Panasonic

Brushless Motor Driver

MINAS-HYPER Inverter

MBD-Series M、D Frame

Operation Manual

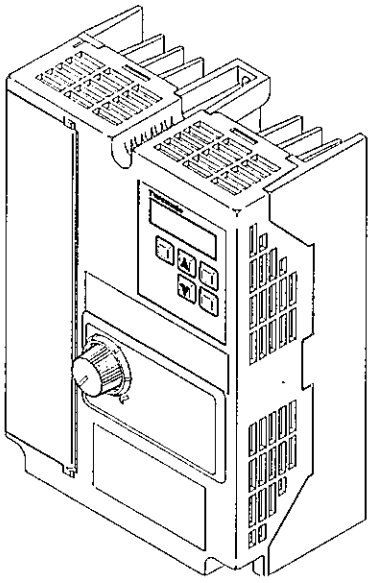


Fig. represents MBDK043BWM

■Thank you for purchasing Panasonic Inverter.
■This product is a variable frequency power unit for brushless motor. This manual describes the function and handling of the inverter.
■This product is easy to handle and operate, however, improper operation could result in unexpected trouble, deteriorate the life or performance of the product.
■Keep this manual at convenient place for further reference.
■(This manual has to be handed to the end customer.)

Unit

SI unit is used in this manual together with current unit.(On the product, current unit is displayed only.)

SAFETY CAUTIONS

Read this manual carefully for proper handling and operation, before installing, operating, maintaining and inspecting. Persons concerned are requested to acquire all of the knowledge about the unit, safety information and cautions given in this manual.

This manual classifies the safety cautions into "WARNING" and "CAUTION" by ranking

⚠ WARNING : indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.

⚠ CAUTION : indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury and physical damage.

Further, even item ranked in ⚠ CAUTION could lead to serious result depending on situation, if operator fails to observe the instruction. Both "WARNING" and "CAUTION" with hazard alert symbol describe important items. Observe the instruction described in therein, without fail.

1. Installation

⚠ CAUTION

- Install the inverter on metal or other incombustible support base.
  Failure to observe this instruction could result in fire.
- Don't place any combustible material near the inverter.
  Failure to observe this instruction could result in fire.
- In handling and transporting, don't catch the inverter front panel.
  Failure to observe this instruction could result in bodily injury by fall-down of the inverter.
- Don't allow inclusion of foreign matters(metal piece, etc.) in the inverter.
  Failure to this instruction could result in fire.
- Select a location which can bear the inverter weight, and install the inverter thereon as instructed in this manual.
  Failure to observe this instruction could result in bodily injury by fall-down of the inverter.

2. Wiring

⚠ WARNING

- Be sure to check that the input power switch is OFF, before beginning the wiring work.
  Failure to observe this instruction could result in electric shock and fire.
- Provide no-fuse breaker(NFB) without fail.
  Failure to observe this instruction could result in fire.
- Ground the earth terminal without fail.
  Failure to this instruction could result in electrical shock and fire.
- Make wiring after complete installation of the inverter body.
  Failure to this instruction could result in electric shock and fire.

⚠ CAUTION

- Don't connect AC power to the output terminals(U, V, W)
  Failure to observe this instruction could result in injury and fire.
- Be sure to verify actual AC power voltage with the rated voltage of the product (inverter).
  Failure to observe this instruction could result in injury and fire.

3. Operation and Run

⚠ WARNING

- Switch ON the input power after mounting the front panel.
  Further, don't remove the front panel while power in ON.
  Failure to observe this instruction could result in electric shock.
- Don't operate the switches with wet hand.
  Failure to observe this instruction could result in electric shock.
- Don't touch the inverter terminal during make, even when machine is in Shutdown.
  Failure to observe this instruction could result in electric shock.

⚠ WARNING

●If TRIP RESET is pressed and the power is turned ON after the power switch was turned off with run signal kept ON, the machine restarts suddenly. Don't approach the machine.
Failure to observe this instruction could result in injury.

⚠ CAUTION

●Don't touch the heat-sink or regenerative resistor which become hot.
Failure to observe this instruction could result in burns

●The inverter enable to easily set up the operating speed within a range from low to high speed. Set up the operating speed so as not exceed the respective permissible speed range of the motor and machine.
Failure to observe this instruction could result in injury.

4. Maintenance and Inspection

⚠ WARNING

●Conduct inspection after 5 minutes and over from input power OFF.
Failure to observe this instruction could result in electric shock.。

●Other than inspection specialist are not allowed to engage in maintenance and inspection(checking).
Take off metallic articles(watch, ring and etc.) before beginning maintenance and inspection.
Further, use insulation-treated tools for maintenance.
Failure to observe this instruction could result in electric shock and injury.

5. Others

⚠ WARNING

●Absolutely avoid random modification.
Failure to observe this instruction could result in electric shock, injury and fire.

GENERAL PRECAUTION

The sketches included in the descriptive instructions in this manual are all drafted, with the front panel or the shield for safe removed, to explain the detailed portions of the inverter unit. When operating the product(inverter), restore the front panel and the shield as specified, without fail, and operate it as instructed in this manual.

Table of contents

1. Forward

1－1 After unpacking

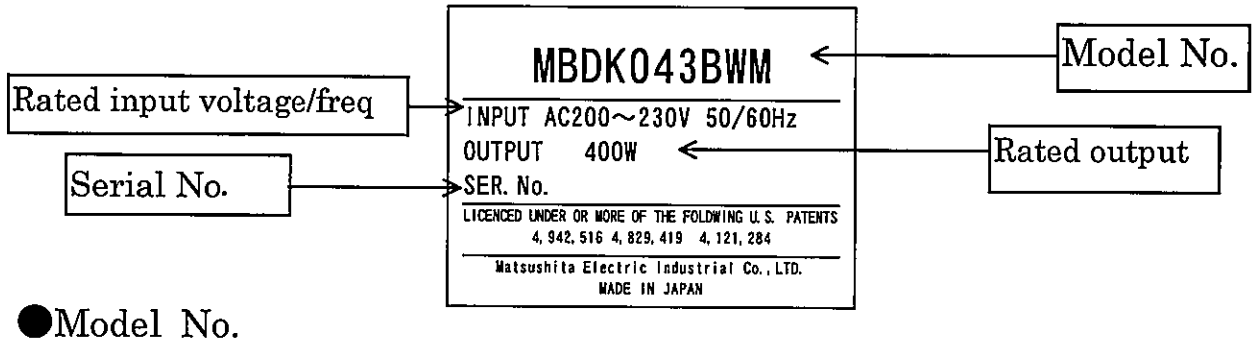
●Check the following items.

(1) Check if the received(delivered) inverter is as ordered by you.

(2) Check if the delivered inverter for damage during transportation.

Should discrepancy or defect be found upon checking, feel free to contact the distributor or the dealer from whom you purchased the inverter.

●Part No.



●Model No.

<E.G.>

M B D K 0 4 3 B W M

MINAS-HYPER Inverter
M B D series

Applicable Motor
K : Ultra compact
H : General purpose

Output of the motor
5B: 5W
1A: 10W
2A: 20W
3A: 25W
4A: 40W
5A: 50W
01:100W
02:200W
:
08:750W
10:1.0Kw
:
15:1.5kW
:
22:2.2kW
:
37:3.7kW
:
C5: 15kW

Input
1: 1 φ 100V
2: 1 φ 200V
3: 3 φ 200V

Rated speed of the motor
A:1800r/min
B:3000r/min
C:3600r/min

Frame shape
M : M-shape
D : D-shape

Standard spec

	Volume	Brake resistor
B	—	○
V	○	—
W	○	○

※For standard specifications, refer to 10. 「SPECIFICATIONS」 (page40～48)

1－2 Applicable motor

Applicable motor to this inverter is Panasonic
MINAS－HYPER motor described in the table below.

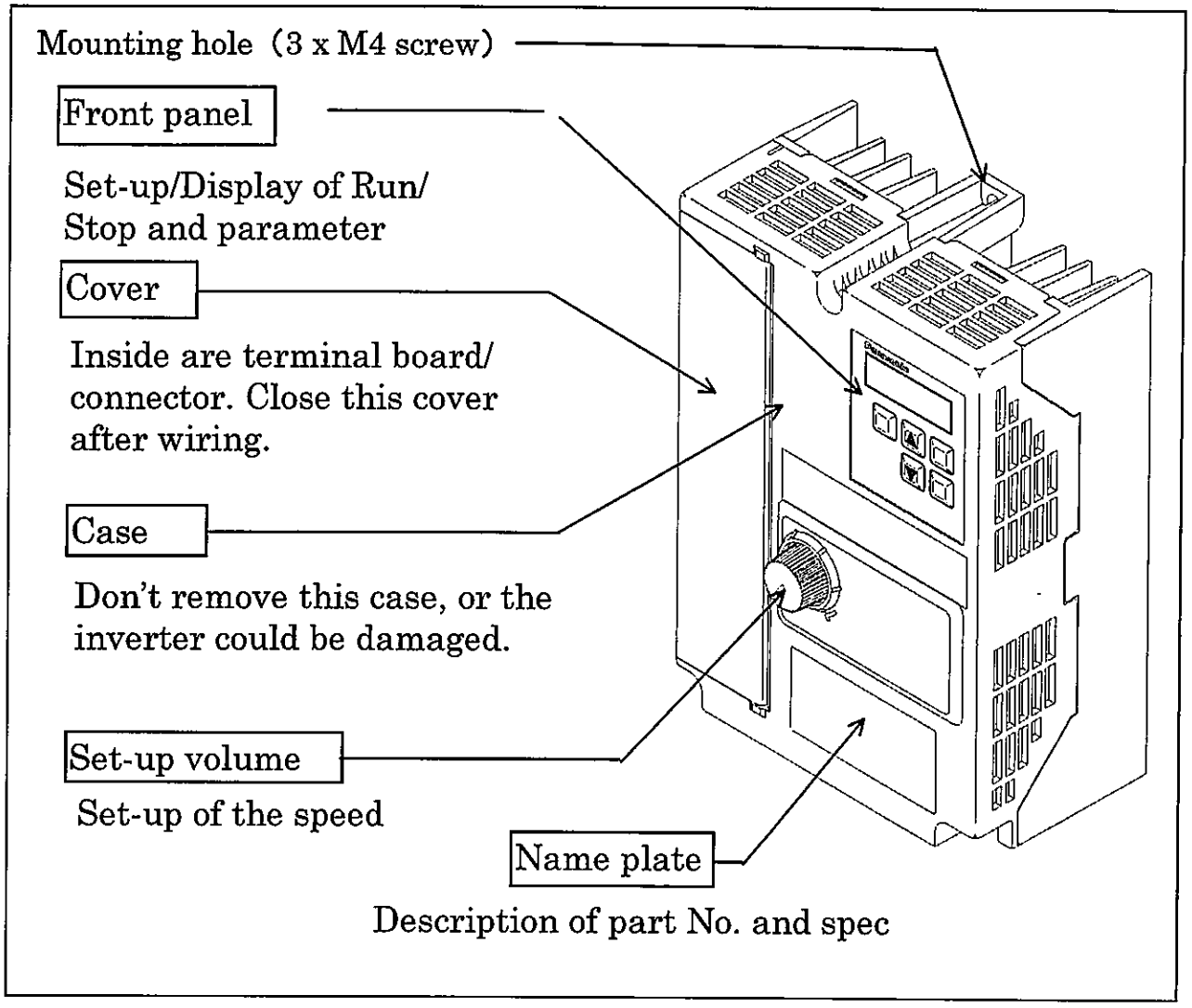
Inverter part No.	Applicable motor part No
MBDK5B1BVM	MBMK5BZBL*
MBDK2A1BVM	MBMK2AZBL*
MBDK5A1BVM	MBMK5AZBL*
MBDK011BVM	MBMK011BL*
MBDK021BVM	MBMK021BL*
MBDK041BVM	MBMK041BL*
MBDK5B3BVM	MBMK5BZBL*
MBDK2A3BVM	MBMK2AZBL*
MBDK5A3BVM	MBMK5AZBL*
MBDK013BVM	MBMK012BL*
MBDK023BVM	MBMK022BL*
MBDK043BVM	MBMK042BL*
MBDK083BVM	MBMK082BL*
MBDK153BBD	MBMK152BL*
MBDK223BBD	MBMK222BL*
MBDK373BBD	MBMK372BL*

