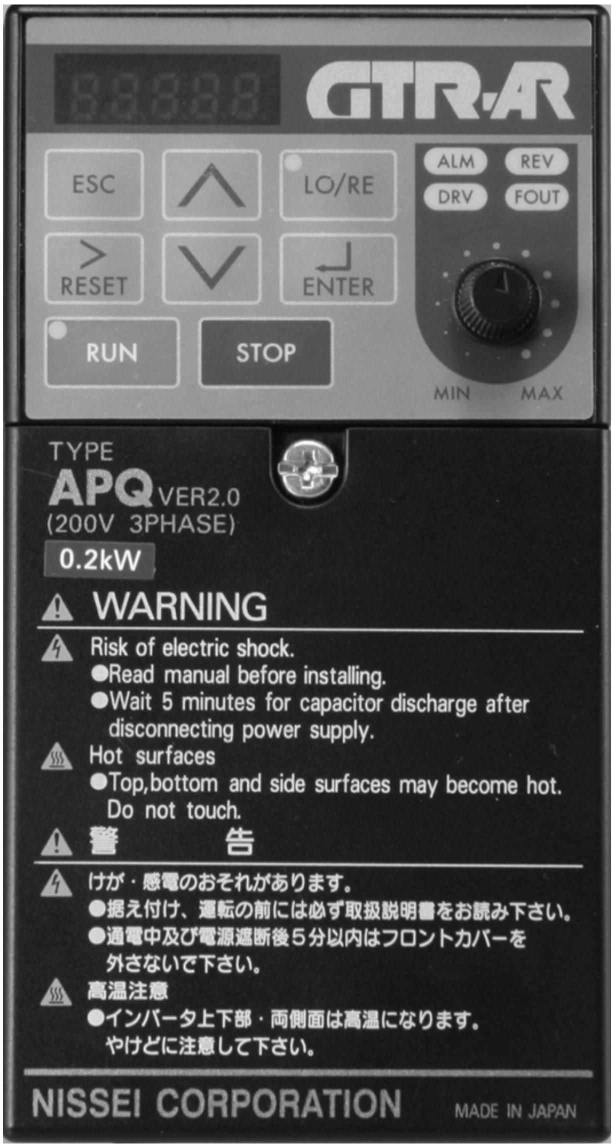
GTR - AR Series

APQ VER2 Driver

Instruction manual



Introduction

Congratulations on your purchase of GTR-AR Series (APQ VER2 driver).
Read the instruction manual to ensure proper operation of the product.

- The contents of this manual are subject to change without prior notice.
- Feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for improving the manual.

For safe operations

- Thoroughly read and understand this manual before operating the product. Note that Nissei Corporation shall not be responsible for and shall not give any warranty for damages caused because of not following these caution points.
- Deliver this instruction manual to the end user of this product.
- Keep this manual at a convenient place so that the operator can easily refer to it.
- Possible injuries and damages caused due to mishandling of the product are basically classified into two categories, "Danger" and "Caution". Following is the definition and representation of "Danger" and "Caution":

Danger	Mishandling of the product may lead to dangerous situations, possibly resulting in death or serious bodily injuries
Caution	Mishandling of the product may lead to dangerous situations, resulting in moderate or minor injuries, and property damage

Note that points mentioned under "Caution" can also result into serious consequences depending on the situation. The safety precautions mentioned here are of utmost importance and must be observed at all times.

Danger

(General)

- Do not use the product in an explosive environment. Negligence may cause explosion, ignition of fire, fire, electric shock, injuries, and damage to the device.
- Do not operate the product when power supply is on. Before operating, turn off the power supply. Negligence may cause electric shock.
- The operators in charge of transportation, installation, wiring, operation, handling, maintenance, and inspection should have enough knowledge and technical skill related to the product. Negligence may cause explosion, ignition of fire, fire, electric shock, injuries, and damage to the device.
- If the product is used in a device such as a personnel transport device, make sure to install a protective device for safety purpose. Negligence may cause accidents leading to injuries or death, or damage to the device.
- If the product is used in lifting and lowering device, install a safety device on the device side to prevent it from falling. Negligence may cause accidents leading to injury or death, or damage to the device due to falling down of the lifting and lowering unit.
- If the product is used in lifting and lowering operations, make sure to calculate resistance value for the consumption of regenerative power generated during lowering operations, and then apply a suitable regenerative power resistance. If applied resistance is insufficient, the driver turns on the lamp for alarm for excessive regeneration and stops the power supply to the motor. The device may fall down if a P type motor that does not have a built-in electromagnetic brake is used.
- Ensure that the driver does not come in contact with water. Negligence may damage the driver.

(Transportation)

- When transporting the driver, carry the cooling fin, do not carry the plastic case and the terminal cover. Negligence may cause coming out and falling down of the unit and injuries.

(Wiring)

- Follow the instruction manual when connecting the product to the power supply cable. If the product is connected to an incorrect terminal, it may cause fire, damage to the driver, or electric shock.
- Do not forcibly bend, pull, and tuck the motor lead wires or power supply cables. Negligence may cause electric shock.

- Ground the earthing terminal properly. Negligence may cause electric shock.
- Use only the power supply specified on the nameplate. Negligence may cause burning of motor and fire.
- Install a fuse and a circuit breaker on the power supply side to immediately stop the operations and cut off the power supply in the event of current overflow. Negligence may cause accident, and failure, and damage of the driver. For recommended capacity, see "10. Selecting wiring equipment".
- Before wiring ensure that the power supply is off. Negligence may cause electric shock and fire.
- The motor rotates if the power supply is turned on and when the operation signal is on. Ensure that the operation signal is off and then turn on the power supply. Negligence may cause injuries.

(Operation)

- Do not turn the power on when the cover of the driver terminal block is removed. Reinstall the cover of the driver terminal block after completing the operations. Negligence may cause electric shock.

⚠ Caution

(General)

- Never touch the inner part of the driver. Negligence may cause electric shock.
- Use the specified combination of the motor and driver. Negligence may cause fire and damage to the equipment.
- Do not touch the regenerative resistor, motor, or driver when the power is on or immediately after turning off the power, as their surfaces may be hot. Negligence may cause burns.
- Never use the product in damp places, corrosive environment, and near flammable gases and combustible materials. Negligence may cause fire and accidents.
- Immediately stop the product if any abnormality is noticed. Negligence may cause fire and injuries.
- Do not remove the nameplate.
- Nissei Corporation shall not be responsible for, and also shall not give any warranty for the damage caused due to remodeling of the product by the customer.

(Inspection on arrival of the product)

- Check whether the product is same as ordered. If an incorrect product is installed, it may cause injuries, and damage to the device.

(Installation)

- Do not keep any combustible material near the product. Negligence may cause fire.
- Operate the product under the conditions specified in this instruction manual. Negligence may cause malfunctioning of the product.
- When installing the product horizontally, take measures to enhance the heat dissipation. Abnormal overheating of the product may cause fire and burns depending on the condition under which the product is used.
- Do not keep any object that will block circulation of the air around the product. Negligence can cause abnormal overheating of the product. It may cause fire and burns.
- Do not step on or place any heavy object on the product.
  Negligence may cause injuries.

- Keep the product away from any type of strong impact. Negligence may cause malfunctioning of the product.

(Wiring)
- Ensure that the wires to the power supply, motor, and driver are connected properly and securely. Negligence may cause damage to the equipment.

(Operation)
- Do not touch the rotating part of the motor.
  Negligence may cause injuries.
- The equipment might suddenly start operating after recovering from the power failure. Make sure not to go near the equipment. Negligence may cause injuries.
- When the operation has stopped due to error occurrence or safeguards, do not start the operation until the causes of error are determined, and countermeasures are taken.

(Daily inspection and maintenance)
- For repairing, disassembling or assembling the parts, contact our nearest business office or factory. There are chances of equipment damage and risk of injuries.

(Disposal)
- When disposing of reducer and lubricant oil, dispose it as a general industrial waste.

Important points for usage

- For optional brake power unit, if DC 24 V is not applied from outside, DC 24 V will not be output based on the brake control code.
  We request the customers to make preparations for the same.
- If the regenerative resistor connects the resistance value which is lower than the resistance value of optional products, it might cause damage to driver.
- If you turn off an electric overload alarm and reset it multiple times, it might cause motor breakdown.

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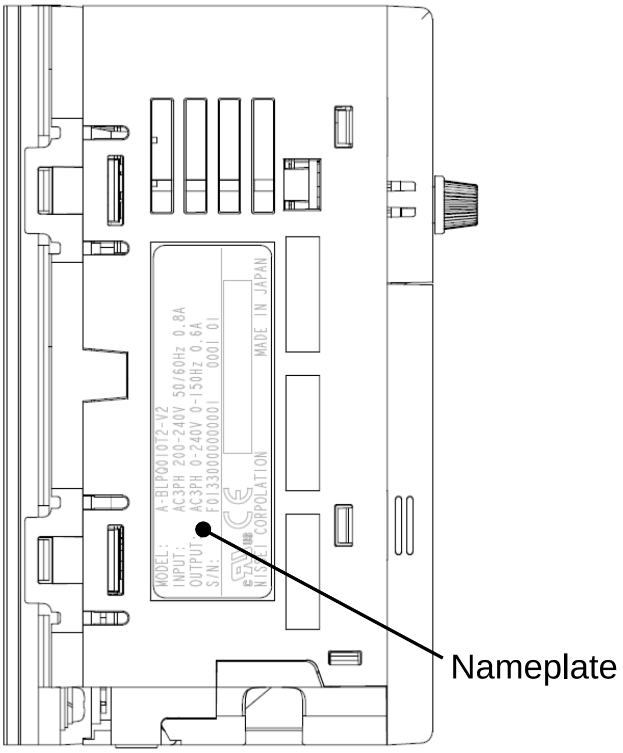
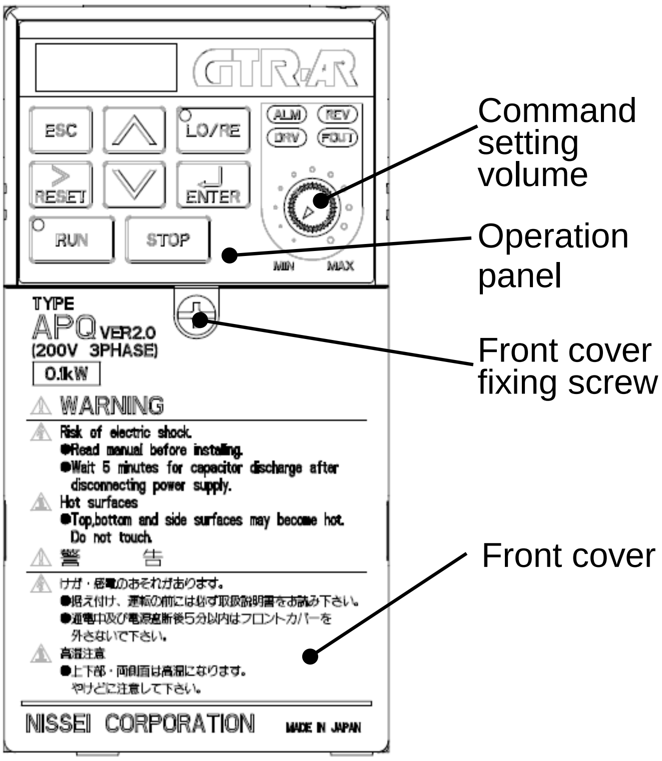
1. Parts names and models

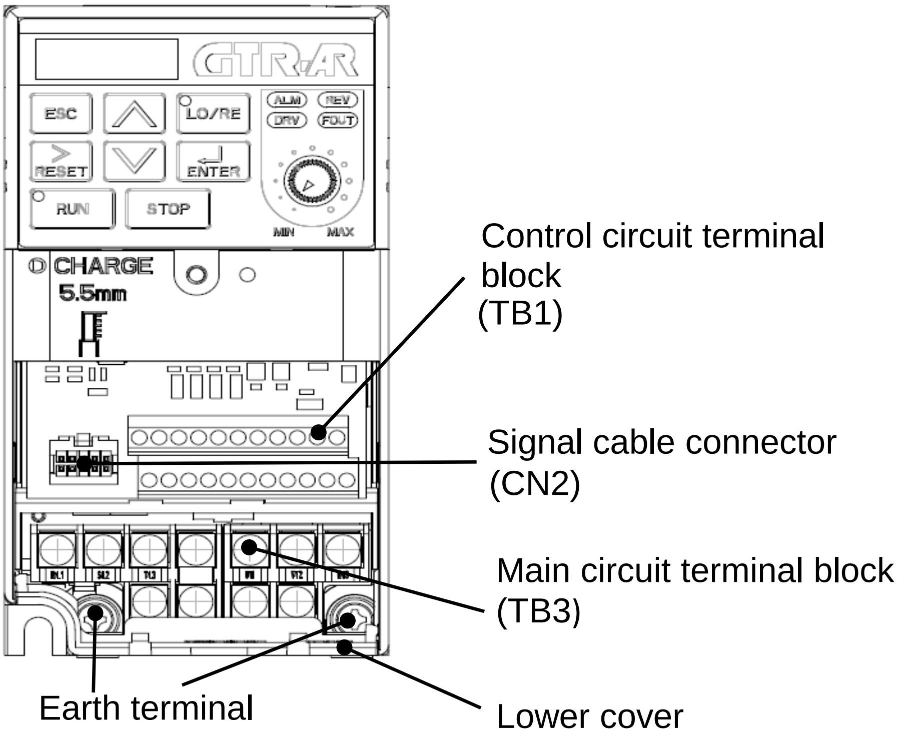
1-1. Part names

Following are the names of the parts.




Command setting volume
Operation panel
Front cover fixing screw
Front cover

When front cover is removed


Control circuit terminal block (TB1)
Signal cable connector (CN2)
Main circuit terminal block (TB3)
Earth terminal
Lower cover

1-2. Description of the model

Following are the details of the model.

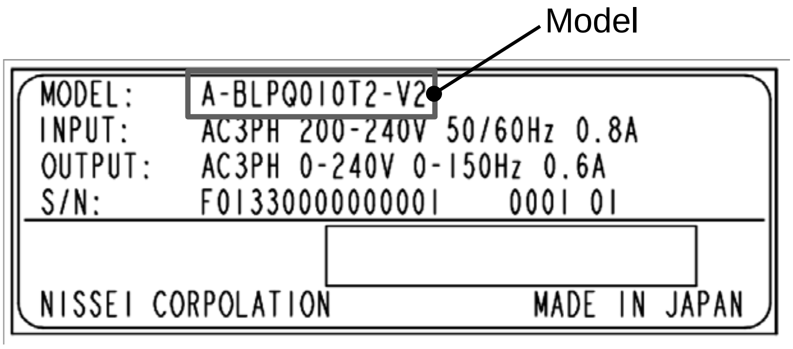
Series		**Motor ver**	**Motor type**	**Capacity**	**Number of phases**	**Voltage**		**Driver Ver**	**Auxiliary code**
A	**-**	**BL**	**PQ**	**010**	**T**	**2**	**-**	**V2**	**X**
(1)		(2)	(3)	(4)	(5)	(6)		(7)	(8)

(1) Series	A : GTR-AR
(2) Motor Ver	BL : Motor version number
(3) Motor type	PQ : Common to With motor and With break motor
(4) Capacity	010 : 0.1 kW
	020 : 0.2 kW
	040 : 0.4 kW
	075 : 0.75 kW
(5) Number of phases*	T : Three phase
	S : Single phase
(6) Voltage	2 : 200 V
(7) Driver Ver	V2 : Driver version number
(8) Auxiliary code	Blank : Standard specifications
	X : Symbol to recognize addition of special specifications

* Only three phase-type is used for 0.75 kW.

■ Driver model mentioning position

The driver model is printed at the following position on the nameplate.



MODEL: A-BLPQ010T2-V2
INPUT: AC3PH 200-240V 50/60Hz 0.8A
OUTPUT: AC3PH 0-240V 0-150Hz 0.6A
S/N: F01330000000001 0001 01
NISSEI CORPOLATION MADE IN JAPAN

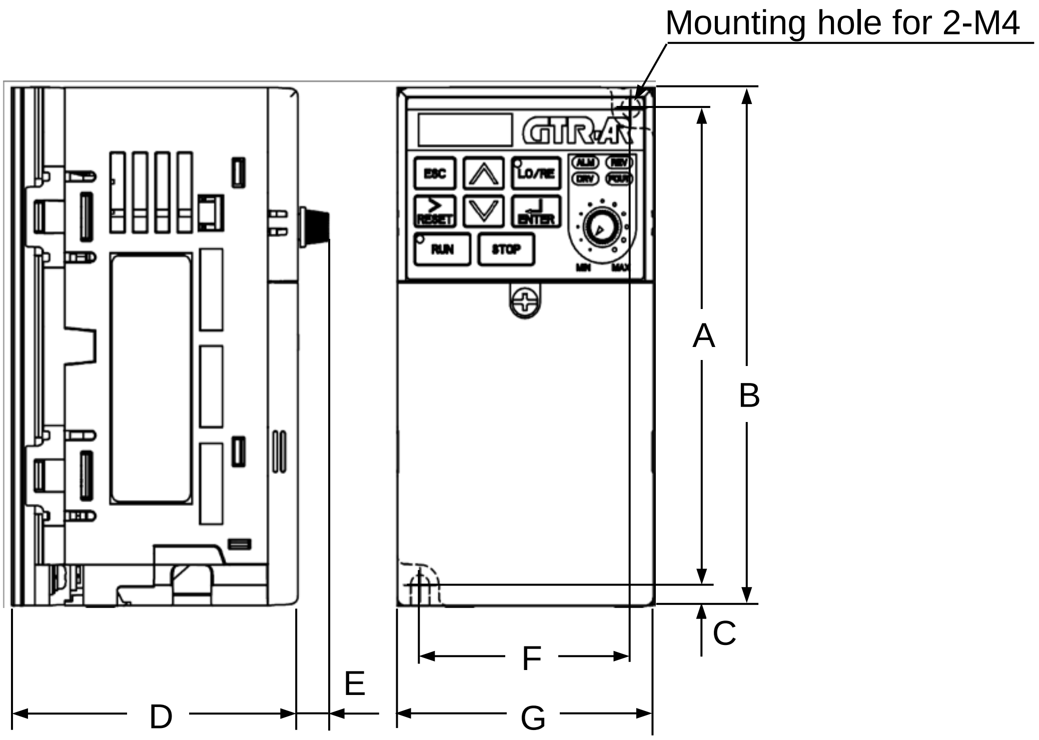
■ Driver model configuration table

Following are the combinations of power supply specifications and capacity.

		Power supply specifications	
		Three-phase 200 V	**Single phase 200 V**
Capacity (kW)	0.1	A-BLPQ010T2-V2	A-BLPQ010S2-V2
	0.2	A-BLPQ020T2-V2	A-BLPQ020S2-V2
	0.4	A-BLPQ040T2-V2	A-BLPQ040S2-V2
	0.75	A-BLPQ075T2-V2	

2. Installation

2-1. External dimensions and weight


Mounting hole for 2-M4
ESC
LO/RE
RESET
ENTER
RUN
STOP
MIN
MAX
A
B
C
D
E
F
G

Model	A dimension (mm)	B dimension (mm)	C dimension (mm)	D dimension (mm)	E dimension (mm)	F dimension (mm)	G dimension (mm)	Approximate weight (kg)
A-BLPQ010T2-V2	118	128	5	76	8	56	68	0.6
A-BLPQ010S2-V2								
A-BLPQ020T2-V2								
A-BLPQ020S2-V2				108				0.7
A-BLPQ040T2-V2								
A-BLPQ040S2-V2				128				0.8
A-BLPQ075T2-V2								

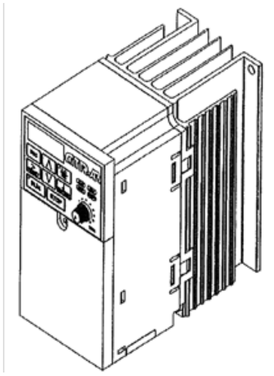
2-2. Mounting

Ensure that the following points are taken into account when mounting the driver

■ Mounting direction

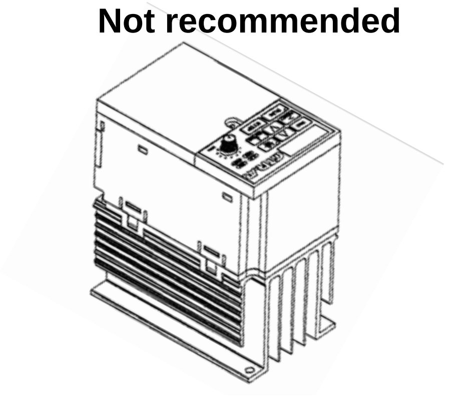
We recommend that you mount the driver vertically to maintain the cooling effect.

