REFERENCE SPECIFICATIONS

Product Name：　　　　　　　　　Brushless Amplifier

Product Series Name：　　　　　　MINAS-BL KP series (Source logic signal input type)

Product Model Number (e.g.)：　　MBEK083BDP

If you have any questions, please contact the seller (Sales office or Distributor) of the product.

Panasonic

REVISIONS

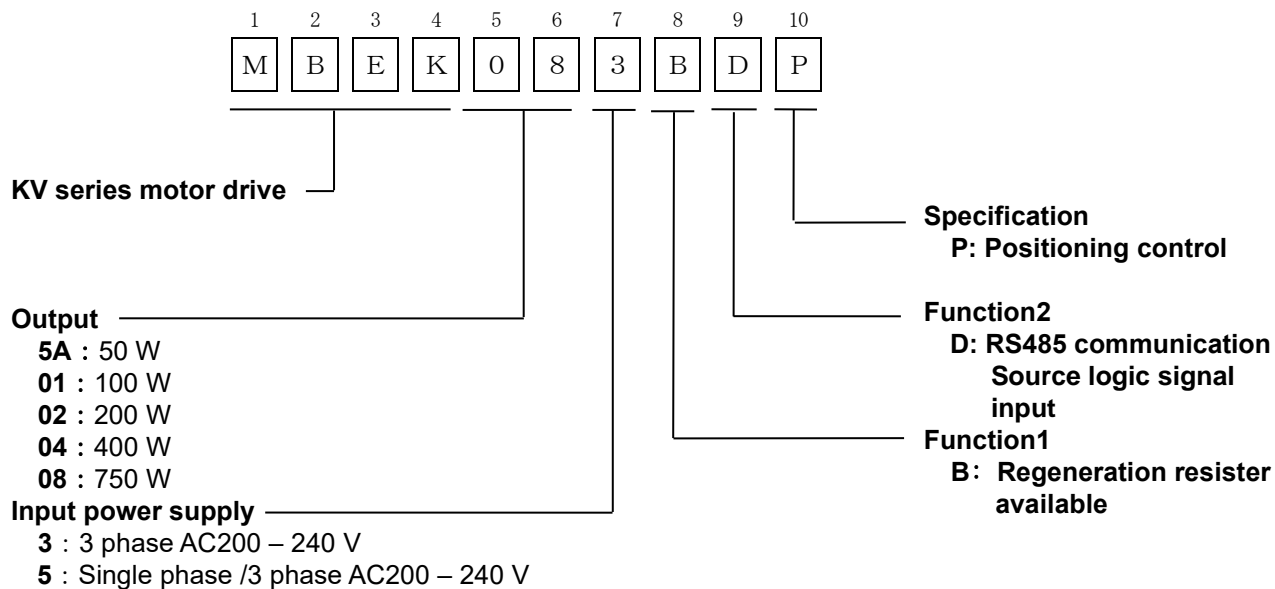| Date	Page	Sym	REVISION	Signed
Apr.18.2019		1.0	NEWLY ISSUED	-
Apr.1.2022	-	1.1	Changed the company name	-
	-		Changed the front cover format	
Oct.1.2022	Page 39	1.2	Changed Conformance to overseas standard	-

Contents

1. Scope of Application

These specifications relate to the brushless Amplifier MINAS-BL KP series source logic signal input type.
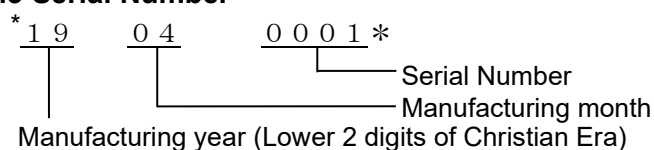This product is for industrial use only and can't be used for other uses eg home use.

2. Overview

2.1 Type
Brushless amplifier

2.2 Model Name

1	2	3	4	5	6	7	8	9	10
M	B	E	K	0	8	3	B	D	P

KV series motor drive

Specification
P: Positioning control

Function2
D: RS485 communication
Source logic signal input

Function1
B: Regeneration resister available

Output
5A : 50 W
01 : 100 W
02 : 200 W
04 : 400 W
08 : 750 W

Input power supply
3 : 3 phase AC200 – 240 V
5 : Single phase /3 phase AC200 – 240 V

2.3 Serial Number

19   04   0001

Serial Number
Manufacturing month
Manufacturing year (Lower 2 digits of Christian Era)

*Indicates production in April 2019, sequential number 0001.
If the sequential number exceeds 9999, the four-digit most significant digit becomes one alphabet in alphabetical order (except I and O). (0001,0002,…,9998,9999,A001,A002,…,A999,B001,…)

3. Model list

Model name	Rated output	Power voltage	Rated input current (for reference)	Rated output current	Applicable Brushless motor
MBEK5A5BDP	50 W	Single phase /3 phase AC200 – 240 V	0.9/0.5 A	0.8 A	MBMS5AZBL□
MBEK015BDP	100 W	Single phase /3 phase AC200 – 240 V	1.3/0.7 A	0.8 A	MBMS012BL□
MBEK025BDP	200 W	Single phase /3phase AC200 – 240 V	2.1/1.2 A	1.8 A	MBMS022BL□
MBEK045BDP	400 W	Single phase /3phase AC200 – 240 V	3.8/2.1 A	2.8 A	MBMS042BL□
MBEK083BDP	750 W	3phase AC200 – 240 V	4.0 A	3.6 A	MBMS082BL□

Please be sure to use in the above-mentioned combination.

Otherwise, it results in failure or malfunction.

4. Specification

4.1 General specification

Basic specification			
Basic specification	Ambient conditions	Allowed range of supply voltage fluctuation	±10 %
		Control method	Speed control by CS signal, PWM sine wave driving system
		Ambient temperature	0 - +50 ℃ (free from freezing)*5
		Ambient humidity	20～85 % RH or below (free from condensation)
		Location	Indoor（No corrosive gas, A place without garbage, and dust）
		Altitude	Not greater than 1000 m
		Vibration	Not greater than 4.9 m/s²(10-60 Hz)
		Storage temperature	-20 ℃~65 ℃ (max temperature 80 ℃72 hr, Free from freezing)*1
		Storage humidity	20～85 % RH or below (free from condensation)
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 ℃ at no load)
		Input signal*3	6 points
		Output signal*3	2 points (Open collector)
		Communication function via RS485	Setting of parameter, monitoring of control condition and the like are enabled with RS485 interface. Max 31 units.
		Communication function via RS232C	Setting of parameter and monitoring of control condition are enabled with commercial PC. (When connecting a commercially available PC, an optional connecting cable is necessary. If PC has no RS232port, RS232-USB converter is required.)
		Digital Keypad(sold separately)	Available
		Regenerative Break	Optional regenerative resistor is available.*6
		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, Digital keypad communication trouble, user parameter error, and system parameter error
Performance		Speed control range	30 – 4000 r/min *4
		Overload rating	Inverse time-lag overload protection Protection level 115 (Torque reference) Torque reference 150, 1 minute
		Permissible length for motor cable	10 m or less (with optional extension cable） *2
		Permissible length for control cable	3 m or less*2
		Cooling system	Self cooling
		Mass (kg)	100 W or less:0.37, 200 W or more:1

*1 Please note that dew condensation easily occurs when the temperature decreases.
*2 It is the maximum length in our evaluation environment and it does not guarantee the operation in the customer's use environment.
*3 The function of signal can be changed by Digital key pad, "Panaterm for BL" or RS485 communication.
*4 It is the range that can control the speed, and the rotation quality such as smoothness is affected by the load condition and gain setting.
*5 Ambient temperature is measured at a distance of 50 mm from the product.
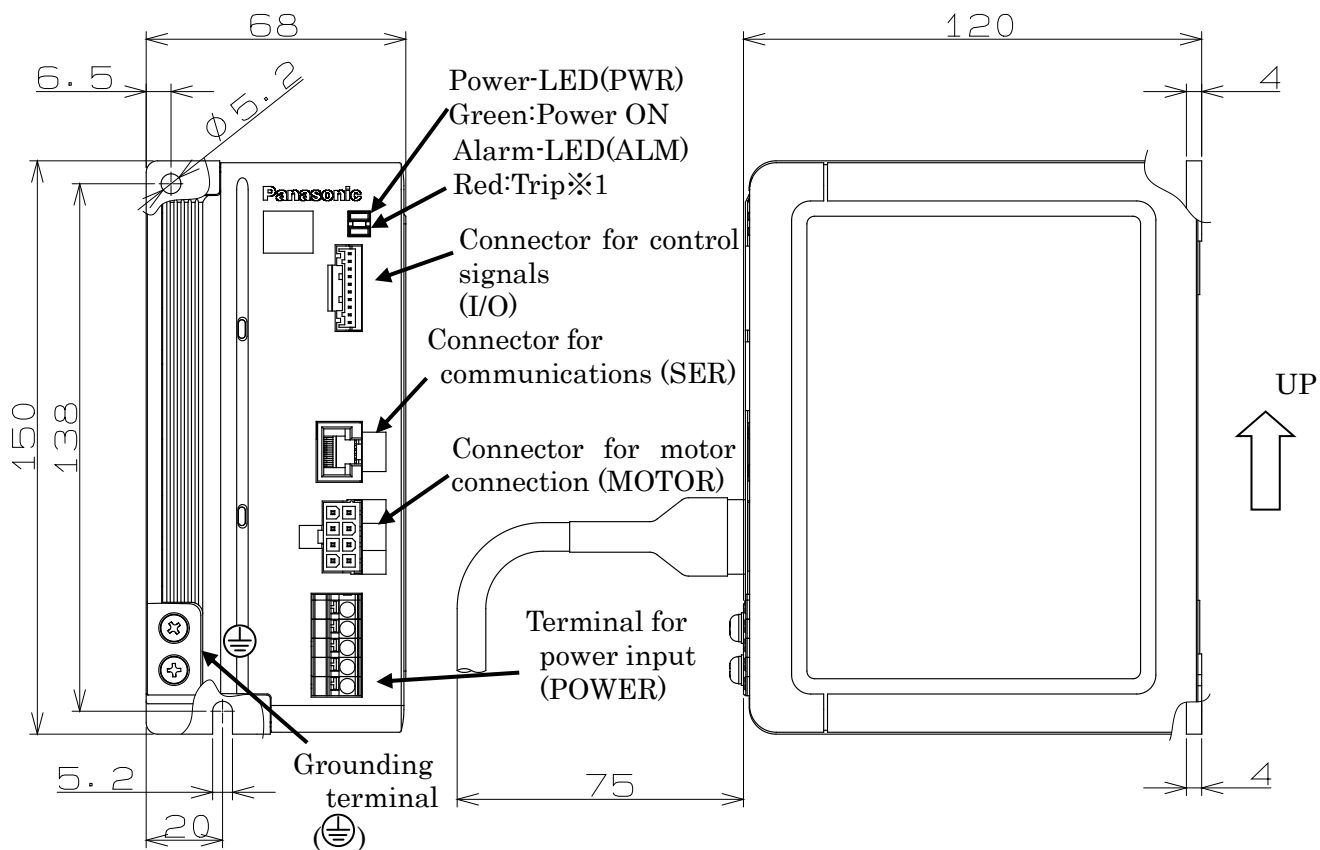*6 External regenerative resistor: DV0P2890/DV0PM20068(100 V/200 V)
＊ Take the signal input (I1, I2 and so on) for Start and Stop basically. The power ON and OFF may cause short lifetime in the internal circuit.
* Trip means that a protection circuit operates and stops.

4.3 **Insulation resistance** More than DC500 V 20 MΩ
(Between power supply and frame)

4.4 **Isolation voltage** Between power supply and earth
AC1500 V 1 minute

4.5 **Dimensional Outline drawing**

200 W, 400 W, 750 W

Power-LED(PWR)
Green:Power ON
Alarm-LED(ALM)
Red:Trip※1
Connector for control signals (I/O)
Connector for communications (SER)
Connector for motor connection (MOTOR)
Terminal for power input (POWER)
Grounding terminal (⏚)
UP
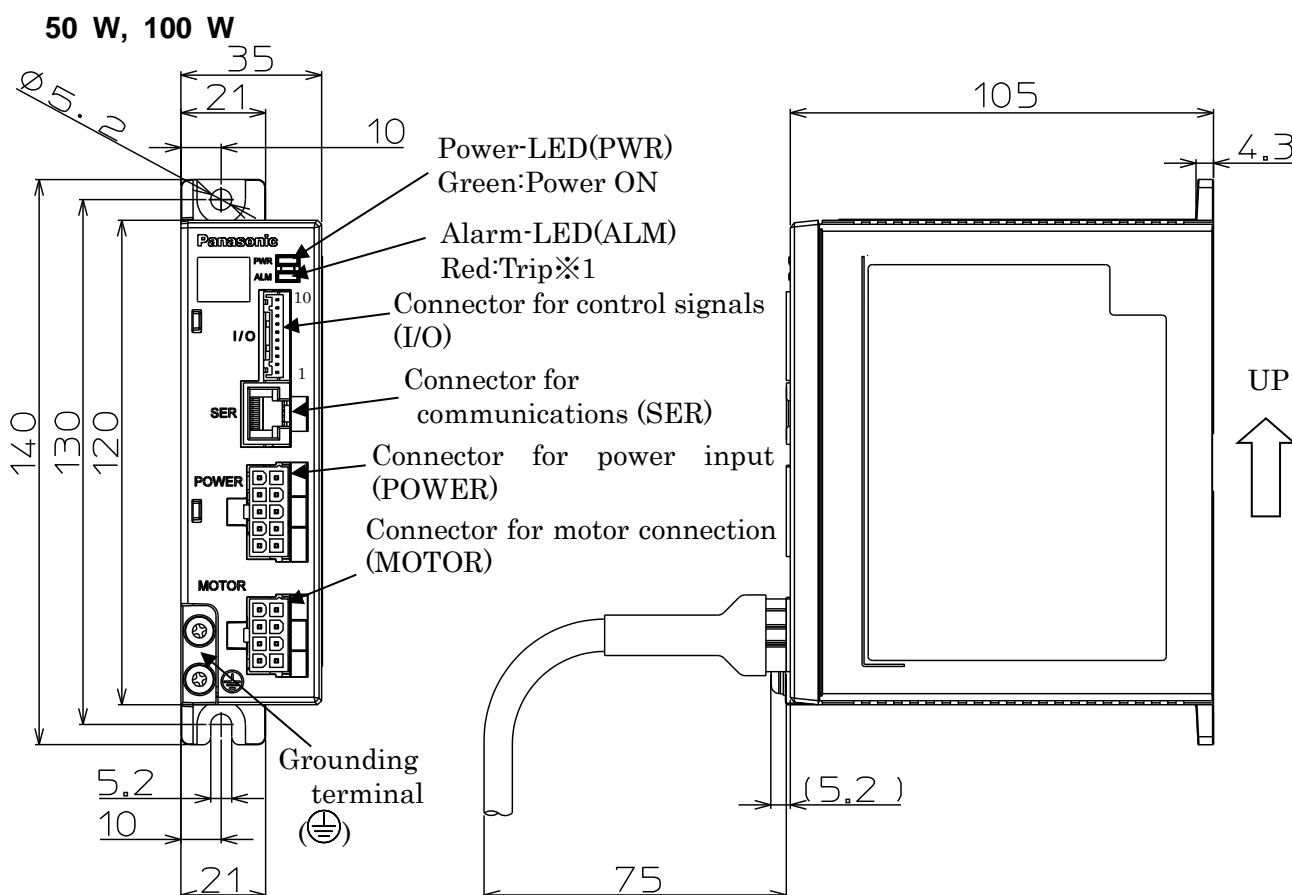
※1 Trip means that a protection circuit operates and stops.
※Install the top and bottom properly, and provide a space of around 10 cm for heat dissipation

When dealing with the product, please take measure against static electricity.

