

YD3000N-IP54

INSTRUCTION MANUAL

MULTI-FUNCTION ALL-DIGITAL TYPE

MODEL: YD3000T4 N-IP54

400V CLASS 30-315KW

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.



CAUTION

- May cause injury or electric shock
Please follow the instructions in the manual before installation or operation.
- Disconnect all power before opening front cover of unit. wait 5 minutes until DC BUS capacitors discharge.
- Use proper grounding techniques.

- Thank you for choosing Electric Co., Ltd. produced by the yolico Yd5000 series of high-performance vector control inverter.
- In order to give full play to the function of the drive to ensure the safety of users, please read the operating instructions, and submitted to end-users of this specification, properly preserved.
- If you have any questions, please even if the agent or the Company to contact officers of our business, we will be happy to serve you.
Shown in the figure of this manual is to illustrate the example, may get the product will be different.
- Since product improvement, there will be appropriate changes.
- This book shows the power of interpretation and change rests with the Wuxi City yolico Electric Company Limited.

Safety Information

The following conventions are used to indicate precautions in this manual. Failure to heed precautions provided in this manual can result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.



Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.



Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

The ISO symbol is used in this manual.

Both of these symbols appear on warning labels on Yaskawa products. Please abide by these warning labels regardless of which symbol is used.

Safety Precautions

■ Confirmations upon Delivery

⚠ CAUTION

- Never install an Inverter that is damaged or missing components. Doing so can result in injury.

■ Installation

⚠ CAUTION

- Always hold the case when carrying the Inverter. If the Inverter is held by the front cover, the main body of the Inverter may fall, possibly resulting in injury.
- Attach the Inverter to a metal or other noncombustible material. Fire can result if the Inverter is attached to a combustible material.
- Install a cooling fan or other cooling device when installing more than one Inverter in the same enclosure so that the temperature of the air entering the Inverters is below 45_C. Overheating can result in fires or other accidents.

■ Wiring

⚠ WARNING

- Always turn OFF the input power supply before wiring terminals. Otherwise, an electric shock or fire can occur.
- Wiring must be performed by an authorized person qualified in electrical work. Otherwise, an electric shock or fire can occur.
- Be sure to ground the ground terminal. (400 V class: Ground to 10 Ω or less) Otherwise, an electric shock or fire can occur.
- Always check the operation of any emergency stop circuits after they are wired. Otherwise, there is the possibility of injury. (Wiring is the responsibility of the user.)
- Never touch the output terminals directly with your hands or allow the output lines to come into contact with the Inverter case. Never short the output circuits. Otherwise, electrical shock or grounding can occur.

⚠ CAUTION

- Check to be sure that the voltage of the main AC power supply satisfies the rated voltage of the Inverter. Injury or fire can occur if the voltage is not correct.
- Do not perform voltage withstand tests on the Inverter. Otherwise, semiconductor elements and other devices can be damaged.
- Connect braking resistors, Braking Resistor Units, and Braking Units as shown in the I/O wiring examples. Otherwise, a fire can occur.
- Tighten all terminal screws to the specified tightening torque. Otherwise, a fire may occur.
- Do not connect AC power to output terminals U, V, and W. The interior parts of the Inverter will be damaged if voltage is applied to the output terminals.
- Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. The Inverter can be damaged or internal parts burnt if these devices are connected.
- Do not connect electromagnetic switches or contactors to the output circuits. If a load is connected while the Inverter is operating, surge current will cause the overcurrent protection circuit inside the Inverter to operate.

■ Setting User Constants

CAUTION

- Disconnect the load (machine, device) from the motor before autotuning. The motor may turn, possibly resulting in injury or damage to equipment. Also, motor constants cannot be correctly set with the motor attached to a load.

■ Trial Operation

WARNING

- Check to be sure that the front cover is attached before turning ON the power supply. Do not remove the front cover during operation. An electric shock may occur.
- Do not come close to the machine when the fault reset function is used. If the alarmed is cleared, the machine may start moving suddenly. Also, design the machine so that human safety is ensured even when it is restarted. Injury may occur.
- Provide a separate emergency stop switch; the Digital Operator STOP Key is valid only when its function is set. Injury may occur.
- Reset alarms only after confirming that the RUN signal is OFF. If an alarm is reset with the RUN signal turned ON, the machine may suddenly start. Injury may occur.

CAUTION

- Don't touch the radiation fins (heat sink), braking resistor, or Braking Resistor Unit. These can become very hot. Otherwise, a burn injury may occur.
- Be sure that the motor and machine is within the applicable ranges before starting operation. Otherwise, an injury may occur.
- Provide a separate holding brake if necessary. Otherwise, an injury may occur.
- Don't check signals while the Inverter is running. Otherwise, the equipment may be damaged.
- Be careful when changing Inverter settings. The Inverter is factory set to suitable settings. Otherwise, the equipment may be damaged. You must, however, you must set the power supply voltage jumper for 400 V class Inverters of 18.5 kW or higher (see 5.2.4).

■ Maintenance and Inspection

WARNING

- Do not touch the Inverter terminals. Some of the terminals carry high voltages and are extremely dangerous.
Doing so can result in electric shock.
- Always have the protective cover in place when power is being supplied to the Inverter. When attaching the cover, always turn OFF power to the Inverter through the MCCB.
Doing so can result in electric shock.
- After turning OFF the main circuit power supply, wait until the CHARGE indicator light goes out before performance maintenance or inspections.
The capacitor will remain charged and is dangerous.
- Maintenance, inspection, and replacement of parts must be performed only by authorized personnel.
Remove all metal objects, such as watches and rings, before starting work. Always use grounded tools.
Failure to heed these warning can result in electric shock.

WARNING

- CMOS IC is used in the control board. Handle the control board and CMOS IC carefully. The CMOS IC can be destroyed by static electricity if touched directly.
- The CMOS IC can be destroyed by static electricity if touched directly.
- Do not change the wiring, or remove connectors or the Digital Operator, during operation. Doing so can result in personal injury.

■ Other

WARNING

- Do not attempt to modify or alter the Inverter.
Doing so can result in electrical shock or injury.

Table of Contents

1 Introduction

1.1 Outline and Functions	3-6
---------------------------------	-----

2 Handling Inverters

2.1 Nameplate	7
2.2 Exterior and Mounting Dimensions	7
2.3 Checking and Controlling the Installation Site	8

3 Wiring

3.1 Devices	8
3.2 Connection Diagram	9
3.3 Terminal Block Configuration	10-15
3.4 Wiring Main Circuit Terminals	15-17
3.5 Wiring Check	17

4 Setting User Constants

4.1 Using the Digital Operator	18-19
4.2 Modes	19-29
4.3 Trial Operation Procedures	30-35

5 Trial Operation

5.1 A: Environmental Setting model parameters	38-40
5.2 B: Program mode parameters	
5.2.1 Operation mode selection	40-42
5.2.2 DC braking	42-43
5.2.3 Speed Search	43
5.2.4 Timing function	43
5.2.5 PID control	43-47
5.2.6 Pause	47
5.2.7 Drop function	47
5.2.8 Energy Saving Control	47
5.2.9 Zero servo	48
5.3 C: self-study parameters	
5.3.1 Deceleration time	48-49
5.3.2 S features	49
5.3.3 Slip compensation	49-50
5.3.4 Torque compensation	50-51
5.3.5 Speed control	51
5.3.6 Carrier frequency	51-52
5.3.7 Adjustment disorder prevention function	52
5.3.8 Speed feedback detection	52
5.4 D: the parameters of a relationship instruction	
5.4.1 Frequency command	52-53
5.4.2 Upper frequency limit, lower limit	53
5.4.3 Jump frequency	53-54
5.4.4 Order to maintain the frequency	54
5.4.5 Torque control	54-55

5.5	E: Motor Parameters	
5.5.1	V/f Pattern: E1	55-59
5.5.2	Motor Setup: E2	59-60
5.5.3	Motor 2 Control Method: E3.....	60
5.5.4	Motor 2 V/f Pattern: E4	60-61
5.5.5	Motor 2 Setup: E5	61-62
5.6	F : Options Constants: F	
5.6.1	PG Option Setup: F1	62-63
5.6.2	Other Options Setup: F2 through F9	63-65
5.7	H Terminal Constants:	
5.7.1	Multi-function Inputs	65-79
5.7.2	Multi-function Outputs	79-82
5.7.3	Analog Inputs	83-85
5.7.4	Analog Outputs	85-86
5.7.5	MEMOBUS Communications	86-87
5.8	L : Protection Constants	
5.8.1	Motor Overload	87
5.8.2	Power Loss Ridethrough	87-88
5.8.3	Stall Prevention	88-89
5.8.4	Reference Detection	89
5.8.5	Fault Restart	89-90
5.8.6	Torque Detection.....	90
5.8.7	Torque Limit	90-91
5.8.8	Hardware Protection.....	91-92
5.9	O : Operator Constants	
5.9.1	Monitor Select	92
5.9.2	Multi-function Selections.....	92-93
6	Troubleshooting	
6.1	Protective and Diagnostic Functions.....	94-99
6.2	Fault Detection	100-103
7	Maintenance and Inspection	
7.1	Maintenance and Inspection	104
8	Specifications	
8.1	Standard Inverter Specifications	105
8.2	Specifications of Options and Peripheral Devices	106
9	Appendix	
9.1	Inverter Application Precautions	107-108
9.2	Motor Application Precautions	108-109
9.3	Peripheral Device Application Precautions.....	109
9.4	Wiring Examples.....	110-118
9.5	List configuration parameters	119-124
9.6	Function Block Diagram	124-125
9.7	Installation dimensions	126
Notes	127

1 Introduction

1.1 Outline and Functions

1.1.1 YD3000T4N Inverter Model

YD3000 Inverters are available in 400 V class models. These are listed in the following Table YD3000N Inverter Model

Model Name	Power Capacity (kVA)	Output Current (A)	Compatible Motor		Dimensions (mm)							Frame
			(kW)	(HP)	W	H	D	A1	A2	B	d1	
YD3030T4N-IP54	50	65	30	40	290	470	235	170	170	412	13	F4
YD337P5T4N-IP54	61	80	37	50	400	720	265	240	240	647	13	F5
YD3055T4N-IP54	98	128	55	75	450	780	353	180	158	707	13	F6
YD3093T4N-IP54	140	180	93	125	500	840	395	200	158	767	13	F7
YD3132T4N-IP54	200	260	132	180	500	840	395	200	158	767	13	
YD3160T4N-IP54	230	302	160	215	570	1048	410	200	158	967	13	F8
YD3315T4N-IP54	460	605	315	400	690	1131	410	260	158	1047	13	F9

Input	Power	380-460VAC±10%, 50/60Hz±5%
	Interface	R/S/T, P/N, P/P1(External DCL), Ground
Output	Voltage	0-380VAC (By power)
	Frequency	0-400Hz (SVPWM)
	Interface	U/V/W, Ground
Performance	Overload	150% @ 60S, 180% @ 1S
	Control	VF、SVC, FVC, Torque Cpntrl
	Speed Ratio	SVC 1: 100 FVC 1: 1000
	Speed Accuracy	SVC ±0.2% FVC ±0.01%
	Torque Accuracy	FVC ±5%
Protection	Motor	Electronic thermal protection
	VFD	Overheating, overcurrent, overvoltage, undervoltage, phase loss, short circuit, grounding, overload, etc.
Environment	Temperature and Humidity	-10° C ~ 40°C(40 -50°Derating); 90%RH down
	Altitude	1000M 以下, 1000-3000M Derating used
	Vibration	10-20Hz 9.8m/S ² (1G); 20-50Hz 2.0m/S ² (0.2G)
	Protection Level	IP54

1.1.2 Outline of Control Methods

The YD3000N uses four control methods.

- Open-loop vector control (factory setting)
 - Flux vector control
 - V/f control without PG
 - V/f control with PG feedback
- PG stands for pulse generator (encoder).

Vector control is a method for removing interference with magnetic flux and torque, and controlling torque according to references.

Current vector control independently controls magnetic flux current and torque current by simultaneously controlling the motor primary current and phases. This ensures smooth rotation, high torque, and accurate speed/torque control at low speeds.

Vector control can be replaced by the conventional V/f control system. If the motor constants required for vector control are not known, the motor constants can be automatically set with autotuning.

The control methods are effective for the following applications:

- Open-loop vector control: General variable-speed drive.
- Flux vector control: Simple servodrives, high-precision speed control/torque control.
- V/f control without PG: Conventional inverter control mode. Used for multi-drive operation (connecting multiple motors to one inverter).
- V/f control with PG feedback: Simple speed feedback control. (For applications with the PG connected to the machine shaft rather than the motor shaft.)

The control characteristics for each mode are shown in Table 1.2.

Table 1.2 Control Method Characteristics

	Vector Control		V/f Control	
	Open-loop	Flux Vector	Without PG	With PG feedback
Speed Control Range	1 : 100	1 : 100	1 : 40	1 : 40
Speed Control Precision	±0.2%	±0.02%	±2~3%	±0.03%
Initial Drive	150% at 1 Hz	150% at 0 r/min	150% at 3 Hz	

1.1.3 Functions

■ Autotuning

Autotuning is effective for vector control. It solves problems in applicable motor restrictions and difficult constant settings. The motor constants are automatically set by entering a value from the motor's rating nameplate.

Autotuning allows flux vector control to operate accurately with virtually any normal AC induction motor, regardless of the supplier.

Always autotune the motor separately before operating using vector control. Refer to 5.2.5 Autotuning and 6.4.3 Autotuning for details.

■ Torque Control

Torque control is effective for flux vector control with PG. Torque is controlled by taking multi-function analog input signals as torque references. Torque control accuracy is ±5%. Switching is possible between torque control and speed control.

■ V/f Pattern Settings

V/f pattern settings are effective for V/f control. Select a V/f pattern according to the application from among the 15 preset V/f patterns. Custom V/f patterns can also be set.

■ Frequency References

The following five types of frequency references can be used to control the output frequency of the inverter:

- Numeric input from the Digital Operator
- Voltage input within a range from 0 to 10 V
- Voltage input within a range from 0 to ±10 V (with negative voltages, rotation is in the opposite direction from the run command.)

- Current input within a range from 4 to 20 mA
- Input from Option Card

Any of the above frequency references can be used by setting a constant.

A maximum of nine frequency references can be registered with the Inverter. With remote multi-step speed reference inputs, the Inverter can operate in multi-step speed operation with a maximum of nine speed steps.

■ PID Control

The Inverter has a PID control function for easy follow-up control. Follow-up control is a control method in which the Inverter varies the output frequency to match the feedback value from the sensor for a set target value.

Follow-up control can be applied to a variety of control operations, such as those listed below, depending on the contents detected by the sensor.

- Speed Control: With a speed sensor, such as a tachogenerator, the Inverter regulates the rotating speed of the motor regardless of the load of the motor or synchronizes the rotating speed of the motor with that of another motor.
- Pressure Control: With a pressure sensor, the Inverter performs constant pressure control.
- Flow-rate Control: By sensing the flow rate of a fluid, the Inverter performs precise flow-rate control.
- Temperature Control: With a temperature sensor, the Inverter performs temperature control by fan speed.

■ Zero-servo Control

Zero-servo control is effective with flux vector control. Even at a motor speed of zero (r/min), a torque of 150% of the motor's rated torque can be generated and the average servomotor holding power (stopping power) can be obtained.

■ Speed Control By Feedback

Speed control using feedback is effective with a PG. An optional PG Speed Control Card can be used to enable feedback control for speeds, thereby improving speed control accuracy.

■ Dwell Function

By holding the output frequency for a constant time during acceleration and deceleration, acceleration and deceleration can be performed without stepping out even when driving a motor with a large startup load.

■ Low Noise

The output transistor of the Inverter is an IGBT (insulated gate bipolar transistor). Using sine-wave PWM with a high-frequency carrier, the motor does not generate metallic noise.

■ Monitor Function

The following items can be monitored with the Digital Operator: Frequency reference, output frequency, output current, motor speed, output voltage reference, main-circuit DC voltage, output power, torque reference, status of input terminals, status of output terminals, operating status, total operating time, software number, speed deviation value, PID feedback value, fault status, fault history, etc.

All types of data can be monitored even with multi-function analog output.

■ Multilingual Digital Operator (SPEC:F)

The Digital Operator can display in seven languages (Japanese, English, German, French, Italian, Spanish, and Portuguese). The Digital Operator's liquid crystal display provides a 16-character x 2-line display area.

Easy-to-read displays in each language allow the advanced functions of the Inverter to be set in interactive operations to input constants, monitoring items, etc. Change the constant setting to select the display language.

■ User Constant Structure and Three Access Levels

The YD3000N has a number of user constants for setting various functions. These user constants are classified into a hierarchy to make them easier to use.

The levels are as follows from top to bottom: Modes, Groups, Functions, and Constants. The access levels for the user constants are shown in Table 1.3.

Table 1.3 Access Levels for User Constants

Level	Contents
Mode	Classified according to operation Operation: For operating the Inverter. (All kinds of monitoring are possible.) Initialize: For selecting the language displayed at the Digital Operator, setting access levels, initialization, and the control modes. Programming: For setting user constants for operation. Autotuning: For automatic calculation or setting motor constants. (Only under the vector control mode.) Modified constants: For referencing or changing user constants after shipping.
Groups	Classified by application.
Functions	Classified by function. (See user constants.)
Constants	Individual user constant settings.

The YD3000N allows the following three access levels to be set in order to further simplify setting user constants. (An access level is a range of user constants that can be referenced or set.)

Quick-Start	Reads/sets user constants required for trial operation. [Factory setting]
Basic	Reads/sets user constants that are commonly used.
Advanced	Reads/sets all the user constants that can be used.

In general, press the DATA / ENTER Key to move from an upper to a lower level. This varies somewhat, however, according to the access level, as shown in Fig. 1.1. For the Quick-Start access level, which has few user constants that can be set, pressing the DATA / ENTER Key jumps directly to the user constant level; whereas for the Advanced access level, which has many user constants, pressing the DATA / ENTER Key first leads to the Group level.

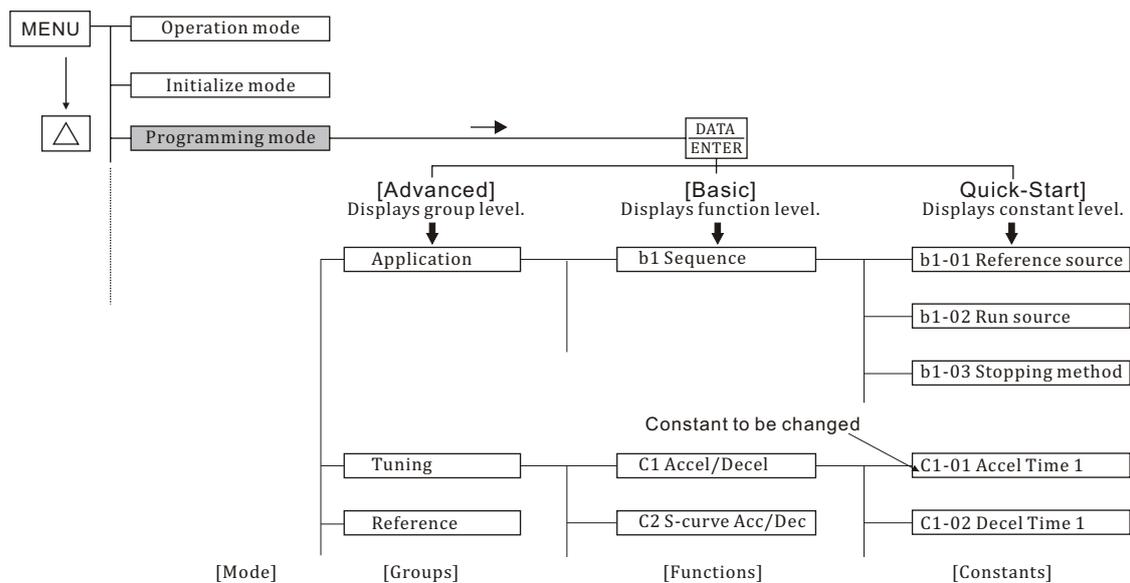


Fig 1.1 Access Level Structure

2 Handling Inverters

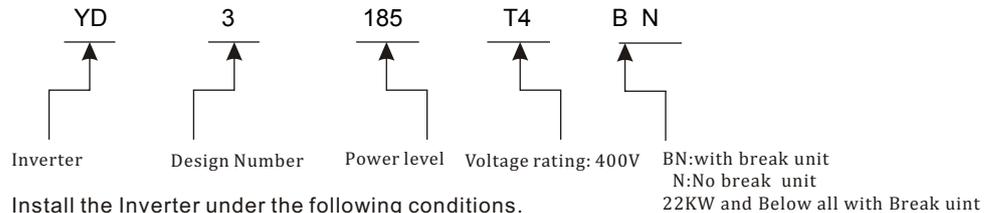
2.1 Example Nameplate

Standard domestic Inverter: 3-phase, 400 VAC, 185kW, IEC IP20 and NEMA 1 standards

Model number	→	INVERTER	WUXI YOLICO ELECTRIC CO.,LTD.
Input specifications	→	MODEL	: YD3185 T4 BN
Output specifications	→	MOTOR RATING	: 250HP/185kW
Lot number	→	INPUT	: AC 3 phase 50/60Hz
		VOVOLLTTAGAGEE	: 380V-460V (+10%,-15%)
		OUTPUT	: AC 3 phases 0-400Hz
		VOLTAGE	: 0-460V
		CURRENT	: 340A
		LOT. NO. :	

SER. NO. :
Yolico No.9,LianHe Road,HuDei Industrial Park,BinHu Borough,Wu xi,China

2.2 Model Description

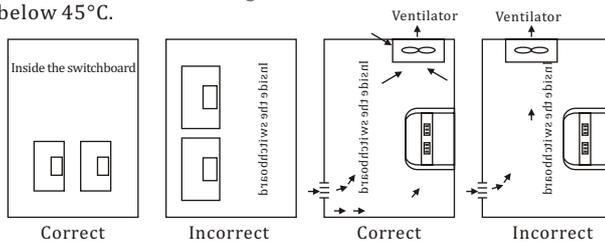


2.3 Installation Site

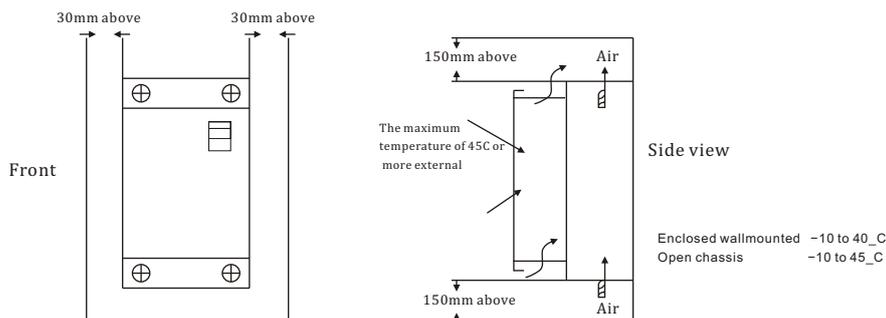
Install the Inverter under the following conditions.

Type Ambient Operating Temperature
 Enclosed wallmounted -10 to 40_C
 Open chassis -10 to 45_C

- Protection covers are attached to the top and bottom of the Inverter. Be sure to remove the protection covers before installing a 200 or 400 V Class Inverter with an output of 15 kW or less in a panel. Do not install the Inverter in a clean location free from oil mist and dust. It can be installed in a totally enclosed panel that is completely shielded from floating dust.
- When installing or operating the Inverter, always take special care so that metal powder, oil, water, or other foreign matter does not get into the Inverter.
- Do not install the Inverter on combustible material, such as wood.
- Install the Inverter in a location free from radioactive materials and combustible materials.
- Install the Inverter in a location free from harmful gasses and liquids.
- Install the Inverter in a location without excessive oscillation.
- Install the Inverter in a location free from chlorides.
- Install the Inverter in a location not in direct sunlight.
- To enhance the reliability of operation, the Inverter should be installed in an environment free from extreme temperature increases. If the Inverter is installed in an enclosed environment, such as a box, use a cooling fan or air conditioner to maintain the internal air temperature below 45°C.



- cover over the Inverter during installation to shield it from metal power produced by drilling.
- Always remove the cover from the Inverter after completing installation. Otherwise, ventilation will be reduced, causing the Inverter to overheat.



3 Wiring

3.1 Connection Diagram

The connection diagram of the YD5000 is shown in Figure 3.2.

When using the Digital Operator, the motor can be operated by wiring only the main circuits.

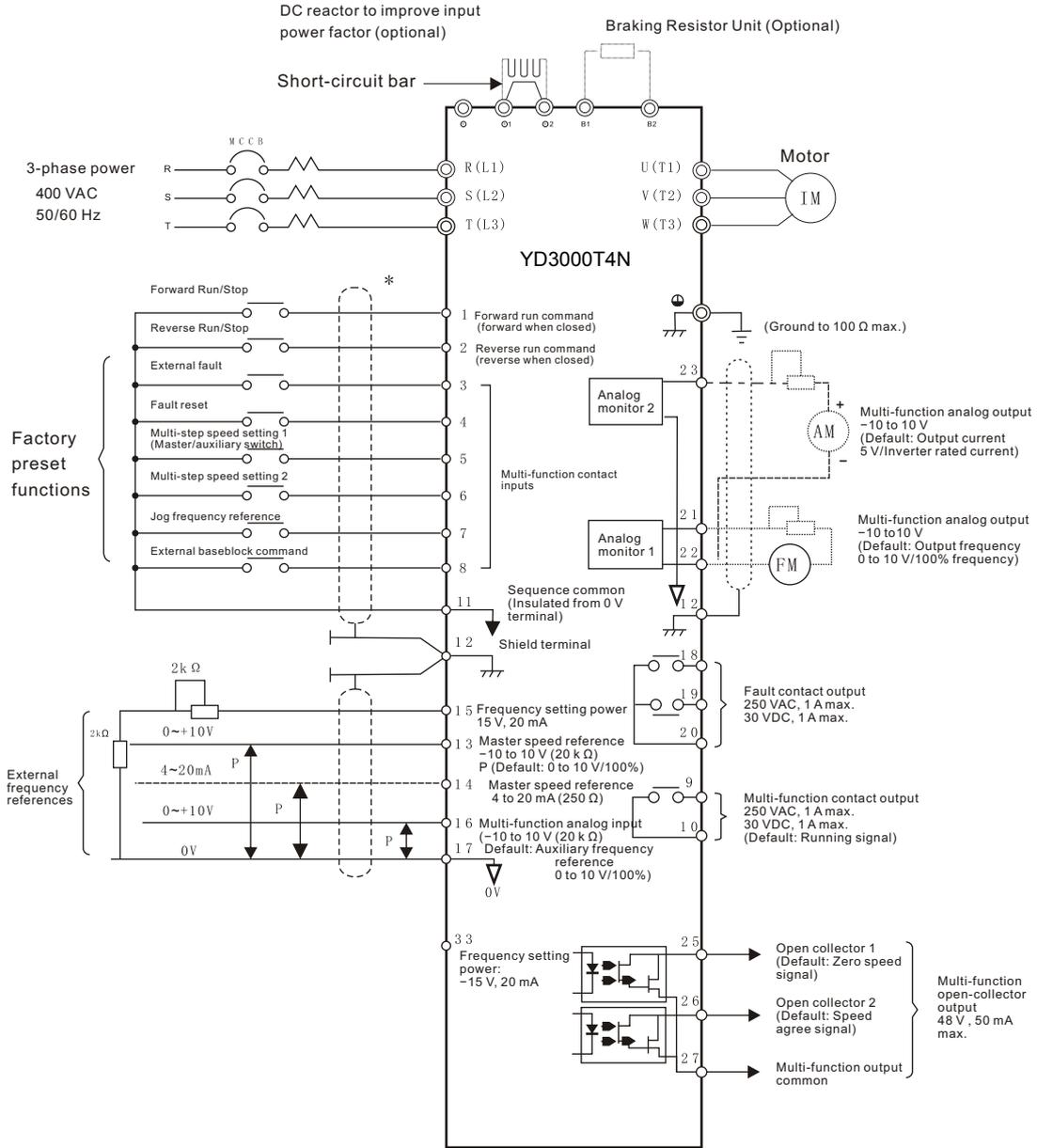


Fig 3.2 Connection Diagram (Model YD3 07P5T4N Shown Above)

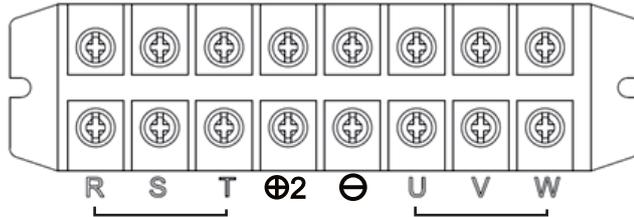
IMPORTANT

1. Control circuit terminals 1 to 33 are not arranged in order of terminal numbers; they are arranged as shown below. Be sure to wire them correctly.

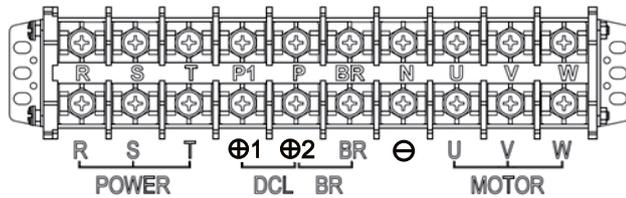
11	12(G)	13	14	15	16	17	25	26	27	33	18	19	20
1	2	3	4	5	6	7	8	21	22	23	9	10	

2. Do not use control circuit terminals 13 and 14 at the same time.
(The two signals will be added inside the Inverter if they are input at the same time.)
3. The maximum output current capacity of the +15 V/-15 V output from control circuit terminals 15 and 33 is 20 mA.
4. The multi-function analog output is a dedicated meter output for a frequency meter, ammeter, etc. Do not use this output for feedback control or for any other control purpose.
Use one of the optional Analog Monitor Cards (AO-08 or AO-012) for analog outputs to the control system.
5. Disable the stall prevention during deceleration (set constant L3-04 to 0) when using a Braking Resistor Unit. If this user constant is not changed to disable stall prevention, the system may not stop during deceleration.
6. Enable protection for the internal DB resistor (model ERF) (set constant L8-01 to 1) when using an internal braking resistor. The braking resistor will not be protected unless this setting is changed to enable protection.
7. DC reactors to improve the input power factor can be connected as an option only to Inverters for 15 kW or less. Remove the short bar from between "1 and "2 when connecting a DC reactor.
8. There is no DC power supply input terminals for 200 V class Inverters of 30 to 75 kW and 400 V class Inverters of 55 to 160 kW, and DC power cannot be input to these Inverters.

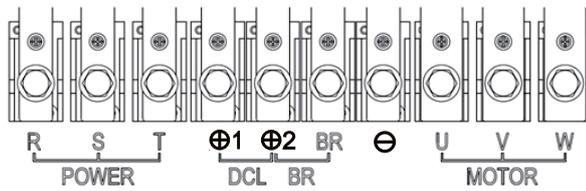
3.2 Terminal Block Configuration



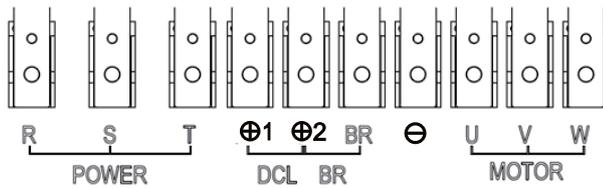
F4:YD3030 T4 N



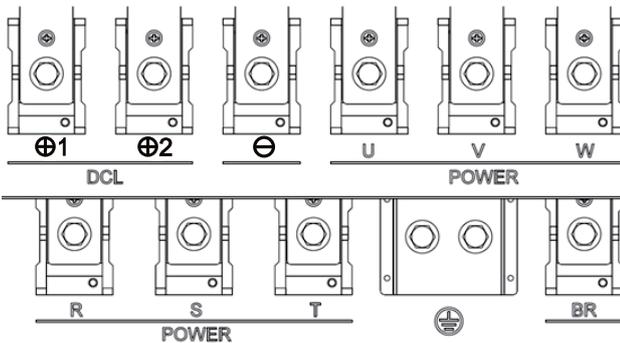
F5:YD3030 T4 BN
YD3045 T4 BN
YD3055 T4 BN



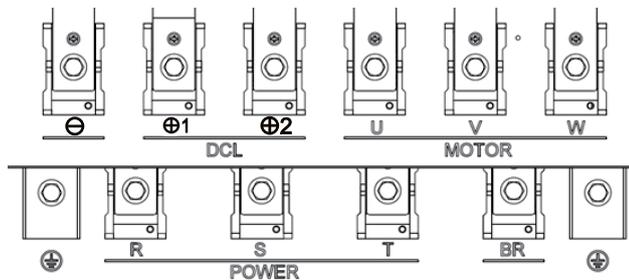
F6:YD3075 T4 BN
YD3093 T4 BN
YD3110 T4 BN



F7:YD3132 T4 BN
YD3160 T4 BN



F8:YD3185 T4 BN
YD3200 T4 BN
YD3220 T4 BN
YD3250 T4 BN



F9:YD3280 T4 BN
YD3315 T4 BN

*R/S/T: Input Power *DCL: DC reactor (When not in use Short circuit chip connection)
*U/V/W: Output (motor) *BR: braking resistor, The other end of the connection "P"

Because of design changes ,There may be differences between the above terminal wiring and physical object
According to the real object

3.3 Wiring the Main Circuits

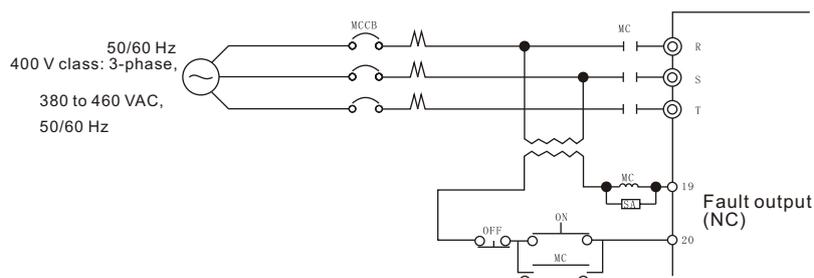
This section describes wiring connections for the main circuit inputs and outputs.

■ Wiring Main Circuit Inputs

Installing a Molded-case Circuit Breaker

Always connect the power input terminals (R, S, and T) and power supply via a molded-case circuit breaker (MCCB) suitable for the Inverter.

- Choose an MCCB with a capacity of 1.5 to 2 times the Inverter's rated current.
- For the MCCB's time characteristics, be sure to consider the Inverter's overload protection (one minute at 150% of the rated output current).
- If the same MCCB is to be used for more than one Inverter, or other devices, set up a sequence so that the power supply will be turned OFF by a fault output, as shown in Figure 3.7.



※ For 400 V class Inverters, connect a 400 V transformer.

Installing a Ground Fault Interrupter

Inverter outputs use high-speed switching, so high-frequency leakage current is generated. Therefore, at the Inverter primary side, use a ground fault interrupter that detects only the leakage current in the frequency range that is hazardous to humans and excludes high-frequency leakage current.

- For the special-purpose ground fault interrupter for Inverters, choose a ground fault interrupter with
- a sensitivity amperage of at least 30 mA per Inverter.

When using a general ground fault interrupter, choose a ground fault interrupter with a sensitivity amperage of 200 mA or more per Inverter and with an operating time of 0.1 s or more.

Installing a Magnetic Contactor

If the power supply for the main circuit is to be shut off during a sequence, a magnetic contactor can be used instead of a molded-case circuit breaker.

When a magnetic contactor is installed on the primary side of the main circuit to forcibly stop the Inverter, however, the regenerative braking does not work and the Inverter will coast to a stop.

- The Inverter can be started and stopped by opening and closing the magnetic contactor on the primary side. Frequently opening and closing the magnetic contactor, however, may cause the Inverter to break down.
- When the Inverter is operated with the Digital Operator, automatic operation cannot be performed after recovery from a power interruption.

Connecting Input Power Supply to the Terminal Block

Input power supply can be connected to any terminal R, S or T on the terminal block; the phase sequence of input power supply is irrelevant to the phase sequence.

Installing an AC Reactor

If the Inverter is connected to a large-capacity power transformer (600kW or more) or the phase advancing capacitor is switched, an excessive peak current may flow through the input power circuit, causing the converter unit to break down.

To prevent this, install an optional AC Reactor on the input side of the Inverter or a DC reactor to the DC reactor connection terminals.

This also improves the power factor on the power supply side.

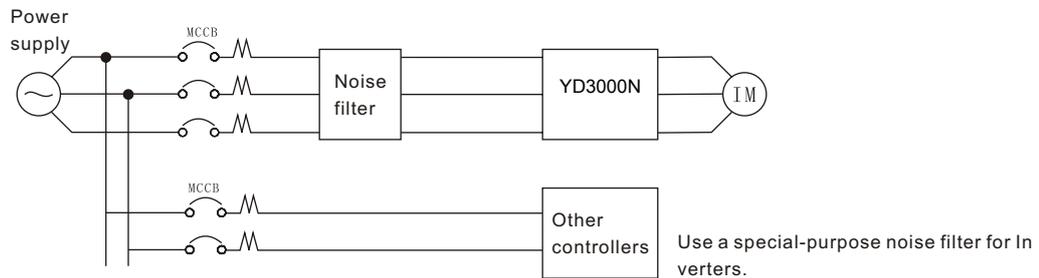
Installing a Surge Absorber

Always use a surge absorber or diode for inductive loads near the Inverter. These inductive loads include magnetic contactors, electromagnetic relays, solenoid valves, solenoids, and magnetic brakes.

Installing a Noise Filter on Power Supply Side

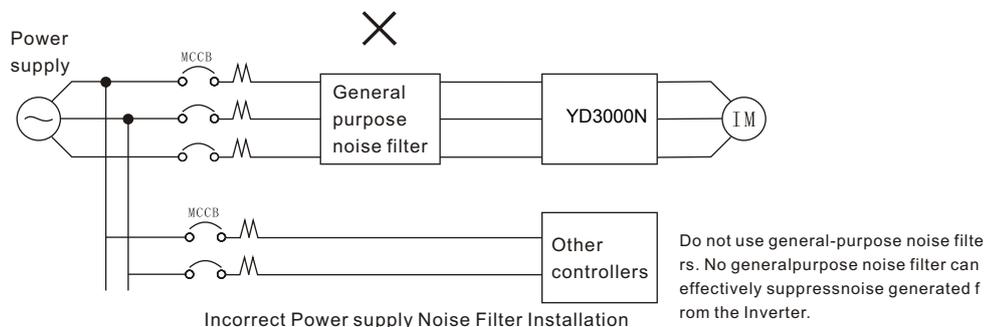
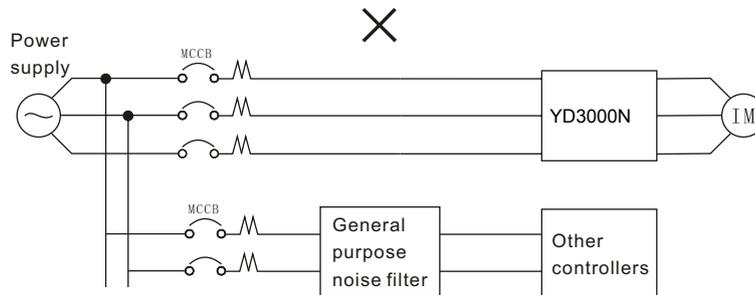
Install a noise filter to eliminate noise transmitted between the power line and the Inverter.

● Wiring Example 1



Correct Power supply Noise Filter Installation

● Wiring Example 2



Incorrect Power supply Noise Filter Installation

■ Wiring on the Output Side of Main Circuit

Connecting the Inverter and Motor

Connect output terminals U, V, and W to motor lead wires U, V, and W, respectively. Check that the motor rotates forward with the forward run command. Switch over any two of the output terminals to each other and reconnect if the motor rotates in reverse with the forward run command.

Never Connect a Power Supply to Output Terminals

Never connect a power supply to output terminals U, V, and W. If voltage is applied to the output terminals, the internal circuits of the Inverter will be damaged.

Never Short or Ground Output Terminals

If the output terminals are touched with bare hands or the output wires come into contact with the Inverter casing, an electric shock or grounding will occur. This is extremely hazardous. Do not short the output wires.

Do Not Use a Phase Advancing Capacitor or Noise Filter

Never to connect a phase advancing capacitor or LC/RC noise filter to an output circuit. Doing so may result in damage to the Inverter or cause other parts to burn.

Do Not Use an Electromagnetic Switch or Magnetic Contactor

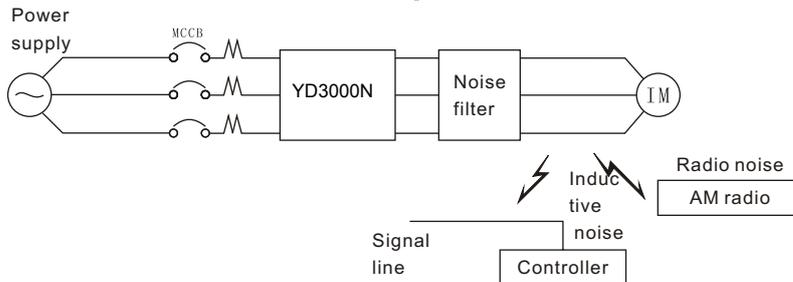
Do not connect an electromagnetic switch or magnetic contactor to an output circuit. If a load is connected to the Inverter during operation, a surge current will actuate the overcurrent protective circuit in the Inverter.

Installing a Thermal Overload Relay

This Inverter has an electronic thermal protection function to protect the motor from overheating. If, however, more than one motor is operated with one Inverter or a multi-polar motor is used, always install a thermal relay (THR) between the Inverter and the motor and set L1-01 to 0 (no motor protection). Set the thermal overload relay to the value on the motor nameplate when operating at 50 Hz and to 1.1 times the value on the nameplate when operating at 60 Hz. The sequence should be designed so that the contacts of the thermal overload relay turn OFF the magnetic contactor on the main circuit inputs.

Installing a Noise Filter on Output Side

Connect a noise filter to the output side of the Inverter to reduce radio noise and inductive noise.



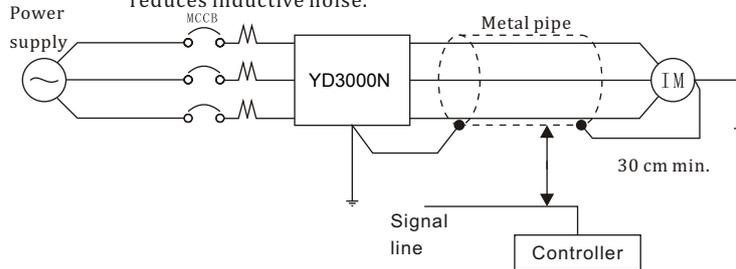
Installing a Noise Filter on the Output Side

Inductive Noise: Electromagnetic induction generates noise on the signal line, causing the controller to malfunction.

Radio Noise: Electromagnetic waves from the Inverter and cables cause the broadcasting radio receiver to make noise.

Countermeasures Against Inductive Noise

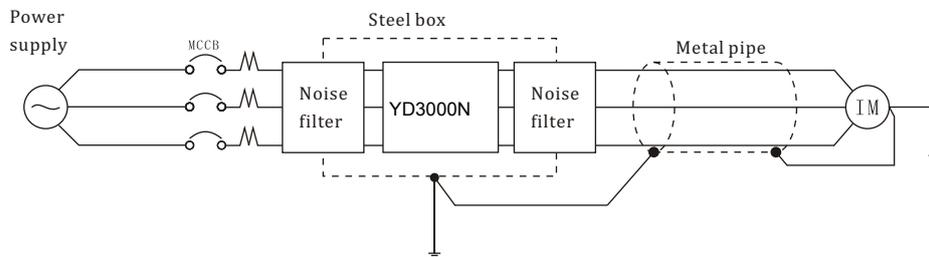
As described previously, a noise filter can be used to prevent inductive noise from being generated on the output side. Alternatively, cables can be routed through a grounded metal pipe to prevent inductive noise. Keeping the metal pipe at least 30 cm away from the signal line considerably reduces inductive noise.



Countermeasures Against Inductive Noise

Countermeasures Against Radio Interference

Radio noise is generated from the Inverter as well as from the input and output lines. To reduce radio noise, install noise filters on both input and output sides, and also install the Inverter in a totally enclosed steel box.



Countermeasures Against Radio Interference

Cable Length between Inverter and Motor

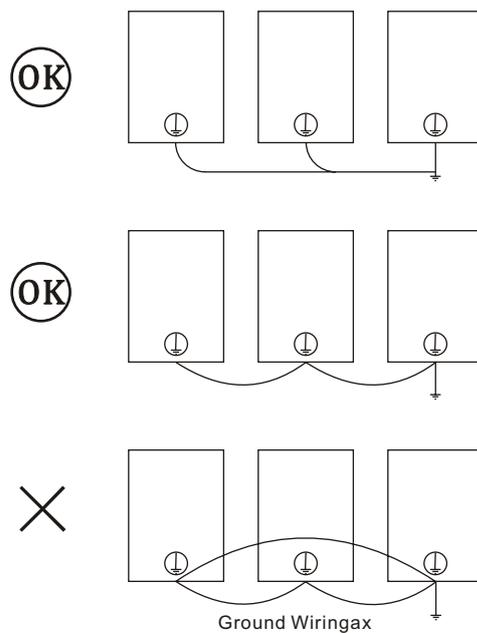
Radio noise is generated from the Inverter as well as from the input and output lines. To reduce radio noise, install noise filters on both input and output sides, and also install the Inverter in a totally enclosed steel box.

The cable between the Inverter and the motor should be as short as possible.

Cable length	50 m max.	100 m max.	More than 100 m
Carrier frequency	15 kHz max.	10 kHz max.	5 kHz max.
(Set value: C6-01)	(15.0)	(10.0)	(5.0)
(Set value: C6-02)	(15.0)	(10.0)	(5.0)
(Set value: C6-03)	(0)	(0)	(0)

Ground Wiring

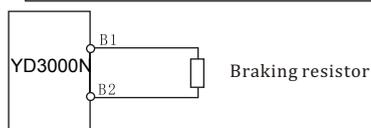
- Always use the ground terminal of the 200 V Inverter with a ground resistance of less than 100 Ω and that of the 400 V Inverter with a ground resistance of less than 10 Ω.
- Do not share the ground wire with other devices, such as welding machines or power tools.
- Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire.
- Leakage current flows through the Inverter. Therefore, if the distance between the ground electrode and the ground terminal is too long, potential on the ground terminal of the Inverter will become unstable. When using more than one Inverter, be careful not to loop the ground wire.



Connecting the Braking Resistor (ERF)

Connect the Braking Resistor Unit and Braking Unit to the Inverter as shown in the Figure 3.15.

L8-01 (Overheat protection of braking resistor)	"1"	(Disables overheat protection)
L3-04 (Stall prevention during deceleration) (Select either one of them.)	"0"	(Disables stall prevention function)
	"3"	(Enables stall prevention function with braking resistor)



Connecting the Braking Resistor

The braking resistor connection terminals are B1 and B2. Do not connect to any other terminals. Connecting to any terminals other than B1 or B2 can cause the resistor to overheat, resulting in damage to the equipment.

■ Connecting the Braking Resistor Unit (LKEB) and Braking Unit (CDBR)

Connect the Braking Resistor Unit and Braking Unit to the Inverter as shown in the Figure 3.15.

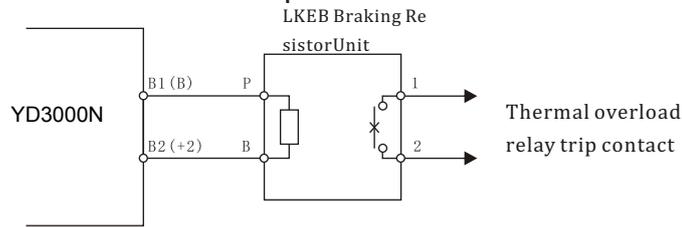
L8-01 (Overheat protection of braking resistor)	"0"	(Disables overheat protection)
L3-04 (Stall prevention during deceleration) (Select either one of them.)	"0"	(Disables stall prevention function)
	"3"	(Enables stall prevention function with braking resistor)

Set L8-01 to "1" before operating the Inverter with the braking resistor without thermal overload relay trip contacts.

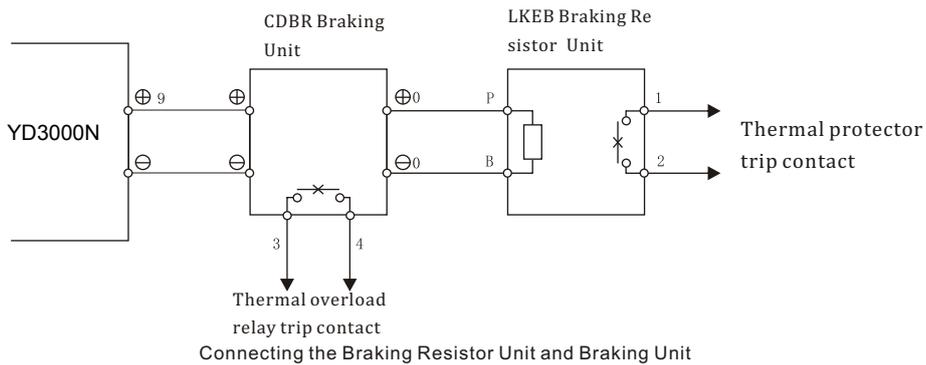
The Braking Resistor Unit cannot be used and the deceleration time cannot be shortened by the Inverter if L3-04 is set to "1" (i.e., if stall prevention is enabled for deceleration).

To prevent the Unit from overheating, design the sequence to turn OFF the power supply for the thermal overload relay trip contacts of the Unit as shown in Figure 3.15.

400V class inverter with 3.7 to 15kw output

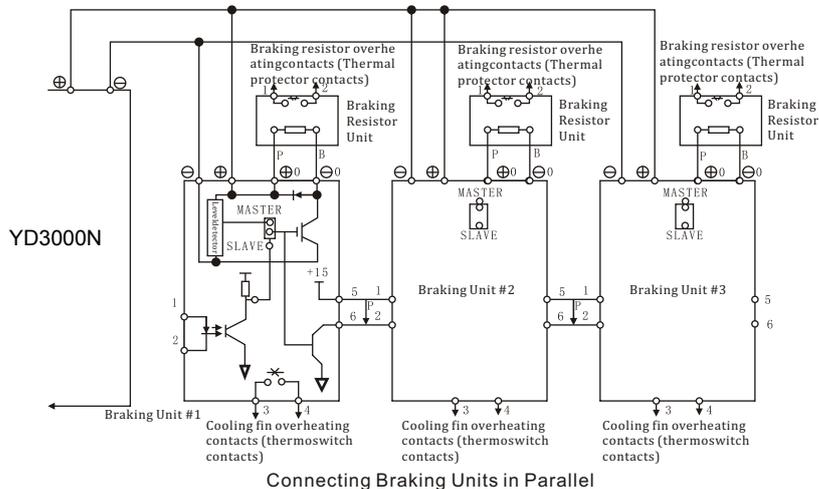


400 V Class Inverters with 18.5 or higher Output



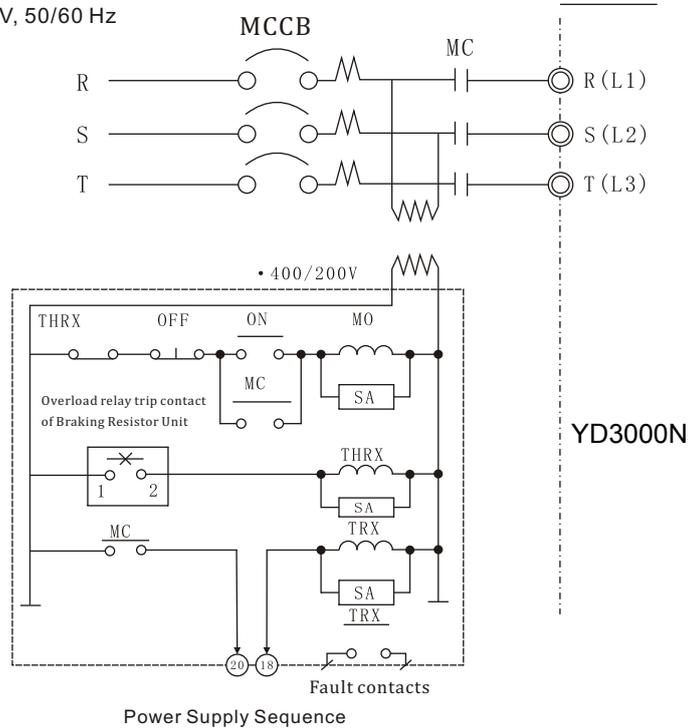
Connecting Braking Units in Parallel

When connecting two or more Braking Units in parallel, use the wiring and connectors shown in Figure 3.16. There are connectors for selecting whether each Braking Unit is to be a Master or Slave. Select "Master" for the first Braking Unit only, and select "Slave" for all other Braking Units (i.e., from the second Unit onwards).



Power Supply Sequence

Three-phase power:
380 to 400 V, 50/60 Hz



3.4 Wiring Control Circuit Terminals

A control signal line must not be longer than 50 m and must be separated from power lines. The frequency reference must be input to the Inverter through twisted-pair wires.

3.4.1 Wire Sizes and Closed-loop Connectors

Terminal numbers and wire sizes are shown in Table 3.7.