Recommended



Vertical mounting

Not recommended

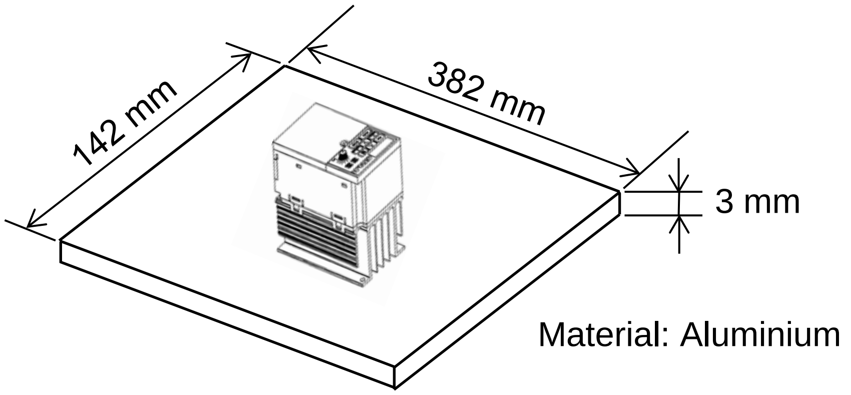


Horizontal mounting

* If you want to mount it horizontally, ensure that the following points are followed.

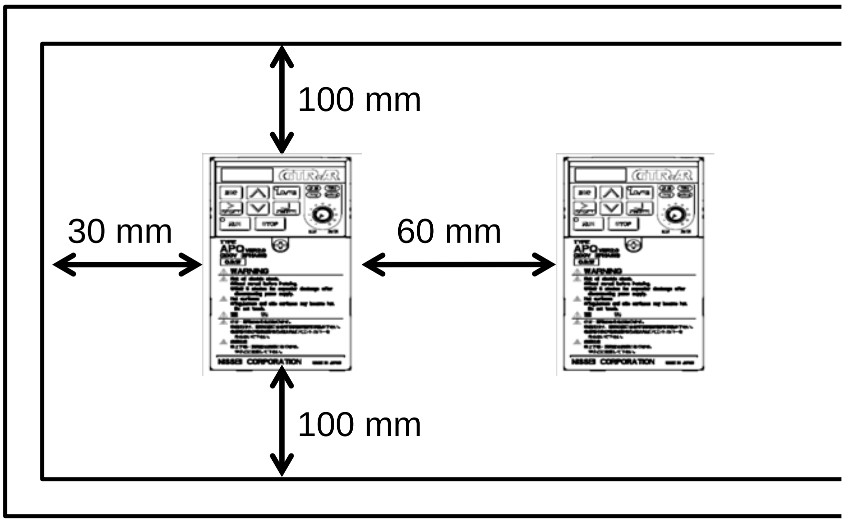
0.1 kW～0.4 kW: Can be used in the current state. Note that temperature of machine and mounted part increases.

0.75 kW: Can be used by devising mounting and increasing radiation.
Can be used with the following radiator plate. See the radiation design.



■ Mounting distance

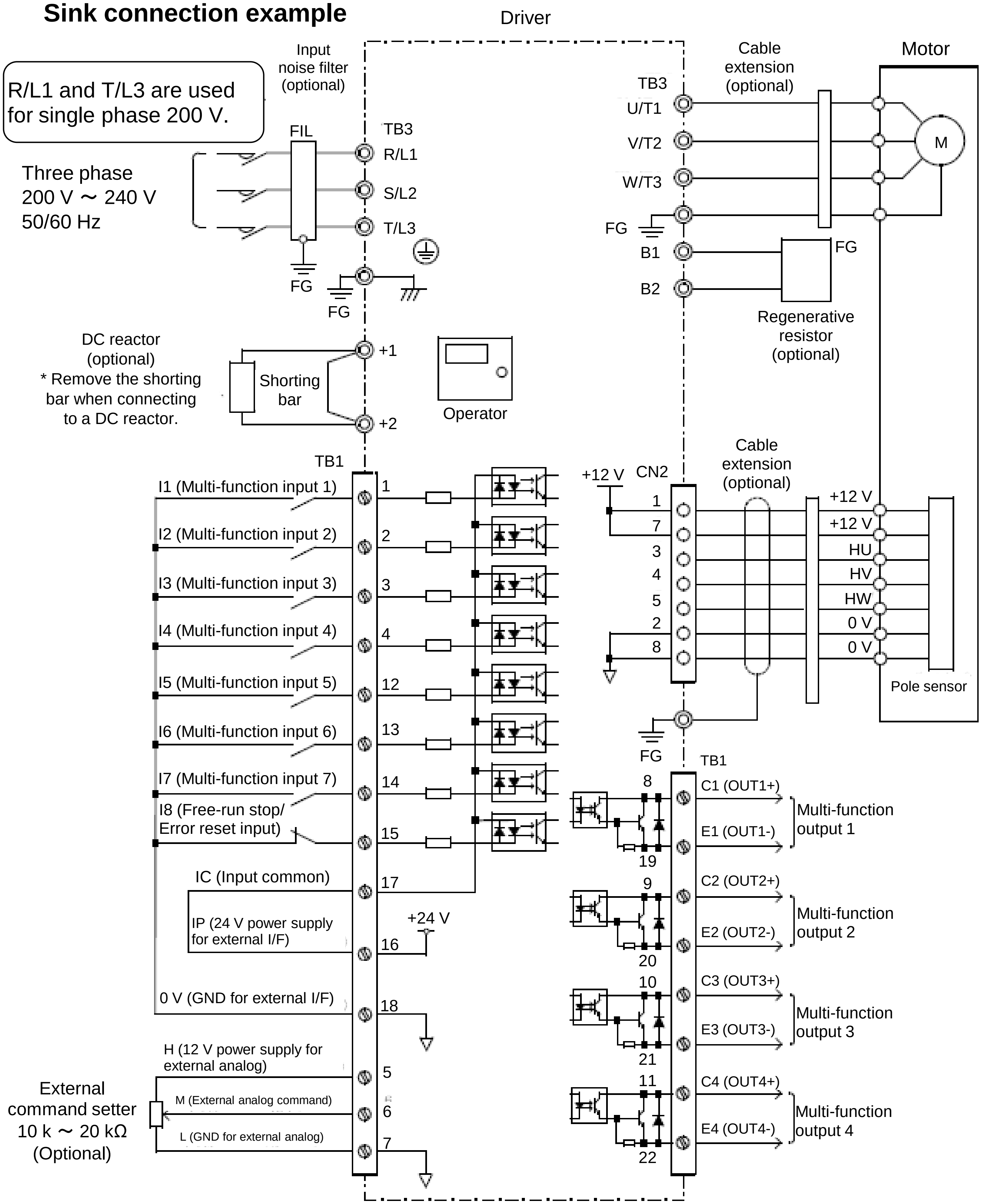
When mounting the drivers in parallel, secure the space as shown in the following image.



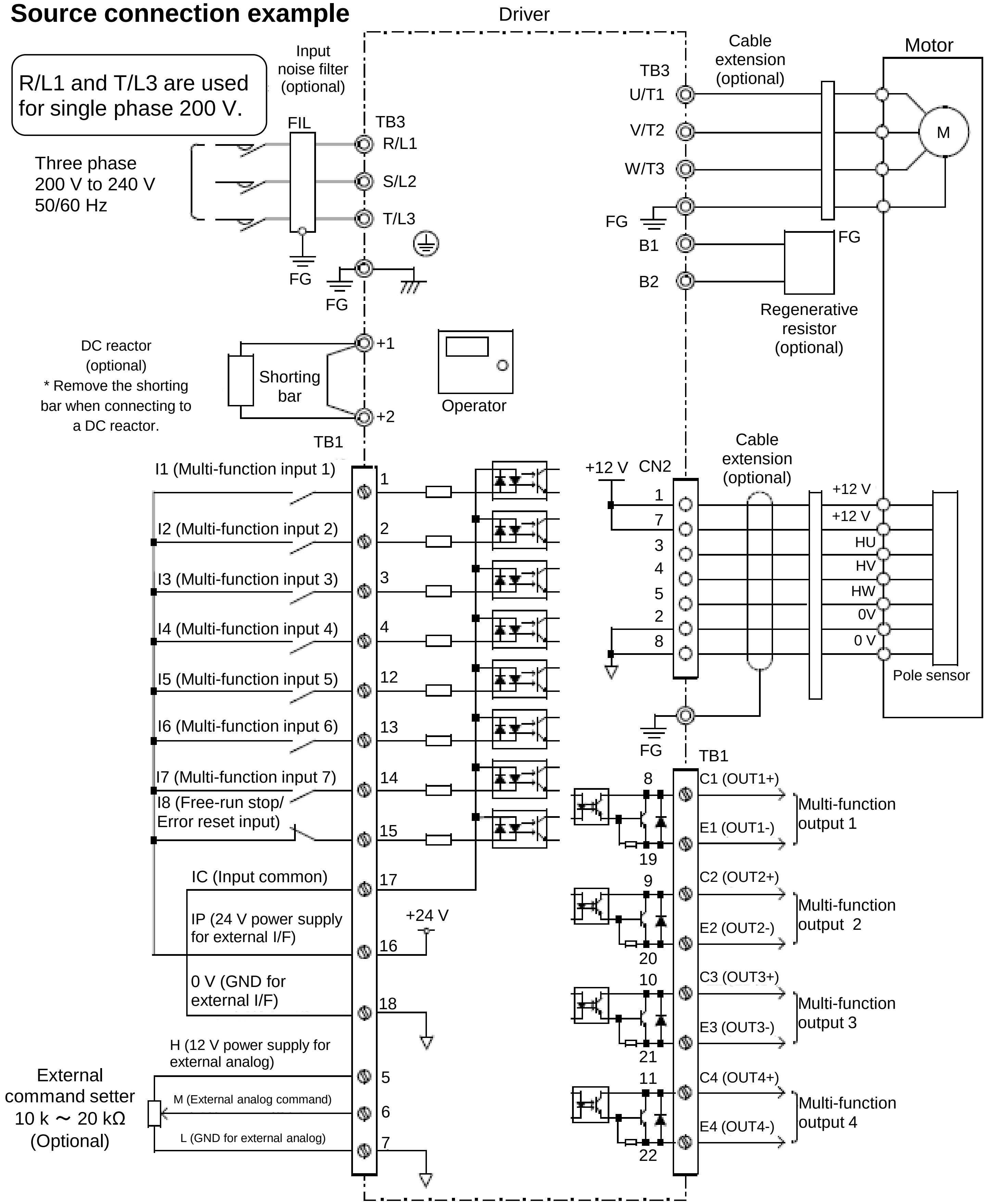
3. Wiring and connection

3-1. Wiring diagram

Sink connection example


Driver
Input noise filter (optional)
R/L1 and T/L3 are used for single phase 200 V.
Three phase 200 V ～ 240 V 50/60 Hz
FIL
FG
TB3
R/L1
S/L2
T/L3
FG
TB3
U/T1
V/T2
W/T3
FG
B1
B2
Cable extension (optional)
Motor
M
FG
Regenerative resistor (optional)
DC reactor (optional)
* Remove the shorting bar when connecting to a DC reactor.
Shorting bar
+1
+2
Operator
TB1
I1 (Multi-function input 1)
I2 (Multi-function input 2)
I3 (Multi-function input 3)
I4 (Multi-function input 4)
I5 (Multi-function input 5)
I6 (Multi-function input 6)
I7 (Multi-function input 7)
I8 (Free-run stop/ Error reset input)
IC (Input common)
IP (24 V power supply for external I/F)
0 V (GND for external I/F)
H (12 V power supply for external analog)
M (External analog command)
L (GND for external analog)
External command setter 10 k ～ 20 kΩ (Optional)
1
2
3
4
12
13
14
15
17
16
18
5
6
7
+24 V
+12 V
CN2
1
7
3
4
5
2
8
Cable extension (optional)
+12 V
+12 V
HU
HV
HW
0 V
0 V
Pole sensor
FG
TB1
8
C1 (OUT1+)
E1 (OUT1-)
19
Multi-function output 1
9
C2 (OUT2+)
E2 (OUT2-)
20
Multi-function output 2
10
C3 (OUT3+)
E3 (OUT3-)
21
Multi-function output 3
11
C4 (OUT4+)
E4 (OUT4-)
22
Multi-function output 4

Source connection example


Driver
R/L1 and T/L3 are used for single phase 200 V.
Input noise filter (optional)
FIL
Three phase
200 V to 240 V
50/60 Hz
FG
TB3
R/L1
S/L2
T/L3
FG
DC reactor (optional)
* Remove the shorting bar when connecting to a DC reactor.
Shorting bar
+1
+2
Operator
TB1
I1 (Multi-function input 1)
I2 (Multi-function input 2)
I3 (Multi-function input 3)
I4 (Multi-function input 4)
I5 (Multi-function input 5)
I6 (Multi-function input 6)
I7 (Multi-function input 7)
I8 (Free-run stop/ Error reset input)
IC (Input common)
IP (24 V power supply for external I/F)
0 V (GND for external I/F)
H (12 V power supply for external analog)
M (External analog command)
L (GND for external analog)
External command setter 10 k ~ 20 kΩ (Optional)
1
2
3
4
12
13
14
15
17
+24 V
16
18
5
6
7
TB3
U/T1
V/T2
W/T3
FG
B1
B2
Cable extension (optional)
Motor
M
FG
Regenerative resistor (optional)
+12 V
CN2
1
7
3
4
5
2
8
Cable extension (optional)
+12 V
+12 V
HU
HV
HW
0V
0 V
Pole sensor
FG
TB1
8
19
9
20
10
21
11
22
C1 (OUT1+)
E1 (OUT1-)
Multi-function output 1
C2 (OUT2+)
E2 (OUT2-)
Multi-function output 2
C3 (OUT3+)
E3 (OUT3-)
Multi-function output 3
C4 (OUT4+)
E4 (OUT4-)
Multi-function output 4

[Important] * Regarding source connection to customers who are using old type drivers, if the similar old type wiring is used in new drivers, there are chances of driver output terminal damage or external power supply damage. Conduct wiring with great caution.

3-2. Description of terminal

■ Terminal block functionality

Connector specifications of each terminal

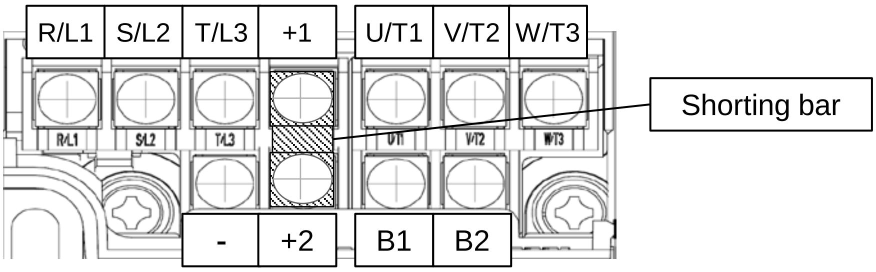
Use	Connector number	Connector type	Remarks
Main circuit terminal	TB3	TBET31166-B (6-pole), TBET31167-B (5-pole)	Total 11-pole
Motor sensor input terminal	CN2	B10B-PADSS-1	10-pole
Control circuit terminal	TB1	MKKDS1/11-3.5	22-pole, plug-in screw

Main circuit terminal (TB3) functionality

Terminal No.	Signal name	Details	Remarks
R/L1	R	AC 200 V input R-phase	Connected during single phase input
S/L2	S	AC 200 V input S-phase	
T/L3	T	AC 200 V input T-phase	Connected during single phase input
- (minus)	N	DC bus voltage (N)	(*)
+1	+1	DC bus voltage (P)	Normal +1 and +2 Short circuit (*)
+2	+2	DC bus voltage (P)	
B1	B1	Regenerative resistor connection terminal 1	
B2	B2	Regenerative resistor connection terminal 2	
U/T1	U	Motor drive output U-phase	
V/T2	V	Motor drive output V-phase	
W/T3	W	Motor drive output W-phase	

* While using the DC power, remove the shorting bar between +1 and +2, and connect it to N (-) and +1 (+).

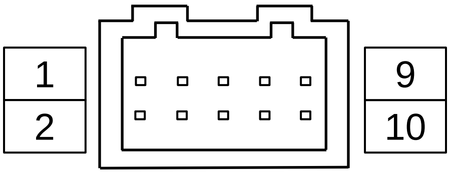
TB3 Terminal No.



Motor sensor input terminal (CN2) functionality

Terminal No.	Signal name	Details	Remarks
1	+12 V	Sensor power +12 V	
2	GND	Signal ground	
3	HU	Pole sensor input U-phase	Photo-coupler input
4	HV	Pole sensor input V-phase	
5	HW	Pole sensor input W-phase	
6	N. C	Not used	
7	+12 V	Sensor power +12 V	
8	GND	Signal ground	
9	-	Reserved (Do not connect anything)	
10	-	Reserved (Do not connect anything)	

CN2 Terminal No.



Control circuit terminal (TB1) functionality * Settings in () are initial settings.

Terminal No.	Signal name	Details	Remarks
16	IP	24 V power supply for I/F *1	24 V output
17	IC	Common input	
18	0 V	GND for I/F	
1	I1	Multi-function input 1 (CW operation command)	Photo-coupler input 24 V/8 mA *2
2	I2	Multi-function input 2 (CCW operation command)	
3	I3	Multi-function input 3 (Selection of speed command 1)	
4	I4	Multi-function input 4 (Selection of speed command 2)	
12	I5	Multi-function input 5 (Selection of torque limit value 1)	
13	I6	Multi-function input 6 (Selection of acceleration and deceleration time 1)	
14	I7	Multi-function input 7 (Brake output forcibly ON command)	
15	I8	Free-run stop/Error reset input	
5	H	12 V analog power supply *1	12 V output
6	M	Analog command (Speed command)	0 to 10 V *3
7	L	Analog GND	
8	C1	Multi-function output 1 (Error detection signal)	Maximum load voltage 48 V Maximum load current 50 mA *4
19	E1		
9	C2	Multi-function output 2 (Brake timing signal)	
20	E2		
10	C3	Multi-function output 3 (Signal during operation)	
21	E3		
11	C4	Multi-function output 4 (Signal during rotation)	
22	E4		

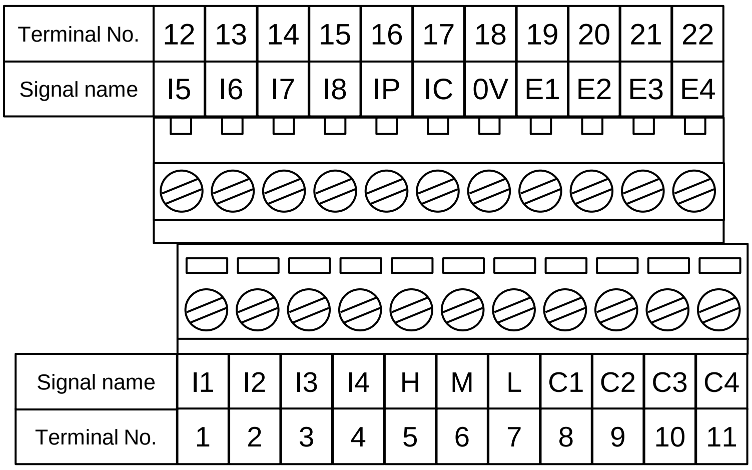
*1 It is the power output terminal. Do not connect an external power supply.

*2 The input function can be changed according to the constant settings (Pn100 ～ 106).
See P.40 for details.

*3 The speed command/torque command can be changed according to the constant settings (Pn200).
See P.42 for details.

*4 The output function can be changed according to the constant settings (Pn120 ～ 123).
See P.41 for details.

TB1 Terminal No.