Inverter part No.	Applicable motor part No
MBDH023AVM	MBMH022AB* MBMH022AL*
MBDH043AWM	MBMH042AB* MBMH042AL*
MBDH083AWM	MBMH082AB* MBMH082AL*
MBDH153ABD	MBMH152AB* MBMH152AL*
MBDH223ABD	MBMH222AB* MBMH222AL*
MBDH373ABD	MBMH372AB* MBMH372AL*
MBDH023CVM	MBMH022CB* MBMH022CL*
MBDH043CWM	MBMH042CB* MBMH042CL*
MBDH083CWM	MBMH082CB* MBMH082CL*
MBDH153CBD	MBMH152CB* MBMH152CL*
MBDH223CBD	MBMH222CB* MBMH222CL*
MBDH373CBD	MBMH372CB* MBMH372CL*

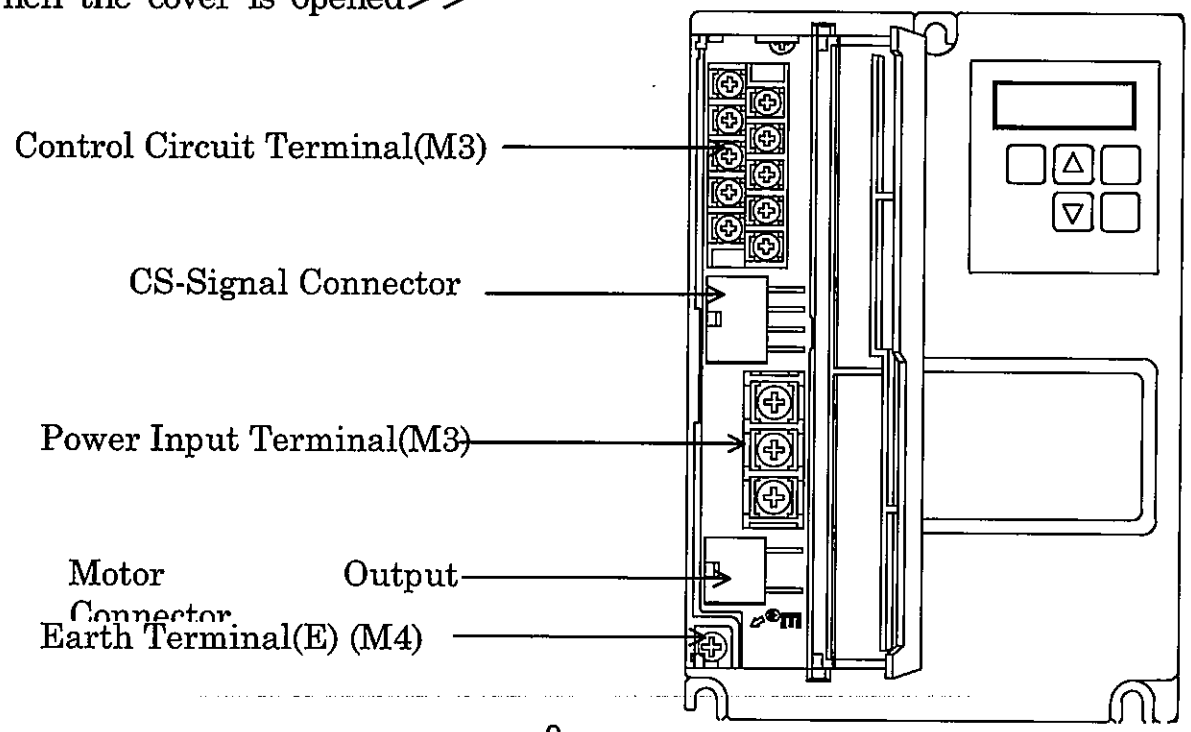
2. Construction

2－1 Appearance and identification

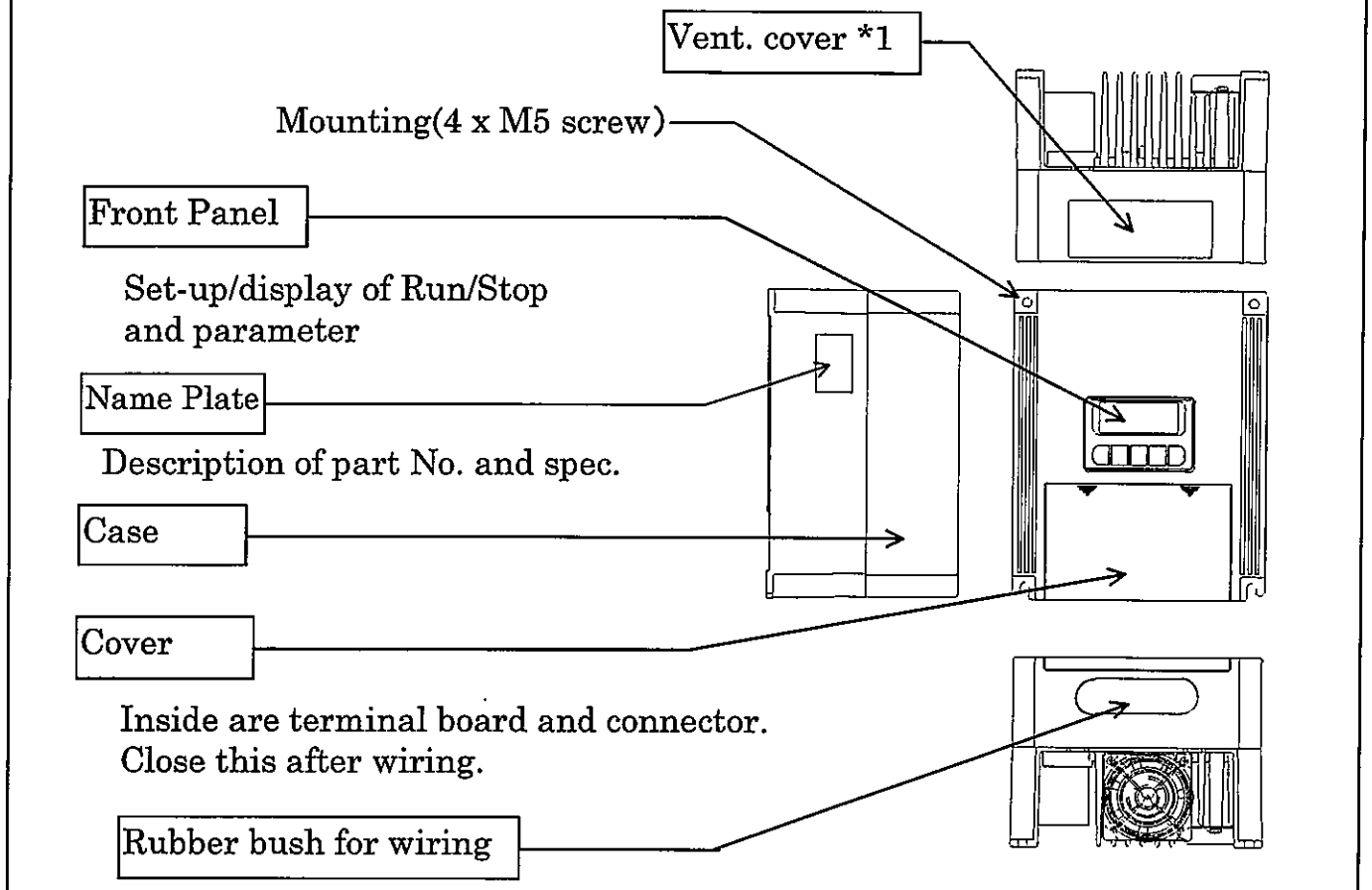
<750 W or smaller>



<<when the cover is opened>>

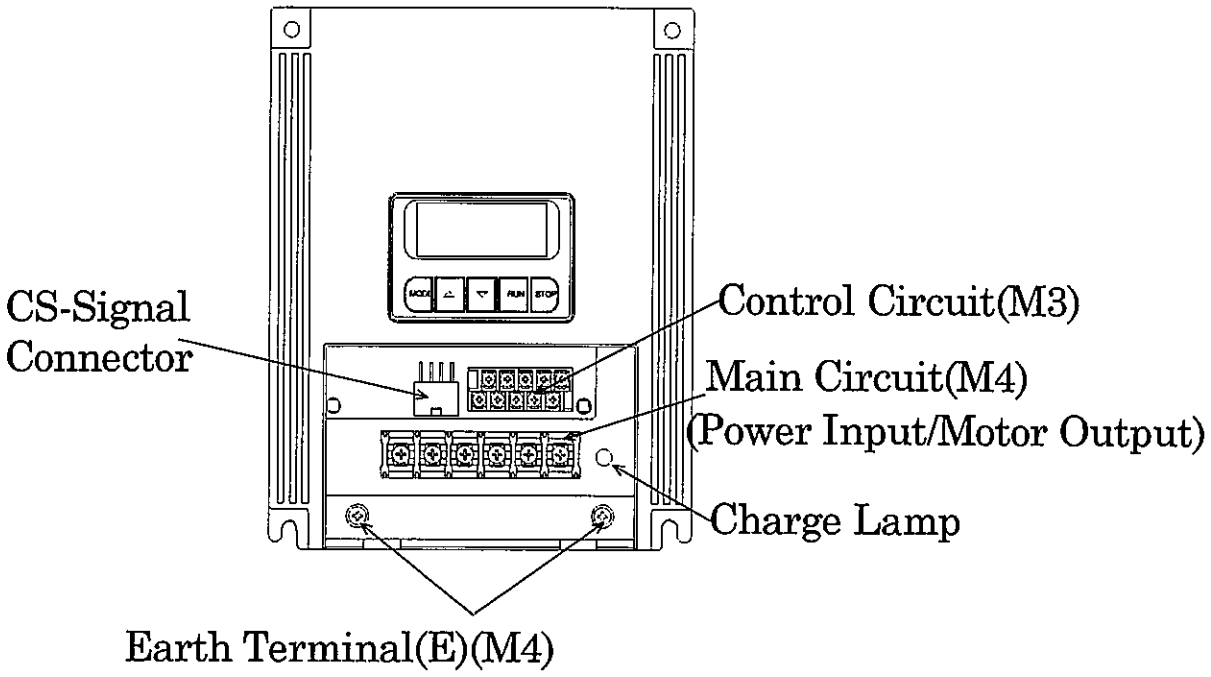


<1.5 kW or larger>



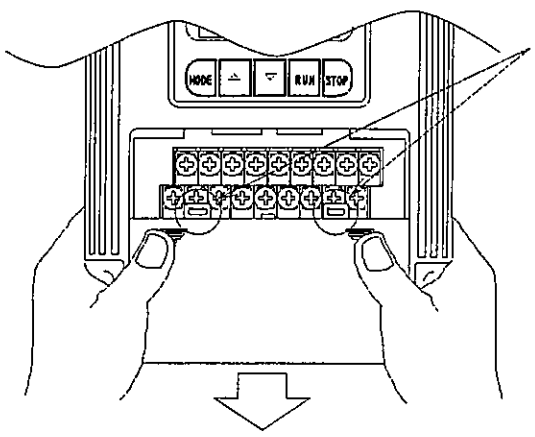
*1) Vent. cover is installed at ex-fac. Remove this and rubber bush if the inverter is used at 40℃ or over.

<<when the cover is opened>>



2－2 Removal and restore of the cover(1.5 kW or larger)

Removal



Pull back while pressing down the cover

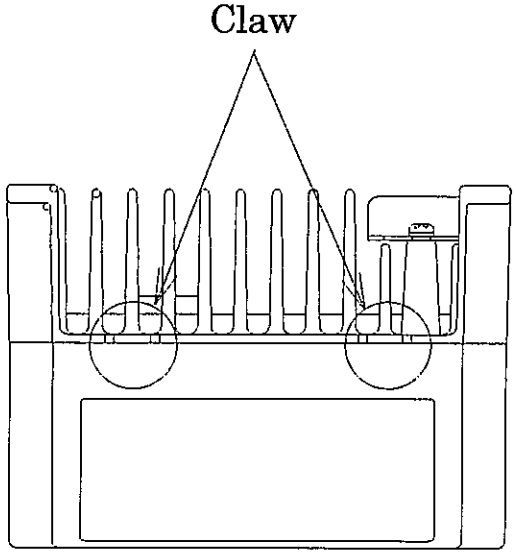
Restore

Make a reverse process of removal.

