other than home sensor.

(2) When the starting point is upon the home sensor.



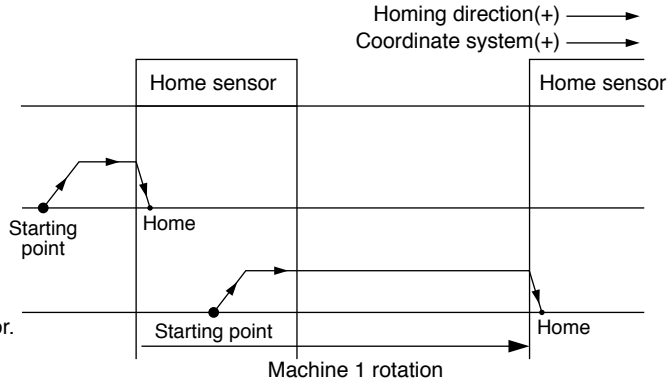
Be sure to set the homing direction so that homing operation is executed in the direction where home sensor is located. In this example, set “Pr41 Detects the homing direction in – direction”.

Home sensor homing 3 (Pr40 = 5) (Only for rotation system)

e.g. : When “Pr41 Detects the homing direction in + direction” is set

(1) When the starting point is out of the home sensor.

(2) When the starting point is upon the home sensor.



Set this option when the machine belongs to rotational system and reversing is not desired.

In this mode, the motor always runs in the set homing direction, and the edge of home sensor is detected and set to the home. (In this case, runs in + direction only with no reversing.)

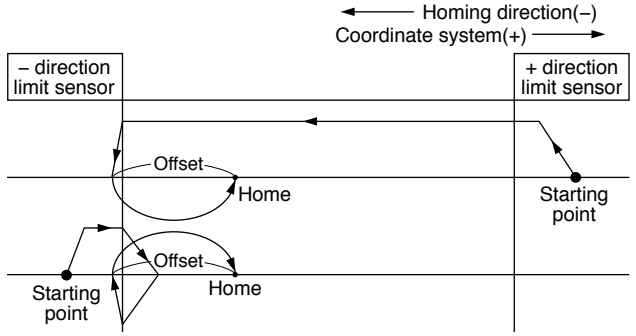
If a limit sensor in running direction is detected during homing, homing error E-HO (E-HO) is found.

Limit sensor homing (Pr40 = 2)

e.g. : When “Pr41 Detects the homing direction in – direction” is set.

(1) When the starting point is not upon the limit sensor in – direction.

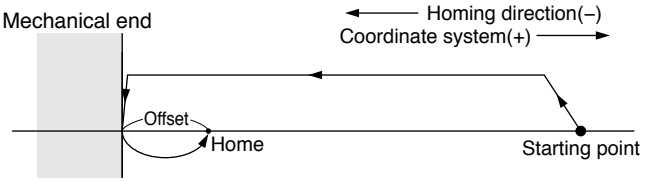
(2) When the starting point is upon the limit sensor in – direction.



In using this mode, the motor at the home position is within the limit sensor, therefore be sure to set the home offset (Pr47). When the offset is set to –100, the point which is moved 100 pulses in + direction as viewed from the edge of limit sensor in - direction is set to the home. (Set a value of plus and minus opposite to the desired travel direction as an offset.)

Bumping homing (Pr40 = 3)

e.g. : When “Pr41 Detects the homing direction in – direction” is set.



When the torque value has exceeded the setting (Pr45) for preset time (Pr46), homing is completed.

During operation of this mode, the value of torque limit is restricted by bumping torque detection value (Pr45).

In bumping homing operation, when limit sensor in operation direction is detected, homing error E-H0 (E-H0) is found.

In using this mode, the motor at the home position is in contact with the mechanical end, therefore be sure to set the home offset (Pr47). (Set a value of plus and minus opposite to the desired travel direction as an offset.)

<Caution>

In setting the bumping homing, too high homing speed or too large torque limit causes excessive shock, which may give damage to the machine or motor. Restrict the homing speed to approx 100 r/min on motor shaft, and bumping torque limit below rated motor torque.

Home resetting (Pr40 = 4)

In this mode, the position where homing start signal is input is set to the home (0 position), and the motor does not run but homing operation is completed.

Detail of parameters

Signal Input and Signal Output Choosing Function

• Signal input choosing function

Function can be assigned to signal input I1 to I4 by Pr50 to 53.

Function number	Assignment function	Description of function
0	Forced trip	When preset signal input is turned on, the Brushless amplifier executes external forced trip E-0L (E-0L). When external forced trip is executed, in order to activate the Brushless amplifier again, reset trip and then input the run command.
1	Instantaneous stop	When preset signal input is turned on, the Brushless amplifier reduces speed and stops in deceleration time set by Pr59 “Deceleration time in instantaneous stop”. (Linear deceleration) When the setting is “0”, the command is an instantaneous stop. (However, the Brushless amplifier may operate for accumulated pulses of command.) Run command cannot be given to the Brushless amplifier with stop signal turned on. Be sure to turn off stop signal in operation.
2	Deceleration stop	When preset signal input is turned on, the Brushless amplifier reduces speed and stops in deceleration time set at the start of Brushless amplifier operation (deceleration time set on each point in positioning operation, jog deceleration time in jog operation, and homing acceleration and deceleration time in homing). (Linear deceleration) Run command cannot be given to the Brushless amplifier with deceleration stop signal turned on. Be sure to turn off deceleration stop signal in operation.
3	Homing start	When this signal is turned on, homing operation is started.
4	Forward jog	The motor runs at jog speed in + direction as long as this signal is on.
5	Reverse jog	The motor runs at jog speed in – direction as long as this signal is on.
6	Point designation 1	Point designation 1
7	Point designation 2	Point designation 2
8	Run start	Motor is positioned at any point designated by point designation 1 and 2.
9	Sequential run start	Motor is positioned at the following point every time the signal is input.
10	Trip reset	The trip is reset (trip cleared) when set signal input is turned on approx 100 ms or longer. When Pr58 is set at "1", trip can be reset by turning on operation start signal (run start, sequential run start, forward jog, reverse jog, and homing start) for approx 1 second or longer. Be sure to remove the cause before trip reset.
11	Home sensor	Make wiring so that the signal is turned on when home sensor is detected.
12	Limit in + direction	Make wiring so that the signal turn on any time. If the input is turned off, the motor does not run in + direction. Limit function is disabled when this signal is not used.
13	Limit in – direction	Make wiring so that the signal turn on any time. If the input is turned off, the motor does not run in - direction. Limit function is disabled when this signal is not used.
14	Direction switching	Direction of homing, jog, and positioning command is all reversed while this signal is turned on.
15	Motor-free	When preset signal is turned on, the motor is free to rotate. If the motor-free signal is turned on during motor operation, the load may keep moving through inertia and hit mechanical stops. In addition, it is impossible to give run command to the motor with motor-free signal turned on. Be sure to turn off the signal in running. In switching the motor-free signal from on to off, input the run start signal after 100ms or longer the motor-free signal is turned off. In the case where relative travel command is used for positioning operation, if positioning operation is executed after turning on and then off the motor-free signal, positioning might shift. If this is inconvenient to your application, set Pr49 to "1. homing operation is required again when motor is free". Then, homing operation is required again for executing positioning operation when motor-free condition (or trip) is cleared.

- When more than one signal input is assigned to the same function, the signal is made effective when any one signal is input.
- Logic of signal input can be changed by setting the polarity change parameter (Pr54 to Pr57) (Set an input desired to be operated on disconnected side of wiring such as 0: Normal logic (Input is effective in connecting with GND), 1: Inverted logic (Input is effective by OPEN), Inverted logic is forced trip (emergency stop input).
- Parameters above (Pr50 to 57) are made effective after power is turned on again.

• Signal output selection function

Function can be assigned to signal output 01 and 02 by Pr5C and 5d.

Function number	Assignment function	Description of function (standard logic)
0	Trip output	This signal is normally on, and turns off when tripping occurs.
1	In-position	This signal turns on when motion command is completed as well as position error is within Pr38.
2	In-motion (BUSY)	This signal turns on during run command. (Run start signal is not accepted as long as this signal is on.)
3	Homing completion	This signal turns on when homing operation is completed.
4	Overload detection	This signal turns on when torque above 100% is output.
5	Torque under restriction	This signal turns on as long as torque is restricted.

- Logic of signal output can be inverted by polarity choosing parameter (Pr5E and 5F).

Gain switching function

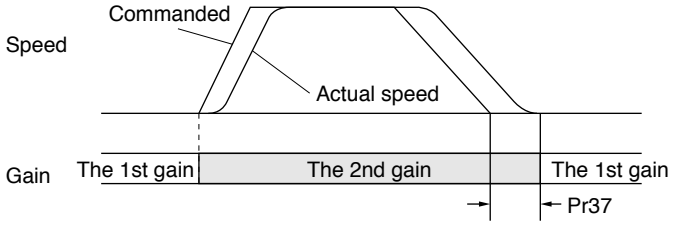
You can switch the gain parameter automatically while the motor is in run-command and is at standstill.

During the automatic gain switching (Pr36 = 2), the 2nd gain is applied while the motor is in runcommand, and the 1st gain is applied while the motor is at standstill.

With this gain switching function, you can change the holding torque at the motor standstill by setting different values of torque limit between 1st and 2nd gain.

Parameter name	Parameter number		Supplement
	The 1st gain (when stopped)	The 2nd gain (during instruction)	
Position loop gain	28	30	Determines the response of position control.
Velocity loop gain	29	31	Determines the response of velocity loop.
Velocity loop integration gain	2A	32	Determines the rigidity of velocity loop.
Velocity feed forward	2b	33	Function to forward (add) position instruction to commanded speed
Speed detection filter	2C	34	Sets the time constant of low-pass filter of speed feedback.
Velocity feed forward time constant	2d		Filter in velocity feed forward
Torque limit	2E	35	Limits the output torque of motor.
Gain switching mode selection	36		**0**: The 1st gain fixed **1**: The 2nd gain fixed **2**: Automatic switching
Gain switching time	37		Changes to the 1st gain in the time set by parameter after command output is completed. Unit [ms].

Operation is as follows when Pr36 is “2”.



Note)

It is not allowed to set switching time in changing from the 1st gain to the 2nd gain in the start of operation.

Outline of PANATERM for BL

Communicating software “PANATERM for BL” (download from our web site) can do the following thing.

(1) Setting and saving of parameters of brushless amplifier and writing setting to memory EEPROM.

(2) Monitor of input/output signals, monitor of a load factor.

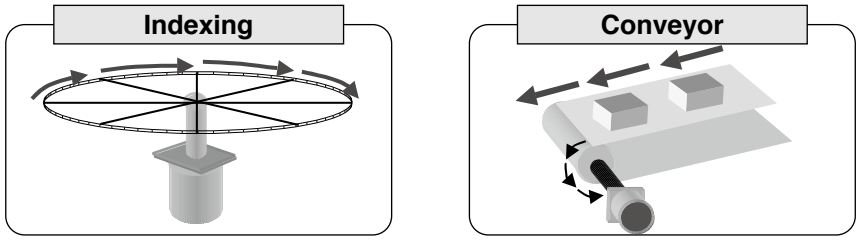
(3) The present trip display and reference of a trip history.

(4) Data measurement of waveform graphics, and the call of preservation data.

Example setting of motion pattern

Indexing (feeding by fixed length)

• When feeding by fixed length of travel



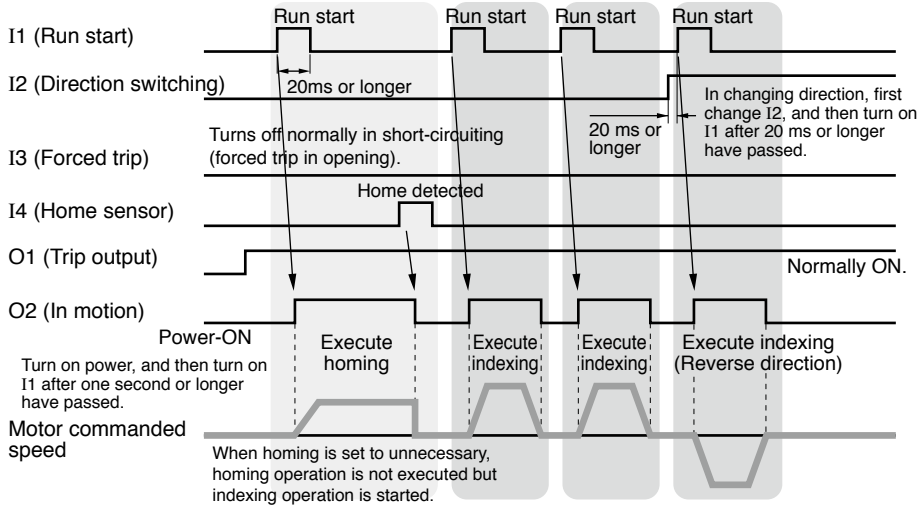
<Example of setting>

- Every time I1 is turned on, the motor runs for fixed travel distance.
- Homing operation is executed and the home is set when I1 is turned on just once after power-on. (It is also possible to set power-on position to the home.)

[Signal function setting]

Terminal symbol	Terminal number	Terminal name	Description of function
I1	1	Signal input 1	Operates when "I1" and "GND" are shorted (Homing operation for the first time after power-on)
I2	2	Signal input 2	CW operation when "I2" and "GND" are shorted, CCW operation when they are opened (including homing operation mode)
I3	11	Signal input 3	Motor trips when "I3" and "GND" are open.
I4	4	Signal input 4	Home detected when "I4" and "GND" are shorted.
O1	6	Signal output 1	Trip output (Normally on, and off in tripping)
O2	12	Signal output 2	In motion signal (including homing operation)

[Operation timing chart]



[Parameter setting] Indicates only the point changed from default setting.
(Parameter marked with * is effective after power resetting.)

Function	Parameter No. (Pr□□)	Name of parameter	Setting	Remarks
Selection of signal function	50*	I1 function selection	8	Run start (used only for the 1st point)
	51*	I2 function selection	14	Direction switching input
	52*	I3 function selection	0	Forced trip input
	53*	I4 function selection	11	Home sensor input
	56*	I3 input logic selection	1	Changes the polarity of 3 to effective when open (forced trip in this case).
	5C	01 function selection	0	Trip output
	5d	02 function selection	2	In-motion signal
Homing function	40	Homing mode	0, 1, 5	Set homing in which to use home sensor.
	41	Homing direction	0, 1	Set any desired homing direction.
	42	Homing speed	200	Set any desired operation speed.
	44	Homing acceleration/ deceleration time	200	Set any desired acceleration/deceleration time.
	48*	Homing function	2	Set to 1 when setting power-on position to the home.
	49	Selecting homing when motor is free	1	Set to 1 (homing is required again when tripping occurs.)
	4A	Present position overflow permission	1	Set to 1 (permits overflow).
The 1st point (indexing length)	00	The 1st target position (rotation number)	10	Set the travel distance by rotation number and pulse (one rotation per 288 pulses). When the setting does not represent proper mechanical reduction gear ratio, accumulated error occurs, which results in dislocation.
	01	The 1st target position (pulse)	0	
	02	The 1st coordinate setting	0	Set relative travel.
	03	The 1st setting speed	2000	Set any desired operation speed.
	04, 05	The 1st acceleration time/ The 1st deceleration time	200	Set any desired acceleration time and deceleration time.
	06	The 1st block setting	0	Set normal operation.

