TOSHIBA

E6580516

High-Performance Inverter
Instruction Manual

TOSVERT VF-A5

200V	0.4	~ 55kW
400V	0.75	~ 75kW

NOTICE

1. Make sure that this Instruction Manual is delivered to the end user of the inverter unit.
2. Read this manual before installing or operating the inverter unit, and store it in a safe place for reference.

Ver. 110~

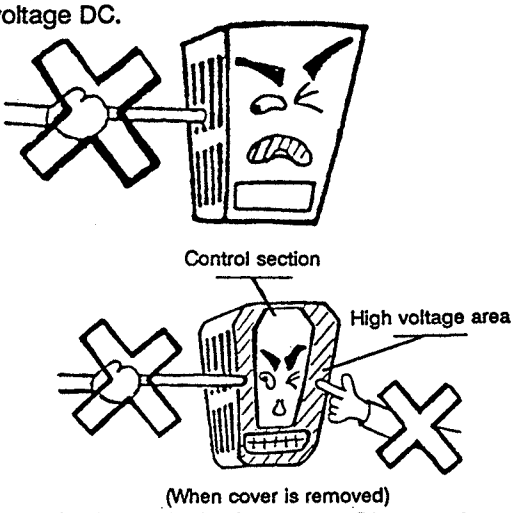
TOSHIBA CORPORATION

Safety Precautions

This inverter is for driving a 3-phase motor, and must not be used for other applications.

[I] Always observe the following items to prevent electrical shock.

1. Do not touch charged parts such as the terminal block while the CHARGE lamp is lit. A charge will still be present in the electrolytic capacitors, and therefore, touching these areas may result in an electrical shock. Always turn the inverter's input power off before wiring the motor terminals. Wait at least five minutes after the "CHARGE" lamp has gone out, and then confirm that the capacitors have fully discharged by using a tester, etc., that can measure high-voltage DC.
2. Do not touch or insert a rod or any other item into the inverter while power is applied (there are high voltage areas on the PCB), as this may lead to electrical shock or inverter damage.
   (When operating with the cover removed, charged areas will be exposed, so always install the unit inside a panel so that it cannot be easily touched.)
   Never attempt to modify the inverter unit.
3. Ground the unit's G/E terminal and the motor. (Electric shock may occur due to leakage currents.)



[II] Retry function

1. This inverter has a "retry function" that automatically resets the unit when a fault trip occurs. Observe the following points when this function is selected.
   Even if the inverter has fault tripped, take care to not get caught in the motor or equipment. When the "retry function" is selected, the inverter will automatically start after the designated time. (Refer to page 78.)
   Take special care when an overload trip occurs, as the "retry function" may activate after a delay of up to 5min.

[III] Observe the following points to prevent fire.

1. Confirm the inverter's rating nameplate, and connect a 3-phase input power source within the rated range to the R/L1, S/L2, and T/L 3 power source terminals.
   If an incorrectly-rated power source is connected to the inverter, such as when a 400V power source is connected to a 200V inverter, the inverter's internal components may explode.
2. No fuse is contained in the inverter, so install a suitable non-fuse breaker (MCCB) on the inverter's input power source.
   (Refer to Table 5-1 on page 14 for Examples of selecting equipment for wiring.)

[IV] Refer to the following chapters for other precautions.

Introduction

Thank you for purchasing the Toshiba High-Performance Inverter "TOSVERT VF-A5".

The "VF-A5" inverter has many various functions built in for use with a 3-phase induction motor. All Operations of this unit are done via the easy-to-use keyboard-type operation panel. A blind function (Refer to page 50) that displays only those functions required for operation, and an edit function (Refer to page 29) that automatically collects parameters that differ from their default settings are used to make basic operation and setting easier. Advanced control technology features (sensorless vector control, feedback control, current limit, retry, and stall prevention functions) are built in, so that the inverter will not trip easily, and will provide unparalleled reliability.

Please read this manual thoroughly before use to properly understand the correct use of the outstanding functions of the "VF-A5".

This manual should be stored by the user of the "VF-A5" for reference during maintenance and inspection.

Symbols used in this manual are as shown below. Understand them before reading this manual.

1. LED display character codes: Refer to page 123
2. To indicate a parameter display on the operation panel in this manual:

   Example Parameter [ACC 1]

   To indicate a panel key:

   Example [ENTER] key

   The box [ ] is not used when indicating parameter group names and parameter settings.

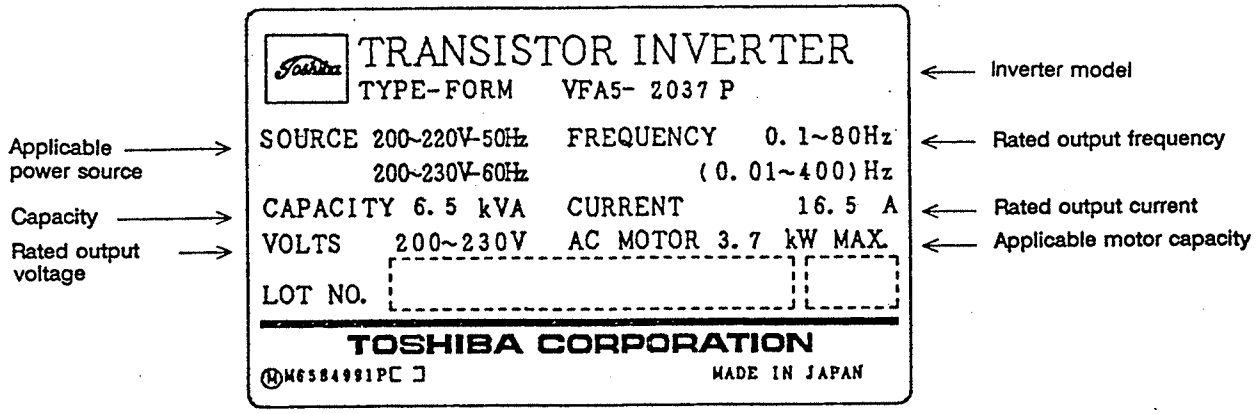
   Note) The box [ ] is not used when displaying parameters in tables.

Table of Contents

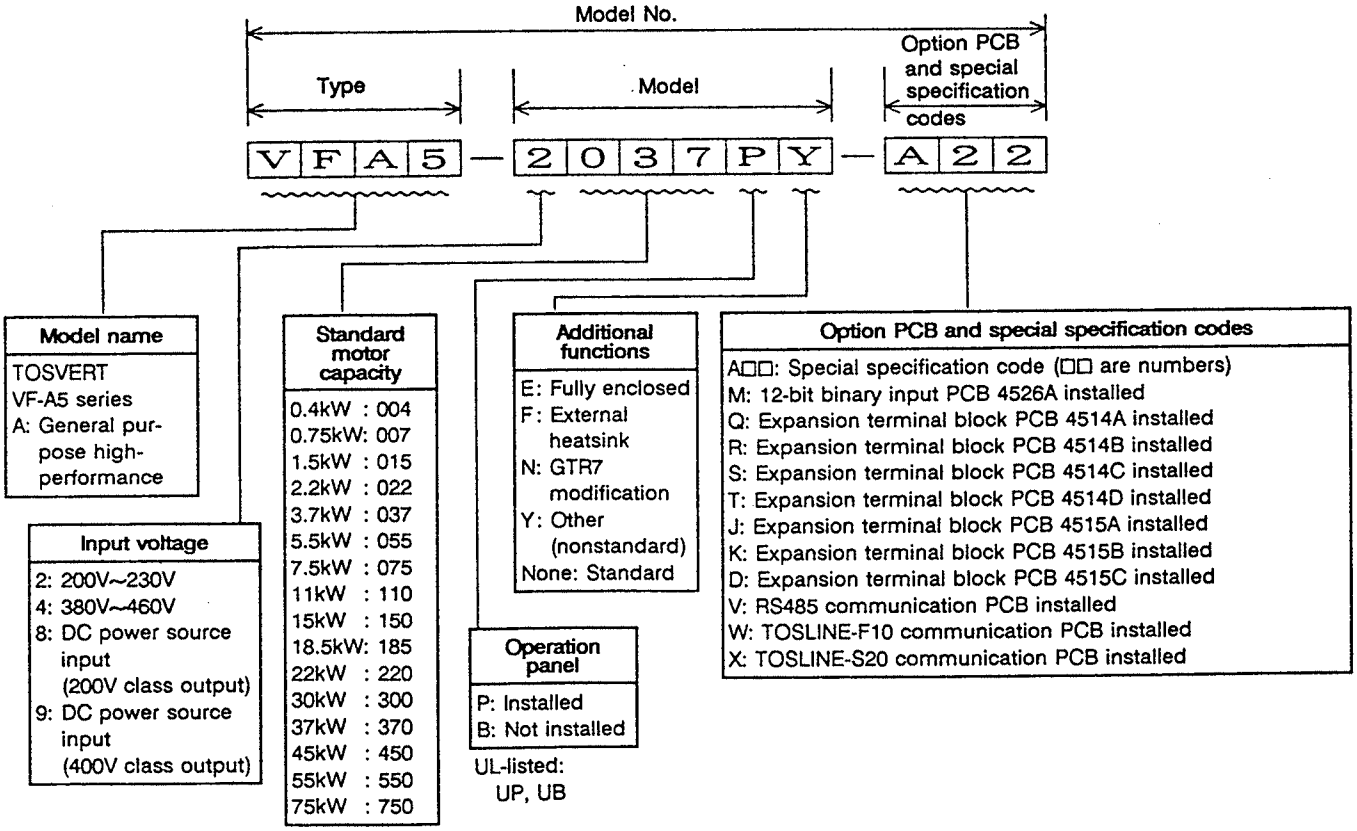
1. Acceptance Inspection and Precautions

(1) Confirm that the unit has not been damaged during shipment.
(2) Confirm that the model noted on the rating nameplate is as ordered.
(3) When storing the unit temporarily after purchase, store it in dust-free, well-ventilated location.
(4) Special care is taken during product manufacturing, packaging, and shipment. If any problems are discovered, however, please contact your dealer immediately.

Details of rating nameplate



Details of model No.

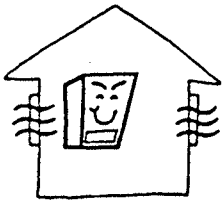


2. Installation Precautions

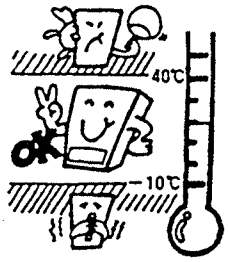
This inverter is an electronic control unit. Take special care concerning the installation environment.

- Confirm that the input power is within ±10% of the rated value. If the input power voltage range tolerances are exceeded during use, the protective circuits may function or the inverter may be damaged.

- Avoid installation in hot and humid locations, where condensation or freezing may occur, or where water, dust, or metal chips may come into contact with the inverter.
  - Install in a location free of corrosive gases or cutting fluids, etc.

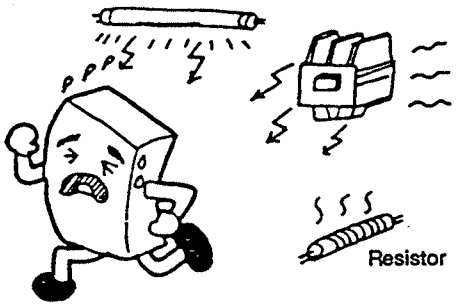


- Use the unit within an ambient temperature of −10 to 40°C.



Because the inverter radiates heat, when installing in a panel take special care concerning ventilation and panel space. Removal of the cover is recommended when using in a panel to ensure maximum longevity and reliability.

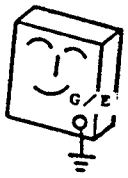
- Do not install the unit in locations that experience large vibrations.



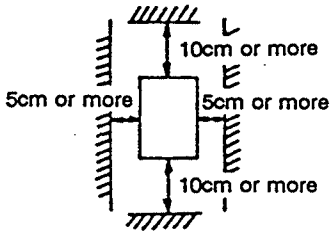
- The inverter may malfunction if the following types of devices are installed nearby, so use proper precautions.
  - Solenoids
  - Brakes
  - Electromagnetic contactors
  - Fluorescent lights

  → Install a surge killer on the exciting coil.
  - Resistors → Keep away from the inverter

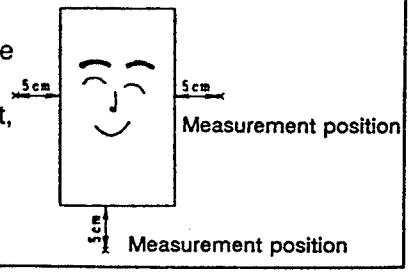
- Ground the G/E terminal to prevent electrical shock and malfunction due to noise.



- Attach the unit to a non-combustible material such as a metal panel. To ensure adequate ventilation, maintain the following installation spaces, and always install the unit vertically in the longitudinal direction. When installing multiple inverters in a row, leave a clearance of at least 10cm between each unit. This clearance can be reduced depending on the environment or by adding fans.
  (For 37kW and larger units, leave a clearance of at least 20cm above and below the inverter to allow for fan replacement and wire bending space.)
  Contact the Engineering Department for further details.



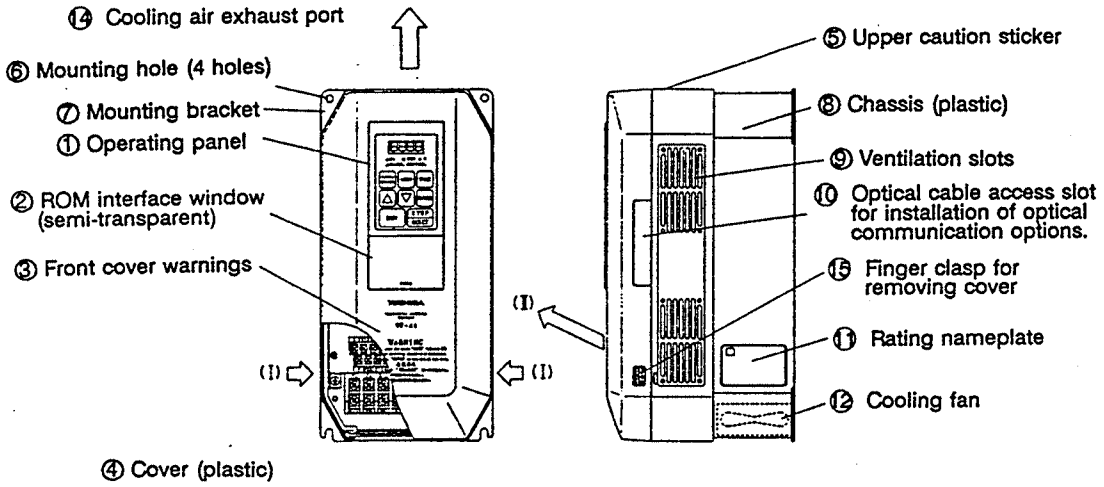
Inverter life depends greatly on the ambient temperature. Make sure that the ambient temperature of the installation location does not exceed the maximum ambient temperature rating (40°C).
Measure the temperature at the positions shown in the diagram on the right, and confirm that it is less than the maximum ambient temperature rating (40°C). (50°C or less when the cover is removed.)
22kW and larger units can be used up to an ambient temperature of 50°C. (Do not remove the cover from 22kW and larger units.)

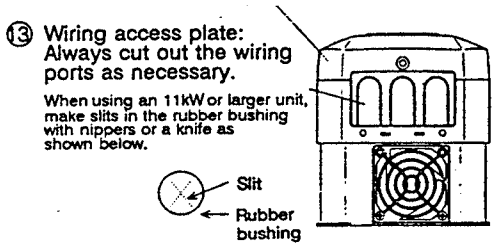


★ Always install the inverter in the longitudinal direction on a vertical surface.

3. External View and Component Names

3.1 Component Explanation (I)





⑤ Upper caution sticker:
Always remove this sticker when the ambient temperature is high.

⑨ Ventilation slots:
A cover-up plate option is available for fully-sealed applications.

① Operating panel: removable
Refer to section 3.3 Removal of operating panel.

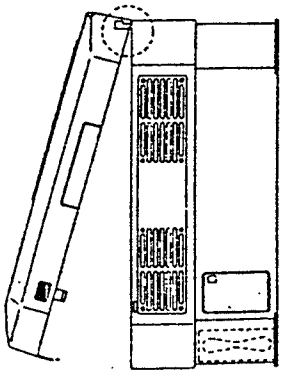
② ROM interface window: removable
Refer to section 3.3 Removal of ROM interface window.

④ Cover
Always read the cautions ③ on the front of the cover and remove the cover when wiring.
Refer to section 3.2 Removal of cover.
If the ambient temperature of the inverter unit exceeds 40°C when mounted in a panel, remove the cover. The unit can then be used up to a temperature of 50°C.

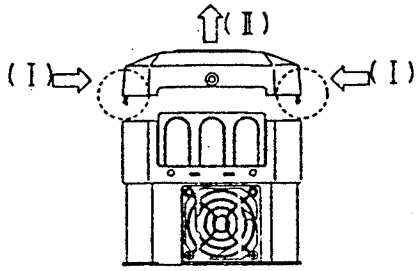
3.2 Removal of Cover

1) For 7.5kW and smaller ... Place your fingers on the finger clasps for removing the cover shown in the 3.1 Component Explanation (I) drawing. Apply force in the direction of the arrows (I), and pull the cover up in the direction of arrow (II). The cover will come off.
2) For 11~18kW ... Remove the two screws on the cover wiring inlet, and then remove the cover like the 7.5kW models.
3) For 22kW and larger ... Wait for the "CHARGE" lamp on the cover (sheet metal) to go out. Then remove the four screws holding the cover (six screws for 37kW and larger), and the cover will come off.

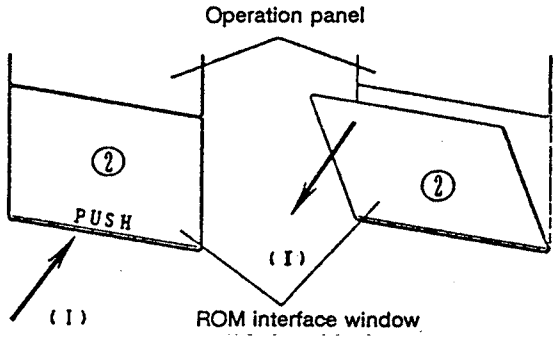
Hook structure

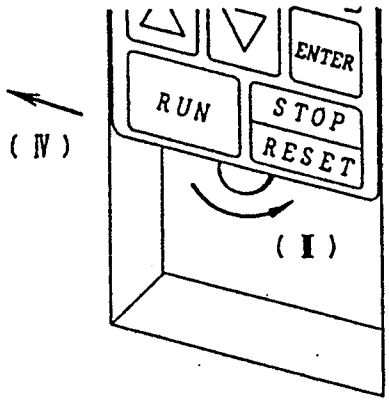


Fitting structures



3.3 Removal of the ROM Interface Window and Operation Panel





(I) Press where the word PUSH is located.

↓

The top of the window will open.

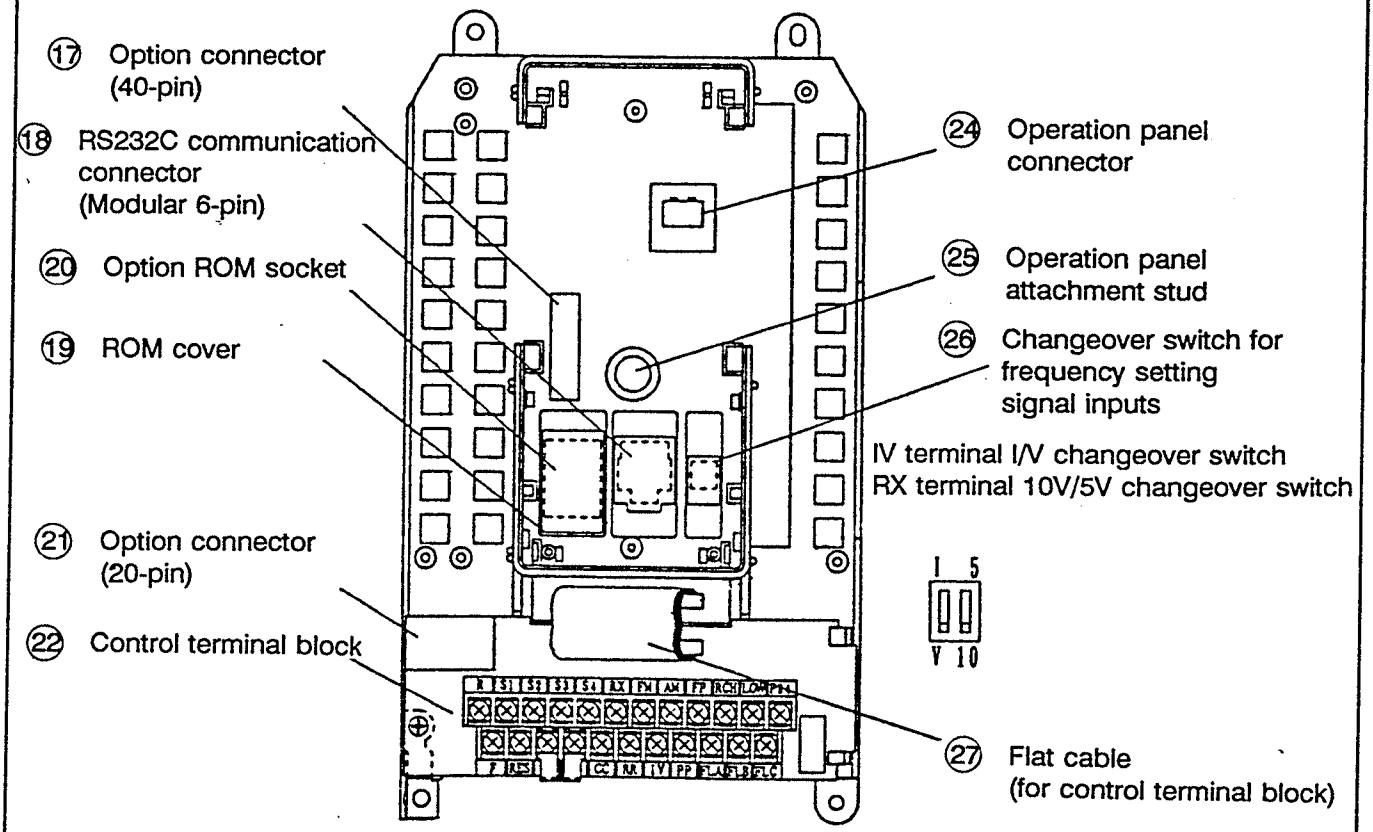
↓

(II) Hold the top of the window, and pull it out in the direction of the arrow (II).

(III) The operation panel attachment screw can now be seen. Turn it in the direction of the arrow (III) until it completely loosens.

(IV) When the screw has completely loosened, pull the operation panel out in the direction of the arrow (IV).

3.4 Component Explanation (II)



4. Operation Precautions

Observe the following points when using the VF-A5 inverter

4.1 Cautions Regarding Motor

Comparison with commercial power source operation:	The VF-A5 inverter uses a sinusoidal-wave PWM method, but the output voltage and output current will be distorted waveforms which closely approximate sinusoidal waveforms, instead of complete sinusoidal waveforms. In comparison to operating with the commercial power source, the motor temperature rise, noise and vibration will increase slightly.
Running at low-speeds:	When the inverter is used in combination with a general purpose motor and run at low speeds, the motor's cooling effect will decrease. Therefore, the output load must be reduced to less than the rated load. If the motor is to be run at the rated torque even at low speeds, use a Toshiba "VF motor" specially designed for use with inverters. When used with a VF motor, the inverter's overload protection level must be adjusted. (Refer to pages 72, 73 for details.)
Adjustment of overload protection level:	When using this inverter with a general purpose motor, the overload protection of the VF-A5 is performed by use of an overload detection circuit (electronic thermal relay) that meets a general purpose motor's reduced load characteristics. The reference current value for this electronic thermal relay is set to the inverter's rated current value; therefore, this may need adjustment depending on the motor.
Running at speeds exceeding 60Hz:	When operating at a frequency that exceeds 60Hz, motor vibration and noise will increase. Furthermore, this type of operation may be limited by the motor's mechanical strength and bearing construction, so please contact the motor manufacturer for further information.
Load equipment lubrication method:	When driving an oil-lubricated speed reduction gear or geared motor, the lubrication may deteriorate at low-speeds, so contact the speed reduction gear manufacturer for information on usable variable-speed areas.
Ultra-light loads and low-inertia loads:	Instability phenomena, such as abnormal vibration or overcurrent trips, may occur when operating with an ultra-light load at a load ratio of 5% or less, or with a load having an extremely small moment of inertia. In these cases, lower the carrier frequency. (Refer to page 66)
Measures for instability phenomena:	Instability phenomena may also occur when using the inverter with the following types of motors or loads, so always confirm applicability before use. (1) Combination with motor exceeding recommended applicable motor rating. (2) Combination with special motors such as explosion-proof motors. (3) Combination with special loads having severe rotational fluctuations, such as piston-type movements.

Braking during power off:

The inverter will enter the coast-stop state when the power source is turned off. The motor will therefore not stop immediately. To stop the motor immediately, install an auxiliary brake unit. Dynamic braking units and mechanical braking units are available, so select one that suits your specific application.

Loads that generate a negative torque:

The overvoltage protection or overcurrent protection may function and trip the inverter when used with loads that generate a negative torque. In this case, a braking resistor that meets the load condition must be installed.

Motors with brakes:

If a motor with a brake is directly connected to the inverter, the voltage when the motor is started will be low, which may result in the brake not being released. In this case, separately wire the brake circuit and motor main circuit. In addition, there is a delay in the time to when the inverter output stops if the inverter's ST to CC control terminal connection is released, so use of the circuit configuration in Fig. 4-1 is recommended.
In Fig. (a), the brake power is turned ON and OFF via MC2 and MC3. If a circuit configuration as shown in the drawing is not used, a bound current may flow during braking and may cause an overcurrent trip. The brake power can also be turned ON and OFF using the low-speed signal LOW as shown in Fig. (b).

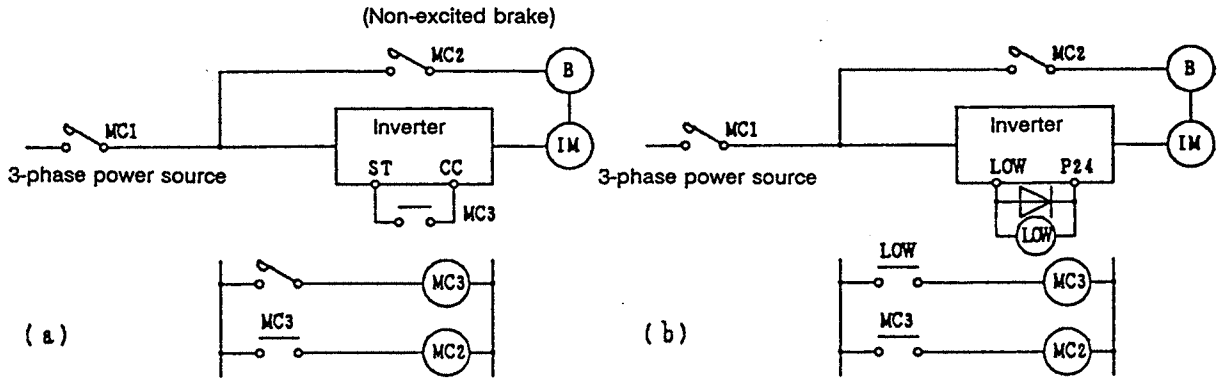


Fig.4.1 Circuit configuration for motor with brake

In some cases, such as in hoist applications, turning the brake ON and OFF by using low-speed detection (LOW terminal function) may be better, so contact your dealer for further details.

4.2 Cautions Regarding the Inverter

Inverter's overcurrent protection:

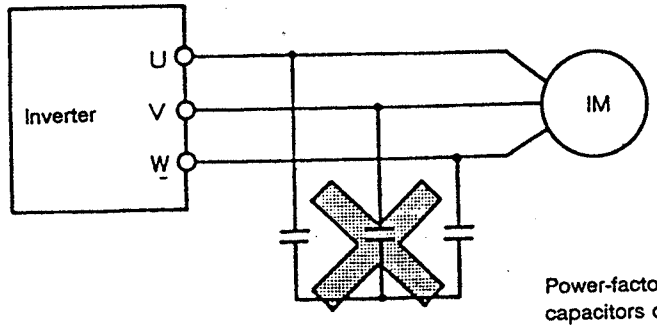
Overcurrent protection is used as the VF-A5 inverter's protection function, and the current setting level is set to match the largest applicable motor. Therefore, when operating a motor that is smaller than the inverter capacity, the overcurrent level and electronic thermal protection parameters must be readjusted. (Refer to pages 72, 73.)

Running with light loads:

Operating a large capacity motor with a light load using a small capacity (kVA) inverter must be avoided. The output peak current will increase due to the current ripple, and overcurrent trips may frequently occur.

Power-factor improvement capacitors:

Power-factor improvement capacitors must not be installed on the inverter's output. When operating a motor with power-factor improvement capacitors installed, remove the capacitors, or the inverter may fault trip or the capacitors may be damaged.



Power-factor improvement capacitors or surge absorbers

Use with voltage sources other than the rated voltage:

Use with voltage sources other than the rated voltage is not possible. If necessary, use a transformer, etc., to increase or decrease the source voltage to the rated voltage.

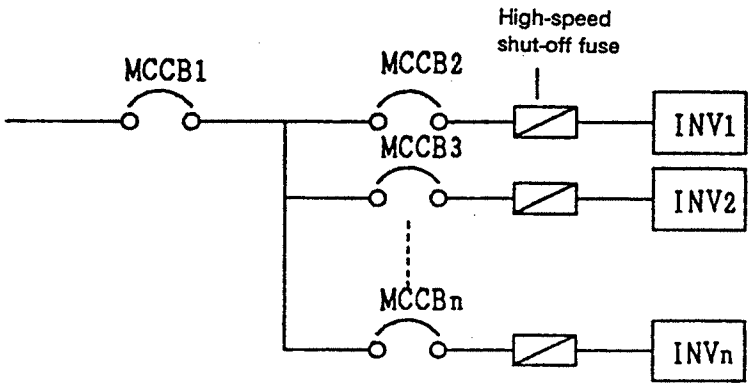
Protection device for lightning surges:

A DSA (lightning surge absorber) is used for protection in the unit. If a surge voltage exceeding 2600 to 3600V peak is applied, the device will light like a glowing electrical discharge. This will cause no problems if the condition does not continue for an extended period of time.

(Refer to Fig. 6-2-1 Fig. Ⓐ on page 21.)

Use of multiple inverter units:

Observe the following points when using multiple inverter units on the same power source line.



As shown above, there is no fuse installed in the inverter's main circuit. If a short circuit fault occurs in the inverter, not only MCCB2 will trip, but the main breaker MCCB1 may also trip.
Select the shut-off characteristics of MCCB1 and MCCB2 so that a selective shutdown can be executed and only MCCB2 trips. If the optimum characteristics cannot be selected, install a high-speed shut-off fuse after MCCB2. (Refer to page 14 for MCCB selection.)

4.3 Inverter Disposal Precautions

Observe the following points when disposing of the inverter.

Explosions from incineration:	Placing the inverter in an incinerator may be dangerous, as the electrolytic fluid used in the electrolytic capacitors may expand and explode.
Gasses from plastics:	The plastic used for the cover, etc., may generate poisonous gases when incinerated.
Disposal method:	Commission the disposal of the inverter to a specialist.

5. Wiring Precautions

5.1 Connection to Main Circuit (Refer to page 11, Fig. 5.1.)

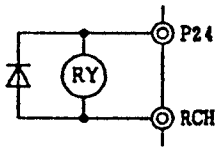
Observe the following precautions when making connections to the inverter.

Confirmation of power OFF:	Always turn the primary power distribution panel switch OFF, and confirm with a tester that a voltage is not present before beginning wiring to the inverter.
Electrical shock prevention— Confirmation of charge dissipation:	Before changing the wiring, wait at least five minutes after the "CHARGE" lamp inside the inverter has gone out, and then confirm that the capacitors have fully discharged by using a tester, etc., that can measure high-voltage DC. The internal electrolytic capacitors are charged, and there is a danger of electrical shock if the charged areas are touched while the "CHARGE" lamp is on. Do not touch the terminal block or remove the upper cover while the lamp is lit.
Confirmation of main circuit connections:	The inverter will be damaged if the input power source is applied to the motor terminals (U/T1, V/T2, W/T3). Always confirm the wiring for the power source terminals (R/L1, S/L2, T/L3) and motor terminals (U/T1, V/T2, W/T3) before turning the power on.
Separation of power source and motor wiring:	To prevent problems due to radio-frequency noise, etc., do not bundle the wiring to the input power terminals (R/L1, S/L2, T/L3) and the motor terminals (U/T1, V/T2, W/T3) together.
Separation of control and main power supplies:	In order to maintain the control power supply to display faults or to operate the communication options while the main circuit power is shut down, remove the two shorting bars (between R/L1-R0, S/L2-S0) on the control power supply terminal block. Connect the control power to a power source that is separate from the main circuit supply.

5.2 Connection of Control Signals

Observe the following points when making control signal connections.

Rating of relay contacts:	Use a relay intended for use with micro-current (min. applicable load rating less than 4mA-24V.), and install a surge killer on the relay's exciting coil.
Power wiring for control circuit:	Use shielded wiring or twisted-pair wiring for the control circuit, and separate the wiring from the main circuit wiring.
Control wiring wire sizes:	The following wiring sizes for the control circuit are recommended. Frequency setting signal input, frequency meter, ammeter: shielded wire that is 0.3mm^2 or larger Other signals: Vinyl-insulated wire that is 0.75mm^2 or larger
Isolation from main circuit:	All control terminals other than FLA, FLB and FLC are connected to internal electronic circuits, so input signals must always be electrically isolated from the main circuit.

Ratings of connected meters:	Connect a full-scale 1mAdc DC ammeter or full-scale 7.5Vdc-1mA DC voltmeter to the control terminals.
Rating of FL signal contacts:	The contact rating of the protection operation detection relay (FL) is 250Vac (cosø=0.4) 30Vdc-1A.
External use of control power:	A max. of 24Vdc-100mA can be used from the P24 control power terminal to drive external relays.
Open collector outputs:	The RCH and LOW control terminals are open-collector outputs, and can output a max. 24Vdc-50mA. Use of a 24Vdc OMRON MY1 relay (RY) is recommended. Always install a diode (200V-1A class) for surge absorption. Take special note of the diode polarity to avoid incorrect application. 
Frequency-setting potentiometer:	Use a potentiometer rated at 1k to 10kΩ-1/4W for the frequency-setting input signal.

5.3 Other Precautions

Use of crimp-on terminal lugs:	The clearance between terminals on the inverter main circuit terminal block is small, so use sleeved crimp-on terminal lugs for all main circuit terminals. Take special care during connection so that the terminal lugs do not make contact with neighboring terminal lugs.
Grounding terminal:	Always ground the G/E grounding terminal with a wire that is 3.5mm^2 or larger.
Built-in braking resistor:	For inverter capacities that are 3.7kW or less, a built-in braking resistor is connected between the main circuit terminals (PA1) and (PB1), providing dynamic braking as a standard feature.
Internally-connected (E) terminal:	The (E) terminal is for internal connections, so do not remove connections from it or make any external connections to it.

The main circuit wiring is shown in Fig. 5.1.
(For 3.7kW or less, not showing control power terminals R0, S0)

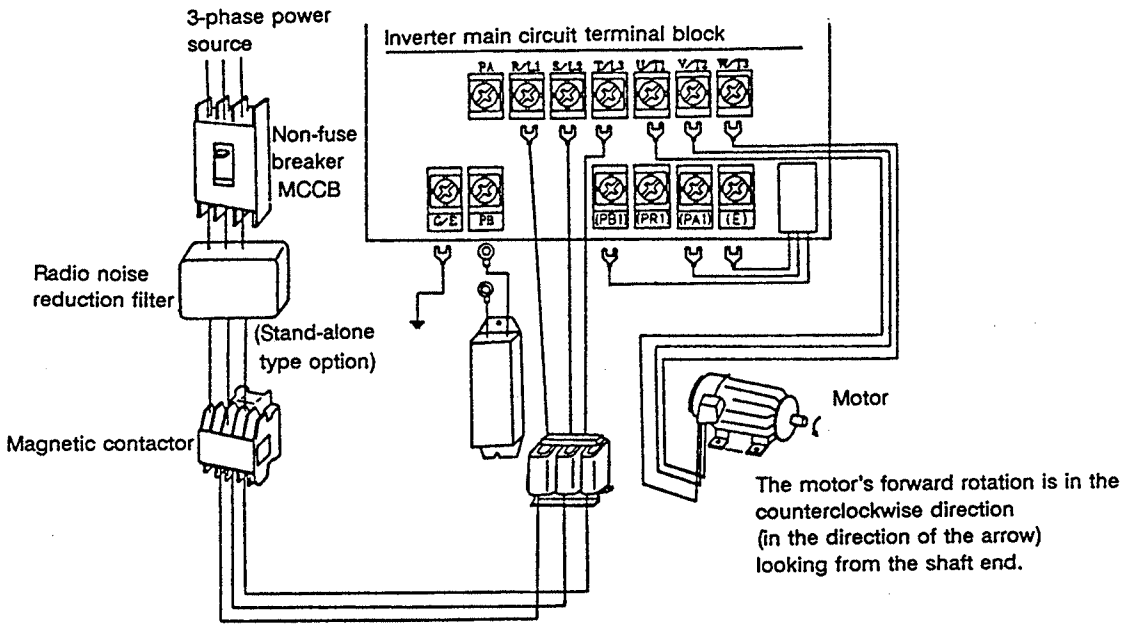


Fig. 5.1 Main circuit wiring

Note) A DC reactor (stand-alone type option) can be installed on 5.5kW and larger units. (Refer to the function of main circuit terminals P0 and PA on page 18.)

Installation of non-fuse breaker

(1) Install a non-fuse breaker (MCCB) for wiring protection on the input power source side.
(2) Avoid frequent starting/stopping by turning the non-fuse breaker ON and OFF.
(3) Start and stop by turning terminals F to CC (or R to CC) ON and OFF.

Installation of primary magnetic contactor

(Refer to page 14; Examples of selecting equipment for wiring.)

(1) When using an external braking resistor, install a magnetic contactor (MC) or non-fuse breaker with trip coil (MCCB) on the inverter's power supply input side for protection. Make sure that the power circuit can be opened with the built-in fault detection relay (FL).
(2) The VF-A5 has a built-in fault detection relay (FL). Connect the contacts of this relay to the primary side magnetic contactor (MC) operation terminals, so that the MC can be opened when the inverter's protection circuit functions.
The fault detection relay (FL) contacts (250VAC-1A cosø=0.4) can be directly connected on 200V systems. When using a 400V system, a transformer must be used to create 200V or less for the FL sequence.
If the MC exciting current exceeds the FL contact rating, install another relay step.
(3) Turn terminal F (or R) to CC ON and OFF to frequently start and stop. Due to repeated inrush currents when the power is turned on, the life of the inverter will be shortened when the primary magnetic contactor is used to start and stop, so do not use this method to start and stop frequently.
(4) Install a surge killer on the magnetic contactor (MC) exciting coil.

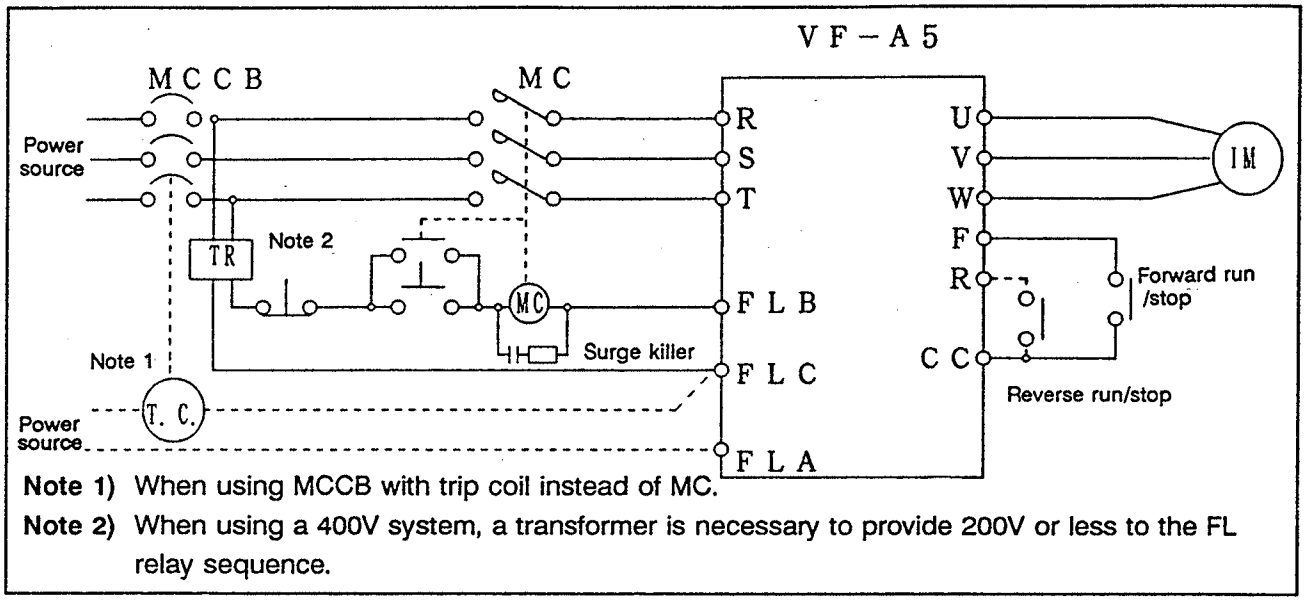


Fig. 5.2 Wiring example using a magnetic contactor

Installation restrictions of secondary-side magnetic contactors

(1) As a rule, if a magnetic contactor is installed between the inverter and motor, do not turn it ON/OFF while running. (If the secondary-side contactor is turned ON and OFF while running, a large current may flow in the inverter, causing inverter damage and failure.)

(2) A magnetic contactor may be installed to change the motor or to change to the commercial power source when the inverter is stopped. Always use an interlock with the magnetic contactor in this situation so that the commercial power supply is not applied to the inverter's output terminals.

Installation of overload relay (thermal relay)

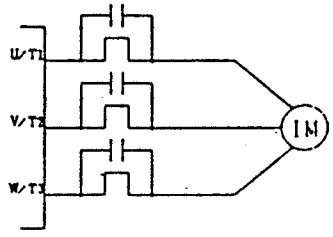
(Refer to page 14; Examples of selecting equipment for wiring.)

(1) The VF-A5 has a built-in overload protection function that uses an electronic thermal relay. However, in the following cases, the thermal relay operation level must be adjusted or an overload relay matching the motor's characteristics must be installed between the inverter and motor.

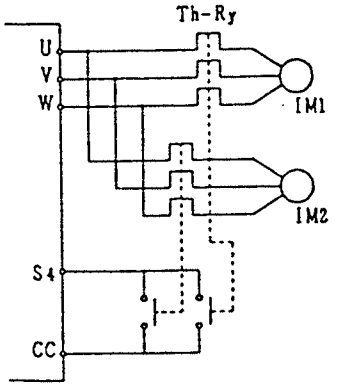
① When using a motor having a rated current value different from a Toshiba general-purpose motor. (Adjust the electronic thermal level)

② When running a single motor with an output less than the specified standard applicable motor, or when running several motor simultaneously (An overload relay must be installed on each motor.)

Note) If the motor cables for a 400V class inverter are long, the thermal relay may malfunction. In this case, lower the carrier frequency (refer to adjustment parameters on page 66), or install a 0.1μ to 0.5μF-1000V film capacitor between the input/output terminals of each phase's thermal relay.



<Example> When using external thermal relays, the inverter can be externally fault-tripped and immediately stopped by using the following method (Fig. 5.3).



Note) In this case, ensure that S4 is set to "Emergency stop function", by setting [1E4] in Gr.5E to 10.
If the Th-Ry functions, the inverter will display " E ", and fault trip.

★ Other unused terminals can also be used instead of the S4 terminal.

Fig. 5.3 Wiring example using external thermal relays

Gr.5E etc., indicate the LED display on the operation panel. (Refer to Appendix 3, Character codes, on page **123.** The boxed items indicate a parameter or panel operation key.

(2) When using the VF-A5 to drive a "Toshiba VF motor", designed exclusively for constant torque/inverter-driven applications, set the electronic thermal protection characteristics for a VF motor.
(Refer to pages **72, 73,** Electronic Thermal Protection.)

(3) For protection measures, use of a motor with an imbedded-type thermal relay in the motor coil is recommended when running a motor at low speeds.

Restrictions on the installation of power-factor improvement capacitors (both input/output)

Do not install power-factor improvement capacitors on the input or output sides of the inverter. Large currents containing high frequency elements may flow to the capacitors and adversely affect them. Capacitors on the output side may cause the inverter to overcurrent trip. Install an input reactor or DC-link reactor (optional) for power-factor improvement.

Countermeasures against radio wave interference

The inverter may cause radio wave interference to audio equipment, etc., used near the inverter. In this case, install a radio noise reduction filter (optional) on the inverter's power source side, or shield the cables to the motor with a conduit to reduce the interference. Contact your dealer for further details.

Cautions concerning ground faults

Verify that there are no incorrect connections between the motor and inverter and that there are no short circuits in the motor before beginning operation. Do not ground the neutral point of a star-connected motor.

Installation of an input reactor

An input reactor can be used to improve the input power-factor, to suppress high harmonic elements, and to miminize the risk of damage to the inverter that may be caused by sudden power fluctuations. Always install an input reactor when connecting the inverter to the following types of systems.

(1) When power source capacity is 500kVA or more, and when power source capacity is greater than the inverter capacity by a factor of 10 times or more.