2－3 Removal and put-back of the cover (1.5kW or larger)

Removal

Hook 4 claws of the case (upper/lower) to remove with screw driver or other tool



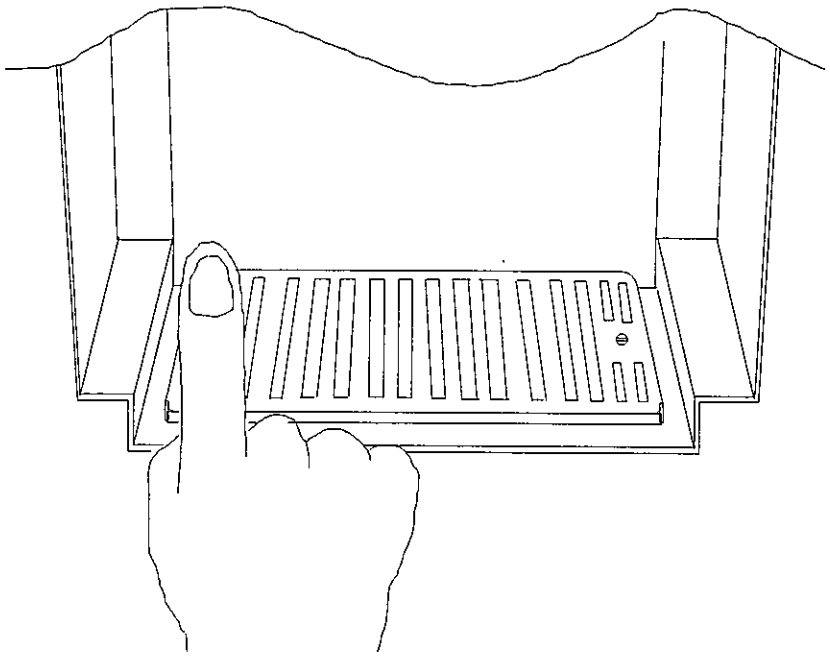
Restore

Make a reverse process of removal.

2 — 4 Removal of vent. cover(1.5 kW or larger)

Vent. cover is attached to the upper side of the case.

Remove the cover and case. Remove the vent. cover by pressing the extrusion from inside.



Note

(1) Check if no wire-pinching to be seen while restoring the cover.
(2) Make sure that the claw of the cover is inserted securely while restoring the cover.
(3) Wipe off any oil from the cover with cloth.

3. Cautions

3－1 Safety cautions

1. Switch off the power source when connenting or disconnecting the cables to main circuit terminals, earth terminal and control circuit terminals.
2. Don't touch absolutely each printed circuit board because of its high voltage circuit.
3. Earth both the inverter and motor earth terminal. For the position of earth terminal, refer to "Section 2-1 「Appearance and Identification」 Class-3 grounding (100 Ω or less, Φ 1.6mm) or more is recommended.
4. In wiring, use no-fuse breaker in accordance with 「Standard Wiring Diagram」.
5. Internal circuits are kept charged with high voltage for a while even after power OFF. When conducting internal check, begin it 5 minutes or more after power OFF.
6. Don't touch absolutely the motor output connector during "Free-Run Stop.
7. The power supply is not cut off even when machine is put in stop condition by stop command. Be careful of electric shock and unintentional start-up.
8. When putting machine in long rest, switch OFF the power source. Failure to observe this instruction could result in electric shock.
9. Operating the motor at over 60Hz could put it in unstable condition and in the worst case, could damage the device. Be sure to check the device can be operated at stable condition. Further, periodical check of each device is recommended.
10. Make sure that the input voltage is withing a range of the rated voltage, before turning ON the the power. Excess voltage input could cause flashing, fuming or abnormal noise inside the inverter.
11. Back side of the inverter is high temperature. Insall the inverter on metal base or other incombustible material. Furthermore, don't touch absolutely inverter during run and until enough time elasps after shutdown.
12. Take special care so as not allow dust, mist, iron powder,etc. to enter into the inverter.
13. Frequent repetition of start/stop could deactivate the motor overload protection. Check the temperature rise of the motor with actual operation pattern of the device.
14. Before turning ON/OFF the power , be sure to check, by operator himself, that the ambient safety is fully secured. Aboslutely avoid operation error by other personnel.
15. Re-switching ON the power source subsequent to power OFF and trip resetting, would permit the inverter to be automatically reset. Therefore, operator must check that safety is secured for ambient persons and articles, before executing the above operation.
16. While executing inspection of the device at stop, absolutely turn off the breaker at the main ciruit.
17. Exactly execute mounting and installation of the inverter to avoid incidental personal accident which may arise from improper execution of this in the case of erthquake.
18. When operating the inverter after earthquake, be sure to check in advance the inverter and motor for the installed condition and the machine for safety.

We have paid supreme effort to qualify assuarance of this product(inverter). However,if unexpected external noise acts on the inverter or improper wiring is made to any of the terminal, the inverter could work beyond the set-up data. To avoid such a trouble, you are kindly requested to take full consideration in your machine itself and its safety.

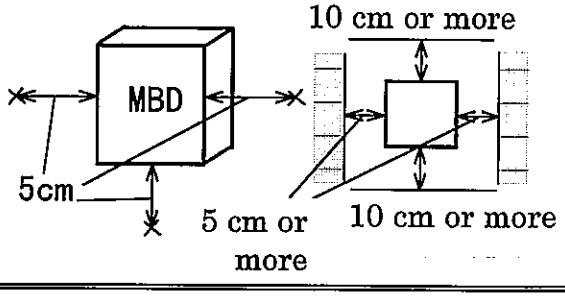
3－2 Caution for Proper Operation

Incorrect operation could result in failure of normal running and, in the worst case, damage of the inverter itself. To avoid such trouble and damage, observe the precaution given hereunder.

1. Don't input power voltage out of the permissible voltage range to the power input terminals(R, S, T). Furthermore, don't connect absolutely the power input cable to any other terminals.
2. Ensure the power capacity in the range from 1.5 times the inverter capacity up to 500 KVA max. Operating the inverter under direct power supply of more than 500 KVA or shifting phase capacitor at the power side would allow excessive peak current to flow into the power input circuit, which could then damage the inverter. In such a case, install a power factor improved AC reactor, which adapts to the inverter capacity, on the inverter at its input side.
3. Avoid absolutely such wiring and operation sequence that input voltage is applied to the inverter output . Failure to observe this instruction could damage the inverter.
4. The inverter life greatly depends on ambient temperature. In use of the inverter, keep the ambient temperature as low as possible.
5. Avoid motor start-stop by electromagnetic contactor which is installed between the inverter andmotor. For starting and stopping the motor, use either RUN/STOP switch on the operation panel or the control input terminas 「11」・「12」.
6. For the specifications of terminals, refere to 5-2, 「Standard Wiring Diagram」.
7. Avoid frequent switching ON/OFF of electromagnetic contactor, installed at power source side.
8. Avoid to operate the inverter under overload condition exceeding the inverter and motor capacity. Failure to observe this instruction could result in damage of the inverter and could cause inverse affect on the inverter life.
9. Running the motor with inverter will increase leaked current, which could then activate the leakage breaker . In such a case, use a leakage breaker, to which a high frequency measure is applied, for not only the inverter power line but also other line.
10. Ensure th total cable length at 20 m max. between the inverter and the motor.
11. Be sure to check that each cable wired to the terminal board is screwed with proper tightening torque. Loose in tightening could result in abnormal overheat.
12. Running the motor by inverter could result in wave noise from I/O cables of the inverter,motor etc.,which could then give inverse affect to the electronic devices. In such a case, wave noise and inverse affect can be restrained up to some extent by providing the inverter I/O with filter or otherwise containing the power cable in conduit.

Notes

- The inverter life greatly depends on ambient temperature. Therefore keep ambient temperature around the inverter in the permissible range.
- Be sure to cheek the ambient temperature is within the permissible range at a cross-point in the right Figure.
  (Refer to 10 「Specifications」



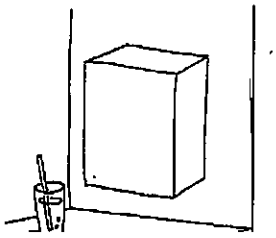
4. Installation

4－1 Caution in carrying

■ In carrying, handling the inverter with good care no to damage it.
■ Avoid such a handling manner as causes abnormal load to act on the plastic case.

4－2 Location

■ Install the inverter in vertical position Ensure sufficient spacing around it for good ventilation.

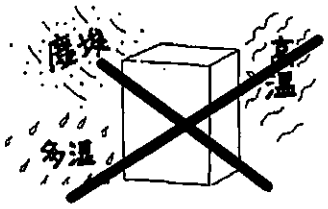


◇ Screw and volt securely the case mount not to allow bending and torsion stresses to act on the inverter body.

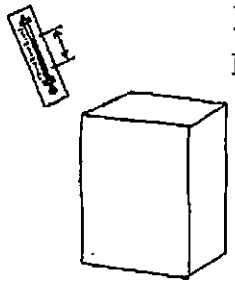
◇ Use M4 screw or bolt for 750 W or smaller, M5 for 1.5kW or larger inverter for mounting.

◇ Proceed with installation, in reference to 10-3 「Outer Dimensions」 (P43).

■ Avoid an environment where the inverter may be exposed to high temperature and humidity, dust and mist, iron powder, chips, etc.

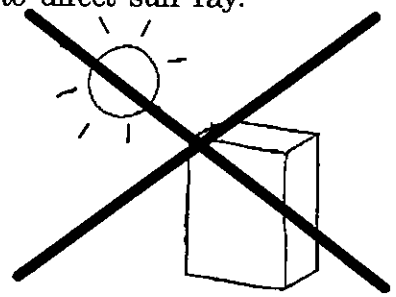


■ Select a location where environment is within a permissible range.

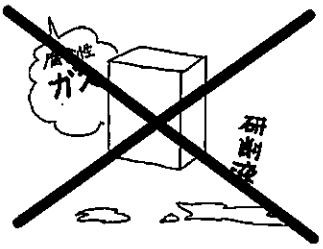


For working temperature, refer to 「Specifications」

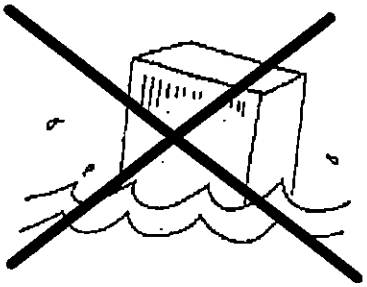
■ Avoid a place where the inverter is exposed to direct sun ray.



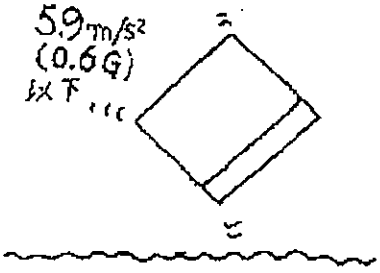
■ Select a corrosive gas free and cutting coolant splash free location.



■ Not a water-proof construction. Avoid outside use.



■ Select a vibrationless location. Avoid continuous operation at resonance point.

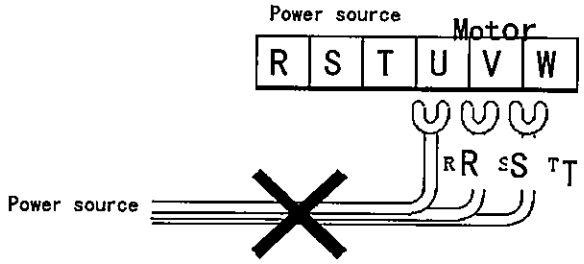


5. Wiring Connection

5－1 Caution in Wiring Connection

Main Circuit

<e.g. 1.5kW or larger>



(1) Inverse connection of the power input terminals(R. S. T) and motor output terminals(U. V. W) would cause damage of the inverter. Absolutely avoid such connecton.(right Fig.)

(2) Don't earth the motor output terminals (U.V.W).

(3) Avoid short-circuiting between motor output terminals(U.V.W).

(4) Make wiring connection in accordance with 5-2 , 「Standard Wiring Diagram」 (p17-18). Select no-fuse breaker (NFB) matching to the motor ratings. Also refer to 5-3, 「Selection of Wiring Devices」 (p19).