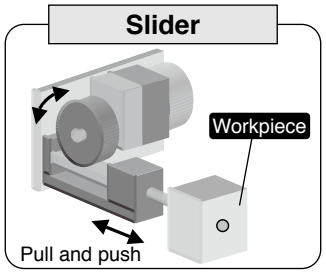
<Information>

In this setting, I3 is set to forced trip when open. Connect an emergency stop switch or the like which is shorted but open at error to I3 terminal.
Please note that the motor will not run due to forced trip without such connection.

Example setting of motion pattern

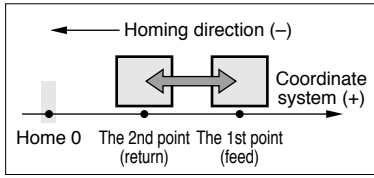
Reciprocating

• When executing reciprocating run between fixed positions



<Example of setting>

- Every time I1 is turned on, feed action → return action → feed action is repeated in turn.
- When power is on, homing operation is executed and home is set by I1.

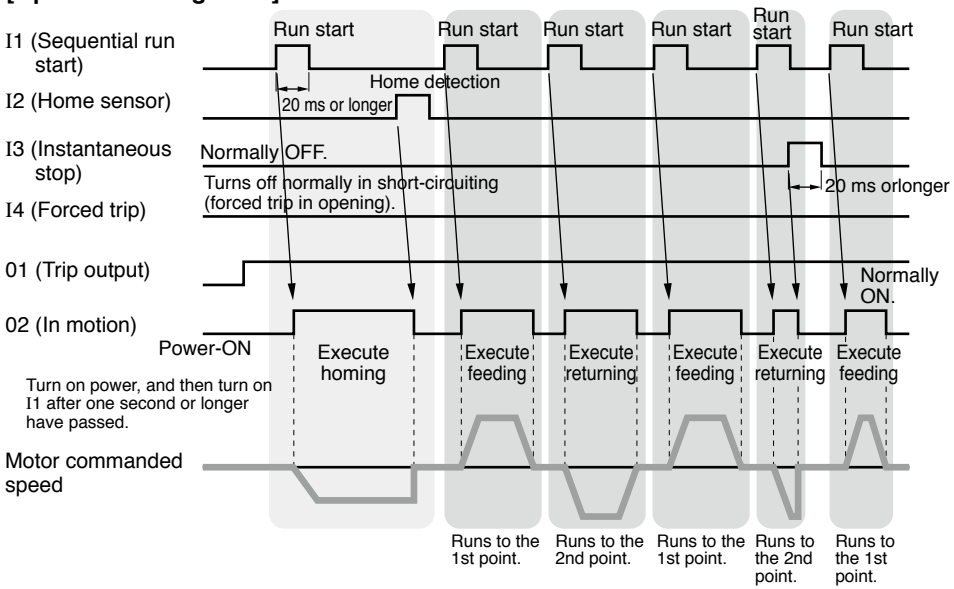


Coordinate system + direction depends on configuration of gear head and machine. When setting the rotation direction CCW of motor shaft to +, set Pr23 at "0", and when setting CW to +, set Pr23 at "1".

[Signal function setting]

Terminal symbol	Terminal number	Terminal name	Description of function
I1	1	Signal input 1	Operates when "I1" and "GND" are shorted (Homing operation for the first time after power-on)
I2	2	Signal input 2	Home detected when "I2" and "GND" are shorted.
I3	11	Signal input 3	Operation stops when "I3" and "GND" are shorted.
I4	4	Signal input 4	Motor trips when "I4" and "GND" are open.
O1	6	Signal output 1	Trip output (Normally on, and off in tripping)
O2	12	Signal output 2	In motion signal (including homing operation)

[Operation timing chart]



After the motor has stopped instantaneously during return operation, when I1 is turned on again, feed operation is executed from stop position.
Similarly, after the motor has stopped instantaneously during feed operation, when I1 is turned on again, return operation is executed.

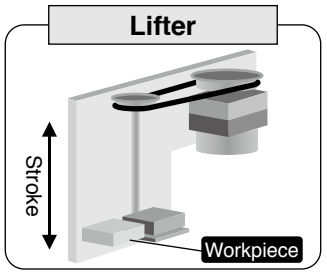
[Parameter setting] Indicates only the point changed from default setting.
(Parameter marked with * is effective after power resetting.)

Function	Parameter No. (Pr□□)	Name of parameter	Setting	Remarks
Selection of signal function	50*	I1 function selection	9	Sequential run start
	51*	I2 function selection	11	Home sensor input
	52*	I3 function selection	1	Instantaneous stop input
	53*	I4 function selection	0	Forced trip input
	57*	I4 input logic selection	1	Changes the polarity of I4 to effective when open (forced trip in this case).
	5C	01 function selection	0	Trip output
	5d	02 function selection	2	In-motion signal
Homing function	40	Homing mode	0	Set homing in which to use home sensor.
	41	Homing direction	1	Set the homing direction normally to minus direction (return direction).
	42	Homing speed	200	Set any desired operation speed.
	44	Homing acceleration/ deceleration time	200	Set any desired acceleration/deceleration time.
	48*	Homing function	2	Homing operation by initial I1 input when power is turned on.
	49	Selecting homing when motor is free	0	Homing is not required when tripping occurs.
	4A	Present position overflow permission	0	Overflow is not permitted because absolute travel is set.
	23*	Coordinate system setting	0, 1	Set so that homing is in minus direction.
The 1st point (feed position)	00	The 1st target position (rotation number)	10	Set the feed position coordinates.
	01	The 1st target position (pulse)	0	
	02	The 1st coordinate setting	1	Set absolute travel.
	03	The 1st setting speed	2000	Set any desired travel.
	04, 05	The 1st acceleration time/ The 1st deceleration time	200	Set any desired acceleration time and deceleration time.
	06	The 1st block setting	0	Set normal operation.
The 2nd point (return position)	08	The 2nd target position (rotation number)	2	Set the return position coordinate. (Set 0 when the position is the same as home.)
	09	The 2nd target position (pulse)	0	
	0A	The 2nd coordinate setting	1	Set absolute travel.
	0b	The 2nd setting speed	2000	Set any desired travel.
	0C, 0d	The 2nd acceleration time/ The 2nd deceleration time	200	Set any desired acceleration time and deceleration time.
	0E	The 2nd block setting	0	Set normal operation.
Others	22	Sequential run Maximum point number	2	Restricts the maximum point number in sequential operation. When this parameter is set to 2, whenever I1 is turned on, system operates in turn from the 1st point → the 2nd point → the 1st point ....

Example setting of motion pattern

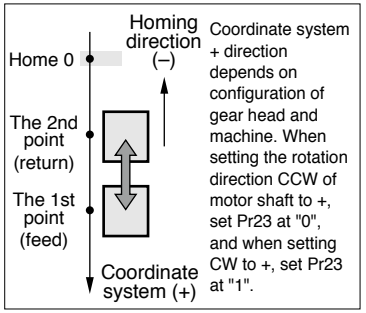
Automatic reciprocating

• When executing fixed reciprocating sequence operation with single run start signal



<Example of setting>

- When I1 is turned on, the unit moves to target position (feed position), waits for a specified time, and returns to original position (return position).
- When power is on, homing operation is executed and home is set by I1.

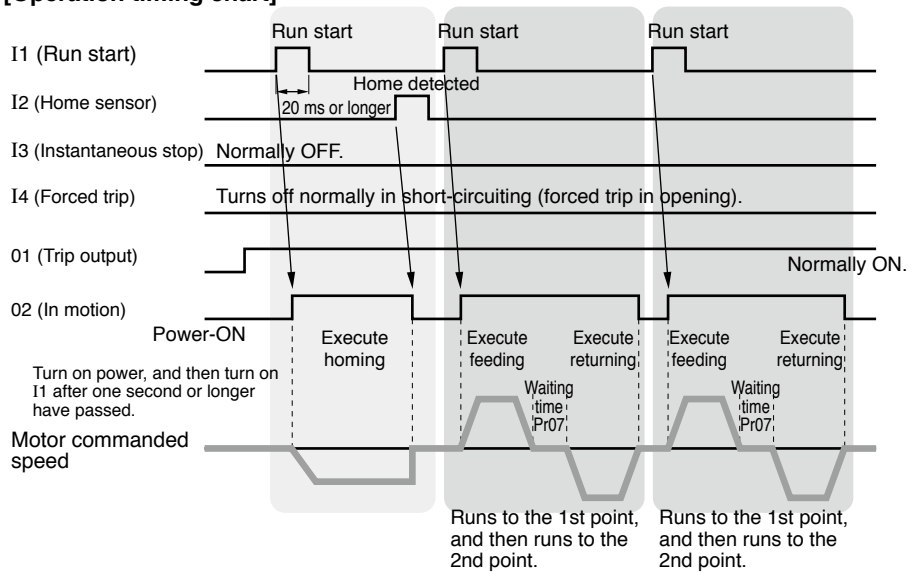


Coordinate system + direction depends on configuration of gear head and machine. When setting the rotation direction CCW of motor shaft to +, set Pr23 at "0", and when setting CW to +, set Pr23 at "1".

[Signal function setting]

Terminal symbol	Terminal number	Terminal name	Description of function
I1	1	Signal input 1	Operates when "I1" and "GND" are shorted (Homing operation for the first time after power-on)
I2	2	Signal input 2	Home detected when "I2" and "GND" are shorted.
I3	11	Signal input 3	Operation stops when "I3" and "GND" are shorted. (Motor does not operate during short-circuit.)
I4	4	Signal input 4	Motor trips when "I4" and "GND" are open.
O1	6	Signal output 1	Trip output (Normally on, and off in tripping)
O2	12	Signal output 2	In motion signal (including homing operation)

[Operation timing chart]



After the motor has stopped instantaneously during operation, when I1 is turned on again, feed operation is always executed in the first (running to the 1st point).

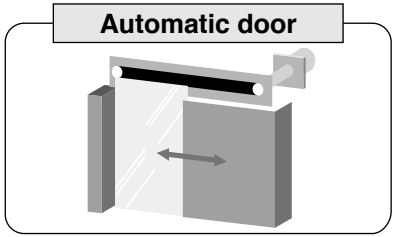
[Parameter setting] Indicates only the point changed from default setting. (Parameter marked with * is effective after power resetting.)

Function	Parameter No. (Pr□□)	Name of parameter	Setting	Remarks
Selection of signal function	50*	I1 function selection	8	Run start
	51*	I2 function selection	11	Home sensor input
	52*	I3 function selection	1	Instantaneous stop input
	53*	I4 function selection	0	Forced trip input
	57*	I4 input logic selection	1	Changes the polarity of I4 to effective when open (forced trip in this case).
	5C	01 function selection	0	Trip output
	5d	02 function selection	2	In-motion signal
Homing function	40	Homing mode	0	Set homing in which to use home sensor.
	41	Homing direction	1	Set the homing direction normally to minus direction (return direction).
	42	Homing speed	200	Set any desired operation speed.
	44	Homing acceleration/ deceleration time	200	Set any desired acceleration/deceleration time.
	48*	Homing function	2	Homing operation by initial I1 input when power is turned on.
	49	Selecting homing when motor is free	0	Homing is not required when tripping occurs.
	4A	Present position overflow permission	0	Overflow is not permitted because absolute travel is set.
	23*	Coordinate system setting	0, 1	Set so that homing is in minus direction.
The 1st point (feed position)	00	The 1st target position (rotation number)	10	Set the feed position coordinates.
	01	The 1st target position (pulse)	0	
	02	The 1st coordinate setting	1	Set absolute travel.
	03	The 1st setting speed	2000	Set any desired operation speed.
	04, 05	The 1st acceleration time/ The 1st deceleration time	200	Set any desired acceleration/deceleration time.
	06	The 1st block setting	1	Execute running to the 2nd point, after executing running to the 1st point.
	07	The 1st block timer setting	500	The 2nd point operation is started in 500 ms.
The 2nd point (return position)	08	The 2nd target position (rotation number)	2	Set the return position coordinate. (Set 0 when the position is the same as home.)
	09	The 2nd target position (pulse)	0	
	0A	The 2nd coordinate setting	1	Set absolute travel.
	0b	The 2nd setting speed	2000	Set any desired operation speed.
	0C, 0d	The 2nd acceleration time/ The 2nd deceleration time	200	Set any desired acceleration/deceleration time.
	0E	The 2nd block setting	0	Set normal operation.
	0F	The 2nd block timer setting	0	Ineffective because 0E is 0.

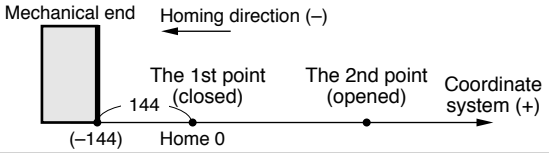
Example setting of motion pattern

Door opening/closing

• When executing reciprocating operation between 2 points



- Coordinate system + direction depends on configuration of gear head and machine. When setting the rotation direction CCW of motor shaft to +, set Pr23 at "0", and when setting CW to +, set Pr23 at "1".
- When setting the Mechanical end offset value to –144, the Home is the point which has moved 144 pulses to the + direction seen from the Mechanical end.



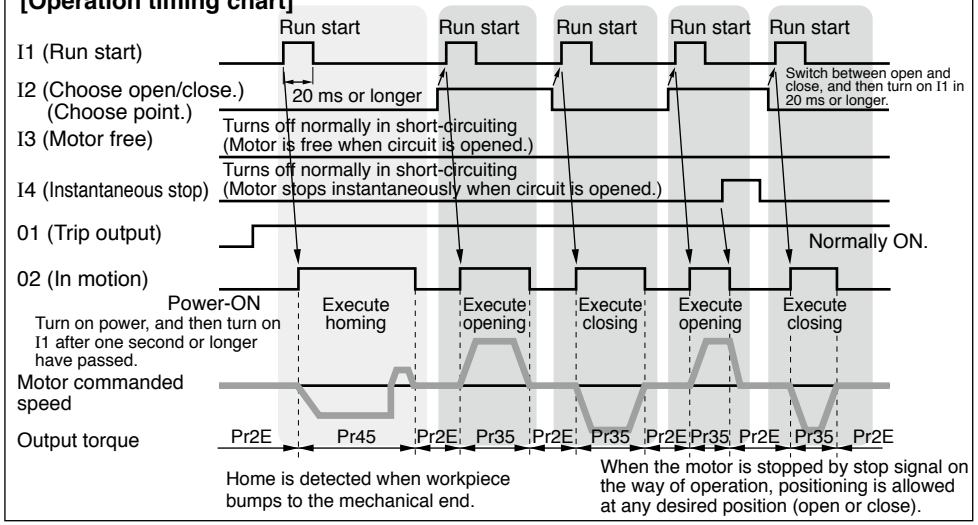
<Example of setting>

- When open/close is chosen and I1 is input, open/close operation is executed.
- When the door is stopped in any position on the way of action, opening or closing operation is enabled from such position. (It is the same when the door is moved by hand with motor disabled.)
- Use of bumping homing enables elimination of home sensor.
- Holding torque when motor is stopped can be changed.

