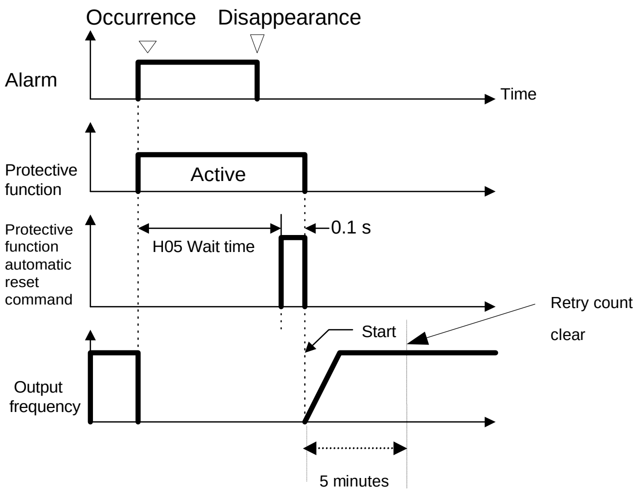
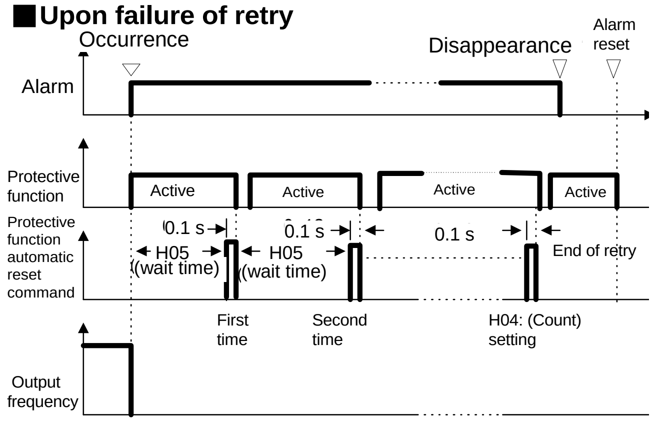
■**Upon success of retry**



■**Upon failure of retry**



H06 ***Fan stop operation***

◆With this function, the temperature of the heat sink is detected while the inverter is turned on, to turn on or off the cooling fan automatically. If this function is not selected, the cooling fan rotates at any time.

Setting 0: No on/off control
1: On/off control

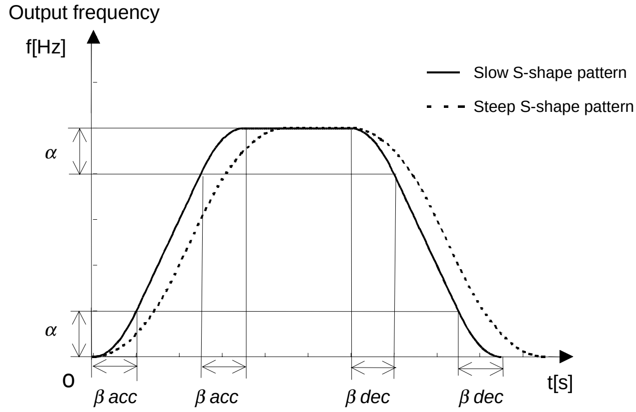
H07 ***ACC/DEC pattern (Mode select)***

◆Select the acceleration/deceleration mode.

Setting 0: Inactive
(linear acceleration/deceleration)
1: S-curve acceleration/deceleration (Weak)
2: S-curve acceleration/deceleration (Strong)
3: Non-linear (for variable torque)

When the function is set at "1", "2" or "3", a change in the acceleration or deceleration time during acceleration or deceleration is not reflected immediately. The setting becomes effective after a constant speed is reached or the inverter is stopped.

【S-curve acceleration/deceleration】
To reduce the shock of the mechanical system, the change in the output frequency is made smooth when the frequency is set.

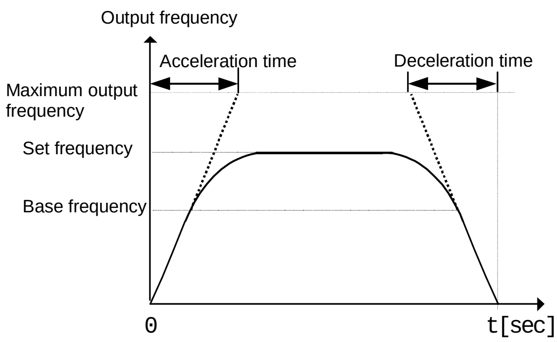


<Constant of each pattern>

	H07 = 1 (slow S-curve pattern)	H07 = 2 (steep S-curve pattern)
Range of S-curve (α)	0.05 x (Maximum output frequency [Hz])	0.10 x (Maximum output frequency [Hz])
S-curve time during acceleration (β acc)	0.10 x (Acceleration time [s])	0.20 x (Acceleration time [s])
S curve time during deceleration (β dec)	0.10 x (Deceleration time [s])	0.20 x (Deceleration time [s])

When the acceleration/deceleration time is extremely long or short, the result is linear acceleration/deceleration.

【Curved acceleration/deceleration】
Use this option to minimize the acceleration/deceleration time for an acceleration/deceleration pattern of the motor including the operation zone in the constant output range.



H09 *Start mode (Rotating motor pickup)*

◆This function smoothly starts a motor coasting due to an external force or the like after momentary power failure.
The speed of the motor is detected upon power recovery or restart and the same frequency as that for the motor speed is output. Therefore the motor starts smoothly without a shock.
However, when the coasting speed of the motor converted in the inverter frequency exceeds 120 Hz, setting of F03 "Maximum frequency 1" or setting of F15 "Frequency limiter (High)", the regular starting method is adopted.

Setting	Regular starting	Restarting after momentary power failure
0	Inactive	Inactive
1	Inactive	Active
2	Active	Active

◆ Description of setting

1:This function is effective when the setting of F14 "Restart after momentary power failure (Operation selection)" is "2" or "3".
Starting is made at the same frequency as that for the coasting speed.

2:Upon restart after momentary power failure, operation command ON and other starting methods, the speed of the coasting motor is detected and starting is made at the same frequency as that for the coasting speed.

Note) When this function is used, use the following setting to detect the accurate rotation speed of the motor.
When a motor other than the one made by Bonfiglioli Riduttori is used or when the wiring length is long, perform P04 Tuning.

H10 *Energy-saving operation*

◆When the output frequency for a small load is constant (constant speed operation) and the setting of F09 "Torque boost 1" is other than "0", the output voltage is automatically lowered to minimize the product (power) of the voltage and the current.
Setting 0: Inactive
1: Active

Notes)
1. Use this function for fans, pumps or other square reduction torque loads. If this function is applied to a constant torque load or to an application with a rapidly changing load, there is a delay in the control response.
2. The energy-saving operation is automatically cancelled to resume regular operation during acceleration or deceleration or when the torque limiter function is activated.

H11 *Dec mode*

◆Select the stopping method of the inverter after a stop command.
Setting 0: Normal
(Deceleration to stop based on data of H07 "ACC/DEC pattern")
1: Coast-to-stop

Note) This function is not activated when the set frequency is lowered to stop. The function is activated only when a stop command is input.

H12 *Instantaneous over current limiting*

◆When the motor load abruptly changes to cause a current exceeding the protective level of the inverter to flow, the inverter trips due to the over current. The Instantaneous over current limiting function controls the inverter output within the protective level even upon an excessive load.

◆The operation level of the Instantaneous over current limiting cannot be adjusted. Use the torque limit function to set on output limitation.

◆The torque generated by the motor may become low in a Instantaneous over current limiting state. Therefore deactivate the momentary over current limit function for applications such as the elevator where the torque generated by the motor must not be low. In this case, because the inverter trips due to an over current when a current exceeding the protective level of the inverter flows, use forcible stopping measures by a mechanical brake or other protective measures.
Setting 0: Inactive
1: Active

H13 *Auto-restart (Restart time)*

◆When the power supply to a running motor is shut off or power failure occurs and the power supply is quickly switched to another system, the phase of the voltage of the new system deviates from the phase of the voltage remaining in the motor and electrical or mechanical trouble may be developed. When switching the power supply system in a short time, write the time for attenuation of the remaining voltage from the motor after power shutoff. The setting is effective during restart after momentary power failure.
Setting range: 0.1 to 5.0 s
If the duration of momentary power failure is shorter than the wait time data, restart is made after this time. If the duration of momentary power failure is longer than the wait time data, restart is made after completion of operation preparation of the inverter (about 0.2 to 0.5 s).

H14 ***Auto-restart (frequency fall rate)***

- This function determines the drop ratio of the output frequency for the synchronization between the output frequency of the inverter and the motor speed, that is, the speed of synchronization. This function is also used to drop the frequency as a stall prevention function for an excessive load during regular operation.
  Setting range: 0.00, 0.01 to 100.0 Hz/s
  Set "0.00" to drop according to the currently selected deceleration time.

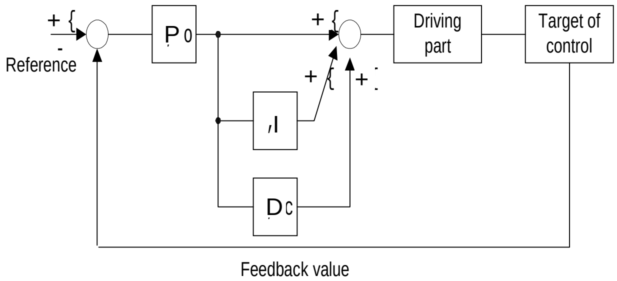
Note) A large frequency drop ratio may cause temporary increase in the regeneration energy from the load, activating the over voltage protection function. On the contrary, a small frequency drop ratio may cause long operation time of the current limit function, activating the inverter overload protection function.

H20 ***PID control (mode select)***

to

H25 ***PID control (feedback filter)***

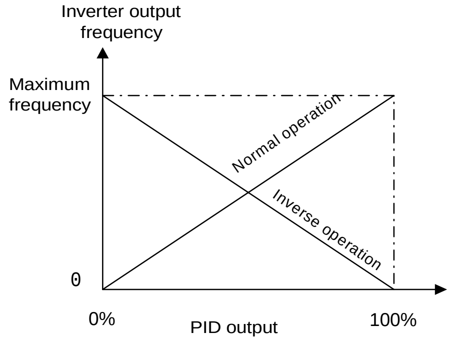
- The PID control detects a control amount (feedback value) from the sensor of the controlled object and compares it with the reference value (set temperature, etc).. Upon difference between them, an action is taken to reduce the difference. That is, this control method makes the feedback value become consistent with the reference value. This method can be applied to flow control, pressure control, temperature control and other process controls.



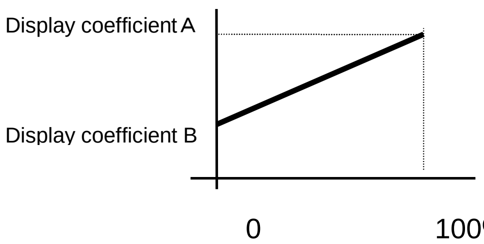
- Because forward and reverse operation can be selected for the output of the PID controller, the rpm of the motor can be increased or decreased in relation to the output of the PID controller.

H20

Setting 0: Inactive
1: Normal operation
2: Inverse operation



- The reference value can be given at F01 "Frequency command 1" or directly input from the keypad panel.
  Select an arbitrary terminal from E01 "X1 terminal (Function selection)" through E05 "X5 (Function selection), and set data "9" (frequency command 2 / frequency command 1).
  To obtain the reference value from F01 "Frequency command 1", input an OFF signal to the selected terminal. When inputting directly from the keypad panel, turn the selected terminal on.
- The process amount of the reference value and feedback value can be displayed based on the setting at E40 "Display coefficient A" and E41 "Display coefficient B".



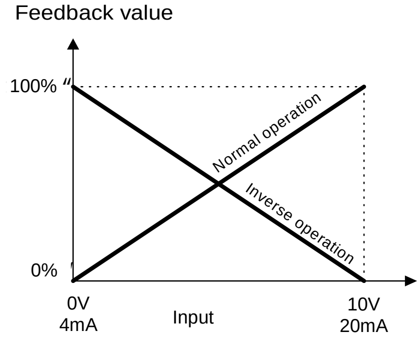
100% reference value
feedback value

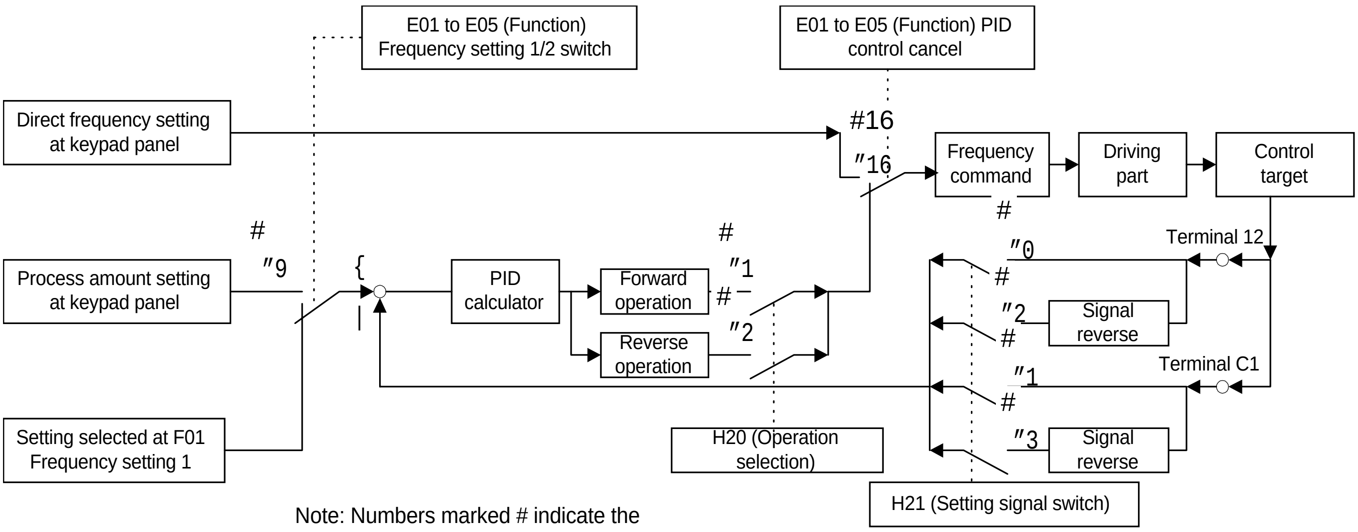
H21 *PID control (Feedback signal)*

◆ Select the feedback value input terminal and electrical specification of the terminal. Select one from the table below according to the specifications of the sensor.

Setting	Selection item
0	Control terminal 12, normal operation (voltage input 0 to +10V)
1	Control terminal C1, normal operation (current input 4 to 20 mA)
2	Control terminal 12, inverse operation (voltage input +10 to 0V)
3	Control terminal C1, inverse operation (current input 20 to 4 mA)

Note) The feedback value of the PID control can be input only in the positive polarity. The negative polarity (0 to -10 Vdc, -10 to 0 Vdc, etc). cannot be input. Therefore the control cannot be applied to reversible operation using the analogue signal.

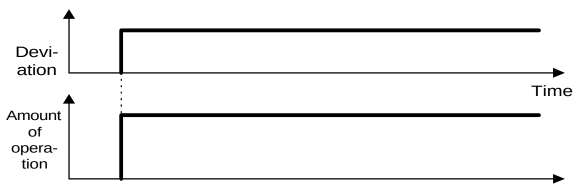




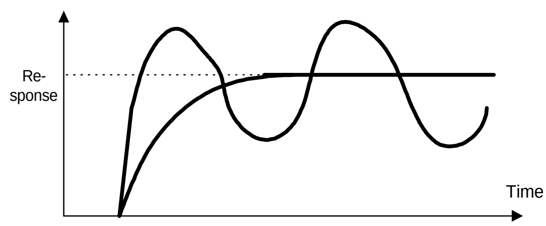
Note: Numbers marked # indicate the setting of each function.

H22 *PID control (P gain)*

- Generally speaking, P: gain, I: integral time and D: differential time are not used alone. Functions are combined like: P control, PI control, PD control and PID control.
- P action
  An operation where there is proportional relationship between the amount of operation (output frequency) and deviation is called P operation. Therefore the P action outputs an operation amount proportional to the deviation. However, the deviation cannot be eliminated by only the P action.
  Setting range: 0.01 to 10.00 times

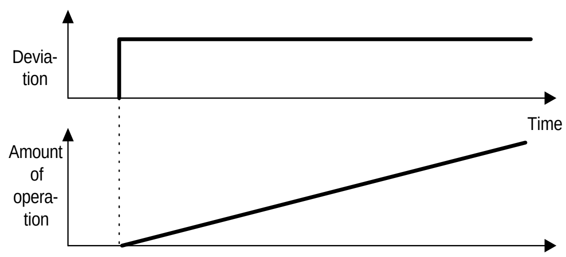


- The P gain is a parameter which determines the degree of response to the deviation of P action. With a large gain, the response is quick but hunting is likely to occur. With a small gain, the response is stable but slow.



H23 *PID control (I integral time)*

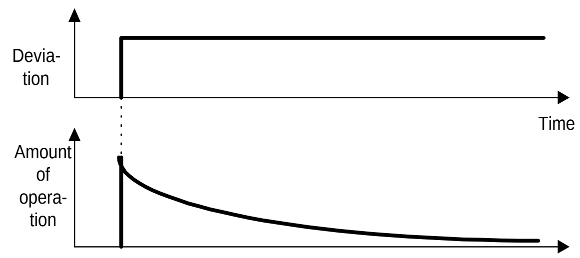
- I action
  An operation where the speed of the change in the amount of operation is proportional to the deviation is called I action. Therefore the I action outputs an operation amount obtained from integration of the deviation. For this reason, the I action is effective to converge the control amount to the reference value. However, response is slow to the deviation with abrupt changes.



Setting range: 0.0 Inactive, 0.1 to 3600 s
To determine the effect of the I action,
I: integral time is used as a parameter.
With a long integral time, the response is slow and reaction to an external force is small. With a small integral time, the response is quick. When the integral time is too small, there is hunting.

H24 *PID control (D Differential time)*

- D action
  An operation where the amount of operation is proportional to the differential value of the deviation is called D action. Therefore, the D action outputs an operation amount obtained from the differentiation of the deviation and the response to abrupt changes is quick.



Setting range: 0.00 Inactive, 0.01 to 10.0 s
D: differential time is used as a parameter to determine the effect of the D action. With a long differential time, decrease in the vibration caused by the P action upon deviation is quick. With too large a differential time, vibration may become larger. With a small differential time, decrease in the deviation becomes smaller.

- PI control
  Deviation remains with P action only. To eliminate the remaining deviation, I action is added and P + I control is generally adopted. The PI control functions to always eliminate deviation in spite of changes in the reference value and stationary disturbances. However, when the I action is strong, response to the deviation with abrupt changes is slow.
  P action only can be used for loads with an integral factor.
- PD control
  Upon deviation, the PD control generates an operation amount larger than that obtained by D action only, to reduce the increase of the deviation. When deviation is reduced to small, the function of the P action is made smaller.
  For a load including integral factors to be controlled, the P action alone can cause hunting in the response due to the action of the integral factors. The PD control is used in such cases to decrease hunting of the P action to stabilize. That is, this control method is applied to loads having no braking in the process itself.
- PID control
  The function of the I action to reduce the deviation and the function of the D action to suppress hunting are combined with the P action. Accurate responses without deviation are obtained.

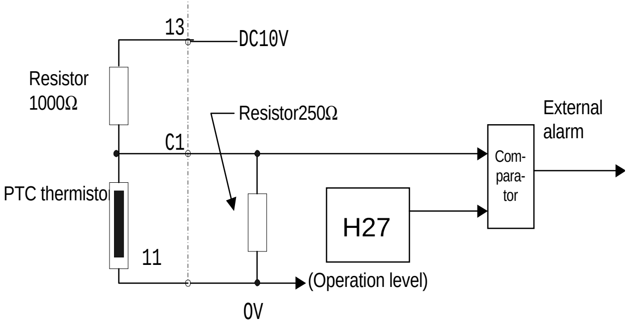
This control method is effective to loads which take time from generation of deviation to development of a response.

H25 *PID control (feedback filter)*

◆This function provides a filter for the feedback signal input at control terminal 12 or C1. The filter makes the operation of the PID control system stable. However, an excessively large setting causes a poor response.
Setting range: 0.0 to 60.0 s

H26 *PTC thermistor (mode select)*

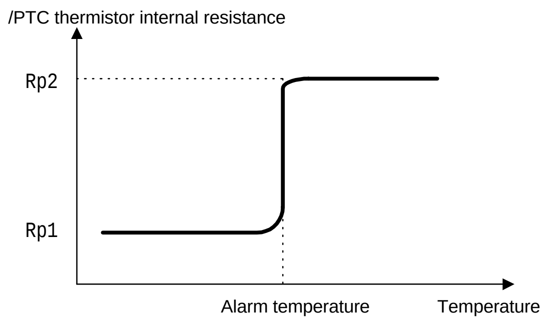
◆Select this function for a motor equipped with a PTC thermistor for overheat protection.
Setting 0: Inactive
1: Active
Connect the PTC thermistor as shown in the figure. The protective operation is common with the external alarm input. Therefore the protective function operates at the "external alarm".



H27 *PTC thermistor (level)*

◆The voltage input at terminal [C1] is compared with the set voltage and, when the input voltage at terminal [C1] is larger than the set voltage (operation level), H26 "PTC thermistor (Operation selection)" is activated.
Setting range: 0.00 to 5.00 V
(The setting smaller than 0.10 is handled as 0.10).

◆The alarm temperature is determined by the PTC thermistor and the internal resistance of the PTC thermistor changes largely at the alarm temperature. Set the operation (voltage) level using this change of resistance.



From the figure of H26 "PTC thermistor (Operation selection)", the 250-ohm resistor and the PTC thermistor (resistance Rp) configure a parallel circuit. Therefore voltage VC1 (operation level) of terminal [C1] is calculated in the following equation.

$$Vc_1 = \frac{\dfrac{250 \cdot Rp}{250 + Rp}}{1000 + \dfrac{250 \cdot Rp}{250 + Rp}} \cdot 10 \quad [\mathrm{V}]$$

The operation level can be set when Rp of the Vc1 calculation equation is in the following range.

