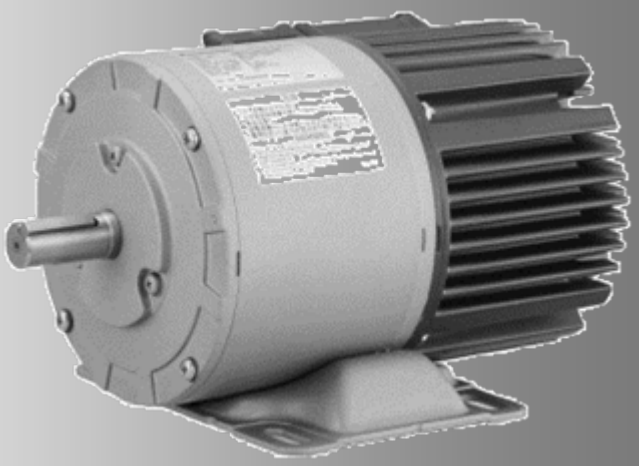
Panasonic

Operating Instructions (Overall)

Circuit Integrated Brushless Motor

B1-S Series

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



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Safety precautions

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

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

DANGER	**Indicates great possibility of death or serious injury.**
CAUTION	**Indicates the possibility of injury or property damage.**

- **The following indications show things that must be observed.**

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

DANGER

	Do not subject the product to water, corrosive or flammable gases, and combustibles.	**The failure could result in fire.**
	Do not touch the rotating part of the motor while operating.	**The failure could result in injuries.**
	Do not touch the terminal for five minutes after turning OFF power.	**The failure could result in electric shocks.**
	Do not step on the product nor place the heavy object on them.	**The failure could result in electric shocks, injuries, malfunction or damages.**
	Do not subject the lead wires to excessive force, heavy object, or pinching force, nor damage the lead wires.	**The failure could result in electric shocks, malfunction or damages.**
	Do not touch the motor and external regenerative resistor, since they become very hot.	**The failure could result in burns.**
	An over-current protection, earth leakage breaker, over temperature protector and emergency stop device must be installed.	**The failure could result in electric shocks, injuries or fire.**
	Install the product properly to avoid personal accidents or fire in case of an earthquake.	**The failure could result in injuries, electric shocks, fire, malfunction or damages.**
	Ground the earth terminal of the motor.	**The failure could result in electric shocks.**
	Wait 10 minutes or more after turning OFF power in moving, wiring, or checking.	**The failure could result in electric shocks or injuries.**
	Wiring must always be performed properly and reliably by the qualified and authorized specialist in electric work.	**The failure could result in electric shocks, injuries, fire, malfunction or damages.**
	Install an external emergency stop device to stop the operation and shut down the main power source in any emergency.	**The failure could result in injuries, electric shocks, fire, malfunction or damages.**

DANGER

	Make sure to secure the safety after the earthquake.	The failure could result in electric shocks, injuries or fire.
	Insulate unused lead wires individually.	The failure could result in electric shocks, fire or malfunction.
	Mount the motor and peripheral equipments on incombustible material such as metal.	The failure could result in fire.

CAUTION

	Do not turn ON and OFF the main power source frequently.	The failure could result in malfunction.
	Do not place any obstacle that blocks ventilation around the motor.	The failure could result in burns or fire.
	Do not approach to the equipment after recovery from the power failure because they may restart suddenly.	The failure could result in injuries.
	Be sure to turn OFF power when not using the motor for a prolonged time.	The failure could result in injuries.
	Never modify, dismantle or repair the product.	The failure could result in fire, electric shocks or injuries.
	Never run and stop the motor by magnetic contactor installed on the main power line.	The failure could result in malfunction.
	Do not hold the lead wires or motor shaft when transporting the motor.	The failure could result in injuries.
	Do not give strong impact shock to the motor or shaft.	The failure could result in malfunction.
	Do not drive the motor by the external force.	The failure could result in fire, electric shocks or malfunction.

CAUTION

	If trip occurs, remove the causes of the trip and secure the safety before restarting.	**The failure could result in injuries.**
	Maintenance and check must be performed by an expert.	**The failure could result in injuries or electric shocks.**
	Use the specified voltage on the product.	**The failure could result in electric shocks, injuries or fire.**
	Execute the trial-operations with the motor fixed and a load unconnected. Connect a load to the motor after the successful trial-operations.	**The failure could result in injuries.**
	This product should be treated as an industrial waste when it is disposed.	

Introduction/Name of each part/Precautions

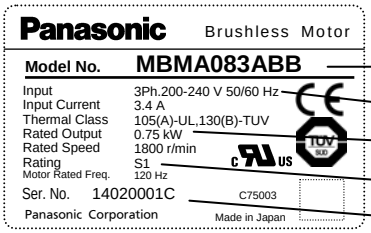
After unpacking

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

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

Checking the model of brushless motor

Nameplate



Model name
Rated input voltage, frequency
Rated output
S1: Continuous rating
Serial Number

Check the Model Name

MBMA 08 3 A B B

Series name

Output
02: 0.2 kW
04: 0.4 kW
08: 0.75 kW

Input power source
1: Single-phase AC100-120 V
3: 3-phase AC200-240 V

Rated rotation speed
A: 1800 r/min
B: 3600 r/min

Structure
B: Base
L: Flange

Function **B**: Standard

Check the Serial Number

* **14 02 0001 ***

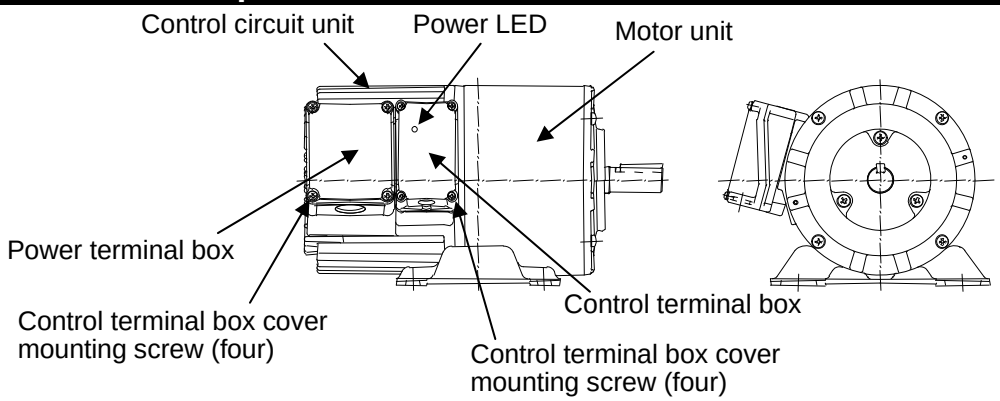
Manufacturing year
(Lower 2 digits of Christian Era)

Manufacturing month

Serial Number

*** Indicates production in February 2014, serial number 0001.**

Name of each part



Precaution for proper use

1. This motor is integrated with control circuit. Control circuit is sensitive to temperature and shock, so read this manual carefully for proper installation.
2. This motor is controlled by switching power element at high speed. Therefore, when the motor runs, leaking current may increase, which may activate the leakage breaker. In such a case, use a leakage breaker which is provided with measure against high frequency for inverter.
3. In starting and stopping the motor, use the operation instruction input "I1" or RUN/STOP switch of Console A and Digital key pad. When the motor is turned on and off by turning on and off of power supply, the life of inner circuit may be shortened.

Installation

How to install

Install the brushless motor properly for preventing failure and accident.

Transport

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

Storage

- **Keep the unit indoors in a clean and dry place free from vibration with little change of temperature.**

Location

- **Location gives great influence upon the life of brushless motor, therefore choose a place in conformance with the conditions below:**

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

Environmental condition

Item		Condition
Ambient temperature	Brushless motor	-10 °C - 40 °C (free from freezing) *1 (UL accreditation of 0.75 kW product is between -10 °C and 30 °C.)
	Console A/Digital key pad (sold separately)	-10 °C - 50 °C (free from freezing)
Ambient humidity		85 %RH or below (free from condensation)
Storage temperature		At normal temperature and normal humidity *2
Protection structure	Brushless motor	IP44 (Excluding output shaft rotation part, lead tip, and terminal box lead portion.) ・ This motor conforms to test condition specified in EN standard (EN60529 and EN60034-5). This motor is not applicable to the use which requires long-term waterproof performance, such as the case where the motor is always washed with water.
	Console A/Digital key pad (sold separately)	Equivalent to IP20
Vibration		Not greater than 4.9 m/s^2 (10 - 60 Hz)
Altitude		Not greater than 1000 m

*1 Ambient temperature is measured at a distance of 5 cm from the motor.
*2 Temperature which is acceptable for a short time, such as during transportation, is –20 ℃ to 60 ℃ (free from freezing).

Others

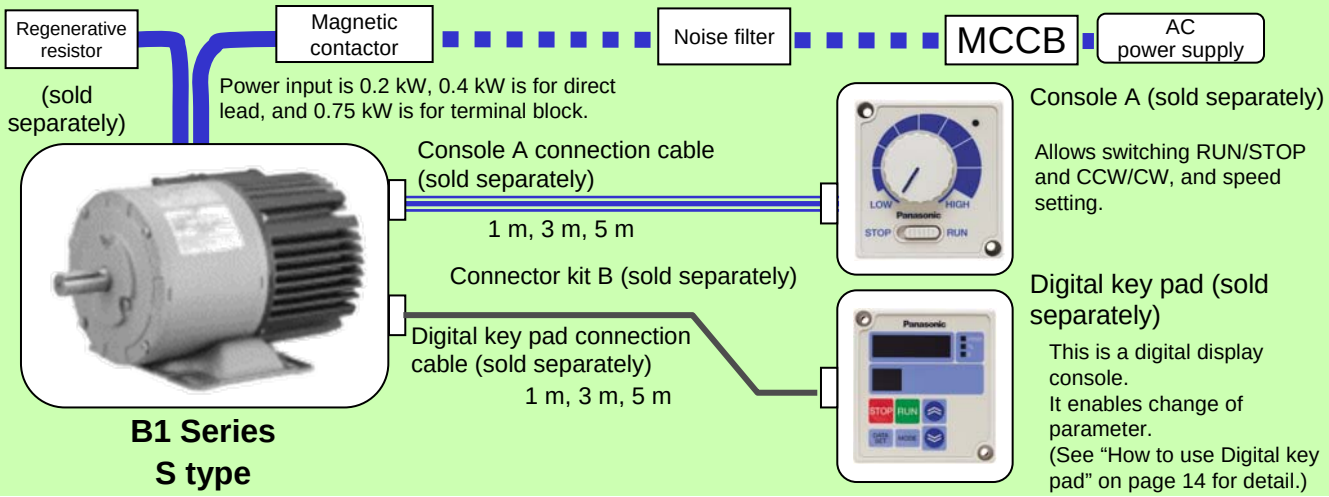
- **Oil and water protections**
  (1) Direct down the lead of cable as far as possible.
  (2) Avoid use in such an environment where motor is always exposed to oil and water.
  (3) Do not keep the lead dipped in oil or water in use.

- **Lead: stress relieving**
  (1) Make sure that stress is not applied to the lead or connection of cable due to bending or dead weight.
  (2) In installation where the motor moves, fix the lead of motor, incorporate the extension cable connected beyond in the cable carrier to reduce stress by bending as small as possible.
  (3) Allow the bending radius of cable as large as possible.

- **Regenerative resistor** (sold separately)
  In using regenerative resistor, be sure to use an option sold separately. Install the regenerative resistor on incombustible substance and take a measure such as placing a protective cover to keep away contact by personnel since it becomes very hot.

System configuration and wiring

System configuration/general wiring diagram



- **Wiring work must always be performed by a professional electric worker.**
- **Do not turn on power before finishing wiring for avoiding electric shock.**

Selection of wiring equipment

- **Recommended noise filter** Option part number: DV0P1441
  Manufacturer's part number: 3SUP-A10H-ER-4
  (OKAYA ELECTRIC INDUSTRIES CO., LTD.)

- **Selection of molded case circuit breaker (MCCB), magnetic contactor and electric wire (wiring within equipment)**
  (See "Adaptation to overseas standard" for compatibility with overseas standard.)

Voltage	Capacity (kW)	MCCB rated current	Magnetic contactor rated current (contact structure)	Electric wire (mm^2)		
				Main circuit	Control circuit	Regenerative resistor
Single-phase 100 V	0.2	5 A	20 A(3P+1a)	2(AWG14)	0.13(AWG26)	0.75(AWG18)
3-phase 200 V	0.2, 0.4	5 A	20 A(3P+1a)	2(AWG14)	0.13(AWG26)	0.75(AWG18)
3-phase 200 V	0.75	10 A	20 A(3P+1a)	2(AWG14)	0.13(AWG26)	0.75(AWG18)

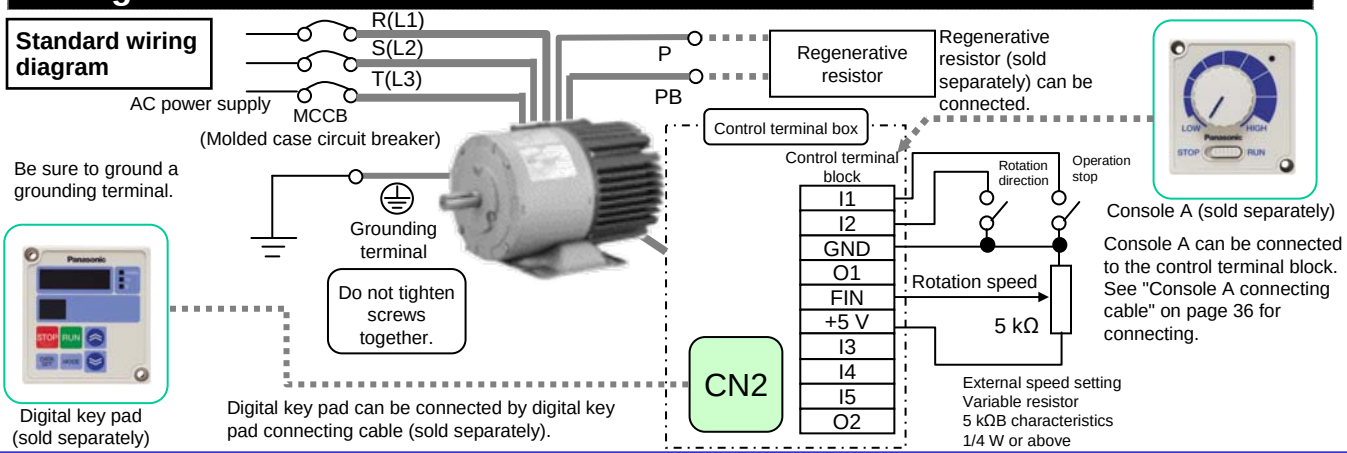
■ Be sure to ground the grounding terminal.
In wiring to power supply (outside of equipment) from MCCB, use an electric wire of 1.6 mm diameter (2.0 mm^2) or more both for main circuit and grounding. Apply grounding class D (100 ohms or below) for grounding.