50 W, 100 W

Power-LED(PWR)
Green:Power ON

Alarm-LED(ALM)
Red:Trip※1

Connector for control signals (I/O)

Connector for communications (SER)

Connector for power input (POWER)

Connector for motor connection (MOTOR)

Grounding terminal (⏚)

UP

※1 Trip means that a protection circuit operates and stops.
※Install the top and bottom properly, and provide a space of around 10 cm for heat dissipation
　When dealing with the product, please take the measure against static electricity.

4.6　Installation method

· Install the product up and down correctly in the direction shown in 4.5 Dimensional Outline drawing .
· Tightening torque of the product mounting screw should be selected appropriately so as not to be loose or damaged considering the strength of the screw to be used and the material of the installation destination.
　Recommended tightening torque (When install to steel plate with steel screw):
　M4 0.8 Nm to 1.2 Nm
· In order to cool effectively, please secure ambient space.
· Measure the ambient temperature 50 mm away from the side and bottom of the brushless amplifier.
　If measurement can't be made at 50 mm distance, including when using brushless amplifiers side by side, measure at the midpoint of the gap between the obstacle and the brushless amplifier or the gap between the brushless amplifier and the adjacent brushless amplifier.
　When the motor is driven, the brushless amplifier generates heat, but be sure to keep the temperature within the range including the heat generation.
· Install in an environment where the pollution degree around the product is 2 or less, such as putting it in a control panel with IP 54 or higher.

5. Function of terminal

5.1 Power input (POWER)
200 W, 400 W, 750 W
Terminal Brock

Terminal symbol	Terminal name	Description of function
B1	for external regen-erative resistor	Connect for external regenerative resister in case. DV0P2890 for 100 V DV0PM20068 for 200 V
P		
L3	Power input	Connect the terminal to commercial power supply conforming to voltage specification. In case of single-phase connect L1 and L2.
L2		
L1		

Recommended pin terminal: TGN TC-1.25-9T (Nichifu Co.,Ltd.)

How to wiring:
Please use a single wire or rod terminal and insert as far into the connection hole.
Recommended rod terminal: TGN TC-1.25-9T(NICHIFU), Applicable wire size: AWG20 to 16.
In case of single wire: Strip length 10 mm (reference), Applicable wire size: AWG20 to 14.
How to remove wiring:
Using a flathead screwdriver with a blade width of 2.6 mm, push the Wire extraction button of the terminal block vertically and remove the electric wire. Be careful not to apply excessive force at this time. (Approximately 20 N or less)
* Please check tools etc. necessary for terminal crimp on the home page of terminal manufacturer or contact terminal manufacturer.
* Since the strip length of the wire depends on the type of wire etc., please decide the optimum strip length according to the processing condition.

50 W, 100 W
Connector: Molex 5569-10A-1210 or equivalent

Pin No.	Terminal symbol	Terminal name	Description of function
3	B	for external regenerative resistor	Connect for external regenerative resister in case. DV0P2890 for 100 V DV0PM20068 for 200 V
5	P		
6	L3	Power input	Connect the terminal to commercial power supply conforming to voltage specification. In case of single-phase connect L1 and L2.
8	L2		
10	L1		
1,2,4,7,9	(NC)	-	Do not connect anything.

CAUTION: To prevent unforeseen circumstances due to poor contact etc., install and wire so that no stress such as pulling is applied to the terminal block through the cable.

5.2 Grounding terminal (⏚)
Terminal for grounding the amplifier.(M4×2pieces)
Fasten only one wire to one terminal.
Fasten torque:0.8-1.2 N·m

5.3 Connector for motor connection (MOTOR)
    MOLEX 5569-8A-1210 or equivalent

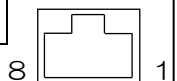| Terminal number	Terminal name	Description of terminal
1	U	Motor U phase
2	V	Motor V phase
3	W	Motor W phase
4	5VS	5 V (not insulated from power supply)
5	CS1	CS signal
6	CS2	CS signal
7	CS3	CS signal
8	GNDS	GND (not insulated from power supply)

■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.
■ No. 4 to 8 terminals of option cable are not isolated from commercial power source. Use care to avoid electric shock and grounding fault.

5.4 Connector for communications (SER)
    MOLEX 85503－0001 or equivalent

Terminal number	Terminal name	Description of terminal
1	－	Do not connect anything.
2	+5VL	power supply 5 V
3	SOT	Digital key pad communication or PANATERM for BL
4	SIN	
5	RS485+	Connect RS485+
6	RS485-	Connect RS485-
7	GNDL	Signal ground
8	SCK	Digital key pad communication

■The pin numbers are shown in the figure at right.
■The connection cable(DV0P383**) for Digital key pad is needed to connect with the Digital key pad. (sold separately)
■The connection cable(DV0P383**) for Digital key and PC cable (DV0P4140) are needed to use RS232C communication control software 「PANATERM for BL」.

5.5 Connector for control signals (I/O)
JST S10B-PASK-2 or equivalent

| Terminal number	Terminal symbol	Terminal name	Default	Description of function
1	I1 *1	Signal input 1	Run start	Select a function with Pr50. In turning on signal, DC24 V source is supplied to "I1" based on "GND". (Input logic can be changed by Pr54.)
2	I2 *1	Signal input 2	Point desig-nation 1	Select a function with Pr51. In turning on signal, DC24 V source is supplied to "I2" based on "GND". (Input logic can be changed by Pr55.)
3	I3 *1	Signal input 3	Home sensor	Select a function with Pr52. In turning on signal, DC24 V source is supplied to "I3" based on "GND". (Input logic can be changed by Pr56.)
4	I5 *1	Signal input 5	Forced trip	Select a function with Pr70. In turning on signal, DC24 V source is supplied to "I5" based on "GND". (Input logic can be changed by Pr72.)
5	I6 *1	Signal input 6	Forced trip	Select a function with Pr71. In turning on signal, DC24 V source is supplied to "I6" based on "GND". (Input logic can be changed by Pr73.)
6	GND	Signal ground		Common ground terminal for control signal.
7	I4 *1	Signal input 4	Forced trip	Select a function with Pr53. In turning on signal, DC24 V source is supplied to "I4" based on "GND". (Input logic can be changed by Pr57.)
8	+5V	Power supply		Set 50 mA or below
9	O1 *1	Signal output 1	Trip output	Open collector output. Choose a function with Pr5C. (Output logic can be changed by Pr5E)
10	O2 *1	Signal output 2	In-motion sig-nal	Open collector output. Choose a function with Pr5d. (Output logic can be changed by Pr5F)

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

■ Do not touch the terminals of the control circuit and do not connect or disconnect the I / O connector while energizing. It may malfunction due to static electricity.

■ When extending the control signal cable, set it to 3 m or less.*2

■ To prevent unexpected situations due to poor contact etc. install and wire so that stress such as pulling is not applied to the connector via cable. Confirm that the caulking of the wire is secure and that the connector is inserted securely.

■ Use a twisted wire or a shielded wire for the wire connected to the control circuit.

■ Please separate the electric wire connected to the control circuit from the power line.

*2 It is the maximum length in our evaluation environment and it does not guarantee the operation in the customer's use environment.
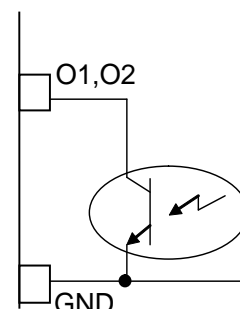
<Input circuit>

◆ Do not touch the terminal of energized control circuit.
  Static electricity or the like may lead to malfunction.
◆ Circuit of input terminal is as shown below.
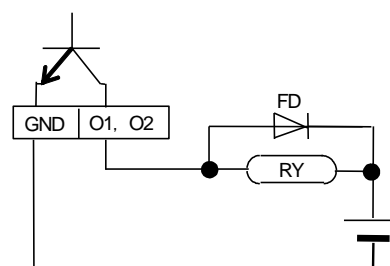 It can be controlled by supplying DC24 V.

I1, I2, I3
I4, I5, I6

DC24 V

4.7 kΩ

GND

<Output circuit>
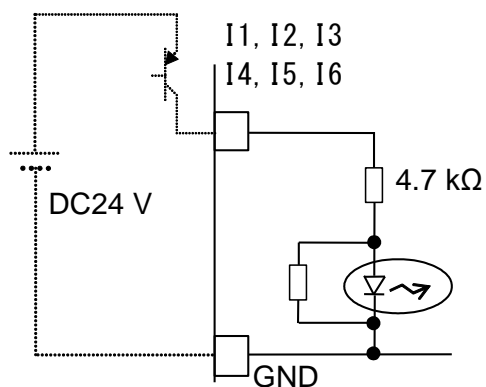
◆ Circuit of output terminal is as shown on the right.
  (Open collector output)

Ic max.= 50 mA
Vce max.= DC30 V

$Vce_{(L)}$ = 0.5 V or less

(at Ic= 50 mA, Ta= 25 ℃)

O1,O2

GND

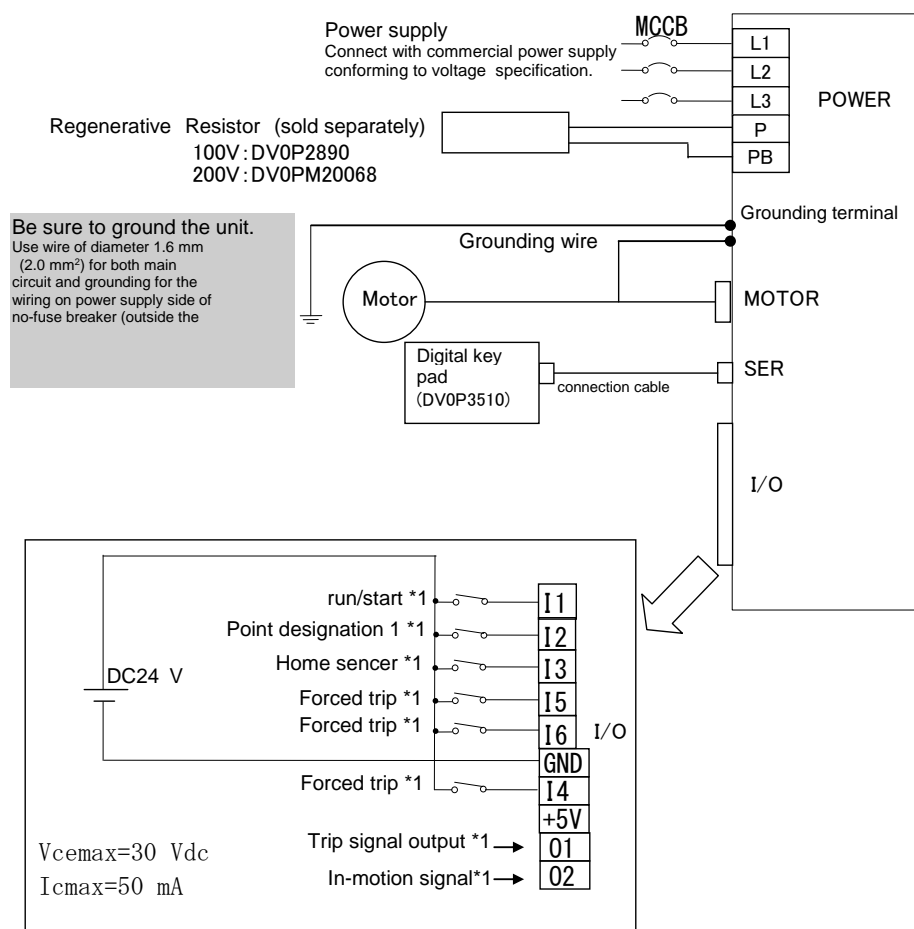To directly drive the relay (RY) using the output terminal (O1, O2 to GND), please insert a flywheel diode (FD). (See the figure below)

FD

GND | O1, O2

RY

6. Wiring

6.1 Standard wiring diagram

Power supply
Connect with commercial power supply
conforming to voltage specification.