(2) When connecting the inverter to the same power system as thyristor-commutated control equipment.

(3) When connecting the inverter to the same power system as a distorted-wave generation source, such as an arc furnace or thyristor-switched converter unit.

Leakage currents

Leakage currents may increase slightly depending on the connection method.

(1) When multiple inverters are connected to one ELCB, increase the ELCB current sensitivity value.

(2) Keep the wiring length between the inverter and motor as short as possible.

(3) Use an ELCB with high-harmonic suppression.

Table 5.1: Examples of selecting equipment for wiring

Voltage class	Applicable motor (kW)	Inverter	Non-fuse breaker (MCCB)		Magnetic contactor (MC)		Overload relay Th-Ry		Surge killer	Wire size		
		Model	Rated current (A)	Toshiba model	Rated current (A)	Toshiba model (Note 1)	Adjusted current value (A) [Reference value]	Toshiba model	Model (Note 2)	Main circuit (mm^2) (Note 3)	Control circuit (mm^2) (Note 4)	Dynamic braking resistor (mm^2)
200V class	0.4	-2004P	5	SS30	12	C12A	2.3	T11A	Toshiba model SS-2 or Marcon Electronics RFM2E224KD	2.0	0.75 or larger	—
	0.75	-2007P	10	SS30	12	C12A	4.2	T11A		2.0		
	1.5	-2015P	15	SS30	12	C12A	6.6	T11A		2.0		
	2.2	-2022P	20	SS30	12	C12A	9.3	T11A		2.0		
	3.7	-2037P	30	SS30	18	C20A	15	T20A		3.5		
	5.5	-2055P	50	ES50	35	C35A	22	T35A		8		5.5
	7.5	-2075P	60	EH100	50	C50A	28	T35A		14		
	11	-2110P	100	EH100	65	C65A	43	T65A		14		8.0
	15	-2150P	125	EH225	80	C80A	57	T65A		22		
	18.5	-2185P	125	EH225	93	C100A	70	T80A		38		22
	22	-2220P	150	EH225	93	C100A	85	T125A		38		
	30	-2300P	200	EH225	180	C180A	108	T125A		60		
	37	-2370P	225	EH225	180	C180A	138	T150A		100		60
	45	-2450P	250	EH400	220	C220A	162	T180A		100		
	55	-2550P	250	EH400	220	C220A	198	T220A		100		
	75	-2750P	500	SH600	300	C300A	3.6	T400A		100×2		
400V class	0.75	-4007P	5	SS30	9	C12A	2.3	T11A	Model SS-2 or Marcon Electronics RFM2H104KD (400V system) (Note 6)	2.0	0.75 or larger	—
	1.5	-4015P	10	SS30	9	C12A	3.6	T11A		2.0		
	2.2	-4022P	10	SS30	9	C12A	5.0	T11A		2.0		
	3.7	-4037P	15	SS30	9	C12A	8	T11A		2.0		
	5.5	-4055P	30	SS30	17	C20A	11	T20A		3.5		2.0
	7.5	-4075P	30	SS30	17	C25A	15	T20A		5.5		
	11	-4110P	50	ES50	33	C35A	22	T35A		8		3.5
	15	-4150P	60	EH100	48	C50A	28	T35A		8		
	18.5	-4185P	75	EH100	50	C50A	35	T35A		14		8.0
	22	-4220P	100	EH100	50	C50A	43	T65A		22		
	30	-4300P	125	EH225	80	C80A	57	T65A		38		
	37	-4370P	125	EH225	93	C100A	70	T80A		38		22
	45	-4450P	150	EH225	180	C180A	85	T125A		38		
	55	-4550P	175	EH225	180	C180A	108	T125A		60		
	75	-4750P	225	EH225	220	C220A	138	T150A		100		

(Note 1) When selecting a magnetic contactor (MC) with 2a auxiliary contacts and using the auxiliary contacts for the control circuit, parallel the 2a contacts to improve contact reliability.

(Note 2) Install a surge killer on the magnetic contactor or relay exciting coil.

(Note 3) The wire sizes for the input side R, S, T and output side U, V, W are shown. These sizes apply only when the wiring length is less than 30m. Increase the wire sizes when the length exceeds 30m.

(Note 4) Use shielded wire.

(Note 5) Use a wire size 3.5mm^2 or more for the grounding wire.

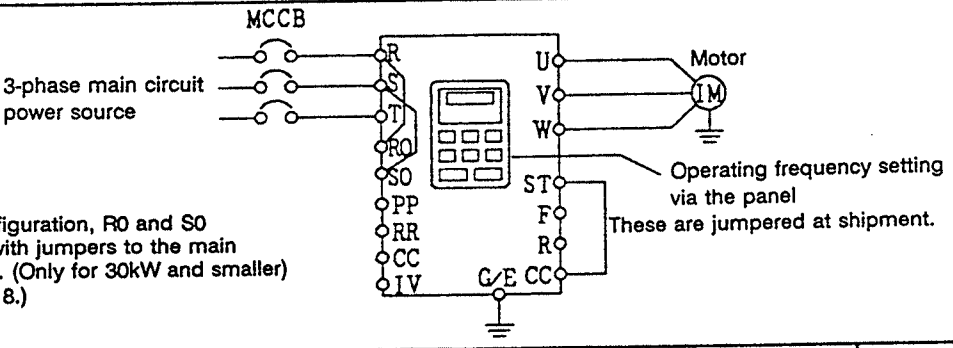
(Note 6) 200V system: type SS-2 or Marcon Electronics RFM2E224KD

6. Standard Connections

Refer to the operation selection explanation (7.4 Operation mode selection, page 40), and parameter list (page 105).

6.1 Standard Connection Example

Example 1	To set run frequency, forward/reverse run, and decelerated stop via the panel.



In standard configuration, RO and SO are connected with jumpers to the main circuit terminals. (Only for 30kW and smaller) (Refer to page 18.)

Setting

Parameter group	Parameter	Setting value	Reference page
Gr.UE	CNOd (Command mode selection)	2 or 4 Note 1)	40
Gr.UE	FNOd (Frequency setting mode selection)	2 or 4 Note 2)	40

Note 1) CNOd set to 2 ... Press [RUN] to start running.

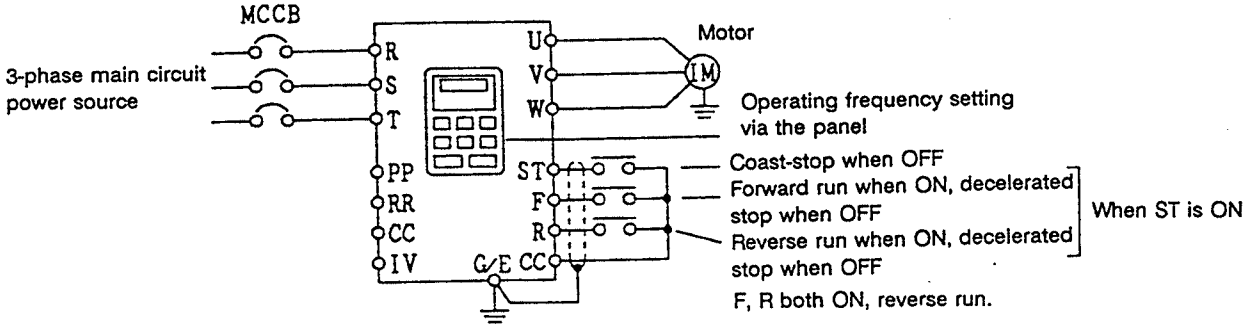
CNOd set to 4 ... Press [PANEL/REMOTE], then [RUN] to start running.

★ Refer to page 28 "7.2 Basic Operation" for the operation methods.

Note 2) FNOd set to 2 ... The reference frequency can be set only from the operation panel.

FNOd set to 4 ... Press [PANEL/REMOTE], and the reference frequency can be entered from the operation panel.

Example 2	To set operating frequency via the panel, and forward/reverse run, decelerated stop, and coast-stop with external signals.



Setting

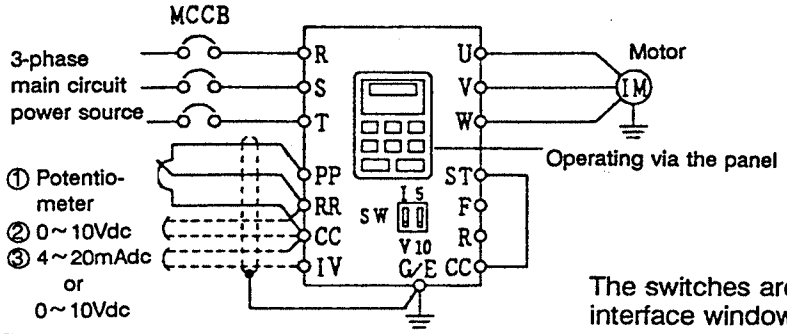
Parameter group	Parameter	Setting value	Reference page
Gr.UE	CNOd (Command mode selection)	1 or 4 Note 3)	40
Gr.UE	FNOd (Frequency setting mode selection)	2	40

Note 3) Emergency stop is possible from the panel by pressing [STOP] twice.

CNOd set to 1 ... Running from operation panel is not possible.

CNOd set to 4 ... Press [PANEL/REMOTE], and running is possible from the operation panel by pressing [RUN].

Example 3	To set operating frequency with external signals, and forward/reverse run and decelerated stop with the panel.



The switches are under the ROM interface window. (Refer to page 4.)

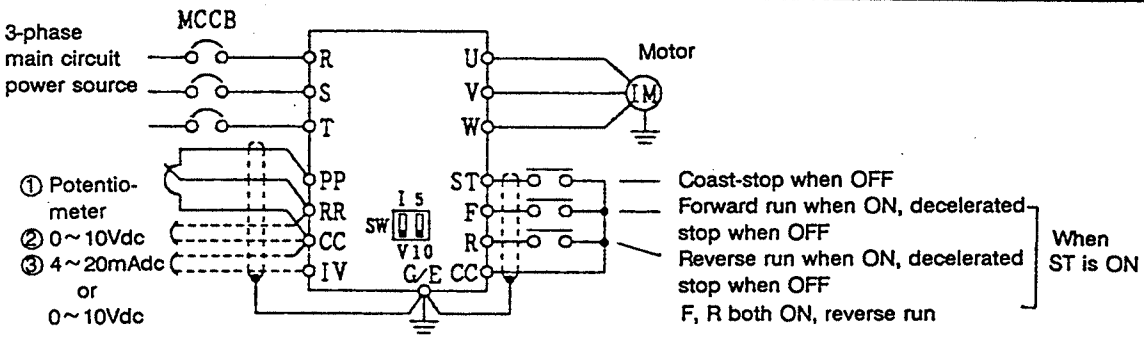
Setting

Parameter group	Parameter	Setting value	Reference page
GrUE	CNOd (Command mode selection)	2 or 4 Note 1)	40
GrUE	FNOd (Frequency setting mode selection)	1	40

External operating frequency signal	Gr.5F FC1 Setting value Note 5)	Switch SW
① Potentiometer	1	—
② 0~10Vdc	1	V side
③ 4~20mAdc	2	I side
0~10Vdc	2	V side

Note 5) Refer to page 69.

Example 4	To set operating frequency, forward/reverse run, decelerated stop, and coast-stop via external signals.



Setting

Parameter group	Parameter	Setting value	Reference page
GrUE	CNOd (Command mode selection)	1 or 4 Note 3)	40
GrUE	FNOd (Frequency setting mode selection)	1 or 4 Note 4)	40

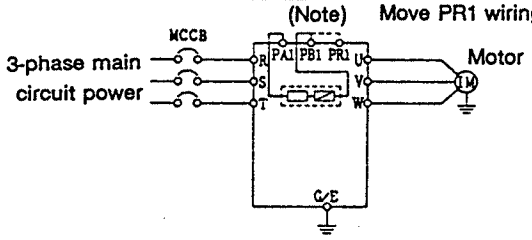
External operating frequency signal	Gr.5F FC1 Setting value Note 5)	Switch
① Potentiometer	1	—
② 0~10Vdc	1	V side
③ 4~20mAdc	2	I side
0~10Vdc	2	V side

Note 5) Refer to page 69.

Note 4) Emergency stop is possible from the panel by pressing STOP twice.
FNOd set to 1 ... The reference frequency can only be input from the terminal block.
FNOd set to 4 ... Press PANEL/REMOTE, and the reference frequency can be entered from the operation panel.

Example 5	When using built-in braking resistor

(For 3.7kW and smaller units)



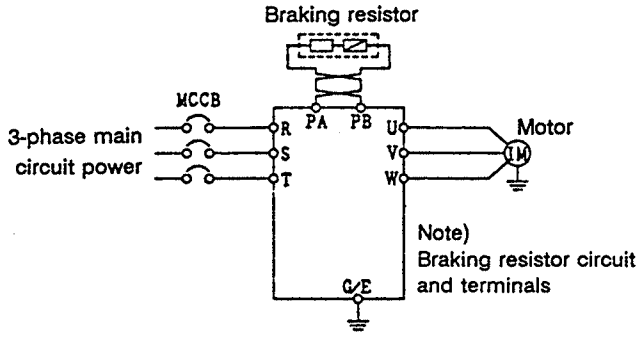
Setting: Set [Pb] in parameter group [Gr.Pr] (dynamic braking selection) to [2] (dynamic braking with overload detection).

The built-in braking resistor is connected to the PB1 terminal (refer to page 23) at shipment.

Example 6	When connecting a braking resistor (optional)

Note) Select a braking resistor that is higher than the min. tolerable resistance value (refer to page 95). For 22kW and larger units, the separate GTR7 (dynamic braking circuit) option is required.

a) When using an optional braking resistor with temperature fuse

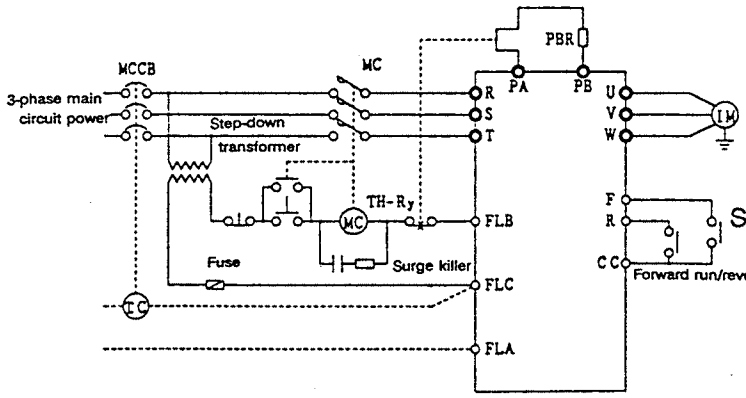


Setting: for 5.5kW and larger units, set [Pb] in parameter group [Gr.Pr] (dynamic braking selection) to [2] (dynamic braking with overload detection).

When using the built-in braking resistor with 3.7kW and smaller units, avoid the use of an external braking resistor. However, parallel connection is possible in the following combinations. (For max. braking rate applications)

		Built-in braking resistor	Minimum external resistor value that can be used with the built-in braking resistor	Min. total braking resistance value
200V systems	2.2kW and smaller	70Ω	70Ω	35Ω
	3.7kW	40Ω	40Ω	20Ω
400V systems	3.7kW and smaller	150Ω	150Ω	75Ω

b) When using an optional braking resistor without temperature fuse



TH-Ry is used as a fire prevention fail-safe. DBR overload and overcurrent protection functions are incorporated in the inverter for protection of the braking resistor, but TH-Ry operates if those protective functions are not possible. Select TH-Ry according to the DBR power rating.

Setting: Set [Pb] in parameter group [Gr.Pr] (dynamic braking selection) to [2] (dynamic braking with overload detection), and set the braking resistor capacity and resistance value. (Refer to [PbC] [PbCP] on page 77.)

Note) The step-down transformer does not need to be installed for 200V class inverters.

6.2 Terminal Functions

Table 6.2.1: Main circuit terminal functions for 3.7kW and smaller units

Main circuit terminal functions for 3.7kW and smaller units are as shown below. The internal circuit diagrams for each terminal are shown on page 21.

Terminal symbol	Terminal function	Internal circuit diagram
G/E	Terminal for external grounding.	A
R/L1, S/L2, T/L3	Connect to properly-rated power source.	A
U/T1, V/T2, W/T3	Connect to motor (3-phase induction motor).	B
PA, PB	When built-in braking resistor is insufficient, connect to external braking resistor (optional). Change the settings related to dynamic braking resistor protection.	C1
PC	Minus potential terminal for internal DC circuit. A DC power source can be input between this terminal and the PA terminal (plus potential).	C1
R0, S0	Control circuit power is input via the shorting bars on the terminal block (R/L1-R0, S/L2-S0). When using a separate power supply for the control power, remove the shorting bars before connecting the power supply.	D1
(PR1), (PB1)	Connected to the built-in braking resistor. When not using the built-in braking resistor, change the wiring from (PB1) to (PR1), and then change the settings of the dynamic braking resistor operation parameters.	C1
(PA1)	This is an internal connection, so do not remove wires from it or connect external wires to it. It is connected to the built-in braking resistor.	C1
(E)	This is for internal connections, so do not remove or connect external wires. This is wired to the inverter chassis.	A

Table 6.2.2: Main circuit terminal functions for 5.5kW and larger units

Main circuit terminal functions for 5.5kW and larger units are as shown below. The internal circuit diagrams for each terminal are shown on page 21.

Terminal symbol	Terminal function	Internal circuit diagram
G/E	Terminal for external grounding.	A
R/L1, S/L2, T/L3	Connect to properly-rated power source.	A
U/T1, V/T2, W/T3	Connector to motor (3-phase induction motor).	B
PA, PB	Connect to the braking resistor (optional) and then set the dynamic braking resistor operation parameters.	C2,C3,C4
PC	Minus potential terminal for internal DC main circuit. A DC power source can be input between this terminal and the PA terminal (plus potential).	C2,C3,C4
PO, PA	Terminals for connecting a DC-link reactor (DCL) (standalone type). This is short circuited with a shorting bar at shipment.	C2,C3,C4
R0, S0	Control circuit power is input via the shorting bars on the main circuit terminal block (R0-R/L1, S0-S/L2). When using a separate power supply for control power, remove the shorting bars before connecting the power supply. On 37kW and larger units, these terminals are not connected to the main circuit terminals at shipment, so connect a power supply for the control circuit.	D1, D2
R20, S20	Power supply output terminals (190 to 220V - 50Hz, 190 to 230V - 60Hz) for operation circuits. Only installed on 400V-class 37kW and larger units (10VA).	D2

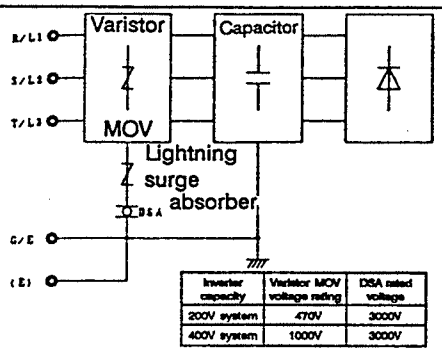
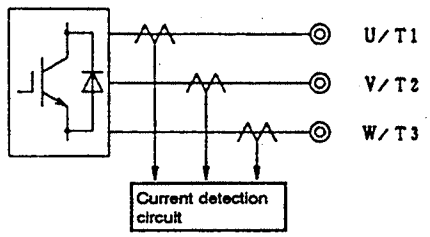
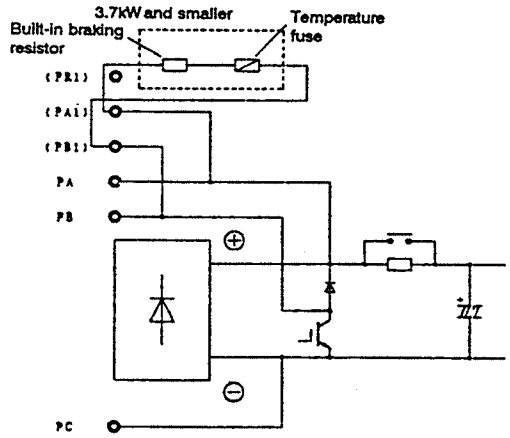
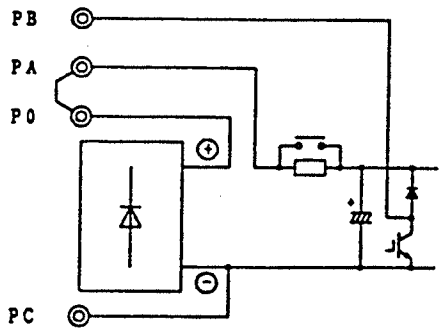
Table 6.2.3. Control circuit terminal functions

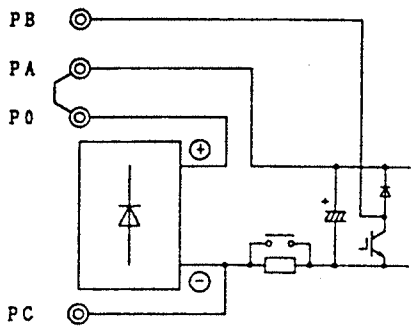
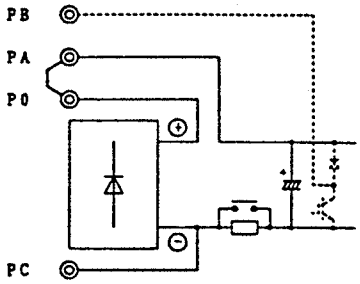
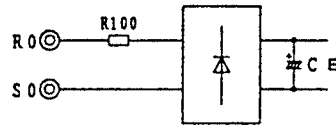
Control circuit terminal functions are as shown below. The internal circuit diagrams for each terminal are shown on page 22.

Terminal symbol	Terminal function	Internal circuit diagram
FLA, FLB, FLC	These are the multifunction programmable relay contact outputs (refer to page 12). The contact ratings are 250Vac-2A (COSø=1), 30Vdc-1A, 250Vac-1A (COSø=0.4). The standard function setting detects when the inverter protection functions have operated. When a protection function activates, FLA-FLC will close, and FLB-FLC will open.	E
P24	24Vdc power output. (Max. 100mA)	F
RCH	This is a multifunction programmable open-collector output (refer to page 57). (Max. 50mAdc) The standard function setting activates this signal when completion of deceleration or acceleration is detected.	G
LOW	This is a multifunction programmable open collector output (refer to page 57). (Max. 50mAdc) The standard function setting activates this signal when a low speed is detected.	G
FP	This is a dedicated open-collector output. (Max. 50mAdc). Pulses that are 48-, 96- or 360-times the output frequency are output according to parameter settings. The standard setting is for 48-times the output frequency.	H
FM	This is a multifunction programmable analog output (refer to page 89.) The standard setting is the pre-compensation reference frequency. When connecting a meter, use a 1mAdc full-scale ammeter or 7.5Vdc-1mA full-scale voltmeter.	I
AM	This is a multifunction programmable analog output (refer to page 89.) The standard setting is the output current. When connecting a meter, use a 1mAdc full-scale ammeter or 7.5Vdc-1mA full-scale voltmeter.	I
PP	This is the power supply for reference frequency setting. (10Vdc) Connect a 3kΩ potentiometer (a 1 to 10kΩ potentiometer may also be used).	J
RR	This is a multifunction programmable analog input. The standard setting is a 0 to 10Vdc input corresponding to a 0 to 80Hz frequency setting.	K
IV	This is a multifunction programmable analog input. Change between 0 to 10Vdc (SW at V side) or 4 (0) to 20mAdc (SW at I side) via SW, located under the ROM interface window. The standard setting is a 0 to 10Vdc input corresponding to a 0 to 80Hz frequency setting with the switch at the V side.	L
RX	This is a multifunction programmable +/− analog input. Change between 0 and ±10Vdc (SW at 10V side) or 0 to ±5Vdc (SW at 5V side) via SW, located under the ROM interface window. The standard setting is a 0 to ±10Vdc input corresponding to a 0 to 80Hz forward/reverse frequency setting with the switch at the 10V side.	M
CC	This is the control circuit common terminal.	N

Terminal symbol		Terminal function	Internal circuit diagram
ST	Multifunction programmable contact inputs.	The standard setting is "run ready" with a short circuit between ST-CC. The motor will coast-stop when opened. This can also be used for interlocks. (Run ready/ coast-stop terminal)	O
F		The standard setting is forward run with a short circuit between F-CC, and decelerated stop when opened. (ST-CC in ON condition)	O
R		The standard setting is reverse run with a short circuit between R-CC, and decelerated stop when opened. (ST-CC in ON condition) The motor will reverse run when both F-CC and R-CC are short circuited.	O
S1		The standard setting is preset speed run with a short circuit between S1-CC.	O
S2		The standard setting is preset speed run with a short circuit between S2-CC.	O
S3		The standard setting is preset speed run with a short circuit between S3-CC.	O
S4		The standard setting is preset speed run with a short circuit between S4-CC.	O
RES		The standard setting is that the hold during operation of the inverter protection functions is reset with a short circuit between RES-CC. Even if RES-CC is short circuited while the inverter is operating normally, the reset function will not activate.	O

Fig. 6.2.1 Input/output internal circuits (1/2)

Symbol	Internal circuit diagram
Ⓐ	
Ⓑ	
C1	
C2	5.5, 7.5kW 

Symbol	Internal circuit diagram
C3	11~18.5kW 
C4	22kW and larger 
D1	

Inverter capacity		Max. power capacity	Peak inrush current during max. input	Component values	
				R100	C
200V system	7.5kW and smaller	50VA	20A-3mS	16Ω	100μF
	30kW and smaller	50VA	20A-7mS	16Ω	220μF
200V	37kW and larger	60VA	10A-13mS	33Ω	200μF
400V system	7.5kW and smaller	50VA	20A-3mS	32Ω	50μF
	30kW and smaller	50VA	20A-7mS	32Ω	110μF

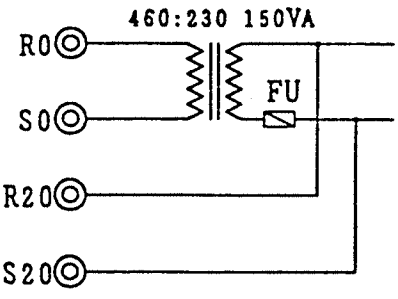
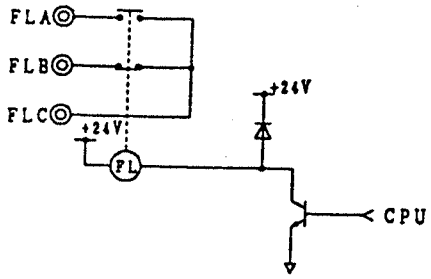
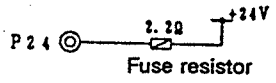
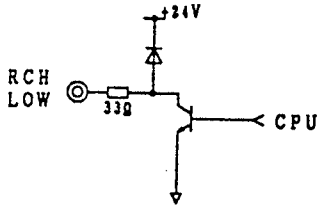
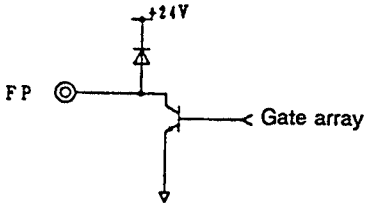
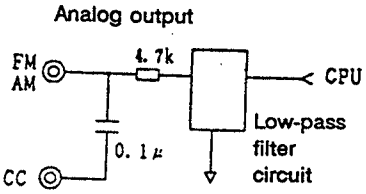
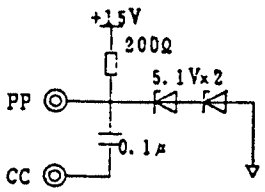
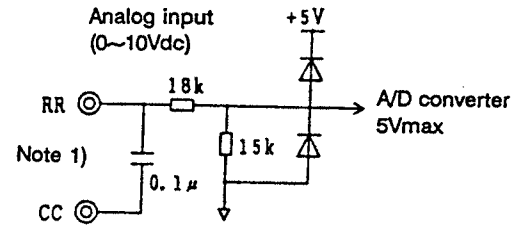
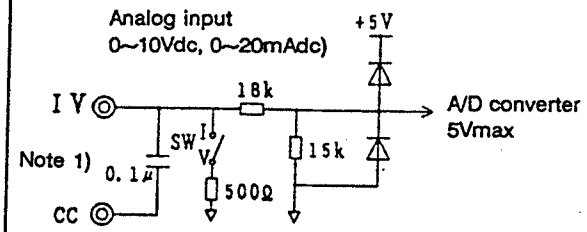
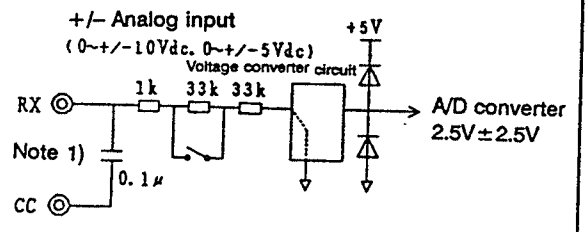
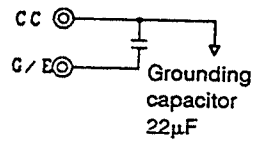
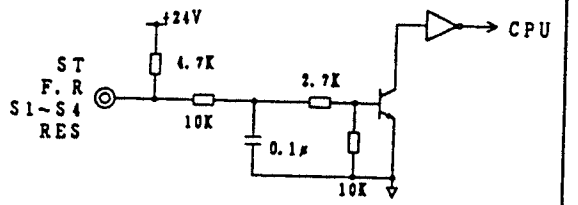
Symbol	Internal circuit diagram
D2	400V system 37~75kW 

Fig. 6.2.1 Input/output internal circuits (2/2)

Symbol	Internal circuit diagram
Ⓔ	
Ⓕ	
Ⓖ	
Ⓗ	
Ⓘ	

	Response	Resolution
AM	3mS	1/256
FM	100mS	1/1024 or better

Symbol	Internal circuit diagram
Ⓙ	
Ⓚ	
Ⓛ	 0~10Vdc (switch at V side) 4~20mAdc (switch at I side)
Ⓜ	 0~5Vdc (switch at 5 side) 0~10Vdc (switch at 10 side)
Ⓝ	
Ⓞ	

Note 1) A capacitor is installed on the analog input terminals (RR, RX, IV), so if an output such as an operational amplifier is directly connected to these terminals, instability may result. Always pass signals of this type to these terminals through a 100Ω to 1kΩ resistor.

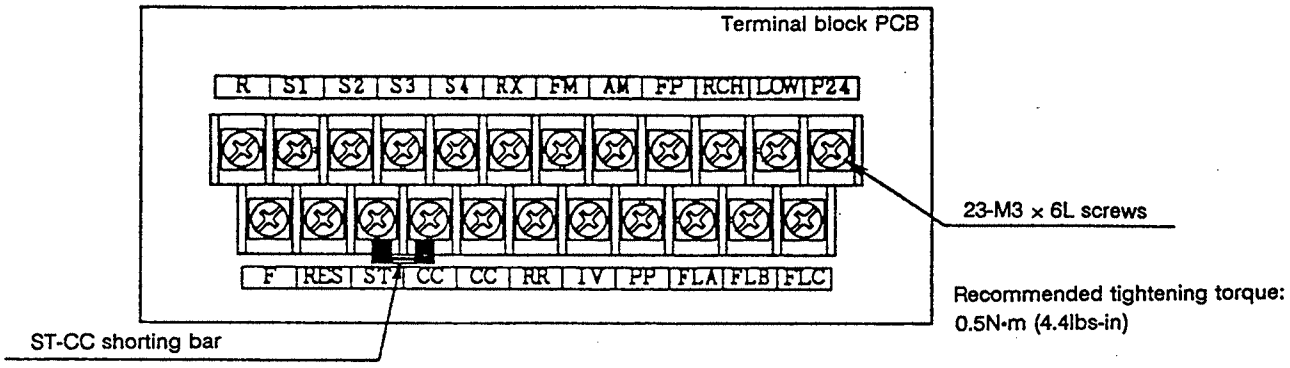
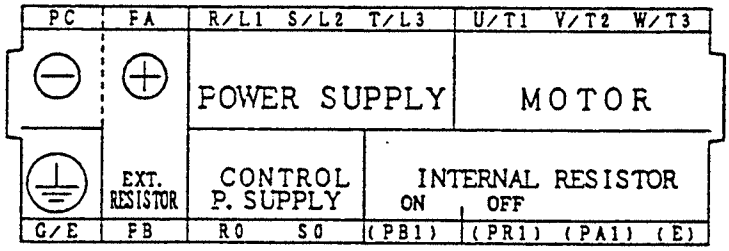


Fig. 6.2.2 Control terminal block

Terminal block cover



Terminal block

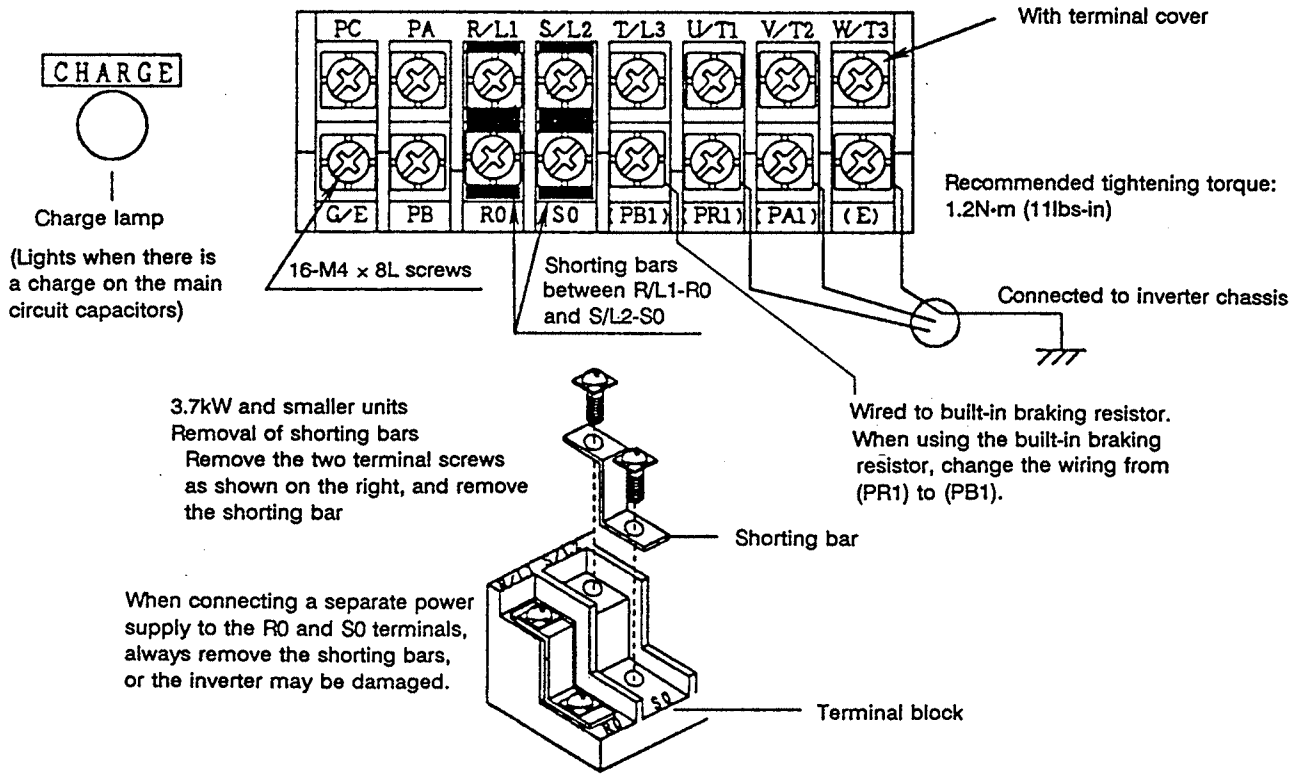


Fig. 6.2.3 Main circuit terminal block (3.7kW and smaller units)

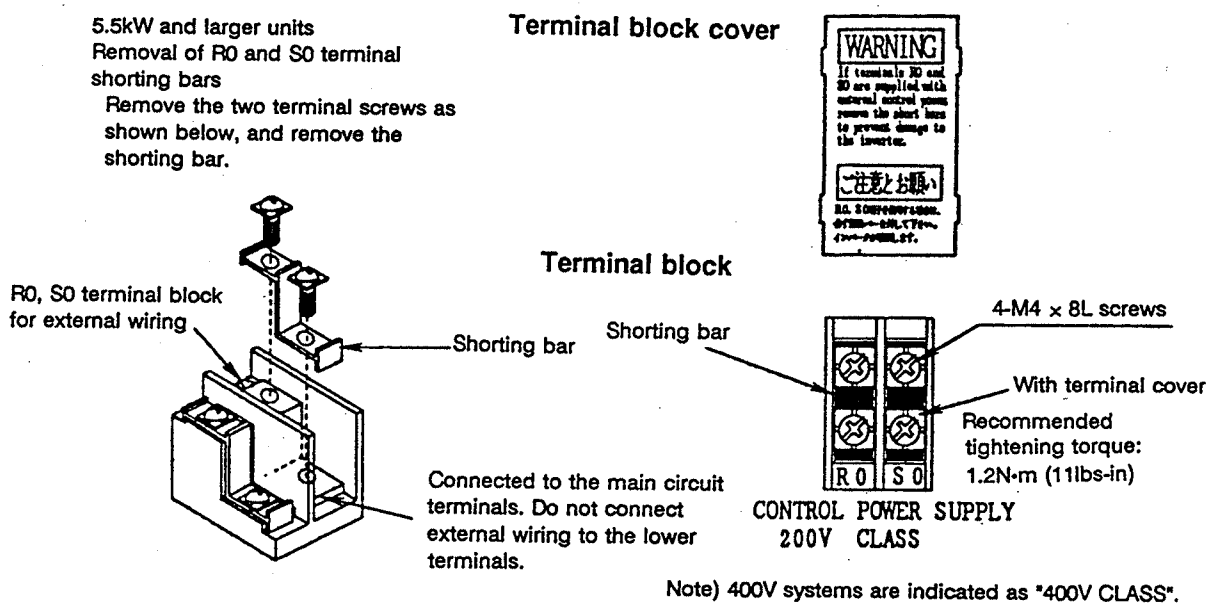
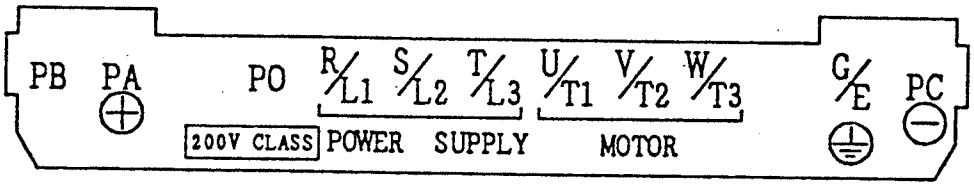


Fig. 6.2.4 Control power terminal block (5.5kW to 30kW units)

Terminal block cover



Note) 400V systems are indicated as 400V CLASS.

Terminal block

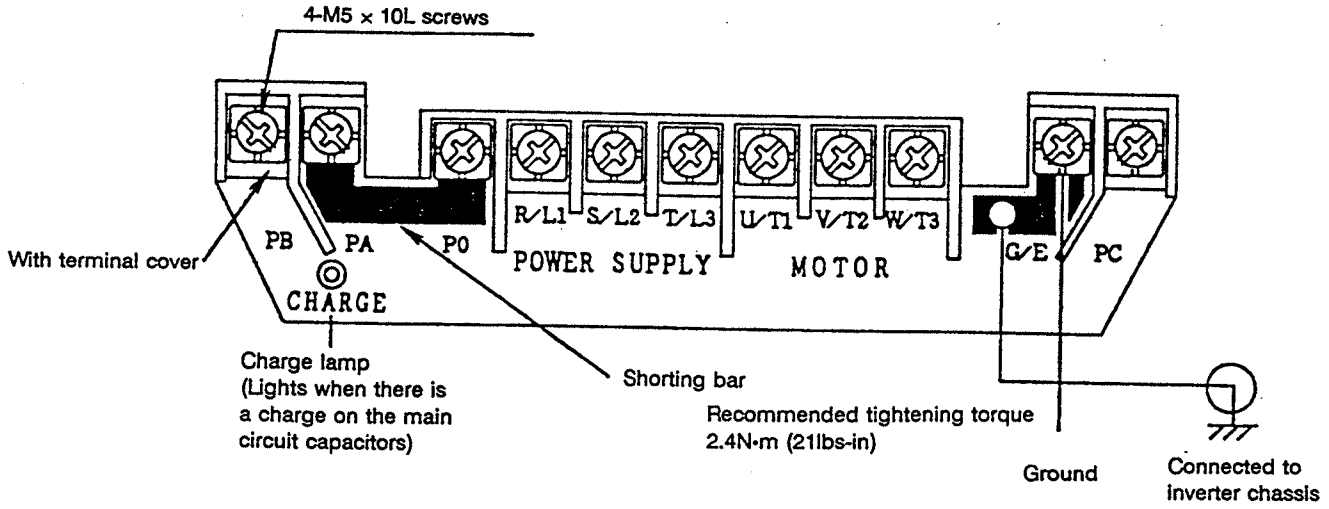
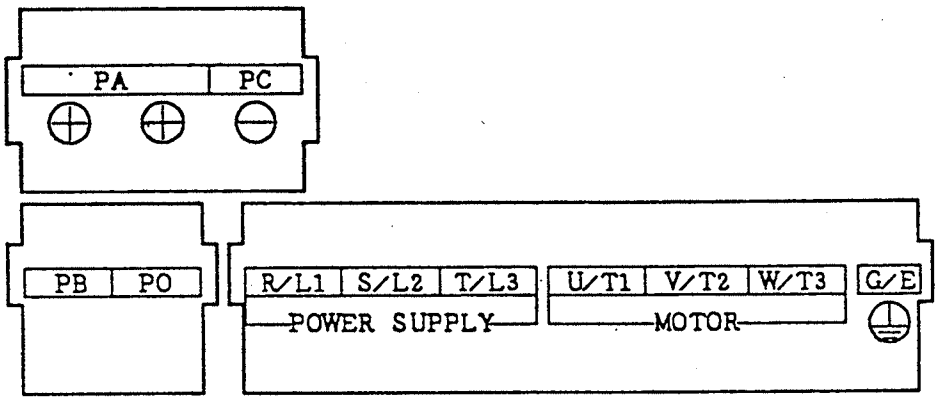
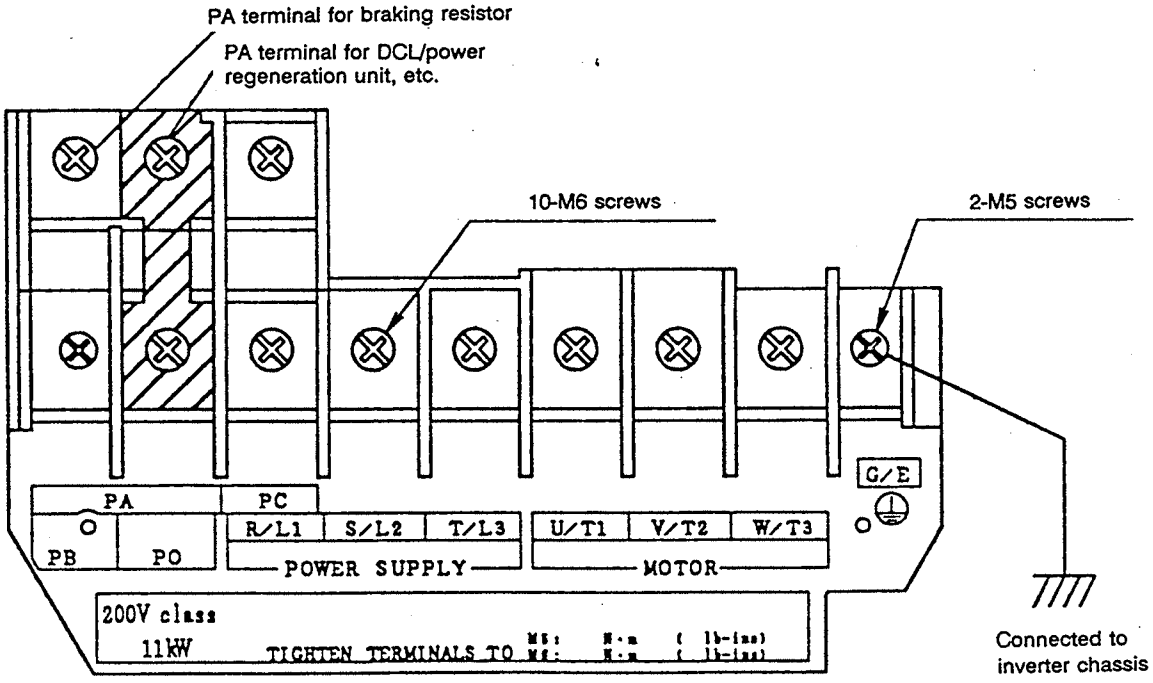


Fig. 6.2.5 Main circuit terminal block (5.5kW to 7.5kW units)

Main circuit terminal block protective covers



Main circuit terminal block

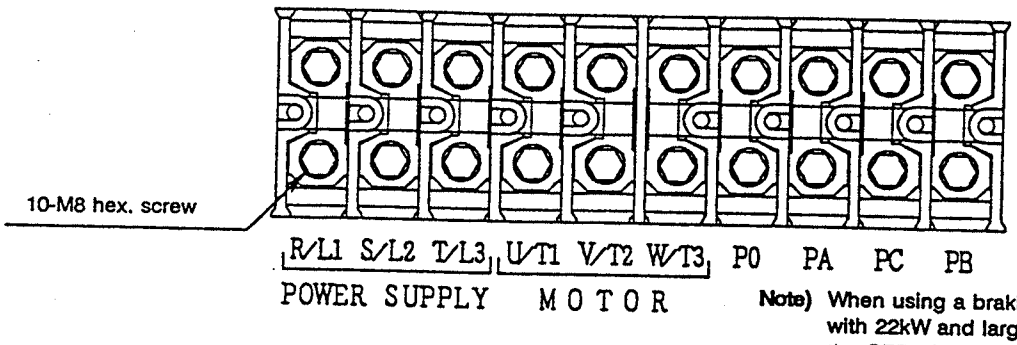


Main circuit terminal block screw tightening torques

	N-m	lb-in
M5	2.4	21
M6	4.0	35
M8	8.0	71

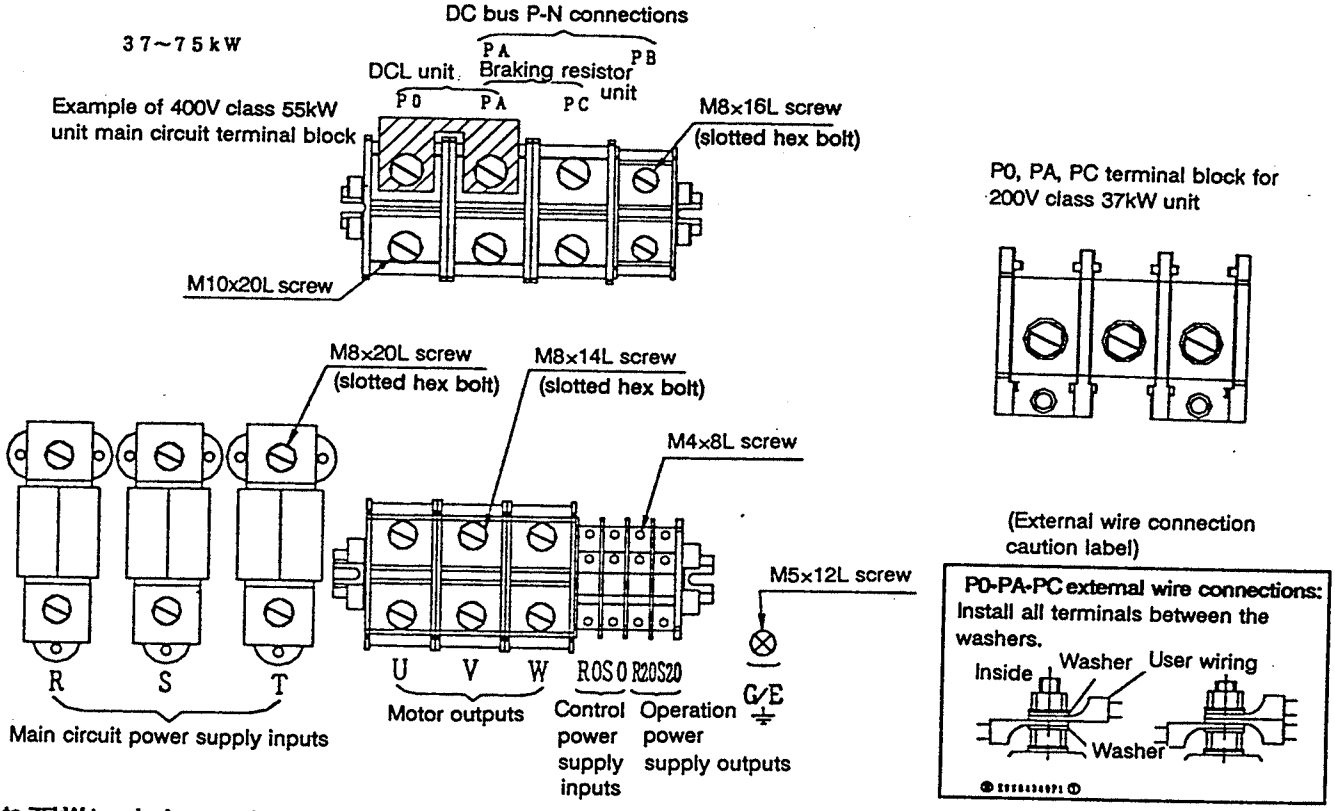
Note) The 200V 18.5kW terminal block screw size has been changed from M6 to M8.