Table 3.7 Terminal Numbers and Wire Sizes (Same for all Models)

Terminals	Terminal Screws	Wire Thickness [mm ²]	Wire Type
1~11, 13~33	M3.5	Stranded wire: 0.5 to 1.25 Single wire: 0.5 to 1.25	● Shielded, twisted-pair wire ● Shielded, polyethylene-cove red, vinyl sheath cable
12 (G)	M3.5	0.5~2	

The closed-loop connectors and tightening torques for various wire sizes are shown in Table 3.8.

Table 3.8 Closed-loop Connectors for Ground Terminal

Wire Thickness [mm ²]	Terminal Screws	Crimp Size	Tightening Torque (N G m)
0.5	M3.5	1.25~3.5	0.8
0.75		1.25~3.5	
1.25		1.25~3.5	
2		2~3.5	

3.4.2 Control Circuit Terminal Functions

The functions of the control circuit terminals are shown in Table 3.9. Use the appropriate terminals for the correct purposes.

Table 3.9 Control Circuit Terminals

Type	No.	Signal Name	Function	Signal Level	
Se- quence input signals	1	Forward run/stop command	Forward run when CLOSED; stopped when OPEN.	24 VDC, 8 mA Photocoupler isolation	
	2	Reverse run/stop command	Reverse run when CLOSED; stopped when OPEN.		
	3	External fault input	Fault when CLOSED; normal when OPEN.		
	4	Fault reset	Reset when CLOSED		
	5	Multi-step speed reference 1 (Master/auxiliary switch)	Auxiliary frequency reference when CLOSED.		
	6	Multi-step speed reference 2	Multi-step setting 2 when CLOSED.		
	7	Jog frequency reference	Jog run when CLOSED.		
	8	External baseblock	Inverter output stopped when CLOSED.		
	11	Sequence input common	—		
Analog input signals	15	15 V power output	15 V power supply for analog references	15 V (Max. current: 20 mA)	
	33	-15 V power output	15 V power supply for analog references	-15 V (Max. current: 20 mA)	
	13	Master speed frequency reference	-10~+10V/-100%~+100% 0~+10V/100%	-10~+10V (20k Ω) 0~+10V (20k Ω)	
	14		4~20mA/100%, -10~+10V/-100%~+100% 0~10V/100%	4~20mA (250k Ω)	
	16	Multi-function analog input	-10~+10V/-100%~+100% 0~+10V/100%	Auxiliary analog input (H3-05)	-10~+10V (20k Ω) 0~+10V (20k Ω)
	17	Control common	—	—	—
12	Shield wire, optional ground line connection point	—	—	—	
Se- quence output signals	9	Running signal (1NO contact)	Operating when CLOSED	Multi-function outputs	Dry contacts Contact capacity: 1 A max. at 250 VAC 1 A max. at 30 VDC
	10		Zero level (b2-01) or below when CLOSED		
	25	Zero speed detection	Zero level (b2-01) or below when CLOSED		
	26	Speed agree detection	Within ±2 Hz of set frequency when CLOSED.		
	27	Open-collector output common	—		
	18	Fault output signal (SPDT)	Fault when CLOSED across 18 and 20 Fault when OPEN across 19 and 20		
19					
20					
Analog output signals	21	Frequency output	0 to 10 V/100% frequency	Multi-function analog monitor1 (H4-01, H4-02)	0 to 10 max. ± 5% 2 mA max
	22	Common	—	—	
	23	Current monitor	5 V/Inverter's rated current	Multi-function analog monitor2 (H4-04, H4-05)	

* When driving an L load, such as a relay coil, always insert a flywheel diode as shown in Figure 3.18.

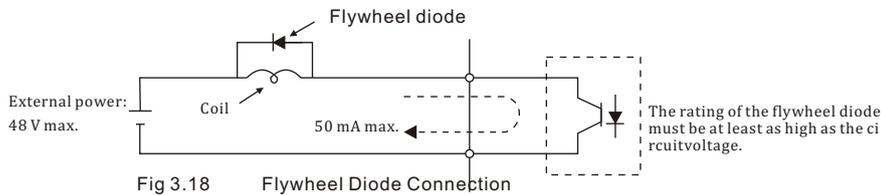


Fig 3.19 Control Circuit Terminal Arrangement

3.4.3 Control Circuit Wiring Precautions

- Separate control circuit wiring (terminals 1 to 33) from main circuit wiring (terminals R, S, T, B1, B2, U, V, W, ©, "1, "2, and "3) and other high-power lines.
- Separate wiring for control circuit terminals 9, 10, 18, 19, and 20 (contact outputs) from wiring for terminals 1 to 8, 21, 22, 23, 25, 26, 27, 33 and 11 to 17.
- Use twisted-pair or shielded twisted-pair cables for control circuits to prevent operating faults. Processable ends as shown in Figure 3.21.
- Connect the shield wire to terminal 12(G).
- Insulate the shield with tape to prevent contact with other signal lines and equipment.

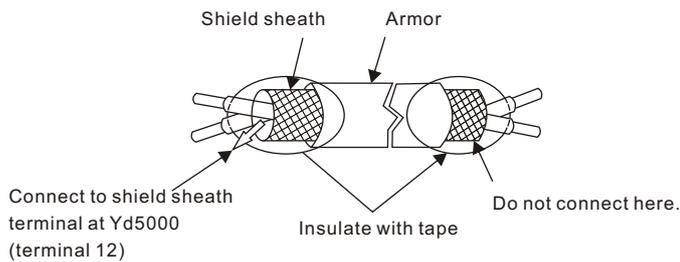


Fig 3.21 Processing the Ends of Twisted-pair Cables

3.6 Wiring Check

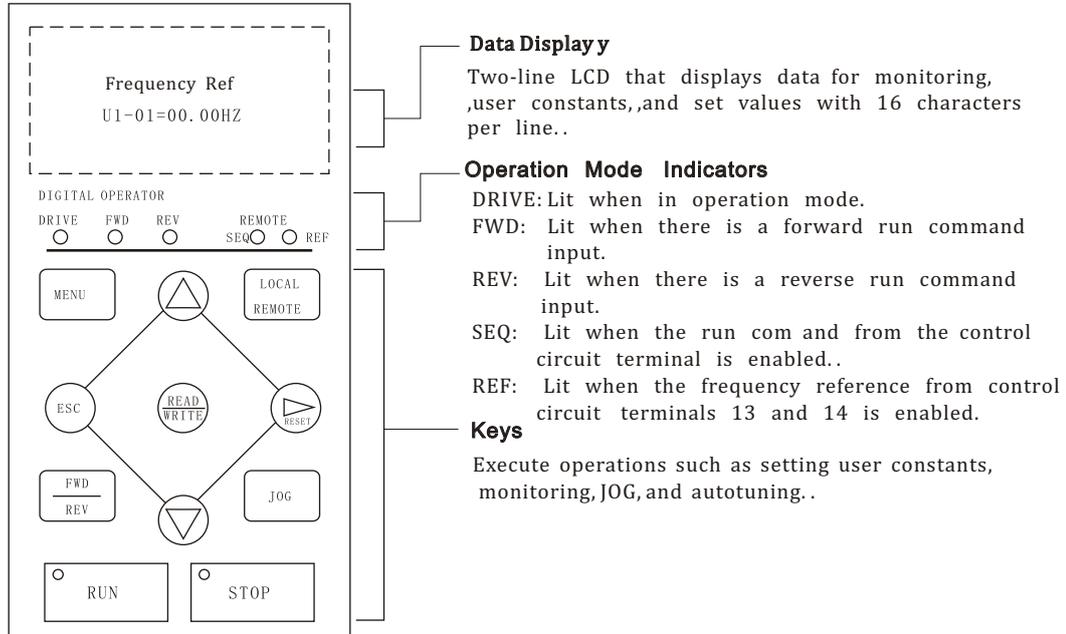
Check all wiring after wiring has been completed. Do not perform a buzzer check on control circuits.

- Is all wiring correct?
- Have any wire clippings, screws, or other foreign material been left?
- Are all screws tight?
- Are any wire ends contacting other terminals?

4 Wiring

4.1 Using the Digital Operator

This section describes the component names and functions of the Digital Operator. The component names and functions are shown in Figure 4.1 and Key functions are described in Table 4.1.

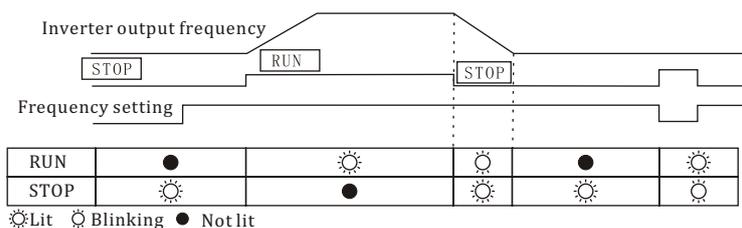


Digital Operator Component Names and Functions

Key Functions

Key	Name	Function
	LOCAL/REMOTE Key	Switches between operation (LOCAL) via the Digital Operator and control circuit terminal (REMOTE) operation. This Key can be enabled or disabled by setting a user constant (o2-01).
	MENU Key	Displays menus.
	ESC Key	Returns to the status before the DATA/ENTER Key was pressed.
	JOG Key	Enables jog operation when the Yd3 000N is being operated from the Digital Operator.
	FWD/REV Key	Selects the rotation direction of the motor when the Yd5000 is being operated from the Digital Operator.
	RESET Key	Sets the number of digits for user constant settings. Also acts as the reset Key when a fault has occurred.
	Increment Key	Selects menu items, groups, functions, and user constant names, and increments set values.
	Decrement Key	Selects menu items, groups, functions, and user constant names, and decrements set values.
	DATA/ENTER Key	Enters menu items, functions, constants, and set values after they are set.
	RUN Key	Starts the YD3 000N operation when the Yd3 000N is in operation with the Digital Operator.
	STOP Key	Stops Yd3 000N operation. This Key can be enabled or disabled by setting a user constant (o2-02) when operating from the control circuit terminal.

Note Except in diagrams, Keys are referred to using the Key names listed in the above table.



The RUN and STOP indicators light and blink to indicate operating status. During DB (initial excitation), RUN blinks and STOP is turned ON.

4.2 Using the Digital Operator

The YD5000 Inverter’s user constants and monitoring functions have been organized in groups called modes that make it easier to read and set user constants. The Yd5000 is equipped with 5 modes, as shown in the Table 4.2.

Table 4.2 Modes

Mode	Primary function(s)
Operation mode	The Inverter can be run in this mode. Use this mode when monitoring values such as frequency references or output current, displaying fault information, or displaying the fault history.
Initialize mode	Use this mode when selecting the language displayed on the Digital Operator, selecting the access level for reading/setting user constants, selecting the control mode, or initializing the user constants.
Programming mode	Use this mode when reading/setting the user constants required for operation. The program-mode functions are subdivided into the following groups: <ul style="list-style-type: none"> • Application: Operation mode selection, DC control, speed search, etc. • Tuning: Acceleration/deceleration times, S-curve characteristics, carrier frequencies, etc. • Reference: Settings related to frequency control • Motor: V/f characteristics and motor constants • Option: Settings for Optional Cards • Terminal: Settings for sequential I/O and analog I/O • Protection: Settings for the motor and inverter protection functions • Operator: Selects the Digital Operator’s display and Key functions
Autotuning mode (See note)	(Usable only with in vector control mode) Use this mode when running a motor with unknown motor constants in the vector control mode. The motor constants are calculated and set automatically.
Modified constants mode	Use this mode to read/set user constants that have been changed from their factory set values.

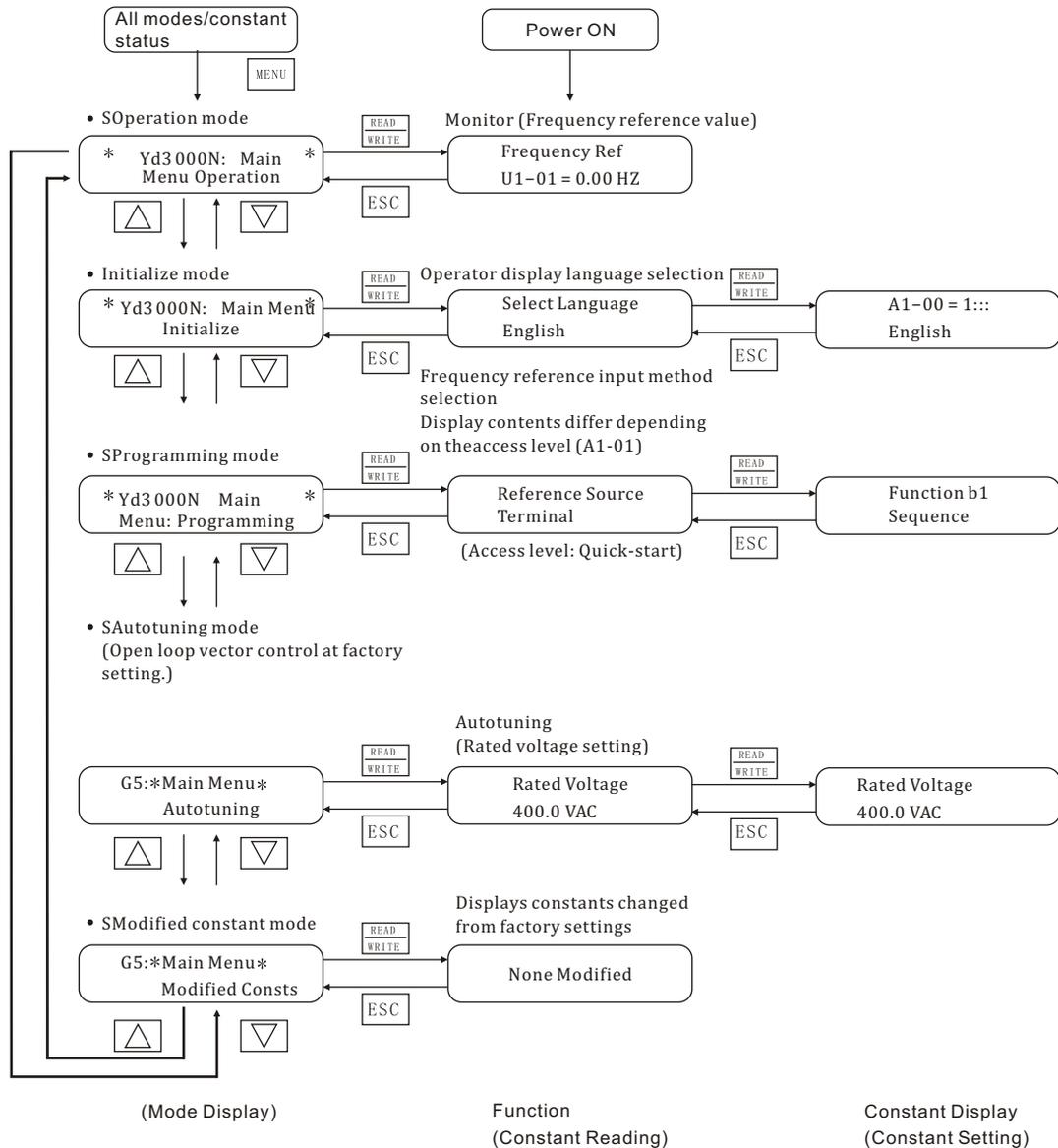
*Note Always perform autotuning before operating in vector control mode. Refer to 5.2.5 Autotuning and 6.4.3 Autotuning for details.

4.2.2 Switching Modes

Once the Inverter has been put into operation mode by pressing the Menu Key, the Increment and Decrement Keys can be pressed to switch to other modes. Press the DATA/ENTER Key to read/set the user constants in each mode.

Press the ESC Key to return to the mode display from the user constant display.

Press the DATA/ENTER Key twice to write a constant and then press the ESC Key to return to the mode display. This is the most Basic operation, so you should remember it.



4.2.3 User Constant Access Levels

The YD3000N has three access levels which divide the various user constants based on their applications, as shown below. The access level restricts which user constants can be set or displayed.

Quick-start	Allows reading/setting of user constants required for simple operation. (factory preset)
Basic	Allows reading/setting of Basic user constants.
Advanced	Allows reading/setting of all user constants.

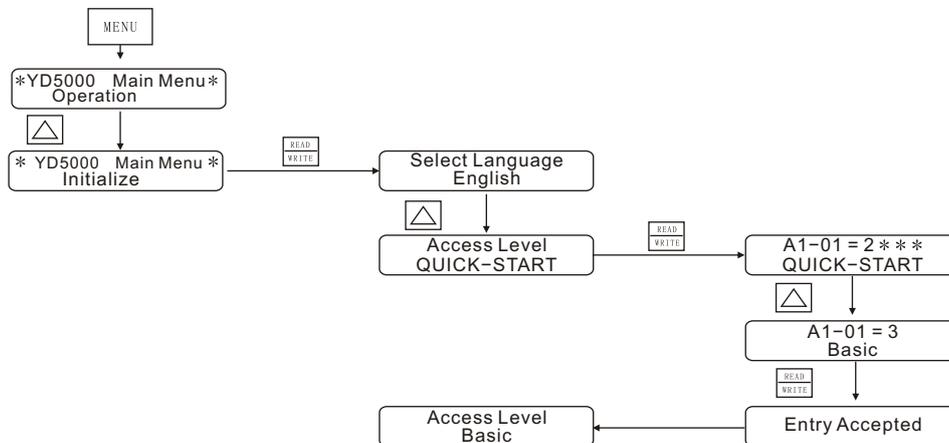
Set the access level in initialize mode with user constant A1-01.

■ Changing the Access Level from Quick-start to Basic

The Inverter is set at the factory to start in the Quick-start access level. Use the following procedure to change from the Quick-start level to the Basic level.

Step	Key Sequence	Digital Operator Display	Remarks
1	MENU	* YD3 000N Main Menu * Operation	
2	△	* YD3 000N Main Menu * Initialize	
3	READ WRITE	Select Language English	
4	△	Access Level QUICK-START	
5	READ WRITE	A1-01 = 2 * * *	
6	△	A1-01 = 3 Basic	
7	READ WRITE	Entry Accepted Access Level Basic	After approx. 3 seconds, the Operator display is as shown on the left.

As shown above, Quick-start has changed to Basic. These seven steps can be illustrated as when in Figure 4.4.



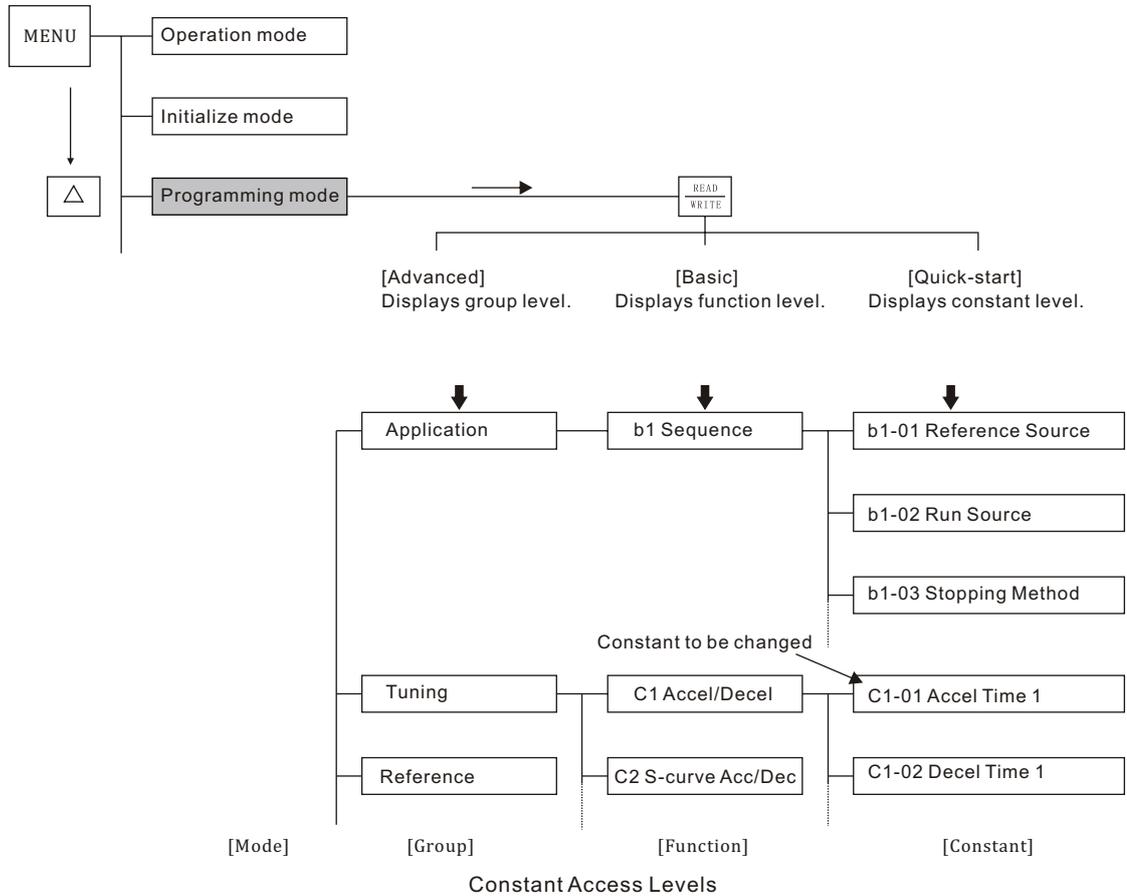
Changing Quick-start to Basic

■ Setting User Constants in Each Access Level

The displayed access level will change when programming mode is selected. The display will not change for access levels in operation mode, initialize mode, autotuning mode, and modified constants mode.

This section provides the procedure to change the acceleration time to 20.0 s in each access level. The acceleration time (C1-01) is a user constant in programming mode.

If the new user constant setting is not written to the Unit by pressing the DATA/ENTER Key within one minute after starting the procedure, the display will automatically revert to the original user constant setting. In this case, the procedure must be started again.



4.2.4 Operation Mode

Operation mode is the mode in which the Inverter can be operated.

Many user constants can't be changed when the Inverter is operating. Refer to User Constant List for details.

The following monitor displays are possible in operation mode: The frequency reference, output frequency, output current, and output voltage, as well as fault information and the fault history.

IMPORTANT

When running the Inverter after using digital operator, press the MENU Key to enter the operation mode and then press the DATA/ENTER Key from the operation mode display to bring up the monitor display. Run commands can't be received from any other display. (Monitor display in the operation mode appears when the power is turned ON.)

■ Operations in Operation Mode

Key operations in operation mode are shown in Figure 4.6.

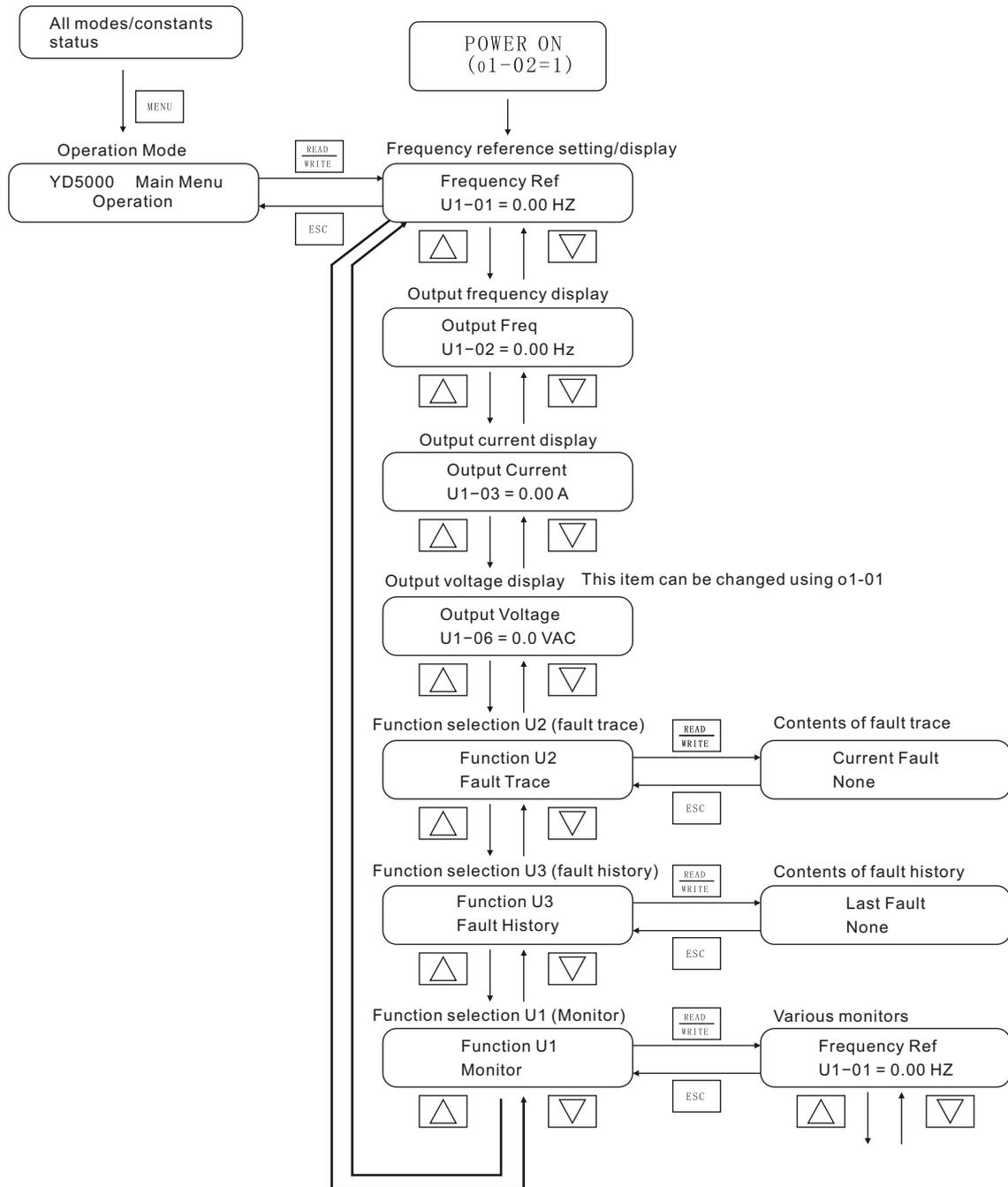


Fig 4.6 Operations in Operation Mode

■ **Conditions for Monitoring**

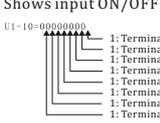
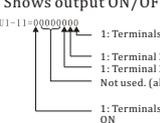
Table 4.3 shows the items that can be monitored in operation mode.

The "Valid access levels" column in the table indicates whether an item can be monitored in a particular access level and control method. The codes in this column have the following meanings.

Q	Items that can be monitored in all access levels. (Quick-start, Basic, and Advanced)
B	Items that can be monitored in the Advanced and Basic access levels.
A	Items that can be monitored only in the Advanced access level.
X	Items that cannot be monitored in the control mode shown.

The output signal levels for multi-function analog outputs shown in the table are for a gain of 100. 0 and a bias of 0.00.

Table 4.3 Constants Monitored in Operation Mode

Function	Constant No.	Name	Function	Output Signal Levels for Multi-function Analog Outputs	Min. Unit	Valid Access Levels			
						V/f	V/f w/ PG	Open-loop Vector	Flux Vector
Digital Operator Display									
Stat us Mon itor	U1-01	Frequency reference Frequency Ref	Monitors/sets the frequency reference value. The display units can be set with user constant o1-03.	10 V: Max. frequency 0 to ±10 V possible)	0.01Hz	Q	Q	Q	Q
	U1-02	Output frequency Output Freq	Monitors the output frequency. The display units can be set with user constant o1-03.	10 V: Max. frequency 0 to ±10 V possible)	0.01Hz	Q	Q	Q	Q
	UP-03	Output current Output Current	Monitors the output current.	10 V: Rated current 0 to +10 V output)	0.01A	Q	Q	Q	Q
	U1-04	Control method Control Method	Shows which control mode is set.	Can't be output	—	Q	Q	Q	Q
	U1-05	Motor speed Motor Speed	Monitors the motor speed. The display unit setting can be changed using o1-03.	10 V: Max. frequency 0 to ±10 V possible)	0.01Hz	×	Q	Q	Q
	U1-06	Output voltage Output Voltage	Monitors the Inverter's internal output voltage reference value.	10 V: 200 (400) VAC 0 to +10 V output)	0.1V	Q	Q	Q	Q
	U1-07	DC bus voltage DC Bus Voltage	Monitors the DC voltage of the Inverter's internal main circuit.	10 V: 400 (800) VDC 0 to +10 V output)	1V	Q	Q	Q	Q
	U1-08	Output power Output kWatts	Monitors the output power. This is an internally detected value.)	10 V: Max. motor capacity 0 to ±10 V possible)	0.1KW	Q	Q	Q	Q
	U1-09	Torque reference Torque Reference	Monitors the internal torque reference value when vector control is used.	10 V: Rated torque 0 to ±10 V possible)	0.1%	×	×	Q	Q
	U1-10	Input terminal status Input Term Sts	Shows input ON/OFF status. 	Can't be output.	—	Q	Q	Q	Q
	U1-11	Output terminal status Output Term Sts	Shows output ON/OFF status. 	Can't be output.	—	Q	Q	Q	Q

Function	Constant No.	Name	Function	Output Signal Levels for Multi-function Analog Outputs	Min. Unit	Valid Access Levels			
						V/f	V/f w/ PG	Open-loop Vector	Flux Vector
Digital Operator Display									
Status Monitor	U1-12	Operation status	Inverter operating status.	Can't be output.	—	Q	Q	Q	Q
		Int Ctl Sts 1							
	U1-13	Cumulative operation time	Monitors the Inverter's elapsed operating time. The initial value and running/power-on time selection can be set with user constants o2-07 and o2-08.	Can't be output.	1小时	Q	Q	Q	Q
	U1-14	Software No.	Manufacturer's ID number	Can't be output.	—	Q	Q	Q	Q
		FLASH ID							
	U1-15	Terminal 13 input voltage level	Monitors the input voltage of the frequency reference (voltage). An input of 10 V corresponds to 100%.	10 V: 100% (10 V) (0 to ±10 V possible)	0.1%	B	B	B	B
		Term 13 Level							
	U1-16	Terminal 14 input current level	Monitors the input current of the frequency reference (current). An input of 20mA corresponds to 100%.	20 mA: 100% (20 mA) (0 to +10 V output)	0.1%	B	B	B	B
		Term 14 Level							
	U1-17	Terminal 16 input voltage level	Monitors the input voltage of the multi-function analog input. An input of 10 V corresponds to 100%.	10 V: 100% (10 V) (0 to +10 V output)	0.1%	B	B	B	B
		Term 16 Level							
	U1-18	Motor secondary current (Iq)	Monitors the calculated value of the motor's secondary current (Iq). The motor's rated secondary current corresponds to 100%.	10 V: Rated secondary current (0 to +10 V output)	0.1%	B	B	B	B
		Mot SEC Current							
	U1-19	Motor exciting current (Id)	Monitors the calculated value of the motor's excitation current (Id). The motor's rated secondary current corresponds to 100%.	10 V: Rated secondary current (0 to +10 V output)	0.1%	X	X	B	B
		Mot EXC Current							
	U1-20	Output frequency after soft-start	Monitors the output frequency after a soft start. The display shows the frequency with out the correction from compensation functions such as slip compensation.	10 V: Max. Frequency (0 to +10 V possible)	0.1Hz	A	A	A	A
		SFS Output							
	U1-21	ASR input	Monitors the input to the speed control loop. The max. frequency corresponds to 100%.	10 V: Max. Frequency (0 to +10 V possible)	0.1%	X	A	X	A
		ASR Input							
	U1-22	ASR output	Monitors the output from the speed control loop. The motor's rated secondary current corresponds to 100%.	10 V: Rated secondary current (0 to +10 V possible)	0.1%	X	A	X	A
ASR Output									
U1-23	Speed deviation	Monitors the speed deviation within the speed control loop. The max. frequency corresponds to 100%.	10 V: Max. Frequency (0 to +10 V possible)	0.1%	X	A	X	A	
	Speed Deviation								
U1-24	PID feedback value	Monitors the feedback value when PID control is used. The input for the max. frequency corresponds to 100%.	10 V: Max. Frequency (0 to +10 V possible)	0.1%	A	A	A	A	
	PID Feedback								
U1-25	DI-16H2 input status	Monitors the reference value from a YD 5000-DI16H2 Digital Reference Card. The value will be displayed in binary or BCD depending on user constant F3-01.	Can't be output. Can't	—	A	A	A	A	
	DI-16 Reference								
U1-26	Output voltage reference (Vq)	Monitors the Inverter's internal voltage reference value for the motor's secondary current control.	10 V: 200 (400) VAC (0 to +10 V possible)	0.1%	X	X	A	A	
	Voltage Ref (Vq)								
U1-27	Output voltage reference (Vd)	Monitors the Inverter's internal voltage reference value for the motor's excitation current control.	10 V: 200 (400) VAC (0 to +10 V possible)	0.1%	X	X	A	A	
	Voltage Ref (Vd)								

Function	Constant No.	Name	Function	Output Signal Levels for Multi-function Analog Outputs	Min. Unit	Valid Access Levels			
						V/f	V/f w/ PG	Open-loop Vector	Flux Vector
Digital Operator Display									
Status Monitor	U1-28	Software No. (CPU) CPU ID	Manufacturer's CPU software ID number	Can't be output.	0.1V	A	A	A	A
	U1-32	ACR output of q axis ACR (q) Output	Monitors current control output value for motor's secondary current.	10V: 100%	0.1%	X	X	A	A
	U1-33	ACR output of d axis ACR (d) Output	Monitors current control output value for motor's excitation current.	10V: 100%	0.1%	X	X	A	A
	U1-34	OPE fault constant OPE Detected	Shows the first constant number where an OPE fault is detected.	Can't be output.	—	A	A	A	A
	U1-35	Zero servo movement pulses	Shows the number of PG pulses for the movement range at the stop point for a zero servo times 4.	Can't be output.	0.1%	X	X	X	A
	U1-36	PID input volume PID Input	PID command + PID command bias - PID feedback volume. The input for the max. frequency corresponds to 100%.	10V: Max frequency	0.01%	A	A	A	A
	U1-37	PID output volume PID Output	PID control output. The input for the max. frequency corresponds to 100%.	10V: Max frequency	0.01%	A	A	A	A
	U1-38	PID command PID Setpoint	PID command + PID command bias. The input for the max. frequency corresponds to 100%.	10V: Max frequency	0.01%	A	A	A	A
Fault trace (See note.)	U2-01	Current fault Current Fault	Information on the current fault		—	Q	Q	Q	Q
	U2-02	Last fault Last Fault	Information on the last fault		—	Q	Q	Q	Q
	U2-03	Frequency reference at fault Frequency Ref	Frequency reference value when the "last fault" occurred.		0.01Hz	Q	Q	Q	Q
	U2-04	Output frequency at fault Output Freq	Output frequency when the "last fault" occurred.		0.01Hz	Q	Q	Q	Q
	U2-05	Output current at fault Output Current	Output current when the "last fault" occurred.		0.1A	Q	Q	Q	Q
	U2-06	Motor speed at fault Motor Speed	Motor speed when the "last fault" occurred.	Can't be output.	0.01Hz	X	Q	Q	Q
	U2-07	Output voltage reference at fault Output Voltage	Output voltage when the "last fault" occurred.		0.1V	Q	Q	Q	Q
	U2-08	DC bus voltage at fault DC Bus Voltage	The main circuit DC voltage when the "last fault" occurred.		1V	Q	Q	Q	Q
	U2-09	Output power at fault Output kWatts	Output power when the "last fault" occurred.		0.1KW	Q	Q	Q	Q
	U2-10	Torque reference at fault Torque Reference	Torque reference when the "last fault" occurred. (The rated torque = 100%.)		0.1%	X	X	Q	Q
	U2-11	Input terminal status at fault Input Term Sts	Input terminal status when the "last fault" occurred. (Same format as U1-10.)		—	Q	Q	Q	Q

Function	Constant No.	Name	Function	Output Signal Levels for Multi-function Analog Outputs	Min. Unit	Valid Access Levels			
						V/f	V/f w/ PG	Open-loop Vector	Flux Vector
Digital Operator Display									
Fault trace (See note.)	U2-12	Output terminal status at fault	Output terminal status when the "last fault" occurred.		—	Q	Q	Q	Q
		Output Term Sts	(Same format as U1-11.)						
	U2-13	Operation status at fault	Inverter operating status when the "last fault" occurred.	Can't be output.	—	Q	Q	Q	Q
Inverter status		(Same format as U1-12.)							
	U2-14	Cumulative operation time at fault	Elapsed operating or power-on time when the "last fault" occurred.		1 hr	Q	Q	Q	Q
Fault history (See note.)	U3-01	Most recent fault	Information on the last fault.	—	Q	Q	Q	Q	
		Last Fault							
	U3-02	Second most recent fault	Information on the 2nd to last fault.	—	Q	Q	Q	Q	
		Fault Message 2							
	U3-03	Third most recent fault	Information on the 3rd to last fault.	—	Q	Q	Q	Q	
		Fault Message 3							
	U3-04	Fourth/oldest fault	Information on the 4th to last fault.	—	Q	Q	Q	Q	
		Fault Message 4							
	U3-05	Cumulative operation time at fault	Elapsed running or power-on time when the last fault occurred.	Can't be output.	1 hr	Q	Q	Q	Q
		Elapsed Time 1							
	U3-06	Accumulated time of second fault	Elapsed running or power-on time when the 2nd to last fault occurred.		1 hr	Q	Q	Q	Q
		Elapsed Time 2							
U3-07	Accumulated time of third fault	Elapsed running or power-on time when the 3rd to last fault occurred.		1 hr	Q	Q	Q	Q	
	Elapsed Time 3								
U3-08	Accumulated time of fourth/oldest fault	Elapsed running or power-on time when the 4th to last fault occurred.		1 hr	Q	Q	Q	Q	
	Elapsed Time 4								

Note Faults CPF00, 01, 02, 03, UV1 and UV2 are not recorded in the fault history.

■ Monitoring at Startup

In operation mode, the frequency reference, output frequency, output current, and output voltage can be monitored immediately if the factory presets are being used. One of these four values, the output voltage, can be changed to a different monitor item. When an item other than the output voltage is to be monitored, set that value in user constant o1-01 (Monitor selection). Refer to the example procedure given later in this manual.

When the power is turned ON, the frequency reference will appear in the Unit's data display if the factory presets are being used. Any one of the four values monitored at startup (frequency reference, output frequency, output current, or the value set in user constant o1-01) can be selected to appear when the power is turned ON.

The value that appears at startup is determined by user constant o1-02 (Monitor selection after power up).

User constants o1-01 and o1-02 can be changed in the Basic or Advanced access levels. These user constants

can be changed during operation.

■ Monitor Displays

The following notation is used in this manual when describing user constants.

User Constant Number	Display Name	Change during Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f	V/f w/ PG	Open-loop Vector	Flux Vector
o1-01	Monitor selection	0	4~38	—	6	B	B	B	B

Use the last two digits from the U1 Monitor list (U1- □□) to select a value. For example, the torque reference is U1-09, so input 9 to select the torque reference.

Change during Operation	Indicates whether or not the constant can be changed during operation.	
	0	Can be changed during operation.
	X	Cannot be changed during operation.
Setting Range	The setting range for the constant.	
Units	The unit used to set the constant ("—" indicates that no unit is used).	
Factory Setting	The value preset at the factory. (There are different factory settings for each control method, i.e., if the control method is changed, the factory setting can also change.)	
PG V/f	Indicates the control methods and access levels under which the constant can be accessed and set.	
	Q	Accessible/settable under all access levels (Quick-start, Basic, and Advanced).
	B	Accessible/settable under Advanced or Basic access levels.
	A	Accessible/settable under Advanced access level.
	X	Not accessible/settable in the specified control method.

User Constant Number	Name	Change during Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f	V/f w/ PG	Open-loop Vector	Flux Vector
o1-02	Monitor selection after power up	0	1~4	—	1	B	B	B	B

Use constant o1-02 to indicate which value will be displayed when the Inverter is started. Refer to the following table.

Monitor Display Contents at Startup

Setting	Contents
1	Indicates the frequency reference at startup.
2	Indicates the output frequency at startup.
3	Indicates the output current at startup.
4	Indicates the value set in user constant o1-01 at startup.

4.3 Procedure

Perform trial operation according to the following operational flow.

Item	
Installation and Mounting ↓	Install the Inverter according to the installation conditions. Ensure that the installation conditions are met.
Wiring and Connection ↓	Connect to the power supply and peripheral devices. Select peripheral devices which meet the specifications and wire correctly.
Power ON ↓	Carrying out the following pre-connection checks before turning ON the power supply: <ul style="list-style-type: none"> Always ensure that a power supply of the correct voltage is used and that the power input terminals (R, S, T) are wired correctly. 400 V class: 3-phase 380 to 460 VDC, 50/60 Hz Make sure that the Motor output terminals (U, V, W) and the Motor are connected correctly. Make sure that the control circuit terminals and the control device are wired correctly. Make sure that all control circuit terminals are turned OFF. When using a PG Speed Control Card, ensure that it is wired correctly. Set the motor to no-load status, (not connected to the mechanical system). Having conducted the above checks, connect the power supply.
Check the Display Status ↓ *1	Check to be sure that there are no faults in the Inverter. <ul style="list-style-type: none"> If the display at the time the power is connected is normal, it will read as follows: Data Display: Frequency Ref When an fault has occurred, the details of the fault will be displayed. In that case, refer to Section 9 Maintenance Operations.
Setting the Input Voltage ↓	Set the Inverter input voltage (E1-01) to the correct voltage.
Set the Motor ↓	Set the proper motor protection (E1-02).
Autotuning *2 ↓	Execute autotuning for the motor separately before operating in open-loop vector control or Flux vector control modes. <ul style="list-style-type: none"> When autotuning is executed, motor constants are set automatically. When this is not possible using autotuning, switch to V/f control mode and set the V/f pattern.
No-load Operation ↓	Start the no-load motor using the Digital Operator. <ul style="list-style-type: none"> Set the frequency reference using the Digital Operator and start the motor using key sequences.
Actual Load Operation ↓	Connect the mechanical system and operate using the Digital Operator. <ul style="list-style-type: none"> When there are no difficulties using the no-load operation, connect the mechanical system to the motor and operate using the Digital Operator.
Operation	Basic Operation: Operation based on the basic settings required to start and stop the Inverter. Advanced Operation: Operation which uses PID control or other functions. <ul style="list-style-type: none"> For operation within standard constants select "Basic Operation." To use the various applied functions such as, direct current control braking, speed search, timer, S-curve acceleration/deceleration, slip compensation, torque compensation, droop control, zero-speed, and torque control, select "Advanced Operation" in combination with "Basic Operation."
* 1 It is sometimes necessary to initialize constants after checking the display status.	
Initializing Constants	Initialize the constants. <ul style="list-style-type: none"> Check the Inverter capacity setting (kVA) in o2-04 before replacing the controller PCB with a spare.

4.3 Trial Operation Procedures

4.3.1 Power ON

■ Checkpoints before Turning ON the Power Supply

- Check that the power supply is of the correct voltage.
400 V class: 3-phase 380 to 460 VDC, 50/60 Hz
Make sure that the motor output terminals (U, V, W) and the motor are connected
- correctly. Make sure that the Inverter control circuit terminal and the control device are
- wired correctly. Set all Inverter control circuit terminals to OFF.
- When using a PG Speed Control Card, make sure that it is wired correctly.
- Make sure that the motor is not connected to the mechanical system (no-load status)
-

4.3.2 Checking the Display Status

If the Digital Operator's display at the time the power is connected is normal, it will read as follows:

[Normal] Frequency Ref
U1-01 = 0.00 HZ The frequency reference monitor is displayed in the data display section.

When an fault has occurred, the details of the fault will be displayed instead of the above display. In that case, refer to Section 9 Maintenance Operations. The following display is an example of a fault display.

[Fault] UV
Under Voltage The display will differ depending on the type of fault.

4.3.3 Initializing Constants

- When replacing the controller PCB, check the Inverter capacity (kVA) in o2-04 first and then initialize constants to the factory settings. There is no need to initialize constants the first time trial operation is performed after purchasing the Inverter.
- To initialize the constants, set "2220" in A1-03 (Initialize).
- After initialization, the access level is set to Quick-start (A1-01). The following table shows the setting method for Quick-start.
Use the following procedure to initialize constants.

Step	Key Sequence	Digital Operator Display	Remarks
1		Frequency Ref U1-01 = 0.00 HZ	Displays operation mode.
2		*YD5000 Main Menu* Operation	Displays initialize mode.
3		*YD5000 Main Menu* Initialize	Puts the Inverter in initialize mode.
4		Select Language English	Displays the Initialize display.
5	 Press 3 times. 	Initialize Select	Displays the constant setting for A1-03.
6		A1-03 = 0 ** Select	Initializes for a 2-wire sequence.
7	 	A1-03 = 2220 2-wire Initial	Writes the set values. "Entry Accepted" is displayed for approximately 0.5 seconds.
8		Entry Accepted * Initialize	Returns to the Initialize display.
		Select YD3000N Main Menu*	Returns to the initialize mode display.
		Initialize	

4.3.4 Setting Input Voltage

Set the input voltage of the Inverter (E1-01) according to the power supply voltage.

■ Input Voltage: E1-01

User Constant Number	Name	Change during Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f	V/f w/ PG	Open-loop Vector	Flux Vector
E1-01	Input voltage setting	×	310-510	VAC	400	Q	Q	Q	Q

* Values in parentheses are for 400 V class Inverters.

Step	Key Sequence	Digital Operator Display	Remarks
1		Main Menu Initialize	Displays initialize mode.
		Main Menu Programming	Displays programming mode.
2		Frequency Ref Terminal	Puts the Unit in programming mode.
3		Input Voltage E1-01 = 400 VAC	Displays the input voltage setting display.
			The leading digit will blink
4		Input Voltage 400 VAC	The 2nd digit will blink.
			Set to "3"
5	Press 10 times	Input Voltage 400 VAC	The set value is overwritten. "Entry
6		Input Voltage 420 VAC	Accepted" is displayed for approximately 0.5 seconds.
			Returns to the input voltage display.
7	Press 3 times	Entry Accepted	Check that the data has been updated.
		Input Voltage E1-01 = 420 VAC	Returns to the programming mode display.
8		Main Menu Programming	

Motor Selection (Motor Overheating Protection): E1-02

Set the type of motor being used with the motor selection constant (E1-02). This setting is a reference for the motor overheat protection.

User Constant Number	Name	Change during Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f	V/f w/ PG	Open-loop Vector	Flux Vector
E1-02	Motor selection (motor overheating protection)	×	0~2	-	0	Q	Q	Q	Q

E1-02 Settings

Setting	Function
0	Standard motor (general-purpose motor)
1	Special motor (inverter-exclusive motor)
2	Special motor (vector-exclusive motor)

4.2.5 Autotuning

Autotuning Operation

Use the following procedure to autotune the motor constants, i.e., set them automatically.

Step	Key Sequence	Digital Operator Display	Remarks
1		YD3 000N Main Menu Programming	Displays programming mode
		YD3 000N Main Menu Auto-Tuning	Displays autotuning mode
2		Rated Voltage 400.0 VAC	Displays the rated voltage.*1, *2
3		Rated Current 1.90 A	Displays the rated current.*1
4		Rated Frequency 60.0 HZ	Displays the rated frequency.*1, *2
5		Rated Speed 1750 RPM	Displays the rated speed.*1
6		Number of Poles 4	Displays the number of poles.*1
7		Select Motor ½ 1	Displays the motor selection. (Leave set at "1" for motor 1 (the normally used motor constants).)
8		\\/ /\\ Tuning Ready ? /\\ Press RUN key /\\	Displays a confirmation prompt for the start of the autotuning function. (The lower line will blink.)
9		\\/ /\\ Tune Proceeding /\\ □HZ □□A /\\	Starts the autotuning function. (The upper line will blink.)
10		Tune Successful	
		Main Menu Operation	

* 1 When the values displayed and the motor constants differ, set each value separately.

* 2 There are differences between simple and advanced settings. Refer to the table below.

Operator Display	Simple Setting (Motor nameplate)	Advanced Setting*
Rated Voltage	Motor rated voltage	No-load voltage at rated revolutions
Rated Frequency	Motor rated frequency	No-load frequency at rated revolutions

* The rated voltage for the vector control motor may be 10% to 20% lower than general-purpose motors. Always check the voltage on the motor nameplate or in the test reports.



Disconnect the load (machine, device) from the motor before autotuning. The motor may turn, possibly resulting in injury or damage to equipment. Also motor constants cannot be correctly set with the motor attached to a load.

The following example procedure changes the motor rated current to 1.60 A.

Step	Key Sequence	Digital Operator Display	Remarks
1			Displays the rated current.
			When changing the set values, press the DATA/ENTER Key and the digit to change will blink.
2			Select the digit to be changed.
3			Set to 001.60 A.
			Press the DATA/ENTER Key to overwrite the set values. "Entry Accepted" will be displayed for approximately 0.5 seconds.
4			
			Returns to the rated current display.

- When autotuning has been executed correctly, the constants (E1-04 to E2-09) will be automatically written. Use the following troubleshooting procedure if a fault occurs during autotuning.

Troubleshooting Autotuning Faults

The displays and countermeasures for autotuning faults are shown below in Table 5.1. If one of these faults is detected, it will be displayed on the Operator and the motor will coast to a stop. The fault contact and alarm contact outputs will not function. When a fault occurs, "Tune Aborted" will be displayed and the messages shown in the following table will blink.

Table 5.1 Troubleshooting Autotuning Faults

Display Message	Fault	Description	Countermeasure
Data Invalid	Motor data fault	Motor data error for autotuning.	<ul style="list-style-type: none"> • Check the input data. • Check the Inverter and motor capacities.
Resistance	Line resistance fault	Autotuning was not completed within a set time.	<ul style="list-style-type: none"> • Check the input data. • Check the motor wiring.
No-load Current	No-load current fault		
Saturation-1	Saturated core coefficient 1 fault		
Saturation-2	Saturated core coefficient 2 fault		
Rated Slip	Rated slip fault		
Accelerate	Acceleration fault	The motor did not accelerate within a set time.	<ul style="list-style-type: none"> • Increase the acceleration time (C1-01). • Increase the torque limits (L7-01, -02) if these have been decreased. • Disconnect the motor from the machine if it has been connected.
PG Direction	Motor direction fault	There is a contact fault between the Inverter, PG (phase A and B), and motor (phases U, V, and W)	<ul style="list-style-type: none"> • Check the PG wiring. • Check the motor wiring. • Check the PG direction and constant F1-05.
Motor Speed	Motor speed fault	The torque reference was too large (100%) during autotuning.	<ul style="list-style-type: none"> • Disconnect the motor from the machine if it has been connected. • Increase the acceleration time (C1-01). • Check the input data (particularly the number of PG pulses).
ALARM: Over Load	Tuning overload fault	The torque reference was over 20% during autotuning.	Check the input data (particularly the number of PG pulses) if the motor is being autotuned separately.
Tune Aborted Minor Fault: □□□	Minor fault	A minor Inverter fault occurred.	Check the minor fault indicated in the boxes in the display shown at the left.
V/f Over Setting	V/f setting exceeded	The torque command exceeded 100%, and the no-load current exceeded 70% of the motor's rated current.	<ul style="list-style-type: none"> • Check and adjust settings if necessary. • Remove the load from the motor.

- Fault displays can be cleared by pressing the MENU Key.
 - All set constants (motor constants) will be initialized if a fault occurs. Reset the constants from the beginning when before starting autotuning again.
- Inverter software Nos. VSG101020 to VSG101026 will display "ALARM: Over Load" when the torque command exceeds 100%.

■ **Switching to V/f Control when Autotuning Is Not Successful**

When autotuning has not been executed correctly (i.e., when “Tune Aborted” is displayed), switch the control method to “V/f control” and set the V/f pattern.

1. Change the control method to V/f control without PG.

Step	Key Sequence	Digital Operator Display	Remarks
1		YD3000N Main Menu Operation	Displays operation mode.
2		Main Menu Initialize	Displays initialize mode.
3		Select Language English	Put the unit in initialize mode. (Select Language display)
4		Control Method Open Loop Vector	The control method selection is displayed.
5	Press twice. 	A1-02=2 *** Open Loop Vector	Control method selection (A1-02) is displayed.
6		A1-02=0 V/f Control	Selects V/f control.
7	Press twice. 	Entry Accepted	These values are overwritten.
		Control Method V/f Control	Return to the control method select display.
8		YD3000N: Main Menu Operation	Return to the operation mode display.

2. Check the motor nameplate and set the following three items.

User Constant Number	Name	Change during Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f	V/f w/ PG	Open-loop Vector	Flux Vector
E1-05	Max.voltage	×	0-510	VAC	400	Q	Q	Q	Q
E1-06	Base frequency	×	0.0~400.0	Hz	60.0	Q	Q	Q	Q
E2-01	Motor rated current	×	10~200%	A	*	Q	Q	Q	Q

* The factory setting for rated current differs according to the inverter capacity. This setting procedure for these three constants is as follows:

Step	Key Sequence	Digital Operator Display	Remarks
1		YD3000N* Main Menu* Operation	Displays operation mode
	Press twice. 	YD3000N* Main Menu* Programming	Displays programming mode.
2		Reference Source Terminal	Put the unit in programming mode.
3		Max. Voltage E1-05=400.0VAC	Displays the maximum voltage.
4		Base Frequency E1-06=60.0HZ	Displays the maximum voltage frequency.
5		Motor Rated FLA E2-01=1.90A	Displays the rated current.
6		YD3000N* Main Menu * Operation	Return to the operation mode display.