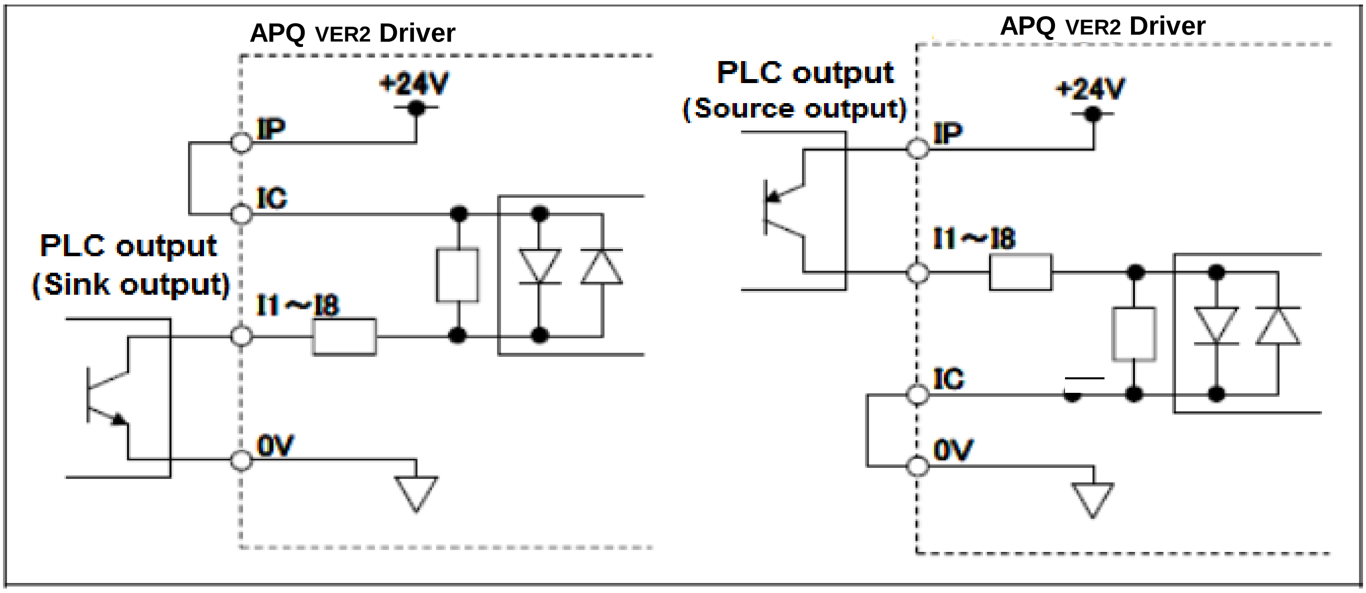
Terminal No.	12	13	14	15	16	17	18	19	20	21	22
Signal name	I5	I6	I7	I8	IP	IC	0V	E1	E2	E3	E4

Signal name	I1	I2	I3	I4	H	M	L	C1	C2	C3	C4
Terminal No.	1	2	3	4	5	6	7	8	9	10	11

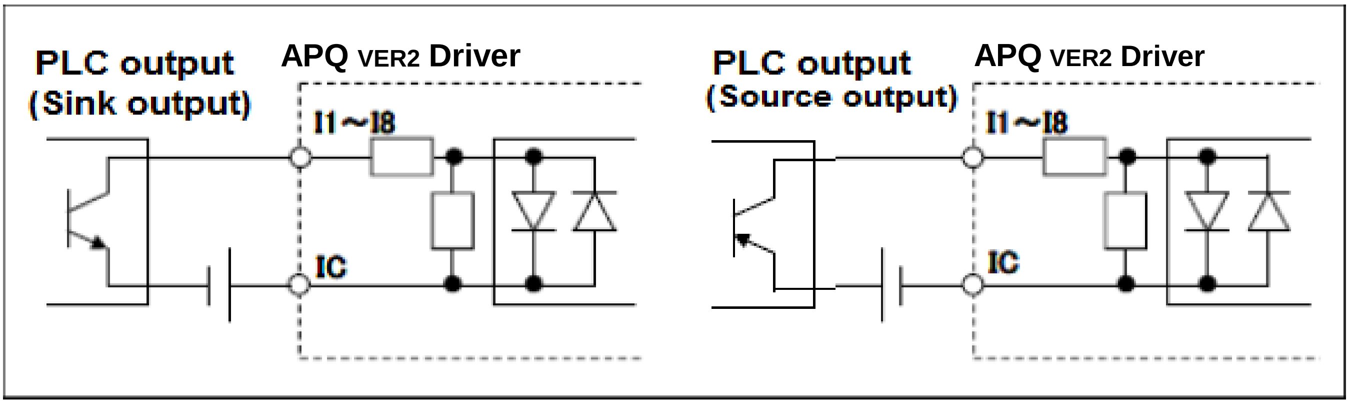
■ Example of external I/O connection

(1) Input example (24 V/8 mA)

When using internal power supply of the driver


APQ VER2 Driver
+24V
IP
IC
PLC output
(Sink output)
I1～I8
0V
APQ VER2 Driver
PLC output
(Source output)
+24V
IP
I1～I8
IC
0V

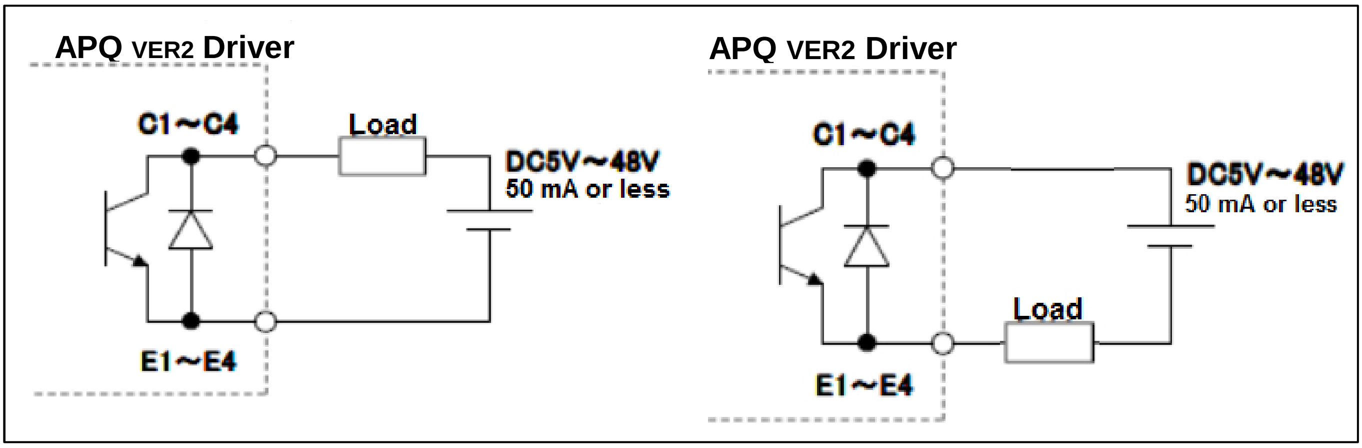
When using external power supply


PLC output
(Sink output)
APQ VER2 Driver
I1～I8
IC
PLC output
(Source output)
APQ VER2 Driver
I1～I8
IC

(2) Output example (48 V/50 mA or less)

Sink connection example

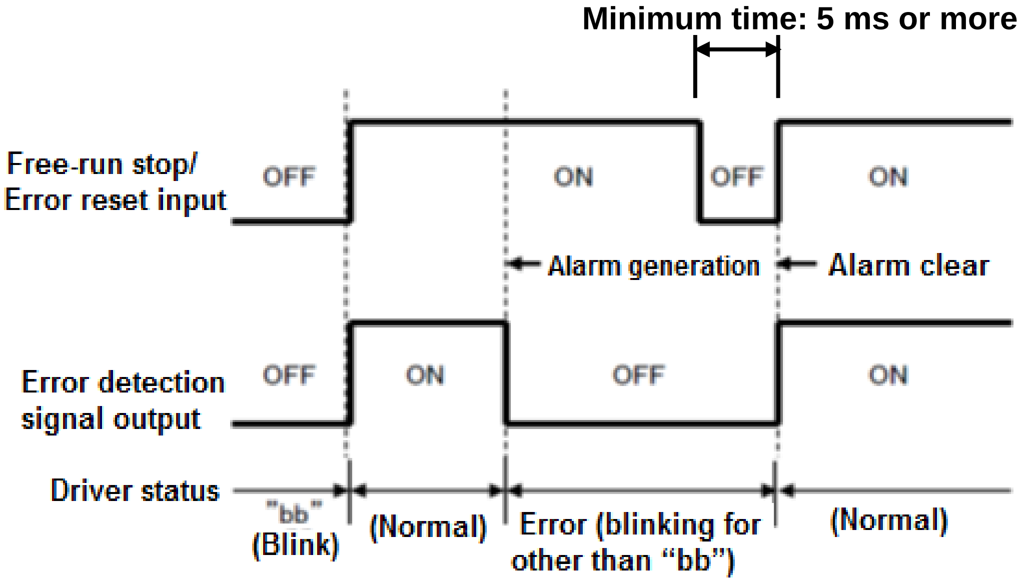
Source connection example


APQ VER2 Driver
C1～C4
Load
DC5V～48V
50 mA or less
E1～E4
APQ VER2 Driver
C1～C4
DC5V～48V
50 mA or less
Load
E1～E4

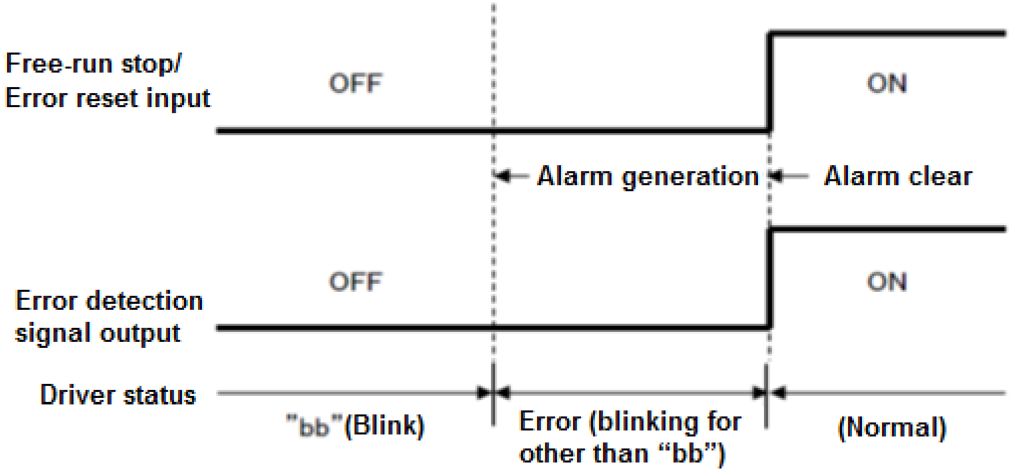
■ Free-run stop/Error reset input (I8)

When the input terminal is off, power supply to the motor stops and the motor enters in free-run state. ("bb" is displayed on monitor.)
When the input is made ON from OFF, the driver state becomes normal.

● If the alarm goes off during normal operation


Minimum time: 5 ms or more
Free-run stop/ Error reset input
OFF
ON
OFF
ON
Alarm generation
Alarm clear
Error detection signal output
OFF
ON
OFF
ON
Driver status
"bb" (Blink)
(Normal)
Error (blinking for other than "bb")
(Normal)

● If the alarm goes off during free-run state

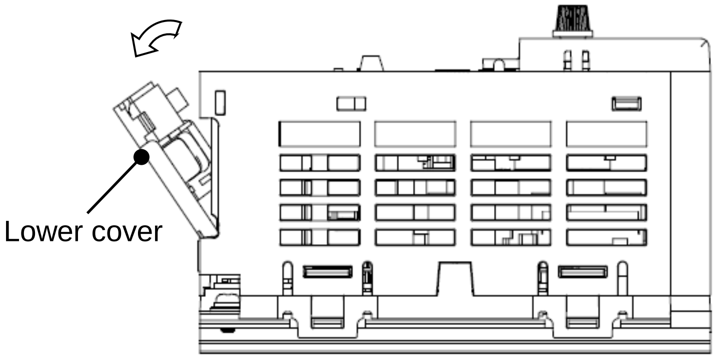

Free-run stop/ Error reset input
OFF
ON
Alarm generation
Alarm clear
Error detection signal output
OFF
ON
Driver status
"bb"(Blink)
Error (blinking for other than "bb")
(Normal)

Note) If the drive command is ON, alarm does not clear even if free-run stop/error reset input is ON.

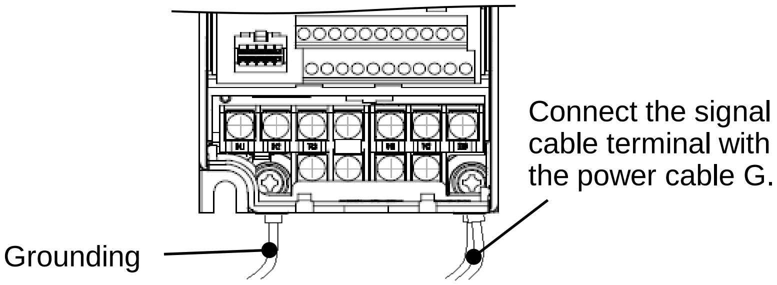
3-3. How to connect

1. Remove the front cover by turning the screw fixed to it.
   The screw does not come out of the cover.

2. Remove the lower cover as shown in the following diagram.


Lower cover

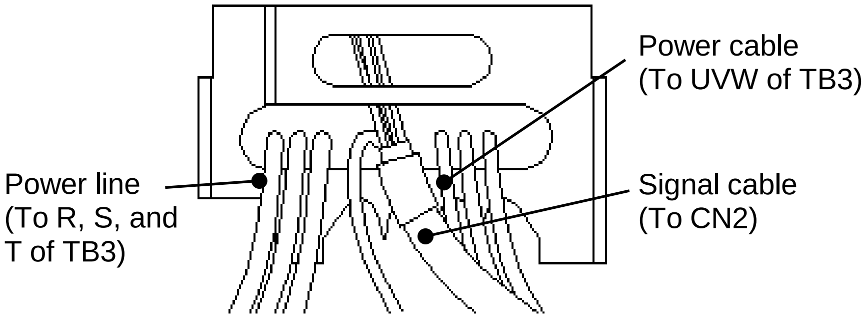
3. Connect the ground terminal as shown in the following diagram.


Connect the signal cable terminal with the power cable G.
Grounding

   Make sure that grounding terminal is fixed by using round terminal.
   Use the wiring size more than 2.5 mm^2.

4. Connect the power cable and signal cable of the motor with the power supply.

   Pass the cables through the long hole under the cover as shown in the following diagram. While wiring the power line, make sure that the power supply is off and route the wiring carefully without getting an electric shock.
   For the wiring to the main circuit terminal, check whether insulating tube covers the caulking part of the crimp terminal, use insulated type crimp terminal, and prevent short circuit and electric shock.

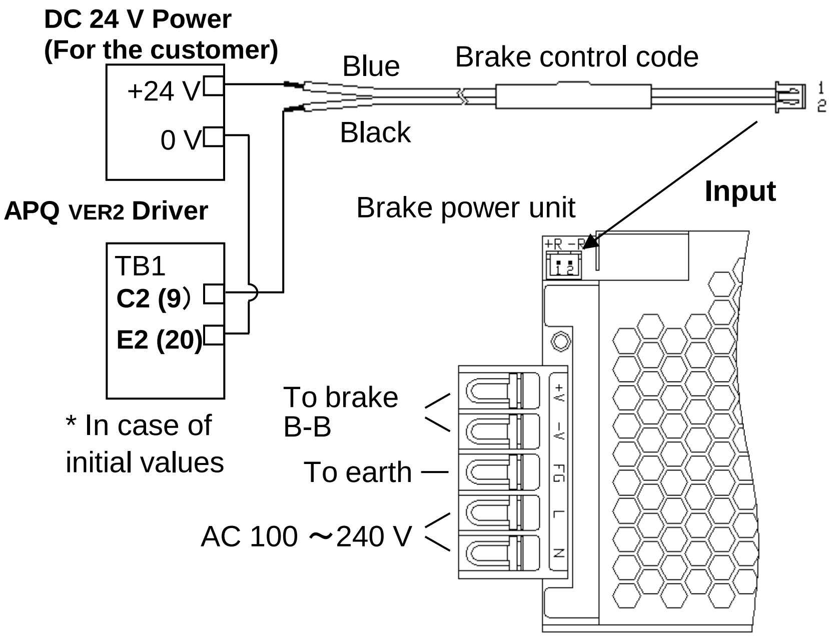

Power cable
(To UVW of TB3)
Power line
(To R, S, and T of TB3)
Signal cable
(To CN2)

Terminal screw of TB3	M 3.5
Tightening torque	1.2 N·m
Recommended wire size	2 mm^2 (AWG 14)

- Brake wiring (When the brake is applied)

  Brake is released if DC 24 V current is supplied between the B-B of the power cable.

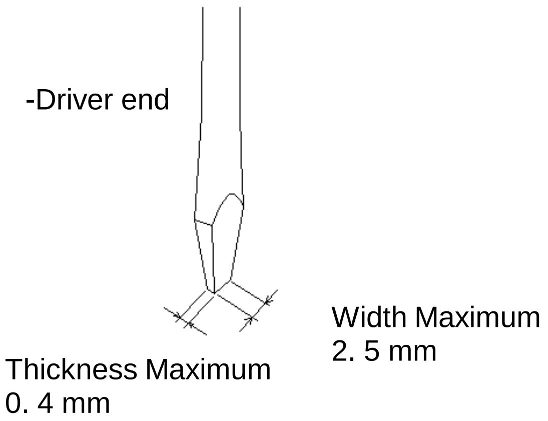
  To turn on/off automatically by the signal from the driver, wire it as shown in the following diagram.

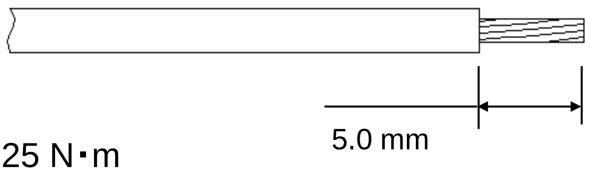

DC 24 V Power
(For the customer)
+24 V
0 V
APQ VER2 Driver
TB1
C2 (9)
E2 (20)
* In case of initial values
Blue
Black
Brake control code
1
2
Input
Brake power unit
+R -R
To brake B-B
To earth
AC 100 ～240 V
+V
-V
FG
L
N

- Wiring the TB1.

  While connecting TB1, by using the right driver,

  peel off the wire as per the following measurements and connect.


-Driver end
Width Maximum 2. 5 mm
Thickness Maximum 0. 4 mm



Terminal screw of TB1	M2
Tightening torque	0.22 ～ 0.25 N・m
Recommended wire size	0.75 mm^2 (AWG 18)

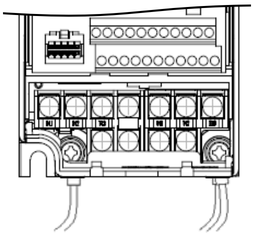
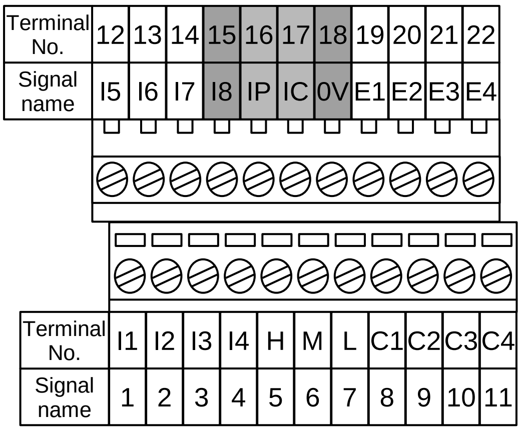
4. How to operate

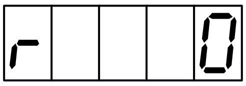
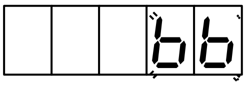
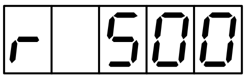
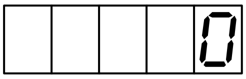
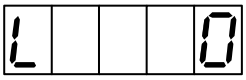
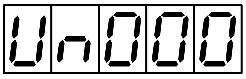
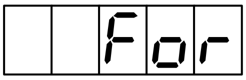
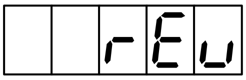
4-1. Starting by using the operation panel

This section describes the procedure to operate motor from the operation panel in initial setting state.

Following is the procedure outline:

(1) Wiring, power input
(2) Switching to local mode
(3) Speed command settings
(4) Starting the CW operation
(5) Stopping the CW operation
(6) Displaying the selection of rotation direction
(7) Switching the rotation direction
(8) Starting the CCW operation
(9) Stopping the CCW operation

Procedure No.	Explanatory diagram	Details
(1)		See the interconnection diagram and the terminal description, to connect the power-supply line and the motor power line to the main circuit terminal. Also connect the earthing terminal. * Ensure that the wiring is correct.
	 Terminal No.: 12 13 14 15 16 17 18 19 20 21 22 Signal name: I5 I6 I7 I8 IP IC 0V E1 E2 E3 E4 Terminal No.: I1 I2 I3 I4 H M L C1 C2 C3 C4 Signal name: 1 2 3 4 5 6 7 8 9 10 11	Connect (short-circuit) IP (16) and IC (17) of TB1, and also connect (short-circuit) 0 V (18) and I8 (15).
		Ensure that the wiring is correct again before supplying the power.