[Signal function setting]

Terminal symbol	Terminal number	Terminal name	Description of function
I1	1	Signal input 1	Operates when "I1" and "GND" are shorted (Homing operation for the first time after power-on)
I2	2	Signal input 2	Opening (point 2) operation when "I2" and "GND" are shorted, and closing (point 1) operation when they are open.
I3	11	Signal input 3	Motor is free when "I3" and "GND" are open. (Servo lock released)
I4	4	Signal input 4	Operation is stopped when "I4" and "GND" are open. (Motor is not activated while they are open.)
O1	6	Signal output 1	Trip output (Normally on, and off in tripping)
O2	12	Signal output 2	In motion signal (including homing operation)

[Operation timing chart]



[Parameter setting] Indicates only the point changed from default setting. (Parameter marked with * is effective after power resetting.)

Function	Parameter No. (Pr□□)	Name of parameter	Setting	Remarks
Selection of signal function	50*	I1 function selection	8	Run start
	51*	I2 function selection	6	Point designation 1 input (choosing the 1st/2nd point)
	52*	I3 function selection	15	Motor-free input
	53*	I4 function selection	1	Instantaneous stop input
	56*	I3 input logic selection	1	Changes the polarity of I3 to effective when open (motor-free in this case).
	57*	I4 input logic selection	1	Changes the polarity of I4 to effective when open (instantaneous stop in this case).
	5C	01 function selection	0	Trip output
	5d	02 function selection	2	In-motion signal
Homing function	40	Homing mode	3	Bumping homing
	41	Homing direction	1	Set the homing direction normally to minus direction (closing direction).
	42	Homing speed	200	Set any desired operation speed.
	44	Homing acceleration/ deceleration time	200	Set any desired acceleration/deceleration time.
	45	Bumping torque detection value	50	Torque limit during bumping homing
	46	Bumping torque detection time	100	Home is detected when torque restriction continues for one second.
	47	Home offset	–144	Set the distance from the home desired to be set to the mechanical end.
	48*	Homing function	2	When power is turned on, homing operation is executed by initial I1 input.
	49	Homing selection when motor is free	0	Homing is not required when tripping occurs.
	4A	Present position overflow permission	0	Overflow is not permitted because absolute travel is set.
	23*	Coordinate system setting	0, 1	Set so that homing is in minus direction.
The 1st point (door closing position)	00	The 1st target position (rotation number)	0	Set the door closing position coordinate. (Coordinate is 0 when closing position is the same as home position.)
	01	The 1st target position (pulse)	0	
	02	The 1st coordinate setting	1	Set absolute travel.
	03	The 1st setting speed	2000	Set any desired operation speed.
	04, 05	The 1st acceleration time/ The 1st deceleration time	200	Set any desired acceleration time and deceleration time.
	06	The 1st block setting	0	Set normal operation.
The 2nd point (door opening position)	08	The 2nd target position (rotation number)	40	Set the door opening position coordinate.
	09	The 2nd target position (pulse)	0	
	0A	The 2nd coordinate setting	1	Set absolute travel.
	0b	The 2nd setting speed	2000	Set any desired operation speed.
	0C, 0d	The 2nd acceleration time/ The 2nd deceleration time	200	Set any desired acceleration time and deceleration time.
	0E	The 2nd block setting	0	Set normal operation.

For automatically changing the retention torque (retention force) when door is stopped

Gain switching function	2E	Torque limit setting	100	Sets the retention torque when door is stopped. The smaller the value is, the weaker the retention force becomes.
	35	The 2nd torque limit setting	150	Maximum output torque when door is operating.
	36	Gain switching mode selection	2	Set to 0 when executing no switching.
	37	Gain switching time	100	Torque is changed in 100 ms after completion of operation instruction.

Communication

Communication

Overview of communication

With the upper host controller, which can be connected with 31 brushless amplifiers at the maximum via serial communication conforming to RS485, enables the following:

1. Rewriting parameters
2. Browsing and clearing status and history of trip condition
3. Monitoring control status including present position, status, I/O, etc.
4. Start and stop of motor

[Advantage]

- It is allowed to write parameters by one operation from host controller in startup of the machine.
- Operating condition of the machine can be displayed, which improves serviceability.

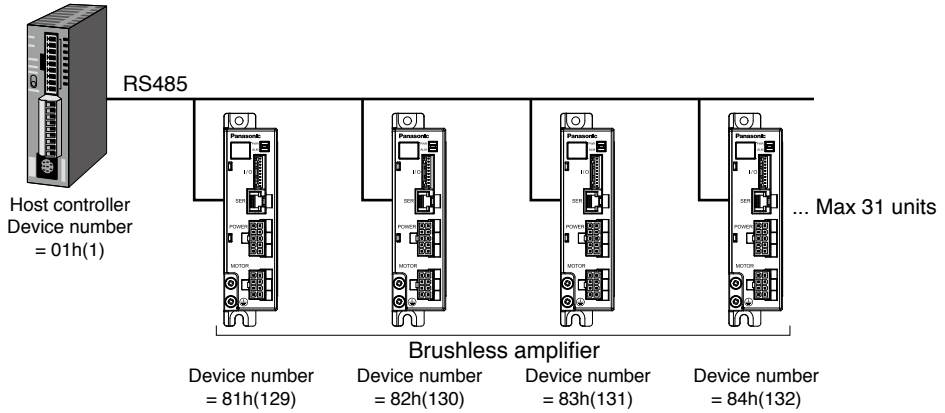
Connection of communications line

Connect one host controller with more than one brushless amplifier via RS485 communication, and set the device number of each brushless amplifier (Pr60) at 81h (129) to 9Fh (159). Set the device number for the host as 01h (1) to 1Fh (31).

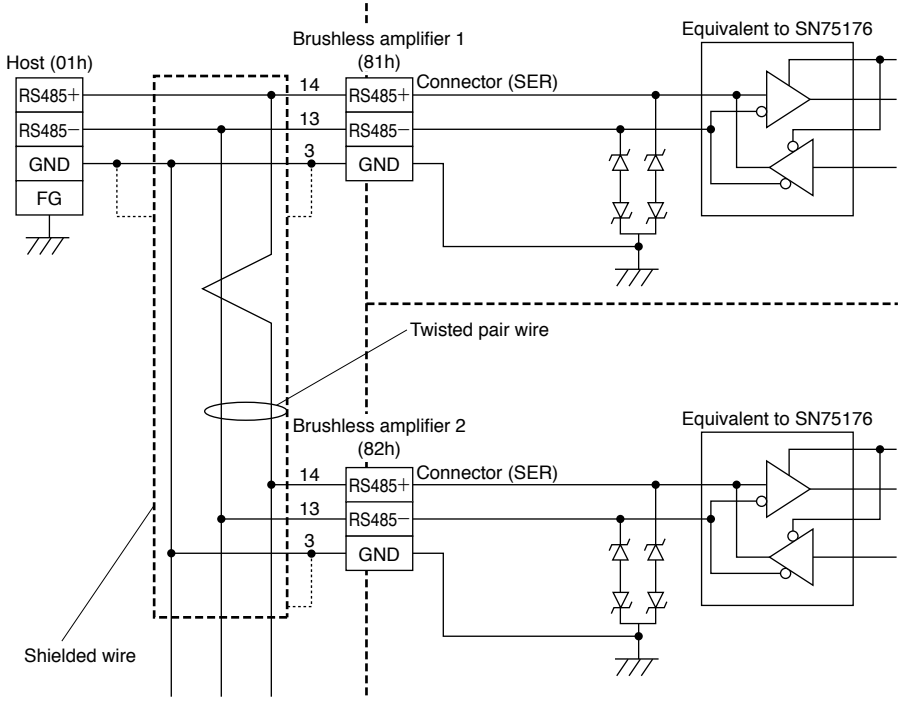
<Note>

Device number is set at 81h (129) in default setting. When connecting more than one brushless amplifier via RS485, be sure to change the device number beforehand with the Digital key pad or communication software “PANATERM for BL” (Can be downloaded from our web site).

[Example of connection]



Interface of connector for communications unit



- Use the shield of shielded wire for GND.
- Set the maximum total extension of cable within 10 m in use.
- Terminal resistor is not required.

Communication system

RS485	Half duplex, asynchronous communication method	
Communication baud rate	2400, 4800, 9600 bps	Set by Pr61
Data	7 bits, 8 bits	Set by Pr62
Parity	None, even number, or odd number	Set by Pr62
Start bit	1 bit	
Stop bit	1 bit, 2 bits	Set by Pr62
Host address	01h to 1Fh	
Amplifier address	80h to 9Fh (80h for simultaneous transmission.)	Set by Pr60

- Modification of transmission parameters (Pr60 to 65) becomes effective when resetting the power supply of the motor.
- The transmission parameters can be changed by the Digital key pad (sold separately) or RS485 communication.

List of data number related to communications

1) Communication parameter

Address	Pr No.	Parameter name	Range of setting	Default	Function/Description
8060h	60	Device number	80h(128) to 9Fh(159)	81h(129)	Set the device number of amplifier in communication (Amplifier ID). This value is the axis number in communication. 80h (128) is the device number for setting control data (such as control start) by one operation to all connected amplifiers. (No response is made by amplifier.) When the device number is set to 80h (128), change of parameter and request for status are ignored, therefore set to 81h (129) to 9Fh (159) normally.
8061h	61	Communication speed	0 to 2	2	Set the communication speed of RS485 communication. **0**: 2400 bps **1**: 4800 bps **2**: 9600 bps
8062h	62	Communication standard	0 to 11	4	Set the communication standard of RS485 communication. **0**: 8 bits, no parity, stop bit 1 **1**: 8 bits, no parity, stop bit 2 **2**: 8 bits, odd number parity, stop bit 1 **3**: 8 bits, odd number parity, stop bit 2 **4**: 8 bits, even number parity, stop bit 1 **5**: 8 bits, even number parity, stop bit 2 **6**: 7 bits, no parity, stop bit 1 **7**: 7 bits, no parity, stop bit 2 **8**: 7 bits, odd number parity, stop bit 1 **9**: 7 bits, odd number parity, stop bit 2 **10**: 7 bits, even number parity, stop bit 1 **11**: 7 bits, even number parity, stop bit 2
8063h	63	Communication response time	10 to 1000	10	Communication response time is the shortest time for setting transmission mode in RS485 bus for response after the amplifier has received communication data. Actual data response time depends on the type and data of order. Unit [ms]
8064h	64	Retry times of communication	0 to 9	9	Set the retry times of RS485 communication. **0** to **8**: Number of retrials **9**: No retrial

Address	Pr No.	Parameter name	Range of setting	Default	Function/Description
8065h	65	Protocol timeout	1 to 255	2	Protocol timeout is the time allowed from reception of a character code to reception of the next one in communication. If normal character code is not received within this time, communication is timed out, and received data is discarded. If timeout should continue to occur, and the number of detections exceed the retry times, the amplifier trips due to RS485 communication error. Unit [seconds]

Change of parameters above is made effective when power is turned on.

- Time required for data transmission per byte is calculated by the following formula for example in the case of 9600 [bps], 8 bits, parity present (even number or odd number), and stop bit 1:
  (1000/9600) × (1 + 8 + 1 + 1) = 1.14 [ms/byte]
  Time is 4.58 [ms/byte] for 2400 [bps], and 2.29 [ms/byte] for 4800 [bps].
  Note, however, actual communication time will be added time necessary for processing received command, and necessary for switching between a line and transmission/reception control.

2) Extension parameter (special command): 8103h to 81B0h

These are parameters to get motor status or to give commands to the amplifier.
Refer to P.81 “Communication command” for detail.

Communication

Transmission sequence

• Handshake code

For line control, following codes are used:

Name	Code	Functions	Description
SOH	01h	Heading start	Start code of communication data, which is followed by address.
STX	02h	Text start	Start code for sending command data.
ETX	03h	Text end	Termination code for command data.
EOT	04h	Transmission end	Sent from the amplifier when transmission message is finished.
ENQ	05h	Request for sending	Inquiry code from host controller to amplifier. The amplifier sends data transmission command when sending data is available, and transmission end command when sending data is not available.
ACK	06h	Positive response	Sent when received message is judged to be normal.
NAK	15h	Negative response	Sent when received message is judged to be abnormal.

• The protocol is compatible with the basic mode data transmission control procedure JISX5002.

• Composition of sent and received data

Shows composition of data transferred on physical phase.

There are two transmission patterns available depending on the contents of command.

Request for sending/ Positive response/ Negative response/ Transmission end command (Host→Amplifier, Amplifier→Host)

SOH
Sending address 1
Sending address 2
Senders address 1
Senders address 2
ENQ/ACK/NAK/EOT

<NOTE>

One block in the table represents 1 byte (character).

Data transmission command (Host→Amplifier, Amplifier→Host)

SOH
Sending address 1
Sending address 2
Senders address 1
Senders address 2
STX
Command 1
Command 2
Data number 1
Data number 2
Data number 3
Data number 4
Data 1
Data 2
Data 3
Data 4
ETX
BCC

Sending address: Set the mating device number for sending data in ASCII2 byte.
Host ID 01h (01) to 1Fh (31)
Amplifier ID 80h (128) to 9Fh (159)
When the sending address is set to 80h (128), all connected amplifiers executes the command (only for some commands). However, response is not made from the amplifier

Senders address: Set the address of communication sending source (self) in ASCII 2 bytes.
Host ID 01h (01) to 1Fh (31)
Amplifier ID 81h (129) to 9Fh (159)

Command: Control command (2 bytes)

Data number: Set the data number to be controlled in ASCII 4 bytes.

Data: Set the writing data in ASCII 4 bytes.
When data is minus, it is converted by signed 16 bits.
(e.g. In the case of –10, data is ASCII code of hexadecimal FFF6.)

BCC: In the case of data transmission command, set XOR (logically inverted) value of each byte from STX to ETX.