* When there are discrepancies between the displayed values and the rating, set each value individually.

4.3.6 No-load Operation

This section describes trial operation in which the motor is operated from the Digital Operator with the motor in the no-load state (with the motor not connected to the mechanical system)

■ Setting the Frequency Reference

Set the frequency reference on the frequency reference monitor in the operation mode

The following is an operation example with the frequency reference set to 10Hz.

Step	Key Sequence	Digital Operator Display	Remarks
		YD3000N: Main Menu : Operation	Displays operation mode
1		FrequencyRef U1-01=0.00HZ	Puts the Unit in operation mode and displays the frequency reference.
2		FrequencyRef U1-01=0.00HZ	Switches operation to the Digital Operator. (SEQ, REF and LED indicator turn OFF.)
3		FrequencyRef 000.00HZ	Set the frequency reference.
4		FrequencyRef 000.00HZ	The tens digit blinks.
5		FrequencyRef 000.00HZ	Set to 010.00Hz.
		Entry Accepted	These set values are overwritten.
		FrequencyRef 010.00HZ	Return to the frequency reference display.

■ Operation Using the Digital Operator

- Press the FWD/REV Key. The motor will rotate in the reverse direction.
- Press the Stop Key. The motor will stop. (The RUN Key indicator will keep blinking until the motor stops.)
- The frequency reference can be changed, even during operation. When this is done, the frequency reference is changed as soon as the DATA/ENTER Key is pressed to input the set values.
- If the Jog Key is pressed when the Inverter is stopped, it will rotate by the jog frequency (Factory setting: 6.0Hz) only while the Key is being pressed.

■ Checking the Operating Status

- After changing the frequency reference or the rotation direction, check that there is no oscillation or abnormal sound from the motor.
- Check that no faults have occurred in the Inverter during operation.

4.3.7 Loaded Operation

After checking the operation with the motor in no-load status as described in 4.3.6, connect the load mechanical system and perform trial operation with an actual load.

■ Connecting the Load System

- After confirming that the motor has stopped completely, connect the mechanical system.
- Be sure to tighten all the screws when securing the motor shaft to the mechanical system.

■ Operation using the Digital Operator

- Use the Digital Operator in the same way as in no-load operation.
- If a fault occurs during operation, make sure the STOP Key on the Digital Operator is easily accessible.
- At first, set the frequency reference to a low speed of one tenth the normal operating speed.

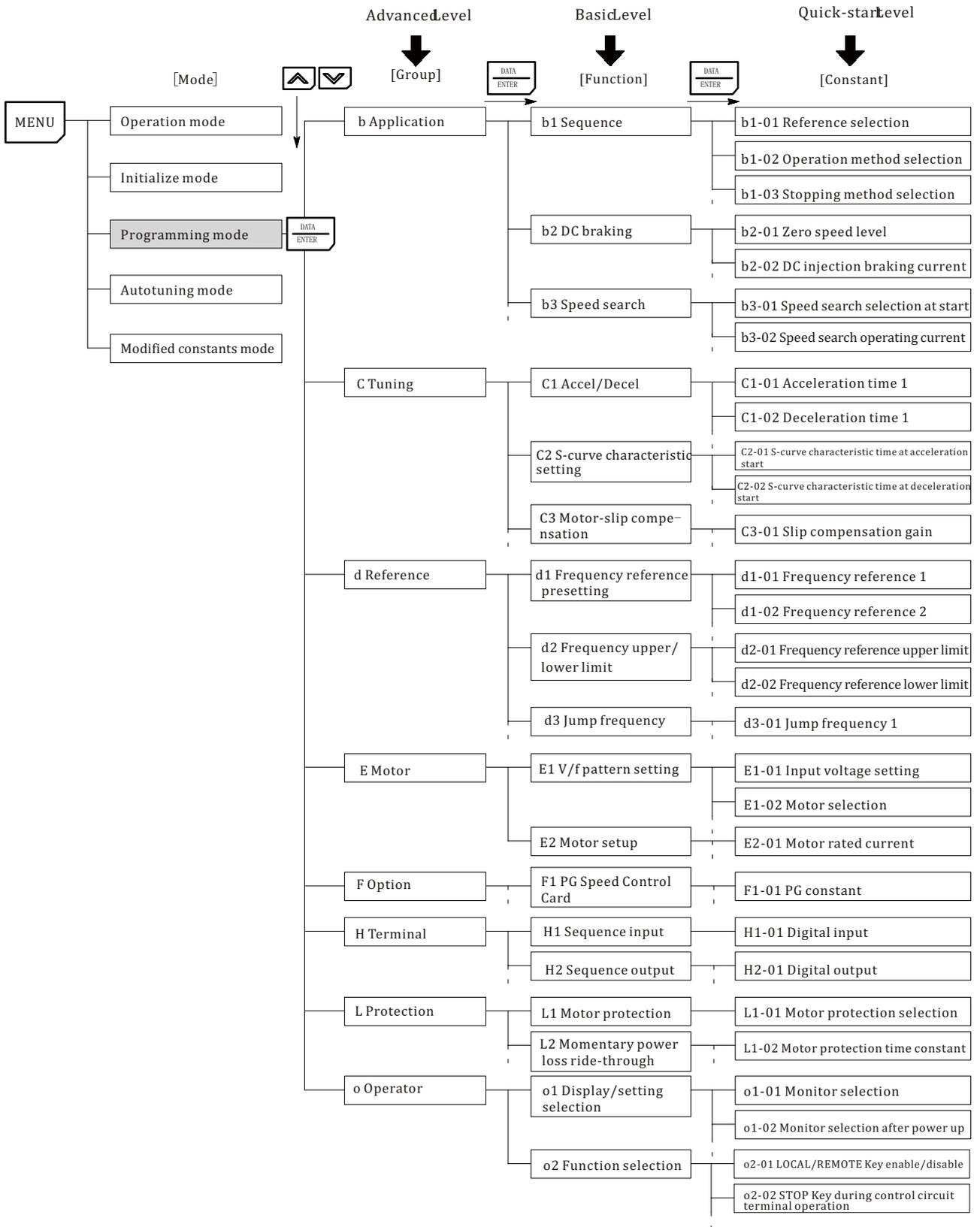
■ Checking Operating Status

- Having checked that the operating direction is correct and that the machine is operating smoothly, at slow speed, increase the frequency reference.
- After changing the frequency reference or the rotation direction, check that there is no oscillation or abnormal sound from the motor. Check the monitor display to ensure that the U1-03 (output current) is not excessive.

■ **User Constant Descriptions**

Constant Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				Page
	Display					V/f	V/f with PG	Open Loop Vector	Flux Vector	
A1-00	Language selection for digital operator display	Used to select the language displayed on the Digital Operator 0: English 1: Chinese	0, 1	1	○	Q	Q	Q	Q	38
	Select Language									

- **Constant Number:** The constant number.
- **Name:** The constant name.
- **Display:** The constant name displayed on the Digital Operator.
- **Description:** Details of the constant function or setting value.
- **Setting Range:** The constant setting range.
- **Factory Setting:** The factory setting value (each control method has its own factory setting. Therefore the factory setting changes when the control method is changed.)
→See page 8 - 45 for factory settings by control method.
- **Change during Operation:** Indicates whether or not the constant can be changed while in the Inverter is in operation.
 - ...Changes possible during operation.
 - × ...Changes not possible during operation.
- **Control Method:** Indicates which control methods and which access levels can be set and referenced.
 - Q... Items which can be set and referenced on all access levels; Quick-Start, Basic, and Advanced.
 - B... Items which can be set and referenced in Advanced and Basic.
 - A... Items which can be set and referenced in Advanced only.
 - × ... Items which cannot be set or referenced in that control method.
- **Page:** Reference page for more detailed information on the constant.



5. 1 Initialize Mode Constants

A1-00 (Select Language) 0 Q Q Q Q

SettingRange

English [0]

Chinese ★ [1]

Function

Used to select the language displayed on the Digital Operator

Description of choice

Use constant A1-00 to select the language displayed by the Inverter. A value of 0 sets English and a value of 1 sets Japanese. This user constant is not returned to the factory setting when constants are initialized. It must be manually reset to the factory setting.

A1-01 (Access Level) 0 Q Q Q Q

SettingRange

Monitoring only (Displays only Operation mode and Initialize mode) [0]

Used to select user constant [1]

Quick-Start: Q ★ [2]

Basic: B [3]

Basic: A [4]

Function

Used to set the constant access level (set/read.

Description of choice

Use constant A1-01 to select the user constant access level. This level determines which user constants can be changed and displayed. The user constants that can be displayed and changed also depend upon the control method being used.

A1-02 (User Param 1 to 32) X Q Q Q Q

SettingRange

V/f control without pulse generator ★ [0]

V/f control with PG feedback [1]

Open-loop vector control [2]

Flux vector control [3]

Function

Used to select the control method for the Inverter

Description of choice

Use constant select one of the four control methods. This user constant is not returned to the factory setting when constants are initialized. It must be manually reset to the factory setting.

A1-03 (Init Constants) X Q Q Q Q

SettingRange

No initializing ★ [0]

Initializes using the User constants [1110]

Initializes using a two-wire sequence. (Initializes to the factory setting.) [2220]

Initializes using a three-wire sequence [3330]

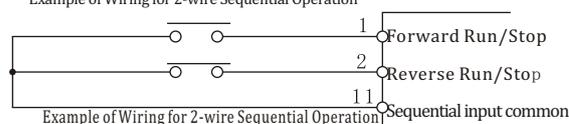
Function

Used to initialize the constants using the specified method.

Description of choice

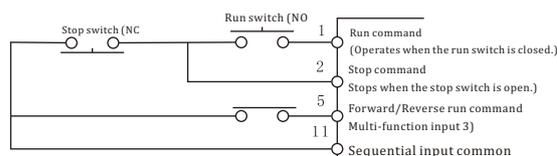
This function initializes the user constants to values that have been recorded as user settings. To record the user settings, change the user constants to the desired values and then set user constant o2-03 (User constant initial value) to 1. Once user settings are recorded, the o2-03 value will be automatically reset to 0. (The 1110 function will be disabled when user constant o2-03 is set to 0.)

Example of Wiring for 2-wire Sequential Operation



Example of Wiring for 3-wire Sequential Operation

The default settings of the multi-function inputs are different from the default settings of the 2-wire sequence



Example of Wiring for 3-wire Sequential Operation

A1-04 (Enter Password) X Q Q Q Q

SettingRange

0~9999 ★ [0]

Function

Password input when a password has been set in A1-05. This function write-protects some constants of the Initialize mode.

A1-05 (Select Password) X Q Q Q Q

SettingRange

0~9999 ★ [0]

Function

Used to set a four digit number as the password.

Description of choice

Use constants A1-04 and A1-05 to write-protect the initialize-mode user constants. User constants A1-01 through A1-03 and A2-01 through A2-32 can be displayed but not changed if the contents of A1-04 and A1-05 are not the same. To write-protect the initialize-mode user constants, set the password in A1-05 after inputting the desired values in A1-01 through A1-03 and A2-01 through A2-32. User constant A1-05 can be displayed by displaying A1-04 and pressing the Menu Key while pressing the Reset Key. (A1-05 can't be displayed with the usual Key sequences.) It will be possible to change the initialize-mode user constants again when the same password is written to A1-04 and A1-05.

Refer to the operation of an example page

◀EXAMPLE▶ Initializing for 2-wire Sequential Operation

Use the following procedure to initialize user constants to the factory settings.

Step	Key Sequence	Digital Operator Display	Remarks
1	MENU	* MainMenu * Operation	
2		* MainMenu * Initialize	
3		SelectLanguage English	
4		InitParameters NoInitialize	
5	Press 3 times 	A1 03=0*** NoInitialize	
6		A1 03=2220 2-wireInitial	
7		EntryAccepted	Writes-in the new setting
		InitParameters NoInitialize	After a few seconds, the Operator display is as shown on the left.

The initialization has been completed for a 2-wire sequence

◀EXAMPLE▶ Setting the Password to 1000

Use the following procedure to set the password to 1000

Step	Key Sequence	Digital Operator Display	Remarks
1	MENU	YD3 000N:* MainMenu * Operation	
2		YD3 000N* MainMenu * Initialize	
3		SelectLanguage English	
4		EnterPassword A1 04=0	
5	Press 4 times. 	EnterPassword A1 04=0	
	Hold RESET	SelectPassword A1 05=0	
6	And press MENU 	SelectPassword 0000	The first digit will blink. The blinking digit can be changed.
7		SelectPassword 0000	The value of the digit will increment each time the Increment Key is pressed and then stop at 9. Press the Decrement Key to decrease the value.
8		EntryAccepted	Writes-in the new setting
		SelectPassword A1 05=1000	
9	ESC	EnterPassword A1 04=0	After a few seconds, the Operator display is as shown on the left

The password has been set to 1000.

To enable changing user constants, set the same password in A1-05=0.

A2-01toA2-32 Setting User Constants X A A A A
 (User Param1 to 32)

SettingRange

b1-01~o1-01 ★ —

Function

user program access level.Parameters can be set to view the number (maximum 32)

Description of choice

User constants A2-01 through A2-32 specify the constants that can be displayed and changed when the access level (A1-01) is set to 1 (user programs)

5.2 Trial Operation Procedures

5. 2. 1Run Mode b1

b1-01 (Reference selection) 0 Q Q Q Q

SettingRange

Digital Operator		[0]
Control circuit terminals (analog inputs)	★	[1]
MEMOBUS transmission (using SI-K2)		[2]
Optional Card		[3]
MEMOBUS transmission (for CP-717)		[4]

Function

Constant b1-01 is used to select the reference source

Description of choice

The frequency reference is input from the control circuit terminals (external terminals), so set b1-01 to 1.

b1-02 (Run Source) X Q Q Q Q

SettingRange

Digital Operator		[0]
Control circuit terminals (analog inputs)	★	[1]
MEMOBUS transmission (using SI-K2)		[2]
Optional Card		[3]
MEMOBUS transmission (for CP-717)		[4]

Function

Run Source and Sequence Input Responsiveness

Description of choice

Constant b1-02 is used to select the source of the run command.When a control circuit terminal (external terminal) is set, the Unit operates with 2-wire forward run/stop and reverse run/stop control. (When the Unit has been initialized for a 3-wire control or a multifunctioninput is set to 0 (3-wire sequence), the Unit operates with 3-wire run, stop and forward/reverse

b1-03 (Stopping Method) X Q Q Q Q

SettingRange

Deceleration to stop	★	[0]
Coast to stop		[1]
DC braking stop: Stops faster than coast to stop, without regenerative operation.		[2]
Coast to stop with timer: Run commands are disregarded during deceleration time.		[3]

Function

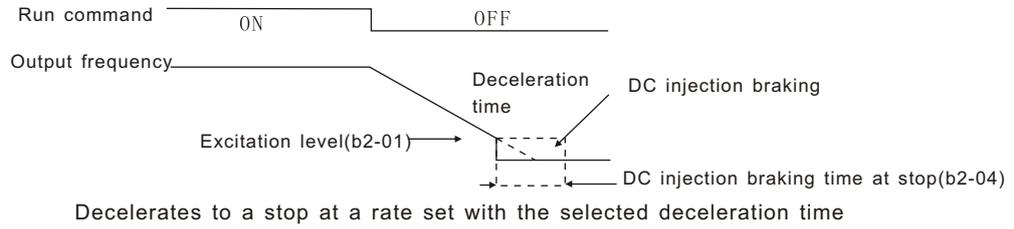
Stopping method selection

Description of choice

Set the stopping method used when a stop command is input. Only settings 0 and 1 can be used with flux vector control

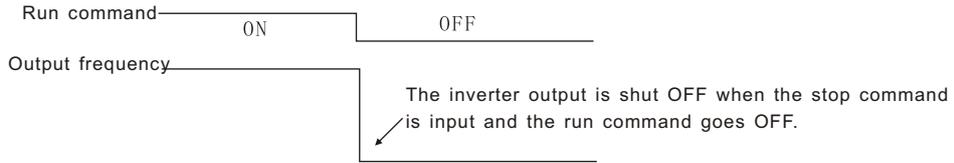
•The following diagrams show the operation of each stopping method.

•Deceleration to Stop(b1-03=0)



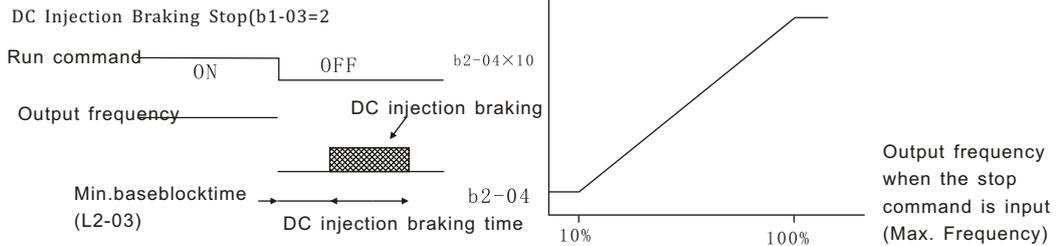
Deceleration to Stop

•Coast to Stop(b1-03=1)



After the stopcommand is input,run commands are disregarded until the minimum baseblock time(L2-03)has elapsed.

Coast to Stop



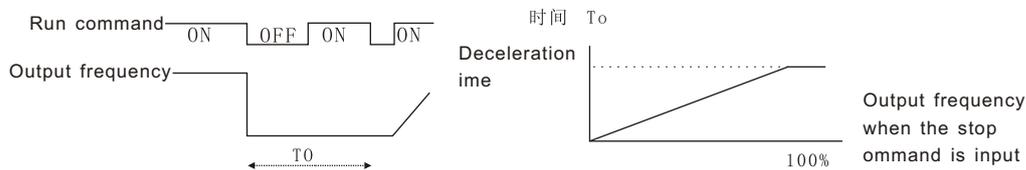
After the stop command is input and the minimum baseblock ime(L2-03) has elapsed,DC injection braking is applied and the motor stopped. The DC injection braking time depends upon the output frequency when the stop command isinput and the"DC injection braking time at stop"setting in b2-04,as shown in Figure6.6.

DC InjectionBraking Stop



Lengthen the minimum baseblocktime(L2-03)when an overcurrent (OC) occurs during stopping.When the power to an induction motor is turned OFF, the counter-electromotive force generated by the residualmagnetic field in the motor can cause an ove rcurrent to be etected when DC injection braking is applied.

Coast to Stop with Timer(b1-03=3)



After the stop command is input,run commands are disregarded until the timeT has elapsed.The time to depends upon the output frequency when the stopcommand is input and the deceleration time.

b1-04 (Reverse Oper) X B B B B

SettingRange

Allows reverse operation. ★ [0]
 Prohibits reverse operation [1]

Function

Prohibition of reverse operation

Description of choice

Set this constant to "1" to disable reverse operation when necessary.

b1-05 (Zero-Speed Oper) X X X X A

SettingRange

Operate according to the frequency reference. (E1-09 is invalid.) [0] ★
 Interrupt the output. (Coast when the frequency reference is below E1-09.) [1]
 Operate at E1-09 frequency. (Output the frequency set in E1-09.) [2]
 Zero-speed operation (Zero reference value when the frequency reference is below E1-09.) [3]

Function

Set the minimum output frequency according to the requirements of the application

Description of choice

Set the operation method used when the frequency reference is below the minimum output frequency.

b1-06 (Cntl Input Scans) X X X X A

SettingRange

Two scans every 2 ms (Use when connecting transistor outputs.) [0]
 Two scans every 5 ms (Use when connecting contact outputs or switches.) ★ [1]

Function

Set the responsiveness of the control inputs (forward/reverse run and multi-function inputs)

Description of choice

Set the responsiveness of the control inputs (forward/reverse run and multi-function inputs)

b1-07 (LOC/REM RUN Sel) X A A A A

SettingRange

o operation even if RUN signal is ON after switching to remote mode. ★ [0]
 Operate according to the RUN signal after switching to remote mode. [1]

Function

Operation selection after switching to remote mode

Description of choice

Set the interlock operation to be used after switching from local mode (operation from Digital Operator) to remote mode (operation according to control circuit terminal).

b1-08 (RUN CMD at PRG) X A A A A

SettingRange

Cannot operate. ★ [0]
 Can operate. Operator selects run command (when B1-02=0). [1]

Function

Used to set the Operation mode in program mode.

5. 2. 2DC Injection Braking:b

b2-01 (DCInj Start Freq) X B B B B

SettingRange

0.0 to 10.0 ★ [0. 5]

Function

Zero speed level(DC injection braking starting frequency)

Description of choice

The DC injection braking function decelerates by applying a DC current to the motor. This happens in the following two cases

- DC Injection Braking Time at Start: Effective for temporarily stopping and then restarting, without regenerative processing, a motorcoasting by inertia.
- DC Injection Braking Time at Stop:

Used to prevent coasting by inertia when the motor is not completely stopped by normal deceleration when there is a large load. The stopping time can be shortened by lengthening the DC injection braking time or increasing the DC injection braking current.

b2-02 (Dcinj Current) X B B B X

SettingRange

0~100 ★ [50]

Function

DC injection braking current

Description of choice

For the DC injection braking current (b2-02), set the value for the current that is output at the time of DC injection braking. DC injection braking current is set as a percentage of Inverter rated output current with the Inverter rated output current taken as 100%.

b2-03 (DCinj Time @Start) X B B B B

SettingRange

0~10. 00 ★ [0. 0]

Function

Used to set the time to perform DC injection braking (initial excitation for flux vector control) at start in units of 1 second.

Description of choice

When the DC injection command (initial excitation command) for multi-function input terminals is used at the same time, open the terminal input, and perform DC injection braking only for the period of time set under b2-03.

b2-04 (DCInj Time @Stop) X B B B B

SettingRange

0. 00~10. 00 ★ [0. 50]

Function

Used to set the time to perform DC injection braking (initial excitation for flux vector control) at start in units of 1 second.

Description of choice

Used to prevent coasting after the stop command is input. When the set value is 0.00, DC injection braking at stop is not performed.

b2-08 (Fidld Comp @Start) X - - A A

SettingRange

0~500 ★ [0]

Function

Used to set the magnetic flux compensation in % units, with the no-load current as 100%

Description of choice

When b2-08 is 100%, it indicates the motor no-load current (notor magnetic flux current).

If b2-08 is set at 100% or greater, a stronger current can be supplied when starting DC injection braking time at start (initial excitation), and the motor's internal magnetic flux startup can be speeded up. The startup time can be reduced by approximately half when the b2-08 is set to 200%.

The magnetic flux startup is slower if b2-08 is less than 100%. (Do not normally set b2-08 to less than 100%. However, the operation will be the same as b2-08=100% when b2-08=0%, and the startup will be at the set DC injection braking current (b2-02). If the magnetic flux compensation volume (b2-08) is set to a large value, there may be greater noise generated from the motor during DC injection braking time at start.

The electrical time constant when the motor's magnetic flux is started (secondary circuit time constant) can be calculated using the motor constant E2 setting and the following formula: Secondary circuit time constant $T_2 = [(E2-012-E2-032) \frac{1}{2} / (2\pi \times E2-02 \times E2-03)]$ (sec) Do not use this function when slow commencement of braking due to DC injection braking time at start (initial excitation) is becoming a problem. Use the separate DC braking command (setting: 60) for multi-function contact input, and start the motor magnetic flux beforehand while stopping the motor.

5. 2. 3 Speed Search: b3

b3-01 (Spdsrch at Start) X A A A A

SettingRange

Speed search disabled [0]
 Speed search enabled ★ [1]

Function

Speed search selection at start

Description of choice

Speed search selection
 Set "1" to use the speed search function. A speed search is performed each time the run command is input. To use speed search freely in control methods without PG, i.e., V/f control and open-loop vector control, set the multi-function contact input selection (H1-01 to H1-06) to 61 or 62 (external search command).

b3-02 (SpdSrCh Current) X A X A X

SettingRange

0~200 ★ [100]

Function

Sets the speed search operation current as a percentage of the Inverter rated current.

Description of choice

The factory setting for V/f control is 150%

Not usually necessary to set. When restarting is not possible with the set value, reduce the value.

b3-03 (SpdSrCh Dec Time) X A X A X

SettingRange

0.1~10.0 ★ [2.0]

Function

Set the time for deceleration from the maximum output frequency to 0 Hz. speed search in 1-second units

Description of choice

When the speed search and DC injection braking are set, set the minimum base block time (L2-03). For the minimum base block time, set the time to wait for the motor's residual voltage to dissipate. If an overcurrent is detected when starting a speed search or DC injection braking, raise the setting to prevent a fault from occurring.

5. 2. 4 Timer Function: b4

b4-01 (Delay-ON Timer) X A A A A

SettingRange

0.0~300.0 ★ [0.0]

Function

Sets the timer function output ON-delay time (dead band) for the timer function input, in 1-second units.

Description of choice

The timer functions are enabled when the timer function input (setting: 18) and the timer function output (setting: 12) are set for the multi-function input and multi-function output respectively. These inputs and outputs serve as general-purpose I/O. Chattering of sensors, switches, and so on, can be prevented by setting a delay time. (timer function ON-delay time)

b4-02 (Delay-OFF Timer) X A A A A

SettingRange

0.0~300.0 ★ [0.0]

Function

Sets the timer function output OFF-delay time (dead band) for the timer function input, in 1-second units.

Description of choice

The timer functions are enabled when the timer function input (setting: 18) and the timer function output (setting: 12) are set for the multi-function input and multi-function output respectively. When the timer function input OFF time is longer than the value set for b4-02 (timer function OFF delay time), the timer function output turns OFF. An operation example of the timer function is shown

5. 2. 5 PID Control: b5

b5-01 (PID Mode) X A A A A

SettingRange

PID control disabled ★ [0]
 PID control enabled, deviation signal is subject to [1]
 derivative control.
 PID control enabled, feedback signal is subject to derivative control. [2]

PID control enabled (frequency command + PID control, [3]
 deviation is subject to D control.)
 PID control enabled (frequency command + PID control, [4]
 feedback is subject to D control.)

Function

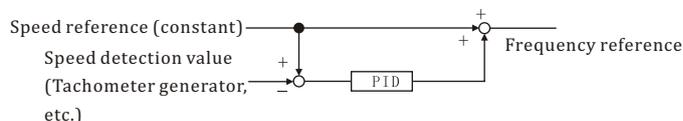
PID control mode selection

Description of choice

If setting the target value input as b1-01=0 (Digital Operator), set the o1-03 to "1" (% unit) and input a percentage value for the target value. (When the speed reference is changed, 100% becomes the maximum frequency reference.)

The feedback value is input from a multi-function analog input terminal or frequency reference current terminal. Set PID feedback (setting: B) for either the constant H3-05 (multi-function analog input, terminal 16), or constant H3-09 (multi-function analog input, terminal 14) function selection. (See Table 7.11.) Adjust the amount of feedback by setting the gain and bias of the analog inputs that are used.

Figure 7.25 shows a speed control application example for settings 3 and 4 (for SPEC: F).



Application Example of Settings 3 and 4

PID Control Applications

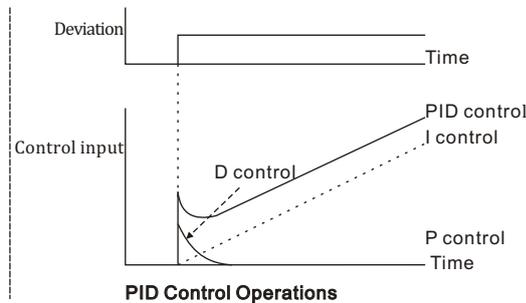
shows examples of PID control applications using the Inverter

PID Control Applications

Application	Control contents	Sensors used(example)
Speed control	Speeds are matched to target values as speed information in a mechanical system. Speed information for another mechanical system is input as target values, and synchronized control is executed by feeding back actual speeds.	Tachogenerator
Pressure control	Pressure information is returned as feedback for stable pressure control.	Pressure sensor
Flow control	Flow information is returned as feedback for accurate flow control.	Flow sensor
Temperature control	Temperature information is returned as feedback to control temperature by turning a fan.	Thermocouple Thermistor

PID Control Operations

In order to distinguish the separate PID control operations (i.e., proportional, integral, and derivative), Figure 7.23 shows the changes in the control input (i.e., the output frequency) when the deviation between the target value and the feedback is held constant.



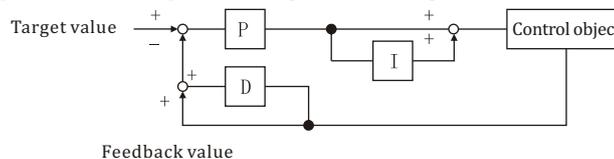
- **P Control:** A control input proportional to the deviation is output. The deviation cannot be zeroed by P control alone.
- **I Control:** A control input which is an integral of the deviation is output. This is effective for matching the feedback to the target value. Sudden changes, however, cannot be followed.
- **D Control:** A control input which is an integral of the deviation is output. Quick response to sudden changes is possible.
- **PID Control:** Optimum control is achieved by combining the best features of P, I, and D control.

Types of PID Control

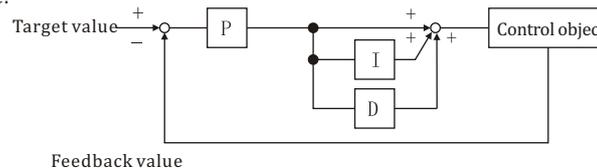
Two types of PID control are possible with the Inverter: Measured-value derivative PID control and basic PID control. The type that is normally used is measured-value derivative PID control.

Measured-value Derivative PID Control:

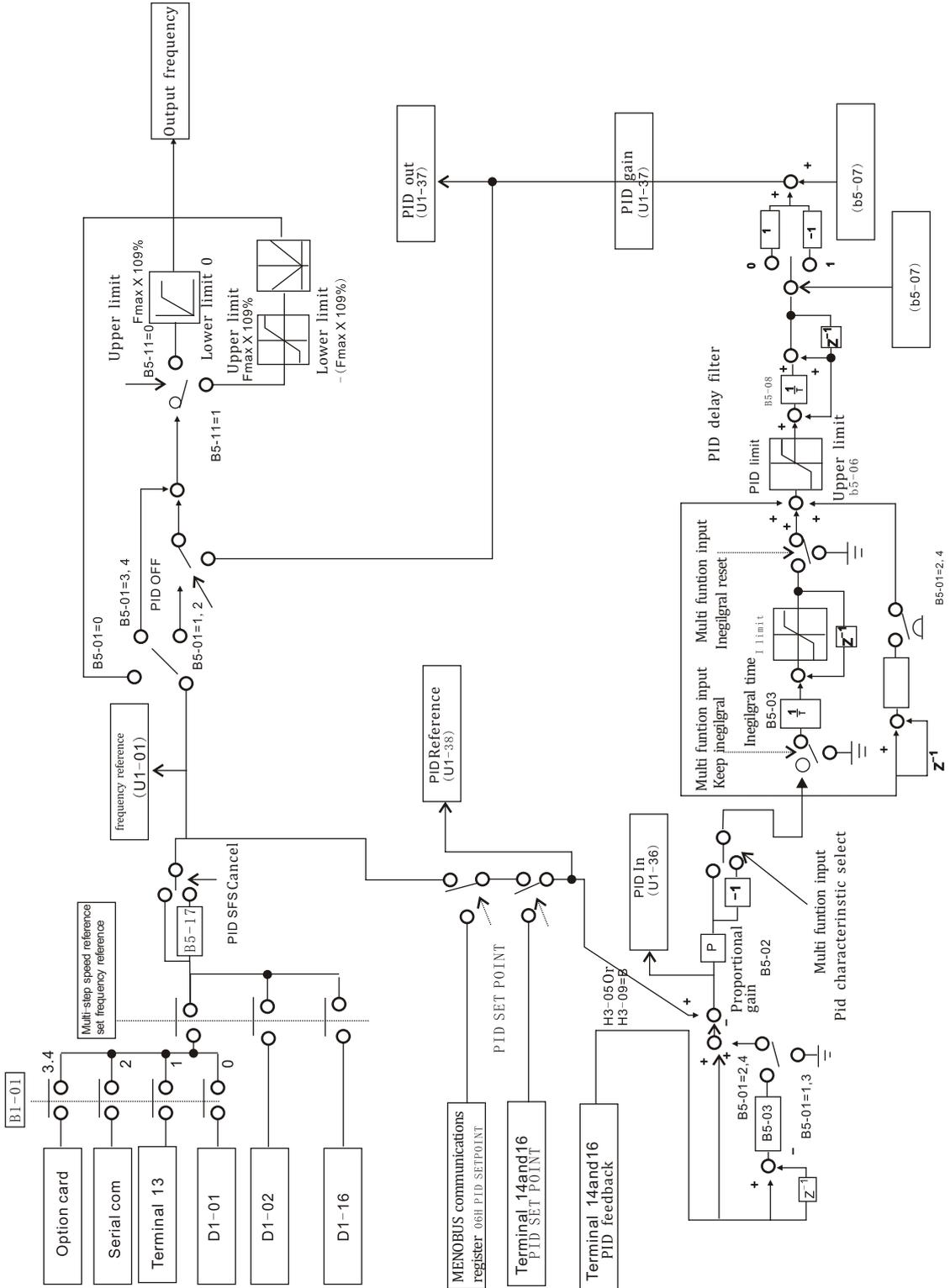
With measured-value derivative PID control, the feedback value is differentiated for PID control. Response is possible with respect to changes both in target values and the control object.



Basic PID Control: This is the basic form of PID control. When the D control response is adjusted to follow changes in the control object, overshooting and undershooting can occur with changes in the target value.



PID Function



b5-02 (PID Gain) 0 A A A A

SettingRange

0.00~25.00 ★ [1.00]

Function

Sets P-control proportional gain as a percentage

Description of choice

Adjust the responsiveness of the PID control by means of the proportional gain (P), integral time(I), and derivative time (D). Optimize the responsiveness by adjusting it while operating an actual load (mechanical system). Any control (P, I, or D) that is set to zero (0.0, 0.00) will not operate.

b5-03 (PID I Time) 0 A A A A

SettingRange

0~360.0 ★ [1.0]

Function

Sets I-control integral time in 1-second units.

Adjust the responsiveness of the PID control by means of the proportional gain (P), integral time(I), and Derivative time (D). Optimize the responsiveness By adjusting it while operating an actual load (mechanical system). Any control (P, I, or D) that is set to zero (0.0, 0.00) will not operate.

b5-04 (PID I Limit) 0 A A A A

SettingRange

0.0~100.0 ★ [100.0]

Function

Sets the I-control limit as a percentage of the maximum output centage frequency.

Description of choice

This constant prevents the calculated value of the integral control in the PID control from exceeding the fixed amount. There is normally no need to change the setting. Reduce the setting if there is a risk of load damage, or of the motor going out of step, by the Inverter's response when the load suddenly changes. If the setting is reduced too much, the target value and the feedback value will not match.

b5-05 (PID D Time) 0 A A A A

SettingRange

0.0~10.0 ★ [0.00]

Function

Sets D-control derivative time in 1-second units.

Description of choice

Adjust the responsiveness of the PID control by means of the proportional gain (P), integral time(I), and derivative time (D). Optimize the responsiveness by adjusting it while operating an actual load (mechanical system). Any control (P, I, or D) that is set to zero (0.0,0.00) will not operate

b5-06 (PID Limit) 0 A A A A

SettingRange

0.0~100.0 ★ [100.0]

Function

Set this constant as a percentage of the maximum output frequency, with the maximum frequency taken as 100%.

Description of choice

Constant b5-06 prevents the frequency reference after PID contrd from exceeding the fixed amount.

b5-07 (PID Offset) 0 A A A A

SettingRange

-100.0~+100.0 ★ [0.0]

Function

Sets the limit after PID-control as a percentage of the maximum output frequency.

Description of choice

If both the target value and the feedback value are set to zero, adjust the Inverter's output frequency to zero.

b5-08 (PID Delay Time) 0 A A A A

SettingRange

0.00~10.0 ★ [0.00]

Function

Sets the time constant for low pass filter for PID-control outputs in 1-second units.

Description of choice

If the viscous friction of the mechanical system is high, or if the rigidity is low, causing the mechanical system to oscillate, increase the setting so that it is higher than the oscillation frequency period. This will decrease the responsiveness, but it will prevent the oscillation.

b5-09 (Output Level Sel) X A A A A

SettingRange

PID output has forward characteristics ★ [0]

PID output has reverse characteristics [1]

Function

Select forward/reverse for PID output.

b5-10 (Output Gain) X A A A A

SettingRange

0.0~25.0 ★ [1.0]

Function

Sets output gain

b5-11 (Output Rev Sel) X A A A A

SettingRange

0 limit when PID output is negative. ★ [0]

Reverses when PID output is negative. [1]

Function

PID reverse output selection

Description of choice

0 limit when reverse prohibit is selected using b1-04. When the PID control output is negative, can reverse the output drive. But if to B1-04 (select static reverse) is set to 1, PID output is 19,0 as the limit

b5-12 (Fb los Det Sel) X A A A A

SettingRange

No detection of loss of PID feedback. ★ [0]

Detection of loss of PID feedback [1]

Detection of loss of PID feedback. [2]

Description of choice

[0]: No detection of loss of PID feedback.

- [1] : Detection of loss of PID feedback. Operation continues during detection, with the malfunctioning contact not operating
- [2] : Detection of loss of PID feedback. Coasts to stop during detection, and fault contact operates.

b5-13 (FB los DET Lv1) X A A A A

SettingRange

0~100 ★ [0]

Function

Sets the PID feedback loss detection level in % units, with the maximum output frequency at 100%.

b5-14 (Fb los Det Time) X A A A A

SettingRange

0.0~25.5 ★ [1.0]

Function

Sets the PID feedback loss detection level in s units.

5. 2. 6Dwell Functions: b6

b5-14 (Dwell Ref@Start) X A A A A

SettingRange

0.0~400.0 ★ [0.0]

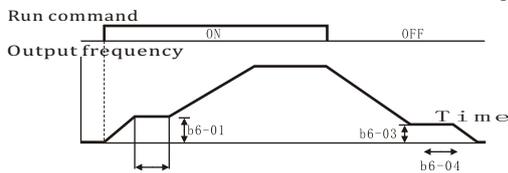
Function

Dwell frequency at start

Description of choice

The dwell functions are used to temporarily hold the output frequency when starting or stopping a motor with a heavy load. This helps to prevent stalling.

The relation between these constants is shown in Figure



Timing Chart for Dwell Functions

b6-02 (Dwell Time@Start) X A A A A

SettingRange

0.0~10.0 ★ [0.0]

Function

DWELL function setting suspension

Description of choice

The relation between these constants is shown in Figure

b6-03 (Dwell Ref@Stop) X A A A A

SettingRange

0.0~400.0 ★ [0.0]

Function

DWELL function setting suspension

Description of choice

The relation between these constants is shown in Figure

b6-04 (Dwell Time@Stop) X A A A A

SettingRange

0.0~10.0 ★ [0.0]

Function

DWELL function setting suspension

Description of choice

The relation between these constants is shown in Figure

5. 2. 7 Droop Control: b7

b7-01 (Droop Gain) 0 X X X A

SettingRange

0.0~100.0 ★ [0.0]

Function

Sets the slip as a percentage of maximum frequency when the maximum output frequency is specified and the rated torque occurs.

Description of choice

Droop-control is not performed when the setting is 0.0.

b7-02 (Droop Delay Time) 0 X X X A

SettingRange

0.03~2.00 ★ [0.05]

Function

Droop control delay time

Description of choice

Droop control responsiveness constant When hunting or oscillation occurs, increase the value.

5. 2. 8 Energy Saving: b8

b8-01 (Energy Save Gain) X A A X X

SettingRange

0~100 ★ [80]

Function

Sets the Inverter output voltage when the energy-saving command is input.

Description of choice

when the energy-saving command is input. Set this value as a percentage of the V/f pattern's voltage. Constant L2-04 (the voltage recovery time) determines the rate at which the output voltage is changed when the energy-saving command is turned ON or OFF.

b8-02 (Energy Save Freq) X A A X X

SettingRange

0.0~400.0 ★ [0.0]

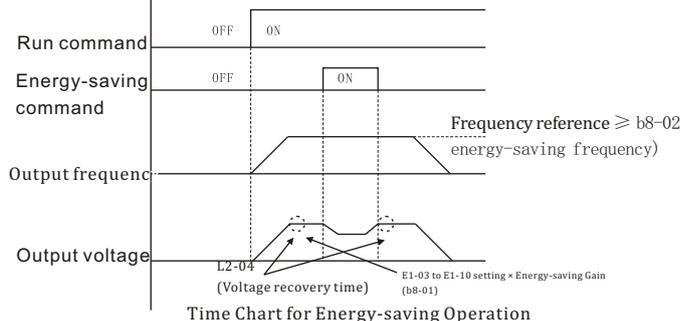
Function

Sets the energy-saving effective range minimum frequency in Hz

Description of choice

The energy-saving function is only enabled when the frequency is greater than the energy saving frequency and the speeds are consistent.

A time chart for energy-saving operation is shown below.



5. 2. 9Zero Servo: b9

b9-01 (Zero Servo Gain) X X X X A

SettingRange

0~100 ★ [5]

Function

Enabled when the “zero-servocommand” is set for the multifunctioninput. When the zeroservocommand has been inputand the frequency referencedrops below excitation level(b2-01), a position control loopis created and the motor stops.Incre-asing the zero-servo gainin turn increases the strength of thelock. Increasing it by too much will cause oscillation.

b9-02 (Zero Servo Count) X X X X A

SettingRange

0~16383 ★ [10]

Function

Set the allowable position displacement from the zero-servo position to 4 times the pulse rate of the PG (pulse generator, encoder) in use.

Description of choice

Assign the zero servo command (setting 72) to one of the multi-function inputs (H1-01 to H1-06). The zero-servo status is entered when the frequency (speed) reference falls below the zero-speed level (B2-01).Be sure to leave the run command input ON. If the run command is turned OFF, the output will be interruptedand the zero-servo function will become ineffective.To output the zero-servo status externally, assign the Zero Servo End signal setting 33) to one of themulti-function outputs (H2-01 to H2-03). The setting in b9-02 (Zero-servo CompletionWidth) is enabledwhen one of the multi-function outputs has been set to 33.The Zero Servo End signal remains ON as long as the position is within this range (starting position± Zero-servo Completion Width).For example, when a 600 p/r encoder is being used, the numberof pulses would be 2,400 p/r after multiplyingby four.The Zero Servo End signal will go OFF when the zero servo command is turned OFF.Do not lock the servo for extended periods of time at 100% when using the zero servo function. Extendedperiods of servo lock can be achieved by ensuring that the current during the servolock is 50% or less or by increasing the Inverter capacity.

5. 3 Self-learning parameters

5. 3. 1Acceleration/Deceleration: C1

C1-01 (Accel Time 1) 0 Q Q Q Q

SettingRange

0. 0~60000. 0 ★ [10. 0]

Function

Sets the acceleration time to acceleratefrom 0 to the maximum celerate output frequency, in 1-second units

C1-02 (Decel Time 1) 0 Q Q Q Q

SettingRange

0. 0~60000. 0 ★ [10. 0]

Function

Sets the deceleration time to deceleratefrom the maximum output cele rate frequency to 0, in 1-second units.

C1-03 (Accel Time 2) 0 B B B B

SettingRange

0. 0~6000. 0 ★ [10. 0]

Function

The acceleration time when the multi function input “accel/ decel multi-time 1” is set to ON.

C1-04 (Decel Time 2) 0 B B B B

SettingRange

0. 0~6000. 0 ★ [10. 0]

Function

The deceleration time when the multi function input “accel/ decel multi-time 2” is set to ON.

C1-05 (Accel Time 3) X A A A A

SettingRange

0. 0~6000. 0 ★ [10. 0]

Function

The deceleration time when the multi function input “accel/ decel multi-time 2” is set to ON.

C1-06 (Decel Time3) X A A A A

SettingRange

0. 0~6000. 0 ★ [10. 0]

Function

he deceleration time when the multi function input “accel/ decel multi-time 2” is set to ON.

C1-07 (Accel Time 4) X A A A A

SettingRange

0. 0~6000. 0 ★ [10. 0]

Function

The acceleration time when the multi-function input “accel/ decel time 1” and “accel/ decel time 2” are set to ON.

C1-08 (Decel Time4) X A A A A

SettingRange

0. 0~6000. 0 ★ [10. 0]

Function

The deceleration time when the multi-function input “accel/ decel time 1” and “accel/ decel time 2” are set to ON.

Description of choice

The setting range for the acceleration/ deceleration times depends on the setting in C1-10 (acceleration/ deceleration time unit). The table shows the setting range when the factory setting is used for C1-10. If C1-10 is set to “0” (0.01 s) the setting range will be 0.00 to 60.00 s.

C1-09 (Fast Stop Time) X B B B B

SettingRange

0. 0~6000. 0 ★ [10. 0]

The deceleration time when the multi-function input “Emergency (fast) stop” is set to ON.

Description of choice

Sets the deceleration time that will be used when an emergency stop signal is input or a fault is detected. The deceleration time is the time required to go from 100% to 0% of the maximum output frequency. When using an emergency stop input, set a multi-function input (H1-01 through H1-06) to for an emergency stop.

C1-10 (Acc/Dec Units) X A A A A

SettingRange

0.01-second units [0]

0.1-second units ★ [1]

Function

The deceleration time when the multi-function input “Emergency (fast) stop” is set to ON

Description of choice

Set "0" to set more precise acceleration and deceleration times. (This will reduce the setting range)

C1-11(Acc/Dec SW Freq) X A A A A

SettingRange

0.0~400.0 ★ [0.0]

Function

Sets the frequency for automatic acceleration/deceleration switching.

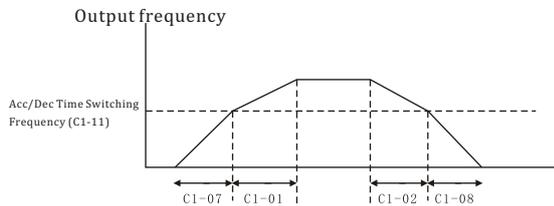
Below set frequency: Accel/decel time 4

Above set frequency: Accel/decel time 1

Description of choice

When an acceleration/deceleration time switching frequency is set, the acceleration and deceleration times will be changed automatically as the frequency passes the set level.

The multi-function input "accel/decel time 1" or "accel/decel time 2" take priority.



Acceleration/Deceleration Times 1 (C1-01 and C1-02) are used when the output frequency \geq C1-11

Acceleration/Deceleration Times 4 (C1-07 and C1-08) are used when the output frequency $<$ C1-11

5. 3. 2S-curve Acceleration/Deceleration: C2

C2-01(SCrv Acc @ Start) X A A A A

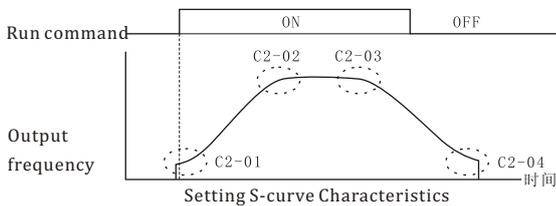
0.0~2.50 ★ [0.20]

Function

All sections of the S-curve characteristic time are set in seconds units.

Description of choice

Using the S-curve characteristic function for acceleration an deceleration can reduce shock to the machinery when stopping and starting. With the Inverter, S-curve characteristics can be set respectively for beginning acceleration, ending acceleration, beginning deceleration, and ending deceleration.



Acceleration time = Selected acceleration time + (S-curve at beginning of acceleration + S-curve at end of acceleration) / 2
 Deceleration time = Selected deceleration time + (S-curve at beginning of deceleration + S-curve at end of deceleration) / 2

C2-02 (SCrv Acc @ End) X A A A A

SettingRange

0.0~2.50 ★ [0.20]

Function

All sections of the S-curve characteristic time are set in seconds units.

C2-03 (SCrv Dec @ Start) X A A A A

SettingRange

0.0~2.50 ★ [0.20]

Function

All sections of the S-curve characteristic time are set in seconds units.

C2-04 (SCrv Dec @ End) X A A A A

SettingRange

0.00~2.50 ★ [0.00]

Function

All sections of the S-curve characteristic time are set in seconds units.

5. 3. 3Motor Slip Compensation: C3

C3-01 (Slip Comp Gain) 0 B X B B

SettingRange

0.0~2.5 ★ [0.0]

Function

The motor slip compensation function calculates the motor torque according to the output current, and sets gain to compensate for output frequency. This function is used to improve speed accuracy when operating with a load. It is mainly effective with V/f control (without PG).

Description of choice

When the control method is switched, the factory setting changes as follows: V/f control: 0.0; V/f with PG: 1.0; open-loop vector 0; flux vector: 1.0. When "1.0" is set, this function compensates for the rated slip that has been set, by the rated torque output.

• With flux vector control, this becomes the gain to compensate for slip caused by motor temperature variation. This function is used to improve speed accuracy when operating with a load. It is mainly effective with V/f control. Correctly set the motor rated slip (constant E2-02) and the motor no-load current (constant E2-03). • The motor rated slip can be calculated by means of the following equation, using the numbers that are shown on the motor nameplate. Motor rated slip = Motor rated frequency (Hz) - rated speed (r/min) x motor (No. of poles) / 120. Set the values at the rated voltage and rated frequency for the motor no-load current. With vector control, the motor rated slip is automatically set by autotuning. Set the slip compensation gain (constant C3-01 to "1.0." (If it is set to "0.0," slip compensation will be disabled.)

C3-02 (Slip Comp Time) X A X A X

SettingRange

0~10000 ★ [2000]

Function

Slip compensation primary delay time is set in ms units.

Description of choice

When responsiveness is low, decrease the set value.

When speed is not stabilized, increase the set value.

C3-03 (Slip Comp Limit) X A X A X

SettingRange

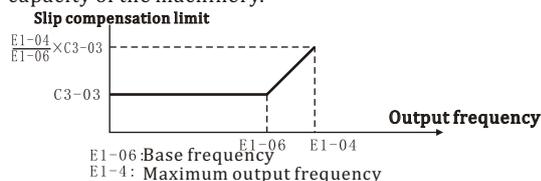
0~250 ★ [200]

Function

Constant C3-03 sets the slip compensation limit as a percentage of motor rated slip (E2-02), with the motor rated slip taken as 100%.

Description of choice

If the speed is lower than the target value and does not change even when the slip compensation gain is adjusted, it is possible that the slip compensation limit has been reached. Raise the limit and then check again. Make sure, however, that the value of the sum of the reference frequency and the slip compensation limit does not exceed the speed capacity of the machinery.



C3-04 (Slip Comp Regen) X A X A X

SettingRange

Slip compensation disabled during regeneration [0]
Slip compensation enabled during regeneration [1]

Function

Slip compensation selection during regeneration

Description of choice

The amount of regeneration is momentarily increased when this function is used, so some control option (e.g., Braking resistor, Braking Resistor Unit, Braking Unit) may be required.

C3-05 (Flux Select) X A X A X

SettingRange

Flux is calculated based on the output frequency after compensation [0] ★
Flux is calculated based on the output frequency before compensation. [1]

Function

Flux calculation method

Description of choice

[0] : Flux is calculated based on the output frequency after compensation.
[1] : Flux is calculated based on the output frequency before compensation.

C3-06 (Output V Limit) X X X A

SettingRange

Invalid ★ [0]
Effective [1]

Function

Limited output voltage operation

Description of choice

If the limited output voltage operation is disabled and output voltage becomes saturated, the output current does not change. However, torque control precision is no longer possible. Enable limited output voltage operation if precise torque control is required.

If the limited output voltage operation is enabled, the magnetic flux current of the motor is automatically controlled, and the output voltage command itself is limited, which maintains precise torque control. Check the Inverter current margins as the output current will be maximum 10% higher (with a rated load) than when limited output voltage operation is disabled.

C3-06 does not need to be changed if the Unit is used only at medium or low speeds, or when the power supply voltage is 10% or more higher than the rated voltage for the motor; when torque control precision in the high-speed region is not required. When the power supply voltage is too low for the rated motor voltage, precise torque control will not be maintained even if limited output voltage operation is enabled.

C4-01 (Torq Comp Gain) 0 B B B X

SettingRange

0.00~2.50 ★ [1.00]

Function

Sets torque compensation gain as a ratio.

Description of choice

This constant can be changed during operation, but normally no adjustments are required. Make adjustments in the following cases under the V/f control mode:

If the wiring distance between the Inverter and the motor is long, raise the setting.
If the motor capacity is less than the Inverter capacity (the maximum application motor capacity), raise the setting.

If the motor generates excessive oscillation, lower the setting.
Adjust the output current range at minimum speed rotation so that it does not exceed the Inverter rated output current. Do not alter the torque compensation gain when in open-loop vector control mode.

C4-02 (Torq Comp Time) X A A A X

SettingRange

0~10000 ★ [200]

Function

The torque compensation delay time is set in ms units.

Description of choice

* When the control method is switched, the factory setting changes as follows: V/f control, V/f with PG: 200 [1000 ms for inverters of 30 kW or larger (200 V class), or inverters of 55 kW or larger (400 V class)]; open-loop vector: 20D. The torque compensation time constant does not normally need to be adjusted, but make adjustments in the following cases:

- If the motor generates excessive oscillation, raise the setting.
- If motor responsiveness is low, lower the setting.

C4-03 (F Torq Cmp @ Start) X X X A X

SettingRange

0.00~200.00 ★ [0.0]

Function

Sets start torque compensation with the motor's rated torque at 100%.