MCCB

| L1 |
| L2 | POWER
| L3 |

Regenerative Resistor (sold separately)
100V：DV0P2890
200V：DV0PM20068

| P |
| PB |

Grounding terminal

Be sure to ground the unit.
Use wire of diameter 1.6 mm
(2.0 mm²) for both main
circuit and grounding for the
wiring on power supply side of
no-fuse breaker (outside the

Grounding wire

Motor

MOTOR

Digital key
pad
(DV0P3510)

connection cable

SER

I/O

DC24 V

run/start *1	I1
Point designation 1 *1	I2
Home sencer *1	I3
Forced trip *1	I5
Forced trip *1	I6	I/O
	GND
Forced trip *1	I4
	+5V
Trip signal output *1 →	01
In-motion signal*1 →	02

Vcemax=30 Vdc

Icmax=50 mA

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

※ **The wiring of SER or I/O connector should separate from power line.**

Wiring equipment

●Selection of molded case circuit breaker (MCCB), magnetic contactor, and electric wire (wiring within equipment)

(See "12. Conformance to overseas standard" for compatibility with overseas standard.)

Voltage	Capacity (w)	MCCB rated current	Magnetic contactor rated current (contact structure)	Electric wire (mm²) (Wiring within equipment)	
				Main circuit/ Grounding wire	Control circuit
Single phase 100 V	100 W or less	5 A	20 A (3P+1a)	0.75(AWG18)	0.13(AWG26)
	200 W	10 A			
Single phase 200 V	200 W or less	5 A			
	400 W	10 A			
3 phase 200 V	400 W or less	5 A			
	750 W	10 A			

■ 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 mm2) or more both for main circuit and grounding. Must be grounded with resistance less than 100 Ω. 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, 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

7. Parameter

Parameter No. (Pr□□)	Name of parameter		Effective after power re-setting	Setting range	Default	Description	
00	The 1st point	The 1st target position (rotation number)		−16384～16383	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)		−288～288	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		0～3000	2000	You can set the speed moving to the 1st point. Setting unit [r/min]	
04		The 1st acceleration time		1～30000	200	You can set time taken for reaching the 1st setting speed. Setting unit [ms]	
05		The 1st deceleration time		1～30000	200	You can set time taken from the 1st setting speed to stop. Setting unit [ms	
06		The 1st block setting		0～2	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		0～30000	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 2ms. (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)		−16384～16383	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)		−288～288	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		0～3000	2000	You can set the speed moving to the 2nd point. Setting unit [r/min]	
0C		The 2nd acceleration time		1～30000	200	You can set time taken for reaching the 2nd setting speed. Setting unit [ms]	
0d		The 2nd deceleration time		1～30000	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) **2**: Combined block operation (2nd point + 3rd point)	
0F		The 2nd block timer setting		0～30000	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 2ms. Setting unit [ms]	
10	The 3rd point	The 3rd target position (rotation number)		−16384～16383	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)		−288～288	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		0～3000	2000	You can set the speed moving to the 3rd point. Setting unit [r/min]	
14		The 3rd acceleration time		1～30000	200	You can set time taken for reaching the 3rd setting speed. Setting unit [ms]	
15		The 3rd deceleration time		1～30000	200	You can set time taken from the 3rd setting speed to stop. Setting unit [ms	
16		The 3rd block setting		0～2	0	**0**: Normal operation **1**: Continuous block operation (3rd point → 4th point) **2**: Combined block operation (3rd point + 4th point)	
17		The 3rd block setting		0～30000	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 2ms. Setting unit [ms]	

Parameter No. (Pr□□)	Name of parameter		Effective after power re-setting	Setting range	Default	Description	
18	The 4th point	The 4th target position (rotation number)		−16384〜16383	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)		−288〜288	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	
1b		The 4th setting speed		0〜3000	2000	You can set the speed moving to the 3rd point. Setting unit [r/min]	
1C		The 4th acceleration time		1〜30000	200	You can set time taken for reaching the 4th setting speed. Setting unit [ms]	
1d		The 4th deceleration time		1〜30000	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) **2**: Combined block operation (4th point + 1st point)	
1F		The 4th block timer setting		0〜30000	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 2ms. 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			1〜4	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 CCW: Clockwise rotation as viewed from the motor shaft. CW: Counterclockwise rotation as viewed from the motor shaft	
28	Position loop gain (the 1st gain)			0〜100	5	You can determine the response of position control. 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)			0〜10000	250	You can determine the response of velocity loop. When it is increased, the response is improved, which is likely to cause oscillation.	
2A	Velocity loop integration gain (the 1st gain)			0〜10000	500	You can determine the rigidity of velocity loop. When it is increased, the rigidity is improved, which is likely to cause oscillation.	
2b	Velocity feed forward gain (the 1st gain)			0〜100	0	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 [%]	
2C	Speed detection filter (the 1st gain)			5〜20	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)			0〜500	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)			0〜200*1	200*1	Upper limit of torque reference is set. (Use as a guide.) torque reference :A value based on a rated torque of 100. By calculating the load factor using this, it aims at the minimum motor burnout protection, and the accuracy can not be guaranteed.	
*1 The value is"180" in case of MBEK083***(750 W)							
2F	Torque filter time constant (Common to the 1st/2nd gain)			0〜500	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)			0〜100	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)			0〜10000	250	You can determine the response of velocity loop.	

Parameter No. (Pr□□)	Name of parameter	Effective after power re-setting	Setting range	Default	Description
32	The 2nd velocity loop integration gain (the 2nd gain)		0～10000	500	You can determine the rigidity of velocity loop.
33	The 2nd velocity feed forward gain (the 2nd gain)		0～100	0	Setting unit [%]
34	The 2nd speed detection filter (the 2nd gain)		5～20	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)		0～200*1	200*1	Upper limit of torque reference is set. (Use as a guide.) torque reference :A value based on a rated torque of 100. By calculating the load factor using this, it aims at the minimum motor burnout protection, and the accuracy can not be guaranteed.
	*1 The value is"180" in case of MBEK083***(750 W)				
36	Gain switching mode selection		0～2	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
37	Gain switching time		0～10000	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		0～16383	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		0～16383	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		0～5	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		0～3000	200	You can set the speed in homing action. Setting unit [r/min]
43	Homing limit		0～16383	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		1～30000	200	You can set time taken for reaching the homing speed. Setting unit [ms]
45	Bumping torque detection value		0～200	50	You can limit the torque reference when returning to bumping home. 100 indicates the rated torque.
46	Bumping detection time		0～15000	100	You can set the detection time of bumping toque in returning to bumping home. Setting unit [ms]
47	Home offset		−16384～ 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	○	0～2	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.

Parameter No. (Pr□□)	Name of parameter	Effective after power re-setting	Setting range	Default	Description
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		0～3000	100	You can set the operation speed in jog operation. Setting unit [r/min]
4C	Jog acceleration time		1～30000	200	You can set time taken for reaching jog speed. Setting unit [ms]
4d	Jog deceleration time		1～30000	200	You can set time taken from jog speed until stopping. Setting unit [ms]
4E	Teaching speed		0～3000	50	You can set speed used in applying teaching function of digital keypad. Acceleration and deceleration time is the same as jog operation. Setting unit [r/min]
50	I1 function selection	○	0～15	8	You can assign functions to I1 through I4. **0**: Forced trip, **1**: Instantaneous stop **2**: Deceleration stop, **3**: Homing start∗
51	I2 function selection	○	0～15	6	**4**: Forward jog∗, **5**: Reverse jog∗ **6**: Point designation 1∗, **7**: Point designation 2∗ **8**: Run start∗, **9**: Sequential run start∗
52	I3 function selection	○	0～15	11	**10**: Trip reset, **11**: Home sensor, **12**: Limit in + direction, **13**: Limit in − direction **14**: Direction switching∗, **15**: Motor-free
53	I4 function selection	○	0～15	0	∗) When Pr3E is 1, this function is effective for I/O input for giving priority to RS485.
54	I1 Input logic selection	○	0, 1	0	**0**: Normal logic (Input is effective (ON) when connected to DC24 V.)
55	I2 Input logic selection	○	0, 1	0	**1**: Reverse rotation logic (Input is effective (ON) when OPEN (open))
56	I3 Input logic selection	○	0, 1	0	Set the reverse rotation logic to the input desired to be operated on wiring break side such as forced trip
57	I4 Input logic selection	○	0, 1	0	(emergency stop input).
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		0～30000	0	Set the deceleration time in executing instantaneous stop. Setting unit [ms]
5C	01 function selection		0～5	0	You can assign functions to 01 and 02. **0**: Trip output, **1**: In-position, **2**: In-motion signal (BUSY), **3**: Homing completion,
5d	02 function selection		0～5	2	**4**: Overload detection, **5**: Torque under restriction
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)
5F	02 output polarity selection		0, 1	0	When only trip output is normal logic, output transistor is off in tripping, and output transistor is on in no tripping.
60	RS485 device number	○	128～159 (80h～9Fh)	129 (81h)	Set the device number of motor in communication (Motor ID). This value is the shaft number in communication. 80h (128) is the device number for setting control data (such as control start) by one operation to all connected motors. (No response is made by motors.) When the device number is set to 80h (128), change of parameter and request for status are ignored, therefore set to 81h (129) - 9Fh (159) normally.
61	RS485 communication speed	○	0～2	2	Set the communication speed of RS485 communication. **0**: 2400bps, **1**: 4800bps, **2**: 9600bps
62	RS485 communication standard	○	0～11	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

Parameter No. (Pr□□)	Name of parameter	Effective after power re-setting	Setting range	Default	Description
63	RS485 communication response time	◯	10～100	10	Communication response time is the shortest time for setting transmission mode in RS485 bus for response after the motor has received communication data. Actual data response time depends on the type and data of order. Unit [ms]
64	RS485 retry times of communication	◯	0～9	9	Set the retry times of RS485 communication. **0 - 8**: Number of retrials, **9**: No retrial
65	RS485 protocol Timeout	◯	1～255	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 motor trips due to RS485 communication error. Unit [seconds]
6A	Trip history clear		0(No), 1(Yes)	n0	When " (1)" is set, trip history (Pr6b - 6F) is cleared. Trip history is also cleared when 1 is set on "PANATERM for BL" (sold separately).
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.
70	I5 function selection	◯	0～15	0	You can assign functions to I5 ,I6. **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∗
71	I6 function selection	◯	0～15	0	**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.
72	I5 Input logic selection	◯	0, 1	0	**0**: Normal logic (Input is effective (ON) when connected to DC24 V.) **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).
73	I6 Input logic selection	◯	0, 1	0	
77	Parameter copy function		No/P.INIT /P.LOAD/P .PROG	n0	This function is only available with use of the digital keypad. See page 26.
7A	Monitor mode switching		0～6	0	You can choose monitor screen to be displayed first when the digital keypad is connected. **0**: Rotation speed (actual speed), **1**: Torque reference, **2**: Load factor, **3**: Command speed, **4**: Internal DC voltage, **5**: Present position (lower 5 digits), **6**: Present position (rotation number) Torque reference : A value based on a rated torque of 100. By calculating the load factor using this, it aims at the minimum motor burnout protection, and the accuracy can not be guaranteed. Load factor: Value obtained by applying first-order lag filter to torque reference.
7b	Numerator of command pulse ratio	◯	1～20000	1	You can set the division multiplier ratio of travel distance. Change of this parameter does not affect operation speed of motor.
7C	Denominator of command pulse ratio	◯	1～20000	1	You can set numerator : denominator = 100:1 - 1:100.
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.

8. Operation setting

8-1. Operation spec

8-1-1. Positioning operation

This product 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) 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) is found.

This product 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 – 53,70,71 as follows and assign the function of signal input. Of signal inputs 1 – 4,5,7 (I1 – I6), 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 1 / Point designation 2	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 – 53,70,71 as follows, and assign the function of signal input.
Of signal inputs 1 – 4,5,7 (I1 – I6), 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.

[Command timing chart]
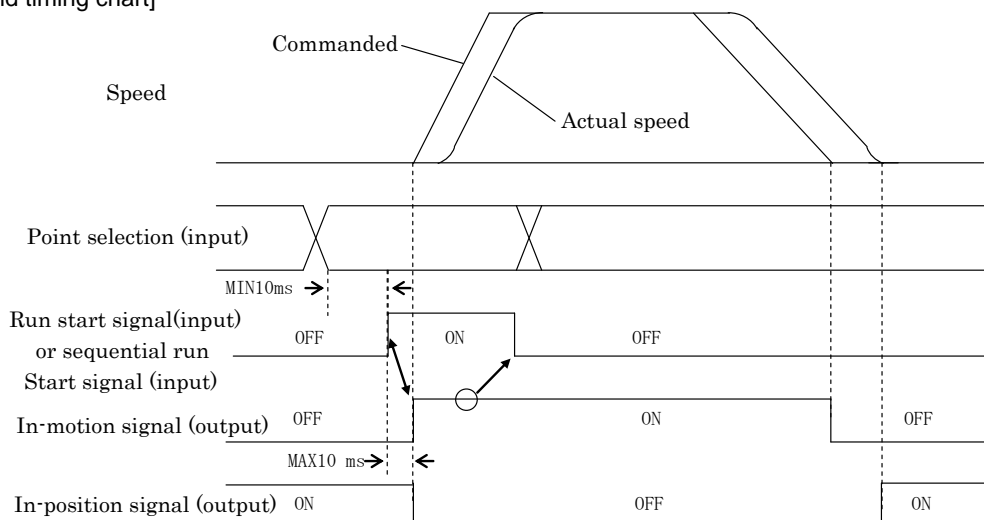
(1) Choose a point number for point designation run. Point designation is not required (made ineffective) in sequential operation.
(2) Set the run start signal at "ON" (Default setting: ON when DC24 V source is supplied based on "GND").
It activates operation.
(3) Make sure that in-motion signal (BUSY) 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.