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

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

Wiring

Standard wiring diagram

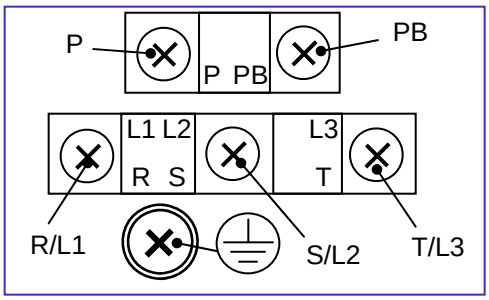


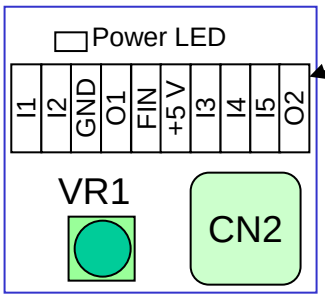
Wiring

Function of terminal

Power terminal box
0.75 kW

Terminal symbol is indicated on terminal block.





<Power input> (0.75 kW for terminal block specification, 0.2 kW/0.4 kW for lead specification)

■ Recommended tightening torque of power supply terminal box cover fixing screw with terminal block specification is between 1.0 to 1.4 N·m.

Terminal symbol	Lead color (0.2 kW, 0.4 kW)	Terminal name	Description of function
R/L1	Red	Power supply input terminal	Connect the product to commercial power supply conforming to rated voltage. As for a model with single-phase power, connect to L1 and L2. Recommended tightening torque of terminal block: 1.0 - 1.4 N·m
S /L2	White		
T /L3	Black		
P	Blue	Regenerative resistor connecting terminal	Regenerative resistor can be connected between P and PB. It is a high voltage wire when unused, therefore be sure to insulate individually. (For lead specification) Recommended tightening torque: 1.0 - 1.4 N·m
PB	Brown		
⏚	Screw	Grounding terminal	Terminal for grounding the motor. It is available in two positions inside and outside the terminal box in terminal block specification. Use either one for grounding. Recommended tightening torque: 0.6 - 1.0 N·m

<Control terminal box> ■ Recommended tightening torque of control terminal box cover fixing screw is between 0.6 to 1.0 N·m.

● Control terminal block

Terminal symbol	Terminal name	Description of function
*1 I1	Signal input 1	Operation instruction input: Motor runs when "I1" and "GND" are shorted, and stops when they are opened.
*1 I2	Signal input 2	Rotation speed changeover input: CW operation when "I2" and "GND" are shorted, and CCW operation when they are opened. *2
GND	Control ground	Common ground terminal for control signal. *3
*1 O1	Signal output 1	Trip signal output: "L" in trip (Contact ON) Open collector Vce max: DC30 V, Ic max: 50 mA
FIN	Analogue speed instruction input	Speed can be set by applying voltage DC 0 to 5 V. Input impedance approx. 17 kΩ. Set VR1 to be maximum (fully clockwise).
+ 5 V	The power supply for external speed setting	Power output dedicated when connecting an external variable resistor (5 kΩ, B characteristics) to FIN input (cannot be used for any other purpose.)
*1 I3	Signal input 3	Free-run stop input: Free-run stop when "I3" and "GND" are shorted.
*1 I4	Signal input 4	Trip reset input: "I4" - "GND": Tripping is reset when "I4" and "GND" are shorted.
*1 I5	Signal input 5	Free-run stop input: Free-run stop when "I5" and "GND" are shorted.
*1 O2	Signal output 2	Speed pulse output: Outputs 24 P/r signal, open collector (12 P/r for 3600 r/min specification)

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

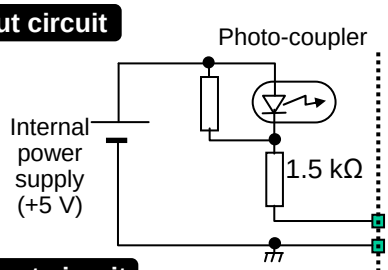
*2 Rotation direction is that on motor shaft. When gear head is incorporated, the rotation direction of motor and that of gear output shaft are reversed for some gear reduction ratio.
(CW: Rotation clockwise when seen from the motor shaft, CCW: Rotation counterclockwise when see from the motor shaft)

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

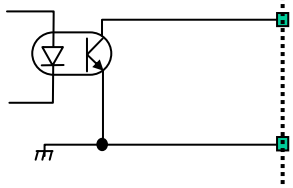
■ Compatible wire of control terminal block : AWG28 - AWG16 (recommended strip-off dimension 5 mm)
Recommended tightening torque: 0.22 - 0.25 N·m

Wiring/Test run

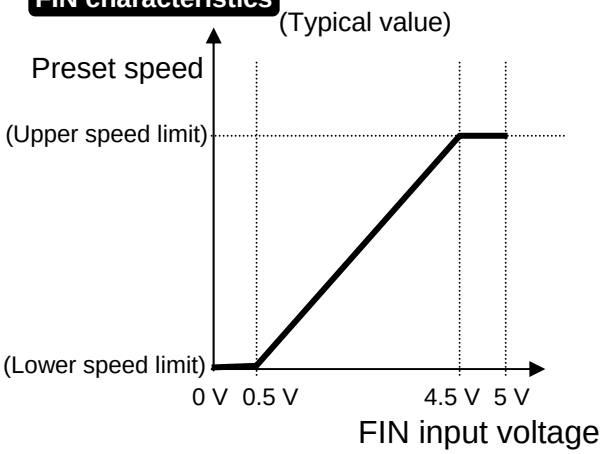
Input circuit



Output circuit



FIN characteristics

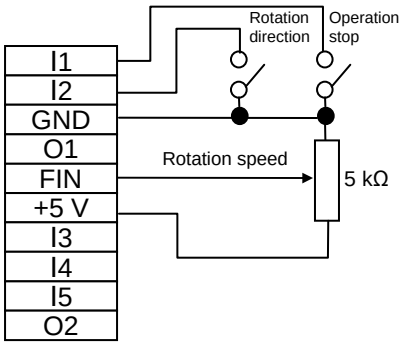


- Connector for digital key pad (CN2)
  Connector for connecting digital key pad (option)
- Incorporated potentiometer for setting speed (VR1)
  Speed can be set by VR1 when "FIN" terminal and "+5 V" terminal are connected.
  Setting in shipment: Maximum (fully clockwise)

Inspection prior to test run

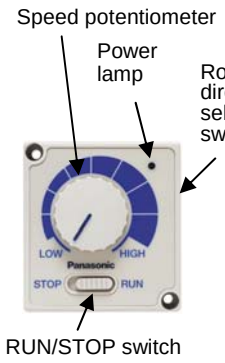
(Inspection prior to test run)

(1) Any mistake found in wiring? (2) Input power supply conforms to rating?



(Test run: When operating with external signal)

The motor runs when terminal "I1" and "GND" are shorted, and stops when they are opened.
CW setting when terminal "I2" and "GND" are shorted, and CCW setting when they are opened.
When using a relay or a switch for shorting, use one for minute electric current (minimum guaranteed amperage 1 mA or below).
Speed can be set by applying voltage DC 0-5 V between terminal "FIN" and "GND". In this case turn the incorporated potentiometer for speed setting (VR1) to the maximum (fully clockwise). (Input impedance approx 17 kΩ)
When the incorporated potentiometer is turned to the minimum (fully counterclockwise), the motor stops. For setting speed with the incorporated potentiometer (VR1), connect "FIN" to "+5 V".



(Test run: For console A)

When RUN/STOP switch is changed to RUN, the motor rotates, and when the motor is returned to STOP, the motor stops.
Rotation direction can be changed by rotation direction choosing switch on the side of console.
When the rotation direction is changed in RUN, the motor is inverted suddenly, and the motor may trip due to some inertia of load.
Rotation speed can be adjusted by the speed potentiometer.
Turn OFF power when the motor is to be stopped for a long time.

- ■ When power is turned OFF with RUN/STOP switch on RUN side, and power is turned on again, the motor may start again, which is dangerous. In turning on power, always make sure that the switch is on STOP side.
- ■ Described above is the operating procedure in default setup. If internal parameters have been changed with the Digital key pad, operation may be different. Return the required setting (such as parameter 30, 31, and 33) to the shipment setting, or initialize parameters. (Parameter 54)
  However, when a parameter is initialized, note that all parameters return to shipment setting.

(Test run: For Digital key pad)

See "Trial run (Digital key pad)" on page 16.

Checking the load and use condition, maintenance and inspections

Checking the load and use condition

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

Standard life

Standard life is 10, 000 hours.
Standard life refers to a designed life at normal temperature and humidity and uniform load (rated torque).

Load torque

Set the load torque so that its effective value is below rated torque. When the digital key pad is used, average torque can be displayed as a load factor. (See the use of digital key pad on page 14.)

Permissible shaft load

Make sure that the shaft load does not exceed the permissible shaft load shown below:

Model name	Permissible radial load	Permissible thrust load
MBMA021□□□	**300 N**	**300 N**
MBMA023□□□	**200 N**	**200 N**
MBMA043□□□	**300 N**	**300 N**
MBMA083□□□	**350 N**	**350 N**

Permissible radial load applies to the case when no thrust load is applied. (Torque point at shaft end)
Permissible thrust load applies to the case when no radial load is applied. (When horizontal shaft is used)

Maintenance and inspections

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

Notes to Maintenance/Inspection Personnel

- **Power-on/off operations should be done by the operators themselves for ensuring safety in checking.**
- **Do not touch the motor while power on.**
- **In performing the measuring insulation resistance, remove all connections.**
  Measuring insulation resistance with connection can cause motor failure.

Maintenance/Inspection item

Inspection item	Inspection procedure	Condition
Input voltage	Voltmeter	Must be within ±10 % of rating.
Input current	Ammeter	Must be within rated input current described on nameplate.
Insulation resistance	Insulation resistance tester	Measure the insulation resistance of motor with 500 V megger. Measured resistance must be more than 1 MΩ. Measurement position: Between power input (R/L1, S/L2, and T/L3) and grounding terminal ⏚
Noise	Hearing	Noise level must not be different from the usual level. In addition, abnormal noise such as rumbling noise must not be heard.
Vibration	By hand	Free from abnormal vibration.
Installing bolt	Torque wrench	Check for the loosening of torque and tighten additionally if necessary.

Be sure to contact our service division or sales agent for disassembling and repairing.

Protective functions/How to clear trip

Protective functions

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

Protective item	Description	Measure	Display on Digital key pad
Undervoltage warning (default)	When the internal DC voltage is below specified value, operation is stopped; when voltage is recovered, operation is started again. (This is not trip, and no trip output is made.) ■**Trip can be set by parameter 50.** 100 V product: Approx DC100 V 200 V product: Approx DC200 V	Investigate the condition of wiring and circumstances of power supply.	**L**
Undervoltage error	The motor trips when internal DC voltage is below specified value **only if trip is set by parameter 50.** 100 V product: Approx DC100 V, 200 V product: Approx DC200 V		**E-LV**
Overload warning (Electronic thermal)	When the load factor reaches the overload warning level (100 %), the monitor display flashes.	Lower the load factor below 100 % by reducing load, changing operation pattern or increasing motor capacity.	5-digit LED flashes.
Overload error (Electronic thermal relay)	The motor trips when motor torque is output continuously above 115 %.		**THr**
Overcurrent error	The motor trips when the motor current exceeds specified current.	Excessive acceleration/deceleration setting or gain setting is possible. Set the longer acceleration/ deceleration time and the smaller gain. If this trip should occur as soon as the unit is started, failure is possible.	**E-OC**
Overvoltage error	The motor trips when internal DC voltage (voltage of smoothing function of power supply) rises and exceeds specified value. Product of 100 V: Approx DC200 V, Product of 200 V: Approx DC400 V	If the motor should trip in running, too short deceleration time is one of the causes. Adjust deceleration time. Connect a regenerative resistor (option).	**E-OV**
Parameter error	Parameter data saved in EEPROM is abnormal.	E-UPr: Recheck and reset all parameters. E-SPr: Internal parameter error. Failure is possible.	**E-UPr** **E-SPr**
CPU error	The motor trips when trouble of control microcomputer is detected.	Malfunction due to external noise is possible. Investigate for noise source.	**Err**
Overspeed error	The motor trips when rotation speed (actual speed) exceeds specified value (Approx 1.5 times of rated speed).	Check for overshooting due to too short acceleration time.	**E-OS**
Sensor error	The motor trips when trouble of CS signal is detected.	Malfunction or failure due to excessive external noise is possible.	**E-CS**
Overheat error	The motor trips when the temperature in control section rises above specified value. Approx 105 ℃	Check the ambient temperature and cooling condition of motor. Check the load factor and operation pattern.	**E-OH**
Setting change warning	The motor trips when any important parameter such as "**30** Run command selection" is changed.	This is not abnormal. Reset trip in order to make change effective.	**CAU**
External forced trip	The motor trips when external forced trip input turns on.	If an external thermal element is used, check the cause of temperature rise.	**E-OL**

How to clear trip

If the motor should trip, eliminate the cause and use <u>any of the procedures</u> [1] – [3] below for clear.