C4-04 (R Torq Cmp @ Start) X X X A X

SettingRange

-200.0~0.0 ★ [0.0]

Function

Sets start torque compensation with the motor's rated torque as 100%.

C4-05 (Torq Cmp Delay T) X X X A X

SettingRange

0~200 ★ [10]

Function

Sets the start torque constant in ms units.

Description of choice

When this function is used, set the starting torque value to the friction load value for ordinary machinery, and to the load for cranes and other lifting devices. Friction load: Set the friction load for both C4-03 and C4-04. Lifting devices: Set the load for the motor side only (hoist). Do not use this function for lifting devices with counterweights as a shock will be generated if there is a regenerative load. Compensation can be set only for the motoring side, for both the forward and reverse directions. It cannot be set for the regenerative side.

Starting torque compensation is disabled when switching between forward and reverse after conducting a speed search. Starting torque compensation is always disabled when the second motor is used.

Set the constant for starting torque compensation (C4-05) to a large value if a shock is generated during startup. Alternatively, use DC injection braking (b2-03) at startup or the DC braking command for multifunction contact input (setting: 60), and start motor magnetic flux before startup.

5. 3. 5 Speed Control (ASR): C5

C5-01 (Asr P Gain 1) 0 X B X B

SettingRange

0. 00~300. 00 ★ [20. 00]

Function

Sets the proportional gain of the speed loop (ASR)

Description of choice

Increase the setting can improve responsiveness, usually a larger load is to increase the set value, but will occur when the shock is too large

C5-02 (Asr I Gain 1) 0 X B X B

SettingRange

0. 000~10. 000 ★ [0. 500]

Function

Sets the integral time of the speed loop (ASR) in 1 second units

Description of choice

When using "V/f control with PG feedback," set the gain at the minimum output frequency and maximum output frequency.

Set the proportional gain (C5-01) and the integral time (C5-02) of the speed control (ASR)

C5-03 (ASR P Gain 2) 0 X B X B

SettingRange

0. 00~300. 00 ★ [20. 00]

Function

Usually setting is not necessary. Set to change the rotational speed gain.

C5-04 (ASR I Time 2) 0 X B X B

SettingRange

0. 000~10. 000 ★ [0. 500]

Function

Usually setting is not necessary. Set to change the rotational speed gain.

Description of choice

Set ASR proportional gain 2 (C5-03) and ASR integral time 2 (C5-04) for the minimum output frequency.

C5-05 (ASR Limit) X X A X X

SettingRange

0. 0~20. 0 ★ [5. 0]

Function

Sets the upper limit for the compensation frequency for the speed control loop (ASR) to a percentage of the maximum output frequency.

Description of choice

Since C5-05 can't be changed during operation, stop the Inverter's operation and then decrease the ASR limit by 0.5 (%).

The ASR limit is the frequency limit for compensation by speed control. Set this frequency limit as a percentage of the maximum output frequency.

C5-06 (ASR Delay Time) X X A X X

SettingRange

0. 000~0. 500 ★ [0. 004]

Function

Sets the filter time constant; the time from the speed loop to the torque command output in units of 1-second command output, second.

Description of choice

Normally it isn't necessary to make this adjustment. Constant C5-06 can be used when adjusting the gain doesn't remove motor oscillation, or adjusting the gain removes oscillation but results in poor responsiveness. A high C5-06 setting lowers the responsiveness of the speed control, but makes it difficult for oscillation to occur.

C5-07 (ASR Gain SW Freq) X X X X A

SettingRange

0. 0~400. 0 ★ [0. 0]

Function

Sets the frequency for switching between Proportion Gain 1, 2 and Integral Time 1, 2 in Hz units

Description of choice

Set constant C5-07 to the frequency at which to switch to the low-speed ASR proportional gain and integral time.

C5-08 (ASR I Limit) X X X X A

SettingRange

0~400 ★ [400]

Function

Set to a small value to prevent any radical load change. Set to 100% of the max- maximum output frequency.

5. 3. 6 Carrier Frequency: C6

C6-01 (Carrier Freq Max) X B B B B

SettingRange

2. 0~5. 0 ★ [7. 0]

Function

Set the carrier frequency upper limit and lower limit in kHz units.

C6-02 (Carrier Freq Max) X A A X X

SettingRange

0. 4~15. 0 ★ [7. 0]

Function

Carrier frequency setting minimum Khz unit limit

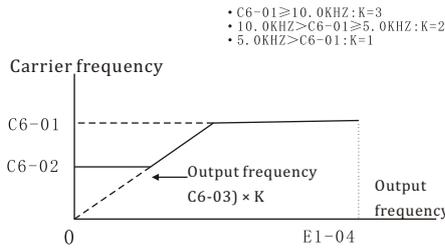
C6-03 (Carrier Gain) X A A X X

SettingRange

00~99 ★ [00]

Function

Set the carrier frequency upper limit and lower limit in kHz units.



Description of choice

The carrier frequency characteristics differ according to the control method. V/f control and V/f with PG feedback control: Carrier frequency variable setting possible. Open-loop vector control and flux vector control: Constant frequency (The carrier frequency upper limit only is set.)

The setting range for the carrier frequency upper limit is as follows for the control methods:

SV/f control (with or without PG): 0.4 to 15.0
 S Vector control (open-loop or flux): 2.0 to 15.0

To make the carrier frequency constant, either set the same value for constants C6-01 and C6-02 or set the carrier frequency proportional gain (constant C6-03) to "0" (i.e., fix at upper limit value). The following settings will generate a constant setting fault (OPE11): Carrier frequency upper limit (C6-01) > 5.0 kHz and carrier frequency lower limit (C6-02) ≤ 5.0 kHz. Carrier frequency proportional gain (C6-03) > 6 and (C6-01) < C6-02

In the vector control modes, the carrier frequency is determined by the carrier frequency upper limit (constant C6-01). In the V/f control modes (both with and without PG), the carrier frequency can be changed in response to the output frequency by setting the carrier frequency lower limit (constant C6-02) and the carrier frequency proportional gain (constant C6-03).

5. 3. 7 Hunting Prevention: C7

C7-01 (Hunt Prev Select) X A A X X

SettingRange

Disabled [0]
 Enabled ★ [1]

Function

The hunting prevention function is used to stop a motor under a light load from hunting. This function is exclusively for the V/f control mode. When greater responsiveness than oscillation control is required, set hunting prevention to "disabled."

C7-02 (Hunt Prev Gain) X A A X X

SettingRange

0.00 ~ 2.50 ★ [1.00]

Function

Sets the ratio for hunting prevention gain.

Description of choice

Increase the setting in C7-02 if oscillation occurs when operating with a light load. If the setting is increased too much, the current can fall to the point where stalling occurs.)

Disable the hunting-prevention function (C7-01 = 0) if high responsiveness is more important than suppressing oscillation.

5. 3. 8 Factory Tuning: C8

C8-08 (AFR Gain) X X X A X

SettingRange

0.00 ~ 10.00 ★ [1.00]

Function

Sets the internal speed feedback detection control section as a ratio.

Description of choice

Normally it isn't necessary to change this setting. Fine-tune the gain when motor operation is unstable causing hunting to occur or torque/speed responsive ness is low. When hunting occurs, increase the gain by 0.05 increments while checking the motor responsiveness. When responsiveness is low, decrease the gain by 0.05 increments while checking the motor responsiveness.

C8-09 (AFR Time) X X X A X

SettingRange

0 ~ 2000 ★ [50]

Function

Sets the internal speed feedback detection control section as a ratio.

C8-30 (Carrier in tune) X X X A A

SettingRange

2 kHz [0]

C6-01 ★ [1]
 C i f i Carrier frequency is set to 5 kHz. (2.5 kHz for 400V class, 185 to 300 kW inverters) [2]

Function

Sets the internal speed feedback detection control section as a ratio.

5. 4 Reference Constants: d

5. 4. 1 Preset Reference: d1

d1-01 (Reference 1) 0 Q Q Q Q

SettingRange

0 ~ 400.00 ★ [0.00]

Function

Sets the frequency reference

d1-02 (Reference 2) 0 Q Q Q Q

SettingRange

0 ~ 400.00 ★ [0.00]

Function

The frequency reference when the multi-function input "multi-step speed reference 1" is ON.

d1-03 (Reference 3) 0 Q Q Q Q

SettingRange

0 ~ 400.00 ★ [0.00]

Function

The frequency reference when the multi-function input "multi-step speed reference 2" is ON.

d1-04 (Reference 4) 0 Q Q Q Q

SettingRange

0 ~ 400.00 ★ [0.00]

Function

The frequency reference when the multi-function input "multi-step speed reference 1, 2" is ON. p

d1-05 (Reference 4) 0 B B B B

SettingRange

0~400.00 ★ [0.00]

Function

The frequency reference when the multi-function input "multi-step speed reference 3" is ON.

d1-06 (Reference 6) 0 B B B B

SettingRange

0~400.00 ★ [0.00]

Function

The frequency reference when the multi-function input "multi-step speed reference 1, 3" is ON.

d1-07 (Reference 7) 0 B B B B

SettingRange

0~400.00 ★ [0.00]

Function

The frequency reference when the multi-function input "multi-step speed reference 2, 3" is ON.

d1-08 (Reference 8) 0 B B B B

SettingRange

0~00.400 ★ [0.00]

Function

The frequency reference when the multi-function input "multi-step speed reference 1, 2, 3" is ON.

d1-09 (Jog Reference) 0 Q Q Q Q

0~400.00 ★ [6.00]

Function

The frequency reference when the multi-function inputs, "Jog frequency reference selection," "FJOG command," and "RJOGJOG command" are ON.

Description of choice

The units for these values are set in o1-03. The frequency reference default value and set value will change when o1-03 is changed. For example, if preset reference 1 is set to 6.00 Hz and o1-03 is changed to 1 (0.01% units), the setting for preset reference 1 will become 10.00%. When using preset references 2 through 8, be sure to set multi-step speed references 1, 2, and 3 in the multi-function inputs (H1-01 through H1-06) as required. When using the jog function, set the jog frequency reference in constant d1-09. When jogging from an external terminal, set the multi-function inputs (H1-01 through H1-06) to "Jog Frequency Reference," "Forward Jog," or "Reverse Jog" as required. The multi-function input setting is unnecessary when jogging from the Operator.

5. 4. 2 Reference Limits: d2

d2-01(Ref Upper Limit)X B B B B

SettingRange

0.0~110.0 ★ [100.0]

Function

Sets the output frequency upper limit as a percentage of the maximum

d2-02(Ref Lower Limit)X B B B B

SettingRange

0.0~109.0 ★ [0.0]

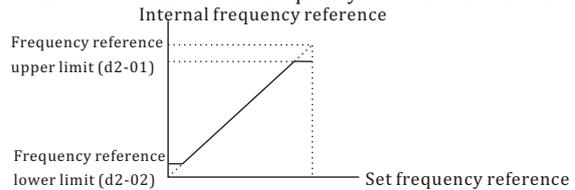
Function

Sets the output frequency lower limit as a percentage of the maximum output frequency.

Description of choice

When the frequency reference is zero and a run command is input, the motor operates at the frequency reference lower limit (d2-02). The motor will not operate, however, if the lower limit is set lower than the minimum output frequency (E1-09).

The frequency reference upper and lower limits are set as a percentage of the maximum output frequency. The upper and lower limits of the frequency reference are shown



Upper and Lower Limits of the Frequency Reference

5. 4. 3 Jump Frequencies: d3

d3-01 (Jump Freq 1) X B B B B

SettingRange

0~400.00 ★ [0.0]

Function

Set the center values of the jump frequencies in Hz

d3-02 (Jump Freq 2) X B B B B

SettingRange

0~400.00 ★ [0.0]

Function

Set the center values of the jump frequencies in Hz.

d3-03 (Jump Freq 3) X B B B B

SettingRange

0~400.00 ★ [0.0]

Function

Set the center values of the jump frequencies in Hz.

d3-04 (Jump Bandwidth)X B B B B

SettingRange

0.0~20.0 ★ [1.0]

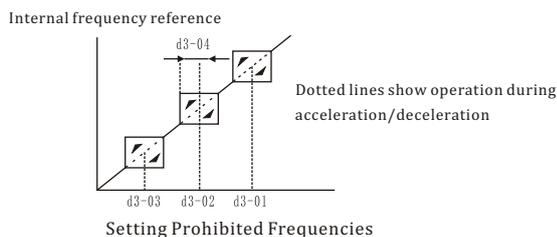
Function

The jump frequency will be the jump frequency \pm d3-04.

Description of choice

This function allows the prohibition or "jumping" of certain frequencies within the Inverter's output frequency range so that the motor can operate without resonant oscillations caused by some machine systems.

For d3-01 to d3-03, set the center values of the frequencies to be jumped. Be sure to set the jump frequency so that $d3-03 \leq d3-02 \leq d3-01$. For d3-04, set the jump frequency bandwidth. The jump frequency \pm the jump frequency bandwidth becomes the jump frequency range. Operation is prohibited within the jump frequency range, but changes during acceleration and deceleration are smooth with no jumps. The relation between the internal frequency reference and the set frequency references



5. 4. 4 Reference Frequency Hold: d4

d4-01 (MOP Ref Memory) X A A A A

Setting Range

Disabled (when operation is stopped or the power is turned on again starts at 0.) ★ [0]

Enabled (when operation is stopped or the power is turned on again starts at the previous hold frequency.) [1]

Function

Sets whether or not frequencies on hold will be recorded.

Description of choice

Constant d4-01 is enabled by making either of the following settings for the multi-function inputs H1-01 to H1-06).
 • Acceleration/deceleration ramp hold (setting: A)
 • Up command (setting: 10)/down command (setting: 11)
 When hold status is established by these external signals, specify whether or not the output frequency is to be retained. When this function is enabled, operation is re-started after power-up using the frequency reference value that was retained. For information regarding the acceleration/deceleration stop (hold) command and the up/down command, refer to the description of Multi-function Inputs (H1).

d4-02 Addition and subtraction instruction limit X A A A A

Setting Range

1~100 ★ [25]

Function

Sets the increase/decrease frequency for analog frequency reference as a percentage of the maximum output frequency.

Description of choice

The trim control level is valid when the trim control increase command (setting: 1C) or trim control decrease command (setting: 1D) is set for a multi-function input (H1-01 to H1-06). If the trim control increase command is ON when a frequency reference is input on the analog input, the trim control level will be added to the analog frequency reference and then output as the output frequency. If the trim control decrease command is ON, the frequency reference will be decreased by the trim control level. Refer to the description of Multi-function Inputs (H1) for details on the trim control increase and trim control decrease commands.

5. 4. 5 Torque Control: d5

d5-01 (Torq Control Sel) X X X X A

Setting Range

Speed control ★ [0]
 Torque control [1]

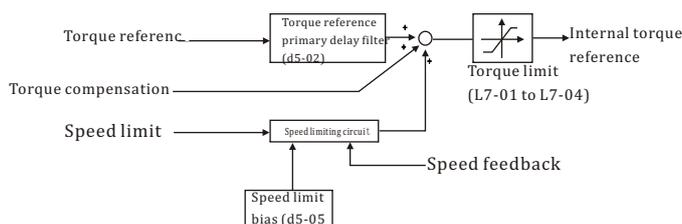
Function

With flux vector control, the motor's output torque can be controlled by a torque reference from an analog input.

Description of choice

Set constant d5-01 to "1" to select torque control.

Set constant d5-01 to 0 (speed control) when using the speed/torque control switching function.



d5-02 (Torq Ref Filter) X X X X A

Setting Range

1~1000 ★ [0]

Function

Sets the torque reference delay time in ms units.

Description of choice

The time constant of the primary filter in the torque reference section can be adjusted. This constant is used to eliminate noise in the torque reference signal and adjust the responsiveness to the host controller. Set the torque reference filter primary delay time constant in ms units. Increase the time constant setting if oscillation occurs during torque control operation.

d5-03 (Speed Limit Sel) X X X X A

Setting Range

The analog input limit from an analog frequency reference terminal (terminals 13 and 14.) ★ [1]

Limited by d5-04 constant setting values. [2]

Function

Sets the speed limit command method for the torque control mode

Description of choice

D Limit with Analog Input (d5-03 = 1)

- The speed limit value is set by the input voltage (H3-01)
- When frequency reference (current) terminal 14 has been set to frequency reference (voltage) terminal 13, this terminal is also used as an input terminal for the speed limit. In this case, the actual speed limit value is the sum of the voltage input value at terminal 13 and the current input value at terminal 14.
- The polarity of the speed limit signal and the direction of the run command determine the direction in which the speed is limited.
- +Voltage input: Forward rotation; Speed is limited in the forward direction. Reverse rotation; Speed is limited in the reverse direction.
- -Voltage input: Forward rotation; Speed is limited in the reverse direction. Reverse rotation; Speed is limited in the forward direction.
- The speed limit value is zero for rotation opposite to the speed limit direction. For example, when a +voltage is being input and the forward rotation command is ON, the effective range of the torque control is from zero to the speed limit value in the forward direction (when constant d5-05, the speed limit bias, is set to 0).

d5-04 (Speed Limit Sel) X X X X A

Setting Range

-120~+120 ★ [0]

Function

Sets the speed limit during torque control as a percentage of the maximum output frequency.

Description of choice

Set the speed limit as a percentage of the maximum frequency. (The max. frequency is 100%.) The sign of the constant setting and the direction of the run command determine the direction in which the speed is limited.

Setting +: Forward rotation; Speed is limited in the forward direction. Reverse rotation; Speed is limited in the reverse direction. Setting -: Forward rotation; Speed is limited in the reverse direction. Reverse rotation; Speed is limited in the forward direction. For example, when a positive value is set in d5-04 and the forward rotation command is ON, the effective range of the torque control is from zero to the speed limit value in the forward direction (when constant d5-05, the speed limit bias, is set to 0).

d5-05 (Speed Limit Sel) X X X X A

SettingRange

0~120 ★ [10]

Function

TSets the speed limit command method for the torque control mode

Description of choice

The speed limit bias can be used to add margins to the speed limit. When the speed limit bias is used, it is possible to set the same speed limit value in both the forward and reverse directions. Set the speed limit bias as a percentage of the maximum output frequency. (The max. frequency is 100%.) For example, the following settings establish speed limits of 50% of the maximum output frequency in both the forward and reverse directions. • Speed limit setting: Zero (with d5-04 as the speed limit: d5-03 = 2, d5-04 = 0) • Speed limit bias setting: 50% (d5-05 = 50)

When a forward speed limit and a speed limit bias have been set, the speed range of the torque control is from the “-speed limit bias setting” to the “speed limit setting + speed limit bias setting. In effect, the speed limit range is extended by the speed limit bias in both the forward and reverse directions.

d5-06 (Ref Hold Time) X X X X A

SettingRange

0~1000 ★ [0]

Function

Sets the delay time from inputting the multi-function input “speed/torque control change” (from ON to OFF or OFF to ON) until the control is actually changed, in ms units.

Description of choice

This setting specifies the only has been set in one of the multi-function inputs (H1-01 to H1-06).

Sets the delay time from inputting the multi-function input “speed/torque control change” (from ON to OFF or OFF to ON) until the control is actually changed, in ms units. During the timer delay, the value of the 3 analog inputs will retain the values they had when the ON/OFF status of speed/torque control switching signal was changed. Use this delay to make any preparations for the change in the control mode.

5. 5. 1 Motor Constant Constants: E

E1-01 (Input Voltage) X Q Q Q Q

SettingRange

155~460VAC ★ [400VAC]

Function

Sets the Inverter input voltage in units of 1V.

Description of choice

This setting is used as the reference value for functions such as the protection functions.

Set the Inverter input voltage (E1-01) to match the power supply voltage.

E1-02 (Motor Selection) X Q Q Q Q

SettingRange

- Standard fan-cooled motor (general-purpose motor) ★ [0]
- Standard blower-cooled motor (Inverter exclusive motor) [1]
- Special motor (vector-exclusive motor) [2]

Function

Motor selection (motor overheating protection)

Description of choice

Set the type of motor being used with the motor selection constant. This setting is a reference or overheating protection functions.

E1-03 (v/f Selection) X Q Q X X

SettingRange

0 to E: Select from the 15 preset patterns. [0]
 Custom user-set patterns (Applicable for settings E1-04 to E1-10) ★ [F]

Function

V/f pattern selection

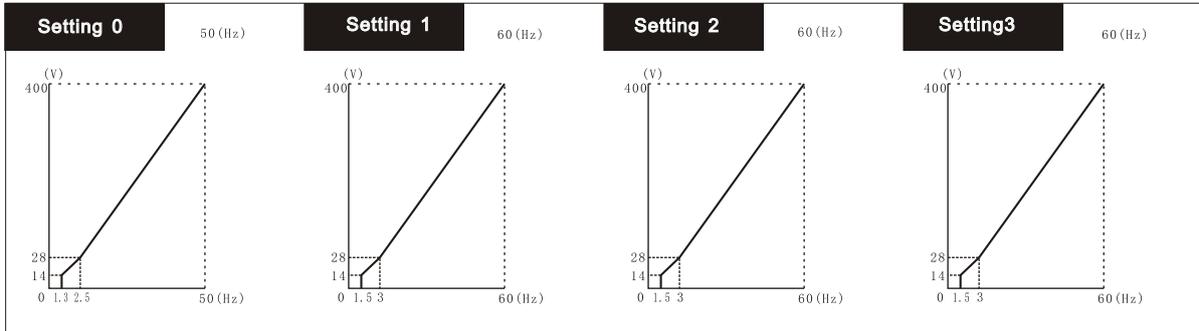
Description of choice

The V/f pattern can be set to any of the following:

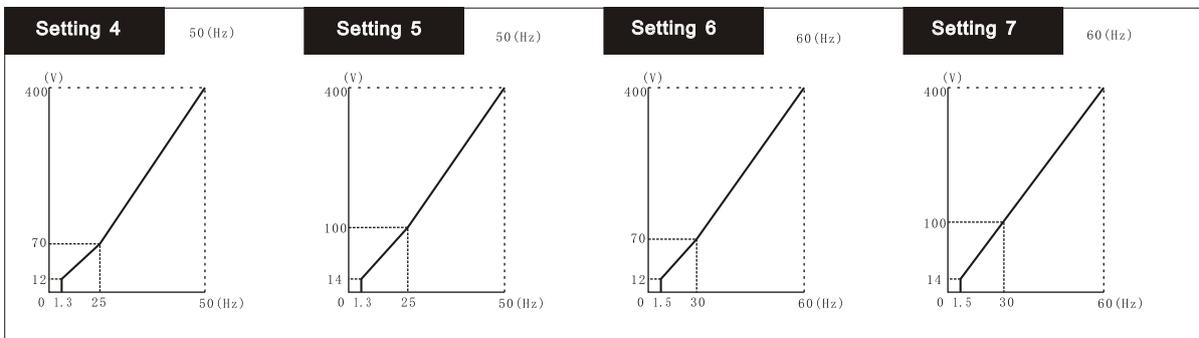
- One of 15 preset patterns (settings 0 through E)
- A custom user-set pattern (setting F)

V/f Patterns: 2.2 to 45kW

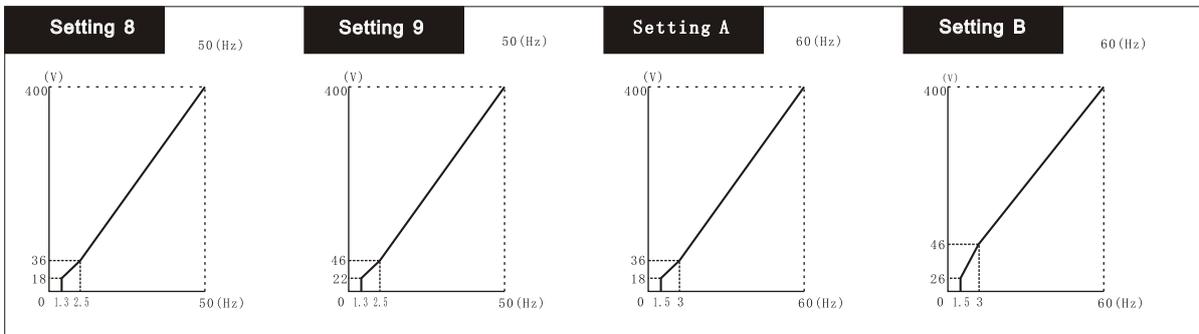
● Fixed Torque Characteristics(Settings 0 to 3)



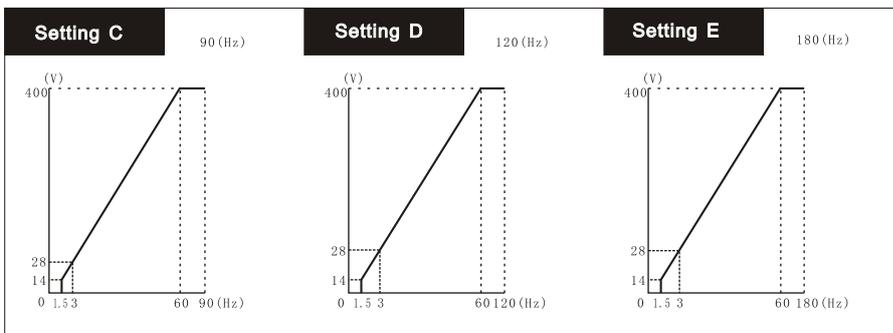
● Variable Torque Characteristics (Settings 4 to 7)



● High Starting Torque Characteristics(Settings 8 to b)

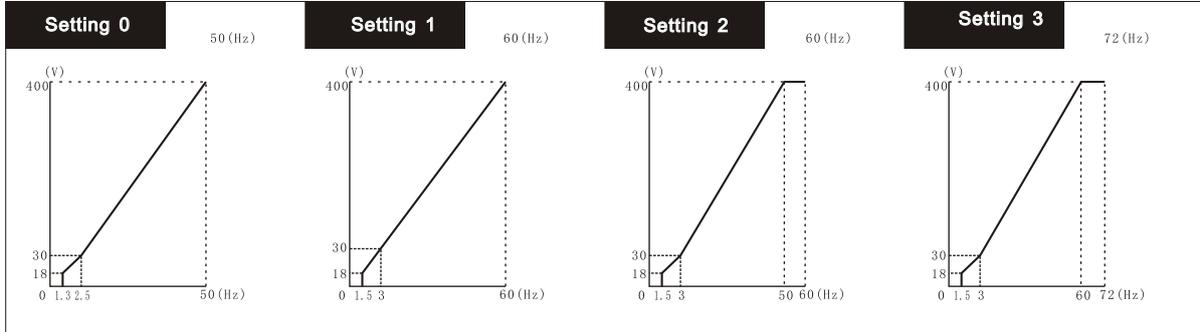


●High-speed Operation(SettingsCtoE)

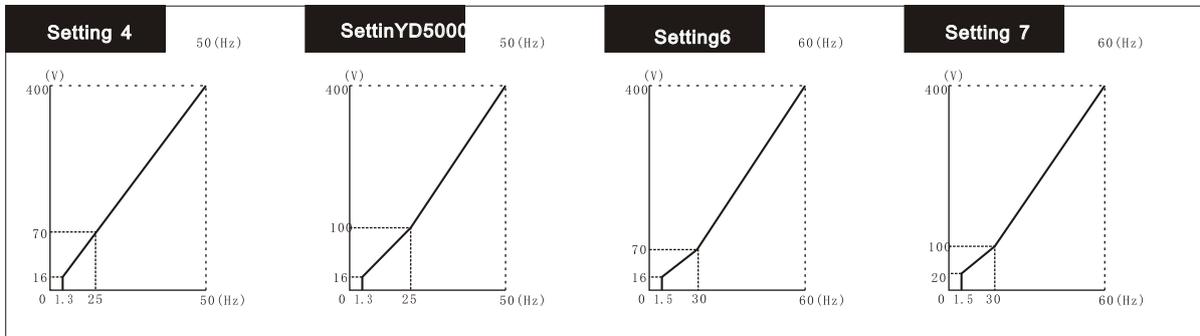


V/fPatterns:0.4 to 1.5kW

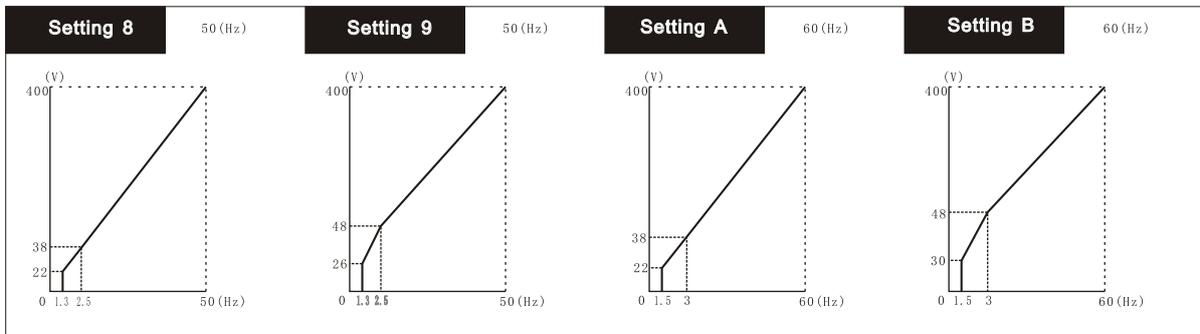
● Fixed Torque Characteristics (Settings 0 to 3)



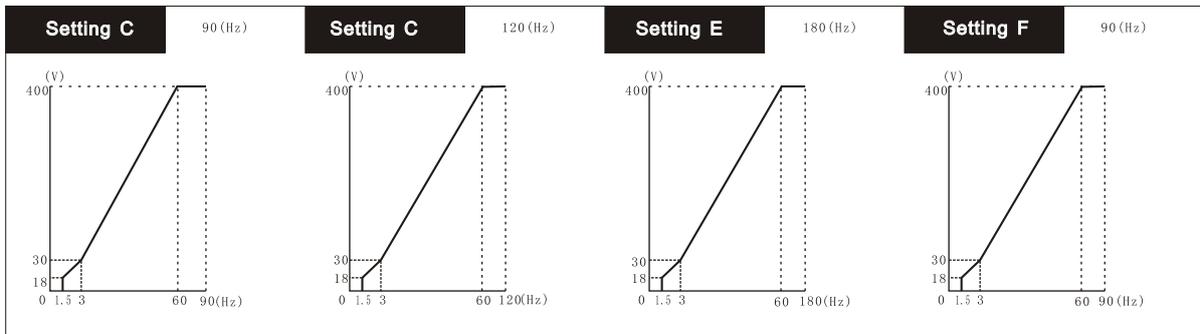
● Variable Torque Characteristics (Settings 4 to 7)



● High Starting Torque Characteristics (Settings 8 to b)

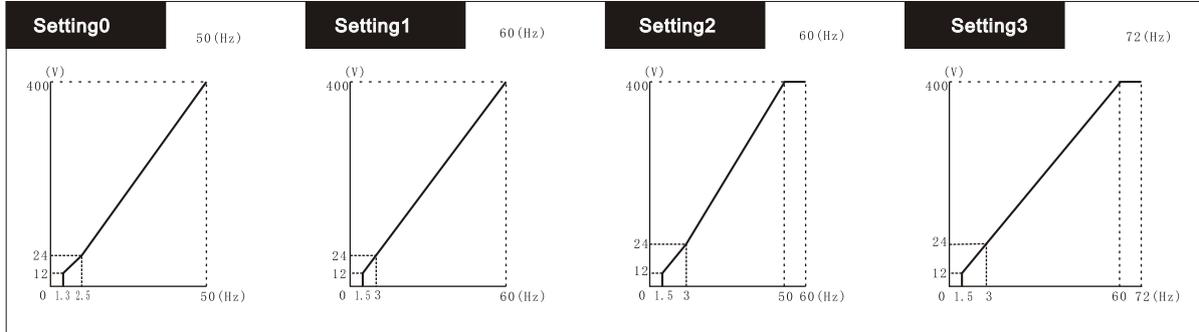


● High-speed Operation (Settings C to E)

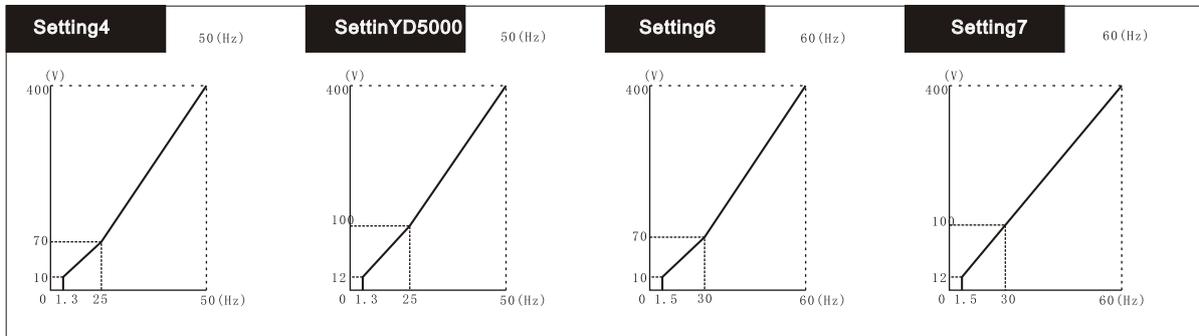


Variable Torque Characteristics(Settings 4 to 7)

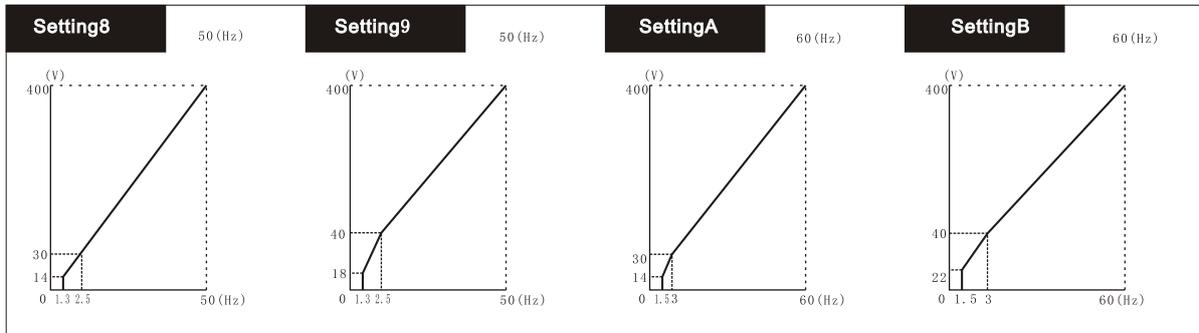
● Fixed Torque Characteristics(Settings 0 to 3)



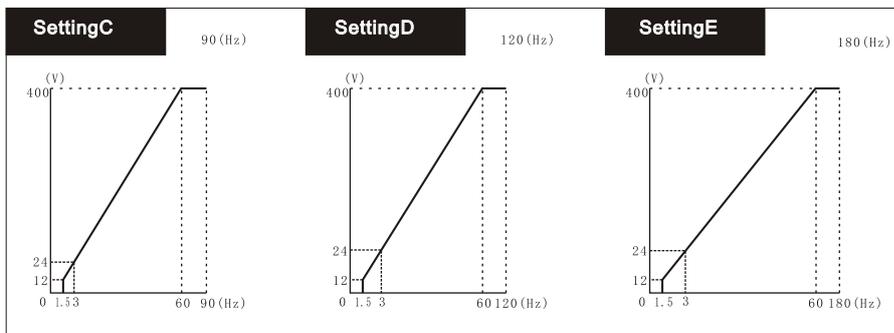
● Variable Torque Characteristics (Settings 4 to 7)



● High Starting Torque Characteristic (Settings 8 to b)



● High-speed Operation (Setting C to E)



E1-04 (Max Frequency) X Q Q Q Q

SettingRange
40.0~400.0 ★ [60.0]

Function
Set V / F curve

E1-05 (Max Voltage) X Q Q Q Q

SettingRange
0.0~510.0 ★ [400.0]

Function
Set V / F curve

E1-06 (Base Frequency) X Q Q Q Q

SettingRange
40.0~400.0 ★ [60.0]

Function
Set V / F curve

E1-07 (Mid Frequency A) X Q Q A X

SettingRange
40.0~400.0 ★ [3.0]

Function
Set V / F curve

E1-08 (Mid Voltage A) X Q Q A X

SettingRange
0.0~510.0 ★ [22.0]

Function
Set V / F curve

E1-09 (Min Frequency) X Q Q Q Q

SettingRange
0.0~400.0 ★ [0.5]

Function
Set V / F curve

E1-10 (Min Voltage) X Q Q Q A

SettingRange
0.0~510.0 ★ [4.0]

Function
Set V / F curve

E1-11 (Mid Frequency B) X A A A A

SettingRange
0.0~400.0 ★ [0.0]

Function
Set only to fine-adjust V/f for the output range when using flux control. Normally, this setting is not required.

E1-12 (2 (VC)) X A A A A

SettingRange

0.0~510.0 ★ [0.0]

Function
Set only to fine-adjust V/f for the output range when using flux vector control. Normally, this setting is not required.

E1-13 (Base Voltage) X A A Q Q

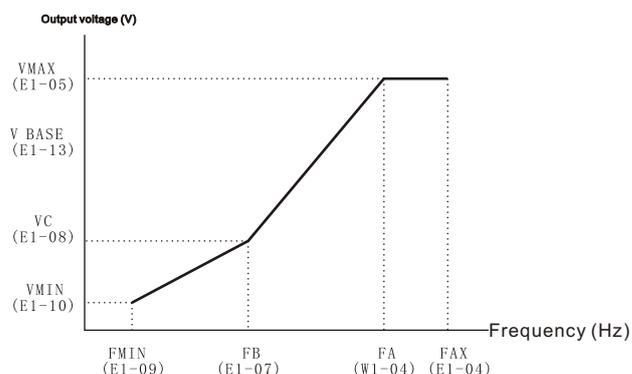
SettingRange
0.0~510.0 ★ [0.0]

Function
Set only to fine-adjust V/f for the output range when using flux vector control. Normally, this setting is not required.

SettingRange

Constants E1-04 through E1-10 can be set by the user when E1-03 has been set to "F." These constants are read-only when E1-03 isn't set to "F." When making the V/f characteristics a straight line, set the same value in E1-07 (middle output frequency) and E1-09 (minimum output frequency). In this case, constant E1-08 (middle output frequency voltage) will be disregarded.

$$E1-04 (FMAX) \geq E1-06 (FA) > E1-07 (FB) \geq E1-09 (FMIN)$$



User-defined V/f Pattern

5. 5. 2Th Motor Setup: E2

E2-01 (Motor Rated FLA) X Q Q Q Q

SettingRange
Click capacity may be based on ★

Function
Sets the motor rated current in 1 A units.

Description of choice
Set the rated current (A) shown on the motor nameplate.

E2-02 (motor Rated Slip) X A A Q Q

SettingRange
0.00~20.00 ★

Function
Sets the motor rated slip in Hz units.

Description of choice
This setting is used as a reference value for the torque compensation function. Calculate the rated slip from the value shown on the motor nameplate with the following equation and set this value.
Rated slip = rated frequency (Hz) - rated speed (r/min) × number of poles / 120

E2-03 (no-load Current) X A A Q Q

SettingRange

The default setting depends upon the Inverter capacity. ★

Function

Sets the motor no-load current in 1 A units.

Description of choice

Set the no-load current (E2-03) at the rated voltage and rated frequency. Normally this value isn't shown on the motor nameplate, so it might be necessary to contact the motor manufacturer.

E2-04 (number Of Poles) X X Q X Q

SettingRange

2~48 ★ [4]

Function

Sets the number of motor poles.

Description of choice

Set constant to the number of poles shown on the motor nameplate.

E2-05 (term Resistance) X A A A A

SettingRange

0.000~65.000 ★

Function

Sets the motor phase-to-phase resistance in Ω units.

SettingRange

This setting is used as a reference value for the torque compensation function.

The default setting depends upon the Inverter capacity.

Set the motor's terminal resistance (U-V, V-W, and W-U).

Normally this value isn't shown on the motor nameplate, so it might be necessary to contact the motor manufacturer.

E2-06 (leak Inductance) X X X A A

SettingRange

0.0~40.0 ★

Function

Sets the voltage drop due to motor leakage inductance as a percentage of the motor rated voltage.

SettingRange

The default setting depends upon the Inverter capacity. Set the voltage drop. This constant does not normally require setting because the Inverter automatically compensates during operation. Normally this value isn't shown on the motor nameplate, so it might be necessary to contact the motor manufacturer. It is also acceptable to set the loss (caused by the motor's leakage inductance) as a percentage.

E2-07 (Saturation Comp 1) X X X A A

SettingRange

0.00~0.50 ★ [0.50]

Function

Sets the motor iron saturation coefficient at 50% of magnetic flux.

E2-08 (Saturation Comp 2) X X X A A

SettingRange

0.00~0.75 ★ [0.75]

Function

Sets the motor iron saturation coefficient at 75% of magnetic flux.

Description of choice

Constants are not required when using the motor at or below the rated frequency.

Set these constants when operating at a frequency higher than the motor's rated frequency. Set the following values:

- Motor iron-core saturation coefficient 1: Iron-core saturation coefficient when magnetic flux is 50%.
- Motor iron-core saturation coefficient 2: Iron-core saturation coefficient when magnetic flux is 75%.

Normally these values aren't shown on the motor nameplate, so it might be necessary to contact the motor manufacturer. Operation will be possible with the factory-preset values.

E2-09 (Mechanical Loss) X X X X A

SettingRange

0.0~10.0 ★ [0.0]

Function

Sets motor mechanical loss as a percentage of motor rated output, W).

Description of choice

Normally it isn't necessary to change this setting in the following cases:

- There is a large torque loss to the motor's bearings
- There is a large torque loss to a fan or pump

Set the mechanical loss as a percentage of the motor's rated output power (W). Constant E2-09 is used to compensate for torque lost mechanically in the motor.

E2-10 (Tcomp Iron Lose) X A A X A

SettingRange

0~6553.5 ★

Function

Sets motor iron loss n W units.

Description of choice

Factory setting varies according to the size of the frequency power, or damage to the motor (W) as the unit set is usually not necessary, but the power inverter power with the click of a big difference, set for motor power and frequency

5. 5. 3 Motor 2 Control Method: E3

E3-01 (Control Method) X A A A A

SettingRange

V/f control [0]

Open loop vector [1]

Open-loop vector control ★ [2]

Flux vector control [3]

5. 5. 4 Motor 2 V/f Pattern: E4

E4-01 (V/F2 Max Freq) X A A A A

SettingRange

40.0~400.0 ★ [60.0]

Function

Set V / F curve

E4-02 (V/F2max Voltage)

SettingRange

0.0~510.0 ★ [400]

Function

Set V / F curve

E4-03(V/F2 Base Freq) X A A A A

SettingRange

0.0~400.0 ★ [60]

Function

Set V / F curve

E4-04 (V/F 2 Mid Freq)X A A A X

SettingRange

0.0~400.0 ★ [3.0]

Function

Set V / F curve

Description of choice

Constants E1-04 through E1-10 can be set by the user when E1-03 has been set to "F." These constants are read-only when E1-03 isn't set to "F."

When making the V/f characteristics a straight line, set the same value in E1-07 (middle output frequency) and E1-09 (minimum output frequency). In this case, constant E1-08 (middle output frequency voltage) will be disregarded.

E4-05 (V/F2 Mid Voltage)X A A A X

SettingRange

0.0~510.0 ★ [22.0]

Function

Set V / F curve

Description of choice

Constants E1-04 through E1-10 can be set by the user when E1-03 has been set to "F." These constants are read-only when E1-03 isn't set to "F."

When making the V/f characteristics a straight line, set the same value in E1-07 (middle output frequency) and E1-09 (minimum output frequency). In this case, constant E1-08 (middle output frequency voltage) will be disregarded.

E4-06 (V/F2 Mid Freq) X A A A A

SettingRange

0.0~400.0 ★ [0.5]

Function

Set V / F curve

Description of choice

Constants E1-04 through E1-10 can be set by the user when E1-03 has been set to "F." These constants are read-only when E1-03 isn't set to "F."

When making the V/f characteristics a straight line, set the same value in E1-07 (middle output frequency) and E1-09 (minimum output frequency). In this case, constant E1-08 (middle output frequency voltage) will be disregarded.

E4-07 (Min Voltage) X A A A X

SettingRange

0.0~510.0 ★ [4.0]

Function

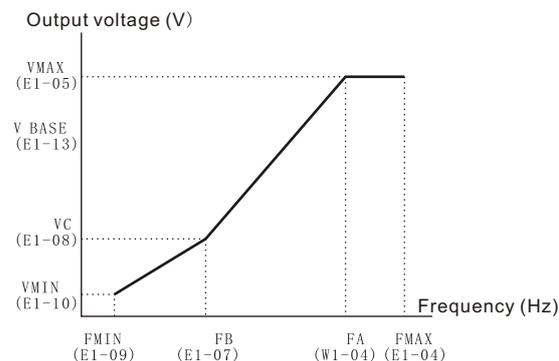
Set V / F curve

Description of choice

Constants E1-04 through E1-10 can be set by the user when E1-03 has been set to "F." These constants are read-only when E1-03 isn't set to "F."

When making the V/f characteristics a straight line, set the same value in E1-07 (middle output frequency) and E1-09 (minimum output frequency). In this case, constant E1-08 (middle output frequency voltage) will be disregarded.

E1-04 (FMAX) > E1-06 (FA) > E1-07 (FB) = E1-09 (FMIN)



User-defined V/f Pattern
5. 5. 4Motor 2 Setup: E5

E5-01 (Motor 2 rated FLA)X A A A A

SettingRange

These values will automatically be set if they were set during autotuning. ★

Function

Sets the motor rated current in 1 A units.

Description of choice

The setting range is 10% to 200% of the Inverter rated output current.

The default setting depends upon the Inverter capacity. (The table shows the default setting for 200V class, 0.4kW Inverters.)

E5-02 (Motor 2 Liip Freq)X A A A A

SettingRange

0.00~20.00 ★

Function

Sets the motor rated slip in Hz units.

Description of choice

The default setting depends upon the Inverter capacity. (The table shows the default settings for 200 V class, 0.4 kW Inverters.) Calculate the rated slip (E2-02) from the value shown on the motor nameplate with the following equation and set this value. Rated slip = rated frequency (Hz) - rated speed (r/min) × number of poles / 120

E5-03 (Motor 2 No-load Iq) X A A A A

SettingRange

These values will be automatically set during autotuning. ★

Function

Sets the motor no-load current in 1 A units.

Description of choice

Set the no-load current at the rated voltage and rated frequency. Normally this value isn't shown on the motor nameplate, so it might be necessary to contact the motor manufacturer.

E5-04 (Motor 2 # Poles)X X A X A

SettingRange

2~48 ★ [4]

Function

Sets the number of motor poles.

Description of choice

Please be recorded in the motor on the motor poles (pole) to set

E5-05 (Motor2 trem Ohms) X A A A A

SettingRange

0.000~65.000 ★

Function

Sets the motor phase-to-phase resistance in Ω units.

Description of choice

The default setting depends upon the Inverter capacity. (The table shows the default settings for 200 V class, 0.4 kW Inverters.) Set the motor terminal resistance (U-V, V-W, and W-U) in constant E2-05. Normally this value isn't shown on the motor nameplate, so it might be necessary to contact the motor manufacturer for the terminal resistance at the insulation class temperature. Use the following equations to calculate the resistance value from the terminal resistance of a test report.

- E-class insulation: Terminal resistance at 75°C in the test report (Ω) x 0.92
- B-class insulation: Terminal resistance at 75°C in the test report (Ω) x 0.92
- F-class insulation: Terminal resistance at 115°C in the test report (Ω) x 0.87

E5-06 (Motor 2 Leak) X X X A A

SettingRange

0.0~40.0 ★

Function

Sets the voltage drop due to motor leakage inductance as a percentage of the motor rated voltage.

Description of choice

The default setting depends upon the Inverter capacity. Set the voltage drop as a percentage of the motor's rated voltage in constant. This constant does not normally required setting because the Inverter automatically compensates during operation. Normally this value isn't shown on the motor nameplate, so it might be necessary to contact the motor manufacturer. It is also acceptable to set the loss (caused by the motor's leakage inductance) as a percentage.

5. 6Options Constants: F

5. 6. 1PG Option Setup: F1

F1-01 (PG Pulse/Rev) X X Q X Q

SettingRange

0~60000 ★ [600]

Function

Sets the number of PG (pulse generator or encoder) pulses

Description of choice

Set the PG (pulse generator or encoder) constant in pulses/revolution. Set the number of phase-A or phase-B pulses in one motor revolution.

F1-02 (PG Fdbk Loss Sel) X X B X B

SettingRange

Ramp to stop [0]
Coast to stop ★ [1]
Fast stop [2]
Continue operation [3]

Function

Sets the PG disconnection stopping method.

Description of choice

Sets the PG open-circuit detection time and stopping method that is used when a break is detected in the PG cable (PGO).

F1-03 (PG Overspeed Sel) X X B X B

SettingRange

Ramp to stop [0]
Coast to stop ★ [1]
Fast stop [2]
Continue operation [3]

Function

Sets the stopping method when an overspeed (os) fault occurs.

Description of choice

Set the conditions (level and time) for detecting overspeed and the stopping method that is used when an overspeed is detected.

F1-04 (PG Deviation Sel) X X B X B

SettingRange

Ramp to stop [0]
Coast to stop [1]
Fast stop [2]
Continue operation ★ [3]

Function

Sets the stopping method when a speed deviation (DEV) fault occurs

Description of choice

These constants set the conditions (level and time) for detecting PG speed deviation and the stopping method that is used when a PG speed deviation is detected.

F1-05 (PG Rotation Sel) X X B X B

SettingRange

Phase A leads with forward run command. ★ [0]
Phase B leads with forward run command. [1]

This constant is used to coordinate the PG's rotation direction with the motor's rotation direction.

The setting for the standard applicable Yaskawa PG (made by SUMTAK) is an advanced phase A for forward rotation. Generally, phase A leads when the PG rotates in the clockwise direction (looking from the input axis). When a forward reference is output, the motor rotates in the counterclockwise direction (looking from the output axis). Set whether phase A or phase B leads when the motor operates in the forward direction.

F1-06 (PG Output Ra-tio) X X B X B

SettingRange

1~132 ★ [1]

Function

Sets the division ratio for the PG speed control card pulse output. Division ratio = (1 + n) / m (n=0,1 m=1 to 32)

Description of choice

This constant is effective only when a PG-B2 PG Control Card is used. It sets the division ratio used when the pulse monitor output is connected to a pulse input device. The first digit in the setting (0 or 1) is n and the second two digits (01 to 32) are m. The division ratio is calculated from n and m with the following equation: Division ratio = (1 + n) / m. Setting Ranges n: 0, 1 m: 1 to 32. F1-06 = □□/□m. Possible division rate settings are as follows: 1/32 ≅ F1-06 ≅ 1. For example, if the division rate is 1/2 (a setting of "2"), the monitor output will be half of the number of pulses output from the PG.

F1-07 (PG Ramp PI/I Sel) X X B X X

SettingRange

Disabled ★ [0]
Enabled [1]

Function

Sets integral control during acceleration/deceleration to either enabled or disabled.

Description of choice

When “V/f control with PG feedback” is used, integral control during acceleration and deceleration can be enabled or disabled with F1-07. Set F1-07 to “1” (integral control enabled) if you want to keep the motor speed as close to the frequency reference as possible during acceleration and deceleration. Set F1-07 to “0” (integral control disabled) if you want to prevent the occurrence of overshooting/undershooting.

F1-08 (PG Overspd level) X X A X A

SettingRange

0~120 ★ [115]

Function

Sets the overspeed detection method.

F1-09 (PG Overspd Time) X X A X A

SettingRange

0.0~2.0 ★ [0.0]

Function

Sets the overspeed detection method.

Description of choice

Frequencies above that set for F1-08 (set as a percentage of the maximum output frequency), which continue to exceed this frequency for the detection time (F1-09), are detected as overspeed faults.

F1-10 (PG Deviate Level) X X A X A

SettingRange

0~50 ★ [10]

Function

Sets the speed deviation detection method.

F1-11 (PG Deviate Time) X X A X A

SettingRange

0.0~10.0 ★ [0.5]

Function

Sets the speed deviation detection method.

Description of choice

F1-10 and F1-11 Settings. Constant F1-10 sets the PG speed deviation detection level as a percentage of the maximum output frequency. Constant F1-11 sets the length of time in seconds that the difference between the motor speed and reference speed must exceed the PG speed deviation detection level in order to detect a PG speed deviation (DEV).

F1-12 (PG # Gear Teeth 1) X X A X A

SettingRange

0.0~1000 ★ [0]

Function

Sets the number of teeth on the gears if there are gears between the PG and the motor.

F1-13 (PG # Gear Teeth 2) X X A X X

SettingRange

0~1000 ★ [0]

Function

Sets the number of teeth on the gears if there are gears between the PG and the motor.

Description of choice

When “V/f control with PG feedback” is used, the motor can be operated even if there are gears between the motor and PG because the responsiveness is lower than it is with vector control. Set the number of teeth on the gears if there are gears between the motor and PG.

$$\text{Motor speed (r/min)} = \frac{\text{Number of pulses input from the PG} \times 60}{\text{Number of PG pulses (F1-01)}} \times \text{Number of gear teeth 2 (F1-13)}$$

Number of gear teeth 1 (F1-12)

A gear ratio of 1 (F1-12 = F1-13 = 1) will be used if either of these constants is set to 0.