Fig. 6.2.6 Main circuit terminal block (11kW to 18.5kW units)



Note) When using a braking resistor with 22kW and larger units, the GTR7 (dynamic braking circuit) option must be installed.

Fig. 6.2.7 Main circuit terminal block (22kW to 30kW units)



37 to 75kW terminal screw sizes

Inverter rating (kW)	Main circuit terminal screw size								
	200V class				400V class				G/E
	R,S,T,U,V,W	Control power supply	PA,PC,P0	PB	R,S,T,U,V,W	R0,S0,R20,S20	PA,PC,P0	PB	
37	M10	M4	M8	M8	M8	M4	M8	M8	M5
45	M10	M4	M10	M8	M8	M4	M8	M8	M5
55	M10	M4	M10	M8	M10	M4	M10	M8	M5
75					M10	M4	M10	M8	M5

Main circuit terminal block screw tightening torques

	N-m	lb-ins
M4	1.2	11
M5	2.4	21
M8	8.0	71
M10	16	142
M12	32	283

Fig.6.2.8 Main circuit terminal block (37kW to 45kW units)

7. Operation and Adjustment

7.1 Operation Panel

The operation panel (hereafter, panel) allows the inverter to be operated, and functions and data to be set and monitored.

LED display

The LED display normally indicates the operating frequency.
During status monitoring, various conditions can be monitored, and the frequency command value can be displayed.
During parameter settings, the groups or parameter titles and setting values can be displayed. During a fault, the cause will be displayed.

① Lights during operating frequency setting, status monitor mode displaying, and displaying of a group name, parameter name or parameter setting value.
② Refer to Appendix 3, Character codes (page 123).
③ Lights during option priority operation
(Refer to the Instruction Manual for the option for details.)

Panel control LED

This LED will light when "Panel control" is selected. The inverter can be operated from the panel when this LED is lit, and it will blink while running.

Panel/remote key

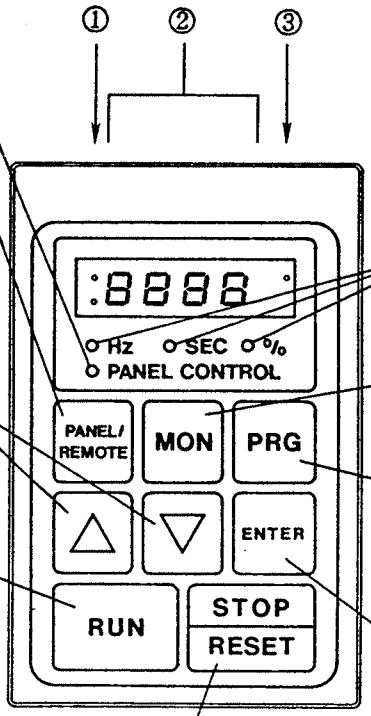
Changes between "Panel operation" and "Terminal block operation".

UP key (△) and DOWN key (▽)

When a numerical value is displayed, it can be incremented/decremented with these keys. When a symbol is displayed, the next item can be displayed by pressing these keys.

Run key

Initiates running. This key is valid only when "Panel control" is selected.



Units LEDs

When a numerical value is displayed on the LED display, the LED corresponding to the numerical value's units will light. (No LEDs will be lit when A or V units are selected.)

Monitor key

Changes between status monitor mode and frequency display status.

Program key

Changes between settings monitor mode and frequency display status.

Enter key

Selects or sets the parameter name, data or frequency, etc.

Stop/reset key

This key functions as the stop key during "Panel control". In all other modes, emergency stop is engaged when this key is pressed twice. During an inverter trip, the tripped state can be reset by pressing this key twice.
(Refer to section 7.4.7 Fault reset.)

7.2 Basic Operation

Verify the following items before starting operation.

(1) Check that the wiring is correct.
(Refer to Chapter 6, Standard connections, on page 15.)

(2) Check that the power source is the correctly-rated value.

After confirming that there are no mistakes, perform simple operations with the standard settings.

Operate according to the following procedure.

When performing trial operations, run the motor at a low frequency (approx. 10Hz).

(1) Starting and stopping via the panel

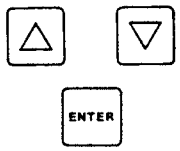
Step	Operation
1) Power ON	Turn ON the power source's non-fuse breaker (MCCB). If the LED display is OFF, all preparation conditions are not established, so running will not be possible. Terminals ST-CC must be "closed". Running is possible when the LED display is 0.0 . Remote operation mode from the control terminal block is automatically entered when power is turned on.
2) PANEL/ REMOTE	Changeover to "Panel control". The panel control LED will light, and operation from the panel will be possible. (If this key is pressed again, the panel control LED will go out, and remote operation mode from the control terminal block will once again be entered.)
3) △ ▽ ENTER	Set the operating frequency. The frequency command value can be incremented/decremented with the UP key (△) or DOWN key (▽). When one of these keys is pressed, the LED display will blink, indicating that the value is being changed. When the desired frequency is displayed, press the ENTER key. FC and the frequency will be alternately displayed on the LED display.
4) RUN	The frequency will increase according to the acceleration time, and the motor will rotate. The panel control LED will blink while running.
5) STOP RESET	The frequency will decrease according to the deceleration time, and the motor will decelerate and stop.

Caution

If the power switch is turned off in the 4) state, the motor will coast-stop. However, this method should only be used in the case of an emergency.

Avoid frequent starting and stopping of the inverter by turning the power switch on and off, as this will shorten the life of the inverter.

(2) Changing the frequency while running

Step	Operation
1) 	The frequency can be changed while running by pressing the UP key (△) or DOWN key (▽). Note that the frequency command value will change and the operating frequency will change. The operating frequency can be changed even if the [ENTER] key is not pressed, but if the power is turned off at this time, the frequency command value will return to the frequency set before changing.

(3) Function setting and adjustment

Use the following procedure to change the "standard settings".
First, refer to the parameter list to find the parameter group where the function to be changed is, and how the symbol name is displayed.

Blind function

In the standard setting, only groups U, F and UE can be displayed on the panel. The other groups are blinded via the blind function in group UE. Unblind the desired group if necessary.
(Refer to Gr.UE [bLnd] Blind function on page 50.)

Gr.U

Gr. U displays only those parameters for which the setting value has been changed by the user, and the changed setting value differs from the standard default setting. [Auto edit function]
The parameter settings can also be changed in this group.
However, if a parameter setting value that is the same as the default setting is once again input, that parameter will no longer be displayed in this group.
Gr.U sequentially compares the settings of all parameters to the standard default setting values, so this process may take several seconds. The Gr.U display will blink and may not appear to immediately react, but the Gr.U search can be stopped by pressing a key other than [△], [▽] or [ENTER].
(There is a changed settings memo section on page 142 in which changed setting values may be recorded.)

Panel operation mode selection

Various panel operation modes ([PNOd] in Gr.UE) can be selected to prevent undesired operations from the operation panel. If this parameter is set by mistake, the function will become valid after a power-on initialization or fault reset is executed, and the anticipated key operations may not be possible. In this case, reset the panel operation mode selection [PNOd].
(Refer to Gr.UE [PNOd] panel operation mode selection on page 84.)

Parameter groups

Gr. U : User parameters	Gr.tr : Communication parameters
Gr. F : Fundamental parameters #1 (V/F, accel/decel etc.)	Gr.01 : Industrial application parameters (pump)
Gr.F2 : Fundamental parameters #2 (V/F, accel/decl etc.)	Gr.02 : Industrial application parameters (fan)
Gr.Pn : Panel control parameters	Gr.03 : Industrial application parameters (conveyor)
Gr.St : Terminal selection parameters	Gr.04 : Industrial application parameters (hoist)
Gr.SC : Special control parameters	Gr.05 : Industrial application parameters (textiles)
Gr.SF : Frequency setting parameters	Gr.06 : Industrial application parameters (machine tools)
Gr.Pr : Protection parameters	Gr.AN : AM/FM adjustment parameters
Gr.Pt : Pattern run parameters	Gr.Ut : Utility parameters
Gr.Fb : Feedback parameters	Gr.Mt : Motor parameters

The following parameters cannot be changed while running, so stop first and then set them.

Gr.F	FH	Max. frequency
	uLSL	Maximum voltage frequency voltage selection
	Pt	V/f pattern
Gr.Ut	APL	Industrial application parameters selection
	tYP	Standard setting mode selection

Gr.Fb	PGPH	PG input-No. of phases
Gr.Mt	Mt.P	No. of motor poles
	Mt.tn	Auto-tuning

The following parameters can be changed while running, but the function will become valid only after the motor has stopped (0.00Hz).

Gr.Ut	CMOd	Command mode selection
	FMOd	Frequency setting mode selection
	PMOd	Panel operation mode selection

Gr.Mt	Mt.C	Motor rated capacity
	Mt.t	Motor type
	Mt.u	Motor rated voltage
	Mt.F	Motor rated frequency
	Mt.r	Motor rated rpm

★ PMOd becomes valid only after resetting.

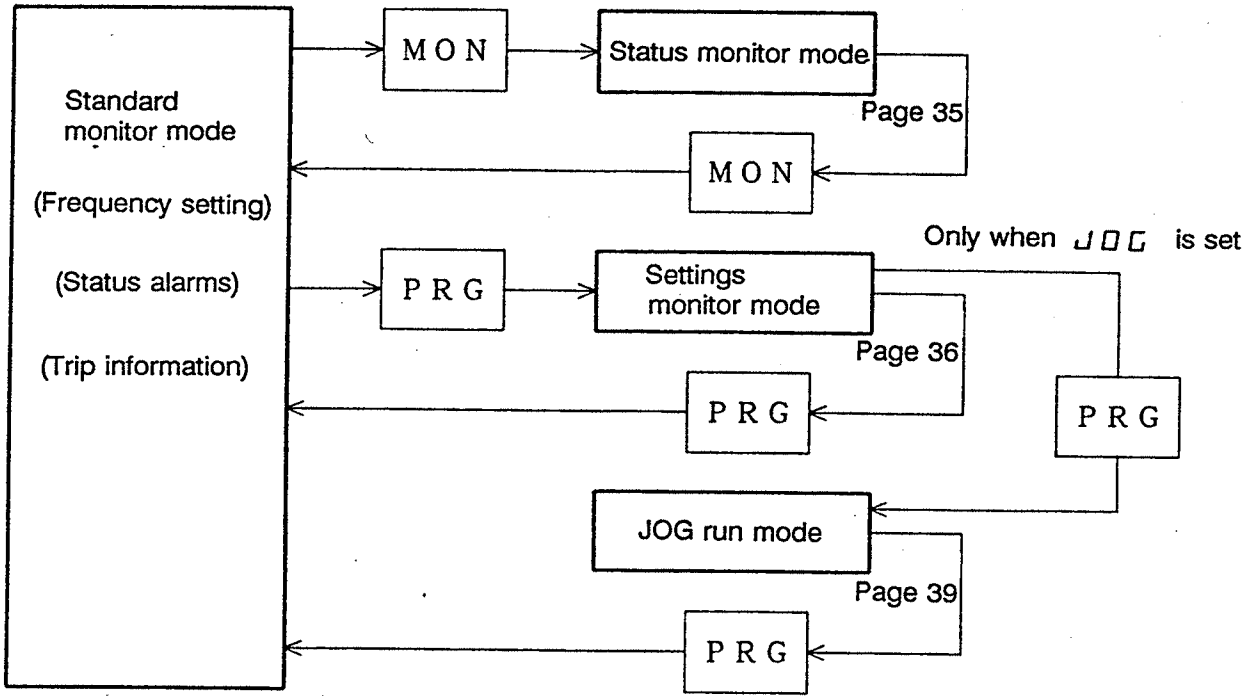
The method for making setting changes is explained below using maximum voltage frequency (Gr.F , uL 1) as an example.

Key operation	LED display	Operation
	0.0	Operating frequency is displayed (standard monitor mode)
1) PRG	:Gr.U	The mode changes from standard monitor mode to parameter setting mode. Gr.U , the first group name, will be displayed.
2) △ ▽ ENTER	:Gr.U ↓ :Gr.F	Select the desired group name with the △▽ keys. ⇄U⇄F⇄U E⇄U⇄ When the desired group name is displayed, press ENTER to display the parameter names in that group.
3) △ ▽	:FH ↓ :uL 1	Select the name of the parameter to be changed with the △▽ keys.
4) ENTER	:uL 1 ↓ :60.0	When the desired parameter name is displayed, press ENTER to display the current parameter value.
5) △ ▽ ENTER	:50.0 :uL 1 ⟷ 50.0 :uL 1	Change the parameter value with the △▽ keys. When the desired parameter value is displayed, press ENTER to save it. After the parameter name and data are alternately displayed, the parameter name will once again be displayed.
6) ENTER ↓ Returns to step 4) above.	or PRG ↓ Returns to standard monitor mode.	or MON ↓ Moves to status monitor mode.	or △ ▽ ↓ Returns to step 3) above.

Another mode can be moved to in any of the above states by pressing the PRG or MON keys. However, if ENTER is not pressed first after changing a parameter setting value, the new value will not be saved, and the original setting will be returned to when the power is turned off. Always press the ENTER key after changing a setting.

7.3 Operation Modes

This inverter unit has the following four operation and display modes.



7.3.1 Standard Monitor Mode

Standard monitor mode is automatically entered when power is turned on. The inverter's output frequency can be monitored and the frequency command value can be set in this mode. Status alarms are displayed while running and trip data is displayed during an inverter trip.

(1) Frequency command value setting function
This function can be used by pressing the △ ▽ keys in standard monitor mode. Status monitor mode can be entered by pressing [MON] and settings monitor mode by pressing [PRG]. (Standard monitor mode will once again be entered if the same key is pressed again.) If the frequency command value is changed while running, the operating frequency will change according to the new value. If the command value is ahead of the operating frequency, the motor will accelerate or decelerate according to the acceleration/deceleration time.
This function can be locked out (changes not possible) with the "frequency setting mode selection" ([FMOd] in Gr.UE).

(2) Forward/reverse run changeover during run function
Forward and reverse run are possible by pressing the following keys in standard monitor mode.

[ENTER] + △ Forward run
[ENTER] + ▽ Reverse run

Note) [ ] key + [ ] key means to press the two keys simultaneously.

This changeover is valid only via panel operation, and the setting value of [Fr] in Gr. Pn will also change when these key sequences are executed.

(3) Status alarms

Alarm characters and the frequency setting may be alternately displayed on the LED in standard monitor mode. The following four types of characters may be displayed.

C .... When current exceeding the overcurrent stall level flows.
P .... When voltage exceeding the overvoltage stall level is generated.
L .... When 50% or more of the overload trip value is reached.
H .... When the temperature reaches the overheat protection alarm setting level.

Several alarms may also be displayed simultaneously. (" LC" " PC" " LPC")
The alarms will automatically go out when the alarm condition is removed.

(4) Trip information

The standard monitor mode trip display will be entered immediately when a trip occurs.

Display	Explanation
OC 1	Overcurrent during acceleration
OC2	Overcurrent during deceleration
OC3	Overcurrent during constant-speed run
OC 1P	DC section overcurrent during acceleration
OC2P	DC section overcurrent during deceleration
OC3P	DC section overcurrent during constant speed run
OCL	Load-end short circuit (output terminal check) trip during start-up
OCA 1	U-phase short circuit
OCA2	V-phase short circuit
OCA3	W-phase short circuit
OP 1	Overvoltage during acceleration
OP2	Overvoltage during deceleration
OP3	Overvoltage during constant-speed run
OL 1n	Inverter overload trip
OLMt	Motor overload trip
OCr	Dynamic braking resistor overcurrent trip
OLr	Dynamic braking resistor overload trip
OH	Overheat trip
E	Emergency stop
EEP 1	EEPROM fault (write error)
EEP2	Initial read fault
Err2	RAM fault
Err3	ROM fault
Err4	CPU error trip
Err5	Communication run command interruption error
Err6	Gate array fault
Err7	Output current detector fault
Err8	Option PCB fault trip
UC	Low-current operating condition trip
UP 1	Undervoltage trip (main circuit)
Ot	Overtorque trip
EF 1 or EF2	Earth-fault trip
Etn	Auto-tuning error
EtYP	Inverter typeform error (Special error, refer to page 42.)
nErr	No error (Refer to past trip display on page 35.)

The inverter status at the time of the saved trips (trips that previously occurred) can also be read. (Refer to Status monitor mode on page 35.)

Trip occurrence example
(Overvoltage trip occurrence during deceleration)

Key operation	Example display	Explanation
	OP2	Standard monitor mode (Trip display will blink) The motor enters the coast-stop state.
MON	: 40.0	Operating frequency at time of trip
▽	:Fr-F	Run direction at time of trip
▽	: 60.0	Operating frequency command value at time of trip Note)
▽	:C 130	Load current (%) at time of trip Note)
▽	:V280	Input voltage (V) at time of trip Note)
▽	:P 150	Output voltage (V) at time of trip Note)
▽	:A.....	Input terminal status at time of trip
▽	:b1111..	Input terminal status at time of trip
▽	:01111..	Output terminal status at time of trip

If there are past trips, the trip status information for a max. of four trips can be displayed in the same manner. If [MON] is pressed, the initial display will be returned to.

If the [▽] key is held down during the above steps, the display will change to the next item every 0.5 sec. The trip title display state can be changed to if the [MON] key is pressed at any time.

★ The trip status monitor function will remain active until power is turned OFF or the trip is cleared.

Note) The display will follow [n0n1] to [n0n4] in Gr.Ut.
Other monitor items can be displayed by changing the settings of [n0n1] to [n0n4] before clearing the trip.

The fault trip hold function will not maintain fault status after power is turned off, after a reset, or if a fault occurs during CPU initialization. Instead, the current monitor item will be displayed.

7.3.2 Status Monitor Mode

This function monitors the various status items (frequency setting, output voltage, current, terminal information, etc.). This mode can be entered by pressing the [MON] key in standard monitor mode. To exit this mode, press the [PRG] key to move to settings monitor mode, or [MON] to return to standard monitor mode.

Example of monitor operation in standard monitor mode.
(Assume that the motor is running.)

Key operation	Example display	Explanation
	60.0	Standard monitor mode (operating frequency is displayed)
MON	:Fr -F	Run direction (Forward run F , reverse run r) Note 1)
△ ▽	: 60.0	Operating frequency command value Note 2) [Mon1] in [Gr.UE]
△ ▽	:C 100	Load current (%/A) monitor Note 2) [Mon2]
△ ▽	:y200	Input voltage (V/%) monitor Notes 2) and 3) [Mon3]
△ ▽	:P200	Output voltage (V/%) monitor Notes 2) and 4) [Mon4]
△ ▽	:A....11	Input terminal status monitor
△ ▽	:b11..11	Input terminal status monitor
△ ▽	:O..1111	Output terminal status monitor
△ ▽	:t0.0 1	Cumulative run time Note 5)
△ ▽	:0C3 ↔ 1	(Alternating display) past trip 1
△ ▽	:0H ↔2	(Alternating display) past trip 2
△ ▽	:0P3 ↔3	(Alternating display) past trip 3
△ ▽	:nErr↔4	(Alternating display) past trip 4
△ ▽	:Fr -F	Run direction (Monitor top menu item)

Note 1) When [d 15r] in Gr.F (reverse run disable selection) is set to 1 , the display will always be: :Fr-F.

Note 2) Four monitor elements can be selected by the status monitor display selections in Gr.Ut. In addition, the display units for current and voltage elements can be set to A, V (respectively) or %.

Note 3) The input voltage value displayed is calculated by multiplying $1/\sqrt{2}$ times the DC voltage obtained by rectifying the input voltage. If the input voltage drops below 100V, the display will be: :y---.

Note 4) The display will be: : P--- when only control power is applied.

Note 5) The cumulative run time is counted only while running.
(The time is not counted when the output frequency monitor is displaying 0.0.)
The value shown is in 100-hour units (0.0 1~999 : 1 hour to 99900 hours)

When the [△][▽] keys are held down during the above steps, the display will change to the next item every 0.5 sec. The run/stop, frequency display status or settings monitor mode can be entered, and terminal input operation mode can be switched to (only when stopped) at any point in the process. The ←→ symbol in the example indicates that the left and right symbols are alternately displayed every 0.5 sec.

7.3.3 Settings Monitor Mode

This mode is entered by pressing the [PRG] key in standard monitor mode.
To exit this mode, press the [PRG] key to move to standard monitor mode, or the [MON] key to move to status monitor mode.

As described below, this mode both displays parameters and settings, and contains the setting and adjustment functions.
The "Panel Operation Mode Selection" ([PnOd] in Gr.Ut) must be set to 32 or greater in order to change parameter settings. (The standard default setting allows this.)
The "Panel Operation Mode Selection" parameter can be changed even when set to "parameter changes prohibited".

(1) Parameter setting and display function

Use the following procedure to set the desired parameter value.

1. Press [PRG] to enter settings monitor mode.
2. At the group title display, press [△][▽] to select the desired group, then press [ENTER] to display the group's parameter names.
3. At the parameter name display, press [△][▽] to select the parameter name, then press [ENTER] to display the data setting.
4. At the data setting display, change the data with the [△][▽] keys.
5. Save the changed data by pressing [ENTER].

(2) Settings monitor mode adjustment function (Parameter group Gr.AN)

This function is used to adjust the scale when an analog meter is installed to monitor the output frequency or current.

This adjustment is done in the same manner as the parameter setting and display function, except that the meter indicator amplitude changes, instead of the LED display, when the △▽ keys are pressed. The value indicated by the meter is adjusted to match the LED display, and is adjusted while running.

If Gr.AN is not displayed, set bLnd (blind function) in Gr.UE. (Refer to page 50.)

Example of FM (Frequency Meter) adjustment

Key operation	Example display	Explanation
	60.0	Standard monitor mode (operating frequency is displayed)
PRG	:Gr.U	Change to settings monitor mode.
△ ▽	:Gr.AN	Select Gr.AN . (The group name will change when △▽ are pressed.) U⇄F⇄F2 ⟶ UE⇄nE⇄U
ENTER	:Gr.AN → :FNSL	Set the group. The first parameter name will be displayed.
△ ▽	:FNSL	Select the parameter name. (The parameter name will change when △▽ are pressed.) FNSL⇄FN⇄ANSL⇄AN
ENTER △ ▽ ENTER	FNSL : 0 :FNSL ↔ 0	Set the parameter. The parameter setting will be displayed. Select the FM terminal function with the △▽ keys to output the pre-compensation reference frequency. Set the data.
▽	:FN	Display the next parameter name.
ENTER	: 60.0	Set the parameter. The FM adjustment mode will be entered. (The adjustment value will be displayed.)
△ ▽ ↓ ENTER	: 60.0 60.0	Adjust the frequency meter value with the △▽ keys. (The display will blink) → (The LED display will not change, but the meter indicator will move.) → (Adjust with the △▽ keys until the LED display and meter value are the same.) The adjustment value will be stored in inverter memory. (The blinking will stop.)
PRG	60.0	Move to standard monitor mode (frequency display).

Note) When DC voltage is selected for FNSL or ANSL and the main circuit power is turned OFF (NOFF status), the FM (AM) output will not be 0, but instead will show a slight output.

(3) Setting value alarm display

When a setting value and one of the following alarms are alternately displayed on the LED, a setting value limitation is indicated.

H I alarm (upper limit alarm) ... When the upper limit of the setting range has been reached, or when the setting value of the current parameter being changed exceeds its upper limit value as a result of another parameter setting value being changed. (In the latter case, the value will be corrected to its upper limit value.)

L O alarm (lower limit alarm) ... When the lower limit of the setting range has been reached, or when the setting value of the current parameter being changed exceeds its lower limit value as a result of another parameter setting value being changed. (In the latter case, the value will be corrected to its lower limit value.)

The data settings of parameters that have an adjustment range limited by the setting values of [LL] and [UL], such as the preset speed frequency parameters, cannot exceed the values of [LL] and [UL].

When the [FH], [UL] or [LL] parameter values are changed, the setting values of some parameters may exceed their limits as a result. In this case, an alarm will be displayed when a parameter with a setting exceeding its adjustment range is selected and adjustment is attempted. To change a parameter with this type of setting value, the moment that the [△][▽] keys are pressed, the alarm will be displayed and the setting value will change to its limiting value.

If [UL] is exceeded, the value will become the same value as [UL].
If [LL] is exceeded, the value will become the same value as [LL].

Example when [UL] = 60Hz, [LL] = 40Hz, and [Sr01] = 80Hz is set.

Key operation	LED display	Operation
PRG	:Gr.U	
△ ▽	:Gr.SF	Select GR.SF.
ENTER	:FC1	
△ ▽	:Sr01	Select [Sr01].
ENTER	: 80.0	
△	: 60.0 ←→ H I	(Upper limit alarm) The value becomes the UL value. (Same as when the ▽ key is pressed.)
▽	: 59.9 : "Decreasing" : 40.0 : 40.0 ←→ L O	Hold down the ▽ key. [LL] is reached (lower limit frequency) The alarm information will be alternately displayed as long as the ▽ key is pressed.

7.3.4 JOG Run Mode

This mode is used to run the inverter at low speeds, and especially allows short-time runs (inching) to be done easily. The following explanation is for executing jog from the panel. When using terminal block signals to execute jog, refer to the parameter explanation section for Gr. SF [JOG].

This mode is entered via the following procedure.

The JOG run frequency ([JOG] in Gr.SF) and JOG stop control ([JSTP] in Gr.SF) parameters must be set from settings monitor mode before entering this mode. (Refer to page 70.)

Key operation	Example display	Explanation
PRG PRG	:Gr.U :FJOG	Press the [PRG] key twice. The JOG mode will not be entered if a different key sequence is pressed. The JOG mode will be entered when the [PRG] key is pressed the second time only if panel control mode is selected and the JOG run frequency setting value is not 0Hz. (Forward JOG) If panel control mode is not selected or the JOG run frequency is not set, operation will return to standard monitor mode (frequency display) when the [PRG] key is pressed the second time.
▽	:rJOG	Execute reverse JOG by pressing ▽. Execute forward JOG by pressing △.
RUN	5.0	The JOG run frequency will continue to be output while the [RUN] key is held down.
PRG	0.0	Standard monitor mode will be returned to when [PRG] is pressed.

Note) If positioning is attempted in JOG run mode and the motor shaft does not smoothly stop at the desired location, set the output short-circuit detection selection ([OCLS] in Gr.Pr) setting value to 2 (position sensing during JOG). (Refer to page 80.)

7.4 Operation Mode Selection

The methods for operation and adjustment from the operation panel, validating/invalidating operating commands from the terminal block, selection of the stopping method, and resetting are explained in this section.

7.4.1 Operation Mode Changeover

Panel operation mode or terminal block operation mode can be selected.

- When terminal block operation mode (REMOTE) is selected, commands from the panel are ignored.
- When panel operation mode (PANEL) is selected, commands from the terminal block are ignored.

The operation mode is changed by the [PANEL/REMOTE] key, and can be done only when the motor is stopped. (When stopped, OFF or a frequency display of 0.0 will be shown.)
Terminal operation mode is automatically entered after power is turned on, unless the input mode is preset as explained below. The panel control LED will be lit when panel operation is selected.

7.4.2 Run/stop Command [CNOd in Gr.UE]

The following sources can be selected for run/stop commands (command mode).

CNOd setting	Function
0	Only RS232C input valid
1	Terminal block input valid Note)
2	Panel input valid
3	Communication option board input valid
4	All valid

Note) The intended input functions are [1E*] in Gr.5E : input terminal function setting values 0 to 5, 8 and 9, on page 55.
(Refer to pages 55 and 86 for details.)

7.4.3 Frequency Command Source Setting Function [FNOd in Gr.UE]

This function allows the selection of the frequency command source as follows, according to the frequency setting mode selection parameter (FNOd in Gr.UE).

FNOd setting	Function
0	Only RS232C input valid
1	Terminal block input valid
2	Panel input valid
3	Communication option board input valid
4	All valid

7.4.4 Parameter Setting Function [PnOd in Gr.UE]

Parameters can be set in the standard mode, but alternatively, the panel operation mode selection (PnOd in Gr.UE) can be changed as follows.

PnOd setting	Function
0	Prohibit all key operations
+ 1	Can perform reset
+ 2	Can perform monitor operations
+ 4	Can perform emergency stop
+ 8	Can perform run/stop operations
+ 16	Can perform parameter read operations
+ 32	Can perform parameter change operations
63	Standard mode (all operations valid)

★ If PnOd is set to 3 , 1 (reset operations) and 2 (monitor operations) will be valid.

7.4.5 Standard Parameter Value Reset Function [tYP in Gr.Ut]

All parameter values can be changed to standard settings at one time by setting parameter tYP . The operation is performed as described below, but cannot be done while the inverter is running. Stop the inverter before performing this operation.

Key operation	Example display	Explanation
	0.0	Frequency display (stopped condition)
1) PRG	:Gr.U	Enter parameter setting mode from standard monitor mode. Gr.U will be displayed.
2) △ ▽ ENTER	:Gr.U ↓ :Gr.Ut	Select Gr.Ut with the △▽ keys. ⇄U⇄F⇄F2 —— Ut⇄nt⇄U⇄ When Gr.Ut is displayed, press the ENTER key. The first parameter name will be displayed.
3) △ ▽ ENTER	:APL ↓ :tYP ↓ :0 0	Select tYP with the △▽ keys. When tYP is displayed, press the ENTER key.
4) △ ▽ ENTER	:0 3 InIt	Change the setting with the △▽ keys. 1 : Standard setting for 50Hz applications. (See Fig. 7.5) 2 : Standard setting for 60Hz applications. (See Fig. 7.5) 3 : Return to factory settings (Fig. 7.5) Note 2) 4 : Trip clear 5 : Save user-set parameters 6 : TYP 5 reset 7 : Initialize inverter typeform Note 3) When the desired data is displayed, press the ENTER key. InIt will be displayed, and operation will return to standard monitor mode.

Notice

1. When tYP = 1 is selected, only the max. frequency FH , maximum voltage frequency uL1 , uL2 , upper limit frequency UL , commercial power/inverter switching frequency FCHG , and frequency setting signals F-P2 , F-P4 , F-P6 , F-P8 , and F-PA will change to 50 . No other data will be changed.
2. When tYP = 2 is selected, only the above parameters will change to 60 .
3. Setting tYP is not possible while running. Stop the inverter and then change the setting.

Note 1) A dual display of the previous setting value and current setting value (always 0) is used.

3 0

Previous setting Current setting

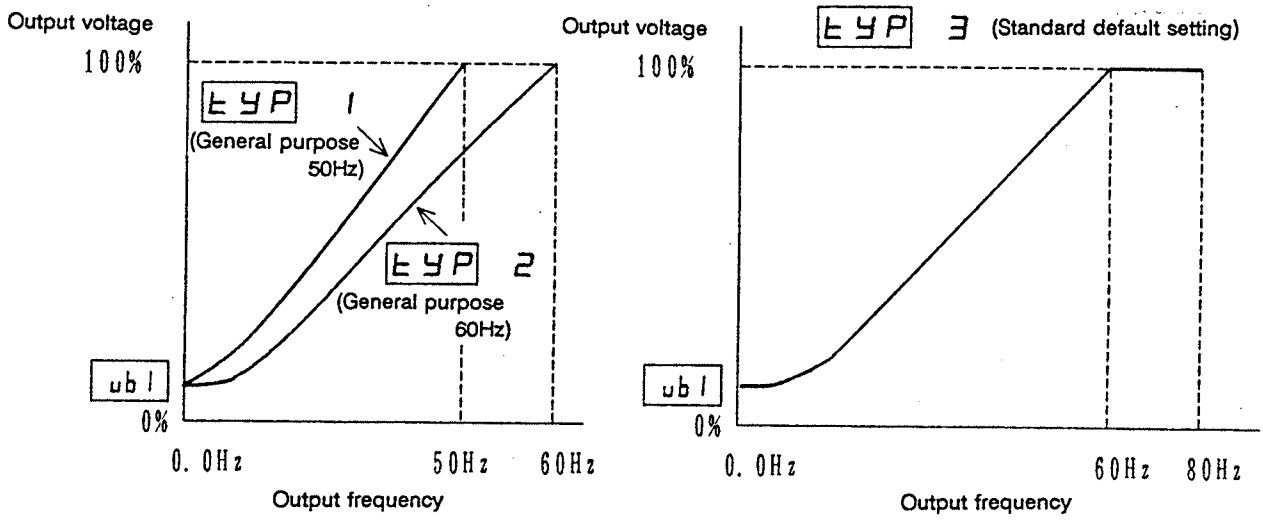


Fig. 7.5 Standard Setting Value

Note 2) When tYP = 3 is selected, all parameters other than those in Gr.AN will return to factory settings.

Note 3) tYP = 7 is used to clear an EtYP error that may occur when a control PCB is installed in a different inverter unit, and to reset the typeform to that of the new inverter. Verify that the inverter typeform contained in the table on page 124 matches the value of FOrn in Gr.UE , and then execute the tYP function.

7.4.6 Selection of Stopping Method from the Panel

In addition to the normal decelerated stop (deceleration according to the set deceleration time) with the STOP/RESET key, the following stopping methods can be used from the panel.

Stopping method	Operation	Method and setting
Coast-stop	The power output to the motor from the inverter is shut off, so the motor will coast and then stop.	This is possible only when operation from the panel is valid. 1. Press PANEL/REMOTE during panel run. 2. Standard monitor mode will be entered, and the LED will display CtrL . 3. Coast-stop will be activated by pressing STOP/RESET . (If another key is pressed, the CtrL display will go out and the process will be canceled. The process will also be canceled if the key is not pressed within 3 seconds.)
Emergency stop (To forcibly stop with the panel when not in panel run mode.)	Select from the following: • Coast-stop • Decelerated stop • Emergency DC injection braking stop (note) The default setting of EStP in Gr.Pr is coast-stop.	Assume that terminal block run mode is active. (Normal stopping is possible when in panel mode.) 1. Press the STOP/RESET key. 2. Standard monitor mode will be entered, and the LED will display EOFF . 3. Press STOP/RESET again. 4. The LED will display E , and the motor will stop according to the setting of EStP in Gr.Pr . This mode will be canceled if a key other than STOP/RESET is pressed when EOFF is displayed.

(Note)

ESTP in Gr.Pr settings: 0 : Coast-stop
1 : Decelerated stop
2 : Emergency DC injection braking stop
If 2 is selected, also set the DC injection current dbC and ESTOP DC injection time EdbT .

★ If DC braking is not required during normal stopping when ESTP = 2 (emergency DC injection braking stop) is selected, set the DC braking time dbT to 0 .

Caution

The emergency stop command forcibly stops the motor with the inverter unit key operation even if the command mode is not set to panel operation mode. This command cannot be prohibited with the command mode selection. When executed, the emergency stop will be regarded as a trip and will be recorded as a past fault.

7.4.7 Fault Reset

Remove the trip cause before resetting an inverter that has tripped due to a failure or other fault. The inverter will trip again if the cause is not removed.
Reset the tripped state with one of the following methods:

Reset

(1) Turn off the power (until the LED display goes out) Note 1)
(2) External signal (short circuit between control terminals RES-CC)
(3) Panel operation

Note 1)
Refer to Gr.Pr
ErCL (page 80).

Resetting with the panel is performed by the following process.

1. Press STOP/RESET and confirm that CLr is displayed.
2. Press STOP/RESET again, and if the trip cause has been removed, the inverter will be reset.

★ For the following overload trips, the inverter cannot be reset with an external signal or with the panel during the required cooling time.

OL In	: inverter overload
OLnt	: motor overload
OLr	: dynamic braking resistor overload

The standard cooling time settings are as follow:

OL In	: Approx. 1 minute after trip
OLnt	: Approx. 5 minutes after trip
OLr	: Approx. 30 seconds after trip

Caution

To reset immediately due to an emergency, the power can be turned off to reset the inverter, but if this method is used frequently, the inverter or motor may be damaged.

8. Parameter Explanations

GR. F (Fundamental Parameters #1)

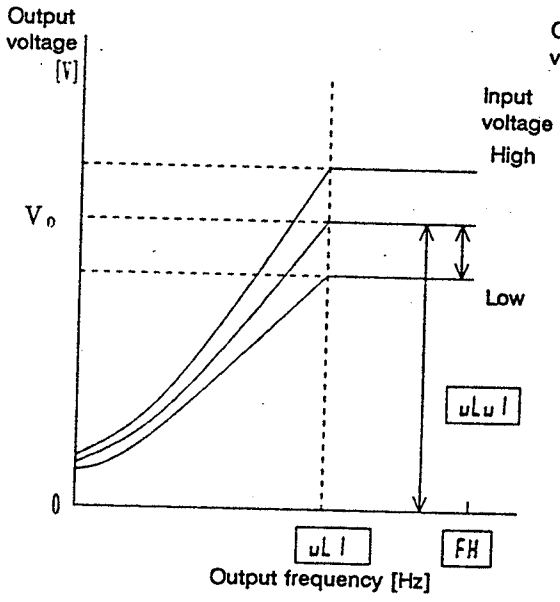
uL 1 / uLSL / uLu 1 — V/f settings (Output voltage and frequency ratio setting)

Related parameters

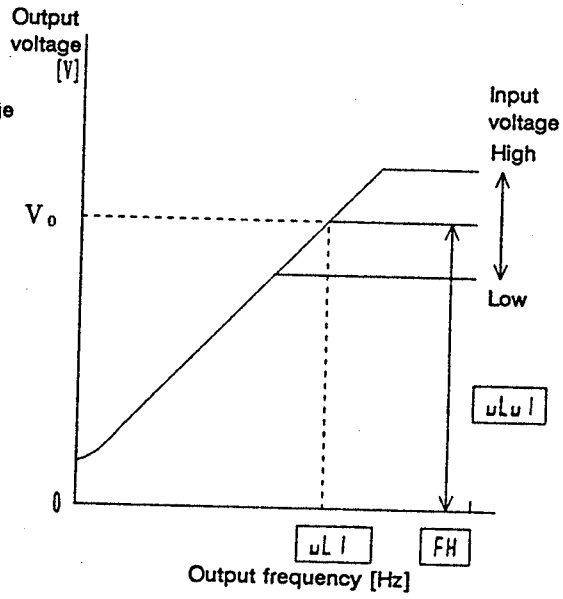
FH	Maximum frequency
uL 1	Maximum voltage frequency
uLSL	Maximum voltage frequency voltage selection
uLu 1	Maximum voltage

The V/f settings are among the most important parameters. The motor voltage to frequency ratio is set by them.

uLSL set to 0



uLSL set to 1, 2



Set to 0 : V_0 fluctuates according to the input voltage

Set to 1 : V_0 is automatically set between the following values according to the input voltage when the power is turned on.
200V class: 200 to 230Vac
400V class: 380 to 460Vac

Set to 2 : V_0 is set with uLu 1 .

★ Even if uLu 1 is set higher than the input voltage, the output voltage will not be higher than the input voltage.

★ Even if uLu 1 is set when uLSL is set to 1, it will be ignored.

Gr. F (Fundamental Parameters #1)

PE V/f pattern ①

Related parameters

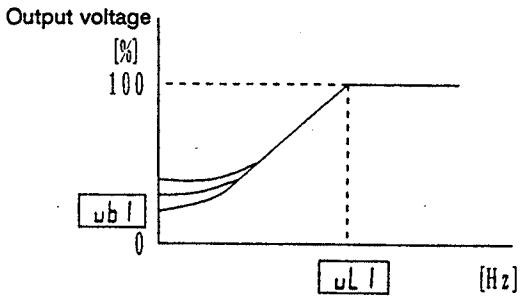
PE	V/f pattern
ub 1	Voltage boost
uL 1	Maximum voltage frequency

Gr. nE

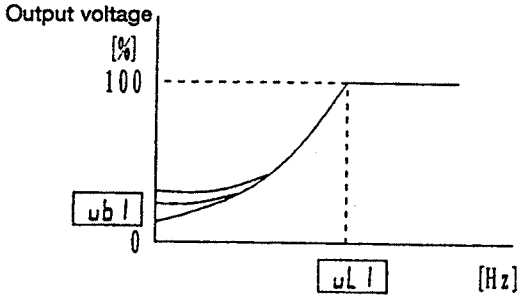
nE.P	No. of motor poles
nE.C	Motor rated capacity
nE.E	Motor type
nE.u	Motor rated voltage
nE.F	Motor rated frequency
nE.r	Motor rated RPM

Constant torque, variable torque, automatic torque boost, automatic energy saving, and vector control can be selected for the V/f pattern.

PE set to 1 Constant torque characteristics



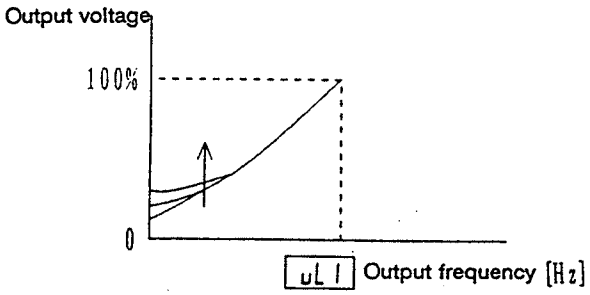
PE set to 2 Variable torque characteristics



★ If the voltage boost value is set too high, the motor will be overexcited, and an OL or OC trip may occur. In some cases, this may also shorten the life of the inverter.

★ The voltage boost value is automatically initially set for the max. applicable motor according to the inverter capacity. If a standard motor matching the inverter capacity is used, the value does not necessarily need to be adjusted. Even when readjusting, setting to within ±2% of the initial setting value is recommended.

PE set to 3 Automatic torque boost



The load current is detected, and the inverter's output voltage (torque) is automatically adjusted.

PE set to 4 Automatic torque boost with automatic energy saving

PE set to 5 Vector control

Motor speed fluctuations are suppressed, even with high torque at low frequencies.