8-1-2 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
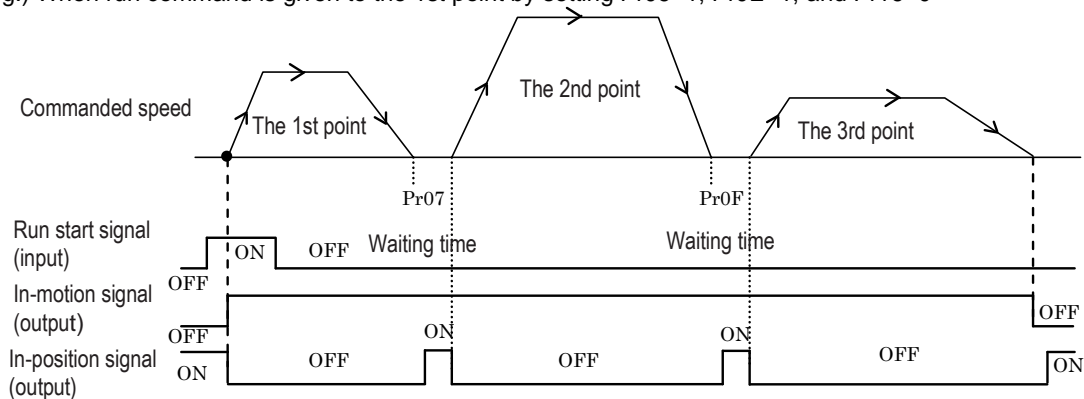
・When block setting parameters (Pr06, 0E, 16, and 1E) are all set to "1", single run start command allows the motor to keep moving in the order: the 1st point □ the 2nd point □ the 3rd point □ the 4th point □ the 1st point □ ・・・ until stop signal is input.
・Changing the value of Pr22 "Sequential run 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).

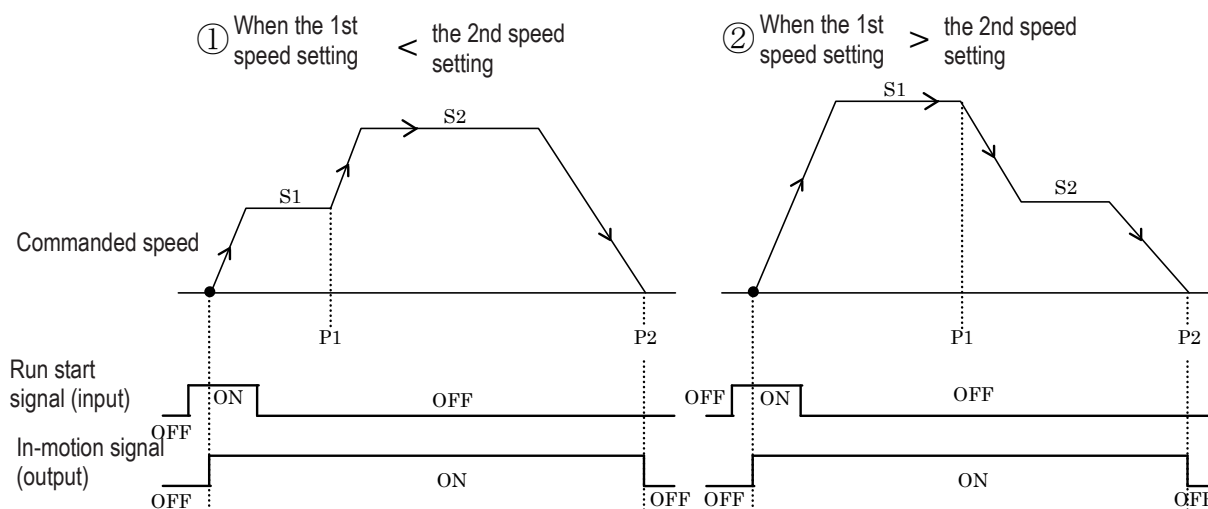## ② **Combined block operation**

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)

① When the 1st speed setting < the 2nd speed setting

② When the 1st speed setting > the 2nd speed setting

Commanded speed

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

Run start signal (input) / In-motion signal (output)

・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) 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.)

8-1-3 **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 – 53,70,71 as follows, and assign the function of signal input.
Of signal inputs 1 – 4,5,7 (I1 – I6), 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 - 4d for parameters relating to jog operation.

[Timing chart of jog operation]
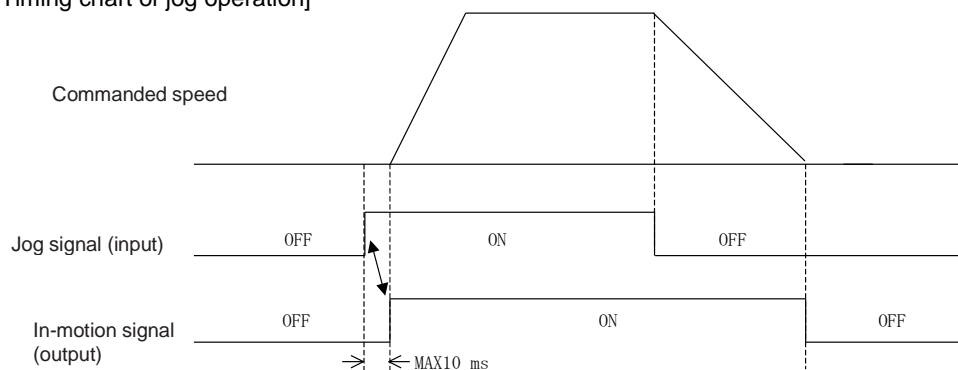
(1) Change the jog start signal from contact-off to the status of connection to DC24 V (on).
   It activates operation.
(2) When the jog start signal is returned to off, the motor starts speed reduction.
(3) When operation is completed, the transistor of in-motion signal (BUSY) returns to off.
   ・Operation 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.

8-1-4 **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) 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 – 53,70,71 as follows to assign the function of signal input.
Assign one of signal inputs 1 – 4,5,7 (I1 – I6) 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 - 49 for parameters relating to homing operation. Set the homing speed as low as possible in order to improve accuracy in homing.
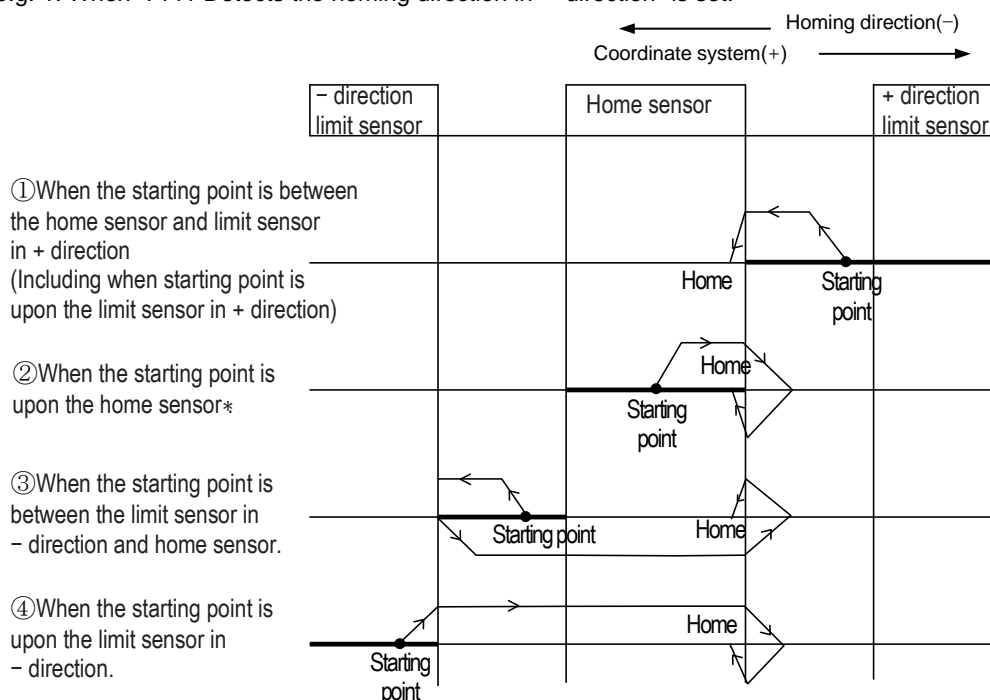
[Timing chart of homing operation]
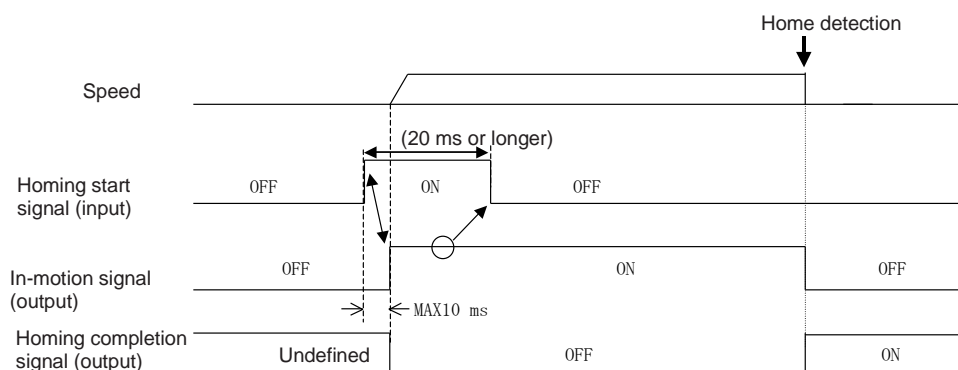
(1) Change the homing start signal (or run start signal (when Pr48 is 2)) from contact off to the status of connection to DC24 V(on). It activates operation. Even when homing has been completed, if homing is started, the homing completion signal turns off.
(2) Make sure that in-motion signal (BUSY) is 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.
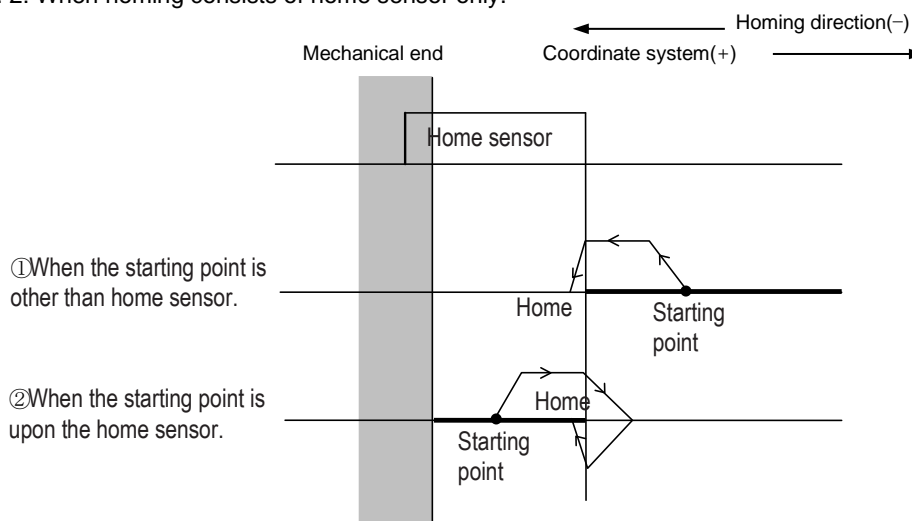
Be sure to set the homing direction so that homing operation is executed in the direction where home sensor is located. In this example, set "Pr41 Detects the homing direction in - direction".
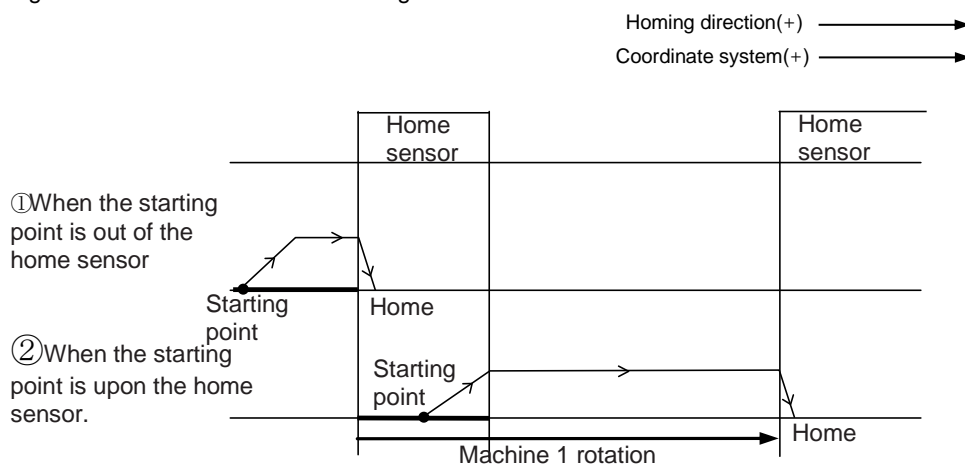
Home sensor homing 3 (Pr40 = 5) (Only for rotation system)
e.g. : When "Pr41 Detects the homing direction in + direction" is set

Homing direction(+) ⟶
Coordinate system(+) ⟶

①When the starting point is out of the home sensor

②When the starting point is upon the home sensor.

Home sensor

Home sensor

Starting point
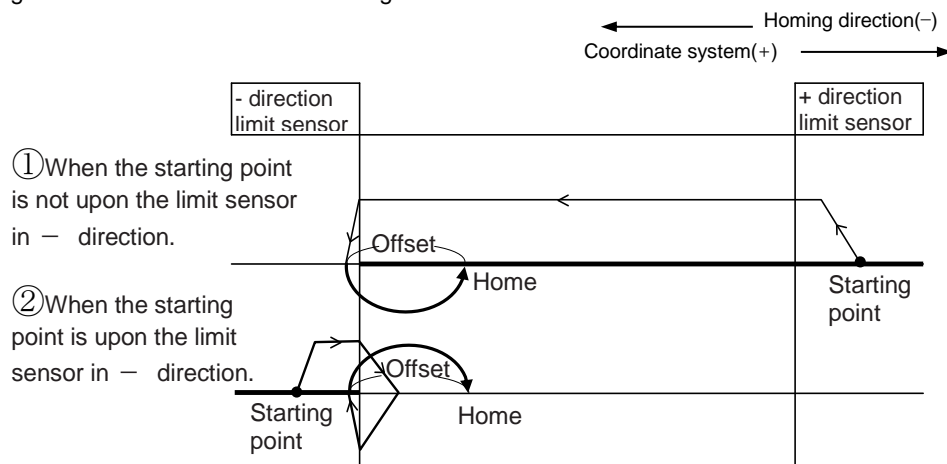
Home

Starting point

Home

Machine 1 rotation

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) is found.

Limit sensor homing (Pr40 = 2)
e.g. : When "Pr41 Detects the homing direction in − direction" is set.

Homing direction(−) ⟵
Coordinate system(+) ⟶

- direction limit sensor

+ direction limit sensor

①When the starting point is not upon the limit sensor in − direction.