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

[2] Press the switch [∧ ∧] and [∨ ∨] of the Digital key pad simultaneously for one second or more with present trip state displayed.

[3] Input the trip reset signal.

When [F-r] or [r-F] is chosen in " **33** . I1/I2 function selection", enter "I1" and "I2" at the same time: when [F-rST] or [r-rST] is chosen, enter "I2 for trip reset".
Further, when [rST] is chosen in any of " **34** . I3 function selection " " **35** . I4 function selection " and " **36** . I5 function selection ", enter respective input signal for clearing trip.
Trip reset signal, when continued to be input, is designed to become ineffective in order to prevent inadvertent restarting. Enter trip signal <u>only when</u> necessary.

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

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

Troubleshooting

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

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

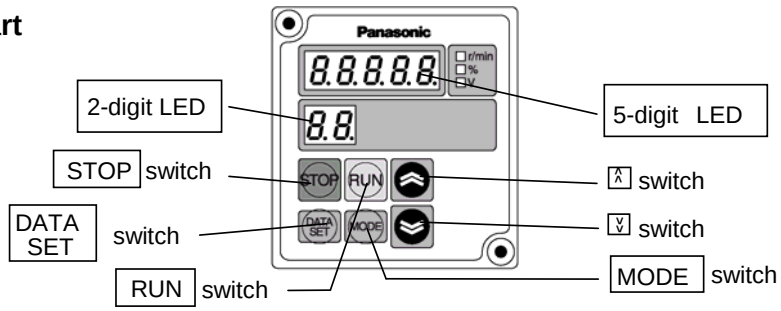
Phenomenon	Detail of checking	Measure, etc
Motor does not rotate.	Check for abnormality of wiring.	Apply proper wiring.
	Check whether protective function is activated.	Check the detail of trip by the Digital key pad. Remove the cause, and clear trip.
	Check whether Power LED of control terminal box is ON.	Turn on power. Turn off power once, and turn it on again.
	Check whether voltage on input power is normal.	Check the supply voltage.
	Check whether operation start signal is input.	Check the condition of operation instruction.
	Check whether Analogue speed instruction is set at 0 V.	Raise the analogue speed instruction little by little.
Motor does not rotate or stops during operation.	Check whether protective function is activated.	Overload is possible. Reduce the load or increase the output capacity.
Motor stops during deceleration.	Check whether the inertia of load is too large.	Over voltage error may have worked. Decrease the inertia. Turn OFF power once, and turn on again, and clear the trip state. Make deceleration time longer by the Digital key pad. Alternatively, apply free-run stop.
Motor does not stop quickly when stop command is input.	The motor with large inertia does not stop quickly because default stop mode is free-run stop.	Stop motor by 0 V analogue speed command. Change stop mode to deceleration stop by Digital key pad.
Large vibration or noise.	The motor output shaft and load shaft are not aligned.	Check the coupling between the motor output shaft and load shaft.
Motor rotates reversely.	Check whether Setting of rotation direction changeover input is wrong.	Check the position of rotation direction choosing switch for the console A. As for others, check the status of "I2".
	Check whether parameter "**33** I1/I2 function selection " setting is wrong.	See “How to use Digital key pad" on page 14 and after for setting properly.
Rotation speed is unstable during operation (actual speed).	Check whether the load fluctuates greatly.	Reduce the fluctuation of load. Increase the output capacity.
Parameter does not change.	Check whether operation start signal is input.	Some parameters cannot be changed when operation instruction is on. (See the check “column of parameter list” on page 20.) Turn OFF operation instruction before changing.

How to use Digital key pad

Name of each part and Installation

- **What can be done by Digital key pad**
  - Monitoring of rotation speed (actual speed) and load factor, etc
    (Rotation speed can be displayed being multiplied by the factor set by parameter **47** and **48** .)
  - Display detail of trip, and trop history. Trip reset by pressing ∧ and ∨ .
  - Parameter setting, initialization, and copying function at the same time.
  - Start and stop of motor by RUN / STOP switch (Setting of parameter " **30** Run command selection" is required.)

- **Name of each part**



5-digit LED	Displays rotation speed (actual speed), commanded speed, trip history, setting of parameter, and the like.
2-digit LED	Displays the number of parameter (in editing parameter). Displays the rotation direction in operation. Displays **00** when the motor is stopped. (CCW as viewed from the output shaft of motor … **F** and CW … **r**)*1
MODE switch	Switch for changing monitor mode. Whenever this switch is pressed, the mode changes in this sequence: Rotation speed (actual speed) → Internal DC voltage (voltage of smoothing capacitor of power supply) → Load factor → Torque → Commanded speed → Rotation speed (actual speed) → …. * * When you press this switch in the parameter setting mode, setting is stored.
DATA SET switch	This is a switch for changing between parameter number mode and parameter setting mode, and for storing parameter setting.
∧ ∨ switch	This switch enables selection of parameter, and setting and changing of contents. When the motor is tripped, pressing ∧ and ∨ at the same time enables clear of trip.
RUN switch	This switch is for instruction of operation. (Only when " **30** Run command selection" is PnL) ■ See " **33** I1/I2 function selection " (2) on page 27 for rotation direction. ■ Operation is stopped by detaching the Digital key pad using RUN switch during operation.
STOP switch	This switch is for instruction of stopping. (Only when " **30** Run command selection " is PnL)

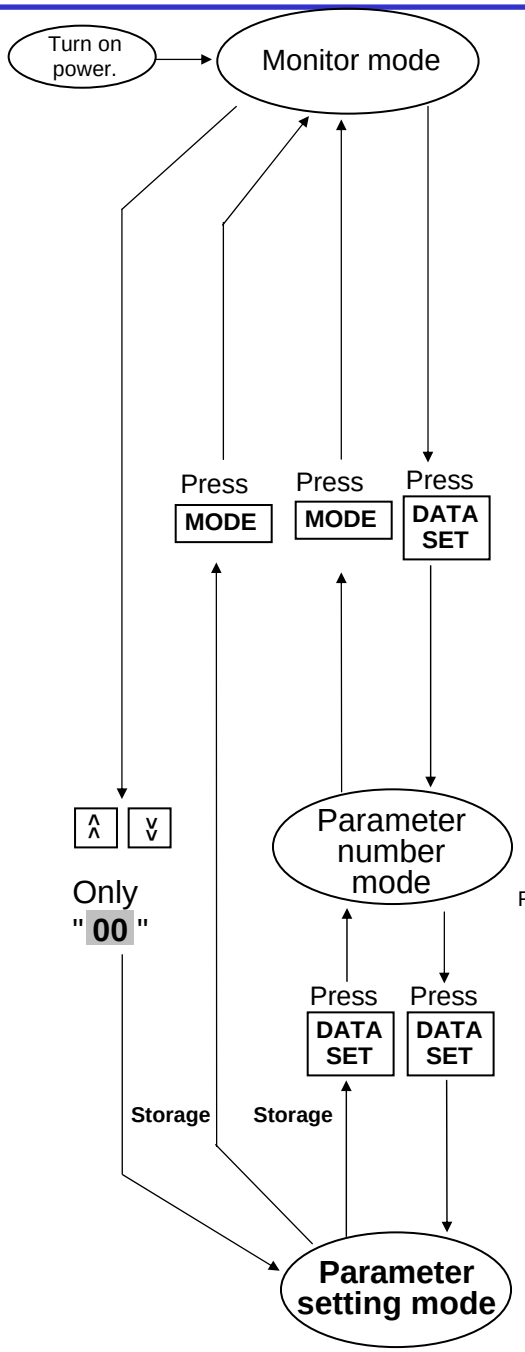
●Description

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

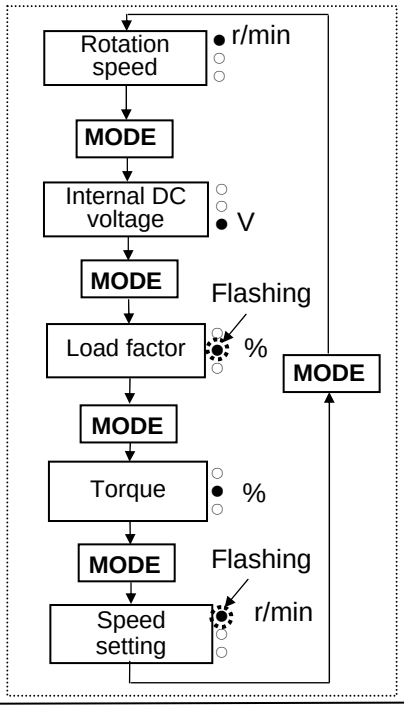
*** Displays rotation speed r/min in normal monitor mode. Displays torque and load factor assuming the rated motor torque at 100 %.**

*** Display is just a guide. Do not use the Digital key pad for a measuring instrument.**

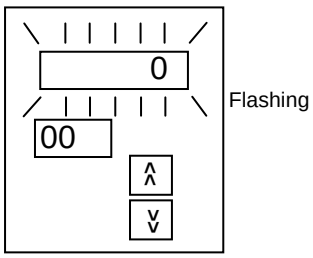
Operating Instruction



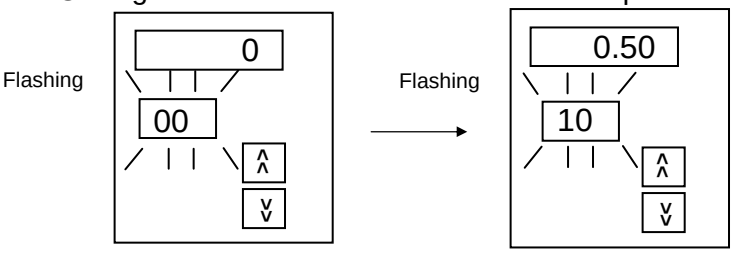
●Press **MODE** switch for changing display.



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

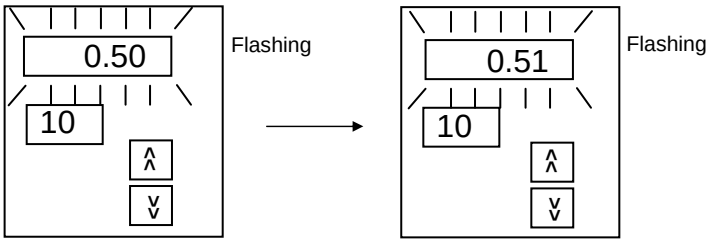


●2-digit LED blinks and allows selection of parameter number.



Change (select) a parameter number by ∧∧ or ∨∨.

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



Change (select) a parameter value by ∧∧ or ∨∨.

When **DATA SET** switch or **MODE** switch is pressed in parameter setting mode, data is stored.

● When ∧∧ or ∨∨ is pressed in monitor mode, detail of " **00** Internal speed (0-th speed)" is displayed in blinking, and speed setting can be changed by ∧∧ and ∨∨. When **31** Speed command selection is PnL, the motor speed also changes following the speed setting if the motor is running.

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

Test run (Digital key pad)

Inspection prior to test run

(Inspection prior to test run)
(1) Make sure that all wiring is correct. (2) Make sure that input power supply conforms to rating.
(Test run)
Test run procedure by the Digital key pad is as follows:
* An example is introduced here where the motor runs CW at 1800 r/min with the Digital key pad.
(1) Be sure to first perform the work below for safety.
Separate the motor from machine or equipment, and make sure that the motor alone can be operated.
(2) Then turn on power and follow the step below for test run.

Description of operation	Digital key pad	
	Switch	LED display
[1] Turn on power		0 (●) / 00
[2] Change of initial setting 1 (Change the choice of operation instruction from I1/I2 [TEr] to the Digital key pad [PnL])	Press [DATA SET]	0 / 00 Flashing → TEr / 30 Flashing
	Press [∧] several times to choose parameter number **30**.	
	Press [DATA SET]	TEr Flashing → PnL Flashing
	Press [∨] to change parameter value.	30 → 30
	Store by [DATA SET].	
	Setting change warning is issued because setting of operation instruction has been changed.	CAU
[3] Trip reset	Press [∧] and [∨] at the same time.	CAU → 0 (●) / 00
[4] Change of initial setting 2 (Change the choice of speed instruction from analogue speed instruction input to "**00** Speed setting (the 0-th speed)" to enable use of Digital key pad.)	Press [DATA SET]	0 / 00 Flashing → VoL-A / 31 Flashing
	Press [∧] several times to choose parameter number **31**.	
	Press [DATA SET]	VoL-A Flashing → PnL Flashing
	Press [∨] to change parameter value.	31 → 31
	Store by [DATA SET].	
	Setting change warning is issued because setting of operation instruction has been changed.	CAU

Description of operation	Digital key pad		
	switch	LED display	
[5] Trip reset	Press ∧ and ∨ at the same time.	CAU → 0 / 00	
[6] Choosing rotation direction* (This operation is not required for rotation forward [CCW].)	Press DATA SET	0 → rS.Fr	
	Press ∧ several times to choose parameter number **33** .	00 Flashing → 33 Flashing	
	Press DATA SET	rS.Fr → r - F	
	Press ∨ to change parameter value.	Flashing / 33 → Flashing / 33	
	Store by DATA SET .		
	Setting change warning is issued because setting of operation instruction has been changed.	CAU	
[7] Trip reset	Press ∧ and ∨ at the same time.	CAU → 0 / 00	
[8] Speed setting	Press ∧	0 Flashing / 00	・Internal speed (0-th speed) is displayed (Setting 0 r/min).
	Press ∧ to set a speed.	1800 Flashing / 00	・Set the Internal speed (0-th speed) at 1800 r/min.
[9] Reset to monitor mode.	Press **MODE**	0 / 00	・Data is still stored if power is cut OFF here.
[10] Operation instruction	Press **RUN**	1800 / r	・Display of rotation speed changes little by little toward 1800 r/min ・Display of rotation direction * (r indicates that the motor is rotating CW.)
[11] Stop instruction	Press **STOP**	0 / 00	・Display of rotation speed changes little by little toward 0 r/min.
[12] Power OFF			

<Checkpoint in Test run>

(1) Check whether the motor rotates smoothly. Check for abnormal noise and vibration.