PE set to 6 Vector control with automatic energy saving

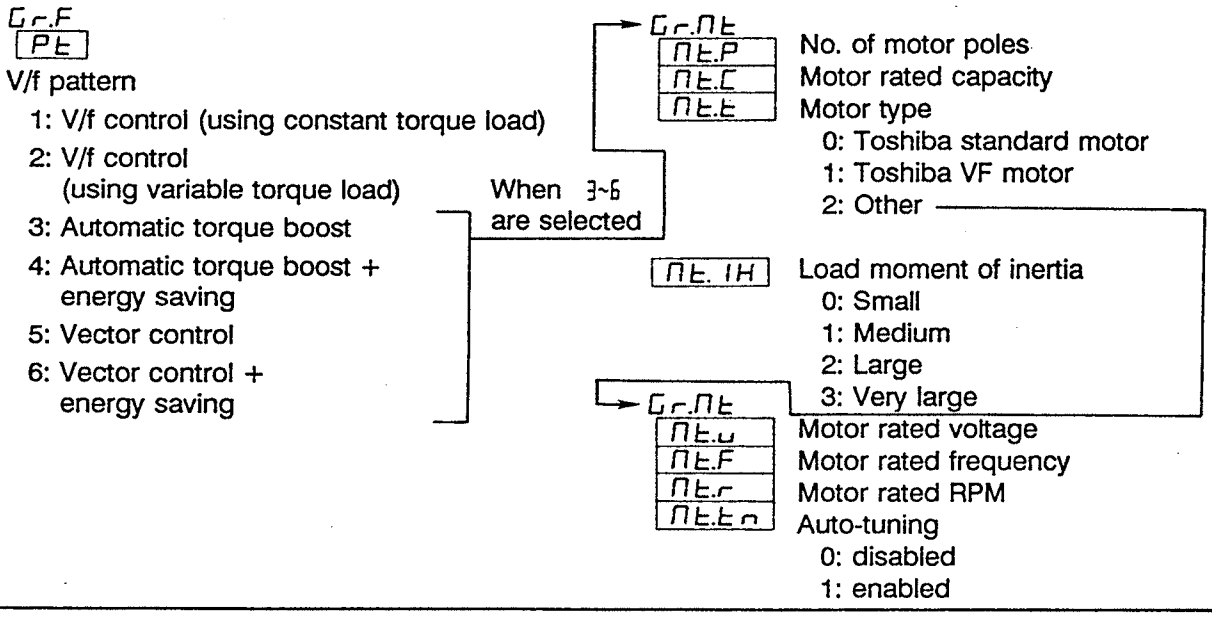
The output voltage is closely monitored during the automatic torque boost (vector control) setting, and energy is saved by allowing only the proper amount of current to flow that is suitable for that output voltage.

PE and nE.P cannot be changed while running. Even if nE.C, nE.E, nE.u, nE.F nE.r are changed while running, the changes will not become valid until the motor is stopped (0.00Hz).

Gr. F (Fundamental Parameters #1)

PE V/f pattern ②

Parameter setting process when [PE] is set to 3 ~ 6



Motor requirements when using vector control

1. Motor capacity should be the same as the inverter, or should be a Toshiba general purpose squirrel-cage type motor or Toshiba constant torque motor that differs by at most 1 rank.
2. No. of motor poles should be 2 to 16.
3. Only one machine should be operated (one motor per inverter).

★ The output frequency and set frequency will not match.
★ The max. wire length that can be used between the inverter and motor is 30m. If 30m is exceeded, the torque can be improved during deceleration by using auto-tuning, but the torque will drop slightly near 60Hz.

The vector control function will operate properly with adequate torque and little speed fluctuation when used below the maximum voltage frequency setting value. However, in situations where the maximum voltage frequency is exceeded (field-weakening area), the same type of characteristics may not be achieved. The maximum voltage frequency setting range during vector control use should be between 40 to 120Hz.
The motor rated voltage parameter [nE.u] is used only to calculate motor constants. The inverter's max. output voltage will always depend on the maximum voltage [uLu 1] during vector control.

Cautions during auto-tuning

① The motor must be completely stopped before executing auto-tuning. Due to motor residual voltage, an error may occur in the tuning if executed immediately after stopping.
② The motor will rotate only slightly during auto-tuning, but use caution, as the main voltage will be applied.
③ Auto-tuning will normally finish within 3 sec. If an error occurs, the inverter will trip and the motor constants will not be set.
④ Auto-tuning of special motors, such as high-speed or high-slip motors, is not possible.

★ The auto-turning error (refer to page 121) will be displayed when auto-tuning fails.
★ Change the [nE. IH] setting value if an overvoltage trip (OP) or overcurrent trip (OC), etc., occur. Then retry the auto-tuning operation.

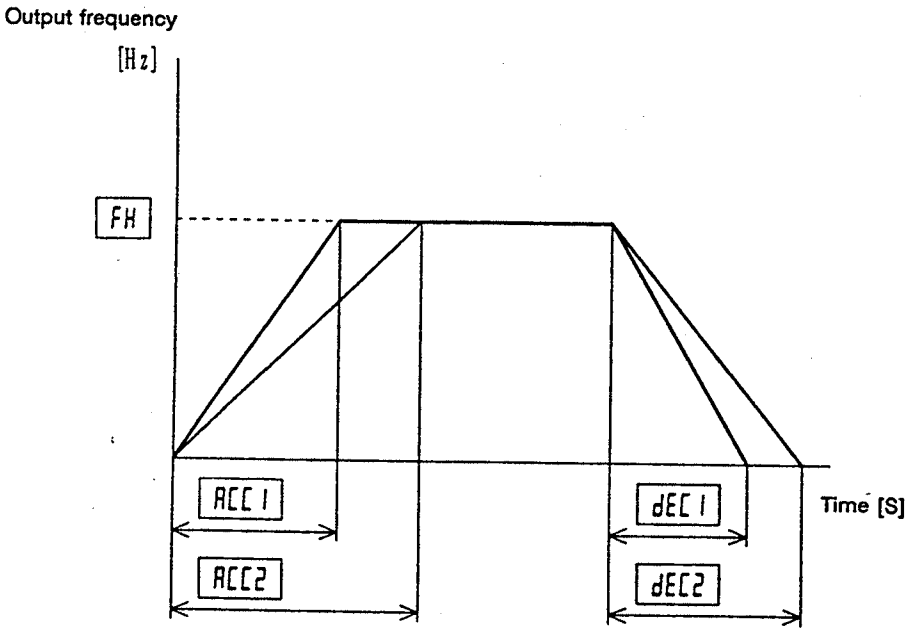
Gr. F (Fundamental Parameters #1)

ACC 1 dEC 1 Acceleration/deceleration time settings

Related parameters

ACC 1	Acceleration time #1	Gr. F2	ACC2	Acceleration time #2
dEC 1	Deceleration time #1		dEC2	Deceleration time #2
		Gr. UE	dSPE	Acc/Dec time units selection

- The acceleration time ACC is the time to reach the max. frequency FH from 0Hz, and the deceleration time dEC is the time to reach 0Hz from the max. frequency FH.
- The setting adjustment range and resolution can be set by the Acc/Dec time units selection dSPE.



★ The default acceleration/deceleration time settings will depend on the inverter capacity.

★ Switching between ACC 1 dEC 1 and ACC2 dEC2 is possible with the operating panel or terminal block. Switching can also take place at a set frequency.
(Refer to acceleration/deceleration #1 and #2 selection on page 52.)

Gr. F (Fundamental Parameters #1)

SCu 1 - Acc/Dec patterns,
SCL SCH Acc/Dec pattern adjustment, Low/High

Related parameters

SCu 1	Acc/Dec pattern #1	SCH	Acc/Dec pattern adjustment (HIGH)
SCL	Acc/Dec pattern adjustment (LOW)		

An acc/dec pattern that matches the application can be selected.

SCu 1 set to 0 (Linear acc/dec) — This is a general acceleration/deceleration pattern, and is used under most circumstances.

SCu 1 set to 1 (Self-adjusting function) — An acceleration/deceleration time that matches the load conditions is automatically set.

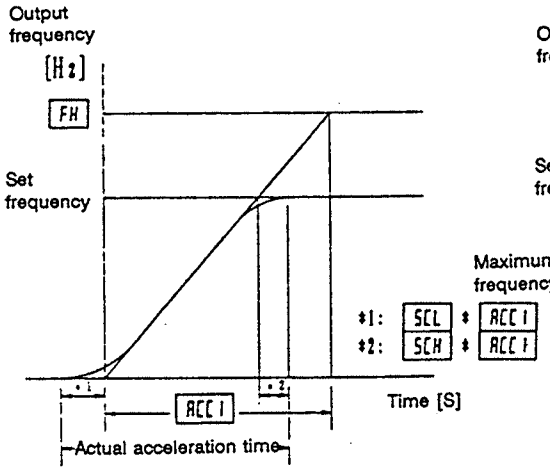
Self-adjusting function
This function cannot be used when the frequency reference constantly fluctuates or when the load changes suddenly. The ACC1 dEC1 parameters will be automatically changed, but when the control power is turned OFF, the settings will return to their original values.
To save the self-adjusting function results, display ACC1 dEC1 in Gr.U, press ENTER, make the data setting blink by pressing the △ or ▽ keys once, and then press ENTER again to write the data.
Set Gr.F2 SCu2 for ACC2 and dEC2.

SCu 1 set to 2 (S-Pattern #1) — This pattern is used when accelerating/decelerating to a high speed area (exceeding 60Hz) is required in a short time. This pattern is suitable for conveyers, etc.

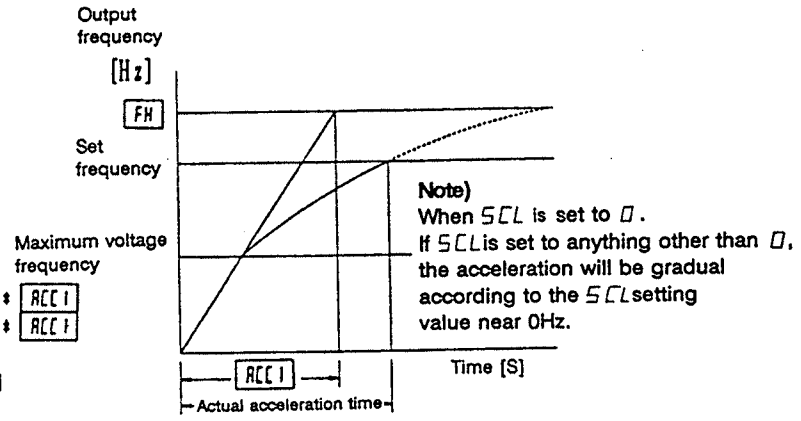
SCu 1 set to 3 (S-Pattern #2) — This pattern gradually accelerates in the field-weakening area where the motor's acceleration torque is small. This pattern is suitable for high-speed spindles.

Examples of acceleration/deceleration pattern settings

SCu 1 set to 2
(Adjusted with SCL and SCH)



SCu 1 set to 3
(Adjusted with maximum voltage frequency)



Note that actual acceleration/deceleration times of the S-pattern will be longer than the linear times by the values of *1 and *2.
The curve will depend on the (max. voltage frequency/max. frequency), and the inclination will taper off as the (max. voltage frequency/max frequency) decrease, and the actual acceleration time will increase. (The rate of acceleration will decrease in the field-weakening area.)

Gr.Ut (Utility Parameters)

bLnd — Blind function selection

Related parameters
bLnd Blind function selection bLF2 ~ bLnE Group blind selections

It is possible to not display the parameter groups other than Gr.F , Ut and U when they are not necessary.

bLnd setting value	Function
0	Blind
1	Selective unblinding

★ The parameters bLF2 ~ bLnE will be displayed when bLnd is set to 1 . Cancel the blind function for the desired parameter group by setting its corresponding parameter value to 1 (bLF2 for Gr.F2).

Example) To cancel the blind function for parameter group Gr.An

Key operation	Display	Explanation
	0.0	Frequency display (stopped condition)
1) PRG	: Gr.U	Enter the parameter setting mode from standard monitor mode. The name of the first group (Gr.U) will be displayed.
2) △▽ ENTER	: Gr.U ↓ : Gr.Ut	Select the group with the △▽ keys. Display Gr.Ut , and press ENTER .
3) △▽ ENTER	: APL ↓ : bLnd ↓ : 0	Select the parameter with the △▽ keys. Display bLnd , and press ENTER .
4) △▽ ENTER	: 1 : bLnd ⟷ 1 : bLnd	Change the data with the △▽ keys. Cancel the blind function. (Set to 1) Press ENTER . The parameter name and data will be alternately displayed, and then the parameter name will be displayed .
5) △▽ ENTER	: bLnd ↓ : bLAn ↓ : 0	Parameters bL + the group name will appear after the bLnd parameter. Select the group which is to be unblinded. Display the group to be unblinded, and then press ENTER .
6) △▽ ENTER	: 1 : bLAn ⟷ 1 : bLAn	Change the data with the △▽ keys. Unblind the group. (Set to 1) The parameter name and data will be alternately displayed, and then the parameter name will be displayed.

Gr. F (Fundamental Parameters #1)

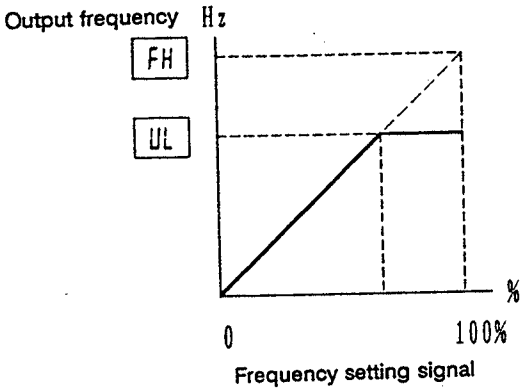
UL LL Upper limit/lower limit frequencies

Related parameters

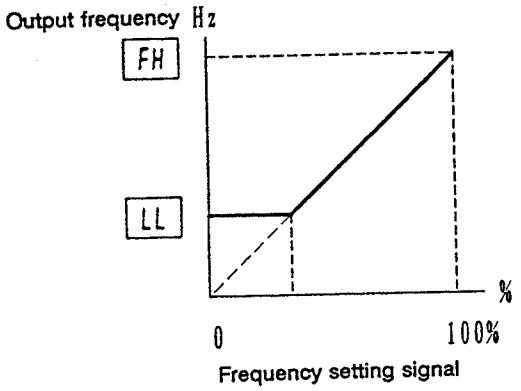
UL Upper limit frequency

LL Lower limit frequency

The upper limit frequency UL sets the upper limit of the output frequency, and the lower limit frequency LL sets the lower limit of the output frequency.
The upper limit frequency can be set between 0 and the max. frequency.
The lower limit frequency can be set between 0 and the upper limit frequency.



★ A frequency exceeding UL will not be output.



★ The output frequency cannot be set below LL.

★ The operating frequency can only be set within the range of the upper limit frequency and lower limit frequency when set from the panel. An error display (H I ⟷ 50.0 alternately displayed) will occur if an attempt is made to set the frequency from the panel above 50Hz when the upper limit frequency is set to 50Hz.

d 15r Reverse operation disable selection

This is used to prevent reverse run problems which may occur if an incorrect start signal is input.

d 15r setting value	Function
0	Reverse operation allowed
1	Reverse operation not allowed

★ This applies to both panel and external control.

Gr. Pn (Panel Control Parameters)

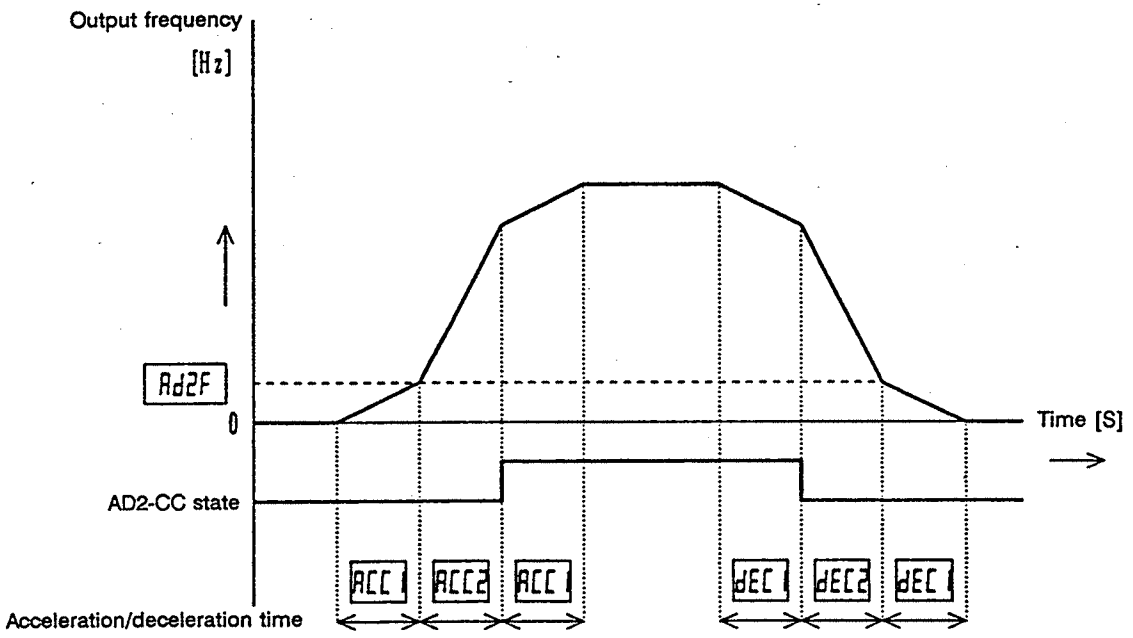
Ad2 Acc/dec #1 and #2 selection

Related parameters

Ad2 Acc/dec #1 and #2 selection Gr.F2 Ad2F Acc/dec #1 and #2 switching frequency

Automatic switching of the acc/dec times can be easily performed by combining the use of terminal block input AD2, acc/dec #1 and #2 selection Ad2 , and acc/dec #1 and #2 switching frequency Ad2F .

(Refer to CNOd in Gr. UE and IE* in Gr. SE (*: 0 to 10) for setting the terminal block inputs.)



★ Refer to the section on command mode selection (CNOd in Gr. UE) for the selection of the start/stop command.

★ If the start/stop command source is selected to be the operating panel, the acc/dec will function according to the setting of parameter Ad2 regardless of the state of terminals AD2-CC.

★ If the start/stop command source is selected to be the input terminals, acceleration/deceleration #1 and #2 switching will be selected by the terminal input AD2-CC state regardless of the setting of parameter Ad2 .

Gr. Pn (Panel Control Parameters)

PFbC Panel feedback control

This is used when Gr. Fb feedback parameters are used.

★ If no feedback control is selected with the Gr. Fb feedback control selection parameter FbP1, feedback control will not occur even if panel feedback control ON (PFbC = 0) is selected.

★ Refer to the section on Gr. Fb for feedback control.

PrES Panel reset selection

The trip causes that can be reset when the inverter trips as a result of a failure or fault, etc., can be selected.

PrES setting value	Function
0	All possible
1	Only OL can be reset
2	Only OL, OC1, OC2, and OC3 can be reset

★ The trip cause must be removed before the inverter is reset, or the inverter will trip again.

OL indicates OL-In, OL-nt, and OLr. Resetting is not possible during the required cooling time after tripping. The inverter can be reset, however, by turning the control power OFF.

Required cooling time under standard settings	OL-In : Approx. 1 min. OL-nt : Approx. 5 min. OLr : Approx. 30 sec.

Gr. Pn (Panel Control Parameters)

PtP | Ad2 — Fundamental parameter switching

Related parameters

PtP — Fundamental parameter switching

Gr. St | Ad2 — Acc/dec #1 and #2 selection
Gr. St | 1t0 ~ 1t 10 — Input terminal selections

This parameter is used when two different types of motors are used by one inverter or when the motor V/F characteristics are to be changed while running.

Gr.F (Fundamental parameters #1) Gr.Pr (Protection parameters)	Gr. F2 (Fundamental parameters #2)	Switching from the panel	Switching from the terminal block
ACC 1 Acceleration time dEC 1 Deceleration time SCu 1 Acc/Dec pattern	ACC2 dEC2 SCu2	Switch with Ad2 1 : Acc/dec #1 2 : Acc/dec #2	Switch with input terminal function 1t* set to 9 (AD2 switching selection)
uL 1 Maximum voltage frequency uLu 1 Maximum voltage ub 1 Voltage boost tHr 1 Electronic thermal protection level StC 1 Stall protection StL 1 Stall protection level	uL2 uLu2 ub2 tHr2 StC2 StL2	Switch with PtP 1: Fundamental parameters #1 (V/F#1) 2: Fundamental parameters #2 (V/F#2)	Switch with input terminal function 1t* set to 12 (fundamental parameter switching)

** : select 1 to 10 according to the terminal being used. (Refer to 1t in Gr.St)

Gr. 5t (Terminal Selection Parameters)

1t - Input terminal selections ①

1t0 ~ 1t 10

Related parameters

1t 1t0 1t 11	~ 1t 10	Input terminal selection Input terminal function selections Potential terminal function selection (Allocated to a function to always be ON.)

Parameter	1t0	1t1	1t2	1t3	1t4	1t5	1t6	1t7	1t8	1t9	1t10	1t11
Input terminal	R	S1	S2	S3	S4	F	RES	ST	S5	S6	S7	Potential terminal

The input terminal functions can be changed by setting 1t0 to 1t 11 according to the data in the following table.

Note 1) Input terminals S5, S6 and S7 are added with the expansion terminal block PCB (optional).
Note 2) If the same setting value is assigned to more than 1 input terminal function, "OR" logic is in effect.
Note 3) To turn each terminal ON/OFF, open/close each terminal-CC (closed=ON, open=OFF).

Setting value	Valid code	Function	Setting value	Valid code	Function
0	C	R (reverse run)	26	F	Binary bit #4
1	C	SS1 (15 preset speed selection)	27	F	Binary bit #5
2	C	SS2 (15 preset speed selection)	28	F	Binary bit #6
3	C	SS3 (15 preset speed selection)	29	F	Binary bit #7
4	C	SS4 (15 preset speed selection)	30	F	Binary bit #8
5	C	F (forward run)	31	F	Binary bit #9
6	A	RES (fault reset)	32	F	Binary bit #10
7	A	ST (gate ON/OFF)	33	A	Ignore terminal input
8	C	JOG selection	34	F	Up/Down frequency setting (UP)
9	C	AD2 selection	35	F	Up/Down frequency setting(DOWN)
10	A	Emergency stop	36	F	Frequency clear
11	C	DC injection braking ON/OFF	37	C	PUSH-type RUN key
12	C	Fundamental parameter switching (V/F #2)	38	C	PUSH-type STOP key
			39	A	Panel/terminal mode selection
13	C	PID control ON/OFF	40	C	Forward/reverse run selection
14	C	Pattern run selection #1	41	C	RUN
15	C	Pattern run selection #2	42	F	Binary data write
16	C	Pattern run selection #3	43	P	PNL/REMOTE key
17	C	Pattern run selection #4	44	P	MON key
18	C	Pattern run continue signal	45	P	PRG key
19	Note	Pattern run step trigger signal	46	P	UP (△) key
20	C	JOG forward run	47	P	DOWN (▽) key
21	C	JOG reverse run	48	P	ENTER key
22	F	Binary bit #0	49	P	RUN key
23	F	Binary bit #1	50	P	STOP key
24	F	Binary bit #2	51	C	Commercial power/INV switching signal
25	F	Binary bit #3			

Gr. 5t (Terminal Selection Parameters)

It — Input terminal selections ②

It0 ~ It 10

★ The relationship between the settings of [CnOd] and [FnOd] in Gr.Ut and the valid modes is given in the following table.

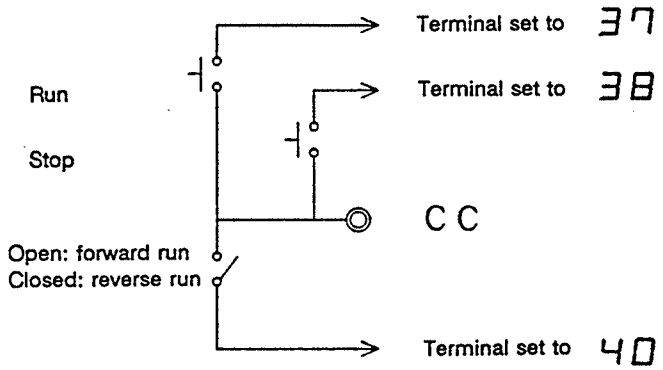
Valid code	CnOd	FnOd	Valid mode
A	0~4	0~4	Always valid
C	1or4	0~4	Valid when terminal block command input is selected.
F	0~4	1or4	Valid when terminal block frequency input is selected.
P	0~4	0~4	Substitute for panel keys
Note	Both terminal block and panel are valid.		

★ If ST is not selected, the setting will be viewed as " 1 ". (Same as ST-CC:ON state)

★ Up/down frequency setting: The rate of change of the frequency command during up/down contact input will follow the [ACC2] [dEC2] setting values. Therefore, to change the setting while displaying the output frequency on the LED display, always set [ACC 1] ≤ [ACC2] and [dEC 1] ≤ [dEC2] . With these settings, the frequency command value and the output frequency can be matched, and the up/down frequency can be adjusted while viewing the LED display.

★ Expansion terminal block PCB (optional): The input terminal block normally has 8 contact points, but by adding the expansion terminal block PCB (optional) an additional three points can be added, for a total of 11 contact points.

★ PUSH-type RUN/STOP: Always use the PUSH-type RUN/STOP (setting values = 37 , 38) and the forward/reverse run selection (setting value = 40) as a pair.



The expansion terminal block PCB is required for PG input.

Gr. 5t (Terminal Selection Parameters)

0t0 ~ 0t3 Output terminal selections ①

The functions for the output terminals RCH (0t0), LOW (0t 1), FL (0t2) and OUT (0t3) can be selected from 62 types of signals according to the data in the following table.

★ The output terminal block normally has three contact points, but by adding the expansion terminal block PCB (optional) the output terminal OUT (0t3) can be added, for a total of four contact points.

Setting value	Function	Setting value	Function
0	LL (Frequency lower limit)	32	Executing emergency stop
1	/LL (opposite of LL)	33	/Executing emergency stop
2	UL (Frequency upper limit)	34	Executing retry
3	/UL (opposite of UL)	35	/Executing retry
4	Low speed signal	36	Pattern run switching output
5	/Low speed signal	37	/Pattern run switching output
6	Accel/decel complete	38	PID variation limit
7	/Accel/decel complete	39	/PID variation limit
8	Selected speed reach signal	40	Run/stop
9	/Selected speed reach signal	41	/Run/stop
10	Fault FL	42	Severe fault (OCA, OCL, open phase, output error, EF)
11	/Fault FL	43	/Severe fault (OCA, OCL, open phase, output error, EF)
12	Fault occurrence other than EF or OCL	44	Non-severe fault (OL, OC1, OC2, OC3, OP)
13	/Fault occurrence other than EF or OCL	45	/Non-severe fault (OL, OC1, OC2, OC3, OP)
14	Overcurrent pre-alarm	46	Commercial power/INV switching output 1
15	/Overcurrent pre-alarm	47	/Commercial power/INV switching output 1
16	Inverter overload pre-alarm	48	Commercial power/INV switching output 2
17	/Inverter overload pre-alarm	49	/Commercial power/INV switching output 2
18	Motor overload pre-alarm	50	FAN ON/OFF
19	/Motor overload pre-alarm	51	/FAN ON/OFF
20	Overheat pre-alarm	52	Executing JOG
21	/Overheat pre-alarm	53	/Executing JOG
22	Overvoltage pre-alarm	54	Terminal block operation command mode
23	/Overvoltage pre-alarm	55	/Terminal block operation command mode
24	Undervoltage alarm	56	Cumulative timer alarm
25	/Undervoltage alarm	57	/Cumulative timer alarm
26	Undercurrent alarm	58	Communication error alarm
27	/Undercurrent alarm	59	/Communication error alarm
28	Overtorque alarm	60	F/R
29	/Overtorque alarm	61	/F/R
30	Braking resistor overload pre-alarm		
31	/Braking resistor overload pre-alarm		

Note) When the expansion terminal block PCB (optional) with 3 relay outputs is used, do not connect any other devices to the standard RCH or LOW terminals.

The alarm and pre-alarm output signals always output the current inverter status, so that when the inverter returns to its normal status, so will the output signals.

Gr. 5t (Terminal Selection Parameters)

Ot0 ~ Ot3 Output terminal selections ②

Open collector output detection level

"ON" : open collector transistor ON
"OFF": open collector transistor OFF

Setting value	Function	Detection level
14	Overcurrent pre-alarm	"ON" during overcurrent stall protection operation "ON" when the output current reaches the setting value level of 5tL 1 in Gr.Pr , or 5tL2 in Gr.F2 when using fundamental parameters #2. (Same level as the blinking C alarm on the operating panel LED)
16	Inverter overload pre-alarm	"ON" when the cumulative trip amount of OL In (inverter overload trip) is 50% or more of the trip level.
18	Motor overload pre-alarm	"ON" when the cumulative trip amount of OLnt (motor overload trip) is 50% or more of the trip level.
20	Overheat pre-alarm	"ON" when heatsink temperature is 84°C or higher Once "ON", turns "OFF" again when temperature drops to 80°C or less
22	Overvoltage pre-alarm	"ON" during overvoltage limit operation (OP stall) of DC main circuit voltage. 200V system: approx. 370Vdc 400V system: approx. 740Vdc (Same level as the blinking P alarm on the operating panel LED)
24	Undervoltage alarm	"ON" when main circuit DC voltage is below the following levels: 200V system: approx. 200Vdc 400V system: approx. 380Vdc
26	Undercurrent alarm	"ON" when output current is lower than the setting value of LLPC in Gr.Pr and continues for longer than the time set in LLPt .
28	Overtorque alarm	"ON" when the torque current exceeds the setting value of OtL in Gr.Pr .
30	Braking resistor overload pre-alarm	"ON" when the OLr cumulative trip amount is 50% or more of the trip level.

★ The checking conditions for the following alarm outputs differ from each other as indicated:

Undervoltage alarm: Checked while running.
Undercurrent alarm: Checked during run command.
Overtorque alarm : Constantly checked.

Note) During reset, all status alarms will enter the OFF state regardless of the operating conditions.

Gr. St (Terminal Selection Parameters)

LF	brCH
HrCH	LrCH

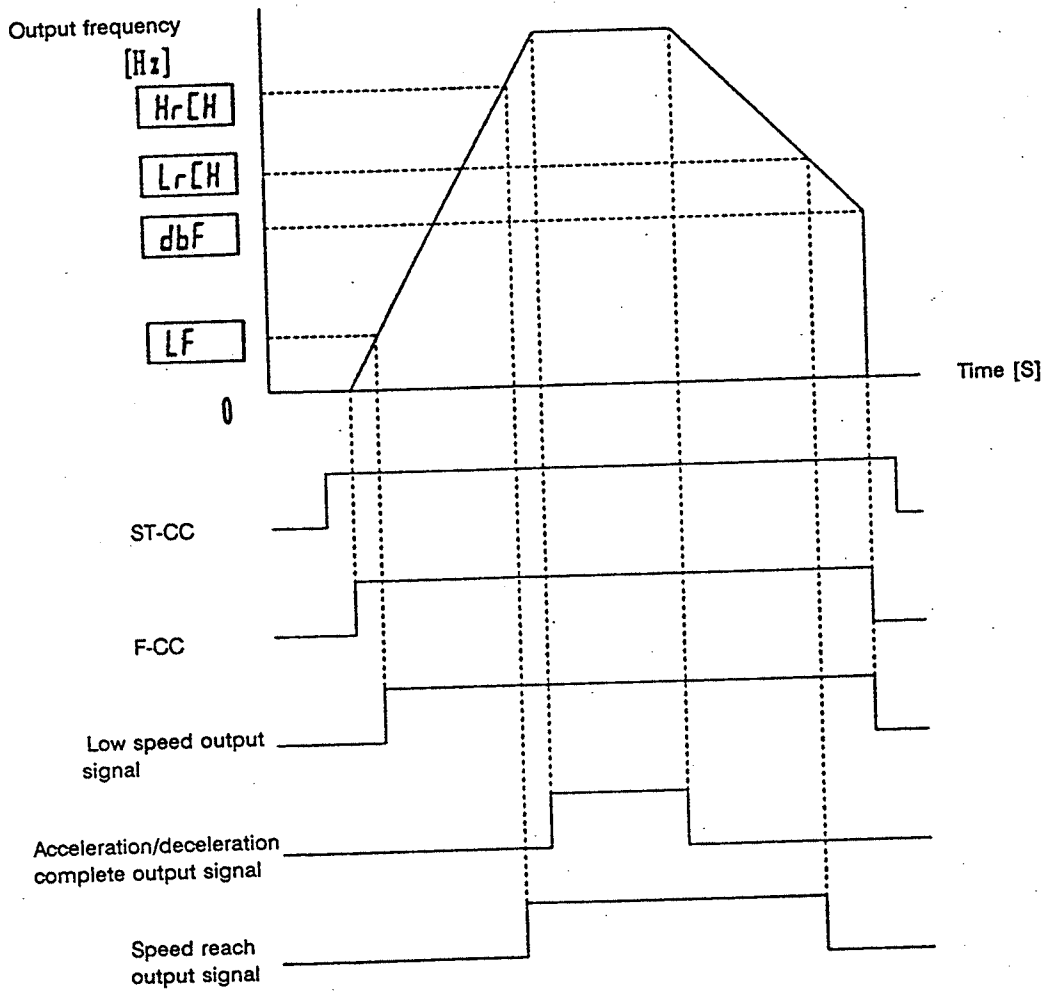
Low speed, acceleration/deceleration complete, speed reach output signals

Related parameters

LF	Low-speed signal output frequency
brCH	Speed reach detection band
Ot0 ~ Ot3	Output terminal selections

HrCH	Speed reach HI frequency
LrCH	Speed reach LO frequency

A signal is output when the output frequency exceeds the set low-speed detection frequency LF .
This can be used as a magnetic brake open/close signal, etc.



★ The speed reach signal is also output when a preset speed is reached.
★ The low speed signal will turn OFF when DC injection braking (refer to Gr. Pr dbF) is applied during a decelerated stop.

Note) The speed reach signal is output when the frequency is greater than HrCH , and turned off when it is less than LrCH .

Gr. St (Terminal Selection Parameters)

1tF	1tSF
0t0d	0t0h

Input/output terminal response time selections

Related parameters

1tF			Input terminals (R, S1, S2, S3, S4, S5, S6, S7) response time selection
1tSF	~	1t7F	Input terminals (F, RES, ST) response time selections
0t0d	~	0t3d	Output terminals (RCH, LOW, FL, OUT) delay times
0t0h	~	0t3h	Output terminals (RCH, LOW, FL, OUT) hold times

If noise effects or input contact point chattering results in undesirable or incorrect operation, increase the terminal response time selections. As the setting value is increased, the response time will also increase proportionally.

★ When set to 1 , the response time will be the shortest, and when set to 100 , the response time will be the max. (approx. 200mS).

★ The output terminals can be set separately for the delay time when turning ON, and the output hold time when turning OFF.

> When the acceleration/deceleration time is 0.1 sec. or less and an analog frequency input is used, chattering may occur in the acceleration/deceleration complete signal or low speed detection signal. Set the output terminal delay times (filter functions) 0t0d 0t1d 0t2d 0t3d as necessary.

Gr. St (Terminal Selection Parameters)

CCHG FCHG Commercial power/INV switching

Related parameters

CCHG	Commercial/inverter switching output
FCHG	Commercial/inverter switching frequency
OtO / Ot1	Output terminal selections

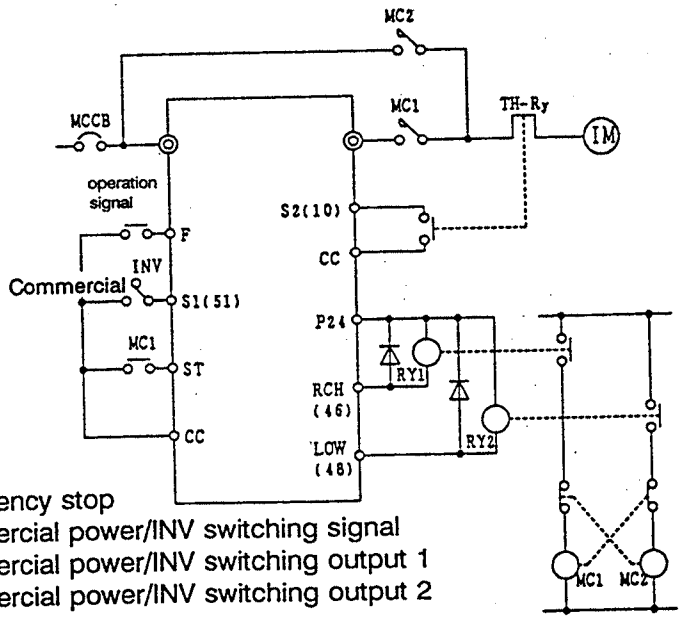
Gr. Pr ArSt Auto-restart (motor speed search)

These parameters allow the inverter to change from commercial power operation to inverter operation, and to restart without having to stop the motor when restoring power after a momentary outage (in the coast-stop state).

By setting the commercial power/INV switching frequency (FCHG), the inverter will accelerate, and then automatically switch the motor to the commercial power source. Energy savings and quieter operation can be realized when the motor is run directly from commercial power.

CCHG setting	Function
0	OFF
1	Automatic switching upon trip
2	Switching at commercial/inverter switching frequency setting
3	Switching at commercial/inverter switching frequency setting, automatic switching upon trip

An example of the commercial power/inverter switching wiring is shown below.



It1	set to 10	Emergency stop
It2	set to 51	Commercial power/INV switching signal
OtO	set to 46	Commercial power/INV switching output 1
Ot1	set to 48	Commercial power/INV switching output 2

★ Short circuit between ST and CC when using only the auto-restart function.

★ Select motor speed search (ArSt in Gr. Pr) on ST make/break (commercial power switching)

Gr. St (Terminal Selection Parameters)

OtFP Output terminal pulse frequency selection

Selects the No. of pulses in proportion to the output frequency from the output terminal FP.

OtFP setting value	Function
0	48f
1	96f
2	360f

Note) When 96f is selected, the pulse output will be an alternating dual-cycle pulse train, so the counting instrument must read an adequate average frequency.
48f and 360f are single pulse trains, so the frequency measurement device can perform high speed reading of the output pulses.

★ By using the pulse output terminal (FP) and the pulse inputs of expansion terminal block PCBs (optional) installed on other inverters, multiple inverters can be proportionally controlled and operated.

The FP output signal may be unstable when power is turned ON, during a fault reset, or when Gr.Ut [tYP] is set.

Inrr RR input special function selection (for optional ROM)

Parameter data can be externally adjusted using the RR input terminal.

Inrr setting value	Function
0	Standard
1	FH (max. frequency)
2	TACC/TDEC (acceleration/deceleration time) multiplication factor
3	VB (torque boost) multiplication factor
4	Current limit adjustment multiplication factor

Set to 1 [FH] adjustment ... The frequency reference from the RR input terminal can be used as the [FH] data.

★ Note that [FH] cannot be changed while running, so the data will be updated only when the inverter is stopped.
The [FH] setting range is from 30 to 400Hz, so a setting of less than 30Hz will be treated as [FH] = 30Hz.

Set to 2 TACC/TDEC multiplication factor ... The acceleration/deceleration times parameter values can be multiplied from 1.0 times to 10.0 times with the RR terminal analog input.

Set to 3 [ub] multiplication factor ... The voltage boost [ub] parameter values can be multiplied from 0.00 times (0%) to 1.00 times (100%) with the RR terminal analog input.

Set to 4 [SEL] multiplication factor ... The current limit adjustment [SEL] parameter values can be multiplied from 0% to 100% with the RR terminal analog input.

Gr. 5C (Special Control Parameters)

Frun FHY5 Run frequency control

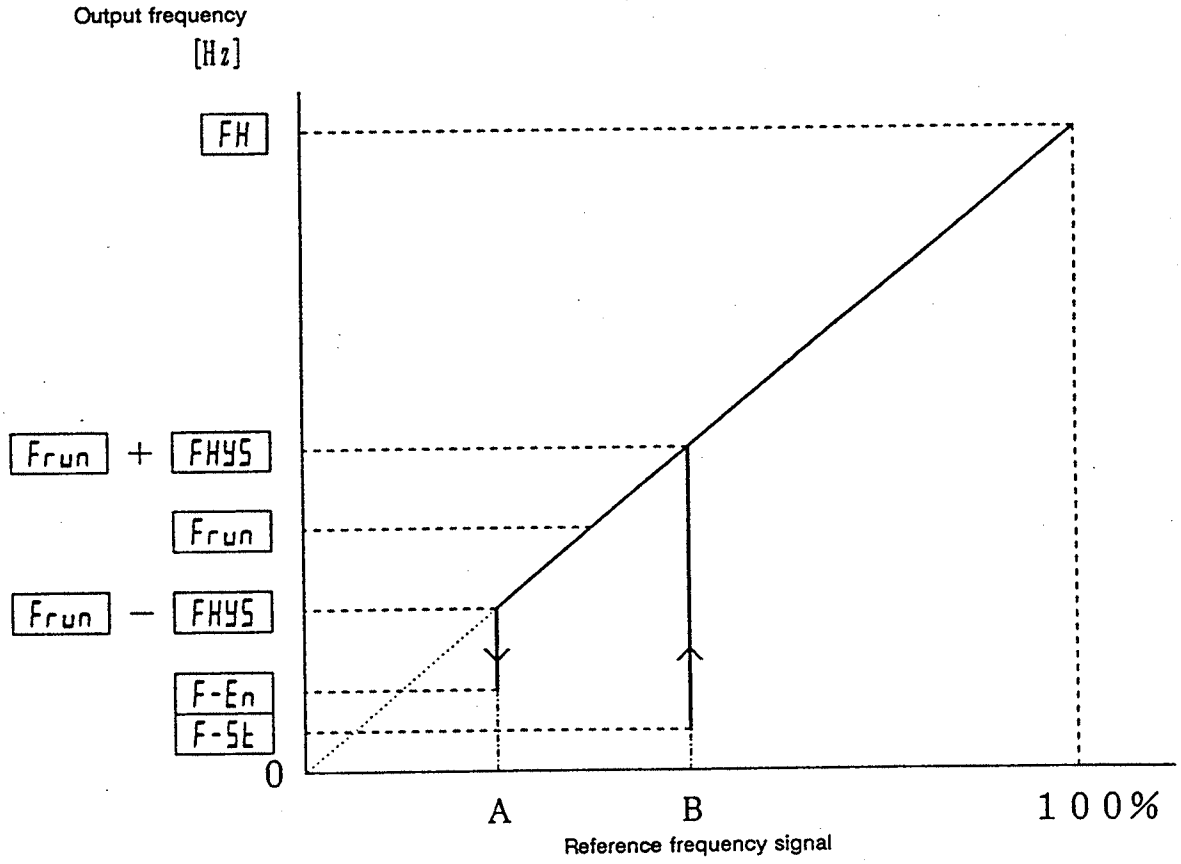
Related parameters

Frun Run frequency

FHY5 Run frequency hysteresis

The inverter run/stop can be controlled with just the reference frequency signal. By setting the run frequency Frun and the run frequency hysteresis FHY5 , the inverter will start running when the reference frequency signal is higher than point B in the following diagram, and will stop when less than point A.

★ For example, when using the inverter for HVAC applications, etc., and automatically operating from a room temperature signal, the inverter can be stopped when the reference frequency signal drops below 30Hz.



★ During acceleration, the inverter will start with start-up frequency F-5t in Gr.5C when the reference frequency signal is higher than point B. During deceleration, the inverter will stop at end frequency F-En in Gr.5C when the reference frequency signal drops below point A.

Gr. 5C (Special Control Parameters)

F-5t Start-up frequency
F-En End frequency

Related parameters

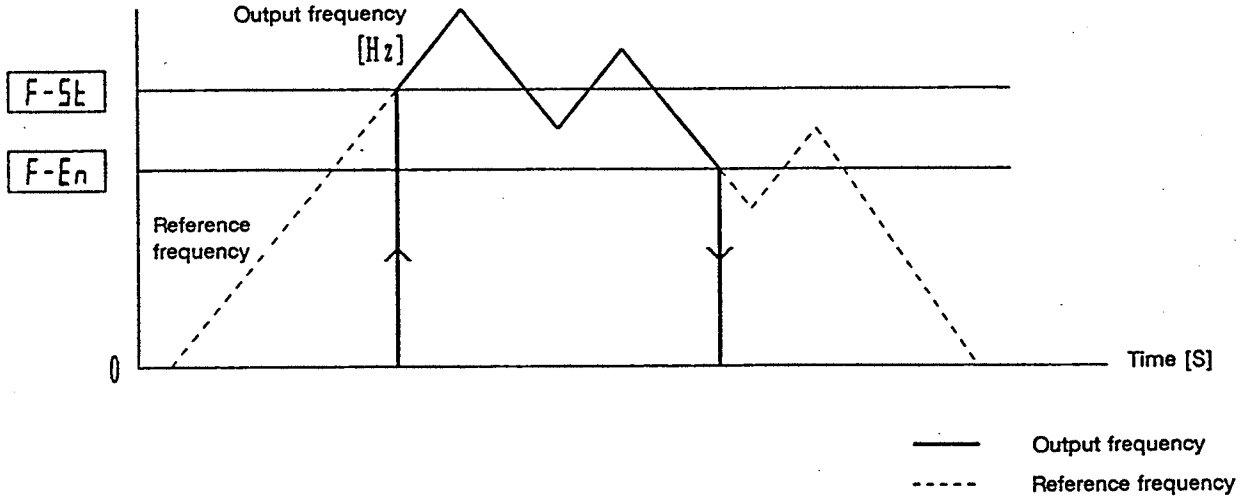
F-5t Start-up frequency

F-En End frequency

These settings are used when the starting torque response delays influence the acceleration/deceleration times. Normal settings of these parameters are from 0.5 to 2Hz, and should be kept less than 5Hz. Overcurrent can be avoided by keeping the frequency less than the motor rated slip amount.