Offset

Home

Starting point

②When the starting point is upon the limit sensor in − direction.

Offset

Starting point

Home

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.

Homing direction(−)

Coordinate system(+)

Mechanical end

Offset

Home

Starting point

When the torque value has exceeded the setting (Pr45) for preset time (Pr46), homing is completed.
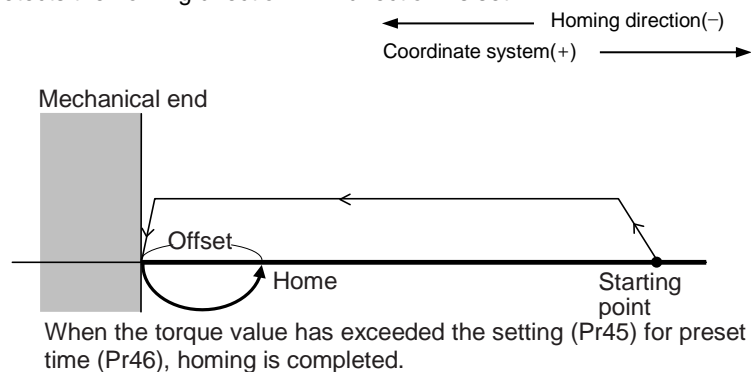
During operation of this mode, the value of torque limit is restricted by bumping torque detection value (Pr45). In bumping homing operation, when limit sensor in operation direction is detected, homing error (E-H0) is found. In using this mode, the motor at the home position is in contact with the mechanical 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.

8.2 Signal Input and Signal Output Choosing Function

8-2-1 **Signal input choosing function**
Function can be assigned to signal input I1 – I6 by Pr50 – 53,70,71.

Func-tion num-ber	Assignment function	Description of function
0	Forced trip	When preset signal input is turned on, the motor executes external forced trip (E-0L). When external forced trip is executed, in order to activate the motor again, reset trip and then input the run command.
1	Instantaneous stop	When preset signal input is turned on, the motor 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 motor may operate for accumulated pulses of command.) Run command cannot be given to the motor 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 motor reduces speed and stops in deceleration time set at the start of motor 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 motor 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 100ms 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.

Func-tion num-ber	Assignment function	Description of function
1 5	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 – 57,72,73) (Set an input desired to be operated on disconnected side of wiring such as 0: Normal logic (Input is effective in connecting with DC24 V), 1: Inverted logic (Input is effective by OPEN), Inverted logic is forced trip (emergency stop input).
・Parameters above (Pr54 – 57,72,73) are made effective after power is turned on again.

8-2-2 Signal output selection function

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

Func-tion num-ber	Assigned 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 reference 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).
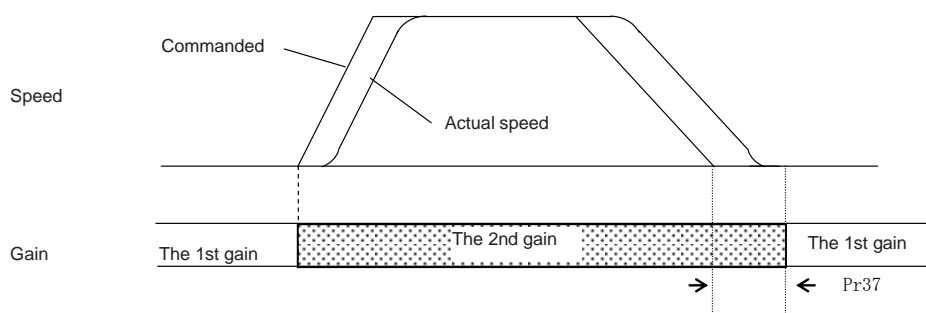
8.3 Gain switching function

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 run command, 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 reference.
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.

9. Digital keypad

Function of the digital keypad
● Monitoring of rotation speed (actual speed) and load factor
● Display detail of trip, and trip history. Trip reset by pressing and
● Parameter setting and copying function at the same time.
● Teaching function (Target point (positioning point) can be set by actually starting the motor.)

Using the digital keypad

2-digit LED

5-digit LED

STOP

DATA SET switch

RUN switch

⊼ switch

⊻ switch

MODE switch
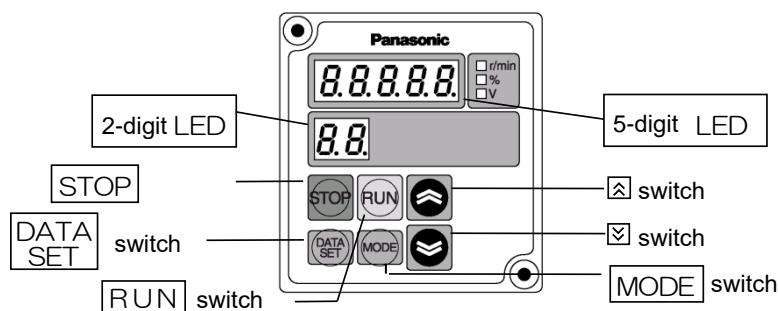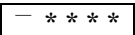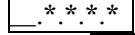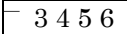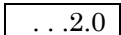
● When power is turned on, rotation speed (actual speed) r/min is displayed in monitor mode (changeable by Pr7A).
● Displayed value is an index. Do not use the digital keypad for a measuring instrument.

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 + ( ): CCW rotation when viewed from motor output shaft (default).
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 reference → 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 motor).

⊼ ⊻ switch	■**In monitor mode** Trip reset can be executed by pressing ⊼ ⊻ 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 ⊼ ⊻ .
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.
STOP switch	When **STOP** switch is pressed, the setting change warning (CAU) is displayed, and the motor is stopped and tripped.

Description of various modes

Monitor mode	Displays rotation speed (actual speed), commanded speed, internal DC voltage, load factor, torque reference, 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 -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 ⊼ ⊻ 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 ⊼ ⊻ switch. When **DATA SET** switch is pressed after change of setting, it is saved in EEPROM.
Point number mode	Displays a parameter number (01- 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 ⊼ ⊻ 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, ‾ * * * * is displayed. □ When present position is smaller than -99999, _.*.*.*. is displayed. Ex. 1) When present position is 123456, only lower 4 digits ‾ 3 4 5 6 are displayed. Ex. 2) When present position is -20, is . . .2.0 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).
Torque reference is a value based on a rated torque of 100. By calculating the load factor using this, it aims at the minimum motor burnout protection, and the accuracy can not be guaranteed.
There is a different offset between the torque reference and
the output torque depending on the motor.

Specification of
torque reference - output torque
(Representative characteristic)
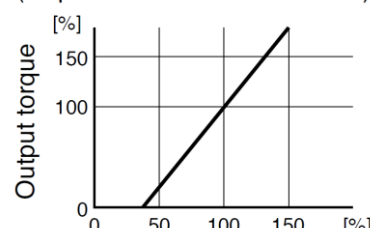
Operation of the digital keypad

①Basic operations

Monitor mode
Power-on
Displays monitored details set by Pr7A

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

Trip reset

Trip detail display mode
E-LU

・Trip can be reset by pressing ⊼ ⊻ switch at the same time.
Display shifts to monitor screen after resetting.
・Shifts to parameter number mode when DATA SET switch is pressed.

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

Parameter number mode
10
00

Displays parameter number.
・Number is changed by ⊼ ⊻ switch.
・Exit this mode with **MODE** switch (returns to monitor).

Displays the contents of displayed parameter (setting).

Parameter setting mode
10
00

・Value is changed by ⊼ ⊻ 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.

②Monitor mode

Monitor display item can be changed after power is turned on and when monitor mode display is on. (See page 43 for setting of Pr7A.)

Rotation speed (actual speed) display — r/min — r/min Lights up.

Internal DC voltage display (Voltage of smoothing capacitor in power supply. unit:V) — V Lights up.

Load factor (average torque) display — % Flashing

Torque display — % Lights up.

Commanded speed display — r/min Flashing

Present position (Lower 5 digits) — All light up.

Present position (shaft rotation number) — All Flashing

Display of present position
・When homing is not completed, - - - - - is displayed.
・When present position is greater than 99999, ⁻**** is displayed.
When present position is smaller than -99999, .*.*.* is displayed.
 Ex. 1) When present position is 123456, only lower 4 digits ⁻ 3 4 5 6 are displayed.
 Ex. 2) When present position is -20, . . .2.0 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.

③Teaching 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.

④Parameter copy function

Parameter copy function (Digital keypad □ Amplifier) can be used by Pr77.
・ **Initializing the data of the digital keypad**
  EEPROM installed onboard the digital keypad is initialized (data cleared). When reading is disabled, or when data transfer fails during copying, execute "Data initialization of the digital keypad". Normally, it is not required.
・ **Reading parameters**
  Parameter of motor is read and saved in EEPROM of the digital keypad. Read parameter is retained even when the digital keypad is separated from the motor.
・ **Writing parameters**
  Parameter information saved in the digital keypad is written to the motor. (Saved in EEPROM of motor)

〈**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 keypad 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 keypad during operation such as "Initializing data of digital keypad", "Reading parameter into digital keypad", "Writing parameter to brushless motor", etc.

Data initialization of
digital keypad

Parameter reading
(Amplifier → Digital keypad)

Parameter writing
(Digital keypad → Amplifier)

n0	r/min
77	%
	V

STOP RUN ∧
DATA SET MODE ∨

P. INIT	r/min
77	%
	V

STOP RUN ∧
DATA SET MODE ∨

P. LOAD	r/min
77	%
	V

STOP RUN ∧
DATA SET MODE ∨

P. PROG	r/min
77	%
	V

STOP RUN ∧
DATA SET MODE ∨

DATA SET + STOP
Hold down
(for about 1 second).

DATA SET + STOP
Hold down
(for about 1 second).

DATA SET + STOP
Hold down
(for about 1 second).

P. INIT	r/min
	%
	V

P. LOAD	r/min
	%
	V

P. PROG	r/min
	%
	V

All
Light up
on display

Process completed
(For about 30 seconds)

All
flashing
on display

Process completed
(For about 30 seconds)

All
flashing
on display

Process completed
(For about 10 seconds)

P. END	r/min
	%
	V

P. END	r/min
	%
	V

P. END	r/min
	%
	V

Press STOP switch After complete this process, then setting change warning (CAU)
occurs. So Execute trip reset.

LED display

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	t
L	L
N	n
O	o、0※
P	P
Q	q
R	r

Alphanumeric	LED display
S	5
T	Γ
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
Example

Description in the text	Display on Digital key pad
「PnL」	「PnL」
「TEr」	「ΓEr」
「FrEE」	「$FrEE$」
「rST」	「$r5\Gamma$」

* LED display of "0" is available in two types.
Example

Description in the text	Display on Digital key pad
「VoL−A」	「$UoL-A$」
「nO」	「$n0$」

10. Protective function

What is protective function?

- ・ Brushless Amplifier MINAS-BL KP 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 keypad (sold separately) is connected.
- ・State of trip and corrective actions
  In tripped state, display of trip details appears on the 7-segment LED of the digital keypad 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 ⊼ ⊻ switch of digital keypad simultaneously in trip detail display mode.

[3] Input the trip reset signal about 100ms or longer (when 10: Trip reset is set in Pr50 – 53,70,71).

[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] Resetting trip with PANATERM for BL

Trip can be reset from the PC by using optional PC connection cable *1 (option) and communication software (PANATERM for BL: can be downloaded from our web site free of charge).

For details, refer to PANATERM for BL instruction manual.

[6] Resetting trip via RS485 communication

Refer to section "Communication" starting with P.37.

*1 To use the optional PC connection cable (sold separately), RS232 port is required.
When the PC has no RS232 port, use RS232-USB converter.

<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],[5],[6])
- ・Setting change warning (CAU) and digital keypad communication error (E_Cn) are not saved in trip history.
- ・Undervoltage error (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

Trip number (RS485)	Display on the digital keypad	Protective function	Causes	Countermeasure
2	E−LV	Undervoltage error (E-LV)	The amplifier trips when internal DC voltage (voltage of smoothing capacitor of power supply) is below specified value. Product of 100 V: Approx DC85 V Product of 200 V: Approx DC170 V	Investigate the condition of wiring and power supply.
3	E−OV	Overvoltage error (E-OV)	The amplifier trips when internal DC voltage (voltage of smoothing function of power supply) rises and exceeds specified value. Product of 100 V: Approx DC205 V Product of 200 V: Approx DC410 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 100, the electronic thermal relay operates and monitor display flashes. It is an alarm for electronic thermal trip.	Reduce the load. Check the load factor in monitor mode.
4	THr	Overload error (Electronic thermal relay) (THr)	The motor trips when torque reference is output continuously above 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.
5	E−OS	Overspeed error (E-OS)	The motor trips when rotation speed (actual speed) exceeds specified value. Approx 6000r/min	Ensure that the actual speed does not exceed rated rotation speed, such as overshooting by unmatching between load and gain.
6	E−POS	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.
7	E−PO	＊ Position error counter overflow (E-PO)	The motor trips when the position error exceeds 8388607 [pulse].	Check the parameter again and adjust gain.
8	E−OC	＊ Overcurrent error (E-OC)	The amplifier 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
9	E−OH	Overheat error (E-OH)	The motor trips when the temperature in control section rises above specified value. Approx 105 ℃	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.
10	E−OL	External forced trip (E-OL)	The motor trips when external forced trip input turns on.	Turn off external forced trip input, and reset tripping.
11	CAU	＊ Setting change warning (CAU)	It occurs when parameter copying function on digital keypad is completed normally. Also, when STOP key on digital keypad is pressed, the motor trips and stops.	It is not abnormal. Execute trip reset.
12	E−485	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 page 65 for detail.)
20	E−rU	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.

Trip number (RS485)	Display on the digital keypad	Protective function	Causes	Countermeasure
21	E−H0	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.
22	E−0F	∗ 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.)
23	E−LT	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 keypad communication error (E_Cn)	It occurs when the digital keypad and motor cannot communicate normally. (This is a trouble on digital keypad side. It does not affect motor operation.)	It can be cleared by reconnecting the digital keypad. Make sure that digital keypad and motor are connected normally.
90	E−UPr	∗ 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.
91	E−SPr	∗ System parameter error (E-SPr)	Internal parameter data saved in EEPROM is abnormal.	Failure is possible.
1	E−CS	∗ Sensor error (E-CS)	The amplifier 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.
Other numbers	Err	∗ 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 page 45.