• List of commands

Command	Code	Transmission direction	Description
$P	24h 50h	Host → Amplifier	Data writing command. Change of parameter and motor control data. (In changing parameter, parameter is not written to EEPROM.)
$S	24h 53h	Host → Amplifier	Data writing command. Change of parameter and motor control data. (In changing parameter, parameter is written to EEPROM.) * Writing to EEPROM should be requisite minimum. (EEPROM endurance: approx. 100,000 write cycle.)
$R	24h 52h	Host → Amplifier	Data reading request command. Command which requests the parameter, status, and control detail of amplifier.
#R	23h 52h	Amplifier → Host	Response to data reading request. Returns the parameter, status, and control detail of amplifier to $R.
#C	23h 43h	Amplifier → Host	Data update request response. Returns the status of amplifier (8103h) to host in response to request for sending command when data of amplifier status (8103h) has changed from previous request for sending.
# I	23h 49h	Amplifier → Host	Initial request response. When the amplifier is powered on, 9999 is sent following # I in response to initial inquiry from host controller (Request for sending).

• Transmission procedure

$P/$S: Data writing/Parameter writing command

(1) Host → Amplifier (Data writing)

SOH					STX	$	P	*	*	*	*	*	*	*	*	ETX	BCC
	Amplifier ID		Host ID			Command		Data number (parameter address)				Data (parameter value)					

(2) Amplifier → Host (result response)

SOH					ACK
	Host ID		Amplifier ID		

- Answers NAK when requested data number (parameter address) or data value (parameter value) is abnormal. Shows that parameter was properly set only when ACK is answered from the amplifier.
- No result is answered from the amplifier when amplifier ID is 80h (128).

$R: Data reading/Parameter reading command

(1) Host → Amplifier (Data reading request)

SOH					STX	$	R	*	*	*	*	0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command		Data number (parameter address)				Data (parameter value)					

- Set data '0000' when executing data reading command.
- When amplifier ID is 80h (128), data reading/parameter reading command is ignored.

(2) Amplifier → Host (Result response)

SOH					ACK
	Host ID		Amplifier ID		

(3) Host → Amplifier (Request for sending)

SOH					ENQ
	Amplifier ID		Host ID		

(4) Amplifier → Host (Response of data)

SOH					STX	#	R	*	*	*	*	*	*	*	*	ETX	BCC
	Host ID		Amplifier ID			Command		Data number (parameter address)				Reading data (parameter value)					

- Response data when amplifier is powered on is initial request response.
- When requested data number (parameter address) is abnormal, '0000' as reading data (parameter address) is answered.
- Check whether the data No. (parameter address) is correct, then use the reading data.

(5) Host → Amplifier (Result response)

SOH					ACK
	Amplifier ID		Host ID		

(6) Amplifier → Host (Communication completion response)

SOH					EOT
	Host ID		Amplifier ID		

ENQ: Request for sending

When request for sending is sent to the amplifier, response data changes depending on the status of amplifier. Response data is returned in the priority order below:

1	When amplifier is powered on	Initial request response is answered.
2	When receiving data reading / parameter reading	Refer to data reading command processing.
3	When the status of amplifier changes	Data update request is answered.
4	Other cases than the above	Communication completion response is answered.

- Initial request response is answered to the initial data request for sending after the amplifier is powered on.
- When the amplifier ID is 80h (128), request for sending to the amplifier is ignored.

1. When the amplifier is powered on

(1) Host → Amplifier (Request for sending)

SOH					ENQ
	Amplifier ID		Host ID		

(2) Amplifier → Host (Request of data)

SOH					STX	#	I	9	9	9	9	0	0	0	0	ETX	BCC
	Host ID		Amplifier ID			Command		Data number				Reading data					

(3) Host → Amplifier (Response of result)

SOH					ACK
	Amplifier ID		Host ID		

(4) Amplifier → Host (Communication completion response)

SOH					EOT
	Host ID		Amplifier ID		

- When initial response is confirmed, write parameters as necessary.

2. When receiving data reading / parameter reading

See “$R: Data reading/Parameter reading command” on P.74.

3. When the status of amplifier changes

(1) Host → Amplifier (Request for sending)

SOH					ENQ
	Amplifier ID		Host ID		

(2) Amplifier → Host (Request of data)

SOH					STX	#	C	8	1	0	3	*	*	*	*	ETX	BCC
	Host ID		Amplifier ID			Command		Data number				Reading data					

(3) Host → Amplifier (Response of result)

SOH					ACK
	Amplifier ID		Host ID		

(4) Amplifier → Host (Communication completion response)

SOH					EOT
	Host ID		Amplifier ID		

- The amplifier saves the status when executing request for sending, and emits the above response when the status in receiving the next request for sending has changed. Read data is the same as in reading data number 8103h.
- When the amplifier is powered on, in the case where request for sending is sent continuously, data update request response is answered after initial request response is made.

4. Cases other than the above

(1) Host → Amplifier (Request for sending)

SOH					ENQ
	Amplifier ID		Host ID		

(2) Amplifier → Host (Communication completion response)

SOH					EOT
	Host ID		Amplifier ID		

- The amplifier makes communication completion response because data is not requested from the host, and the status of amplifier has not changed.

Example of data communication

• When power is turned on

Communication data is shown below in chronological order when request for sending is executed in power-on for the amplifier. Initial request response at the first, and then data update request response is answered from the amplifier. Then, if the status of amplifier has not changed, only transmission completion response is answered. Shown below is the status where the amplifier is connected with host ID = 01h (1), amplifier ID = 81h (129). It is represented by ASCII characters. (Data in the parenthesis is hexadecimal ASCII code.)

(1) Request for sending

Host →	SOH (01h)	8 (38h)	1 (31h)	0 (30h)	1 (31h)	ENQ (05h)

(2) Initial request response

Amplifier ←	SOH (01h)	0 (30h)	1 (31h)	8 (38h)	1 (31h)	STX (02h)	# (23h)

Host →	SOH (01)	8 (38)

Amplifier ←	I (49h)	9 (39h)	9 (39h)	9 (39h)	9 (39h)	0 (30h)	0 (30h)	0 (30h)	0 (30h)	ETX (03h)	BCC (6Bh)

Host →	1 (31h)	0 (30h)	1 (31h)	ACK (06h)

Amplifier ←	SOH (01h)	0 (30h)	1 (31h)	8 (38h)	1 (31h)	EOT (04h)

(3) Request for sending

Host →	SOH (01h)	8 (38h)	1 (31h)	0 (30h)	1 (31h)	ENQ (05h)

(4) Data update request response

Amplifier ←	SOH (01h)	0 (30h)	1 (31h)	8 (38h)	1 (31h)	STX (02h)	# (23h)

Host →	SOH (01)	8 (38)

Amplifier ←	C (43h)	8 (38h)	1 (31h)	0 (30h)	3 (33h)	0 (30h)	0 (30h)	0 (30h)	2 (32h)	ETX (03h)	BCC (69h)

Host →	1 (31h)	0 (30h)	1 (31h)	ACK (06h)

Amplifier ←	SOH (01h)	0 (30h)	1 (31h)	8 (38h)	1 (31h)	EOT (04h)

(5) Request for sending

Host →	SOH (01h)	8 (38h)	1 (31h)	0 (30h)	1 (31h)	ENQ (05h)

(6) Transmission completion response

Amplifier ←	SOH (01h)	0 (30h)	1 (31h)	8 (38h)	1 (31h)	EOT (04h)

• Example of trip reset

Shown below is communication data in chronological order when executing trip reset. This is an example where trip reset of all amplifiers connected by host ID = 01h (1).
Data is represented by ASCII character. (Data in parenthesis is hexadecimal ASCII code.)

Host →	SOH (01h)	8 (38h)	0 (30h)	0 (30h)	1 (31h)	STX (02h)	$ (24h)	P (50h)	8 (38h)	1 (31h)	9 (39h)	0 (30h)	0 (30h)
Amplifier ←													

Host →	0 (30h)	0 (30h)	1 (31h)	ETX (03h)	BCC (74h)
Amplifier ←					

• There is no response from the amplifier because amplifier ID is set at 80h (128).

• Example of changing parameter (writing data)

Shown below is communication data in chronological order when changing parameter (not written to EEPROM).
This is an example of changing Pr00 (8000h) “The 1st target position (rotation number)” to 10 (0000Ah) with amplifier connected by host ID = 01h (1) and amplifier ID = 81h (129).
Data is represented by ASCII character. (Data in parenthesis is hexadecimal ASCII code.)

Host →	SOH (01h)	8 (38h)	1 (31h)	0 (30h)	1 (31h)	STX (02h)	$ (24h)	P (50h)	8 (38h)	0 (30h)	0 (30h)	0 (30h)	0 (30h)
Amplifier ←													

Host →	0 (30h)	0 (30h)	A (41h)	ETX (03h)	BCC (0Ch)
Amplifier ←					

	SOH (01h)	0 (30h)	1 (31h)	8 (38h)	1 (31h)	ACK (06h)

• Example of reading parameter (reading data)

In reading data, reading request is emitted to the amplifier, and then request for sending command is issued.
This is an example of reading Pr40 (8040h) “Homing mode” with the amplifier connected by host ID = 01h (1) and amplifier ID = 81h (129). Data is represented by ASCII character. (Data in parenthesis is hexadecimal ASCII code.)

(1) Parameter reading request

Host →	SOH (01h)	8 (38h)	1 (31h)	0 (30h)	1 (31h)	STX (02h)	$ (24h)	R (52h)	8 (38h)	0 (30h)	4 (34h)	0 (30h)	0 (30h)
Amplifier ←													

Host →	0 (30h)	0 (30h)	0 (30h)	ETX (03h)	BCC (7Bh)
Amplifier ←					

	SOH (01h)	0 (30h)	1 (31h)	8 (38h)	1 (31h)	ACK (06h)

(2) Request for sending

Host →	SOH (01h)	8 (38h)	1 (31h)	0 (30h)	1 (31h)	ENQ (05h)
Amplifier ←						

	SOH (01h)	0 (30h)	1 (31h)	8 (38h)	1 (31h)	STX (02h)	# (23h)

Host →	SOH (01)	8 (38)

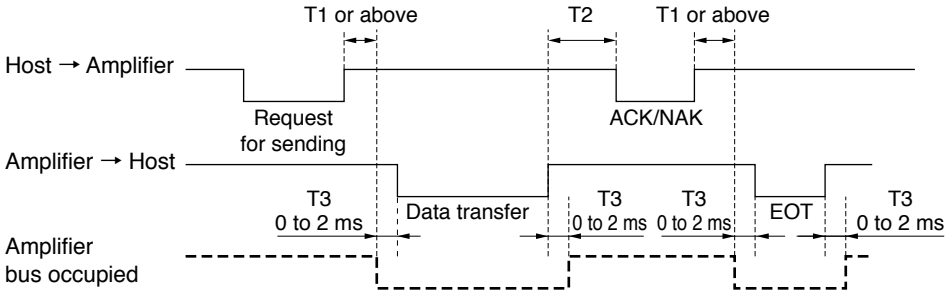
Amplifier ←	R (52h)	8 (38h)	0 (30h)	4 (34h)	0 (30h)	0 (30h)	0 (30h)	0 (30h)	1 (31h)	ETX (03h)	BCC (7Dh)

Host →	1 (31h)	0 (30h)	1 (31h)	ACK (06h)
Amplifier ←				

	SOH (01h)	0 (30h)	1 (31h)	8 (38h)	1 (31h)	EOT (04h)

Communication

Communication timing



Symbol	Name	Value
T1	Communication response time (Amplifier)	Set by **Pr63**.
T2	Communication response time (Host)	Take interval 10 ms or longer.
T3	Data emitting time from amplifier to host after bus is occupied	0 to 2 ms

<Information>

(1) Time is counted from the rising edge of stop bit.

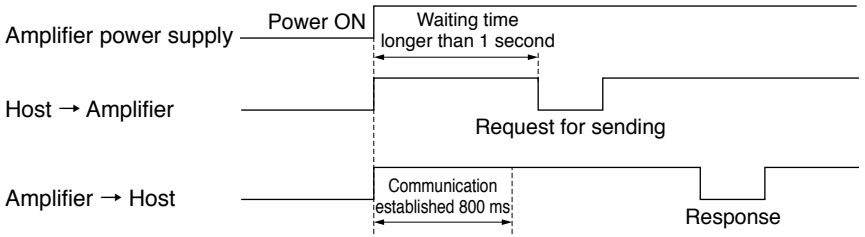
(2) Time allowed from receiving one character code until receiving the next character code can be set by **Pr65** "Protocol timeout". If the next normal character code cannot be received within the time set by this parameter, the amplifier detects communication timeout and received data is canceled. If communication timeout is detected continuously, and the number of detections exceeds the number of retrials (**Pr64**), the amplifier trips because of RS485 communication error.

(3) When the host sends data and still does not receive any response from the amplifier, communication error may be present through effect of noise, etc. In this case, the host should send data again after time set by **Pr65** "Protocol timeout".

<Communication establishing time when power is turned on>

Establishment communication takes about 800 ms when the amplifier is powered on. The amplifier does not make response in the meantime, therefore allow waiting time longer than a second.

[Timing in power-on]



Communication command

Data number	Applicable command on host side	Description
8000h to 807Fh	$P/$S/$R	Parameter
8103h	$R	Amplifier status
8104h	$R	Model code 1
8105h	$R	Model code 2
8110h	$R	Rotation speed (actual speed)
8111h	$R	Commanded speed
8112h	$R	Internal DC voltage
8113h	$R	Torque
8114h	$R	Load factor
8115h	$R	Present position (rotation number)
8116h	$R	Present position (pulse)
8117h	$R	Target position (rotation number)
8118h	$R	Target position (pulse)
8120h	$R	Detail of trip
8130h	$R	Input terminal status
8131h	$R	Output terminal status
8180h	$P/$S	Run command
8190h	$P/$S	Trip reset
8191h	$P/$S	Forced trip
81B0h	$P/$S	Parameter EEPROM writing

Communication command in detail

8000h to 807Fh: Parameter

• $P: Parameter writing command (Without EEPROM writing function)

Received data (Host → Motor)

SOH					STX	$	P	8	0			P1	P2	P3	P4	ETX	BCC
	Amplifier ID		Host ID			Command		Parameter address				Parameter value					

- When the device number set on the amplifier (value of **Pr60**) matches with the amplifier ID of received data, parameter change is executed.
- When parameter address and parameter value are abnormal, NAK is answered.
- Set the parameter address at '80 □□ '. ('8062' for **Pr62**)
- Set the parameter value in 4 digits of ASCII code (P1, P2, P3, and P4) which is obtained by conversion from the data to hexadecimal. (e.g. 100 = '0064', –100 = 'FF9C')
- NAK is answered while the amplifier detects undervoltage error, and the parameter is not changed.
- Changed parameter is not written to EEPROM by this command. In order to make changed parameter still effective after power resetting, execute EEPROM writing command by data number 81B0h.
- When run command is executed by I/O while parameter is being written by communication at the same time, enter the run command after receiving ACK response from the amplifier. The amplifier runs per the written parameter.