During start-up ... The F-5t frequency setting is instantaneously output.
During stopping ... The output frequency is instantaneously changed to 0Hz when the F-En frequency setting is reached.

Start-up frequency F-5t > End frequency F-En



Start-up frequency F-5t < End frequency F-En

★ Avoid this setting as chattering will occur.

Gr. 5C (Special Control Parameters)

FJ.n Jump frequencies

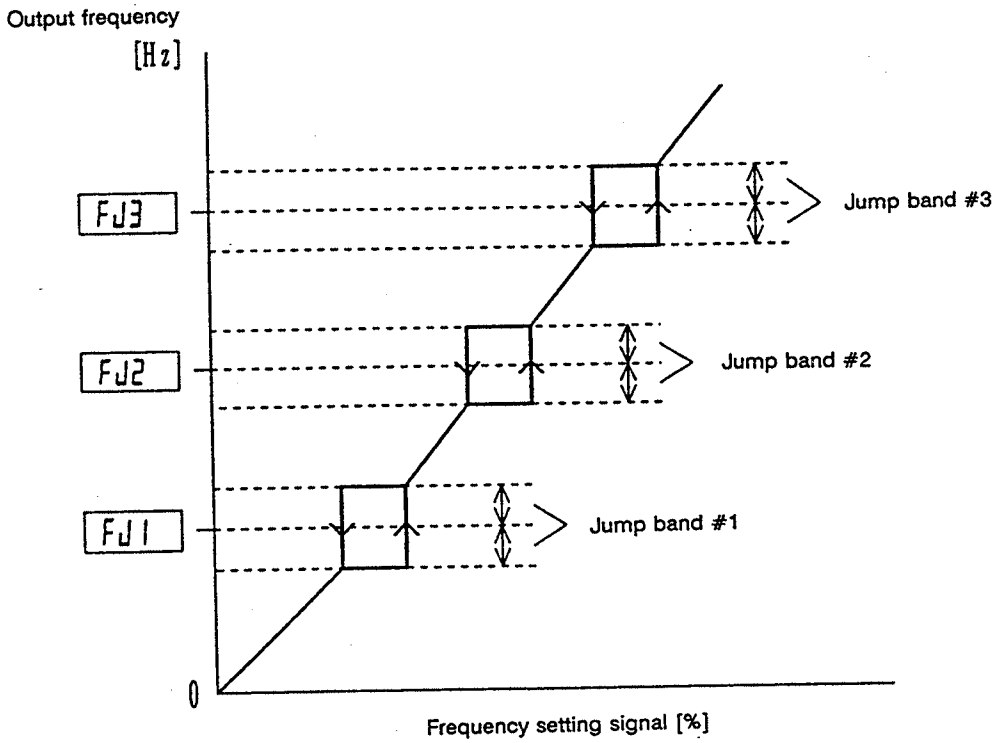
Related parameters

FJ.n Jump frequency selection

FJ1 ~ FJ3 Jump frequencies

bFJ1 ~ bFJ3 Jump bands

To avoid operating at frequencies where the mechanical system's characteristic vibrations may cause resonance, jump the resonant frequencies.
During jumping, there is a +/– hysteresis band associated with the jump frequency.



★ During acceleration/deceleration, the output frequency will not instantaneously jump from one hysteresis point to the next once the reference frequency has passed the latter point, but will accelerate/decelerate through the jump region.

Gr. 5C (Special Control Parameters)

CF PWM carrier frequency

The motor's resonant acoustic noise can be changed by changing the PWM carrier frequency. If resonance occurs between the motor and the load machine or motor fan cover, change the PWM carrier frequency.
The PWM carrier frequency CF can be set between 3kHz and 17kHz.
(18.5kW to 75kW units can be adjusted between 3kHz to 15kHz.)

- ★ At low-speed and very high-speed operation, the carrier frequency will be automatically adjusted to meet motor drive requirements.
- ★ If the carrier frequency is set higher than the default setting value, the overload trip level will automatically be reduced, which may result in more frequent overload trips.
- ★ 15kW and smaller units: if the standard 15kHz setting is changed to 17kHz, the overload trip level will be reduced 4% for 200V units and 6% for 400V units.
  18kW and larger units: if the standard 12kHz setting is changed to 15kHz, the overload trip level will be reduced 7% for 200V units and 11% for 400V units.

Gr. SF (Frequency Setting Parameters)

Sr.n | Sr.n — Preset speed operation ①

Related parameters

Sr.n	Preset speed selection
Sr.n	Mode selection
Sr01 ~ Sr15	Operating frequency settings
SrN1 ~ SrNF	Operating mode settings

By changing external contact signal inputs, a max. of 15 preset speeds can be selected. (Refer to Gr. 5E 1E* for terminal allocation.)
Each speed (frequency) can be set between 0 and 400Hz.

★ Note that the preset speeds cannot be set higher than the value of the max frequency FH , so the value of FH must also be changed if a higher preset speed is desired.

Basic setting method

1. Select the desired No. of speeds for preset speed operation. Sr.n : 0 : disabled
   1~15 : Speeds 1 to 15

2. Select the operating mode. Sr.n :
   - 0 : Deactivated
   - 1 : Activated

   SrN* :
   - 0 : Acc/dec #1, V/F#1, forward run
   - +1 : Reverse run selection
   - +2 : Acc/dec #2 selection
   - +4 : V/F #2 selection

   ★ Data setting of parameters indicated as using the "+" mark is as follows:
   Example) (+1) + (+2) = 3
   Both reverse run and Acc/Dec #2 will be in effect when 3 is selected.

3. Set the operating frequencies for the applicable speeds between the lower limit and upper limit frequencies.
   Sr01 ~ Sr15

4. Allocate the terminals for preset speed operation.
   (Refer to Gr. 5E 1E* (*: 0 to 10).)

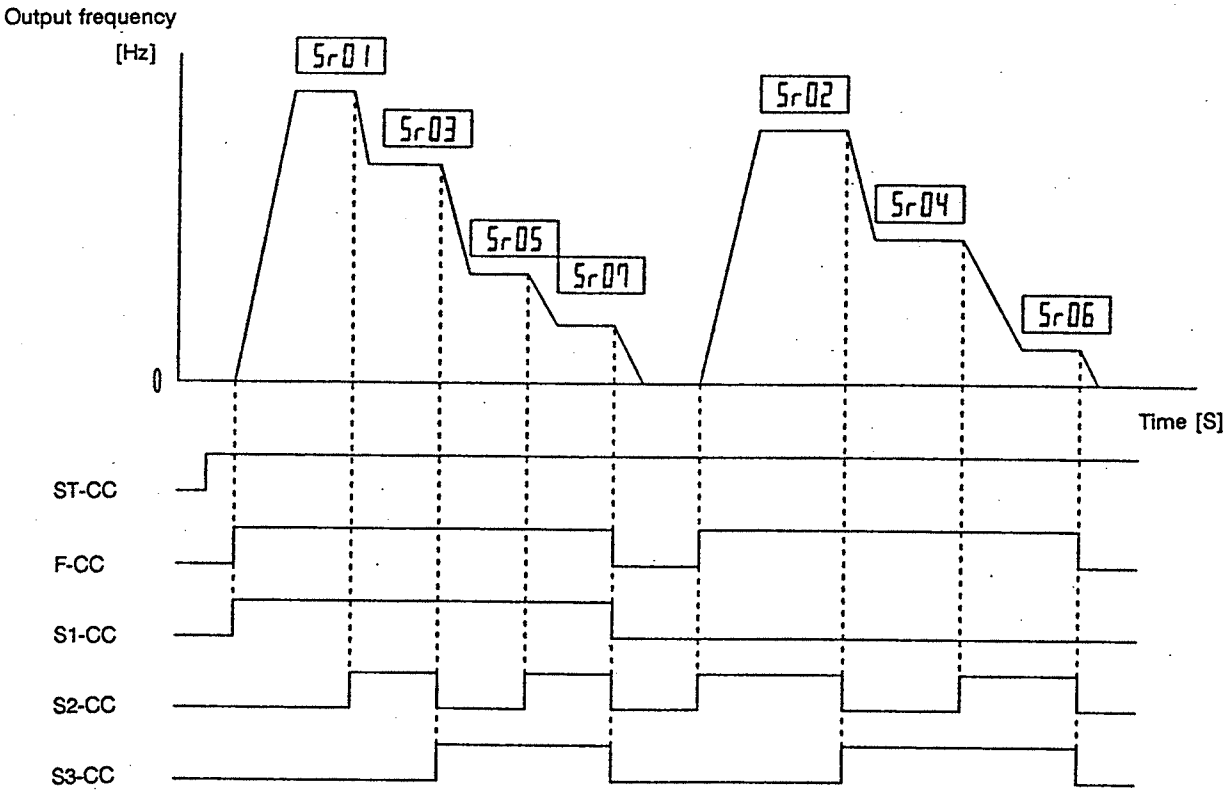
Terminal signal	Preset speed No.															
	Normal frequency command	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SS1	—	O	—	O	—	O	—	O	—	O	—	O	—	O	—	O
SS2	—	—	O	O	—	—	O	O	—	—	O	O	—	—	O	O
SS3	—	—	—	—	O	O	O	O	—	—	—	—	O	O	O	O
SS4	—	—	—	—	—	—	—	—	O	O	O	O	O	O	O	O

(— = terminal-CC open, O = terminal-CC closed)

Gr. 5F (Frequency Setting Parameters)

5r.n	5r.N	**Preset speed operation ②**

Example of 7-speed run



The above example assumes that the following settings are allocated to the terminals:

Gr.5E	1E0	(S1) set to 1 (SS1)
	1E1	(S2) set to 2 (SS2)
	1E2	(S3) set to 3 (SS3)

★ If a selected preset speed number (selected by SS1~SS4) is larger than the setting value of 5r.n, 0Hz will be output.

Gr. 5F (Frequency Setting Parameters)

FC1 FC2 Frequency priority selections

Related parameters

FC1 FC2 Frequency priority selections

InF Analog input filter

Two types of reference frequency signals input from the terminal block can be automatically selected.

FC1, 2 setting value	Function
1	RR
2	IV
3	RX
4	PG (pulse input setting)
5	BIN (binary setting or up/down frequency setting)

FC1 selection input: Frequency priority selection #1
FC2 selection input: Frequency priority selection #2

★ If a signal is input into the selected #1 frequency priority input, that value will be used as the actual frequency reference. Even if a signal is input into the selected #2 frequency priority input, the #1 input has priority. However, if the #1 frequency priority input signal becomes 0, the #2 frequency priority input will be used as the actual frequency reference.

The standard default settings are FC1 : RR and FC2 : IV, so to use the RX, PG or BIN inputs, change the FC1 or FC2 setting values to 3 ~ 5.

By setting the analog input filter parameter InF , a built-in filter constant can be configured to remove noise in the input terminal voltage- and current-source frequency command signals. If stable operation is not possible due to noise, increase the filter time constant. The response will decrease, however, as the setting value is increased.

Gr. SF (Frequency Setting Parameters)

JOG JSTP Jogging operation

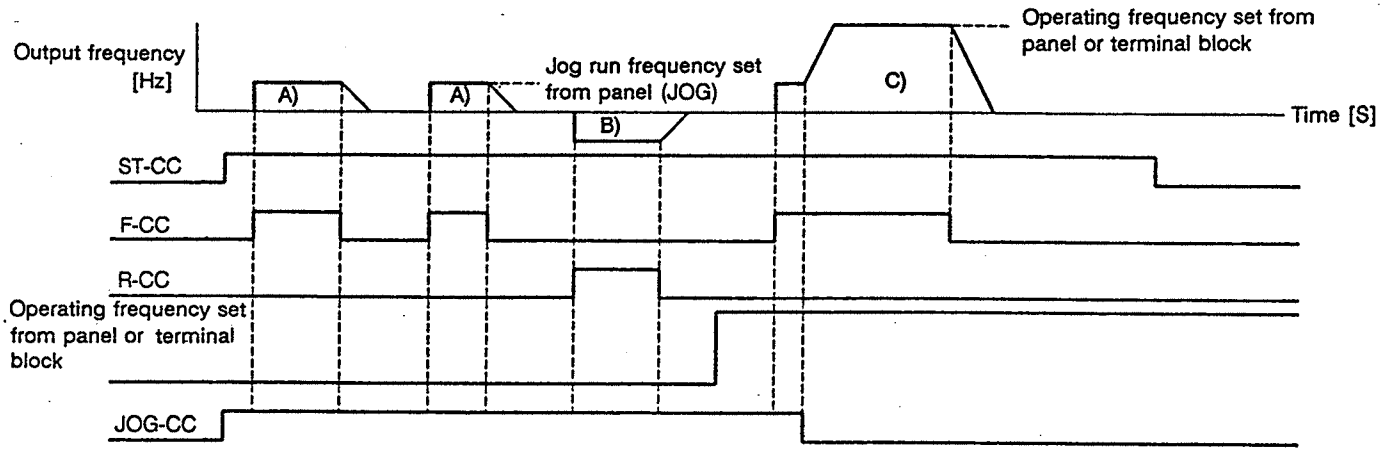
Related parameters

JOG Jog run frequency

JSTP Jog stop control

A jog run can be started and stopped with the F, R terminal signals by setting the jog run frequency JOG. (Refer to the section on Gr. St IT* for allocating the input terminals.)

★ Short circuit JOG-CC before starting a jog run.



A) Jog forward run

B) Jog reverse run

C) Runs at the operating frequency set from the panel or terminal block when JOG-CC is opened.

★ Jogging will not occur if JOG-CC is shorted while running.

★ When using JOG run and preset speed run modes simultaneously, the preset speed run mode will have priority. (For example, if the preset speed run mode is set for reverse run, the preset speed is selected by SS1-SS4, and then a JOG operation is performed, the motor will jog in reverse.)

Select the jog stop method with JSTP .

Set the jog run frequency to a value other than 0 to execute a jog run.

JSTP setting	Function
0	Decelerated stop (Decelerated stop according to the dEC1 parameter.)
1	Coast-stop
2	DC injection braking stop (Stop according to DC braking parameters set by dbF dbC dbt)

The jog run acceleration time is set to zero, so setting the JOG run frequency to 5Hz or less is recommended. If set higher, overcurrent trips may occur, or the motor may not rotate smoothly.

Note) During a jog operation, the LOW and RCH signals will not be output, and PID control will not be enabled.

Gr. SF (Frequency Setting Parameters)

rr In Frequency setting input signal characteristics

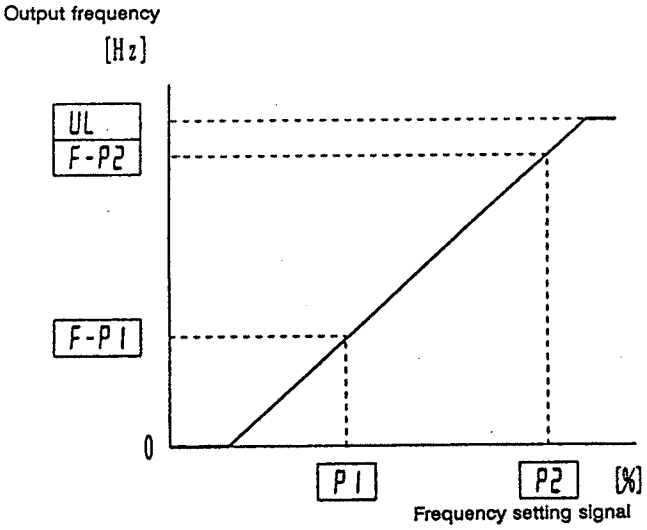
Related parameters

rr In	RR input selection
P1	RR reference point #1
P2	RR reference point #2

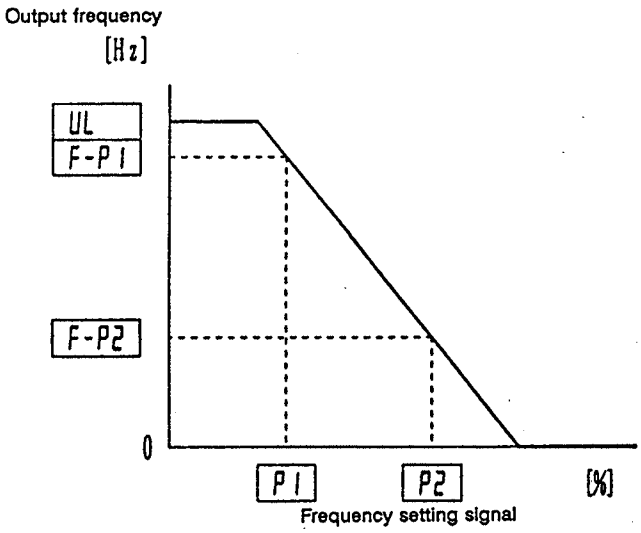
F-P1	Point #1 output frequency
F-P2	Point #2 output frequency

If rr In is set to 1, the characteristics of the RR terminal frequency setting signal and output frequency can be set.

(Example 1)
RR input frequency setting signal characteristics



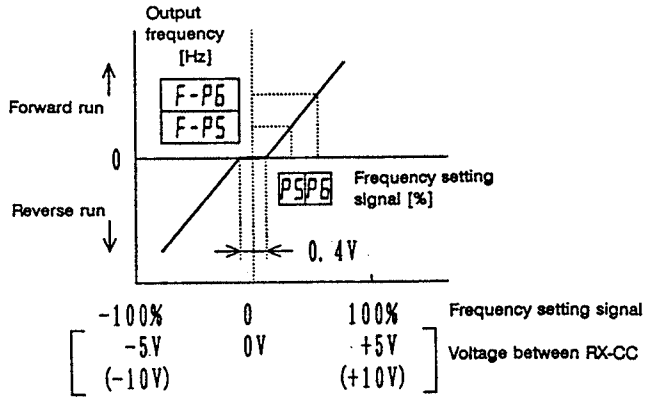
(Example 2)
RR input frequency gain setting signal characteristics



★ Points P1 and P2 must be set at least 10% apart.
If points P1 and P2 are the same, Err.1 will be displayed.

The P3 ~ PA and F-P3 ~ F-PA parameters can be set in the same manner for the IV, RX, PG and BIN inputs.

★ The RX, PG and BIN inputs can also be configured for both forward or reverse operation.



Even if the frequency setting signal is at 100%, there may be some slight deviation from the set frequency due to error.

The RX-CC analog input signal has a dead band of approx. 0.4V about the 0V point.

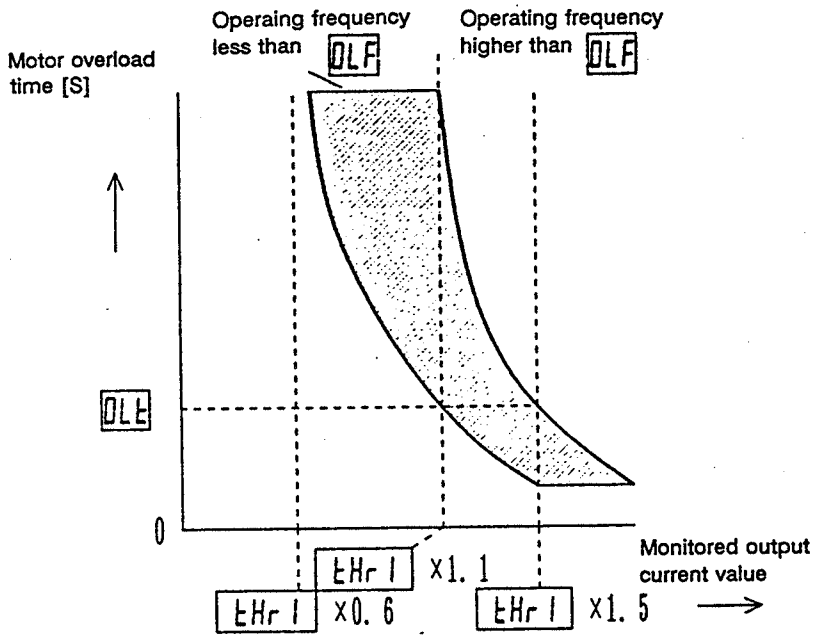
Gr. Pr (Protection Parameters)

tHr 1 OLF OLt Electronic thermal protection ①

Related parameters

tHr 1	Motor overload protection level
OLF	OL reduction start-up frequency
OLt	Motor 150% overload time limit

The motor overload protection level tHr 1 can be adjusted according to the motor rating and characteristics.



Motor overload start-up level

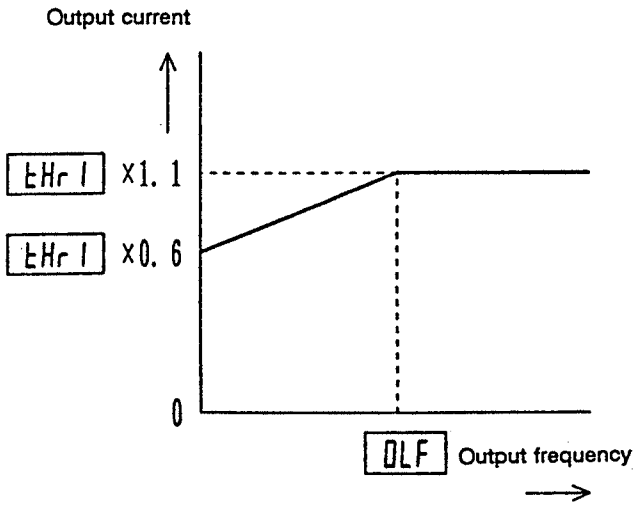
When operating a motor at low frequencies, the motor's cooling ability decreases. Therefore, the OL reduction start-up frequency OLF can be used to lower the OL operation start-up level.

This should be set according to the motor characteristics.

The following settings are recommended:

30Hz for a standard motor
6Hz for a VF motor

By setting OLt , the time before an OL trip will occur when the motor is operated at 150% load can be adjusted between 10 and 2400 seconds.



Gr. Pr (Protection Parameters)

OLn - Electronic thermal protection ②

Related parameters

OLn	OL selection
StC 1	Stall protection
StL 1	Stall protection level

The OL selection parameter [OLn] can be set as follows.

OLn setting value	Function
0	Standard
+1	Soft-stall ON
+2	Motor overload (OLnt) trip OFF

Note) When 3 is selected, both the +1 and +2 functions are enabled.

★ The motor overload trip can be enabled/disabled with [OLn] , but the inverter overload trip is always enabled.

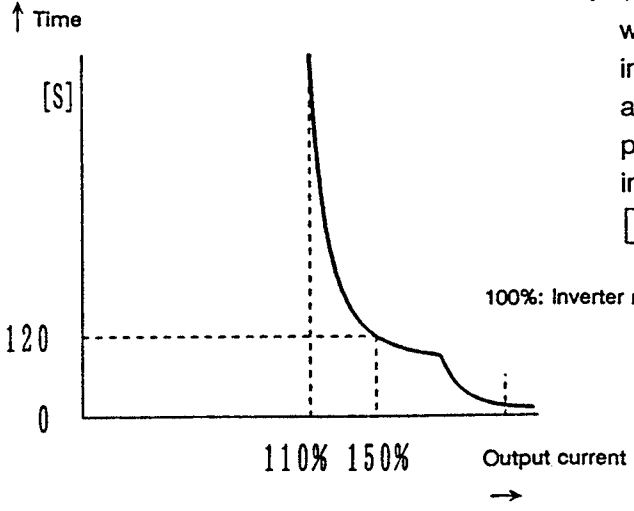
Soft-stall function:

When the inverter detects an overload, the output frequency will automatically be lowered before the motor overload trips (OLnt). The load current will stabilize at the reduced frequency, and operation will continue without tripping.

This function is applicable to variable torque loads such as fans, pumps and blowers, which exhibit the characteristic that when the operating speed decreases, the load current also decreases.

★ Do not use soft-stall on constant torque loads (loads with a constant load current regardless of speed).

Inverter overload protection curve



100%: Inverter rated current

: This protection curve cannot be changed or turned off with parameter settings. This is built-in to protect the inverter unit. If the inverter overload trip (OL In) activates, lower [StL 1] in Gr.Pr (stall protection level (current limit level adjustment)), and increase the acceleration time ([ACC 1] or [ACC2]) to decrease the chances of this occuring.

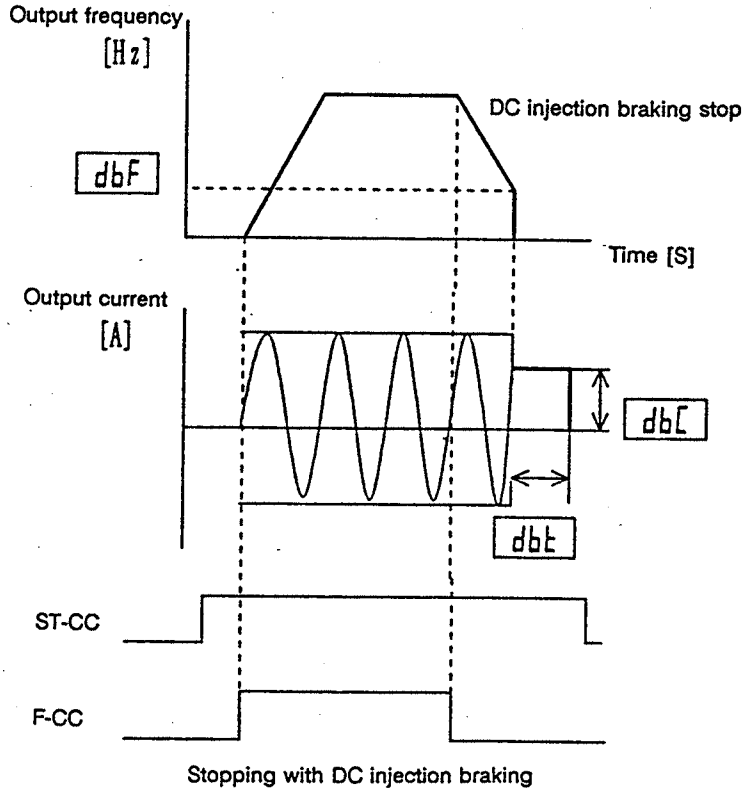
Gr. Pr (Protection Parameters)

dbF / dbSL / db In — DC injection braking settings ①

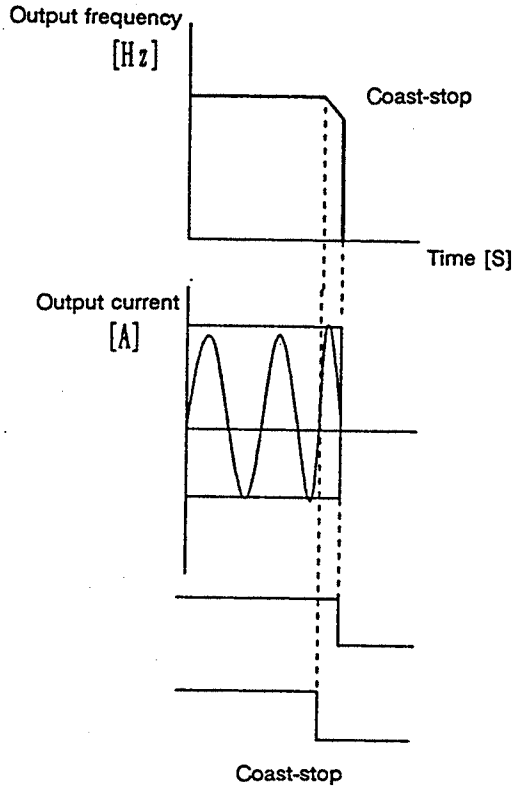
Related parameters

dbF	DC injection starting frequency
dbC	DC injection current
dbt	DC injection time
dbSL	Forward/reverse DC injection priority control
db In	Motor shaft stationary control

By setting the DC injection current, DC injection time, and DC injection starting frequency, the stopping precision for positioning, etc. can be adjusted to match the load.



Stopping with DC injection braking



Coast-stop

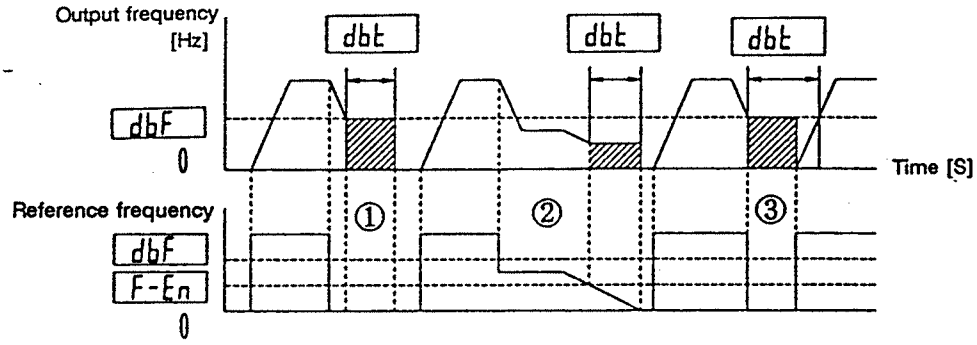
★ DC injection braking is a function that forcibly stops the motor, so do not set dbC or dbt higher than necessary, as the motor may overheat.

★ The inverter's overload protection sensitivity is increased during DC injection braking, so if dbC is set to approx. 90% or higher, the electronic thermal overload protection may activate depending on the dbt setting.
(The overload protection will activate in approx. 3 sec. when dbC is set to 100%.)

DC injection braking will start when the inverter stop command is issued and the output frequency is less than [dbF].

<<Explanation of normal DC injection braking>>

[dbSL] 0 : Normal



① When [dbF], [F-En] > reference frequency : DC injection braking is executed.
② When [dbF] > reference frequency > [F-En] : Motor runs at the commanded frequency.
When [dbF], [F-En] > reference frequency : DC injection braking is executed.

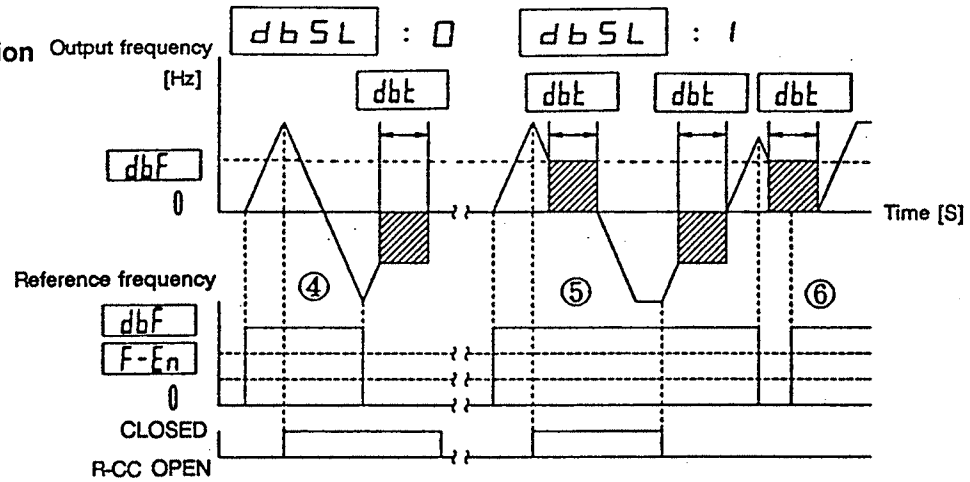
Note 1) The inverter stop command includes when the reference frequency becomes 0Hz, or when the output frequency becomes less than [F-En], in addition to the run/stop command.

③ When a run command is issued during DC injection braking: DC injection braking is terminated, and the motor starts running.

<<Explanation of DC injection braking priority>>

[dbSL] 1 : Priority

[dbSL] 0 : Normal



④ During normal forward/reverse run ([dbSL] set to 0), DC injection braking is not executed, as the command is not regarded as an inverter stop command.

⑤ When a reverse run (forward run) command is issued during a forward run (reverse run): DC injection braking starts when [dbF] > reference frequency during deceleration.

⑥ When a run command is issued during DC injection braking: DC injection braking has priority.

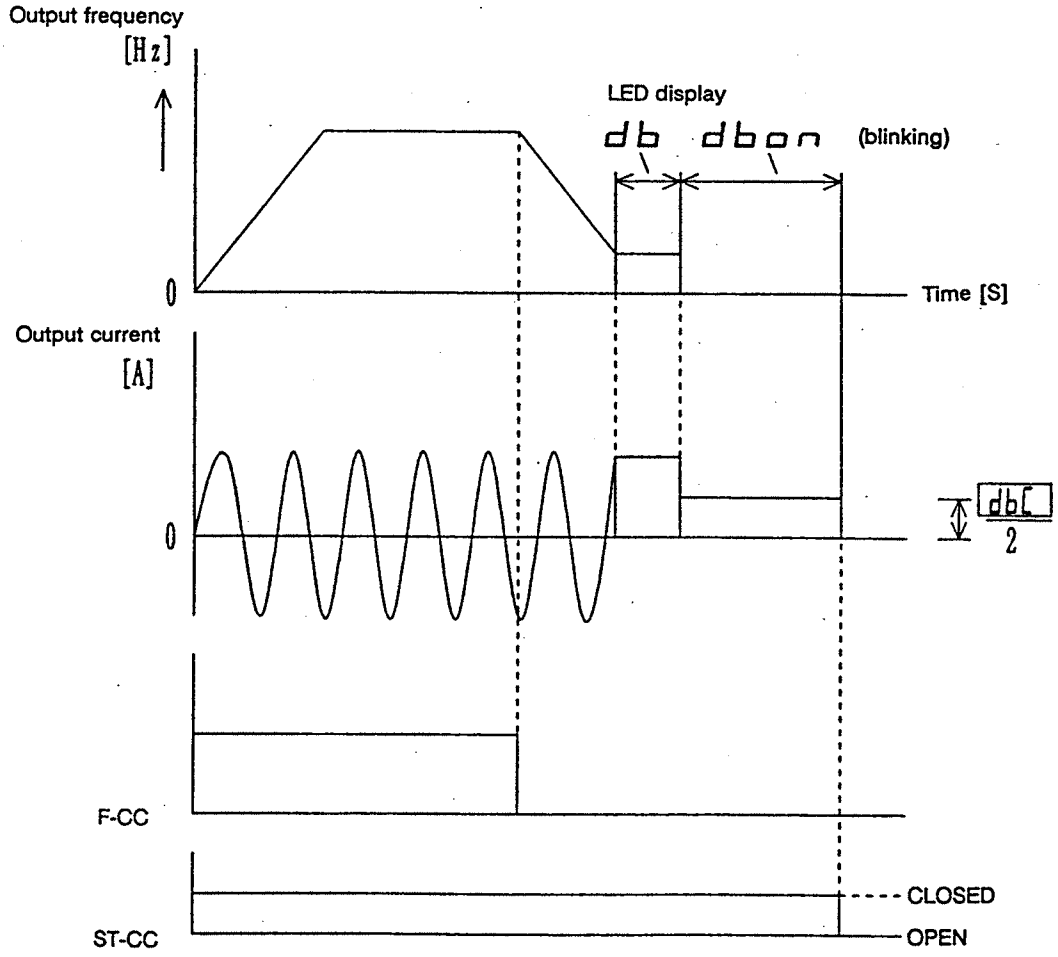
GR. PR (Protection Parameters)

dbF / dbSL / db In — DC injection braking settings ②

db In Motor shaft stationary control

This function is effective when the motor shaft has stopped and is not to be rotated, or when preheating the motor.

When **db In** is set to **1** to activate motor shaft stationary control, DB can be continued at half the **dbC** setting value after normal DB operation. This condition can be maintained as long as ST-CC is not opened, emergency stop is not engaged, or the power is not turned OFF. To stop this function, disengage the operating command by one of the methods previously mentioned, and DB will stop.



★ Approximately the same control is possible with the external contact input DC injection braking ON/OFF selection. (Refer to **Gr.St** **1E*** (*: **0** to **10**).) DC injection braking will activate if the output frequency is less than **dbF** and ST-CC is shorted, and will continue regardless of the **dbt** setting. However, if **dbC** is set to 60% or higher, depending on the DC injection time, the inverter's electronic thermal overload protection may activate (when using a standard motor).

Gr. Pr (Protection Parameters)

Pb	Pbr
PbCP	OPSS

Dynamic braking operation

Related parameters

Pb	Dynamic braking selection
Pbr	DBR resistor value
PbCP	DBR capacity
OPSS	Overvoltage stall protection

Dynamic braking can be selected to prevent an overvoltage trip during sudden deceleration or a decelerated stop.

Pb setting value	Function
0	No DBR
1	Dynamic braking without overload detection
2	Dynamic braking with overload detection

OPSS setting value	Function
0	ON
1	OFF

★ Overvoltage stall protection automatically controls the deceleration rate to prevent overvoltage tripping when the voltage in the DC section of the inverter rises during deceleration. Note that this may cause the deceleration time to be longer than the set time.

★ The resistor can become extremely hot (approx. 150°C) when dynamic braking is frequently operated, so take this into consideration when selecting the installation site.

When Pb is set to 2, and the standard resistor is not used (refer to Appendix Table 3 on page 124), the following settings are required for braking resistor overload protection.

Pbr	1.0~1000Ω
PbCP	0.01~600kW

★ Select a dynamic braking resistor exceeding the min. allowable resistance value. (Refer to page 95.)

When using a nonstandard braking resistor with no temperature fuse, install a magnetic contactor (MC) or a non-fuse breaker (MCCB) with shunt release on the inverter's power supply input, so that the power circuit can be opened by the inverter's built-in fault detection relay (FL) or an overload detection device in series with the braking resistor.

Gr. Pr (Protection Parameters)

ESTP EdbT Emergency stop

Related parameters

ESTP Emergency stop selection

EdbT Emergency stop DC injection time

Emergency stop is not allocated to a terminal with the standard default settings, so if activation from the terminal block is desired, select emergency stop for a random terminal with Gr. St IT* (*: 0~ 10). Emergency stop (setting value 10) will be performed according to the setting of ESTP , the inverter will trip (E will blink), and the FL relay will operate.

ESTP setting value	Function
0	Coast-stop
1	Decelerated stop
2	DC injection stop

★ When ESTP is set to 2 , set the emergency stop DC injection time EdbT and DC injection current dbC .

★ If a controlled emergency stop is desired, keep ST-CC shorted. If ST-CC is opened, the inverter output will be 0Hz, and the motor will coast-stop.

rtry rtt Retry function

Related parameters

rtry Retry selection

rtt Retry time setting

Retry is a function that automatically resets and restarts the inverter when a fault occurs.
Set the No. of retry times when a fault occurs with rtry .

rtry setting value	Function
0	No retry function
1~ 10	1 to 10 times

Set the time to wait before restarting after an inverter fault with rtt .

When a fault occurs, the inverter will automatically start running after the retry wait time set in rtt , so when using this function, make sure that workers are not exposed to danger from equipment suddenly starting.

When retry rtry is selected, the motor speed search function will automatically operate during retry, so a smooth start will be possible.

Gr. Pr (Protection Parameters)

UuC UuCt Regeneration power ride-through control

Related parameters

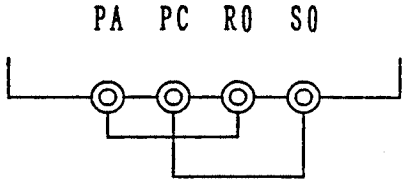
UuC Regeneration power ride-through control

UuCt Ride-through time

This function allows operation to continue using regenerated energy from the motor when a momentary power failure occurs.
Continuation may not be possible depending on the machine's inertia or load state, so when selecting this function, always perform a confirmation test. If an overvoltage trip (OP) occurs when this function is operating or continuation is not possible for long periods of time, lengthen the acceleration/deceleration times. Automatic restarting is possible without fault stopping when this function is used with the retry function.

UuC setting value	Function
0	Regeneration power ride-through control OFF
1	Regeneration power ride-through control ON

★ The ride-through time UuCt can be set between 0.0 and 25.0 seconds.
Since this function can keep only the inverter operational during an extended momentary power failure, the applicability will depend on the remainder of the load system equipment.
Note that when using the standard control power connections, the inverter will be able to maintain control power and operate for only approx. 100msec during a momentary power failure. However, for 30kW and smaller units, control power can be maintained for a longer period of time by using the main circuit DC terminals PA and PC as shown below.



Remove the shorting bars between R0-R/L1 and S0-S/L2, or the inverter may be damaged.

Never use the above wiring for 37kW or larger units, as the inverter may be damaged.

ArSt Auto-restart

★ Set the auto-restart parameter ArSt to use auto-restart.

ArSt setting value	Function
0	OFF
1	On momentary power failure
2	On ST make/break
3	Both 1 and 2

ArSt set to 1 ... Activates when power is restored after a main circuit and control power circuit undervoltage is detected.

ArSt set to 2 ... Activates when ST-CC is opened and then closed again. (For commercial/inverter power switching)

★ Depending upon the inverter capacity, a wait time of 200ms to 1500ms is automatically set when restarting after a gate block or CPU reset to reduce the motor's residual voltage.

Gr. Pr (Protection Parameters)

StC 1	UPSL
LLP	OtSL
Otl	trCL

Trip function selections

Related parameters

StC 1	Stall protection
UPSL	Undervoltage trip selection
LLP	Low current detection selection
LLPC	Low current detection level
OtSL	Overtorque trip selection

StL 1	Stall protection level
UPt	Undervoltage detection time
LLPt	Low current detection time
trCL	Fault trip saving
Otl	Overtorque trip level

The stall protection, undervoltage trip, low current detection and overtorque trip functions can be selectively enabled/disabled.

Parameter	Standard setting	Function	When set to 1
StC 1	0	Stall protection ON.	Stall protection OFF.
UPSL	0	Undervoltage trip disabled.	Undervoltage trip enabled.
LLP	0	Low current trip disabled.	Low current trip enabled.
OtSL	0	Overtorque trip disabled.	Overtorque trip enabled.

★ By setting the fault trip saving function [trCL], when a trip occurs, whether or not the trip will be maintained or cleared when the inverter is powered OFF can be selected.

A low current condition is detected when the inverter output current is less than the low current detection level [LLPC] for a duration exceeding the low current detection time [LLPt].

OCLS Output short circuit detection selection

This parameter allows the selection of the method for detecting an output short circuit, dependent upon the motor and usage conditions.

OCLS set to 0: Standard ... Detection is executed upon start-up.

OCLS set to 1: For high-speed motor use ... Because a high-speed motor's inductance is small, the detection method is altered to prevent nuisance trips.

OCLS set to 2: For positioning ... Detection is performed during initialization after power is turned ON. This is used to improve positioning accuracy during JOG, because the positioning will deviate with the output short-circuit check pulses.

OCLS set to 3: For high-speed motor positioning

★ This function only changes the method for evaluating an overcurrent trip. Overcurrent protection will still always be in effect.

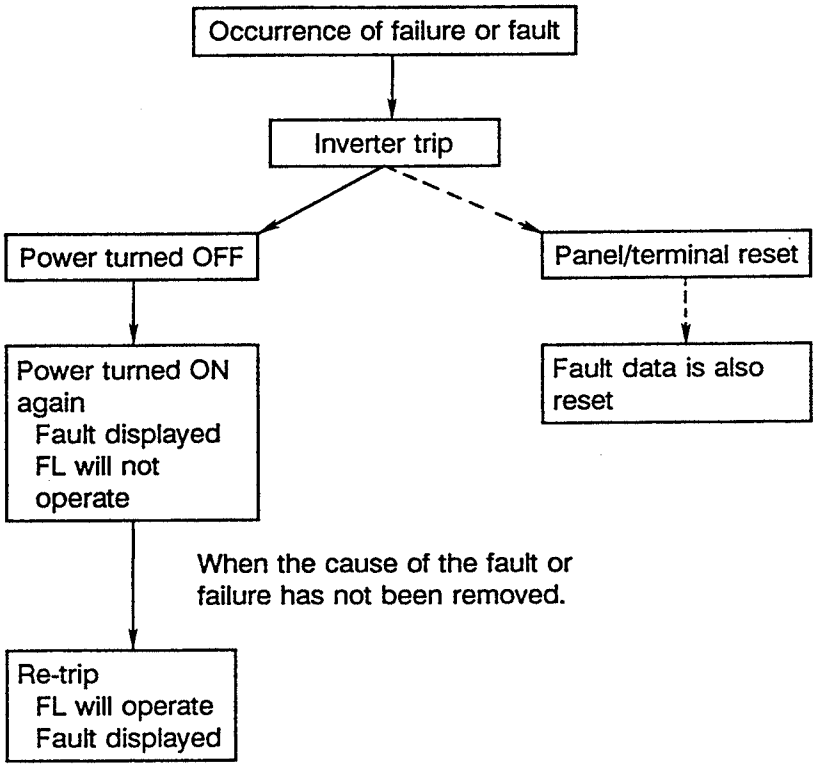
Gr. Pr (Protection Parameters)

trCL Fault trip saving

Dependent upon the setting of this parameter, trip causes can be displayed after power is cycled off and on.

trCL setting value	Function
0	Trip cause cleared when powered OFF
1	Trip cause retained when powered OFF

When trCL is set to 1 :



Note) The information in the trip status monitor (load current, input/output voltage, etc., at time of trip) will not be maintained when power is turned on again.

Gr. Pt (Pattern Run Parameters)

PSEL | PtN — Pattern run ①

Related parameters

PSEL — Pattern run selection

Pt 1.0 ~ Pt4.7 — Pattern group speed selections

SLn 1 ~ SLnF — Drive continuation modes

PtN — Pattern run mode

PtL 1 ~ PtL4 — Pattern group number of cycles

SLt 1 ~ SLtF — Speed drive times

Gr.St 1t0 ~ 1t 10 — Input terminal function selections

One pattern while in panel operation mode and four patterns while in terminal operation mode can be automatically executed according to the 15 preset speeds, drive times and acceleration/deceleration times. For further information on preset speed operating frequencies and run modes, refer to Gr. SF Sr.n .