Time characteristics of over load protection
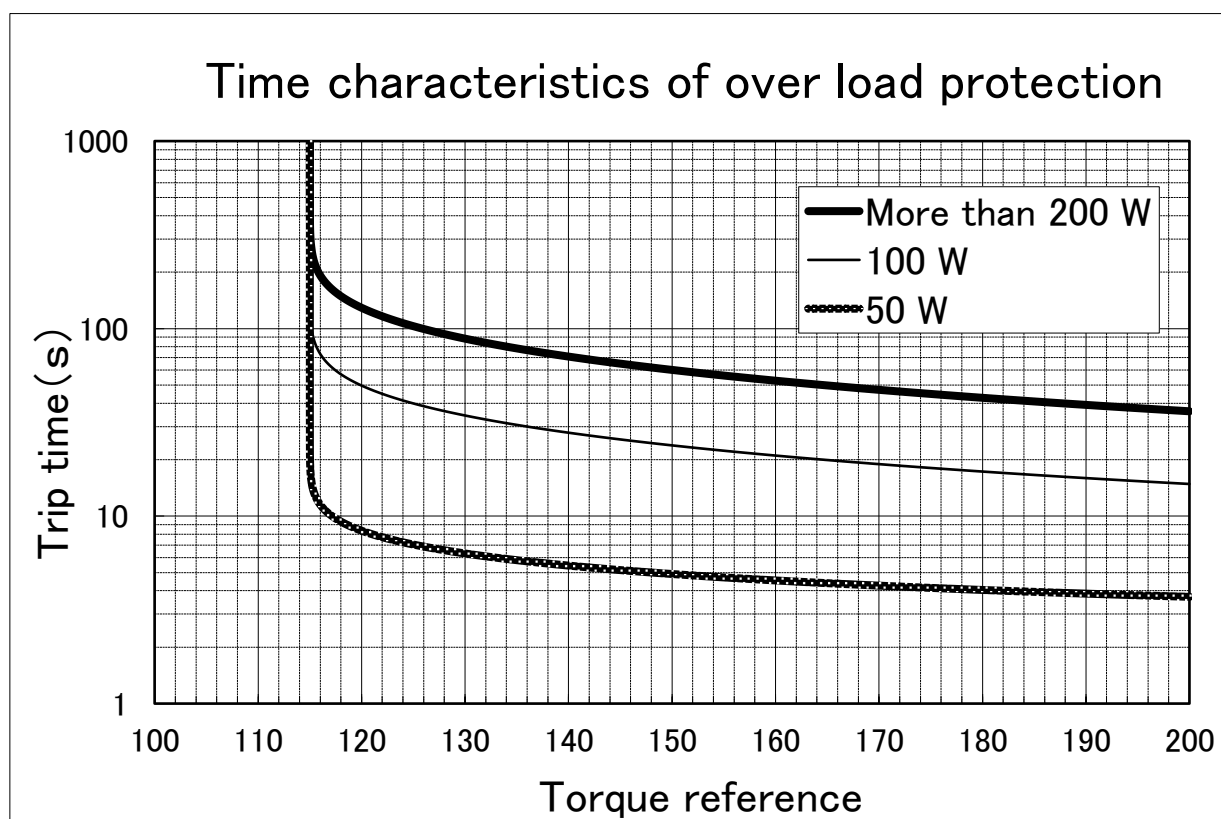
11. Troubleshooting

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 keypad (sold separately) or communication software "PANATERM® for BL" (sold separately) to check the detail of trip. If the motor 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 keypad or PANATERM for BL. Turn off power once, and turn on again. Reset tripping.
	(Only when the motor is connected to the key pad) Check whether power LED (green) is lighted up.	If the LED is off when power is input to the brushless amplifier, failure is possible. Contact us for repair.
	Check whether voltage on input power is normal.	Check the supply voltage.
	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 does not rotate or stops during operation.	Check whether protective function is activated. Check whether alarm LED (red) is on.	It may be overloaded. Reduce the load or increase the output capacity.
Motor stops during deceleration.	Check whether the inertia of load is too large.	Regenerative overvoltage protection may have worked. Reduce inertia. Increase deceleration time with Digital key pad or "PANATERM for BL" or RS485 communication. Use an external regenerative resistor (option).
Large vibration or noise.	Output shaft of motor and shaft of load are not aligned.	Check the joint between the output shaft and load shaft of the motor.
	Damage to 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.	Check the setting of parameter. Coordinate system setting.
Rotation speed is unstable during operation (actual speed).	Check whether the load fluctuates greatly.	Increase the speed proportional gain. (If you increase the proportional gain too much, the motor may vibrate causing a malfunction, so be careful.) Change to a motor with a large output.
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.

12. Conformance to overseas standard

EU Directives
This brushless amplifier realizes compliance with the relevant standard of low voltage directive in order to facilitate conformity to the EU directive of the machinery and equipment to be incorporated.

EMC Directives
EN 61800-3
Brushless amplifiers are not intended for general home use or connection to low-voltage public communication lines. Connecting to such a circuit may cause radio frequency interference.
This brushless amplifier decides the model such as installation and wiring, and it conforms to the relevant standard of the EMC directive in that model. Wiring conditions, grounding conditions, etc. may not be the same as those of the model in the state where it is incorporated in actual machinery / equipment. Therefore, as for compliance with the EMC directive in machinery / equipment, it is necessary to measure with the final machinery / equipment incorporating this product (especially Radiated Emissions, Conducted Emissions etc.).

EN 55011
Warning: Class A equipment is intended for use in an industrial environment. Conductive and radioactive interference can make it difficult to ensure electromagnetic compatibility in other environments.
Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Applicable standard

		Applicable standard	Installation condition	File No.
UL	UL508C	Standard for electric converter equipment	Class Ⅰ equipment Pollution degree 2 ＊1	E164620
CSA	C22.2 No.14-10	Adjustable speed drives		
CE/ UKCA	EN61800-5-1	Adjustable speed electrical power drive systems (Safety requirements— Electrical, thermal and energy)	Overvoltage category Ⅱ Class1 equipment Pollution degree 2 Group 1, Class A and Category C3 2nd environment	-
	EN61800-3	Adjustable speed electrical power drive systems (EMC requirements and specific test methods)		
	EN55011	Radio interference wave characteristics of industrial, scientific, and medical high-frequency equipment		
	EN61000-6-2	Standards for immunity in industrial environment		
KC	Radio Waves Act (South Korea)＊2	Broadcasting and Communication Equipments	-	-

＊1   SCCR: 5,000 rms symmetrical amperes, 240 Volts maximum.
  Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
  (These devices are not provided with motor over-temperature sensing.)
＊2   Precautionary note written in Korean
  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)
  (English translation)
  Distributors and users must understand that this product meet the electromagnetic compatibility requirements and is designed for industrial use (class A). Do not use the product in a residential area.
  (Application product: Brushless Amplifier)

12.1 Configuration of peripheral equipment

Power supply	・100 V system: Single phase 100 V – 120 V ± 10%, 50/60 Hz ・200 V system: Single / 3 phase 200 V – 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 amplifier. ・Use an electric wire size suitable to EN60204-1.
Fuse breaker	Be sure to connect a specified no-fuse breaker certified by IEC standard and UL, or a fuse certified by UL between power supply and noise filter. Observance of 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 amplifier 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 ground the grounding terminal (⏚) of brushless amplifier for preventing electric shock. Brushless amplifier is provided with two grounding terminals. Connect the grounding wire of brushless motor to the other one.

12.2 Wiring of peripheral equipment
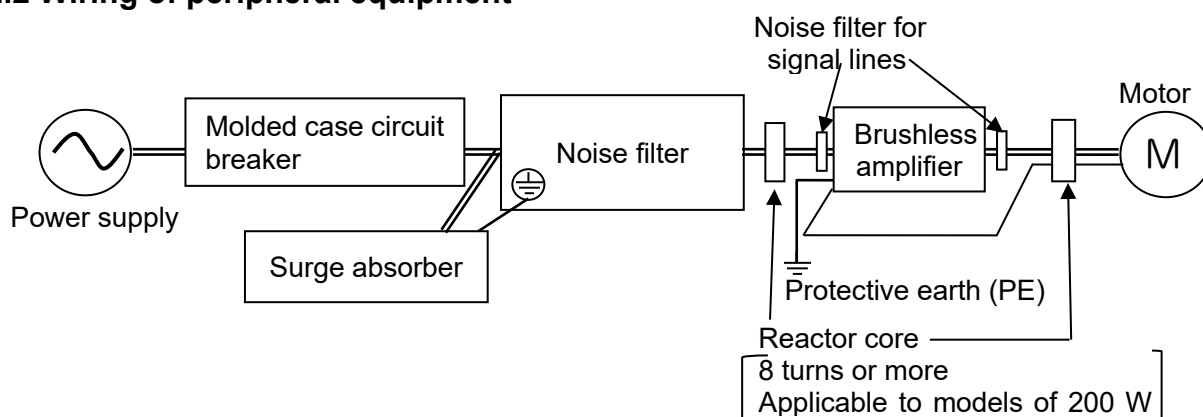
12.3 List of compatible peripheral equipment

Part name	Optional part number	Manufacturer's part No.	Manufacturer
Noise filter (for single phase)	DV0P4170	SUP-EK5-ER-6	OKAYA ELECTRIC IND. CO., LTD.
Noise filter (for 3- phase)	DV0PM20042	3SUP-HU10-ER-6	OKAYA ELECTRIC IND. CO., LTD.
Surge absorber (for single phase)	DV0P4190	R.A.V-781BWZ-4	OKAYA ELECTRIC IND. CO., LTD.
Surge absorber (for 3- phase)	DV0P1450	R.A.V-781BXZ-4	OKAYA ELECTRIC IND. CO., LTD.
Noise filter for signal lines	DV0P1460	ZCAT3035-1330	TDK CORPORATION
Reactor core (recommended)	-	RJ8035	KK-CORP.CO.JP

Contact :OKAYA ELECTRIC IND. CO., LTD.   Japan   +81-3-3424-8120
TDK CORPORATION   Japan   +81-49-283-7575
KK-CORP.CO.JP   Japan   +81-184-53-2307

Recommended Molded case circuit breaker(MCCB)

Made by Sensata Technologies Japan Limited:
    For 3-phase   IELH-1-111-63-5A-M
    For single phase   IELH-1-11-63-5A-M
    (Rated current 5A, cutoff characteristics DELAY63)
    ■ Recommended cutoff characteristics: DELAY61-63
Contact: Sensata Technologies: http://www.sensata.com/

13. Communication spec

13-1．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:

①Rewriting parameters
②Browsing and clearing status and history of trip condition
③Monitoring control status including present position, status, I/O, etc.
④Start and stop of motor
⑤Trip reset

[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.

13-2．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 (Pr5A) at 81h (129) ─ 9Fh (159).
Set the device number for the host as 01h (1) ─ 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 keypad or communication software "PANATERM for BL".

[Example of connection]

RS485

Host controller
Device
Number=01h(1)

···Max 31 units

Brushless amplifier
Device number
=81h(129)

Brushless amplifier
Device number
=82h(130)

Brushless amplifier
Device number
=83h(131)