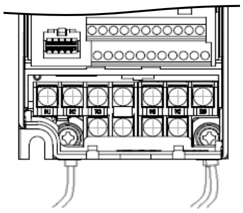
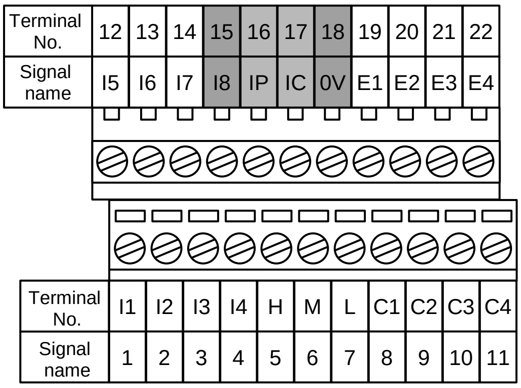
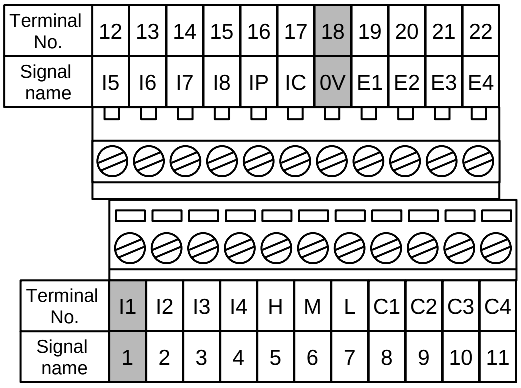
Procedure No.	Operation	Display	Details
(2)	-		It is a default display when the power supply is turned on. If the display as shown on the left side appears, it means wiring is done correctly. * If nothing is displayed, check the wiring of the power supply, and start again from (1).
	-		As shown on the left, if "bb" blinks, it means that TB1 is not wired correctly. Try again from (1).
			Press the LO/RE key to switch to local mode. LO/RE lamp will turn on.
(3)			Turn the command setting volume to set the rotation speed. * The 7 segment LED display as shown on the left will appear when the speed command is 500 [r/min].
(4)			Press the RUN key to rotate the motor in the CW direction at the specified rotation speed. * RUN lamp will turn on while driving.
(5)		–	Press STOP to stop the motor.
(6)			Press [∧] key. The display will switch to the motor speed display. * The 7 segment LED display as shown on the left will appear when the motor speed is 0 [r/min].
			Press [∧] key. The display will switch to the load factor display. *The 7 segment LED display as shown on the left will appear when the load factor is 0%.
			Press [∧] key. The display will switch to the monitor selection display. * The 7 segment LED display as shown on the left will appear when the monitor number is Un000.
			Press [∧] key. The display will switch to the rotation direction switching display. * The 7 segment LED display as shown on the left will appear when the rotation direction is CW (default value).
(7)			Press the ENTER key to switch the rotation direction. * The 7 segment LED display as shown on the left will appear when the rotation direction is CCW.
(8)			Press the RUN key to rotate the motor at the specified rotation speed. * RUN lamp will turn on while driving.
(9)		-	Press STOP to stop the motor.

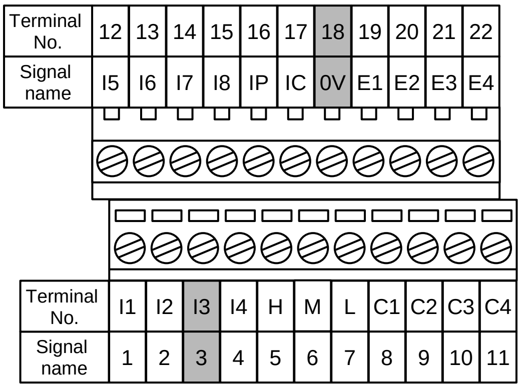
4-2. Starting by using external switch

This section describes the procedure for operating the motor by using the external switch in the initial setting state.

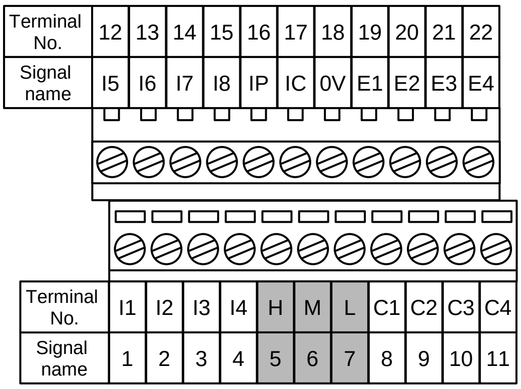
Following is the procedure outline:

1. (1) Wiring 1
2. (2) Wiring 2, Power supply
3. (3) Analog speed command
4. (4) Starting the CW operation
5. (5) Stopping the CW operation
6. (6) Digital speed command settings
7. (7) Starting the CW operation
8. (8) Stopping the CW operation

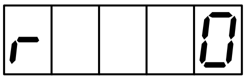
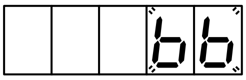
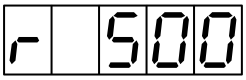
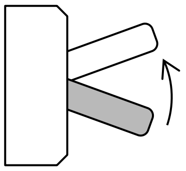
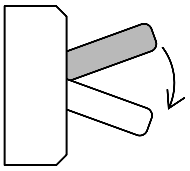
<table>
<tr><th>Procedure No.</th><th>Explanatory diagram</th><th>Details</th></tr>
<tr><td>(1)</td><td></td><td>See the interconnection diagram and the terminal description, to connect the power supply line and the motor power line to the main circuit terminal.
Also connect the earthing terminal.
* Ensure that the wiring is correct.</td></tr>
<tr><td></td><td>
<table>
<tr><td>Terminal No.</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td></tr>
<tr><td>Signal name</td><td>I5</td><td>I6</td><td>I7</td><td>I8</td><td>IP</td><td>IC</td><td>0V</td><td>E1</td><td>E2</td><td>E3</td><td>E4</td></tr>
</table>
<table>
<tr><td>Terminal No.</td><td>I1</td><td>I2</td><td>I3</td><td>I4</td><td>H</td><td>M</td><td>L</td><td>C1</td><td>C2</td><td>C3</td><td>C4</td></tr>
<tr><td>Signal name</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr>
</table></td><td>Connect (short-circuit) IP (16) and IC (17) of TB1, and also connect (short-circuit) 0 V (18) and I8 (15).</td></tr>
<tr><td></td><td>
<table>
<tr><td>Terminal No.</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td></tr>
<tr><td>Signal name</td><td>I5</td><td>I6</td><td>I7</td><td>I8</td><td>IP</td><td>IC</td><td>0V</td><td>E1</td><td>E2</td><td>E3</td><td>E4</td></tr>
</table>
<table>
<tr><td>Terminal No.</td><td>I1</td><td>I2</td><td>I3</td><td>I4</td><td>H</td><td>M</td><td>L</td><td>C1</td><td>C2</td><td>C3</td><td>C4</td></tr>
<tr><td>Signal name</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr>
</table></td><td>Connect the switch between 0 V (18) and I1 (1) of TB1 and set the switch to OFF state.
(Connect the switch to the CW operation command.)</td></tr>
</table>

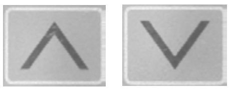
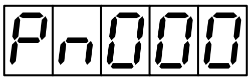
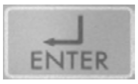
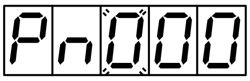
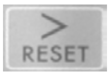
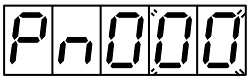
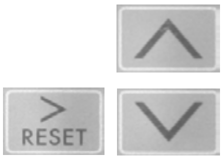
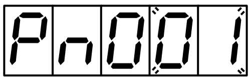
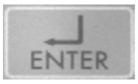
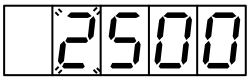
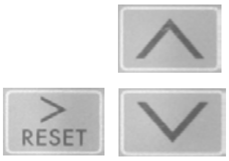
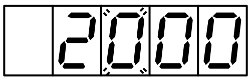
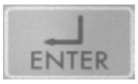
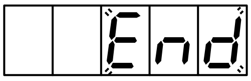
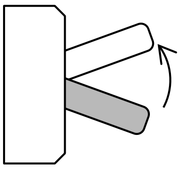
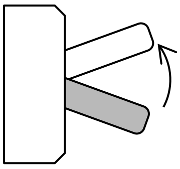
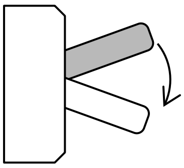
<table>
<tr><th>Procedure No.</th><th colspan="2">Explanatory diagram</th><th>Details</th></tr>
<tr><td rowspan="3">(2)</td><td colspan="2">

Terminal No.
12 13 14 15 16 17 18 19 20 21 22
Signal name
I5 I6 I7 I8 IP IC 0V E1 E2 E3 E4
Terminal No.
I1 I2 I3 I4 H M L C1 C2 C3 C4
Signal name
1 2 3 4 5 6 7 8 9 10 11

</td><td>Connect the switch between 0 V (18) and I3 (3) of TB1 and set the switch to OFF state.
(Connect the switch to the selection of speed command 1.)</td></tr>
<tr><td colspan="2">

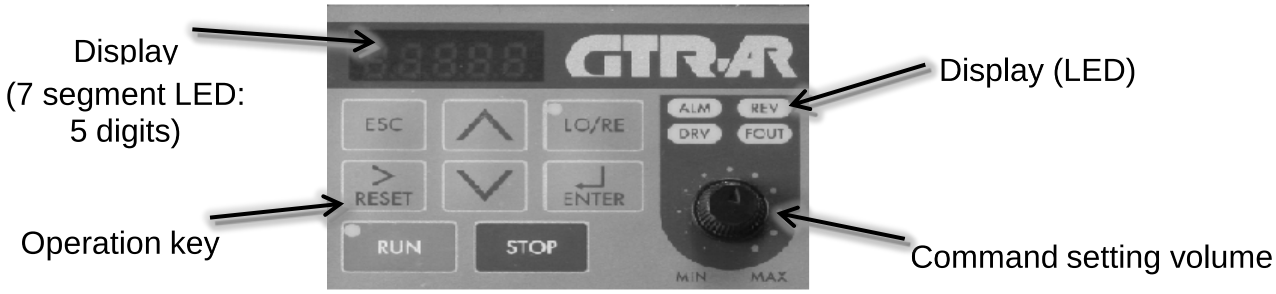
Terminal No.
12 13 14 15 16 17 18 19 20 21 22
Signal name
I5 I6 I7 I8 IP IC 0V E1 E2 E3 E4
Terminal No.
I1 I2 I3 I4 H M L C1 C2 C3 C4
Signal name
1 2 3 4 5 6 7 8 9 10 11

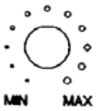
</td><td>Connect the OP-RV-24B20K of option between the H (5), M (6), L (7) of TB1.
H (5) - Option (3) terminal,
M (6) - Option (2) terminal,
L (7) - Option (1) terminal</td></tr>
<tr><td colspan="2"></td><td>Ensure that the wiring is correct again before supplying the power.</td></tr>
<tr><td rowspan="3">(3)</td><td>-</td><td> </td><td>It is a default display when the power supply is turned on. If the display as shown on the left side appears, it means wiring is done correctly.
* If nothing is displayed, check the wiring of the power supply, and start again from (1).</td></tr>
<tr><td>-</td><td> </td><td>As shown on the left, if "bb" blinks, it means that TB1 is not wired correctly.
Try again from (1).</td></tr>
<tr><td> </td><td> </td><td>Turn the external command setter to set the rotation speed.
* The 7 segment LED display as shown on the left will appear when the speed command is 500 [r/min].</td></tr>
<tr><td>(4)</td><td></td><td></td><td>Turn on the switch that is connected in (1), to rotate the motor in CW direction.</td></tr>
<tr><td>(5)</td><td></td><td></td><td>Turn off the switch that is connected in (1), to stop the motor.</td></tr>
</table>

Procedure No.	Explanatory diagram		Details
(6)			Press [∧] key 5 times or [∨] key once. The display will switch to the constant selection display.
			Press the ENTER key to switch to the constant selection mode. The constant number portion will blink.
			Press [>] key to change the desired digit (blinking display). * The digit to be changed is divided into the upper 1 digit and the lower 2 digits.
			Use [>] key, and [∧] key, or [∨] key to display Pn001.
			After displaying Pn001, press the ENTER key. The existing Pn001constant value (2500) will be displayed.
			Use [>] key, and [∧] key, or [∨] key to change the set value. * The 7 segment LED display as shown on the left will appear when the set value is 2000.
			After setting 2000 in the constant value, press the ENTER key. An input confirmation message "End" will be displayed for about 1 second.
(7)			Turn on the switch that is connected in (2). (Turn on the selection of speed command 1.)
			Turn on the switch that is connected in (1), to rotate the motor in CW direction at the specified rotation speed.
(8)			Turn off the switch that is connected in (1), to stop the motor.

5. Operation panel

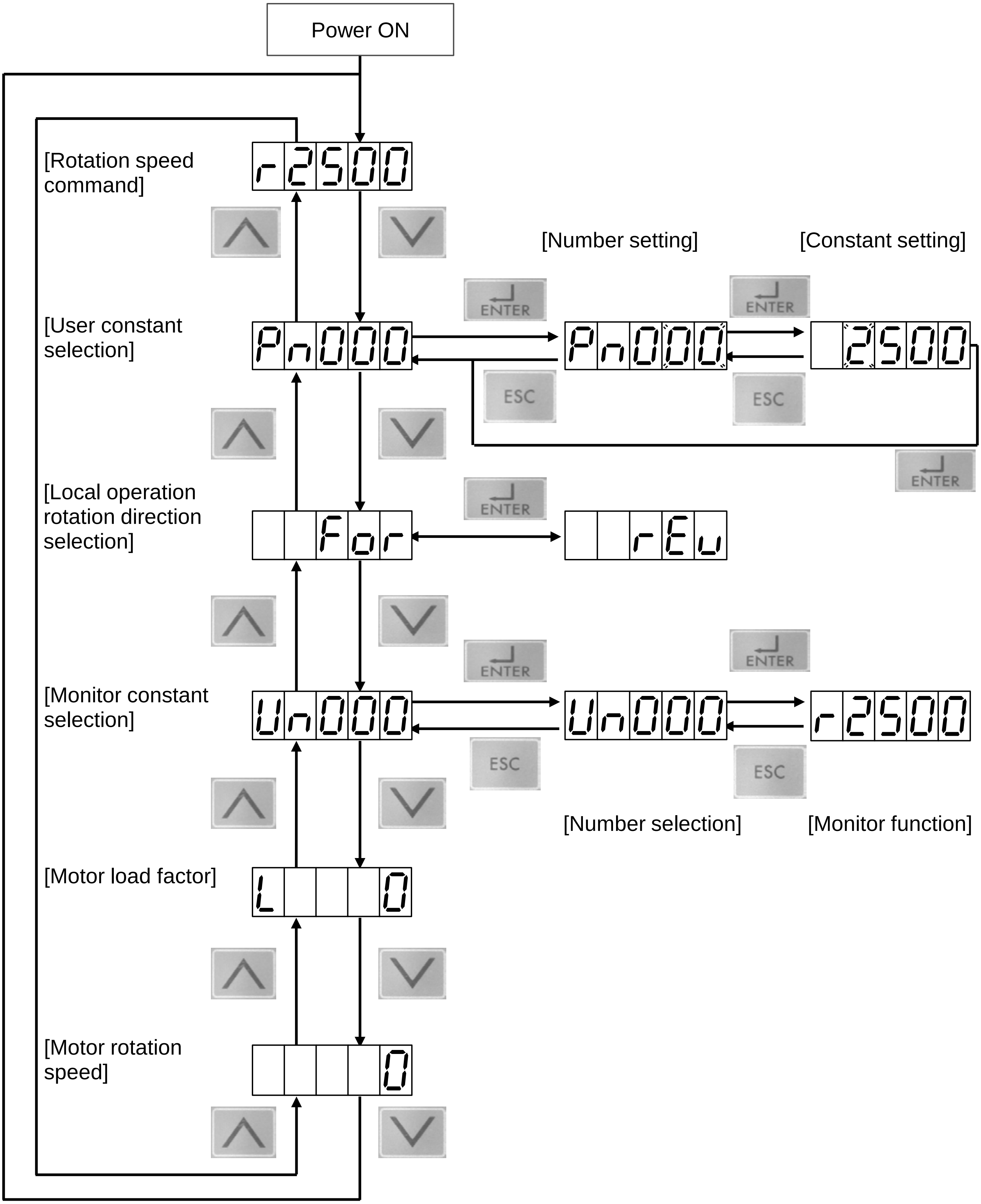
5-1. Part names and their functions


Display
(7 segment LED:
5 digits)
Operation key
GTR-AR
ESC
LO/RE
RESET
ENTER
RUN
STOP
ALM
REV
DRV
FOUT
MIN
MAX
Display (LED)
Command setting volume

No.	Diagram	Name	Function
1		ESC key	Returns to the previous screen.
2		RESET key	• Moves the digit to be changed to right when setting the numerical value. • Set as an error reset key in local mode.
3		RUN key	Drives the motor in local mode.
4		UP key	• Changes (increases) the numerical value when setting the numerical value. • Moves the screen.
5		Down key	• Changes (decreases) the numerical value when setting the numerical value. • Moves the screen.
6		STOP key	Stops the motor in local mode.
7		ENTER key	• Determines the numerical value setting. • Switches the rotation direction on the rotation direction selection screen.
8		LO/RE selection key	Switches between the local mode and remote mode.
9		RUN lamp	Turns on while the motor is running.
10		LO/RE lamp	Turns on in local mode.
11		FOUT LED lamp	Turns on while the motor is energizing.
12		REV LED lamp	Turns on during reverse direction operation.
13		DRV LED lamp	Turns on when the motor can be operated using RUN key.
14		ALM LED lamp	Turns on when error is detected.
15		Command setting Volume	Enters the analog command selected in the parameter (Pn200). * The default value is the speed command in the local mode.

5-2. Switching between operation panel display items

You can switch the display items as follows by using the up and down keys on the operation panel.


Power ON
[Rotation speed command]
r2500
[User constant selection]
Pn000
[Number setting]
[Constant setting]
ENTER
ESC
Pn000
2500
[Local operation rotation direction selection]
For
rEu
[Monitor constant selection]
Un000
Un000
r2500
[Number selection]
[Monitor function]
[Motor load factor]
L 0
[Motor rotation speed]
0

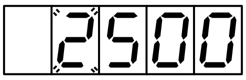
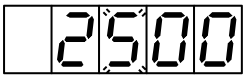
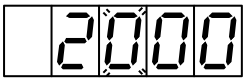
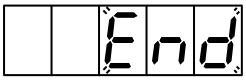
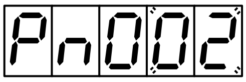
5-3. Example of setting the constant

This section describes how to set a constant by giving an example of "Changing Pn002 constant from "2500" to "2000" when the power supply is turned on".

Following is the procedure outline:

(1) Selecting constant selection mode
(2) Selecting Pn002
(3) Displaying the details of Pn002 constant
(4) Changing the set value to 2000
(5) Confirming the input

Procedure No.	Operation	Display	Details
(1)	-	r2500	It is a default display when the power supply is turned on. Existing speed command is displayed. * The 7 segment LED display as shown on the left will appear when the speed command is 2500 [r/min].
	∧	0	Press [∧] key. The display will switch to the motor speed display. * The 7 segment LED display as shown on the left will appear when the motor speed is 0 [r/min].
	∧	L 0	Press [∧] key. The display will switch to load factor display. * The 7 segment LED display as shown on the left will appear when the load factor is 0%.
	∧	Un000	Press [∧] key. The display will switch to the monitor selection display. * The 7 segment LED display as shown on the left will appear when the monitor number is Un000.
	∧	For	Press [∧] key. The display will switch to the rotation direction switching display. * The 7 segment LED display as shown on the left will appear when the rotation direction is CW.
	∧	Pn000	Press [∧] key. The display will switch to the constant selection display. * The 7 segment LED display as shown on the left will appear when the constant number is Pn000.
(2)	ENTER	Pn000	Press the ENTER key to switch to the constant selection mode. The constant number portion will blink.
	> RESET	Pn000	Press [>] key to change the desired digit (blinking display). * The digit to be changed is divided into the upper 1 digit and the lower 2 digits.
	∧	Pn002	Press [∧] key until Pn002 is displayed.

Procedure No.	Operation	Display	Details
(3)			After displaying Pn002, press the ENTER key. The existing Pn002 constant value (2500) will be displayed.
(4)			Press [>] key to change the desired digit (blinking display).
			Press [V] key until the constant value reaches to 2000. *The constant value increases when the key is long pressed.
(5)			After setting 2000 in the constant value, press the ENTER key. An input confirmation message "End" will be displayed for about 1 second.
	-		The display will switch to Pn002 display after the input confirmation message "End" has been displayed. * Hereafter, for changing other constants, repeat the procedure from (2) to (5).

6. Monitor function

6-1. List of monitor constants

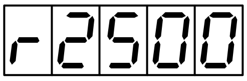
Constant No.	Details	Unit	Remarks
Un000	Speed command	r/min	
Un001	Motor rotation speed	r/min	
Un002	Load factor	%	Ratio of motor electric current to motor rated electric current
Un003	Motor electric current	A	
Un004	Torque limit value	%	
Un005	Main circuit direct current bus voltage	V	
Un007	Error history	-	
Un008	Software version	-	
Un009	Integrated overload value	%	Ratio of integrated load to overload error
Un010	Input terminal status	-	ON/OFF state of the input terminal is displayed.
Un011	Input function status	-	ON/OFF state of the input function is displayed.
Un020	Output terminal status	-	ON/OFF state of the output terminal is displayed.
Un021	Output function status	-	ON/OFF state of the output function is displayed.

6-2. Description of monitor constants

Un000 Speed command value

The existing speed command value is displayed.

Display example



This example shows that the speed command value is 2500 [r/min].

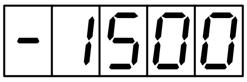
Un001 Motor rotation speed

The existing motor rotation speed is displayed.

When rotating in the CCW direction, "-" is displayed in the beginning.

(When rotating in the CW direction, nothing is displayed in the beginning.)

Display example

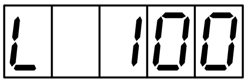


This example shows that the rotation speed is 1500 [r/min], and motor rotates in the CCW direction.

Un002 Motor load factor

The existing motor load factor (Ratio of motor electric current to motor rated electric current) is displayed.