F1-14 (PG open-circuit time) X X A X A

SettingRange

0.0~10.0 ★ [2.0]

Function

PG disconnection detection time, in seconds

5. 6. 2 Other Options Setup: F2 through F9

F2-01 (AI-14 Input Sel) X B B B B

SettingRange

3-channel individual ★ [0]
3-channel addition [1]

Function

Sets the functions for channel 1 to 3 which are effective when the AI-14B Analog Reference Card is used.

Description of choice

When using a AI-14B/AI-14U Analog Reference Card, set constant b1-01 (reference selection) to “3” (option). When using a AI-14B, set the function for channels 1 to 3 with constant F2-01. (There are no constants to set for AI-14U.) Constant b1-01 (reference selection) must be set to “1” (external terminal), when 3-channel individual input (setting: 0) is set. When using a AI-14B and setting 3-channel individual input, the multi-function inputs cannot be set to the Option/Inverter selection function (setting: 2).

F3-01 (DI Input) X B B B B

SettingRange

BCD 1% ★ [0]
BCD 0.1% [1]
BCD 0.01% [2]
BCD 1Hz [3]
BCD 0.1Hz [4]
BCD 0.01Hz [5]
BCD special setting [6]
Binary input [7]

Function

Sets the Digital Reference Card input method.

Description of choice

When using a DI-08 or DI-16H2 Digital Reference Card, set constant b1-01 (reference selection) to “3” (option) and set the input method with constant F3-01. The maximum frequency (100% speed) reference will be used when the binary input is set (setting: 7) and all bits are “1.”

- DI-08: Maximum output frequency reference (255/100%).
- DI-16H2: Maximum output frequency reference (16 bits: 30000/100%, 12 bits: 4095/100%). Setting 6, BCD special setting (5-digit input), is valid only when the DI-16H2 is used. Using this setting, a frequency from 0.00 to 399.98 Hz can be set in BCD. The data input method is different from that for settings of 1 to 5.

Setting: 1 to 5	Sign	8×10^3	4×10^3	2×10^3	1×10^3
Setting: 6		2×10^4	1×10^4	8×10^3	4×10^3
		8×10^0	4×10^0	2×10^0	1×10^0
		1×10^1	8×10^0	4×10^0	2×10^0

The sign bit is used as a data bit, so only positive (plus) data can be set.

The second digit below the decimal point is set by bits 8x100, 4x100, and 2x100, so the settings are made in units of 0.02 Hz. (If these three bits are "111," "110," and "101," they will be recognized as "9.")

If "2" or higher is set for 01-03, the input will become BCD, and the units will change to the 01-03 setting.

F4-01 (AO Ch1 Select) X B B B B

SettingRange

1~38 ★ [2]

Function

Effective when the Analog Monitor Card is used.

F4-02 (AO Ch1 Gain) 0 B B B B

SettingRange

0.00~2.50 ★ [1.00]

Function

Effective when the Analog Monitor Card is used.

F4-03 (AO Ch2 Select) X B B B B

SettingRange

1~30 ★ [3]

Function

Effective when the Analog Monitor Card is used.

F4-04 (AO Ch2 Gain) 0 B B B B

SettingRange

0.00~2.50 ★ [0.50]

Function

F4-05 (AO Ch1 Bias) 0 B B B B

SettingRange

-10.0~10.0 ★ [0.0]

Function

Sets the channel 1 item bias to 100%/10 V when the analog monitor card is used or used.

F4-06 (AO Ch2 Bias) 0 B B B B

SettingRange

-10.0~10.0 ★ [0.0]

Function

Sets the channel 2 item bias to 100%/10 V when the analog monitor card is used or used.

When using an AO-08 or AO-12 Analog Monitor Card, set the monitor items and gain with the following constants

•For the output monitor selections (F4-01, F4-03), set the numbers for the right side of the "U1" constants in the Table 4.3. The setting range is 1 to 38, but the following numbers cannot be set: 4, 10, 11, 12, 13, 14, 25, and 28 to 35.

•When the AO-12 is used, outputs of 0 to ±10 V are possible. For that, set constant H4-07 (multi-function analog output signal level selection) to "1" (0 to ±10 V outputs). There are some monitor items. However, that can only use outputs of 0 to +10 V even if constant H4-07 is set to "1." •When the AO-08 is used, only outputs of 0 to +10 V are possible regardless of the constant H4-07 setting.

F5-01 (DO-02 Ch1 Select) X B B B B

SettingRange

0.0~37 ★ [0]

Function

Effective when a Digital Output Card is used. Set the number of the multi-function output to be output.

Description of choice

Set the output selections in the following constants when using a DO-02 Digital Output Card.

Set the number of the multi-function output to be output

F5-02 (DO-02 Ch2 Select) X B B B B

SettingRange

0.0~37 ★ [1]

Function

Effective when a Digital Output Card is used. Set the number of the multi-function output to be output.

Description of choice

Set the output selections in the following constants when using a DO-02 Digital Output Card.

User Constant Number	Name	Change during Operation	Setting Range	Unit	Factory Setting
F5-01	Channel 1 output selection	×	00~37	×	0
F5-02	Channel 2 output selection	×	00~37	×	1

V/f Control	V/f with PG	OpenLoop Vector	Flux Vector
B	B	B	B
B	B	B	B

F6-01 (DO-08 Select) X B B B B

SettingRange

channels of individual out outputs ★ [0]

Binary code output [1]

Function

Effective when a DO-08 Digital Output Card is used. Set the output mode.

Description of choice

Set the output mode in the following constants when using a DO-08 Digital Output Card.

The items output from the DO-08 will be as follows according to the setting of F6-01.

Setting	Terminal	Output
0: 8 channels of individual out outputs	TD5-TD11	Overcurrent (SC, OC, GF)
	TD6-TD11	Overvoltage (OV)
	TD7-TD11	Inverter overload (OL2)
	TD8-TD11	Fuse blown (PUF)
	TD9-TD11	Overspeed (OS)
	TD10-TD11	Inverter overheat (OH1) or motor overload (OL1)
	TD1-TD2	Zero speed detection
1: Binary code output	TD3-TD4	Speed agree
	TD5-TD11	Bit 0
	TD6-TD11	Bit 1
	TD7-TD11	Bit 2
	TD8-TD11	Bit 3
	TD9-TD11	Zero speed detection
	TD10-TD11	Speed agree
TD1-TD2	Running	
TD3-TD4	Minor fault	

Coded Outputs

Bit 3210	Meaning	Bit 3210	Meaning
0000	No fault	1000	External fault (EFx)
0001	Overcurrent (SC, OC, GF)	1001	Controller fault (CPFx)
0010	Overvoltage (OV)	1010	Motor overload (OL1)
0011	Inverter overload (OL2)	1011	Not used
0100	Inverter overheat (OH, OH1)	1100	Power loss (UV1, UV2, UV3)
0101	Overspeed (OS)	1101	Excessive speed deviation (DEV)
0110	Fuse blown (PUF)	1110	PG disconnected (PGO)
0111	Braking Resistor Unit overheat (RH) Braking Transistor fault (RR)	1111	Not used.

F7-01 (P0-36F Selection) X B B B B

SettingRange

01 x Inverter output frequency	[0]
6 x Inverter output frequency	★ [1]
10 x Inverter output frequency	[2]
12 x Inverter output frequency	[3]
36 x Inverter output frequency	[4]

Function

Effective when the Pulse Monitor Card is used. Sets the number of output pulses.

Description of choice

When using a PO-36F Pulse Monitor Card, set the output pulse in constant F7-01.

Setting Description

F= the output frequency displayed in Hz. Example: When 0 (1F) is set, and the output frequency is 60Hz, 60 pulses per second are output. (50% duty)

F8-01 (E-15 Det Sel) 0 B B B B

Function

Deceleration to stop	[0]
Coast to stop	★ [1]
Emergency stop	[2]
Continue operation	[3]

F9-01 (E-15 Selection) X B B B B

NO contact	★ [0]
NC contact	[1]

Function

External fault input level from Optical option

F9-02 (EFO Detection) X B B B B

SettingRange

Always detect	★ [0]
Detect during operation	[1]

F9-03 (EFO Fault Act) X B B B B

SettingRange

Deceleration to stop	[0]
Coast to stop	★ [1]
Emergency stop	[2]
Continue operation	[3]

F9-04 (Trace Sample Time) X B B B B

SettingRange

0~60000	★ [0]
---------	-------

F9-05 (Torq Ref/Lmt Sel) X X X X B

SettingRange

Torque reference/ torque limit from transmission disabled.	[0]
Torque reference/ torque limit from transmission enabled.	★ [1]

F9-06 (BUS Fault Sel) X B B B B

SettingRange

Decelerate to stop	[0]
Coast to stop	★ [1]
Emergency stop	[2]
Continue operation	[3]

Function

Sets stop method when transmission error (BUS) is detected.

Description of choice

Operation selection when transmission error detected for transmission card other than SI-K2

5. 7 Terminal Constants: H

5. 7. 1 Multi-function Inputs: H1

H1-01 (Terminal 3 Sel) X B B B B

SettingRange

0~77	★ [24]
------	--------

Function

Multi-function input 1 (terminal 3)

Description of choice

Refer to the following instructions

H1-02 Terminal 4 Sel X B B B B

SettingRange

0~77	★ [14]
------	--------

Function

Multi-function input 2 (terminal 4)

Description of choice

Refer to the following instructions

H1-03 (Terminal 5 Sel) X B B B B

SettingRange

0~77	★ [3 (0)]
------	-----------

SettingRange

Multi-function input 3 (terminal 5)

Function

Refer to the following instructions

H1-04(Terminal 6 Sel)X B B B B**SettingRange**

0~77 ★ [4(3)]

Function

Multi-function input 4 (terminal 6)

Description of choice

Refer to the following instructions

H1-05 (Terminal 7 Sel)X B B B B**SettingRange**

0~77 ★ [6(4)]

Function

Multi-function input 5 (terminal 7)

Description of choice

Refer to the following instructions

H1-06 (Terminal 8 Sel) X B B B B**SettingRange**

0~77 ★ [8(6)]

Function

Multi-function input 6 (terminal 8)

Description of choice

Refer to the following instructions

7.5.5 External Terminal Functions: H

This section describes the settings for the external terminal functions.

Multi-function Input Settings: H1

The settings and functions for the multi-function inputs are listed in Table 7.8.

Table 7.8 Multi-function Input Functions

Setting value	Function	Control Method			
		V/f	V/tw/PG	Open loop Vector	Flux vector
0	3-wire sequence(Forward/Reverse run command)	○	○	○	○
1	Local/Remote selection(ON:Operator,OFF:Constantsetting)	○	○	○	○
2	Option/Inverter selection(ON:Optioncard)	○	○	○	○
3	Multi-step speed reference 1 When H3-05 is set to "0,"this function is combined with "Master/auxiliary speed switch."	○	○	○	○
4	Multi-step speed reference 2	○	○	○	○
5	Multi-step speed reference 3	○	○	○	○
6	Jog frequency reference (higher priority than multi-step speed reference)	○	○	○	○
7	Accel/Decel time 1	○	○	○	○
8	External baseblock NO (NO contact:Baseblock at ON)	○	○	○	○
9	External baseblock NC(NC contact:Baseblock at OFF)	○	○	○	○
A	Accel/Decel ramp hold(ON:Accel/decel stopped,frequency on hold)	○	○	○	○
B	OH2 alarm signal input (ON: OH2 will be displayed)	○	○	○	○
C	Multi-function analog input selection (ON: Enable)	○	○	○	○
D	No V/f control with PG (ON: Speed feedback control disabled,) (normal V/f control)	X	○	X	X
E	Speed control integral reset (ON: Integral control disabled)	X	○	X	—
F	Not used.	—	—	—	—
10	Up command (Always set with the down command)	○	○	○	○
11	Down command (Always set with the up command)	○	○	○	○
12	FJOG command (ON: Forward run at jog frequency d1-09)	○	○	○	○
13	RJOG command (ON: Reverse run at jog frequency d1-09)	○	○	○	○
14	Fault reset (Reset when turned ON)	○	○	○	○
15	Emergency stop (when NO contact is ON: Deceleration to stop in emergency stop time C1-09)	○	○	○	○
16	Motor switch command (Motor 2 selection)	○	○	○	○
17	Emergency stop (normally closed condition: Deceleration to stop in emergency when OFF) stop time C1-09	○	○	○	○
18	Timer function input (Functions are set with b4-01, b4-02 and the timer function is set at the same time)	○	○	○	○
19	PID control disable (ON: PID control disabled)	○	○	○	○
1A	Accel/Decel time 2	○	○	○	○
1B	Constants write enable (ON: All constants can be written-in. OFF: All constants other than frequency monitor are write protected.)	○	○	○	○
1C	Trim control increase (ON: d4-02 frequencies are added to analog frequency references.)	○	○	○	○
1D	Trim control decrease (ON: d4-02 frequencies are subtracted from analog frequency references.)	○	○	○	○
1E	Analog frequency reference sample/hold	○	○	○	○
1F	Frequency reference terminal 13/14 selection (ON: selects terminal 14); valid only when H309=1F	○	○	○	○
20 to 2F	External fault (Desired settings possible) Input mode: NO contact/NC contact, Detection mode: Normal/during operation Stopping method: Deceleration to stop, coast to stop, emergency stop or continue operation.	○	○	○	○
30	PID control integral reset (ON: Reset)	○	○	○	○
31	PID control integral hold (ON: Hold)	○	○	○	○
60	DC injection braking command (ON: Performs DC injection braking)	○	○	○	○
61	External speed search command 1: Maximum output frequency (ON: speed search)	○	X	○	X
62	External speed search command 2: Set frequency (ON: speed search)	○	X	○	X
63	Energy-saving command (ON: Energy-saving control set for b8-01, b8-02)	○	○	X	X
64	External speed search command 3	○	○	○	○
65	KEB (deceleration at momentary power loss) command (NO contact)	○	○	○	○
66	KEB (deceleration at momentary power loss) command (NO contact)	○	○	○	○
71	Speed/torque control change (ON: Torque control)	X	X	X	○
72	Zero-servo command (ON: Zero-servo)	X	X	X	○
77	Speed control (ASR) proportional gain switch (ON: C5-03)	X	X	X	○

- The factory settings in parentheses are for when the Unit is initialized for 3-wire control.
- The following table shows the settings and section references for some common functions.

Function	Setting
3-wire sequence (forward/reverse run command)	0
Multi-step speed references 1 to 3 and jog frequency reference	3to6
Accel/Decel time 1 and 2	7, 1A
Emergency stop	15
FJOG/RJOG commands	12, 13
Terminal 13/14 switch	1F
Timer function input	18
Energy-saving command	63

Local/Remote Selection (Setting: 1)

OFF	Operate with the frequency reference and run command specified in b1-01 (the frequency reference source) and b1-02 (run source).
ON	Operate with the frequency reference and run command set at the Digital Operator.

- With this setting, the multi-function input selects the input method for the frequency reference and run command.
- The input method can be switched only when the Inverter is stopped.
- The Digital Operator LOCAL/REMOTE Key is disabled when this function has been set in a multifunction input.

Option Card/Inverter Selection (Setting: 2)

OFF	The Inverter frequency reference is enabled.
ON	The Option Card frequency reference is enabled.

- With this setting, the multi-function input enables the frequency reference input from the Inverter itself or the one from Option Card. The frequency reference input can be switched only when the Inverter is stopped.
- Be sure that b1-01 (the frequency reference source selector) has been set to 0 (Operator) or 1 (external terminal). Only the frequency reference from the Option Card will be enabled if b1-01 is set to 3 (Option PCB).

External Baseblock NO (Setting: 8)

OFF	Normal operation
ON	Baseblock

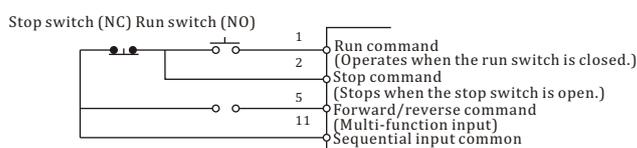
Constant Settings

User Constant Number	Name	Change during Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open Loop Vector	Flux Vector
H1-01	Multi-function input 1 (terminal 3)	×	0 to 77	-	24	B	B	B	B
H1-02	Multi-function input 2 (terminal 4)	×	0 to 77	-	14	B	B	B	B
H1-03	Multi-function input 3 (terminal 5)	×	0 to 77	-	3 (0)	B	B	B	B
H1-04	Multi-function input 4 (terminal 6)	×	0 to 77	-	4 (3)	B	B	B	B
H1-05	Multi-function input 5 (terminal 7)	×	0 to 77	-	6 (4)	B	B	B	B
H1-06	Multi-function input 5 (terminal 8)	×	0 to 77	-	8 (6)	B	B	B	B

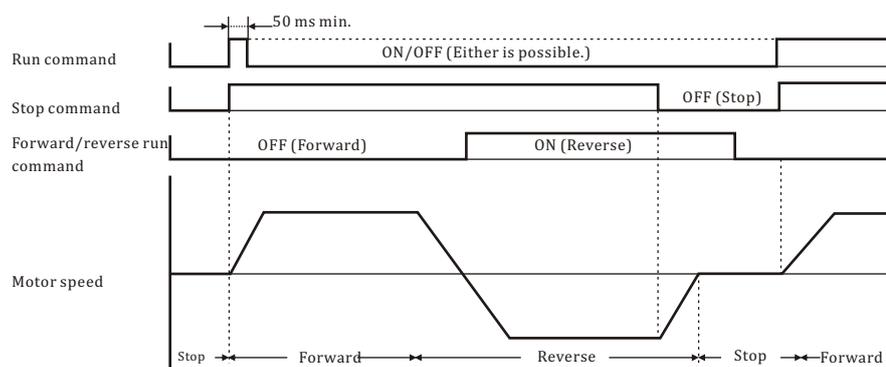
- The factory settings in parentheses are for when the Unit is initialized for 3-wire control.
- The following table shows the settings and section references for some common functions.
- 3-wire sequence (forward/reverse run command) Setting 0
- Multi-step speed references 1 to 3 and jog frequency Setting 3 to 6
- Accel/Decel time 1 and 2 Setting 7, 1A
- Emergency stop Setting 15
- FJOG/RJOG commands Setting 12, 13
- Terminal 13/14 switch Setting 1F

3-wire Sequence (Forward/Reverse Run Commands): "0"

- When a value of "0" is set for any one of the multi-function inputs (H1-01 through H1-06), 3-wire sequence control is used and the multi-function input terminal for which "0" was set becomes the forward/ reverse run command terminal.
- When the Unit is initialized for 3-wire sequence control with A1-03, multi-function input 3 (terminal 5) becomes the input terminal for the forward/reverse run command.



3-wire Sequence Wiring Example



Timing Chart for 3-wire Sequence

Multi-step Speed References 1 through 3 and JOG Reference: "3" to "6"

- Eight frequency references and one jog frequency reference can be used.
- Set the multi-step speed references 1, 2, and 3 and the JOG reference change the output speed and frequencies.

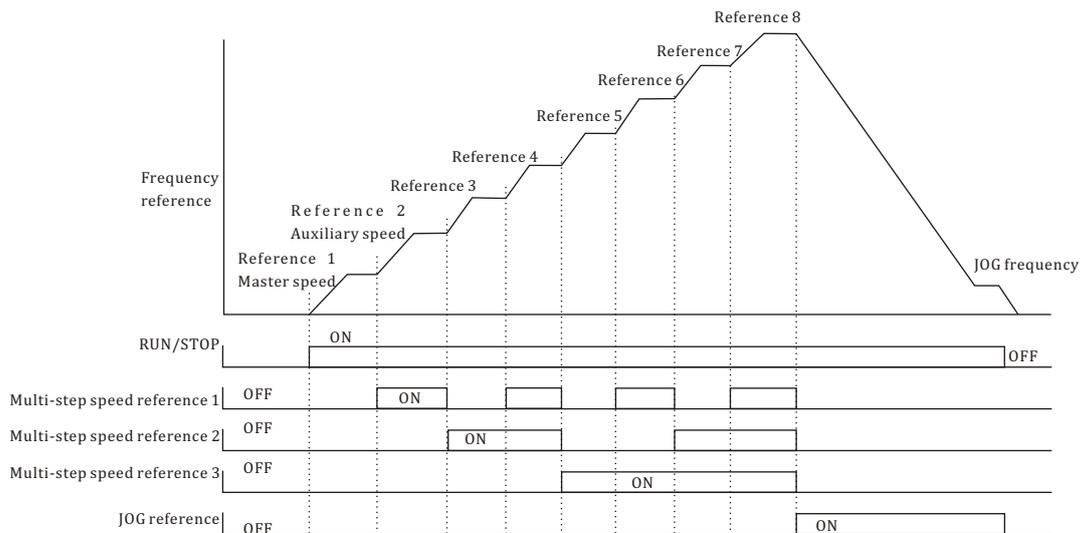
Terminal	Constant	Setting	Function
5	H1-03	3	Multi-step speed reference 1 (Also used for master-speed/auxiliary-speeds switching when an auxiliary reference is set for the multi-function analog input in H3-05.)
6	H1-04	4	Multi-step speed reference 2
7	H1-05	5	Multi-step speed reference 3
8	H1-06	6	JOG reference (This setting has higher priority than the multi-step speed reference.)

- The following table shows which frequency is selected by each possible combination of multi-step speed and JOG reference settings.

Terminal 5	Terminal 6	Terminal 7	Terminal 8	Selected frequency
Multi-step speed reference 1	Multi-step speed reference 2	Multi-step speed reference 3	JOG reference	
OFF	OFF	OFF	OFF	Reference 1: d1-01 (master speed frequency)
ON	OFF	OFF	OFF	Reference 2: d1-02 (auxiliary speed frequency)
OFF	ON	OFF	OFF	Reference 3: d1-03
ON	ON	OFF	OFF	Reference 4: d1-04
OFF	OFF	ON	OFF	Reference 5: d1-05
ON	OFF	ON	OFF	Reference 6: d1-06
OFF	ON	ON	OFF	Reference 7: d1-07
ON	ON	ON	OFF	Reference 8: d1-08
-	-	-	ON	Jog frequency: d1-09

Selecting 1-step and 2-step Frequency References

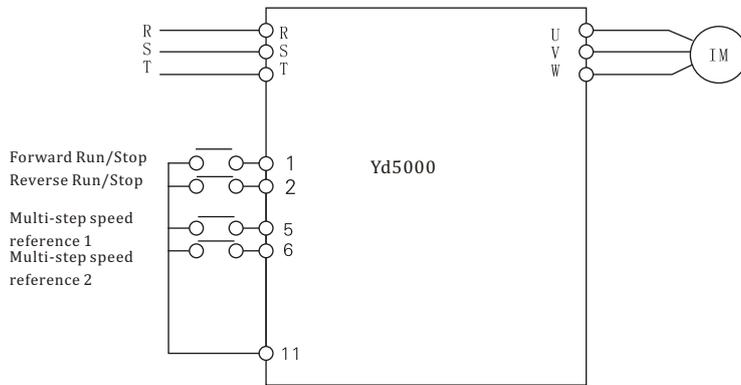
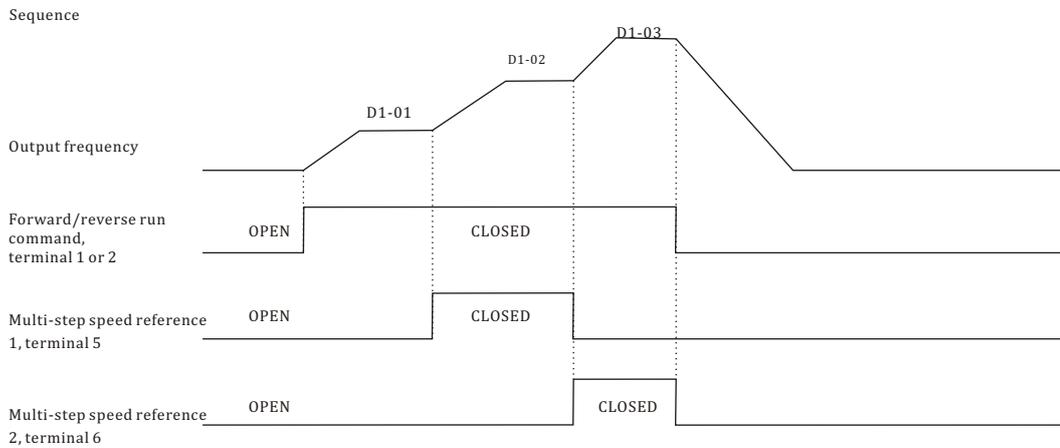
- To use the master frequency (analog terminal 13 or 14), set b1-01 to 1.
- To use frequency reference 1 (d1-01), set b1-01 to 0.
- To use the auxiliary frequency reference (analog terminal 16), use the factory setting.
- To use frequency reference 2 (d1-02), set H3-05 to 1F.



Timing Chart for Multi-step Speed and JOG References

Three-step Speed Operation Example

The following example shows three-step speed operation with frequencies set at Inverter constants.



User Constant Settings

Constant No.	Name	Setting
A1-01	Constant access level	3: Basic (B)
B1-01	Reference selection	0: Operator
D1-01	Frequency reference 1	::Hz (frequency setting)
D1-02	Frequency reference 2	::Hz (frequency setting)
D1-03	Frequency reference 3	::Hz (frequency setting)
H1-03	Multi-function input (terminal 5)	3: Multi-step speed reference 1 (factory setting)
H1-04	Multi-function input (terminal 6)	4: Multi-step speed reference 2 (factory setting)
H3-05	Multi-function input (terminal 16)	1F: Not used

Terminal 6 would not be needed if 2-step speed operation were required.

■ Acceleration/Deceleration Time Selectors 1 and 2: “7” and “1A”

- Four acceleration times and four deceleration times can be set. The multi-function inputs can be set as acceleration/deceleration time selectors 1 and 2 to switch between these acceleration and deceleration times.

Setting	Function
7	Acceleration/Deceleration time selector 1
1A	Acceleration/Deceleration time selector 2

- The following table shows which acceleration and deceleration times are selected by each possible combination of acceleration/deceleration time selectors 1 and 2.
- The acceleration and deceleration times can be changed while the Inverter is operating.

Accel/Decel Time Selector 1	Accel/Decel Time Selector 2	Acceleration Time	Deceleration Time
OFF or not set	OFF or not set	Acceleration time 1 (C1-01)	Deceleration time 1 (C1-02)
ON	OFF or not set	Acceleration time 2 (C1-03)	Deceleration time 2 (C1-04)
OFF or not set	ON	Acceleration time 3 (C1-05)	Deceleration time 3 (C1-06)
ON	ON	Acceleration time 4 (C1-07)	Deceleration time 4 (C1-08)

■ Emergency Stop: “15” and “17”

- When the multi-function input that is set as an emergency stop is turned ON, the motor will decelerate to a stop at the rate set with the deceleration time in C1-09 (emergency stop time).
- To clear the emergency stop, turn OFF the run command, turn OFF the emergency stop input, and then turn ON the run command again.
- Set “17” to make the emergency stop the normally closed condition.

Setting	Function
15	Emergency stop (normally open condition: Decelerates to stop when ON in the emergency stop period C1-09)
17	Emergency stop (normally closed condition: Decelerates to stop when OFF in the emergency stop period C1-09)

■ Forward and Reverse Jog Commands: “12” and “13”

The jogging can be performed in forward or reverse.

Setting	Function
12	Forward jog command: Runs forward at the jog frequency (d1-09).
13	Reverse jog command: Runs in reverse at the jog frequency (d1-09).

- The forward jog and reverse jog commands have priority over other frequency reference commands.
- The inverter will stop operation with the stopping method set in b1-03 if the forward jog and reverse jog commands are both ON for more than 500 ms.
- Turn ON either the forward jog command or the reverse jog command, not both.
- These jog commands can operate the Inverter independently. It isn't necessary for a forward/reverse run command to be input.

■ Terminal 13/14 Switch: “1F”

When this function is set for a multi-function input, that input terminal can be used to switch between terminal 13 and terminal 14.

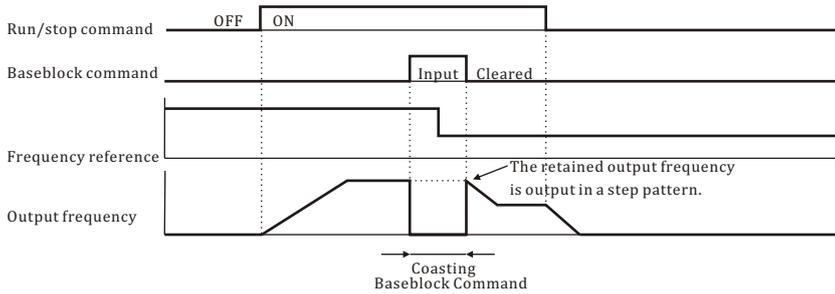
OFF	The analog input from terminal 13 is used as the master-speed frequency reference.
ON	The analog input from terminal 14 is used as the master speed frequency reference.

- When terminal 14 is used as the frequency reference, set “1F” (frequency reference) in constant H3-09; this constant is the function selector for (current) terminal 14. A setting fault (OPE03) will occur if this function is selected without setting “1F” in H3-09. When H3-09 is set to “1F” (frequency reference) but none of the multi-function inputs is set to “1F” (terminal 13/14 switch), the sum of the inputs and 14 will be used as the master speed frequency reference.

External Baseblock NC (Setting: 9)

OFF	Baseblock
ON	Normal operation

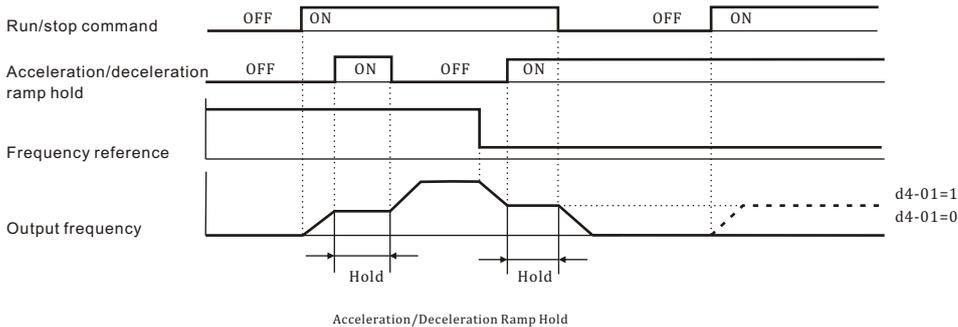
- With either of these settings, the multi-function input controls baseblock operation.
- Baseblock is an interruption of the Inverter output. The motor coasts while the baseblock command is being input.
- The output frequency is retained internally, so the same frequency will be output again when the baseblock command is cleared. The output frequency will change in a step pattern when the output resumes, so take some safety precaution such especially if the baseblock is turning OFF the run command – command was input when the motor was operating at high speed. (When the run command is turned OFF, the internally retained output frequency is reset to zero.)
- After a baseblock command is cleared, the voltage will be restored in the voltage recovery time set in



Acceleration/Deceleration Ramp Hold (Setting: A)

OFF	Normal operation or restart acceleration/deceleration.
ON	Pause acceleration/deceleration and maintain the present frequency.

- With this setting, the multi-function input pauses acceleration or deceleration and maintains (holds) the output frequency.
- Acceleration/deceleration is restarted when the acceleration/deceleration ramp hold input is turned OFF.
- The motor will be stopped if a stop command is input while the acceleration/deceleration ramp hold input is ON.
- When constant d4-01 (the frequency reference hold function selector) is set to 1, the held frequency will be stored in memory. This stored frequency will be retained even after a power loss and the motor will be restarted at this frequency when a run command is input again.



- When d4-01 is set to 1, the held output frequency will be retained. To operate at this frequency even after the Inverter is stopped,
- ON input hold ramp the acceleration/deceleration with input is command run the if zero at held be will frequency output the 0, to set is d4-01 When input the run command with the acceleration /deceleration ramp hold input ON.

OH2 Alarm Signal (Setting: B)

OFF	Normal operation
ON	Normal operation (The warning message "OH2" will be displayed on the Digital Operator.)

- The message "OH2" will be displayed on the Digital Operator while the multi-function input is ON and the display will revert to its previous status when the input is turned OFF. (It isn't necessary to reset the alarm.) The Inverter will continue operation without detecting a fault.
- With this setting, a temperature sensor can be connected to the multi-function input to display a warning message when the temperature rises too high.

Multi-function Analog Input Selection (Setting: C)

OFF	Disables the multi-function analog input (terminal 16).
ON	Enables the multi-function analog input (terminal 16).

- With this setting, the multi-function input can be used to enable or disable the multi-function analog input.
- Turning the input OFF has the same effect as setting H3-05 (the multi-function analog input selector for terminal 16) to 1F.

No V/f Control with PG (Setting: D)

OFF	V/f control with PG feedback (enables speed control with speed feedback)
ON	Normal V/f control (disables speed feedback control.)

- With this setting, the multi-function input can be used to switch "V/f control with PG feedback" to "Normal V/f control." It is possible to switch between these control methods during operation.

Speed Control Integral Reset (Setting: E)

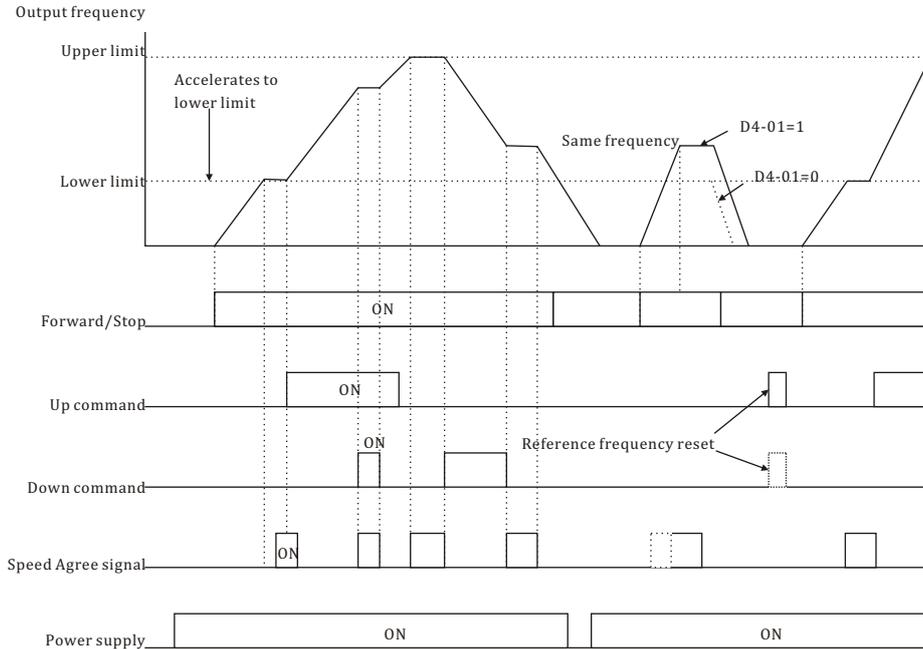
OFF	Operates with PI-control speed control loop.
ON	Operates with P-control speed control loop. (The speed control integral values are reset by the integral time constant.)

- This function is valid only for V/f control with PG feedback when constant F1-07 is set to 0. (Setting F1-07 to 0 disables integral operation during acceleration/deceleration.)
- It is possible to switch between these speed control modes during operation.

Up and Down Commands (Settings: 10 and 11)

Operation	Acceleration	Deceleration	Hold	Hold
Up command	ON	OFF	ON	OFF
Down command	OFF	ON	ON	OFF

- With these settings, the multi-function inputs can be used to control the Inverter's output frequency.
- When using this function, be sure to set both the up command (setting 10) and the down command (setting 11) for 2 multi-function inputs. An OPE03 option fault will occur if only one of these commands is set or if an acceleration/deceleration ramp hold input (setting A) is set at the Be sure to set constant b1-02 (the run command source selector) to 1 (external terminal). The up/down function won't operate with any other b1-02 setting. The frequency up/down commands operate according to the normal acceleration/deceleration times in C1-01 to C1-08. Upper limit = Maximum output frequency (E1-04) × Reference upper limit (d2-01) / 100. The upper and lower limits for the output frequency with the up/down commands are determined by the following settings: Lower limit = Maximum output frequency (E1-04) × Reference lower limit (d2-02) / 100. When frequency reference (voltage) terminal 13 or frequency reference (current) terminal 14 is being used as a frequency reference input, the greatest frequency value becomes the lower limit (except when UP and DOWN are OFF, and run command is turned ON.) When the up/down function is being used, the output frequency will be accelerated to the lower limit if a run command is input. When the up/down function and jog frequency reference are both assigned to multi-function inputs, an ON jog frequency reference input has the highest priority. Multi-step speed references 1 to 8 are all disabled when the up/down function has been set. The output frequency held by the up/down function will be stored in memory if d4-01 (the frequency reference hold function selector) is set to 1. This output frequency will be retained even after a power loss, and operation will be restarted at this frequency the next time that a run command is input. The stored output frequency will be cleared from memory if the up or down command is turned ON while the run command is OFF (see "Reference frequency reset" in Figure 7.36).



The Speed Agree signal remains ON while the run command is ON and the motor is not accelerating or decelerating.

Timing Chart for Up and Down Commands

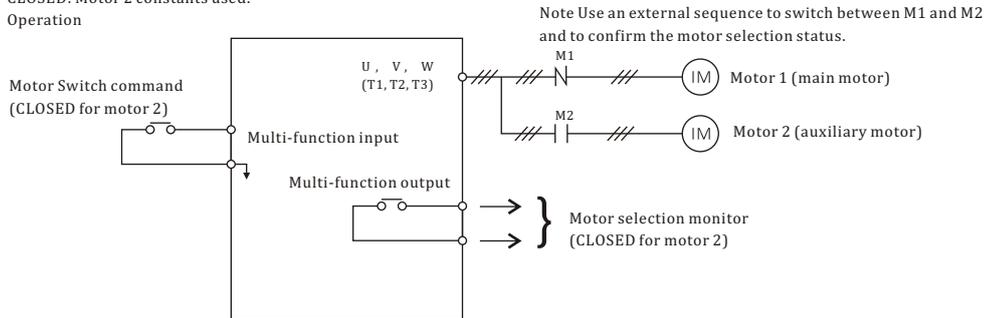
Fault Reset (Setting: 14)

OFF	Normal operation
ON	Resets faults when input goes from OFF to ON. (Normal operation when no fault has occurred.)

- With this setting, the multi-function input resets faults that have occurred.
- When a fault has occurred, be sure to find out what kind of fault occurred, take steps to correct the cause of the fault, and restart the Inverter. The Inverter by repeatedly resetting a fault without correcting the cause. To resume operation after a fault has occurred, turn the run command OFF, turn the fault reset input from ON to OFF, and then turn the run command ON. If a fault hasn't occurred, turning the fault reset ON and OFF will have no effect on operation.

Motor Switch Command (Motor 2 Selection, Setting: 16)

CLOSED: Motor 2 constants used.
Operation

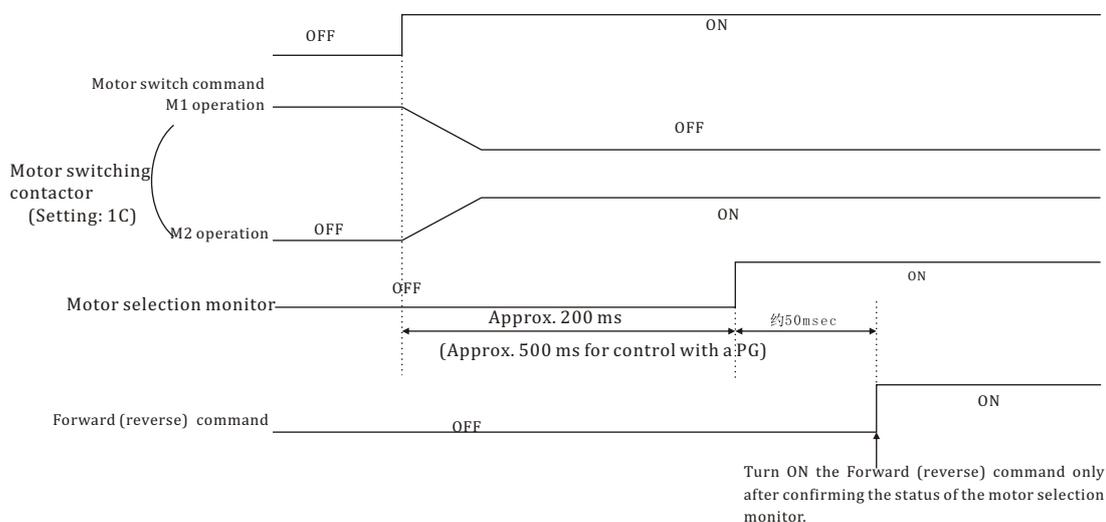


- The control method, V/f characteristics, and motor constants recorded in the Inverter can be switched by setting "16" (motor switch command) for a constant from H1-01 to 06 (multi-function inputs), and then inputting a signal while the motor is stopped.
- The current motor selection can be monitored at a multi-function output terminal by setting "1C" (motor selection monitor) for a constant from H2-01 to 03 (multi-function outputs).

- Set the Basic (3) or Advanced (4) access level in the initialize setting A1-01 (access level).
- The constants being used will be changed as shown in the following table for the motor switch command.

Motor Switch command	OPEN (motor 1)	CLOSED (motor 2)
Control method *	A1-02 (control method in initialize settings)	E3-01 (motor 2 control method)
V/f characteristics	E1-04 to 13 (V/f characteristics)	E4-01 to 07 (motor 2 V/f characteristics)
Motor constants	E2-01 to 09 (motor constants)	E5-01 to 06 (motor 2 motor constants)
Motor selection monitor	OPEN	CLOSED

-
- When A1-02 ≠ E3-01, the constants under 8.2.9 are initialized each time the motor is switched. The timing chart for switching between motor 1 and motor 2 is shown below.



PID Control Disable (Setting: 19)

OFF	Enables PID control.
ON	Disables PID control. (Normal Inverter control)

- With this setting, the multi-function input switches between PID control and normal inverter control. This function can be used to perform trial operation or jog operation with normal inverter control (open-loop control) and then switch to PID control (closed-loop control using feedback) after adjusting the system. The PID disable function can also be used to switch to open-loop control when there is a problem with the feedback value.

Constants Write Enable (Setting: 1B)

OFF	Write-protects all constants except for frequency monitor.
ON	Allows constants specified in Initialize mode to be changed.

- With this setting, the multi-function input can be used to write-protect the Operator constants. When the input is OFF, the Operation mode frequency can be monitored and the frequency can be changed but other changes are prohibited.

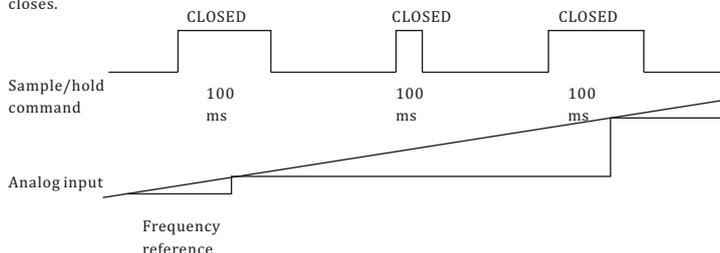
Trim Control Increase and Decrease (Settings: 1C and 1D)

Output frequency	Reference frequency			
	+ trim control level (d4-02)	Reference frequency - trim control level (d4-02)	Reference frequency	Reference frequency
Trim Control Increase	ON	OFF	ON	OFF
Trim Control Decrease	OFF	ON	ON	OFF

- The trim control increase function adds the level in d4-02 to the analog frequency reference.
- The trim control decrease function subtracts the level in d4-02 to the analog frequency reference.
- These functions are effective when the frequency reference is input from an analog input. These functions must both be set at the same time or an OPE03 fault will occur. The analog frequency reference won't be changed when both the trim control increase and decrease inputs are ON. The output frequency will be zero when the trim control decrease input is ON and the result of the subtraction is less than zero.

Analog Frequency Reference Sample/Hold (Setting: 1E)

The analog input value will become the frequency reference 100 ms after the multi-function input closes.



Analog Frequency Reference Sample/Hold

- The analog frequency reference sample/hold function is valid only for terminals 13, 14, and 16 or for the analog inputs from the AI-14U or AI-14B.
- An OPE03 fault will occur if two or more of the following signals turn ON at the same time: acceleration/deceleration ramp hold command (0A), up/down commands (10 or 11), trim control increase/decrease commands (1C or 1D), and the analog frequency reference sample/hold command.

External Faults (Settings: 20 to 2F)

- With this setting, the multi-function input can be used to stop the Inverter or output an alarm when a malfunction or fault occurs in a peripheral device.
- There are 16 external fault inputs available with all 16 combinations of the following variables. Select the setting with the desired combination.
- Input level: Normally open or normally closed
- Detection method: Always or During operation only
- Operation selection: Deceleration to stop, Coast to stop, Emergency stop, or Continue operation

External Fault Settings

Setting	Input level		Detection method			Operation selection		
	NO contact	NC contact	Always	During operation	Deceleration stop (Fault)	Coast to stop (Fault)	Emergency stop (Fault)	Continue operation (Alarm)
20	<input type="radio"/>		<input type="radio"/>			<input type="radio"/>		
21		<input type="radio"/>	<input type="radio"/>			<input type="radio"/>		
22	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>			
23		<input type="radio"/>		<input type="radio"/>	<input type="radio"/>			
24	<input type="radio"/>		<input type="radio"/>			<input type="radio"/>		
25		<input type="radio"/>	<input type="radio"/>			<input type="radio"/>		
26	<input type="radio"/>			<input type="radio"/>		<input type="radio"/>		
27		<input type="radio"/>		<input type="radio"/>		<input type="radio"/>		
28	<input type="radio"/>		<input type="radio"/>				<input type="radio"/>	
29		<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	
2A	<input type="radio"/>			<input type="radio"/>			<input type="radio"/>	
2B		<input type="radio"/>		<input type="radio"/>			<input type="radio"/>	
2C	<input type="radio"/>		<input type="radio"/>					<input type="radio"/>
2D		<input type="radio"/>	<input type="radio"/>					<input type="radio"/>
2E	<input type="radio"/>			<input type="radio"/>				<input type="radio"/>
2F		<input type="radio"/>		<input type="radio"/>				<input type="radio"/>

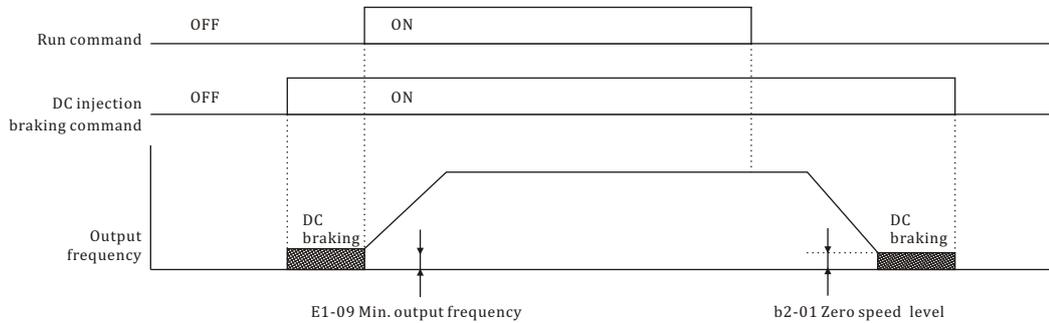
- For the input level, select whether you want a fault to be detected when the input signal is ON (normally open input) or OFF (normally closed input). For the detection method, select whether you want faults to be detected any time that the Inverter is ON or only during operation.

- For the operation selection, select the processing method that you want to be performed when a fault has been detected.
- Deceleration to stop: A fault is output and the output stopped in the selected deceleration time.
- Coast to stop: A fault is output and the Inverter output is cut off.
- Emergency stop: A fault is output and the output stopped in the emergency stop time (C1-09).
- Continue operation: An alarm is output and operation continues.
- When an alarm is going to be output externally, be sure to set one of the multi-function outputs (H2-01, 02, and 03) to alarm (setting 10).
- An external fault setting cannot be set in more than one multi-function input.
- Unlike other constant settings, the external fault settings have an input procedure, as shown in the following diagrams.

DC Injection Braking Command (Setting: 60)

OFF	Normal operation
ON	Applies DC injection braking if the Inverter is stopped. (Applies initial excitation when flux vector control is being used.)

- DC injection braking is used to prevent the motor from rotating due to inertia or external forces when the Inverter is stopped.
- DC injection braking is performed if the DC injection braking input is ON while the Inverter is stopped.
- If a run command or jog command (jog, forward jog, or reverse jog) is input, the DC injection braking will be cleared and motor operation will be started.



Timing Chart for DC Injection Braking Command

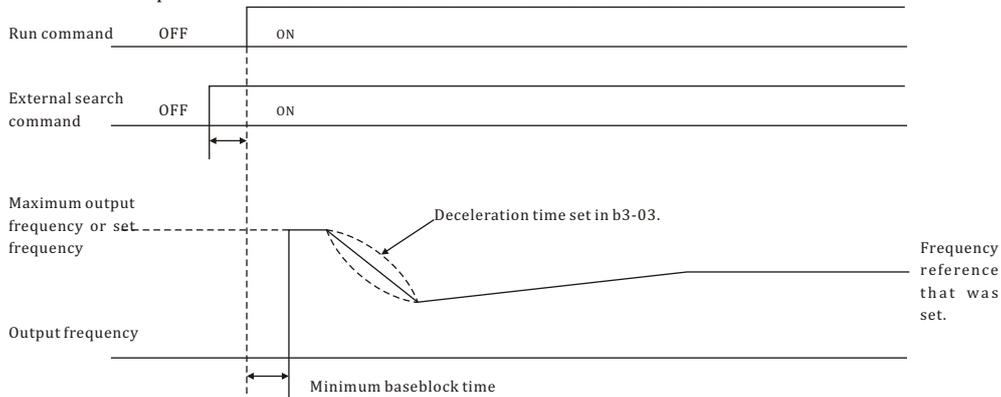
External Speed Search 1 (Settings: 61)

OFF	Normal operation
ON	Starts a speed search from the maximum output frequency.

External Speed Search 2 (Settings: 62)

OFF	Normal operation
ON	Starts a speed search from the set frequency (from the current reference frequency when the external search command turn ON).

- Either one of the external search functions can be set, but not both.
- The speed search function can be used to operate the motor without tripping when switching operation from a commercial power supply and the Inverter or starting a coasting motor.
- The speed search will begin after the minimum baseblock time (L2-03) has elapsed when the run command is input after the external search command has been turned ON.



Timing Chart for the External Search Command

Speed/Torque Control Change (Setting: 71)

OFF	Speed control
ON	Torque control

- With this setting, the multi-function input can be used to switch between speed and torque control. Refer to 7.3.4 Speed/Torque Control Switching Function for more details.

Zero-servo Command (Setting: 72)

OFF	Normal operation
ON	Zero-servo when the frequency (speed) reference falls below the zero-speed level in b2-01.

- With this setting, the multi-function input controls the zero-servo function (b9-01 and b9-02).
- When the zero-servo command is ON, a position control loop is formed and the motor is completely stopped when the frequency (speed) reference falls below the excitation level set in b2-01. Refer to 7.3.2 Zero-servo Function for more details.

Speed Control (ASR) Proportional Gain Switch (Setting: 77)

OFF	The gain is set according to the values in C5-01, C5-03, and C5-07.
ON	The gain is set to the value in C5-03 (ASR proportional gain 2).

With this setting, the multi-function input switches the proportional gain used in speed control (ASR). The integral time is not changed.