• $S: Parameter writing command (with EEPROM writing function)

Received data (Host → Amplifier)

SOH					STX	$	S	8	0			P1	P2	P3	P4	ETX	BCC
	Amplifier ID		Host ID			Command		Parameter address				Parameter value					

- When the device number set on the amplifier (value of **Pr60**) matches with the amplifier ID of received data, parameter change is executed.
- When parameter address and parameter value are abnormal, NAK is answered.
- Set the parameter address at '80 □□ '. ('8062' for **Pr62**)
- Set the parameter value in 4 digits of ASCII code (P1, P2, P3, and P4) which is obtained by conversion from the data to hexadecimal.
  (e.g. 100 = '0064', –100 = 'FF9C')
- NAK is answered while the amplifier detects undervoltage error, and the parameter is not changed.
- Changed parameter is written to EEPROM by this command. Response may take some time since EEPROM writing process is required.
- When run command is executed by I/O while parameter is being written by communication at the same time, enter the run command after receiving ACK response from the amplifier. The motor runs per the written parameter.
- Writing to EEPROM should be requisite minimum.

• $R: Parameter reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	0			0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command		Parameter address				Parameter value					

- Set the parameter address at '80 □□ '. ('8062' for **Pr62**). Set the parameter value at '0000'.
- Enter request for sending after execution of this command, parameter value is responded.

• #R: Parameter response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	0			P1	P2	P3	P4	ETX	BCC
	Host ID		Amplifier ID			Command		Parameter address				Parameter value					

- When requested parameter address is abnormal, '0000' as parameter value is answered. You should check parameter address as you requested.
- When the parameter reading request command is normally completed, the amplifier answers a parameter value when it receives request for sending.
- Parameter address which is read out is sent by '80 □□ '.
- Parameter value is sent in 4 digits of ASCII code (P1, P2, P3, and P4) which is obtained by conversion from the data to hexadecimal.
  (e.g. 100 = '0064', –100 = 'FF9C')

8103h: Amplifier status

• $R: Status reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	0	3	0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command		Data number				Data value					

- Enter request for sending after execution of this command, the amplifier status is answered.
- Set '0000' in data value.

• #R: Status response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	0	3	D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command		Data number				Data value					

- When the amplifier receives request for sending after normal completion of status reading request command, the amplifier answers status value.

• #C: Data updating request command

Transmission data (Amplifier → Host)

SOH					STX	#	C	8	1	0	3	D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command		Data number				Data value					

- The amplifier saves the status in executing request for sending, and makes the response above when the status in receiving the next request for sending has changed. Read data is the same as in execution of data number 8103.

[Detail of status]

	Bit 3	Bit 2	Bit 1	Bit 0
D1	0	0	0	0
D2	0	0	0	0
D3	Torque under restriction	Overload detection	0	0
D4	Homing completion	In-motion	In-position	Trip output

Detail above is converted into hexadecimal and represented in ASCII code.
e.g.) Data value = 30h 30h 30h 41h = '000A' = indicates in-position status with homing completed.

8104h: Model code 1, 8105h: Model code 2

• $R: Model code reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	0		0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command			Data number			Data value					

- Enter request for sending after execution of this command, model code of amplifier is answered.
- Set '0000' in data value.

• #R: Model code response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	0		D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command			Data number			Data value					

- When the amplifier receives request for sending after completion of model code reading request command, the model code value is answered.
- Model name of the amplifier is sent in ASCII code of total 8 characters, consisting of 4 characters respectively.
  e.g.) Model code 1 ('8104') = 4Dh 42h 4Dh 50h = 'MBMP'
  Model code 2 ('8105') = 33h 41h 31h 45h = '3A1E'

8110h: Rotation speed (actual speed), 8111h: Commanded speed

• $R: Speed reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	1		0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command			Data number			Data value					

- Rotation speed of amplifier (actual speed) ('8110') and commanded speed ('8111') are answered by request for sending after execution of this command.
- Set '0000' in data value.

• #R: Speed response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	1		D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command			Data number			Data value					

- When the amplifier receives request for sending after normal completion of speed reading request command, rotation speed value (actual speed value) ('8110') and commanded speed value ('8111') are answered.
- Data value is answered in rotation speed (actual speed) and commanded speed in [r/min].
  e.g.) Data value = 30h 42h 42h 38h = '0BBB' = 3000 [r/min]
  Data value = 30h 35h 44h 43h = '05DC' = 1500 [r/min]
  The value shall be positive at CCW rotation and negative at CW rotation.

8112h: Internal DC voltage

• $R: Internal DC voltage reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	1	2	0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command			Data number				Data value					

- Enter request for sending after execution of this command, the internal DC voltage (voltage in smoothing capacitor of power supply) of the amplifier is answered.
- Set '0000' in data value.

• #R: Internal DC voltage response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	1	2	D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command			Data number				Data value					

- When the amplifier receives request for sending after normal completion of internal DC voltage reading command, internal DC voltage (voltage in smoothing capacitor of power supply) is answered.
- Voltage of amplifier is answered in [V] for data value.
  e.g.) Data value = 30h 31h 31h 38h = '0118' = 280 [V]

8113h: Torque, 8114h: Load factor

• $R: Torque reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	1		0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command			Data number			Data value					

- Enter request for sending after execution of this command, torque of amplifier ('8113') and load factor ('8114') are answered.
- Set '0000' in data value.

• #R: Torque response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	1		D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command			Data number			Data value					

- When the amplifier receives request for sending after normal completion of torque reading request command, torque ('8113') and load factor ('8114') are answered.
- Torque of amplifier/Load factor multiplied by 10 is answered in [%] for data value.
  e.g.) Data value = 30h 31h 32h 43h = '012C' = 30.0 [%]

8115h: Present position (rotation number), 8116h: Present position (pulse)

• $R: Present position reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	1		0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command			Data number				Data value					

- Enter request for sending after execution of this command, present position (rotation number) (‘8115’) and present position (pulse) (‘8116’) of the motor are answered.
- Set ‘0000’ in data value.
- **This command updates the data of 8116h (pulse) when the present position information 8115h (rotation number) reading command is received. Therefore, if data of 8116h (pulse) should be read first, it is possible that wrong present position information before updating may be read out; so be sure to follow the reading order: 8115h (rotation number) → 8116h (pulse). Use for only monitoring function.**

• #R: Present position response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	1		D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command			Data number				Data value					

- When the motor receives request for sending after normal completion of present position reading request command, present position (rotation number) (‘8115’) and present position (pulse) (‘8116’) of the motor are answered.
- Present position of the motor in command pulse unit (288 pulses per rotation) is described by rotation number × 288 + pulse.

8117h: Target position (rotation number), 8118h: Target position (pulse)

• $R: Target position reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	1		0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command			Data number				Data value					

- Enter request for sending after execution of this command, travel target position (rotation number) (‘8117’) and target position (pulse) (‘8118’) in the absolute coordinates of motor in positioning operation are answered.
- Set ‘0000’ in data value.
- **This command updates data of 8118h (pulse) when reading 8117h (rotation number) of target position information. Therefore, if data of 8118h (pulse) should be read first, it is possible that wrong target position information before updating may be read out; so be sure to follow the reading order: 8117h (rotation number) → 8118h (pulse). Use for only monitoring function.**

• #R: Target position response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	1		D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command			Data number				Data value					

- When the motor receives request for sending after normal completion of target position reading request command, travel target position (rotation number) (‘8117’) and target position (pulse) (‘8118’) of the motor are answered.
- Target position of the motor in command pulse unit (288 pulses per rotation) is described by rotation number × 288 + pulse.
- Target position in power-on is ‘0’. Target position when the motor trips is updated to the present position. When the motor is stopped halfway by stop command, the target position is updated to the stop position.

8120h: Detail of trip

• $R: Trip detail reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	2	0	0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command			Data number				Data value					

- Enter request for sending after execution of this command, the detail of trip is answered.
- Set ‘0000’ in data value.

• #R: Trip detail response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	2	0	D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command			Data number				Data value					

- When the amplifier receives request for sending after normal completion of trip detail reading request command, detail of amplifier trip is answered.
- Detail of trip is answered by trip number. (See the list of protective functions on P.33.) When the trip number is 0, it indicates that no tripping has occurred.
  e.g.) Data value = 30h 30h 31h 35h = ‘0015’ = 21 = Homing error
- Trip history can be read out with parameter (**Pr6b** to **6F**).

8130h: Input terminal status

• $R: Input terminal status reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	3	0	0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command			Data number				Data value					

- Enter request for sending after execution of this command, the status of amplifier input terminal is answered.
- Set ‘0000’ in data value.

• #R: Input terminal status response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	3	0	D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command			Data number				Data value					

• When the amplifier receives request for sending after normal completion of input terminal status reading request command, the input terminal status of the amplifier is answered.

[Status of input terminal]

	Bit 3	Bit 2	Bit 1	Bit 0
D1	0	0	0	0
D2	0	0	0	0
D3	0	0	0	0
D4	I4	I3	I2	I1

Detail above is converted into hexadecimal and represented in ASCII code.
e.g.) Data value = 30h 30h 30h 35h = '0005' = Indicates that I1 and I3 are on.

8131h: Output terminal status

• $R: Output terminal status reading request command

Received data (Host → Amplifier)

SOH					STX	$	R	8	1	3	1	0	0	0	0	ETX	BCC
	Amplifier ID		Host ID			Command			Data number				Data value					

• Enter request for sending after execution of this command, the status of amplifier output terminal is answered.
• Set '0000' in data value.

• #R: Output terminal status response command

Transmission data (Amplifier → Host)

SOH					STX	#	R	8	1	3	1	D1	D2	D3	D4	ETX	BCC
	Host ID		Amplifier ID			Command			Data number				Data value					

• When the amplifier receives request for sending after normal completion of output terminal status reading request command, the output terminal status of the amplifier is answered.

[Status of output terminal]

	Bit 3	Bit 2	Bit 1	Bit 0
D1	0	0	0	0
D2	0	0	0	0
D3	0	0	0	0
D4	0	0	O2	O1

Detail above is converted into hexadecimal and represented in ASCII code.
e.g.) Data value = 30h 30h 30h 31h = '0001' = Indicates that O1 is on.

8180h: Run command

• $P/$S: Run command

Received data (Host → Amplifier)

SOH					STX	$	P	8	1	8	0	D1	D2	D3	D4	ETX	BCC
	Amplifier ID		Host ID			Command			Data number				Data value					

• When the amplifier is powered on with **Pr3E** set at "1" (Command through RS485), this command enables sending run command to the amplifier. At this time, point selection or run command cannot be given through I/O. (See I1/I2 function selection on P.44.) When **Pr3E** is "0" (command through I/O), run command by this command is ignored.
• When run command is given to the amplifier with this command, first send '0000' as a data value.
• Operation is the same both for $P command and $S command.
• When the amplifier ID is 80h (128), all connected amplifiers execute the command. However, no response is emitted from the amplifier.

[Run command]

	Bit 3	Bit 2	Bit 1	Bit 0
D1	REV	0	0	0
D2	0	M_FREE	S_STOP	H_STOP
D3	POINT2	POINT1	0	HOMING
D4	JOG_REV	JOG_FWD	POINT	STEP

Name	Function	Detail
H_STOP*	Instantaneous stop	When the motor is in motion, stop the motor based on setting of Pr59 "Deceleration time in instantaneous stop". Operation directive is not accepted as long as this signal is on.
S_STOP*	Deceleration stop	The motor reduces speed and stops when it is in motion. Operation directive is not accepted when the motor is stopped or when this signal is on.
M_FREE*	Motor-free	Sets the motor free. Operation directive is not accepted as long as this signal is on.
STEP	Sequential run start	Whenever this signal is turned on, positioning point number is automatically incremented by 1 to executed positioning. Maximum point number of positioning is determined by Pr0E.
POINT	Run start	Executes positioning operation to the point chosen by POINT 1 and 2.
JOG_FWD	Forward jog start	The motor operates in + direction as long as this signal is on.
JOG_REV	Reverse jog start	The motor operates in – direction as long as this signal is on.
HOMING	Homing start	Homing operation is started when this signal is turned on.
POINT1	Point designation 1	Choose a point number.
POINT2	Point designation 2	Choose a point number.
REV	Direction switching	Motor operation signal is inverted when this signal is on.

* When a signal of the same function is assigned to the input signal (I1 to I4), function is made effective by activation of any signal.

Detail above is converted into hexadecimal and represented in ASCII code.
e.g.) Data value = 30h 30h 31h 30h = '0010' = Indicates homing start.

8190h: Trip reset

• $P/$S: Trip reset command

Received data (Host → Amplifier)

SOH					STX	$	P	8	1	9	0	0	0	0	1	ETX	BCC
	Amplifier ID		Host ID			Command			Data number			Data value						

- When data value is set at '0001' and this command is executed during trip, trip reset is executed.
- When data value is other than '0000' and '0001', NAK is answered.
- Operation is the same for both $P command and $S command.
- This command is incapable of resetting some trips depending on their factor. As for tripped condition after executing trip reset command, check it by status reading or trip detail reading command.
- When amplifier ID is set to 80h (128), all connected amplifiers execute the command. However, no response is answered from the amplifier.

8191h: Forced trip

• $P/$S: Forced trip command

Received data (Host → Amplifier)

SOH					STX	$	P	8	1	9	1	0	0	0	1	ETX	BCC
	Amplifier ID		Host ID			Command			Data number			Data value						

- When data value is set to '0001' and this command executed, the amplifier trips (forced trip).
- When data value is other than '0000' and '0001', NAK is answered.
- Operation is the same for both $P command and $S command.
- When amplifier ID is set to 80h (128), all connected amplifiers execute the command. However, no response is answered from the amplifier.

81B0h: Parameter EEPROM writing

• $P/$S: Parameter EEPROM writing command

Received data (Host → Amplifier)

SOH					STX	$	P	8	1	B	0	0	0	0	1	ETX	BCC
	Amplifier ID		Host ID			Command			Data number			Data value						

- When data value is set to '0001' and this command executed, parameter is written to EEPROM contained in the amplifier. Response may take some time because EEPROM writing process is executed. Use this command when you want to change the parameter by $P command and make change still effective after power resetting.
- NAK is answered and EEPROM writing process is not executed as long as the amplifier detects undervoltage error.
- When data value is other than '0000' and '0001', NAK is answered.
- Operation is the same for both $P command and $S command.
- When amplifier ID is set to 80h (128), all connected amplifiers execute the command. However, no response is answered from the amplifier.
- Writing to EEPROM should be requisite minimum.

