REFERENCE

SPECIFICATIONS

Product Name： Brushless Amplifier

Product Series Name： MINAS-BL KV series

Product Model Number： MBEK041BCV

Motion Control Business Unit, Industrial Device Business Division
Panasonic Industry Co., Ltd.
7-1-1 Morofuku, Daito－City, Osaka 574-0044, Japan

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

Panasonic

REVISIONS

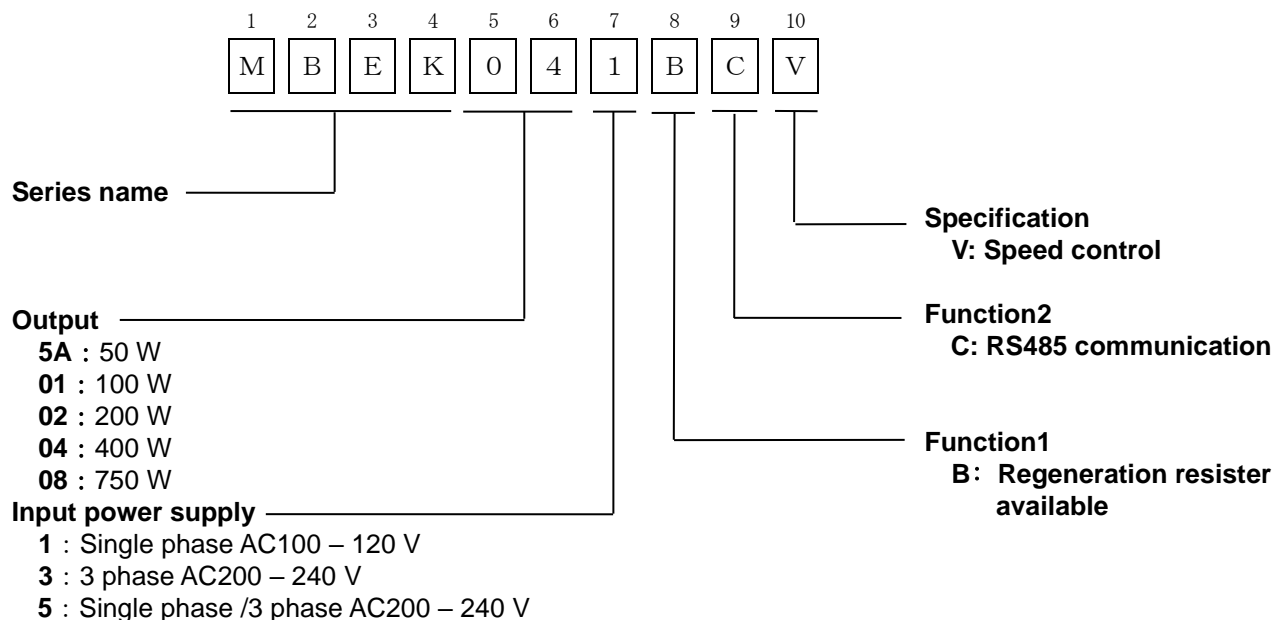| Date	Page	Sym	REVISION	Signed
Jun.4.2013		-	NEWLY ISSUED	-
Jan.1.23	Page 2, 4, 8	1.0	Correction of external regenerative resistor. (DV0P2890⇒DV0P2891)	-
	Page 2		Clarification of permissible load inertia in use of regenerative brake.	
	Page 57		Safety precautions for regenerative resistor are added.	
Apr.1.2022	-	1.1	Changed the company name	-
	-		Changed the front cover format	
Oct.1.2022	Page 34	1.2	Changed Conformance to overseas standard	-

Contents

1. Scope of Application

These specifications relate to the integrated drive brushless Amplifier MINAS-BL KV series

2. Overview

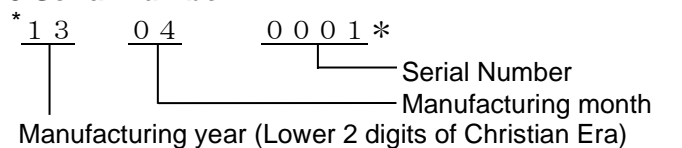### 2.1 Type   Brushless amplifier

2.2 Model Name

1	2	3	4	5	6	7	8	9	10
M	B	E	K	0	4	1	B	C	V

Series name

Specification
V: **Speed control**

Function2
C: RS485 communication

Function1
B： **Regeneration resister available**

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

Input power supply
1 : Single phase AC100 – 120 V
3 : 3 phase AC200 – 240 V
5 : Single phase /3 phase AC200 – 240 V

2.3 Serial Number

13 04 0001

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

*Indicates production in April 2013, serial number 0001.

3. Model list

Model name	Rated output	Power voltage	Rated output current	Applicable Brushless motor
MBEK041BCV	400 W	Single phase AC100 – 120 V	4.4 A	MBMS041BL□

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		Allowed range of supply voltage fluctuation	±10 %
		Power supply frequency	50 / 60 Hz
		Control method	Speed control by CS signal, PWM sine wave driving system
	Ambient conditions	Ambient temperature	0 - +40 ℃ (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	Normal temperature *1
		Storage humidity	Normal humidity
Function		Speed setting	Voltage instruction DC0-5 V. Corresponds to speed potentiometer of Console -A [Digital key pad] *2
		Speed setting Resolution	Analogue：About 1/ 200 of Upper speed limit 【Digital：1 ［r/min］】
		Speed setting precision (at 20 ℃)	Analogue: ±3 % or below of upper limit speed (±90 r/min or below at upper limit speed 3000 r/min) [Digital: 1 % or below of upper limit speed]
		Acceleration/ Deceleration time	0.01-300 sec (Time for changing from 0 to 1000 r/min) *2
		Stopping procedure	Speed reduction stop. Free-run stop*2
		Operation mode	8 speed
		Signal input	5 inputs (run/ stop, CW run/ CCW run, multi function 3bit) *3
		Signal output	2 outputs (Open collector) (Trip output etc) *3
		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. (Connection cable (sold separately) is required when commercial PC is connected. If PC has no RS232port, RS232-USB converter is required.)
		Digital Keypad(sold separately)	Available
		Regenerative Break	Regenerative resistor(sold separately) is available.*6 Permissible load inertia: 30×10⁻⁴ kgm² or less
		Protective function	Warning: Undervoltage warning *4 Overload warning, Protect: Overcurrent, Overvoltage, Undervoltage *4, Overload, User parameter error, System parameter error, CPU error, External forced trip error, Overspeed, Sensor error, Overheat, RS485 communication error and setting change warning
Performance		Speed control range	100 – 4000 r/min
		Overload protection	Inverse time-lag overload protection Protection level 115 (Torque reference)
		Permissible length for motor cable	10 m or less (with option extension cable）
		Cooling system	Self cooling
		Protection structure	Equivalent to IP20
		Mass (kg)	1

*1 Temperature which is acceptable for a short time, such as during transportation is –20 ℃ to 60 ℃ (free from freezing)

*2 Changeable by Digital key pad (DV0P3510 sold separately)

*3 If you use Digital key pad (sold separately), the function of a signal input and a signal output can be changed.

*4 It is possible to be changed from undervoltage warning (Operation will be resumed if voltage returns without trip) to undervoltage error (Brushless amplifier trips out and a state is held) by using Digital key pad (sold separately).

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

＊ 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.

*6 For external regenerative resistor: DV0P2891

* Trip means that a protection circuit operates and stops.

4.3   Insulation resistance   More than DC500 V 20 MΩ
             (Between a power supply and earth)
4.4   Isolation voltage   Between a power supply and earth
              AC1500 V   1 minute
4.5   Dimensional Outline drawing
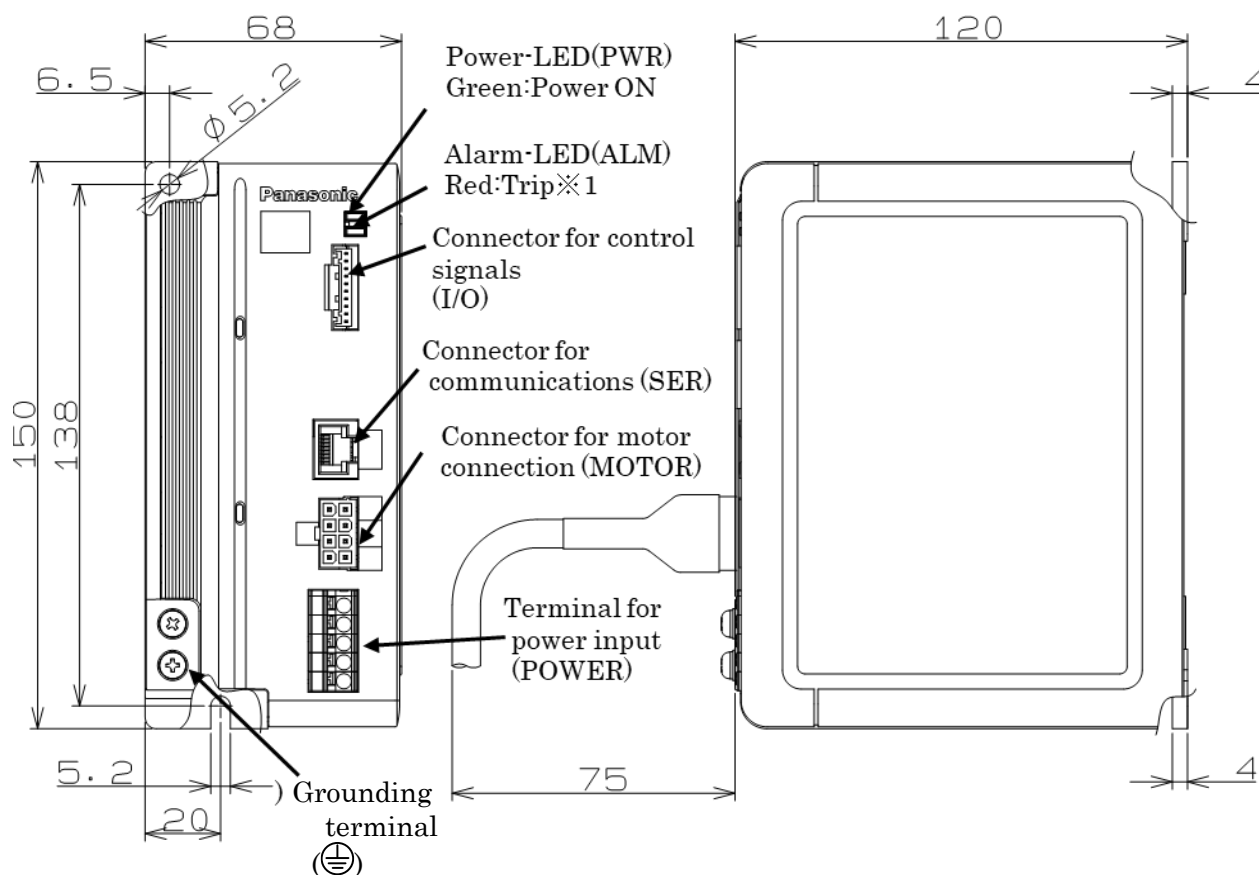
1 Trip means that a protection circuit operates and stops.

5. Function of terminal

5.1 Power input (POWER)

Terminal Brock

Terminal symbol	Terminal name	Description of function
B1	for external regenerative resistor	Connect for external regenerative resister in case. DV0P2891
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-1.25-11T (Nichifu Co.,Ltd.)

5.2 Grounding terminal (⏚)
Terminal for grounding the amplifier.(M4×2pieces)
Fasten only one wire to one terminal.
Fasten torque:0.5-1.0 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.

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	GND
8	SCK	Digital key pad communication

■The pin numbers are shown in the figure at right.

8 ⌷ 1

■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」.

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

Terminal number	Terminal symbol	Terminal name	Description of function
1	I1 *1	Signal input 1	run/stop input *1 Motor runs when "I1" and "GND" are shorted, and stops when they are opened.
2	I2 *1	Signal input 2	CCW/CW direction *1 CW operation when "I2" and "GND" are shorted, and CCW operation when they are opened.
3	I3 *1	Signal input 3	Free-run stop input *1 Free-run stop when "I3" and "GND" are shorted.
4	I4 *1	Signal input 4	Trip reset input *1 Trip reset when "I4" and "GND" are shorted.
5	I5 *1	Signal input 5	Free-run stop input *1 Free-run stop when "I5" and "GND" are shorted.
6	GND *2	Control ground	Common ground terminal for control signal.
7	FIN	Input for setting speed	Speed can be set by applying voltage DC0 – 5 V. Input impedance 100 kΩ.
8	+5V	External speed setting power supply	Power output dedicated when connecting an external variable resistor (5 kΩ, B characteristics) to FIN input (Cannot be used for any other purpose.)
9	O1 *1	Signal output 1	Trip signal output. *1 "L" in trip (Contact ON) Open collector Vce max: DC30 V, Ic max: 50 mA
10	O2 *1	Signal output 2	Speed pulse output. *1 (24 pulses/ rotation) Open collector Vce max: DC 30 V, Ic max: 50 mA

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

*2 When resistor and control GND are disconnected in use of external variable resistor, 5 V is input to FIN irrespective of setting of variable resistor, and upper speed limit is directed; therefore use caution enough for connecting GND.

■ Connector for control signals pin number is 1, 2, … 10 in the order from grounding terminal side.

■ Do not touch the connector for control signals with power on, to avoid failure by dielectric shock

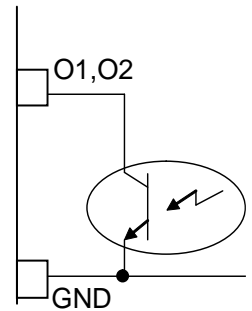■ Permissible length for control signal cable is 5 m or less.