Basic operation setting method

1. Activate pattern run selection. PSEL : 0: OFF / 1 : ON
2. Set all the applicable preset speeds and run modes. Sr01 ~ Sr 15 / Srn1 ~ SrnF
3. Set the drive times and continuation modes as required for each preset speed set in step 2.
   Speed drive times SLt 1 ~ SLtF
   Speed drive continuation modes SLn1 ~ SLnF
4. Set the order of each speed configured in steps 2 and 3.
   1) Select the pattern run/stop method with the pattern run mode.
   PtN : 0 : When the inverter is stopped, the run pattern is reset.
   1 : Upon continuation after a stop, the pattern switches after the current pattern is finished.
   2) In each pattern group, select the preset speeds to be output for each pattern. Pt 10 ~ Pt 17 / Pt20 ~ Pt27 / Pt30 ~ Pt37 / Pt40 ~ Pt47
   3) Allocate the pattern run selection functions #1, #2, #3 and #4 with the input terminal selections Gr.St 1t* (*: 0~ 10) according to the desired pattern groups. If 5 (continue until next step command) was set in SLn1 ~ SLnF in step 3, assign the pattern run step trigger signal to 1t* . The run/stop method can also be selected by allocating the pattern run continuation signal.

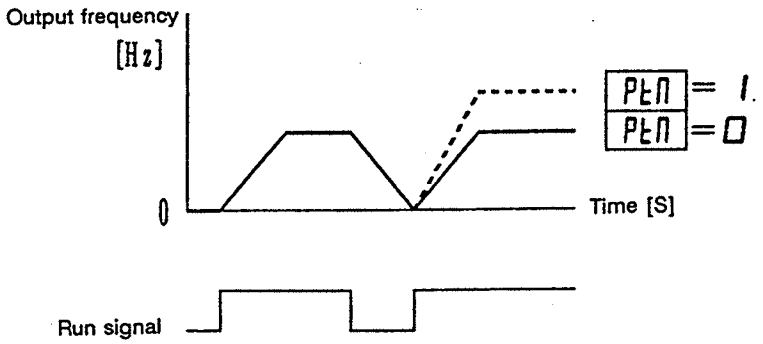
   During pattern run, the following pattern run status elements can be monitored at the beginning of status monitor mode (refer to page 35).

Pattern group, pattern number	Pt 1.0	1.: Indicates the pattern group No. 0 : Indicates the pattern No.
No. of repetitions remaining in the pattern group	n 123	Indicates 123 repetitions remaining
Preset speed	Sr. 1	Indicates preset speed #1 is being used.
Remaining pattern time	1234	The current pattern will end in 1234 sec.
	- - - -	When infinite looping or until next step command is selected.

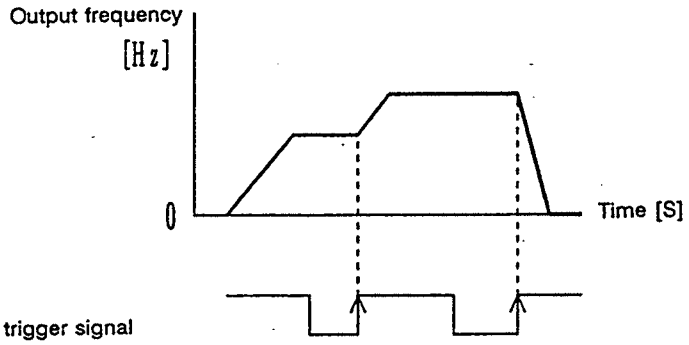
Gr. Pt (Pattern Run Parameters)

PSEL | PtN — Pattern run ②

SLN set to 4



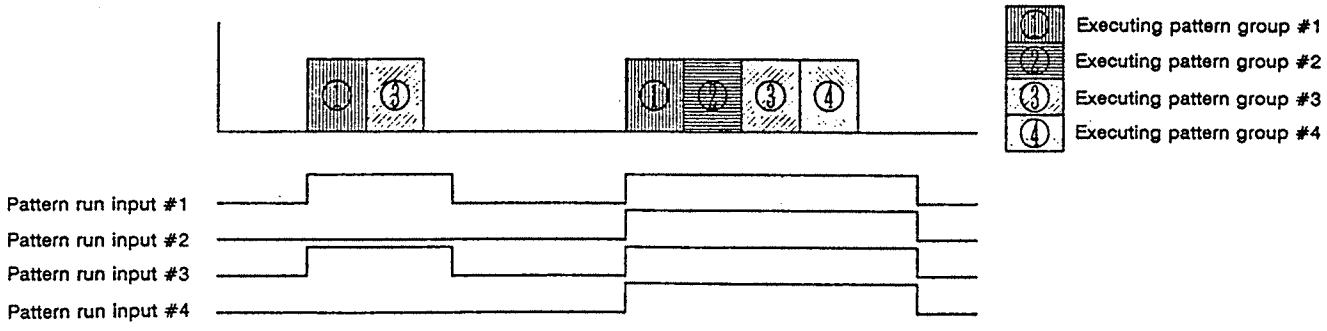
SLN set to 5



★ Allocate the pattern run step trigger signal to an input terminal with the input terminal selection Gr. 5t | It*.

★ The pattern run group may need to be selected from the terminal block.
If panel command mode is active, group #1 will always be selected.
(To use a group other than group #1, allocate the pattern run selection functions #1, #2, #3 or #4 with the input terminal selections Gr. 5t | It* (*: 0 ~ 10), and operate from the terminal block.)

* If all pattern run input terminals are OFF or if the pattern run is completed, normal operation will be performed.



If several contacts are simultaneously activated, the smallest pattern group No. will be executed first, and the following groups will be automatically executed in sequence.
It may take approx. 0.06 sec. to search for a pattern.

Gr. Ut (Utility Parameters)

PnOd PASS Panel operation permission

Related parameters

PnOd Panel operation mode selection

PASS Pass number

Various levels of key operations can be prohibited to prevent accidental or unwanted operations.

PnOd setting value	Function
0	Prohibit all key operations
+1	Can perform reset
+2	Can perform monitor operations
+4	Can perform emergency stop
+8	Can perform run/stop operations
+16	Can perform parameter read operations
+32	Can perform parameter change operations
63	Standard mode (all operations possible)

★ Data setting of parameters indicated as using the "+" mark is performed as follows:
Example) Set (+1) + (+2) = 3 and both +1 and +2 become valid.

Canceling the "prohibit all key operations" mode

1. Simultaneously press the following four keys.

   PANEL/REMOTE △ PRG ENTER

   After these keys have been pressed, 0 will be displayed on the LED display.
2. Input the pass number by selecting it with the △ ▽ keys. (Note)
3. Press ENTER .

This will cancel the "prohibit all key operations" mode.

(Note) The pass number can be set between 0 and 99 with the PASS parameter. Set this number before setting PnOd . The default value is 0.

The PnOd setting is validated after power has been cycled OFF and ON or after a fault reset and subsequent system initialization.

★ If "can perform parameter change operations" is selected, "can perform parameter read operations" must also be selected in order to access and change parameter settings.

Gr. Ut (Utility Parameters)

APL Industrial application parameters selection

This parameter is used to configure various industrial application parameters (Gr. 01~Gr. 06).

APL setting value	Function
0	Does nothing
1	Pump application
2	Fan application
3	Conveyor application
4	Hoist application
5	Textiles application
6	Machine tools application

LED display method :0 1
(Previous setting value / Current setting value)

★ The system is initialized after an industrial application parameter is selected.

Note)
If Gr.01 to Gr.06 are only unblinded via the blind function, the industrial application parameter values will not be initialized (written).

★ Refer to the industrial application parameter tables starting on page 125.

tYP Standard setting mode selection

All parameter values can be automatically changed to standard values at one time by selecting one of the following settings:

tYP setting value	Function
0	Does nothing
1	50Hz standard settings
2	60Hz standard settings
3	Return to factory settings
4	Trip clear
5	Save user-set parameters
6	Type 5 reset
7	Initialize inverter typeform

LED display method :0 1
(Previous setting value / Current setting value)

★ tYP 7 is used to clear an EtYP error that may occur when the control PCB is installed in a different inverter unit, and to reset the typeform to that of the new inverter. If an inverter typeform error occurs when the control PCB has not been changed, do not execute a tYP 7 , but contact your service representative for repairs.

★ tYP 5 will save the current parameter settings. Even if parameters are changed, each parameter can be reset to previously-saved values by executing a tYP 6 . This can be used for retaining individualized user settings.

Gr.Ut APL and tYP cannot be changed while running, so always set them after the motor has stopped.

Gr. Ut (Utility Parameters)

CnOd / FnOd Command/frequency mode selections

Related parameters

CnOd Command mode selection

FnOd Frequency setting mode selection

CnOd and FnOd select the terminal, panel and option inputs.

CnOd , FnOd setting value	Function
0	Only RS232C input valid
1	Terminal input valid
2	Panel input valid
3	Communication option board input valid
4	All valid

Note)
RS232C input is always valid.

★ The priority when set to 4 is as follows:

1. RS232C communication
2. Panel (select with PANEL/REMOTE key)
3. Terminal block (when selected by the user) Note)
4. Communication option board
5. Terminal block (normal)

Note) When 39 (panel/terminal mode selection) is allocated to a terminal with the input terminal selection function.
When the switching signal is not input to the terminal, terminal block mode is selected.

The following three types of contact terminal inputs are always valid regardless of the CnOd and FnOd settings.
(See p.55 Gr.5t 1t*) (*: 0 ~ 10).)

Setting value	Function
6	RES (fault reset)
7	ST (gate ON/OFF)
10	Emergency stop

★ CnOd and FnOd can be changed while running, but the new settings will not become valid until the motor has stopped once (0.00Hz). (Always stop once after changing CnOd or FnOd.)

Gr. Ut (Utility Parameters)

nOn 1 ~ nOn 4 Status monitor display selections

The 4 programmable status monitor items can be selected from the following 14 types.
(Note that No. 14 corresponds to an option ROM function.)

nOn setting value	Display item	Display	Units
1	Post-compensation output frequency	: 60.0	Hz/variable setting
2	Frequency setting value	: 60.0	Hz/variable setting
3	Output current	:C 0	A/%
4	Input voltage	:y 0	V/%
5	Output voltage	:P 0	V/%
6	Torque current	:q 0	A/%
7	Excitation current	:E 0	A/%
8	PID feedback value	:d 0	Hz/variable setting
9	Motor overload ratio	:L 0	%
10	INV overload ratio	:G 0	%
11	DBR overload ratio	:r 0	%
12	Input power	:h 0	W
13	Output power	:H 0	W
14	RR input	:U 0	%

★ Refer to Gr.Ut dSP* for details on the units display selection.

bLnd Blind function selection

Related parameters

bLnd Blind function selection bLF2 ~ bLnt Group unblind selections

Displaying of parameter groups other than Gr. F, Ut and U can be selectively configured by these parameters.

bLnd setting value	Function
0	Blind
1	Selective unblinding

★ By setting bLnd to 1, the various parameters bLF2 ~ bLnt will be displayed. Set the parameter corresponding to the desired parameter group (bLF2 for Gr.F2) to 1 to cancel its blind function.

dSP* Units settings

Related parameters

dSP2	Frequency units multiplication factor
dSPF	Frequency display resolution
dSPE	ACC/DEC time units selection
dSPC	Current units selection
dSPU	Voltage units selection

Each configurable monitor and parameter display units can be selected by these parameters.

<Frequency units multiplication factor>

dSP2 setting	0 (OFF) 0.01~200

By setting dSP2 , the motor speed or load equipment speed can be displayed for all parameters normally displayed in frequency units.

★ When dSP2 is set to a value other than 0, the LED display will be the normal display value × dSP2 .

<Frequency display resolution>

dSPF setting value	Resolution	LED display
0	1Hz	: 60.
1	0.1Hz	: 60.0
2	0.01Hz	:60.00

<ACC/DEC time units selection>

dSPE setting value	Resolution	LED display
0	0.1 sec.	: 10.0
1	0.01 sec.	: 10.00

<Current units selection>

dSPC setting value	Function	Panel units LED lit
0	%	%
1	A	None

Note) The values of the monitor items that display current and the values of the following parameters will change according to the setting value.

Electronic thermal protection level #1, #2 — EHr1
Stall protection level #1, #2 — StL1
Low current detection level — LLPC

EHr2
StL2

DC injection current — dbC
Overtorque trip level — OtL

<Voltage units selection>

dSPU setting value	Function	Panel units LED lit
0	%	%
1	V	None

Note) Only the voltage monitor values will change according to this setting. The values of parameters that are set in voltage units will always be displayed in V.

Gr. AN (AM/FM Adjustment Parameters)

FMSL	AMSL
FM	AM

Meter adjustment parameters

Related parameters

FMSL	FM terminal function selection
FM	Frequency meter adjustment
AMSL	AM terminal function selection
AM	Current meter adjustment

A frequency meter or current meter can be connected to the unit and configured according to the FMSL and AMSL settings.

★ The output signal from the FM (AM) terminal is a 0-1mAdc, 0-7.5Vdc analog signal.
Use a 1mAdc full-scale ammeter or 7.5Vdc-1mA full-scale voltmeter.

The meter's zero point should be adjusted with the meter's adjusting screw. Calibrate the scale with FM or AM .

★ The max. scale of the ammeter should be at least 2.5 times the inverter's rated output current.

FMSL setting value AMSL	Function	Default gain (full-scale level)
0	Pre-compensation reference frequency	FH
1	Post-compensation output frequency	FH
2	Frequency setting value	FH
3	Output current	130%
4	DC voltage Note)	260V (400V class is 520V)
5	Output voltage	260V (400V class is 520V)
6	Torque current	130%
7	Excitation current	130%
8	PID feedback value	FH
9	Motor overload ratio	100%
10	Inverter overload ratio	100%
11	DBR overload ratio	100%
12	Input power	130% of ($\sqrt{3}$ × 200 or 400V × rated current)
13	Output power	130% of ($\sqrt{3}$ × 200 or 400V × rated current)

Note) If FMSL (or AMSL) is set to 4 (DC voltage), a DC voltage that is less than approx. 50% of the rated voltage cannot be measured. Also, if main circuit power is OFF (NOFF displayed), an approx. 50% bias amount will be constantly output.

9. Device Specifications

9.1 Model and Standard Specifications

200V Series

Item			Standard specifications															
Voltage class			200V class															
Applicable motor (kW)			0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	
Model rating	Type		VFA5-															
	Model		2004P	2007P	2015P	2022P	2037P	2055P	2075P	2110P	2150P	2185P	2220P	2300P	2370P	2450P	2550P	
	Capacity (kVA)		1.0	2.0	3.0	4.0	6.5	9.5	13	19	25	28	34	46	55	69	84	
	Rated output current (A)		3.0	5.0	7.5	10.0	16.5	25	33	49	66	73	88	120	144	180	220	
	Rated output voltage		3-phase 200 to 230V (The max. output voltage is the same as the input source voltage.)															
	Overload current rating		2 minutes at 150%, 0.5 seconds at 215%															
Input power	Electrical braking	Dynamic braking	Dynamic braking circuitry installed										Optional					
		Built-in dynamic braking resistor	Max. braking 150%, allowable duty cycle 3% ED			100%max, 3%ED		Optional external resistor										
	Voltage/ frequency	Main circuit: Note 1)	3-phase 200V~220V-50Hz, 200~230V-60Hz															
		Control circuit: Note 1)	Single-phase 200V~220V-50Hz, 200~230V-60Hz															
	Tolerance		Voltage: ±10%, Frequency ±5%															
Protective method			Sealed structure (JEM1030) IP20: Note 7)										Open structure (JEM1030) IP00					
Cooling method			Forced-air cooling															
Color			Front cover: dark gray, Main cover: N1.5										Front cover, Main cover: N3.0					
Approx. weight (kg)			3.4	3.4	3.5	3.5	3.7	5.8	5.8	11.5	12	12	23	23	38	55	56	

400V Series

Item			Standard specifications															
Voltage class			400V class															
Applicable motor (kW)				0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
Model rating	Type		VFA5-															
	Model			4007P	4015P	4022P	4037P	4055P	4075P	4110P	4150P	4185P	4220P	4300P	4370P	4450P	4550P	4750P
	Capacity (kVA)			2.0	3.0	4.0	6.5	9.5	13	19	25	28	34	46	55	69	84	110
	Rated output current (A)			2.5	4.0	5.0	8.5	13	17	25	33	37	44	60	72	90	110	144
	Rated output voltage		3-phase 380 to 460V (The max. output voltage is the same as the input source voltage.)															
	Overload current rating		2 minutes at 150%, 0.5 seconds at 215%															
Input power	Electrical braking	Dynamic braking	Dynamic braking circuitry installed										Optional					
		Built-in dynamic braking resistor	Max. braking 150%, allowable duty cycle 3% ED			100%max, 3%ED		Optional external resistor										
	Voltage/ frequency	Main circuit: Note 1)	3-phase 380V~460V-50Hz, 380~460V-60Hz															
		Control circuit: Note 1)	Single-phase 380V~440V-50Hz, 380~460V-60Hz															
	Tolerance		Voltage: ±10%, Frequency ±5%															
Protective method			Sealed structure (JEM1030) IP20: Note 7)										Open structure (JEM1030) IP00					
Cooling method			Forced-air cooling															
Color			Front cover: dark gray, Main cover: N1.5										Front cover, Main cover: N3.0					
Approx. weight (kg)				3.4	3.5	3.5	3.7	5.8	5.8	11	11	11	24	24	38	39	51	60

■ General specifications

Control specifications	Control method	Sinusoidal PWM control
	Output voltage regulation	Main circuit voltage feedback control. (Automatic regulation, "fixed" and "control off" selections possible)
	Output frequency range	0.01 to 400Hz, set to 0.01 to 80Hz by default, max. frequency adjustable from 30 to 400Hz: Note 2)
	Frequency setting resolution	0.01Hz: operation panel input (60Hz base), 0.1Hz: analog input (60Hz base, 12-bit/0 to 10Vdc) 0.01Hz: communication input (50Hz base)
	Frequency precision	±0.2% of the max. output frequency (25°C±10°C): analog input, ±0.01 (25°C±10°C): digital input
	Voltage/frequency characteristics	Constant V/f, variable torque, automatic torque boost, voltage vector control and automatic energy-saving control/maximum voltage frequency adjustment (25 to 400Hz), torque boost adjustment (0 to 30Hz), start-up frequency adjustment (0 to 10Hz), end frequency adjustment (0 to 30Hz)
	Frequency setting signals	3kΩ potentiometer (1 to 10KΩ potentiometer connection also possible) 0 to 10Vdc (Input impedance Zin: 33kΩ), 0 to ±10Vdc (Zin: 67kΩ), 0 to ±5Vdc (Zin: 34kΩ) 4 to 20mA (Zin: 500Ω)
	Terminal block reference frequency inputs	2 sources can be set from a total of five types, including analog input (RR, IV, RX), pulse input and binary input.
	Frequency jump	Can be set in three places, jump frequency and band setting
	Upper/lower limit frequencies	Upper limit frequency: 0 to max. frequency, Lower limit frequency: 0 to upper limit frequency
	PWM carrier frequency selection	Adjustable between 3 and 17kHz (18.5kW to 75kW adjustable between 3 and 15kHz)
	PID control	Proportional gain, integral gain, anti-hunting gain, lag-time constant adjustments
Operating specifications	Acceleration/deceleration times	0.1 to 6000 sec., acceleration/deceleration times #1 and #2 selection, acceleration/deceleration pattern selection
	DC injection braking	Braking starting frequency adjustment (0 to 120Hz), braking current adjustment (0 to 100%), braking time adjustment (0 to 10 sec.), emergency stop braking function, motor shaft stationary control function
	Forward/reverse run	Forward run when F-CC "closed", reverse run when R-CC "closed", reverse run when both "closed", coast-stop when ST-CC "opened". Emergency stop from panel or terminal block.
	Jog run	Jog run from panel with JOG mode selection. Terminal block operation possible with parameter settings.
	Preset speed operation: Note 6)	Set frequency + 15 preset speeds possible with open/closed combinations of SS1, SS2, SS3, SS4 and CC.
	Retry	When a protective function activates, after main circuit devices are checked, running restarts. Settable to a max. of 10 times. Wait time adjustment (0 to 10 sec.).
	Soft stall	Automatic load reduction control during overload. (Default setting: OFF)
	Cooling fan ON/OFF	Fan is automatically stopped when not necessary to ensure extended lifetime.
	Panel key operation ON/OFF control	Prohibit functions such as reset only or monitor only, etc., can be selected. All key operations can also be prohibited. A cancel protection function using a password (number) is also built-in.
	Regeneration power ride-through control	Operation is continued even during momentary power failure using regenerative energy from the motor. (Default setting: OFF)
	Auto-restart	A coasting motor can be smoothly restarted. (Default setting: OFF)
	Simple pattern run	4 groups of 8 patterns each can be set to the 15 preset speed values. A max. of 32 different patterns can be run. Terminal block control/repetitive run possible.

Protection	Protective functions		Stall prevention, current limit, overcurrent, overvoltage, load-side short circuit, load-side ground fault, undervoltage, momentary power failure (15ms and longer), regeneration power ride-through control, electronic thermal overload protection, armature overcurrent during start-up, load-side overcurrent during start-up, dynamic braking resistor overcurrent/overload, heatsink overheat, emergency stop, <open output phase>: Note 3)
	Electronic thermal protection characteristics		Standard motor/constant-torque VF motor switching, electronic thermal stall prevention operation level adjustment
	Reset		Reset when 1a contact point is "closed", or reset by panel. Tripped state retention and clear settings.
Display	4-digit, 7-segment LED	Output frequency/ stop display	Displays 0.0 to 400Hz and OFF status. While running, displays stall prevention, overvoltage limit, overload, power-source undervoltage, DC circuit undervoltage, and executing retry. Parameters: setting error, upper limit, lower limit
		Fault causes	Overcurrent, overvoltage, heatsink overheat, load-side short circuit, load-side ground fault, inverter overload, armature overcurrent during start-up, load-side overcurrent during start-up, (dynamic braking unit overcurrent/overload), (emergency stop), EEPROM error, RAM error, ROM error, communication error, (undervoltage), (low current), (overtorque), (open output phase), (motor overload). Items in parentheses can be selected/deselected.
		Monitor functions	Terminal input/output status, forward/reverse, frequency setting value, output current, DC current, output voltage, <output power> : Note 3) torque current, cumulative run time, past faults, overload ratio, post-compensation output frequency
		Selectable units display	Can select frequency display to match motor speed, line speed, etc. Selection of display of current in amperes/%, voltage in volts/%.
		Edit function	Automatic editing of parameters differing from standard values. Allows for easy searching of changed parameters.
		Blind function	Select to not display unneeded parameter groups.
		User settings initialization	Saving of user parameter values for initialization resetting possible. Parameters can be easily reset to user default setting values.
	LED	Charge indicator	Indicates that main circuit capacitors are charged.
Output signals	Fault detection signal : Note 4)		1c contact output (ac250V-2A-cosø=1, ac250V-1A-cosø=0.4, DC30V-1A)
	Low speed/speed reach signal outputs : Note 4)		Open-collector outputs (Max. 24Vdc, Max. 50mA, output impedance: 33Ω)
	Upper/lower limit frequency signal outputs : Note 4)		Open-collector outputs (Max. 24Vdc, Max. 50mA, output impedance: 33Ω)
	Frequency meter/ammeter outputs : Note 5)		1mAdc full-scale ammeter or 7.5Vdc-1mA voltmeter
	Pulse-train frequency output		Open-collector output (Max. 24Vdc, Max. 50mA)
Communication functions			RS232C equipped as standard (Connector: modular 6P), RS485, TOSLINE-F10, TOSLINE-S20 are optional.
Service conditions	Service environment		Indoor, altitude 1000m or less, not subject to direct sunlight or corrosive/explosive gases
	Ambient temperature		−10 to +40°C (Max. 50°C possible when cover is removed: notes 8 and 9)
	Storage temperature		−25 to +65°C
	Relative humidity		20 to 90% (no condensation allowed)
	Vibration		5.9m/s^2 {0.6G} or less (10 to 55Hz) (according to JIS C0911)

Note 1) In standard configuration on 30kW and smaller units, the control power inputs are connected to the main circuit power source. These can be easily separated if necessary.

Note 2) 800Hz is possible with special modifications, but a de-rating of the output current rating is necessary.

Note 3) Optional.

Note 4) Programmable ON/OFF output terminal signals. Can be allocated from 38 types of signals. (Up to 62 types with options.)

Note 5) Programmable analog output terminals. Can be allocated from 12 types of signals. (Up to 14 types with options.)

Note 6) The 11 contact input terminals (of which three are optional) are programmable contact input terminals, and can be allocated from 34 types of signals. (Up to 51 types with options.)

Note 7) Three holes can be opened for input main circuit wiring, output main circuit wiring, and control circuit wiring, but the openings must be securely covered after wiring.

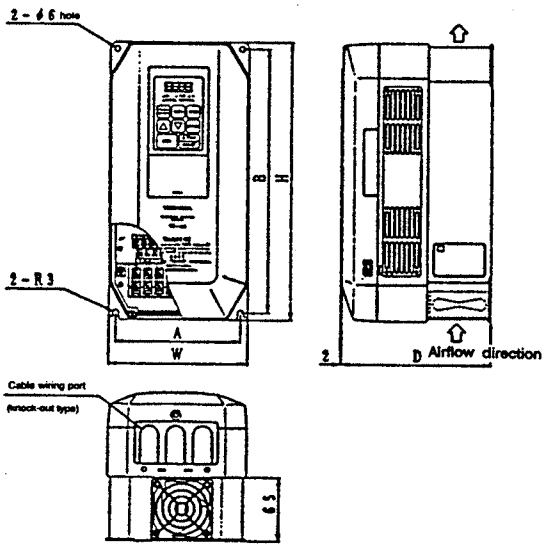
Note 8) When the cover is removed, always store the unit in a panel so that charged sections are not exposed. 22kW and larger units can handle −10 to 50°C without removal of the cover.

Note 9) 22kW and larger units have a large opening instead of a wiring cover, and there is no space for bending externally-connected cables inside the unit. Use the optional wire opening cover when the unit is not installed in a panel.

9.2 External Dimensions

3.7kW and smaller

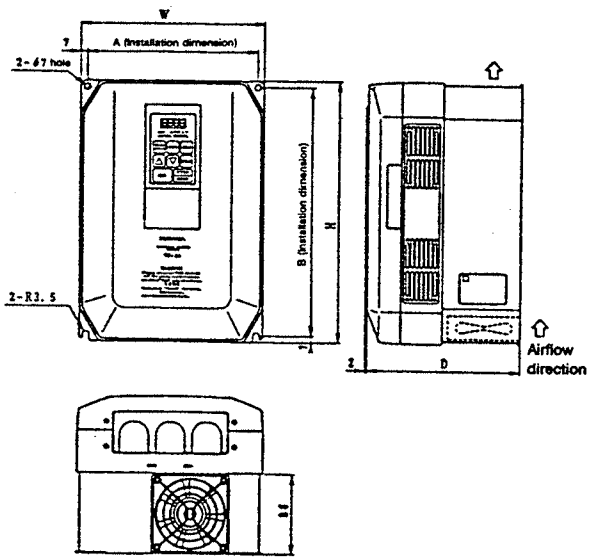
Model VFA5-2004~2037
VFA5-4007~4037



Dimensions (mm)				
W	H	D	A	B
140	280	151	126	266

5.5~7.5kW

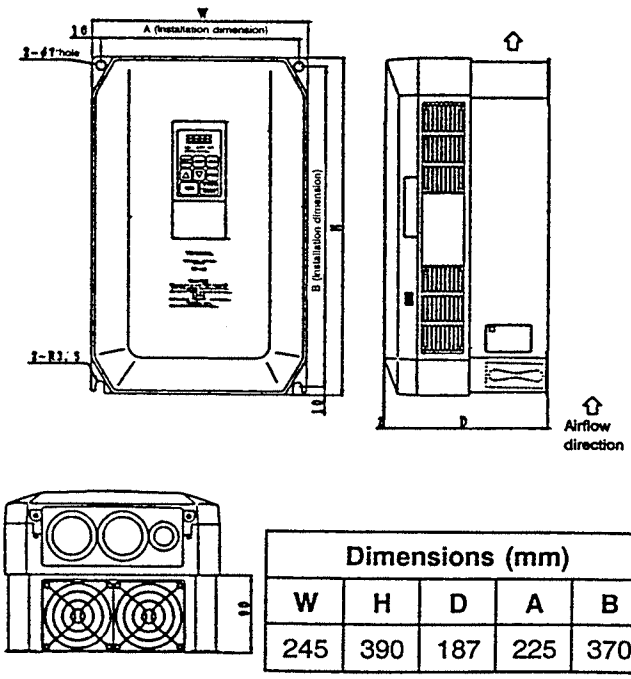
Model VFA5-2055, 2075
VFA5-4055, 4075



Dimensions (mm)				
W	H	D	A	B
200	280	167	186	266

11~18.5kW

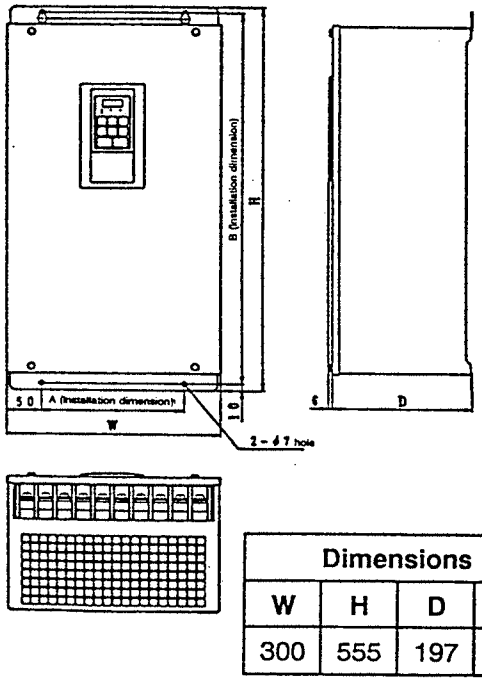
Model VFA5-2110~2185
VFA5-4110~4185



Dimensions (mm)				
W	H	D	A	B
245	390	187	225	370

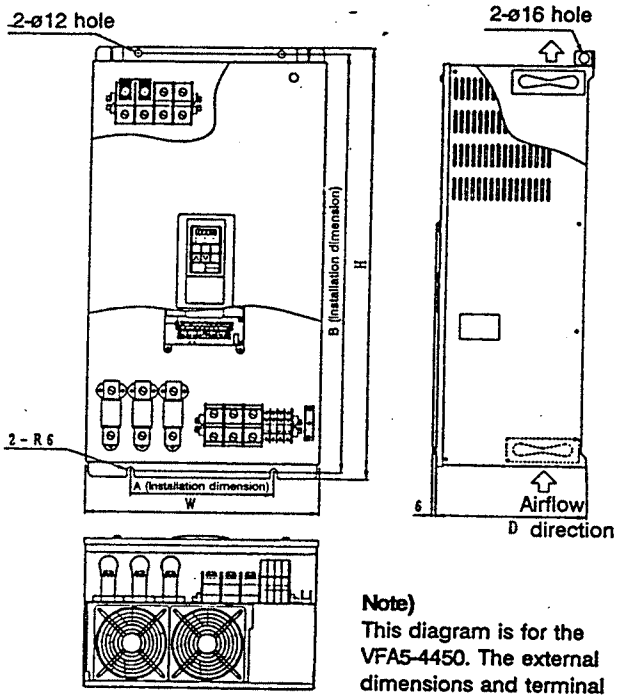
22, 30kW

Model VFA5-2220, 2300
VFA5-4220, 4300



Dimensions (mm)				
W	H	D	A	B
300	555	197	200	537

37kW~



Note)
This diagram is for the VFA5-4450. The external dimensions and terminal configurations for other models will vary.

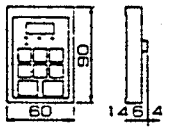
WARNING

- For safety reasons, unless making wiring connections, please leave this cover installed at all times.
- Never remove this cover while the "CHARGE" lamp is lit.
- When making wiring connections, please read the wiring cautions on the back side of this cover.

Model	Dimensions (mm)				
	W	H	D	A	B
VFA5-2370	375	680	240	230	660
2450	375	870	260	250	850
2550	375	870	260	250	850
4370	375	680	240	230	660
4450	375	680	240	230	660
4550	375	800	260	250	780
4750	375	870	260	250	850

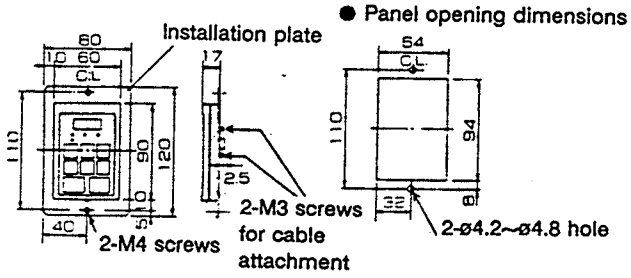
External installation of operating panel

● Panel dimensions



● Installation plate dimensions

● Panel opening dimensions



10. Options

Standalone and installable options are available for this unit. Select according to your application.

10.1 Standalone Options

Name	Model	Functions and purpose
Input AC reactor	PFL 2012~2300	Input power-factor improvement Input high-harmonic reduction External surge suppression (These units are always necessary when connecting to a power source with a very large capacity or which contains distortion or surges from thyristor drives, etc.)
Low-impedance AC reactor	PFL 2012Z~2300Z	
DC reactor	DCL 2055~2550	
Radio noise reduction filter	HF3005A-Z HF~3240A-Z	Effective for preventing radio noise interference to audio equipment used near the inverter.
Braking resistor	PBR3	Resistor for consumption of energy during dynamic braking. (Refer to table below.) The optional dynamic braking drive circuit (GTR7) is required for 22kW and larger units.
Operation box for remote operation	CBV-7B2	Unit with built-in frequency meter, frequency selector and ON/OFF pushbutton.
	CBV-CE	Unit with RUN/STOP switch to start and stop the inverter.
Parameter writer	PWA5-003	For reading, editing, copying and writing inverter parameters.
Application control unit	AP series	When used in combination with the VF-A5, the AP series performs various application control functions.
RS232C communication cable	R2A5-0J5	For J3100 DB9 : 5m
	R2A5-0P5	For PC98 DB25: 5m

★ Braking resistor value ... Do not connect a braking resistor with a resistance less than the min. allowable resistance.

Inverter capacity (kW)	200V system		400V system	
	Standard option resistance	Min. allowable resistance	Standard option resistance	Min. allowable resistance
0.4	70Ω (built-in)	35Ω	—	—
0.75	70Ω (built-in)	35Ω	150Ω (built-in)	67Ω
1.5	70Ω (built-in)	35Ω	150Ω (built-in)	67Ω
2.2	70Ω (built-in)	35Ω	150Ω (built-in)	67Ω
3.7	40Ω (built-in)	20Ω	150Ω (built-in)	67Ω
5.5	20Ω	16.7Ω	80Ω	60Ω
7.5	15Ω	15Ω	80Ω	60Ω
11	10Ω	10Ω	40Ω	20Ω
15	7.5Ω	7.5Ω	30Ω	20Ω
18.5	7.5Ω	5Ω	30Ω	20Ω
22	3.3Ω	3.3Ω	13.3Ω	13.3Ω
30	3.3Ω	3.3Ω	13.3Ω	13.3Ω
37	2Ω	2Ω	8Ω	6.7Ω
45	2Ω	1.7Ω	8Ω	6.7Ω
55	2Ω	1.7Ω	8Ω	5Ω
75	—	—	8Ω	3.3Ω

10.2 Installable Options

	Option name	Function and purpose	Model	Remarks (Note)
Input/output expansion	12-bit Binary Input	12-bit binary input	VE5X-4526A	A
	Expansion terminal block PCB	Expansion terminal block PCB 1A Expansion terminal block PCB 1B Expansion terminal block PCB 1C Expansion terminal block PCB 1D	VF5X-4514A VF5X-4514B VF5X-4514C VF5X-4514D	B
		Expansion terminal block PCB 2A Expansion terminal block PCB 2B Expansion terminal block PCB 2C	VF5X-4515A VF5X-4515B VF5X-4515C	B
Communication	RS-485 PCB	Allows use of RS-485 communication.	VF5X-4524A	A
	TOSLINE-F10 interface PCB	Allows use of TOSLINE-F10 communication.	VF5X-1254A	C
	TOSLINE-S20 interface PCB	Allows use of TOSLINE-S20 communication.	VF5X-1255A	C

Note) Simultaneous use of built-in options:
Only simultaneous use of one option from the A group and B group is possible.
Example: VF5X-4526A and VF5X-4515A: Simultaneous use possible
VF5X-4515B and VF5X-1254A: Simultaneous use not possible
The C group options must be used independently.

The functions of each expansion terminal block PCB are as shown below:

	S5-7 terminals	Ry outputs	PG input	TG input	4-20mA output
Expansion terminal block PCB 1A	Available	1C	Selectable	Selectable	1 circuit
Expansion terminal block PCB 1B	Available	1C	Selectable	Selectable	Not available
Expansion terminal block PCB 1C	Available	1C	Available	Not available	Not available
Expansion terminal block PCB 1D	Available	1C	Available	Not available	1 circuit
Expansion terminal block PCB 2A	Selectable	3C	Selectable	Not available	2 circuits
Expansion terminal block PCB 2B	Selectable	3C	Selectable	Not available	Not available
Expansion terminal block PCB 2C	Available	3C	Not available	Not available	Not available

Note) S5-7 terminals : Contact input terminals S5, S6, S7
Ry outputs : No. of relay contact outputs
PG input : Pulse generator input terminals (PG, P12)
TG input : Tachometer input circuit (absolute value circuit + gain adjustment)
4-20mA output: Circuit to convert FM/AM output signals to 4-20mA current signals.

11. Error Displays and Troubleshooting

Inverter trip causes and remedies are shown in Table 11-1, and the causes and remedies of other problems are shown in Table 11-2. If part replacement is necessary, or when the problem cannot be remedied with the listed procedures, contact your nearest Toshiba branch or sales office.

11.1 Inverter Trip Causes and Remedies

Trip cause displays, alarm displays, display details, and applicable remedies are listed below.

Table 11-1 Fault displays, details, and remedies

Display	Details	Presumed causes	Remedies	Reference page
OC 1 OC 1P	Overcurrent during acceleration (DC section)	• The acceleration time [ACC] is too short.	Increase the acceleration time [ACC].	48
		• The V/f selection is incorrect.	Check the V/f pattern setting.	45
		• Start was attempted on a rotating motor after a momentary power failure, etc.	Use auto-restart or regeneration power ride-through control.	79
		• Is a special (low impedance) motor being used?	Try inserting an AC reactor on the output.	95
			Try increasing the carrier frequency.	66
OC2 OC2P	Overcurrent during deceleration (DC section)	• The deceleration time [dEC] is too short.	• Increase the deceleration time [dEC].	48
OC3 OC3P	Overcurrent during constant speed run (DC section)	• The load changed suddenly. • The load is faulty.	Reduce the load fluctuations. Check the load equipment.	5
Note) There are causes other than those listed above for OC 1P, OC2P and OC3P.		• A main circuit power transistor is faulty. • The overheating protection has functioned. (5.5~30kW) • The control power supply undervoltage protection has functioned. (5.5~30kW)	Refer to OCA. Refer to OH. Refer to UP 1, POFF, nOFF.	97 98 99
OCL	Overcurrent (overcurrent on load-side during start-up)	• The output main circuit wiring or motor insulation is faulty.	Check the condition of the wiring and insulation.	9
		• The motor impedance is too small.	Change the setting of the output short circuit detection selection [OCLS].	80
OCA 1	U-phase armature short circuit	• The main circuit U-phase power transistor is faulty.	Check the main circuit U-phase power transistor. The transistor element must be replaced.	21
OCA2	V-phase armature short circuit	• The main circuit V-phase power transistor is faulty.	Check the main circuit V-phase power transistor. The transistor element must be replaced.	21
OCA3	W-phase armature short circuit	• The main circuit W-phase power transistor is faulty.	Check the main circuit W-phase power transistor. The transistor element must be replaced.	21
OP 1	Overvoltage during acceleration	• The input voltage fluctuated abnormally. ① The power source capacity is 500kVA or more. ② Power-factor improvement capacitors went on-line/off-line. ③ A device using thyristors is connected to the same power line.	Try inserting an input AC reactor.	13
		• Start was attempted on a rotating motor after a momentary power failure, etc.	Use auto-restart or regeneration power ride-through control.	79
OP2	Overvoltage during deceleration	• The acceleration time [dEC] is too short.	Increase the deceleration time [dEC].	48
		(The amount of regenerated power is too large.)	Install a dynamic braking resistor.	95
		• The DBR resistance value [Pbr] is too large.	Decrease the dynamic braking resistance value [Pbr].	77
		The dynamic braking function [Pb] is OFF.	Select the dynamic braking function [Pb].	
		• OP stall [OPSS] is OFF.	Select OP stall [OPSS].	
		• The input voltage fluctuated abnormally. ① The power source capacity is 500kVA or more. ② Power-factor improvement capacitors went on-line/off-line. ③ A device using thyristors is connected to the same power line.	Try inserting an input AC reactor.	13

Table 11-1 Fault displays, details, and remedies

Display	Details	Presumed causes	Remedies	Reference page
OP3	Overvoltage during constant speed run	• The input voltage fluctuated abnormally. ① The power source capacity is 500kVA or more. ② Power-factor improvement capacitors went on-line/off-line. ③ A device using thyristors is connected to the same power line.	Try inserting an input AC reactor.	13
		• The motor is rotating at a frequency higher than the inverter output frequency due to a force on the load, and is in a regenerative state. ① There are multiple machanically-coupled motors. ② The load undergoes piston-type cyclic movement.	Change the load so that a regenerative state is not entered. Install a dynamic braking resistor.	17
OL In	Inverter overload	• Sudden motor acceleration was attempted.	Decrease the acceleration time [ACC].	48
		• The DC injection current (time) is set too high (long).	Decrease the DC injection current [dbC] and DC injection time [dbt].	74, 75, 76
		• Start was attempted on a rotating motor after momentary power failure, etc.	Use auto-restart or regeneration power ride-through control.	79
		• The load is too large.	Increase the inverter rating.	90
OLMt	Motor overload	• V/f is incorrect.	Check the V/f pattern setting.	45
		• The motor is constrained.	Check the load equipment.	5
		• Continuous running at low speeds. • Motor is being operated in the overload area.	Adjust [OLF] according to the motor's overload handling characteristics at low speeds.	72
OCr	Dynamic braking resistor overcurrent trip	• The motor decelerated suddenly.	Decrease the deceleration time [dEC].	48
OLr	Dynamic braking resistor overload trip	• The DC injection current is too high.	Decrease the DC injection current [dbC] and DC injection time [dbt].	74, 75, 76
OH	Overheat	• The cooling fan is not working.	Check the cooling fan.	—
		• The fan ventilation inlet is blocked. • Another heat-generating device is located nearby.	Check the inverter installation space. Do not place heat-generating devices near the inverter.	2
		• The thermistor in the unit is dislocated.	Check the main circuit PCB CN6.	—
E	Emergency stop	• Motor was stopped during automatic run or remote operation with the panel.	Reset.	43, 44
EEP1	EEPROM fault	• An error occurred during writing of data to the EEPROM.	Cycle power to the unit OFF/ON. If the error persists, repair is required.	44
EEP2	Initial read fault	• Fault in the internal data.	Repair is required.	—
Err2	RAM fault	• Fault in the microcontroller RAM.	Repair is required.	—
Err3	ROM fault	• Fault in the microcontroller ROM.	Repair is required.	—
Err4	CPU fault	• Fault in the microcontroller CPU.	Repair is required.	—
Err5	Communication operating command fault	• A fault occurred during communication operation.	Check the communication device and wiring, etc.	—
Err6	Gate array fault	• Fault in the main gate array.	Repair is required.	—
Err7	Output current detection device fault	• Fault in the output current detection device	Repair is required.	—
Err8	Option PCB fault	• Fault in an option PCB.	Check the option PCB connections, etc.	—
*UC	Low current run condition trip	• The output current dropped to the low current detection level while running.		—

Table 11-1 Fault displays, details, and remedies

Display	Details	Presumed causes	Remedies	Reference page
*UP 1	Undervoltage trip (main circuit)	• Input voltage (main circuit) is insufficient while running.	Check the input voltage.	—
		• Momentary power failure exceeding the undervoltage detection time [UPt] occurred.	Set the regeneration power ride-through control [UuC] , auto-restart [ArSt], and undervoltage detection time [UPt] .	79, 80
*Ot	Overtorque trip	• Load torque reached overtorque detection level while running.	Decrease load fluctuations.	5
EF 1 EF2	Ground fault trip	• Ground fault in output cable or motor	Check the grounding wires, etc.	13
Etn	Auto-tuning error	• Is a motor that is 2 or more ranks smaller than the inverter capacity being used? • Are extremely small inverter output cables being used? • Is the motor rotating? • Is a device other than a 3-phase induction motor connected?		90
EtyP	Inverter typeform error	• Has the control PCB been replaced? (Or the main circuit/drive PCB)	If replaced, ... Check the inverter typeform with Gr.Ut [FOrn] , and compare with the typeform table on page 124. If the typeform is the same, set Gr.Ut [tyP] to 0 to clear the error. If not replaced, ... Repair is required.	85, 124

The trip validity can be selected via parameters for items marked with *.

Table 11-1 Fault displays, details, and remedies

Informational messages (messages that do not indicate trips).