Rp1 < Rp < Rp2

To determine RP simply, calculate the following equation.

$$Rp = \frac{Rp_1 + Rp_2}{2} \quad [\Omega]$$

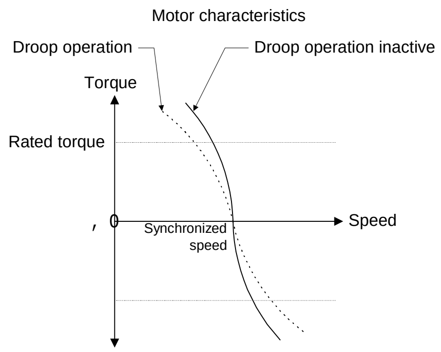
H28 *Droop operation*

◆ To drive one machine with two or more motors, a larger load is exerted on the motor with a larger speed. The droop control attributes drooping characteristics to the speed during load fluctuation to balance the load.

◆ The drooping amount is calculated in the following formula.

$$\text{Drooping amount} = \text{Base frequency} \times \frac{\text{Drooping content of speed at rated torque } [\mathrm{r/min}]}{\text{Synchronized speed } [\mathrm{r/min}]} \ [\mathrm{Hz}]$$

Setting range: - 9.9 Hz to 0.0 Hz



H30 *Serial link (function select)*

◆RS485 (standard accessory) can be connected as a link function (communication function).

◆As a link function, the following items are possible.

1) Monitoring (monitoring of various data, confirmation of function code data)
2) Frequency setting
3) Operation command (FWD, REV and other commands set for digital input)
4) Function code data writing

Setting range: 0 to 3

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The validity of communication can be switched by a digital input. Set the link functions available through communications.

Setting	Frequency setting	Operation command
0	Invalid	Invalid
1	Valid	Invalid
2	Invalid	Valid
3	Valid	Valid

The monitor function and function code data writing function are always valid. When the communication is disabled by means of a digital input, a state similar to setting "0" is obtained.

H31 ***RS485 (address)***

to

H39 ***RS485 (response interval)***

◆ Set the various conditions of RS485 communication. Set according to the specifications of the host unit. Refer to section 9-4 for protocol and other specifications.

H31

◆ Set the station address of RS485.
Setting range: 1 to 31

H32 ***RS485 (**mode select on no response error**)***

◆ Set the communication error handling process and the error handling timer value.
Setting range: 0 to 3

Setting	Communication error handling process
0	Immediate Er 8 trip (coast to stop)
1	Operation continues until the timer time elapses, then Er 8 trip.
2	Operation continues and retry is made until the timer time elapses, then Er 8 trip upon a communication error or continuation of operation upon no communication error.
3	Operation continues.

H33 ***RS485 (timer)***

◆ Set the error handling timer value.
Setting range: 0.0 to 60. 0 s

H34 ***RS485 (baud rate)***

◆ Set the transmission speed.

Setting	Transmission speed
0	19200 bit/s
1	9600 bit/s
2	4800 bit/s
3	2400 bit/s
4	1200 bit/s

H35 ***RS485 (data length)***

◆ Set the data length.

Setting	Data length
0	8 bits
1	7 bits

H36 ***RS485 (parity check)***

◆ Set the parity bit.

Setting	Parity bit
0	None
1	Even
2	Odd

H37 ***RS485 (stop bits)***

◆ Set the stop bit.

Setting	Stop bit
0	2bits
1	1bit

H38 ***RS485 (no response error detection time)***

◆ In a system where there is always an access to the station at certain intervals, no access caused by broken wire or other errors is detected and the inverter trips in Er8.
Setting range: 0 to 60 s
0: No detection

H39 ***RS485 (response interval)***

◆ Set the time taken until a response is sent back to the host unit upon a request.
Setting range: 0.00 to 1.00 s

H40 ***Maximum temperature of heat sink***

◆ The maximum value in each hour is displayed in degree C.

H41 ***Maximum effective current***

◆ The maximum value in each hour is displayed in A.

H42 ***Main circuit capacitor life***

◆ The capacity of the capacitor in the main circuit is displayed in %. For the measuring conditions, refer to section 8-2 (1) "Measurement of capacitance of capacitor in main circuit".

H43 ***Cooling fan operation time***

◆ Integral hours is displayed. The displayed time is 0 to 6500, indicating 0 to 65000 hours. (Though the displayed value is in ten hours, the inverter adds each hour. Operation shorter than one hour is not counted).

H44 ***Inverter ROM version***

◆ The version of the software of the inverter is displayed.

H45 ***Keypad panel ROM version***

◆ The version of the software of the keypad panel is displayed.

H46 ***Option ROM version***

◆ For inverters with optional equipment, the version of the optional software is displayed.

A: Alternative motor parameters

A01 ***Maximum frequency 2***

The maximum frequency output by the inverter for motor 2. This parameter functions in the same way as F03 "Maximum output frequency 1". For the description, refer to F03 "Maximum output frequency 1".

A02 ***Base frequency 2***

The maximum output frequency in the constant torque zone of motor 2, that is, the output frequency at the rated output voltage. This parameter functions in the same way as F04 "Base frequency 1". For the description, refer to F04 "Base frequency 1".

A03 ***Rated voltage 2 (at base frequency 2)***

The rated output voltage supplied to motor 2. This parameter functions in the same way as F04 "Rated voltage 1". For the description, refer to F05 "Rated voltage 1".

A04 ***Maximum voltage 2 (at maximum frequency 2)***

The maximum output voltage of the inverter for motor 2. This parameter functions in the same way as F06 "Maximum voltage 1". For the description, refer to F06 "Maximum voltage 1".

A05 ***Torque boost 2***

The torque boost function of motor 2. This parameter functions in the same way as F09 "Torque boost 1". For the description, refer to F09 "Torque boost 1".

A06 ***Electronic thermal overload relay for motor 2 (Select)***

A07 ***Electronic thermal overload relay for motor 2 (Level)***

A08 ***Electronic thermal overload relay for motor 2 (Thermal time constant)***

The electronic thermal overload relay functions of motor 2. These parameters function in the same way as F10 through F12 Electronic thermal overload relay for motor 1. For the description, refer to F10 through F12.

A09 ***Torque vector control 2***

The torque vector function of motor 2. This parameter functions in the same way as F42 "Torque vector control 1". For the description, refer to F42 "Torque vector control 1".

A10 ***Number of motor 2 poles***

The number of poles of driven motor 2. This parameter functions in the same way as P01 "Number of motor 1 poles". For the description, refer to P01 "Number of motor 1 poles)".

A11 ***Motor 2 (Capacity)***

The capacity of motor 2. This parameter functions in the same way as P02 "Motor 1 (Capacity)". For the description, refer to P02 "Motor 1 (Capacity)". However, the function of related motor data changes to A12 "Motor 2 (Rated current)", A15 "Motor 2 (No-load current)", A16 "Motor 2 (%R1 setting)" and A17 "Motor 2 (%X setting)".

A12 ***Motor 2 (Rated current)***

The rated current of motor 2. This parameter functions in the same way as P03 "Motor 1 (Rated current)". For the description, refer to P03 "Motor 1(Rated current)".

A13 ***Motor 2 (Tuning)***

Tuning of motor 2. This parameter functions in the same way as P04 "Motor 1 (Tuning)". For the description, refer to P04 "Motor 1 (Tuning)".

A14 ***Motor 2 (Online turning)***

Online tuning of motor 2. This parameter functions in the same way as P05 "Motor 1 (Online tuning)". For the description, refer to P05 "Motor 1 (Online turning)".

A15 ***Motor 2 (No-load current)***

The no-load current of motor 2. This parameter functions in the same way as P06 "Motor 1 (No-load current)". For the description, refer to P06 "Motor 1 (No-load current)".

A16 ***Motor 2 (%R1 setting)***

A17 ***Motor 2 (%X setting)***

%R1 and %X of motor 2. These parameters function in the same way as P07 "Motor 1 (%R1 setting)" and P08 "Motor 1 (%X setting)". For the description, refer to P07 and P08.

A18 ***Motor 2 (Slip compensation control 2)***

The slip compensation control of motor 2. This parameter functions in the same way as P09 "Motor 1 (Slip compensation control 1)". For the description, refer to P09 "Motor 1 (Slip compensation control 1)".

A19 ***Motor 2 (Slip compensation response time 2)***

Set the response time for slip compensation of motor 2. This parameter functions in the same way as P10 "Motor 1 (Slip compensation response time)". For the description, refer to P10 "Motor 1 (Slip compensation response time)".

o: Optional functions

o00 ***Option selection***

0: Option inactive
1: Option active
Set 0 when option card is used.
Refer to the instruction manual of option card for detail of optional functions.

6. Protective Operation

6-1 List of Protective Operations

When an error occurs to the inverter, a protective function is activated to trip the inverter immediately, displaying the name of the alarm at the LED and allowing the motor to coast to stop.

Table 6-1-1 List of alarm display and protective operations

Name of alarm	Display	Description of operation	
Over current protection	OC1	During acceleration	The protective function is activated when an over current flowing in the motor or a short circuit or ground fault in the output circuit causes the instantaneous inverter output current to exceed the over current detection level.
	OC2	During deceleration	
	OC3	During constant speed operation	
Over voltage protection	OU1	During acceleration	The protective function is activated when the regenerative power from the motor increases to cause the DC link voltage of the main circuit to exceed the over voltage detection level (Approx. 400 Vdc for 200V class, Approx. 800V for 400V class). When an excessive voltage is added to the source voltage, the inverter trips due to the over voltage, but inverter protection against the over voltage is impossible.
	OU2	During deceleration	
	OU3	During constant speed operation	
Under voltage protection	LU	The protective function is activated when the source voltage drops to cause the DC link voltage in the main circuit to become lower than the under voltage detection level (Approx. 200 Vdc for 200V class, Approx. 400V for 400V class). If F14 Restart after momentary power failure has been selected, no alarm display is given. If the voltage drops below the control power maintenance level, no alarm is displayed.	
Input phase loss protection	Lin	When the inverter is operated while one of the three phases of the power supply connected to the main power supply input terminals L1/R, L2/S and L3/T of the main circuit is missing or there is an unbalance among the three-phase voltages, the rectifying diode or smoothing capacitor of the main circuit may be broken. The inverter is stopped upon an alarm in these cases.	
Heat sink overheat	OH1	The protective function is activated when the temperature of the heat sink of the inverter is high because of a broken cooling fan or for other reasons.	
External alarm input	OH2	The protective function is activated by a contact signal from an alarm contact of the external device such as the braking unit, braking resistor, and external thermal overload relay connected to the control circuit terminal (THR). Or an overheat protective function is activated by the PTC thermistor.	
Braking resistor overheat	dbH	If the electronic thermal overload relay (for braking resistor) has been selected for function code F13, the protective function is activated upon a high operation frequency of the braking resistor to prevent the resistor from being burned due to the temperature rise.	
Motor 1 overload	OL1	If electronic thermal overload relay 1 has been selected for function code F10, the protective function is activated by a motor current exceeding the set operation level.	
Motor 2 overload	OL2	If motor 2 has been selected and driven and electronic thermal overload relay 2 has been selected for function code A06, the protective function is activated by the current in motor 2 exceeding the set operation level.	
Inverter overload	OLU	The protective function is activated by an output current exceeding the overload current rating to protect the semiconductor elements in the main circuit of the inverter from high temperatures.	
Memory error	Er1	The protective function is activated by a data writing error or other errors in the memory.	
Keypad panel communication error	Er2	The protective function is activated when a data transmission error or transmission stoppage is detected between the keypad panel and the control section in the keypad panel operation mode.	
CPU error	Er3	The protective function is activated by electric noise or other errors developed in the CPU, or if P24 is overloaded.	
Option error	Er4 Er5	Error during operation of option	
Output phase loss	Er7	The protective function is activated during auto tuning when there is a broken wire or no connection in the inverter output circuit.	
RS485 communication error	Er8	The protective function is activated when a communication error occurs during communication through RS485.	

6-2 Alarm Reset

When the inverter trips, remove the cause then press the PRG/RESET key on the keypad panel or input a reset command from the RST control terminal to reset the tripping state. Because the reset command is activated by an edge, supply the command in an OFF - ON - OFF sequence as shown in Fig. 6-2-1. When resetting the tripping state, deactivate the operation command. If the operation command is left turned on, the inverter starts operation immediately after the error is reset.

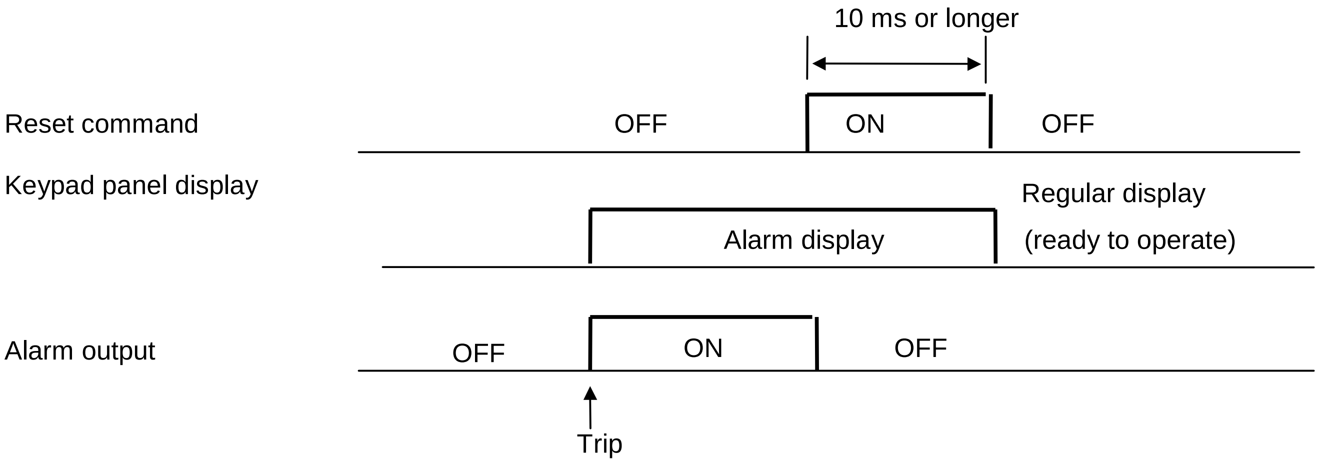


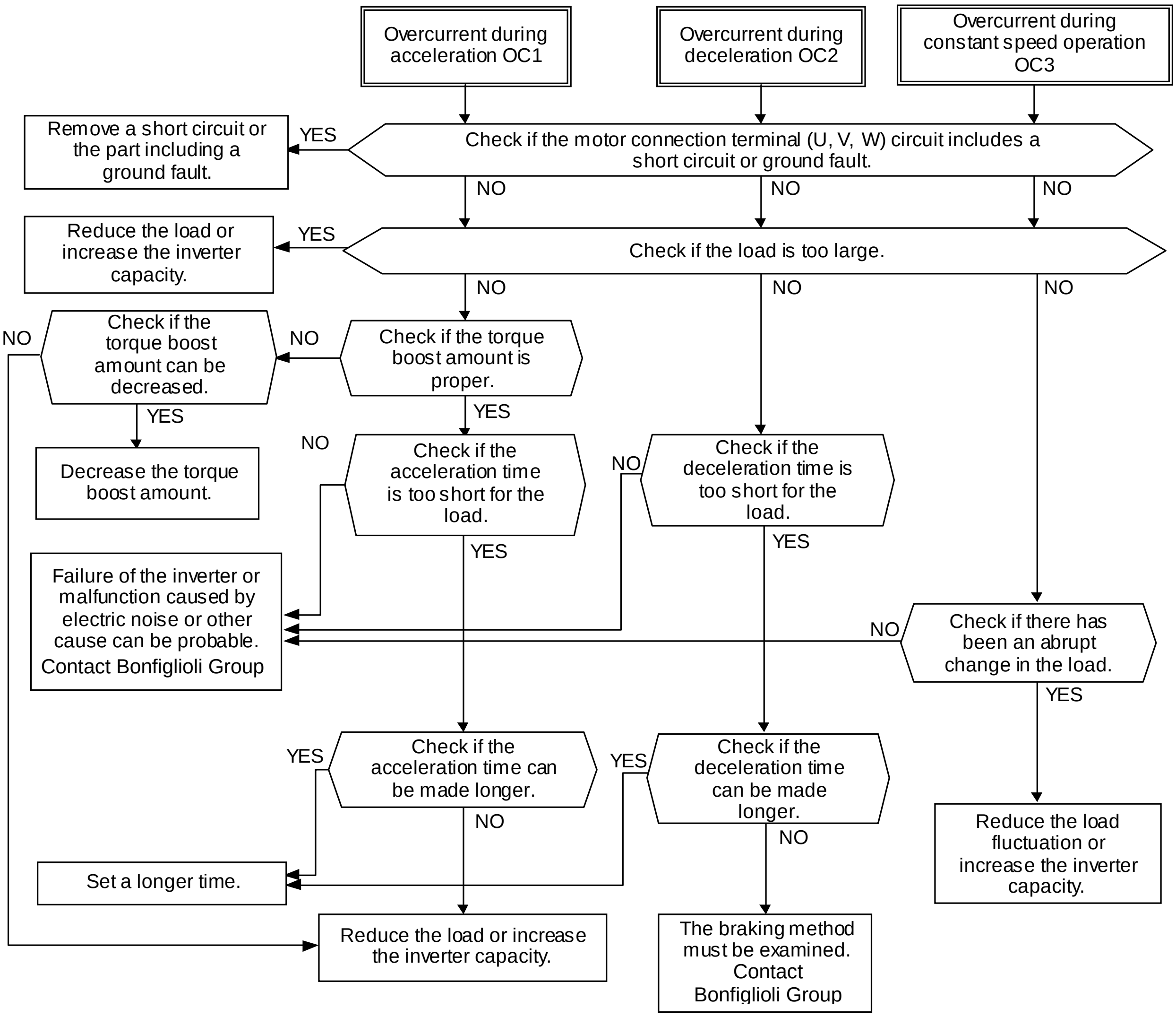
Figure 6-2-1

WARNING	If an alarm reset is made with the operation signal turned on, a sudden start will occur. Check that the operation signal is turned off in advance. **Otherwise an accident could occur.**