(2) Check whether the motor is accelerated and decelerated smoothly.

(3) Is the rotation direction and rotation speed of the motor matched?

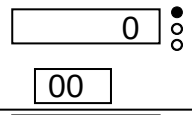
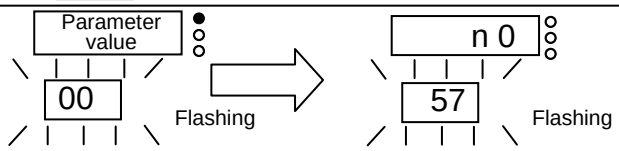
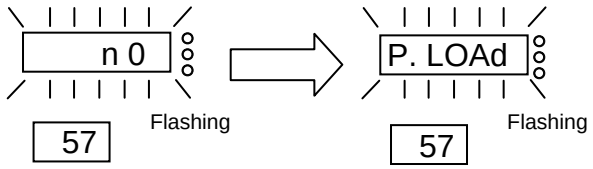
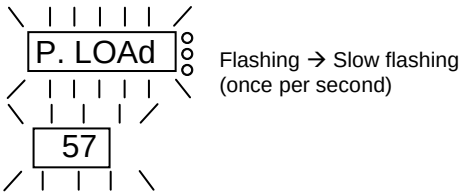
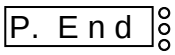
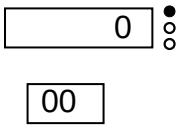
* Rotation direction can also be changed by using "I2". See " **33** I1/I2 function selection" (2) on page 26.

(Note) Setting data will stay stored when power is turned OFF. When operating the motor with Digital key pad only in trial run, either reset the setting or initialize parameters after completion of trial run. (Parameter **54**)
Here, note that all parameters return to default when parameters are initialized.

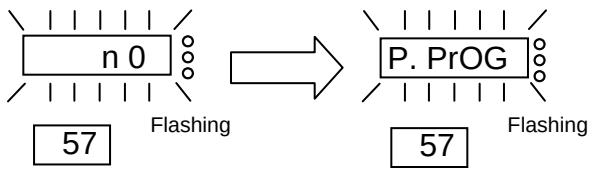
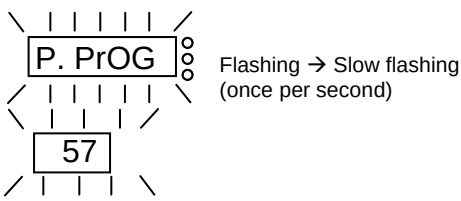
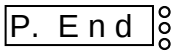
How to copy parameter

1. Reading a parameter value from Motor to the Digital key pad

■Once parameters are read into the console, their details are stored in the Digital key pad.

Description of operation	Digital key pad	
	Switch	LED display
[1] Turn on power.		
[2] Call **57** Parameter Copy.	Press DATA SET Hold down ∧ to choose parameter number **57** .	
[3] P.LOAd Choose reading a parameter into the Digital key pad.	Press DATA SET Press ∧ twice to choose P.LOAd .	
[4] Read a parameter into the Digital key pad.	Press DATA SET for 1 second while holding down STOP .	
[5] Wait about 30 seconds.		
[6] Reading of parameter into the Digital key pad completed	Press STOP	

2. Copy a parameter value saved in the Digital key pad onto the brushless inverter.

Description of operation	Digital key pad	
	Switch	LED display
Turn on power. Call out **57** Parameter. (Same operation as 1. 1 and 2)		
[1] P.PrOG Choose writing a parameter to the motor.	Press DATA SET twice. Press ∧ three times to choose P.PrOG .	
[2] Write a parameter to the motor.	Press DATA SET for 1 second while holding down STOP .	
[3] Wait about 10 seconds.		

Description of operation	Digital key pad	
	Switch	LED display
[4] Completion of writing a parameter from the Digital key pad to the motor		CAU
[5] Return to monitor mode.	Press ∧ and ∨ at the same time for clear trip.	0 / 00

Error while copying a parameter

P.Err1 : Data is abnormal while copying.

→ Press STOP switch for clearing, and then copy data again. If data is still abnormal, initialize the Digital key pad and retry.

P.Err2 : Copy error

→ This error occurs in an attempt to copy data between products of different function.
Press STOP switch for clear. (It is impossible to copy parameters between rated rotation speed 1800 r/min specification and 3600 r/min specification.)
Parameters can be copied between the same models (for example, between 0.2 kW and 0.4 kW of 1800 r/min specification), but parameters should be copied between motors of same output in principle.

3. Initializing of data of Digital key pad

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

Description of operation	Digital key pad	
	Switch	LED display
Turn on power and call **57** Parameter. (Same operation as 1. 1 and 2)		
[1] P. InIT Choose initialization of data of Digital key pad.	Press DATA SET Press ∧ once and choose P.InIT.	n 0 / 57 (Flashing) → P. InIT / 57 (Flashing)
[2] Initialization of Digital key pad	Press DATA SET for 1 second while holding down STOP.	P. InIT / 57 — Flashing → Continuous lighting LED display changes from flashing to continuous lighting during initializing operation.
[3] Wait about 30 seconds.		P. End
[4] Initializing of data of Digital key pad completed	Press STOP	0 / 00

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

Parameters (Default)

Overview of parameter

Brushless motor of this series is provided with various parameters for adjusting and controlling its characteristics and function. Purpose and function of respective parameter are described. Understand them well enough and adjust the unit at your optimum operation condition.

List of parameter composition and setting

Parameter No.	Name of parameter	Parameter setting			
		Setting range	Minimum unit	Default	Check*1
00	Internal speed (0-th speed)	0 – " **3b** Upper speed limit"	1 r/min	0	
01	1st speed			1800	
02	2nd speed			1200	
03	3rd speed			600	
04	4th speed			0	
05	5th speed			0	
06	6th speed			0	
07	7th speed			0	
10	1st acceleration time	0.01 - 3600 sec - 3 sec : Incremented by 0.01 sec 3 sec - 30 sec : Incremented by 0.1 sec 30 sec - 3600 sec : Incremented by 1 sec		0.50	
11	2nd acceleration time			5.0	
12	1st deceleration time			0.50	
13	2nd deceleration time			5.0	
14	Acceleration mode selection	L I n Linear S - 1 S shape-1 S - 2 S shape-2		L I n	
15	Deceleration mode selection			L I n	
16	Stop mode selection	FrEE Free-run stop dEC Speed reduction stop		FrEE	
17	Free-run waiting time	0.0 - 10. 0 sec	0.1 sec	1.0	
1A	Velocity loop proportional gain	0 - 10000	1	500	
1b	Velocity loop integration gain	0 - 10000	1	1000	
30	Run command selection	PnL RUN and STOP of Digital key pad TEr I1/I2*3		TEr	C
31	Speed command selection	PnL " **00** Internal speed (0-th speed)" VoL-A FIN*4		VoL-A	C
32	Operation mode selection	1 1st speed operation mode 2 2nd speed operation mode 4 4th speed operation mode 8 8th speed operation mode		1	C
33	I1/I2 function selection	F - r I1: CCW run/stop, I2: CW run/stop r - F I1: CW run/stop, I2: CCW run/stop rS.Fr I1: run/stop, I2: CW /CCW direction F - rST I1: CCW run/stop, I2:Trip reset r - rST I1: CW run/stop, I2:Trip reset		rS.Fr	C

Parameter No.	Name of parameter	Parameter setting			
		Setting range	Minimum unit	Default	Check*1
34	I3 function selection	FrEE Free run THr External forced trip U - d The 2nd acceleration/deceleration rST Trip reset		FrEE	C
35	I4 function selection			rST	C
36	I5 function selection			FrEE	C
3A	Lower speed limit	0 – " **3b** Upper speed limit "	1 r/min	0	C
3b	Upper speed limit	0 - Rated rotation speed	1 r/min	Rated rotation speed	C
3C	Torque limit	0 - 150 %*5	1 %	150	
40	O1 function selection	TrIP Trip; F CCW run STbL Arriving; r CW run rUn Running; Ck - L Overload detection FrEE Free-run; POUT Speed pulse signal		TrIP	
41	O2 function selection			POUT	
42	O1 output polarity selection	nOr Normal polarity rEV Reverse polarity		nOr	
43	O2 output polarity selection			nOr	
44	Speed matching range	20 – " **3b** Upper speed limit"	1 r/min	50	
45	Output pulse count selection	1, 2, 3, 4, 6, 8, 12, 24 (24 is allowed for setting only for 1800 r/min specification.)		24/12*6	
46	Monitor mode selection	O. - r Rotation speed (Actual speed); S. – r Command speed O. - L Torque; d C - V Internal DC voltage A V. - L Load factor (average torque)		O. - r	
47	Numerator of display magnification factor	1 – " **48** Denominator of display magnification factor" x 10	1 time	1	
48	Denominator of display magnification factor	1 - 1000	1 time	1	
4A	Trip history clear	nO No operation YES Clear trip history		nO	
4b	Trip history 1	-		-	
4C	Trip history 2			-	
4d	Trip history 3			-	
4E	Trip history 4			-	
4F	Trip history 5			-	
50	Under voltage trip selection	nO No trip YES Trip		nO	C
51	Retrial selection	nO , 1 - 4		nO	C
52	Retrial start time	1 - 120 sec	1 sec	5	
54	Parameter initializing	nO No operation YES Initialize to default		nO	
57	Parameter copy function	nO No copying of parameter P.InIT Initializing the data of Digital key pad P.LOAd Reading a parameter to the Digital key pad P.PrOG Writing a parameter to the motor		nO	
F0	For manufacturer use	-		-	

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

***3 Only "I1" and "I2" are effective for operation instruction. (They correspond to RUN/STOP switch on console A.)**

***4 Corresponds to incorporated potentiometer for setting speed (VR1), speed potentiometer of console A, or analogue speed direction.**

***5 Torque is not controlled directly, and no precision is obtained. Especially in setting below 30 %, torque is not generated and the motor does not start. Be cautious.**

***6 Setting in shipment depends on rated rotation speed.**
1800 r/min specification: 24, 3600 r/min specification: 12 (It is impossible to set 24 for 3600 r/min specification.)

LED display

LED display

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

Alphanumeric	LED display
A	
B	
C	
D	
E	
F	
G	
H	
I	
K	
L	
N	
O	
P	
Q	
R	

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

LED display

Example)

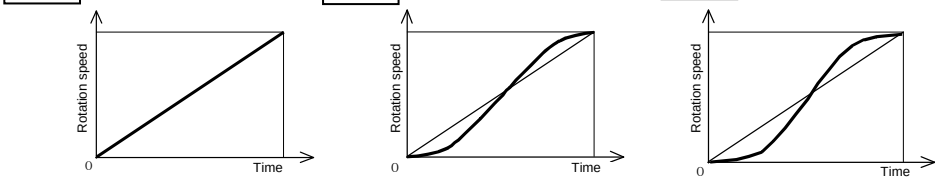
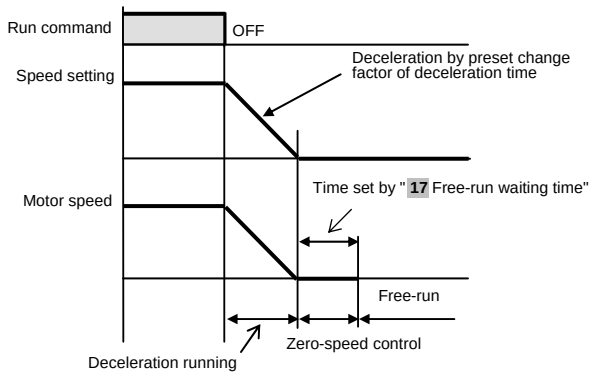
Description in the text	Display on Digital key pad
「PnL」	
「TEr」	
「FrEE」	
「rST」	

* Example of LED display

Example)

Description in the text	Display on Digital key pad
「VoL－A」	
「nO」	

Detail of parameter

Parameter No.	Name of parameter	Description
00	Internal speed (0-th speed)	Desired running speed can be set. This is effective when " **31** Speed command selection" is PnL (PANEL). Upper limit is limited by " **3b** Upper speed limit".
01	1st speed to 7th speed	Speed in multi-speed running can be set. It is effective when " **32** Operation mode selection" is set to 2-speed operation mode.
10 **11**	1st acceleration time to 2nd acceleration time	The change factor of output speed in acceleration can be determined. ・ **Set by time for changing 1000 r/min.** ・ Time can be incremented by 0.01 sec for below 3 sec, by 0.1 sec from 3 sec up to 30 sec exclusive, and by 1 sec from 30 sec upward.
12 **13**	1st deceleration time 2nd deceleration time	The change factor of output speed in deceleration can be determined. ・ **Set by time for changing 1000 r/min.** ・ Time can be incremented by 0.01 sec for below 3 sec, by 0.1 sec from 3 sec up to 30 sec exclusive, and by 1 sec from 30 sec upward.
14 **15**	Acceleration mode selection Deceleration mode selection	Straight line acceleration/deceleration and curve (S-shape) acceleration and deceleration can be chosen individually for acceleration and deceleration. LIn LINEAR — Straight line up to speed setting. Standard mode for accelerating and decelerating. S-1 "S"SHAPE-1 — Relaxes the speed change in start and end of acceleration and deceleration. S-2 "S"SHAPE-2 — Curve is emphasized more than S shape-1. 
16	Stop mode selection	You can select how to stop the motor. FrEE (FREE) Power supply to the motor is cut OFF and the motor is stopped naturally when stop command is input (free-run stop). It takes longer for the motor to completely stop when load inertia is big. dEC (DECEL) When stop command is input, the motor reduces its speed according to preset deceleration time, Electric-brake is performed by Zero-speed control, and then power is cut OFF to the motor after elapse of time set by " **17** Free-run waiting time", and the motor is set in free-run state. <Example or running pattern in deceleration stop> ■ The motor is servo-locked in Zero-speed control. (Electrically controlled so that motor speed is Zero) 
17	Free-run waiting time	When " **16** Stop mode selection" is set to dEC (DECEL) deceleration stop, servo lock time(Zero-speed control)after deceleration can be adjusted. (Free-run state is set after that.)
1A	Velocity loop proportional gain	Enables setting of proportional gain of velocity amplifier. It need not be changed normally. When this value is made greater, gain is increased, which improves responsiveness of the motor. When this value is made too large, operation is vibratory. Setting range: 0 – 10000, Setting resolution: 1
1b	Velocity loop integration gain	Enables setting of integration gain of velocity amplifier. It need not be changed normally. When this value is made greater, gain is increased, which improves rigidity of the motor (strength of servo lock). When this value is made too large, overshooting becomes greater, and the motor is vibratory. Setting range: 0 – 10000, Setting resolution: 1