Display	Details	Presumed causes	Remedies	Reference page
OFF	ST terminal not activated	• The ST-CC connection is open.	Close ST-CC.	15
POFF	Control circuit undervoltage	• The voltage between the control power terminals R0 and S0 is insufficient.	Measure the control power voltage. Unit repair is required if correct.	15
nOFF	Main circuit undervoltage	• The voltage between the main circuit power terminals R, S and T is insufficient.	Measure the main circuit power voltage. Unit repair is required if correct.	15
rtry	Displayed during retry	• Retry is being executed.	If the inverter starts again after a few seconds, there is no problem.	78
Err 1	Frequency point setting fault alarm	• The settings of frequency reference points [P 1] and [P2] are too close.	Set [P 1] and [P2] further apart.	71
CLr	"Clear acceptance possible" display	• This display will appear if [RESET] is pressed after a trip display.	Press [RESET] again, and the unit will be reset.	44
EOFF	"Emergency stop acceptance possible" display	• Stop has been executed from the panel during automatic or remote operation.	The motor will emergency stop if [STOP] is pressed again. To cancel, press another key.	43, 44
CtrL	"Operating panel coast-stop acceptance possible" display	• The inverter is in the coast-stop input standby state.	Stop with the [STOP] key or press another key to cancel.	43
H 1 LO	Setting value limit warnings Error display and data are alternately displayed twice	• A setting value limit has been reached.	Check that the desired setting value is correct.	—
db dbon	DC injection braking display	• DC injection braking is being executed.	If the display goes out after a few seconds, there is no problem. Note)	74, 75, 76
		• Motor shaft stationary control is being executed.	If the display goes out with the stop command, there is no problem.	74, 75, 76
Err	Password No. error	• The password No. entered is incorrect.	Input the correct password No.	84
E 1	Too many digits attempted to be displayed	• The No. of digits attempted to be displayed on the panel, such as for frequency, exceeds four digits.	Decrease the [dSP2] (frequency multiplication factor) setting.	88

Note) If the DC injection braking ON/OFF function is selected with an input terminal selection, open that terminal and CC. If the "db" display goes out, there is no problem.

L	Overload alarm	Same as OLIn and OLNE
P	Overvoltage alarm	Same as OP 1~OP3
C	Overcurrent alarm	Same as OC 1~OC3
H	Overheat alarm	Same as OH

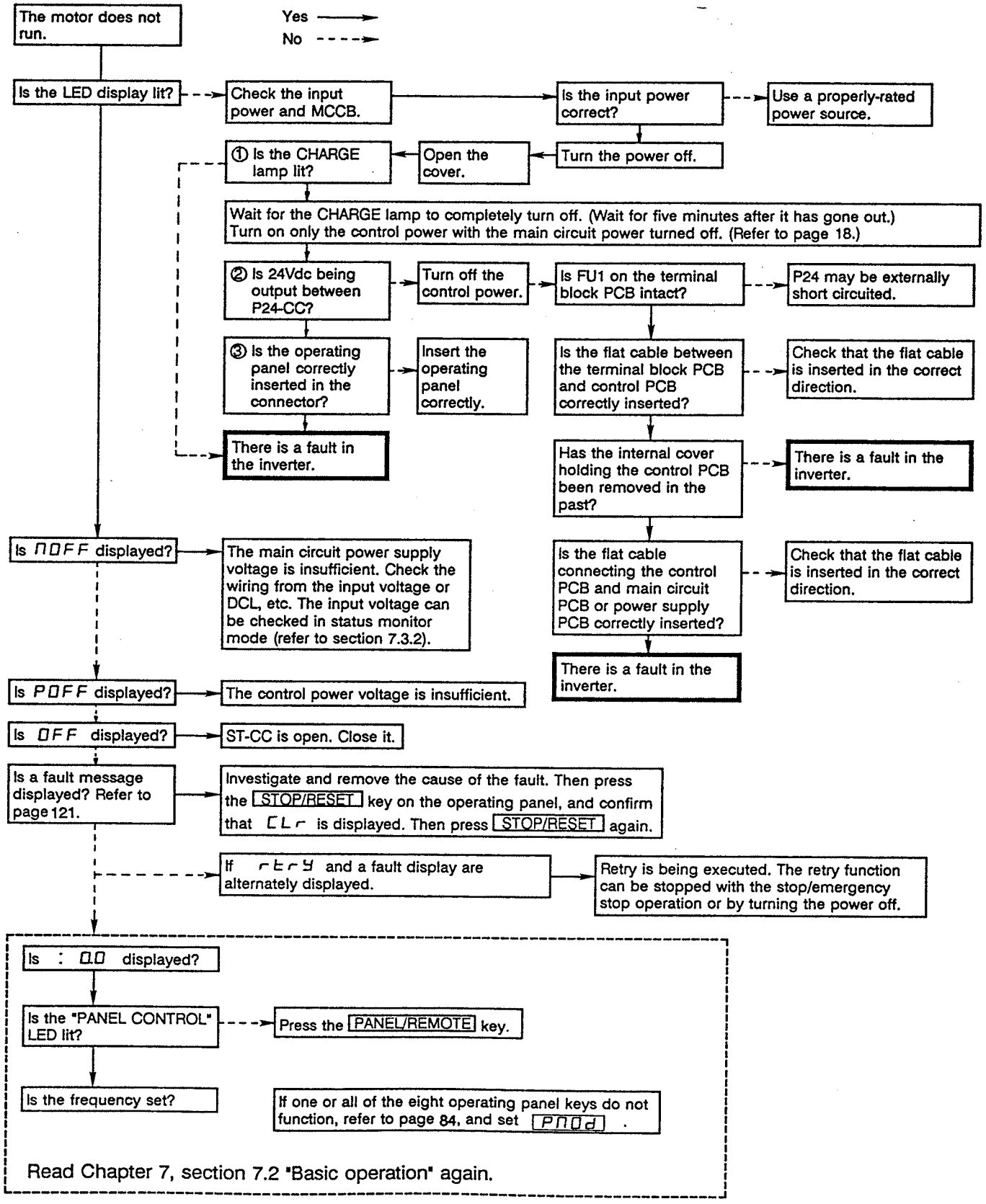
If multiple alarms from the above set occur simultaneously the display will behave as follows:

LC
PC
CH
LPC
:
:
LPCH

L, P, C, H will be sequentially displayed from the left.

11.2 Other Fault Troubleshooting

Perform the following checks if other faults occur.



12. Maintenance and Inspection

12.1 Preventive Maintenance and Periodic Inspection

Preventive maintenance is required to operate this inverter in its optimal condition, and to ensure a long unit lifetime.

Perform a periodic inspection once every three to six months, depending on operating conditions.
Before starting inspections, always turn off all power supplies to the unit. Wait at least five minutes after the "CHARGE" lamp has gone out, and then confirm that the capacitors have fully discharged by using a tester, etc., that can measure high-voltage DC. (Measure the voltage between PA and PC on the inverter's main circuit terminal block.)

[Inspection points]

1. Check that the wiring terminal screws are not loose. Tighten if necessary.
2. Check that there are no defects in the wire terminal crimp points. Visually check that the crimp points are not scarred by overheating.
3. Visually check the wiring and cables for damage.
4. Clean off any dust and dirt with a vacuum cleaner. Place special emphasis on cleaning the ventilation ports and PCBs. Always keep these areas clean, as adherence of dust and dirt can cause unforeseen failures.
5. If use of the inverter is discontinued for a long period of time, turn the power on at least once every two years and confirm that it still functions properly.
   To confirm functionality, disconnect the motor and energize the inverter for five hours or more before attempting to run a motor with it.
   Do not directly connect a commercial power source to the inverter, but gradually raise the input voltage using a Variac, etc.
6. When performing an insulation test, use a 500V megger, and test only the main circuit terminals.

   Never perform an insulation test on the other terminals or the control circuit terminals on the PCB.

★ When performing an insulation test on the motor, disconnect the output terminals U, V and W from the motor.

7. Hi-pot tests
   Do not perform hi-pot tests on the inverter as they may damage the unit's internal components.
8. Voltage and temperature checks.
   Regular measurements of the inverter's input and output voltages with a tester is effective for detecting problems before they become critical. The output voltage reading may differ depending on the type of tester or voltmeter being used. It is for this reason that a record should be kept of your inverter's daily or weekly output voltages, in order to identify deviations from the normal values.
   Measure the voltages on the input side between terminals R-S, S-T and T-R.
   Measure the voltages on the output side between terminals U-V, V-W and W-U.

   [Recommended voltmeters] Input side: Moving-iron voltmeter ()
   Output side: Rectifying voltmeter ()

   Regular measurements of the ambient temperatures of the inverter at start-up, while running, and at shutdown is also an effective method for finding problems before they can become critical.

12.2 Component Replacement

The inverter is composed of various electronic components including semiconductor elements. Periodic inspection of the following components is necessary, as their characteristics will change over time due to their structure or material. This may cause inverter performance to decrease and may lead to more serious failures.

1) Cooling fan
   The lifetime of the cooling fan (used to cool heat-generating components such as the main circuit semiconductor elements) is approx. 30,000 hours (approx. 2 to 3 years of continuous operation). If abnormal noise or vibration is detected during a periodic inspection and the fan is determined to be the cause, it must be replaced.
2) Smoothing capacitor
   Large-capacity aluminum electrolytic capacitors are used for smoothing in the main circuit DC section. The characteristics of these capacitors will deteriorate over time due to ripple currents, etc. The time period involved is largely dependent upon the ambient temperature and the operating conditions, but when operated under normal conditions, replacement is required approx. every 5 years.
   (On 3.7kW and smaller units, the smoothing capacitors are located on the PCB, so the PCB must also be replaced.)

   Capacitor appearance inspection and evaluation standards:
   a) Is any fluid leaking?
   b) Is the knob (safety valve) protruding or expanded?
   c) Measure the capacitance and leakage current.

★ A time guideline for the replacement period of these components can be established by checking the cumulative run time monitor.

Table 12-1 Standard component replacement periods

Part name	Standard replacement period
Cooling fan	2 to 3 years (Approx. 30,000 hours)
Smoothing capacitors	5 years

13. Storage

Observe the following points when the inverter is not used immediately after purchase or when not used for a long period of time.

1. Avoid storing the unit in places that are hot or humid, or that contain large quantities of dust or metallic dust. Store the unit in a well-ventilated location.
2. For inverters that have a black anti-static cover, do not remove this cover during storage. Always remove this cover before applying power for the first time after the storage period.
3. When not using the inverter for an extended period of time, turn the power on at least once every two years to restore the main circuit electrolytic capacitor characteristics. Also verify that the inverter functions normally.
   Do not directly connect a commercial power source to the inverter, but gradually raise the input voltage using a variac, etc. (The power must be applied for five hours or more before running a motor.)
   The large-capacity electrolytic capacitors used in this inverter will deteriorate over time if left de-energized.

14. Warranty

Failures and damages that occur during the warranty period will be repaired free of charge.

The warranty period of this unit is 12 months from the date of delivery.

The following items will be charged for even if they occur during the warranty period.

1) Failures and damages caused by misuse, inappropriate repairs or modifications.
2) Damage caused by dropping or transportation after delivery.
3) Failures and damages due to natural causes such as fire, salt damage, gas damage, earthquakes, wind or water damage, lightning, erroneous voltages, etc.
4) Damage caused by use of the inverter other than as an inverter.

If there are other predetermined warranty conditions, those will have priority.

★ Please perform adequate maintenance and inspection procedures.

Appendix

Appendix Table 1. Parameter list

Parameter groups	Gr. □	U : User parameters F : Fundamental parameters #1 (V/F, accel/decel etc.) F2 : Fundamental parameters #2 (V/F, accel/decel etc.) Pn : Panel control parameters SE : Terminal selection parameters SC : Special control parameters SF : Frequency setting parameters Pr : Protection parameters PE : Pattern run parameters Fb : Feedback parameters tr : Communication parameters 01 : Industrial application parameters (pump) 02 : Industrial application parameters (fan) 03 : Industrial application parameters (conveyer) 04 : Industrial application parameters (hoist) 05 : Industrial application parameters (textiles) 06 : Industrial application parameters (machine tools) AN : AM/FM adjustment parameters UE : Utility parameters nE : Motor parameters

This parameter list is for Version 110. Shaded parameters are option ROM features which are displayed, but do not function.

GrP. U (User Parameters)

Function	Title		Adjustment range	Resolution	Default	Page
(User-changed parameters) * Displays the parameters that differ from the standard setting values, excluding GrAN and GrUt tYP. * When a parameter value is once again set to the standard setting value, the parameter is removed from this group.	xx		xx (depends on the adjustment range for each parameter)	xx	xx	29

GrP. F (Fundamental Parameters #1)

Function	Title		Adjustment range	Resolution	Default	Page
Maximum frequency	FH		30~400	0.01/0.1 Hz	80.0	45
Maximum voltage frequency	uL 1		25~400	0.01/0.1 Hz	60.0	45
Maximum voltage frequency voltage selection	uLSL		0: Input voltage level (no output voltage control) 1: Automatic setting (output voltage control) 2: Stationary setting (output voltage control)		1	45
Maximum voltage	uLu 1		0~600V (Note 1)	1V	200V system: 200V 400V system: 400V	45
Reverse operation disable selection	d !Sr		0: Reverse operation allowed 1: Reverse operation not allowed	—	0	51
Upper limit frequency Lower limit frequency	UL LL		0~max. frequency (FH) 0~upper limit frequency	0.01/0.1 Hz 0.01/0.1 Hz	80.0 0.0	51 51
V/F pattern	Pt		1: Constant torque 2: Variable torque 3: Automatic torque boost 4: 3 with automatic energy saving 5: Vector control 6: 5 with automatic energy saving	—	1	46, 47
1-2 Voltage boost #1	ub 1	*	0~30	0.1%	Depends on inverter rating	46
Acceleration time #1 Deceleration time #1	ACC 1 dEC 1		0.1~6000/0.01~600.0 0.1~6000/0.01~600.0	0.1/0.01 S 0.1/0.01 S	Depends on inverter rating	48
Acc/dec pattern #1	SCu 1		0: Linear 1: Self-adjusting 2: S-Pattern #1 3: S-Pattern #2	—	0	49
Acc/dec pattern adjustment amounts	SCL SCH		0~50 0~50	1%	25 25	49

* << Skip Function >>
  Parameters with a * to the right of their title are displayed only when the indicated setting is selected.
  Parameters with ** are displayed only when the indicated setting of the parameter with a * is selected.

Note 1) 200V system: Internally limited to 255V.
400V system: Internally limited to 510V.

uLu 1 and uLu2 in GrF2 are valid only when uLSL is set to " 2 ".

GrF2 (Fundamental Parameters #2)

Function	Title	Adjustment range	Resolution	Default	Page
Maximum voltage frequency #2	uL2	25~400	0.01/0.1 Hz	60.0	54
Maximum voltage #2	uLu2	0~600 (Note 1)	1V	200V system: 200V 400V system: 400V	54
Voltage boost #2	ub2	0~30	0.1%	Depends on inverter rating	54
Electronic thermal protection level #2	tHr2	10~100%/A (Note 2)	1%/A	100.0	54
Stall protection #2	StC2	0: ON 1: OFF	—	0	54
0 Stall protection level #2 (current limit level adjustment)	StL2	10~215%/A	1%/A	150.0	54
Acceleration time #2 Deceleration time #2	AC2 dEC2	0.1~6000/0.01~600.0 0.1~6000/0.01~600.0	0.1/0.01 S 0.1/0.01 S	Depends on inverter rating	48
Acc/dec pattern #2	SCu2	0: Linear 1: Self-adjusting 2: S-Pattern #1 3: S-Pattern #2	—	0	54
Acc/dec #1/#2 switching frequency	Ad2F	0~max. frequency (FH)	0.1/0.01 Hz	0.0	52

GrPn (Panel Control Parameters)

Function	Title	Adjustment range	Resolution	Default	Page
Forward/reverse	Fr	0: Reverse 1: Forward	—	1	—
Stop pattern selection	StPP	0: Decelerated stop 1: Coast stop	—	0	—
Fundamental parameter switching	PtP	1: Fundamental parameters #1 (V/F#1) 2: Fundamental parameters #2 (V/F#2)		1	54
Acc/dec #1/#2 selection	Ad2	1: Acc/dec #1 2: Acc/dec #2	—	1	52
Panel reset selection	PrES	0: All possible 1: OL only (fault ignore #1) 2: OL, OC1, OC2, OC3 only (fault ignore #2)		0	53
Panel feedback control • PID • Speed Feedback • Drooping	PFbC	0: ON (valid when panel operation is selected) 1: OFF (invalid when panel operation is selected)	—	0	53

Note 1) 200V system: Internally limited to 255V.
400V system: Internally limited to 510V.

Note 2) Parameters with note "A" shown in the Adjustment Range and Resolution columns will be displayed in either percent or Amps depending on the setting of dSPC in Gr.Ut .

uLu2 and uLu1 in GrF are valid only when uLSL in Gr.F is set to " 2 ".

Gr.SC (Special Control Parameters)

Function		Title		Adjustment range	Resolution	Default	Page
Start-up frequency		F-St		0.0~10	0.1/0.01 Hz	0.1	64
End frequency		F-En		0.0~30	0.1/0.01 Hz	0.1	64
Run frequency		Frun		0.0~max. frequency (FH)	0.1/0.01 Hz	0.0	63
Run frequency hysteresis		FHYS		0.0~30	0.1/0.01 Hz	0.0	63
Jump frequency selection		FJn		0: Function OFF 1: Function ON	—	0	65
1	Jump frequency #1		*	0~max. frequency (FH)	0.1/0.01 Hz	0.0	
	Jump frequency band #1		*	0~30	0.1/0.01 Hz	0.0	
	Jump frequency #2		*	0~max. frequency (FH)	0.1/0.01 Hz	0.0	
	Jump frequency band #2		*	0~30	0.1/0.01 Hz	0.0	
	Jump frequency #3		*	0~max. frequency (FH)	0.1/0.01 Hz	0.0	
	Jump frequency band #3		*	0~30	0.1/0.01 Hz	0.0	
PWM carrier frequency		CF		3~17	0.1 kHz	Depends on inverter rating	66

Gr.St (Terminal Selection Parameters)

Function	Title		Adjustment range	Resolution	Default	Page
Input terminal selection	it		0: Standard terminal functions 1: Individual selection	—	0	55, 56
1 Input terminal 0 (R)	it0	*	0~51 (Terminal No. : terminal symbol) 0: R		0	55, 56
Input terminal 1 (S1)	it1	*	1: S1		1	
Input terminal 2 (S2)	it2	*	2: S2		2	
Input terminal 3 (S3)	it3	*	3: S3		3	
Input terminal 4 (S4)	it4	*	4: S4		4	
Input terminal 5 (F)	it5	*	5: F		5	
Input terminal 6 (RES)	it6	*	6: RES		6	
Input terminal 7 (ST)	it7	*	7: ST		7	
Input terminal 8 (S5)	it8	*	8: S5		8	
Input terminal 9 (S6)	it9	*	9: S6		9	
Input terminal 10 (S7)	it10	*	10: S7		10	
Input terminal 11 (potential terminal)	it11	*	11: Potential terminal		33	
Input terminal (0~4, 8~10) response time selection (filtering function)	itF		1: Quickest response 1~100	1	6	60
Input terminal 5 (F) response time selection	itSF		Same as itF	1	6	60
Input terminal 6 (RES) response time selection	itGF		Same as itF	1	6	60
Input terminal 7 (ST) response time selection	it7F		Same as itF	1	6	60
Output terminal 0 (RCH) function selection	Ot0		0~61	1	6	57, 58, 60
Output terminal 0 (RCH) delay time	Ot0d		1~100	1	1	
Output terminal 0 (RCH) hold time	Ot0h		1~100	1	1	
Output terminal 1 (LOW) function selection	Ot1		0~61	1	4	57, 58, 60
Output terminal 1 (LOW) delay time	Ot1d		1~100	1	1	
Output terminal 1 (LOW) hold time	Ot1h		1~100	1	1	
Output terminal 2 (FL) function selection	Ot2		0~61	1	10	57, 58, 60
Output terminal 2 (FL) delay time	Ot2d		1~100	1	1	
Output terminal 2 (FL) hold time	Ot2h		1~100	1	1	
Output terminal 3 (OUT) function selection	Ot3		0~61	1	8	57, 58, 60
Output terminal 3 (OUT) delay time	Ot3d		1~100	1	1	
Output terminal 3 (OUT) hold time	Ot3h		1~100	1	1	
Low-speed signal output frequency	LF		0~max. frequency (FH)	0.1/0.01 Hz	0.0	59
Speed reach detection band	br-CH		0~max. frequency (FH)	0.1/0.01 Hz	2.5	59
Speed reach HI frequency	Hr-CH		0~max. frequency (FH)	0.1/0.01 Hz	0.0	59
Speed reach LO frequency	Lr-CH		0~max. frequency (FH)	0.1/0.01 Hz	0.0	59
Commercial power/inverter switching output	CCHC		0: OFF 1: Automatic switching upon trip 2: Switching at commercial power switching frequency setting 3: Switching at commercial power switching frequency setting, automatic switching upon trip	—	0	61
2-3 Commercial power/Inverter switching frequency	FCHC	*	0~max. frequency (FH)	0.1/0.01 Hz	60.0 Hz	61
Output terminal pulse frequency selection	OtFP		0: 48f 1: 96f 2: 360f	—	0	62

Function	Title	Adjustment range	Resolution	Default	Page
RR input special function selection	inrr	0: Standard 1: FH 2: TACC/TDEC multiplication factor 3: VB multiplication factor 4: CL multiplication factor	—	0	62

Note) The option ROM is required for the RR input special function selection (inrr).

Gr.SF (Frequency Setting Parameters)

Function	Title		Adjustment range	Resolution	Default	Page
Frequency priority selection #1	FC 1		1: RR 2: IV 3: RX 4: PG (pulse input setting from option PCB) 5: BIN (binary setting or up/down setting)		1	69
Frequency priority selection #2	FC2		Same as above		2	69
Analog input filter	inF		0~3 0: No filter 3: Maximum filter	—	0	69
1 RR input selection	rr in		0: Standard 1: Adjustable	—	0	71
1 RR reference point #1	P 1	*	0~100	1%	0	71
RR point #1 frequency	F-P 1	*	0~FH	0.1/0.01 Hz	0.0	
RR reference point #2	P2	*	0~100	1%	100	
RR point #2 frequency	F-P2	*	0~FH	0.1/0.01 Hz	80.0	
2 IV input selection	iv in		0: Standard 1: Adjustable	—	0	71
1 IV reference point #1	P3	*	0~100	1%	20	71
IV point #1 frequency	F-P3	*	0~FH	0.1/0.01 Hz	0.0	
IV reference point #2	P4	*	0~100	1%	100	
IV point #2 frequency	F-P4	*	0~FH	0.1/0.01 Hz	80.0	
3 RX input selection	rE in		0: Standard 1: Adjustable	—	0	71
1 RX reference point #1	P5	*	-100~100	1%	0	71
RX point #1 frequency	F-P5	*	-FH~FH	0.1/0.02 Hz	0.0	
RX reference point #2	P6	*	-100~100	1%	100	
RX point #2 frequency	F-P6	*	-FH~FH	0.1/0.02 Hz	80.0	
4 PG input selection	PG in		0: Standard 1: Adjustable	—	0	71
1 PG reference point #1	P7	*	-100~100	1%	0	71
PG point #1 frequency	F-P7	*	-FH~FH	0.1/0.02 Hz	0.0	
PG reference point #2	P8	*	-100~100	1%	100	
PG point #2 frequency	F-P8	*	-FH~FH	0.1/0.02 Hz	80.0	
5 BIN (binary or up/down setting) selection	bi in		0: Standard 1: Adjustable	—	0	71
1 BIN reference point #1	P9	*	0~100	1%	0	71
BIN point #1 frequency	F-P9	*	-FH~FH	0.1/0.02 Hz	0.0	
BIN reference point #2	PA	*	0~100	1%	100	
BIN point #2 frequency	F-PA	*	-FH~FH	0.1/0.02 Hz	80.0	
Jog run frequency	JOG		0.0~20	0.1/0.01 Hz	0.0	70
Other than 0 Jog stop control	JSTP	*	0: Decelerated stop 1: Coast-stop 2: DC injection braking stop	—	0	70

Function		Title		Adjustment range	Resolution	Default	Page
Preset speed selection		SrSn		0: disabled 1~15: speeds (1~15)	—	0	67, 68
Other than 0	Mode selection	SrS1	*	0: Deactivated 1: Activated	—	0	
	1st speed	Sr01	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	1st speed run mode	SrM1	*	0: Acc/dec #1, V/F #1, forward run +1: Reverse run +2: Acc/dec #2 +4: V/F #2		0	
2 or higher	2nd speed	Sr02	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	2nd speed run mode	SrM2	*	Same as SrM1	—	0	
3 or higher	3rd speed	Sr03	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	3rd speed run mode	SrM3	*	Same as SrM1	—	0	
4 or higher	4th speed	Sr04	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	4th speed run mode	SrM4	*	Same as SrM1	—	0	
5 or higher	5th speed	Sr05	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	5th speed run mode	SrM5	*	Same as SrM1	—	0	
6 or higher	6th speed	Sr06	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	6th speed run mode	SrM6	*	Same as SrM1	—	0	
7 or higher	7th speed	Sr07	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	7th speed run mode	SrM7	*	Same as SrM1	—	0	
8 or higher	8th speed	Sr08	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	8th speed run mode	SrM8	*	Same as SrM1	—	0	
9 or higher	9th speed	Sr09	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	9th speed run mode	SrM9	*	Same as SrM1	—	0	
10 or higher	10th speed (A)	Sr 10	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	10th speed run mode	SrMA	*	Same as SrM1	—	0	
11 or higher	11th speed (B)	Sr 11	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	11th speed run mode	SrMb	*	Same as SrM1	—	0	
12 or higher	12th speed (C)	Sr 12	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	12th speed run mode	SrMC	*	Same as SrM1	—	0	
13 or higher	13th speed (D)	Sr 13	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	13th speed run mode	SrMd	*	Same as SrM1	—	0	
14 or higher	14th speed (E)	Sr 14	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	14th speed run mode	SrME	*	Same as SrM1	—	0	
15	15th speed (F)	Sr 15	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	15th speed run mode	SrMF	*	Same as SrM1	—	0	

GrPr (Protection Parameters)

	Function	Title		Adjustment range	Resolution	Default	Page
	Dynamic braking selection (DBR)	Pb		0: No DBR 1: With DBR, no OLr detection 2: With DBR and OLr detection	—	Depends on inverter rating	77
2	DBR resistor value	Pbr	*	1.0~1000	0.1Ω		
	DBR capacity	PbCP	*	0.01~600	0.01 kW		
	Overvoltage stall protection	OPSS		0: ON 1: OFF	—	0	77
	DC injection starting frequency	dbF		0~120	0.1/0.01 Hz	0.0	74, 75, 76
Other than 0	DC injection current	dbC	*	0~100%/A	1%/A	0	
Other than 0	DC injection time	dbt	*	0~10	0.1 sec.	0.0	
	Forward/reverse DC injection priority control	dbSL		0: OFF 1: ON	—	0	75
	Motor shaft stationary control	db in		0: OFF 1: ON	—	0	76
	Emergency stop selection	ESTP		0: Coast-stop 1: Decelerated stop 2: DC injection stop	—	0	78
2	ESTOP DC injection time	Edbt	*	0~10	0.1 sec.	0.1	
	Retry selection	rtry		0: no retry function 1~10: 1~10 times	—	0	78
Other than 0	Retry time setting	rtt	*	0~10	0.1 sec.	1.0	
	Regeneration power ride-through control	UuC		0: OFF 1: ON	—	0	79
1	Ride-through time	UuCt	*	0~25	0.1 sec.	2.0	
	Auto-restart (motor speed search)	ArSt		0: OFF 1: On momentary power failure 2: On ST make/break (commercial power switching) 3: Both 1 and 2		0	79
	Motor overload protection level	tHr 1		10~100%/A	1%/A	100	72
	OL reduction start-up frequency	OLF		0~30	0.1/0.01 Hz	30.0	72
	Motor 150% overload time limit	OLt		10~2400	10 sec.	600	72
	OL selection	OLn		0: standard +1: soft-stall ON +2: OLMt trip OFF	—	0	73
	Stall protection	StC 1		0: ON 1: OFF	—	0	73
0	Stall protection level (current limit level adjustment)	StL 1	*	10~215%/A	1%/A	150	

Function	Title	Adjustment range	Resolution	Default	Page
Undervoltage trip selection	UPSL	0: Trip disabled 1: Trip (during run)	—	0	80
Undervoltage detection time	UPt	0~10	0.01 sec.	0.03	80
Low current detection selection (output fault detection)	LLP	0: Trip disabled 1: Trip on detection	—	0	80
Low current detection level	LLPC	0~100%/A	1%/A	0	80
Low current detection time	LLPt	0~255	1 sec.	0	80
Output short-circuit detection selection (OCL)	OCLS	0: Standard +1: High-speed motor use +2: Position sensing (during JOG)		0	80
Overtorque trip selection	OtSL	0: Trip disabled 1: Trip enabled	—	0	80
Overtorque trip level	OtL	0~200%/A	1%/A	150	80
Fault trip saving	trCL	0: Cleared when powered OFF 1: Data retained when powered OFF	—	0	81
Cooling fan control selection	FAn	0: Automatic (temperature detection) 1: Always ON	—	0	—
Cumulative run timer alarm setting	Out	0.00~999.9 (1 = 100 hours)	0.02 (two hours)	175.0	35

GrNt (Motor Parameters)

Function		Title		Adjustment range	Resolution	Default	Page
Number of motor poles		nEP		2, 4, 6, 8, 10, 12, 14, 16	2	4	47
Motor rated capacity		nEC		0.1~75.0	0.1 kW	Depends on inverter rating	
Motor type		nEt		0: Toshiba standard motor 1: Toshiba VF motor 2: Other	—	0	
2	Rated voltage	nEu	*	90~600	5V	200/400	
	Rated frequency	nEF	*	0~400	2 Hz	60	
	Rated RPM	nEr	*	0~9999	1 RPM	1710	
	Auto-tuning	nEtn	*	0: Auto-tuning disabled 1: Auto-tuning enabled	—	0	
Load moment of inertia		nC. IH		0: Small (Ver100/102) 1: Medium (Ver110 standard) 2: Large 3: Very large	—	1	

GrPt (Pattern Run Parameters)

Function		Title		Adjustment range	Resolution	Default	Page
Pattern run selection		PSEL		0: OFF 1: ON	—	0	82, 83
1	Pattern run mode	Pt0	*	0: When the inverter is stopped, run pattern is reset. 1: Upon continuation after a stop, pattern switches after current pattern is finished.		0	
	Pattern group #1 speed selections	Pt 10 Pt 11 Pt 12 Pt 13 Pt 14 Pt 15 Pt 16 Pt 17	* * * * * * * *	0: Skip 1~15: preset speeds 1~15	— — — — — — — —	1 2 3 4 5 6 7 8	
	Pattern group #1 number of cycles	PtL1	*	1~254, 255 = ∞	—	1	
	Pattern group #2 speed selections	Pt20 Pt21 Pt22 Pt23 Pt24 Pt25 Pt26 Pt27	* * * * * * * *	0: Skip 1~15: preset speeds 1~15	— — — — — — — —	9 10 11 12 13 14 15 0	
	Pattern group #2 number of cycles	PtL2	*	1~254, 255 = ∞	—	1	
	Pattern group #3 speed selections	Pt30 Pt31 Pt32 Pt33 Pt34 Pt35 Pt36 Pt37	* * * * * * * *	0: Skip 1~15: preset speeds 1~15	— — — — — — — —	1 2 3 4 5 6 7 8	
	Pattern group #3 number of cycles	PtL3	*	1~254, 255 = ∞	—	1	
	Pattern group #4 speed selections	Pt40 Pt41 Pt42 Pt43 Pt44 Pt45 Pt46 Pt47	* * * * * * * *	0: Skip 1~15: preset speeds 1~15	— — — — — — — —	9 10 11 12 13 14 15 0	
	Pattern group #4 number of cycles	PtL4	*	1~254, 255 = ∞	—	1	

Function	Title		Adjustment range	Resolution	Default	Page
Speed #1 drive continuation mode	SLn1	*	0: Count in seconds from time of activation 1: Count in minutes from time of activation 2: Count in seconds from time set speed is reached 3: Count in minutes from time set speed is reached. 4: Non-stop (continue until STOP command) 5: Continue until next step command		0	82, 83
Less than 4 Speed #1 drive time	SLt1	**	0~8000	1 sec./min.	0	
Speed #2 drive continuation mode	SLn2	*	Same as SLn1		0	
Less than 4 Speed #2 drive time	SLt2	**	Same as SLt1	1 sec./min.	0	
Speed #3 drive continuation mode	SLn3	*	Same as SLn1		0	
Less than 4 Speed #3 drive time	SLt3	**	Same as SLt1	1 sec./min.	0	
Speed #4 drive continuation mode	SLn4	*	Same as SLn1		0	
Less than 4 Speed #4 drive time	SLt4	**	Same as SLt1	1 sec./min.	0	
Speed #5 drive continuation mode	SLn5	*	Same as SLn1		0	
Less than 4 Speed #5 drive time	SLt5	**	Same as SLt1	1 sec./min.	0	
Speed #6 drive continuation mode	SLn6	*	Same as SLn1		0	
Less than 4 Speed #6 drive time	SLt6	**	Same as SLt1	1 sec./min.	0	
Speed #7 drive continuation mode	SLn7	*	Same as SLn1		0	
Less than 4 Speed #7 drive time	SLt7	**	Same as SLt1	1 sec./min.	0	
Speed #8 drive continuation mode	SLn8	*	Same as SLn1		0	
Less than 4 Speed #8 drive time	SLt8	**	Same as SLt1	1 sec./min.	0	
Speed #9 drive continuation mode	SLn9	*	Same as SLn1		0	
Less than 4 Speed #9 drive time	SLt9	**	Same as SLt1	1 sec./min.	0	
Speed #A drive continuation mode	SLnA	*	Same as SLn1		0	
Less than 4 Speed #A drive time	SLtA	**	Same as SLt1	1 sec./min.	0	
Speed #B drive continuation mode	SLnb	*	Same as SLn1		0	
Less than 4 Speed #B drive time	SLtb	**	Same as SLt1	1 sec./min.	0	
Speed #C drive continuation mode	SLnC	*	Same as SLn1		0	
Less than 4 Speed #C drive time	SLtC	**	Same as SLt1	1 sec./min.	0	
Speed #D drive continuation mode	SLnd	*	Same as SLn1		0	
Less than 4 Speed #D drive time	SLtd	**	Same as SLt1	1 sec./min.	0	
Speed #E drive continuation mode	SLnE	*	Same as SLn1		0	
Less than 4 Speed #E drive time	SLtE	**	Same as SLt1	1 sec./min.	0	
Speed #F drive continuation mode	SLnF	*	Same as SLn1		0	
Less than 4 Speed #F drive time	SLtF	**	Same as SLt1	1 sec./min.	0	

GrFb (Feedback Parameters)

	Function	Title		Adjustment range	Resolution	Default	Page
Feedback control selection		FbP1		0: No feedback control 1: PID control 2: Speed feedback control	—	0	—
1•2	Feedback input signal selection	Fb In	*	1: RR input 2: IV input 3: RX input 4: PG feedback (option board) 5: RS232C input 6: Communication (option board) 7: 12-bit binary input	—	2	
	Proportional gain	GP	*	0.01~2.55	0.01	0.30	
	Integral gain	G1	*	0.01~360.0	0.01S	5.00	
	Anti-hunting gain	GR	*	0.0~25.5	0.1S	0.0	
	Lag time constant	GFS	*	0~255	1	80	
PID variation limit selection		PuL		0: No PID variation limit 1: PID variation limited	—	0	—
1	PID variation upper limit	PuUL	*	0~50%	1%	50	
	PID variation lower limit	PuLL	*	0~50%	1%	50	
PG input - number of pulses Note)		PG		1~9999	1	500	—
PG input - number of phases		PGPH		1: Single-phase input 2: Two-phase input	—	2	—
Drooping control		dr-PC		0: OFF 1: ON	—	0	—
1	Drooping control amount	dr-Pt	*	0.0~10.0%	0.1%	0.0	
Override control		Ord1		0: OFF 1: FCRR 2: FCIV 3: FCRX 4: FCPG 5: FCPNL 6: FCOPT 7: FCMLT	—	0	—
7	Override change amount setting	Ord2	*	0: Reference 1: KRR 2: KIV 3: KRX 4: KBIN	—	0	
	Override change amount	Ord3	*	-100.0~100.0%	0.1%	0.0	

Note) When using PG feedback, the frequency command = (pulse input frequency)/ PG .
When using PG feedback, always set GrPt : number of motor poles, and set PG input-number of pulses to the number of pulses per rotation.

Cr.tr (Communication Parameters)

	Function	Title		Adjustment range	Resolution	Default	Page
	RS232C baud rate	brt2		0: 2400 baud 1: 4800 baud 2: 9600 baud **(Note)** Use only when RS485 option is not used.	—	2	—
	Number of data bits	Sn78		0: 7 bits 1: 8 bits	—	0	—
	Parity	SnE0		0: Even parity 1: Odd parity	—	0	—
	Inverter number	ino		0~255	—	0	—
	Communication selection	OPt		0: OFF 1: RS485 2: TOSLINE-F10 3: TOSLINE-S20 4: 12 bit binary input 5: 3-digit BCD input (0.1Hz units) 6: 3-digit BCD input (1Hz units)	—	0	—
1	Master/slave selection	nSt	*	0: Slave 1: Master (frequency command) 2: Master (output frequency)	—	0	
	RS485 baud rate	brt4	*	0: Normal mode 1: High-speed mode	—	0	
2·3	TOSLINE-F10 command input TOSLINE-S20	n in	*	0~3 0: OFF +1: Frequency command +2: Command input	—	0	
2·3	TOSLINE-F10 monitor output TOSLINE-S20	nOut	*	0~15 0: OFF +1: Output frequency +2: Status +4: Output current +8: Output voltage	—	0	
2·3	TOSLINE-F10 TOSLINE-S20 Communication error mode	nErr	*	0: Data cleared 1: Data retained	—	0	
	RS485/12-bit binary % input: bias and gain settings	Er in		0: OFF 1: ON	—	0	—
1	Point #1 setting signal	PL	*	0~100%	1%	0	
	Point #1 frequency	F-PL	*	0~FH	0.1/0.01 Hz	0.0	
	Point #2 setting signal	PH	*	0~100%	1%	100	
	Point #2 frequency	F-PH	*	0~FH	0.1/0.01 Hz	FH	

Note) • Cr.tr (communication parameter group) parameters can be changed during inverter operation, but the new settings will become valid only after the inverter has been reset.

• All OPt selections require optional PCBs and optional ROMs.

GrUt (Utility Parameters)

Function	Title	Adjustment range	Resolution	Default	Page
Industrial application parameters selection	APL	0: Does nothing 1: Pump application 2: Fan application 3: Conveyor application 4: Hoist application 5: Textiles application 6: Machine tools application	—	0	85
Standard setting mode selection	tYP	0: Does nothing 1: 50Hz standard settings 2: 60Hz standard settings 3: Return to factory settings 4: Trip clear 5: Save user-set parameters 6: TYPE 5 reset 7: Initialize inverter typeform	—	0	85
Command mode selection	CMOd	0: Only RS232C input valid 1: Terminal input valid 2: Panel input valid 3: Communication option board input valid 4: All valid (changeover possible)	— Note) RS232C is always valid.	4	86
Frequency setting mode selection	FMOd	0: Only RS232C valid 1: Terminal input valid 2: Panel input valid 3: Communication option board input valid 4: All valid (changeover possible)	— Note) RS232C is always valid.	4	86
Panel operation mode selection	PMOd	0: Prohibit all key operations +1: Can perform reset +2: Can perform monitor operations +4: Can perform emergency stop +8: Can perform run/stop operations +16: Can perform parameter read operations +32: Can perform parameter change operations 63: Standard mode (can perform all operations)		63	84
Pass number	PASS	0~99	—	0	84
CPU version	uCPU uCOn uEEP	—	—	Can be monitored only	—
Inverter typeform	FOrn	2-digit HEX display	—		124
Status monitor display selections	nOn1	1~13	—	2	87
	nOn2	1~13	—	3	87
	nOn3	1~13	—	4	87
	nOn4	1~13	—	5	87
Frequency units multiplication factor	dSP2	0 (OFF), 0.01~200	0.01	0.00	88
Frequency display resolution	dSPF	0: 1 Hz 1: 0.1 Hz 2: 0.01 Hz	—	1	88
ACC/DEC time units selection	dSPt	0: 0.1 sec. 1: 0.01 sec.	—	0	88
Current units selection	dSPC	0: % 1: A	—	0	88
Voltage units selection	dSPu	0: % 1: V	—	1	88

Function		Title		Adjustment range	Resolution	Default	Page
Blind function selection		bLnd		0: Blind 1: Selective unblinding	—	0	50
1	Fundamental parameters #2	bLF2	*	0: Blind 1: Unblind	—	0	
	Panel Control Parameters	bLPn	*	0: Blind 1: Unblind	—	0	
	Terminal Selection Parameters	bLSt	*	0: Blind 1: Unblind	—	0	
	Special Control Parameters	bLSC	*	0: Blind 1: Unblind	—	0	
	Frequency Setting Parameters	bLSF	*	0: Blind 1: Unblind	—	0	
	Protection Parameters	bLPr	*	0: Blind 1: Unblind	—	0	
	Pattern Run Parameters	bLPt	*	0: Blind 1: Unblind	—	0	
	Feedback Parameters	bLFb	*	0: Blind 1: Unblind	—	0	
	Communication Parameters	bLtr	*	0: Blind 1: Unblind	—	0	
	Industrial Application Parameters (Pump)	bL01	*	0: Blind 1: Unblind	—	0	
	Industrial Application Parameters (Fan)	bL02	*	0: Blind 1: Unblind	—	0	
	Industrial Application Parameters (Conveyor)	bL03	*	0: Blind 1: Unblind	—	0	
	Industrial Application Parameters (Hoist)	bL04	*	0: Blind 1: Unblind	—	0	
	Industrial Application Parameters (Textiles)	bL05	*	0: Blind 1: Unblind	—	0	
	Industrial Application Parameters (Machine Tools)	bL06	*	0: Blind 1: Unblind	—	0	
	AM/FM Adjustment Parameters	bLAn	*	0: Blind 1: Unblind	—	0	
	Motor Parameters	bLnt	*	0: Blind 1: Unblind	—	0	

GrAn (AM/FM Adjustment Parameters)

Function	Title	Adjustment range	Resolution	Default	Page
FM terminal function selection	FnSL	0: Pre-compensation reference frequency 1: Post-compensation output frequency 2: Frequency setting value 3: Output current 4: DC voltage 5: Output voltage 6: Torque current 7: Excitation current 8: PID feedback value 9: Motor overload ratio 10: Inverter overload ratio 11: DBR overload ratio 12: Input power 13: Output power	—	0	89
Frequency meter adjustment	Fn	—	—	—	
AM terminal function selection	AnSL	Same as FnSL (0~13)	—	3	
Ammeter adjustment	An	—	—	—	

Appendix Table 2. List of trips

- **Trips (registered as past faults)**

nErr	No error (only during display of past faults)
OC 1	Overcurrent during acceleration
OC2	Overcurrent during deceleration
OC3	Overcurrent during constant speed run
OC 1P	Overcurrent in DC section during acceleration
OC2P	Overcurrent in DC section during deceleration
OC3P	Overcurrent in DC section during constant speed run
OCL	Short circuit (output terminal check) trip during starting
OCA 1	U-phase armature short circuit
OCA2	V-phase armature short circuit
OCA3	W-phase armature short circuit
OP 1	Overvoltage during acceleration
OP2	Overvoltage during deceleration
OP3	Overvoltage during constant speed run
OL In	Inverter overload trip
OLnt	Motor overload trip
OCr	Dynamic braking resistor overcurrent trip
OLr	Dynamic braking resistor overload trip
OH	Overheat trip
E	Emergency stop
EEP 1	EEPROM fault (error during write)
EEP2	Initial read error
Err2	RAM fault
Err3	ROM fault
Err4	CPU fault
Err5	Erroneous interruption of communication run command
Err6	Gate array fault
Err7	Output current detector error
Err8	Option PCB error trip
UC	Low current operating condition trip
UP 1	Undervoltage trip (main circuit)
Ot	Overtorque trip
EF 1	Earth fault trips
EF2	
Etn	Auto-tuning error
EtYP	Inverter typeform error

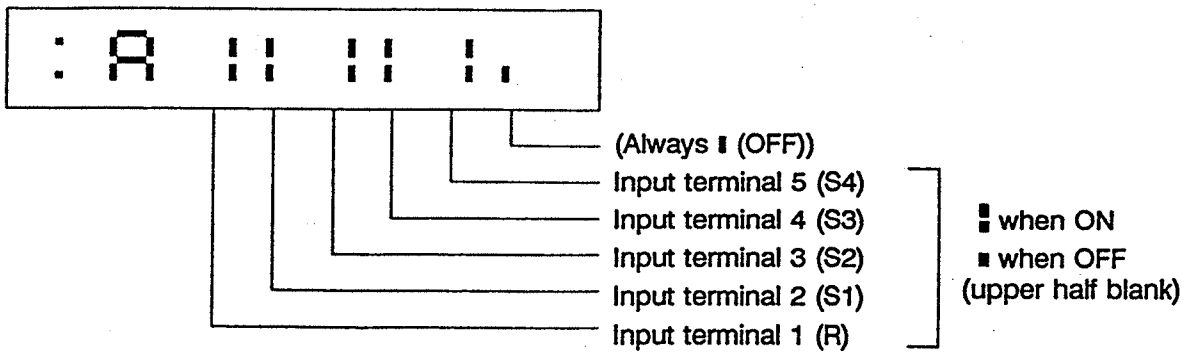
- **Messages (not caused by trips)**

OFF	ST-CC open
POFF	Control circuit undervoltage
nOFF	Main circuit undervoltage
rtry	Displayed during retry
Err 1	Frequency point setting error alarm
CLr	Clear acceptance display
EOFF	Emergency stop acceptance display
CtrL	Operating panel coast-stop operation possible
H 1	A setting value upper limit has been reached
LO	A setting value lower limit has been reached
Err	Password No. error
E 1	No. of panel display digits exceeded

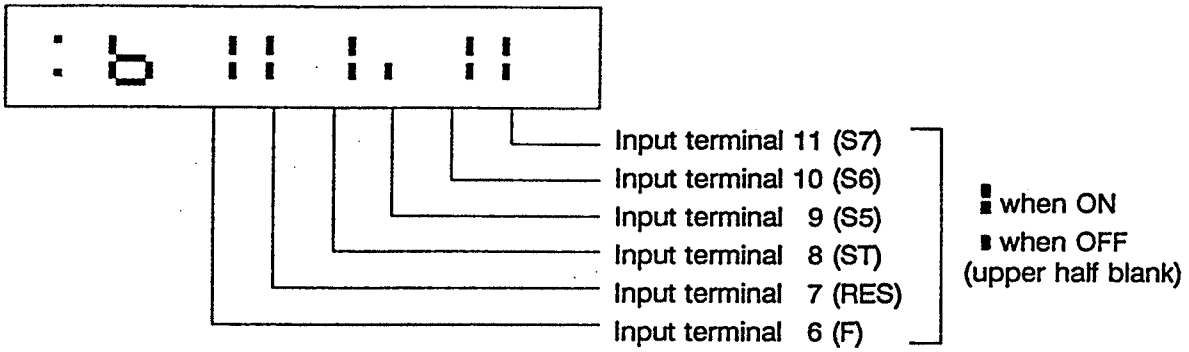
Appendix Figure 1. Input terminal information

The eleven input terminals correspond to the following bits.