Display example

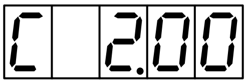


This example shows that the motor load factor is 100% of the motor rated electric current.

Un003 Motor electric current value

The existing motor electric current value is displayed.

Display example

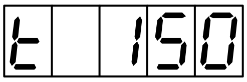


This example shows that electric current of 2.0 A flows to the motor.

Un004 Torque limit value

The existing torque limit value (command value) is displayed.

Display example

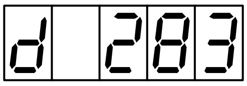


This example shows that the torque limit value is 150% and it is charged.

Un005 Main circuit direct current bus voltage

The existing main circuit direct current bus voltage is displayed.

Display example



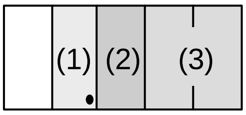
This example shows that the main circuit direct current bus voltage is 283 V.

Un007 Error history

The history of the errors occurred on the driver is displayed.

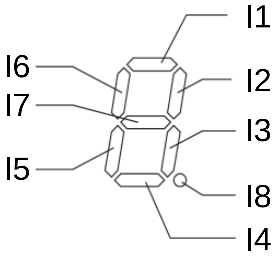
Error history records last 10 errors.

- Following are the display details.



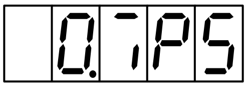
(1) History No. (0 to 9 (10 errors), 0 is the latest)
(2) Input terminal status (The input terminal status immediately after alarm generation)
(3) Alarm information

(2) Detailed part specifications



When input is on, the corresponding LED turns on.

Display example

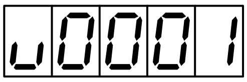


This example shows that the latest error is the pole sensor error, and only I1, I3 input terminals were ON at that time.

Un008 Software version

The software version of the driver is displayed.

Display example



This example shows that the software version of the driver is 0001.

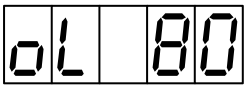
Un009 Integrated motor overload value

The internal integrated value till an electric overload alarm rings is displayed.

It easily increases with the increase in the motor load, and when it reaches to 100%, the electric overload alarm rings.

The motor load will reach to 80% immediately after the power supply is turned on. (Hot start)

Display example

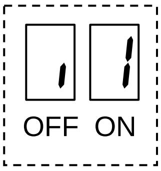


This example shows that the integrated value of electric overload will reach to 80% of alarm generation.

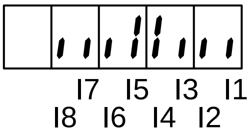
Un010 Input terminal status

ON/OFF state of the input terminals from I1 to I8 is monitored.

ON/OFF display is as follows:



Display example



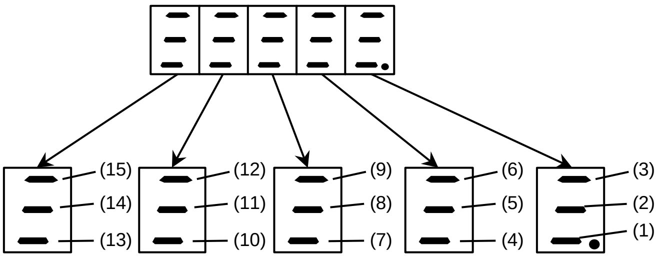
This example shows that I4, I5 terminals are ON, and other terminals are OFF.

Un011 Input function status

ON/OFF state for each input function is monitored.

It is monitored regardless of the parameter settings.

Following are the display details:



(1) ~ (15): Function names

Light off: Function OFF state

Light on: Function ON state

Corresponding functions

(1) Clockwise driving command

(2) Anticlockwise driving command

(3) Selection of speed command 1

(4) Selection of speed command 2

(5) Selection of speed command 3

(6) Selection of speed command 4

(7) Selection of acceleration and deceleration time 1

(8) Selection of acceleration and deceleration time 2

(9) Selection of torque limit value 1

(10) Selection of torque limit value 2

(11) Selection of torque limit value 3

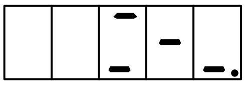
(12) Brake control output command

(13) (Backup)

(14) (Backup)

(15) Emergency stop

Display example



This example shows that the following functions are ON.

(1) Clockwise driving command

(5) Selection of speed command 3

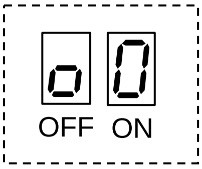
(7) Selection of acceleration and deceleration time 1

(9) Selection of torque limit value 1

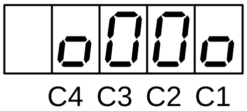
Un020 Output terminal status

ON/OFF state of output terminals from C1 to C4 is monitored.

ON/OFF display is as follows:



Display example



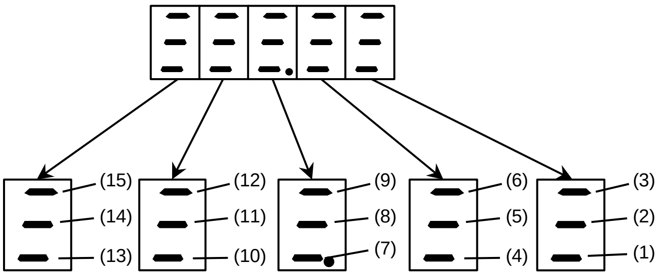
This example shows that C2, C3 terminals are ON, and C1, C4 terminals are OFF.

Un021 Output function status

ON/OFF state for each output function is monitored.

It is monitored regardless of the parameter settings.

Following are the display details:



(1) ~ (15): Function names

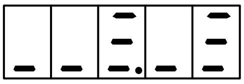
Light off: Function OFF state

Light on: Function ON state

Corresponding functions

(1) Error detection
(2) Brake timing output
(3) Rotation pulse
(4) Clockwise driving pulse
(5) Anticlockwise driving pulse
(6) Rotation direction
(7) Signal during operations
(8) Signal during rotations
(9) Speed match
(10) Specified speed over
(11) Rated torque over
(12) Signal during torque limit
(13) Specified torque over
(14) (Backup)
(15) (Backup)

Display example



This example shows that the status of the following functions is ON.

(1) Error detection
(2) Brake timing output
(3) Rotation pulse
(4) Clockwise driving pulse
(7) Signal during operations
(8) Signal during rotations
(9) Speed match
(10) Specified speed over
(13) Specified torque over

7. User constants

7-1. List of user constants

Command constants: Constants related to command setting

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn000	Speed command 1	Set speed command 1.	r/min	100 ～ 3000	2500	D
Pn001	Speed command 2	Set speed command 2.	r/min	100 ～ 3000	2500	D
Pn002	Speed command 3	Set speed command 3.	r/min	100 ～ 3000	2500	D
Pn003	Speed command 4	Set speed command 4.	r/min	100 ～ 3000	2500	D
Pn004	Speed command 5	Set speed command 5.	r/min	100 ～ 3000	2500	D
Pn005	Speed command 6	Set speed command 6.	r/min	100 ～ 3000	2500	D
Pn006	Speed command 7	Set speed command 7.	r/min	100 ～ 3000	2500	D
Pn007	Speed command 8	Set speed command 8.	r/min	100 ～ 3000	2500	D
Pn008	Speed command 9	Set speed command 9.	r/min	100 ～ 3000	2500	D
Pn009	Speed command 10	Set speed command 10.	r/min	100 ～ 3000	2500	D
Pn010	Speed command 11	Set speed command 11.	r/min	100 ～ 3000	2500	D
Pn011	Speed command 12	Set speed command 12.	r/min	100 ～ 3000	2500	D
Pn012	Speed command 13	Set speed command 13.	r/min	100 ～ 3000	2500	D
Pn013	Speed command 14	Set speed command 14.	r/min	100 ～ 3000	2500	D
Pn014	Speed command 15	Set speed command 15.	r/min	100 ～ 3000	2500	D
Pn015	Speed command 16	Set speed command 16.	r/min	100 ～ 3000	2500	D
Pn016	Operator speed command	Set the speed command of operator.	r/min	100 ～ 3000	1000	D
Pn017	Maximum value of the analog speed command	Set the highest speed command of the external analog input and command setting volume.	r/min	100 ～ 3000	2500	D
Pn020	Acceleration time 1	Set acceleration time 1 from 0 [r/min] up to acceleration and deceleration time standard speed (Pn028).	sec	0.000 ～ 5.000	0.1	-
Pn021	Deceleration time 1	Set deceleration time 1 from acceleration and deceleration time standard speed (Pn028) up to 0 [r/min].	sec	0.000 ～ 5.000	0.1	-
Pn022	Acceleration time 2	Set acceleration time 2 from 0 [r/min] up to acceleration and deceleration time standard speed (Pn028).	sec	0.000 ～ 5.000	0.1	-
Pn023	Deceleration time 2	Set deceleration time 2 from acceleration and deceleration time standard speed (Pn028) up to 0 [r/min].	sec	0.000 ～ 5.000	0.1	-
Pn024	Acceleration time 3	Set acceleration time 3 from 0 [r/min] up to acceleration and deceleration time standard speed (Pn028).	sec	0.000 ～ 5.000	0.1	-
Pn025	Deceleration time 3	Set deceleration time 3 from acceleration and deceleration time standard speed (Pn028) up to 0 [r/min].	sec	0.000 ～ 5.000	0.1	-

D: Can be changed during operations

Command constants: Constants related to command setting

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn026	Acceleration time 4	Set acceleration time 4 from 0 [r/min] up to acceleration and deceleration time standard speed (Pn028).	sec	0.000 ～ 5.000	0.1	-
Pn027	Deceleration time 4	Set deceleration time 4 from acceleration and deceleration time standard speed (Pn028) up to 0 [r/min].	sec	0.000 ～ 5.000	0.1	-
Pn028	Acceleration and deceleration time standard speed	Set the standard speed of acceleration and deceleration time. Acceleration time: Time from 0 [r/min] up to this constant Deceleration time: Time from this constant up to 0 [r/min]	r/min	1000 ～ 3000	2500	-
Pn030	Torque limit value 1	Set torque limit value 1.	%	0 ～ 200	150	D
Pn031	Torque limit value 2	Set torque limit value 2.	%	0 ～ 200	150	D
Pn032	Torque limit value 3	Set torque limit value 3.	%	0 ～ 200	150	D
Pn033	Torque limit value 4	Set torque limit value 4.	%	0 ～ 200	150	D
Pn034	Torque limit value 5	Set torque limit value 5.	%	0 ～ 200	150	D
Pn035	Torque limit value 6	Set torque limit value 6.	%	0 ～ 200	150	D
Pn036	Torque limit value 7	Set torque limit value 7.	%	0 ～ 200	150	D
Pn037	Torque limit value 8	Set torque limit value 8.	%	0 ～ 200	150	D
Pn038	Operator torque limit value	Set the torque limit value of operator.	%	0 ～ 200	150	D
Pn039	Maximum value of the analog torque limit level	Set the maximum torque limit value of the external analog input and command setting volume.	%	0 ～ 200	150	D

D: Can be changed during operations

Operator constants: Constants related to operator setting

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn045	Selection of the operation command source when the power is turned on	Select the operation command source when the power is turned on. 0: Remote, 1: Local	-	0 ～ 1	0	-
Pn046	Selection of the rotation direction of the local operation when the power is turned on	Select the rotation direction of the local operation when the power is turned on. 0: FOR (CW), 1: REV (CCW)	-	0 ～ 1	0	-
Pn047	Selection of items displayed on a monitor when the power is turned on	Select the items displayed on a monitor when the power is turned on. 0: Rotation speed command 1: Motor rotation speed 2: Motor load factor 3: Un monitor	-	0 ～ 3	0	-
Pn048	Selection of the number to be initially displayed on Un monitor	Select the initial display number on Un monitor. For numbers, see P.31 "List of monitor constants".	-	0 ～ 22 *1	0	-
Pn049	Monitor filter time constant	Set the filter time constant to be displayed on Un monitor.	sec	0 ～ 5.00	0.1	D

*1 If you select an undefined monitor number, the initial display number will be Un000.

D: Can be changed during operations

Input terminal constants: Constants related to input terminal setting

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn100	Selection of I1 multi-function	Select the external terminal input I1 function.	-	1 ～ 13	1	P
Pn101	Selection of I2 multi-function	Select the external terminal input I2 function.	-	1 ～ 13	2	P
Pn102	Selection of I3 multi-function	Select the external terminal input I3 function.	-	1 ～ 13	3	P
Pn103	Selection of I4 multi-function	Select the external terminal input I4 function.	-	1 ～ 13	4	P
Pn104	Selection of I5 multi-function	Select the external terminal input I5 function.	-	1 ～ 13	9	P
Pn105	Selection of I6 multi-function	Select the external terminal input I6 function.	-	1 ～ 13	7	P
Pn106	Selection of I7 multi-function	Select the external terminal input I7 function.	-	1 ～ 13	12	P
Pn107	Selection of I1 polarity	Select the valid polarity of external terminal input I1. 0: Valid with ON, 1: Valid with OFF	-	0 ～ 1	0	P
Pn108	Selection of I2 polarity	Select the valid polarity of external terminal input I2. 0: Valid with ON, 1: Valid with OFF	-	0 ～ 1	0	P
Pn109	Selection of I3 polarity	Select the valid polarity of external terminal input I3. 0: Valid with ON, 1: Valid with OFF	-	0 ～ 1	0	P
Pn110	Selection of I4 polarity	Select the valid polarity of external terminal input I4. 0: Valid with ON, 1: Valid with OFF	-	0 ～ 1	0	P
Pn111	Selection of I5 polarity	Select the valid polarity of external terminal input I5. 0: Valid with ON, 1: Valid with OFF	-	0 ～ 1	0	P
Pn112	Selection of I6 polarity	Select the valid polarity of external terminal input I6. 0: Valid with ON, 1: Valid with OFF	-	0 ～ 1	0	P
Pn113	Selection of I7 polarity	Select the valid polarity of external terminal input I7. 0: Valid with ON, 1: Valid with OFF	-	0 ～ 1	0	P

P: It is a constant. The function gets enabled after you enter a constant and restart the device.

Input terminal List of selectable functions

Set value	Function name	Set value	Function name
1	CW operation command	8	Selection of acceleration and deceleration time 2
2	CCW operation command	9	Selection of torque limit value 1
3	Selection of speed command 1	10	Selection of torque limit value 2
4	Selection of speed command 2	11	Selection of torque limit value 3
5	Selection of speed command 3	12	Brake output forcibly ON command
6	Selection of speed command 4	13	Emergency stop/Error reset input
7	Selection of acceleration and deceleration time 1		

Output terminal constants: Constants related to output terminal setting

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn120	C1-E1 Multi-function selection	Select external terminal output C1-E1 function.	-	1 ～ 13	1	P
Pn121	C2-E2 Multi-function selection	Select external terminal output C2-E2 function.	-	1 ～ 13	2	P
Pn122	C3-E3 Multi-function selection	Select external terminal output C3-E3 function.	-	1 ～ 13	7	P
Pn123	C4-E4 Multi-function selection	Select external terminal output C4-E4 function.	-	1 ～ 13	8	P
Pn125	C1-E1 Polarity selection	Select the polarity of external terminal output C1-E1 function. 0: Positive logic 1: Negative logic	-	0 ～ 1	0	P
Pn126	C2-E2 Polarity selection	Select the polarity of external terminal output C2-E2 function. 0: Positive logic 1: Negative logic	-	0 ～ 1	0	P
Pn127	C3-E3 Polarity selection	Select the polarity of external terminal output C3-E3 function. 0: Positive logic 1: Negative logic	-	0 ～ 1	0	P
Pn128	C4-E4 Polarity selection	Select the polarity of external terminal output C4-E4 function. 0: Positive logic 1: Negative logic	-	0 ～ 1	0	P

P: It is a constant. The function gets enabled after you enter a constant and restart the device.

Output terminal List of selectable functions.

Set value	Function name	Remarks	Set value	Function name	Remarks
1	Error detection signal		8	Signal during rotations	
2	Brake timing signal		9	Speed matching signal	
3	Rotation pulse	Only Pn122, Pn123 can be set. (C3-E3, C4-E4 terminal)	10	Specified speed over	
4	CW pulse		11	Rated torque over	
5	CCW pulse		12	Signal during torque limit	
6	Rotation direction signal		13	Specified torque over	
7	Signal during operations				

Control constants: Constants related to the command source

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn200	Selection of speed command 1/torque limit value 1	Set a combination of speed command 1 and torque limit value 1.	-	0 ～ 7	0	-

List of the speed command 1/torque limit value 1 selection combination

Set value	Selecting command source for remote operations		Selecting command source for local operations	
	Speed command	Torque limit value	Speed command	Torque limit value
0	External analog command	Torque limit value 1 (Pn030)	Command setting volume	Operator torque limit value (Pn038)
1	External analog command	Torque limit value 1 (Pn030)	Operator speed command (Pn016)	Operator torque limit value (Pn038)
2	Speed command 1 (Pn000)	External analog command	Operator speed command (Pn016)	Command setting volume
3	Speed command 1 (Pn000)	Torque limit value 1 (Pn030)	Operator speed command (Pn016)	Operator torque limit value (Pn038)
4	Speed command 1 (Pn000)	Torque limit value 1 (Pn030)	Command setting volume	Operator torque limit value (Pn038)
5	Speed command 1 (Pn000)	External analog command	Command setting volume	Operator torque limit value (Pn038)
6	External analog command	Command setting volume	Operator speed command (Pn016)	Operator torque limit value (Pn038)
7	Command setting volume	External analog command	Operator speed command (Pn016)	Operator torque limit value (Pn038)

Gain constants: Gain related constants

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn201	Rigidity table	Set the rigidity table. Select a combination of speed control proportional gain, speed control integration time, torque filter time constant from the rigidity table.	-	1 ～ 5	3	-
Pn202	Speed control proportional gain	Set the speed control proportional gain.	Hz	1 ～ 1000	20	D
Pn203	Speed control integration time	Set the speed control integration time.	ms	0 ～ 1000 *2	45	D
Pn204	Torque filter time constant	Set the time constant of the torque filter.	ms	0.00 ～ 327.67	2	-
Pn205	Inertia moment ratio	Set the inertia moment ratio of the connected load. Set the percentage of the motor rotor inertia as the motor axis conversion inertia.	%	0 ～ 3000	0	D

*2 The integral control is disabled when the set value is "0 ms".

D: Can be changed during operation

Rigidity table list

Set value	Speed control proportional gain (Pn202)	Speed control integration time (Pn203)	Torque filter time constant (Pn204)
1	10 Hz	80 ms	3.00 ms
2	15 Hz	60 ms	2.50 ms
3	20 Hz	45 ms	2.00 ms
4	30 Hz	30 ms	1.30 ms
5	40 Hz	20 ms	1.00 ms

Comparison constants: Constants related to the comparison of output functions

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn210	Speed matching level	Set the speed matching level of the external terminal output. When the motor speed is “Command speed” ± ”root constant”, it is considered as 'speed matching'.	r/min	0 ～ 1000	50	-
Pn211	Speed detection level	Set the specified speed over level of the external terminal output. When the motor speed is more than the root constant , it is considered as 'specified speed over'.	r/min	0 ～ 3000	2500	-
Pn212	Speed detection hysteresis width	Set the hysteresis width of the specified speed over detection of the external terminal output. When the motor speed is less than “speed detection level” – “root constant”, the specified speed over is canceled.	r/min	0 ～ 999	10	-
Pn213	Torque detection level	Set the specified torque over level of the external terminal output. When the motor current is more than the root constant, it is considered as 'specified torque over'.	%	0 ～ 200	80	-
Pn214	Torque detection hysteresis width	Set the hysteresis width of the specified torque over detection of the external terminal output. When the electric current of the motor is less than “torque detection level” – “root constant”, the specified speed over is canceled.	%	0 ～ 50	10	-
Pn215	Rated torque detection hysteresis width	Set the hysteresis width of the rated torque over detection of the external terminal output. When the electric current of the motor is less than “rated torque (100%)” – “root constant”, the rated torque over is canceled.	%	0 ～ 50	10	-
Pn216	Output in torque limit hysteresis width	Set the hysteresis width of the detection in torque limit of the external terminal output. When the electric current of the motor is less than “torque limit value” – “root constant”, the detection in torque limit is canceled.	%	0 ～ 50	10	-

Mechanical brake constants: Constants related to mechanical brake

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn220	Selection of the mechanical brake automatic control function	Enable or disable the mechanical brake automatic control function. 0: Disable (Always OFF) 1: Enable	-	0 ～ 1	1	P
Pn221	Mechanical brake release speed level	Set the internal speed command level for releasing the mechanical brakes. Release the mechanical brake when the internal speed command is more than the root constant.	r/min	1 ～ 1000	20	-
Pn222	Mechanical brake operation speed level	Set the internal speed command level for operating mechanical brakes. Operate the mechanical brake when the internal speed command is less than the root constant.	r/min	0 ～ 1000	20	-
Pn223	Mechanical brake release standby time	Set the delay time when the mechanical brake is released. Release the internal speed command when it becomes greater than the mechanical brake release speed and surpasses the root constant.	sec	0.000 ～ 2.000	0.005	-
Pn224	Mechanical brake operation standby time	Set the delay time when the mechanical brake is operated. Operate the internal speed command when it becomes lower than the mechanical brake operation speed and surpasses the root constant.	sec	0.000 ～ 2.000	0.005	-

P: It is a constant. The function gets enabled after you enter a constant and restart the device.