5.7.2

H2-01 (Terminal 9 Sel)	X	B	B	B	B
------------------------	---	---	---	---	---

SettingRange

0~37 ★ [0]

Function

Multi-function input (terminal 9-10)

Description of choice

Refer to the following instructions

H2-02 (Terminal 25 Sel)	X	B	B	B	B
-------------------------	---	---	---	---	---

SettingRange

0~37 ★ [1]

Function

Multi-function input (terminal 25-27)

Description of choice

Refer to the following instructions

H2-03 (Terminal 26 Sel)	X	B	B	B	B
-------------------------	---	---	---	---	---

SettingRange

0~37 ★ [2]

Function

Multi-function input (terminal 26-27)

Description of choice

Refer to the following instructions

Multi-function Output Settings: H2

Multi-function Output Functions

Setting value	Function	Control Methods			
		V/f	V/f w / PG	Open loop Vector	Flux vector
0	During run (ON: run command is ON or voltage is being output)	○	○	○	○
1	Zero-speed	○	○	○	○
2	Frequency agree 1: (Detection width L4-02)	○	○	○	○
3	Desired frequency agree 1 (ON: Output frequency = \pm L4-01, detection width in L4-02)	○	○	○	○
4	Frequency (Four) detection 1 (ON: +L4-01 \geq output frequency \geq -L4-01, detection width in L4-02)	○	○	○	○
5	Frequency (Four) detection 2 (ON: Output frequency \geq +L4-01 or output frequency \leq -L4-01, detection width in L4-02)	○	○	○	○
6	Inverter operation ready READY: After initialization, no faults	○	○	○	○
7	During DC bus undervoltage (UV) detection	○	○	○	○
8	During baseblock (ON: during baseblock)	○	○	○	○
9	Frequency reference selection (ON: Frequency reference from Operator)	○	○	○	○
A	Run command selection (ON: Run command from Operator)	○	○	○	○
B	Overtorque detection 1 NO (NO contact: Overtorque detection at ON)	○	○	○	○
C	Loss of frequency reference (Effective when operation selection is "1" for L4-05 frequency reference missing)	○	○	○	○
D	Braking resistor fault (ON: Resistor overheat or braking transistor fault)	○	○	○	○
E	Fault (ON: Faults other than CPF00, CPF01 have occurred.)	○	○	○	○
F	Not used.	—	—	—	—
10	Minor fault (ON: Alarm displayed)	○	○	○	○
11	Fault reset command active	○	○	○	○
12	Timer function output	○	○	○	○
13	Frequency agree 2 (Detection width: L4-04)	○	○	○	○
14	Desired frequency agree 2 (ON: Output frequency = L4-03, detection width in L4-04)	○	○	○	○
15	Frequency detection 3 (ON: Output frequency \leq -L4-03, detection width in L4-04)	○	○	○	○
16	Frequency detection 4 (ON: Output frequency \geq -L4-03, detection width in L4-04)	○	○	○	○
17	Overtorque detection 1 NC (NC Contact: Torque detection at OFF)	○	○	○	○
18	Overtorque detection 2 NO (NO Contact: Torque detection at ON)	○	○	○	○
19	Overtorque detection 2 NC (NC Contact: Torque detection at OFF)	○	○	○	○
1A	During reverse run (ON: During reverse run)	○	○	○	○
1B	During baseblock 2 (OFF: During baseblock)	○	○	○	○
1C	Motor selection (Motor under selection)	○	○	○	○
1D	Regenerating (ON: Regenerating)	X	X	X	○
1E	Restart enabled (ON: Restart enabled)	○	○	○	○
1F	Motor overload (OL1) pre-alarm (ON: 90% or more of the detection level)	○	○	○	○
20	Inverter overheat (OH) pre-alarm (ON: Temperature exceeds L8-02 setting)	○	○	○	○
30	During torque limit (current limit) (ON: During torque limit)	X	X	○	○
31	During speed reference limit. (ON: During speed reference limit)	X	X	X	○
33	Zero-servo end (ON: Zero-servo function completed)	X	X	X	○
37	During run 2 (ON: Frequency output, OFF: Base block, DC injection braking, initial excitation, operation stop.)	○	○	○	○

Constant Settings

User Constant Number	Name	Change during Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open Loop Vector	Flux Vector
H2-01	Multi-function input (terminal 9-10)	×	0 to 37	–	0	B	B	B	B
H2-02	Multi-function input (terminal 25)	×	0 to 37	–	1	B	B	B	B
H2-03	Multi-function input (terminal 26)	×	0 to 37	–	2	B	B	B	B

The following table shows the settings and section references for functions that are described in more

Function	Setting	Section
Frequency Agree 1	2	Frequency Detection Settings: L4-01 to L4-05 in L4 to L4 in 7.5.6
Desired Frequency Agree 1	3	
Frequency Detection 1	4	
Frequency Detection 2	5	
Overtorque Detection 1 (NO)	B	Overtorque Detection Settings: L6-01 to L6-06 in 7.5.6
Loss of Frequency Reference	C	Timer Functions: b4 01 b4 02 in 7.5.1
Timer Function Output	12	
Frequency Agree 2	13	Frequency Detection Settings: L4-01 to L4-05 in 7.5.6
Desired Frequency Agree 2	14	
Frequency Detection 3	15	
Frequency Detection 4	16	
Overtorque Detection 1 (NC)	17	Overtorque Detection Settings: L6-01 to L6-06 in 7.5.6
Overtorque Detection 2 (NO)	18	
Overtorque Detection 2 (NC)	19	

Refer to Table 7.10 Multi-function Output Functions for information on the following functions.

Function	Setting
Inverter Operation Ready	6
DC Bus Undervoltage	7
During Baseblock	8
Frequency Reference Selection	9
Run Command Selection	A
Braking Resistor Fault	D
Fault	E
Minor Fault	10
Fault Reset Command Active	11
During Reverse Run	1A
During Baseblock 2	1B
Regenerating	1D
Restart Enabled	1E
During Torque Limit (Current Limit)	30
During Speed Limit	31

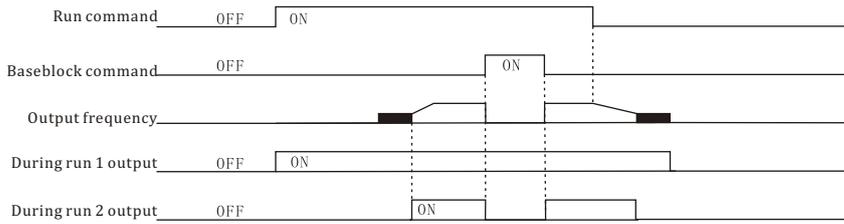
During Run (Setting: 0)

OFF	The run command is OFF and there is not output voltage.
ON	The run command is ON or a voltage is being output.

During Run 2 (Setting: 37)

OFF	The Inverter is not outputting a frequency. (Baseblock, DC injection braking, initial excitation, or stopped)
ON	The Inverter is outputting a frequency.

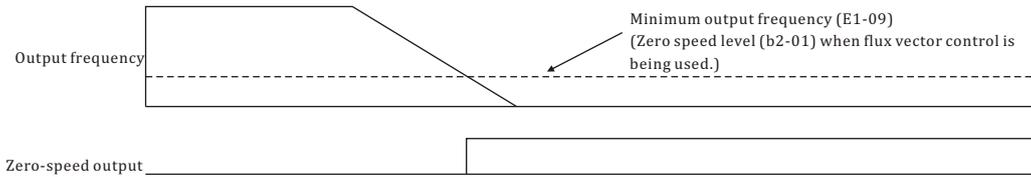
• These outputs can be used to indicate the Inverter's operating status.



Timing Chart for "During RUN" Output

Zero-speed (Setting: 1)

OFF	The output frequency is greater than the minimum output frequency (E1-09). (With flux vector control, is greater than the zero speed level (b2-01).)
ON	The output frequency is less than the minimum output frequency (E1-09). (With flux vector control, is less than the zero speed level (b2-01).)



Timing Chart for Zero-speed

Motor Overload (OL1) Pre-alarm (Setting: 1F)

OFF	The motor protection function's electronic thermal value is less than 90% of the detection level.
ON	The motor protection function's electronic thermal value is greater than 90% of the detection level.

- This output function is valid when the motor overload protection function is enabled (L1-01 = 1).
- This output can be used to warn of overheating before the protection function itself operates.

Inverter Overheat (OH) Pre-alarm (Setting: 20)

OFF	The cooling fin temperature is less than the "OH Pre-Alarm Level" set in L8-02.
ON	The cooling fin temperature exceeds the "OH Pre-Alarm Level" set in L8-02.

Zero-servo End (Setting: 33)

OFF	The zero-servo command isn't being input or zero-servo position control hasn't been completed.
ON	The position has been brought within the zero servo completion width (b9-02) after the zeroservo command was input.

- This output function indicates that zero-servo position control has been completed.
- The output is turned ON after the zero-servo command is input and the difference between the zero-servo operation starting position and the current position is within the zero servo completion width (b9-02).

5. 7. 3 Multi-function Analog Input: H3

H3-01 (Term 13 Segnal) X B B B B

SettingRange

0~+10V ★ [0]
-10~+10V [1]

Function

Signal level selection (terminal 13)

Description of choice

The frequency reference (voltage) is valid when constant b1-01 has been set to 1.

H3-02 (Term 13 Gain) 0 B B B B

SettingRange

0. 0~1000. 0 ★ [100. 0]

Function

A 10 V (20 mA) input indicates a frequency reference that is 100% of the max. output frequency.

Description of choice

Refer to the following adjustment of analog input

H3-03 (Term 13 Biss) 0 B B B B

SettingRange

-100. 00~+100. 0 ★ [0. 0]

Function

Sets the frequency when 0 V is input as a percentage of the maximum frequency.

Description of choice

Refer to the following adjustment of analog input

H3-04 (Term 16 Sel Segnal) X B B B B

SettingRange

0~+10V ★ [0]
-10~+10V [1]

Function

Set the signal level for the multi-function analog input.

Description of choice

Description of settings

Setting	Function
0	0 to 10 VDC input [11-bit + polarity (positive/negative) input]
1	-10 to 10 VDC input (A negative voltage is a reference for reverse rotation.)

H3-05 (Term 16 Sel) X B B B B

SettingRange

0~1F ★ [0]

Function

Multi-function analog input (terminal 16)

Description of choice

The analog input signal level, gain, and bias are set with the following constants. When a voltage input is being input to terminal 14, be sure to disconnect jumper wire J1 on the control PC board.

Set the time constant in constant H3-12 when adding a primary delay filter to an analog input. This filter time constant applies to all three of the analog inputs. Settings 2 and D cannot be set at the same time. OPE 7 will be detected.

Terminal 16 signal level selector	H3-04 (0 to +10 V or 0 to ±10 V)
Terminal 16 input gain	H3-06
Terminal 16 input bias	H3-07
Terminal 14 signal level selector	H3-08 (0 to +10 V, 0 to ±10 V, or 4 to 20 mA)
Terminal 14 input gain	H3-10
Terminal 14 input bias	H3-11

Multi-function Input/Frequency Reference (Voltage) Function

Setting	Function	Equivalent of 100% Input (10 V or 20 mA)	Control Method			
			V/f	V/f w/ PG	Open-loop Vector	Flux Vector
0	Auxiliary frequency reference (H3-05)	Maximum output frequency	○	○	○	○
1	Frequency gain	Frequency reference (voltage) command value	○	○	○	○
2	Frequency bias (zero-limited when the rotation direction changes)	Maximum output frequency (added to H3-03)	○	○	○	○
4	Voltage bias	Motor rated voltage (E1-05)	○	○	X	X
5	Accel/Decel change (reduction coefficient)	Accel/Decel times (C1-01 to C1-08)	○	○	○	○
6	DC injection braking current	Inverter rated output current	○	○	○	X
7	Overtorque detection level	Motor rated torque	○	○	○	○
8	Stall prevention level during run	Inverter rated output current	○	○	X	X
9	Frequency reference lower limit level	Maximum output frequency	○	○	○	○
A	Jump frequency	Maximum output frequency	○	○	○	○
B	PID feedback	Maximum output frequency	○	○	○	○
C	PID target value	Maximum output frequency				
D	Frequency bias	Maximum output frequency (Added to the H3-03 value)				
10	Forward side torque limit	Motor rated torque	X	X	○	○
11	Reverse side torque limit	Motor rated torque	X	X	○	○
12	Regeneration for torque limit		X	X	○	○
13	Torque reference/torque limit for speed control	Motor rated torque	X	X	X	○
14	Torque compensation	Motor rated torque	X	X	X	○
15	Forward/reverse torque limit	Motor rated torque	X	X	○	○
	Disable analog input (H3-05)	—	○	○	○	○
1F	Refer to 12.6 Function Block Diagram for details. Frequency Reference (H3-09)	Maximum output frequency	○	○	○	○

H3-06 (Term 16 Gain) 0 B B B B

SettingRange

0.0~1000.0 ★ [100.0]

Function

Sets the input gain (level) when terminal 16 is 10 V. Set according to the 100% value

Description of choice

Refer to the following adjustment of analog input

H3-07 (Term 16 Bias) 0 B B B B

SettingRange

-100.0~+100.0 ★ [0.0]

Function

Sets the input gain (level) when terminal 16 is 0 V. Set according to the 100% value

Description of choice

Refer to the following adjustment of analog input

H3-08 (Term 14 Sel) X A A A A

SettingRange

0~+10V [0]

0~±10V [1]

4~+20mA ★ [2]

Function

Signal level selection (terminal 14)

Description of choice

The frequency reference (current) is valid when constant b1-01 has been set to 1.

Set the signal level for the frequency reference (current).

Setting	Function
0	0 to 10 VDC input (10-bit input)
1	-10 to 10 VDC input (A negative voltage is a reference for reverse rotation.)
2	4 to 20 mA input

When the terminal is being used as a voltage input terminal (setting 0 or 1), jumper J1 must be disconnected on the control board. (See Figure 6.1.) The terminal's input resistor will be destroyed if the terminal is used for a voltage input with jumper J1 connected. When frequency references are being input simultaneously from both the voltage terminal 13 and the current terminal 14, the final reference value will be the sum of the two references that are input. To switch the frequency reference input between the voltage terminal 13 and the current terminal 14, set a value of 1F in any one of the multi-function inputs (H1-01 through H1-06). The voltage terminal 13 will be used when this multi-function input is OFF and the current terminal 14 will be used when this multi-function input is ON. If a 0 to ±10 VDC input is set, H3-01 must also be set to a 0 to ±10 VDC input.

H3-09 (Term 14 Sel) X A A A A

SettingRange

0~1F ★ [1F]

Function

Gain (terminal 14)

Description of choice

Reference H3-05 Description

H3-10 (terminal 14 Gain) 0 A A A A

SettingRange

0.0~1000.0 ★ [100]

Function
Sets the input gain (level) when terminal 14 is 10 V (20 mA). Set according to the 100% value

Description of choice

Refer to the following adjustment of analog input

H3-11 (Terminal 14 Bias) 0 A A A A

SettingRange

-100.0~+100.0 ★ [0.0]

Function

Sets the input gain (level) when terminal 14 is 0 V (4 mA). Set according to the 100% value

Description of choice

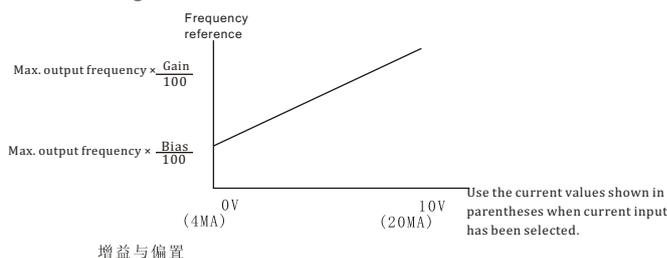
There are three constants used to adjust the analog inputs: The gain, bias (both set separately for each input), and filter time constant (a single value for all of the inputs).

- The gain and bias can be adjusted separately for each analog input (terminals 13, 14, and 16).

Gain: Set the frequency corresponding to a 10 V (20 mA) input as a percentage of the maximum frequency. (The maximum output frequency set in E1-04 is 100%.)

Bias: Set the frequency corresponding to a 0 V (4 mA) input as a percentage of the maximum frequency. (The maximum output frequency set in E1-04 is 100%.)

- Set the gains and biases for terminals 13, 14, and 16 as follows:



H3-12 (Filter Avg Time) X A A A A

SettingRange

0.00~2.00 ★ [0.00]

Function

Sets terminals 13, 14, 16 to primary delay filter time constant, in seconds units

Description of choice

A primary delay digital filter can be set for all three analog inputs (frequency reference (voltage), frequency reference (current), and multi-function analog input) This setting is effective when there are sudden changes or noise in the analog input signal. Responsiveness decreases as the setting increases.

5. 7. 4 Analog Outputs: H4

H4-01 (Terminal 21 Sel) X B B B B

SettingRange

1~38 ★ [2]

Function

Sets the number of the monitor item to be output (U1-jj) from terminal 2

Description of choice

The multi-function outputs can be set to monitor any of the U1 Inverter status items by setting the last two digits of the constant number (U1-jj). Refer to page 4 - 12 for a table listing all of these U1 settings. Settings 4, 10, 11, 12, 13, 14, 25, 28, 34 and 35 can't be set and settings 29, 30, and 31 aren't used.

H4-02 (Terminal 21 Gain) 0 B B B B

SettingRange

0.00~2.50 ★ [1.00]

Function

Sets the multi-function analog output 1 voltage level gain. Sets whether the monitor item output will be output in multiples of 10 V.

H4-03 (Terminal 21 Bias) 0 B B B B

SettingRange

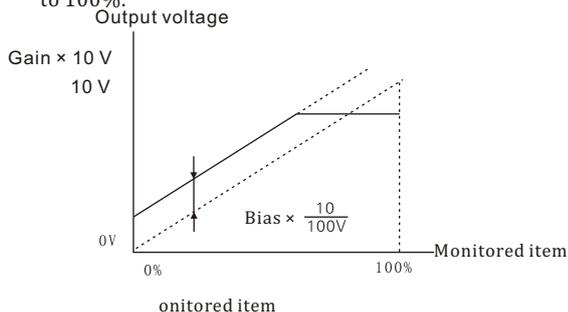
-10.0~+10.0 ★ [0.0]

Function

Sets the multi-function analog output 1 voltage level bias. Sets output characteristic up/down parallel movement as a percentage of 10 V.

Description of choice

For the output gain, set what multiple of 10 V will correspond to a 100% output of the monitored item. For the output bias, set the amount that the output characteristic will be shifted vertically. Set this amount as a percentage, with 10 V corresponding to 100%.



H4-04 (Terminal 23 Sel) X B B B B

SettingRange

1~38 ★ [3]

Function

Sets the number of the monitor item to be output (U1-jj) from terminal 23.

Description of choice

Reference H4-01 Description

H4-05 (Terminal 23 Gain) 0 B B B B

SettingRange

0.00~2.50 ★ [0.05]

Function

Sets the multi-function analog output 2 voltage level gain. Sets whether the monitor item output will be output in multiples of 10 V.

Description of choice

Reference H4-02 Description

H4-06 (Terminal 23 Bias) 0 B B B B

SettingRange

-10.0~+10.0 ★ [0.0]

Function

Sets the multi-function analog Sets output characteristic up/down parallel movement as a percentage of 10 V.

Description of choice

Reference H4-03 Description

H4-07 (Ao Level Select) X B B B B

SettingRange

0 to +10 V output ★ [0]
0 to 10 V +output [1]

Function

Sets the signal output level for multi-function outputs 1 and 2 (terminals 21, 23.)

Description of choice

This signal level setting applies to analog outputs 1 and 2 (terminals 21 and 23). When the 0 to ±10 V signal level is used to output speed values (frequency reference, output frequency or motor speed), positive voltage indicates inverter output in the forward direction and negative voltage indicates inverter output in the reverse direction. (Assuming a bias setting of 0.0.) There are some monitor items that are limited to the 0 to +10 V signal range even when the 0 to ±10 V signal level has been selected.

Setting	Function
0	0~+10V Absolute value output
1	0~±10V

5. 7. 5MEMOBUS Communications: H5

H5-01 (Serial Comm ADR) X A A A A

SettingRange

0~20 ★ [1F]

Function

Set the Inverter's node address

H5-02 (Serial Com Sel) X A A A A

SettingRange

1200Baud [0]
2400Baud [1]
4800Baud [2]
9600Baud ★ [3]
19200Baud [4]

Function

Set the baud rate for 6CN MEMOBUS communications.

H5-03 (Serial Com Sel) X A A A A

SettingRange

No parity ★ [0]
Even parity [1]
Odd parity [2]

Function

Set the parity for 6CN MEMOBUS communications.

H5-04 (Serial Fault Sel) X A A A A

SettingRange

Deceleration stop [0]
Coast to stop [1]
Emergency stop [2]
Continue operation ★ [3]

Function

Set the stopping method for communications errors.

H5-05 (Send timeout detected) X A A A A

SettingRange

Do not detect. [0]
 Detect ★ [1]

Function

Set whether or not a communications timeout is to be detected as a communications error.

5. 8 Protection Constants: L

5. 8. 1 Motor Overload: L1

L1-01 (Mol Fault Select) X B B B B

SettingRange

Disabled [0]
 Enabled ★ [1]

Function

Sets whether the motor overload function is enabled or disabled at electric thermal overload relay.

Description of choice

The rated current setting (E2-01) is used as a basis for overload detection. Disable the motor protection function (setting 0) when two or more motors are connected to a single inverter. Use another method to provide overload protection separately to each motor, such as connecting a thermal overload relay to the power line of each motor. The motor protection function may not protect a motor when the power supply is turned ON and OFF frequently, because the thermal value is reset each time that the power is turned OFF. If the Overload OL1 alarm (1F) is set in one of the multi-function outputs (H2-01 to H2-03), the output will be turned ON when the electronic thermal value reaches 90% of the overload detection level.

L1-02 (Mol Time Const) X B B B B

SettingRange

0.1~5.0 ★ [1.0]

Function

Sets the electric thermal detection time in seconds units.

Description of choice

Normally it isn't necessary to change this setting. (The factory setting is a 150%, 1 minute capacity.) Set the electronic thermal protection operation time if a 150% overload is applied after operating continuously at the motor's rated current (hot start). When the motor's overload capacity level is known, set the hot-start overload resistance level for the motor, but be sure to allow some margin for safety. Decrease this setting when you want to detect an overload more quickly.

5. 8. 2 Power Loss Ridethrough: L2

L2-01 (Pwr1 Selection) X B B B B

SettingRange

Disabled ★ [0]
 Enabled [1]
 Enabled while CPU is operating [2]

Function

This constant specifies the processing that is performed when a momentary power loss occurs.

Description of choice

When power loss ridethrough is enabled (setting 1 or 2), operation will be restarted after a speed search if the power is restored within the allowed time interval. When power loss ridethrough is disabled (setting 0), an undervoltage fault will be detected if power is interrupted for more than 15 ms.

L2-02 (Pwr1 Ridethru t) X B B B B

SettingRange

0.0~2.0 ★ [2.0]

Function

Sets the recovery time, when momentary power loss selection (L2-01) is set to 1 in units of one L2-1, second.

Description of choice

This setting is valid only when constant L2-01 is set to 1. Set the power loss ridethru time in seconds.

L2-03 (Pwr1 Baseblock t) X B B B B

SettingRange

0.1~5.0 ★ [0.5]

Function

Sets the Inverter's minimum baseblock time in units of one second, when the Inverter is restarted after power loss ridethrough.

Description of choice

This setting is used with the speed search and DC injection braking functions. Set the time required for the leakage voltage to dissipate. Increase the setting if an overcurrent (OC) occurs when the speed search or DC injection braking function starts. This setting is valid for speed searches performed after a momentary power loss and regular speed searches.

L2-04 (Pwr1 V/F Ramp T) X A A A A

SettingRange

0.0~5.0 ★ [0.3]

Function

Sets the time required to return to normal voltage at the completion of a speed search, in units of one second.

Description of choice

Set the time allowed for the normal voltage to be restored after completion of the speed search. For a 200V class Inverter, this is the time in seconds for voltage to be restored from 0VAC to 200VAC. For a 400V class Inverter, this is the time in seconds for voltage to be restored from 0VAC to 400VAC. This setting is valid for speed searches after a momentary power loss, regular speed searches, the voltage changes with energy-saving control, and the voltage changes with baseblock clearing.

L2-05 (PUV Det Level) X A A A A

SettingRange

130~420 ★ [380]

Function

Sets the main circuit under voltage (UV) detection level (main circuit DC voltage) in V units.

Description of choice

The values in parentheses are for 400V class Inverters. Normally it isn't necessary to change this setting. Use this constant when you want to add an AC reactor and lower the main circuit undervoltage detection level. Be sure to set a main circuit DC voltage value (V) that will detect a main circuit undervoltage.

L2-06 (KEB Frequency) X A A A A

SettingRange

0.0~100.0 ★ [0.0]

Function

Restores the operating conditions for momentary power loss by applying a frequency deceleration to plugging create inertia energy when a power loss occurs, and thus avoid the power loss.

Description of choice

This function is normally used with film lines and other applications where multiple Inverters are connected to the main DC line. Synchronous deceleration for power loss prevents the line from stopping as the result of speed fluctuations. The KEB operation is performed using a KEB command (setting of 65 or 66) for a multi-function input. 400 V class Inverters: 0.4 to 18.5 kW

5. 8. 3 Stall Prevention: L3

L3-01 (Staiip Accel Sel)	X	B	B	B	X
--------------------------	---	---	---	---	---

SettingRange

Disabled	★ [0]
Enabled	[1]
Intelligent acceleration mode	[2]

Stall prevention selection during accel

Description of choice

A stall occurs if the rotor cannot keep up with the rotating magnetic field on the motor stator side when a large load is applied to the motor or a sudden acceleration/deceleration is performed. In the Inverter, stall prevention functions can be set independently for accelerating, running, and decelerating. (Some functions are restricted depending on the control method.) When setting 1 (enabled) is selected, acceleration is stopped if the motor current exceeds the acceleration stall prevention level. Acceleration is started again when the current falls below this level. The acceleration time can be longer than the setting depending on the load. When setting 2 (optimum acceleration) is selected, acceleration is performed using the acceleration stall prevention level as a basis. In this case, the acceleration time is disregarded.

L3-02 (Staiip Accel Lv1)	X	B	B	B	X
--------------------------	---	---	---	---	---

SettingRange

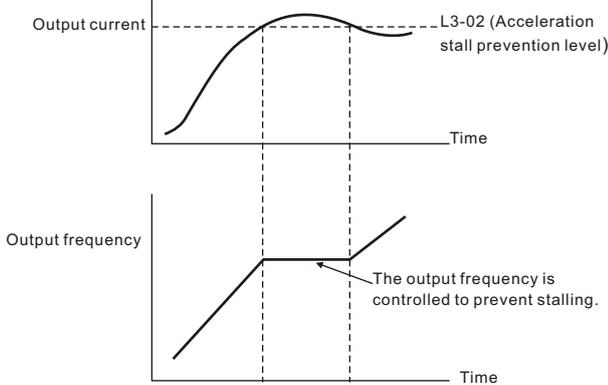
0~200	★ [150]
-------	---------

Function

Effective when L3-01 is set to 1 or 2. Set as a percentage of Inverter rated current.

Description of choice

This setting is valid when L3-01 is set to 1 or 2. Normally it isn't necessary to change this setting. Decrease this setting when the motor capacity is small compared to the Inverter capacity or stalling occurs when the motor is operated with the factory setting. The standard target setting is 2 to 3 times the motor's rated current. (Set this current value as a percentage of the Inverter's rated current, i.e., 100% corresponds to the Inverter's rated current.)



Acceleration Stall Prevention Function: L3-01 = 1

L3-03 (Staiip Chp Lv1)	X	A	A	A	X
------------------------	---	---	---	---	---

SettingRange

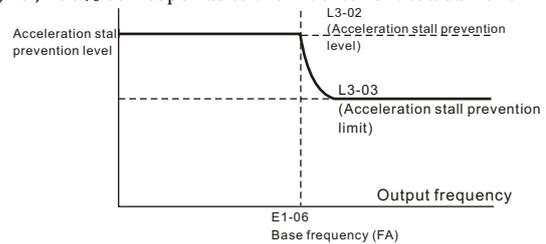
0~100	★ [50]
-------	--------

Function

Sets the lower limit for stall prevention during acceleration, as a percentage of the Inverter rated current, when operation is in the frequency range above the maximum voltage frequency

Description of choice

Sets the lower limit for stall prevention. Normally it isn't necessary to change this setting. Set this constant when a high-speed motor is being used in the high-speed range (the high frequency range above the base frequency). The standard target setting is the motor's rated current. Set this current value as a percentage of the Inverter's rated current, i.e., 100% corresponds to the Inverter's rated current.



Note When the motor is used in the high-speed range, the acceleration stall prevention level is automatically lowered to provide smoother

Acceleration. The acceleration stall prevention limit (L3-03) limits how much the acceleration stall prevention level is lowered so that it isn't lowered any more than necessary.

L3-04 (Staiip Decel Sel)	X	B	B	B	B
--------------------------	---	---	---	---	---

SettingRange

Disabled	[0]
Enabled	★ [1]
Intelligent deceleration mode	[2]
Enabled	[3]

Function

Stall prevention selection during decel

Description of choice

When setting 1 (enabled) is selected, the deceleration time is extended automatically so that a main circuit overvoltage doesn't occur. Always select setting 0 or 3 when a braking option (Braking Resistor, Braking Resistor Unit, or Braking Unit) is being used.

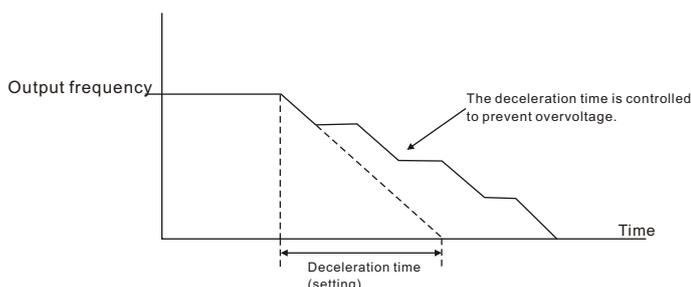
Stall Prevention Selection During Decel: L3-04

User Constant Number	Name	Change Operation	Setting Range	Unit	Factory Setting	Valid Access Levels
L3-04	Stall prevention selection during decel	X	0~3	—	1	B B B B

Settings

Setting	Function
0	Disabled. (Decelerate according to the settings. Main circuit overvoltage may occur if the deceleration time is too short.)
1	Enabled. (Stops deceleration if the main circuit voltage exceeds the overvoltage level. Decelerate again when voltage recovers.)
2	Optimum deceleration. (Decelerate as fast as possible judging from the main circuit voltage. Disregard the deceleration time setting.)
3	Enabled (with braking resistor)

If setting 1 or 2 is selected, the braking option won't be used and the deceleration time can't be shortened. L3-04 cannot be set to 2 for open-loop vector control mode. (Settings can be made for SPEC:F and later) L3-04=3 cannot be set in open-loop vector control mode.



Deceleration Stall Prevention Function: L3-04 = 1

L3-05 (Stall p run sel) X B B X X

SettingRange

Disabled. [0]
 Enabled -deceleration time 1. ★ [1]
 Enabled -deceleration time 2. [2]

Function

Stall prevention selection during running

Description of choice

When setting 1 or 2 (enabled) is selected, deceleration is started if the current of the stall prevention level during operation continues for more than 100 ms. The motor is accelerated back to the reference frequency again when the current falls below this level.

L3-06 (Stall p Run Level) X B B X X

SettingRange

3 0 ~ 2 0 0 ★ [160]

Function

Effective when L3-05 is 1 or 2. Set as a percentage of the Inverterrated current.

Description of choice

Usually setting is not necessary necessary. The factory setting reduces these values when the motor stalls.

5. 8. 4Reference Detection: L4

L4-01 (Spd Agree Level) X B B B B

SettingRange

0. 0 ~ 4 0 0. 0 ★ [0. 0]

Function

Set these constants when outputting one of the frequency agree or frequency detection signals from a multi-function output.

Description of choice

In the multi-function output, the same frequency, any frequency the same, such as the frequency detection signal output setting. Vector control with PG the occasion, the output motor speed

L4-02 (Spd Agree Width) X B B B B

SettingRange

0. 0 ~ 2 0. 0 ★ [2. 0]

Function

Set these constants when outputting one of the frequency agree or frequency detection signals from a multi-function output.

L4-03 (Spd Agree Lvl +/-) X A A A A

SettingRange

- 4 0 0. 0 ~ + 4 0 0. 0 ★ [0. 0]

Function

In the multi-function output, set "an arbitrary frequency (speed) line 2"

L4-04 (Spd agree width +/-) X A A A A

SettingRange

0. 0 ~ 2 0. 0 ★ [2. 0]

Function

In the multi-function output, set "an arbitrary frequency (speed) line 2"

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open Loop Vector	Flux Vector
L4-01	Speed agree detection level	X	0.0~400.0	Hz	0.0	B	B	B	B
L4-02	Speed agree detection width	X	0.0~20.0	Hz	2.0	B	B	B	B
L4-03	Speed agree detection level (+/-)	X	-400.0~+400.0	Hz	0.0	A	A	A	A
L4-04	Speed agree detection width (+/-)	X	0.0~20.0	Hz	2.0	A	A	A	A

L4-05 (RefLoss Sel) X A A A A

SettingRange

Stop [0]
 Continue operation at 80% speed. [1]

Function

Frequency of detection of movement

Description of choice

The frequency reference is considered lost when the frequency reference voltage drops by 90% for more than 400 ms.

5. 8. 5Fault Restart: L5

L5-01 (Num Of Restarts) X B B B B

SettingRange

0 ~ 1 0 ★ [0]

Function

Sets the number of auto restart attempts. Automatically restarts after a fault and conducts a speed search from the run frequency.

Description of choice

The fault restart function automatically restarts the Inverter even when an internal fault occurs during Inverter operation. Use this function only when continuing operation is more important than possibly damaging the Inverter. The fault restart function is effective with the following faults. With other faults, the protective operations will engage immediately without attempting to restart operation.

S OC (Overcurrent) S PF (Main circuit voltage fault) S OL1 (Motor overload) S GF (Ground fault) S LF (Output open-phase) S OL2 (Inverter overload) S PUF (Fuse blown) S RF (Braking resistor overheated) S OL3 (Overtorque) S OV (Main circuit overvoltage) S RR (Braking transistor fault) S OL4 (Overtorque) S UV1 (Main circuit undervoltage) The fault restart count is cleared in the following cases: • When operation is normal for 10 minutes after a fault restart is performed. • When the fault reset input is received after the protection operation has been activated and the fault confirmed. • When the power is turned OFF and then ON again. When one of the multi-function outputs (H2-01, H2-02, or H2-03) is set to 1E (Restart Enabled), the output will be ON while the fault restart function is in progress.

L5-02 (Restart Sel) X B B B B

SettingRange

Not output ★ [0]
Output [1]

Function

Sets whether a fault contact output is activated during fault restart.

5. 8. 6 Torque Detection: L6

L6-01 (Torq Det 1 Sel) X B B B B

SettingRange

Overtorque detection disabled. ★ [0]
Detection during speed agreeonly/Operation continues after detection [1]
Detection during run/Operation continues after detection [2]
Minor [3]
Detection during speed agreeonly/Inverter output is shut off after detection [4]
Detection during run/Inverter output is shut off after detection [4]

Function

Torque detection selection

Description of choice

- 0: Overtorque detection disabled.
- 1: Detection during speed agreeonly/Operation continues after detection (Minor fault)
- 2: Detection during run/Operation continues after detection (Minor fault)
- 3: Detection during speed agreeonly/Inverter output is shut after detection (Fault)
- 4: Detection during run/Inverter output is shut off after detection (Fault)

L6-02 (Torq Det 1 Lv1) X B B B B

SettingRange

0~300 ★ [150]

Function

Vector control: Motor rated torque is set as 100%. V/f control: Inverter rated current is set as 100%.

Description of choice

Refer to instructions

L6-03 (Torq Det 1 Time) X B B B B

SettingRange

0. 0~10. 0 ★ [0. 1]

Function

Sets the torque detection time in 1 second units 1-units.

Description of choice

Refer to instructions

L6-04 (Torq Det 2 Sel) X A A A A

SettingRange

0~4 ★ [0]

Function

Setting procedure is the same as for "Torque detection selection 1" (L6 01 L6 03) Torque detection selection 1: Multi-function output "Torque detection selection 1" NO/NC Torque detection selection 2: Multi-function output "Torque detection selection 2" NO/NC

Description of choice

Refer to instructions

L6-05 (Torq Det 2 Lv1) X A A A A

SettingRange

0~300 ★ [150]

Function

Setting procedure is the same as for "Torque detection selection 1" (L6 01 L6 03) Torque detection selection 1: Multi-function output "Torque detection selection 1" NO/NC Torque detection selection 2: Multi-function output "Torque detection selection 2" NO/NC

Description of choice

Refer to instructions

L6-06 (Torq Det 2 Time) X A A A A

SettingRange

0. 0~10. 0 ★ [0. 1]

Function

Setting procedure is the same as for "Torque detection selection 1" (L6 01 L6 03) Torque detection selection 1: Multi-function output "Torque detection selection 1" NO/NC Torque detection selection 2: Multi-function output "Torque detection selection 2" NO/NC

Description of choice

The overtorque detection function detects an excessive mechanical load from an increase in the output current (or output torque). The settings in the torque detection selection constants (L6-01 and L6-04) determine whether overtorque conditions will be detected and what kind of processing will be performed if an overtorque condition is detected. When overtorque detection is enabled, be sure to set the overtorque detection level (L6-02 or L6-05) and the overtorque detection time (L6-02 or L6-05). An overtorque condition is detected when the current exceeds the overtorque detection level for longer than the overtorque detection time. The overtorque detection level settings depend on the control method:

- Open-loop or flux vector control: Set as a percentage of the motor rated torque.
- Normal V/f or V/f with PG feedback control: Set as a percentage of the Inverter rated current.

Any of the following functions can be set in a multi-function output (H2-01, H2-02, or H2-03) to indicate fact that an overtorque condition has been detected.

- S Setting B: Overtorque detection 1 (NO)
- S Setting 18: Overtorque detection 2 (NO)
- S Setting 17: Overtorque detection 1 (NC)
- S Setting 19: Overtorque detection 2 (NC)

5. 8. 7 Torque Limit: L7

L7-01 (Torq Del 1 Sel) X X X B B

SettingRange

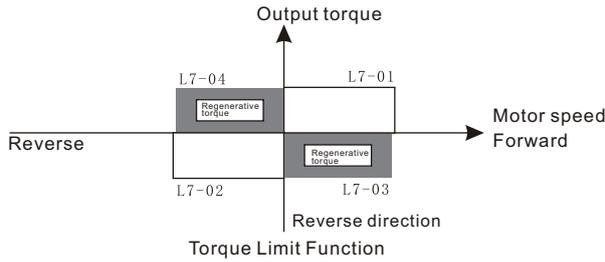
0~300 ★ [200]

Function

Sets the torque limit value as a percentage of the motor rated torque. Four individual regions can be set.

Description of choice

Torque limits can be set separately for the 4 ways that torque can be applied: forward torque, reverse torque, forward regenerative torque, and reverse forward regenerative torque.



Torque Limit Function
When the torque limit function is used, the torque limits have priority and motor speed control and compensation will be disregarded, so the acceleration/deceleration times might be lengthened and motor speed might be reduced.

L7-02 (Torq Del 1 Lvl)	X	X	X	B	B
-------------------------------	---	---	---	---	---

SettingRange
0~300 ★ [200]

Function
Sets the torque limit value as a percentage of the motor rated torque. Four individual regions can be set.

Description of choice
Reference L7-01 selection

L7-03 (Torq Del 1 Time)	X	X	X	B	B
--------------------------------	---	---	---	---	---

SettingRange
0~300 ★ [200]

Function
Sets the torque limit value as a percentage of the motor rated torque. Four individual regions can be set.

Description of choice
Reference L7-01 selection

L7-04 (Torq Del 1 Sel1)	X	X	X	B	B
--------------------------------	---	---	---	---	---

SettingRange
0~300 ★ [200]

Function
Sets the torque limit value as a percentage of the motor rated torque. Four individual regions can be set.

Description of choice
Reference L7-01 selection

5. 8. 8Hardware Protection: L8

L8-01 (DB Resistor Prot)	X	B	B	B	B
---------------------------------	---	---	---	---	---

SettingRange
Disabled ★ [0]
Enabled [1]

Function
Protect selection for internal DB resistor (Type ERF)

Description of choice

Setting	Function
0	Disabled. (Select 0 when a braking resistor isn't being used or a Braking Resistor Unit is being used.)
1	Enabled. (Protects the braking resistor from overheating.)

L8-02 (OH Pre-Alarm Lvl)	X	A	A	A	A
---------------------------------	---	---	---	---	---

SettingRange
50~110 ★ [95]

Function
Sets the detection temperature for the Inverter overheat detection pre-alarm in °C.

Description of choice
Constant L8-02 specifies the detection temperature in °C for the Inverter overheat (OH) pre-alarm function. An overheat pre-alarm occurs when the temperature of the cooling fins reaches this level.

L8-03 (OH Pre-Alarm Lvl)	X	A	A	A	A
---------------------------------	---	---	---	---	---

SettingRange
Decelerate to stop in deceleration time C1-02. [0]
Coast to stop [1]
Fast stop in fast-stop time C1 09 [2]
Continue operation (Monitor display only.) ★ [3]

Function
Sets the operation for when the Inverter overheat pre-alarm goes ON.

Description of choice
Constant L8-03 specifies the processing that will be performed when an overheat pre-alarm occurs. Apart from this setting, cooling fin overheating (OH1) is detected as a protection function at 105 °C.

L8-05 (PH Los In Sel)	X	A	A	A	A
------------------------------	---	---	---	---	---

SettingRange
Disabled ★ [0]
Enabled [1]

Function
Input open-phase protection selection

Description of choice
This function detects changes in the main circuit DC voltage which indicate a power supply open phase, large imbalance in the power supply voltage, or deterioration of the main circuit capacitor.

L8-07 (PH Los Out Sel)	X	A	A	A	A
-------------------------------	---	---	---	---	---

SettingRange
Disabled ★ [0]
Enabled [1]

Function
Output open-phase protection selection

Description of choice
When the motor capacity is small compared to the Inverter capacity, false open-phase detection may occur or open-phase cannot be detected. In this case, disable the detection function by setting L8-07 to 0.

L8-10 (Gnd Det Sel)	X	A	A	A	A
----------------------------	---	---	---	---	---

SettingRange
Disabled [0]
Enabled ★ [1]

L8-17 (L-spd IGBT Prtct)	X	A	A	A	A
---------------------------------	---	---	---	---	---

SettingRange
No carrier frequency reduction. [0]
With carrier frequency reduction. ★ [1]
For factory adjustments. [2]
For factory adjustments. [3]

Function
Carrier frequency reduction selection

Description of choice

When the motor capacity is small compared to the Inverter capacity, false open-phase detection may occur or open-phase cannot be detected. In this case, disable the detection function by setting L8-07 to 0.

L8-19 (OL2 Chara@L-Spd) X A A A A

SettingRange

Disabled ★ [0]
Enabled [1]

Function

OL2 characteristics selection at low speeds

Description of choice

When using OL2 to trip at low speeds (less than 6 Hz) despite a light load, set L8-17 to 1 (with carrier frequency reduction) and L8-19 (OL2 characteristics selection at low speeds) to 0 (disabled). However, do not set L8-19 to 0 for 400 V class, 185 to 300 kW Inverters. Do not L8-17 and L8-19 to 0 at the same time when using V/f control and open loop vector control. Reduce the carrier frequency (C6-01) to 2 kHz when continuously operating at low speeds with heavy loads when using flux vector control.

5. 90operator Constants: o

5. 9. 1Monitor Select: o1

o1-01 (Monitor Select) 0 B B B B

SettingRange

4~38 ★ [6]

Function

Constant No. Display selection

Description of choice

In operation mode, the frequency reference, output frequency, output current, and output voltage can be monitored immediately if the factory settings are being used. One of these four values, the output voltage, can be changed to a different value. When you want to monitor a value other than the output voltage, set that number in constant o1-01. Use the last two digits from the "U1 Monitor" list (U1-jj) to select a value.

o1-02 (Power-On Monitor) 0 B B B B

SettingRange

Frequency reference ★ [1]
Output frequency [2]
Output current [3]
The monitor item set for o1-01 [4]

Function

Set the number of the monitor item to be

Description of choice

When the power is turned on, the frequency reference will appear in the Unit's data display if the factory settings are being used. Any one of the four values monitored at startup (frequency reference, output frequency, output current, or the value set in constant o1-01) can be selected to appear when the power is turned ON.

o1-03 (Dispay Scaling) X B B B B

SettingRange

0.01 Hz ★ [0]
0.01% [1]

Function

Sets the units that will be set and displayed for the frequency reference and frequency monitor.

Description of choice

When the 40 to 39,999 range is used, any unit can be set for the reference frequency. For example, the frequency reference can be displayed or set in units such as mm/s or m/min to coincide with the linear operating speed of the machine.

o1-04 (Display Units) X X X X B

SettingRange

Hz units ★ [0]
r/min units [1]

Function

Set the V/f pattern setting units. (E1-04, 06,09 set units)

Description of choice

The setting units for constants E1-04, E1-06, and E1-09 can be changed. The unit for other frequencies will not change. Constant o1-04 is specific to flux vector control.

o1-05 (Address Display) X A A A A

SettingRange

Normal display ★ [0]
Display MEMOBUS communications register address [1]

Function

Set the Operator constant number display method.

5. 9. 2Multi-function Selections: o2

o2-01 (Local/remote Key) X B B B B

SettingRange

Disabled [0]
Enabled ★ [1]

Function

Sets the Digital Operator Local/Remote Key

Description of choice

This constant enables or disables the LOCAL/REMOTE Key (the Operation Mode Selector Key) on the Digital Operator.

o2-02 (Oper Stop Key) X B B B B

SettingRange

Disabled [0]
Enabled ★ [1]

Function

STOP Key during control circuit terminal operation

Description of choice

This constant enables or disables the STOP on the Digital Operator

o2-03 (User Defaults) X B B B B

SettingRange

STOP No change. ★ [0]
Record user defaults. [1]
Clear user defaults. [2]

Function

This constant is used to record or clear the user constant defaults.

Description of choice

If the "Out Of Memory Max Param Change" display appears on the digital operator when registering the user constants after the setting has been changed, do not immediately change or register the settings because pre-registered user settings may be cleared. The Digital Operation display will return to 0 after the settings have been made.

o2-04 (Inverter Model#) X B B B B

SettingRange

0~FF ★ Do not set.

Function

Do not set

Description of choice

The setting range and factory setting depend on the Inverter capacity.

o2-05 (operator M.o.p) X A A A A

SettingRange

Enter Key needed ★ [0]
Enter Key not needed [1]

Function

When the frequency reference is set on the Digital Operator frequency reference monitor, sets whether the Enter Key is necessary.

Description of choice

This constant determines whether it is necessary to press the Enter Key when changing the frequency reference with the Digital Operator's frequency reference monitor; it cannot be changed during operation. When o2-05 is set to 1 (DATA/ENTER Key input not required.), the frequency reference changes simultaneously with the Digital Operator's value.

o2-06 (Oper Delection) X A A A A

SettingRange

Disabled ★ [0]
Enabled [1]

Function

Sets the operation when the Digital Operator is disconnected.

o2-07 (Elapsed Time Set) X A A A A

SettingRange

0 65535 ★ [0]

Function

Sets the cumulative operation time in hour units.

Description of choice

Set the initial elapsed time in constant o2-07. The elapsed operating time will start from this value.

o2-08 (Elapsed Time Run) X A A A A

SettingRange

Cumulative time when the Inverter power is on. ★ [0]
Cumulative Inverter run time. [1]

Function

Cumulative operation time selection

Description of choice

Set the cumulative time

6 Troubleshooting

6.1 Protective and Diagnostic Functions

Fault Detection

- When the Inverter detects a fault, the fault code is displayed on the Digital Operator, the fault contact output operates, and the Inverter output is shut OFF causing the motor to coast to a stop. (The stopping method can be selected for some faults, and the selected stopping method will be used with these faults.)
- When a fault has occurred, refer to the following table to identify and correct the cause of the fault.
- Use one of the following methods to reset the fault after restarting the Inverter:
 - Turn ON the fault reset signal.
 - (A multi-function input (H1-01 to H1-06) must be set to 14 (Fault Reset).)
 - Press the RESET Key on the Digital Operator.
 - Turn the main circuit power supply off and then on again.

Fault Displays and Processing

Fault Display	Meaning	Probable Causes	Corrective Actions
OC Overcurrent	Overcurrent The Inverter output current exceeded the overcurrent detection level. (200% of rated current)	at the Inverter output. (A short or ground fault can be caused by motor burn damage, worn insulation, or a damaged cable.) The load is too large or the acceleration/ deceleration time is too short. A special-purpose motor or motor with a capacity too large for the Inverter is being used. A magnetic switch was switched at the Inverter output.	Reset the fault after correcting its cause.
GF Ground Fault	Ground Fault The ground fault current at the Inverter output exceeded approximately 50% of the Inverter rated output current	A ground fault occurred at the Inverter output. (A ground fault can be caused by motor burn damage, worn insulation, or a damaged cable.)	Reset the fault after correcting its cause.
PUF DC Bus Fuse Open	Fuse Blown The fuse in the main circuit is blown.	The output transistor has failed because of a short-circuit or ground fault at the Inverter output. Check whether there is a short-circuit between the following terminals. A short-circuit will damage the output transistor: B1 (3) ↔ U, V, W ⊙ ↔ U, V, W	Replace the Inverter after correcting the cause.
SC Short Circuit	Load Short-circuit The Inverter output or load was shortcircuited.	A short-circuit or ground fault occurred or ground fault can be caused by motor burn damage, worn insulation, or a damaged cable.)	Reset the fault after correcting its cause.
OV Overvoltage	Main Circuit Overvoltage The main circuit DC voltage exceeded the overvoltage detection level. 200 V class: Approx. 406 V 400 V class: Approx. 812 V	The deceleration time is too short and the regenerative energy from the motor is too large.	Increase the deceleration time or connect a braking resistor (or Braking Resistor Unit).
UV1 DC Bus Undervolt	Main Circuit Undervoltage The main circuit DC voltage is below the undervoltage detection level (L2-05). 200 V class: Approx. 190 V 400 V class: Approx. 380 V	An open-phase occurred with the input power supply. A momentary power loss occurred. The wiring terminals for the input power supply are loose. The voltage fluctuations in the input power supply are too large.	Reset the fault after correcting its cause.
UV2 CTL PS Undervolt	Control Power Fault The control power supply voltage dropped.	—	Try turning the power supply off and on. Replace the Inverter if the fault continues to occur.
UV3 MC Answerback	Inrush Prevention Circuit Fault A fault occurred in the inrush prevention circuit.	—	Try turning the power supply off and on. Replace the Inverter if the fault continues to occur
PF Input Pha Loss	Main Circuit Voltage Fault The main circuit DC voltage oscillates unusually (not when regenerating). This fault is detected when L8-05 is set to "Enabled."	An open-phase occurred in the input power supply. A momentary power loss occurred. The wiring terminals for the input power supply are loose. The voltage fluctuations in the input power supply are too large. The voltage balance between phases is bad.	Reset the fault after correcting its cause.

Fault Display	Meaning	Probable Causes	Corrective Actions
LF Output Pha Loss	Output Open-phase An open-phase occurred at the Inverter output. This fault is detected when L8-07 is set to "Enabled."	There is a broken wire in the output cable. There is a broken wire in the motor winding. The output terminals are loose. The motor being used has a capacity less than 5% of the Inverter's maximum motor capacity.	Reset the fault after correcting its cause. Check the motor and Inverter capacity.
OH(OH1) Heatsink Over tmp	Cooling Fin Overheating The temperature of the Inverter's cooling fins exceeded the setting in OH: The temperature exceeded the setting in L8-02 (Stopping method b h db L8 03) Heatsink Over tmp g p p g can be changed by L8-03.). OH1: The temperature exceeded 105°C (Stopping method: Coast to stop).	The ambient temperature is too high. There is a heat source nearby. The Inverter's cooling fan has stopped.	Install a cooling unit. Remove the heat source. Replace the cooling fan. (Contact our sales representative.)
	Inverter's Cooling Fan Stopped (18.5 kW or larger)	The Inverter's cooling fan has stopped. (18.5 kW or larger)	
RH Dyn Brk Resistor	Installed Braking Resistor Overheating The braking resistor is overheated and the protection function set with L8-01 has operated.	The deceleration time is too short and the regenerative energy from the motor is too large.	Reduce the load, increase the deceleration time, or reduce the motorspeed. Change to a Braking Resistor Unit.
RR Dyn Brk Transistr	Internal Braking Transistor Fault The braking transistor is not operating properly.	—	Try turning the power supply off and on. Replace the Inverter if the fault continues to occur.
OL1 Motor Overloaded	Motor Overload The motor overload protection function has operated based on the internal electronic thermal value.	The load is too heavy. The acceleration time, deceleration time, and cycle time are too short. The V/f characteristics voltage is too high. The motor's rated current setting (E2-01) is incorrect.	Check the size of the load and the length of the acceleration, deceleration, and cycle times. Check the V/f characteristics. Check the motor's rated current setting (E2-01).
OL2 Inv Overloaded	Inverter Overload The Inverter overload protection function has operated based on the internal electronic thermal value.	The load is too heavy. The acceleration time, deceleration time and cycle time are too short. The V/f characteristics voltage is too high. The Inverter capacity is too low.	Check the size of the load and the length of the acceleration, deceleration, and cycle times. Check the V/f characteristics. Replace the Inverter with one that has a larger capacity.
OL3 Overtorque Det1	Overtorque 1 There has been a current greater than the setting in L6-02 for longer than the setting in L6-03.	—	Make sure that the settings in L6-02 and L6-03 are appropriate. Check the mechanical system and correct the cause of the overtorque.
OL4 Overtorque det2	Overtorque 2 There has been a current greater than the setting in L6-05 for longer than the setting in L6-06.	—	Make sure that the current setting in L6-05 and time setting in L6-06 are appropriate. Check the mechanical system and correct the cause of the overtorque.
OS Over speed	Overspeed The speed has been greater than the setting in F1-08 for longer than the setting in F1-09.	Overshooting/Undershooting are occurring. The reference speed is too high. The settings in F1-08 and F1-09 aren't appropriate.	Adjust the gain again. Check the reference circuit and reference gain. Check the settings in F1-08 and F1-09.
PG0 PG open	PG Disconnection Detected PG pulses aren't being input due to the following conditions: The status has exceeded F1-14 time. Flux vector: Soft start output $\geq 2\%$ Flux V/f: Soft start output $\geq E1-09$	There is a break in the PG wiring. The PG is wired incorrectly. Power isn't being supplied to the PG. —	Fix the broken/disconnected wiring. Fix the wiring. Supply power to the PG properly. Check for open circuit when using brake (motor).
DEV Speed Deviation	Excessive Speed Deviation After the actual (motor) speed and the reference speed agree (depending on the setting of F1-04), the speed deviation changes so it is greater than the setting in F1-10 for longer than the setting in F-11.	The load is too heavy. The acceleration time and deceleration time are too short. The load is locked. The settings in F1-10 and F1-11	Reduce the load. Lengthen the acceleration time and deceleration time. Check the mechanical system. Check the settings in F1-10 and F1-11. Check for open circuit when using brake (motor).