(5) Earth terminal(E) is connected to the motor frame. Apply Class-3 Earthing(100 Ω max., Φ 1.6 mm min.) or higher class.

(6) Use the fasten terminals with insulated coating for the connection to the main circuit terminals (R. S. T. U. V. W).

Control circuit

(1) Don't apply over DC24V・50mA or reversed polarity between control output terminals, 01-COM or POUT-G .

(2) Control input terminal is composed as below.

750 W or smaller(M-frame) :

Photocoupler input(2.2k Ω of internal resistance) connected internal power supply of +8V.

1.5kW or larger(D-frame) :

CMOS input pulled-up with 4.7k Ω from internal power supply of +5V.

They can be controlled either by contact or open collector.

Don't apply voltage thereto externally.

(3) Don't short-circuit between speed-setting power terminal(5V) and control ground terminal(GND).

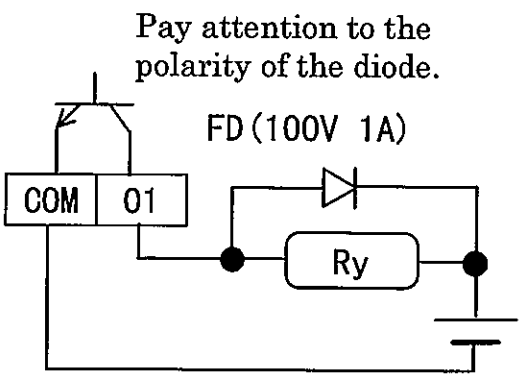
(4) When directly driving relay by output terminal (01-COM), insert flywheel diode(FD).

(5) Use twist cable or shield cable as the cable to be connected to the control circuit.

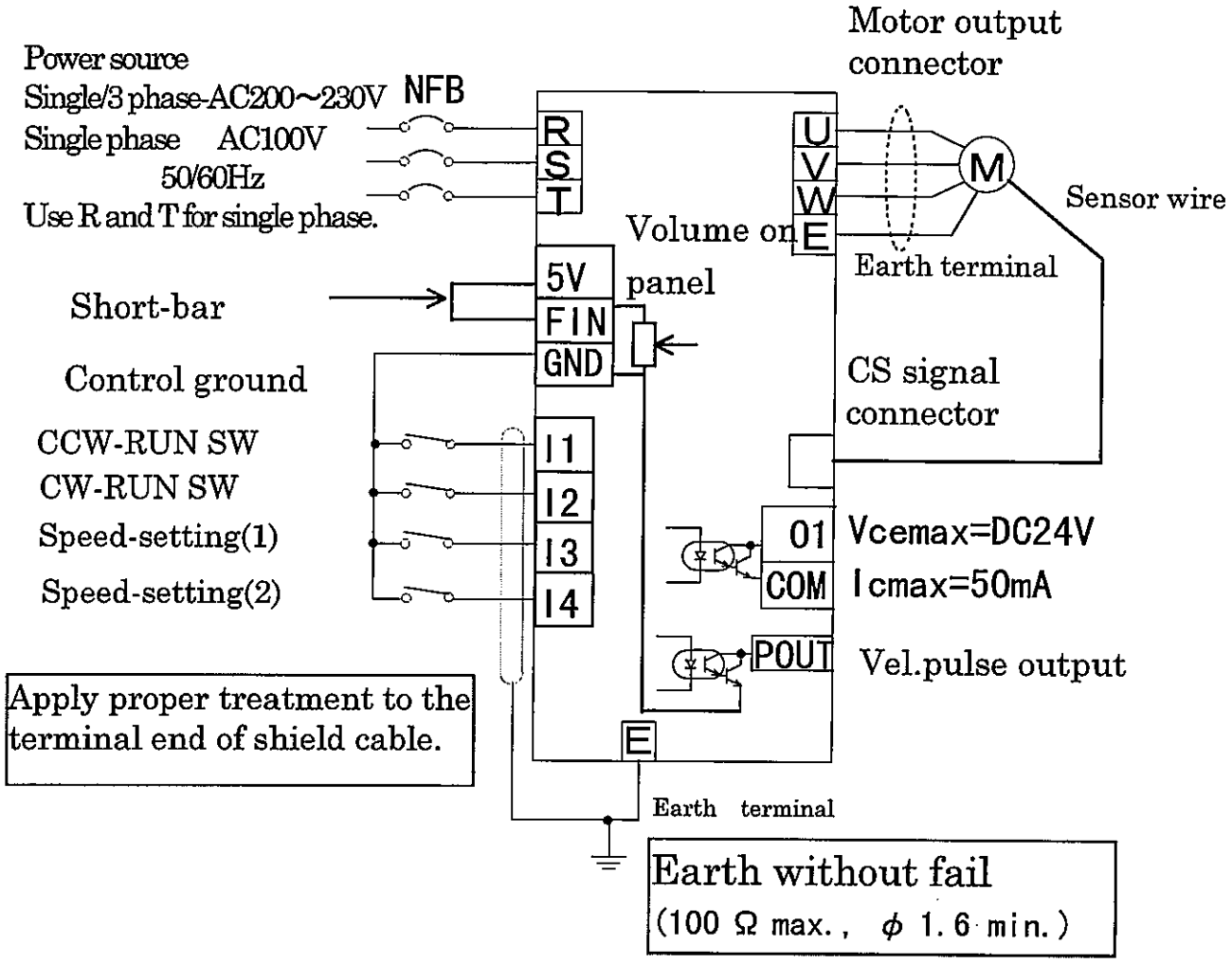
(6) Earth the shield of shield cable.

(7) Isolate the cable connected to the control circuit from the power line.

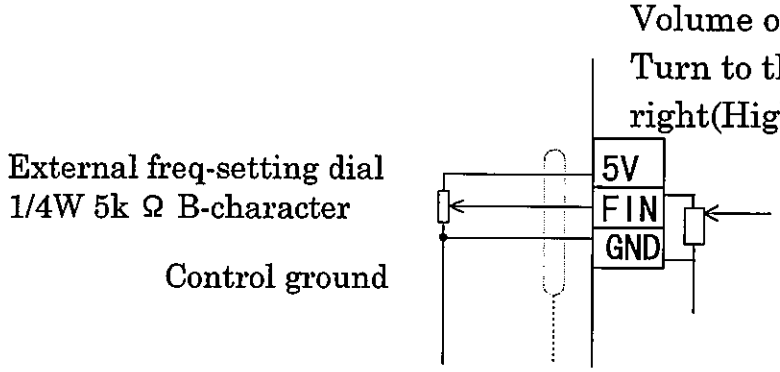
(8) When tightening the cable, apply screw driver vertically to the terminal.



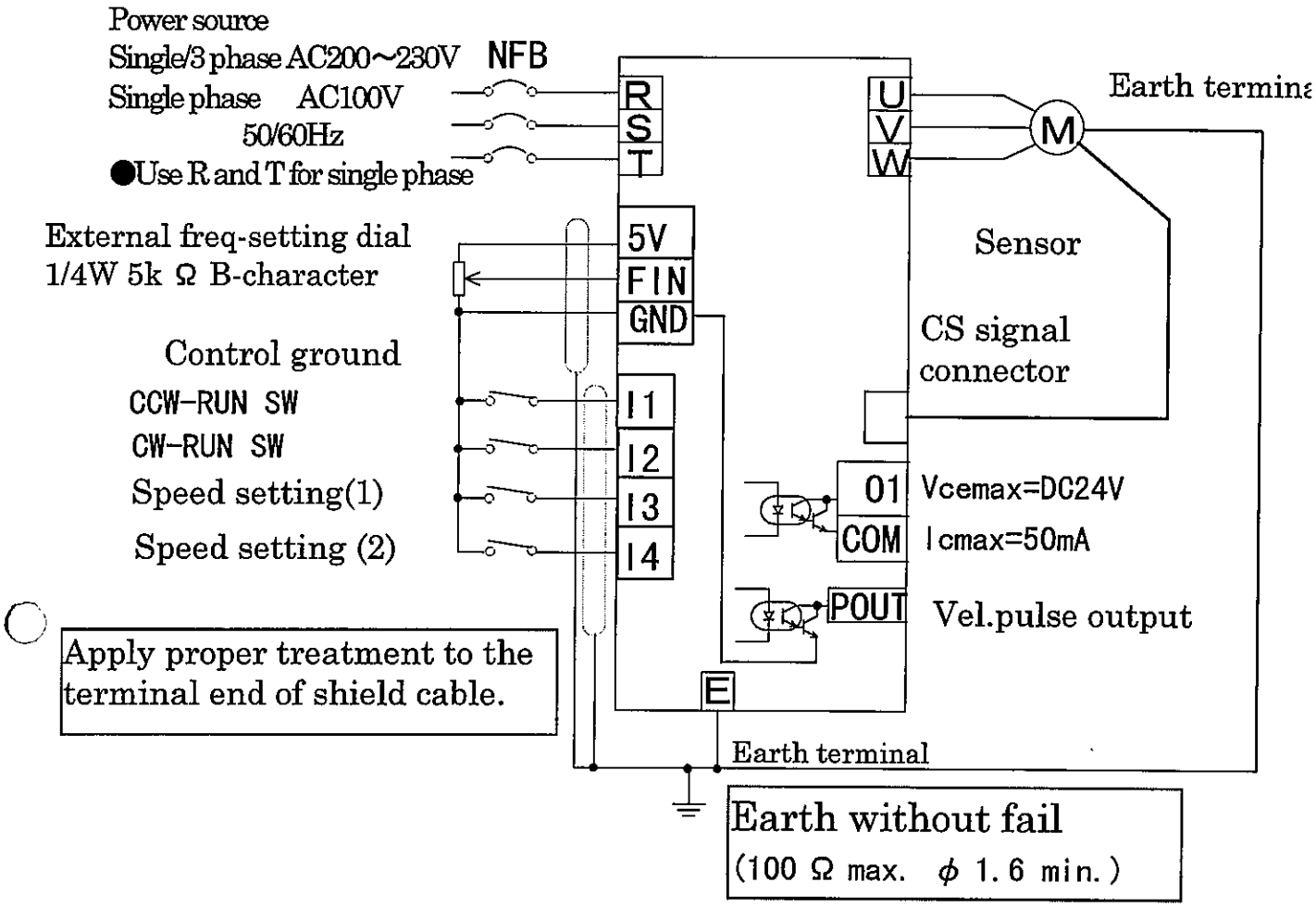
5－2 Standard Wiring Diagram
<750W or smaller>



《In case external freq-setting dial is used》



<1.5kW or larger>



5－3 Selection of Wiring Devices

(1) No-fuse breaker, electromagnetic contactor, wires

Inverter model No.	No-fuse breaker (rated current)	Electromagnetic contactor (contact)	Wire (mm^2)	
			Input	Output
MBDH013***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDH023***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDH043***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDH083***	BBP310 (10A)	BMF61842N (3P+1a)	2.0	—
MBDH153***	BBP315 (15A)	BMFT61042N (3P+1a)	2.0	2.0
MBDH223***	BBP320 (20A)	BMFT61042N (3P+1a)	3.5	2.0
MBDH373***	BBP330 (30A)	BMFT61042N (3P+1a)	3.5	2.0
MBDK5A3***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDK013***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDK023***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDK043***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDK083***	BBP310 (10A)	BMF61842N (3P+1a)	2.0	—
MBDK153***	BBP315 (15A)	BMFT61042N (3P+1a)	2.0	2.0
MBDK223***	BBP320 (20A)	BMFT61042N (3P+1a)	3.5	2.0
MBDK373***	BBP330 (30A)	BMFT61042N (3P+1a)	3.5	2.0
MBDK5A1***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDK011***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDK021***	BBP35 (5A)	BMF61842N (3P+1a)	2.0	—
MBDK041***	BBP310 (10A)	BMF61842N (3P+1a)	2.0	—

Notes) Screw for terminal board : Control circuit : M3 screw
Main circuit : M4 screw(750W or smaller)
M5 screw(1.5kW or larger)

(2) Relay

Relays connected to the control input terminals(「I1」 ～ 「I4」) should be the ones for micro-signal(min.current:1mA or less).

(3) Switches for control circuit

When switches are used instead of relays for control circuit, use the ones for micro-current.