External analog constants: Constants related to external analog input

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn230	External analog input level	Select the external analog voltage level. 0:0 V ～ 5 V 1:0 V ～ 10 V	-	0 ～ 1	1	-
Pn231	External analog filter time constant	Set the filter time constant of the external analog voltage detection.	sec	0.001 ～ 1.000	0.1	-
Pn232	External analog adjustment gain	Set the inclination of the external analog voltage detection.	-	0.500 ～ 2.000	1	-
Pn233	External analog adjustment offset	Set the offset value of the external analog voltage detection.	V	-9.900 ～ 9.900	0	-

Dynamic break constants: Constants related to dynamic break

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn240	Selection of dynamic brake function after stopping	Select the dynamic brake function after stopping. *3 0: Not used 1: Used (Disabled during emergency stop) 2: Used (Enabled during emergency stop) 3: Used (Disabled during emergency stop or forceful release of mechanical brake) 4: Used (Enabled during emergency stop and disabled during forceful release of mechanical brake)	-	0 ～ 4	0	-

*3 Irrespective of the settings, dynamic brakes are disabled if the free-run stop (I8) is OFF.

Safety constants: Constants related to safety

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn245	Selection of overload detection method	Set the selection of overload detection method. 0: Electronic thermal system 1: Motor current continuous detection system	-	0 ～ 1	0	-
Pn246	Overload detection interval	Set the overload detection interval of the motor current continuous detection system. When the motor current is constantly 100% or more, and if it is detected more than or equal to this constant, there is an overload.	sec	0.01 ～ 10.00	10.00	-

Initializing the constants: Constants related to initialization

No.	Name	Details	Unit	Set range	Initial value	Attribute
Pn400	Initializing the user constants	Initialize the user constants. 0: Does not initialize 1: Initialize the user constants	-	0 ～ 1	0	N
Pn401	Clearing the alarm history	Clear the alarm history. 0: Does not clear the alarm history 1: Clear the alarm history	-	0 ～ 1	0	N
Pn402	Reserving the constant	Do not change the settings.	-	-	-	-
Pn403	Reserving the constant	Do not change the settings.	-	-	-	-

N: Unsaved constant

7-2. Description of user constants

■ Command constants

Constants related to various command settings

Pn000 ～ Pn015 Speed command 1 ～ 16
Pn016 Operator speed command

Set the speed command (digital command) for the motor.

Select the speed commands 1 ～ 16 and operator speed commands by using the Multi-function input: Selection of speed command 1 ～ 4.

The speed command settings corresponding to the speed command selection are as follows:

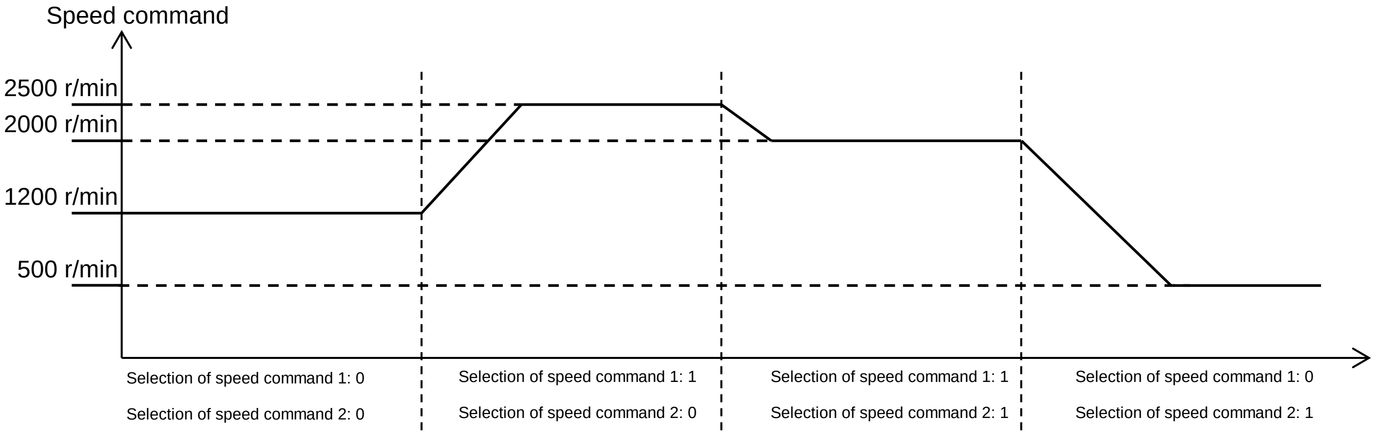
Speed command	Selection of speed command 1	Selection of speed command 2	Selection of speed command 3	Selection of speed command 4
External analog command Command setting volume Speed command 1 (Pn000) Operator speed command (Pn016) *	OFF	OFF	OFF	OFF
Speed command 2 (Pn001)	ON	OFF	OFF	OFF
Speed command 3 (Pn002)	OFF	ON	OFF	OFF
Speed command 4 (Pn003)	ON	ON	OFF	OFF
Speed command 5 (Pn004)	OFF	OFF	ON	OFF
Speed command 6 (Pn005)	ON	OFF	ON	OFF
Speed command 7 (Pn006)	OFF	ON	ON	OFF
Speed command 8 (Pn007)	ON	ON	ON	OFF
Speed command 9 (Pn008)	OFF	OFF	OFF	ON
Speed command 10 (Pn009)	ON	OFF	OFF	ON
Speed command 11 (Pn010)	OFF	ON	OFF	ON
Speed command 12 (Pn011)	ON	ON	OFF	ON
Speed command 13 (Pn012)	OFF	OFF	ON	ON
Speed command 14 (Pn013)	ON	OFF	ON	ON
Speed command 15 (Pn014)	OFF	ON	ON	ON
Speed command 16 (Pn015)	ON	ON	ON	ON

* Select the external analog command, command setting volume, speed command 1, operator speed command by Pn200.

[Example]

Following are the speed command settings corresponding to the speed command selection for speed command 2: 2500 r/min, speed command 3: 500 r/min, speed command 4: 2000 r/min, external speed command: 1200 r/min.

* In the remote mode, Pn200 is 0 (initial value).



Pn017 Maximum value of the analog speed command

Set the highest speed command of the external analog input and command setting volume.

* Select the external analog command and command setting volume command by Pn200.

Pn020 ～ Pn027 Acceleration time 1 ～ 4, Deceleration time 1 ～ 4
Pn028 Acceleration and deceleration time standard speed

The motor start/stop time can be set by using the acceleration/deceleration time constants.

By setting this time, the motor can be started/stopped at the desired time.

[Acceleration time 1 ～ 4, deceleration time 1 ～ 4 (Pn020 ～ Pn027)]

Select the acceleration and deceleration time by using multi-function input: Selection of acceleration and deceleration time 1 ～ 2.

The acceleration and deceleration time settings corresponding to the acceleration and deceleration time selection are as follows:

Acceleration and deceleration time	**Selection of acceleration and deceleration time 1**	**Selection of acceleration and deceleration time 2**
Acceleration time 1 (Pn020) Deceleration time 1 (Pn021)	OFF	OFF
Acceleration time 2 (Pn022) Deceleration time 2 (Pn023)	ON	OFF
Acceleration time 3 (Pn024) Deceleration time 3 (Pn025)	OFF	ON
Acceleration time 4 (Pn026) Deceleration time 4 (Pn027)	ON	ON

‖ Notes ‖

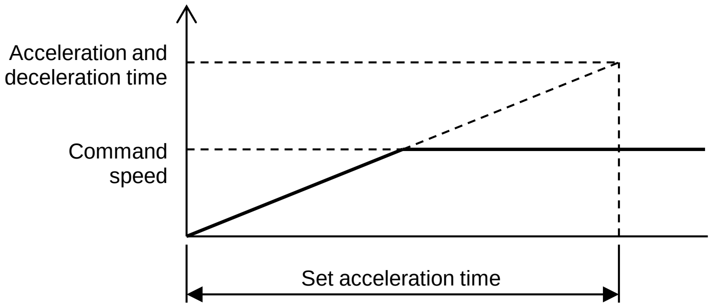
Based on the load on the motor, the acceleration and deceleration may not happen at a set acceleration and deceleration time.

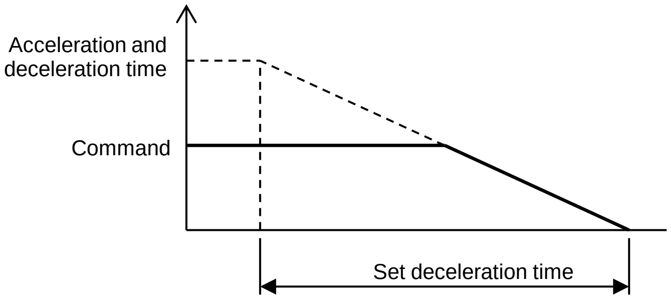
[Acceleration time]

As the acceleration time, set the time of acceleration from the motor stopped condition to the acceleration and deceleration time standard speed (Pn028). Even if the speed command is less than the standard speed, motor accelerates with the acceleration rate from the motor stopped condition to the standard speed.

[Deceleration time]

As the deceleration time, set the time of deceleration from the acceleration and deceleration time standard speed (Pn028) to the stopped condition. Even if the speed command is less than the standard speed, motor decelerates with the deceleration rate from the standard speed to the motor stopped condition.





Pn030 ～ Pn037 Torque limit value 1 ～ 8
Pn038 Operator torque limit value

Set the motor output torque limit.

[Torque limit value 1 ～ 8 (Pn030 ～ Pn037) and operator torque limit value (Pn038)]

Select the torque limit value 1 ～ 8 and operator torque limit value by using the Multi-function input: Selection of torque limit value 1 ～ 3.

The torque limit value settings corresponding to the torque limit value selection are as follows:

Torque limit	Selection of torque limit 1	Selection of torque limit 2	Selection of torque limit 3
External analog command Command setting volume Torque limit value 1 (Pn030) Operator torque limit value (Pn038) *	OFF	OFF	OFF
Torque limit value 2 (Pn031)	ON	OFF	OFF
Torque limit value 3 (Pn032)	OFF	ON	OFF
Torque limit value 4 (Pn033)	ON	ON	OFF
Torque limit value 5 (Pn034)	OFF	OFF	ON
Torque limit value 6 (Pn035)	ON	OFF	ON
Torque limit value 7 (Pn036)	OFF	ON	ON
Torque limit value 8 (Pn037)	ON	ON	ON

* Select the external analog command, command setting volume, torque limit value 1 and operator torque limit value by Pn200.

Pn039 Maximum value of the analog torque limit level

Set the maximum torque limit value of the external analog input and command setting volume.

* Select the external analog command and command setting volume command by Pn200.

■ Operator constants

Constants related to operator settings

Pn045 Selection of the operation command source when the power is turned on

Select the operation command source when the power is turned on.

0: Remote (A mode that includes operations through the input terminal)

1: Local (A mode that includes operations through the operation panel)

‖ Notes ‖

1. This parameter selects the initial settings when the power is turned on.
   The operation command source is not changed immediately after the settings are changed.
2. The changes after the power is turned on can be done through the panel operations.

Pn046 Selection of the rotation direction of the local operation when the power is turned on

Select the rotation direction of the local operation when the power is turned on.

0: FOR (CW)

1: REV (CCW)

‖ Notes ‖

1. This parameter selects the initial settings when the power is turned on.
   The rotation direction is not changed immediately after the settings are changed.
2. The changes after the power is turned on can be done through the panel operations.

Pn047 Selection of items displayed on a monitor when the power is turned on

Pn048 Selection of the number to be initially displayed on Un monitor

Select the items displayed on a monitor when the power is turned on.

0: Rotation speed command

1: Motor rotation speed

2: Motor load factor

3: Un monitor

3: When set to the Un monitor, the monitor set by the Un monitor initial display number selection (Pn048) will be displayed.

For numbers and monitor functions, see P.31 "List of monitor constants".

Example) When set with the Pn047: 3 and Pn048: 4,

Un004: Torque limit value details will be displayed when power supply is turned on.

Pn049 Monitor filter time constant

Set filter time constant when displaying Un monitor.

‖ Notes ‖

1. If set value is increased, the actual value will be displayed on the monitor with delay.

■ Input terminal constant

Constants for input terminal I1 ～ I7

Pn100	**I1 input function selection**
Pn101	**I2 input function selection**
Pn102	**I3 input function selection**
Pn103	**I4 input function selection**
Pn104	**I5 input function selection**
Pn105	**I6 input function selection**
Pn106	**I7 input function selection**

Set each function of input terminal I1 ～ I7.

The relationship between set value and its corresponding function is as follows:

Set value	Function name	Set value	Function name
1	CW operation command	8	Selection of acceleration and deceleration time 2
2	CCW operation command	9	Selection of torque limit value 1
3	Selection of speed command 1	10	Selection of torque limit value 2
4	Selection of speed command 2	11	Selection of torque limit value 3
5	Selection of speed command 3	12	Brake output forcibly ON command
6	Selection of speed command 4	13	Emergency stop/Error reset input
7	Selection of acceleration and deceleration time 1		

1 CW operation command

2 CCW operation command

If input is turned on, the motor will run in CW (CCW) direction and if input is turned off, the motor speed will reduce and finally it will stop.

If it is turned on at the same time, the motor will stop.

3 ～ 6 Selecting speed command 1 ～ 4

Select the speed command value from the combination of the ON/OFF state.

* For detailed correspondence table, see the description of the speed command parameters Pn000 ～ Pn016.

7 ～ 8 Selecting acceleration and deceleration time 1 ～ 2

Select the acceleration time and deceleration time from the combination of the ON/OFF state.

* For detailed correspondence table, see the description of the acceleration and deceleration time parameters Pn020 ～ Pn028.

9 ～ 11 Selecting torque limit value 1 ～ 3

Select the torque limit value from the combination of the ON/OFF state.

* For detailed correspondence table, see the description of the torque limit parameters Pn030 ～ Pn038.

12 Brake output forcibly ON command

Forcibly turn on the brake timing signal output.

* For more information, see the description of the mechanical brake-related parameters Pn220 ～ Pn224.

13 Emergency stop/Error reset input

Forcibly stop the motor.

After stopping the motor, the state (dynamic brake or free-run) can be set using Pn240.

When the input is made OFF from ON, the driver state becomes normal.

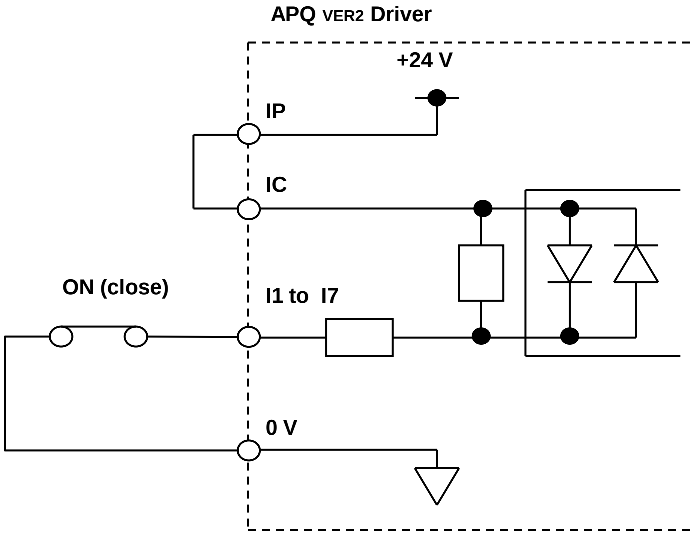
If this function is set, the value can be reset by entering either set input terminal or free-run stop/error reset input (I8).

* While executing the error reset operation, turn OFF the motor for minimum time (5 ms) or more.

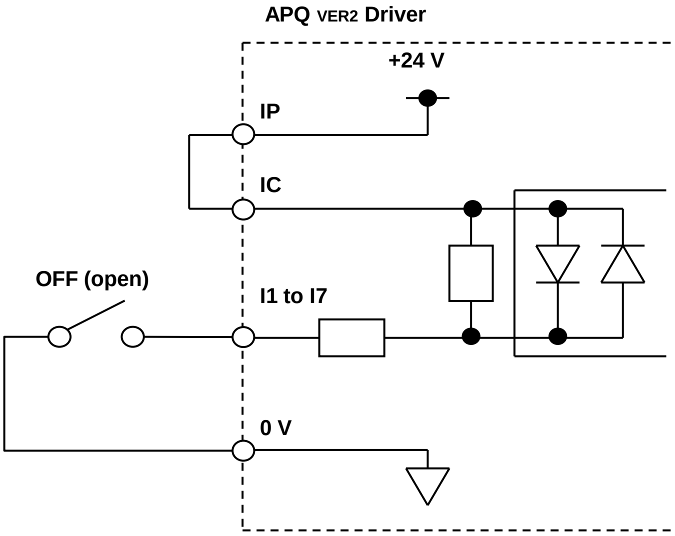
Pn107	**I1 input polarity selection**
Pn108	**I2 input polarity selection**
Pn109	**I3 input polarity selection**
Pn110	**I4 input polarity selection**
Pn111	**I5 input polarity selection**
Pn112	**I6 input polarity selection**
Pn113	**I7 input polarity selection**

The polarity of the input terminal (I1 ～ I7) can be switched by setting the input polarity selection constant (Pn107 ～ Pn113).
Set the ON/OFF polarity of each input terminal according to the specifications of the host device.

Each constant set value recognizes input state at driver side as follows:
When 0: Enabled by turning OFF (open)
When 1: Enabled by turning ON (close)



When set value 0: Recognized as OFF (disabled)
When set value 1: Recognized as ON (enabled)
(Initial value)



When set value 0: Recognized as ON (enabled)
When set value 1: Recognized as OFF (disabled)
(Initial value)

‖ Important ‖

If this constant is changed, the value does not change immediately after setting.
It changes to the set value by resupplying the power source of driver.

■ Output terminal constant

Constants for output terminal C1 ～ C4

Pn120	**C1 Output function selection**
Pn121	**C2 Output function selection**
Pn122	**C3 Output function selection**
Pn123	**C4 Output function selection**

Each function of the output terminal (C1-E1 ～ C4-E4) is set by selecting the output function (Pn120 ～ Pn123).

The relationship between set value and its corresponding function is as follows:

Set value	Function name	Remarks	Set value	Function name	Remarks
1	Error detection signal		8	Signal during rotations	
2	Brake timing signal		9	Speed matching signal	
3	Rotation pulse	Set only for Pn122 and Pn123. (C3-E3, C4 - E4 terminal)	10	Specified speed over	
4	CW pulse		11	Rated torque over	
5	CCW pulse		12	Signal during torque limit	
6	Rotation direction signal		13	Specified torque over	
7	Signal during operations				

1 Error detection signal

Turn off if an error is detected.

The output signal will turn on by supplying the power source again or setting the free-run stop/error reset input.

2 Brake timing signal

The timing signal will output for mechanical brake ON/OFF.

* For more information, see the description of the mechanical brake-related parameters Pn220 to Pn224.

3 Rotation pulse

4 CW pulse

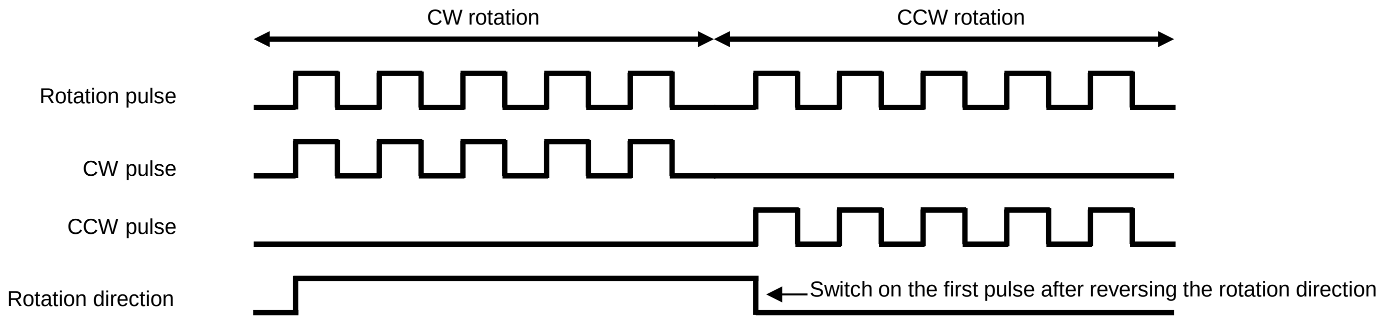
5 CCW pulse

6 Rotation direction signal

Output the signal (pulse) depending on the motor rotation.

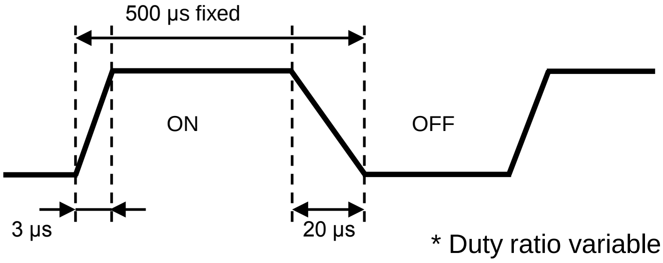
The number of pulses is 18 pulses per rotation.