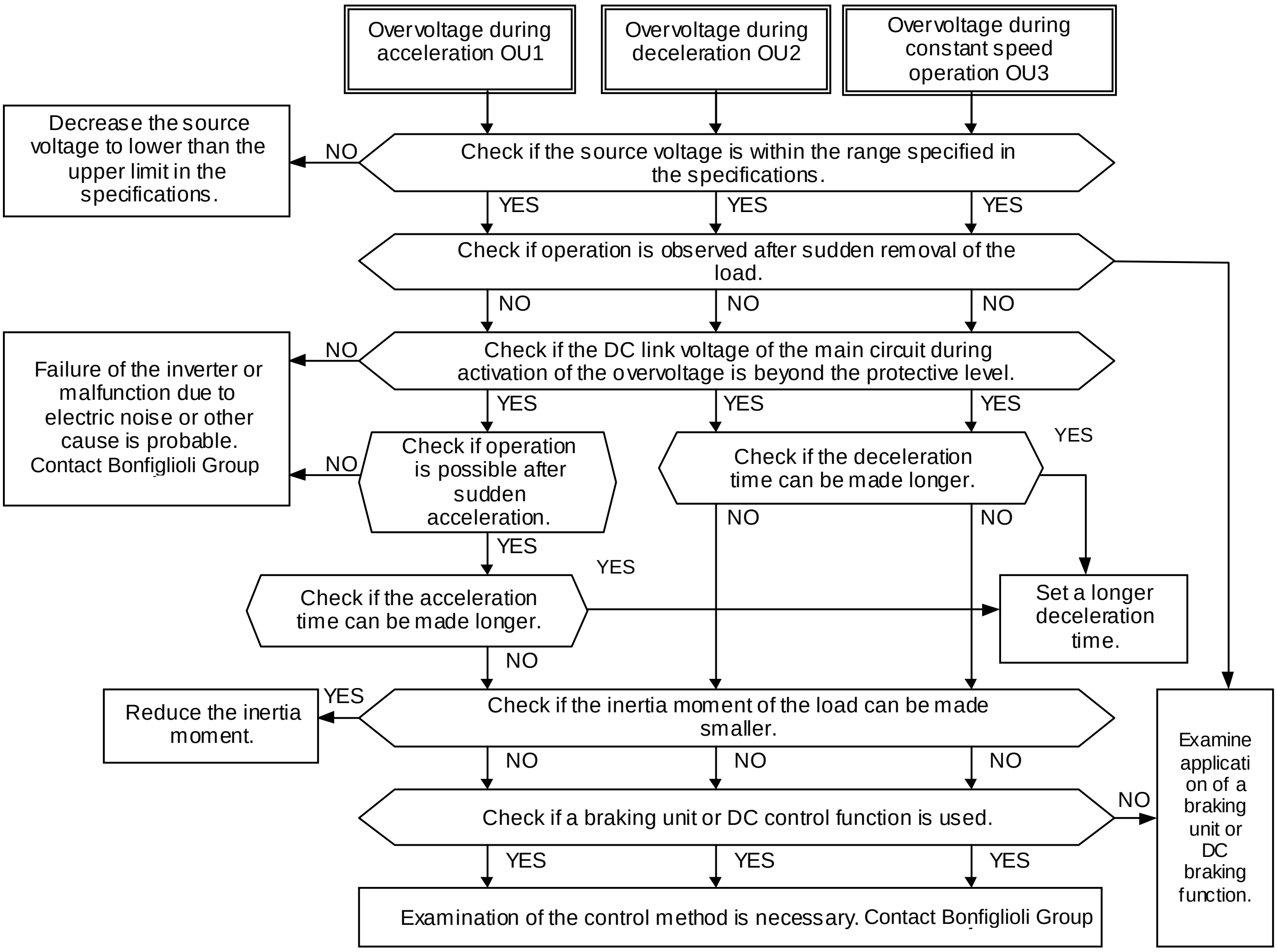
7. Troubleshooting

7-1 When Protective Function Goes Active

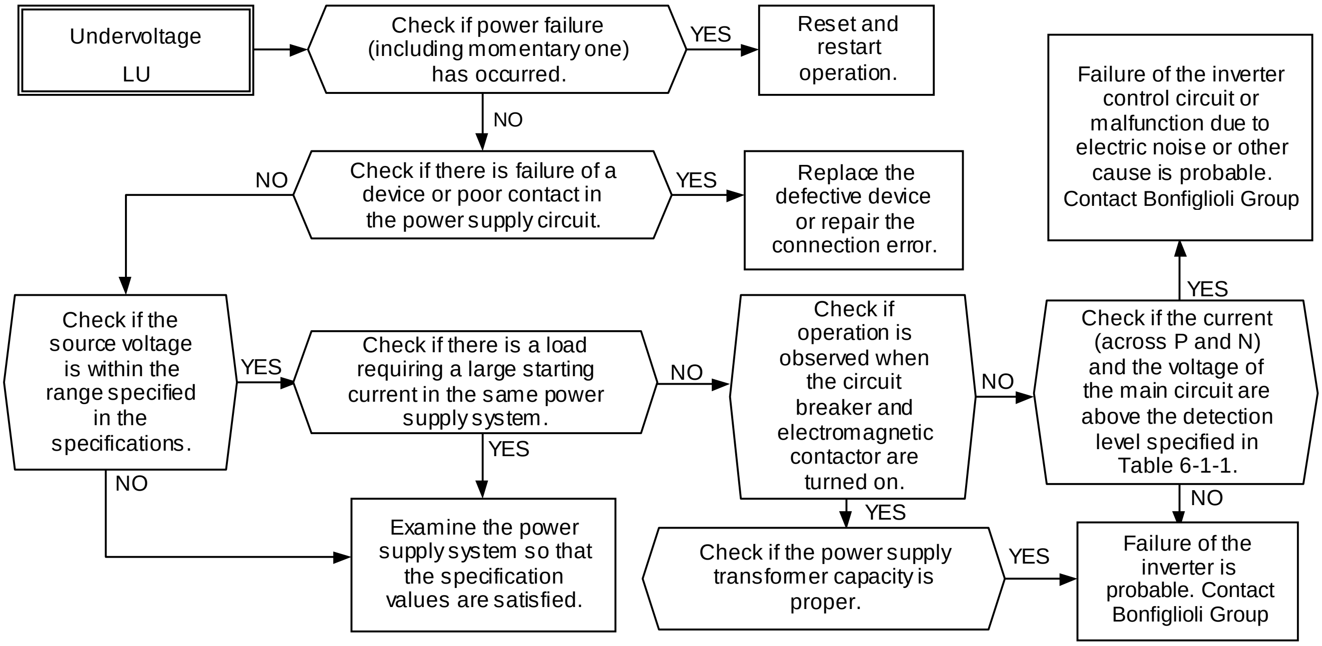
(1) Over current



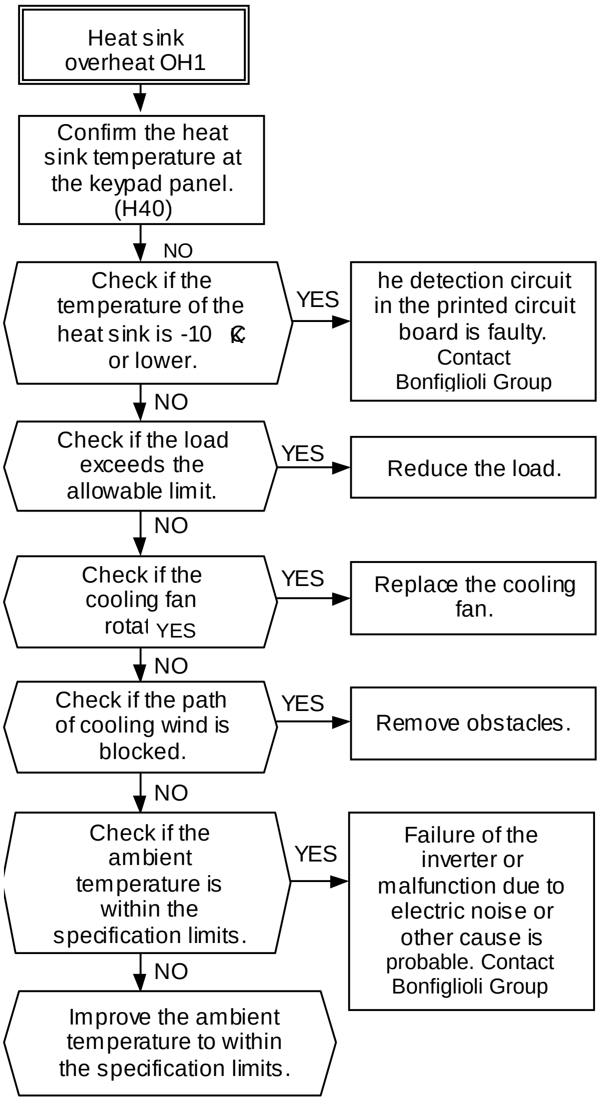
(2) Over voltage



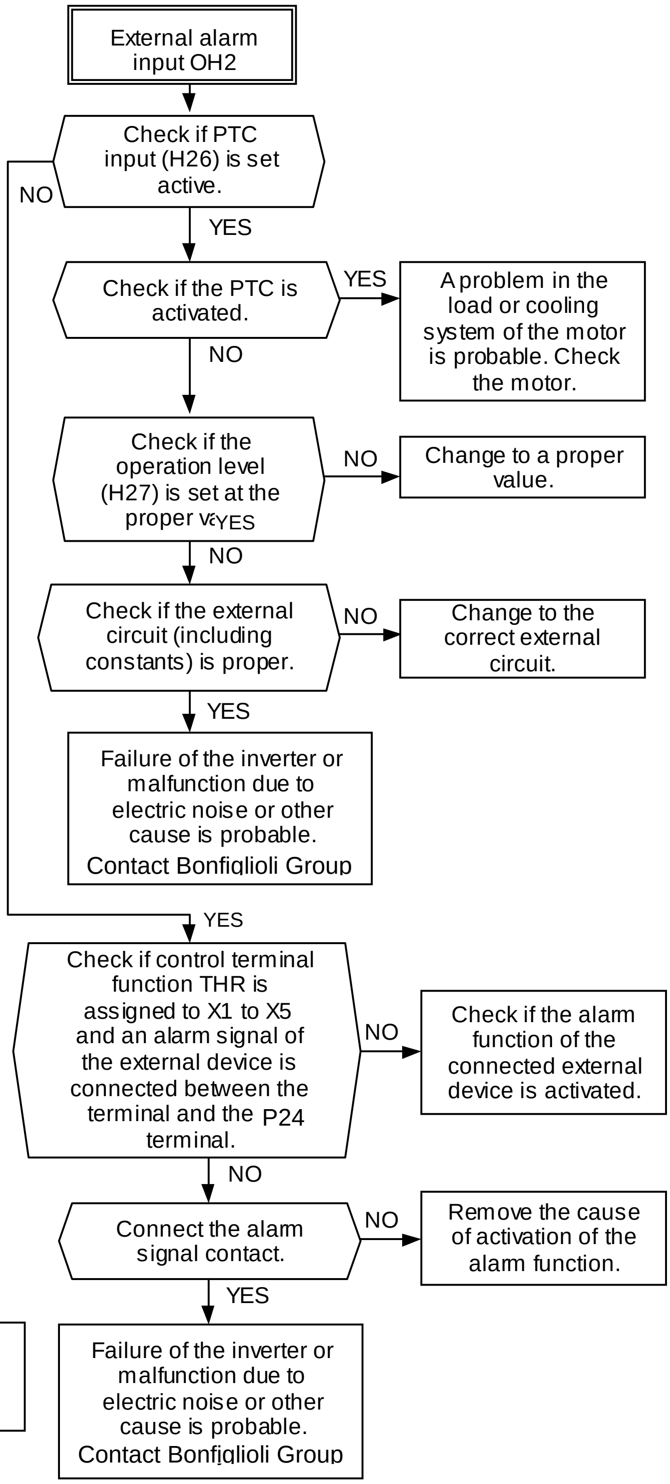
(3) Under voltage



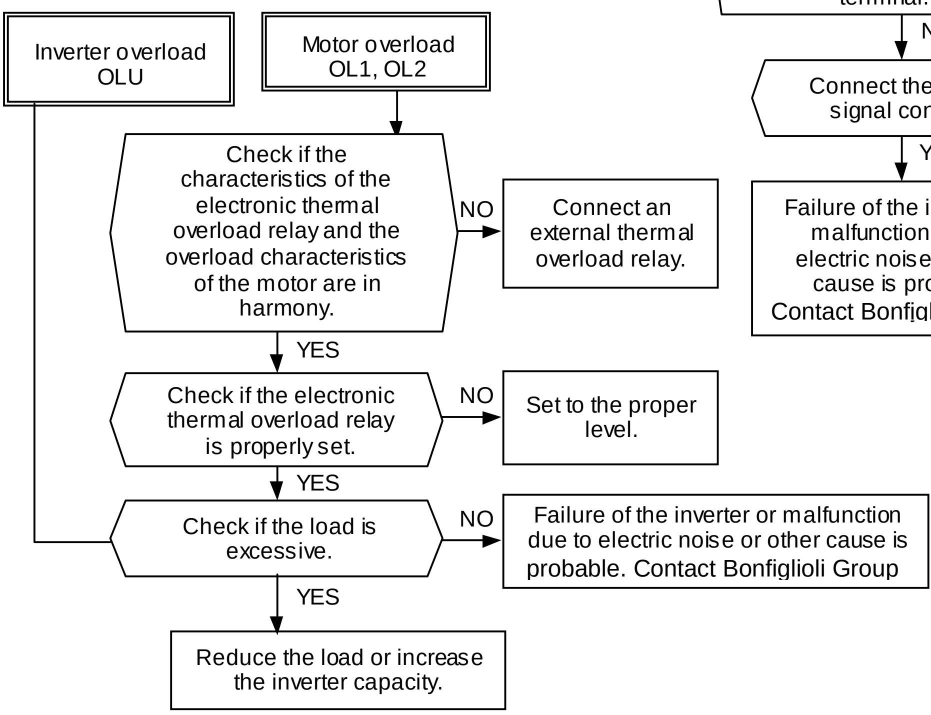
(4) Inverter inside overheat or heat sink overheat



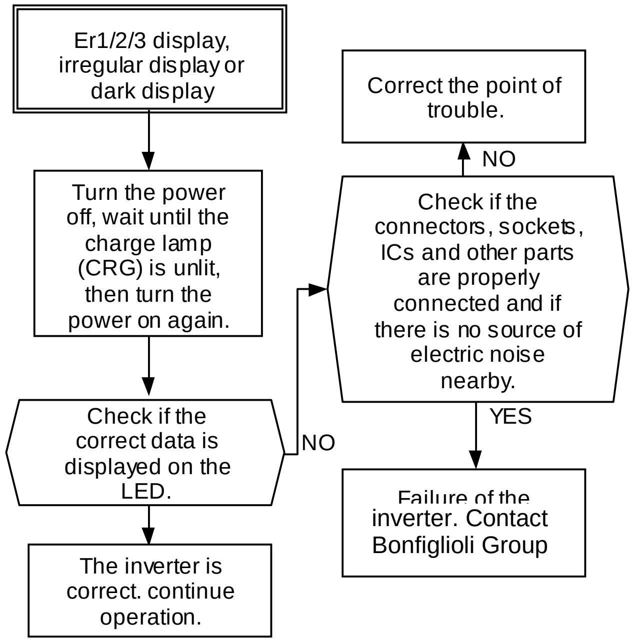
(5) Eternal alarm input



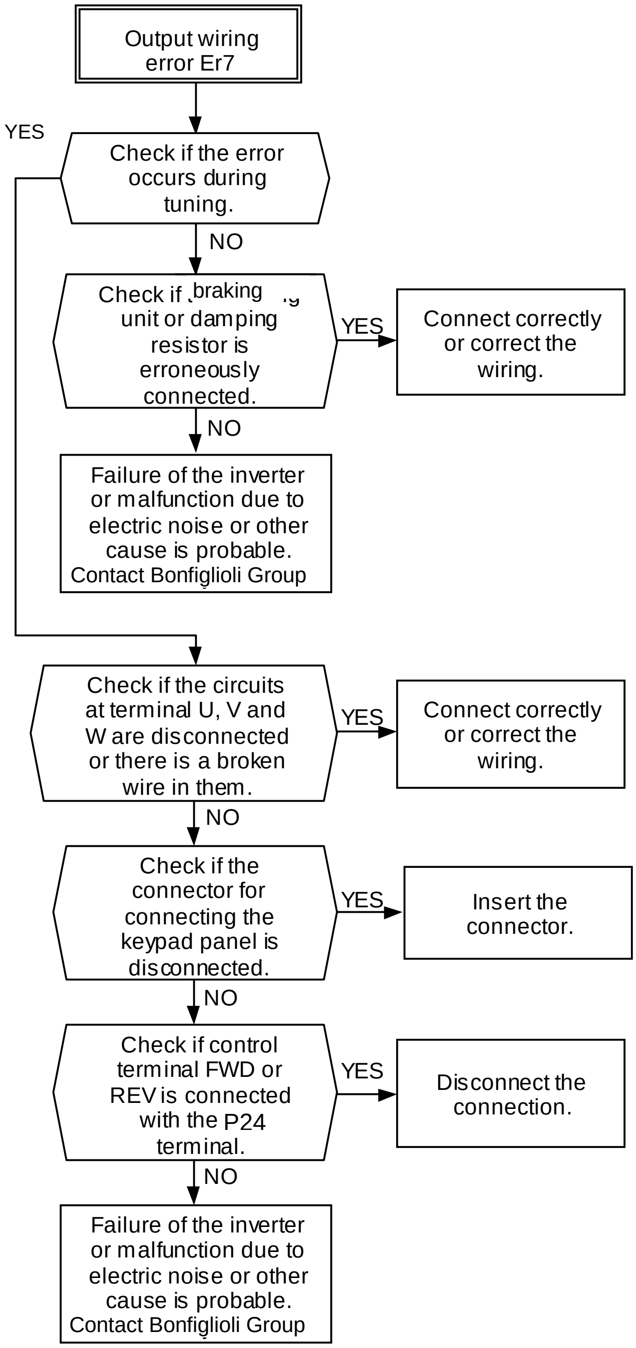
(6) Inverter overload, motor overload



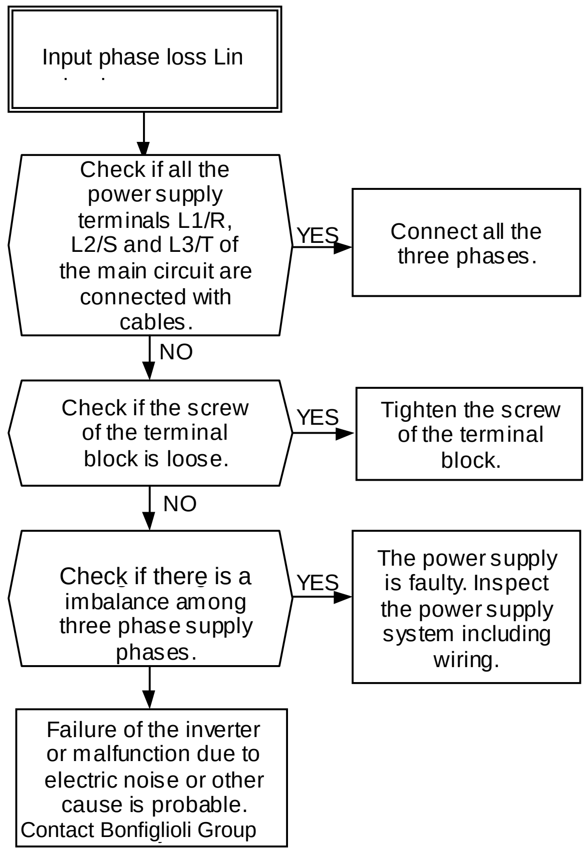
(7) Memory error Er1, keypad panel communication error Er2, CPU error Er3



(8) Output wiring error

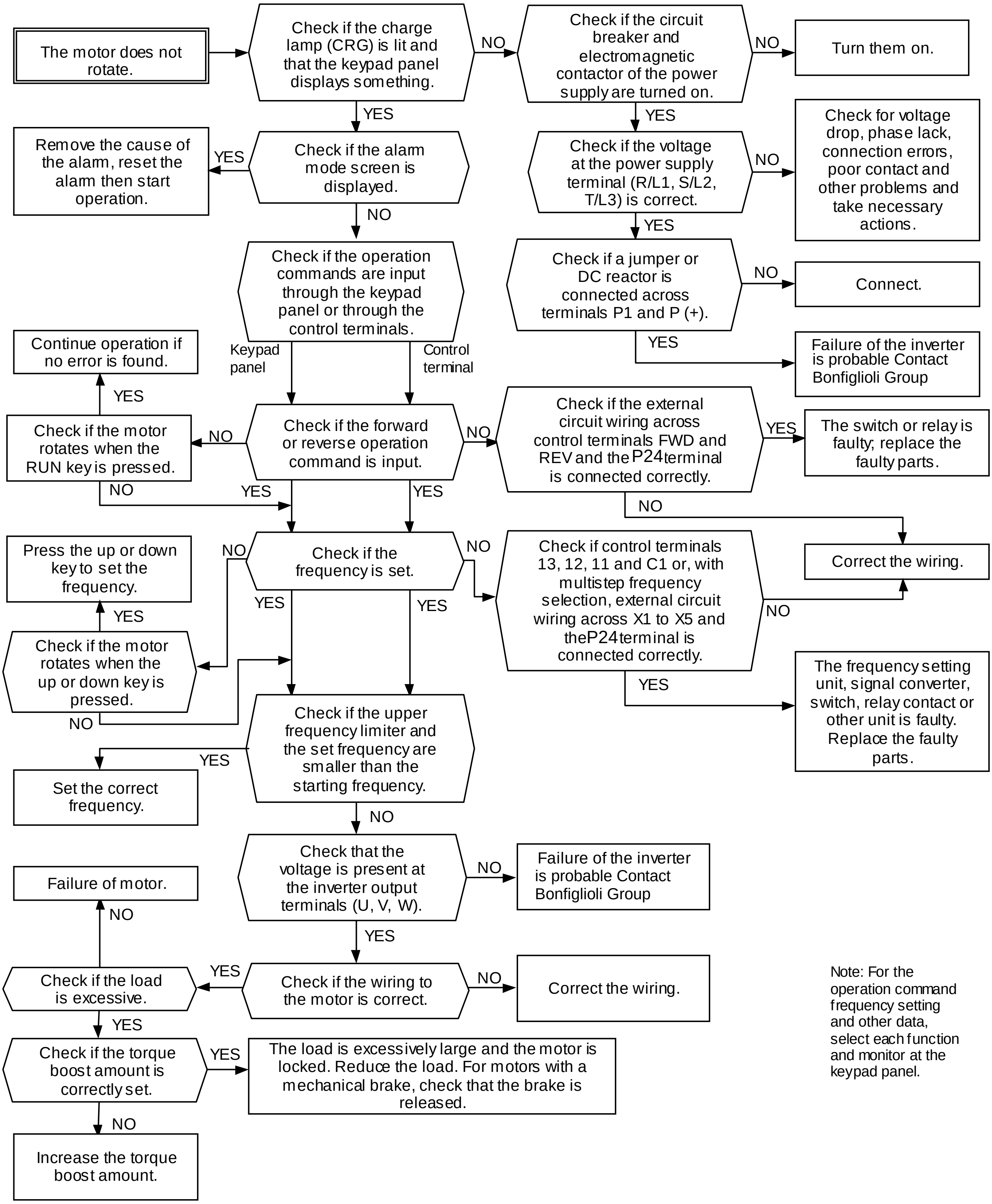


(9) Input phase loss



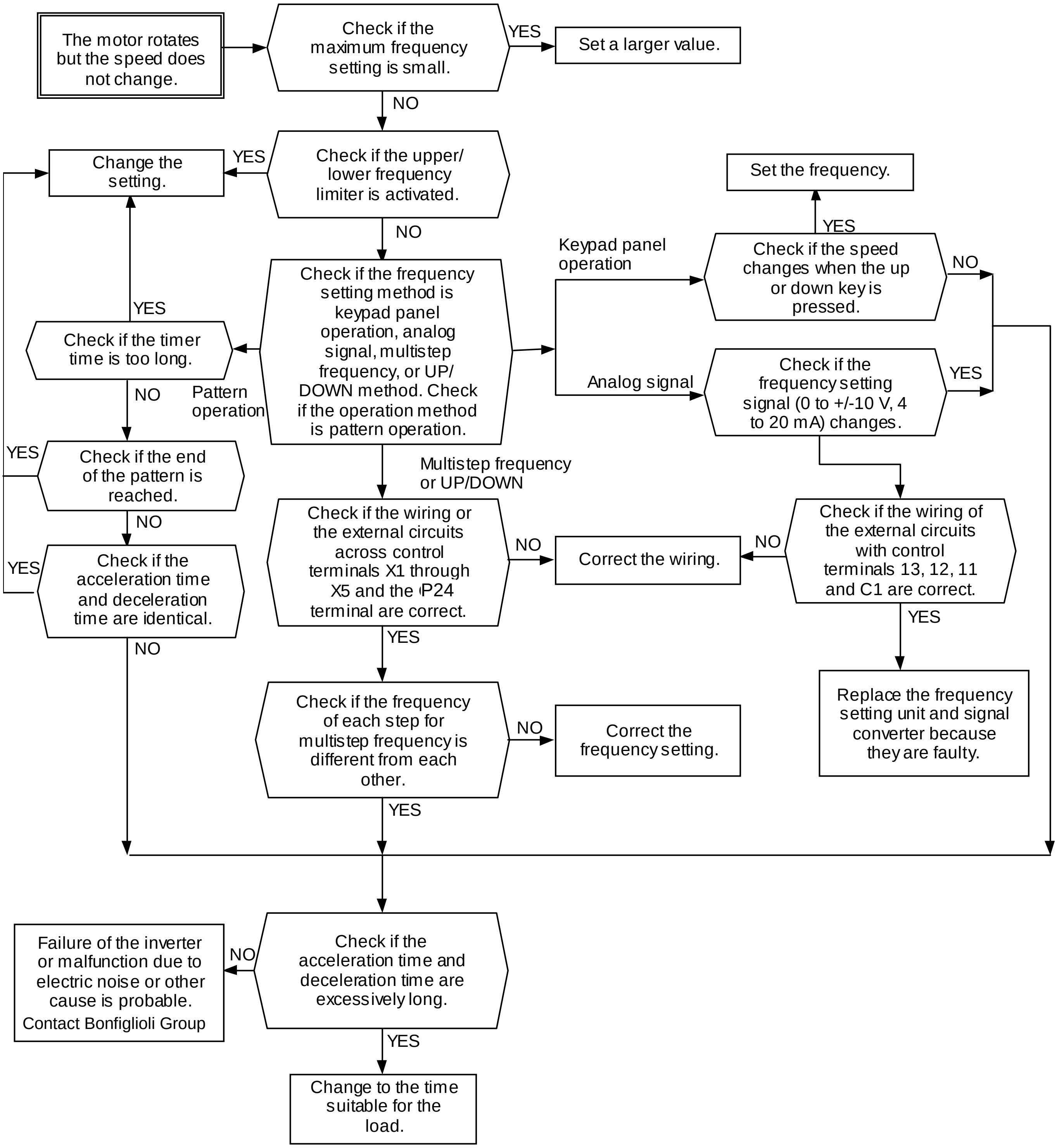
7-2 When Motor rotates Incorrectly

(1) The motor does not rotate.