6. Operation

6－1 Pre-check items

Check the following check items after completion of the installation and wiring work and before operating.

(1) Wired properly ? (particularly connection error in power input terminals (R. S. T) and motor output terminals(U. V. W))
(2) Input power , as rated ?
(3) No portion short-circuited by cable pieces, etc.?
(4) Screws and terminals loose free ?
(5) No short-circuit and no earth at the load(machine) side ?

6－2 Operation mode

Six(6) different operation modes(patterns) are available as below for this MINA S－HYPER series inverters by selection of front panel switches and control terminals.

	Speed command			RUN command		Parameter setting	
	Operation panel	Panel*2 volume	Terminal board 「FIN」	Operation panel	Terminal board	05 Speed command select	04 RUN command select
1	○			○*1	○*1	PnL (panel)	b0rH (both)
2		○*2	○	○*1	○*1	0—5 (T.board)	b0rH (both)
3	○			○		PnL (panel)	PnL (panel)
4		○*2	○	○		0—5 (T.board)	PnL (panel)
5	○				○	PnL (panel)	rEr (T.board)
6		○*2	○		○	0—5 (T.board)	rEr (T.board)

*1) When RUN command from both panel and terminal board are effective, the command from terminal board is given priority. RUN switch becomes effective when both CCW-RUN and CW-RUN switch(「I1」 , 「I2」) on the panel are OFF. If either 「I1」 or 「I2」 , or both of them are tuned ON, previous status through the switches on the panel will be canceled

*2) This volume comes with MBD*****V/W* models.
Terminals 「FIN」 and 「5V」 are short-circuited by Short-bar at ex-factory. To use this terminal 「FIN」 , take off this short-bar, then turn the volume to the max. (high)

☆ Utilizing the terminals, 「I3」 and 「I4」 , following function can be selected other than normal RUN/STOP.

- Free-Run Command
- External Forced Trip
- Two(2) sets of acceleration/deceleration time select
- Trip Reset
- Multistage speed up to four(4)

6－3 Trial Run

(1) Execute the following procedures for safety.

① Prepare so as to enable to operate the motor alone.

② Turn all of inputs of control circuit terminal to 「OFF」 (open).

(2) Turn ON the power(turn No-fuse breaker(NFB) at input side of the inverter to 「ON」), then check the operation status per the following procedures for trial run.

<e.g. 750W or smaller>

Operation	Panel volume	Panel Switches	Panel LED	Notes
①Main power ON			0	・Monitor mode at power on. (Output speed is displayed)
②Speed setting	Turn this to the center portion			・Set the initial speed to about 50 % of the rated speed.
④CCW-Run command		Press RUN	900 *1	・Speed changes gradually.
⑤Stop cmnd		Press STOP	0	・Speed changes gradually.

*1)Changes up to 50 % of the rated speed.

<e.g. 1.5kW or larger>

Operation	Panel Switch	Panel LED	Notes
①Main Power ON		0	・Monitor Mode at power-ON (Output speed is displayed)
②Speed setting	Press △	0	・Initial setting speed is displayed. (factory setting is 0r/min) (If you don't operate switches for more than 3 sec. inverter returns to monitor mode. Then press △ 、▽ again.)
	Press △ to set the speed.	1800	・Set the initial speed setting to 1800 r/min.
③Return to monitor mode		0	・Returns to monitor mode if you don't touch switches for 3 sec.
④CCW-Run command	Press RUN	1800	・Speed changes gradually.
⑤STOP command	Press STOP	0	・Speed changes gradually.

*1) Speed increases with △ , and decreases with ▽ .

<Check points at trial run>

① Does the motor runs smoothly, any abnormal noise or vibration ?

② Is the acceleration or deceleration smooth ?

③ Does the rotational direction of the motor match to what you want ?

☆ If any error occurs such as trip, take necessary measures referring to 9. 「Troubleshooting」 (P35) . When the inverter trips, the trip factor will be displayed on the panel LED, and the motor becomes Free-Run. Refer to 7－3 「Monitor」 (P27~28) for display.

6－4 Running Function

MINAS－HYPER inverter has the following running functions, which can be operated with operation panel or switches on the terminal board.

Function	Description
Normal Run	■ Running function with accel/decel. time. Accel/decel. Time can be set dindividually.*1
Free-Run Stop	Shuts off the voltage to the motor, and makes it Free-Run, and can be used when mechanical brake is applied. Note that even at Free-Run Stop, if you touch the motor output terminals (U, V, W) , it could cause electric shock.

*1) Time to change 1,000 r/min

6－5 Running Mode

MINAS-HYPER inverter has 1-Speed,2-Speeds, and 4-Speeds Running Modes. Select this mode with parameter 「09 I3 Input Select」 and 「10 I4 Input Select」 (P30). For the selection, refer to 7. 「Operation」 (P24~)

Running Mode	09 I3 Input Select	10 I4 Input Select	Function of terminal board I1	I2	I3	I4
1-Speed Mode	FrEE / rSt / U-d / rHr	FrEE / rSt / U-d / rHr	CCW Run	CW Run	Free-Run / Trip Reset / 2nd.Accel/Decel.Time/ Ext. Forced Trip	Free-Run / Trip Reset / 2nd.Accel/Decel.Time Ext. Forced Trip
2-Speeds Mode	SrEP	FrEE / rSt / U-d / rHr	CCW Run	CW Run	Speed-Setting Select	Free-Run / Trip Reset / 2nd Accel/Decel Time/ Ext. Forced Trip
	FrEE / rSt / U-d / rHr	SrEP	CCW Run	CW Run	Free-Run / Trip Reset / 2nd. Accel/Decel Time/ Ext. Forced Trip	Speed-Setting Select
Factory Setting 4-Speeds Mode	SrEP	SrEP	CCW Run	CW Run	Speed-Setting Select	Speed-Setting Select

In case of 2-Speeds/4-Speeds Running Mode, Multispeed Run can be selected with the combination of 「Open」 and 「Short」 of the Speed-Setting Select Terminals as below. If all of the Terminals are open, Initial-Set Speed will be selected when initial speed can be set by either parameter 「**00** Initial-Set Speed」 (P29) or panel volume or external frequency setting dial. (In this case, select either parameter setting or panel volume or external speed setting of the Initial-Set Speed by 「**05** Speed Command Select」 (p29).)

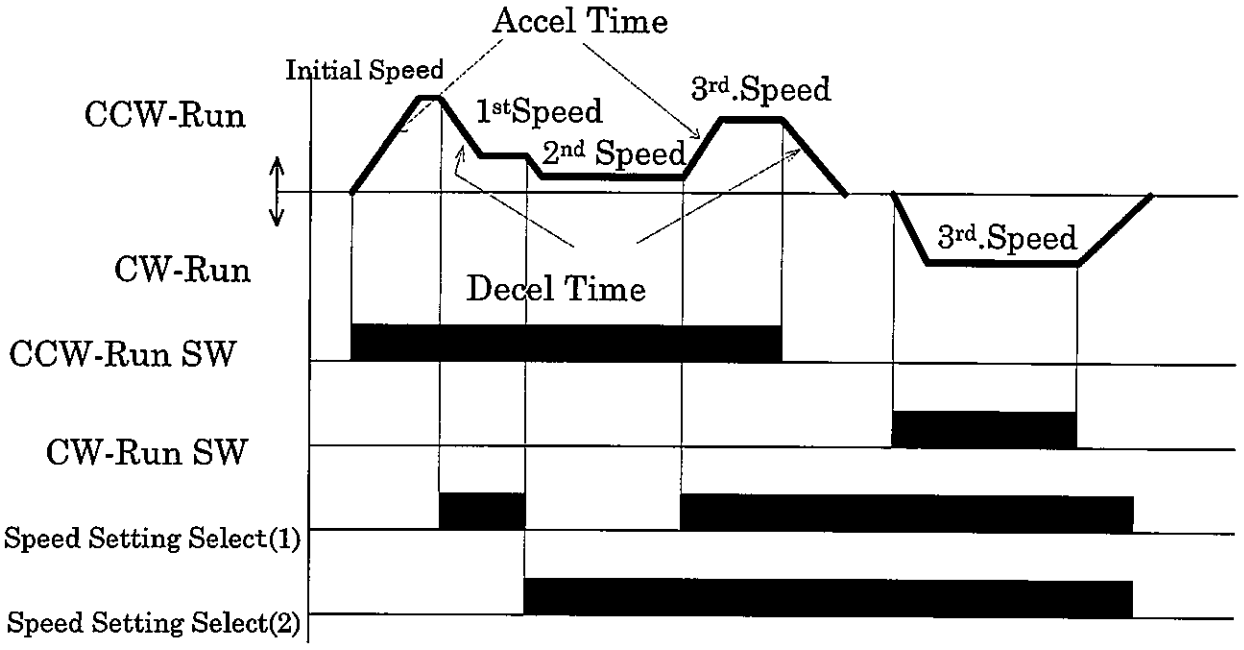
<Speed Setting at 4-Speeds Mode>

「I3」-「GND」	「I4」-「GND」	Speed Setting
Open	Open	Initial-Set Speed
Short	Open	1st-Set Speed
Open	Short	2nd-Set Speed
Short	Short	3rd-Set Speed

<Speed Setting at 2-Speeds Mode>

「I3」-「GND」 or 「I4」-「GND」	Speed Setting
Open	Initial-Set Speed
Short	1st-Set Speed

■ Running example at 4-Speeds Running Mode



6 — 6 Speed Setting Range

- Set the speed so as the calculated speed at motor axis does not exceed the rated speed of the motor.
- Speed may become unstable at 300 r/min or lower.
  Set the no load speed at 300 r/min or higher.

7. Operation

7－1 Operation Panel

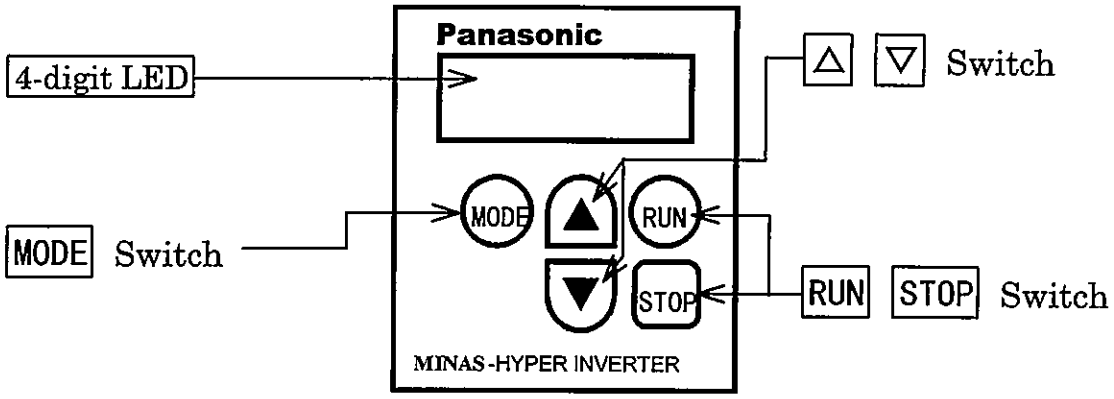
(1) Outline of function

This portion consists of 4-digit LED, [8888], Mode-Switch [MODE], Setting Switch [△] [▽], Run Switch [RUN] and Stop Switch [STOP]

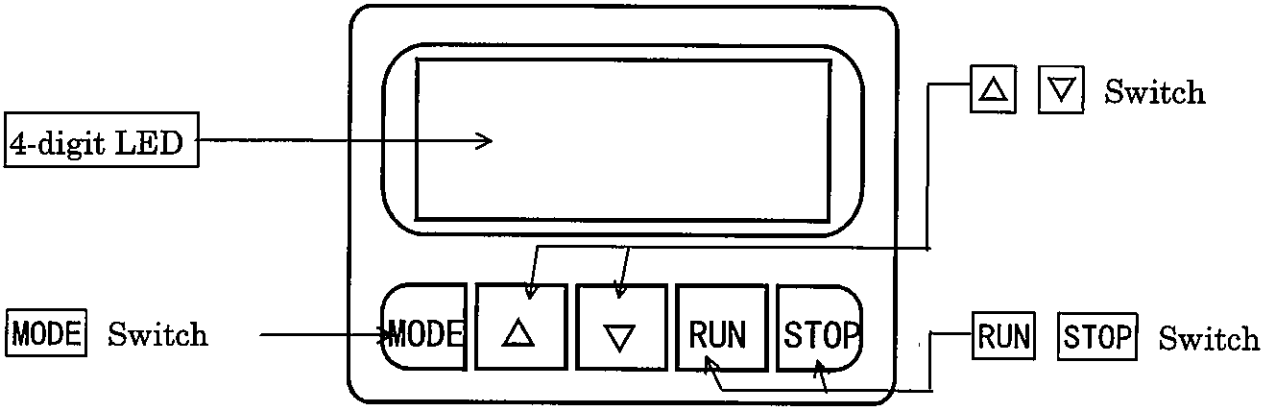
You can run/stop, confirm/change the parameter, display the inverter status(output speed, set-speed, and error etc.), and release the trip of the inverter.