<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 on the right.
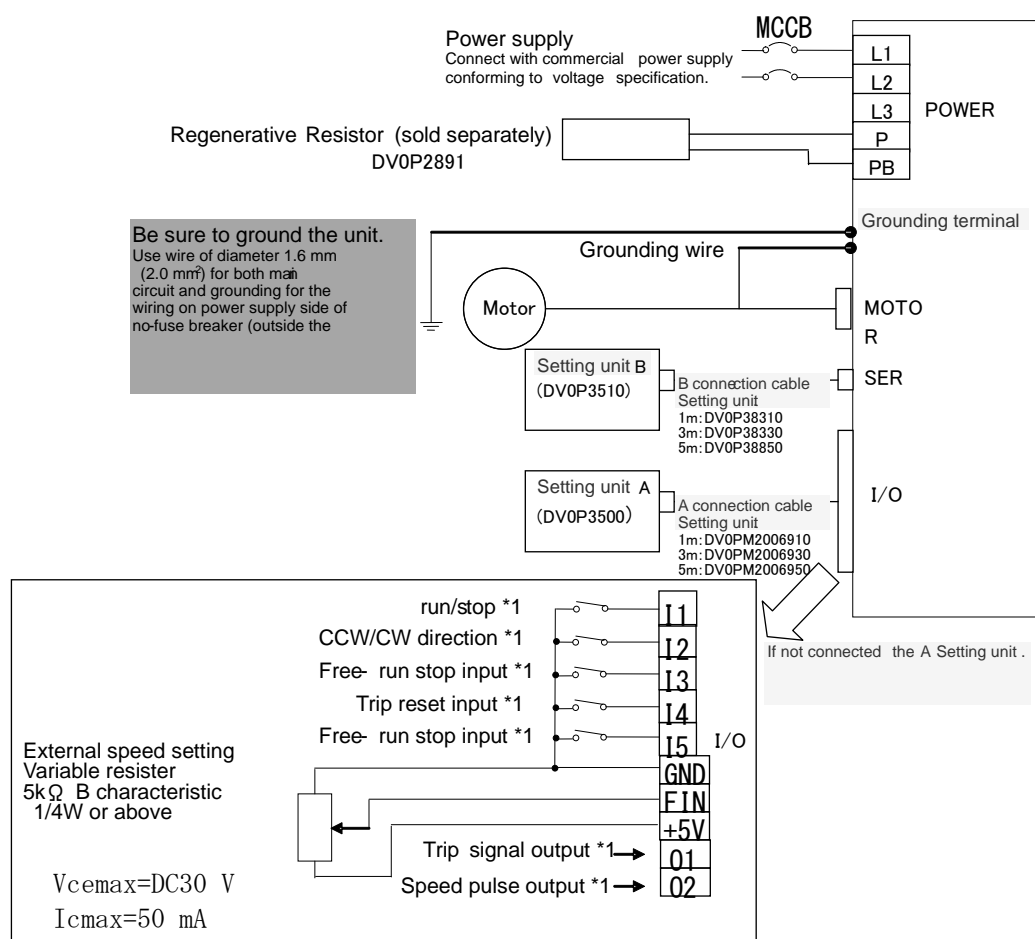It can be controlled by contact or open collector output.

I1, I2, I3
I4, I5

$1\ k\Omega$

$+5\ V$

GND

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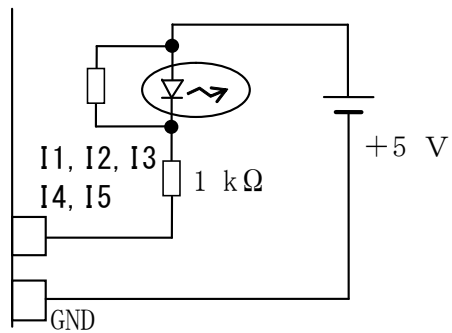
◆ Circuit of output terminal is as shown on the right.
(Open collector output)

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

$Vce_{(L)}$ = 0.5 V or less
(at Ic= 50 mA, Ta= 25 ℃)

O1,O2

GND

6. Wiring

6.1 Standard wiring diagram

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

MCCB

| L1 |
| L2 |
| L3 | POWER
| P |
| PB |

Regenerative Resistor (sold separately)
DV0P2891

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

Setting unit B
（DV0P3510）

B connection cable
Setting unit
1m：DV0P38310
3m：DV0P38330
5m：DV0P38850

SER

Setting unit A
（DV0P3500）

A connection cable
Setting unit
1m：DV0PM2006910
3m：DV0PM2006930
5m：DV0PM2006950

I/O

run/stop *1   I1
CCW/CW direction *1   I2
Free- run stop input *1   I3
Trip reset input *1   I4
Free- run stop input *1   I5   I/O

If not connected the A Setting unit .

External speed setting
Variable resister
5kΩ B characteristic
1/4W or above

$V_{cemax} = DC30\ V$
$I_{cmax} = 50\ mA$

GND
FIN
+5V
Trip signal output *1 → O1
Speed pulse output *1 → O2

*1 Function of input/output can be changed by the Digital key pad. 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 "13. Conformance to overseas standard" for compatibility with overseas standard.)

Voltage	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	20 A	20 A (3P+1a)	0.75(AWG18)	0.13(AWG26)

● Selection of relay
As for use for control circuit such as control input terminal, use a relay for small signal (minimum guarantee current 1 mA or less) for preventing poor contact. <Reference example> Panasonic : DS type, NK type, HC type, OMRON: G2A type

● Control Circuit Switch
When using a switch instead of relay, use one for minute current in order to prevent poor contact.
<Example> Nihon Kaiheiki Ind.Co.,Ltd : M-2012J-G

7. Parameter

Parameter No.	Name of parameter	Parameter setting			
		Setting range	Minimum unit	Default	Check *1
0 0	Internal speed (0-th speed)	0 – " **3b** Upper speed limit"	1 r/min	0	
0 1	1st speed			3000	
0 2	2nd speed			1200	
0 3	3rd speed			600	
0 4	4th speed	0 – " **3b** Upper speed limit"	1 r/min	0	
0 5	5th speed			0	
0 6	6th speed			0	
0 7	7th speed			0	
1 0	1st acceleration time	0.01 - 300 sec - 3 sec : Incremented by 0.01 second 3 sec-30 sec : Incremented by 0.1 second 30 sec-300 sec : Incremented by 1 second		0.30	
1 1	2nd acceleration time			0.30	
1 2	1st deceleration time			0.30	
1 3	2nd deceleration time			0.30	
1 4	Acceleration mode selection	L I n Linear		L I n	
1 5	Deceleration mode selection	S－1 S shape-1 *4 S－2 S shape-2 *4		L I n	
1 6	Stop mode selection	F r E E Free-run stop d E C Speed reduction stop		d E C	
1 7	Free-run waiting time	0.0 -10.0 sec	0.1 sec	1.0	
1 A	Velocity loop proportional gain	0-10000	1	250	
1 b	Velocity loop integration gain	0-10000	1	500	
3 0	Run command selection	P n L R U N and S T O P of Digital key pad T E r I1/I2 *2 S I G RS485 communication		T E r	C
3 1	Speed command selection	P n L " **00** Internal speed (0-th speed)" V o L－A FIN *3		V o L－A	C
3 2	Operation mode selection	1 1st speed operation mode 2 2nd speed operation mode		1	C

*1 When parameter marked with　C　in the check column is changed and stored, the unit is tripped for safety. It is not allowed to change them while the motor is running.
*2 Corresponds to RUN/STOP switch of the console A or signal input.
*3 Corresponds to the speed potentiometer or analogue speed instruction of the console A.
*4 Select this when " **3 1** Speed command selection" is　P n L　(PANEL).

Parameter No.	Name of parameter	Parameter setting			
		Setting range	Minimum unit	Default	Check *1
3 3	I1/I2 function selection	$\boxed{\text{F} - \text{r}}$ ⌐I1: CCW run/stop └I2: CW run/stop $\boxed{\text{r} - \text{F}}$ ⌐I1: CW run/stop └I2: CCW run/stop $\boxed{\text{r S. F r}}$ ⌐I1: run/stop I2: CW /CCW direction $\boxed{\text{F} - \text{r S T}}$ ⌐I1: CCW run/stop └I2: Trip reset $\boxed{\text{r} - \text{r S T}}$ ⌐I1: CW run/stop └I2: Trip reset		$\boxed{\text{r S. F r}}$	C
3 4	I3 function selection	$\boxed{\text{F r E E}}$ Free run		$\boxed{\text{F r E E}}$	C
3 5	I4 function selection	$\boxed{\text{T H r}}$ External forced trip $\boxed{\text{U} - \text{d}}$ 2nd acceleration / deceleration		$\boxed{\text{r S T}}$	C
3 6	I5 function selection	$\boxed{\text{r S T}}$ Trip reset		$\boxed{\text{F r E E}}$	C
3 A	Lower speed limit	0 – " **3b** Upper speed limit "	1 r/min	0	C
3 b	Upper speed limit	0 – 4000 r/min	1 r/min	4000	C
3 C	Torque limit	0 – 150	1	150	
4 0	O1 function selection	$\boxed{\text{T r I P}}$ Trip $\boxed{\text{S T b L}}$ Arriving $\boxed{\text{r U n}}$ Running $\boxed{\text{F r E E}}$ Free-run		$\boxed{\text{T r I P}}$	
4 1	O2 function selection	$\boxed{\text{F}}$ CCW run $\boxed{\text{r}}$ CW run $\boxed{\text{C k} - \text{L}}$ Overload detection $\boxed{\text{P O U T}}$ Speed pulse signal *4		$\boxed{\text{P O U T}}$	
4 2	O1 output polarity selection	$\boxed{\text{n O r}}$ Normal polarity		$\boxed{\text{n O r}}$	
4 3	O2 output polarity selection	$\boxed{\text{r E V}}$ Reverse polarity		$\boxed{\text{n O r}}$	
4 4	Speed matching range	20 – " **3b** Upper speed limit"	1 r/min	50	
4 5	Output pulse count selection	1, 2, 3, 4, 6, 8, 12, 24 *3		24	
4 6	Monitor mode selection	$\boxed{\text{O.} - \text{r}}$ Rotation speed(Actual speed) $\boxed{\text{O.} - \text{L}}$ Torque reference $\boxed{\text{A V .} - \text{L}}$ Load factor *2 $\boxed{\text{S.} - \text{r}}$ Command speed $\boxed{\text{d C} - \text{V}}$ Internal DC voltage		$\boxed{\text{O.} - \text{r}}$	

*1 When parameter marked with $\boxed{\text{C}}$ in the check column is changed and stored, the unit is tripped for safety. It is not allowed to change them while the motor is running.

*2 Load factor: The value multiplied by the primary delay filter to a percentage of the rated torque of the torque reference directive.

*3 Select 12 or less, when you need exceeding 3000 r/min.
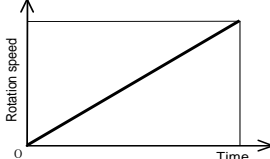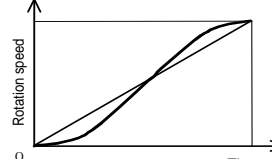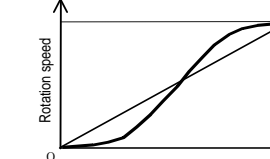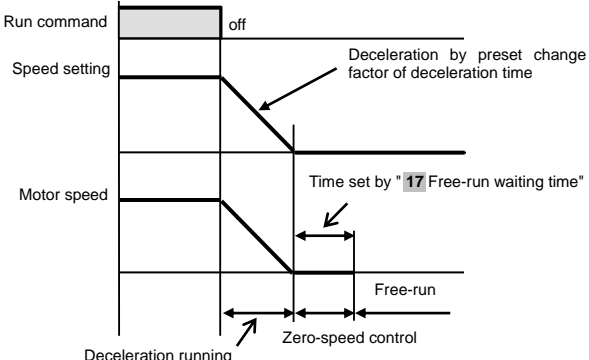
*4 Rotation angle of a motor is divided into the number set up by Pr45, and a pulse is outputted at the division position.
By using an analog filter, it is a signal for checking a near speed in analog meter etc.
Since there are no hysteresis characteristics, and there is possibility of the incorrect detection by disturbance or motor vibration, please do not use it for position detection.

Parameter No.	Name of parameter	Parameter setting			Check *1
		Setting range	Minimum unit	Default	
4 7	Numerator of display magnification factor	1 - " **48** Denominator of display magnification factor" x 10		1 time	1
4 8	Denominator of display magnification factor	1 - 1000		1 time	1
4 A	Trip history clear	n O No operation Y E S Clear trip history		n O	
4 b	Trip history 1			—	
4 C	Trip history 2			—	
4 d	Trip history 3	—		—	
4 E	Trip history 4			—	
4 F	Trip history 5			—	
5 0	Undervoltage trip selection	n O No trip Y E S Trip		n O	C
5 1	Retrial selection	n O ,1 - 4		n O	C
5 2	Retrial start time	1 - 120 sec	1 sec	5	
5 4	Parameter initializing	n O No operation Y E S Initialize to default		n O	
5 7	Parameter copy function	n O No copying of parameter P.I n I T Initializing the data of Digital key pad P.L O A d Reading a parameter to the Digital key pad P.P r O G Writing a parameter to brushless amplifier		n O	
5 A	RS485 device number	128 – 159 (80h – 9Fh)		129	C
5 b	RS485 communication speed	0:2400bps, 1:4800bps, 2:9600bps		2	C
5 C	RS485 communication standard	0 – 11		4	C
5 d	RS485 communication response time	10 - 10000	1 ms	10	C
5 E	RS485 retry times of communication	0 – 8: Retry count, 9: No retry		9	C
5 F	RS485 protocol timeout	1 - 255	1 s	2	C
F 0	For manufacturer use	—		—	

*1 When parameter marked with   C   in the check column is changed and stored, the unit is tripped for safety. It is not allowed to change them while the motor is running.