The motor does not start when a coast-to-stop command or DC braking command is being input.

(2) The motor rotates but the speed does not change.

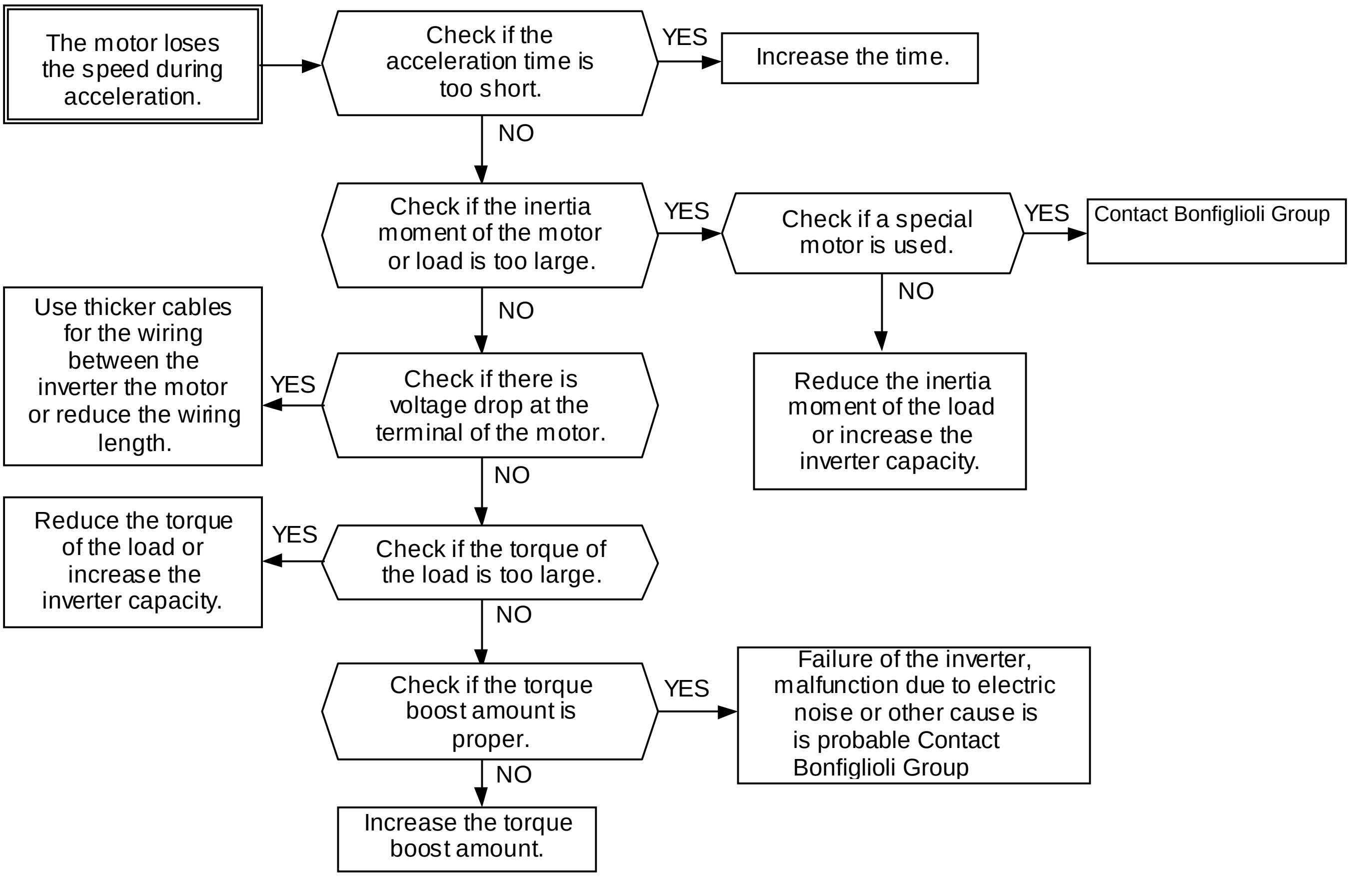


The change in the rotation speed of the motor is also small in the following cases.

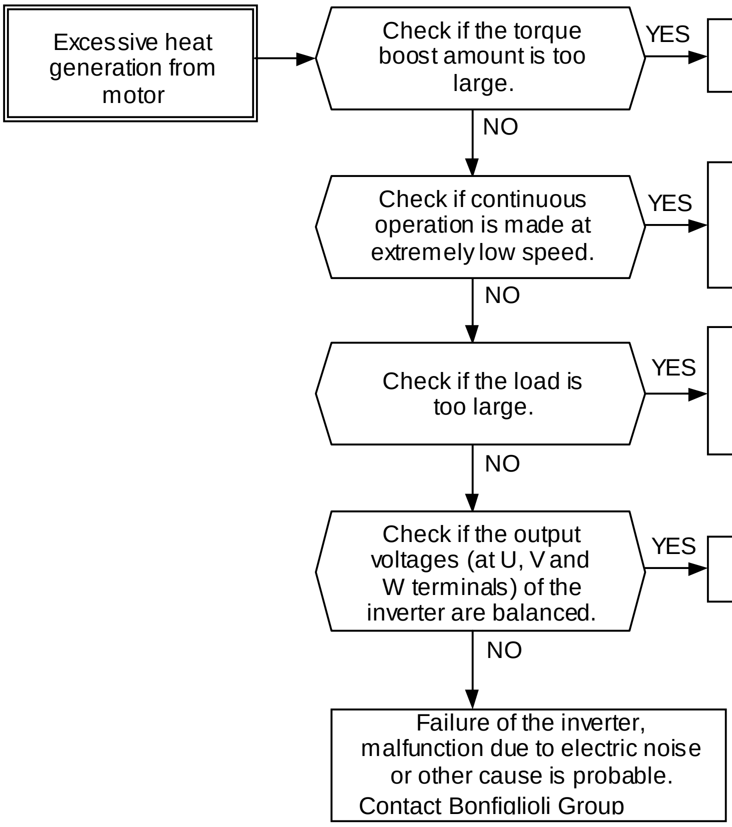
— F01 "Frequency command 1" and C30 "Frequency command 2" are set at "3" and a signal is input from both of control terminals 12 and C1, and there is no change in the sum of them.

— The load is excessively large and the torque limit and current limit functions are activated.

(3) The motor loses speed during acceleration.



(4) Excessive heat generation from motor



Note: Heat generation with a large frequency setting may be caused by the waveform of the current.
Contact Bonfiglioli Group

8. Maintenance and Inspection

Perform daily and periodic inspection to avoid trouble and keep reliable operation for a long time. Take care of the following items during work.

8-1 Daily Inspection

Visually inspect errors in the state of operation from the outside without removing covers while the inverter operates or while it is turned on.

1) Check if the expected performance (satisfying the standard specification) is obtained.
2) Check if the surrounding environment satisfies the standard specification.
3) Check that the display of the keypad panel is free from errors.
4) Check for abnormal noise, excessive vibration and bad smell.
5) Check for traces of overheat, discoloration and other defects.

8-2 Periodic Inspection

After stopping the operation, turn the power off and remove the front cover to perform periodic inspection. The smoothing capacitor at the DC section of the main circuit takes time to be discharged after the power is turned off. After checking that the charge lamp (CRG) is unlit, check that the DC voltage is lower than the safety level (25 VDC) using a multimeter or the like before starting work.

⚠ **WARNING**	• Turn the power off and wait for at least five minutes before starting inspection. (Further, check that the charge lamp is unlit and measure the DC voltage across the P (+) and N (-) terminals to check that it is lower than 25V). **Otherwise electric shock could occur.** • Maintenance and inspection and parts replacement should be made only by appointed persons. (Take off the watch, rings and other metallic matter before starting work). (Use insulated tools). • Never remodel. **Otherwise electric shock or injuries could occur.**

Table 8-2-1 List of periodic inspection

Check part	Check item	How to inspect	Evaluation criteria
Environment	1) Check the ambient temperature, humidity, vibration and atmosphere (dust, gas, oil mist, water drops). 2) Check if tools or other foreign matter or dangerous objects are left around the equipment.	1) Check visually or measure using apparatus. 2) Visual inspection	1) The standard specification must be satisfied. 2) No foreign or dangerous objects are left.
Voltage	Check if the voltages of the main circuit and control circuit are correct.	Measure using a multimeter or the like.	The standard specification must be satisfied.
Keypad panel	1) Check if the display is clear. 2) Check if there is missing parts in the characters.	1), 2) Visual inspection	1, 2) The display can be read and there is no fault.
Structure such as frame and cover	1) Abnormal noise and excessive vibration 2) Loose bolts (tightened parts) 3) Deformation and breakage 4) Discoloration and deformation caused by overheat 5) Stains and dust	1) Visual or hearing inspection 2) Retighten. 3), 4), 5) Visual inspection	1),2),3),4),5) No abnormalities

Main circuit	Common	1) Check if bolts and screws are tight and not missing. 2) Check the devices and insulators for deformation, cracks, breakage and discoloration caused by overheat and deterioration. 3) Check for foulness and dust.	1) Retighten. 2), 3) Visual inspection	1), 2), 3) No abnormalities
	Conductor and wire	1) Check the conductor for discoloration and distortion caused by overheat. 2) Check the sheath of the cable for cracks and discoloration.	1), 2) Visual inspection	1), 2) No abnormalitie s
	Terminal block	Damage	Visual inspection	No abnormalities
	Smoothing capacitor	1) Check for electrolyte leakage, discoloration, cracks and swelling of the case. 2) Check for safety valve protrusion and remarkably protruding valve 3) Measure the capacitance.	1), 2) Visual inspection 3) Monitor H42 Life judgment and measure with capacitance probe.	1), 2) No abnormalities 3) Capacitance ≧ (Initial value) x 0.85
Main circuit	Resistor	1) Check for odour caused by overheat and cracked insulator. 2) Check for broken wire.	1) Smelling and visual inspection 2) Visual inspection or measurement with multimeter under disconnection of one lead	1) No abnormalities 2) Within ± 10% of displayed resistance
	Transformer	Check for abnormal roaring noise and odour.	Hearing, visual and smelling inspection	No abnormalities
	Relay	1) Check for chatters during operation. 2) Check for rough contacts.	1) Hearing inspection 2) Visual inspection	1),2) No abnormalities
Control circuit	Control printed circuit board, connector	1) Check for loose screws and connectors. 2) Check for odour and discoloration. 3) Check for cracks, breakage, deformation and remarkable rust. 4) Check the capacitors for electrolyte leaks and deformation.	1) Retighten. 2) Smelling and visual inspection 3), 4) Visual inspection	1),2),3),4) No abnormalities
Cooling system	Cooling fan	1) Check for abnormal noise and excessive vibration. 2) Check for loose bolts. 3) Check for discoloration caused by overheat.	1) Hearing and visual inspection, or turn manually (be sure to turn the power off). 2) Retighten. 3) Visual inspection 4) Life judgment based on maintenance data*	1) Smooth rotation 2),3) No abnormalities
	Ventilation path	Check the heat sink, intake and exhaust ports for clogging and foreign matter.	Visual inspection	No abnormalities

Remarks: Remove foulness using cleaning cloth which is chemically neutral. Use a vacuum cleaner to remove dust.

∗ Judgment of life using maintenance data

The maintenance data of function codes H42 and H43 can be used to display data for the judgment of the capacitance of the capacitor in the main circuit and the life of the cooling fan to obtain a measure for the judgment of parts replacement. The capacitor life forecast signal is issued at the Y1 and Y2 terminals according to the measured capacitance after the capacitance of the capacity reaches 85%.

(1) Measurement of capacitance of capacitor in main circuit
This inverter is provided with a function where the capacitance of the main circuit capacitor is automatically measured upon shutoff of the inverter under certain conditions and it is displayed on the keypad panel upon power-up.
The capacitance of the capacitor is displayed in the reduction ratio (% display) of the initial value stored inside the inverter before shipment.

Procedure of measurement of capacitor capacitance

1. Remove the optional card from the inverter if it is mounted. Disconnect the braking unit or direct current bus to another inverter from the P (+) and N (-) terminals of the main circuit if there is any. The power factor improving reactor (DC reactor) may not be disconnected.
2. Turn the digital inputs (FWD, REV, X1-X5) at the control terminals off. Disconnect the RS 485 communication terminal if it is connected.
3. Turn the main power supply on. Check that the cooling fan rotates. Check that the inverter is stopped. (The "OH2 external alarm" caused by deactivated digital input terminals does not cause a problem).
4. Turn the main power supply off.
5. After the charge lamp is unlit completely, turn the main power supply on again.
6. Monitor function code H42 to check the capacitor capacitance (%).

(2) Life of cooling fan
Function code H43 indicates the total operation time of the cooling fan. The time is integrated in units of an hour and fractions shorter than an hour are ignored.
The actual life of the fan is largely effected by the temperature. Take the time as a measure.

Table 8-2-2 Measure for judgment of life based on maintenance data

Part	Judgment level
Main circuit capacitor	85% or lower of the initial value
Cooling fan	30,000 hours (4.0 kW or less), 25,000 hours (5.5 kW or more) *1

*1: Assumed life of cooling fan at ambient inverter temperature of 40 degree C.

8-3 Measurement of Electrical Amounts in Main Circuit

Because the voltage and current of the power supply (input) of the main circuit of the inverter and the output (motor) include harmonic components, the indicated value varies according to the type of the meter. Use meters indicated in Table 8-3-1 when measuring with meters for commercial frequencies. Marketed power factor meters measuring phase difference between the voltage and current cannot measure the power factor. To obtain the power factor, measure the power, voltage and current on each of the input and output sides and calculate in the following formula.

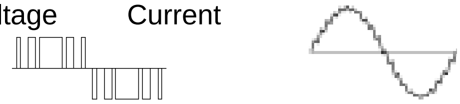
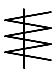
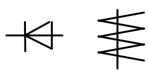
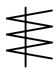
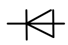
In case of Three-phase

$$\text{Power factor} = \frac{\text{Electric power[W]}}{\sqrt{3} \times \text{Voltage[V]} \times \text{Current[A]}} \times 100[\%]$$

In case of Single-phase

$$\text{Power factor} = \frac{\text{Electric power[W]}}{\text{Voltage[V]} \times \text{Current[A]}} \times 100[\%]$$

Table 8-3-1 Meters for measurement of main circuit

Item	Input (power supply) side			Output (motor) side			Link voltage (P(+)-N(-))
	Voltage Current 			Voltage Current 			
Name of meter	Ammeter $A_{R,S,T}$	Voltmeter $V_{R,S,T}$	Wattmeter $W_{R,S,T}$	Ammeter $A_{U,V,W}$	Voltmeter $V_{U,V,W}$	Wattmeter $W_{U,V,W}$	DC voltmeter V
Type of meter	Moving iron type	Rectifier or moving iron type	Digital power meter	Moving iron type	Rectifier type	Digital power meter	Moving coil type
Symbol of meter							

Note) When the output voltage is measured by a rectifier type, an error may be included. To increase the accuracy, use a digital AC power meter.

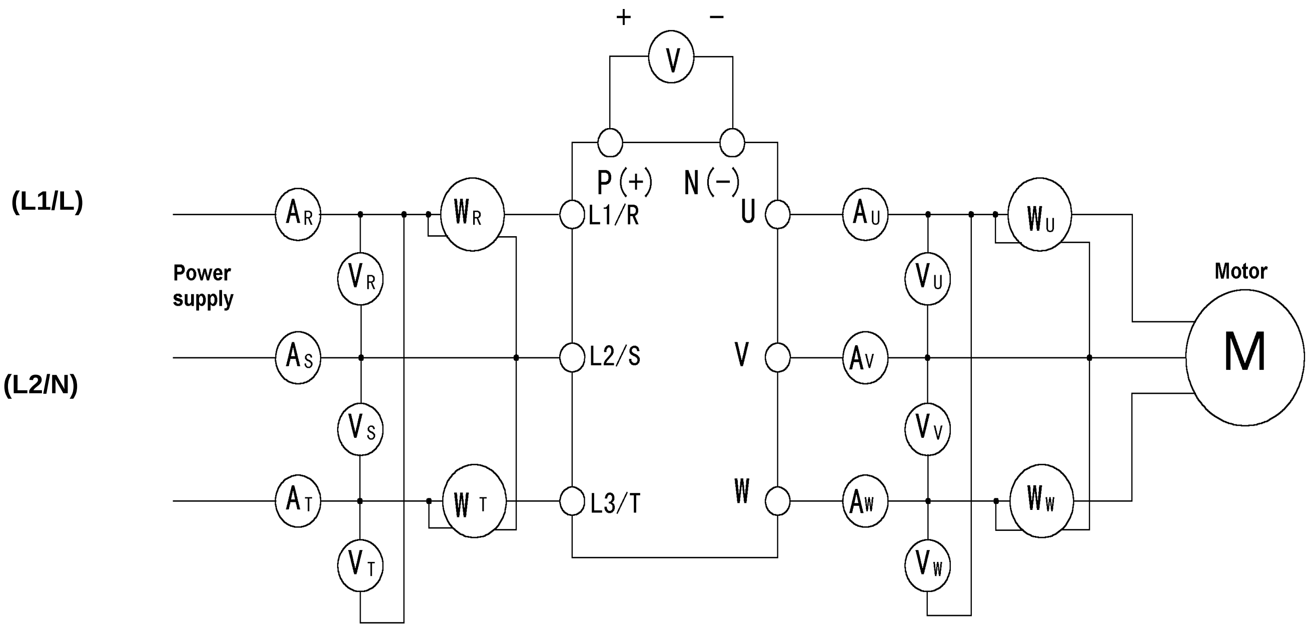


Fig. 8-3-1
Connection of meters

8-4 Insulation Test

Because an insulation test is made in the factory before shipment, avoid a Megger test. If a Megger test is unavoidable, follow the procedure below. Because a wrong test procedure will cause breakage of the inverter, take sufficient care.
A withstand voltage test will cause breakage of the inverter similarly to the Megger test if the test procedure is wrong. When the withstand voltage test is necessary, contact Bonfiglioli Group.

(1) Megger test of main circuit

1) Use a 500 VDC Megger and shut off the main power supply without fail during measurement.
2) If the test voltage leaks to the control circuit due to the wiring, disconnect all the control wiring.
3) Connect the main circuit terminals with a common cable as shown in Fig. 8-4-1.
4) The Megger test must be limited to across the common line of the main circuit and the ground terminal (⊜G).
5) MΩ or a larger value displayed at the Megger indicates a correct state. (The value is for a discrete inverter).

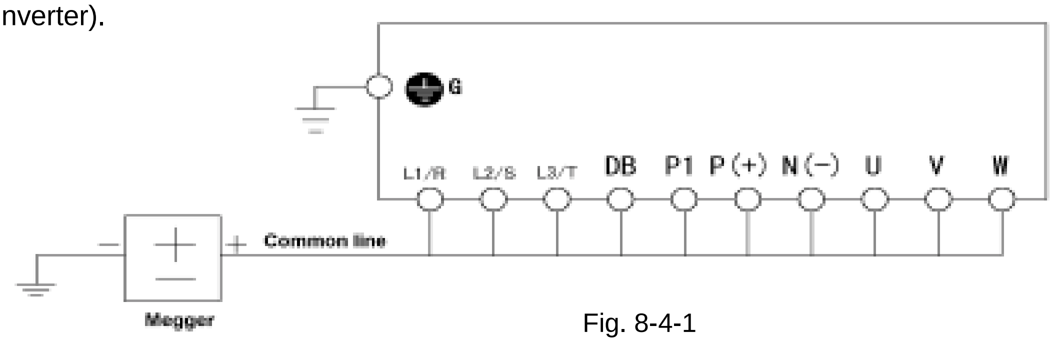


Fig. 8-4-1
Megger test

(2) Do not perform a Megger test or withstand voltage test to the insulation test control circuit of the control circuit. Prepare a high resistance range tester for the control circuit.

1) Disconnect all the external wiring from the control circuit terminals.
2) Perform a continuity test to the ground. 1 MΩ or a larger measurement indicates a correct state.

(3) External main circuit and sequence control circuit
Disconnect all the inverter terminals so that the test voltage is not applied

8-5 Replacement Parts

The life of the part is determined by the type of the part. The life of the part varies according to the environment and operating conditions, and replacement according to Table 8-5-1 is recommended.

Table 8-5-1 Replacement parts

Name of part	**Standard replacement years**	**Replacement method and others**
Cooling fan	3 years	Replace with a new part.
Smoothing capacitor	5 years	Replace with a new part. (Replace after inspection).
Electrolytic capacitors on printed circuit board	7 years	Replace with new circuit board. (Replace after inspection).
Other parts	–	Determine after inspection.