A group (input terminals 1 to 5)



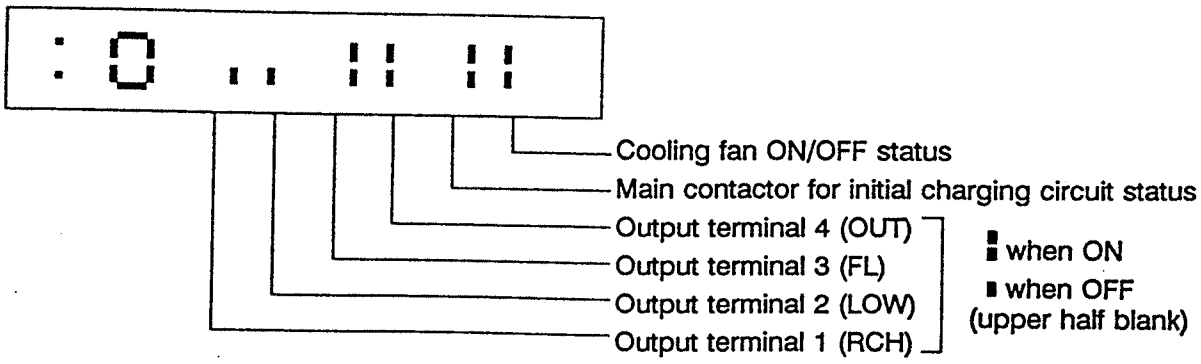
B group (input terminals 6 to 11)



Appendix Figure 2. Output terminal information

(Including status display of cooling fan and main contactor for initial charging circuit)

The four output terminals correspond to the following bits. The operating statuses of the cooling fan and main contactor for the initial charging circuit are also displayed.



Note) Output terminal 4 (OUT): Option PCB

Appendix Figure 3. Character codes

Character codes (numbers)

0	1	2	3	4	5	6	7	8	9	—
0	1	2	3	4	5	6	7	8	9	-

Character codes (letters)

A a	B b	C c	D d	E e	F f	G g	H h	I i	J j
A	b	C	d	E	F	G	H h	I	J

K k	L l	M m	N n	O o	P p	Q q	R r	S s	T t
—	L	n	n	o o	P	q	r	5	t

U u	V v	W w	X x	Y y	Z z
U	u	—	—	y	—

Appendix Table 3. Standard default settings per inverter capacity

Inverter model	Inverter typeform display	Voltage boost ub %	Maximum voltage uLu1 uLu2 (V)	DBR control Pb 0 : OFF 2 : ON	DBR resistance value Pbr (Ω)	DBR capacity PbCP (kW)	Motor capacity nEC (kW)	Acceleration/ deceleration times ACC dEC (S)	Carrier frequency CF (kHz)
A5-2004	21	8	200	2	70	0.12	0.4	10	15
A5-2007	22	8	200	2	70	0.12	0.7	10	15
A5-2015	23	6	200	2	70	0.12	1.5	10	15
A5-2022	24	6	200	2	70	0.12	2.2	10	15
A5-2037	25	6	200	2	40	0.12	3.7	10	15
A5-2055	26	4	200	0	20	0.12	5.5	10	15
A5-2075	27	4	200	0	20	0.12	7.5	10	15
A5-2110	28	4	200	0	10	0.56	11	10	15
A5-2150	29	4	200	0	7.5	0.68	15	10	15
A5-2185	2A	3	200	0	7.5	0.83	18.5	60	12
A5-2220	2C	3	200	0	3.3	1.20	22	60	12
A5-2300	2d	3	200	0	3.3	1.20	30	60	12
A5-2370	30	3	200	0	2	2.00	37	60	12
A5-2450	31	3	200	0	2	2.00	45	60	12
A5-2550	32	3	200	0	2	2.00	55	60	12
A5-4007	42	8	400	2	150	0.12	0.7	10	15
A5-4015	43	6	400	2	150	0.12	1.5	10	15
A5-4022	44	6	400	2	150	0.12	2.2	10	15
A5-4037	45	6	400	2	150	0.12	3.7	10	15
A5-4055	46	4	400	0	80	0.12	5.5	10	15
A5-4075	47	4	400	0	80	0.12	7.5	10	15
A5-4110	48	4	400	0	40	0.66	11	10	15
A5-4150	49	4	400	0	30	0.88	15	10	15
A5-4185	4A	3	400	0	30	0.83	18.5	60	12
A5-4220	4C	3	400	0	13.3	1.20	22	60	12
A5-4300	4d	3	400	0	13.3	1.20	30	60	12
A5-4370	50	3	400	0	8	2.00	37	60	12
A5-4450	51	3	400	0	8	2.00	45	60	12
A5-4550	52	3	400	0	8	2.00	55	60	12
A5-4750	53	3	400	0	6	2.00	75	60	12

Appendix Table 4. Industrial Application Parameters

Industrial Application Parameters (Pump)

When GrUt APL is set to 1, GrU, GrF, Gr01 and GrUt will be available in settings monitor mode, and the initial setting values will change to those for a pump application.

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
Gr01 Pump	Panel feedback control • PID • Speed Feedback • Drooping	PFbC		0: ON 1: OFF	—	0	Gr.Pn
	Input terminal selection	it		0: Standard terminal functions 1: Individual selection	—	0	Gr.St
	1 Input terminal 0 (R)	it0	*	0~51 (Terminal No. : terminal symbol)	0: R	0	
	Input terminal 1 (S1)	it1	*		1: S1	1	
	Input terminal 2 (S2)	it2	*		2: S2	2	
	Input terminal 3 (S3)	it3	*		3: S3	3	
	Input terminal 4 (S4)	it4	*		4: S4	4	
	Input terminal 5 (F)	it5	*		5: F	5	
	Input terminal 6 (RES)	it6	*		6: RES	6	
	Input terminal 7 (ST)	it7	*		7: ST	7	
	Input terminal 8 (S5)	it8	*		8: S5	8	
	Input terminal 9 (S6)	it9	*		9: S6	9	
	Input terminal 10 (S7)	it10	*		10: S7	10	
	Input terminal 11 (potential terminal)	it11	*		11: Potential terminal	33	
	Output terminal 0 (RCH) function selection	Ot0		0~61	—	46	Gr.St
	Output terminal 1 (LOW) function selection	Ot1				48	
	Output terminal 2 (FL) function selection	Ot2				10	
	Commercial power/inverter switching output	CCHG		0: OFF 1: Automatic switching upon trip 2: Switching at commercial power switching frequency setting 3: Switching at commercial power switching frequency setting, automatic switching upon trip	—	0	Gr.St
	2-3 Commercial power/Inverter switching frequency	FCHG	*	0~maximum frequency	0.1/0.01 Hz	60.0	
	Jump frequency selection	FJn		0: Function OFF 1: Function ON	—	0	Gr.SC
	1 Jump frequency #1	FJ1	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	Jump frequency band #1	bFJ1	*	0~30	0.1/0.01 Hz	0.0	
	Jump frequency #2	FJ2	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	Jump frequency band #2	bFJ2	*	0~30	0.1/0.01 Hz	0.0	
	Jump frequency #3	FJ3	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	Jump frequency band #3	bFJ3	*	0~30	0.1/0.01 Hz	0.0	
	Frequency priority selection #1	FC1		1: RR 2: IV 3: RX 4: PG (pulse input setting) 5: BIN (binary or up/down key setting)		1	Gr.SF
	Frequency priority selection #2	FC2		Same as above		2	Gr.SF

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
Gr.01 Pump	RR input selection	rr in		0: Standard 1: Adjustable	—	1	Gr.SF
	1 RR reference point #1	P1	*	0~100	1%	0	
	RR point #1 frequency	F-P1	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	RR reference point #2	P2	*	0~100	1%	100	
	RR point #2 frequency	F-P2	*	0~maximum frequency	0.1/0.01 Hz	60.0	
	IV input selection	iv in		0: Standard 1: Adjustable	—	1	Gr.SF
	1 IV reference point #1	P3	*	0~100	1%	20	
	IV point #1 frequency	F-P3	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	IV reference point #2	P4	*	0~100	1%	100	
	IV point #2 frequency	F-P4	*	0~maximum frequency	0.1/0.01 Hz	60.0	
	Preset speed selection	Sr.n		0: disabled 1~15: speeds (1~15)	—	0	Gr.SF
	Other than 0 Mode selection	Sr.n	*	0: deactivated 1: activated	—	0	
	1st speed	Sr01	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	1st speed run mode	Srn1	*	0: Acc/dec #1, V/F #1, forward run +1: Reverse run +2: Acc/dec #2 +4: V/F #2		0	
	(Up to 15th speed omitted)						
	Emergency stop selection	ESTP		0: Coast-stop 1: Decelerated stop 2: DC injection stop	—	0	Gr.Pr
	2 ESTOP DC injection time	Edbt	*	0~10	0.1 sec.	0.1	
	Retry selection	rtry		0: no retry function 1~10: 1~10 times	—	0	Gr.Pr
	Other than 0 Retry time setting	rtt	*	0.0~10	0.1 sec.	1.0	
	Regeneration power ride-through control	UUC		0: OFF 1: ON	—	1	Gr.Pr
	1 Ride-through time	UUCt	*	0.0~25	0.1 sec.	2.0	
	Auto-restart (Motor speed search)	ArSt		0: OFF 1: On momentary power failure 2: On ST make/break (commercial power switching) 3: Both 1 and 2		3	Gr.Pr
	Motor overload protection level	tHr1		10~100%/A	1%/A	100	Gr.Pr
	OL reduction start-up frequency	OLF		0~30	0.1/0.01 Hz	30.0	Gr.Pr
	OL selection	OLn		0: Standard +1: Soft-stall ON +2: OLMt trip OFF	—	0	Gr.Pr
	Stall protection	StC1		0: ON 1: OFF	—	0	Gr.Pr
	0 Stall protection level (current limit level adjustment)	StL1	*	10~215%/A	1%/A	150	
	Low current detection selection (output fault detection)	LLP		0: Trip disabled 1: Trip on detection	—	0	Gr.Pr
	Low current detection level	LLPC		0~100%/A	1%/A	0	Gr.Pr
	Low current detection time	LLPt		0~255	1 sec.	0	Gr.Pr

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
Gr01 Pump	Feedback control selection	FbP1		0: No feedback control 1: PID control 2: Speed feedback control	—	0	Gr.Fb
	1-2 Feedback input signal selection	Fb In	*	1: RR input 2: IV input 3: RX input 4: PG feedback (option board) 5: RS232C input 6: Communication (option board) 7: 12-bit binary input	—	2	
	Proportional gain	GP	*	0.01~2.55	0.01	0.30	
	Integral gain	G1	*	0.01~360.0	0.01s	5.00	
	Anti-hunting gain	GA	*	0.0~25.5	0.1s	0.0	
	Lag time constant	GFS	*	0~255	1	80	
	FM terminal function selection	FMSL		0~13 Refer to the standard parameter list for details.	—	0	Gr.AM
	Frequency meter adjustment	FM		—	—	—	Gr.AM
	AM terminal function selection	AMSL		0~13 Refer to the standard parameter list for details.		3	Gr.AM
	Ammeter adjustment	AM		—	—	—	Gr.AM

The pump application data initial settings that differ from standard settings are as follows.

Group	Function	Title	Default	Remarks
GrF	Maximum frequency	FH	60.0	—
	Upper limit frequency	UL	60.0	—
	V/F pattern	Pt	2	—
GrSt	Output terminal 0 (RCH) function selection	Ot0	46	Gr.01
	Output terminal 1 (LOW) function selection	Ot1	48	Gr.01
GrSF	RR input selection	rr In	1	Gr.01
	1 RR point #2 frequency	F-P2	60.0	
	IV input selection	Iv In	1	Gr.01
	1 IV point #2 frequency	F-P4	60.0	
GrPr	Regeneration power ride-through control	UUC	1	Gr.01
	Auto restart (Motor speed search)	Ar-St	3	Gr.01
GrUt	Blind function selection	bLnd	1	—
	1 Industrial Application Parameters (Pump)	bL01	1	

Industrial Application Parameters (Fan)

When Gr.UE APL is set to 2, Gr.U, Gr.F, Gr.02 and Gr.UE will be available in setting monitor mode, and the initial setting values will change to those for a fan application.

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
Gr.02 Fan	Panel feedback control • PID • Speed Feedback • Drooping	PFbC		0: ON 1: OFF	—	0	Gr.Pn
	Input terminal selection	tE		0: Standard terminal functions 1: Individual selection	—	0	Gr.St
	1 Input terminal 0 (R)	tE0	*	0~51 (Terminal No. : terminal symbol)	0: R	0	
	Input terminal 1 (S1)	tE1	*		1: S1	1	
	Input terminal 2 (S2)	tE2	*		2: S2	2	
	Input terminal 3 (S3)	tE3	*		3: S3	3	
	Input terminal 4 (S4)	tE4	*		4: S4	4	
	Input terminal 5 (F)	tE5	*		5: F	5	
	Input terminal 6 (RES)	tE6	*		6: RES	6	
	Input terminal 7 (ST)	tE7	*		7: ST	7	
	Input terminal 8 (S5)	tE8	*		8: S5	8	
	Input terminal 9 (S6)	tE9	*		9: S6	9	
	Input terminal 10 (S7)	tE10	*		10: S7	10	
	Input terminal 11 (potential terminal)	tE11	*		11: Potential terminal	33	
	Output terminal 0 (RCH) function selection	OtO		0~61	—	46	Gr.St
	Output terminal 1 (LOW) function selection	Ot1				48	
	Output terminal 2 (FL) function selection	Ot2				10	
	Commercial power/inverter switching output	CCHG		0: OFF 1: Automatic switching upon trip 2: Switching at commercial power switching frequency setting 3: Switching at commercial power switching frequency setting, automatic switching upon trip	—	0	Gr.St
	2-3 Commercial power/Inverter switching frequency	FCHG	*	0~maximum frequency	0.1/0.01 Hz	60.0	
	Jump frequency selection	FJ.n		0: Function OFF 1: Function ON	—	0	Gr.SC
	1 Jump frequency #1	FJ1	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	Jump frequency band #1	bFJ1	*	0~30	0.1/0.01 Hz	0.0	
	Jump frequency #2	FJ2	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	Jump frequency band #2	bFJ2	*	0~30	0.1/0.01 Hz	0.0	
	Jump frequency #3	FJ3	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	Jump frequency band #3	bFJ3	*	0~30	0.1/0.01 Hz	0.0	
	Frequency priority selection #1	FC1		1: RR 2: IV 3: RX 4: PG (pulse input setting) 5: BIN (binary or up/down key setting)		1	Gr.SF
	Frequency priority selection #2	FC2		Same as above		2	Gr.SF

Group	Function	Title		Adjustment range	Resolution	Default	Re-marks
Gr02 Fan	RR input selection	rr in		0: Standard 1: Adjustable	—	1	Gr.SF
	1 RR reference point #1	P1	*	0~100	1%	0	
	RR point #1 frequency	F-P1	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	RR reference point #2	P2	*	0~100	1%	100	
	RR point #2 frequency	F-P2	*	0~maximum frequency	0.1/0.01 Hz	60.0	
	IV input selection	iu in		0: Standard 1: Adjustable	—	1	Gr.SF
	1 IV reference point #1	P3	*	0~100	1%	20	
	IV point #1 frequency	F-P3	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	IV reference point #2	P4	*	0~100	1%	100	
	IV point #2 frequency	F-P4	*	0~maximum frequency	0.1/0.01 Hz	60.0	
	Preset speed selection	Sr.n		0: disabled 1~15: speeds (1~15)	—	0	Gr.SF
	Other than 0 Mode selection	Sr.n	*	0: deactivated 1: activated	—	0	
	1st speed	Sr01	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	1st speed run mode	Srn1	*	0: Acc/dec #1, V/F #1, forward run +1: Reverse run +2: Acc/dec #2 +4: V/F #2		0	
	(Up to 15th speed omitted)						
	Emergency stop selection	ESTP		0: Coast-stop 1: Decelerated stop 2: DC injection stop	—	0	Gr.Pr
	2 ESTOP DC injection time	Edbt	*	0~10	0.1 sec.	0.1	
	Retry selection	rtry		0: no retry function 1~10: 1~10 times	—	0	Gr.Pr
	Other than 0 Retry time setting	rtt	*	0.0~10	0.1 sec.	1.0	
	Regeneration power ride-through control	Uvc		0: OFF 1: ON	—	1	Gr.Pr
	1 Ride-through time	Uvct	*	0.0~25	0.1 sec.	2.0	
	Auto-restart (Motor speed search)	ArSt		0: OFF 1: On momentary power failure 2: On ST make/break (commercial power switching) 3: Both 1 and 2		3	Gr.Pr
	Motor overload protection level	tHr1		10~100%/A	1%/A	100	Gr.Pr
	OL reduction start-up frequency	OLF		0~30	0.1/0.01 Hz	30.0	Gr.Pr
	OL selection	OLn		0: Standard +1: Soft-stall ON +2: OLMt trip OFF	—	0	Gr.Pr
	Stall protection	StC1		0: ON 1: OFF	—	0	Gr.Pr
	0 Stall protection level (current limit level adjustment)	StL1	*	10~215%/A	1%/A	150	

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
Gr02 Fan	Feedback control selection	FbP 1		0: No feedback control 1: PID control 2: Speed feedback control	—	0	Gr.Fb
	1-2 Feedback input signal selection	Fb In	*	1: RR input 2: IV input 3: RX input 4: PG feedback (option board) 5: RS232C input 6: Communication (option board) 7: 12-bit binary input	—	2	
	Proportional gain	GP	*	0.01~2.55	0.01	0.30	
	Integral gain	G I	*	0.01~360.0	0.01s	5.0	
	Anti-hunting gain	GA	*	0.0~25.5	0.1s	0.0	
	Lag time constant	GFS	*	0~255	1	80	
	FM terminal function selection	FMSL		0~13 Refer to the standard parameter list for details.	—	0	Gr.AM
	Frequency meter adjustment	FM		—	—	—	Gr.AM
	AM terminal function selection	AMSL		0~13 Refer to the standard parameter list for details.	—	3	Gr.AM
	Ammeter adjustment	AM		—	—	—	Gr.AM

The fan application data initial settings that differ from standard settings are as follows.

Group	Function	Title	Default	Remarks
GrF	Maximum frequency	FH	60.0	—
	Upper limit frequency	UL	60.0	—
	V/F pattern	Pt	2	—
GrSt	Output terminal 0 (RCH) function selection	Ot0	46	Gr.02
	Output terminal 1 (LOW) function selection	Ot 1	48	Gr.02
GrSF	RR input	rr In	1	Gr.02
	1 RR point #2 frequency	F-P2	60.0	
	IV input	Iv In	1	Gr.02
	1 IV point #2 frequency	F-P4	60.0	
GrPr	Regeneration power ride-through control	UvC	1	Gr.02
	Auto-restart (Motor speed search)	ArSt	3	Gr.02
GrUt	Blind function selection	bLnd	1	—
	1 Industrial Application Parameters (Fan)	bL02	1	

Industrial Application Parameters (Conveyor)

When GrUt APL is set to 3, GrU, GrF, GrF2, GrPt, Gr03 and GrUt will be available in settings monitor mode, and the initial setting values will change to those for a conveyor application.

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
Gr03 Conveyor	Input terminal selection	it		0: Standard terminal functions 1: Individual selection	—	0	Gr.St
	1 Input terminal 0 (R)	it0	*	0~51 (Terminal No. : terminal symbol)	0: R	0	
	Input terminal 1 (S1)	it 1	*		1: S1	1	
	Input terminal 2 (S2)	it2	*		2: S2	2	
	Input terminal 3 (S3)	it3	*		3: S3	3	
	Input terminal 4 (S4)	it4	*		4: S4	4	
	Input terminal 5 (F)	it5	*		5: F	5	
	Input terminal 6 (RES)	it6	*		6: RES	6	
	Input terminal 7 (ST)	it7	*		7: ST	7	
	Input terminal 8 (S5)	it8	*		8: S5	8	
	Input terminal 9 (S6)	it9	*		9: S6	9	
	Input terminal 10 (S7)	it10	*		10: S7	10	
	Input terminal 11 (potential terminal)	it11	*		11: Potential terminal	33	
	Output terminal 0 (RCH) function selection	Ot0		0~61	—	6	Gr.St
	Output terminal 1 (LOW) function selection	Ot1				4	
	Output terminal 2 (FL) function selection	Ot2				10	
	Low speed signal output frequency	LF		0~maximum frequency	0.1/0.01 Hz	0.5	Gr.St
	Start-up frequency	F-St		0.0~10	0.1/0.01 Hz	0.5	Gr.SC
	End frequency	F-En		0.0~30	0.1/0.01 Hz	0.5	Gr.SC
	Frequency priority selection #1	FC1		1: RR 2: IV 3: RX 4: PG (pulse input setting) 5: BIN (binary or up/down key setting)		1	Gr.SF
	Frequency priority selection #2	FC2		Same as above		3	Gr.SF
	RR input selection	rr in		0: Standard 1: Adjustable	—	0	Gr.SF
	1 RR reference point #1	P1	*	0~100	1%	0	
	RR point #1 frequency	F-P1	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	RR reference point #2	P2	*	0~100	1%	100	
	RR point #2 frequency	F-P2	*	0~maximum frequency	0.1/0.01 Hz	80.0	
	RX input selection	rE in		0: Standard 1: Adjustable	—	0	Gr.SF
	1 RX reference point #1	P5	*	-100~100	1%	0	
	RX point #1 frequency	F-P5	*	-Maximum frequency~maximum frequency	0.1/0.02 Hz	0.0	
	RX reference point #2	P6	*	-100~100	1%	100	
	RX point #2 frequency	F-P6	*	-Maximum frequency~maximum frequency	0.1/0.02 Hz	80.0	
	Preset speed selection	Sr.n		0: disabled 1~15: speeds (1~15)	—	0	Gr.SF
	Other than 0 Mode selection	Sr.n	*	0: deactivated 1: activated	—	0	

Group	Function		Title		Adjustment range	Resolution	Default	Re-marks
Gr03 Conveyor	Other than 0	1st speed	Sr01	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
		1st speed run mode	Sr01	*	0: Acc/dec #1, V/F #1, forward run +1: Reverse run +2: Acc/dec #2 +4: V/F #2		0	
		(Up to 15th speed omitted)						
	Dynamic braking selection (DBR)		Pb		0: No DBR 1: With DBR, no OLr detection 2: With DBR and OLr detection	—	Depends on inverter rating	Gr.Pr
	Overvoltage stall protection		OPSS		0: ON 1: OFF	—	0	Gr.Pr
	DC injection starting frequency		dbF		0~120	0.1/0.01 Hz	0.0	Gr.Pr
	Other than 0	DC injection current	dbC	*	0~100%/A	1%/A	0	
		DC injection time	dbt	*	0~10	0.1 sec.	0.0	
	Forward/reverse DC injection priority control		dbSL		0: OFF 1: ON	—	0	Gr.Pr
	Motor shaft stationary control		db in		0: OFF 1: ON	—	0	Gr.Pr
	Emergency stop selection		ESTP		0: Coast-stop 1: Decelerated stop 2: DC injection stop	—	0	Gr.Pr
	2	ESTOP DC injection time	Edbt	*	0~10	0.1 sec.	0.1	
	Motor overload protection level		tHr1		10~100%/A	1%/A	100	Gr.Pr
	OL reduction start-up frequency		OLF		0~30	0.1/0.01 Hz	30.0	Gr.Pr
	OL selection		OLn		0: Standard +1: Soft-stall ON +2: OLMt trip OFF	—	0	Gr.Pr
	Stall protection		StC1		0: ON 1: OFF	—	0	Gr.Pr
	0	Stall protection level (current limit level adjustment)	StL1	*	10~215%/A	1%/A	150	
	Output short-circuit detection selection (OCL)		OCLS		0: Standard +1: High-speed motor use +2: Position sensing (during JOG)	—	0	Gr.Pr
	Overtorque trip selection		OtSL		0: Trip disabled 1: Trip enabled	—	0	Gr.Pr
	Overtorque trip level		OtL		0~200%/A	1%/A	150	Gr.Pr
	Fault trip saving		trCL		0: Cleared when powered OFF 1: Data retained when powered OFF	—	0	Gr.Pr
	Feedback control selection		FbP1		0: No feedback control 1: PID control 2: Speed feedback control	—	0	Gr.Fb
	1·2	Feedback input signal selection	Fb in	*	1: RR input 2: IV input 3: RX input 4: PG feedback (option board) 5: RS232C input 6: Communication (option board) 7: 12-bit binary input	—	2	
		Proportional gain	GP	*	0.01~2.55	0.01	30	
		Integral gain	G1	*	0.01~360.0	0.01s	3.0	

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
Gr.03 Conveyor	1-2 Anti-hunting gain	GA	*	0.0~25.5	0.1s	0.0	
	Lag time constant	GFS	*	0~255	1	80	
	PG input - number of pulses	PG		1~9999	1	500	Gr.Fb
	PG input - number of phases	PGPH		1: Single-phase input 2: Two-phase input	—	2	Gr.Fb
	FM terminal function selection	FMSL		0~13 Refer to the standard parameter list for details.	—	0	Gr.AM
	Frequency meter adjustment	FM		—	—	—	Gr.AM
	AM terminal function selection	AMSL		0~13 Refer to the standard parameter list for details.	—	3	Gr.AM
	Ammeter adjustment	AM		—	—	—	Gr.AM
	Number of motor poles	MtP		2, 4, 6, 8, 10, 12, 14, 16	2	4	Gr.Mt
	Motor rated capacity	MtC		0.1~75.0	0.1kW	(Note 1)	Gr.Mt
	Motor type	Mtt		0: Toshiba standard motor 1: Toshiba VF motor 2: Other	—	0	Gr.Mt
	2 Rated voltage	Mtu	*	90~600	5V	200/400	
	Rated frequency	MtF	*	0~400	2Hz	60	
	Rated RPM	Mtr	*	0~9999	1RPM	1710	
	Auto-tuning	Mttn	*	0: Auto-tuning disabled 1: Auto-tuning enabled	—	0	
	Load moment of inertia	Mt.IH		0: Small (Ver100/102) 1: Medium (Ver110 standard) 2: Large 3: Very large	—	1	Gr.Mt

(Note 1) Same as inverter capacity

The conveyor application data initial settings that differ from standard settings are as follows.

Group	Function	Title	Default	Remarks
Gr.F	Acc/Dec #1 pattern	SCu1	2	—
Gr.St	Low-speed signal output frequency	LF	0.5	Gr.03
Gr.SC	Start-up frequency	F-St	0.5	Gr.03
	End frequency	F-En	0.5	Gr.03
Gr.SF	Frequency priority selection #2	FC2	3	Gr.03
Gr.Ut	Blind function selection	bLnd	1	—
	1 Fundamental parameters #2	bLF2	1	
	Pattern run parameters	bLPt	1	
	Industrial Application Parameters (Conveyor)	bL03	1	

Industrial Application Parameters (Hoist)

When GrUt APL is set to 4, GrU, GrF, GrF2, Gr04 and GrUt will be available in settings monitor mode, and the initial setting values will change to those for a hoist application.

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
Gr04 Hoist	Input terminal selection	it		0: Standard terminal functions 1: Individual selection	—	0	Gr.St
	1 Input terminal 0 (R)	it0	*	0~51 Terminal No. : terminal symbol 0: R 1: S1 2: S2 3: S3 4: S4 5: F 6: RES 7: ST 8: S5 9: S6 10: S7 11: Potential terminal		0	
	Input terminal 1 (S1)	it 1	*			1	
	Input terminal 2 (S2)	it2	*			2	
	Input terminal 3 (S3)	it3	*			3	
	Input terminal 4 (S4)	it4	*			4	
	Input terminal 5 (F)	it5	*			5	
	Input terminal 6 (RES)	it6	*			6	
	Input terminal 7 (ST)	it7	*			7	
	Input terminal 8 (S5)	it8	*			8	
	Input terminal 9 (S6)	it9	*			9	
	Input terminal 10 (S7)	it10	*			10	
	Input terminal 11 (potential terminal)	it 11	*			33	
	Output terminal 0 (RCH) function selection	Ot0		0~61	—	6	Gr.St
	Output terminal 1 (LOW) function selection	Ot 1				4	
	Output terminal 2 (FL) function selection	Ot2				10	
	Low-speed signal output frequency	LF		0~maximum frequency	0.1/0.01 Hz	0.5	Gr.St
	Start-up frequency	F-St		0.0~10	0.1/0.01 Hz	0.5	Gr.SC
	End frequency	F-En		0.0~30	0.1/0.01 Hz	0.5	Gr.SC
	Frequency priority selection #1	FC 1		1: RR 2: IV 3: RX 4: PG (pulse input setting) 5: BIN (binary or up/down key setting)		1	Gr.SF
	Frequency priority selection #2	FC2		Same as above		2	Gr.SF
	RR input selection	rr in		0: Standard 1: Adjustable	—	0	Gr.SF
	1 RR reference point #1	P 1	*	0~100	1%	0	
	RR point #1 frequency	F-P 1	*	0~maximum frequency	0.1/0.01 Hz	0.0	
	RR reference point #2	P2	*	0~100	1%	100	
	RR point #2 frequency	F-P2	*	0~maximum frequency	0.1/0.01 Hz	80.0	
	Preset speed selection	Sr.n		0: disabled 1~15: speed (1~15)	—	0	Gr.SF
	Other than 0 Mode selection	Sr.M	*	0: deactivated 1: activated	—	0	
	1st speed	Sr01	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
	1st speed run mode	Sr.1	*	0: Acc/dec #1, V/F #1, forward run +1: Reverse run +2: Acc/dec #2 +4: V/F #2		0	
	(Up to 15th speed omitted)						

Group	Function	Title		Adjustment range	Resolution	Default	Re-marks
Gr.04 Hoist	Dynamic braking selection (DBR)	Pb		0: No DBR 1: With DBR, no OLr detection 2: With DBR and OLr detection	—	Depends on inverter rating	Gr.Pr
	Overvoltage stall protection	OPSS		0: ON 1: OFF	—	0	Gr.Pr
	DC injection starting frequency	dbF		0~120	0.1/0.01 Hz	0.0	Gr.Pr
	Other than 0: DC injection current	dbC	*	0~100%/A	1%/A	0	
	Other than 0: DC injection time	dbt	*	0~10	0.1 sec.	0.0	
	Forward/reverse DC injection priority control	dbSL		0: OFF 1: ON	—	1	Gr.Pr
	Emergency stop selection	ESTP		0: Coast-stop 1: Decelerated stop 2: DC injection stop	—	0	Gr.Pr
	2: ESTOP DC injection time	Edbt	*	0~10 sec.	0.1 sec.	0.1	
	Motor overload protection level	tHr 1		10~100%/A	1%/A	100	Gr.Pr
	OL reduction start-up frequency	OLF		0~30	0.1/0.01 Hz	30.0	Gr.Pr
	OL selection	OLn		0: Standard +1: Soft-stall ON +2: OLMt trip OFF	—	0	Gr.Pr
	Stall protection	StC 1		0: ON 1: OFF	—	0	Gr.Pr
	0: Stall protection level (current limit level adjustment)	StL 1	*	10~215%/A	1%/A	150	
	Output short-circuit detection selection (OCL)	OCLS		0: Standard +1: High-speed motor use +2: Position sensing (during JOG)	—	0	Gr.Pr
	Fault trip saving	trCL		0: Cleared when powered OFF 1: Data retained when powered OFF	—	0	Gr.Pr
	FM terminal function selection	FMSL		0~13 Refer to the standard parameter list for details.	—	0	Gr.AM
	Frequency meter adjustment	FM		—	—	—	Gr.AM
	AM terminal function selection	AMSL		0~13 Refer to the standard parameter list for details.	—	3	Gr.AM
	Ammeter adjustment	AM		—	—	—	Gr.AM
	Number of motor poles	MtP		2, 4, 6, 8, 10, 12, 14, 16	2	4	Gr.Mt
	Motor rated capacity	MtC		0.1~75.0	0.1kW	(Note 1)	Gr.Mt
	Motor type	Mtt		0: Toshiba standard motor 1: Toshiba VF motor 2: Other	—	0	Gr.Mt
	2: Rated voltage	Mtu	*	90~600	5V	200/400	
	Rated frequency	MtF	*	0~400	2 Hz	60	
	Rated RPM	Mtr	*	0~9999	1RPM	1710	
	Auto-tuning	Mtn	*	0: Auto-tuning disabled 1: Auto-tuning enabled	—	0	
	Load moment of inertia	Mt. IH		0~3	—	1	Gr.Mt

(Note 1) Same as inverter capacity

The hoist application data initial settings that differ from standard settings are as follows.

Group	Function	Title	Default	Remarks
Gr.St	Low-speed signal output frequency	LF	0.5	Gr.04
Gr.SC	Start-up frequency	F-St	0.5	Gr.04
	End frequency	F-En	0.5	Gr.04
Gr.Pr	Forward/reverse DC injection priority control	dbSL	1	Gr.04
Gr.Ut	Blind function selection	bLnd	1	—
	1 Fundamental parameters #2	bLF2	1	
	Industrial Application Parameters (Hoist)	bL04	1	

Industrial Application Parameters (Textiles)

When GrUt APL is set to 5, GrU, GrF, GrOS and GrUt will be available in settings monitor mode, and the initial setting values will change to those for a textiles application.

Group		Function	Title		Adjustment range	Resolution	Default	Remarks
GrOS		Input terminal selection	it		0: Standard terminal functions 1: Individual selection	—	0	Gr.St
Textiles	1	Input terminal 0 (R)	it0	*	0~51	0: R	0	
		Input terminal 1 (S1)	it1	*		1: S1	1	
		Input terminal 2 (S2)	it2	*		2: S2	2	
		Input terminal 3 (S3)	it3	*		3: S3	3	
		Input terminal 4 (S4)	it4	*		4: S4	4	
		Input terminal 5 (F)	it5	*	Terminal No. : terminal symbol	5: F	5	
		Input terminal 6 (RES)	it6	*		6: RES	6	
		Input terminal 7 (ST)	it7	*		7: ST	7	
		Input terminal 8 (S5)	it8	*		8: S5	8	
		Input terminal 9 (S6)	it9	*		9: S6	9	
		Input terminal 10 (S7)	it10	*		10: S7	10	
		Input terminal 11 (potential terminal)	it11	*		11: Potential terminal	33	
		Output terminal 0 (RCH) function selection	Ot0		0~61	—	6	Gr.St
		Output terminal 1 (LOW) function selection	Ot1				4	
		Output terminal 2 (FL) function selection	Ot2				10	
		Low speed signal output frequency	LF		0~maximum frequency	0.1/0.01 Hz	0.0	Gr.St
		Frequency priority selection #1	FC1		1: RR 2: IV 3: RX 4: PG (pulse input setting) 5: BIN (binary or up/down key setting)		1	Gr.SF
		Frequency priority selection #2	FC2		Same as above		2	Gr.SF
		RR input selection	rr in		0: Standard 1: Adjustable	—	0	Gr.SF
	1	RR reference point #1	P1	*	0~100	1%	0	
		RR point #1 frequency	F-P1	*	0~maximum frequency	0.1/0.01 Hz	0.0	
		RR reference point #2	P2	*	0~100	1%	100	
		RR point #2 frequency	F-P2	*	0~maximum frequency	0.1/0.01 Hz	80.0	
		Preset speed selection	Sr.n		0: disabled 1~15: speeds (1~15)	—	0	Gr.SF
	Other than 0	Mode selection	Sr.0	*	0: deactivated 1: activated	—	0	
		1st speed	Sr01	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
		1st speed run mode	Sr01	*	0: Acc/dec #1, V/F #1, forward run +1: Reverse run +2: Acc/dec #2 +4: V/F #2		0	
		(Up to 15th speed omitted)						

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
GrOS Textiles	Emergency stop selection	ESTP		0: Coast-stop 1: Decelerated stop 2: DC injection stop	—	0	Gr.Pr
	2 ESTOP DC injection time	Edbt	*	0~10	0.1 sec.	0.1	
	Motor overload protection level	tHr 1		10~100%/A	1%/A	100	Gr.Pr
	OL reduction start-up frequency	OLF		0~30	0.1/0.01 Hz	30.0	Gr.Pr
	OL selection	OLN		0: Standard +1: Soft-stall ON +2: OLMt trip OFF	—	0	Gr.Pr
	Stall protection	StC 1		0: ON 1: OFF	—	1	Gr.Pr
	0 Stall protection level (current limit level adjustment)	StL 1	*	10~215%/A	1%/A	215	
	Fault trip saving	trCL		0: Cleared when powered OFF 1: Data retained when powered OFF	—	0	Gr.Pr
	FM terminal function selection	FMSL		0~13 Refer to the standard parameter list for details.	—	—	Gr.AM
	Frequency meter adjustment	FM		—	—	—	Gr.AM
	AM terminal function selection	AMSL		0~13 Refer to the standard parameter list for details.	—	3	Gr.AM
	Ammeter adjustment	AM		—	—	—	Gr.AM

The textiles application data initial settings that differ from standard settings are as follows.

Group	Function	Title	Default	Remarks
GrPr	Stall protection	StC 1	1	Gr.05
	0 Stall protection level	StL 1	215	
GrUt	Blind function selection	bLnd	1	—
	1 Industrial Application Parameters (Textiles)	bLOS	1	

Industrial Application Parameters (Machine tools)

When GrUt APL is set to 6, Gr.U, Gr.F, Gr.06 and GrUt will be available in settings monitor mode, and the initial setting values will change to those for a machine tools application.

Group	Function		Title		Adjustment range	Resolution	Default	Remarks
Gr.06 Machine tools	Input terminal selection		It		0: Standard terminal functions 1: Individual selection	—	0	Gr.St
	1	Input terminal 0 (R)	It 0	*	0~51 (Terminal No. : terminal symbol)	0: R	0	
		Input terminal 1 (S1)	It 1	*		1: S1	1	
		Input terminal 2 (S2)	It 2	*		2: S2	2	
		Input terminal 3 (S3)	It 3	*		3: S3	3	
		Input terminal 4 (S4)	It 4	*		4: S4	4	
		Input terminal 5 (F)	It 5	*		5: F	5	
		Input terminal 6 (RES)	It 6	*		6: RES	6	
		Input terminal 7 (ST)	It 7	*		7: ST	7	
		Input terminal 8 (S5)	It 8	*		8: S5	8	
		Input terminal 9 (S6)	It 9	*		9: S6	9	
		Input terminal 10 (S7)	It 10	*		10: S7	10	
		Input terminal 11 (potential terminal)	It 11	*		11: Potential terminal	33	
	Output terminal 0 (RCH) function selection		Ot 0		0~61	—	6	Gr.St
	Output terminal 1 (LOW) function selection		Ot 1				4	
	Output terminal 2 (FL) function selection		Ot 2				10	
	Low-speed signal output frequency		LF		0~maximum frequency	0.1/0.01 Hz	0.0	Gr.St
	Frequency priority selection #1		FC 1		1: RR 2: IV 3: RX 4: PG (pulse input setting) 5: BIN (binary or up/down key setting)		1	Gr.SF
	Frequency priority selection #2		FC2		Same as above		2	Gr.SF
	RR input selection		rr in		0: Standard 1: Adjustable	—	0	Gr.SF
	1	RR reference point #1	P 1	*	0~100	1%	0	
		RR point #1 frequency	F-P 1	*	0~maximum frequency	0.1/0.01 Hz	0.0	
		RR reference point #2	P2	*	0~100	1%	100	
		RR point #2 frequency	F-P2	*	0~maximum frequency	0.1/0.01 Hz	80.0	
	Preset speed selection		Sr.n		0: disabled 1~15: speeds (1~15)	—	0	Gr.SF
	Other than 0	Mode selection	Sr.0	*	0: deactivated 1: activated	—	0	
		1st speed	Sr 1	*	Lower limit frequency~upper limit frequency	0.1/0.01 Hz	0.0	
		1st speed run mode	Sr0 1	*	0: Acc/dec #1, V/F #1, forward run +1: Reverse run +2: Acc/dec #2 +4: V/F #2		0	
		(Up to 15th speed omitted)						

Group	Function	Title		Adjustment range	Resolution	Default	Remarks
Gr.08 Machine tools	Dynamic braking selection (DBR)	Pb		0: No DBR 1: With DBR, no OLr detection 2: With DBR and OLr detection	—	Depends on inverter rating	Gr.Pr
	Overvoltage stall protection	OPSS		0: ON 1: OFF	—	0	Gr.Pr
	DC injection starting frequency	dbF		0~120	0.1/0.01 Hz	0.0	Gr.Pr
	Other than 0: DC injection current	dbC	*	0~100%/A	1%/A	0	
	Other than 0: DC injection time	dbt	*	0~10	0.1 sec.	0.0	
	Motor shaft stationary control	db in		0: OFF 1: ON	—	0	Gr.Pr
	Emergency stop selection	ESTP		0: Coast-stop 1: Decelerated stop 2: DC injection stop	—	0	Gr.Pr
	2: ESTOP DC injection time	Edbt	*	0~10	0.1 sec.	0.1	
	Motor overload protection level	tHr 1		10~100%/A	1%/A	100	Gr.Pr
	OL reduction start-up frequency	OLF		0~30	0.1/0.01 Hz	30.0	Gr.Pr
	OL selection	OLn		0: Standard +1: Soft-stall ON +2: OLMt trip OFF	—	0	Gr.Pr
	Stall protection	StC 1		0: ON 1: OFF	—	0	Gr.Pr
	0: Stall protection level (current limit level adjustment)	StL 1	*	10~215%/A	1%/A	215	
	Low current detection selection (output fault detection)	LLP		0: Trip disabled 1: Trip on detection	—	0	Gr.Pr
	Low current detection level	LLPC		0~100%/A	1%/A	0	Gr.Pr
	Low current detection time	LLPt		0~255	1 sec.	0	Gr.Pr
	Output short-circuit detection selection (OCL)	OCLS		0: Standard +1: High-speed motor use +2: Position sensing (during JOG)	—	0	Gr.Pr
	Overtorque trip selection	OtSL		0: Trip disabled 1: Trip enabled	—	0	Gr.Pr
	Overtorque trip level	OtL		0~200%/A	1%/A	150	Gr.Pr
	Fault trip saving	trCL		0: Cleared with powered OFF 1: Data retained when powered OFF	—	0	Gr.Pr
	Override control	Ord 1		0: OFF 1: FCRR 2: FCIV 3: FCRX 4: FCPG 5: FCPNL 6: FCOPT 7: FCMLT	—	0	Gr.Fb
	7: Override change amount setting	Ord2	*	0: Reference 1: KRR 2: KIV 3: KRX 4: KBIN	—	0	
	Override change amount	Ord3	*	−100.0~100.0%	0.1%	0.0	

Group	Function	Title	Adjustment range	Resolution	Default	Remarks
Gr.08 Machine tools	FM terminal function selection	FMSL	0~13 Refer to the standard parameter list for details.	—	0	Gr.AM
	Frequency meter adjustment	FM	—	—	—	Gr.AM
	AM terminal function selection	AMSL	0~13 Refer to the standard parameter list for details.	—	3	Gr.AM
	Ammeter adjustment	AM	—	—	—	Gr.AM

The machine tools application data initial settings that differ from standard settings are as follows.

Group	Function	Title	Default	Remarks
Gr.F	Acc/Dec #1 pattern	SCU 1	3	—
Gr.Pr	0 Stall protection level	StL 1	215	Gr.05
Gr.Ut	Blind function selection	bLnd	1	—
	1 Industrial Application Parameters (Machine tools)	bL08	1	

Appendix Table 5. Changed settings memo

Display the parameters that differ from the standard default settings with GR.U , and make a note of them below. The display sequence is in the order of groups: GR.F → GR.F2 → ··· → GR.nt , so confirm your settings with Appendix Table 1 (page 105).

Inverter rating	VFA5	V	kW	Lot No.

Title	Setting value	Remarks

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