Detail of parameter

<table>
<tr><th>Parameter No.</th><th>Name of parameter</th><th>Description</th></tr>
<tr><td>30</td><td>Run command selection</td><td>Run Command can be chosen from the following:
PnL (PANEL) : command the motor to stop with RUN STOP switch of Digital key pad. The motor cannot be operated by signal input "I1" and "I2". Signal input is effective only in setting rotation direction, etc.
See "33 I1/I2 function selection".
TEr (TERMINAL) : Only the input terminal "I1" and "I2" are effective.
(Corresponds to RUN/STOP, rotation direction selection switch of Console-A.)</td></tr>
<tr><td>31</td><td>Speed command selection</td><td>You can choose whether to use "00 Internal speed (0-th speed)" or analog input terminal "FIN" for speed command.
PnL (PANEL) "00 Internal speed (0-th speed)"
VoL-A (VOL-A) Analog input terminal "FIN" (voltage instruction DC 0-5 V)
(Corresponds to speed potentiometer of Console-A.)</td></tr>
<tr><td>32</td><td>Operation mode</td><td>Parameter for choosing operation mode
<table>
<tr><th rowspan="2">Setting</th><th rowspan="2">Operation mode</th><th colspan="3">Function of signal input</th></tr>
<tr><th>I3</th><th>I4</th><th>I5</th></tr>
<tr><td>1</td><td>1st speed operation mode</td><td colspan="3">Free-run stop
External forced trip
The 2nd acceleration/deceleration time
Trip reset</td></tr>
<tr><td>2</td><td>2nd speed operation mode</td><td>Speed setting</td><td></td><td></td></tr>
<tr><td>4</td><td>4th speed operation mode</td><td>Speed setting</td><td>Speed setting</td><td></td></tr>
<tr><td>8</td><td>8th speed operation mode</td><td>Speed setting</td><td>Speed setting</td><td>Speed setting</td></tr>
</table>
(1) 2nd speed operation mode
<table>
<tr><th>I3</th><th>Setting to be chosen</th></tr>
<tr><td>OFF</td><td>Internal speed (0-th speed) or FIN</td></tr>
<tr><td>ON</td><td>1st speed</td></tr>
</table>
(2) 4th speed operation mode
<table>
<tr><th>I3</th><th>I4</th><th>Setting to be chosen</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Internal speed (0-th speed) or FIN</td></tr>
<tr><td>ON</td><td>OFF</td><td>1st speed</td></tr>
<tr><td>OFF</td><td>ON</td><td>2nd speed</td></tr>
<tr><td>ON</td><td>ON</td><td>3rd speed</td></tr>
</table>
(3) 8th speed operation mode
<table>
<tr><th>I3</th><th>I4</th><th>I5</th><th>Setting to be chosen</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>Internal speed (0-th speed) or FIN</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>1st speed</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>2nd speed</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>3rd speed</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>4th speed</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>5th speed</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>6th speed</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>7th speed</td></tr>
</table></td></tr>
</table>

Parameter No.	Name of parameter	Description
33	I1/I2 function selection	**(1) For setting "I1" or "I2" function**

F - r (FORWARD-REVERSE)

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

r - F (REVERSE - FORWARD)

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

rS.Fr (RUN·STOP – FORWARD·REVERSE)

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

F - rST (FORWARD-TRIP RESET)

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

r - rST (REVERSE-TRIP RESET)

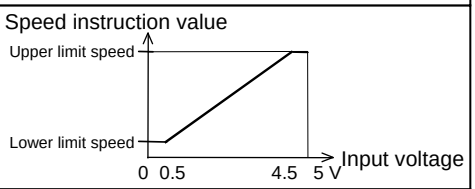
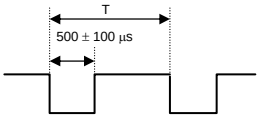
State of I1 and I2		Action
I1	I2	
OFF	-	Stop Deceleration stop when " 16 Stop mode selection" is dEC
ON	-	CW run
-	ON	Trip reset (which must be retained 0.2 sec or longer)*

*Effective only when trip occurs.

Detail of parameter

<table>
<tr><th>Parameter No.</th><th>Name of parameter</th><th>Description</th></tr>
<tr><td>33</td><td>I1/I2 function selection (continued)</td><td>
(2) When " 30 Run command selection" is PnL (PANEL), the motor can be commanded with RUN STOP switch of Digital key pad.
Rotation direction in this case can be set by parameter and "I1" "I2" state.
"I1" "I2" are off when only digital key pad is connected.
F - r (FORWARD-REVERSE)
<table>
<tr><th colspan="2">State of I1 and I2</th><th rowspan="2">Action</th></tr>
<tr><th>I1</th><th>I2</th></tr>
<tr><td>-</td><td>OFF</td><td>CCW rotation selection</td></tr>
<tr><td>OFF</td><td>ON</td><td>CW rotation selection</td></tr>
<tr><td>ON</td><td>ON</td><td>Free-run stop irrespective of RUN switch
Trip reset (which must be retained 0.2 sec or longer)*</td></tr>
</table>
r - F (REVERSE-FORWARD)
<table>
<tr><th colspan="2">State of I1 and I2</th><th rowspan="2">Action</th></tr>
<tr><th>I1</th><th>I2</th></tr>
<tr><td>-</td><td>OFF</td><td>CW rotation selection</td></tr>
<tr><td>OFF</td><td>ON</td><td>CCW rotation selection</td></tr>
<tr><td>ON</td><td>ON</td><td>Free-run stop irrespective of RUN switch
Trip reset (which must be retained 0.2 sec or longer)*</td></tr>
</table>
rS.Fr (RUN·STOP – FORWARD·REVERSE)
<table>
<tr><th colspan="2">State of I1 and I2</th><th rowspan="2">Action</th></tr>
<tr><th>I1</th><th>I2</th></tr>
<tr><td>-</td><td>OFF</td><td>CCW rotation selection</td></tr>
<tr><td>-</td><td>ON</td><td>CW rotation selection</td></tr>
</table>
F - rST (FORWARD-TRIP RESET)
CCW run with RUN switch
<table>
<tr><th colspan="2">State of I1 and I2</th><th rowspan="2">Action</th></tr>
<tr><th>I1</th><th>I2</th></tr>
<tr><td>-</td><td>ON</td><td>Trip reset (which must be retained 0.2 sec or longer)*</td></tr>
</table>
r - rST (REVERSE-TRIP RESET)
CW run with RUN switch
<table>
<tr><th colspan="2">State of I1 and I2</th><th rowspan="2">Action</th></tr>
<tr><th>I1</th><th>I2</th></tr>
<tr><td>-</td><td>ON</td><td>Trip reset (which must be retained 0.2 sec or longer)*</td></tr>
</table>
</td></tr>
<tr><td>34
35
36</td><td>I3 function selection
I4 function selection
I5 function selection</td><td>
FrEE (FREE) : ON (shorted between signal 13 and "GND") → Free-run stop instruction
THr (THERMAL) : OFF (open between signal 13 and "GND") → External forced trip instruction
U - d (UP-DOWN) : ON (shorted between signal 13 and "GND") →2nd acceleration/deceleration time
rST (RESET) : ON (open between signal 13 and "GND") → Trip reset
</td></tr>
</table>

* Effective only when trip occurs.

Parameter No.	Name of parameter	Description
3A	Lower speed limit	When " **31** Speed command selection" is analogue speed instruction [VoL-A] (VOL-A), motor setting speed at 0 V input is set. 
3b	Upper speed limit	Upper limit of motor command speed. When " **31** Speed command selection" is analogue speed command [VoL-A] (VOL-A), motor setting speed at 5 V input is set. Further, the upper limit of " **00** Setting speed (the 0th speed)" " **01** The 1st speed" - " **07** The 7th speed" is restricted by this parameter.
3C	Torque limit	Upper limit of motor output torque is set. (No precision is provided because torque is not controlled. Use as a guide.) 100 % indicates the rated torque.
40 **41**	O1 function selection O2 function selection	Output terminal " **O1** " and " **O2** " can also be selected as follows. Polarity of " **40** O1 function selection" and " **41** O2 function selection" can be inverted by " **42** O1 output polarity selection" and " **43** **O2** Output polarity selection". [TrIP] (TRIP) : Trip signal (Trip: ON) [STbL] (STABLE) : Arriving signal (When reached to a command value ON) → See " **44** Speed matching range". [rUn] (RUN) : Run/Stop signal (When running: ON) [FrEE] (FREE) : Free-run signal (During free run: ON) [F] (FORWARD) : CCW run signal (During CCW run: ON) [r] (REVERSE) : CW run signal (During CW run: ON) [Ck - L] (CHECK－L) : Overload detection Output when load exceeds 100 % (Load exceeds 100 %:ON) [POUT] (PULSE-OUT) : Speed pulse signal → See " **45** Output pulse count selection".
42 **43**	O1 output polarity selection O2 output polarity selection	This is a function for inverting the polarity of signal output between output terminal " O1 " " O2" and "GND". [nOr] (NORMAL) : Transistor "ON" when activated [rEV] (REVERSE) : Transistor "OFF" when activated
44	Speed matching range	When " **40** O1 function selection " and " **41** O2 function selection" are chosen to [STbL] (STABLE) Arriving signal, "Speed matching range" for output arriving signal can be adjusted. ・When difference between actual rotation speed and speed setting is smaller than "Speed matching range", arriving signal is output. ・Even if the speed is reached, when speed matching range is set too small, arriving signal may turn on and off due to speed fluctuation. ・Arriving signal is not output when CCW/CW changes.
45	Output pulse count selection	When " **40** O1 function selection " and " **41** O2 function selection " are set to [POUT] (PULSE-OUT), pulse count is set to be output to " O1" and " O2" while the motor makes one turn. (To be selected from 1, 2, 3, 4, 6, 8, 12, and 24) * 24 is allowed for setting only for 1800 r/min specification.  It is impossible to set 24 for a motor with rated rotation speed 3600 r/min. (Ex) When rotation number is 1800 r/min, in the case where " **45** Output pulse selection" is 24, $T = \frac{60}{1800 \times 24} = 1.39$ ms Frequency f = 1 / T = 720 Hz
46	Monitor mode selection	You can choose description to be displayed on 5-digit LED when turning on power. [O. - r] (OUTPUT-REVOLUTION) : Rotation speed [O. - L] (OUTPUT-LOAD) : Torque [AV. - L] (AVERAGE-LOAD) : Load factor (average torque) [S. - r] (SETTING-REVOLUTION) : Speed command [d C - V] (DC-VOLTAGE) : Internal DC voltage (Voltage of smoothing capacitor of power supply) In speed display mode, the value multiplied by " **47** Numerator of display multiplying factor" / " **48** Denominator of display multiplying factor" is displayed.

Detail of parameter

Parameter No.	Name of parameter	Description
47	Numerator of display magnification factor	You can set the multiplying factor of a value displayed on 5-digit LED. Value of **47** ÷ **48** is a display multiplying factor. Set a value in the range where calculated display magnifying factor is 10 – 1/1000. ・Capable of displaying the speed of line, etc. When the display magnifying factor is changed, the parameter relating to speed (below) is displayed by a value multiplied by display multiplying factor. " **00** Internal speed (0-th speed)" " **01** 1st speed" - " **07** 7th speed" " **3A** Lower speed limit" " **3b** Upper speed limit " " **44** Speed matching range"
48	Denominator of display magnification factor	
4A	Trip history clearing	Trip history 1 – 5 can be cleared. <Clearing procedure> Cut off power with [YES] (YES) selection, and turn on power again after display has disappeared, then [- - - - -] is displayed, and trip history is cleared. When power is turned on again, normal operation is started.
4b **4C** **4d** **4E** **4F**	Trip history 1 Trip history 2 Trip history 3 Trip history 4 Trip history 5	Trip history for 5 times in the past is stored. Trip history 1 is the latest history. See "Protective function" for displayed description. When no history is available, [- - - - -] is displayed.
50	Undervoltage trip selection	When [nO] (NO) is selection, the motor is not tripped at insufficient voltage. If voltage should fall and undervoltage status is found while the motor is running, the motor stops after running free, while if operation instruction is input after recovery of power, the motor is restarted automatically. (■Be cautious.) When [YES] (YES) is selection, the motor is tripped at undervoltage, and trip signal is output. When normal power is off, trip is not stored in trip history. Trip is stored only when power has stopped instantaneously. (Trip is stored in trip history only when voltage once becomes short and then is recovered normal)
51	Retrial selection	Automatic reset in trip (trip retrial) can be set here. Trip can be is automatically reset to allow operation to continue. Use this function only on such equipment that has no problem of safety even if the motor is automatically restarted. ■ Retrial is impossible if trip is by Overcurrent error [E - OC], Sensor error [E - CS], CPU error [Err], User parameter error [E - UPr], or System parameter error [E - SPr]. When [nO] (NO) is selection, retrial is not effective. When [1] – [4] is selection, retrial is made for the set number of times. When 2 hours has elapsed with no trip, the number of retrying times is initialized to 0. Set the interval between retrials by **52** Retrial start time. When trip occurs in excess of preset number of trials, the brushless inverter outputs trip signal and stops. ■ During retrial, trip signal is not output (It is stored in trip history)
52	Retrial start time	You can set waiting time until retrial operation is performed after tripping is found. You can set 1 to 120 seconds.
54	Parameter initializing	Parameters can be initialized to the factory default. <Initializing procedure> Cut off power with [YES] (YES) selected, and turn on power again after display has disappeared, then [- - - - -] is displayed , and parameters are initialized to the factory default.
57	Parameter copy	Parameters can be copied. [nO] (NO) Parameters are not copied [P.InIT] (PARAMETER-INITIALIZE) : Initialization of Digital key pad data [P.LOAd] (PARAMETER-LOAD) : Reading parameters into Digital key pad data [P.PrOG] (PARAMETER-PROGRAM) : Writing parameters to the brushless inverter See "How to copy parameter" in page 18 for details.
F0	For manufacturer use	It cannot be changed.