8-6 Inquiries about Product and Guarantee

(1) When making an inquiry
Upon breakage of the product, uncertainties, failure or inquiries, report the following information to Bonfiglioli Group.

a) Inverter type
b) SER NO. (serial number of equipment)
c) Date of purchase
d) Inquiries (for example, point and extent of breakage, uncertainties, failure phenomena, and other circumstances)

(2) Guarantee of the product
The product guarantee term is one year after the date of delivering. However, the product will not be repaired free of charge in the following cases, even if the guarantee term has not expired:

a) The cause includes incorrect usage or inappropriate repairs or remodelling.
b) The product is used outside the standard specified range.
c) The failure is caused by dropping, damage or breakage during transportation after the purchase.
d) The cause is earthquake, fire, storm or flood, lightening, excessive voltage, or other types or secondary disasters.

9. Specifications

9-1 Standard Specifications

(1) Single-phase 200V input

Item		Detail specifications					
Inverter type GVX1000-[][]-S		0.1	0.2	0.4	0.75	1.5	2.2
Nominal applied motor *1 [kW]		0.1	0.2	0.4	0.75	1.5	2.2
Output ratings	Rated capacity *2 [kVA]	0.31	0.59	1.1	1.9	3.1	4.3
	Rated voltage *3 [V]	Three-phase 200V / 50 Hz, 200V, 220V, 230V / 60 Hz (with AVR function)					
	Rated current *4 [A]	0.8 (0.7)	1.5 (1.4)	3.0 (2.5)	5.0 (4.0)	8.0 (7.0)	11 (10)
	Overload capability	150% of rated output current for 1 min. 200% of rated output current for 0.5 s					
	Rated frequency [Hz]	50, 60Hz					
Input ratings	Phases, Voltage Frequency	Single-phase 200 to 240 V / 50 to 60 Hz *10					
	Voltage/frequency fluctuation	Voltage : +10 to -10% Frequency : +5 to -5%					
	Momentary voltage dip capability *5	Operation continues at 165V or higher voltage. When the input voltage drops below 165V from the rated voltage, operation continues for 15 ms.					
	Rated current [A] (With DCR)	1.2	2.0	3.5	6.5	11.8	17.7
	(Without DCR) *9	2.3	3.9	6.4	11.4	19.8	28.5
	Required power supply capacity *6 [kVA]	0.3	0.4	0.7	1.3	2.4	3.6
Braking	Braking torque *7 [%]	100		70			40
	Braking torque *8 [%]	150					
	DC braking	Starting frequency: 0.0 to 60 Hz, braking current (0 to 100% in 1% increment), braking time (0.0 to 30.0 s)					
Enclosure (IEC60529)		IP20					
Cooling method		Natural cooling				Fan cooling	
Mass [kg]		0.6	0.7		1.2	1.8	1.9

*1 The applicable standard motor indicates the case for a 4P standard motor made by Bonfiglioli Group.
*2 The rated capacity indicates the case for 230V output voltage.
*3 Voltages larger than the source voltage cannot be output.
*4 Amperage values in parentheses () are applicable to operation with 4 kHz or higher carrier frequencies (F26 = 4 or more) or ambient temperatures exceeding 40 °C.
*5 Tests at standard load condition (85% load)
*6 Indicates the value when using a DC reactor (DCR).
*7 Indicates the average braking torque for decelerating and stopping a discrete motor from 60 Hz. (Varies according to the efficiency of the motor).
*8 Indicates the value with an external braking resistor (option).
*9 Calculated on assumption that the inverter is connected to 500kVA power supply.
*10 Safe separation for control interface of this inverter is provided when this inverter is installed in over voltage category II. Basic insulation for control interface of this inverter is provided when this inverter is installed in over voltage category III.

(2) Three-phase 400V input

Item		Detail specifications						
Inverter type GVX1000-[][]-T		0.4	0.75	1.5	2.2	4.0	5.5	7.5
Nominal applied motor *1 [kW]		0.4	0.75	1.5	2.2	4.0	5.5	7.5
Output ratings	Rated capacity *2 [kVA]	1.0	1.7	2.6	3.9	6.4	9.3	12
	Rated Voltage *3 [V]	Three-phase 380,400,415V/50Hz, 380,400,440,460V/60Hz (with AVR function)						
	Rated current *4 [A]	1.5 (1.4)	2.5 (2.1)	3.7 (3.7)	5.5 (5.3)	9.0 (8.7)	13 (12)	18 (16)
	Overload capability	150% of rated output current for 1 min. 200% of rated output current for 0.5s						
	Rated frequency [Hz]	50, 60Hz						
Input ratings	Phases, Voltage Frequency	Three-phase 380 to 480 V / 50 to 60Hz *11						
	Voltage/frequency fluctuation	Voltage : +10 to -15% Voltage unbalance 2% or less *10 Frequency : +5 to -5%						
	Momentary voltage dip capability *5	Operation continues at 300V or higher voltage. When the input voltage drops below 300V from the rated voltage, operation continues for 15 ms.						
	Rated current [A] (With DCR)	0.82	1.5	2.9	4.2	7.1	10.0	13.5
	(Without DCR) *9	1.8	3.5	6.2	9.2	14.9	21.5	27.9
	Required power supply capacity *6 [kVA]	0.6	1.1	2.1	3.0	5.0	7.0	9.4
Braking	Braking torque *7 [%]	70			40		20	
	Braking torque *8 [%]	150						
	DC braking	Starting frequency: 0.0 to 60.0 Hz, braking current (0 to 100% in 1% increment), braking time (0.0 to 30.0 s)						
Enclosure(IEC60529)		IP20						
Cooling method		Natural cooling		Fan cooling				
Mass [kg]		1.1	1.2	1.3	1.4	1.9	4.5	

*1 The applicable standard motor indicates the case for a 4P standard motor made by Bonfiglioli Group.
*2 The rated capacity indicates the case for 415V output voltage.
*3 Voltages larger than the source voltage cannot be output.
*4 Amperage values in parentheses () are applicable to operation with 4 kHz or higher carrier frequencies (F26 = 4 or more) or ambient temperatures exceeding 40 °C.
*5 Tests at standard load condition (85% load)
*6 Indicates the value when using a DC reactor (DCR).
*7 Indicates the average braking torque for decelerating and stopping a discrete motor from 60 Hz. (Varies according to the efficiency of the motor).
*8 Indicates the value with an external braking resistor (option).
*9 Calculated on assumption that the inverter is connected to 500kVA power supply.
*10 Refer to IEC61800-3 5.2.3.
*11 Safe separation for control interface of this inverter is provided when this inverter is installed in over voltage category II. Basic insulation for control interface of this inverter is provided when this inverter is installed in over voltage category III.

9-2 Common Specifications

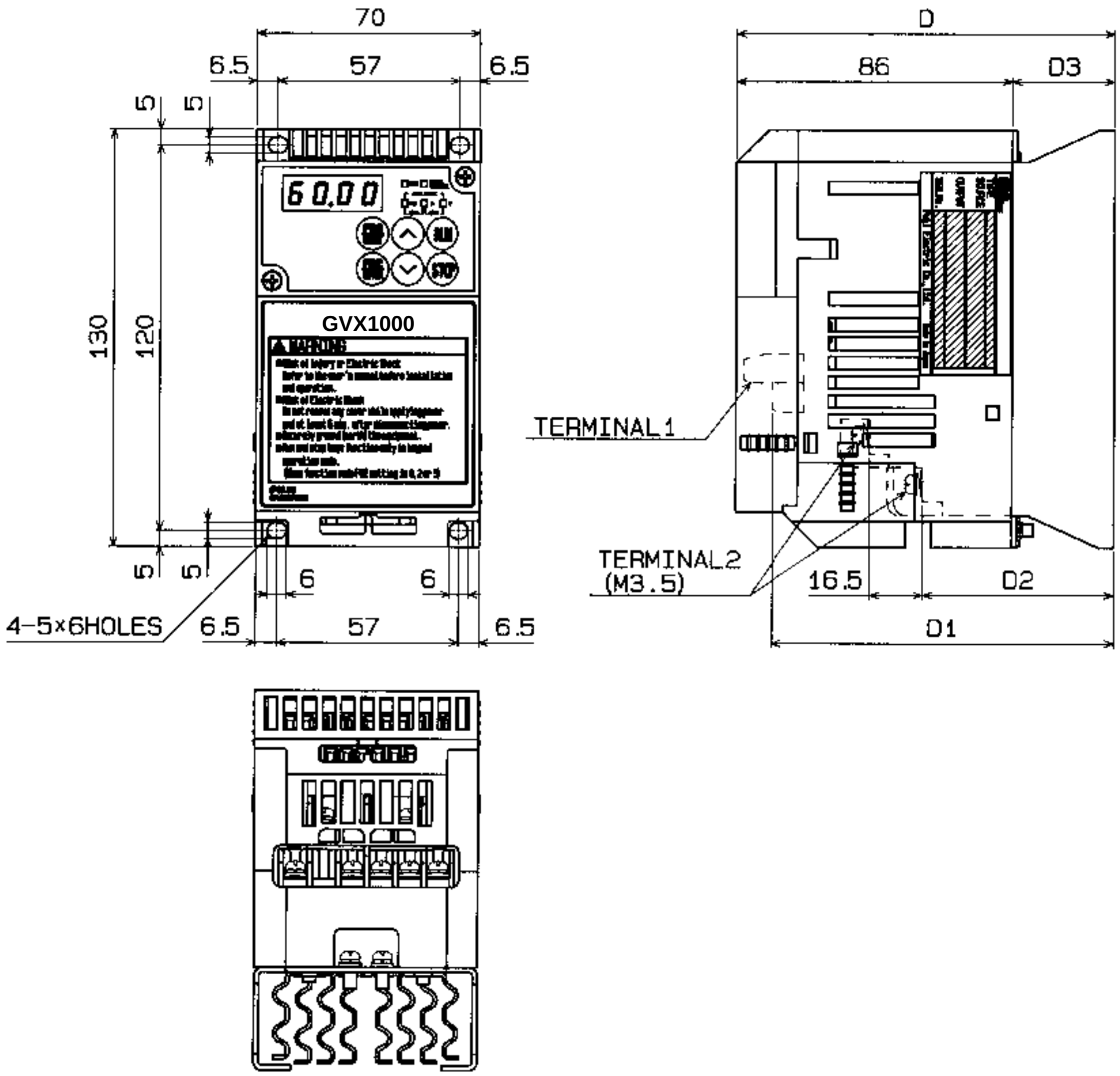
Item			Detail specifications
Output frequency	Adjustment	Maximum frequency	50 to 400 Hz variable
		Base frequency	25 to 400 Hz variable
		Starting frequency	0.1 to 60.0 Hz variable, Holding time : 0.0 to 10.0s.
		Carrier frequency	0.75 to 15 kHz (The carrier frequency may automatically drop to 0.75 kHz to protect the inverter.)
	Accuracy		Analogue setting: Within ± 0.2 % (25 ± 10 °C) Digital setting: Within 0.01% (-10 to +50 °C)
	Setting resolution		Analogue setting: 1/3000 of maximum output frequency Keypad panel setting: 0.01 Hz (99.99 Hz or lower), 0.1 Hz (100.0 to 400.0 Hz) Link setting : 1/20000 of Maximum frequency (0.003Hz at 60Hz,0.006Hz at 120Hz,0.02Hz at 400Hz) or 0.01Hz (Fixed)
Control	Voltage/freq. Characteristics		Adjustable at base and maximum frequency, with AVR control : 80 to 240 V(200V class),160 to 480V(400V class)
	Torque boost		Automatic : Automatic torque boost can be selected with code setting. Manual : Setting by codes 1 to 31 (Boost for Variable torque available)
	Starting torque		Starting torque 200% or above (with dynamic torque vector turned on, during 0.5 Hz operation)
	DC braking		Braking time (0.0 to 30.0 s), braking current (0 to 100%), braking starting frequency (0.0 to 60.0 Hz) variable
	Control method		Sinusoidal PWM (Dynamic torque vector control) with "current vibration suppression function" and "dead time compensation function"
	Operation method		Keypad operation: starting and stopping with RUN and STOP keys. (Keypad panel) Digital input signal: forward (reverse) operation, stop command (3-wire operation possible), coast-to-stop command, external alarm, error reset, etc. Link operation : RS485 (Standard) Profibus-DP, Interbus-S, DeviceNet, Modbus Plus, CAN open (Option)

Item		Detail specifications
Control	Frequency setting	Keypad operation: ∧ key and ∨ key. Setting with potentiometer (external potentiometer: 1 to 5 kΩ 1/2 W) Setting with 0 to ± 5 Vdc. Setting with 0 to ± 10 Vdc. Setting with 4 to 20 mAdc. 0 to +10 Vdc / 0 to 100% can be switched to +10 to 0 Vdc / 0 to 100% externally. 4 to 20 mAdc / 0 to 100% can be switched to 20 to 4 mAdc / 0 to 100% externally.
	(UP/DOWN control)	An external signal can be used to control the UP or DOWN command.
	(Multistep frequency)	Up to 16 different frequencies can be selected by digital input signals.
	(Link operation)	Link operation : RS485 (Standard) Profibus-DP, Interbus-S, DeviceNet, Modbus Plus, CAN open (Option)
	Acceleration / deceleration time (Mode select)	Variable setting in 0.01 to 3600s range. (2 sets of time can be set internally for each of acceleration and deceleration). Linear, S-curve (weak, strong), Non-linear available.
	Frequency limiter	The high and low frequency limits can be set variably in a 0 to 100% range in Hz.
	Bias frequency	Can be set variably in -400 to 400 Hz range.
	Gain (frequency setting)	Can be set variably in a 0 to 200% range.
	Jump frequency control	Three jump frequencies and jump width (0 to 30 Hz) can be set.
	Rotating motor pickup (Flying start)	Operation without shock is possible.
	Auto-restart after momentary power failure	The motor speed can be detected after power recovery so that the motor is started at the speed.
	Slip compensation control	The load during regular operation can be detected for the control of the frequency. The compensation value can be set variably in a 0.00 to +15.00 Hz range to the rated frequency.
	Droop operation	The load during regular operation can be detected for the control of the frequency. The compensation value can be set in a -9.9 to 0.0 Hz range to the rated frequency. (Speed droop characteristics)
	Torque limiter	When the load torque in the driving or braking mode exceeds the setting, the frequency is controlled to control the load torque to an almost constant level. The limiting torque can be set 20 to 200% and the driving and braking torque values can be independently set. The second torque limits can be set.

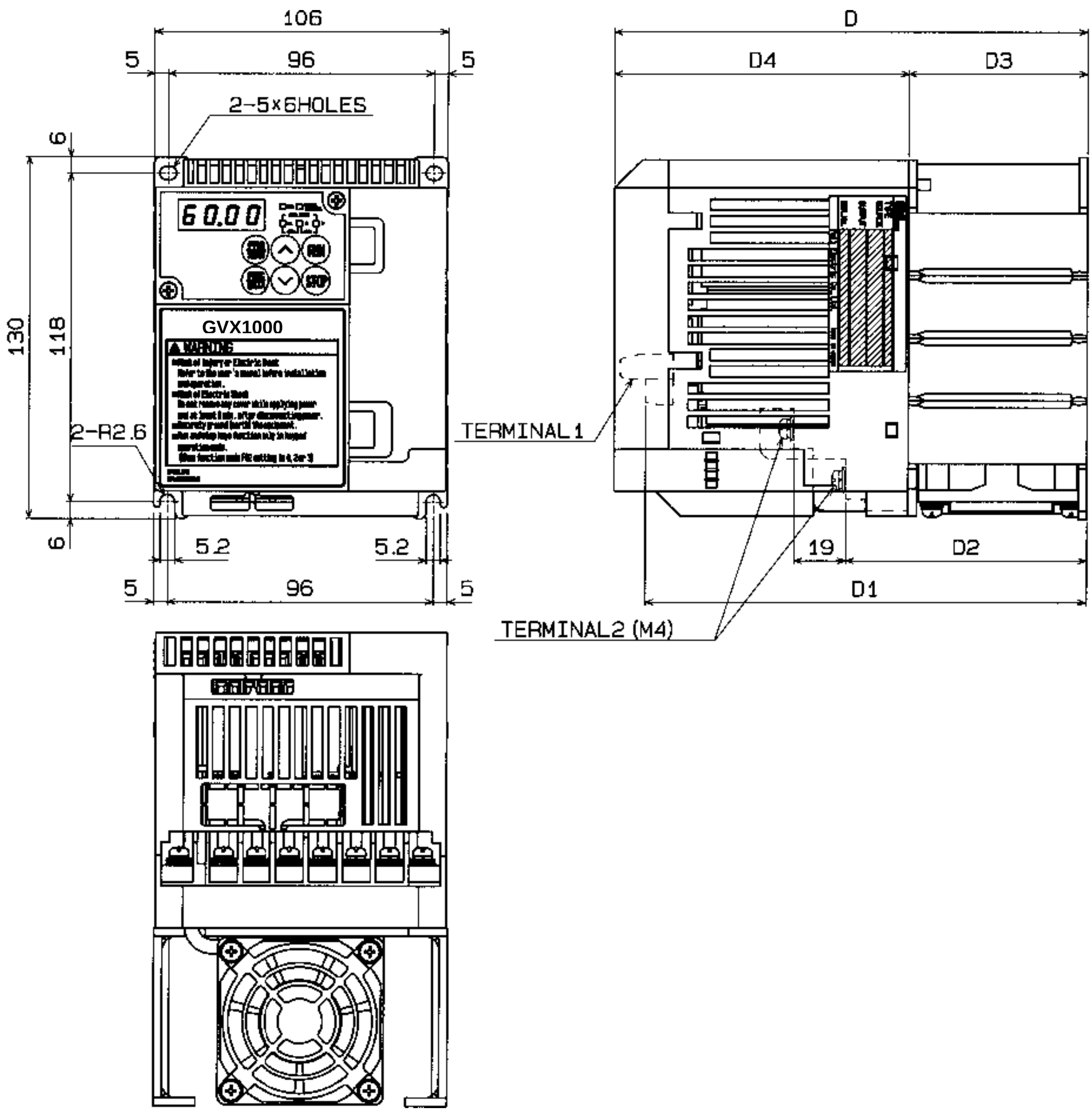
Item		Detail specifications
Control	PID control	This function can control flowrate, pressure, etc. with analogue feedback signal. The reference and feedback values are displayed in %. **Reference signal** Keypad operation (∧) key and (∨) key. : 0.0 to 100% Voltage input (Terminal 12) : 0 to 10Vdc Current input (Terminal C1) : 4 to 20mAdc Multistep frequency setting : Setting freq./Max. freq.x100% RS485 : Setting freq./Max. freq.x100% **Feedback signal** Terminal 12 (0 to +10Vdc or +10 to 0Vdc) Terminal C1(4 to 20mAdc or 20 to 4mAdc)
	Second motor's setting	The V/f pattern of the second motor can be internally set for selection by means of an external signal. The constant of the second motor can be internally set for selection by means of an external signal. The electronic thermal overload relay of the second motor can be internally set for selection by means of an external signal.
	Energy saving operation	Weak magnetic flux can be set for small loads for operation with an increased motor efficiency.
Display	During operation/stop	The keypad panel can be extended. (Optional 5m extension cable is available). 7-segment LED display items • Set frequency • Output frequency • PID setting/feedback value • Output current • Motor r/min • Output voltage • Line speed (A soft filter is provided to attenuate the fluctuation in the displayed value). A charge lamp indicates power supply.
	When setting	The function code and data code are displayed.
	When tripping	[The cause of tripping is displayed.] • OC1 (over current: during acceleration) • OC2 (over current: during deceleration) • OC3 (over current: during constant speed operation) • OU1 (over voltage: during acceleration) • OU2 (over voltage: during deceleration) • OU3 (over voltage: during constant speed operation) • LU (under voltage) • Lin (input phase loss) (for 3-phase inverter) • dbH (external damping resistor overheat (thermal overload relay)) • OH1 (overheat: heat sink) • OH2 (overheat: external thermal overload relay) • OL1 (overload: motor 1) • OL2 (overload: motor 2) • OLU (overload: inverter) • Er1 (memory error) • Er2 (keypad panel communication error) • Er3 (CPU error) • Er4 (option error) • Er5 (option error) • Er7 (output wiring error) (impedance imbalance) • Er8 (RS485 communication error)
	During operation, when tripping	The latest four records of trip history are stored and displayed.