(2) Composition

<750W or smaller>



<1.5kW or larger>

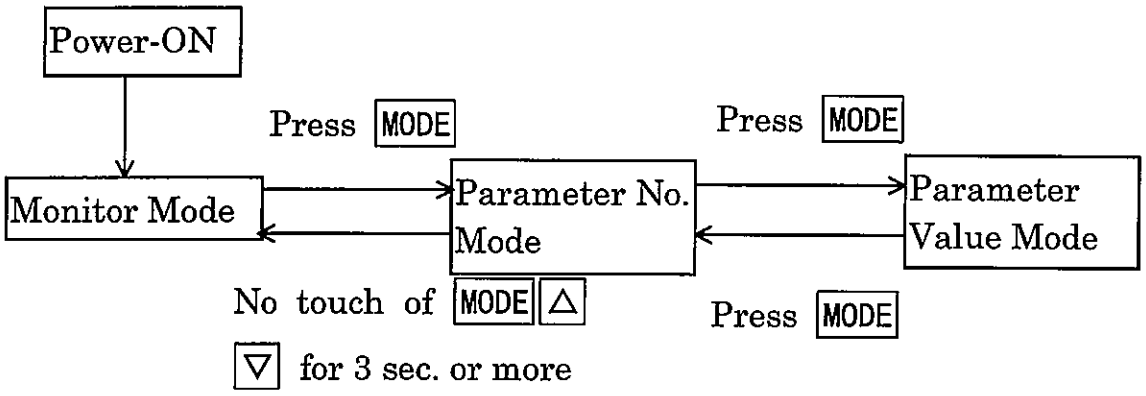


4-digit LED	Display of Output Speed, Set-Speed, Parameter No. and Value.
[MODE] Switch	Selection of either Monitor Mode, Parameter No. Mode or Parameter Value mode.
[△][▽] Switch	Selection of Parameter, Setting/Change of Parameter Value. Changes continuously by keep pressing.
[RUN][STOP] Switch	Run and Stop Command Switch(in case of Panel Operation)

●Details of each mode

Monitor Mode	Displays either Output Speed, Set-Speed or DC Voltage at converter. You can select with parameter 「*12* Monitor Select」. **This mode appears at the Main Power ON.**
Parameter No. Mode	Displays parameter Nos. (*00~26*) at the first 2 digits of LED. (e.g. *00*) Select the parameter to be confirmed or to be changed with △ ▽ switch. **If you don't touch MODE △ ▽ for approx 3 seconds in this mode, it returns to Monitor Mode.** If you press MODE switch again, previous parameter No. will be displayed.
Parameter Value Mode	Displays the parameter contents(set-value) with flashing. Change with △ ▽ switch.

●Shift between each mode



0 Display of speed etc.	*00* Display of parameter No.	*0* Display of parameter value with Flash
Set or change the Initial-Set Speed with △ ▽ directly. e.g.) *0* → *1800* Press △ ▽ Note) Valid when 「*05* Speed-Set Select」 is *PnL*.	Select the parameter with △ ▽. e.g.) *00* → *06* Press △ ▽	Select the value with △ ▽ e.g.) *1.0* → *5.0* Press △ ▽

7－2 Parameter Setting

MINAS－HYPER inverters have parameters which adjust the performance of inverter. You can set these parameters with Operation Panel so that you can obtain optimum performance to fit to your machine.

The followings describe how to set the parameters.

<e.g.> Set the 「06 Accel. Time」 to 5.0 seconds

Operation	Switch	LED	Note
①Power-ON		0	・Monitor Mode
②Call for 「06 Accel. Time」	Press MODE	00	・Displays the parameter No. (This returns to Monitor Mode if you don't touch switch for 3 sec. or more. In this case, press MODE again.)
	Press △ to select 06	06	・「06 Accel. Time」
③Set to 5.0 seconds.	Press MODE	1.00	・Factory Setting : 1 sec.
	Set to 5. 0 with △	5.0	
④Returns to Monitor Mode	Press MODE	06	・Displays the parameter No.
		0	・Returns to Monitor Mode in 3 seconds.

注意

■ After you change the parameter value, change content will be stored in memory, when you shift the parameter No., or return to Monitor Mode without touching switch. If the main power is shut off while you change the parameter, the last value will be stored.

■ Changes of most of the parameters will be reflected to the operation immediately after the change except the following parameters, with which the inverter trips for safety. Reset the trip first, then operate the inverter. Refer to 9－3 「How to Reset Trip」 (P37).

「04 Run Command Select」	「05 Speed Command Select」
「08 11／12 Function Select」	「09 13 Input Select」
「10 14 Input Select」	「25 Restart-Prevention at Power Resumption」
	「26 Carrier Frequency」

■ Note that if the inverter trips during the parameter change, the changed content will not be stored. If necessary, adjust again after resetting the trip.

7－3 Monitor

(1) Speed Monitor

The inverter enters to this mode at Power-ON, or returns to this mode from Parameter No. Mode(Parameter No. is displayed at the first 2-digits of LED) if you don't touch switch for 3 seconds.
(You can monitor the Set-Speed by selecting 「12 Monitor Select」(P28).)

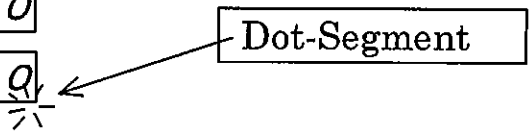
(2) Rotational Direction Monitor

The dot-segment of the last digit of LED will be lit with Motor CW-Run when 「12 Monitor Select」 is set to Output Speed, [0.-r] .

<e.g.> when the motor runs at 1800 r/min

at CCW-Run: [1800]

at CW-Run : [1800.]



(3) Warning/Error Monitor

The inverter displays warning and error on LED when it detects warning or Trip status. This display is given the first priority. For countermeasures, refer to 9－2 「Protective Functions」

Warning	Error	4-digit LED	Content
○	－	[L]	Undervoltage
○	－	Flashing	Electronic Thermal(Overload)
－	○	[r.P.]	Re-start prevention at power resume
－	○	[0.C.]	Overcurrent Trip
－	○	[0.U.]	Overvoltage Trip
－	○	[0.L.]	External Forced Trip
－	○	[Erhr]	Electronic Thermal
－	○	[E-0.S.]	Overspeed Detect Trip
－	○	[E.-CS]	Sensor Error Detect Trip
－	○	[Err.]	CPU Error
○	－	[CAU.]	Storage of the following parameter c change 「04 Run Command Select」 「05 Speed Command Select」 「08 I1／I2 Function Select」 「09 I3 Input Select」 「10 I4 Input Select」 「25 Re-Start Prevention at Power Resumption」 「26 Carrier Frequency」

(4) Monitor of the past Trip Factors

The inverter stores the factors of the past 5 Trips at 「16 Trip Factor ①」 ~ 「20 Trip Factor ⑤」. You can confirm these the same way you set the Parameters.

<table>
<tr><th>No.</th><th>Parameter</th><th>Description</th></tr>
<tr><td>00</td><td>Initial-Set Speed</td><td>You can set the speed you want to run. This is valid when 「05 Speed Command Select」 is [PnL].</td></tr>
<tr><td>01
02
03</td><td>1st-Set Speed
2nd-Set Speed
3rd-Set Speed</td><td>You can set the speed at Multispeed Run.
1st-Set Speed at 「2-Speeds Run Mode」, 1st～3rd-Set Speed at 「4- Speeds Run Mode」 become valid.</td></tr>
<tr><td>04</td><td>Run Command Select</td><td>You can select the Run Command among the below.
● [PnL] (PANEL) : [RUN] switch on the Panel
● [rEr] (TERMINAL) : Input Terminal 「I1」、「I2」
● [bOrH] (BOTH) : Both Panel and Terminal are valid
※When [PnL] is selected, you can't use Input Terminal (「I1」～「I4」) as Run/Speed Command.</td></tr>
<tr><td>05</td><td>Speed Command Select</td><td>You can select Initial-Speed Frequency Setting either by「00 Initial-Set Speed」, or Speed Setting Input Terminal 「FIN」
● [PnL] 「00 Initial-Set Speed」
● [0-5] Speed Setting Terminal「FIN」(Analog DC0～5V)</td></tr>
<tr><td>06
07</td><td>Accel. Time
Decel. Time</td><td>You can set the speed varying rate at Accel/Decel.
・<u>Set with the time to change by 1000 r/min.</u>
・0.01 sec step at 3 sec or shorter, 0.1 sec step at 3 sec or longer.</td></tr>
<tr><td>08</td><td>I1/I2 Function Select</td><td>You can select the command by 「I1」「I2」 as below.
Also [RUN] switch function will be selected at the same time.
<table>
<tr><th rowspan="2">Selection</th><th colspan="2">「I1」-「GND」</th><th colspan="2">「I2」-「GND」</th><th rowspan="2">[RUN] switch</th></tr>
<tr><th>Short</th><th>Open</th><th>Short</th><th>Open</th></tr>
<tr><td>[F-r]</td><td>CCW Run</td><td>Stop</td><td>CW Run</td><td>Stop</td><td>CCW Run</td></tr>
<tr><td>[r-F]</td><td>CW run</td><td>Stop</td><td>CCW Run</td><td>Stop</td><td>CW Run</td></tr>
<tr><td>[rSFr]</td><td>Run</td><td>Stop</td><td>CW</td><td>CCW</td><td>Run*1</td></tr>
</table>
*1)Rotational direction becomes CCW when 「I2」-「GND」 is open, CW when it is shorted.</td></tr>
</table>

No.	Parameter	Description
09 10	I 3Input Select I 4Input Select	You can select the functions of 「I 3」 「I 4」 as below.

Selection	「I3」—「GND」 「I4」—「GND」	Function
FrEE	Short	Free-Run Stop Input
rHr	Open *2	Ext. Forced Trip Command
U—d	Short	2nd Accel/Decel Time Select
rSr	Short	Trip Reset Input
SrEP	Short/Open*1	Multispeed Run Speed Select

*1) For Multispeed Run, refer to 6-5 「Running Mode」 (P22)
*2)Use in a sequence so as normal run is at short.

No.	Parameter	Description
11	Output Signal Select	You can select the output signal between Output Terminal 「O 1」 — 「COM」 as below.

Selection	Content	Output Logic(Open collector)
rrIP	Trip Output	at Trip : ON
SrbL	Speed-Reach Signal	at Reach : ON
rUn	Run Signal	Running : ON
FrEE	Free-Run Signal	Free-Running : ON
F	CCW-Run Signal	CCW-Running : ON
r	CW-Run Signal	CW-Running : ON

No.	Parameter	Description
12	Monitor Select	You can select the contents to be displayed on LED.