EC Directives

The EC directives apply to all such electronic products as those having specific functions and directly sold to general consumers in EU countries. These products are required to meet the EU unified standards and to be furnished with CE marking.
Our brushless motor meet the EC Directives for Low Voltage Equipment so that the machine or equipment comprising our AC servo can meet relevant EC Directives.

EMC Directives

Our brushless motor can meet EMC Directives and related standards. However, to meet these requirements, the systems must be limited with respect to configuration and other aspects, e.g. the installation and some special wiring conditions must be met. This means that in some cases machines and equipment comprising our servo systems may not satisfy the requirements for wiring and grounding conditions specified by the EMC Directives. Therefore, conformance to the EMC Directives (especially the requirements for emission noise and noise terminal voltage) should be examined based on the final products that include our system.

Applicable standard

	Applicable standard		Installation condition
UL	UL1004 UL508C	Standard for electric motor Standard for electric converter equipment	Class I equipment Pollution degree 2 SCCR *1
CSA (c-UL)	C22.2 No.14 C22.2 No.100	Industrial control equipment. Standard for electric motor	
CE	EN61800-5-1 EN60034-1 EN60034-5 EN61800-3 EN55011 EN61000-6-2	Adjustable speed electrical power drive systems – Safety requirements. Electrical, thermal and energy Standard for rotary electric machine (low voltage directive) Standard for rotary electric machine (low voltage directive) Adjustable speed electrical power drive systems – EMC requirements and specific test methods Radio interference wave characteristics of industrial, scientific, and medical high-frequency equipment Standards for immunity in industrial environment (EMC directive)	Overvoltage category II Class I equipment Pollution degree 2
CCC	GB12350	Safety standard for low-power electric motor	
KC	Korea Radio Law *2	Class A Instrument (commercial broadcast communications equipment)	—

*1 SCCR: Symmetrical current 5,000 Arms, Max. 240 V
Motor over-temperature protection is not provided.
Motor over-load-temperature protection shall be provided at the final installation upon required by the NEC (National Electric Code).

*2 Information related to the Korea Radio Law
This brushless amplifier is a Class A commercial broadcasting radio wave generator not designed for home use. The user and dealer should be aware of this fact.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용(A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

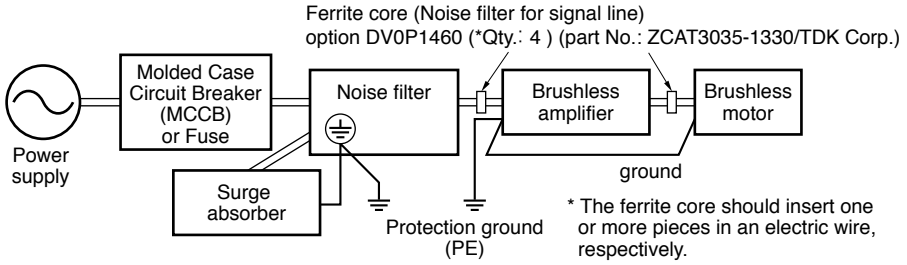
(대상기종 : Brushless Amplifier)

Conformance to EC directive and UL standard

Configuration of peripheral equipment

Power supply	· 100 V system: Single phase 100 V to 120 V ± 10%, 50/60 Hz 200 V system: Single phase 200 V to 240 V ± 10%, 50/60 Hz · Use the equipment under the environment of overvoltage category II specified by IEC60664-1. · In order to obtain overvoltage category III, insert a transformer conforming to EN standard or IEC standard to the input of brushless motor. · Use an electric wire size suitable to EN60204-1.
MCCB (breaker) Fuse	Be sure to connect the specified Molded Case Circuit Breaker (MCCB) certified by IEC and UL, or fuse certified by UL, between power supply and noise filter so that symmetrical current upon short-circuiting of power source will not exceed 5000 Arms. Meeting this condition allows conformance with UL508C (file No. E164620) and UL1004 (file No. E166557).
Noise filter	When installing one noise filter at the power supply for more than one brushless motor used, contact the manufacturer of noise filter.
Surge absorber	Install a surge absorber on the primary side of noise filter. However, in performing the voltage resistance test of machine and equipment, be sure to remove the surge absorber; otherwise, the surge absorber may be ruptured.
Grounding	Be sure to connect the grounding Terminal of brushless amplifier and protective grounding wire (PE) of system for preventing electric shock. Do not tighten the grounding wires together but connect them individually.

Wiring of peripheral equipment

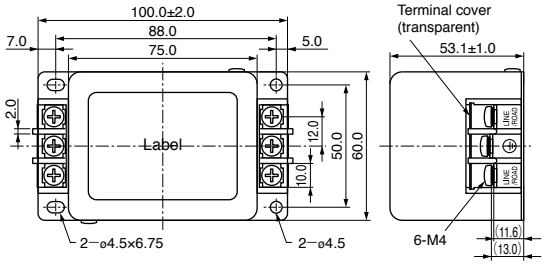


List of compatible peripheral equipment

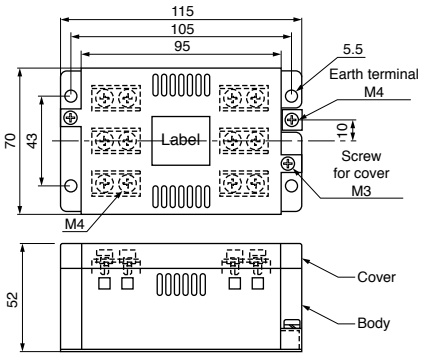
Part name	Optional parts number (option)	Manufacturer's parts number	Qty.	Manufacturer
Noise filter (single phase 100, 200 V)	DV0P4170	SUP-EK5-ER-6	1	Okaya Electric Industries Co. Ltd.
Noise filter (3-phase)	DV0PM20042	3SUP-HU10-ER-6	1	
Surge absorber (single phase 100, 200 V)	DV0P4190	R·A·V-781BWZ-4	1	
Surge absorber (3-phase)	DV0P1450	R·A·V-781BXZ-4	1	
Noise filter for control signals	DV0P1460	ZCAT3035-1330	4	TDK Corporation

Noise filter

• DV0P4170



• DV0PM20042



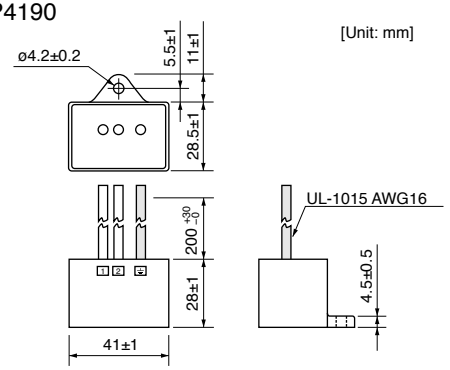
[Unit: mm]

Conformance to EC directive and UL standard

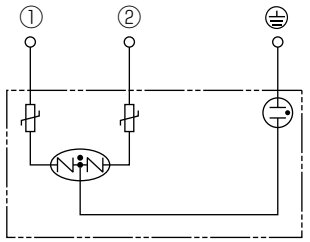
Surge absorber

• DV0P4190

[Unit: mm]

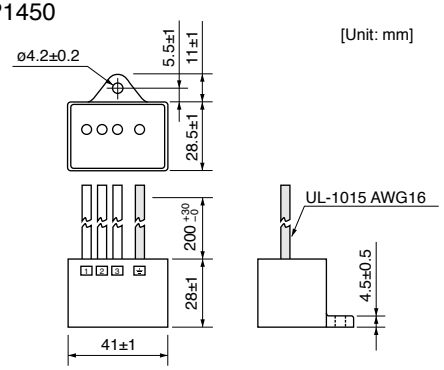


Circuit diagram

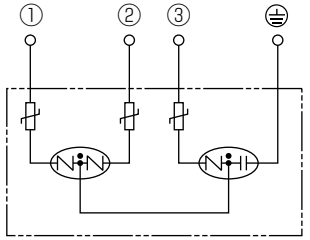


• DV0P1450

[Unit: mm]

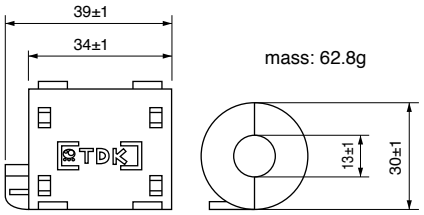


Circuit diagram



Noise filter for control signals

• DV0P1460



[Unit: mm]

Recommended circuit breaker (MCCB)

Made by Sensata Technologies Japan Limited:

Type IELH-1-11-63-5A-M (single phase) Type IELH-1-111-63-5A-M (3-phase)

(Rated current 5A, cutoff characteristics DELAY63)

• Recommended cutoff characteristics: DELAY61-63

Specifications

• Brushless motor specifications

Item	Specifications					
Flange size	80 mm sq.		90 mm sq.			
Motor model No.	MBMU5AZAB		MBMU9A1AB	MBMU9A2AB	MBMU1E1AB	MBMU1E2AB
Motor rated output (W)	50		90		130	
Voltage	for 100 V/200 V		for 100 V	for 200 V	for 100 V	for 200 V
Rated torque (N·m)	0.16		0.29		0.41	
Starting torque *1 (N·m)	0.24		0.43		0.62	
Rated input current (A(rms))	0.53	0.53	1.00	0.50	1.30	0.72
Moment of inertia of rotor (×10^{-4}kg·m^2)	0.12		0.27		0.36	
Rating	Continuous					
Rated rotation speed *2 (r/min)	3000					
maximum rotation speed (r/min)	4000					
Speed control range (r/min)	30 to 4000					
Axial runout	0.05 mm or less at the position of 3 mm from the shaft end					
Bearing	Ball bearing					
Insulation resistance	Measure the insulation resistance with 500 V Megger. It must be above 20 MΩ Measuring position: Between power input line (L1, L2,L3) and grounding wire					
Isolation voltage	1500 VAC, 1 minute, 10 mA or less (between power and grounding wire)					
Ambient temperature	–10 °C to +40 °C (free from freezing) * Ambient temperature is measured at a distance of 5 cm from the motor.					
Ambient humidity	20 to 85% RH (free from condensation)					
Altitude	Lower than 1000m					
Vibration	4.9 m/s^2 or less (10 to 60 Hz) X, Y, Z					
Impact	Lower than 98m/s^2					
Motor insulation class	130(B) (UL certified 105 (A))					
Storage temperature	–20˚C to 60˚C (free from condensation) *Extreme temperatures are permissible only for short period such as during transportation.					
Storage humidity	85%RH or below (free from condensation)					
Protection structure	IP65*3					
Number of poles	8					
Motor mass (kg)	0.7		1.0		1.2	

*1 Representative value

*2 Motor shaft speed: to be multiplied by the reduction ratio when the gear head is used.

*3 Excluding the shaft pass-through section and cable end connector.

* Should conform to the test conditions specified in EN standard (EN60529 and EN60034-5). Not suitable for application where watertightness is required over a prolonged period, even if frequently washed.

• Standard characteristics measurement conditions are temperature of 25 °C and relative humidity of 65%, and may be extended to 5 to 35 °C and 45 to 85% RH.

Specifications

• Brushless amplifier GP series specifications

Item			Specifications								
Basic Specifications	Amplifier model No.		MBEG5A1BCP	MBEG5A5BCP		MBEG9A1BCP	MBEG9A5BCP		MBEG1E1BCP	MBEG1E5BCP	
	Applicable motor model No.		MBMU5AZAB			MBMU9A1AB	MBMU9A2AB		MBMU1E1AB	MBMU1E2AB	
	Motor rated output (W)		50			90			130		
	Input power supply voltage (V)		Single phase 100 to 120	Single phase	3-phase	Single phase 100 to 120	Single phase	3-phase	Single phase 100 to 120	Single phase	3-phase
				200 to 240			200 to 240			200 to 240	
	Frequency (Hz)		50/60								
	Rated input current (A)		1.5	0.7	0.35	2.2	1.1	0.5	2.8	1.5	0.7
	Rated output current (A)		0.6			1.1	0.6		1.7	0.8	
	Voltage tolerance		±10%								
	Control method		Speed control by CS signal Driving system by PWM sine wave								
	Ambient conditions	Ambient temperature	0 °C to +50 °C (free from freezing) * Ambient temperature is measured at a distance of 5 cm from the amplifier.								
		Ambient humidity	20% to 85% RH (free from condensation)								
		Atmosphere	Indoor (without corrosive gas, dirt, dust, etc.)								
		Altitude	Lower than 1000 m								
		Vibration	5.9 m/s^2 or less (10 to 60 Hz)								
	Storage temperature		–20 ˚C to 60 ˚C (free from condensation) Extreme temperatures are permissible only for short period such as during transportation.								
	Storage humidity		20 to 85%RH (free from condensation)								

<Note>

To start/stop the motor, use signal inputs (I1, I2, I3, I4, etc.).

If power is turned on/off to start/stop the motor, the life of the internal circuitry will be shortened.

Item		Specifications
Function	Number of positioning points	4 points (Travel distance, speed, acceleration time, deceleration time, and relative/absolute can be set per point)
	Positioning resolution	288 pulse/rotation (Accuracy: Within ±5° degrees at 20 °C at no load)
	Signal input	4 inputs *1
	Signal output	2 outputs (Open collector) *1
	Communication function via RS485	Setting of parameter, monitoring of control condition and the like are enabled with RS485 interface. Max 31 units.
	Change parameter/ Monitor of condition	Parameter change, status monitor, etc., can be executed through a store-bought PC: (Communication software “PANATERM for BL”, Digital key pad connection cable (DV0P383**) and PC connection cable (DV0P4140) are required. The PC should be provided with RS232 port or RS232-USB convertor.
		Parameter change, status monitor, etc., can be executed through the optional Digital key pad DV0P3510 (sold separately). (Digital key pad connection cable (DV0P383**) (option, sold separately) is required.)
	Protective function	Overload, Overcurrent, Overvoltage, Undervoltage, System error, Setting change warning, Over-speed, Sensor error, Overheat, Position error, External forced trip, Position error counter overflow, RS485 communication error, Operation execution error, Homing error, present position overflow, Hardware limit error, Digital key pad communication trouble, user parameter error, and system parameter error
	Regenerating brake	Regenerative braking resistor can be externally connected. *2 Instantaneous braking torque 150%, Continuous regenerative power 10 W (Regenerative operation with which motor shaft is rotated by load, e.g. load lowering operation, should not be continued.
Performance	Rated rotation speed	3000 r/min
	Speed control range	30 to 4000 r/min (Speed ratio 1:133)
	Allowable motor cable extension length	Up to 10 m (Panasonic option cable)
	Protection level	115%/ Overload protection time characteristics 150% 60 sec
Insulation resistance		Measure the insulation resistance with 500 V Megger. It must be above 20 MΩ. Measuring position: Between power input line (L1, L2, L3) and grounding wire.
Isolation voltage		1500 VAC, 1 minute, 10 mA or less (between power and grounding wire)
Protection structure/ Cooling system		Equivalent to IP20 /Self cooling
Amplifier mass (kg)		0.37

*1 Function of signal input and signal output can be changed by using the optional Digital key pad (sold separately) or PANATERM for BL or through communication over RS485.