Example of running pattern

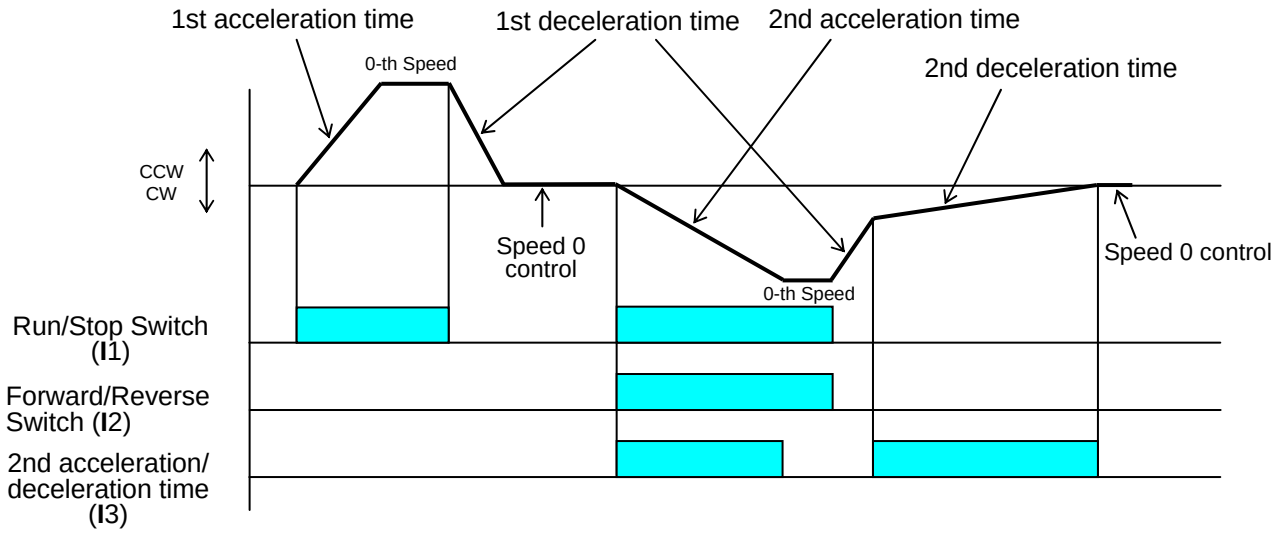
- Example of running pattern by use of 2nd acceleration/deceleration time

When you choose " **16** Stop mode selection" at [dEC]: Deceleration stop

Choose " **32** Operation mode selection" at [1]: 1st Speed operation mode,

Choose " **33** I1/I2 function selection" at [rS.Fr]: (RUN·STOP – FORWARD·REVERSE), and

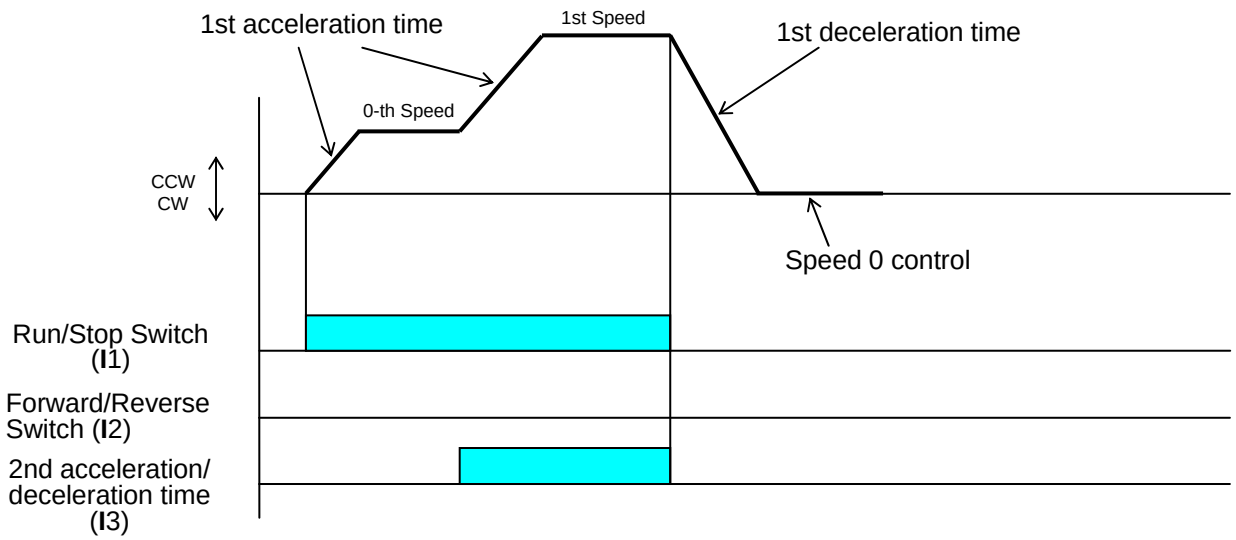
Choose " **34** I3 function selection" at [U - d]: 2nd acceleration and deceleration time



- Example of operation pattern in 2nd speed operation mode

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

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



Conformance to EC directive and UL standard

EC Directives

The EC directives apply to all such electronic products as those having specific functions and directly sold to general consumers in EU countries. These products are required to meet the EU unified standards and to be furnished with CE marking.

Our brushless motor meet the EC Directives for Low Voltage Equipment so that the machine or equipment comprising our motor can meet relevant EC Directives.

EMC Directives

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

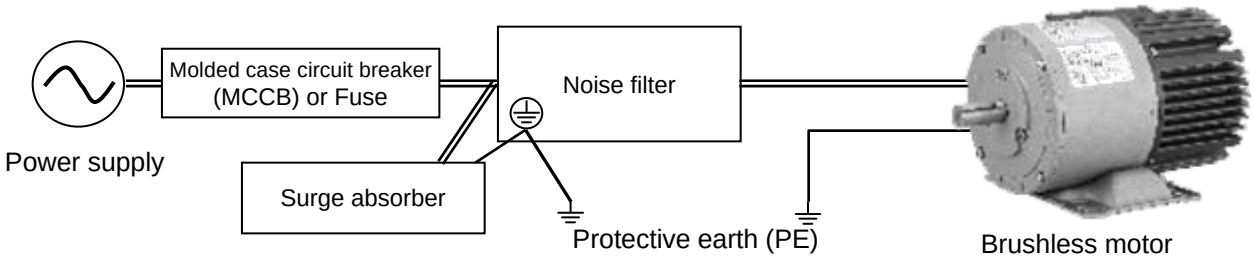
Applicable standard

	Applicable standard	Installation condition
UL	UL1004 standard for electric motor UL508C standard for electric converter equipment	-
CE	EN50178 Electronic and electric equipment used for electric power facilities (low voltage directive) EN60034-1 Electric rotation equipment (motor) (low voltage directive) EN55011 Radio interference wave characteristics of industrial, scientific, and medical high-frequency equipment EN61000-6-2 standards for immunity in industrial environment (EMC directive) IEC61000-4-2 Electrostatics Discharge Immunity Test IEC61000-4-3 Radio Frequency Electromagnetic Field Immunity Test IEC61000-4-4 Electric high-speed transient phenomenon/burst immunity test IEC61000-4-5 Lightening surge Immunity Test IEC61000-4-6 High Frequency Conduction Immunity Test IEC61000-4-11 Instantaneous Outage-Immunity Test	Overvoltage category II Class I equipment Pollution degree 2 (circuit assembly)

Configuration of peripheral equipment

Power supply	・100 V system: single phase 100 V – 120 V ± 10 %, 50/60 Hz 200 V system: single phase 200 V – 240 V ± 10 %, 50/60 Hz ・Use the equipment under the environment of overvoltage category II specified by IEC60664-1. ・In order to obtain overvoltage category II, insert a transformer conforming to EN standard or IEC standard to the input of brushless motor. ・Use an electric wire size suitable to EN60204-1.
MCCB (breaker) Fuse	Be sure to connect a specified molded case circuit breaker (MCCB) certified by IEC standard and UL, or a fuse certified by UL between power supply and noise filter. Observance of this condition allows conformance with UL508C (file No. E164620) and UL1004 (file No.E166557).
Noise filter	When installing one noise filter at the power supply for more than one brushless motor used, contact the manufacturer of noise filter.
Surge absorber	Install a surge absorber on the primary side of noise filter. However, in performing the voltage resistance test of machine and equipment, be sure to remove the surge absorber; otherwise, the surge absorber may be ruptured.
Grounding	Be sure to connect the connecting terminal of brushless motor with the protective earth (PE) for preventing electric shock. Do not tighten protective earths together but connect them individually.

Wiring of peripheral equipment

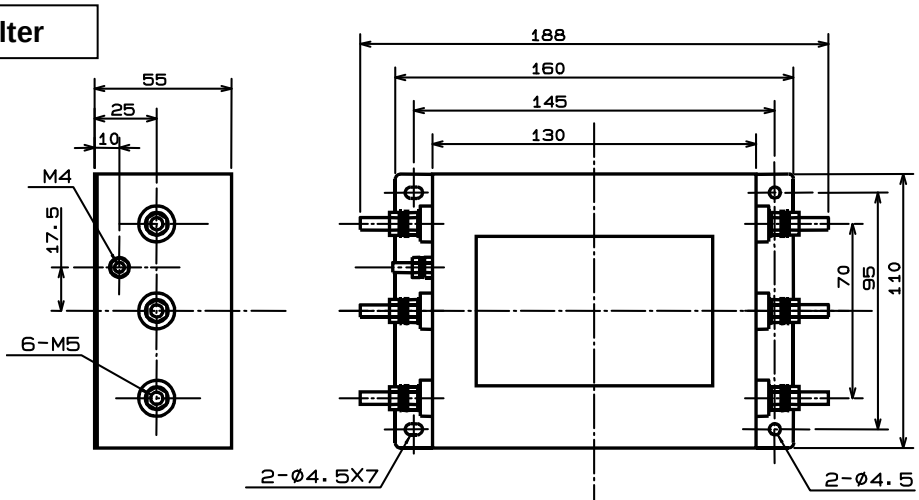


List of compatible peripheral equipment

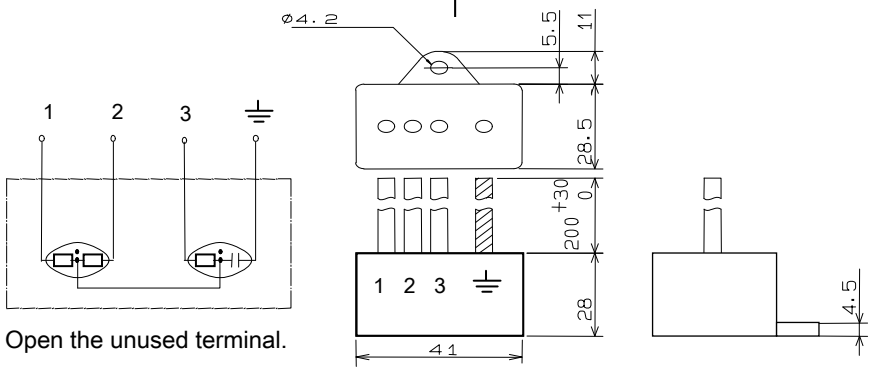
Part name	Optional part number (sold separately)	Manufacturer's part No.	Manufacturer
Noise filter	**DV0P1441**	**3SUP-A10H-ER-4**	OKAYA ELECTRIC INDUSTRIES CO., LTD.
Surge absorber	**DV0P1450**	**R·A·V-781BXZ-4**	OKAYA ELECTRIC INDUSTRIES CO., LTD.

Contact: OKAYA ELECTRIC INDUSTRIES CO., LTD. Japan +81-3-4544-7040

Noise filter



Surge absorber



Open the unused terminal.