Output signal for each setting is shown in the following diagram.


CW rotation
CCW rotation
Rotation pulse
CW pulse
CCW pulse
Rotation direction
Switch on the first pulse after reversing the rotation direction

*** For pulse waveform**

Specification of the output pulse will be shown in the diagram on the right. Select the counter according to the specifications.


500 µs fixed
ON
OFF
3 µs
20 µs

* Duty ratio variable

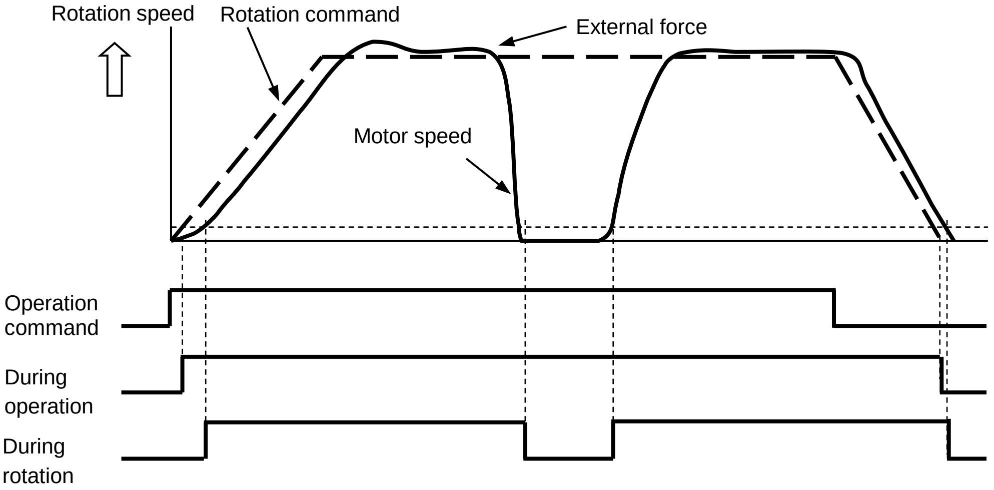
7 Signal during rotations

Signal will turn on when the motor is rotating, and it will turn off when the motor is stopped.

Signal will turn on when motor is rotated externally.

8 Signal during operations

The signal will turn on when the motor is energizing, and it will turn off when the energizing is stopped.



9 Speed matching signal

The signal will turn on when the motor rotation speed is matched with the speed command value.

10 Specified speed over

The signal will turn on when the motor rotation speed exceeds parameter set value.

* For more information, see the description of the speed detection-related parameters Pn210 to Pn212.

11 Rated torque over

The signal will turn on when the motor torque exceeds the rated torque.

12 Signal during torque limit

The signal will turn on when the motor torque reaches to the limit.

13 Specified torque over

The signal will turn on when the motor torque exceeds parameter set value.

* For more information, see the description of the speed detection-related parameters Pn213 to Pn216.

Pn125	**C1 Output polarity selection**
Pn126	**C2 Output polarity selection**
Pn127	**C3 Output polarity selection**
Pn128	**C4 Output polarity selection**

The polarity of the output terminal is set by setting the output polarity selection constant (Pn125 ～ Pn128).

Set the ON/OFF polarity of each output terminal according to the specifications of the equipment that imports the output signal.

The status detected from the driver side is output when each constant set value changes as follows:

If 0: OFF (open) when the value is enabled

If 1: ON (close) when the value is enabled

‖ Important ‖

If this constant is changed, the value does not change immediately after setting.

It changes to the set value by resupplying the power source of driver.

■ Control constants

Constants related to command source

Pn200 Selection of speed command 1/torque limit value 1

Use input function to set the command source when speed command 1 and torque limit value 1 are selected.

* For details, see speed command parameters (Pn000 ～ Pn016) and torque limit value parameters (Pn030 ～ Pn038).

Following is the correspondence table of the set values and the command sources.

Set value	Selecting command source for remote operations		Selecting command source for local operations	
	Speed command	Torque limit value	Speed command	Torque limit value
0	External analog command	Torque limit value 1	Command setting volume	Operator torque limit value
1	External analog command	Torque limit value 1	Operator speed command	Operator torque limit value
2	Speed command 1	External analog command	Operator speed command	Command setting volume
3	Speed command 1	Torque limit value 1	Operator speed command	Operator torque limit value
4	Speed command 1	Torque limit value 1	Command setting volume	Operator torque limit value
5	Speed command 1	External analog command	Command setting volume	Operator torque limit value
6	External analog command	Command setting volume	Operator speed command	Operator torque limit value
7	Command setting volume	External analog command	Operator speed command	Operator torque limit value

* You cannot control both speed commands and torque limit values by using analog commands.

* If you select 7 by using Pn200 and do not use external analog command for the torque limit value, reduce input terminal H and M.

Speed command 1

Similar to the speed commands (2 ～ 16), values set by using the parameter Pn000 become the command speeds.

* Use this parameter exclusively in remote mode.

Torque limit value 1

Similar to the torque limit values (2 ～ 8), values set by using the parameter Pn030 become torque limit values.

* Use this parameter exclusively in remote mode.

External analog command

Speed command values and torque limit values will change depending on the analog input voltage of terminal M. You can adjust the voltage and the command value by using the analog related parameters (Pn230 ～ Pn233). Also, you can set the maximum value in the analog speed command maximum value Pn017 and the analog torque limit level maximum value Pn038.

Command setting volume

Speed command values and torque limit values will change according to the instruction memory of command setting volume in the operation panel. The controllable maximum value can be set in the analog speed command maximum value Pn017 and the analog torque limit level maximum value Pn038.

Operator speed command

Similar to the speed commands (2 ～ 16), values set by using the parameter Pn016 become the command speed.

* Use this parameter exclusively in local mode.

Operator torque limit value

Similar to the torque limit values (2 ～ 8), values set by using the parameter Pn038 become torque limit values.

* Use this parameter exclusively in local mode.

■ Gain constants

Constants related to gain adjustment

Pn201 Rigidity table

Select the control gain (speed control proportion gain, speed control integration time, torque filter time constant) depending on the loaded machine rigidity connected to the motor.

Set in accordance with the machine rigidity.

Each control gain for the Pn201 set values is as follows.

Set value	Speed control proportion gain (Pn202)	Speed control integration time (Pn203)	Torque filter time constant (Pn204)
1	10 Hz	80 ms	3.00 ms
2	15 Hz	60 ms	2.50 ms
3	20 Hz	45 ms	2.00 ms
4	30 Hz	30 ms	1.30 ms
5	40 Hz	20 ms	1.00 ms

‖ Notes ‖

1. If the rigidity table is set after setting the control gain (speed control proportion gain, speed control integration time, torque filter time constant), each control gain will be overwritten to the values in the table.
2. When the values in the rigidity table increase, the control gain and speed response also increase. However, if the set value extensively increases, vibration might occur depending on the machine configuration.

Pn202 Speed control proportion gain

Set the responsiveness of the speed control.

‖ Notes ‖

1. If gain is set to lower value, the responsiveness reduces and overshoot occurs.
   Furthermore, if gain is set to extensively higher value, vibration will occur in the mechanical system.
2. This constant can be changed during operations. However, if the set value changes significantly during operations, the motor operations might become unstable. Hence, gradually change the constant during operations.

Pn203 Speed control integration time

Set the integration time constant of the speed control.

‖ Notes ‖

1. If the longer integration time is set, the responsiveness deteriorates and overshoot occurs.
   Furthermore, if gain is set to extensively higher value, vibration will occur in the mechanical system.
2. This constant can be changed during operations. However, if the set value changes significantly during operations, the motor operations might become unstable. Hence, gradually change the constant during operations.

Pn204 Torque filter time constant

Set the filter time constant of the torque command value inside the driver control.

The smaller set value enables control with good responsiveness. However, there are limitations depending on the machine condition.

Pn205 Inertia moment ratio

Set the inertia moment ratio connected to the motor.
For set value, enter the load inertia moment ratio of motor input shaft conversion regarding the rotor inertia.

$$\text{Pn205} = \frac{\text{Load inertia moment of motor input shaft conversion}}{\text{Inertia moment of rotor}} \times 100$$

■ Comparison constants

Constants related to comparison of output functions

Pn210 Speed matching level

Set the range to output the speed matching signal.
When the difference between motor rotation speed and rotation speed command value is within ± (set value), the speed matching signal is output.

Pn211 Speed detection level

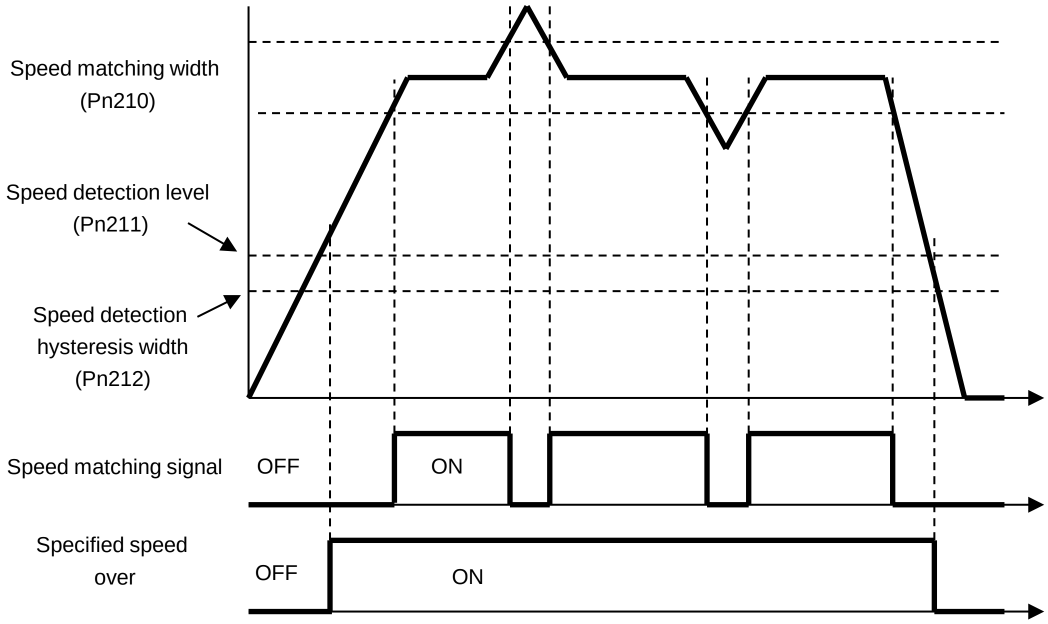
Set the rotation speed to be compared with the motor rotation speed.
When the motor rotation speed exceeds the set value, the specified speed over signal will be displayed.

Pn212 Speed detection hysteresis width

Set a range to maintain the output ON status of the specified speed over signal.
When the output is set to ON and if the motor rotation speed comes down up to the set value (%) for speed detection level (Pn211), the output status will be OFF.

● Speed detection output specifications

Following is the relationship of output signals with Pn210 ～ Pn212.


Speed matching width
(Pn210)
Speed detection level
(Pn211)
Speed detection
hysteresis width
(Pn212)
Speed matching signal
OFF
ON
Specified speed
over
OFF
ON

Pn213 Torque detection level

Set the torque value to be compared with the motor output torque.

When the motor output torque exceeds the set value, the specified torque over signal will be displayed.

Pn214 Torque detection hysteresis width

Set a range to maintain the output ON status of the specified torque over signal.

When the output is set to ON and if the motor output torque comes down up to the set value (%) for speed detection level (Pn213), the output status will be OFF.

Pn215 Rated torque detection hysteresis width

Set a range to maintain the output ON status of the rated torque over signal.

When the output is set to ON and if the motor output torque comes down up to the set value (%) for rated torque, the output status will be OFF.

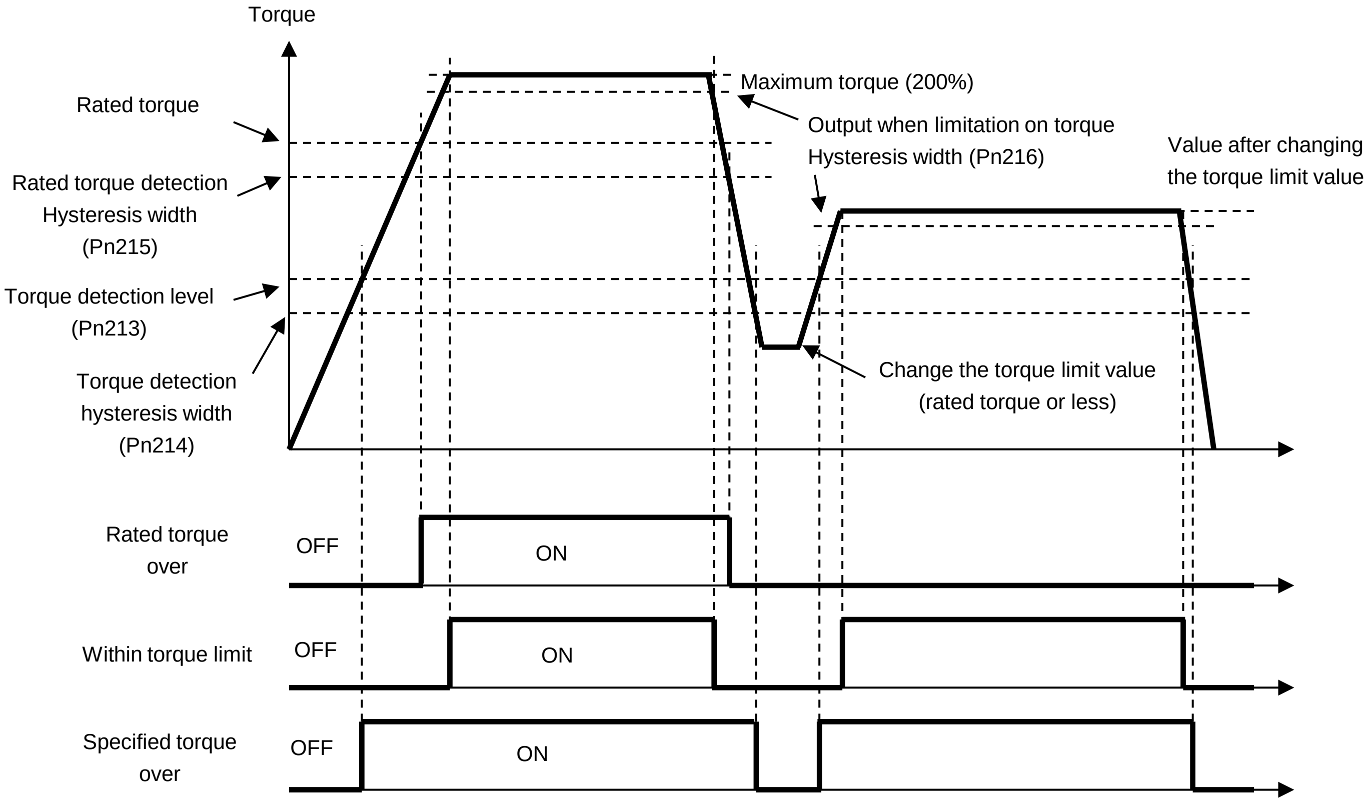
Pn216 Output hysteresis width during torque limit

Set a range to maintain the output ON status of the signal during torque limit.

When the output is set to ON and if the motor output torque comes down up to the set value (%) for torque limit value, the output status will be OFF.

- **Torque detection output chart**

Following is the relationship of output signals with Pn213 ～ Pn216.


Torque
Rated torque
Rated torque detection Hysteresis width (Pn215)
Torque detection level (Pn213)
Torque detection hysteresis width (Pn214)
Maximum torque (200%)
Output when limitation on torque Hysteresis width (Pn216)
Value after changing the torque limit value
Change the torque limit value (rated torque or less)
Rated torque over
OFF
ON
Within torque limit
OFF
ON
Specified torque over
OFF
ON

■ Mechanical brake constants

Constants related to brake timing output

Pn220 Selection of mechanical brake automatic control functions

Enable or disable the automatic control functions of mechanical brake.

If a numeric value is set to 1, the brake timing output will be enabled and displayed according to the set value given in Pn221 ～ Pn224.

If a numeric value is set to 0, the brake timing output will be always OFF.

Pn221 Mechanical brake release speed level

Set the internal speed command level to release the mechanical brake.

The internal speed command releases the mechanical brake when value is more than or equal to this constant.

Pn222 Mechanical brake operation speed level

Set the internal speed command level to operate mechanical brake.

The internal speed command operates the mechanical brake when value is less than or equal to this constant.

Pn223 Mechanical brake release standby time

Set a delay time (time-lag) to release the mechanical brake.

The internal speed command releases the brake after the value becomes more than mechanical brake release speed and exceeds this constant.

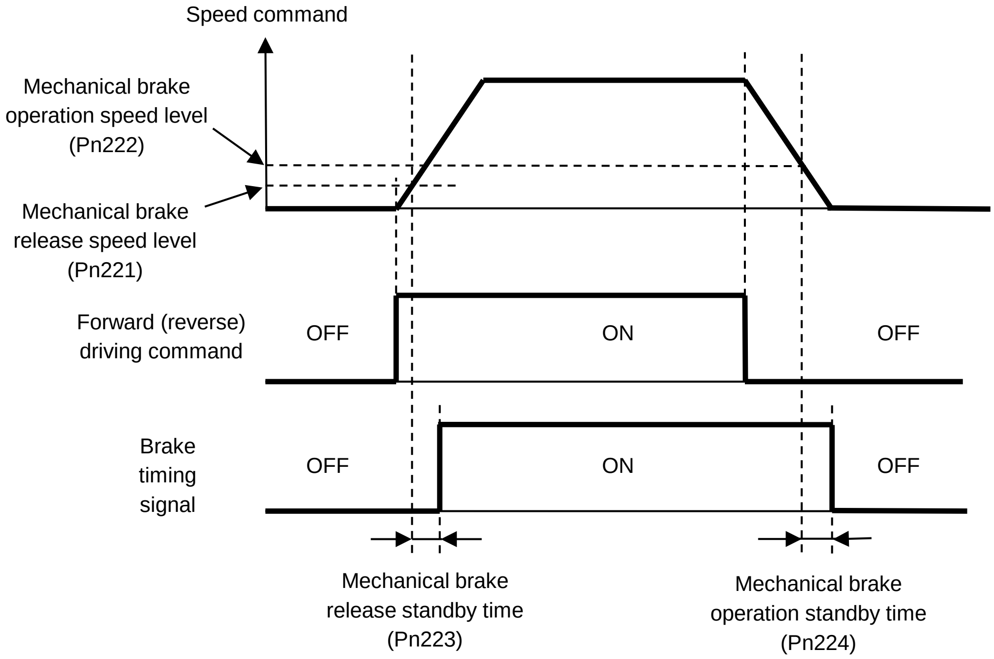
Pn224 Mechanical brake operation standby time

Set a delay time (time-lag) to operate the mechanical brake.

The internal speed command operates the brake after the value becomes less than mechanical brake operation speed and exceeds this constant.

- **Brake timing signal chart**

  Following is the relationship of output signals with Pn221 ～ Pn224.


Speed command
Mechanical brake operation speed level (Pn222)
Mechanical brake release speed level (Pn221)
Forward (reverse) driving command
OFF
ON
OFF
Brake timing signal
OFF
ON
OFF
Mechanical brake release standby time (Pn223)
Mechanical brake operation standby time (Pn224)

■ External analog constants

Constants related to external analog input

Pn230 External analog input level

Select the input level of external analog command.

0: 0 V ～ 5 V
1: 0 V ～ 10 V

If external analog adjustment gain (Pn232) is 1, there will be maximum analog command (Pn017, Pn039) by the maximum input level.

Pn231 External analog filter time constant

Set filter time constant of external analog command.
If the input voltage is unstable, the command value can be stabilized by increasing the set value.

‖ Notes ‖

1. If set value increases, the tracking of command value slow down.
   It also delays the response to the motor.
2. If set value is too small, the command reacts even to fine variations such as noise, and also affects motor operations.

Pn232 External analog adjustment gain

Set adjustment gain of external analog command.

External analog voltage x External analog adjustment gain = Command voltage

‖ Notes ‖

1. Even if set value increases, the maximum analog command (Pn017, Pn039) reaches the upper limit.
   A command exceeding the maximum value cannot be entered.
   If you enter the voltage equivalent to command more than the maximum value, the value of maximum analog command will be the command value.

Pn233 External analog adjustment offset

Set adjustment offset of external analog command.

Calculate the command value for offset set value by using the formula
Maximum analog command (Pn017, Pn039) ÷
(External analog input level (10 V) ÷ External analog adjustment offset (Pn233))

Example) In case of Pn017: 2500 and Pn233: 0.100,
2500 ÷ (10 ÷ 0.100) = 25 r/min
If input voltage 0 V is detected, there will be offset for driving at 25 r/min.

‖ Notes ‖

1. Set according to the condition of analog input device you want to use.
2. Depending on the setting and usage environment, there is a risk of motor driving even if you set the analog input to OFF.