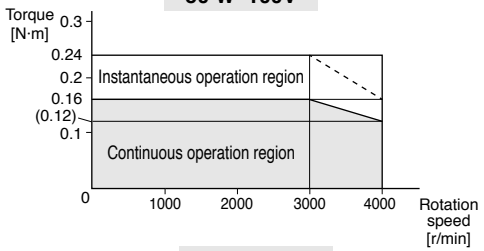
*2 Use the optional external regenerative resistor (For 100 V: DV0P2890, For 200 V: DV0PM20068) (sold separately).

Specifications

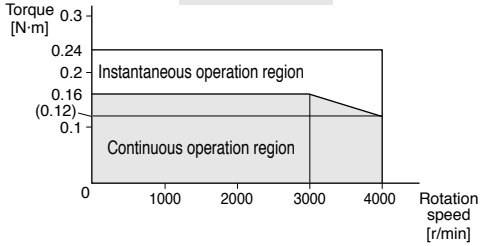
• Speed-torque characteristic

**MBEG5A1BCP／MBMU5AZ * *
MBEG5A5BCP／MBMU5AZ * ***

50 W 100V

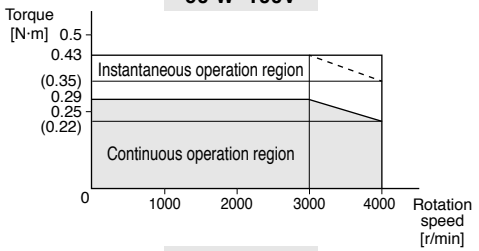


50 W 200V

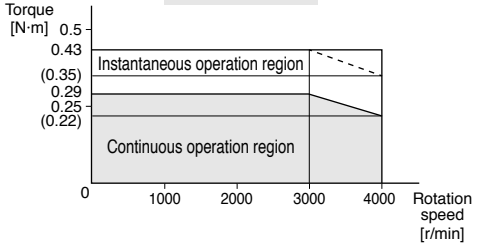


**MBEG9A1BCP／MBMU9A1 * *
MBEG9A5BCP／MBMU9A2 * ***

90 W 100V

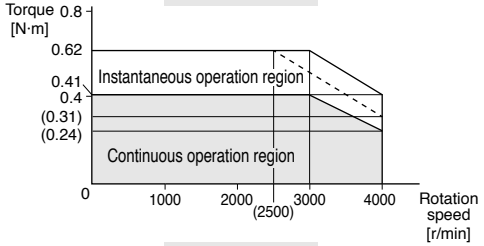


90 W 200V

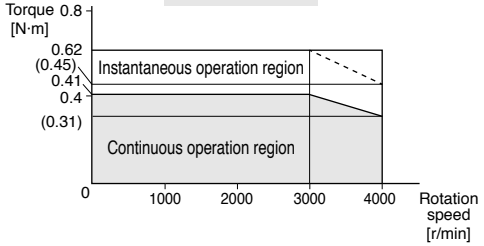


**MBEG1E1BCP／MBMU1E1 * *
MBEG1E5BCP／MBMU1E2 * ***

130 W 100V



130 W 200V



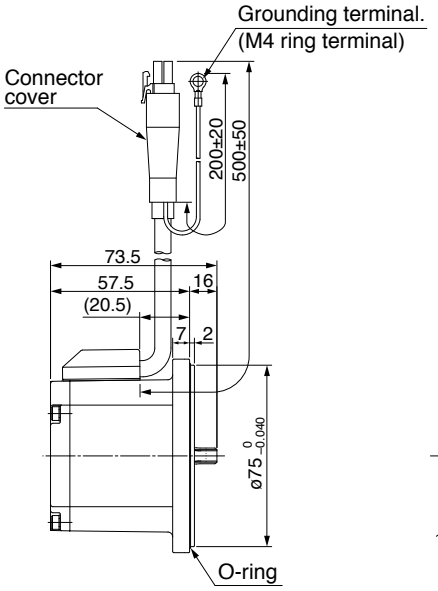
<Note>

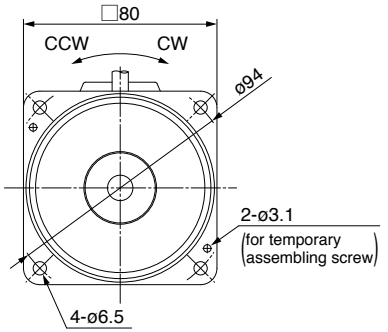
1. Instantaneous operation region is a typical value.
2. Dashed line represents the torque when power supply voltage falls 10%.

Dimensions [Unit: mm]

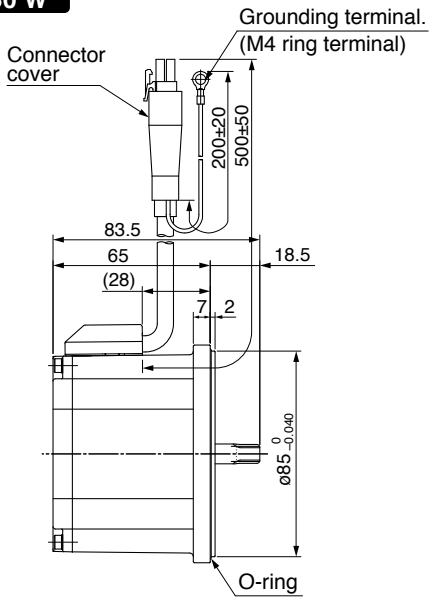
• Motor

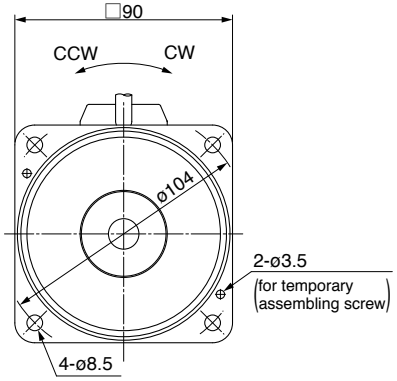
50 W





90 W/130 W





Specifications

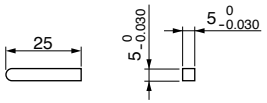
Dimensions [Unit: mm]

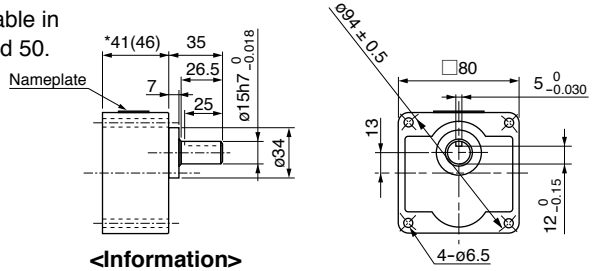
• Gear head

MB8G□BV (For 50W motor, sold separately)

- Reduction gear ratio in □
- Reduction gear ratio is available in 6 types: 5, 10, 15, 20, 30, and 50.

Key dimension





- Backlash
  Less than 2 ° (design value)

<Information>
Dimension in ( ) marked with * indicates dimension with reduction gear ratio 30 or above.

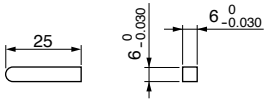
[Attachments of MB8G]

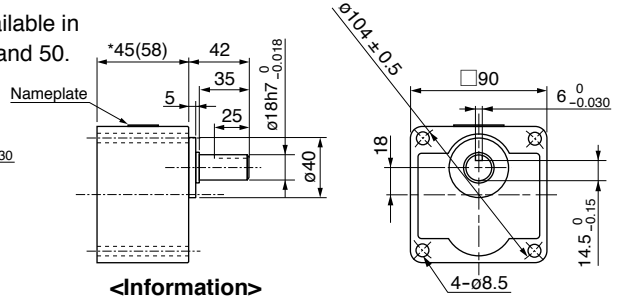
Parts name	Dimension	Application	Quantity	Remarks
Gear head mounting screw	M6 × length 65	MB8G5BV to MB8G20BV	4	Hexagon socket head bolt
	M6 × length 70	MB8G30BV, MB8G50BV	4	Hexagon socket head bolt
Nut	M6		4	
Flat washer	For M6		4	
Temporary assembling screw	M2.6 × length 12		2	Hexagon socket head bolt
Key	(See key dimension.)		1	

MB9G□BV (For 90W/130W motor, sold separately)

- Reduction gear ratio in □
- Reduction gear ratio is available in 6 types: 5, 10, 15, 20, 30, and 50.

Key dimension





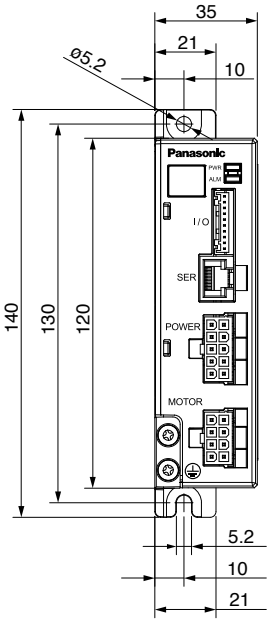
- Backlash
  Less than 2 ° (design value)

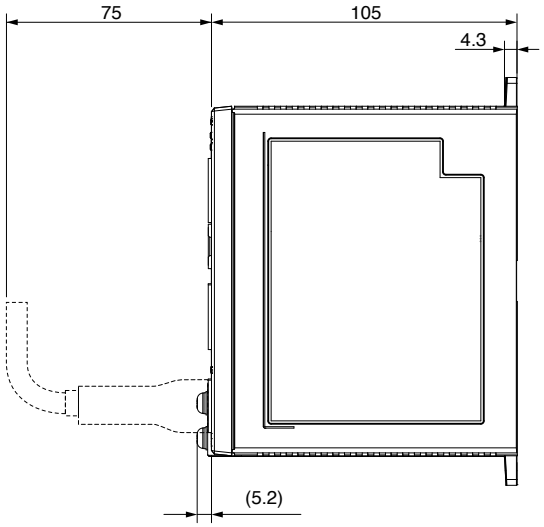
<Information>
Dimension in ( ) marked with * indicates dimension with reduction gear ratio 30 or above.

[Attachments of MB9G]

Parts name	Dimension	Application	Quantity	Remarks
Gear head mounting screw	M8 × length 75	MB9G5BV to MB9G20BV	4	Hexagon socket head bolt
	M8 × length 90	MB9G30BV, MB9G50BV	4	Hexagon socket head bolt
Nut	M8		4	
Flat washer	For M8		4	
Temporary assembling screw	M3 × length 12		2	Hexagon socket head bolt
Key	(See key dimension.)		1	

• Brushless amplifier

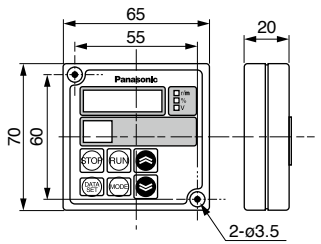




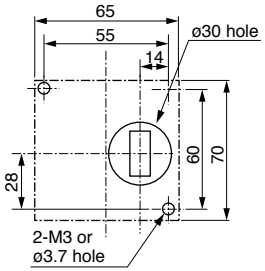
Options

• Digital key pad

DV0P3500



Mounting hole side

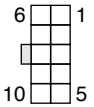


[Unit: mm]

Digital key pad connector terminal symbol

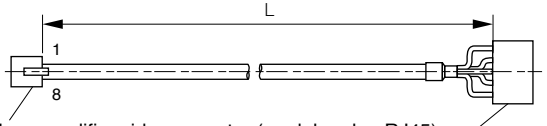
Terminal No.	1	2	3	4	5	6	7	8	9	10
Terminal name	—	—	GND	—	+5V	—	SCK	SIN	SOT	—

Digital key pad connector pin No.



• Digital key pad connection cable

Optional parts number	Length (L)
DV0P38310	1 m
DV0P38330	3 m
DV0P38350	5 m



Brushless amplifier side connector (modular plug RJ45)
Connected to (SER)

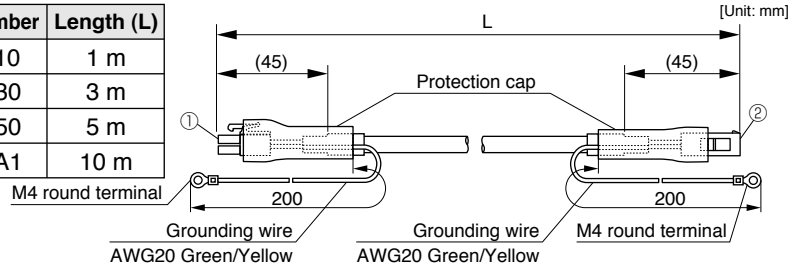
<Digital key pad side connector>
(MoleX.)
Housing : 39-01-2105(5557-10R-210)
Terminal : 39-00-0046(5556T2)
or
39-00-0047(5556T2L)

Terminal No. of SER connector	1	2	3	4	5	6	7	8
Terminal name	—	+5V	SOT	SIN	—	—	GND	SCK
Digital key pad side connector pin No.	—	5	9	8	—	—	3	7

• Motor extension cable

Optional parts number	Length (L)
DV0PQ1000110	1 m
DV0PQ1000130	3 m
DV0PQ1000150	5 m
DV0PQ10001A1	10 m

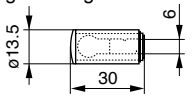
[Unit: mm]



• Accessories

- Insulating cap (for grounding wire insulation) 1
- M4 × 6 pan head screw with spring washer 1
- M4 hex. nut 1

Insulating cap
(for grounding wire insulation)



[Unit: mm]

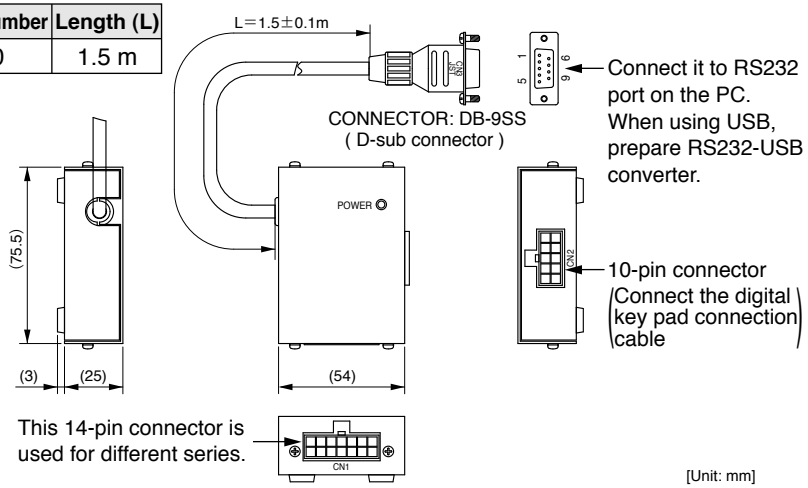
①Brushless amplifier side connector (MoleX.)
Connector : 39-01-2085
Connector pin : 39-00-0038 or 39-00-0039(for AWG 20)
39-00-0046 or 39-00-0047(for AWG 26)

②Motor side connector (MoleX.)
Connector : 39-01-2086
Connector pin : 39-00-0040 or 39-00-0041(for AWG 20)
39-00-0048 or 39-00-0049(for AWG 26)

- When using motor extension cable, be sure to connect its grounding wire to the grounding wire of the motor, and connect the other end of grounding wire of the extension cable to the earth terminal of the brushless amplifier.
  For connecting grounding wire of motor and motor extension cable, use M4 screw and insulating cap supplied as accessories.