8. The function of parameters

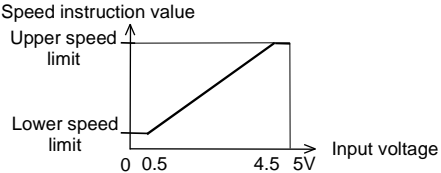| Parameter No.	Name of parameter	Description
0 0	Internal speed (0-th speed)	Desired running speed can be set. This is effective when " **31** Speed command selection" is ⬚ P n L (PANEL). Upper limit is limited by " **3b** Upper speed limit".
0 1 – 0 7	1st speed - 7th speed	Speed in multi-speed running can be set. It is effective when " **32** Operation mode selection" is set to 2-speed operation mode.
1 0 1 1	1st acceleration time 2nd acceleration time	The change factor of output speed in acceleration can be determined. ・**Set by time for changing 1000 r/min.** 　When it is 0.3 sec (default), time taken for accelerating from 0 to 3000 r/min is 0.9 sec. ・Time can be incremented by 0.01 sec for below 3 sec, by 0.1 sec from 3 sec up to 30 sec exclusive, and by 1 sec from 30 sec upward.
1 2 1 3	1st deceleration time 2nd deceleration time	The change factor of output speed in deceleration can be determined. ・**Set by time for changing 1000 r/min.** 　When it is 0.3 sec (default), time taken for decelerating from 0 to 3000 r/min is 0.9 sec. ・Time can be incremented by 0.01 sec for below 3 sec, by 0.1 sec from 3 sec up to 30 sec exclusive, and by 1 sec from 30 sec upward.
1 4 1 5	Acceleration mode selection Deceleration mode selection	Straight line acceleration/deceleration and curve (S-shape) acceleration and deceleration can be chosen individually for acceleration and deceleration. 　L I n LINEAR　　　　S－1 "S"SHAPE-1　　　　S－2 "S"SHAPE-2 Select S-shape when " 3 1 Speed command selection" is ⬚ P n L (PANEL) Straight line up to speed setting. Standard mode for accelerating and decelerating.　　Relaxes the speed change in start and end of acceleration and deceleration.　　Curve is emphasized more than S shape-1.
1 6	Stop mode selection	You can select how to stop the motor. F r E E (FREE) Power supply to the motor is cut off and the motor is stopped naturally when stop command is input (free-run stop). It takes longer for the motor to completely stop when load inertia is big. d E C (DECEL) When stop command is input, the motor reduces its speed according to preset deceleration time, Electric-brake is performed by Zero-speed control, and then power is cut off to the motor after elapse of time set by " **17** Free-run waiting time", and the motor is set in free-run state. <Example or running pattern in deceleration stop> ■The motor is servo-rocked in Zero-speed control. (Electrically controlled so that motor speed is Zero)

Parameter No.	Name of parameter	Description
17	Free-run waiting time	When " **16** Stop mode selection" is set to $\boxed{\text{d E C}}$ (DECEL) deceleration stop, servo lock time(Zero-speed control)after deceleration can be adjusted. (Free-run state is set after that.)
1 A	Velocity loop proportional gain	Enables setting of proportional gain of velocity amplifier. It need not be changed normally. When this value is made greater, gain is increased, which improves responsiveness of the motor. When this value is made too large, operation is vibratory. Setting range: 0 – 10000, Setting resolution: 1
1 b	Velocity loop integration gain	Enables setting of integration gain of velocity amplifier. It need not be changed normally. When this value is made greater, gain is increased, which improves rigidity of the motor (strength of servo lock). When this value is made too large, overshooting becomes greater, and the motor is vibratory. Setting range: 0 – 10000, Setting resolution: 1
30	Run command selection	Run command can be chosen from the following: $\boxed{\text{P n L}}$ (PANEL) :Command the motor to stop with $\boxed{\text{R U N}}$ $\boxed{\text{S T O P}}$ switch of Digital key pad. The motor cannot be operated by signal input "I1" and "I2". Signal input is effective only in setting rotation direction, etc. See " **33** I1/I2 function selection". $\boxed{\text{T E r}}$ (TERMINAL) : Only the input terminal "I1" and "I2" are effective. (Corresponds to RUN/STOP, rotation direction selection switch of Console-A.) $\boxed{\text{S I G}}$ (SIGNAL) :Command by RS485 (Operation command by I/O is invalid, but trip or sensor input is excluded.)
31	Speed command selection	You can choose whether to use " **00** Internal speed (0-th speed)" or analog input terminal "FIN" for speed command. $\boxed{\text{P n L}}$ (PANEL) " **00** Internal speed (0-th speed)" $\boxed{\text{V o L-A}}$ (VOL-A) Analog input terminal "FIN" (voltage instruction DC 0-5 V) (Corresponds to speed potentiometer of Console-A.)

Parameter No.	Name of parameter	Description
3 2	Operation mode selection	Parameter for choosing operation mode
		I1/I2 function selection

Parameter for choosing operation mode

Setting	Operation made	Function of signal input		
		I3	I4	I5
1	1st speed operation mode	Free-run stop / External forced trip / 2nd acceleration/deceleration time / Trip reset		
2	2nd speed operation mode	Speed setting		
4	4th speed operation mode	Speed setting	Speed setting	
8	8th speed operation mode	Speed setting	Speed setting	Speed setting

2nd speed operation mode

I3	Setting to be chosen
OFF	Internal speed (0-th speed) or FIN
ON	1st speed

4th speed operation mode

I3	I4	Setting to be chosen
OFF	OFF	Internal speed (0-th speed) or FIN
ON	OFF	1st speed
OFF	ON	2nd speed
ON	ON	3rd speed

8th speed operation mode

I3	I4	I5	Setting to be chosen
OFF	OFF	OFF	Internal speed (0-th speed) or FIN
ON	OFF	OFF	1st speed
OFF	ON	OFF	2nd speed
ON	ON	OFF	3rd speed
OFF	OFF	ON	4th speed
ON	OFF	ON	5th speed
OFF	ON	ON	6th speed
ON	ON	ON	7th speed

3 3 I1/I2 function selection

(1) For setting "I1" or "I2" function

F - r (FORWARD-REVERSE)

State of I1 and I2		Action
I1	I2	
OFF	OFF	Stop / Deceleration stop when " **16** Stop mode selection" is d E C
ON	OFF	CCW run
OFF	ON	CW run
ON	ON	Free-run stop / Trip reset (which must be retained 0.2 sec or longer) *

r − F (REVERSE - FORWARD)

State of I1 and I2		Action
I1	I2	
OFF	OFF	Stop / Deceleration stop when " **16** Stop mode selection" is d E C
ON	OFF	CW run
OFF	ON	CCW run
ON	ON	Free-run stop / Trip reset (which must be retained 0.2 sec or longer) *
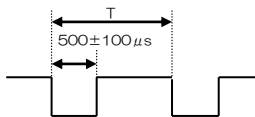
* Effective only when trip occurs

Parameter No.	Name of parameter	Description
3 3	I1/I2 function selection （Continued）	(see below)

r S． F r (RUNSTOP. FORWARD-REVERSE)

State of I1 and I2		Action
I1	I2	
OFF	OFF	Stop Deceleration stop when " **16** Stop mode selection" is d E C
ON	OFF	CCW run
OFF	ON	Stop Deceleration stop when " **16** Stop mode selection" is d E C
ON	ON	CW run

F － r S T (FORWARD-TRIP RESET)

State of I1 and I2		Action
I1	I2	
OFF	-	Stop Deceleration stop when " **16** Stop mode selection" is d E C
ON	-	CCW run
-	ON	Trip reset (which must be retained 0.2 sec or longer) *

r － r S T (REVERSE-TRIP RESET)

State of I1 and I2		Action
I1	I2	
OFF	-	Stop Deceleration stop when " **16** Stop mode selection" is d E C
ON	-	CW run
-	ON	Trip reset (which must be retained 0.2 sec or longer) *

(2) When " **30** Run command selection" is P n L (PANEL), the motor can be commanded with RUN STOP switch of Digital key pad.
Rotation direction in this case can be set by parameter and "I1" "I2" state.
"I1" "I2" are off when only digital key pad is connected.

F － r (FORWARD - REVERSE)

State of I1 and I2		Action
I1	I2	
-	OFF	CCW rotation selection
OFF	ON	CW rotation selection
ON	ON	Free-run stop irrespective of RUN switch Trip reset (which must be retained 0.2 sec or longer)*

r － F (REVERSE-FORWARD)

State of I1 and I2		Action
I1	I2	
-	OFF	CW rotation selection
OFF	ON	CCW rotation selection
ON	ON	Free-run stop irrespective of RUN switch Trip reset (which must be retained 0.2 sec or longer)*

r S． F r (RUNSTOP. FORWARD-REVERSE)

State of I1 and I2		Action
I1	I2	
-	OFF	CCW rotation selection
-	ON	CW rotation selection

* Effective only when trip occurs

Parameter No.	Name of parameter	Description
3 3	I1/I2 function selection （Continued）	$\boxed{F-rST}$ (FORWARD-TRIP RESET) CCW run with $\boxed{RUN}$ switch **State of I1 and I2 / Action** I1: - , I2: ON → Trip reset (which must be retained 0.2 sec or longer)* $\boxed{r-rST}$ (REVERSE-TRIP RESET) CW run with $\boxed{RUN}$ switch **State of I1 and I2 / Action** I1: - , I2: ON → Trip reset (which must be retained 0.2 sec or longer)*
3 4 3 5 3 6	I3 function selection I4 function selection I5 function selection	$\boxed{FrEE}$ (FREE) : ON (shorted between signal I3 and "GND") → Free-run stop instruction $\boxed{THr}$ (THERMAL): OFF (open between signal I3 and "GND") → External forced trip instruction $\boxed{U-d}$ (UP-DOWN): ON (shorted between signal I3 and "GND") → 2nd acceleration/deceleration time $\boxed{rST}$ (RESET) : ON (open between signal I3 and "GND") → Trip reset instruction
3 A	Lower speed limit	When " **31** Speed command selection" is analogue speed instruction $\boxed{VoL\text{-}A}$ (VOL-A), motor setting speed at 0V input is set.
3 b	Upper speed limit	Upper limit of motor command speed. When " **31** Speed command selection" is analogue speed command $\boxed{VoL\text{-}A}$ (VOL-A), motor setting speed at 5 V input is set. Further, upper limit of " **00** Internal speed (0-th speed) " and " **01** 1st speed " and " **44** Speed matching range" is limited by this parameter.
3 C	Torque limit	Upper limit of torque reference is set. (No precision is provided because torque is not controlled. Use as a guide.) 100 indicates the rated torque.
4 0	O1 function selection	Output terminal " O1 " and " O2 " can also be selected as follows. Polarity of " **40** O1 function selection " and " **41** O2 function selection " can be inverted by " **42** O1 output polarity selection " and " **43** O2 output polarity selection " $\boxed{TriP}$ (TRIP) :Trip signal (Trip: ON) $\boxed{STbL}$ (STABLE) :Arriving signal (Speed is reached to a command value ON)→See " **44** Speed matching range". $\boxed{rUn}$ (RUN) :Run/Stop signal (When running: ON) $\boxed{FrEE}$ (FREE) :Free-run signal (During free run: ON) $\boxed{F}$ (FORWARD) :CCW run signal (During CCW run: ON) $\boxed{r}$ (REVERSE) :CW run signal (During CW run: ON) $\boxed{Ck-L}$ (CHECK-L) :Overload detection Output when load exceeds 100% (Load exceeds 100%:ON) $\boxed{POUT}$ (PULSE-OUT):Speed pulse signal →See " **45** Output pulse count selection".
4 1	O2 function selection	
4 2	O1 output polarity selection	This is a function for inverting the polarity of signal output between output terminal " O1 " " O2 " and "GND". $\boxed{nOr}$ (NORMAL) : Transistor "ON" when activated $\boxed{rEV}$ (REVERSE) : Transistor "OFF" when activated
4 3	O2 output polarity selection	

* Effective only when trip occurs

Parameter No.	Name of parameter	Description
4 4	Speed matching range	When " **40** O1 function selection " and " **41** O2 function selection " are chosen to $\boxed{\text{S T b L}}$ (STABLE) Arriving signal, "Speed matching range" for output arriving signal can be adjusted. ・When difference between actual rotation speed and speed setting is smaller than "Speed matching range", arriving signal is output. ・Even if the speed is reached, when speed matching range is set too small, arriving signal may turn on and off due to speed fluctuation. ・Arriving signal is not output when CCW/CW changes.
4 5	Output pulse count selection	When " **40** O1 function selection " and " **41** O2 function selection " are set to $\boxed{\text{P O U T}}$ (PULSE-OUT), pulse count is set to be output to " O1" " O2" while the motor makes one turn. (To be selected from 1, 2, 3, 4, 6, 8, 12, and 24) (Ex) When rotation number is 3000 r/min, in the case where " **45** Output pulse selection" is 24, $T = \dfrac{60}{3000 \times 24} = 0.83ms$ Frequency f = 1/T = 1.2kHz T $500 \pm 100 \mu s$ Rotation angle of a motor is divided into the number set up by Pr45, and a pulse is outputted at the division position. By using an analog filter, it is a signal for checking a near speed in analog meter etc. Since there are no hysteresis characteristics, and there is possibility of the incorrect detection by disturbance or motor vibration, please do not use it for position detection.
4 6	Monitor mode selection	You can choose description to be displayed on 5-digit LED when turning on power. $\boxed{\text{O.-r}}$ (OUTPUT-REVOLUTION) :Rotation speed $\boxed{\text{O.-L}}$ (OUTPUT-LOAD) :Torque reference $\boxed{\text{A V.-L}}$ (AVERAGE-LOAD) :Load factor (average torque reference) $\boxed{\text{S.-r}}$ (SETTING-REVOLUTION) :Speed command $\boxed{\text{d C-V}}$ (DC-VOLTAGE) :Internal DC voltage (Voltage of smoothing capacitor of power supply) In speed display mode, the value multiplied by " **47** Numerator of display magnification factor" / " **48** Denominator of display magnification factor" is displayed.
4 7	Numerator of display magnification factor	You can set the multiplying factor of a value displayed on 5-digit LED. Value of **47** ÷ **48** is a display multiplying factor. Set a value in the range where calculated display magnifying factor is 10 – 1/1000. The speed of line can be displayed.
4 8	Denominator of display magnification factor	When the display magnifying factor is changed, the parameter relating to speed (below) is displayed by a value multiplied by display multiplying factor. " **00** Internal speed(0-th speed)" " **01** 1st speed" " **3A** Lower speed limit" " **3b** Upper speed limit" " **44** Speed matching range"

Parameter No.	Name of parameter	Description
4 A	Trip history clear	Trip history 1 – 5 can be cleared. <Clear procedure> Cut off power with $\boxed{\text{Y E S}}$(YES) selection, and turn on power again after display has disappeared, then $\boxed{\text{- - - - -}}$ is displayed, and trip history is cleared. When power is turned on again, normal operation is started.
4 b 4 C 4 d 4 E 4 F	Trip history 1 Trip history 2 Trip history 3 Trip history 4 Trip history 5	Trip history for 5 times in the past is stored. Trip history 1 is the latest history. See "Protective function" for displayed description. When no history is available, $\boxed{\text{- - - - -}}$ is displayed.
5 0	Undervoltage trip selection	When $\boxed{\text{n O}}$ (NO) is selection, the motor is not tripped at insufficient voltage. If voltage should fall and undervoltage status is found while the motor is running, the motor stops after running free, while if operation instruction is input after recovery of power, the motor is restarted automatically. (■Be cautious.) When $\boxed{\text{Y E S}}$ (YES) is selection, the motor is tripped at undervoltage, and alarm LED blinks. When normal power is off, trip is not stored in trip history. Trip is stored only when power has stopped instantaneously (Trip is stored in trip history only when undervoltage once becomes short and then is recovered normal)
5 1	Retrial selection	Automatic reset in trip (trip retrial) can be set here. Trip can be is automatically reset to allow operation to continue. Use this function only on such equipment that has no problem of safety even if the motor is automatically restarted. ■Retrial is impossible if trip is by Overcurrent error $\boxed{\text{E－O C}}$, Sensor error $\boxed{\text{E－C S}}$, System error $\boxed{\text{E r r}}$, User parameter error $\boxed{\text{E－U P r}}$, or System parameter error $\boxed{\text{E－S P r}}$. When $\boxed{\text{n O}}$ (NO) is selection, retrial is not effective. When $\boxed{1}$ – $\boxed{4}$ is selection, retrial is made for the set number of times. When 2 hours has elapsed with no trip, the number of retrying times is initialized to 0. Set the interval between retrials by "**52** Retrial start time". When trip occurs in excess of preset number of trials, the brushless amplifier outputs trip signal and stops. ■During retrial, trip signal is not output (It is stored in trip history)
5 2	Retrial start time	You can set waiting time until retrial operation is performed after tripping is found. You can set 1 to 120 seconds.
5 4	Parameter initializing	Parameters can be initialized to the factory default. <Initializing procedure> Cut off power with $\boxed{\text{Y E S}}$ (YES) selection, and turn on power again after display has disappeared, then $\boxed{\text{- - - - -}}$ is displayed, and parameters are initialized to the factory default.
5 7	Parameter copy	Parameters can be copied. $\boxed{\text{n O}}$(NO) Parameters are not copied $\boxed{\text{P. I n I T}}$(PARAMETER-INITIALIZE):Initialization of Digital key pad data $\boxed{\text{P. L O A d}}$(PARAMETER-LOAD):Reading parameters into Digital key pad data $\boxed{\text{P. P r O G}}$(PARAMETER-PROGRAM):Writing parameters to the brushless amplifier See the copying method of parameters on page 19 for detail

Parameter No.	Name of parameter	Description
5 A	RS485 device number	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.
5 b	RS485 communication speed	Set the communication speed of RS485 communication. 0: 2400bps, 1: 4800bps, 2: 9600bps
5 C	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
5 d	RS485 communication response time	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]
5 E	RS485 retry times of communication	Set the retry times of RS485 communication. 0 - 8: Number of retrials, 9: No retrial
5 F	RS485 protocol timeout	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]
F 0	For manufacturer use	It cannot be changed.