Brushless amplifier
Device number
=84h(132)
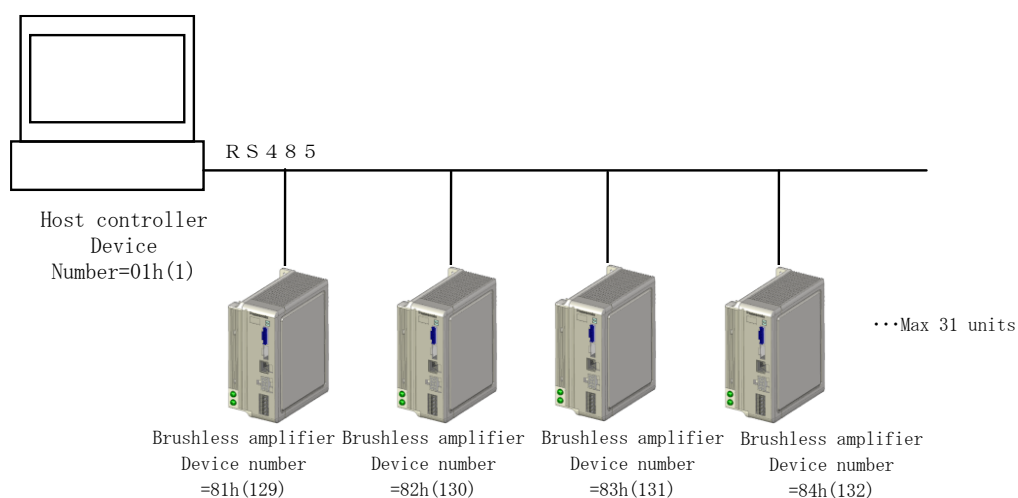
13-3. Interface of connector for communications unit
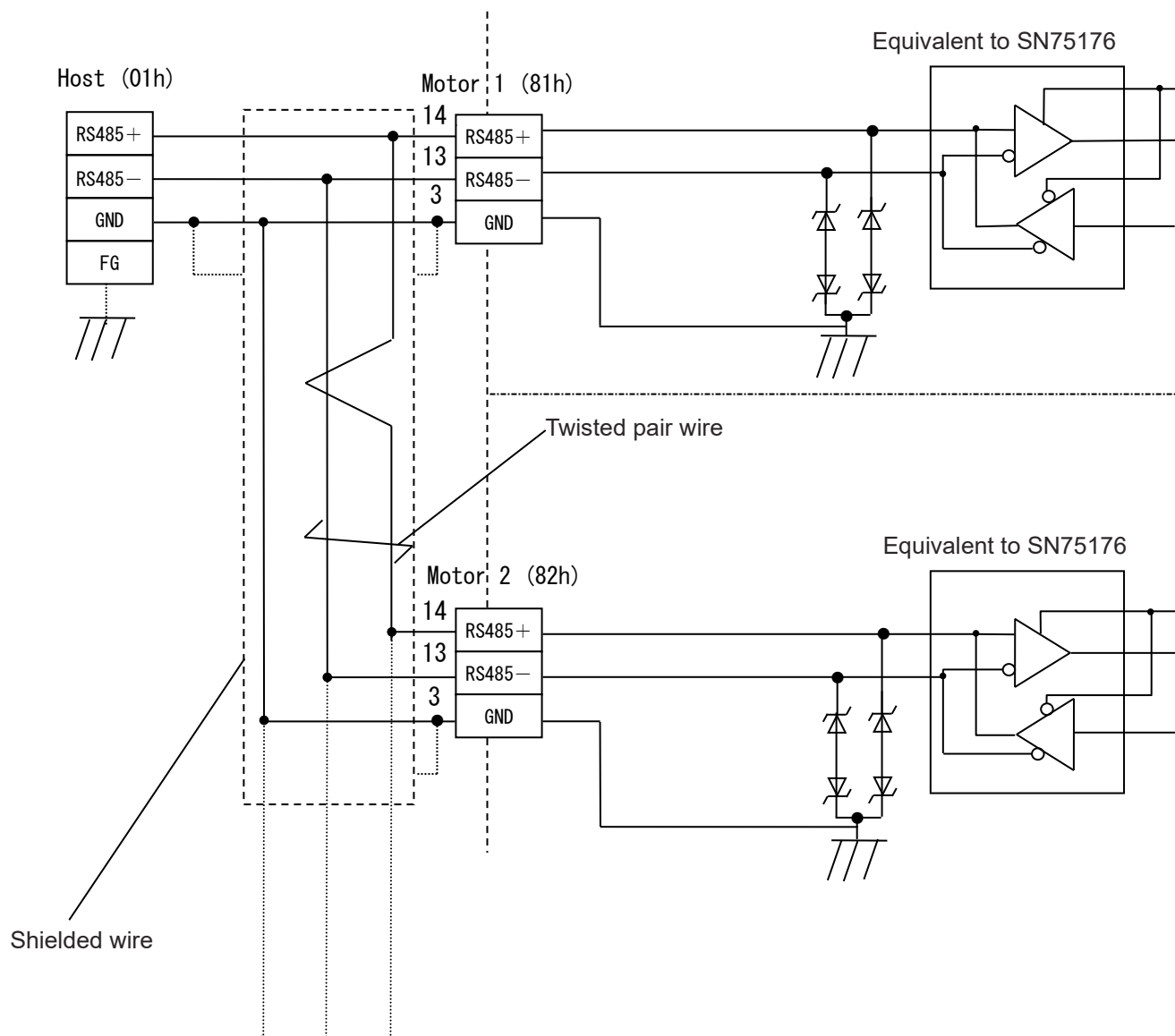
·Use the shield of shielded wire for GND.
·Set the maximum total extension of cable within 10m in use.
·Terminal resistor is not required.

13-4. 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 – 1Fh	
Amplifier address	80h – 9Fh (80h for simultaneous transmission.)	Set by Pr60

·Modification of transmission parameters (Pr60 – 65) becomes effective when resetting the power supply of the motor.
·The transmission parameters can be changed by the digital keypad (sold separately) or RS485 communication.

13-5. List of data number related to communications
(1) Communication parameter:

Address	Pr No. *1	Parameter name	Data value	Default	Note
8060h	60	RS485 device number	80h − 9Fh	0081h	*9 *10
8061h	61	RS485 communication speed	0: 2400 bps, 1: 4800 bps, 2: 9600 bps	0002h	*9
8062h	62	RS485 communication standard	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	0004h	*9
8063h	63	RS485 communication response time	10 − 1000 (ms)	000Ah	*9
8064h	64	RS485 retry times of communication	0 − 8: Retry count, 9: No retry	0009h	*9
8065h	65	RS485 protocol timeout	1 − 255 (s)	0002h	*9

*1) Pr No. shows the parameter number in Digital keypad.

*9) Change becomes effective, when power is turned off once and turned on again after 10 seconds.

*10) When the device number is set to 80h (128), change of parameter and request for status are ignored, therefore set to 81h (129) - 9Fh (159) normally.

Data No. (address)	PrNo.	Parameter name	Range of setting	Default	Function/Description
8060h	6 0	Device number	80 h (128) 〜 9Fh (159)	81h (129)	Set the device number of motor in communication (Motor ID). This value is the shaft number in communication. 80h (128) is the device number for setting control data (such as control start) by one operation to all connected motors. (No response is made by motors.) When the device number is set to 80h (128), change of parameter and request for status are ignored, therefore set to 81h (129) - 9Fh (159) normally.
80061h	6 1	Communication speed	0 〜 2	2	Set the communication speed of RS485 communication. **0**: 2400bps, **1**: 4800bps, **2**: 9600bps
8062h	6 2	Communication standard	0 〜 1 1	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	6 3	Communication response time	1 0 〜 1 0 0 0	1 0	Communication response time is the shortest time for setting transmission mode in RS485 bus for response after the motor has received communication data. Actual data response time depends on the type and data of order. Unit [ms]
8064h	6 4	Retry times of communication	0 〜 9	9	Set the retry times of RS485 communication. **0 - 8**: Number of retrials, **9**: No retrial
8065h	6 5	Protocol timeout	1 〜 2 5 5	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 motor 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:

$$(1000/9600) \cdot (1 + 8 + 1 + 1) = 1.14 \text{ [ms/byte]}$$

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 - 81B0h
These are parameters to get motor status or to give commands to the motor. Refer to P.76 "Communication command" for detail.

13-6. 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.

●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

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) - 1Fh (31)

　　　　Amplifier ID 80h (128) - 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) - 1Fh (31)

　　　　Amplifier ID 81h (129) - 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 　　　　　　 : :n the case of data transmission command, set XOR (logically inverted) value of each byte from STX to ETX.

●List of commands

Com-mand	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 motor.
#R	23h 52h	Amplifier → Host	Response to data reading request. Returns the parameter, status, and control detail of motor 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

①Host →Amplifier (Data writing)

SOH				STX	$	P	*	*	*	*	*	*	*	*	ETX	BCC

Amplifier ID   Host ID   Command   Data number(parameter address)   Data(parameter value)

②Amplifier →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

①Host →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.

②Amplifier →Host (Result response)

SOH					ACK

Host ID   Amplifier ID

③Host →Amplifier (Request for sending)

SOH					ENQ

Amplifier ID   Host ID

④Amplifier →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
·Please use reading data after checking a data number (parameter number)

⑤Host →Amplifier (Result response)

SOH					ACK

Amplifier ID   Host ID

⑥Amplifier →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

①Host →Amplifier (Request for sending)

SOH					ENQ

Amplifier ID   Host ID

②Amplifier →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

③Host →Amplifier (Response of result)

SOH					ACK

Amplifier ID   Host ID

④Amplifier →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 page before.

3. When the status of amplifier changes

①Host →Amplifier (Request for sending)

SOH					ENQ

Amplifier ID   Host ID

②Amplifier →Host (Request of data)

SOH				STX	#	C	8	1	0	3	*	*	*	*	ETX	BCC

Host ID   Amplifier ID   Command   Data number   Reading data

③Host →Amplifier (Response of result)

SOH					ACK

Amplifier ID   Host ID

④Amplifier →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

①Host →Amplifier (Request for sending)

SOH					ENQ

Amplifier ID   Host ID

②Amplifier →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.

13-7. 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.)

①Request for sending

Host →

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

②Initial 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)

③Request for sending

Host →

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

④Data 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)

⑤Request for sending

Host →

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

⑥Transmission 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)
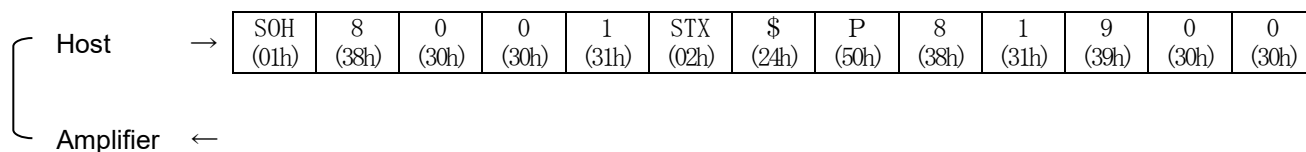
Amplifier　←

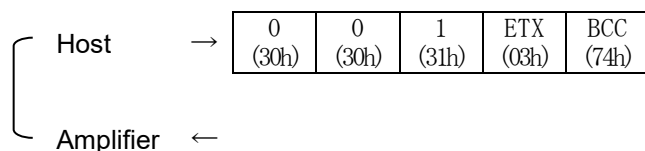・There is no response from the amplifier because amplifier ID is set at 80h (128).

●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)
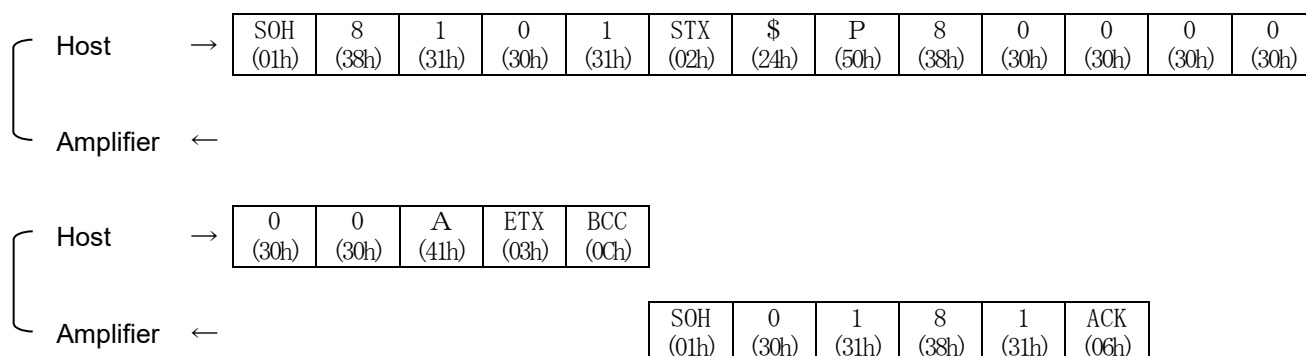
●Example of reading parameter (reading data)

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 in parenthesis is hexadecimal ASCII code.)
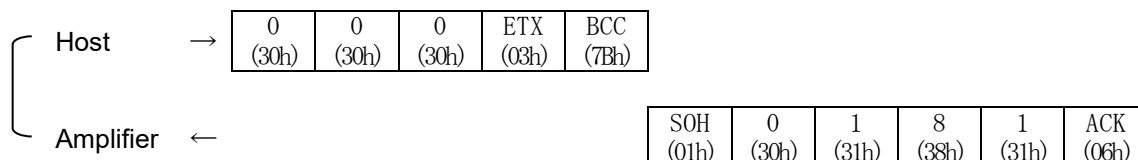
①Parameter reading request

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)

②Request 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)

13-8. Communication timing
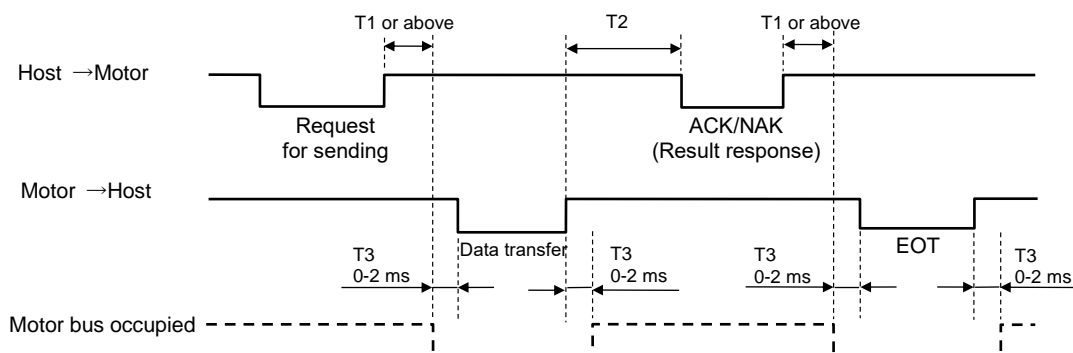
Symbol	Name	Value
T1	Communication response time (Amplifier)	Set by Pr5d.
T2	Communication response time (Host)	Take interval 10ms or longer.
T3	Data emitting time from amplifier to host after bus is occupied	0 – 2 ms

<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]
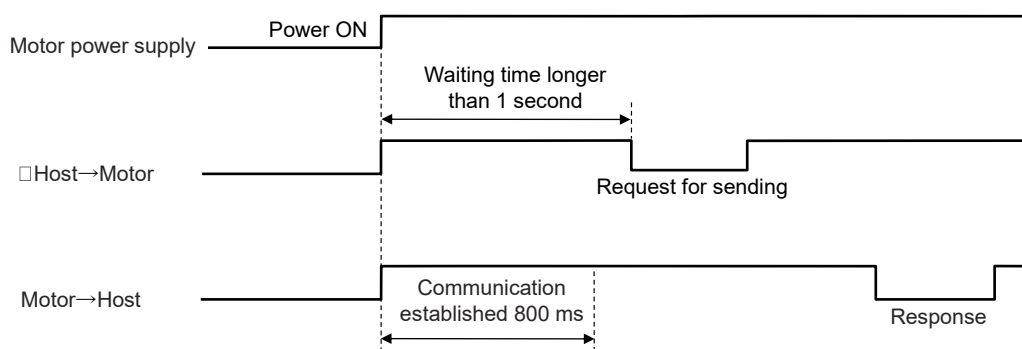
13-9. Communication command

Data number	Applicable command on host side	Description
8000h – 805Fh	$P/$S/$R	Parameter
8103h	$R	Motor 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 reference
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

13-10. Communication command in detail

8000h - 807Fh: Parameter

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

Host →Amplifier (Data writing)

SOH				STX	$	P	8	0			P1	P2	P3	P4	ETX	BCC
	Amplifier ID		Host ID			Command			Data number Data				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□□'. ('805C' 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.
  (EEPROM endurance: approx. 100,000 write cycle.)