Fault Display	Meaning	Probable Causes	Corrective Actions
SVE Zero Servo Fault	Zero Servo Fault The rotation position moved during zero servo operation.	The torque limit is too small.	Increase the limit.
		The load torque is too large.	Reduce the load torque.
		—	Check for signal noise.
OPR Oper Disconnect	Operator Connection Fault The Operator was disconnected during operation started by a run command from the Operator.	—	Check the Operator connection.
EF0 Opt External Fit	External fault input from Transmission Option Card.	—	Check the Transmission Option Card and transmission signal.
EF3 External Fault 3	External fault (Input terminal 3)		
EF4 EF5 EF6 EF7 EF8	External fault (Input terminal 4) External fault (Input terminal 5) External fault (Input terminal 6) External fault (Input terminal 7) External fault (Input terminal 8)	An "external fault" was input from a multi-function input	Reset external fault inputs to the multi-function inputs. Remove the cause of the external fault.
CPF00 COM-ERR(OP&INV)	Operator Communications Error 1 Communications with the Operator were not established within 5 seconds after the power was turned on.	The Digital Operator's connector isn't connected properly.	Disconnect the Digital Operator and then connect it again.
		The Inverter's control circuits are faulty.	Replace the Inverter.
CPF01 COM-ERR(OP&INV)	Operator Communications Error 2 After communications were established there was a transmission error with the Digital Operator for more than 2 seconds.	The Digital Operator isn't connected properly.	Disconnect the Digital Operator and then connect it again.
		The Inverter's control circuits are faulty.	Replace the Inverter.
CPF02 BB Circuit Err	Baseblock circuit error	—	Try turning the power supply off and on again.
		—	Replace the Inverter.
CPF03 EEPROM Error	EEPROM error	—	Try turning the power supply off and on again.
		The control circuit is damaged.	Replace the Inverter.
CPF04 Internal A/D Err	CPU internal A/D converter error	—	Try turning the power supply off and on again.
		The control circuit is damaged.	Replace the Inverter.
CPF05 External A/D Err	CPU external A/D converter error	—	Try turning the power supply off and on again.
		The control circuit is damaged.	Replace the Inverter.
CPF04 Internal A/D Err	CPU internal A/D converter error	—	Try turning the power supply off and on again.
		—	Replace the Inverter.
CPF05 External A/D Err	CPU external A/D converter error	—	Try turning the power supply off and on again.
		—	Replace the Inverter.
CPF06 Option Error	Option Card connection error	The Option Card is not connected properly.	Turn off the power and insert the Card again.
		The Inverter or Option Card is faulty.	Replace the faulty component.
CPF20 Option A/D Err	Option Card A/D converter error	The Option Card is not connected properly.	Turn off the power and insert the Card again.
		The Option Card's A/D converter is faulty.	Replace the Option Card.
CPF21 Option CPU down	Transmission Option Card self diagnostic error	Option Card fault.	Replace the Option Card.
CPF22 Option Type Err	Transmission Option Card model code error		
CPF23 option dpram err	Transmission Option Card DPRAM error		

6. 1. 2 Minor Fault Detection

Minor faults are a type of Inverter protection function that do not operate the fault contact output and are automatically returned to their original status once the cause of the minor fault has been removed.

The Digital Operator display blinks and the minor fault is output from the multi-function outputs (H2-01 to H2-03). Take appropriate countermeasures according to the table below.

Minor Fault Displays and Processes

Minor fault display	Meaning	Probable causes	Corrective Actions
EF (BOINKING) EXTERNAL FAULT	Forward/Reverse Run Commands Input Together Both the forward and reverse run commands have been ON for more than 0.5 s.	—	Check the sequence of the forward and reverse run commands. :Since the rotational direction is unknown, the motor will be decelerated to a stop when this minor fault occurs.
UV (BOINKING) DC BUS UNDERVOLT	Main Circuit Undervoltage The following conditions occurred when there was no Run signal. The main circuit DC voltage was below the undervoltage detection level (L2-05). The surge current limiting contactor opened. The control power supply voltage when below the CUV level.	See causes for UV1, UV2, and UV3 faults.	See corrective actions for UV1, UV2, and UV3 faults.
OV (BOINKING) OVERVOLTAGE	Main Circuit Overvoltage The main circuit DC voltage exceeded the overvoltage detection level. 200 V class: Approx. 406 V 400 V class: Approx. 812 V	The power supply voltage is too high.	Decrease the voltage so it's within specifications.
OH (BLINKING) HEATSINK OVER TMP	Cooling Fin Overheating The temperature of the Inverter's cooling fins exceeded the setting in L8-02.	The ambient temperature is too high.	Install a cooling unit.
		There is a heat source nearby.	Remove the heat source.
		The Inverter cooling fan has stopped.	Replace the cooling fan. (Contact your Yaskawa representative.)
OH2 (BOINKING) OVERTORQUE DET 1	Inverter Overheating Pre-alarm An Oh2 alarm signal (Inverter overheating alarm signal) was input from a multi-function input.	—	Clear the multi-function input's overheating alarm input.
OL3 (BLINKING) Overtorque Det 1	Overtorque 1 There has been a current greater than the setting in L6-02 for longer than the setting in L6-03.	—	Make sure that the settings in L6-02 and L6-03 are appropriate. Check the mechanical system and correct the cause of the overtorque.
OL4 (BLINKING) Overtorque Det 1	Overtorque 2 There has been a current greater than the setting in L6-05 for longer than the setting in L6-06.	—	Make sure that the current setting in L6-05 and time setting in L6-06 are appropriate. Check the mechanical system and correct the cause of the overtorque.
OS (blinking) Overtorque Det 1	Overspeed The speed has been greater than the setting in F1-08 for longer than the setting in F1-09.	Overshooting/undershooting are occurring. The reference speed is too high. The settings in F1-08 and F1-09 aren't appropriate.	Adjust the gain again. Check the reference circuit and reference gain. Check the settings in F1-08 and F1-09.
PGO (blinking) Pgopen	The PG is disconnected. The Inverter is outputting a frequency, but PG pulses aren't being input.	There is a break in the PG wiring. The PG is wired incorrectly. Power isn't being supplied to the PG.	Fix the broken/disconnected wiring. Fix the wiring. Supply power to the PG properly.
DEV (boinking) Speed Deviation	Excessive Speed Deviation The speed deviation has been greater than the setting in F1-10 for longer than the setting in F1-11.	The load is too large. The acceleration time and deceleration time are too short. The load is locked. The settings in F1-10 and F1-11 aren't appropriate.	Reduce the load. Lengthen the acceleration time and deceleration time. Check the mechanical system. Check the settings in F1-10 and F1-11.

Minor fault display	Meaning	Probable causes	Corrective Actions
EF3 (blinking) External Fault 3	External fault (Input terminal 3)	An "external fault" was input from a multi-function input	Reset external fault inputs to their multi-function inputs. Remove the cause of the external fault.
EF4 (blinking)	External fault (Input terminal 4)		
EF5 (blinking)	External fault (Input terminal 5)		
EF6 (blinking)	External fault (Input terminal 6)		
EF7 (blinking)	External fault (Input terminal 7)		
EF8 (blinking)	External fault (Input terminal 8)		
CE MEMOBUS Com Err	Communications Error Normal reception was not possible for 2 s after received control data.	—	Check the communications devices and signals.
BUS Option Com Err	Option Card Transmission Error A communications error occurred in a mode where the run command or a frequency reference is set from an Transmission Option Card.	—	Check the Transmission Card and signals.
CALL Serial Com Call	SI-B Communications Error Control data was not normally received when power was turned ON.	—	Check the communications devices and signals.
E-15 Si-F/G Com Err	SI-F/G Communications Error Detected A communications error occurred in a mode where run or a frequency reference is set from an Transmission Option Card and E-15 is set to continue operation	—	Check the communications signals.
EF0 Opt External Flt	SI-K2 External Error Detected An external error was received from an Option Card when EF0 was set to continue operation.	—	Remove the cause of the external error

6. 1. 3 Operation Errors

After the constants have been set, an operation error will occur if there is an invalid setting or a contradiction between two constant settings. It won't be possible to start the Inverter until the constants have been set correctly. (The minor fault output and fault contact output will not operate, either.)

When an operation error has occurred, refer to the following table to identify and correct the cause of the errors.

Operation Error Displays and Incorrect Settings

Display	Meaning	Incorrect settings
OPE01	Incorrect Inverter capacity setting	The Inverter capacity setting doesn't match the Unit. (Contact your Yaskawa representative.)
OPE02 Limit	Constant setting range error	The constant setting is outside of the valid setting range.
OPE03 Terminal	Multi-function input selection error	One of the following errors has been made in the multi-function input (H1-01 to H1-06) settings: The same setting has been selected for two or more multi-function inputs. An up or down command was selected independently. (They must be used together.) The up/down commands (10 and 11) and Accel/Decel Ramp Hold (A) were selected at the same time. Speed Search 1 (61, maximum output frequency) and Speed Search 2 (62, set frequency) were selected at the same time. External Baseblock NO (8) and External Baseblock NC (9) were selected at the same time. The up/down commands (10 and 11) were selected while PID control (b5-01) was enabled. The Terminal 13/14 Switch (1F) was selected, but the terminal 14 function selector (H3-09) wasn't set to frequency reference (1F). Positive and negative speed commands have not been set at the same time. The emergency stop command NO and NC have been set at the same time.
OPE05 Sequence Select	Option Card selection error	The Option Card was selected as the frequency reference source by setting b1-01 to 3, but an Option Card isn't connected
OPE06 PG Opt Missing	Control method selection error	V/f control with PG feedback was selected by setting A1-02 to 1, but a PG Speed Control Card isn't connected. Flux vector control was selected by setting A1-02 to 3, but a PG Speed Control Card isn't connected.
OPE07 ANALOG SELECTION	Multi-function analog input selection error	The same setting (other than 1F) has been selected for H3-05 and H3-09. S An A1-14B Analog Reference Card is being used and F2-01 is set to 0, but a multifunction input (H1-01 to H1-06) has been set to Option/Inverter Selection (2). S 2 and D have been set to H3-05 and H3-09 (2 and D cannot be used simultaneously).
OPE08 ELEVATOR TABLE	Constant selection error	A setting has been made that is not required in the current control method. Ex.: A function used only with flux vector control was selected for open-loop vector control.
OPE10 V/F PTRN SETTING	V/f data setting error	Constants E1-04, E1-06, E1-07, and E1-09 do not satisfy the following conditions: $E1-04 (FMAX) \geq E1-06 (FA) > E1-07 (FB) \geq E1-09 (FMIN)$
OPE 11 CARRFRG /ON /DELAY	Constant setting error	One of the following constant setting errors exists. The carrier frequency upper limit (C6-01) > 5 KHz and the carrier frequency lower limit (C6-02) ≤ 5 KHz. The carrier frequency gain (C6-03) > 6 and (C6-01) > (C6-02). Upper/lower limit error in C6-01 to 03 or C8-15.
ERR EEPROM RNV ERR	EEPROM write error	A verification error occurred when writing EEPROM. Try turning the power supply off and on again. Try setting the constants again.

6. 2 Troubleshooting

Due to constant setting errors, faulty wiring, and so on, the Inverter and motor may not operate as expected when the system is started up. If that should occur, use this section as a reference and apply the appropriate measures. If the contents of the fault are displayed, refer to 9.1 Protective and Diagnostic Functions.

6. 2. 1 If Constant Constants Cannot Be Set

- The display does not change when the Increment and Decrement Keys are pressed.
 1. **Passwords do not match. (Only when a password is set.)**
 - If the constant A1-04 (Password 1) and A1-05 (Password 2) numbers are different, the constants for the initialize mode cannot be changed. Reset the password.
 - If you cannot remember the password, display A1-05 (select password) by pressing the Reset/Select Key and the Menu Key simultaneously while in the A1-04 display. Then reset the password. (Input the reset password in constant A1-04.)
 2. Constant write enable is input.
 - This occurs when "constant write enable" (set value: 1B) is set for a multi-function input. If the constant write enable input is OFF, the constants cannot be changed. Turn it ON and then set the constants.
 3. The Inverter is operating (drive mode).
 - There are some constants that cannot be set during operation. Turn the Inverter off and then make the settings.
- OPE01 through OPE11 is displayed.

This is a constant setting error. The set value for the constant is wrong. Refer to 9.1.3 Operation Errors and correct the setting.
- CPF00 or CPF01 is displayed.

This is a Digital Operator communications error. The connection between the Digital Operator and the Inverter may be faulty. Remove the Digital Operator and then re-install it.

6. 2. 2 If the Motor Does Not Operate

- The motor does not operate when the Run Key on the Digital Operator is pressed.
 1. The operation method setting is wrong.
 - Run Key is pressed. Either press the Local/Remote Key* to switch to Digital Operator operation or set constant b1-02 to "0" (Digital Operator).
 - The Local/Remote Key is enabled (set value: 1) or disabled (set value: 2) by means of constant o2-01. It is enabled when the drive mode is entered.
 2. The frequency reference is too low.
 - Verter will not operate.
 - Raise the frequency reference to at least the minimum output frequency. (Related constants: b1-05, E1-09)
 3. There is a multi-function analog input setting error.
 - If multi-function analog inputs H3-05 and H3-09 are set to "1" (frequency gain), and if no voltage (current) is input, then the frequency reference will be zero. Check to be sure that the set value and analog input value are correct.
 4. Frequency reference 2 is specified with multi-step speed operation, and auxiliary frequency reference is not input.
 - If multi-function analog input H3-05 is set to "0" (auxiliary frequency reference), and if multi-step speed reference is used, the auxiliary frequency reference will be treated as frequency reference 2. Check to be sure that the set value and analog input value (terminal 16) are correct.
 5. A digital setting was made for frequency reference 2 for multi-step speed operation.
 - The auxiliary frequency reference is treated as frequency reference 2 when the multi-step speed references are used and "0" (auxiliary frequency reference) is set for the multi-function analog input (H3-05). Make sure that "1F" is set for the multi-function analog input (H3-05) and that the setting of frequency reference 2 is appropriate.
 6. "1F" was not set for a multi-function analog input
 - The auxiliary frequency reference is treated as frequency reference 2 when the multi-step speed references are used and "0" (auxiliary frequency reference) is set for the multi-function analog input (H3-05).
 - Make sure that "1F" is set for the multi-function analog input (H3-05) and that the setting of frequency reference 2 is appropriate.
- The motor does not operate when an external operation signal is input.
 1. The operation method selection is wrong.
 - If constant b1-02 (run source) is set to "0" (Digital Operator), the motor will not operate when an external operation signal is input. Set b1-02 to "1" (control circuit terminal) and try again.
 - Similarly, the motor will also not operate if the Local/Remote Key has been pressed to switch to Digital Operator operation. In that case press the Local/Remote Key* again to return to the original setting.
 - The Local/Remote Key is enabled (set value: 1) or disabled (set value: 2) by means of constant o2-01. It is enabled when drive mode is entered.
 2. A 3-wire sequence is in effect.
 - The input method for a 3-wire sequence is different than when operating by forward/stop and reverse/stop (2-wire sequence). When 3-wire sequence is set, the motor will not operate even when an input terminal suitable for forward run/stop and reverse run/stop is turned ON.

- When using a 3-wire sequence, refer to the timing chart on page 6 - 14 and input the proper signals. When using a 2-wire sequence, set multi-function inputs H1-01 through H1-06 to a value other than 0.
- 3 The frequency reference is too low.
 - If the frequency reference is set below the frequency set in E1-09 (minimum output frequency), the Inverter will not operate.
 - Raise the frequency reference to at least the minimum output frequency. (Related constants: b1-05, E1-09)
- 4 There is a multi-function analog input setting error.
 - If multi-function analog inputs H3-05 and H3-09 are set to "1" (frequency gain), and if no voltage (current) is input, then the frequency reference will be zero. Check to be sure that the set value and analog input value are correct.
- 5 Frequency reference 2 is specified with multi-step speed operation and auxiliary frequency reference is not input.
 - If multi-function analog input H3-05 is set to "0" (auxiliary frequency reference) and if multi-step speed reference is used, the auxiliary frequency reference will be treated as frequency reference 2. Check to be sure that the set value and analog input value (terminal 16) are correct.
- 6 A digital setting was made for frequency reference 2 for multi-step speed operation, but "1F" was not set for a multi-function analog input (H3-05).
 - The auxiliary frequency reference is treated as frequency reference 2 when the multi-step speed references are used and "0" (auxiliary frequency reference) is set for the multi-function analog input (H3-05).
 - Make sure that "1F" is set for the multi-function analog input (H3-05) and that the setting of frequency reference 2 is appropriate.
- 7 A digital setting was made for frequency reference 2 for multi-step speed operation, but "1F" was not set for a multi-function analog input (H3-05).
 - The auxiliary frequency reference is treated as frequency reference 2 when the multi-step speed references are used and "0" (auxiliary frequency reference) is set for the multi-function analog input (H3-05).
 - Make sure that "1F" is set for the multi-function analog input (H3-05) and that the setting of frequency reference 2 is appropriate.
- The motor stops during acceleration or when a load is connected.
 - The load may be too heavy. The Inverter has a stall prevention function and an automatic torque boost function, but the motor responsiveness limit may be exceeded if acceleration is too rapid or if the load is too heavy. Lengthen the acceleration time or reduce the load. Also consider increasing the motor capacity.
- The motor only rotates in one direction.
 - "Reverse run prohibited" is selected. If b1-04 (prohibition of reverse operation) is set to "1" (reverse run prohibited), the Inverter will not receive reverse run commands. To use both forward and reverse operation, set b1-04 to "0."

6. 2. 3 If the Direction of the Motor Rotation is Reversed

The motor output wiring is faulty. When the Inverter T1 (U), T2 (V), and T3 (W) are properly connected to the motor T1 (U), T2 (V), and T3 (W), the motor operates in a forward direction when a forward run command is executed. The forward direction depends on the manufacturer and the motor type, so be sure to check the specifications. Switching two wires among the T1 (U), T2 (V), and T3 (W) will reverse the direction of rotation.

6. 2. 4 If the Motor Does Not Put Out Torque or If Acceleration is Slow

- The torque limit has been reached.
 - When a torque limit has been set in constants L7-01 to L7-04, no torque will be output beyond that limit. This can cause the torque to be insufficient, or the acceleration time to be too long. Check to be sure that the value set for the torque limit is suitable.
 - If the torque limit has been set by multi-function analog inputs H3-05 and H3-09 (set value: 10 to 13), check to be sure that the analog input value is suitable.
- The stall prevention level during acceleration is too low.
 - If the value set for L3-02 (stall prevention level during acceleration) is too low, the acceleration time will be too long. Check to be sure that the set value is suitable.
- The stall prevention level during running is too low.
 - If the value set for L3-06 (stall prevention level during running) is too low, the speed will drop before outputting torque. Check to be sure that the set value is suitable.
- Autotuning has not been performed for vector control
 - Vector control will not perform if autotuning has not been performed. Perform autotuning separately for the motor, or set the motor constants through calculations. Alternatively, change the control mode selection (A1-02) to V/f control.

6. 2. 5 If the Motor Does Not Operate According to Reference

- The motor runs faster than reference.
 - 1 The frequency reference bias setting is wrong (the gain setting is wrong).
 - The frequency reference bias set in constant H3-03 is added to the frequency reference. Check to be sure that the set value is suitable.
 - 2 Frequency bias is set for multi-function analog inputs.
 - When "2" (frequency bias) is set for multi-function analog inputs H3-05 and H3-09, a frequency corresponding to the input voltage (current) is added to the frequency reference. Check to be sure that the set value and analog input value are suitable.
 - 3 A signal is being input to the frequency reference (current) terminal 14.
 - When "1F" (frequency reference) is set for constant H3-09 (multi-function analog input terminal 14), a frequency corresponding to the terminal 14 input voltage (current) is added to the frequency reference. Check to be sure that the set value and analog input value are suitable.
- The motor does not rotate according to reference.
 - Torque control mode is selected. When constant d5-01 (torque control selection) is set to "1" (torque control), speed control cannot be executed. (Speed limits can be set.) To switch torque control and speed control, set the following

- Set constant d5-01 to “0” (speed control).
 - Set one of the constants from H1-01 through H1-06 (multi-function inputs) to “71” (speed/torque control change).
- 6. 2. 6** If the Slip Compensation Function Has Low Speed Precision
- The slip compensation limit has been reached. With the slip compensation function, compensation cannot be carried out beyond the slip compensation limit set in constant C3-03. Check to be sure that the set value is suitable.
- 6. 2. 7** If There is Low Speed Control Accuracy at High-speed Rotation in Open-loop Vector Control Mode
- The motor’s rated voltage is high.
 - The Inverter’s maximum output voltage is determined by its input voltage. (For example, if 200 VAC is input, then the maximum output voltage will be 200VAC.) If, as a result of vector control, the output voltage reference value exceeds the Inverter output voltage maximum value, the speed control accuracy will decrease. Set C3-06 to 1, or, alternatively use a motor with a low rated voltage (i.e., a special motor for use with vector control), or change to flux vector control.
- 6. 2. 8** If Motor Deceleration is Slow
- The deceleration time is long even when braking resistor is connected.
 1. “Stall prevention during deceleration enabled” is set.
 - When braking resistor is connected, set constant L3-04 (stall prevention selection during deceleration) to “0” (disabled) or “3” (deceleration stall prevention with braking resistor). When this constant is set to “1” (enabled, the factory-set default), braking resistor does not fully function.
 2. The deceleration time setting is too long.
 - Check the deceleration time setting (constants C1-02, C1-04, C1-06, and C1-08).
 3. Motor torque is insufficient.
 - If the constants are correct and there is no overvoltage fault, then the motor’s power is limited. Consider increasing the motor capacity.
 4. The torque limit has been reached.
 - When a torque limit has been set in constants L7-01 to L7-04, no torque will be output beyond that limit.
 - This can cause the deceleration time to be too long. Check to be sure that the value set for the torque limit is suitable.
 - If the torque limit has been set by multi-function analog inputs H3-05 and H3-09 (set value: 10 to 13), check to be sure that the analog input value is suitable.
 - If the Vertical-axis Load Drops When Brake is Applied
 - The sequence is incorrect.
 - The Inverter goes into DC injection braking status for 0.5 seconds after deceleration is completed. (This is the factory-set default.)
 - To ensure that the brake holds, set frequency detection 2 (H2-01=5) for the multi-function contact output terminals (9-10) so that the contacts will OPEN when the output frequency is greater than L4-01 (3.0 to 5.0 Hz). (The contacts will close below L4-01.)
 - There is hysteresis in frequency detection 2 (L4-02 = 2.0 Hz). Change the setting to approximately 0.5 Hz if there are drops during stop. Do not use the “running” signal (H2-01 = 0) for the brake ON/OFF signal.
- 6. 2. 9** If the Motor Overheats
- The load is too big.
 - If the motor load is too heavy and the motor is used with the effective torque exceeding the motor’s rated torque, the motor will overheat. Some motor ratings are given for short period performance and are not continuous ratings. Reduce the load amount by either lightening the load or lengthening the acceleration/ deceleration time. Also consider increasing the motor capacity.
 - The ambient temperature is too high.
 - The motor rating is determined within a particular ambient operating temperature range. The motor will burn out if it is run continuously at the rated torque in an environment in which the maximum ambient operating temperature is exceeded. Lower the motor’s ambient temperature to within the acceptable ambient operating temperature range.
 - The withstand voltage between the motor phases is insufficient.
 - When the motor is connected to the Inverter output, a surge is generated between the Inverter switching and the motor coil. Normally the maximum surge voltage is three times the Inverter’s input power supply voltage (i.e., 1,200V for 400V class). Be sure to use a motor with a withstand voltage between the motor phases that is greater than the maximum surge voltage. In particular, when using a 400V class Inverter, use a special motor for Inverters.
 - Autotuning has not been performed for vector control
 - Vector control will not perform if autotuning has not been performed. Perform autotuning separately for the motor, or set the motor constants through calculations. Alternatively, change the control mode selection (A1-02) to V/f control.
- 6. 2. 10** If There is Noise When the Inverter is Started or From an AM Radio
- If noise is generated by Inverter switching, implement the following countermeasures:
- Lower the Inverter’s carrier frequency (constant C6-01). This will help to some extent by reducing the amount of internal switching.
 - Install an Input Noise Filter at the Inverter’s power supply input area.
 - Install an Output Noise Filter at the Inverter’s power supply output area.
 - Use metal tubing. Electric waves can be shielded by metal, so encase the Inverter with metal (steel).
 - Ground the Inverter and motor.
 - Separate main circuit wiring from control wiring.

- 6. 2. 11** If the Ground Fault Interrupter Operates When the Inverter is Run
 The Inverter performs internal switching, so there is a certain amount of leakage current. This may cause the ground fault interrupter to operate and cut off the power supply. Change to a ground fault interrupter with a high leakage detection level (i.e., a sensitivity current of 200mA or greater per Unit, with an operating time of 0.1 s or more), or one that incorporates high frequency countermeasures (i.e., One designed for use with Inverters). It will also help to some extent to lower the Inverter's carrier frequency (constant C6-01). In addition, remember that the leakage current increases as the cable is lengthened.
- 6. 2. 12** There is Mechanical Oscillation
- The machinery is making unusual sounds.
 1. There may be resonance between the mechanical system's characteristic frequency and the carrier frequency. If the motor is running with no problems and the machinery is oscillating with a high-pitched whine, it may indicate that this is occurring. To prevent this type of resonance, adjust the carrier frequency with constants C6-01 to C6-03.
 2. There may be resonance between a machine's characteristic frequency and the output frequency of the Inverter. To prevent this from occurring, either use the jump frequency functions in constants d3-01 to d3-04 or install rubber padding on the motor base to reduce oscillation.
 - Oscillation and hunting are occurring with open-loop vector control.

The gain adjustment may be insufficient. Reset the gain to a more effective level by adjusting constants C4-02 (torque compensation time constant), C8-08 (AFR gain), and C3-02 (slip compensation primary delay time) in order. Lower the gain setting and raise the primary delay time setting.

Vector control will not perform if autotuning has not been performed. Perform autotuning separately for the motor, or set the motor constants through calculations. Alternatively, change the control mode selection (A1-02) to V/f control.
 - Oscillation and hunting are occurring with V/f control.

The gain adjustment may be insufficient. Reset the gain to a more effective level by adjusting constants C4-02 (torque compensation time constant), C7-02 (hunting prevention gain), and C3-02 (slip compensation primary delay time) in order. Lower the gain setting and raise the primary delay time setting.
 - Oscillation and hunting are occurring with flux vector control.

The gain adjustment may be insufficient. Adjust the various types of speed control loop (ASR) gain. The gain adjustment may be insufficient. Adjust the various types of speed control loop (ASR) gain. If the mechanical system's resonance point coincides with the Inverter's operating frequency and the oscillation cannot be eliminated in this way, increase the ASR primary delay time (constant C5-06) and then try adjusting the gain again.

Vector control will not perform if autotuning has not been performed. Perform autotuning separately for the motor, or set the motor constants through calculations. Alternatively, change the control mode selection (A1-02) to V/f control.
 - Oscillation and hunting are occurring with V/f w/PG control.

The gain adjustment may be insufficient. Adjust the various types of speed control loop (ASR) gain. (For details, refer to page 6 - 45.)

If the oscillation cannot be eliminated in this way, set the hunting prevention selection (constant C7-01) to "0" (disabled) and then try adjusting the gain again.

Oscillation and hunting are occurring with PID control. Check the oscillation cycle and individually adjust the P, I, and D. Autotuning has not been performed with vector control.

Vector control will not perform if autotuning has not been performed. Perform autotuning separately for the motor, or set the motor constants through calculations. Alternatively, change the control mode selection (A1-02) to V/f control.
- 6. 2. 13** If the Motor Rotates Even When Inverter Output is Stopped
 The DC injection braking is insufficient. If the motor continues operating at low speed, without completely stopping, and after a deceleration stop has been executed, it means that the DC injection braking is not decelerating enough. Adjust the DC injection braking as follows:
 Increase the constant b2-02 (DC injection braking current) setting.
 Increase the constant b2-04 (DC injection braking time at stop) setting.
- 6. 2. 14** If 0 V is Detected When the Fan is Started, or Fan Stalls
 Generation of 0V and stalling can occur if the fan is turning when it is started. The DC injection braking is insufficient when starting.
 This can be prevented by slowing fan rotation by DC injection braking before starting the fan.
 Increase the constant b2-03 (DC injection braking time at start) setting.
- 6. 2. 15** If Output Frequency Does Not Rise to Frequency Reference
- The frequency reference is within the jump frequency range.

When the jump frequency function is used, the output frequency does not change within the jump frequency range.

Check to be sure that the jump frequency (constants d3-01 to d3-03) and jump frequency width (constant d3-04) settings are suitable.

The frequency reference upper limit has been reached.

The output frequency upper limit is determined by the following formula:
 Maximum output frequency (E1-04) × Frequency reference upper limit (d2-01) / 100

Check to be sure that the constant E1-04 and d2-01 settings are suitable.

7 Maintenance and Inspection

7.1 The maintenance period of the Inverter is as follows:
 Maintenance Period: Within 18 months of shipping from the factory or within 12 months of being delivered to the final user, whichever comes first.

7.1.1 Daily Inspection

Check the following items with the system in operation.
 The motor should not be vibrating or making unusual noises.
 There should be no abnormal heat generation.
 The ambient temperature should not be too high.
 The output current value shown on the monitor display should not be higher than normal.
 The cooling fan on the bottom of the Inverter should be operating normally.

7.1.2 Periodic Inspection

Check the following items during periodic maintenance. Always turn OFF the power supply before beginning inspection. Confirm that the LED indicators on the front cover have all turned OFF, and then wait until at least one minute (or at least three minutes for Inverters of 30kW or more) has elapsed before beginning the inspection. Be sure not to touch terminals right after the power has been turned off. Doing so can result in electric shock.

Periodic Inspections

Item	Inspection	Corrective Procedure
External terminals, mounting bolts, connectors, etc.	Are all screws and bolts tight? Are connectors tight?	Tighten loose screws and bolts firmly. Reconnect the loose connectors.
Cooling fins	Are the fins dirty or dusty?	Clean off any dirt and dust with an air gun using dry air at a pressure of 39.2 × 104 to 58.8 × 104 Pa (4 to 6 kgScm ²).
PCBs	Is there any conductive dirt or oil mist on the PCBs?	Clean off any dirt and dust with an air gun using dry air at a pressure of 39.2 × 104 to 58.8 × 104 Pa (4 to 6 kgScm ²). Replace the boards if they cannot be made clean.
Cooling fan	Is there any abnormal noise or vibration or has the total operating time exceeded 20,000 hours?	Replace the cooling fan.
Power elements	Is there any conductive dirt or oil mist on the elements?	Clean off any dirt and dust with an air gun using dry air at a pressure of 39.2 × 104 to 58.8 × 104 Pa (4 to 6 kgScm ²).
Smoothing capacitor	Are there any irregularities, such as discoloration or odor?	Replace the capacitor or Inverter.

7.1.3 Periodic Maintenance of Parts

The Inverter is configured of many parts, and these parts must be operating properly in order to make full use of the Inverter functions. Among the electronic components, there are some that require maintenance depending on their usage conditions. In order to keep the Inverter operating normally over a long period of time, it is necessary to perform periodic inspections and replace parts according to their service life. Periodic inspection standards vary depending on the Inverter's installation environment and usage conditions. The Inverter's maintenance periods are noted below. Keep them as reference.

Part Replacement Guidelines

Part	Standard Replacement Period	Replacement Method
Cooling fan	5 years	Replace with new part.
Smoothing capacitor	5 years	Replace with new part. (Determine need by inspection.)
Breaker relays	—	Determine need by inspection.
Fuses	5 years	Replace with new part.
Aluminum capacitors on PCBs	5 years	Replace with new board. (Determine need by inspection.)

Note Usage conditions are as follows:

- Ambient temperature: Yearly average of 30°C
- Load factor: 80% max.
- Operating rate: 12 hours max. per day

8 Specifications

8.1 Standard Inverter Specifications

Model Name	Power Capacity (kVA)	Output Current (A)	Compatible Motor		Dimensions (mm)							Frame
			(kW)	(HP)	W	H	D	A1	A2	B	d1	
YD3030T4N-IP54	50	65	30	40	290	470	235	170	170	412	13	F4
YD337P5T4N-IP54	61	80	37	50	400	720	265	240	240	647	13	F5
YD3055T4N-IP54	98	128	55	75	450	780	353	180	158	707	13	F6
YD3093T4N-IP54	140	180	93	125	500	840	395	200	158	767	13	F7
YD3132T4N-IP54	200	260	132	180	500	840	395	200	158	767	13	F7
YD3160T4N-IP54	230	302	160	215	570	1048	410	200	158	967	13	F8
YD3315T4N-IP54	460	605	315	400	690	1131	410	260	158	1047	13	F9

* 1. The maximum applicable motor output is given for a standard 4-pole Yaskawa motor.

When selecting the actual motor and Inverter, be sure that the Inverter's rated current is applicable for the motor's rated current.

* 2. Tuning is sometimes required.

8.2 Option Cards Specifications

The following Option Cards are available.

Option Cards

Type	Descriptions
RS-232C/485/422 Interface Card SI-K2	Used to convert RS-232C to RS-485 or RS-422. Supports baud rates up to 9.6 kbps. SPEC: F and later versions support baud rates up to 19.2 kbps.

Optional Cards (Continued)

Type	Name	Descriptions
Built-in (connect to connector)	PG Speed Co Control Cards	PG-A2 Used for V/f control. Speed feedback is performed using the PG attached to the motor to compensate for speed fluctuations caused by slipping. A-phase pulse (single pulse) input (voltage, complementary, open-collector input) Maximum input frequency: 32767 Hz Pulse monitor output: +12 V, 20 mA
		PG-B2 (PG power supply output: +12 V, 200 mA max.) Used for flux vector control. A-, B-phase input (complimentary input) Maximum input frequency: 32767 Hz Pulse monitor output: Open-collector (PG power supply output: +12 V, 200 mA max.)
		PG-D2 Differential input. S A-phase pulse (differential pulse) input, for V/f control Maximum input frequency: 300 kHz Input: Conforms to RS-422 Pulse monitor output: RS-422 (PG power supply output: +5 or +12 V, 200 mA max.)
		PG-X2 Used for flux vector control. S A-, B-, Z-phase pulse (differential pulse) input Maximum input frequency: 300 kHz Input: Conforms to RS-422 Pulse monitor output: RS-422 (PG power supply output: +5 or +12 V, 200 mA max.)
		Synchronous Phase Control Card SP-A2 Connector to Inverter to enable synchronized startup control with the motor. An external voltage detection transformer (CPT005845) is required.

9 Appendix

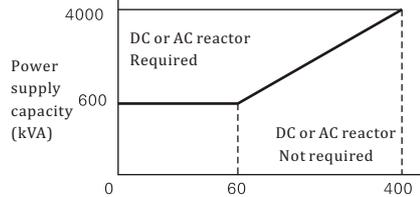
9.1 Inverter Application Precautions

9.1.1 Selection

■ Installing Reactors

A large peak current will flow in the power input circuit when the Inverter is connected to a large-capacity power transformer (600kVA or higher) or when switching a phase capacitor. Excessive peak current can destroy the converter section. To prevent this, install a DC or AC reactor (optional) to improve the power supply power factor.

DC reactors are built into 200V class Inverters of 18.5 to 75kW and 400V class Inverters of 18.5 to 160 kW. If a thyristor converter, such as a DC drive, is connected in the same power supply system, connect a DC or AC reactor regardless of the power supply conditions shown in the following diagram.



■ Inverter Capacity

When connecting special motors or multiple motors in parallel to an Inverter, select the Inverter capacity so that the rated output current of the Inverter is 1.1 times the sum of all the motor rated currents.

■ Initial Torque

The startup and acceleration characteristics of the motor are restricted by the overload current ratings of the Inverter that is driving the motor. The torque characteristics are generally less than those required when starting using a normal commercial power supply. If a large initial torque is required, select an Inverter with a somewhat larger capacity or increase the capacity of both the motor and the inverter.

■ Emergency Stop

Although the Inverter's protective functions will stop operation when a fault occurs, the motor will not stop immediately. Always provide mechanical stop and protection mechanisms on equipment requiring an emergency stop.

■ Options

Terminals B1, B2, ©, "1, "2, "3 are for connecting only the options specifically provided by Yaskawa. Never connect any other devices to these terminals.

9.1.2 Installation

■ Installation in Enclosures

Either install the Inverter in a clean location not subject to oil mist, air-borne matter, dust, and other contaminants, or install the Inverter in a completely enclosed panel. Provide cooling measures and sufficient panel space so that the temperature surrounding the Inverter does not go beyond the allowable temperature. Do not install the Inverter on wood or other combustible materials.

■ Installation Direction

Mount the Inverter vertically to a wall or other horizontal surface.

9.1.3 Settings

■ Upper Limits

The Digital Operator can be used to set high-speed operation up to a maximum of 400 Hz. Incorrect settings can be dangerous. Use the maximum frequency setting functions to set upper limits. (The maximum output frequency is factory-set to 60 Hz.)

■ DC Injection Braking

The motor can overheat if the DC injection braking voltage or braking time is set to a large value.

■ Acceleration/Deceleration Times

The motor's acceleration and deceleration times are determined by the torque generated by the motor, the load torque, and the load's inertial moment ($GD^2/4$). If the stall prevention functions are activated during acceleration or deceleration, increase the acceleration or deceleration time. The stall prevention functions will increase the acceleration or deceleration time by the amount of time the stall prevention function is active. To reduce the acceleration or deceleration times, increase the capacity of the motor and Inverter.

9.1.4 Handling

■ Wiring Check

The Inverter will be internally damaged if the power supply voltage is applied to output terminal U, V, or W. Check wiring for any mistakes before supplying power. Check all wiring and sequences carefully.

■ Magnetic Contactor Installation

Do not start and stop operation frequently with a magnetic contactor installed on the power supply line. Doing so can cause the Inverter to malfunction.

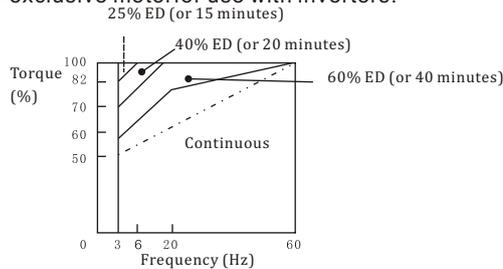
■ Inspections

The internal capacitors in the Inverter require time to discharge after the power supply is turned OFF. Do not start inspections until the CHARGE indicator goes out.

9. 2 Motor Application Precautions

9. 2. 1 Using the Inverter for an Existing Standard Motor

When a standard motor is operated with the Inverter, power loss is slightly higher than when operated with a commercial power supply. In addition, cooling effects also diminish in the low-speed range, resulting in an increase in the motor temperature. Therefore, the motor torque should be reduced in the low-speed range. The following graph shows the allowable load characteristics of a standard motor. If 100% torque is continuously required in the low-speed range, use a special motor or vector-exclusive motor for use with inverters.



If the input voltage is high (440V or higher) or the wiring distance is long, the motor insulation voltage must be considered. Contact your Yaskawa representative for details.

■ High-speed Operation

When using the motor at a high speed (60 Hz or more), problems may arise in dynamic balance and bearing durability. Contact your Yaskawa representative for details.

■ Torque Characteristics

The motor may require more acceleration torque when the motor is operated with the Inverter than when operated with a commercial power supply. Check the load torque characteristics of the machine to be used with the motor to set a proper V/f pattern.

■ Vibration

The Inverter uses a high carrier PWM to reduce motor vibration. When the motor is operated with the Inverter, motor vibration is almost the same as when operated with a commercial power supply. Motor vibration may, however, become greater in the following cases.

Resonance with the Natural Frequency of the Mechanical System Takes special care when a machine that has been operated at a constant speed is to be operated in variable speed mode. If resonance occurs, install vibration-proof rubber on the motor base or use the frequency jump function to skip any frequency resonating the machine. Imbalanced Rotor Take special care when the motor is operated at a higher speed (60 Hz or more).

■ Noise

Noise is almost the same as when the motor is operated with a commercial power supply. Motor noise, however, becomes louder when the motor is operated at a speed higher than the rated speed (60 Hz).

9. 2. 2 Using the Inverter for Special Motors

■ Pole-changing Motor

The rated input current of pole-changing motors differs from that of standard motors. Select, therefore, an appropriate Inverter according to the maximum input current of the motor to be used. Before changing the number of poles, always make sure that the motor has stopped. Otherwise, the overvoltage protective or overcurrent protective mechanism will be actuated, resulting in an error.

■ Submersible Motor

The rated input current of submersible motors is higher than that of standard motors. Therefore, always select an Inverter by checking its rated output current. When the distance between the motor and Inverter is long, use a cable thick enough to connect the motor and Inverter to prevent motor torque reduction.

■ Explosion-proof Motor

When an explosion-proof motor or increased safety-type motor is to be used, it must be subject to an explosion-proof test in conjunction with the Inverter. This is also applicable when an existing explosion-proof motor is to be operated with the Inverter. Since the Inverter itself is, however, not explosion-proof, always install it in a safe place.

■ Gearmotor

The speed range for continuous operation differs according to the lubrication method and motor manufacturer. In particular, continuous operation of an oil-lubricated motor in the low speed range may result in burning. If the motor is to be operated at a speed higher than 60 Hz, consult with the manufacturer.

■ Synchronous Motor

A synchronous motor is not suitable for Inverter control. If a group of synchronous motors is individually turned ON and OFF, synchronism may be lost.

■ Single-phase Motor

Do not use an Inverter for a single-phase motor. The motor should be replaced with a 3-phase motor.

9. 2. 3 Power Transmission Mechanism (Speed Reducers, Belts, and Chains)

If an oil-lubricated gearbox or speed reducer is used in the power transmission mechanism, oil lubrication will be affected when the motor operates only in the low speed range. The power transmission mechanism will make noise and experience problems with service life and durability if the motor is operated at a speed higher than 60 Hz.

9. 3 Peripheral Device Application Precautions

If an oil-lubricated gearbox or speed reducer is used in the power transmission mechanism, oil lubrication will be affected when the motor operates only in the low speed range. The power transmission mechanism will make noise and experience problems with service life and durability if the motor is operated at a speed higher than 60 Hz.

Using Magnetic Contactors on the Power Supply Line

The Inverter can be used without a magnetic contactor on the power supply line. Although a magnetic contactor can be installed to protect from accidents that can occur by automatic recovery following power losses during remote operation, do not start and stop operation frequently with a magnetic contactor installed on the power supply line. Doing so can cause the Inverter to malfunction. The motor will not be automatically restarted after power recovery during Digital Operator operation, and starting via a magnetic contactor is thus not possible.

Although operation can be stopped using a magnetic contactor in the power supply line, the regenerative control of the Inverter will not operate and a coast to a stop will occur. If a Braking Unit or Braking Resistor Unit is used, wire a sequence that turns OFF the magnetic contactor with the thermal protector contact of the Braking Resistor Unit.

Using Magnetic Contactors on the Motor Line

As a rule, do not install a magnetic contactor between the Inverter and motor to turn the motor ON and OFF during operation. Supplying power to the motor while the Inverter is operating will cause a large surge current to flow, and the Inverter's overcurrent protection function will operate. If a magnetic contactor is installed to switch to a commercial power supply, switch the lines only after stopping both the Inverter and the motor. Use the speed search function if switching is required while the motor shaft is rotating. If a magnetic contactor is required for momentary power losses, use a contactor with delayed operation.

Installing Thermal Overload Relays

The Inverter has a protection function using an electronic thermal to protect the motor from overheating. However, if more than one motor is operated from one Inverter or if a multi-pole motor is operated, install thermal overload relays or thermal protectors between the Inverter and motors. Set the constant L1-01 to "0" and set the heat-operating thermal overload relay or thermal protector to 1.0 times the value on the motor nameplate at 50 Hz or 1.1 times the value at 60 Hz.

Improving the Power Factor (Eliminating Phase Advancing Capacitors)

Install a DC or AC reactor on the power supply line to the Inverter to improve the power factor. (200V class Inverters of 18.5 to 75kW and 400 V class Inverters of 18.5 to 160kW have built-in DC reactors.)

Capacitors or surge suppressors on the output line from the Inverter can overheat or be destroyed by the high frequency component of the Inverter's output. They can also cause overcurrents to flow to the Inverter, causing the overcurrent protection function to activate. Do not install capacitors or surge suppressors in the output line.

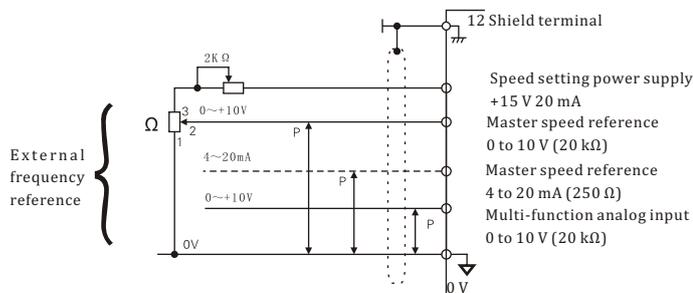
Electromagnetic Interference

The Inverter's I/O circuits (main circuits) contain a high-frequency component, which may adversely affect communications devices (e.g., AM radios) located nearby. This interference can be reduced by installing noise filters, or you can install the wiring between the Inverter and motor and the power supply wiring in a metal duct and ground the duct.

Wire Sizes and Distances

Motor torque will be reduced by voltage drop along the cable if the distance between the Inverter and the motor is too long. This is particularly noticeable for low-frequency outputs. Use wires of sufficient size. Always use the optional extension cables when operating the Digital Operator separated from the Inverter. For remote operation using analog signals, keep the control line length between the Analog Operator or operation signals and the Inverter to 50m or less, and separate the lines from high-power lines (main circuits or relay sequence circuits) to reduce induction from peripheral devices.

When setting frequencies from an external frequency setter (and not from a Digital Operator), use shielded twisted-pair wires and ground the shield to terminal 12, as shown in the following diagram.



9. 4 Installing and Wiring PG Speed Control Cards

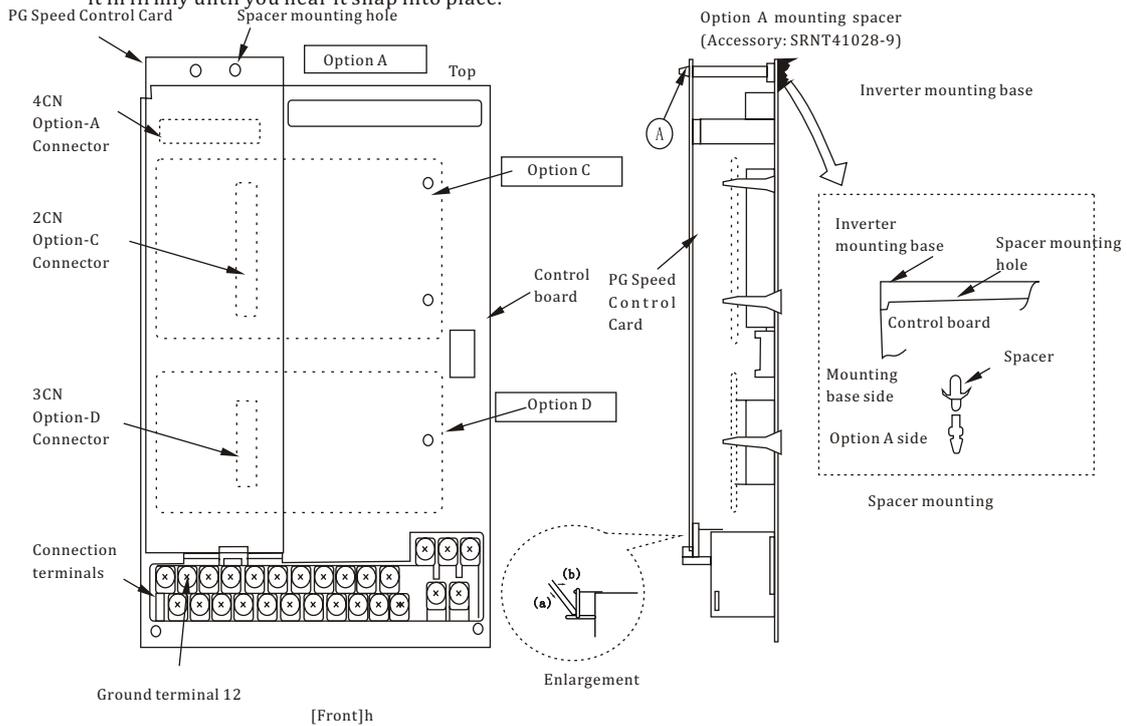
PG Speed Control Cards are used for executing speed control using a pulse generator (PG). There are four types of PG speed control, as shown below. Select the type that fits the application and control method.

PG-A	A-phase (single) pulse input for open collector output or complementary outputs, for V/f control
PG-B	A/B-phase pulse input for open collector output or complementary outputs, for vector control
PG-D	A-phase (single) pulse input for line driver input, for V/f control
PG-X	A/B/Z-phase pulse input for line driver input, for vector control

9. 4. 1 Installing a PG Speed Control Card

Use the following procedure to install a PG Speed Control Card.

- 1 Turn off the main-circuit power supply.
- 2 Leave it off for at least one minute before removing the front cover of the Inverter (or at least threeminutes for Inverters of 30 kW or more). Check to be sure that the CHARGE indicator is OFF.
- 3 Insert the spacer (which is provided) into the spacer hole in the Inverter's mounting base. For Inverters of 3.7 kW or lower, there are two adjacent holes. Insert the spacer into the 7CN hole. This spacer cannot be easily removed if inserted into the wrong hole. Be very careful to insert the spacer into the correct hole, and in the proper direction.
- 4 Referring to the enlarged illustration in the following diagram, align the PG Speed Control Card with the catch position as shown by (a) and (b) and fit it precisely to the Option-A connector. Insert at (a) first.
- 5 Pass the spacer through the spacer hole at the Card. (Refer to A in the illustration.) Check to be sure that it is precisely aligned with the 4CN position, and snap it into the proper position. Be sure to press it in firmly until you hear it snap into place.



Installing a PG Speed Control Card

9. 4. 2 PG Speed Control Card Terminal Blocks

The terminal specifications for each PG Speed Control Card are given in the following tables.

■ PG-A2 (For V/f with PG Feedback Mode Only)

PG-A2 Terminal Specifications

Terminal	No.	Contents	Specifications
TA 1	1	Power supply for pulse generator	12 VDC ($\pm 5\%$), 200 mA max.
	2		0 VDC (GND for power supply)
	3	+12 V/open collector switching terminal	Terminal for switching between 12 V voltage input and open collector input For open collector input short across 3 and 4.
	4		
	5	Pulse input terminal	H: +4 to 12 V; L: +1 V max. (Maximum response frequency: 30 kHz)
	6		Pulse input common
	7	Pulse motor output terminal	12 VDC (+10%), 20 mA max.
	8		Pulse monitor output common
TA 2	(E)	Shield connection terminal	—

■ PG-B2 (For Flux Vector Control Mode Only)

PG-B2 Terminal Specifications

Terminal	No.	Contents	Specifications
TA 1	1	Power supply for pulse generator	12 VDC ($\pm 5\%$), 200 mA max.
	2		0 VDC (GND for power supply)
	3	A-phase pulse input terminal	H: +8 to 12 V L: +1 V max. (Maximum response frequency: 30 kHz)
	4		Pulse input common
	5	B-phase pulse input terminal	H: +8 to 12 V L: +1 V max. (Maximum response frequency: 30 kHz)
	6		Pulse input common
TA 2	1	A phase monitor output terminal	Open collector output, 24 VDC, 30 mA max.
	2		A-phase monitor output common
	3	B phase monitor output terminal	Open collector output, 24 VDC, 30 mA max.
	4		B-phase monitor output common
TA 3	(E)	Shield connection terminal	—

■ PG-D2 (For V/f with PG Feedback Mode Only)

PG-D2 Terminal Specifications

Terminal	No.	Contents	Specifications
TA 1	1	Power supply for pulse generator	12 VDC ($\pm 5\%$), 200 mA max. (see note)
	2		0 VDC (GND for power supply)
	3		5 VDC ($\pm 5\%$), 200 mA max. (see note)
	4	Pulse input + terminal	Line driver input (RS-422 level input) Maximum response frequency: 300 kHz
	5	Pulse input - terminal	
	6	Common terminal	—
	7	Pulse monitor output + terminal	Line driver output (RS 422 level output)
	8	Pulse monitor output - terminal	
TA 2	(E)	Shield connection terminal	—

Note 5 VDC and 12 VDC cannot be used at the same time.