LED display

Figures displayed on the 7 segment display of the digital key pad are shown below:

Alphanumeric	LED display
A	Π
B	b
C	Γ
D	d
E	E
F	F
G	Ն
H	H
I	ı
K	ե
L	L
N	∩
O	o、ロ ※
P	P
Q	q
R	┌

Alphanumeric	LED display
S	5
T	Γ
U	Ս
V	Ս
Y	५
0	ロ
1	ı
2	੨
3	੩
4	५
5	5
6	Б
7	⁊
8	Β
9	੫

Example of LED display
Example

Description in the text	Display on Digital key pad
「PnL」	「PnL」
「TEr」	「ΓEr」
「FrEE」	「FrEE」
「rST」	「r5Γ」

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

Description in the text	Display on Digital key pad
「VoL−A」	「ՍoL-Π」
「nO」	「nロ」

9. How to use Digital key pad

● What can be done by Digital key pad

・Monitoring of rotation speed (actual speed) and load factor, etc
  (Rotation speed can be displayed being multiplied by the factor set by parameter **47** and **48** .)
・Display detail of trip, and trip history. Trip reset by pressing ⌃ and ⌄
・Parameter setting, initialization, and copying function at the same time.
・Start and stop of motor by $\boxed{RUN}$ / $\boxed{STOP}$ switch (Setting of parameter " **30** Run command selection"
  is required.)

●Name of each part

5-digit LED	Displays rotation speed (actual speed), commanded speed, trip history, setting of parameter, and the like.
2-digit LED	Displays the number of parameter (in editing parameter). Displays the rotation direction in operation. Displays $\boxed{0\ 0}$ when the motor is stopped. (CCW as viewed from the output shaft of motor … $\boxed{F}$ and CW … $\boxed{r}$)
$\boxed{MODE}$ switch	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 of power supply) → Load factor → Torque reference → Commanded speed → Rotation speed (actual speed) →…. * * When you press this switch in the parameter setting mode, setting is stored.
$\boxed{\substack{DATA\\SET}}$ switch	This switch is for changing parameter number mode and parameter setting mode, and for saved parameter setting.
$\boxed{⌃}$ $\boxed{⌄}$ switch	This switch enables selection of parameter, and setting and changing of contents. When the motor is tripped, pressing ⌃ and ⌄ at the same time enables reset of trip.
$\boxed{RUN}$ switch	This switch is for instruction of operation. (Only when " **30** Run command selection" is $\boxed{PnL}$) ■See " **33** I1/I2 function selection" (2) on page 10 for rotation direction.
$\boxed{STOP}$ switch	This switch is for instruction of stopping. (Only when " **30** Run command selection" is $\boxed{PnL}$)

●Description

Monitor mode	Displays rotation speed (actual speed), setting speed, internal DC voltage, load factor, and torque reference on 5-digit LED. When power is turned on, this mode is set. This mode is set when power is turned on. Control changes to this mode when $\boxed{MODE}$ switch is pressed in parameter number mode, parameter setting mode.
Parameter number mode	Displays a parameter number (**00** – **F0**) in blinking. Control changes to this mode when switch is pressed in parameter number mode. Control changes to this mode when $\boxed{\substack{DATA\\SET}}$ switch is pressed in parameter number mode. Parameter number can be changed and selected by and switch. Parameter number can be changed and selected by ⌃ and ⌄ switch.
Parameter setting mode	Displays the detail of parameter (setting) in flashing. Control changes to this mode when $\boxed{\substack{DATA\\SET}}$ switch is pressed in monitor mode. Change setting by ⌃ and ⌄ switch. When $\boxed{\substack{DATA\\SET}}$ switch is pressed after change of setting, it is saved in EEPROM.

*Displays rotation speed r/min in normal monitor mode. Displays torque reference and load factor assuming the
  rated motor torque at 100 .
*Display is just a guide. Do not use the Digital key pad for a measuring instrument.

9.1 Operating Instruction

Turn on power. → Monitor mode

●Press MODE switch for changing display.

Rotation speed ● r /min

MODE

Internal DC voltage ● V

MODE

Flashing

Load factor ● %

MODE

Torque ● %

MODE

Flashing

Speed setting ● r /min

Internal speed (0-th speed) can be directly set by ⌃ and ⌄ in monitor mode.

O

OO Flashing

⌃ ⌄

Press MODE Press MODE Press DATA SET

⌃ ⌄

Only " **00** "

Parameter number mode

Press DATA SET Press DATA SET

Storage

Storage

Parameter setting mode

●2-digit LED blinks and allows selection of parameter number.

O

OO Flashing ⌃ ⌄

→ Flashing →

0.30

10 Flashing ⌃ ⌄

Change (select) a parameter number by ⌃ or ⌄ .

●5-digit LED blinks and allows change of parameter value.

0.30

10 ⌃ ⌄ Flashing

→ Flashing →

0.31

10 ⌃ ⌄ Flashing

Change (select) a parameter value by ⌃ or ⌄ .

When DATA SET switch or MODE switch is pressed in parameter setting mode, data is stored.
● When ⌃ or ⌄ is pressed in monitor mode, detail of " **00** Internal speed(0-th speed)" is displayed in blinking, and speed setting can be changed by ⌃ and ⌄ . When " **31** Speed command selection" is PnL , the motor speed also changes following the speed setting if the motor is running.

Data is stored only when DATA SET switch is pressed. Note that data returns to settings when power is turned off.

Motion Control Business Unit, Panasonic Industry Co., Ltd.

9.2 Test run (Digital key pad)

<Inspection prior to test run>
(1) Make sure that all wiring is correct.   (2) Make sure that input power supply conforms to rating.
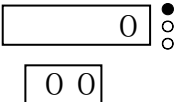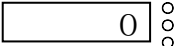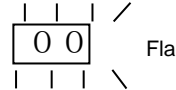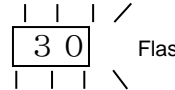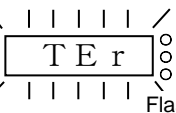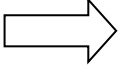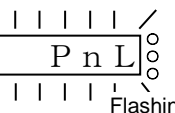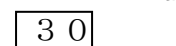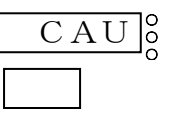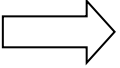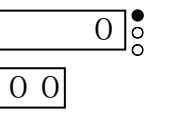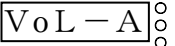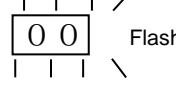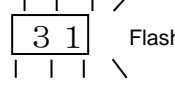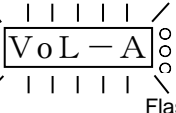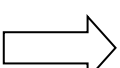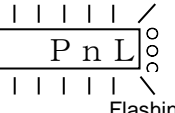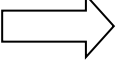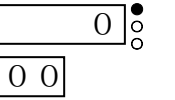
<Test run>
Test run procedure by the Digital key pad is as follows:
An example is introduced here where the motor runs CW at 1800 r/min with the Digital key pad.
(1) Be sure to first perform the work below for safety.
   Separate the motor from machine or equipment, and make sure that the motor alone can be operated.
(2) Then turn on power and follow the step below for test run.
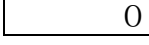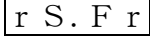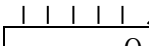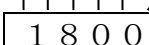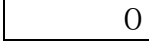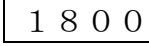
Description of operation	Digital key pad	
	Switch	LED display
[1]Turn on power		0 / 0 0
[2]Change of initial setting (Change the choice of operation instruction from I1/I2 T Er to the Digital key pad PnL.)	Press DATA SET	0 T E r
	Press ⌃ several times to choose parameter number **30**.	0 0 Flashing 3 0 Flashing
	Press DATA SET	T E r ⟹ P n L
	Press ⌄ to change parameter value.	Flashing Flashing
	Store by DATA SET .	3 0 3 0
	Setting change warning is issued because setting of operation instruction has been changed.	C A U
[3] Trip reset	Press ⌃ and ⌄ at the same time.	C A U ⟹ 0 / 0 0
[4] Change of initial setting 2 (Change the choice of speed instruction from analogue speed instruction input to " **00** Internal speed (0-th speed)" to enable use of Digital key pad.)	Press DATA SET	0 VoL−A
	Press ⌃ several times to choose parameter number **31**.	0 0 Flashing 3 1 Flashing
	Press DATA SET	VoL−A ⟹ P n L
	Press ⌄ to change parameter value.	Flashing Flashing
	Store by DATA SET .	3 1 3 1
	Setting change warning is issued because setting of operation instruction has been changed.	C A U
[5] Trip reset	Press ⌃ and ⌄ at the same time.	C A U ⟹ 0 / 0 0

Description of operation	Digital key pad		
	Switch	LED display	
[6]Choosing rotation direction* (This operation is not required for rotation forward [CCW].)	Press DATA SET	`0` ○○○	`r S. F r` ○○○
	Press ⋀ several times to choose parameter number **33**.	`0 0` \ ‖ / Flashing	`3 3` \ ‖ / Flashing
	Press DATA SET	`r S. F r` \‖‖/ Flashing	`r − F` \‖‖/ Flashing
	Press ⋁ to change parameter value.	`3 3`	`3 3`
	Store by DATA SET		
	Setting change warning is issued because setting of operation instruction has been changed.	`C A U` ○○○	
[7] Trip reset	Press ⋀ and ⋁ at the same time.	`C A U` ○○○	`0` ●○○ `0 0`
[8] Speed setting	Press ⋀	`0` ○○○ `0 0` Flashing	• Internal speed(0-th speed) is displayed (setting at 0r/min).
	Press ⋀ to set a speed.	`1 8 0 0` ○○○ `0 0` Flashing	• Set the Internal speed setting (0-th speed) at 1800 r/min.
[9]Reset to monitor mode.	Press MODE	`0` ●○○ `0 0`	• Data is still stored if power is cut off here.
[10]Operation instruction	Press RUN	`1 8 0 0` ●○○ `r`	• Display of rotation speed changes little by little toward 1800 r/min • Display of rotation direction* (r indicates that the motor is rotating CW.)
[11]Stop instruction	Press STOP	`0` ●○○ `0 0`	• Display of rotation speed changes little by little toward 0 r/min.
[12] Power OFF			

<Checkpoint in Test run>
 (1) Check whether the motor rotates smoothly. Check for abnormal noise and vibration.
 (2) Check whether the motor is accelerated and decelerated smoothly.
 (3) Rotation direction and rotation speed of the motor are matched?

 *Rotation direction can also be changed by use of "I2". See " **33** I1/I2 function selection" (2) on page 10.
 ■Setting is still stored when power is turned off. When operating the motor with Digital key pad only in trial run, either reset the setting or initialize parameters after completion of trial run. (Parameter **54**)
   Here, note that all parameters return to default when parameters are initialized.

9.3 How to copy parameter
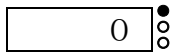
<1 Reading a parameter value from brushless amplifier to the Digital key pad.>
■Once parameters are read into the console, their details are stored in the Digital key pad.

Description of operation	Digital key pad	
	Switch	LED display
[1]Turn on power		`0` ●○○ `0 0`
[2]Call **57** Parameter copy.	Press `DATA SET` Hold down `⌃` to choose parameter number **57**.	Parameter value ●○○ `0 0` Flashing → `nO` ○○○ `5 7` Flashing
[3] `P.LOAd` Choose reading a parameter into the Digital key pad.	Press `DATA SET` Press `⌃` twice to choose `P.LOAd`.	`nO` ○○○ `5 7` Flashing → `P.LOAd` ○○○ `5 7` Flashing
[4]Read a parameter into the Digital key pad.	Press `DATA SET` for 1 second while holding down `STOP`.	`P.LOAd` ○○○ `5 7` Flashing →Slow flashing (once per second)
[5]Wait about 30 seconds.		`P.End` ○○○
[6]Reading of parameter into the Digital key pad completed	Press `STOP`	`0` ●○○ `0 0`

<2 Copy a parameter value saved in the Digital key pad onto the brushless amplifier.>

Description of operation	Digital key pad	
	Switch	LED display
Turn on power. Call out **57** Parameter. (Same operation as 1. [1] and [2])		
[1] `P.ProG` Choose writing a parameter to the brushless amplifier.	Press `DATA SET` twice. Press `⌃` three times to choose `P.ProG`.	`nO` ○○○ `5 7` Flashing → `P.ProG` ○○○ `5 7` Flashing
[2] Write a parameter to the brushless amplifier.	Press `DATA SET` for 1 second while holding down `STOP`.	`P.ProG` ○○○ `5 7` Flashing →Slow flashing (once per second)
[3]Wait about 10 seconds.		`P.End` ○○○

Description of operation	Digital key pad	
	Switch	LED display
[4]Completion of writing a parameter from the Digital key pad to the brushless amplifier.		$\boxed{CAU}\ \overset{\circ}{\underset{\circ}{\bullet}}$ $\boxed{}$
[5]Reset to monitor mode.	Press $\boxed{\wedge}$ and $\boxed{\vee}$ at the same time for clear trip.	$\boxed{\qquad 0}\ \overset{\bullet}{\underset{\circ}{\circ}}$ $\boxed{0\ 0}$

Error while copying a parameter

$\boxed{P.Err1}$:Data is abnormal while copying.