Item		Detail specifications
Protection	Overload protection	Inverter protection electronic thermal overload relay
	Over voltage protection	An excess in the DC link circuit voltage (approx. 400 Vdc for 200V class, approx. 800Vdc for 400V class) is detected for inverter protection.
	Over current protection	The inverter is protected against an over current caused by an overload on the output side.
	Surge protection	The inverter is protected against a surge voltage penetrating between the power supply cable of the main circuit and the ground.
	Undervoltage protection	Voltage drop (approx. 200 Vdc for 200V class, approx. 400Vdc for 400V class) in the DC link circuit voltage is detected to stop the inverter.
	Overheat protection	The inverter is protected against failure and overload of the cooling fan.
	Short-circuit protection	The inverter is protected against an overcurrent caused by a short-circuit on the output side.
	Ground fault protection	The inverter is protected against an overcurrent caused by ground fault in the output wiring. * Detection when starting
	Motor protection	Electronic thermal overload relays protect general purpose motors and Bonfiglioli Group inverter motor. The thermal time constant can be adjusted to 0.5 to 10.0 min. Second electronic thermal overload relay can be provided. (Switching with external signal)
	Braking resistor protection	Upon an overheat of the damping resistor (external unit), discharging operation and inverter operation stop
	Stall prevention (simple torque limit)	• When the output current exceeds the limit during acceleration, the frequency change is stopped to avoid overcurrent stop. • When the output current exceeds the setting during constant speed operation, the frequency is decreased to maintain an almost constant torque. • When the DC voltage exceeds the limit during deceleration, the frequency change is stopped to avoid overvoltage stop.
	Input phase loss protection	The inverter is protected against phase loss in the input voltage.
	Output phase loss protection	An unbalance in the impedance of the output circuit is detected to output an alarm. (Error during tuning only)
	Auto reset	The number of retries and wait time can be set for the alarm stop.
Environment	Installation location	• Indoors • Places without corrosive gases, flammable gases or dust (degree of pollution: 2) • Places without direct sunlight
	Ambient temperature	-10 to +50 °C
	Relative humidity	5 to 95% RH (without condensation)
	Altitude	1000 m Max. (Atmospheric pressure 86 to 106 kPa)
	Vibration	3mm 2 to 9 Hz 9.8m/s^2 9 to 20 Hz 2m/s^2 20 to 55 Hz 1m/s^2 55 to 200 Hz
	Storage temperature	-25 to +65 °C
	Storage humidity	5 to 95% RH (without condensation)

9-3 External Dimensions

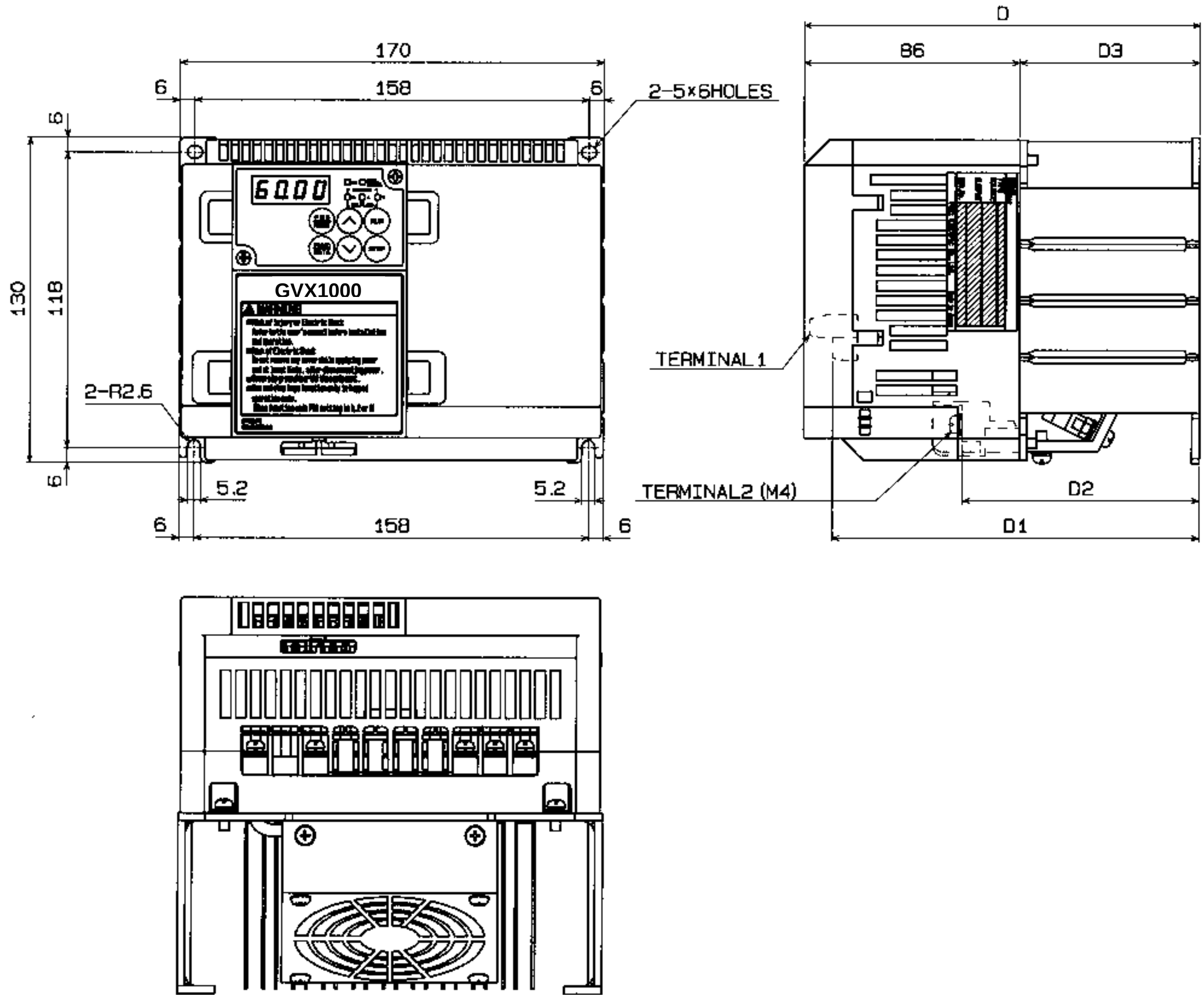


Type	Standard applicable motor [kW]	External dimensions (mm)			
		D	D1	D2	D3
GVX1000-0.1-S	0.1	96	85	38	10
GVX1000-0.2-S	0.2	101	90	43	15
GVX1000-0.4-S	0.4	118	107	60	32



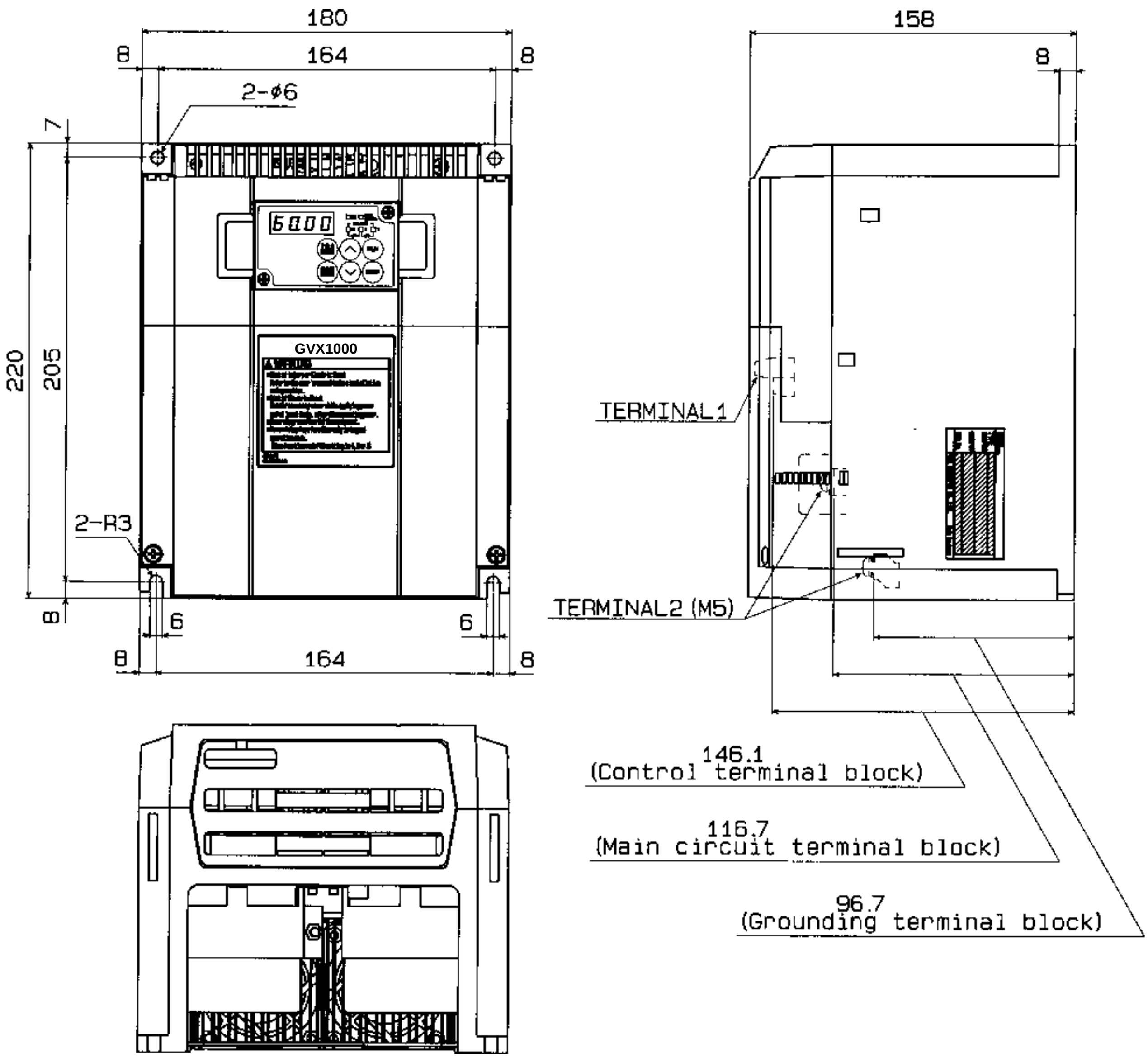
Installation screw size : M4 (4 pcs)

Type	Standard applicable motor [kW]	External dimensions (mm)				
		D	D1	D2	D3	D4
GVX1000-0.75-S	0.75	126	115	63	40	86
GVX1000-0.4-T	0.4	126	115	63	40	86
GVX1000-0.75-T	0.75	150	139	87	64	86
GVX1000-1.5-T	1.5	170	159	87	64	106
GVX1000-2.2-T	2.2	170	159	87	64	106



Installation screw size : M4 (4 pcs)

Type	Standard applicable motor [kW]	External dimensions (mm)			
		D	D1	D2	D3
GVX1000-1.5-S	1.5	158	147	95	72
GVX1000-2.2-S	2.2				
GVX1000-4.0-T	4.0				



Installation screw size : M5 (4pcs)

GVX1000-5.5-T
GVX1000-7.5-T

9-4 RS485 Communication

Remove the keypad panel of the inverter referring to section 1-3 (3) and use the connector having been connected with the keypad panel to connect up to 31 inverters in a line to perform the following operations.

- Frequency setting, forward/reverse rotation, stop, coast to stop, alarm reset and other operations
- Monitoring of output frequency, output current, operation state, alarm description, and so on
- Setting of function code data (function code data, command data and monitor data)

The transmission frame is character data having a fixed length of 16 bytes, so that development of programs for the host controller is easy. The operation and frequency setting command requiring fast speeds can be in a short frame for shorter communication time. The functions of the serial communication connector are shown in Table 9-4-1.

Table 9-4-1 Functions of serial communication connector

Terminal No.	Terminal symbol	Name of terminal	Specification
4	DX+	RS 485 communication signal (not inverse)	Connection of serial communication signal; compliance with RS485
3	DX-	RS485 communication signal (inverse)	

The leftmost terminal of the connector when viewed from the front of the inverter is terminal 1.
Never connect the terminals other than the above because signal cables used for the keypad panel are connected. A terminator is built in the inverter.
Turn SW2 on (left side) below the serial communication connector for the inverter connected at the end of the cable to connect the terminator.
When you communicate more than one inverter, use a branch adapter in the table 9-4-2 and connect like Fig9-4-2.

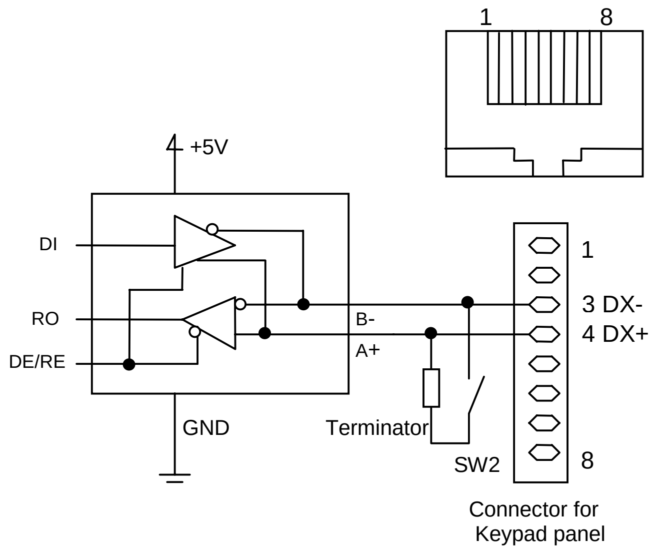
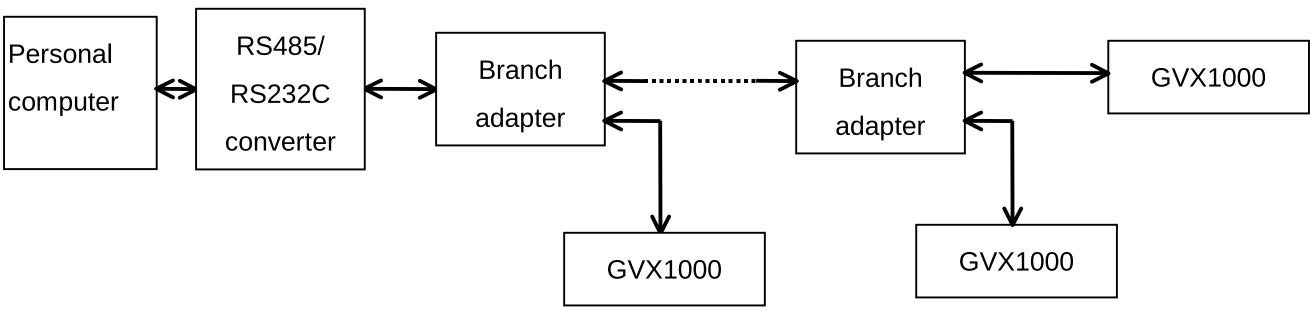


Fig. 9-4-1 Equivalent circuit of RS485 interface



(Remark)The branched cable length has to be 1m or less.
Terminator in the branched inverter has to be OFF.(SW2 OFF)

Fig. 9-4-2 Communication method with more than one inverter

9-4-1 Connector and Communication Cable

Use marketed products for the connector, the communication cable and branch adapter. Table 9-4-2 shows the specification of each of them.

Table 9-4-2 Connector and cable specification

Item	Specification
Connector	RJ45 connector
Cable	Cable complying with EIA568 (for 10BASE-T Straight connection) (Max. wiring length: 500m)
Branch adapter	MS8-BA-JJJ (SK KOHKI CO., LTD or equivalent).

9-4-2 Recommended RS-232C/RS485 Converter

For communications with PCs having an RS232C terminal, the following insulation type converter is recommended.

Model : Adam 4520
Manufacture : Advantech

9-4-3 Remote/local changeover

Operation between according to the frequency setting and operation commands sent via serial communication, and according to the frequency setting and operation commands set in the inverter main body, can be switched over.
The frequency setting and operation command selection is made as follows, using function H30 and remote/local switching.
The function of any of the X1 through X5 terminals of the inverter main body is changed to be the LE terminal which is used for remote/local switching. Any of the functions E01 through E05 is used to change the function of X1 to X5 terminal. If X1 through X5 terminals are not assigned to the LE terminal, it is always in the remote mode.

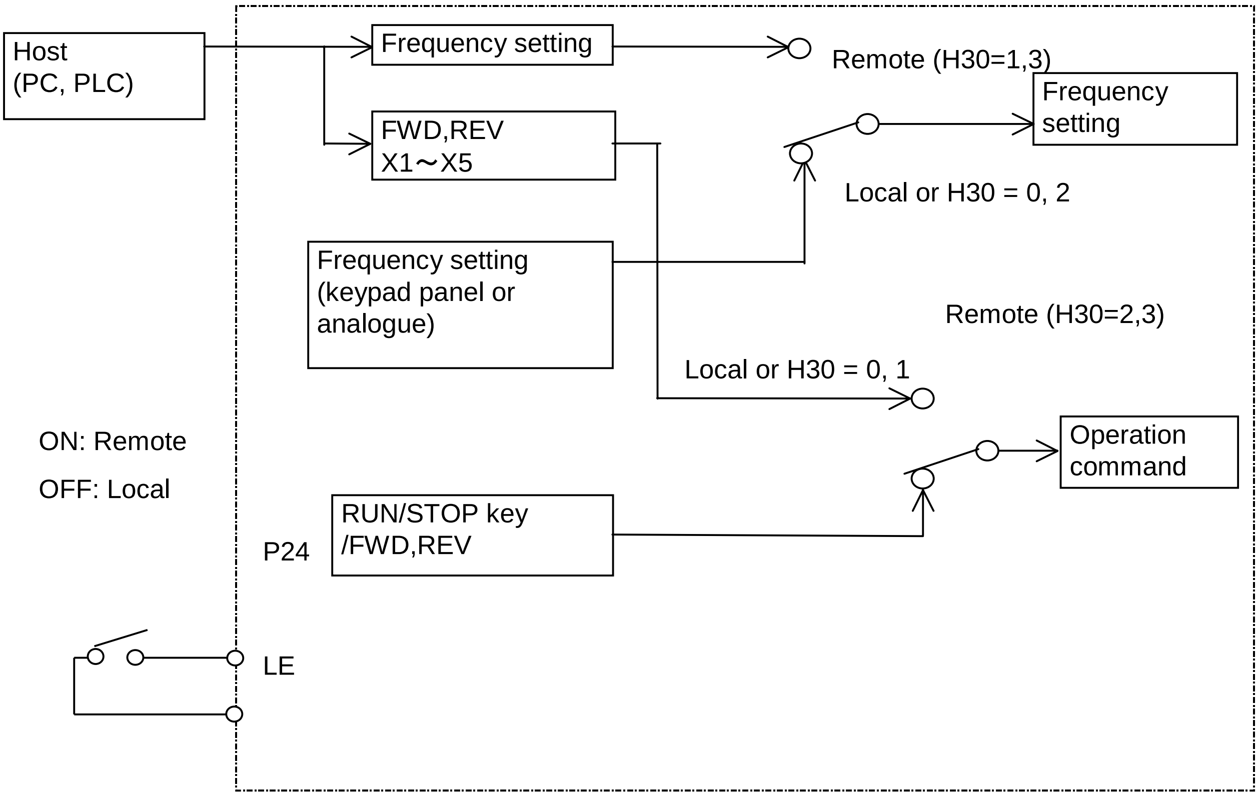


Fig. 9-4-3 Command switching block diagram

When X1 through X5 terminals are assigned with BX, THR and RST functions, the BX, THR and RST functions are activated even in the remote mode according to the inputs to the terminals. RS485 can not make THR ON/OFF.

9-4-4 Communication Protocol

(1) Serial communication specification

Table 9-4-3 Serial communication specification

Physical level	Compliance with EIA RS-485 (2-wire type)
Number of connected stations	Host x 1 unit, inverter x 31 units (Station address 1 to 31)
Transmission speed	19200, 9600, 4800, 2400, 1200[bit/s]
Synchronization method	Start-stop
Transmission method	Half duplex
Transmission protocol	Polling/selecting, broadcast
Character type	ASCII 7 bits
Character length	Selection between 7 and 8 bits
Transmission distance	Max. 500 m
Stop bit	Selection between 1 and 2 bits
Frame length	Standard frame: fixed to 16 bytes, short frame: 8 or 12 bytes
Parity	Selection from none, even and odd
Error check method	Checksum, parity, framing error

(2) Transmission protocol

It is the half duplex communication in the polling/selecting method. The inverter always waits for a write request (selecting) or a read request (polling) from the host. The inverter, when receiving in the wait state a request frame to the own station from the host, returns a response frame. Upon polling, it returns data together. In the case of broadcasting (selection of all stations in a batch), no response is returned.

(3) Transmission procedure

1) Set communication functions H30 through H39.
2) Make communication according to transmission frames.
3) If no response returns for one second from the inverter upon a frame from the host, retry communication. Several retries indicate certain errors. Make investigation.
4) If no communication is received from the host for 30 seconds after the first operation command is received, the inverter judges a transmission breakdown error and shuts down the inverter output, leaving the motor to coast to stop.
5) After consecutive eight communication errors, the inverter output is shut down and the motor coasts to stop.

(4) Host controller transmission procedure

Do not send the next frame unless the response is returned.

If the inverter does not respond for longer than the standard time, timeout should be judged and retry should be performed. If a retry is started before timeout, normal reception may become impossible, so that timeout should be judged correctly. The timeout time is one second in the selecting mode and 0.5 second in the polling mode. In the retry sequence, send the same frame again as that sent before no response, or send a polling (M26: communication error monitor) frame for reading an error, and check for a normal response. (Judge the timeout again during the check).

If a normal response is returned, a transient transmission error due to noise or the like is indicated, and correct communication can be continued. If retries occur frequently, any abnormalities are probable. In-depth investigation is necessary. If no response is returned, continue retrying. If there are three retries, there is some trouble in the hardware or software of the host controller. Terminate the software of the host controller and investigate.

No error code is returned in the case of negative acknowledgment of a short frame. Judge the error code using the communication error monitor (M26) separately.

9-4-5 Standard Frame

The ASCII code character method is employed. A standard frame has a fixed length of 16 bytes.
Using optional frames (12 bytes or 8 bytes), the transmission speed can be increased.
Host→Inverter frame
Note: Numbers with "H" at the end indicate hexadecimals.

Byte	7(6) ... 0	
0	Start-of-heading character (SOH)	← Fixed to 01H.
1	Tens digit of station address (ASCII)	Designate a station address of the destination inverter with 01 to 31 or 99. (ASCII designation of each digit)
2	Units digit of station address (ASCII)	
3	Enquiry character (ENQ)	←Fixed to 05H.
4	Command type character (ASCII)	←E: Reset command, R: Polling (reading), W: Selecting (writing)
5	Function type character (ASCII)	←"S", "M", "F", "E", "C", "P", "H" or "A" is designated.
6	Tens digit of function number (ASCII)	Designate a function number using a two-digit number. (Designate each digit of 00 to 46 in ASCII).
7	Units digit of function number (ASCII)	
8	Space (ASCII)	←Fixed to 20H
9	First character of data (ASCII)	The data corresponding to the function is converted into a 4-digit hexadecimal, and each digit is designated in ASCII.
10	Second character of data (ASCII)	
11	Third character of data (ASCII)	
12	Fourth character of data (ASCII)	
13	End-of-text character (ETX)	← Fixed to 03H
14	Upper digit of checksum (ASCII)	From tens digit of the station address to ETX are added in a binary and the lower two digits of it in hexadecimal notation are stored in ASCII as a checksum.
15	Lower digit of checksum (ASCII)	

Inverter→Host frame

Byte	7(6) ... 0	
0	Start-of-heading character (SOH)	← Fixed to 01H
1	Tens digit of station address (ASCII)	Station address of responding inverter (01 to 31) (ASCII designation of each digit)
2	Units digit of station address (ASCII)	
3	Response character (ACK/NAK)	← 06H: Normal response (ACK), 15H: Faulty response (NAK)
4	Command type character (ASCII)	← E: Reset command, R: Polling (reading), W: Selecting (writing)
5	Function type character (ASCII)	← "S", "M", "F", "E", "C", "P", "H" or "A" is responded (the character transmitted by the host is returned).
6	Tens digit of function number (ASCII)	The function number is designated in a two-digit number. (The number sent by the host is returned).
7	Units digit of function number (ASCII)	
8	Special additional data (ASCII)	← Space (20H) or "-" (2DH)
9	First character of data / space (ASCII)	The data sent by the host is returned in normal response, or an error code is returned upon an error.
10	Second character of data / space (ASCII)	
11	Third character of data / tens digit of error code (ASCII)	
12	Fourth character of data / units digit of error code (ASCII)	
13	End-of-text character (ETX)	← Fixed to 03H
14	Upper digit of checksum (ASCII)	From tens digit of the station address to ETX are added in a binary and the lower two digits of it in hexadecimal notation are stored in ASCII as a checksum.
15	Lower digit of checksum (ASCII)	

9-4-6 Short Frame

Short frames are prepared for special functions to reduce the data transmission time.