●$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□□'. ('805C' 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 re-striction	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' = It is shown that it is running.

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') = 4Dh42h45h4bh = 'MBEK'
      Model code 2 ('8105') = 30h38h33h42h = '083B'

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 [0.1V] for data value.
  e.g.) Data value = 30h 31h 31h 38h = '0118' = 280[V]

8113h: Torque reference 8114h: Load factor

●$R: Torque reference 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 reference of amplifier ('8113') and load factor('8114') are answered.
・Set '0000' in data value.

●#R: Torque reference 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 reference reading request command, torque reference ('8113') and load factor ('8114') are answered.
・Torque reference of amplifier/Load factor multiplied by 10 is answered 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 x 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 x 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 10.Protective function.)
 When the trip number is 0, it indicates that no tripping has occurred.
 e.g.) Data value = 30h 30h 3 1 h 35h = '0015' = 21 = homing error
・Trip history can be read out with parameter (Pr6b - 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	I 6	I 5
D4	I4	I 3	I 2	I 1

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 function selection on chapter 7 Pr50.)
  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

Detail above is converted into hexadecimal and represented in ASCII code.
e.g.) Data value = 30h 30h 30h 31h = '0001' = Input signal Ｉ1 is on.

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 - I6), 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	0	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.

8192h: Clear trip history

●$P/$S: clear trip history

Received data (Host →Amplifier)

SOH				STX	$	P	8	1	9	2	0	0	0	0	ETX	BCC
	Amplifier ID		Host ID		Command				Data number				Data value			

・When data value is set to '0001' and this command executed, trip history is cleared.

・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.
  (EEPROM endurance: approx. 100,000 write cycle.)

14. Options

14.1 Cable

Name	Model No.	Length
Digital key pad connection cable	DV0P38310	1 m
	DV0P38330	3 m
	DV0P38350	5 m
Motor extension cable (100 W or less)	DV0PQ1000110	1 m
	DV0PQ1000130	3 m
	DV0PQ1000150	5 m
	DV0PQ10001A0	10 m
Motor extension cable (200 W or more)	DV0PQ1000310	1 m
	DV0PQ1000330	3 m
	DV0PQ1000350	5 m
	DV0PQ10003A0	10 m
PC connection cable	DV0P4140	1.5 m
Control signal cable	DV0PM20076	2 m
Power connection cable (100 W or less)	DV0PM20077	2 m

14.2 Connector kit

Name	Model No.	Manufacturer	Name	Manufacturer's parts No.	Qty.	
Power connector kit (100 W or less)	DV0P2870	Molex Inc	Connector	39-01-2105(5557-10R-210)	1	Fits to Power connector
			Connector pin	39-00-0060(5556PBTL)	6	
I/O connector kit	DV0PM20070	J.S.T Mfg. Co .,Ltd.	Connector	PAP-10V-S	1	Fits to I/O connector
			Connector pin	SPHD-002T-P0.5	10	
Panel connector kit	DV0P3610	Molex Inc	Connector	39-01-2105(5557-10R-210)	1	Fits to Digital key pad
			Connector pin	39-00-0047(5556T2L)	10	

14.3 Console

Name	Model No.
Digital key pad	DV0P3510

14.4 Compatible peripheral equipment for EU directive and UL standard

Name	Model No.	Manufacturer	Manufacturer's parts No.	Qty.	
Noise filter	DV0P4170	Okaya Electric Industries Co. Ltd.	SUP-EK5-ER-6	1	single phase
	DV0PM20042		3SUP-HU10-ER-6	1	three phase
Surge absorber	DV0P4190		R.A.V-781BWZ-4	1	single phase
	DV0P1450		R.A.V-781BXZ-4	1	three phase
Noise filter for control signals	DV0P1460	TDK Corporation	ZCAT3035-1330	4	

14.5 Communication software

Name	
Panaterm for BL	Can be downloaded from our web site

14.6 External regenerative resister

Name	Model No.	
External regenera-tive resister	DV0P2890	For 100 V input model. 50 Ω
	DV0PM20068	For 200 V input model. 200 Ω

Because it becomes high temperature, please install the external regenerative resistor as follows.
- Please install it on incombustible materials such as metal.
- Please place it in a place where you can not touch directly, such as covering with incombustible material.
· Do not install near combustibles.

Although a thermal fuse is built in the external regenerative resistor, the surface temperature of the regenerative resistor may exceed the operating temperature and become high temperature before the thermal fuse with built-in regenerative resistor operates when the amplifier malfunctions. Temperature fuse with built-in regenerative resistor is for preventing ignition of regenerative resistance when the amplifier fails, not for suppressing the surface temperature of the resistor.

14.7 DIN rail attachment unit

Name	Optional parts number
DIN rail attachment unit (100 W or less)	DV0P3811

⚠ Safety　precautions

15. Safety precautions

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.

Safety precaution in transportation and opening package.

⚠ Caution

🚫	(1)	Do not carry the motor by holding the cable or the shaft.
❗	(2) Do not drop or topple products. (3) Confirm top and bottom of product before opening package. (4) Please follow instructions of cargo handling label.	

Safety precaution in installation

⚠ Danger

🚫	(5) Do not install in environments below. ・Vibration or shock exceeds product specifications. ・Foreign matter such as dust, metal powder, oil mist etc. exists. ・Liquids such as water, oil and grinding fluid may adhere. ・Near combustibles, corrosive gas or flammable gas atmosphere. (6) Do not put your hands in the brushless amplifier. (7) Do not install near heating element.
❗	(8) Install in an environment with pollution degree 2 or pollution degree 1. (9) Install on incombustible materials such as metal. (10) Confirm the direction of rotation before installing in the machine. (11) Install an external emergency stop device to shut down the main power source in any emergency. (12) When used in a clean room or the like, take measures against smoke and dust.

Safety precaution in installation (continued)

⚠ Danger

❗	**(13)** Install an overcurrent protection device, an earth leakage circuit breaker, and an over-heat prevention device.
	(14) Be sure to ground the ground wire (terminal) with the specified method.
	(15) Please install it firmly to prevent fire and injury in case of earthquake.
	(16) When installing in the vicinity of the vibration source, use a vibration isolator on the mounting surface.

⚠ Caution

🚫	**(17)** Do not use the product except for specified combination of brushless motor and brushless amplifier.
	(18) Do not use / store in direct sunlight.
	(19) Do not place obstacles that block ventilation around the brushless amplifier.
❗	**(20)** Appropriate installation according to product weight shall be performed.
	(21) Before attaching the motor to the mechanical system, confirm the operation with the motor fixed.
	(22) Before turning on the power supply, confirm that the input supply voltage is within the rated range.
	(23) Please follow the instructions for installation method and installation direction.
	(24) Brushless motors and brushless amplifiers generate heat during operation. Even considering this amount of heat, set the ambient temperature measured at the specified point within the allowable ambient temperature range.
	(25) Do not drop or topple products.

Safety precaution in wiring

⚠ Danger

🚫	**(26)** Do not scratch the cable, apply excessive force, place heavy objects, or pinch it.
	(27) Do not use cables when immersed in water or oil.
	(28) Do not wire with wet hands.

Safety precaution in wiring (continued)

⚠ Danger

❗	**(29)** When inserting the electric wire into a metal duct etc., the allowable electric current of the electric wire is lowered due to the temperature rise, so the electric wire is selected after studying the current reduction coefficient.
	(30) Wiring has to be carried out by the qualified and authorised specialist.
	(31) Connect cables reliably. Insulate the conductive part with an insulator. And fix the cable so that any stress is not applied to the connection part such as the connector or terminal block.
	(32) Conductive material such as electric wire scraps should not get inside the product.
	(33) Turn off the power when wiring or disconnecting wiring.

⚠ Caution

❗	**(34)** Commercial power supply should be used for power supply of brushless amplifier.
	(35) When connecting the grounding terminal of the extension cable, use a terminal block or an insulation sleeve for insulation.

Safety precautions during operation

⚠ Danger

🚫	**(36)** Do not touch the brushless amplifier or brushless motor as it will be hot.
	(37) Do not set very high velocity loop gain, and do not change the velocity loop gain significantly.
	(38) Do not touch the rotating part of the brushless motor during operation.
	(39) Do not operate with wet hands.
❗	**(40)** While energizing, pay attention to unintentional restart during stop.
	(41) Turn on and turn off the power after the worker themselves confirms the safety of the surroundings.
	(42) Turn off the power when touching the motor connector.

⚠ Caution

🚫	**(43)** Do not constrain the output shaft of the motor.
	(44) Do not start / stop the brushless motor frequently using the electromagnetic contactor installed on the main power supply side.

Safety precautions during operation(continued)

⚠ Caution

🚫	(45) In case of overload, do not start / stop by power on / off.
	(46) Do not turn on / off the power frequently.
	(47) Do not drive the brushless motor shaft from the outside regardless of whether the power is on or off.
	(48) Do not approach the parts driven by the brushless motor while the power is on.
❶	(49) Brushless motor / brushless amplifier should be used within the operating temperature range and ambient humidity range.

Safety precautions during maintenance

⚠ Danger

❶	(50) The inspection work should be done after 15 minutes or more after shutting off the power supply.

⚠ Caution

❶	(51) Maintenance and inspection should be done by experts.
	(52) Turn off the power when not using for a long time.
	(53) In order to prevent failure due to capacity reduction of the internal capacitor, replace the product in about 5 years.

Safety precautions in case of abnormality

⚠ Danger

🚫	(54) Do not use damaged products.
❶	(55) Turn off the power supply at the time of power failure or when the overheating prevention device is activated.
	(56) Stop operation by turning off the power immediately when an abnormality occurs.
	(57) Trip reset should be carried out after confirming the safety of the people and things around.
	(58) After the earthquake occurrence, it is necessary to confirm the safety.

Safety precautions in case of abnormality(continued)

⚠ Caution

🚫	**(59)** Do not approach the machine after the power recovery in case of instantaneous power failure, because there is a possibility of a sudden restart.
❗	**(60)** When the protection function is activated, remove the cause and ensure safety before resetting and restarting.

Other safety precautions

⚠ Danger

❗	**(61)** Turn off the power when installing, moving, wiring and inspection.
	(62) In order to cope with unexpected movements due to unexpected abnormalities, ensure customer safety and safety within the operable range at the operation site.

⚠ Caution

🚫	**(63)** Do not use the product except for specifications described in the instruction manual and nameplate
	(64) Do not get on the product. Do not place heavy object on the product.
	(65) Do not give strong impact to the product.
	(66) Do not modify, disassemble or repair.
❗	**(67)** When disposing of the product, it should be treated as industrial waste.

16. Other remarks

16.1 Operating a brushless motor or brushless amplifier increases the leakage current and may cause unnecessary operation of the earth leakage breaker. In that case, please use self-system and other-system earth leakage breaker with harmonic countermeasure applied.

16.2 During operation, radio noise may be generated from input / output lines, brushless motors, brushless amplifiers, etc., which may affect electronic devices. In that case, it can be suppressed to some extent by installing a noise filter at the input or by placing the electric wire inside the conduit.

16.3 This product is designed for general industrial products etc. Do not use it in nuclear power control, aerospace equipment, transportation equipment, medical equipment, various safety devices, devices requiring cleanliness such as human life related equipment, special environment.

16.4 If this product is operated in a state where the shaft is not electrically grounded, such as driving a fan, electrolytic corrosion of the motor bearing may occur depending on the actual machine and the installation environment, so bearings sound may become high, so please check and verify.

16.5 Precautions for exporting this product and equipment incorporating this product
If the end user or end use of this product is concerned with military or weapons etc., it may be subject to export restrictions prescribed by the "Foreign Exchange and Foreign Trade Control Law". When exporting, please take the examination and necessary export procedures. Please note the matching with our products when changing the specifications of your machine.

16.6 Please confirm the following in the finished equipment.
· Conformity of standards, laws and regulations
· Matching of structure, dimensions, lifetime and characteristics with finished equipment.

16.7 It is conceivable that the final equipment malfunctions due to malfunction of this product due to signal disconnection or signal loss, or abnormal operation of this product due to external noise / static electricity application. Please design failsafe to prevent it. Also ensure the safety within the operable range at the operating location.

16.8 Depending on the malfunction of this product, there is a possibility of smoking.
Please be careful when used in a clean room etc.

16.9 There is a possibility that noise resistance performance may be influenced by the wiring condition such as earth grounding method, cable length, shielding condition of signal line, so please check noise resistance even with the final equipment.

16.10 Do not use benzine, thinner, alcohol, acidic or alkaline detergent as it may discolor or break the exterior case.

16.11 Please contact us beforehand with items that need to be arranged in items not described in this specification.

16.12 When a problem occurs, we will respond after consultation based on the items described in this specification.

16.13 Please do not remove the nameplate.

16.14 After arrival, please confirm whether the actual item is as ordered.

16.15 To the extent that this specification is satisfied, parts may be partially changed for performance improvement etc.

16.16 Specification change shall be made in our delivery specifications or documents specified by your company, and we will change the specification after confirmation by prototype if there is an effect on function / characteristics etc.

16.17 Prices may change if there is a change in specifications.

16.18 Please consider the tightening torque of the installation screw of the product appropriately so as not to loosen or break, considering the strength of the screw to be used and the material of the installation destination.

17. Product lifespan
(This item is not guaranteed)

17.1 Brushless amplifier expectation lifespan

When used continuously under the following conditions, there is an expected life of 28,000 hours.
Definition of lifetime   Lifetime is the time until the capacity of the electrolytic capacitor drops by 20% from the time of shipment.
Conditions   Input power source: Single phase AC 100 V 50/60 Hz,
                              Three-phase AC 200 V 50/60 Hz,
             Ambient temperature: 50 degC
             Above sea level :   100 m or less
             Output torque: Constant rated torque
             Rotational speed: Constant rated speed
             The lifetime varies greatly depending on usage conditions.

17.2 Standard lifespan
    17.2-1 Inrush current prevention circuit
             The expected life of the inrush current prevention circuit is about 20,000 times. However, it depends on environmental conditions and usage.