→Press $\boxed{STOP}$ switch for clearing, and then copy data again. If data is still abnormal, initialize the Digital key pad and retry.
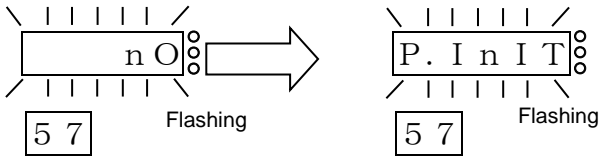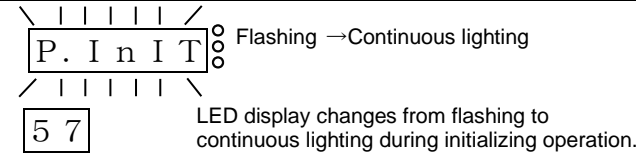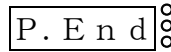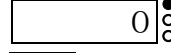
$\boxed{P.Err2}$:Copy error

→This error occurs in an attempt to copy data between products of different function. Press $\boxed{STOP}$ switch for clear.
　Parameters can be copied between the same models, but parameters should be copied between the same output in principle because gain setting is different.

<3 Initializing of data of Digital key pad.>
■When any trouble occurs during copying, it can be often solved by initializing the Digital key pad. (Stored data is cleared by initializing.)

Description of operation	Digital key pad	
	Switch	LED display
Turn on power and call **57** Parameter. (Same operation as 1. [1] and [2])		
[1]$\boxed{P.InIT}$ Choose initialization of data of Digital key pad.	Press $\boxed{\substack{DATA\\SET}}$ Press $\boxed{\wedge}$ once and choose $\boxed{P.InIT}$.	$\boxed{nO}$ Flashing $\boxed{5\ 7}$ ⟹ $\boxed{P.InIT}$ Flashing $\boxed{5\ 7}$
[2]Initialization of Digital key pad	Press $\boxed{\substack{DATA\\SET}}$ for 1 second while holding down $\boxed{STOP}$.	$\boxed{P.InIT}$ Flashing →Continuous lighting $\boxed{5\ 7}$ LED display changes from flashing to continuous lighting during initializing operation.
[3]Wait about 30 seconds.		$\boxed{P.End}$
[4]Initializing of data of Digital key pad completed	Press $\boxed{STOP}$	$\boxed{\qquad 0}\ \overset{\bullet}{\underset{\circ}{\circ}}$ $\boxed{0\ 0}$

■Do not turn off power or disconnect the cable of Digital key pad during operation such as "Reading a parameter from the brushless amplifier to the Digital key pad", "Copying a parameter value stored in the Digital key pad to the brushless amplifier", and "Initializing the data of Digital key pad".

10. Operation mode

This series has the following operation modes.
Please choose operation mode with a parameter " **32** Operation mode selection."

Operation mode	Function of a terminal					Selection value of " **32** Operation mode selection."
	I 1	I 2	I 3	I 4	I 5	
1st speed operation mode	RUN/ STOP	CW/CCW ※1		Free-run stop, External forced trip, 2nd acceleration / deceleration time, Trip reset		1 [Factory default]
2nd speed operation mode	RUN/ STOP	CW/CCW ※1				2
4th speed operation mode	RUN/ STOP	CW/CCW ※1	Speed setting selection			4
8th speed operation mode	RUN/ STOP	CW/CCW ※1				8

Please choose
Function of 「I1」 「I2」 terminal with a parameter " **33** I1/I2 function selection"
See 8. The functionof parameters on page 8 for detail.
Function of 「I3」
・In the case of 1 st speed operation mode, please choose.
Function of 「I3」 terminal with a parameter " **34** I3 function selection"
・In the case of 2nd speed operation mode, speed setting selection can be carried out by
"short" / "open" of the terminal I3.
When a terminal is opening, Internal speed (0-th speed) is chosen, and it speed is set by
the parameter " **00** Internal speed (0-th speed)" or FIN (analog voltage instructions).
(Please select PnL (setting by parameter) or Vol-A (setting by analog voltage) by " **31**
speed instruction selection".)

※1 CW: Rotation clockwise when seen from the motor shaft, CCW: Rotation counterclockwise when
see from the motor shaft.

■Example of running pattern by use of 2nd acceleration / deceleration time
When you choose " **32** Operation mode selection" at [1] : 1st speed operation mode,
Choose " **33** I1/I2 function selection " at [rS.Fr] : (RUNSTOP, FORWARD-REVERSE) , and
Choose " **34** I3 function selection " at [U-d] : 2nd acceleration and deceleration time.

1st acceleration time
Internal speed
(0-th speed)
1st deceleration time
2nd acceleration time
2nd deceleration time
C C W
C W
Zero-speed control
Zero-speed control
Run/Stop switch (I 1)
CCW/CW switch (I 2)
2nd acceleration / deceleration time (I 3)
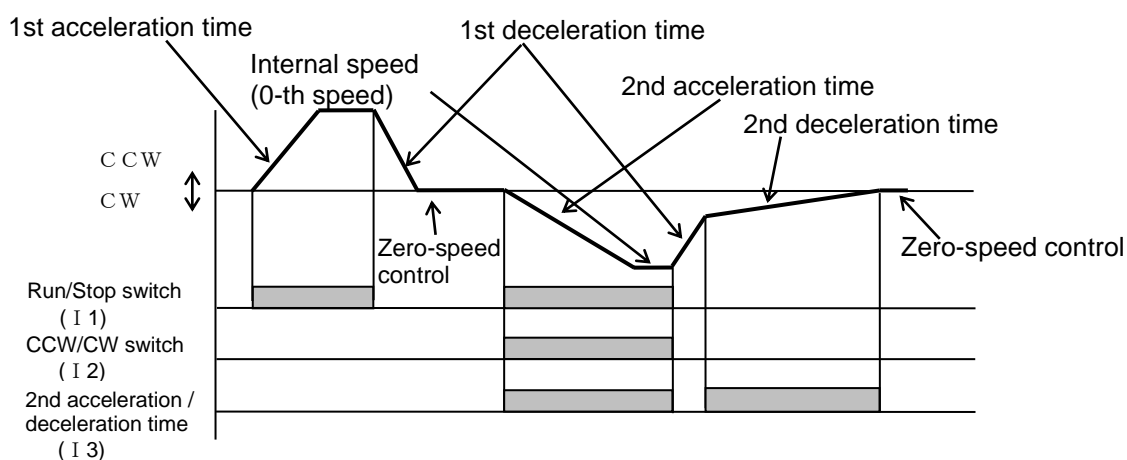
■Example of operation pattern in 2nd speed operation mode

When you choose " **32** Operation mode selection" at [2] : 2nd speed operation mode,
"I3" is choosing of speed setting, and works as follows:

I 3	**Speed setup**
OFF	Internal speed (0-th speed) or FIN
ON	1st speed

1st acceleration time
1st speed
Internal speed (0-th speed)
1st deceleration time
C C W
C W
Zero-speed control
Run/Stop switch (I 1)
CCW/CW switch (I 2)
1st speed (I 3)
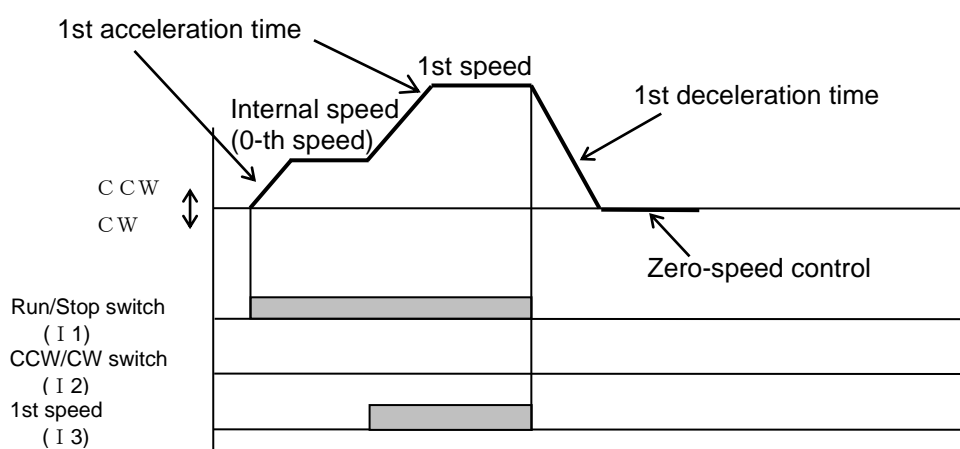
11 Protective functions / How to clear trip

11.1 List of protective functions

■**Description of trip can be displayed only when the Digital key pad (option) is connected. Protection function works even when the Digital key pad is not connected, but it is not displayed.**

Trip number	Protective item	Description	Measure	Display on Digital key pad
Other number	System error	The brushless amplifier trips when trouble of control microcomputer is detected.	①Malfunction due to external noise is possible. Investigate for noise source in the vicinity and eliminate such source. ②Internal circuit may be in failure.	**Err**
1	Sensor error	The brushless amplifier trips when trouble of CS sensor signal is detected.		**E-CS**
―	Undervoltage warning (default)	When the internal DC voltage is below specified value, operation is stopped; when voltage is recovered, operation is started again. (This is not trip, and no trip output is made.) ■**Trip can be set by parameter 50.** Approx DC100 V,	Investigate the condition of wiring and circumstances of power supply.	**L**
2	Undervoltage error	The brushless amplifier trips when internal DC voltage is below specified value **only if trip is set by parameter 50**. Approx DC100 V,		**E-LV**
3	Overvoltage error	The brushless amplifier trips when internal DC voltage (voltage of smoothing function of power supply) rises and exceeds specified value. Approx DC200V,	If the motor should trip in running, too short deceleration time is one of the causes. Adjust deceleration time. No measure can be taken in continuous regenerative operation such as lowering.	**E-OV**
―	Overload warning (Electronic thermal)	When load factor exceeds specified value, the electronic thermal relay operates and monitor display flashes. It is a warning for electronic thermal trip. 100 %	Reduce the load. Check the load factor in monitor mode.	5-digit LED flashes.
4	Overload error (Electronic thermal relay)	The brushless amplifier trips when torque reference is output continuously above specified value. 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.	**THr**
5	Overspeed error	The brushless amplifier trips when rotation speed (actual speed) exceeds specified value. Approx 6000 r /min	Ensure that the actual speed does not exceed rated rotation speed, such as overshooting by unmatching between load and gain.	**E-OS**
8	Overcurrent error	The brushless amplifier trips when the motor current exceeds specified current.	Excessive acceleration / deceleration setting or gain setting is possible. Set the longer acceleration / deceleration time and the smaller gain. If this trip should occur as soon as the unit is started, failure is possible.	**E-OC**

Trip number	Protective item	Description	Measure	Display on Digital key pad
9	Overheat error	The brushless amplifier motor trips when the temperature in control section rises above specified value. Approx 105 °C	Check the ambient temperature and cooling condition of brushless amplifier. Check the load factor. If the ambient temperature is low enough, and the protection occurs soon after power-on, failure is possible.	**E-OH**
10	External forced trip	The brushless amplifier trips when external forced trip input turns on.	Turn off external trip input, and reset trip.	**E-OL**
11	Setting change warning	The brushless amplifier trips when any important parameter such as " 30 Run command selection" is changed.	This is not abnormal. Reset trip in order to make change effective.	**CAU**
12	RS485 communication error	The motor trips when communication error of RS485 communication function occurs.	Check for noise problem in the vicinity.	**E-485**
30	Parameter initialization display	" 54 Parameter initialization" YES (1) is chosen and a trip is carried out after turning off a power supply at the time of a power supply re-injection.	This is not abnormal. The parameter was initialized. It is clearable only by power supply re-injection.	**-----**
90	User parameter error	Parameter data saved in EEPROM is abnormal.	Check all parameters again and set them again. If this protection works frequently, failure is possible	**E-UPr**
91	System parameter error	Internal parameter data saved in EEPROM is abnormal.	Failure is possible.	**E-SPr**

Time charactoristics of over load protection
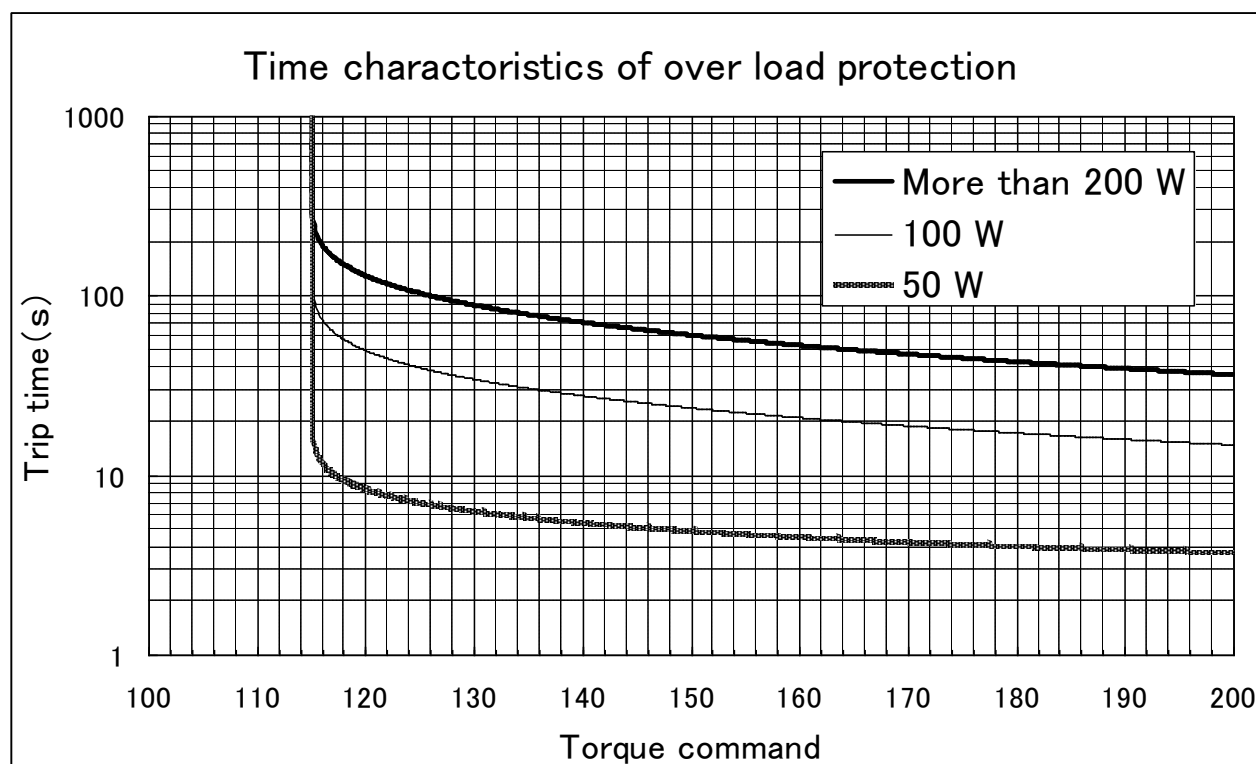
11.2 How to clear trip.