(1) Selecting

Host→ Inverter (selecting)

	7(6) 0	
0	Start-of-heading character (SOH)	← Fixed to 01H
1	Tens digit of station address (ASCII)	Designate a station address of the destination inverter with 01 to 31 or 99. (Designation of each character in ASCII)
2	Units digit of station address (ASCII)	
3	Enquiry character (ENQ)	← Fixed to 05H
4	Command type character (ASCII)	← "a", "e", "f" or "m" is designated.
5	First character of data (ASCII)	The data corresponding to the function is converted into a four-digit hexadecimal and each digit is designated in ASCII.
6	Second character of data (ASCII)	
7	Third character of data (ASCII)	
8	Fourth character of data (ASCII)	
9	End-of-text character (ETX)	← Fixed to 03H
10	Upper digit of checksum (ASCII)	From tens digit of the station address to ETX are added in a binary and the lower two digits of it in hexadecimal notation are stored in ASCII as a checksum.
11	Lower digit of checksum (ASCII)	

Inverter→ Host frame (selecting)

	7(6) 0	
0	Start-of-heading character (SOH)	← Fixed to 01H
1	Tens digit of station address (ASCII)	Station address of responding inverter (01 to 31) (designation of each digit in ASCII)
2	Units digit of station address (ASCII)	
3	Response character (ACK/NAK)	← 06H: Normal response (ACK), 15H: Faulty response (NAK)
4	Command type character (ASCII)	← "a", "e", "f" or "m" sent from the host is returned.
5	End-of-text character (ETX)	← Fixed to 03H
6	Upper digit of checksum (ASCII)	From tens digit of the station address to ETX are added in a binary and the lower two digits of it in hexadecimal notation are stored in ASCII as a checksum.
7	Lower digit of checksum (ASCII)	

(2) Polling

Host→ Inverter (polling)

Byte	7(6) … 0	Remarks
0	Start-of-heading character (SOH)	←Fixed to 01H
1	Tens digit of station address (ASCII)	Designate the station address of the destination inverter with 01 to 31 or 99. (Designation of each digit in ASCII)
2	Units digit of station address (ASCII)	
3	Enquiry character (ENQ)	← Fixed to 05H
4	Command type character (ASCII)	← "g", "h", "i", "j" or "k" is designated.
5	End-of-text character (ETX)	← Fixed to 03H
6	Upper digit of checksum (ASCII)	From tens digit of the station address to ETX are added in a binary and the lower two digits of it in hexadecimal notation are stored in ASCII as a checksum.
7	Lower digit of checksum (ASCII)	

Inverter→ Host frame (polling)

Byte	7(6) … 0	Remarks
0	Start-of-heading character (SOH)	
1	Tens digit of station address (ASCII)	Station address of responding inverter (01 to 31) (Designation of each digit in ASCII)
2	Units digit of station address (ASCII)	
3	Response character (ACK/NAK)	← 06H: Normal response (ACK), 15H: Faulty response (NAK)
4	Command type character (ASCII)	← "g", "h", "i", "j" or "k" sent from the host is returned.
5	First character of data (ASCII)	The data corresponding to the command is converted into a four digit hexadecimal and each digit is designated in ASCII.
6	Second character of data (ASCII)	
7	Third character of data (ASCII)	
8	Fourth character of data (ASCII)	
9	End-of-text character (ETX)	← Fixed to 03H
10	Upper digit of checksum (ASCII)	From tens digit of the station address to ETX are added in a binary and the lower two digits of it in hexadecimal notation are stored in ASCII as a checksum.
11	Lower digit of checksum (ASCII)	

9-4-7 Details of Frame

(1) Start-of-heading character (ASCII; SOH)

01H in binary.

(2) Tens digit and units digit of station address

Two ASCII characters expressing a decimal station address between 1 and 31.

Example: Station address 1: Tens digit of station address: ASCII "0", units digit of station address: ASCII "1"

Station address 31: Tens digit of station address: ASCII "3", units digit of station address: ASCII "1"

(3) Enquiry character (ASCII; ENQ)

05H in binary.

(4) Response character (ASCII; ACK/NAK)

The inverter sets ACK (06H) to recognize a request.

NAK (15H) is set when the request from the host includes a logical error.

(5) Command type character

In a standard frame, set "R" in ASCII for a polling (reading) request, or set "W" in ASCII for a selecting (writing) request. Set "E" in ASCII for a resetting command. Only the upper case characters are valid.
In a short frame, the function is directly designated using a command type character. Refer to (3) Short Frame in section 9-4-11 Function Code List for details.

(6) Function type character and tens digit and units digit of function number

A request function is designated in three characters. Refer to section 9-4-11 Function Code List for details.

(7) Special additional data

This is normally a space (20H). In a response frame issued by an inverter to request for frequency monitor (M09), a minus sign is set in ASCII during reverse rotation output.

(8) Data

In a selecting (writing) request frame sent from the host to an inverter, designate writing data. Refer to section 9-4-10 Data Type. In a polling (reading) frame, set space or arbitrary letter or number character. in a selecting response frame sent from an inverter to the host, data "0000" or an error code is contained, and in a polling frame, data or an error code is contained.

(9) End-of-text character (ASCII; ETX)

03H in binary.

(10) Upper digit and lower digit of checksum

A binary sum of all the characters from tens digit of the station address to the end-of-text character is obtained and the lower two digits of it in hexadecimal notation are expressed in ASCII codes. Set in the upper case.
Example. When the binary sum is "17EH"→ The upper digit of the checksum is "7" in ASCII. The lower digit of the checksum is "E" in ASCII.

9-4-8 Broadcasting

An operation command or frequency command destined to station address "99" is received and processed by all the inverters as broadcasting. However, no response is issued by the inverters.

9-4-9 Communication Error Code

The inverter detects the following errors. The error code is in hexadecimal notation.

Table 9-4-4 Communication error code

Error code (hexadecimal)	Name of error	Description
47H	Checksum error	The checksum of the frame sent to the own station is in discrepancy.
48H	Parity error	The parity is in discrepancy.
49H	Others	Reception error other than above (framing, overrun)
4AH	Format error	The enquiry character or the end-of-text character in the transmitted frame is in an incorrect position.
4BH	Command error	A code other than designated commands (standard and option) is sent.
4EH	Function code error	A request for an unknown function code is issued.
4FH	Write disable	A write prohibited function or in-operation write prohibited function is written during operation.
50H	Data error	Data exceeding the standard range is written.

The inverter does not return NAK in response to errors 47 through 49 above. It issues no response.
In the case of errors 4A through 50, an NAK response with an NAK code in the response character field and the two digit hexadecimal error code in the data field is returned.
The latest error can be referred to using the transmission error end code monitor (M26).

9-4-10 Data Type

(1) In the case of value data

16 bit data is expressed in a hexadecimal and set using four ASCII codes. Concretely speaking, the data is between "0000" and "FFFF".
Decimal fractions are weighted into integers. Refer to the corresponding section because the weight varies according to each piece of function data. In some functions, the negative value is expressed in two's complement.
The bit data is converted into the hexadecimal and expressed.
The acknowledgement sent from the inverter in response to a selecting (writing) request is the writing data. In the negative acknowledgement, the error code is returned in two hexadecimal characters.
Set "0000" or an arbitrary letters and numbers in the data to be transmitted to the inverter in a polling (reading) frame.
Example: Frequency data, weight 100 times
120.00Hz 120×100=12000=2EE0H
The data is "2" in ASCII, "E" in ASCII, "E" in ASCII and "0" in ASCII in order from the first character to the fourth character.
Acceleration time data, weight 10 times
6.5 sec: 6.5 x 10 = 65 = 41H
The data is "0" in ASCII, "0" in ASCII, "4" in ASCII and "1" in ASCII in order from the first character to the fourth character.

(2) In the case of bit data

For bit type data requested by S06, M13 or other functions, the bit data is expressed in hexadecimal notation and each digit is transmitted in ASCII codes.
Example: S06 with FWD (bit 0) ON, X1 (bit 2) ON, and X3 (bit 4) ON
Bit data = 0000 0000 0001 0101 → 0015H → 30H 30H 31H 35H
(Hexadecimal) (ASCII)

9-4-11 Function Code List

The function code includes the function codes indicated in chapter 5 "Selecting Functions" and the following functions for the standard and short frames.

(1) Functions for standard frame (command data)

Table 9-4-5 Standard frame (command data)

Name	Command type	Function type character and number	Data and operation
Reset command	E	3 spaces	Space is transmitted in the data field. The function resets a protective operation (tripping).
Frequency and speed command	R/W	S01	±20000d/fmax (Max. frequency)
Frequency command	R/W	S05	0.00 to 400.00 Hz / 0 to 40000 (100 times value) The inverter operates at the maximum frequency even if a value larger than the maximum frequency is set by function code F03. A communication command is read in the reading mode.
Operation command	R/W	S06	bit15:RESET 1: ON,0:OFF bits 14 to 7: Fixed to 0 bit6: X5 1:ON,0:OFF bit5: X4 1:ON,0:OFF bit4: X3 1:ON,0:OFF bit3: X2 1:ON,0:OFF bit2: X1 1:ON,0:OFF bit 1: REV (reverse rotation command) 1:ON,0:OFF bit 0: FWD (forward rotation command) 1:ON,0:OFF X1, X2, X3, X4 and X5 function according to function code E01 to E05 settings.
Acceleration time 1	R/W	S08	0.0～3600.0s/0～36000 (Value multiplied by 10)
Deceleration time 1	R/W	S09	0.0～3600.0s/0～36000 (Value multiplied by 10)
Torque limit level 1	R/W	S10	100% (rated torque) / + 10000 (Value multiplied by 100)
Torque limit level 2	R/W	S11	100% (rated torque) / + 10000 (Value multiplied by 100)

Notes)

1) Negative values are set in 2's complements.

2) When reading S01 or S05, the data commanded via communication is read out instead of the command value in the actual operation. To read the actual command value, read the monitor data.

3) If both S01 and S05 are designated (written with data other than zero), the S01 command is effective.

4) For the alarm input, "0" indicates a failure.

5) X1 through X5 are used for general purpose inputs; set the function of each terminal using the general input terminal setting of the inverter.

6) To cancel the torque limit of S10 and S11, send 7FFFH.

(2) Functions for standard frame (monitor data)

Table 9-4-6 Standard frame (monitor data)

Name	Command type character	Function type character and number	Data and operation
Frequency (Final value)	R	M01	±20000d/fmax (Max. frequency)
Frequency command value	R	M05	100=1.00Hz (Value multiplied by 100) The current frequency setting is returned.
Calculated torque value	R	M07	100% (rated torque) / ± 10000 (value multiplied by 100)
Torque current	R	M08	100% (rated current) / ± 10000 (value multiplied by 100)
Output frequency	R	M09	100=1.00Hz (Value multiplied by 100; special additional data: sign) The current output frequency is returned.
Motor output (power consumption)	R	M10	100% (rated output) / ± 10000 (value multiplied by 100)
Output current	R	M11	100 = 1% of rated inverter current The current output current is returned in the ratio to the rated current.
Output voltage	R	M12	10=1V
Operation command	R	M13	bit15:RESET 1:ON,0:OFF bits 14 to 5: Fixed to 0 bit6:X5 1:ON, 0:OFF bit5:X4 1:ON, 0:OFF bit4:X3 1:ON, 0:OFF bit3:X2 1:ON, 0:OFF bit2:X1 1:ON, 0:OFF bit 1: REV (reverse rotation command) 1:ON,0:OFF bit 0: FWD (forward rotation command) 1:ON,0:OFF The final command value including the state of the actual control terminal of the inverter is returned.
Operation status	R	M14	bit 15: Function code data being written bit 12: 1: Communication valid bit 11: 1: Batch failure (tripping) bit 10: 1: During deceleration bit 9: 1: During acceleration bit 8: 1: Current limit operation bit 7: 1: Voltage limit operation bit 6: 1: Torque limit operation bit 5: 1: DC link voltage established bit 4: 1: During braking bit 3: 1: During output shutoff bit 2: 1: During DC braking bit 1: 1: During reverse rotation bit 0: 1: During forward rotation
General purpose output terminal	R	M15	bit 1: Y2; active upon "1" bit 0: Y1; active upon "1"

Name	Command type character	Function type character and number	Data and operation
Failure description; current one	R	M16	Refer to (4) Alarm display data
Failure description; previous one	R	M17	
Failure description; one before previous one	R	M18	
Failure description; one before two previous ones	R	M19	
Total operation time	R	M20	0 to 65000 / 0 to 65000 hours
DC link voltage monitor	R	M21	0 to 500 / 0 to 500V (200V class) 0 to 1000 / 0 to 1000V (400V class)
Function code	R	M23	4112H = GVX1000 single-phase 200V 4113H = GVX1000 3-phase 200V 4114H = GVX1000 3-phase 400V
Capacity code	R	M24	1=0.01kW
ROM version	R	M25	0 to 99: Standard, > 100: Non-standard
Transmission error handling code	R	M26	Refer to section 9-4-9. The latest error is returned. The communication error is initialised when the power is turned off.
Main circuit capacitor life	R	M46	1=0.1%
Cooling fan life	R	M48	1 = 1 hour

Note)

1) Output frequency monitoring (M09, M35) adds an ASCII code for forward rotation (space), reverse rotation (minus) and stop (space) as direction of rotation data, and handled as 5-byte data.

(3) Functions for short frame

Table 9-4-7 Short frame

Function	Command type character	Data direction	Data range; transmission data / actual data	Change during operation
Frequency command	a	Selecting	Same as S01	O
Frequency command	e	Selecting	Same as S05	O
Operation command	f	Selecting	Same as S06	O
Reset command	m	Selecting	4 spaces	–
Calculated torque value monitor	h	Polling	Same as M07	–
Torque current monitor	I	Polling	Same as M08	–
Output frequency monitor	j	Polling	Same as M09; no sign is attached.	–
Operation state monitor	k	Polling	Same as M14	–

(4) Alarm display data

The failure description (alarm description) is as shown in the table below. The failure code is in the hexadecimal notation.

Table 9-4-8 Failure description

Failure code	Description	Indication on panel	Failure code	Description	Indication on panel
0000	No alarm	---	0012	External alarm	OH2
0001	Overcurrent, during acceleration	OC1	0016	Braking resistor overheat	dbH
0002	Overcurrent, during deceleration	OC2	0017	Motor 1 overload,	OL1
0003	Overcurrent, during constant speed operation	OC3	0018	Motor 2 overload,	OL2
0006	Overvoltage, during acceleration	OU1	0019	Inverter overload	OLU
0007	Overvoltage, during deceleration	OU2	001F	Memory error	Er1
0008	Overvoltage, during constant speed operation	OU3	0020	Keypad panel communication error	Er2
000A	Undervoltage	LU	0021	CPU error	Er3
000B	Input phase loss	Lin	0025	Output phase loss error	Er7
0011	Heat sink overheat	OH1	0026	RS485 communication error	Er8

9-4-12 Data format

The data format of each piece of function code data of the inverter is defined here.
Prepare data according to the format numbered in the data format for each function code. (Refer to section 5-1 Function Setting List and section 9-4-11 Function Code List for the data format).
The data field of the transmission frame except for data format 10 consists of a 4-digit ASCII code converted from a 4-digit hexadecimal data as shown in the figure below. For details of each format, refer to the following data formats (1) through (11).

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4-digit hexadecimal data => 4-digit ASCII code															

(1) Data format 0

16-bit binary code, least increment 1, positive value only.

Example) In the case that F15: (frequency limiter, upper limit) = 60 Hz

60 x 1 = 60 (dec). = 003C (hex)., hence: 003C ⇒

0	0	3	C

(2) Data format 1

16-bit binary code, least increment 1, positive/negative value
The negative value is expressed in 2's complement. -1 -> FFFF (hex).

Example: In the case that F18: (bias frequency) = -20 Hz

-20 x 1 = -20 (dec). = FFEC (hex)., hence: FFEC ⇒

F	F	E	C

(3) Data format 2

16-bit binary code, least increment 0.1, positive value only

Example) In the case that F17: (gain frequency setting signal) = 100.0%

100.0 x 10 = 1000 (dec). = 03E8 (hex)., hence: 03E8 ⇒

0	3	E	8

(4) Data format 3

16-bit binary code, least increment 0.1, positive/negative value
The negative value is expressed in 2's complement. -1→ FFFF (hex).

Example: In the case that C31: (analogue input offset adjustment, terminal 12) = -5.0%

-5.0 × 10 = -50 (dec.) = FFCE (2's complement) ⇒

F	F	C	E

(5) Data format 4

16-bit binary code, least increment 0.01, positive value only

Example) In the case that C05: (multistep frequency 1) = 50.25 Hz

50.25 x 100 = 5025 (dec). = 13A1 (hex)., hence: 13A1 ⇒

1	3	A	1

(6) Data format 5

16-bit binary code, least increment 0.01, positive/negative value
The negative data is expressed in 2's complement. -1 -> FFFF (hex).

Example: In the case that M07: (actual torque) = -85.38%

-85.38 x 100 = -8538 (dec). = DEA6 (hex)., hence: DEA6 ⇒

D	E	A	6

(7) Data format 6

Acceleration/deceleration time, amperage data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	Index		Data field									

Polarity Unused

0 : 0.01	×	001～999	(0.01～9.99)
1 : 0.1	×	100～999	(10.0～99.9)
2 : 1	×	100～999	(100～999)
3 : 10	×	100～360	(1000～3600)

0: Positive (+), 1: Negative (-)

Example: In the case that F07: communication No. (acceleration time 1) = 20.0 seconds

20.0 = 0.1 x 200, hence: 04C8 ⇒

0	4	C	8

(8) Data format 8

Operation command

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RESET	0	0	0	0	0	0	0	0	X5	X4	X3	X2	X1	REV	FWD

Unused General-purpose input FWD: forward rotation

command,

REV: reverse rotation

command

(All bits: "1" when turned on)

Example: In the case that M13: (operation command) = 0000 0000 0100 0101 (bin).: FWD, X1, X5 = ON

M13 = 0045 (hex)., hence: 0045 ⇒

0	0	4	5

(9) Data format 9

General-purpose output terminal

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	Y2	Y1

Unused (bits 15–2)

General-purpose output (bits 1–0)

(All bits: "1" when turned on)

Example: In the case that M15: (general-purpose output terminal) = 0000 0000 0000 0001 (bin).: Y1 = ON

M15 = 0001 (hex)., hence: 0001 ⇒

0	0	0	1

(10) Data format 10

Operation state

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
BUSY	—		RL	ALM	DEC	ACC	IL	VL	TL	NUV	BRK	INT	EXT	REV	FWD

(All bits: "1" when turned on or active)
FWD: During forward rotation
REV: During reverse rotation
EXT: During DC braking
INT: Inverter shutdown
BRK: During braking
NUV: DC link established
TL: Torque limit operation
VL: Voltage limit operation
IL: Current limit operation
ACC: During acceleration
DEC: During deceleration
ALM: Batch alarm
RL: Transmission valid/invalid
BUSY: During data writing (processing)

Example) ... Omitted (The monitoring method is similar to format 8).

(11) Data format 11

16-bit binary code, least increment 0.01, positive/negative data (5-byte ASCII code)

19 18 17 16	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
ASCII code (of minus sign)	4-digit hexadecimal data ⇒ 4-digit ASCII code

Example: In the case that M09 (output frequency) = +60.00 Hz

60.00 × 100 = 6000 (dec). = 1770 (hex)., hence: ⇒

1	7	7	0

Positive data is handled in a 4-byte ASCII code similarly to data format 0.

・In the case that M09 (output frequency) = -60.00 Hz

60.00 x 100 = 6000 (dec). = 1770 (hex).. An ASCII code of the minus sign is added at the top.: -1770

⇒

–	1	7	7	0

(12) Data format 12

Data format for P04, A13 (auto tuning)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	REV	FWD	0	0	0	0	0	0	*	*
Unused (fixed to "0")								Unused (fixed to "0")						Data field	

Communication data (P04 or A13)	H30 setting		
	0 or 1		2 or 3
	Operation command		
	Keypad panel	Terminal block	RS485
0000H	ACK: However, no operation	ACK: However, no operation	NAK
0100H	NAK	NAK	ACK: However, no operation
0200H	NAK	NAK	ACK: However, no operation
0300H	NAK	NAK	NAK
0001H	NAK	Note 1	NAK
0101H	NAK	NAK	Note 2
0201H	NAK	NAK	Note 2
0301H	NAK	NAK	NAK
0002H	NAK	Note 1	NAK
0102H	NAK	NAK	Note 2
0202H	NAK	NAK	Note 2
0302H	NAK	NAK	NAK

Note 1: Tuning is started upon a terminal block operation command. After tuning is completed, an ACK response is given. (The ACK response is given before the terminal block is turned off).

Note 2: After data is written via RS485, tuning is started. After tuning is completed, an ACK response is given. (The operation command is automatically turned off).

10. Options

10-1 External Options

Table 10-1-1 External options

Molded case circuit breaker	The molded case circuit breaker (MCCB) is connected for the protection of the main circuit wiring up to the inverter and for turning the power on and off. The rated current or the rated interrupting capacity varies according to the power supply specifications.
DC reactor (DCR)	Connect in the following cases. (1) When the power supply transformer capacity exceeds 500 kVA. (2) When a thyristor load is connected to the same power supply or when the capacitor for power factor improvement is turned on or off. (3) When the unbalance rate between phases of the source voltage exceeds 2%. $\text{Unbalance rate between phases} = \dfrac{\text{(Max. voltage [V]) - (Min. voltage [V])}}{\text{(Average voltage of three phases [V])}} \times 67\ [\%]$ (4) To reduce the harmonic current in the input. The input power factor can be improved to 0.9 to 0.95.
Magnetic contactor (MC)	The inverter can be operated without an electromagnetic contactor. Connect one to turn the power off for the safety after the protective function of the inverter is activated.
Surge absorber	Connect to suppress the surge generated when the electromagnetic contactors, control relays or other exciting coils are opened or closed. S2-A-0 (for electromagnetic contactors), S1-B-0 (for miniature control relays)
Reactor for radio noise reduction	Use for noise reduction when electric noise interference is caused to radios or electronic devices near the inverter.
Frequency setting unit	Connect to set the frequency from the control circuit terminals using the inverter power supply.