• PC connection cable (10-pin D-sub connector pin 1.5 m)

Optional parts number	Length (L)
DV0P4140	1.5 m



[Unit: mm]

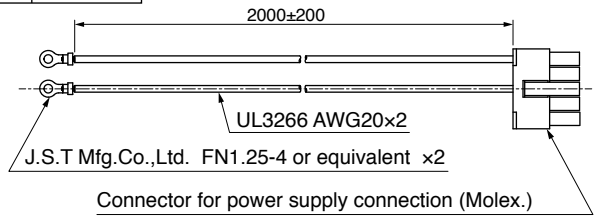
• Communication software "PANATERM for BL"

Can be downloaded from our web site, free of charge.
http://industrial.panasonic.com/ww/i_e/25000/motor_fa_e/motor_fa_e.html

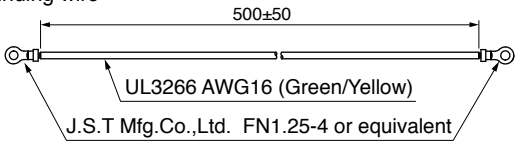
Options

• Power cable (single phase 100 V, 200 V) with connector

Optional parts number	Length (L)
DV0PM20077	2 m



• Grounding wire



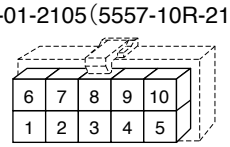
[Unit: mm]

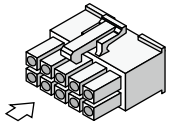
- When supplying 3-phase power source to a 200 V brushless amplifier, use the supplied power cable and connect 2 conductors to L1 and L2.
- When supplying 3-phase power, use a power connection kit and connect three conductors to L1, L2 and L3.

• Power supply connector kit

Optional parts number	Name	Manufacturer's parts No.	Qty.	Manufacturer	Note
DV0P2870	Connector	39-01-2105(5557-10R-210)	1	Molex Inc	Fits to power supply connector (POWER)
	Connector pin	39-00-0060(5556PBTL)	6		

• 39-01-2105（5557-10R-210）

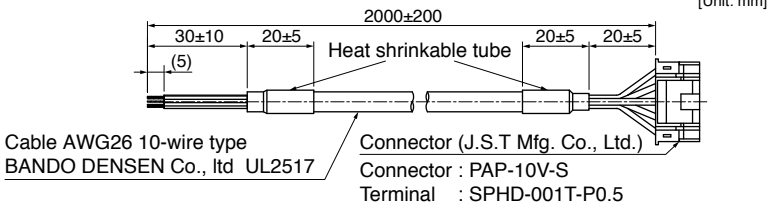




• Control signal cable (Cable with an I/O connector)

Optional parts number	Length (L)
DV0PM20076	2 m

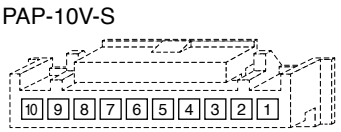
[Unit: mm]

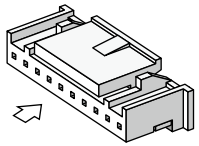


• I/O connector kit

Optional parts number	Name	Manufacturer's parts No.	Qty.	Manufacturer	Note
DV0PM20070	Connector	PAP-10V-S	1	J.S.T Mfg.Co.,Ltd.	Fits to I/O connector
	Connector pin	SPHD-002T-P0.5	10		

• PAP-10V-S

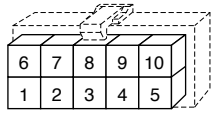


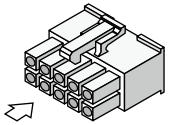


• Panel connector kit (Fits to Console B)

Optional parts number	Name	Manufacturer's parts No.	Qty.	Manufacturer	Note
DV0P3610	Connector	39-01-2105(5557-10R-210)	1	Molex Inc	Fits to Console A
	Connector pin	39-00-0047(5556T2L)	10		

• 39-01-2105（5557-10R-210）

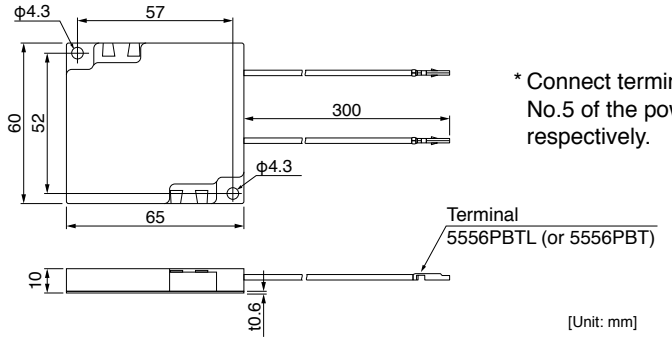




• External regenerative resistor

Optional parts number	Specifications
DV0P2890	100 V, 50 Ω
DV0PM20068	200 V, 200 Ω

• DV0P4190, DV0PM20068



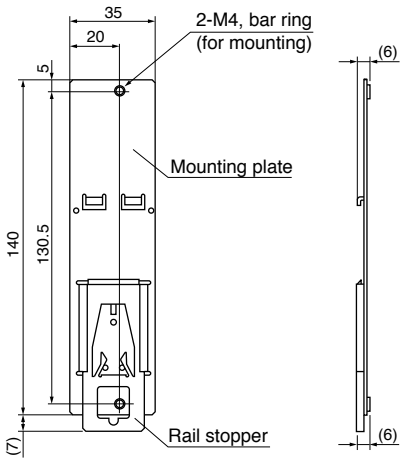
* Connect terminals to pins No.3 and No.5 of the power supply connector, respectively.

[Unit: mm]

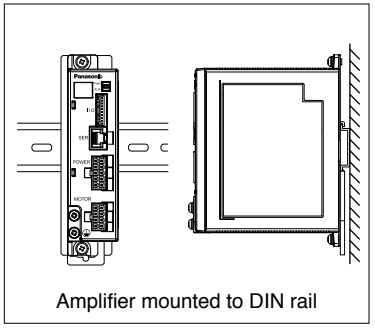
Options

• DIN rail attachment unit

Optional parts number
DV0P3811

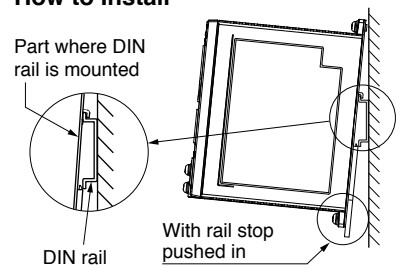


[Unit: mm]

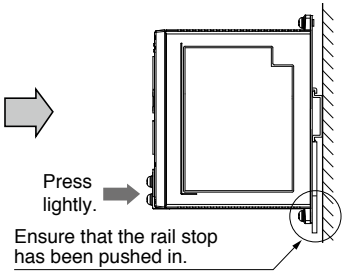


Amplifier mounted to DIN rail

• How to Install

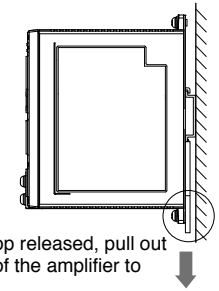


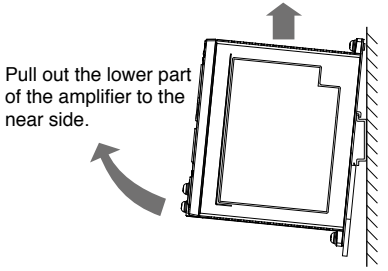
Hook the upper side of DIN rail mounting part on the DIN rail.



Press lightly the lower part of the main body of amplifier.

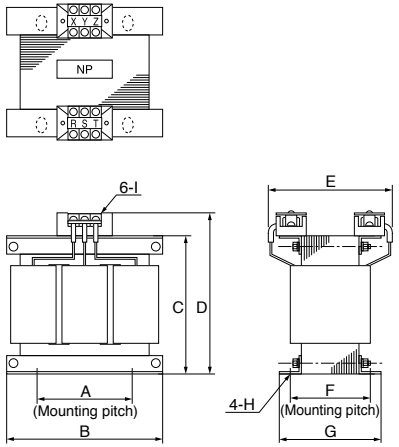
• Removing from DIN Rail





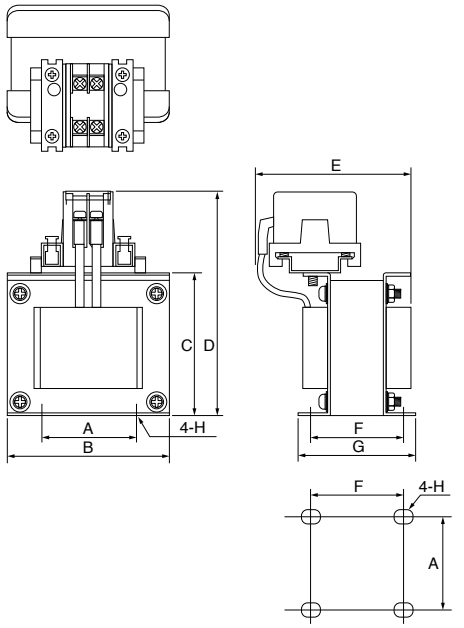
• Reactor

Fig.1(for 3-phase power supply)



F: Center-to-center distance on outer circular arc

Fig.2 (for single phase power supply)



F: Center-to-center distance on slotted hole

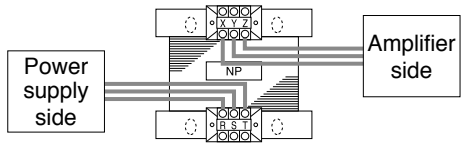
	Optional parts number	A	B	C	D	E (Max)	F	G	H	I	Inductance (mH)	Rated current (A)
Fig.1	**DV0P220**	65±1	125±1	(93)	136Max	155	70+3/–0	85±2	4-7φ×12	M4	6.81	3
Fig.2	**DV0P227**	55±0.7	80±1	66.5±1	110Max	90	41±2	55±2	4-5φ×10	M4	4.02	5

<Remarks>

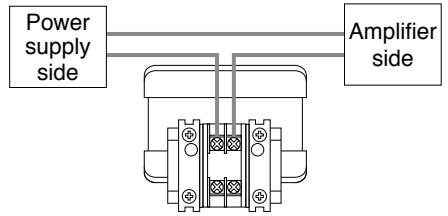
When using a reactor, be sure to install one reactor to one brushless amplifier.

• Wiring of the reactor

<3-Phase 200 V>



<Single phase 100, 200 V>



Options

List of Peripheral Equipments

Manufacturer	Tel No. / Home Page	Peripheral components
TDK Corporation	+81-3-5201-7229 http://www.tdk.co.jp/	Noise filter for signal lines
Okaya Electric Industries Co. Ltd.	+81-3-4544-7040 http://www.okayatec.co.jp/	Surge absorber Noise filter
Sensata Technologies Japan Limited	+81-49-283-7575 www.sensata.com/japan	Circuit breaker (MCCB)
Japan Molex Inc.	+81-462-65-2313 http://www.molex.co.jp	Connector
J.S.T. Mfg. Co., Ltd.	+81-45-543-1271 http://www.jst-mfg.com/index_i.html	
Iwaki Musen Kenkyusho Co., Ltd.	+81-44-833-4311 http://www.iwakimusen.co.jp/	Regenerative resistor

* This list is for reference only and subject to change without notice.

Cautions for Proper Use

Cautions for Proper Use

- Practical considerations for exporting the product or assembly containing the product
  When the end user of the product or end use of the product is associated with military affair or weapon, its export may be controlled by the Foreign Exchange and Foreign Trade Control Law. Complete review of the product to be exported and export formalities should be practiced.
- Parts are subject to minor change to improve performance.
- This product is intended to be used with a general industrial product, but not designed or manufactured to be used in a machine or system that may cause personal death when it is failed.
- Install a safety equipments or apparatus in your application, when a serious accident or loss of property is expected due to the failure of this product.
- If you are planning to use this product under special environment, such as atomic power control, aerospace equipment, traffic organization, medical equipment, various safety systems, and equipment which requires cleanliness, please contact us.
- We have been making the best effort to ensure the highest quality of the products, however, application of exceptionally larger 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.
- When this product is operated without the shaft electrically grounded, such as in driving the fan, bearing noise may become higher due to the occurence of electrocorrosion depending on the motor used or setting emvironment, so confirm and verify the condition on the customer side in such a case.
- Failure of this product depending on its content, may generate smoke of about one cigarette. Take this into consideration when the application of the machine is clean room related.
- Please be careful when using in an environment with high concentrations of sulphur or sulphuric gases, as sulphuration can lead to disconnection from the chip resistor or a poor contact connection.
- Take care to avoid inputting a supply voltage which significantly exceeds the rated range to the power supply of this product. Failure to heed this caution may result in damage to the internal parts, causing smoking and/or a fire and other trouble.

After-Sale Service (Repair)

Repair

Consult to a dealer from whom you have purchased the product for details of repair. When the product is incorporated to the machine or equipment you have purchased, consult to the manufacuter or the dealer of the machine or equipment.

Technical information

Technical information of this product (Instruction Manual, CAD data) can be downloaded from the following web site.

http://industrial.panasonic.com/ww/i_e/25000/motor_fa_e/motor_fa_e.html

Pursuant to at the directive 2004/108/EC,article 9(2)

Panasonic Testing Centre
Panasonic Marketing Europe GmbH
Winsbergring 15,22525 Hamburg,F.R.Germany

For your records:

The model number and serial number of this product can be found on either the back or the bottom of the unit. Please note them in the space provided and keep for future reference.

Model No.	MBEG ☐☐☐ BCP MBMU ☐☐☐ A ☐	**Serial No.**	
Date of purchase			
Dealer	Name		
	Address		
	Phone	( ) -	

Motor Business Unit, Panasonic Corporation
7-1-1 Morofuku, Daito, Osaka, 574-0044, Japan Phone : +81-72-871-1212

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