If the brushless amplifier should trip, eliminate the cause and use <u>any of the procedures</u> [1] – [5] below for reset.

[1] Turn off power, and when power LED has gone out, turn on power again.

[2] Press the switch $\boxed{\wedge}$ and $\boxed{\vee}$ of the Digital key pad simultaneously for one second or more with present trip state displayed.

[3] Input the trip reset signal.

(When $\boxed{\text{F-r}}$ or $\boxed{\text{r-F}}$ is chosen in " **33** I1/I2 function selection", enter "I1" and "I2" at the same time; when $\boxed{\text{F-rST}}$ or $\boxed{\text{r-rST}}$ is chosen, enter "I2" for trip reset.

Trip reset signal, when continued to be input, is designed to become ineffective in order to prevent inadvertent restarting. Enter trip reset signal only when necessary.)

[4] 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.

[5] Resetting trip via RS485 communication
Refer to section "Communication" starting with P.53.

Note: As for overcurrent error $\boxed{\text{E-OC}}$, sensor error $\boxed{\text{E-CS}}$, system error $\boxed{\text{Err}}$, and user parameter error $\boxed{\text{E-Upr}}$, reset them by turning off power as shown in [1] above. No other procedure is effective.

(Caution) In clear trip, be sure to find and remove the trip factor before clear.
*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.

12. Troubleshooting

If any trouble should be found, follow the steps below for check and countermeasure.

●If the cause cannot be found, it is recommended to use the Digital key pad and check the detail of trip. If failure is likely, or when any part is damaged, or when you are in any other trouble, contact the sales agent of purchase or our company.

Phenomenon	Detail of checking	Measure, etc
Motor does not rotate.	Check for abnormality of wiring.	Apply proper wiring.
	Check whether protective function is activated. Check whether alarm LED (red) is on.	Check the detail of trip by the Digital key pad. Turn off power once, and turn on again.
	(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 operation start signal is input.	Check the condition of operation instruction.
	Check whether analogue speed instruction is set at 0V.	Raise the analogue speed instruction little by little.
Motor does not rotate or stops during operation.	Check whether protective function is activated. Check whether alarm LED (red) is on.	Overload is possible. Reduce the load or increase the output capacity.
Motor stops during deceleration.	Check whether the inertia of load is too large.	Regenerative voltage protection may have worked. Decrease the inertia. Turn off power once, and turn on again, and reset the trip state. Make deceleration time longer by the Digital key pad. Alternatively, apply free-run stop.
Motor does not stop quickly when stop command is input	The motor with large inertia does not stop quickly because default stop mode is Free-run stop.	Stop motor by 0 V analogue speed command. Change stop mode to deceleration stop by Digital key pad.
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.
Motor rotates reversely.	Check whether setting of rotation direction changeover input is wrong.	Check the position of rotation direction choosing switch for the console - A. As for others, check the status of "I2".
Rotation speed is unstable during operation (actual speed).	Check whether the load fluctuates greatly.	Reduce the fluctuation of load. Increase the output capacity.
Parameter dose not change.	Check whether operation start signal is input.	Some parameters cannot be changed when operation instruction is on. (See the check column of parameter list on page 6.) Turn off operation instruction before changing.

13. Conformance to overseas standard

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

EMC Directives
EN 61800-3
Our brushless motor and brushless amplifier can meet EMC Directives and related standards. However, to meet these requirements, the systems must be limited with respect to configuration and other aspects, e.g. the installation and some special wiring conditions must be met. This means that in some cases machines and equipment comprising our brushless motor and brushless amplifier may not satisfy the requirements for wiring and grounding conditions specified by the EMC Directives. Therefore, conformance to the EMC Directives (especially the requirements for emission noise and noise terminal voltage) should be examined based on the final products that include our system.

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 1 equipment Pollution degree 2 ＊1	E166557 E164620
CE/ UKCA	EN61800-5-1	Adjustable speed electrical power drive systems (Safety requirements— Electrical, thermal and energy)	Overvoltage category II Class I equipment Pollution degree 2 Group 1, Class A and Category Ⅲ, 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		
	IEC61000-4-2	Electrostatics Discharge Immunity Test		
	IEC61000-4-3	Radio Frequency Electromagnetic Field Immunity Test		
	IEC61000-4-4	Electric high-speed transient phenomenon/burst immunity test		
	IEC61000-4-5	Lightening Surge Immunity Test		
	IEC61000-4-6	High Frequency Conduction Immunity Test		
	IEC61000-4-11	Instantaneous Outage-Immunity Test		
KC	Radio Waves Act (South Korea)＊2	Broadcasting and Communication Equipments	-	-

＊1 Motor over-temperature protection is not provided.
　　Motor over-load-temperature protection shall be provided at the final installation upon required by the NEC (National Electric Code).
　SCCR: 5,000 rms symmetrical amperes, 240 Volts maximum.
＊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)

13.1 Configuration of peripheral equipment

Power supply	Single phase 100 V – 120 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.

13.2 Wiring of peripheral equipment
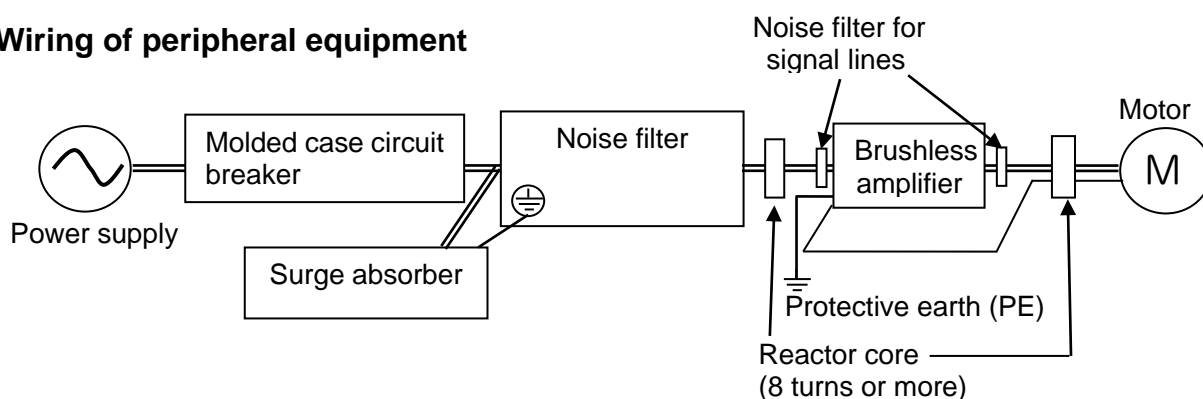
13.3 List of compatible peripheral equipment