11. Applicable Reactor

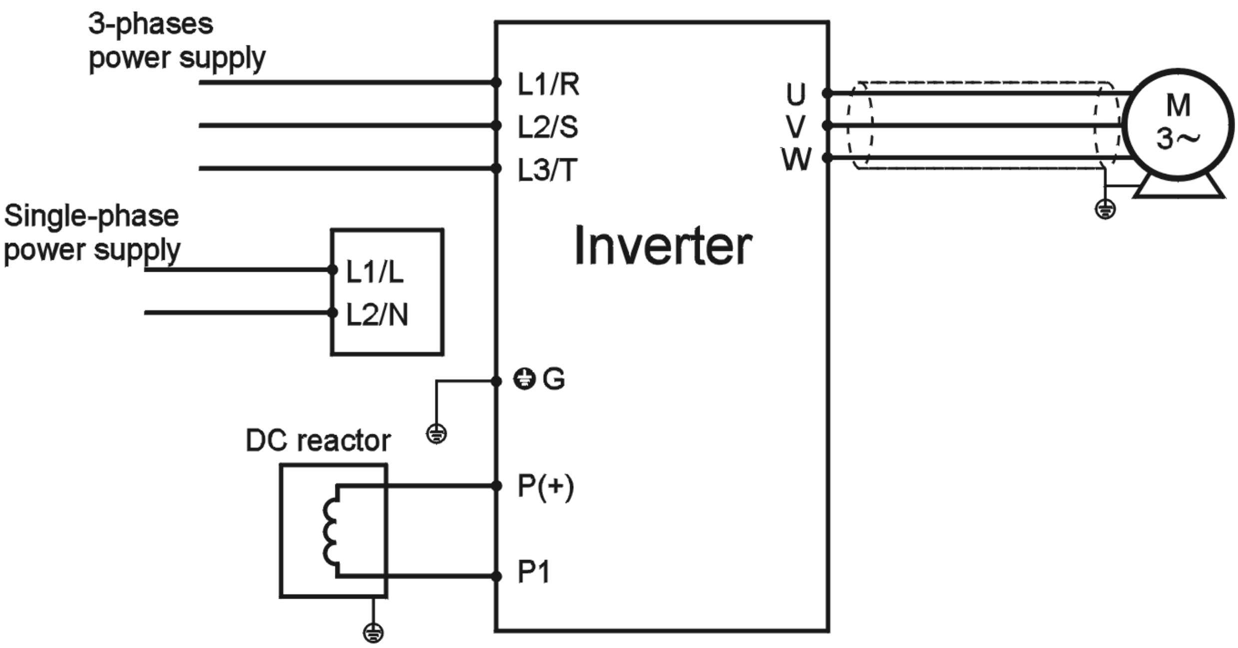
The DC reactors are recommended to reduce inverter input harmonic current or to correct inverter input power factor.

Table 11-1-1 List of applicable reactor

Applicable inverter model	DC reactor (DCR)
GVX1000-0.1-S	DCR2-0.2
GVX1000-0.2-S	DCR2-0.4
GVX1000-0.4-S	DCR2-0.75
GVX1000-0.75-S	DCR2-1.5
GVX1000-1.5-S	DCR2-2.2
GVX1000-2.2-S	DCR2-3.7
GVX1000-0.4-T	DCR4-0.4
GVX1000-0.75-T	DCR4-0.75
GVX1000-1.5-T	DCR4-1.5
GVX1000-2.2-T	DCR4-2.2
GVX1000-4.0-T	DCR4-3.7
GVX1000-5.5-T	DCR4-5.5
GVX1000-7.5-T	DCR4-7.5

Fig. 11-1-1 Connection method of DC reactor (DCR)

DC reactor connection method



12. Electromagnetic Compatibility (EMC)

12-1General

In accordance with the provisions described in the European Commission Guidelines Document on Council Directive 89/336/EEC, Bonfiglioli Group has chosen to classify the GVX1000 range of inverters as "Complex Components".

Classification as a "Complex Components" allows a product to be treated as an "apparatus", and thus permits compliance with the essential requirements of the EMC Directive to be demonstrated to both an integrator of GVX1000 inverters and to his customer or the installer and the user.

GVX1000 inverters is supplied `CE-marked', signifying compliance with EC Directive 89/336/EEC when fitted with specified filter units installed and earthed in accordance with this sheet.

This Specification requires the following performance criteria to be met.

EMC product standard **EN61800-3/1996**

Immunity : **Second environment** (Industrial environment)
Emission : **First environment** (Domestic environment)

Finally, it is customer's responsibility to check whether the equipment conforms to EMC directive.

12-2 Recommended Installation Instructions

It is necessary that to conformed to EMC Directive, these instructions must be followed.

Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, Inverter and motor must be made by a qualified electrical technician.

1) Use the correct filter according to Table 12-2-1.
2) Install the Inverter and filter in the electrically shielded metal wiring cabinet.
3) The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc. from the mounting holes and face area of the panel. This will ensure the best possible earthing of the filter.
4) Use the screened cable for the control, motor and other main wiring which are connected to the inverter, and these screens should be securely earthed.
5) It is important that all wire lengths are kept as short as possible and that incoming mains and outgoing motor cables are kept well separated.

"To minimize the conducted radio disturbance in the power distribution system, the length of the motor-cable should be as short as possible. "

Table 12-2-1 RFI filters

Applied Inverter	Filter Type	Rated Current	Max. Rated Voltage	Max. motor cable length	
				EN55011 Class B	EN55011 Class A
GVX1000-0.1-S GVX1000-0.2-S GVX1000-0.4-S	EFL-0.4E11-7	6.5A	1ph 240Vac	10m	50m
GVX1000-0.75-S	EFL-0.75E11-7	18A			
GVX1000-1.5-S GVX1000-2.2-S	EFL-2.2E11-7	29A			
GVX1000-0.4-T GVX1000-0.75-T	EFL-0.75E11-4	5A	3ph 480Vac		
GVX1000-1.5-T GVX1000-2.2-T	EFL-2.2E11-4	10A			
GVX1000-4.0-T	EFL-4.0E11-4	15A			
GVX1000-5.5-T GVX1000-7.5-T	EFL-7.5E11-4	30A			

Note : For detail, refer to the instruction manual that came with the RFI filters.

12-2-1 Single phase filter dimensions

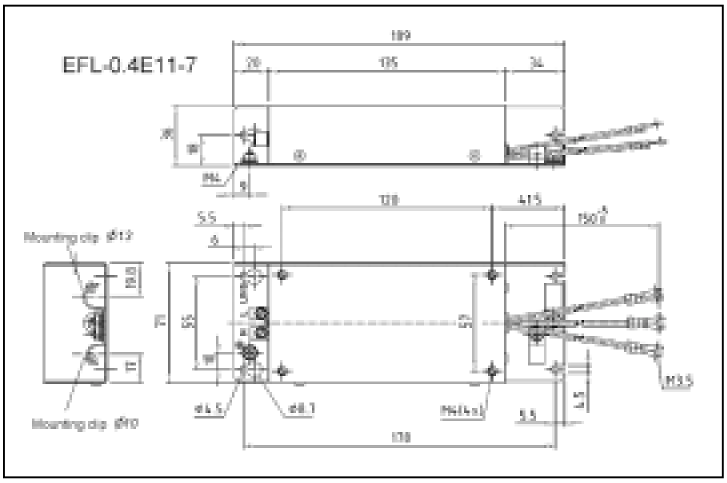


Fig. 12-3-1 Filter dimensions for GVX1000-0.1/0.2/0.4-S

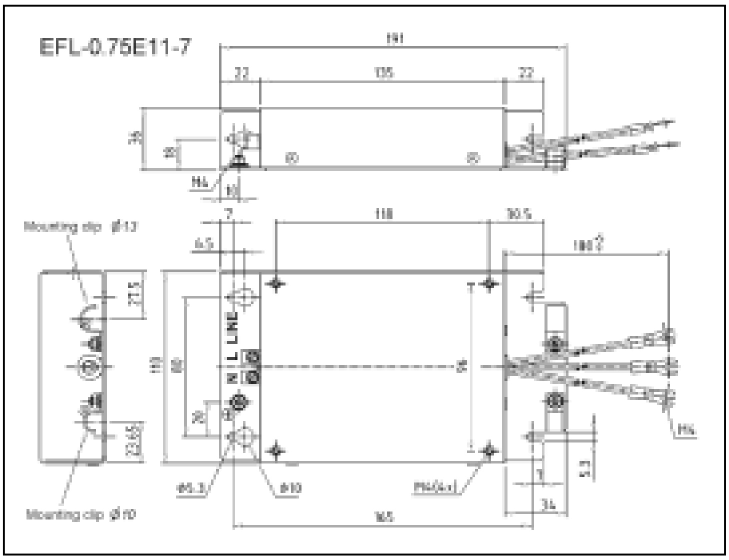


Fig. 12-3-2 Filter dimensions for GVX1000-0.75-S

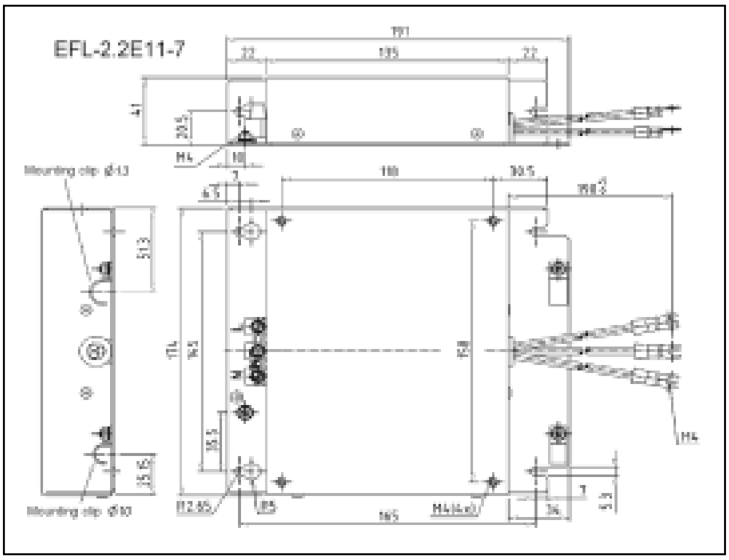


Fig. 12-3-3 Filter dimensions for GVX1000-1.5/2.2-S

12-2-2 Three phase filter dimensions

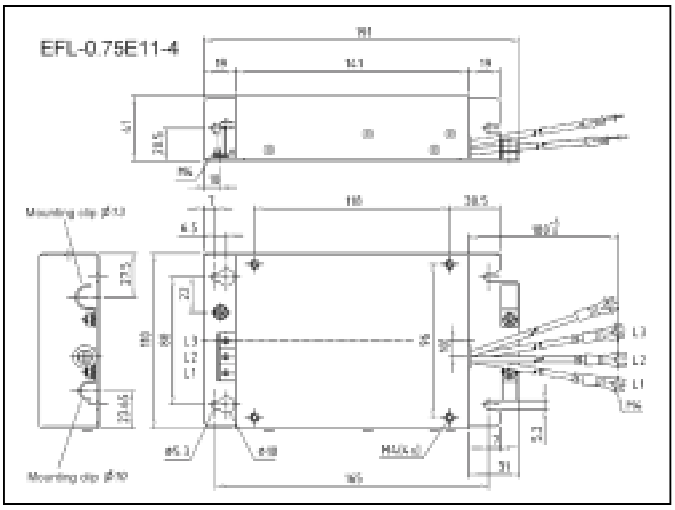


Fig. 12-3-4 Filter dimensions for GVX1000-0.4/0.75-T

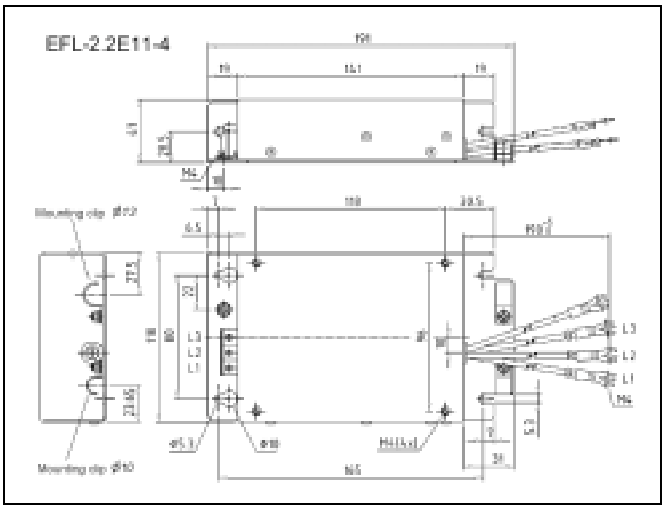


Fig.12-3-5 Filter dimensions for GVX1000-1.5/2.2-T

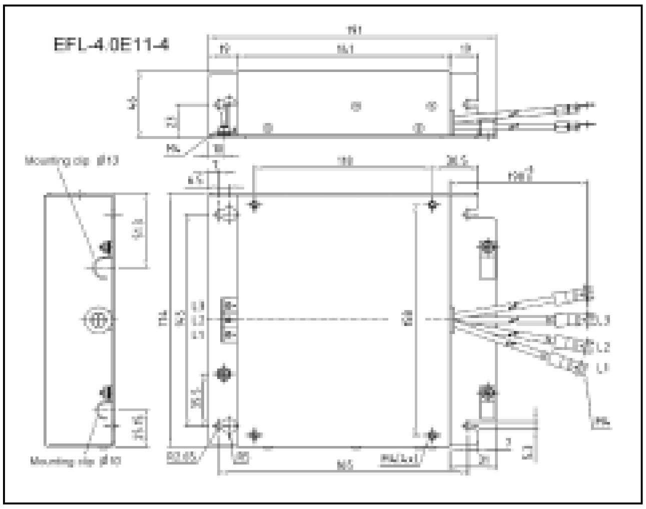


Fig. 12-3-6 Filter dimensions for GVX1000-4.0-T

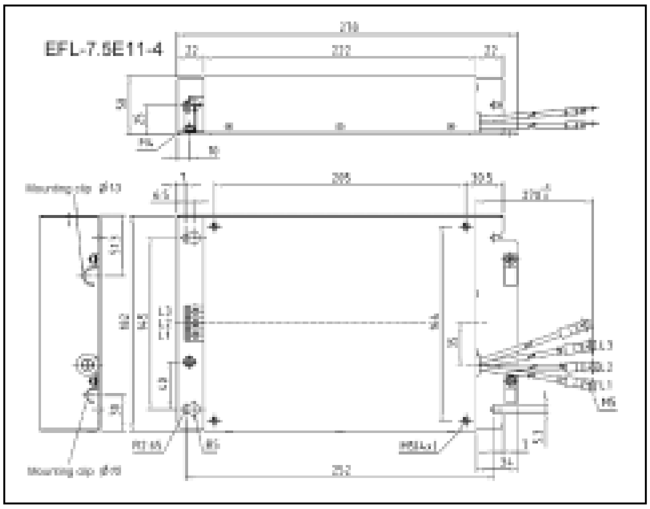
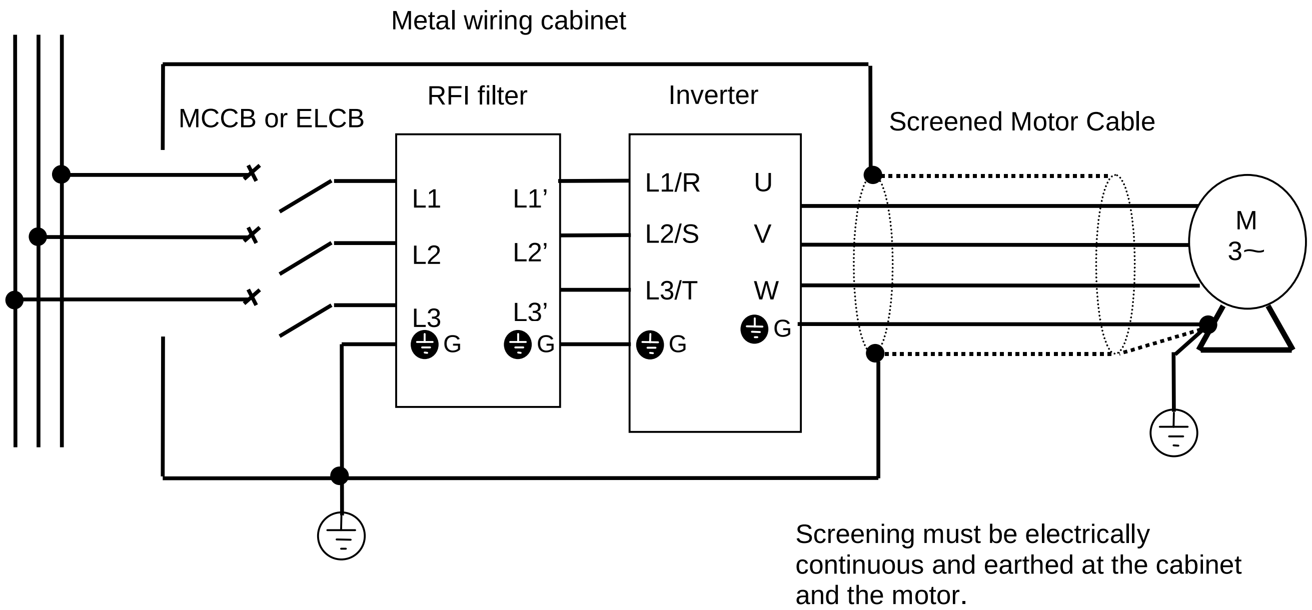


Fig. 12-3-7 Filter dimensions for GVX1000-5.5/7.5-T

Three-phase power supply



Single-phase power supply

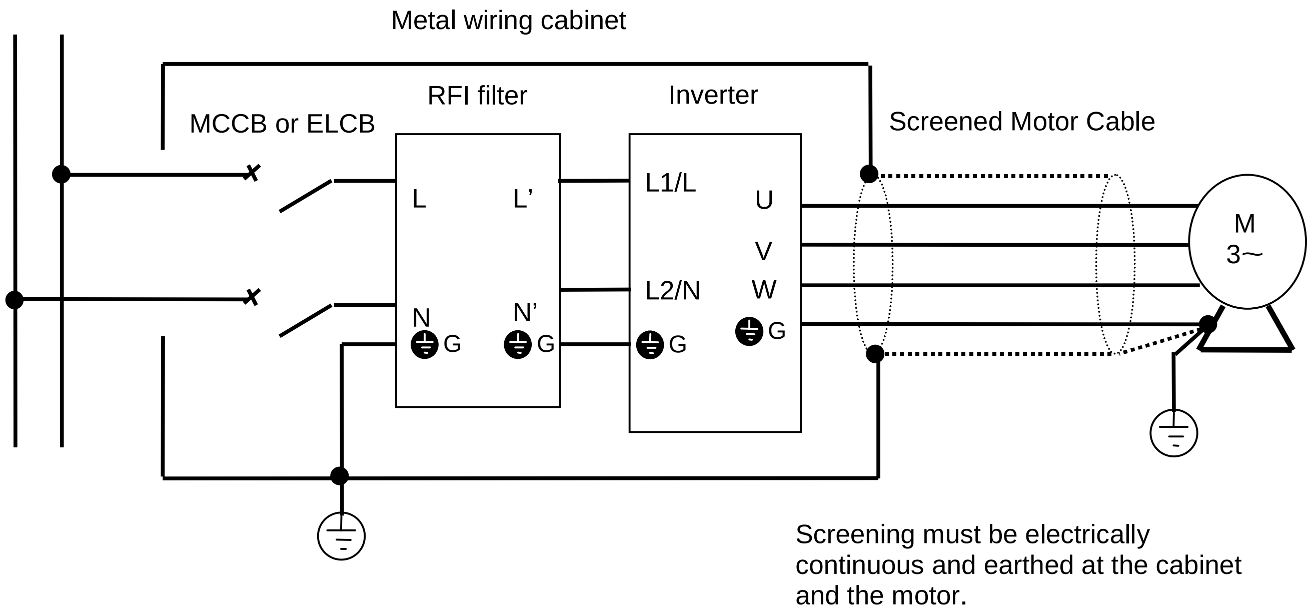


Fig.12-2-1 Recommended installation

EC Declaration of Conformity

EU Representative:	**Bonfiglioli Riduttori S.p.A.**
Address:	**ViaArmaroli, 15-40012 Calderara di Reno**
	Bologna ITALY

Product identification

Product :	**Inverter**		
Brand :	**Bonfiglioli Riduttori S.p.A.**		
Model/type :	**GVX1000-0.1-S**	**to**	**GVX1000-2.2-S**
	GVX1000-0.4-T	**to**	**GVX1000-7.5-T**
	GVX1000-0.1-SY	**to**	**GVX1000-2.2-SY**
	GVX1000-0.4-TY	**to**	**GVX1000-7.5-TY**

Above listed products are in accordance with the regulations of following council directives and their amendments:

EMC Directive 89/336/EEC (Electromagnetic Compatibility)
Low Voltage Directive 73/23/EEC (LVD)

For assessment of conformity the following relevant standards have been taken into consideration:

EN61800-3:1996
EN50178:1997

The conformity with regulations of the EMC directive have been, as far as required, certified by competent body:

	PHOENIX TEST-LAB GmbH
Address:	**Königswinkel 10**
	D-32825 Blomberg in Germany

Number of Certificate: **Z010303** Date of issue: **15.03.2001**

Year of appending CE mark for LVD: **2000**

Bonfiglioli Riduttori S.p.A.
Dated: 22th March 2001

Francesco Petilli
Chief Executive Officer

This declaration verifies the accordance with the mentioned directives, but retains no assurance of properties.
The safety- and installation instructions of the product documentation which is included in the shipping have to be considered.

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DIVISIONE:

Silectron sistemi

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NUMERO VERDE 800-442288

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