■ Dynamic brake constant

Constants related to dynamic brake function

Pn240 Selection of dynamic brake function after stopping

Select the dynamic brake function after stopping.

The relationship between set value, operation state and forced brake ON command is shown in the following table.

Pn240	Forced brake ON command: OFF			Forced brake ON command: ON		
	Normal	bb state	bb2 state	Normal	bb state	bb2 state
0	Free-run	Free-run	Free-run	Free-run	Free-run	Free-run
1	DB	Free-run	Free-run	DB	Free-run	Free-run
2	DB	Free-run	DB	DB	Free-run	DB
3	DB	Free-run	Free-run	Free-run*	Free-run	Free-run
4	DB	Free-run	DB	Free-run*	Free-run	Free-run

* ALM lamp blinks

Free-run: Free-run state

DB: Dynamic brake state

‖ Notes ‖

1. This parameter does not change the DB selection during deceleration.
   Also, there is no function of DB selection during deceleration since torque generates during deceleration and speed reduces.
2. When I8: Free-run stop/error reset input is off (bb state), there will be Free-run state in any setting.

■ Safeguard constants

Constants related to safeguards

Pn245 Selection of overload

Pn246 Overload detection time

You can select the method of overload detection by Pn245.

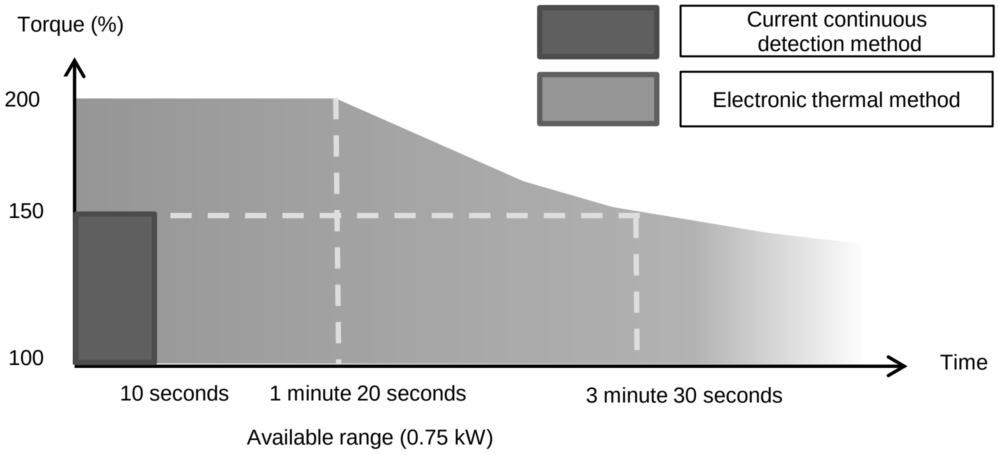
0: Electronic thermal method
1: Motor current continuous detection method

Electronic thermal method

This method is used to detect the overload by estimating the temperature from the actual motor current and thermal characteristics of the motor.

You can use this method to expand the available time of overload range as follows.

[Example] In case of 0.75 W



Motor current continuous detection method

In this method, the overload is detected when the time is more than set value of Pn246 and when the motor current more than rated value flows continuously .

For protecting the connected devices, use this method to limit the available time.

‖ Notes ‖

1. The motor current continuous detection method includes the operations, such as change in load or intermittent operations in which overload protection cannot be detected.
   If there is no special reason to use this method, we recommend to use electronic thermal method.
2. Even if you select both methods, and even if you perform error reset by power off for many times, the motor temperature exceeds the allowable value.
   Use I8: Free-run stop/error reset or multi function 13: Use emergency stop/error reset to perform the abnormal reset.

■ Initialization constants

Constants related to initialization functions

Pn400 Initializing the user constants

Initialize the user constants.

If you enter 1 in the number field, all user constants will be reset to initial value.

‖ Notes ‖

Once the number is entered, the value will be reset to 0.

Pn401 Clearing the alarm history

Initialize the alarm history.

If you enter 1 in the number field, the alarm history will be cleared.

‖ Notes ‖

Once the number is entered, the value will be reset to 0.

Pn402 Pn403 Reserving the constant

Do not change the settings.

8. Safeguards

8-1. List of safeguards

The errors other than bb and bb2 will be recorded in the monitor Un007: Error history.

Error name	Display	Details	Operation when error is detected	Recovery method
Instantaneous overcurrent	oC	The output current value exceeded about 450% of the motor rated current value.	Free-run stop	Error reset input The following conditions must be satisfied: • Eliminating causes of the detected error • Operation command: OFF
		The output current value exceeded the following reference values: 0.1 kW: 4.48 A 0.2 kW: 6.51 A 0.4 kW: 13.84 A 0.75 kW: 23.30 A		
Overload	oL	Detected overload condition of the output current. *1		
Main circuit overvoltage	Ou	The voltage of the main circuit DC bus exceeded 390 V continuously for the duration of 500 ms or more.		
		The voltage of the main circuit DC bus exceeded 407 V continuously for the duration of 2 ms or more.		
Main circuit voltage reduction	Uu	When the operation command was ON, the voltage of the main circuit DC bus dropped down by 212 V continuously for the duration of 15 ms or more.		
		When the operation command was ON, the voltage of the main circuit DC bus dropped down by 127 V continuously for the duration of 2ms or more.		
Overspeed	OS	The rotational speed of the motor exceeded 3600 r/min or more continuously for the duration of 1 second.		
Regeneration error	rF	Regeneration circuit error or regeneration transistor remained in ON state continuously for the duration of 10 seconds or more.		
Driver overheating	oH	The temperature of the driver heat dissipation FIN exceeds about 95℃.		
Pole sensor error	PS	Detected an undefined pattern of the pole sensor (U:V:W = 0:0:0 or 1:1:1).		
Power disconnection	ob	Detected disconnection of the output cable.		
Dynamic brake failure	db	Detected abnormal current during dynamic brake processing. *2		

*1 A method for detecting the overload condition varies according to the set constants.
For details, see the explanation of user-defined constants.

*2 The detection level is the same as the instantaneous overcurrent level.

Error name	**Display**	**Details**	**Operation when error is detected**	**Recovery method**
Free-run stop input	bb (Flashing)	Include free-run stop/error reset input.	Free-run stop	Canceling the free-run stop input.
Emergency stop input	bb2 (Flashing)	Include emergency stop/error reset input. *3		Canceling the emergency stop input.
System error	CPF00	A communication with the operator is not established within 7 seconds after applying the power.	Local: Free-run stop Remote: Continuous operation	If the fault is not eliminated even after applying the power again, inform us.
	CPF01	A communication with the operator is not established within 7 seconds after initiating the communication.		
	F2	Detected disconnection or short circuit of the thermistor used for detecting the temperature.	Free-run stop	
	F3	Detected an error in the EEPROM used for storing the constants and error history.		
	F4	Detected an error in the CPU with built-in A/D conversion circuit. Detected an error in the current detector circuit.		
	F6	Detected an error in the hardware ID circuit.		

*3 Enable only when 'Emergency stop' is selected from the multi-function options.

8-2. Failure causes and troubleshooting

Name	Display	Main cause	Method of confirmation	Troubleshooting
Instantaneous overcurrent	**oC**	A short circuit inside the motor or a ground fault.	Check the resistance of the motor winding wire.	A motor might be faulty. Replace the motor.
		A short circuit inside the extension cable or a ground fault.	Check the extension cable continuity.	Repair or replace the extension cable.
		A short circuit inside the driver or a ground fault.	Check the continuity of the UVW and FG terminals of the driver.	A driver might be faulty. Replace the driver.
		Heavily loaded while operating the motor.	Confirm that the operation condition is not outside the specified range.	Revise the operation condition, and reduce the load. Otherwise, switch to a motor driver having large capacity.
Overload	**oL**	Incorrect wiring or contact of the extension cable.	Check the wiring.	Adjust the wiring.
		Operated by surpassing the overload protection characteristic limit.	Check the overload protection characteristic and the operation command.	Revise the operation condition, and make the corresponding changes. Otherwise, switch to a motor driver having large capacity.
		A motor did not run and the load increased due to mechanical factors. (Example: operating brakes in the locked status)	Check the operation command and the motor rotation speed.	Improve the mechanical factors.
Main circuit overvoltage	**ov**	Entered impermissible power supply voltage.	Measure the power supply voltage.	Set the power supply voltage within the range specified for the product.
		The resistance value of the regenerative resistor is high for the operation condition. (or it is not connected.)	Check the operation condition and the regenerative resistance value.	Examine the regenerative resistance value again by considering the operation condition.
		Run with the impermissible inertia moment.	Confirm that the load inertia moment is within the allowable range.	Prolong the deceleration time or reduce the load inertia moment. Otherwise, switch to a motor driver having large capacity.
Main circuit voltage reduction	**Uv**	Entered the power supply voltage that is less than the permissible value.	Measure the power supply voltage.	Set the power supply voltage within the range specified for the product.
		Reduced the power supply voltage during operation.	Measure the power supply voltage during operation.	Increase the power supply capacity.
		Instantaneous power failure occurred.	-	-

Name	Display	Main cause	Method of confirmation	Troubleshooting
Overspeed	**oS**	Overshoot the motor speed.	Check the motor rotation speed.	Adjust the gain. Or, revise the operation condition.
		A motor is rotated at high speed from the outside.	Check the motor rotation speed.	Revise the entire system and change the operation condition.
Regeneration error	**rF**	Defective wiring or disconnection of the regenerative resistor.	Check the wiring.	Adjust the wiring.
		The power supply voltage exceeds the specified range.	Measure the power supply voltage.	Set the power supply voltage within the range specified for the product.
		A capacity to regenerate is less with respect to the operation condition.	Check the operation condition and the regenerative resistance value.	Select the regenerative resistance value again. Otherwise, switch to a motor driver having large capacity.
Driver overheating	**oH**	The ambient temperature is high.	Confirm the ambient temperature.	Adjust the temperature such that it will be within the range specified for the product.
		Repeatedly reset and operated the overload alarm by turning the power supply off.	Confirm by referring to the error history.	Change the error reset method.
Pole sensor error	**PS**	Defective contact or disconnection of the signal cable.	Check the continuity of the signal cable.	Replace the signal cable.
		The pole sensor inside the motor is faulty.	-	Replace the motor.
Power disconnection	**ob**	Defective wiring or disconnection of the power cable.	Check the wiring.	Adjust the wiring.
		A detecting circuit inside the driver is faulty.	-	If an error occurs even after applying the power again, the driver might be faulty. Replace the driver.
Dynamic brake failure	**db**	A motor is run by applying external forces.	Check the operation condition.	Do not run the motor by applying external forces.
		A short circuit inside the motor or a ground fault during DB processing.	Check the resistance of the motor winding.	A motor might be faulty. Replace the motor.
		A short circuit inside the extension cable or a ground fault during DB processing.	Check the extension cable continuity.	Repair or replace the extension cable.
		A short circuit inside the driver or a ground fault during DB processing.	Check the continuity of the UVW and ground terminals of the driver.	A driver might be faulty. Replace the driver.

Name	Display	Main cause	Method of confirmation	Troubleshooting
Free-run stop input	**bb**	I8 free-run stop is turned off.	Confirm the condition of I8 as per the condition of Un010 input terminal.	I8 free-run stop is turned on.
Emergency stop input	**bb2**	Emergency stop input has enabled. (ON/OFF varies according to the polarity settings.)	Check the status of Emergency stop input by using Un011 input function status.	Enter the signal such that the emergency stop input will be disabled. (ON/OFF varies according to the polarity settings) Or, cancel the allocation of emergency stop input.
System error	**CPF00** **CPF01** **F2** **F3** **F4** **F6**	-	-	Contact us if an error occurs even after supplying the power source again.

9. Product specifications

Item			**Model**				**Remarks**
			0.1 kW	**0.2 kW**	**0.4 kW**	**0.75 kW**	
Applicable motor			Our gear motor APQ series (200 V)				
			0.1 kW	0.2 kW	0.4 kW	0.75 kW	
Output	Rated output capacity		0.3 kVA	0.6 kVA	1.1 kVA	1.9 kVA	
	Rated output current		0.6 A	0.9 A	2.0 A	3.8 A	
	Maximum output current		1.2 A	1.8 A	4.0 A	7.6 A	
	Maximum output voltage		Three-phase 200 to 240 V				
Power supply	Rated voltage and frequency		Three-phase/Single phase 200 to 240 V 50/60 Hz				
	Allowable voltage fluctuation		-15 to +10%				
	Allowable frequency fluctuation		±5%				
	Rated input current	Three-phase	1.1 A	1.6 A	2.7 A	4.7 A	
		Single phase	1.7 A	2.5 A	4.6 A		
Control characteristics	Control method		Sine wave PWM method				Carrier frequency 8 kHz
	Speed control range		100 to 3000 r/min				
	Speed command settings		Switching selection method (Selection by setting the command source) ▪ Digital command: Constant settings (maximum 16 points) * Switching selection by external terminal ▪ Analog command: External terminal 0 to 10 V input Set by command setting volume				[Resolution] ▪ Analog command and command setting volume: Maximum rotational speed 1/1023 r/min ▪ Digital command: 1 r/min
	Acceleration and deceleration time		0.00 to 5.00 seconds Setting acceleration and deceleration individually * Maximum four points of each, switching selection by external terminal				
	Torque limit		Switching selection method (Selection by setting the command source) ▪ Digital command: Constant settings (maximum 8 points) * Switching selection by external terminal ▪ Analog command: External terminal 0 to 10 V input Set by command setting volume				[Resolution] ▪ Analog command and command setting volume: Maximum torque limit value 1/1023% ▪ Digital command: 1%
Protective structure			Mounting inside a panel (IP20) and enclosed wall-mounted type				
Cooling system			Auto cooling				
Environment	Ambient temperature		Mounting inside a panel: -10 to +50°C Enclosed wall-mounted type: -10 to +45°C (Do not freeze)				
	Humidity		95% RH or less (Do not condensate)				
	Storage temperature		-20 to +60^{0}C				Temperature during short duration transport
	Mounting location		Indoor (Places without corrosive gas and dust)				
	Altitude		1000 m or less				
	Vibration		9.8 m/s^2 (1G) is allowed for 10 to 19 Hz, and 2.0 m/s^2 (0.2G) is allowed for 20 to 50 Hz				
Restriction of Hazardous Substances command (ROHS command)			Supports				

Item			Model				Remarks
			0.1 kW	0.2 kW	0.4 kW	0.75 kW	
Function	Input *1	Multi-function input 7 points	Select 7 points from the following 13 points: 1: CW operation command 2: CCW operation command 3: Selection of speed command 1 4: Selection of speed command 2 5: Selection of speed command 3 6: Selection of speed command 4 7: Selection of acceleration and deceleration time 1 8: Selection of acceleration and deceleration time 2 9: Selection of torque limit value 1 10: Selection of torque limit value 2 11: Selection of torque limit value 3 12: Brake output forcibly ON command 13: Emergency stop/error reset input				
		Free-run stop/error reset	Stop free-run or reset the error occurred while detecting drivers.				
		Analog command	You can select either speed command or torque command from the constant settings.				0 to 10 V input
	Output *1	Multi-function output 4 points	Select 4 points from the following 13 points: 1: Error detection signal 2: Brake timing signal 3: Rotation pulse (only C3 and C4 can be selected) 4: CW pulse (only C3 and C4 can be selected) 5: CCW pulse (only C3 and C4 can be selected) 6: Rotation direction signal 7: Signal during operation 8: Signal during rotation 9: Speed matching signal 10: Specified speed over 11: Rated torque over 12: Signal during torque limit 13: Specified torque over				
Function	Built-in function		Command setting volume operator operation (LOCAL/REMOTE switching)				Command setting volume is mounted on the operation panel.
	Dynamic brake		Dynamic brake by the power module Nch-ON				
	Display	Status display LED	POWER and ALARM display * It can be checked only when the operator is removed				
		Operator	7 segments LED x 5 digits Monitor display: Switching display such as speed command, load factor, and current value Constant display: Constant value confirmation and constant input				

Item		Model				Remarks
		0.1 kW	0.2 kW	0.4 kW	0.75 kW	
Safeguards	Instantaneous overcurrent	Stops at approximately 450% or more of rated output current.				
	Overload	Stops when overload of motor current is detected.				Select detection method according to the constant settings ▪ Electronic thermal ▪ Motor current continuous detection
	Overvoltage	Stops when main circuit DC voltage is 400 V or more.				
	Undervoltage	Stops when main circuit DC voltage is 215 V or less.				
	Overspeed	Stops when the rotational speed of motor is 3600 r/min or more for 1 second.				
	Power disconnection	Stops when motor power line is disconnected.				
	Pole sensor	Stops when an undefined pattern of the pole sensor is detected.				
	Overheat protection	Stops when there is abnormal overheating of the driver body.				
	System error	Error in self-diagnosis of the driver body				
Others	Connected terminals	Main circuit: Screw terminal, Control circuit: Plug-in screw terminal Motor sensor: Connector				A separate relay cable is required to connect with the motor.
	Wiring distance between the driver and motor	Within 30 m				

*1: The polarity of input and output ON/OFF can be changed depending on the constant settings.

10. Selecting wiring equipment

Install a fuse and a circuit breaker on the driver input side.

Driver type	Input current at the time of rated rotation speed（A)	Fuse capacity(A)	Brief loss at the time of rated load(W)
A-BLPQ010T2-V2	1.1	3	10
A-BLPQ010S2-V2	1.7	3	10
A-BLPQ020T2-V2	1.6	3	12
A-BLPQ020S2-V2	2.5	6	12
A-BLPQ040T2-V2	2.7	6	20
A-BLPQ040S2-V2	4.6	10	21
A-BLPQ075T2-V2	4.7	10	35

* When international standard support is required, see "11. International standards".

11. Standards Compliance

11-1. Compliance with CE Marking

(1) Low Voltage Directive

This driver is tested in accordance with following European standard, and complies with Low Voltage Directive.

Applicable standard : EN61800-5-1：2007
Overvoltage category ： Ⅱ
Pollution degree ： 2
Protection Class ： 1

- In order to come under overvoltage category Ⅱ, insert an insulation transformer
- Install fast blow fuse to the input side.
- Only basic insulation is provided with control circuit terminals. Additional insulation may be necessary in the end product to conform to CE requirements.

(2) EMC Directive

This driver is tested in accordance with European standards EN61800-3：2004, and complies with EMC Directive. The following conditions must be met to ensure continued compliance with EMC Directive.

- Ground the drive enclosure.
- Install the EMC noise filter to the input side.
- Use shield cable or install cut core for motor power cable.

11-2. Compliance with UL Standard

This driver is tested in accordance with UL standard UL508C, and complies with UL requirements. To ensure continued compliance when using this drive in combination with other equipment, meet the following conditions.

(1) Compliance with Installation

- This driver must be installed in a panel, and used within the ambient temperature specification. (Maximum Surrounding Air Temperature 50℃)
- Do not install the driver to an area greater than pollution degree 2.
- Motor over temperature protection is not provided by the drive.

(2) Recommended Peripheral devices

- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection fuse specified in this manual must be provided in accordance with the National Electrical Code and any additional local codes.
- Suitable for use on a circuit capable of delivering not more than 5,000 Arms symmetrical ampare, 240 volts maximum, when protected by UL Class J fuse with following rating of ampare.

Model	Current (UL Listed Class J Fuse)
A-BLPQ010T2	3A
A-BLPQ020T2	3A
A-BLPQ040T2	6A
A-BLPQ075T2	10A

(3) Overload Protection Level

The driver has the following overload protection functions.

- Stop with more than 450% of rated output current.
- Stop with more than 100% of rated output current for 10 seconds, or stop because of electronic thermal. (Option through the constant.)

12. Warranty

1. Warranty period

The warranty period is 18 months from the date of delivery, or 12 months after commencing the usage of the product, whichever is shorter.

2. Warranty scope

1) The warranty is limited to our products.

2) During the warranty period, we provide free-of-charge repair services in case of any faults in our products under the operating conditions based on normal installation, connection or handling (inspection and maintenance) described in this instruction manual.
However, we will exclude if it corresponds to the following disclaimer of warranty.
When using our purchased products, we will not take any responsibility of the business loss because of production shutdown that customer encounters due to operational damages as well as we are not liable for any compensation against the damage of the product other than the product of our company.

3. Disclaimer of warranty

1) When the product is damaged due to dismantling or remodeling by the customer, and in such case if product is repaired, replaced, or substitute product is provided.

2) When the product is operated under the conditions excluding the rated data or mutually agreed upon specifications described in the company catalog or instruction manual.

3) When the power transmission part of the customer's device is defective.
(such as coupling centering).

4) When the defects are caused by an inevitable accidents such as natural disaster
(e.g.: earthquake, thunderbolt, fire, flood) or artificial malfunction.

5) When the defect in customer's device is considered as secondary cause of break-down.

6) When there is a defect in the components or driving units (such as electric motor, servo motor, and hydraulic unit) provided or specified by the customer.

7) When deliverables are not properly maintained and stored, and products are not correctly handled.

8) The damages other than those mentioned above are out of scope of our production responsibility.

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