Recommended circuit breaker

Made by Sensata Technologies, Inc.: Circuit Protector Type:IELH-1-111-63-10A-M
(Rated current 10 A, cutoff characteristics DELAY63)
■Recommended cutoff characteristics: DELAY61-63

Contact: Sensata Technologies, Inc. http://www.sensata.com/

Specifications

• Specifications

Model name	Rated output (kW)	Power input				Rated Torque (N·m)	Starting torque (N·m)	Rated rotation speed (r/min)	Mass (kg)
		Rated voltage (V)	Tolerance (%)	Frequency (Hz)	Rated input amperage (A)				
MBMA021ABB	0.2	Single-phase 100 - 120	±10	50/60	4.1	1.06	1.59	1800	5.0
MBMA023ABB		3-phase 200 - 240			1.1				4.0
MBMA043ABB	0.4	3-phase 200 - 240			2.0	2.12	3.18	1800	6.3
MBMA083ABB	0.75	3-phase 200 - 240			3.4	3.98	5.97	1800	9.0
MBMA021ALB	0.2	Single-phase 100 - 120			4.1	1.06	1.59	1800	6.4
MBMA023ALB		3-phase 200 - 240			1.1				5.2
MBMA043ALB	0.4	3-phase 200 - 240			2.0	2.12	3.18	1800	7.6
MBMA083ALB	0.75	3-phase 200 - 240			3.4	3.98	5.97	1800	10.5
MBMA023BBB	0.2	3-phase 200 - 240			1.1	0.53	0.80	3600	3.6
MBMA043BBB	0.4	3-phase 200 - 240			2.0	1.06	1.59	3600	5.3
MBMA083BBB	0.75	3-phase 200 - 240			3.4	1.99	2.98	3600	7.6
MBMA023BLB	0.2	3-phase 200 - 240			1.1	0.53	0.80	3600	4.8
MBMA043BLB	0.4	3-phase 200 - 240			2.0	1.06	1.59	3600	6.6
MBMA083BLB	0.75	3-phase 200 - 240			3.4	1.99	2.98	3600	9.1

■ Starting torque is a typical value.

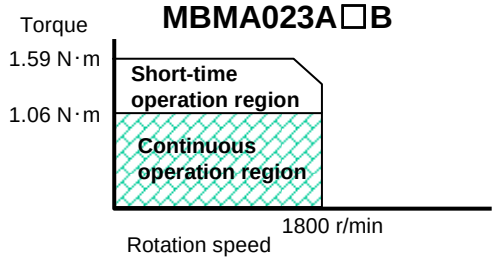
• Common specifications

Item		Specifications
Speed control range		Rated rotation speed/100 - Rated rotation speed (Speed ratio 1:100)
Speed fluctuation factor	With load	±1 % or below (at 0 – Rated torque, Rated rotation speed)
	With voltage	±1 % or below (at supply voltage ±10 %, rated rotation speed)
	With temperature	±1 % or below (at -10 – 40 °C, rated rotation speed)
Acceleration/Deceleration time		0.5 sec (time for changing 1000 r/min)*
Stopping procedure		Free-run stop*
Speed setting		Analogue voltage (0-5 V), incorporated potentiometer, or console A or Digital key pad (digital)
Speed setting solution		Analogue: 1/200 of upper speed limit Digital: 1 r/min
Speed setting precision (at 20 °C)		Analogue: ±5 % or below of upper speed limit (±90 r/min at upper speed limit 1800 r/min) [Digital: 1 % or below of upper speed limit]
Protective function		Warning: Undervoltage warning *, Overload warning Protect: Overcrrent, Overvoltage, Undervoltage, Overload, User parameter error, System parameter error, System error, Overspeed, Sensor error, Overheat, and setting change warning
Motor thermal class		130 (B) (UL certification 105 (A))
Time rating		Continuous (Continuous regenerative operation is not allowed when motor shaft is rotated from load side, such as lowering load operation.)
Working ambient temperature		-10 °C – 40 °C (UL certification of 0.75 kW product is between -10 °C and 30 °C.)
Working ambient humidity		Below 85 %RH (free from condensation)
Working atmosphere		Indoor (free from corrosive gas and dust)
Protection class		IP44 (excluding output shaft rotating part, tip of lead, and terminal box lead portion)
Vibration resistance		Below 4.9 m/s^2 (10-60 Hz)

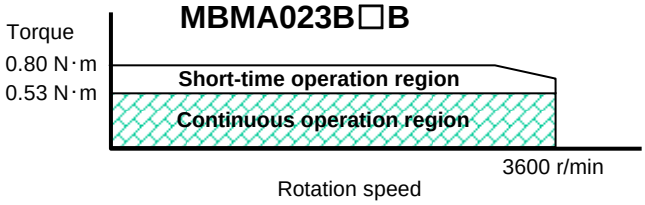
* Can be changed by Digital key pad.

● Speed – Torque characteristics (Torque in short-time run area is a typical value.)

MBMA021A☐B
MBMA023A☐B



MBMA023B☐B



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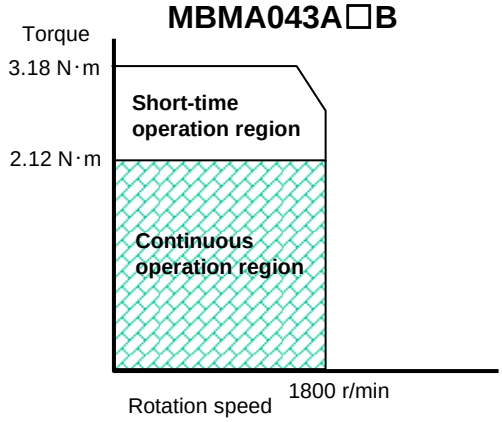

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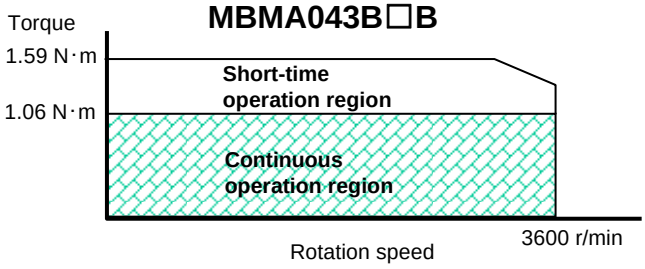

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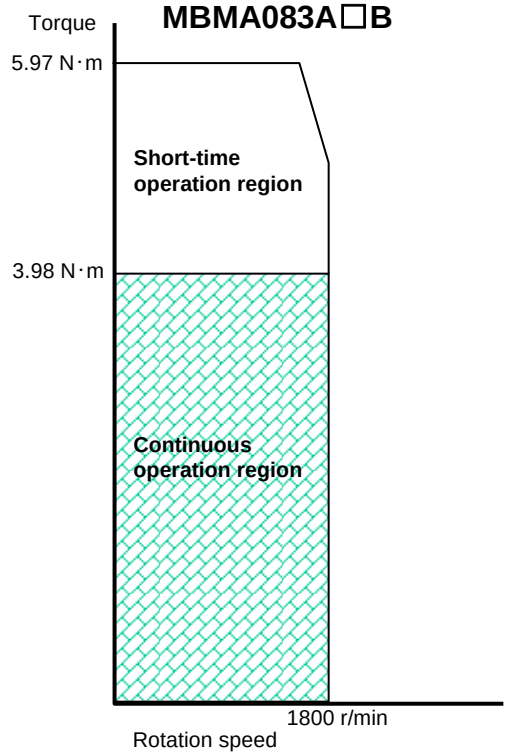

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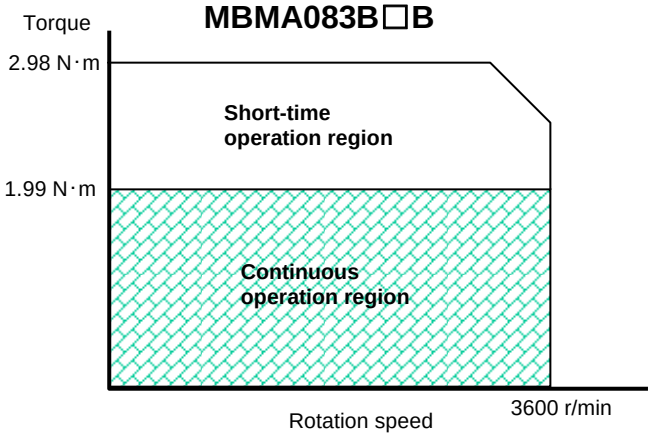
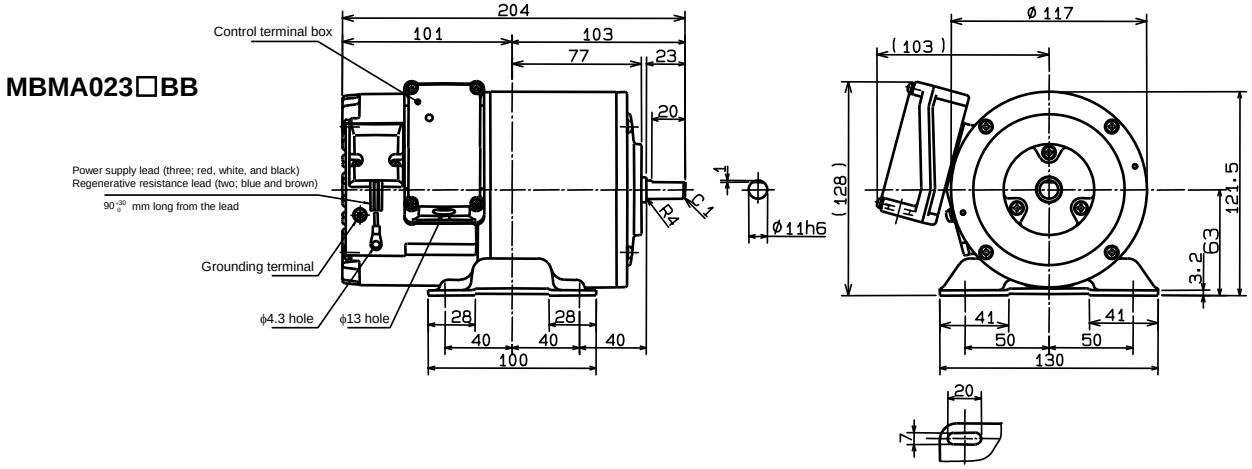
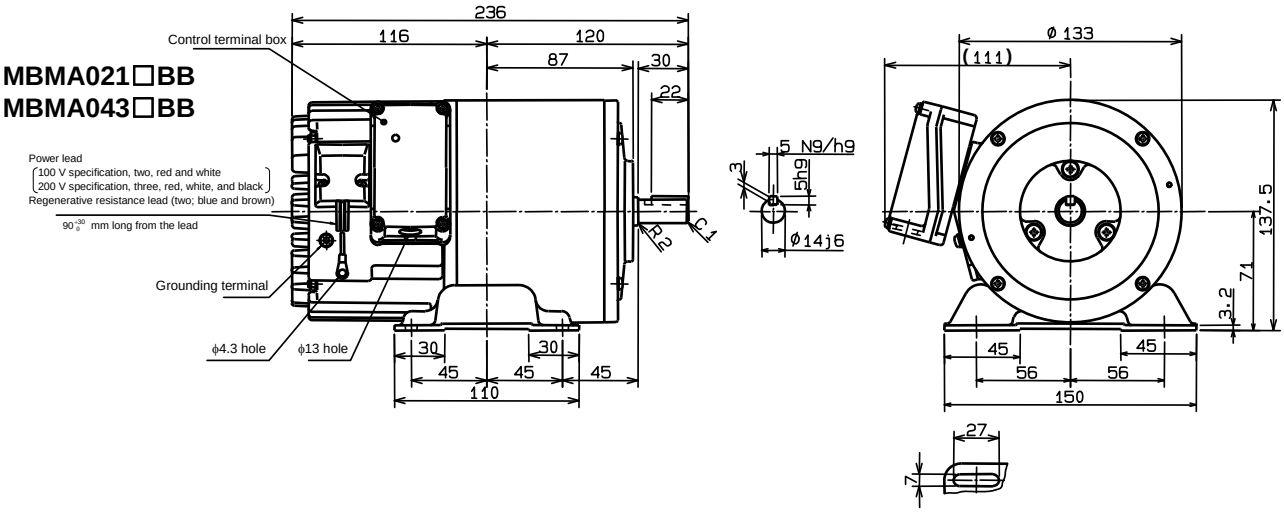


● Dimensional Outline Drawing (in mm)

MBMA023□BB



MBMA021□BB
MBMA043□BB



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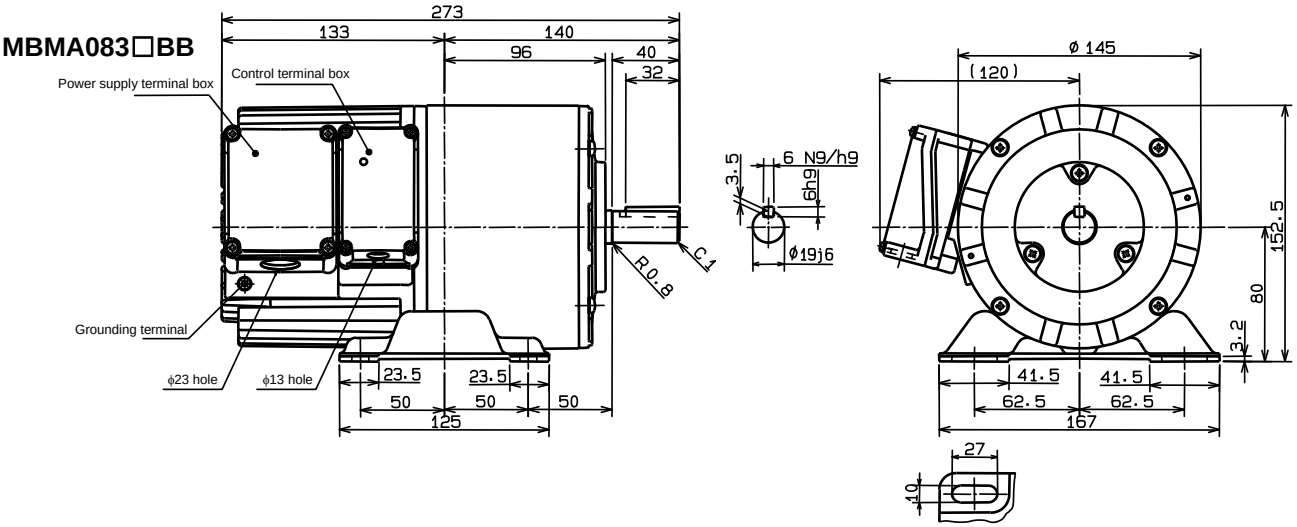