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/

14. Communication spec

14-1．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
⑤Resetting trip
```

[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.

14-2．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]
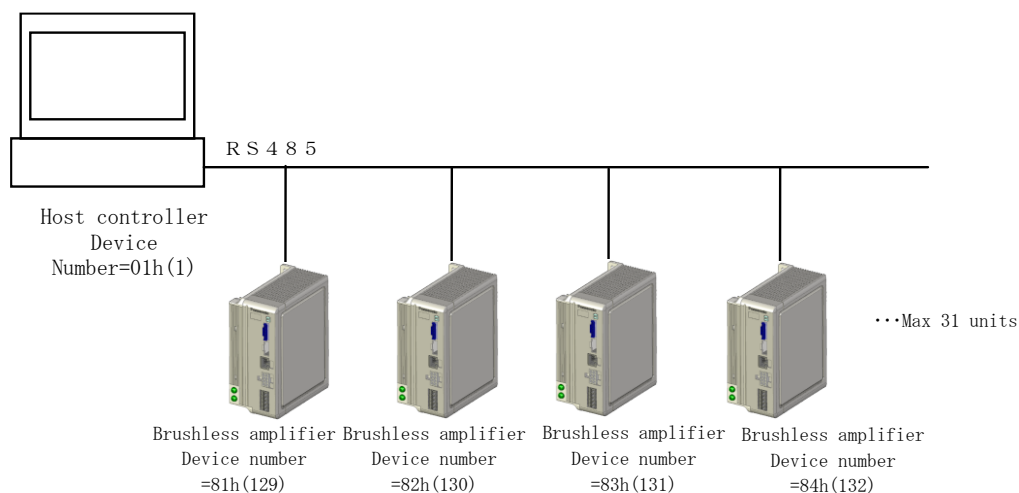
14-3. Interface of connector for communications unit

Equivalent to SN75176

Host (01h)

Motor 1 (81h)

Twisted pair wire

Equivalent to SN75176

Motor 2 (82h)
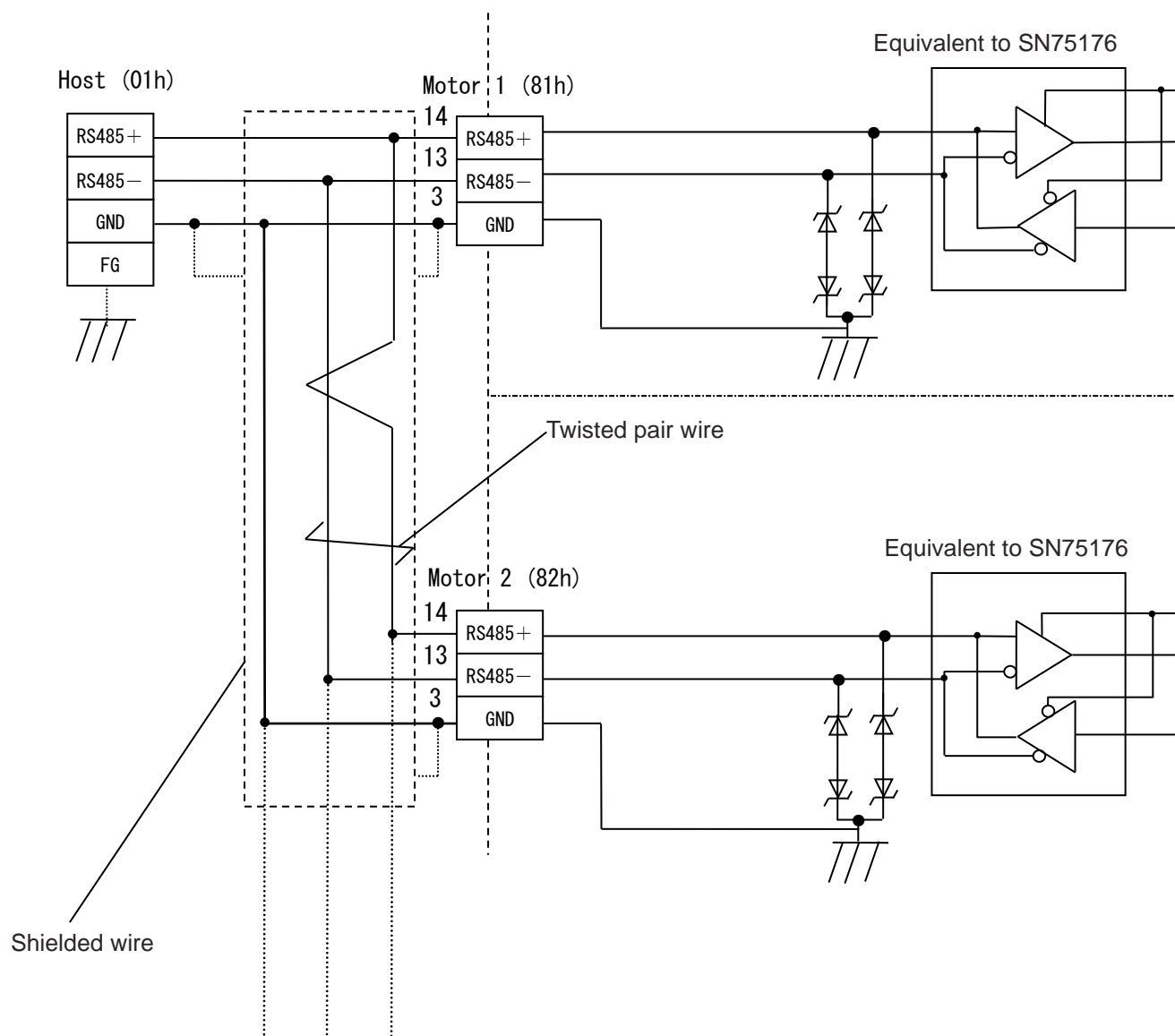
Shielded wire

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

14-4. Communication system

RS485	Half duplex, asynchronous communication method	
Communication baud rate	2400, 4800, 9600bps	Set by Pr5b
Data	7 bits, 8 bits	Set by Pr5C
Parity	None, even number, or odd number	Set by Pr5C
Start bit	1 bit	
Stop bit	1 bit, 2 bits	Set by Pr5C
Host address	01h – 1Fh	
Amplifier address	80h – 9Fh (80h for simultaneous transmission.)	Set by Pr5A

·Modification of transmission parameters (Pr5A – 5F) 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.

14-5. List of data number related to communications

(1) Parameter: 8000h – 805Fh

Lower 2 figures show parameter number. (e.g. :parameter Pr.10 = database 8010h)

＊NAK is answered while the amplifier detects undervoltage error, and change of a parameter and preservation to EEPROM are not performed.

＊Please refer to "10. The function of a parameter" about the contents and the detail function of a parameter.

＊Please do not perform data communications to any addresses (parameter) other than the address mentioned in this specifications.

＊Time required for data transmission per byte is calculated by the following formula for example in the case of 9600 [bps], 8 bits, parity present (even number or odd number), and stop bit 1:

(1000 / 9600) ´ (1 + 8 + 1 + 1) = 1.14 [ms/byte]

Time is 4.58 [ms/byte] for 2400 [bps], and 2.29 [ms/byte] for 4800 [bps].

Note, however, actual communication time will be added time necessary for processing received command, and switching between a line and transmission/reception control.

Address	Pr No. ＊1	Parameter name	Data value	Default	Upper limit	Lower limit	Note
8000h	0	Internal speed (0-th speed)	0 – " 803Bh:Upper speed limit "	0000h (0)	＊2	0000h (0)	
8001h	1	1st speed		0BB8h (3000)	＊2	0000h (0)	
8002h	2	2nd speed		0B40h (1200)	＊2	0000h (0)	
8003h	3	3rd speed		0258h (600)	＊2	0000h (0)	
8004h ∼ 8007h	4 ∼ 7	4th speed ∼ 7th speed		0000h (0000)	＊2	0000h (0)	
8010h	10	1st acceleration time	1 - 30000 (0.01s) 1 - 299: input value - it remains as it is (0.01s above - less than 3s) 300 - 2999: Lower 1-figure omission (3s above - less than 30s) 3000 - 30000: Lower 2-figure omission (30s above - 300s or less) e.g.) input value 100 (1.00s) → 100 (1.00s) 555 (5.55s) → 550 (5.50s) 3678 (36.78) → 3600 (36.00s)	001Eh (0.3s)	7530h (300s)	0001h (0.01s)	＊3
8011h	11	2nd acceleration time		001Eh (0.3s)	7530h (300s)	0001h (0.01s)	＊3
8012h	12	1st deceleration time		001Eh (0.3s)	7530h (300s)	0001h (0.01s)	＊3
8013h	13	2nd deceleration time		001Eh (0.3s)	7530h (300s)	0001h (0.01s)	＊3
8014h	14	Acceleration mode selection	0: Linear, 1: S shape-1, 2: S shape-2	0000h	0002h	0000h	
8015h	15	Deceleration mode selection		0000h			
8016h	16	Stop mode selection	0: Free-run stop, 1: Speed reduction stop	0001h	0001h	0000h	
8017h	17	Free-run waiting time	0 - 100 (0.1s)	000Ah	0064h	0000h	
801Ah	1A	Velocity loop proportional gain	0 - 10000	00FAh	2710h	0000h	
801Bh	1b	Velocity loop integration gain	0 - 10000	01F4h	2710h	0000h	
8030h	30	Run command selection	0: Digital keypad, 1: Terminal, 2: RS485 communication	0001h	0002h	0000h	＊6
8031h	31	Speed command selection	0: Digital keypad, 1: Vol-A	0001h	0001h	0000h	＊6
8032h	32	Operation mode selection	1: 1 speed mode, 2: 2 speed mode 3: 4 speed mode, 4:8 speed mode	0001h	0004h	0001h	＊6

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

＊2) Upper limit is dependent on " 803Bh:Upper speed limit ". It is restricted by the value of " 803Bh:Upper speed limit " when the value exceeding " 803Bh:Upper speed limit " is set.

＊3) As for the input value more than 3 second (300), lower 1 figure is omitted. In more than 30 second (3000), lower 2 figures are omitted.

＊6) It can change when motor stop. NAK will be returned if it rewrites when motor running. Moreover, since the amplifier is tripped for safety after parameter is changed, when you operate continuously, please transmits the trip reset instructions mentioned later.

Address	Pr No. *1	Parameter name	Data value	Default	Upper limit	Lower limit	Note
8033h	33	I1/I2 function selection	0: I1-CCW run/stop, I2-CW run/stop 1: I1-CW run/stop, I2-CCW run/stop 2: I1-run/stop, I2-CW /CCW direction 3: I1-CCW run/stop, I2-Trip reset 4: I1-CW run/stop, I2-Trip reset	0002h	0004h	0000h	*6
8034h	34	I3 function selection	0: Free run, 1: External forced trip, 2: 2nd acceleration / deceleration, 3: Trip reset	0000h	0003h	0000h	*6
8035h	35	I4 function selection	0: Free run, 1: External forced trip, 2: 2nd acceleration / deceleration, 3: Trip reset	0003h	0003h	0000h	*6
8036h	36	I5 function selection	0: Free run, 1: External forced trip, 2: 2nd acceleration / deceleration, 3: Trip reset	0000h	0003h	0000h	*6
803Ah	3A	Lower speed limit	0 – " 803Bh:Upper speed limit "	0000h	*2	0000h	*6
803Bh	3b	Upper speed limit	0 – 4000 (r/min)	0FA0h	0FA0h	0000h	*6
803Ch	3C	Torque limit	0 – 150	0096h	0096h	0000h	
8040h	40	O1 function selection	0: Trip, 1: Arriving, 2: Running, 3: Free-run, 4: CCW run, 5: CW run, 6: Overload detection, 7: Speed pulse signal	0000h	0007h	0000h	
8041h	41	O2 function selection		0007h	0007h	0000h	
8042h	42	O1 output polarity selection	0: Normal, 1: Reverse	0000h	0001h	0000h	
8043h	43	O2 output polarity selection		0000h	0001h	0000h	
8044h	44	Speed matching range	20 – " 803Bh:Upper speed limit "	0032h	*2	0000h	
8045h	45	Output pulse count selection	0:1, 1:2, 2:3, 3:4, 4:6, 5:8, 6:12, 7:24	0007h	0007h	0000h	
8046h	46	Monitor mode switching	0: Rotation speed (Actual speed), 1: Torque reference, 2: Load factor, 3: Command speed, 4: Internal DC voltage	0000h	0004h	0000h	
8047h	47	Numerator of display magnification factor	0 – " 8048h: Denominator of display magnification factor " x 10	0001h	*7	0000h	
8048h	48	Denominator of display magnification factor	0 - 1000	0001h	03E8h	0000h	
804Bh	4b	Trip history 1	0: No history, 1: Sensor error, 2: Undervoltage, 3: Undervoltage, 4: Overload, 5: Overspeed, 8: Overcurrent, 9: Overheat, 10: External forced trip, 12: RS485 communication error, 90: User parameter error, 91: System parameter error, Other numbers: System error,	0000h	005Eh	0000h	*8
804Ch	4C	Trip history 2		0000h	005Eh	0000h	*8
804Dh	4d	Trip history 3		0000h	005Eh	0000h	*8
804Eh	4E	Trip history 4		0000h	005Eh	0000h	*8
804Fh	4F	Trip history 5		0000h	005Eh	0000h	*8
8050h	50	Undervoltage trip selection	0:No trip, 1:Trip	0000h	0001h	0000h	*6
8051h	51	Retrial selection	0:No retry, 1 - 4:Retry count	0000h	0004h	0000h	*6

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

*2) Upper limit is dependent on " 803Bh:Upper speed limit ". It is restricted by the value of " 803Bh:Upper speed limit " when the value exceeding " 803Bh:Upper speed limit " is set.

*6) It can change when motor stop. NAK will be returned if it rewrites when motor running. Moreover, since the amplifier is tripped for safety after parameter is changed, when you operate continuously, please transmits the trip reset instructions mentioned later.

*7) Maximum value is dependent on " 8048h: Denominator of display magnification factor ". It is restricted by the value of " 8048h: Denominator of display magnification factor " x 10 when the value more than " 8048h: Denominator of display magnification factor " x 10 is set up.

*8) It can't be changed, when rewriting is done, NAK is answered. Rewriting returns NAK.

*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.

Address	Pr No. *1	Parameter name	Data value	Default	Upper limit	Lower limit	Note
8052h	52	Retrial start time	1 – 120 (s)	0005h	0078h	0001h	
8054h	54	Parameter initializing	0:No operation, 1:Initialize to default	0000h	0001h	0000h	*11
805Ah	5A	RS485 device number	80h – 9Fh	0081h	009Fh	0080h	*9*10
805Bh	5b	RS485 communication speed	0: 2400bps, 1: 4800bps, 2: 9600bps	0002h	0002h	0000h	*9
805Ch	5C	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	000Bh	0000h	*9
805Dh	5d	RS485 communication response time	10 – 1000 (ms)	000Ah	03E8h	0005h	*9
805Eh	5E	RS485 retry times of communication	0 – 8: Retry count, 9: No retry	0009h	0009h	0008h	*9
805Fh	5F	RS485 protocol timeout	1 – 255 (s)	0002h	00FFh	0001h	*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.
*11) Change this parameter to "1: Initialize to default " and write to EEPROM by $S command.
　　　After writing to EEPROM, parameter is initialized when power is turned off once and turned on again after 10 seconds.
　　　When writing to EEPROM is not done, parameter is not initialized after power is supplied.

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

These are parameters to get amplifier status or to give commands to the amplifier. Refer to P.44 "Communication command" for detail.

14-6. 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

Command	Code	Transmission direction	Description
$P	24h 50h	Host → Amplifier	Data writing command. Change of parameter and motor control data. (In changing parameter, parameter is not written to EEPROM.)
$S	24h 53h	Host → Amplifier	Data writing command. Change of parameter and motor control data. (In changing parameter, parameter is written to EEPROM.) *Writing to EEPROM should be requisite minimum. (EEPROM endurance: approx. 100,000 write cycle.)
$R	24h 52h	Host → Amplifier	Data reading request command. Command which requests the parameter, status, and control detail of 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 38.

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.

14-7. 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)
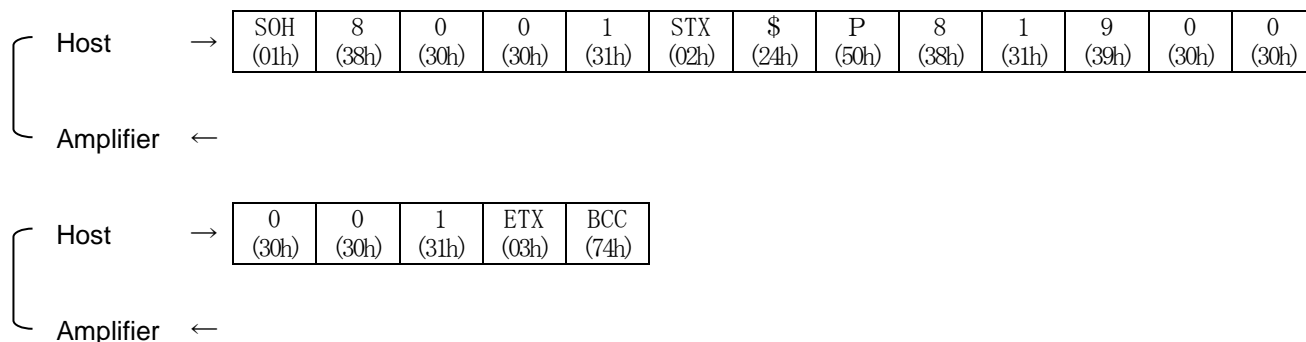
Amplifier ←

・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)
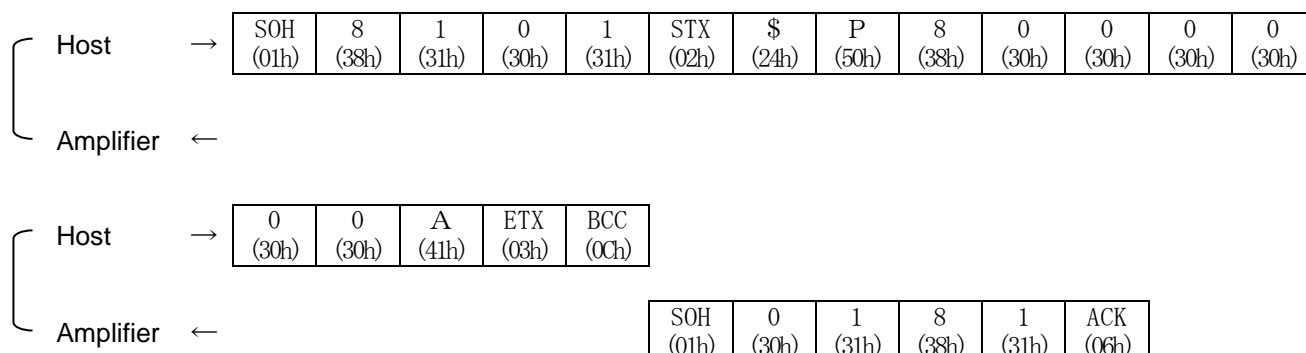
●Example of reading parameter (reading data)

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)

14-8. Communication timing
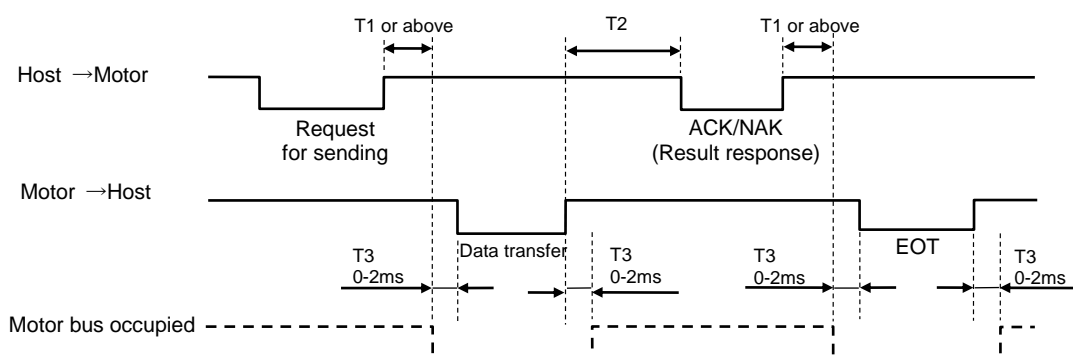
Symbol	Name	Value
T1	Communication response time (Amplifier)	Set by Pr5d.
T2	Communication response time (Host)	Take interval 10ms or longer.
T3	Data emitting time from amplifier to host after bus is	0 - 2ms

<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 Pr5F "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 (Pr5E), 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 Pr5F "Protocol timeout".

<Communication establishing time when power is turned on>
Establishment communication takes about 800ms 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]
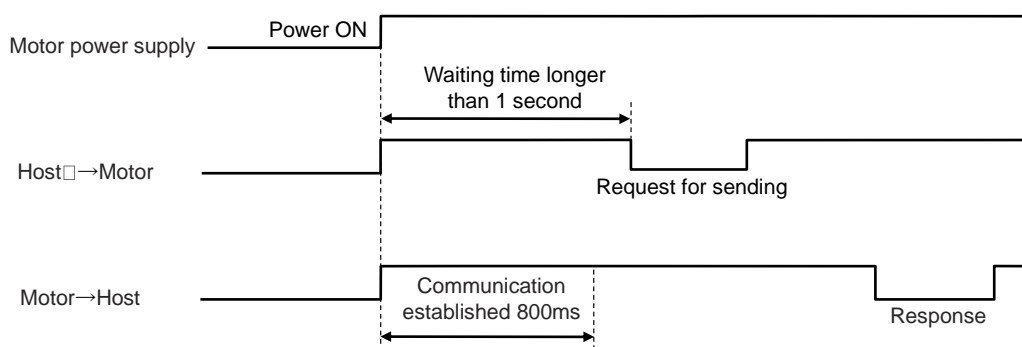
14-9. Communication command

Data number	Applicable command on host side	Description
8000h – 805Fh	$P/$S/$R	Parameter
8103h	$R	Amplifier status
8104h	$R	Model code 1
8105h	$R	Model code 2
8110h	$R	Rotation speed (actual speed)
8111h	$R	Commanded speed
8112h	$R	Internal DC voltage
8113h	$R	Torque reference
8114h	$R	Load factor
8120h	$R	Detail of trip
8130h	$R	Input terminal status
8131h	$R	Output terminal status
8180h	$P/$S	Run command
8181h	$P/$S	Free-run stop command
8190h	$P/$S	Trip reset
8191h	$P/$S	Forced trip
8192h	$P/$S	Trip history clear
81B0h	$P/$S	Parameter EEPROM writing

14-10. Communication command in detail

8000h - 805Fh: 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 Pr5A) 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 Pr5C)
・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 Pr5A) 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 Pr5C)
・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 Pr5C). 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	0	0	0	0
D4	0	Running	Speed attainment	Trip state

Detail above is converted into hexadecimal and represented in ASCII code.
e.g.) Data value = 30h 30h 30h 34h = '0004' = 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') = 35h41h31h42h='5A1B'

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

●$R: Speed reading request command

Received data (Host →Amplifier)

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

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

●#R: Speed response command

Transmission data (Amplifier →Host)

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

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

8112h: Internal DC voltage

●$R: Internal DC voltage reading request command

Received data (Host →Amplifier)

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

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

●#R: Internal DC voltage response command

Transmission data (Amplifier →Host)

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

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

8113h: Torque 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

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 page 28.)
  When the trip number is 0, it indicates that no tripping has occurred.
  e.g.) Data value = 30h 30h 30h 41h = '000A' = 10 = External forced trip
・Trip history can be read out with parameter (Pr4b - 4F).

8130h: Input terminal status

●$R: Input terminal status reading request command

Received data (Host →Amplifier)

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

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

●#R: Input terminal status response command

Transmission data (Amplifier →Host)

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

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

[Status of input terminal]

	Bit 3	Bit 2	Bit 1	Bit 0
D1	0	0	0	0
D2	0	0	0	0
D3	0	0	0	0
D4	0	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 Pr30 set at "2" (Command through RS485), this command enables sending run command to the amplifier. At this time, point selection or run command cannot be given through I/O. (See Ⅰ1/Ⅰ2 function selection on page 13.)