Selection	Contents
0.—r	Output Speed
S.—r	Set-Speed
dC—U	DC Voltage at Converter

<table>
<tr><th>No.</th><th>Parameter</th><th>Description</th></tr>
<tr><td>13</td><td>Upper-Limit Speed</td><td>You can set the upper limit of the speed set by parameter 「00～03 Initial～3rd Set Speed」, or by panel volume and FIN.
Setting Range : See below(depends on the rated speed)
<table><tr><th>Rated Speed</th><th>Setting Range</th></tr><tr><td>1800 r/min</td><td>0・60～2100 r/min</td></tr><tr><td>3000 r/min</td><td>0・60～3600 r/min</td></tr><tr><td>3600 r/min</td><td>0・60～4000 r/min</td></tr></table>It becomes Overspeed Error [E-05] when you set to 0.
Setting Resolution : 10r/min</td></tr>
<tr><td>15</td><td>Trip Factor Clearance</td><td>You can clear the contents of 「16～21 Trip Factor ①～Trip Factor ⑤」.
<table><tr><th>Selection</th><th>Contents</th></tr><tr><td>[YES]</td><td>Trip Factor Clear*1</td></tr><tr><td>[no]</td><td>-</td></tr></table>*1)Trip Factor can be cleared only after you shift the Parameter from this No.</td></tr>
<tr><td>16
17
18
19
20</td><td>Trip Factor①
Trip Factor②
Trip Factor③
Trip Factor④
Trip Factor⑤</td><td>The inverter stores the factors of the past 5 trips, and you can confirm this by selecting the respective Parameters.
For the displayed contents, refer to 7－3 「Monitor」 (P27～).</td></tr>
<tr><td>21</td><td>Speed-Loop Proportion Gain</td><td>You can set the proportion gain of the speed Amp.
Higher the value, higher the gain you can obtain.
Setting Range : 0～500 Setting Resolution : 2</td></tr>
<tr><td>22</td><td>Speed-Loop Integration Gain</td><td>You can set the integration gain of the speed Amp.
Higher the value, higher the gain you can obtain.
Setting Range : 0～500 Setting Resolution : 2</td></tr>
<tr><td>23
24</td><td>2nd.Accel. Time
2nd.Decel. Time</td><td>You can set the 2nd. Accel/Deceleration Time
This input becomes valid when you select 「09 | 3 Input Select」 or 「10 | 4 Input Select」 to [U-d] 2nd. Accel/Decel. Time.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Parameter</th><th>Description</th></tr>
<tr><td>25</td><td>Re-Start Prevention at Power Resumption</td><td>You can prevent Re-Starting of the inverter at Power Resumption after Instantaneous Power Failure (IPF) by setting to [YES] and makes the inverter trip by setting to [rP] .
If you set to [nO] to make the inverter re-start at Power Resumption, this could cause mechanical shock to the load.</td></tr>
<tr><td>26</td><td>Carrier Frequency</td><td>You can select the Carrier Frequency as below.
<table><tr><th>Set-Value</th><th>Carrier Frequency</th></tr><tr><td>3</td><td>6 kHz</td></tr><tr><td>4</td><td>8 kHz</td></tr><tr><td>5</td><td>10 kHz</td></tr><tr><td>6</td><td>12 kHz</td></tr><tr><td>7</td><td>15 kHz</td></tr></table>Factory Setting
Higher the Carrier Frequency you set, higher the temperature rise the inverter generates.
When you run the motor exceeding 8 kHz, allow the motor at 80 % or less load.</td></tr>
</table>

8. Maintenance and Inspection

This inverter is a static unit which has applied semiconductors, but it is subjected to routine inspection to prevent incidental troubles which may arise from change of the inverter operating environment(temperature, humidity, mist and dust, vibration, etc.), aging change and lives of the components in use, etc.

8－1 Cautions in Maintenance and Inspection

(1)Check the Power ON/OFF by operator himself to prevent operation by unauthorized personnel other than an authorized operator.
(2)The internal circuit is kept charged with high voltage for a while after the power switch was turned OFF. When checking the inverter, turn OFF the power switch and wait 5 minutes or longer after the panel LED turned OFF.

8－2 Check Items and Cycle

When the inverter is in general and normal operating conditions(Ambient temperature: 30℃ at annual mean value, Load factor:80%, 12 hours max. per day), conduct routine check and periodic check on each of the following check items.

Division	Cycle	Items
Routine	Daily	· Check for ambient temperature and humidity, mist, dust, foreign matter, etc. · Abnormal vibration and noise ? · Main circuit voltage normal ? · No offensive odor ? · Any obstructive material on the ventilation hole ? · Operation unit kept clean ?
Periodic	1 year	· Megger Test(Main Circuit Terminal and Earth Terminal) · Screws and bolts loose free ? · No overheat mark exists ? When the inverter is operated in individual mode, the output voltage of each phase is balanced with that of order ? · Terminal board and connectors damage free ?

Note) The periodic check cycle is subject to change depending on difference in actual operating conditions.

<Replacement of components>

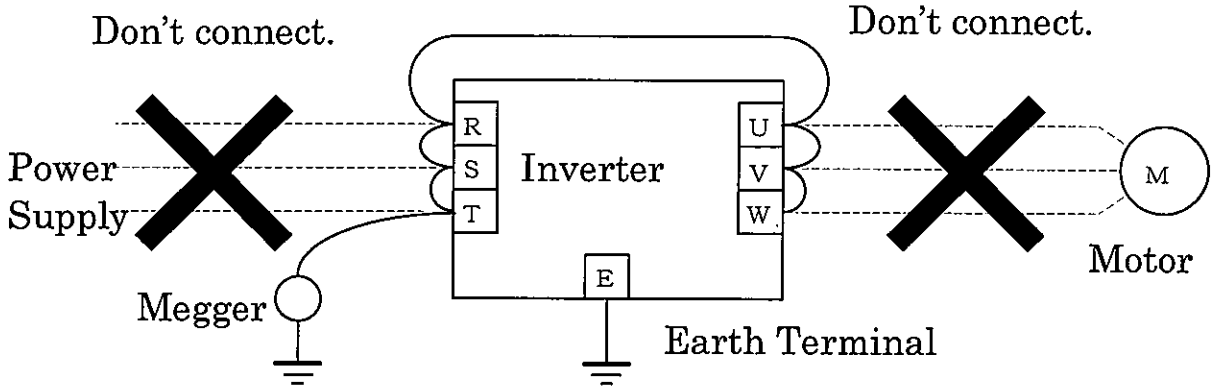
The life of the component is not constant depending on the inverter locational environment and running hours. Under the above condition, for example, the service life of smoothed aluminum electrolytic capacitor is approx. 5 years. It is therefore recommended to replace it before expire of its life.

8－3 Megger Test

(1)For megger test of the inverter, conduct the test on its main circuit only, as illustrated below. Don't apply this test to the control circuit.

(2)For megger test of the external circuit, remove all the terminals from the main not to apply test voltage to the inverter.

(3)In megger test, check the measured insulation resistance is 1 MΩ or more on DC500V insulation resistance meter.



9. Troubleshooting

9－1 Causes of troubles

Should the inverter result in trouble, search the cause and take appropriate corrective actions in accordance with the troubleshooting table below.

Contact the nearest distributor/dealer or directly contact us for unknown cause, possible trouble of the inverter itself, replacement of components and any other inquiry.

Phenomena	Check items	Corrective actions, etc.
Motor fails to run.	Wiring normal ?	Re-wire properly.
	Power is supplied into the power input terminal(R,S,T)	Switch ON the power Once cut off and re-enter the power.
	Operation Panel LED is lit ?	Re-check the above items.
	Voltage in the power input terminal(R,S,T) normal ?	Check the power voltage.
	Error is displayed ?	If so, refer to 9-2 「Protective Functions」.
	Free-Run commanded ?	If so, reset the Free-Run.
	Both CCW-Run and CW-Run switch are ON ?	If so, turn ON either required Run-switch.
	Speed Setting normal ?	Check the Set Speed. If set the speed with volume(in case of MBD*****V/W), short terminal board of 「FIN」 and 「5V」 with short-bar.
	Motor is locked ? (Load is too much ?)	If so, reset the lock.(Reduce the load, or use larger motor and inverter.
	Open-phase running ?	If so, re-check the inverter to motor wiring.
Motor runs in reverse direction.	「08 1 1／1 2 Function Select」 is set properly ?	Set 「08 1 1／1 2 Function Select」 properly.
Motor runs but invariably.	Load is too much ?	Reduce the load, or use larger motor and inverter.
Motor speed deviates from specified rate.	Combination of the motor and inverter correct ?	Use the proper combination of the motor and inverter.
Speed fluctuates during run.	Load fluctuates too much ?	Minimize its fluctuation, or use larger motor and inverter.
	Speed-Amp. Gain proper ?	Adjust the gain(may improve)

9－2 Protective Functions

MINAS－HYPER inverter has the following built-in protective functions.

① Shuts off the output as well as warning display

② Trips to protect

	Function LED display	Contents	Corrective actions, etc.
①	Undervoltage Warning, Instantaneous Power-Failure (IPF) Protection [L]	Shuts off the inverter output when DC voltage at converter becomes 200V or lower(AC200V type), or 100V or lower(AC100V type), by detecting it as 「IPF」. Control circuit will be reset at 150V or lower(AC200V type) or, 75V or lower(AC100V type). If the voltage resumes before reset is made, the inverter will restart automatically.(when「25 Start Prevention at Power Resumption」 is [nO] .).	Check cable wiring or power supply condition.
②	Re-Start Prevention at Power Resump-tion [r.P.]	During power resumption from IPF, if Run is commanded, the inverter trips by preventing automatic re-start. But if control circuit is reset, this function be-comes void. (when 「25-Start Prevention at Power Resumption 」 is [YES] .)	Reset the trip after confirming system safety. Refer to 9-3, 「How to Reset Trip」. The motor restarts if run is commanded.
	Overcurrent Trip [O.C.]	Inverter trips when output current from converter exceeds the specified value.	Load might be short-circuited, or grounded.. Make a careful check of the causes.
	Regenerative Overvoltage Trip [O.U.]	Inverter trips when DC voltage at converter exceeds 400V (AC200V type), 200V(AC100 V type).	When it trips during run, decel. time might be too short. Set this time longer enough. When it trips at power-ON, inductance of power factor improve AC reactor installed at inverter input side might be too large. Select the proper Reactor matching to inverter capacity.

	Function LED display	Contents	Corrective action, etc.
②	Overload Trip (Electronic Thermal) ΓHΓ	Inverter trips when the motor current is kept exceeding 100% of the rated load current.	Check causes to lower the load, change running pattern, or use larger motor and inverter.
	Overspeed Trip E-05	Inverter trips when motor speed exceeds 1.5 times of upper limit speed.	If the motor is driven externally, set the speed within the rating.
	Sensor Error E.-C5	Inverter trips when it detects error in sensor.	Check if no broken wire of CS-signal.
	CPU Error ErΓ.	Inverter trips when it detects error in CPU.	This might be caused by external noise. Check noise source near by, and remove it.
	Self-Diagnosis Trip CAU.	Inverter trips when such parameter is change as 「04 Run Command Select」 Refer to 7-3, 「Monitor」(P27～).	This is not an error. Changed content becomes valid after re-setting the trip.
	External Forced Trip 0.L.	Inverter trips while 「09 I3 Input Select」 or 「10 I4Input Select」(P30) is set to External Forced Trip, and when 「Respective Terminal」-「GND」 is open. Short them, then reset referring to 9-3「How to Reset Trip」.	Check causes to lower the load, change running pattern, or use larger motor and inverter. (when thermal relay is connected to input terminal)

9－3 How to Reset Trip

Remove the cause of the trip, then reset by either way of the followings.

How to Reset Trip

[1] Turn off the power, then turn on again after trip display disappears.