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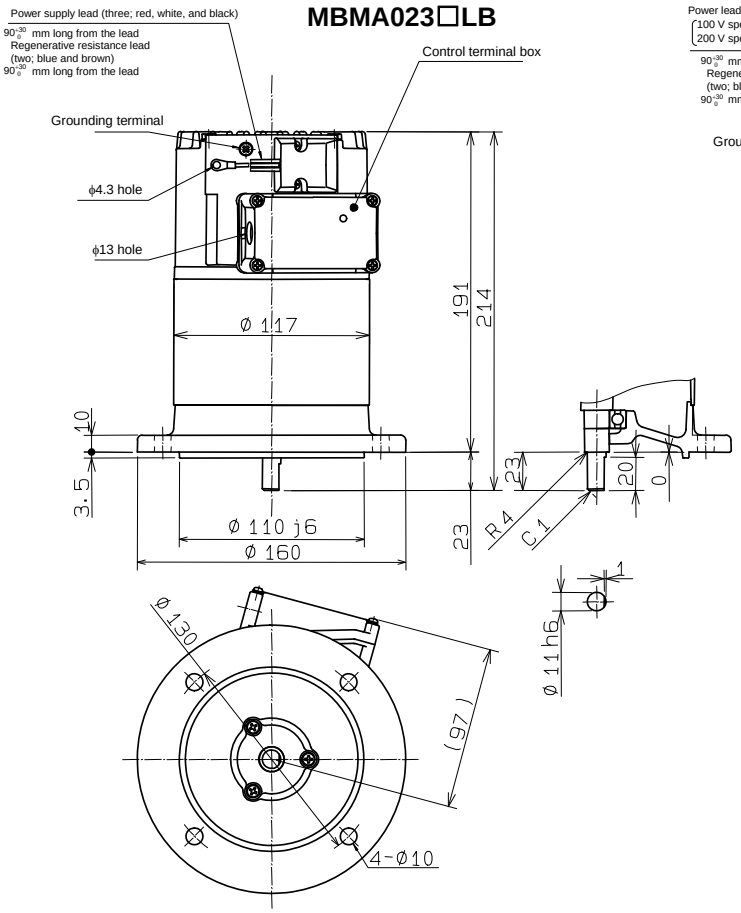
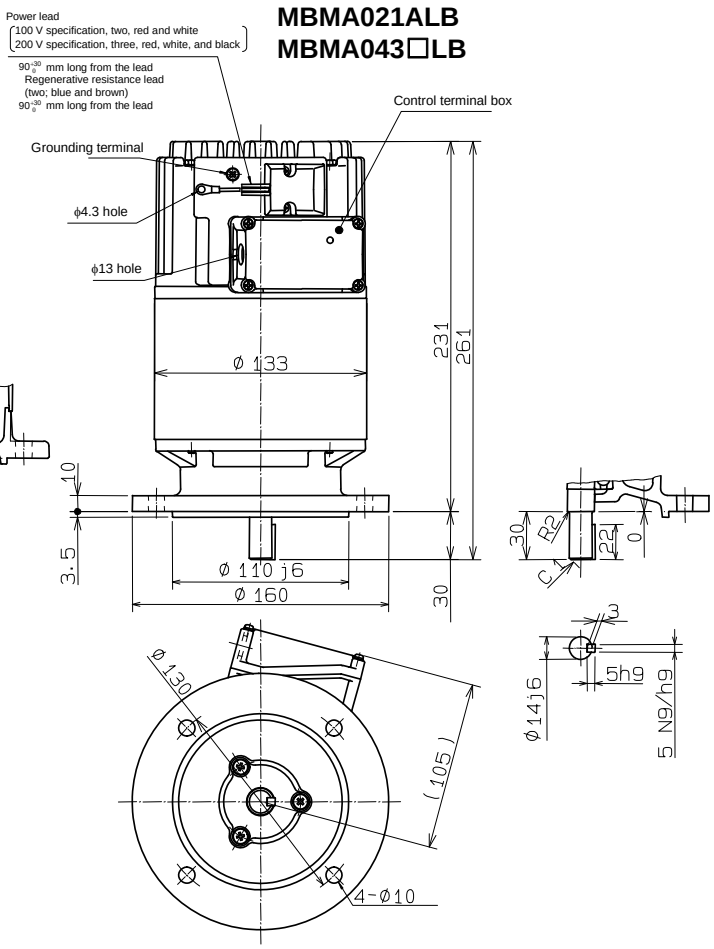


MBMA021ALB
MBMA043□LB



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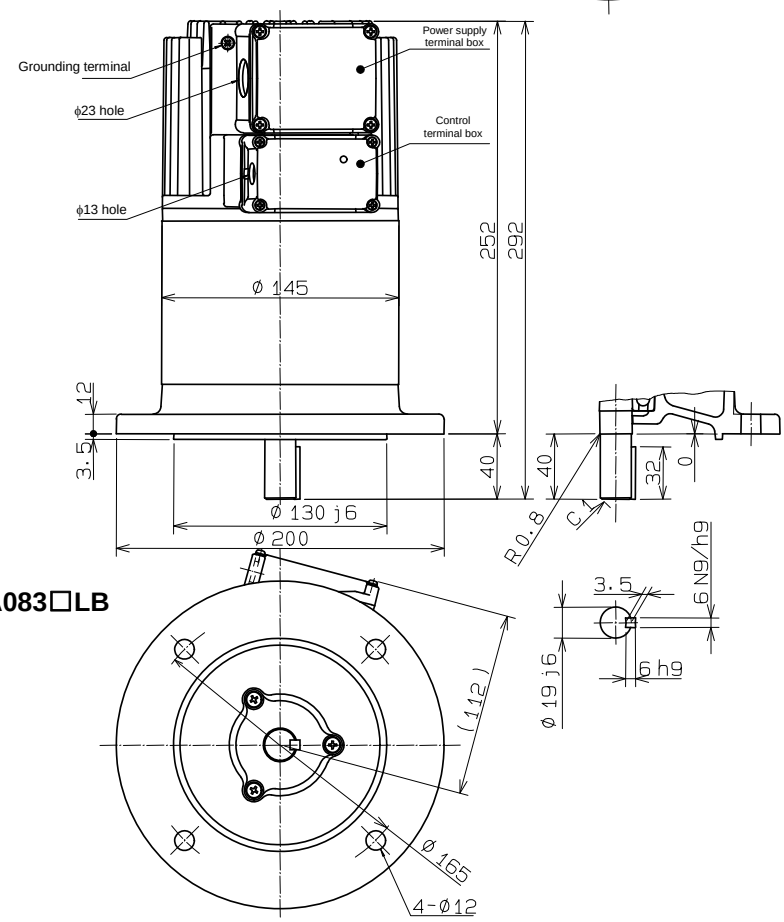
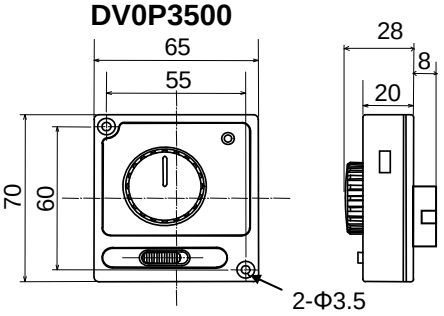
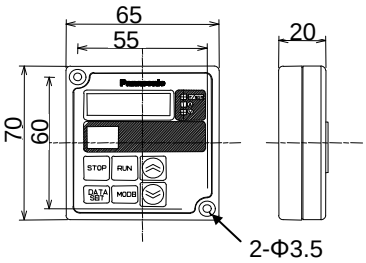


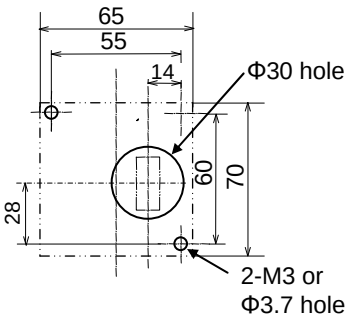
Options

- **Console A (sold separately) DV0P3500**



- **Digital key pad (sold separately) DV0P3510**

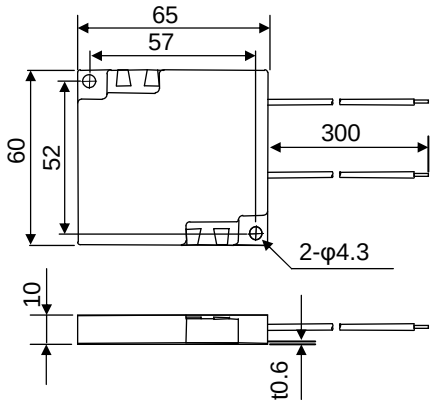




Mounting hole drilling drawing for Console A and Digital key pad

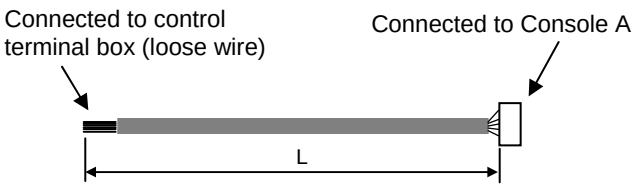
- **Regenerative resistor (sold separately)**

Power supply voltage	Model name	Specifications
AC100 V	**DV0P37902**	40 W/50 Ω
AC200 V	**DV0P37901**	40 W/200 Ω



- **Console A connection cable (sold separately)**

Model name	Length (L)
DV0P35710	1 m
DV0P35730	3 m
DV0P35750	5 m

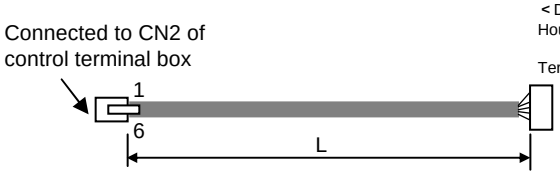


■ Connect the Console A connection cable with control terminal box as shown on the right.

Terminal block	Lead color of cable	Connector pin number on Console A side
I1	Brown	1
I2	Red	2
GND	Orange	3
O1		-
FIN	Yellow	4
+ 5 V	Green	5
I3		-
I4		-
I5		-
O2		-

- **Digital key pad connection cable (sold separately)**

Model name	Length (L)
DV0P35810	1 m
DV0P35830	3 m
DV0P35850	5 m



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

Terminal number of CN2	1	2	3	4	5	6
Terminal name	-	+ 5 V	SOT	SIN	GND	SCK
Connector pin number on Digital key pad side	-	5	9	8	3	7

- **Control signal connector kit B (sold separately)**

Model name		Description
DV0P3610	Engaged on digital keypad side	39-01-2105 (5557-10R-210) x One, pin 39-00-0047 (5556T2L) x 10 (Nihon Molex)

・ Applicable wire size: AWG22-26
・ Applicable manual crimping tool: 57064-5000 or 57038-5300 (Nihon Molex)

Warranty

Warranty period

• Warranty period of this product is 1 year from purchasing, or 1.5 years from our manufacturing month.

Detail of warranty

• If any trouble should be found within warranty period under normal use condition in conformance with this instruction manual, it will be repaired free of charge.
Repair will be chargeable in the following cases even if within warranty period:
(1) When trouble is caused by wrong use, and inappropriate repair or modification.
(2) When trouble is caused by dropping after purchase, or damage in transportation.
(3) When trouble is caused by use out of specification range of the product.
(4) When trouble is caused by fire, earthquake, lightning stroke, damage by wind and flood, damage by salt, abnormal voltage and any other natural disaster.
(5) When trouble is caused by entry of water, oil, metal strip, and any other foreign substance.

• Warranty covers only the body of delivered product, and damage induced by trouble of delivered products will be excluded from compensation.

Cautions for Proper Use

• Practical considerations for exporting the product or assembly containing the product
When the end user of the product or end use of the product is associated with military affair or weapon, its export may be controlled by the Foreign Exchange and Foreign Trade Control Law. Complete review of the product to be exported and export formalities should be practiced.
• This product is intended to be used with a general industrial product, but not designed or manufactured to be used in a machine or system that may cause personal death when it is failed.
• Installation, wiring, operation, maintenance, etc., of the equipment should be done by qualified and experienced personnel.
• Install a safety equipments or apparatus in your application, when a serious accident or loss of property is expected due to the failure of this product.
• Consult us if the application of this product is under such special conditions and environments as nuclear energy control, aerospace, transportation, medical equipment, various safety equipments or equipments which require a lesser air contamination.
• We have been making the best effort to ensure the highest quality of the products, however, application of exceptionally larger external noise disturbance and static electricity, or failure in input power, wiring and components may result in unexpected action. It is highly recommended that you make a fail-safe design and secure the safety in the operative range.
• If the motor shaft is not electrically grounded, it may cause an electrolytic corrosion to the bearing, depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Checking and verification by customer is required.
• Failure of this product depending on its content, may generate smoke of about one cigarette. Take this into consideration when the application of the machine is clean room related.
• Please be careful when using in an environment with high concentrations of sulfur or sulfuric gases, as sulfuration can lead to disconnection from the chip resistor or a poor contact connection.
• Take care to avoid inputting a supply voltage which significantly exceeds the rated range to the power supply of this product. Failure to heed this caution may result in damage to the internal parts, causing smoking and/or a fire and other trouble.
• The user is responsible for matching between machine and components in terms of configuration, dimensions, life expectancy, characteristics, when installing the machine or changing specification of the machine. The user is also responsible for complying with applicable laws and regulations.
• The product will not be guaranteed when it is used outside its specification limits.
• Parts are subject to minor change to improve performance.

MEMO

MEMO

After-sale service (Repair)

Repair

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

Technical information

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

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

Sales Group, Motor Business Division, Panasonic Corporation

7-1-1, Morofuku, Daito, Osaka, 574-0044, Japan

Phone +81-72-870-3065
Fax +81-72-870-3151

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

Model No.	MBMA☐☐☐☐☐B	**Serial No.**	
Date of purchase			
Dealer	Name		
	Address		
	Phone	( ) -	

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

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