When Pr30 is "1" (command through I/O) and "0" (Digital keypad), 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	0	0	0	0
D2	0	0	0	0
D3	0	0	0	0
D4	0	0	Ⅰ2	Ⅰ1

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.

8181h: Free-run stop command

●$P/$S: Free-run stop command

Received data (Host →Amplifier)

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

・When the amplifier is powered on with Pr30 set at "2" (Command through RS485), this command enables sending free-run stop command to the amplifier.
 When Pr30 is "1" (command through I/O) and "0" (Digital keypad), free-run stop command by this command is ignored.
・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.
・When data value is other than '0000' and '0001', NAK is answered.
・A motor cannot be driven after free run stop instructions until it transmits operation is possible (free run release).
 e.g.) Data value = 30h 30h 30h 31h = '0001' = Free-run stop command is on.

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.)

⚠ Safety precautions

15. Safety precautions

Observe the following precaution in order to avoid electric shock and injures of operators and other persons, and fire.

15.1 Don't use in the condition out of specification and name plate indication.

15.2 Use the motor and amplifier in the specified combination.

Safety precaution in transportation and opening package

15.3 Pay much attention to its dropping and falling down at transportation.

15.4 Confirm top and bottom of product before opening package.

15.5 Comply with display on package to avoid package damage when putting on it additionally.

Safety precaution in installation

15.6 Absolutely don't use it in such corrosive circumstance as hydrogen sulfide, sulfur dioxide, erosive gas, chlorine, ammonia, sulfur, gas chloride, gas sulfide, acid, alkali, salt and so on, in flammable circumstance and near flammables.

15.7 Don't store the obstacle not to make airflow through around brushless amplifier.

15.8 In stall it on the nonflammables like steel and so on because it get very high in temperature.

15.9 Make suitable installation to output and weight of brushless amplifier.

15.10 Never place hands inside the brushless amplifier.

15.11 Confirm the rotating direction before coupling the machine.

15.12 Make trial run after mounting it, driving it alone and confirming its performance.

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

15.14 Install the external emergency stop circuit so that the operation can be topped immediately and the power can be shut down.

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

15.16 Connect the earth cable of motor with more than contact condition D class(100 Ω or less, ϕ 1.6 ㎜ or more). Otherwise the electric shock may take place.

15.17 Turn power on after the input voltage is confirmed within the rated range. The input voltage with more than rating causes brushless motor or brushless amplifier to be burned out and smoked inside and get the abnormal noise possibly.

15.18 Make sure brushless motor and brushless amplifier installation is safe to avoid the fatal accident when the earthquake takes place.

15.19 Regenerative resistor gets very hot.
・Please attach the regenerative resistor to non-combustible materials such as metal.
・Please install the regenerative resistor in such place where it cannot be touched directly, or cover it with non-combustible material.
・Please do not install the regenerative resistor near flammable materials.
Built-in thermal fuse of generative resistor is intended to prevent from ignition during the failure of the driver and not intended to suppress the surface temperature of the resistor.

Precaution in wiring

15.20 Wiring must be executed by the electrician inevitably, correctly and surely.

15.21 Connect the lead wire and isolate it with isolation material, correctly and surely.

15.22 Don't expose the cables to sharp edge, excessive pressing force, heavy load or pinching and pulling force.

15.23 Make sure the cables are connected and isolated surely. Otherwise it causes the brushless motor and brushless amplifier to be burned out and out of control.

⚠ Safety precautions

15.24　Turn off the power when wiring to main circuit, control terminal and the earth or disconnecting them.

15.25　Use the commercial power supply for Brushless amplifier inevitably.

15.26　Use a Molded case circuit breaker (MCCB) inevitably to shut down power with safety in emergency.　　　　(Never connect the terminal of brushless amplifier with the cable equipped by the plug)

15.27　Isolate the earth terminal of the extension cable by something like the terminal box or the insulation sleeve not to let human hand touch it.

Safety precaution in operation

15.28　Never touch brushless motor and brushless amplifier and peripheral equipment during operation or for moment after it stops, since they become very hot.

15.29　Ambient temperature of installed brushless motor and brushless amplifier should be under permmitable one.

15.30　Don't lock the output shaft during motor operation, it may cause overheat.

15.31　The power is still on, even if motor stops with stop command. Take extra caution for unexpected restart and so on.

15.32　Turn on and shut down power after the operator makes sure safety is insured around. Don't let someone not in charge operate it

15.33　Don't start and stop by power on and off at specially overload situation. Otherwise the motor may be burned out without protective function because the electronic thermal protector is reset once power is off.

15.34　Don't execute a extreme gain adjustment or change, otherwise operation of the machine causes unstable action.

15.35　Do not turn on or off the power. The failure could result in damages.

15.36　The authorized person should execute power on and off inevitably after confirming the safety in the surrounding. Never let person, who is not in charge, do so.

15.37　Shut down the power inevitably in case of touching the connector since handling motor and CS cable may cause electric shock during power is ON.

15.38　No matter how power is on or off, do not drive the motor shaft from the outside. The failure could result in fire, electric shocks, or damages.

Safety precaution in maintenance

15.39　The expert should maintain and check the equipment.

15.40　Shut down power in case brushless amplifier is not driven for long time. Possibly wrong operation may be taken place.

15.41　Ensure the power breaker is off and then you can check the equipment.

Safety precaution in abnormal situation

15.42　Switch off power when the power failure takes place and the overheat protection is activated.

15.43　Don't use the damaged brushless motor and brushless amplifier.

15.44　Don't be closer to the machine after power comes back after power failure because it restarts suddenly.

15.45　Shut down power and stop brushless amplifier when the abnormal situation takes place.

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

15.47　Secure safety with surrounding environment since motor automatically resumes its running after trip is reset.

15.48　Check safety of motor installation and machine when driving motor after earthquake and operate it.

⚠ Safety precautions

Other safety precaution

15.49   Switch off power during installing, moving, wiring and checking.

15.50   Never get on and put a heavy staff on the motor.

15.51   Don't apply a strong impact force to the brushless motor and brushless amplifier.

15.52   Carry out disassembly and repair it by the qualified through Panasonic and Panasonic itself.

15.53   Don't modify the brushless amplifier that is subject to being out of warranty.

15.54   Consider safety secure within possible operation range in the place where it is driven and fail safe design from your side. Because it is driven abnormally by unexpected external noise, static voltage and failure of input voltage, wiring and components even though a lot of paying attention and effort to quality is done before shipping.

15.55   This product should be treated as the industrial wastes when it is disposed.

16. Precautions in use

16.1   Confirm the noise resistance with your machine inevitably, because it can be varied, based upon wiring and other condition.

16.2   Don't make overload running with exceeding brushless motor and brushless amplifier rated output, or it may case its damage or short lifetime.

16.3   Leakage current increases while brushless motor and brushless amplifier is running, and it may activate a leakage current breaker occasionally.
In this case equip the leakage current breaker with high frequency countermeasure for brushless amplifier in self and other line

16.4   The electromagnetic noise from brushless motor and brushless amplifier takes place on input and output line and may influence the electronic equipment while it is operated. In this case installing the noise filter on input line of brushless amplifier and shielding the cables with the metal pipe can suppress this influence.

16.5   Perform insulation test to main circuit as per the figure below and don't execute it to control one. When performing insulation test to brushless amplifier itself and other external circuit, take off all terminals of main circuit so that no test voltage may be applied to brushless amplifier. Double check whether it is more than $1M\Omega$ by DC500V insulation tester in case of insulation test.
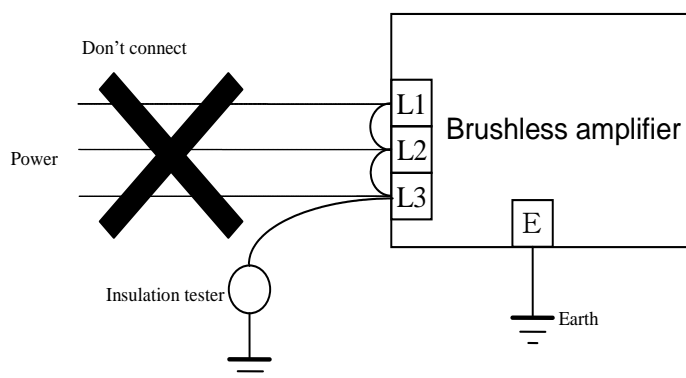
16.6   Be sure the connector is connected properly. Improper connection may cause heating.

16.7   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.

16.8   Keep direction of cable outlet as low as possible for oil and water proof.

16.9   Contact us in case of using brushless motor and brushless amplifier in special circumstance like unclear control, machine for space, facilities of travel, medical equipment, safety equipment.

16.10   The bearing noise may get increased by the electric corrosion, based upon the actual machine and mounting condition like fan driving. Therefore, confirm and verify it in your side.

17. Precaution in wiring

1) Main circuit

    1. Shut down power inevitably in case of wiring the main circuit, earth and control terminal and unwiring them.

    2. Install the Molded case circuit breaker (MCCB) by the following standard wiring diagram when d riving brushless amplifier.

    3. The lead (Green/Yellow) is the frame ground (FG). Ensure the earth contact is D class(100Ω or less, φ1.6mm or more)

2) Control circuit

    1. Don't apply voltage with more than DC30V, current with more than 50mA or reverse one to the output terminal.

    2. Don't apply the external voltage to the input terminal (I1, I2, I3) and the power terminal for analogue input (+5V).

    3. Integrate the flywheel diode (FD) when directly driving the relay by the output terminal (O1, O2-GND). (See the figure below)
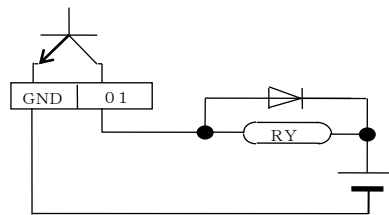
    4. Use the twist-pair or shield cable as cable connected with the control circuit.

    5. Please ground the shield of the shield line.

    6. Separate the cable connected with the control circuit from the power line as far as possible.

18. Confirmed items

    18.1   Make sure that your machine matches this product when changing the specification of yours to be used with it.

    18.2   Remark in case of exporting this product and the machine which has it
Take full examination and necessary exporting procedure when exporting this product since [Foreign exchange and Foreign exchange control law] may be applied in case the end user and application are related to the military, weapon and so on.

    18.3   You are responsible for judging whether or not the machine and component match to the structure, dimension, service life, characteristics directive and so on.

    18.4   You are responsible for judging the conformity of this product with your machine to be used with it in terms of the regulation and directive.

    18.5   There may be possibility that burning, smoking or dust out of motor takes place because of brushless motor and brushless amplifier failure. For example,

        ① In case brushless motor gets overload situation by its stalling under a certain reason so that brushless amplifier protection don't work.

        ② In case insulation is failed in the winding wire of brushless amplifier so that the overcurrent protection or short circuit protection to the earth don't work properly.

19. Other remarks

19.1   Don't use this product in the place where it is exposed to direct sunshine and oil.
19.2   Don't use this product in the place with sever vibration, impact force and a lot of dust, an also in such corrosive circumstance as hydrogen sulfide, sulfur dioxide, erosive gas, chlorine, ammonia, sulfur, gas chloride, gas sulfide, acid, alkali, salt and so on.
19.3   Don't store this product in the place where it is exposed to rain water, water drop, harmful gas or liquid.
19.4   Store this product in the place where there is no sunlight, under control with a certain range of temperature.
19.5   Apply adequate tightening torque to the product mounting screw by taking into consideration strength of the screw and the characteristics of material to which the product is installed. Over tightening can damage the screw and/or material; under tightening can result in loosening.
    Example) Steel screw (M4) into steel section: 1.35-1.65 N·m. Steel screw (M5) into steel section: 2.7-3.3 N·m.
19.6   Don't take out the nameplate.
19.7   Confirm whether or not it is requested after receiving it.

20. General precautions

20.1   This product is standard. Our changing specification may be done without notification.
20.2   Be careful that we can't guarantee this product when exceeding the range of specification.