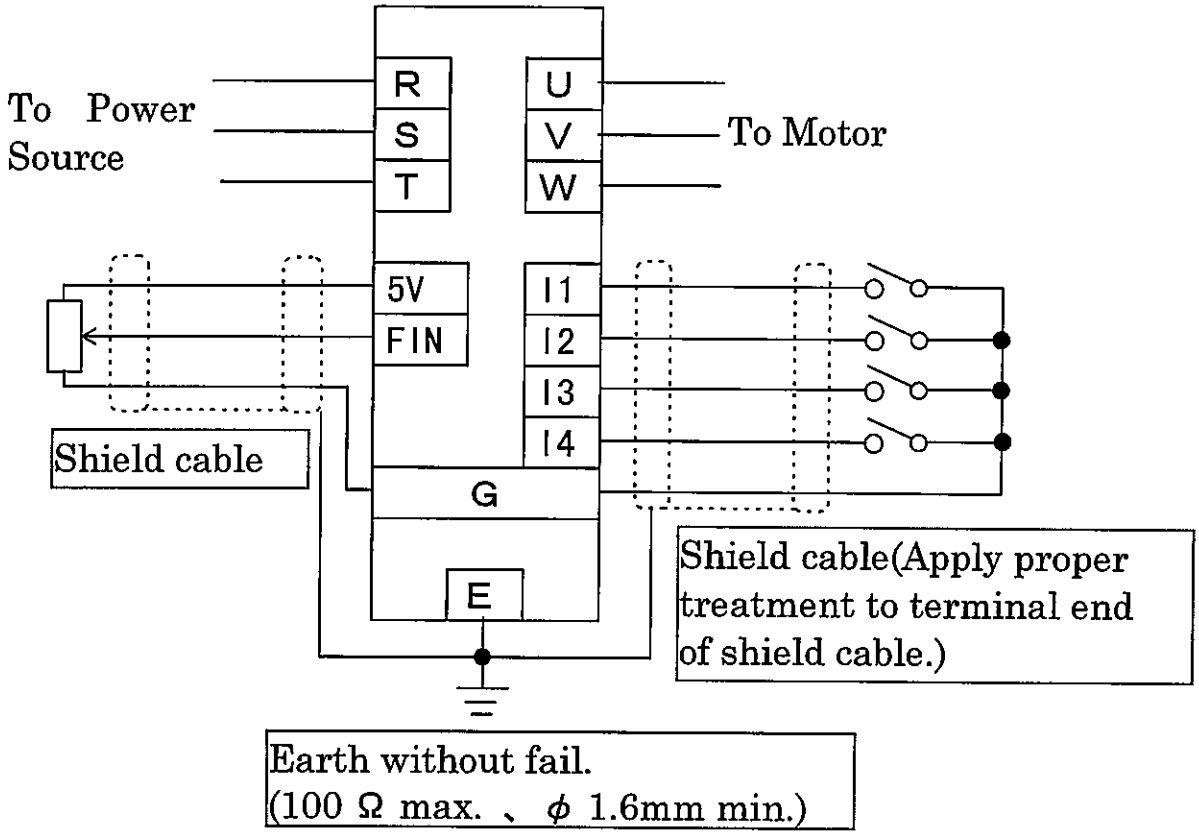
[2] Short both 「I1」-「GND」 and 「I2」-「GND」 for more than 0.1 sec, while current trip factor is displayed.

[3] Press △ ▽ switch for more than 1.0 sec. at the same time, while current trip factor is displayed.

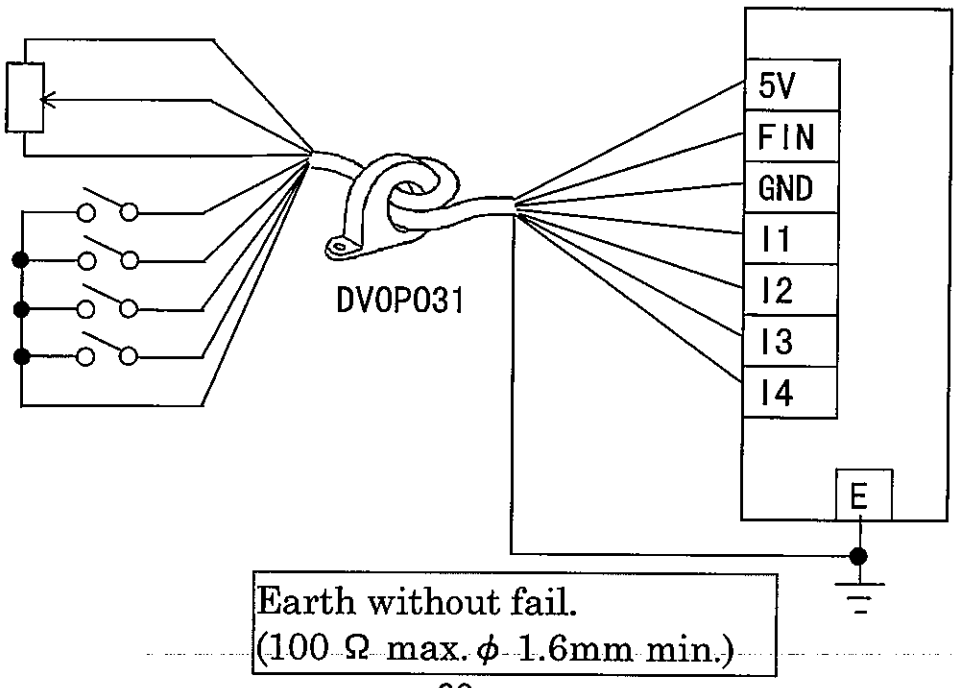
[4] Enter trip reset command while current trip factor is displayed.

※ Note that CPU Error ErΓ. can only be reset by above [1], and can't be reset by [2]、[3]、[4].

● Isolate the control circuit cables from power line.



● Extending the control circuit cables could result in operation error of the inverter, due to the noise transferred through these cables, depending on operating environment. In such a case, as an effective countermeasure against noise, it is recommended to wind the cables by 2-3 times on data-line filter (DV0P031)as illustrated below. Install this filter as near as to the inverter.



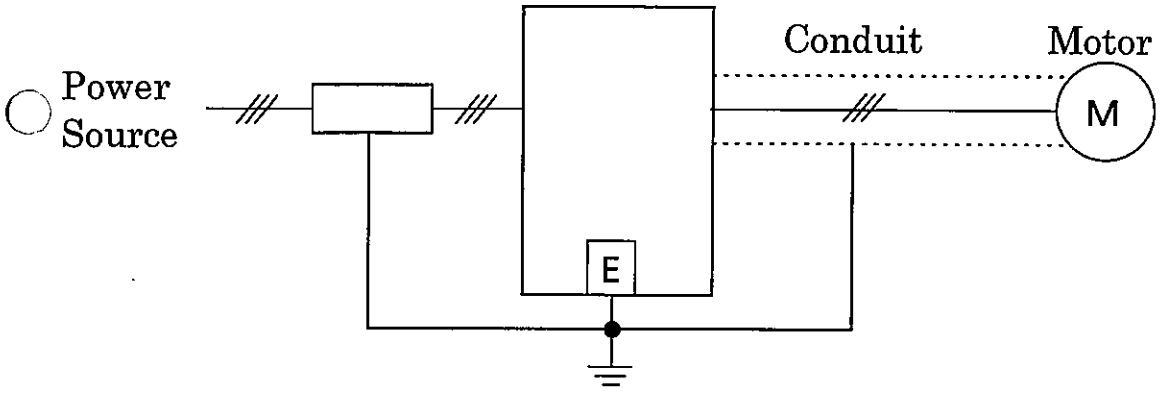
9－5 Countermeasures against Radio Noise

Radio noise is electromagnetic wave noise which is irradiated from the inverter and its power line. In area with weak field strength, the electromagnetic wave noise gives affect to the frequency band of 10 MHz and below, and could result in fault particularly in medium wave band(general radio broadcasting band 535 to 1605 kHz).

<How to suppress Radio Noise>

It is possible, to some extent, to control radio noise leaking outside the inverter by connecting a noise filter to the power input terminal and, in addition, containing the inverter and cables in an earth box and a cable conduit.

Connect noise filter OUT side to power line and its IN side to the inverter as illustrated below.



Earth without fail. (100 Ω max., ϕ 1.6mm min.)

10. Specifications

10－1 Common Specifications

Basic Specs.	Power Frequency		50/60 Hz
	Control		Speed Control with CS-Signal
	Environment	Temperature	−10 ℃～+50℃ (free from freezing) ＊4
		Humidity	90 %RH max. (free from dew)
		Atmosphere	Indoor(free from erosive gas, mist and dust)
		Elevation	1000 m max.
		Vibration	5.6m/s² (0.6G) max.(10～60 Hz)
Functions	Speed Setting Resolution		・Digital : 5 r/min ・Analog : Set Speed Range/ 250 r/min
	Speed Setting		Digital, Panel Volume, Analog(DC 0 ～ 5V)
	Accel/Decel. Time		0.01 ～ 30 seconds (time to change by 1000 r/min) 2 types can be set
	Multispeed		Max. 4-speeds
	Input Signal		4-bit ＊3 (CCW-Run, CW-Run, Multispeed Run, Free-Run Stop, Trip Reset, External Forced Trip, 2nd Accel/Decel Command Analog voltage Input(Speed Setting)
	Output Signal		Open Collector Output 1-bit(insulated) (Trip, Speed-Reach, Run-Output, Free-Run Stop, CCW-Run, CW-Run) Speed Pulse Output 1-bit(Open Collector) ＊1
	Protective Function		Undervoltage, Overvoltage, Overcurrent, Overspeed, CS-Sensor Error(Stores past 5 trip factors)
Performance	Control Speed Range		300 r/min～rated speed ＊2
	Output Torque		Max.200%
	Speed Fluctuation		−3% max.(at rated speed)
	Overload rating		150% 1 minute

＊1) 50W or larger : 24 pulses/rev
20W or smaller : 12 pulses/rev

＊2) Rated speed differs by models. Refer to 10-2 「Individual Specifications」.

＊3) 750W or smaller(M-frame): Photocoupler Input, 1.5kW or larger(D-frame) : CMOS Input pulled up to 5V by 4.7kΩ.

＊4) In the following model/case, this becomes −10～40℃.

① MBDK083***、 MBDK041***

② 1.5kW and 2.2kW, when ventilation cover and rubber bush are not removed.

③ Factory setting of 3.7kW

10－2 Individual Specifications

Inverter Model No.	Applicable Motor Model	Motor Output	Rated Speed	Power Voltage	Regenerative Brake Resistor
MBDK5B1BVM	MBMK5BZB**	5W		1 Φ	
MBDK2A1BVM	MBMK2AZB**	20W		AC100V	None
MBDK5A1BVM	MBMK5AZB**	50W		～115V	
MBDK011BVM	MBMK011B**	100W		±10%	
MBDK021BWM	MBMK021B**	200W			Built-in
MBDK5B3BVM	MBMK5BZB**	5W			
MBDK2A3BVM	MBMK2AZB**	20W			
MBDK5A3BVM	MBMK5AZB**	50W			None
MBDK013BVM	MBMK012B**	100W			
MBDK023BVM	MBMK022B**	200W			
MBDK043BWM	MBMK042B**	400W			
MBDK083BWM	MBMK082B**	750W			
MBDK153BBD	MBMK152B**	1.5kW		3-phase	Built-in
MBDK223BBD	MBMK222B**	2.2kW		AC200V	
MBDK373BBD	MBMK372B**	3.7kW		～230V	
MBDH023AVM	MBMH022A**	200W		±10%	None
MBDH043AWM	MBMH042A**	400W			
MBDH083AWM	MBMH082A**	750W	1800r/min		
MBDH153ABD	MBMH152A**	1.5kW			Built-in
MBDH223ABD	MBMH222A**	2.2kW			
MBDH373ABD	MBMH372A**	3.7kW			
MBDH023CVM	MBMH022C**	200W			None
MBDH043CWM	MBMH042C**	400W			
MBDH083CWM	MBMH082C**	750W	3600r/min		
MBDH153CBD	MBMH152C**	1.5kW			Built-in
MBDH223CBD	MBMH222C**	2.2kW			
MBDH373CBD	MBMH372C**	3.7kW			

Inverter Model No.	Brake Torque	Cooling method	Mass (kg)	Outer Dimensions	H-dimensions (mm)
MBDK5B1BVM					
MBDK2A1BVM	20% min.		0.5		35
MBDK5A1BVM	(Short Time)				
MBDK011BVM			0.6		40
MBDK021BWM	200% min. (Short Time)		0.8	A	60
MBDK5B3BVM					
MBDK2A3BVM	20% min.		0.5		35
MBDK5A3BVM	(Short Time)	Self			
MBDK013BVM					
MBDK023BVM			0.6		40
MBDK043BWM	200% min. (Short Time)		0.8		60
MBDK083BWM			1.2		90
MBDK153BBD	100% min.		2.9		
MBDK223BBD	(Short Time)	Fan	3.1	B	–
MBDK373BBD					
MBDH023AVM	20% min. (Short Time)		0.6		40
MBDH043AWM	200% min. (Short Time)	Self	0.8	A	60
MBDH083AWM			1.2		90
MBDH153ABD	100% min.		2.9		
MBDH223ABD	(Short Time)	Fan	3.1	B	–
MBDH373ABD					
MBDH023CVM	20% min. (Short Time)		0.6		40
MBDH043CWM	200% min. (Short Time)	Self	0.8	A	60
MBDH083CWM			1.2		90
MBDH153CBD	100% min.		2.9		
MBDH223CBD	(Short Time)	Fan	3.1	B	–
MBDH373CBD					