■ PG-X2 (For Flux Vector Control Mode Only)

PG-X2 Terminal Specifications

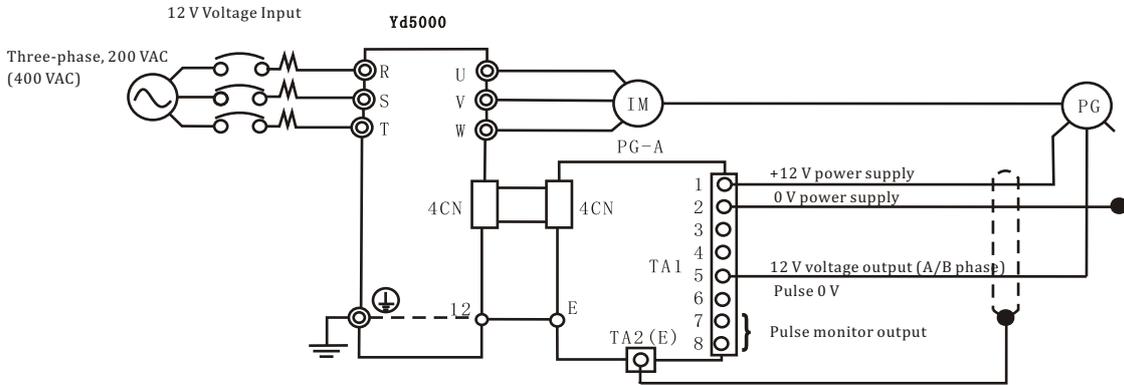
Terminal	No.	Contents	Specifications
TA1	1	Power supply for pulse generator	12 VDC ($\pm 5\%$), 200 mA max. (see note)
	2		0 VDC (GND for power supply)
	3		5 VDC ($\pm 5\%$), 200 mA max. (see note)
	4	A-phase + input terminal	Line driver input (RS-422 level input) Maximum response frequency: 300 kHz
	5	A-phase - input terminal	
	6	B-phase + input terminal	
	7	B-phase - input terminal	
	8	Z-phase + input terminal	
	9	Z-phase - input terminal	
	10	Common terminal	0 VDC (GND for power supply)
TA2	1	A-phase + output terminal	Line driver output (RS 422 level output)
	2	A-phase - output terminal	
	3	B-phase + output terminal	
	4	B-phase - output terminal	
	5	Z-phase + output terminal	
	6	Z-phase - output terminal	
	7	Control circuit common	Control circuit GND
TA3	(E)	Shield connection terminal	—

Note 5 VDC and 12 VDC cannot be used at the same time.

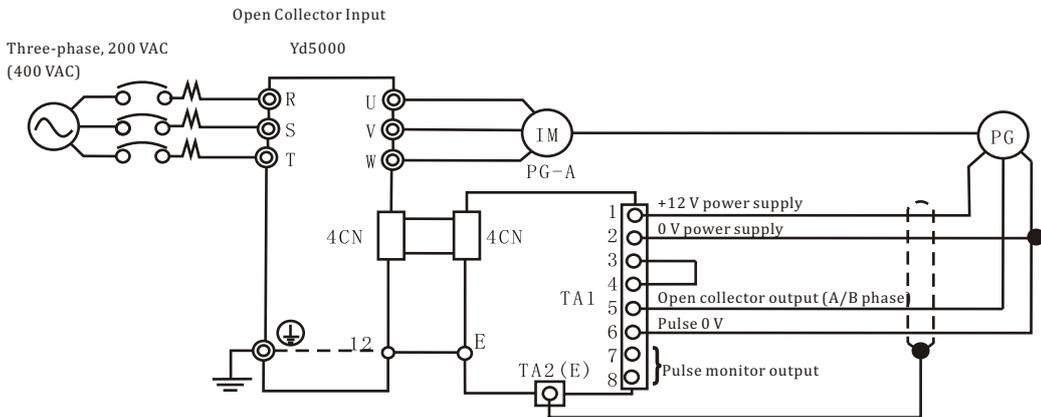
9. 4. 3 Wiring a PG Speed Control Card

Wiring examples are provided in the following illustrations for the PG Speed Control Cards.

PG-A2 (For V/f with PG Feedback Mode Only)

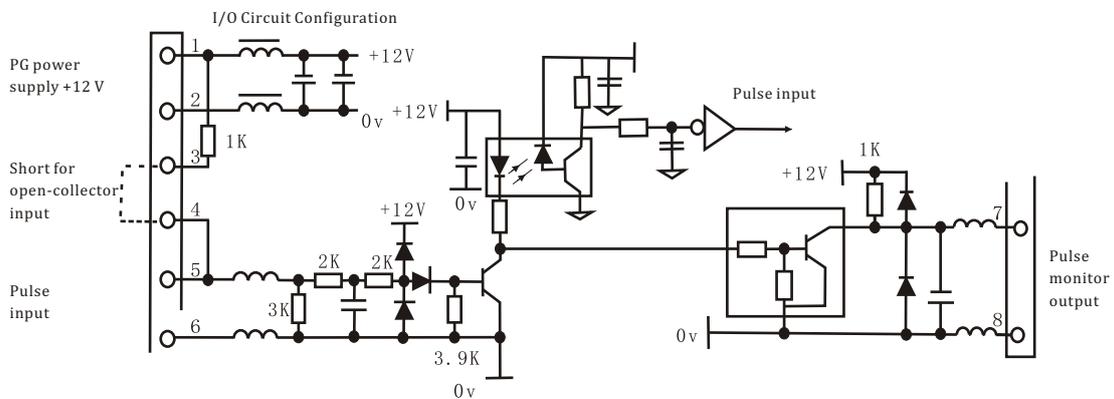


Wiring a 12 V Voltage Input



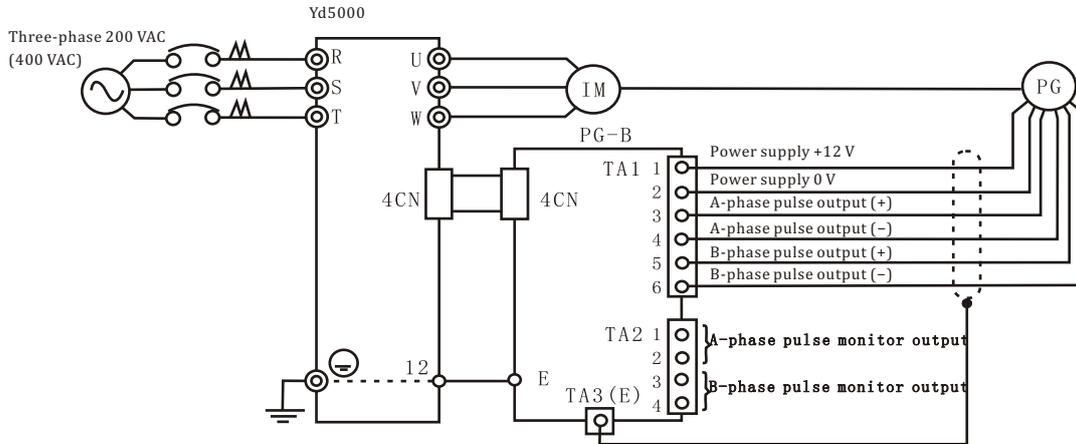
- Shielded twisted-pair wires must be used for signal lines.
- Do not use the pulse generator's power supply for anything other than the pulse generator (encoder). Using it for another purpose can cause malfunctions due to noise.
- The length of the pulse generator's wiring must not be more than 100 meters.

Wiring an Open-collector Input



I/O Circuit Configuration of the PG-A2

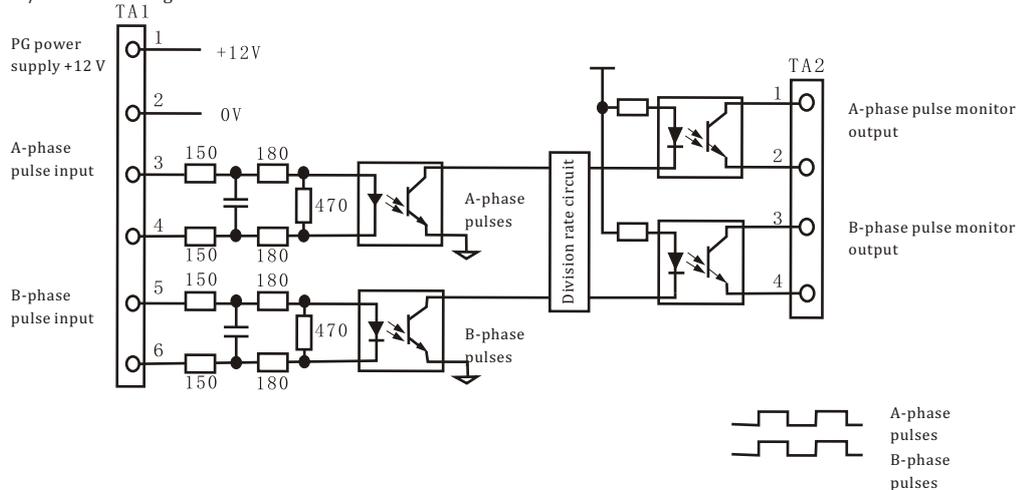
PG-B2 (For Flux Vector Control Mode Only)



- Shielded twisted-pair wires must be used for signal lines.
- Do not use the pulse generator's power supply for anything other than the pulse generator (encoder). Using it for another purpose can cause malfunctions due to noise.
- The length of the pulse generator's wiring must not be more than 100 meters.
- The direction of rotation of the PG can be set in user constant F1-05. The factory preset is for forward rotation, A-phase advancement.

PG-B2 Wiring

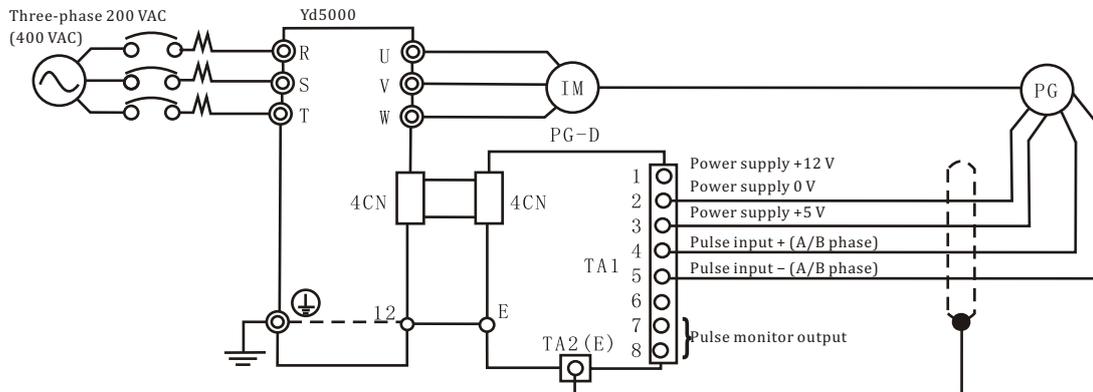
I/O Circuit Configuration



- When connecting to a voltage-output-type PG (encoder), select a PG that has an output impedance with a current of at least 12 mA to the input circuit photocoupler (diode).
- The pulse monitor dividing ratio can be changed using constant

I/O Circuit Configuration of the PG-B2

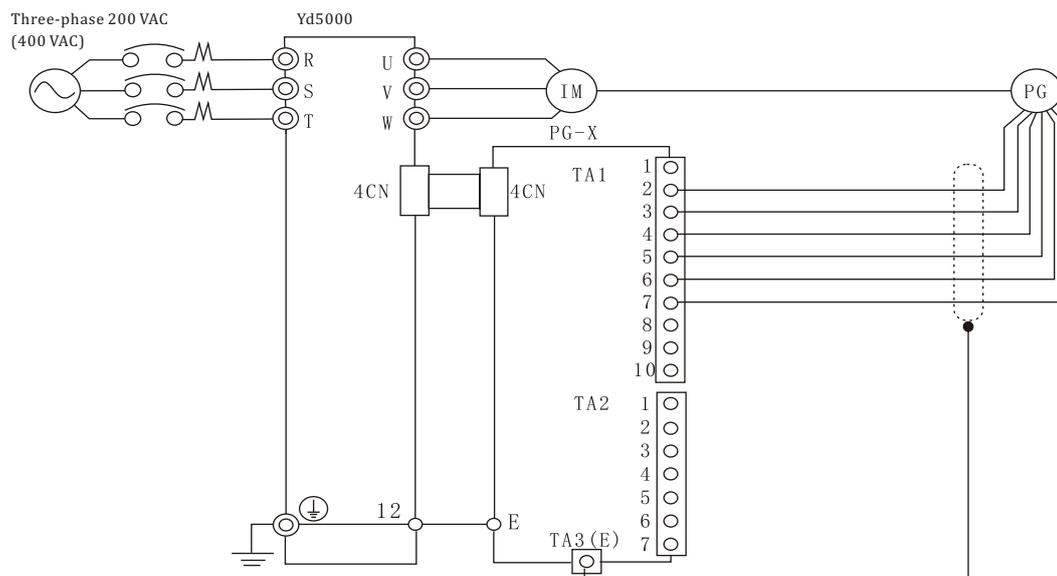
■ **PG-D2 (For V/f with PG Feedback Mode Only)**



- Shielded twisted-pair wires must be used for signal lines.
- Do not use the pulse generator's power supply for anything other than the pulse generator (encoder). Using it for another purpose can cause malfunctions due to noise.
- The length of the pulse generator's wiring must not be more than 100 meters.

PG-D2 Wiring

■ **PG-X2 (For Flux Vector Control Mode Only)**



- Shielded, twisted-pair wire must be used for signal lines.
- Do not use the pulse generator's power supply for anything other than the pulse generator (encoder). Using it for another purpose can cause malfunctions due to noise.
- The length of the pulse generator's wiring must not be more than 100 meters.
- The direction of rotation of the PC can be set in user constant F1-05. The factory preset is for forward rotation, A-phase advancement.

PG-X2 Wiring

9. 4. 4 Wiring PG Speed Control Card Terminal Blocks

Use no more than 100 meters of wiring for PG (encoder) signal lines, and keep them separate from power lines. Use shielded, twisted-pair wires for pulse inputs and pulse output monitor wires, and connect the shield to the shield connection terminal.

■ **Wire Sizes (Same for All Models)**

Terminal wire sizes are shown in Table 3.14.

Table 3.14 Wire Sizes

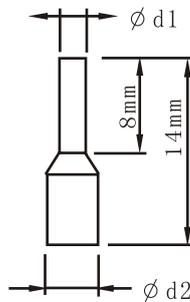
Terminal	Terminal Screws	Wire Thickness (mm ²)	Wire Type
Pulse generator power supply Pulse input terminal Pulse monitor output terminal	—	Stranded wire: 0.5 to 1.25 Single wire: 0.5 to 1.25	Shielded, twisted-pair wire Shielded, polyethylene-covered vinyl sheath cable
Shield connection terminal	M3.5	0.5 to 2	

■ **Solderless Terminals for Control Circuit Terminals**

The use of solderless terminals for the control circuit terminals is recommended because solderless terminals are easy to connect securely.

Straight Solderless Terminal Sizes

Wire Thickness	Model	d1	d2	Manufacturer
0.5mm ²	A10.5-8WH	1.00	2.60	Phoenix Contact
0.75mm ²	A10.75-8GY	1.20	2.80	
1mm ²	A11-8RD	1.40	3.00	
1.5mm ²	A11.5-8BK	1.70	3.50	



Straight Solderless Terminal Sizes



Do not solder wires with the control circuit terminals if wires are used instead of solderless terminals. Wires may not contact well with the control circuit terminals or the wires may be disconnected from the control circuit terminals due to oscillation if the wires are soldered

■ Closed-loop Connector Sizes and Tightening Torque

The closed-loop connectors and tightening torques for various wire sizes are shown in Table 3.16.

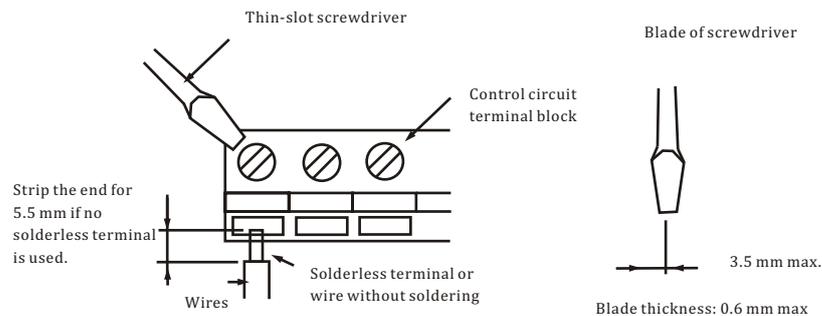
Closed-loop Connectors and Tightening Torques

Wire Thickness [mm ²]	Terminal Screws	Crimp Terminal Size	Tightening Torque (N G m)
0.5	M3.5	1.25-1.35	0.8
0.75		1.25-1.35	
1.25		1.25-1.35	
2		2-3.5	

■ Wiring Method

Use the following procedure to connect wires to the terminal block.

1. Loosen the terminal screws with a thin-slot screwdriver.
2. Insert the wires from underneath the terminal block.
3. Tighten the terminal screws firmly.

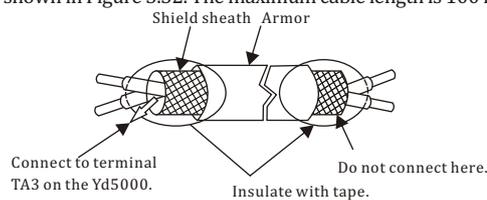


Connecting Wires to Terminal Block

Wiring Precautions

IMPORTANT

1. Separate PG Speed Control Card control circuit wiring (terminals TA1 and TA2) from main circuit wiring and other high-power lines.
2. Use twisted-pair or shielded twisted-pair cables to connect the PG to prevent operating faults. Process cable ends as shown in Figure 3.32. The maximum cable length is 100 m.



Processing the Ends of Twisted-pair Cables

3. Connect the shield to the ground terminal.
4. Do not solder the wires to the control circuit terminals. The wires may not contact well with the control circuit terminals if the wires are soldered.
5. The end of each wire connected to the control circuit terminals must be stripped for approximately 5.5 mm.

9. 4. 5 Selecting the Number of PG (Encoder) Pulses

PG-A2/PG-B2

The maximum response frequency is 32,767 Hz.

Use a PG that outputs a maximum frequency of approximately 20 kHz for the rotational speed of the motor.

$$\frac{\text{Motor speed at maximum frequency output (r/min)}}{60} \times \text{PG rating (p/rev)} = 20,000 \text{ Hz}$$

Some examples of PG output frequency (number of pulses) for the maximum frequency output are shown in Table 3.17.

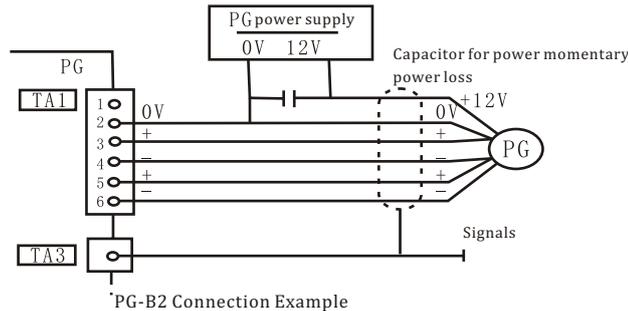
PG Pulse Selection Examples

Motor's Maximum Speed (r/min)	PG Rating (p/rev)	PG Output Frequency for Maximum Frequency Output (Hz)
1800	600	18,000
1500	800	20,000
1200	1000	20,000
900	1200	18,000

Note 1. The motor speed at maximum frequency output is expressed as the sync rotation speed.

2. The PG power supply is 12 V.

3. A separate power supply is required if the PG power supply capacity is greater than 200 mA. (If momentary power loss must be handled, use a backup capacitor or other method.)



PG-B2 Connection Example

PG-D2/PG-X2

There are 5 V and 12 V PG power supplies.

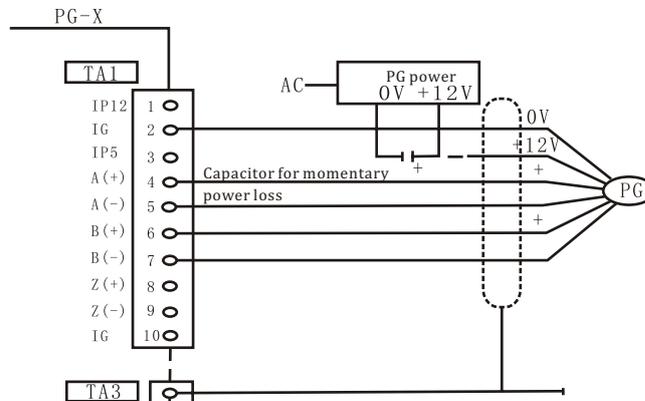
Check the PG power supply specifications before connecting.

The maximum response frequency is 300 kHz.

Use the following equation to compute the output frequency of the PG (fPG).

$$\frac{\text{Motor speed at maximum frequency output (r/min)}}{60} \times \text{PG rating (p/rev)}$$

A separate power supply is required if the PG power supply capacity is greater than 200 mA. (If momentary power loss must be handled, use a backup capacitor or other method.)



PG-X2 Connection Example (for 12 V PG power supply)

No.	Name (Display)	Factory Setting	Setting	No.	Name (Display)	Factory Setting	Setting
A1-00	Language selection for digital operator display (Select Language)	0~6		b5-07	PID offset adjustment (PID Offset)	-100.0 +100.0	
A1-01	Constant access level (Access Level)	0~4		b5-08	PID primary delay time constant (PID Delay Time)	0.00~10.0	
A1-02	Control method selection (Control Method)	0~3		b5-09	PID output characteristics selection (Output Level Sel)	0~1	
A1-03	Initialize (Init Parameters)	0~3330		b5-10	PID output gain (Output Gain)	0.0~25.0	
A1-04	Password 1 (Enter Password)	0~9999		b5-11	PID reverse output selection (Output Rev Sel)	0~1	
A1-05	Password 2 (Select Password)	0~9999		b5-12	Selection of PID feedback command loss detection (Fb los Det Sel)	0~2	
A2-01 ~ A2-32	User setting constant (User Pram 1 to 32)	b1-01 ~ a2-08		b5-13	PID feedback command loss detection level (Fb los Det Lvl)	0~100	
b1-01	Reference selection (Reference Source)	0~4		b5-14	PID feedback command loss detection time (Fb los Det Time)	0.0~25.5	
b1-02	Operation method selection (Run Source)	0~4		b6-01	Dwell frequency at start (Dwell Ref @ Start)	0.0~400.0	
b1-03	Stopping method selection (Stopping Method)	0~3		b6-02	Dwell time at start (Dwell Time @ Start)	0.0~10.0	
b1-04	Prohibition of reverse operation (Reverse Oper)	0. 1		b6-03	Dwell frequency at stop (Dwell Ref @ Stop)	0.0~400.0	
b1-05	Operation selection for setting of E1-09 or less (Zero-Speed Oper)	0~3		b6-04	Dwell time at stop (Dwell Time @ Stop)	0.0~10.0	
b1-06	Read sequence input twice (Cntl Input Scans)	0. 1		b7-01	Droop control gain:2 (Droop Gain)	0.0~100.0	
b1-07	Operation after switching to remote mode:2 (LOC/REM RUN Sel)	0. 1		b7-02	Droop control delay time:2 (Droop Delay Time)	0.03~2.00	
b1-08	Run command selection for PRG mode (RUN CMD at PRG)	0. 1		b8-01	Energy-saving gain (Energy Save Gain)	0~100	
b2-01	Zero speed level (DC injection braking start frequency)(DCInj Start Rreq)	0.0~10.0		b8-02	Energy-saving frequency (Energy Save Freq)	0.0~400.0	
b2-02	DC injection braking current (DCInj Current)	0~100		b9-01	Zero-servo gain (Zero Servo Gain)	0~100	
b2-03	DC injection braking time at start (DCInj Time @ Start)	0.00~10.00		b9-02	Zero-servo completion width (Zero Servo Count)	0~16383	
b2-04	DC injection braking time at stop (DCInj Time @ Stop)	0.00~10.00		c1-01	Acceleration time 1 (Accel Time 1)		
b2-08	Magnetic flux compensation volume (Field Comp@ Start)	0~500		c1-02	Deceleration time 1 (Decel Time 1)		
b3-01	Speed search selection at start (SpdSrch at Start)	0. 1		c1-03	Acceleration time 2 (Accel Time 2)		
b3-02	Speed search operating current (SpdSrch Current)	0~200		c1-04	Deceleration time 2 (Decel Time 2)		
b3-03	Speed search deceleration time (SpdSrch Dec Time)	0.1~10.0		c1-05	Acceleration time 3 (Accel Time 3)	0.0~6000.0	
b4-01	Speed search deceleration time (SpdSrch Dec Time)	0.0~300.0		c1-06	Deceleration time 3 (Decel Time 3)		
b4-02	Timer function OFF-delay time (Delay-OFF Timer)	0.0~300.0		c1-07	Acceleration time 4 (Accel Time 4)		
b5-01	PID control mode selection (PID Mode)	0~4		c1-08	Deceleration time 4 (Decel Time 4)		
b5-02	Proportional gain (P) (PID Gain)	0.00~25.00		c1-09	Emergency stop time (Fast Stop Time)		
b5-03	Integral (I) time (PID I Time)	0.0~360.0		c1-10	Accel/dec time setting unit (Acc/Dec Units)	0. 1	
b5-04	Integral (I) limit (PID I Limit)	0.0~100.0		c1-11	Accel/dec time switching frequency (Acc/Dec SW Freq)	0.0~400.0	
b5-05	Differential (D) time (PID D Time)	0.00~10.00		c2-01	S-curve characteristic time at acceleration start (Scrv Acc @ Start)	0.0~2.50	
b5-06	PID limit (PID Limit)	0.0~100.0		c2-02	S-curve characteristic time at acceleration end (Scrv Acc @ End)	0.0~2.50	

* 1. Not initialized. (Japanese standard specifications: A1-01 = 1, A1-02 = 2)

* 2. Not displayed for some models depending on software version No.

* 3. Factory setting depends on the control method (A1-02).

User Constants (Continued)

No.	Name	Factory Setting	Setting	No.	Name	Factory Setting	Setting
c2-03	S-curve characteristic time at deceleration start (ScrV Dec @ Strat)	0.00~2.50		d1-03	Frequency reference 3 (Reference 3)		
c2-04	S-curve characteristic time at deceleration end (ScrV Dec @ End)	0.00~2.50		d1-04	Frequency reference 4 (Reference 4)		
c3-01	Slip compensation gain (Slip Comp Gain)	0.0~2.5		d1-05	Frequency reference 5 (Reference 5)		
c3-02	Slip compensation primary delay time (Slip Comp Time)	0~10000		d1-06	Frequency reference 6 (Reference 6)	0~400.0	
c3-03	Slip compensation limit (Slip Comp Limit)	0~250		d1-07	Frequency reference 7 (Reference 7)		
c3-04	Slip compensation during regeneration (Slip Comp Regen)	0.1		d1-08	Frequency reference 8 (Reference 8)		
c3-05	Flux calculation method (Flux Select)	0.1		d1-09	Jog frequency reference (Jog Reference)		
c3-06	Output voltage limited operation selection (Output V Limit)	0.1		d2-01	Frequency reference upper limit (Ref Upper Limit)	0.0~110.0	
c4-01	Torque compensation gain (Torq Comp Gain)	0.00~2.50		d2-02	Frequency reference lower limit (Ref Lower Limit)	0.0~109.0	
c4-02	Torque compensation time constant (Torq Comp Time)	0~10000		d3-01	Jump frequency 1 (Jump Freq 1)		
c4-03	Start torque compensation (forward direction) (F TorqCmp@ Start)	0.00~200.0		d3-02	Jump frequency 2 (Jump Freq 2)	0.0~400.0	
c4-04	Start torque compensation (reverse direction) (R TorqCmp@ Start)	-200.0~0.0		d3-03	Jump frequency 3 (Jump Freq 3)		
c4-05	Start torque time constant (TorqCmp Delay T)	0~200.0		d3-04	Jump frequency width (Jump Bandwidth)	0.0~20.0	
C5-01	ASR proportional (P) gain 1 (ASR P Gain 1)	0.00~300.00		d4-01	Frequency reference hold function selection (MOP Ref Memory)	0.1	
C5-02	ASR integral (I) time 1 (ASR I Time 1)	0.000~10.000		d4-02	+ - Speed limits:2 (Trim Control Lvl)	1~100	
C5-03	ASR proportional (P) gain 2 (ASR P Gain 2)	0.00~300.00		d5-01	Torque control selection (Torq Control Sel)	0.1	
C5-04	ASR integral (I) time 2 (ASR I Time 2)	0.000~10.000		d5-02	Torque reference delay time (Torq Ref Filter)	1~1000	
C5-05	ASR limit (ASR Limit)	0.0~20.0		d5-03	Speed limit selection (Speed Limit Sel)	1.2	
C5-06	ASR primary delay time (ASR Delay Time)	0.000~0.500		d5-04	Speed limit (Speed Lmt Value)	-200~+120	
C5-07	ASR switching frequency (ASR Gain SW Freq)	0.0~400		d5-05	Speed limit bias (Speed Lmt Bias)	0~120	
C5-08	ASR integral (I) limit:2 (ASR I Limit)	0~400		d5-06	Speed/torque control switching timer (Ref Hold Time)	0~1000	
c6-01	Carrier frequency upper limit (Carrier Freq Max)	2.0~15.0*2		E1-01	Input voltage setting (Input Voltage)	155~255*1	
c6-02	Carrier frequency lower limit (Carrier Freq Min)	0.4~15.0		E1-02	Motor selection (Motor Selection)	0~2	
c6-03	Carrier frequency proportional gain (Carrier Freq Gain)	00~99		E1-03	V/f pattern selection (V/F Selection)	0~F	
c7-01	Carrier frequency proportional gain (Carrier Freq Gain)	0.1		E1-04	Max. output frequency (Max Frequency)	40.0~400.0	
c7-02	Hunting prevention gain (Hunt Prev Gain)	0.00~2.50		E1-05	Max. voltage (Max Voltage)	0.0~255.0*1	
c8-08	AFR gain (AFR Gain)	0.00~10.00		E1-06	Base frequency (Base Frequency)	0.0~400.0	
c8-09	Speed feedback detection control (AFR) time:2 (AFR Time)	0~2000		E1-07	Mid. output frequency (Mid. Frequency A)	0.0~400.0	
*c8-30	Carrier frequency during autotuning:2 (Carrier in tune)	0~2		E1-08	Mid. output frequency voltage (Mid Voltage A)	0.0~255.0*1	
*d1-01	Frequency reference 1 (Reference 1)	0~400.00		E1-09	Min. output frequency (Min Frequency)	0.0~400.0	
d1-02	Frequency reference 2 (Reference 2)	0~400.00		E1-10	Min. output frequency voltage (Min Voltage)	0.0~255.0*1	

- *1. Factory setting depends on the control method (A1-02).
- *2. Not displayed for some models depending on software version No.
- *3. Setting unit and initial setting depend on Inverter capacity.
- *4. Setting for 200 V class Inverters. For 400 V class Inverters, double the value.

User Constants (Continued)

No.	Name (Display)	Factory Setting	Setting	No.	Name (Display)	Factory Setting	Setting
E1-11	Mid. output frequency 2:2 (Mid Frequency B)	0.0~400.0		F1-06	PG division rate (PG pulse monitor) (PG output Ratio)	0-132	
E1-12	Mid. output frequency voltage 2:2 (Mid Voltage B)	0.0~255.0*1		F1-07	Integral value during accel/decel enable/ disable (PG Ramp Pl/I Sel)	0, 1	
E1-13	Base voltage:2 (Base Voltage)	0.0~255.0*1		F1-08	Overspeed detection level (PG Overspd Level)	0-120	
E2-01	Motor rated current (Motor Rated FLA)	0.32~6.40*2		F1-09	Overspeed detection delay time (PG Overspd Time)	0.32~6.40*2	
E2-02	Motor rated slip (Motor Rated Slip)	0.00~20.00		F1-10	Excessive speed deviation detection level (PG Deviate Level)	0-50	
E2-03	Motor no-load current (No-Load Current)	*3		F1-11	Excessive speed deviation detection delay time (PG Deviate Time)	0.0~10.0	
E2-04	Number of motor poles (Number of Poles)	2~48		F1-12	Number of PG gear teeth 1 (PG# Gear Teeth 1)	0-1000	
E2-05	Motor line-to-line resistance (Term Resistance)	0.000~ 65.000		F1-13	Number of PG gear teeth 2 (PG# Gear Teeth 2)		
E2-06	Motor leak inductance (Lead Inductance)	0.0~40.0		F1-14	PG open-circuit detection time:1 (PGO Time)	0.0~10.0	
E2-07	Motor iron saturation coefficient 1 (Saturation Comp 1)	0.00~0.50		F2-01	Bi-polar or uni-polar input selection (AI-14 Input Sel)	0, 1	
E2-08	Motor iron saturation coefficient 2 (Saturation Comp 2)	0.00~0.75		F3-01	Digital input option (DI Input)	0~7	
E2-09	Motor mechanical loss (Mechanical Loss)	0.0~10.0		F4-01	Channel 1 monitor selection (AO Ch1 Select)	1-38	
E2-10	Motor iron loss for torque compensation (Tcomp Iron Loss)	0~6553.75		F4-02	Channel 1 gain (AO Ch1 Gain)	0.0~2.50	
E3-01	Motor 2 control method selection:1 (Control Method)	0~3		F4-03	Channel 2 monitor selection (AO Ch2 Select)	1-30	
E4-01	Motor 2 max. output frequency:1 (V/F2 Max Freq)	40.0~400.0		F4-04	Channel 2 gain (AO Ch2 Gain)	0.0~2.50	
E4-02	Motor 2 max. voltage:1 (V/F2 Max Voltage)	0.0~255.0*1		F4-05	Channel 1 output monitor bias (AO Ch1 Bias)	-10.0~10.0	
E4-03	Motor 2 max. voltage frequency:1 (V/F2 Base Freq)	0.0~400.0		F4-06	Channel 2 output monitor bias (AO Ch2 Bias)	-10.0~10.0	
E4-04	Motor 2 mid. output frequency 1:1 (V/F2 Mid Freq)	0.0~400.0		F5-01	Channel 1 output selection (DO-02 Ch1 Select)	0.0~37	
E4-05	Motor 2 mid. output frequency voltage 1:1 (V/F2 Mid Voltage)	0.0~255.0*1		F5-02	Channel 2 output selection (DO-02 Ch2 Select)	0.0~37	
E4-06	Motor 2 min. output frequency (V/F2 Min Freq)	0.0~400.0		F6-01	Output mode selection (DO-08 Selection)	0, 1	
E4-07	Motor 2 min. output frequency voltage:1 (V/F2 Min Voltage)	0.0~255.0*1		F7-01	Frequency multiple selection (PO-36F Selection)	-4	
E5-01	Motor 2 rated current:1 (Motor 2 rated FLA)	0.32~6.40*2		F8-01	Transmission option (SI-F/G):1 (E-15 Det Sel)	-3	
E5-02	Motor 2 rated slip:1 (Motor 2 Slip Freq)	0.00~20.00		F9-01	External fault input level from transmission option (Ff0 Selection):	0, 1	
E5-03	Motor 2 no-load current:1 (Motor 2 No-Load I)	*2		F9-02	External fault detection from transmission option (Ef0 Detection):1	0, 1	
E5-04	Motor 2 number of poles:1 (Motor 2 # poles)	2~48		F9-03	Action for external fault from transmission option (Ef0 Fault Act):1	0-3	
E5-05	Motor 2 line-to-line resistance (Motor 2 Term Ohms)	0.000~ 65.000		F9-04	Transmission option trace sampling time (Trace Sample Time):1	0~60000	
E5-06	Motor 2 leak inductance:1 (Motor 2 Leak)	0.0~40.0		F9-05	Torque reference/ torque limit selection from non-SI-K2 transmission cards (Torg Ref/Lmt Sel)	0~1	
F1-01	PG constant (PG Pulse/Rev)	0~60000		F9-06	Operation selection for non-SI-K2 tran smission error detection (BUS Fault Sel)	0~3	
F1-02	Operation selection at PG open circuit (PG Fdbk Loss Sel)	0~3		H1-01	Multi-function input (terminal 3) (Terminal 3 Sel)	0~77	
F1-03	Operation selection at overspeed (PG Overspeed Sel)	0~3		H1-02	Multi-function input (terminal 4) (Terminal 4 Sel)	0~77	
F1-04	Operation selection at deviation (PG Deviation Sel)	0~3		H1-03	Multi-function input (terminal 5) (Terminal 5 Sel)	0~77	
F1-05	PG rotation (PG Rotation Sel)	0, 1		H1-04	Multi-function input (terminal 6) (Terminal 6 Sel)	0~77	

* 1. Not displayed for some models depending on software version No.

* 2. Setting for 200 V class Inverters. For 400 V class Inverters, double the value.

* 3. Setting unit and initial setting depend on Inverter capacity.

* 4. Depends on the control method (A1-02).

* 5. Factory setting in the parentheses is for 3-wire sequence.

User Constants (Continued)

No.	Name (Display)	Factory Setting	Setting	No.	Name (Display)	Factory Setting	Setting
H1-05	Multi-function input (terminal 7) (Terminal 7 Sel)	0~77		L2-01	Momentary power loss detection (PwrL Selection)	0~2	
H1-06	Multi-function input (terminal 8) (Terminal 8 Sel)	0~77		L2-02	Momentary power loss ridethru time (PwrL Ridethru t)	0.0~2.0	
H2-01	Multi-function input (terminal 9-10) (Terminal 9 Sel)	0~37		L2-03	Min. baseblock time (PwrL Baseblock t)	0.1~5.0	
H2-02	Multi-function input (terminal 25-27) (Terminal 25 Sel)	0~37		L2-04	Voltage recovery time (PwrLV/F Ramp t)	0.1~5.0	
H2-03	Multi-function input (terminal 26-27) (Terminal 26 Sel)	0~37		L2-05	Undervoltage detection level (PUV Det Level)	150~210*2	
H3-01	Signal level selection (terminal 13) (Term 13 Signal)	0, 1		L2-06	KEB deceleration rate (KEB Frequency)	0.0~100.0	
H3-02	Gain (terminal 13) (Terminal 13 Gain)	0.0~1000.0		L3-01	Stall prevention selection during accel (StallP Accel Sel)	0~2	
H3-03	Bias (terminal 13) (Terminal 13 Bias)	-100.00~ +100.0		L3-02	Stall prevention selection during accel (StallP Accel Sel)	0~200	
H3-04	Signal level selection (terminal 16) (Term 16 Signal)	0, 1		L3-03	Stall prevention limit during accel (StallP CHP Lvl)	0~100	
H3-05	Multi-function analog input (terminal 16) (Terminal 16 Sel)	0~1F		L3-04	Stall prevention selection during decel (StallP Decel Sel)	0~3	
H3-06	Gain (terminal 16) (Terminal 16 Gain)	0.0~1000.0		L3-05	Stall prevention selection during running (StallP Run Sel)	0~2	
H3-07	Bias (terminal 16) (Terminal 16 Bias)	-100.0~ +100.0		L3-06	Stall prevention level during running (StallP Run Level)	30~200	
H3-08	Signal level selection (terminal 14) (Term 14 Signal)	0~2		L4-01	Speed agree detection level (Spd Agree Level)	0.0~400.0	
H3-09	Multi-function analog input (terminal 14) (Terminal 14 Sel)	0~1F		L4-02	Speed agree detection width (Spd Agree Width)	0.0~20.0	
H3-10	Gain (terminal 14) (Terminal 14 Gain)	0.0~1000.0		L4-03	Speed agree detection level (+/-) (Spd Agree Lvl +/-)	-400.0~+400.0	
H3-11	Bias (terminal 14) (Terminal 14 Bias)	-100.0~ +100.0		L4-04	Speed agree detection width (+/-) (Spd Agree Wdth +/-)	0.0~20.0	
H3-12	Analog input filter time constant (Filter Avg Time)	0.00~2.00		L4-05	Operation when frequency reference is missing(Ref Loss Sel)	0, 1	
H4-01	Monitor selection (terminal 21) (Terminal 21 Sel)	1~38		L5-01	Number of auto restart attempts (Num of Restarts)	0~10	
H4-02	Gain (terminal 21) (Terminal 21 Gain)	0.00~2.50		L5-02	Auto restart operation selection (Restart Sel)	0, 1	
H4-03	Bias (terminal 21) (Terminal 21 Bias)	-10.0~ +10.0		L6-01	Torque detection selection 1 (Torq Det 1 Sel)	0~4	
H4-04	Monitor selection (terminal 23) (Terminal 23 Sel)	1~38		L6-02	Torque detection level 1 (Torq Det 1 Lvl)	0~300	
H4-05	Gain (terminal 23) (Terminal 23 Gain)	0.00~2.50		L6-03	Torque detection time 1 (Torq Det 1 Time)	0.0~10.0	
H4-06	Bias (terminal 23) (Terminal 23 Bias)	-10.0~ +10.0		L6-04	Torque detection selection 2 (Torq Det 2 Lvl)	0~4	
H4-07	Analog output signal level selection (AO Level Select)	0, 1		L6-05	Torque detection level 2 (Torq Det 2 Lvl)	0~300	
H5-01	Station address (Serial Comm ADR)	0~20		L6-06	Torque detection time 2 (Torq Det 2 time)	0.0~10.0	
H5-02	Communication speed selection (Serial Baud Rate)	0~4		L7-01	Forward torque limit (Torq Limit Fwd)	0~300	
H5-03	Communication parity selection (Serial Com Sel)	0, 1, 2		L7-02	Reverse torque limit (Torq Limit Rev)	0~300	
H5-04	Stopping method after communication error (Serial Fault Sel)	0~3		L7-03	Forward regenerative torque limit (Torq Lmt Fwd Rgn)	0~300	
H5-05	Communication error detection selection:1 (Serial Flt Dtct)	0, 1		L7-04	Reverse regenerative torque limit (Torq Lmt Rev Rgn)	0~300	
L1-01	Motor protection selection (MOL Fault Select)	0, 1		L8-01	Protect selection for internal DB resistor (DB Resistor Prot)	0, 1	
L1-02	Motor protection time constant (MOL Time Const)	0.1~5.0		L8-02	Overheat pre-alarm level (OH Pre-Alarm Lvl)	50~110	

- * 1. Not displayed for some models depending on software version No.
- * 2. Setting unit and initial setting depend on Inverter capacity.
- * 3. Setting for 200 V class Inverters. For 400 V class Inverters, double the value.
- * 4. Not initialized. (Japanese standard specification is o2-09 = 0.)

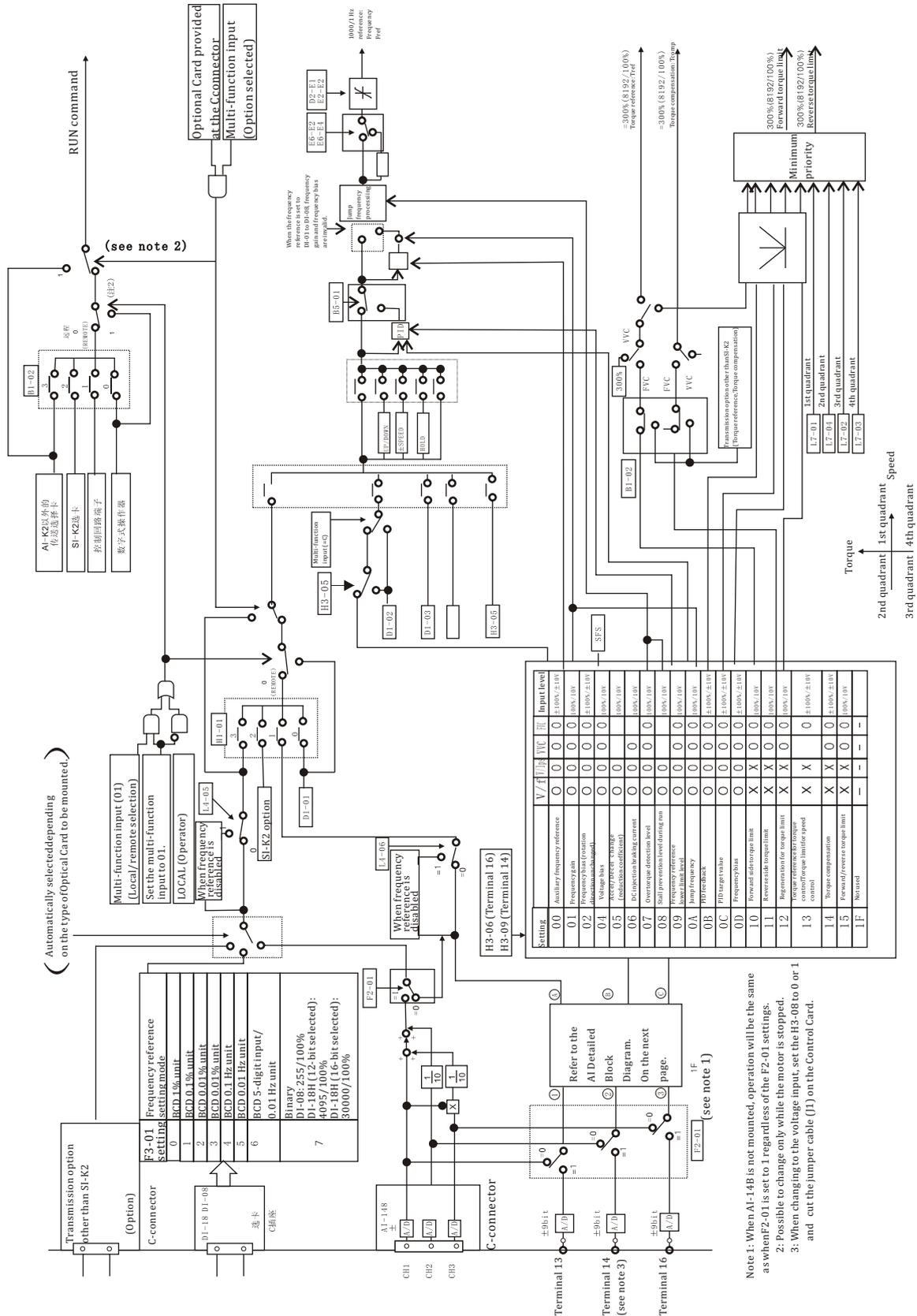
User Constants (Continued)

No.	Name (Display)	Factory Setting	Setting	No.	Name (Display)	Factory Setting	Setting
L8-03	Operation selection after overheat pre-alarm (OH Pre-Alarm Sel)	0~3		o1-05	Constant no. display selection (Address Display)	0, 1	
L8-05	Input open-phase protection selection (Ph Loss In Sel)	0, 1		o2-01	LOCAL/REMOTE key enable/disable (Local/Remote Key)	0, 1	
L8-07	Output open-phase protection selection (Ph Loss Out Sel)	0, 1		o2-02	STOP key during control circuit terminal operation (Oper STOP Key)	0, 1	
L8-10	Ground protection selection(Gnd Det Sel)	0, 1		o2-03	User constant initial value (User Defaults)	0~2	
L8-17	Carrier frequency reduction selection (L-Spd IGBT Prtct)	0~3		o2-04	kVA selection (Inverter Model #)	0~FF*	
L8-19	OL2 characteristics selection for low speeds (OL2 Chara@ L-Spd)	0, 1		o2-05	Frequency reference setting method:1* (Operator M.O.P.)	0, 1	
o1-01	Monitor selection(Monitor Select)	4~38		o2-06	Operation selection when digital operator is disconnected (Oper Detection)	0, 1	
o1-02	Monitor selection after power up (Power-On Monitor)	1~4		o2-07	Cumulative operation time setting (Elapsed Time Set)	0~65535	
o1-03	Frequency units of reference setting/monitor (Display Scaling)	0~39999		o2-08	Cumulative operation time selection (Elapsed Time Run)	0, 1	
o1-04	Frequency units of constant setting (Display Units)	0, 1		o2-09	Initialize mode selection:1 (Init Mode Sel)	* 0~2	

* 1. Not displayed for some models depending on software version No.

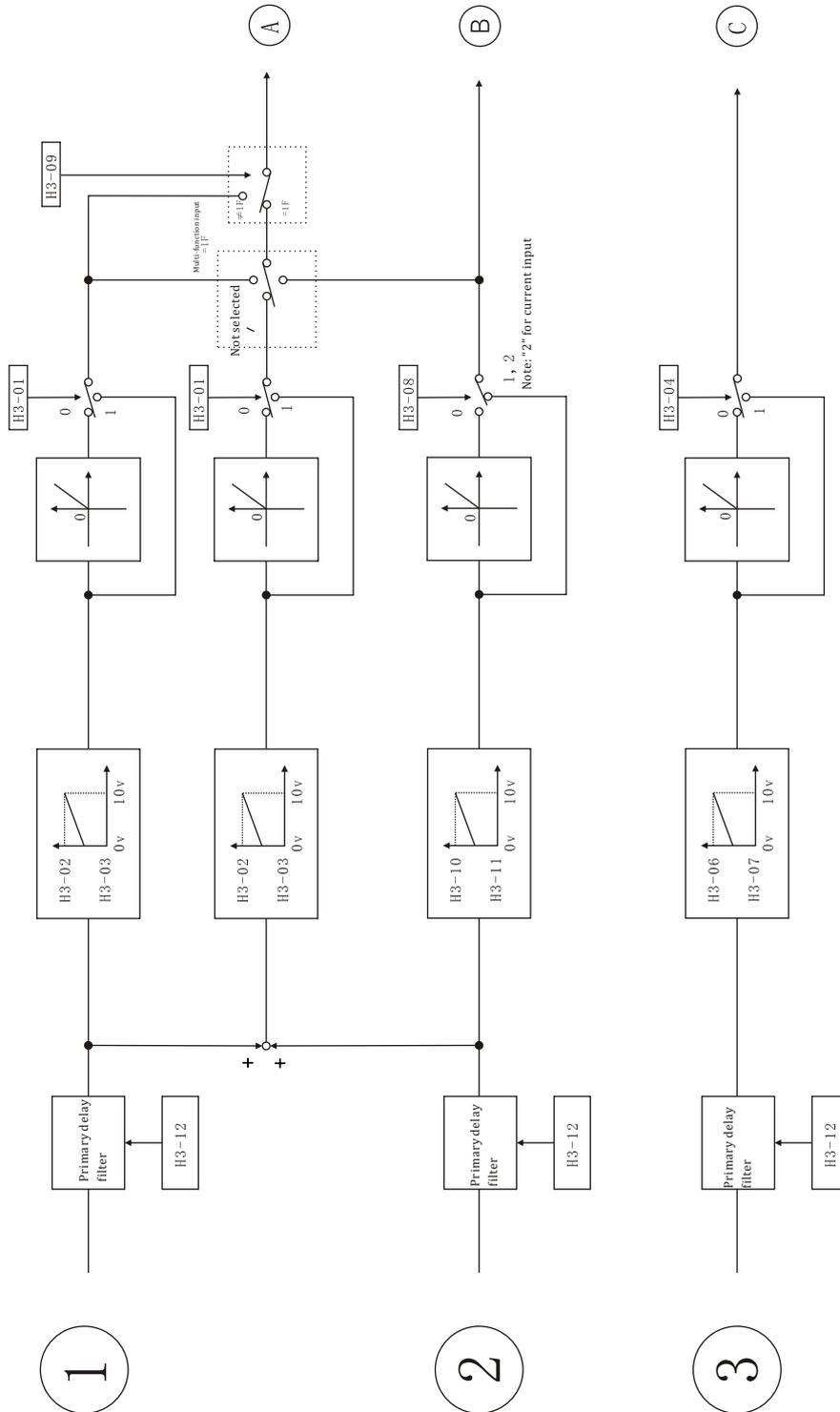
* 2. Setting unit and initial setting depend on Inverter capacity.

9.6 Function Block Diagram

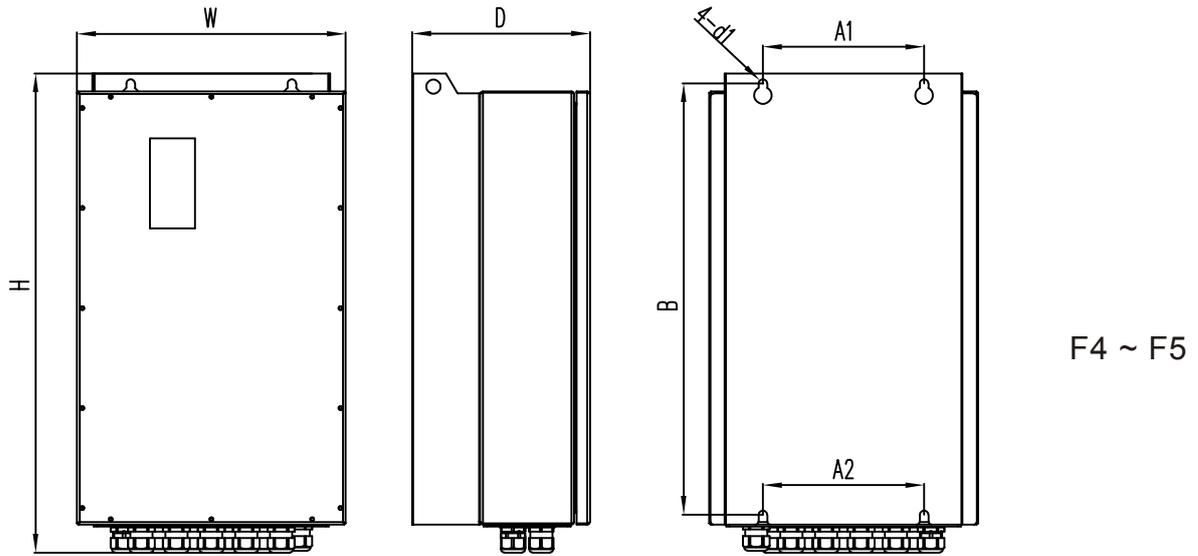


Note 1: When AI-14B is not mounted, operation will be the same as when F2-01 is set to 1 regardless of the F2-01 settings.
 2: Possible to change only while the motor is stopped.
 3: When changing to the voltage input, set the H3-08 to 0 or 1 and cut the jumper cable (J1) on the Control Card.

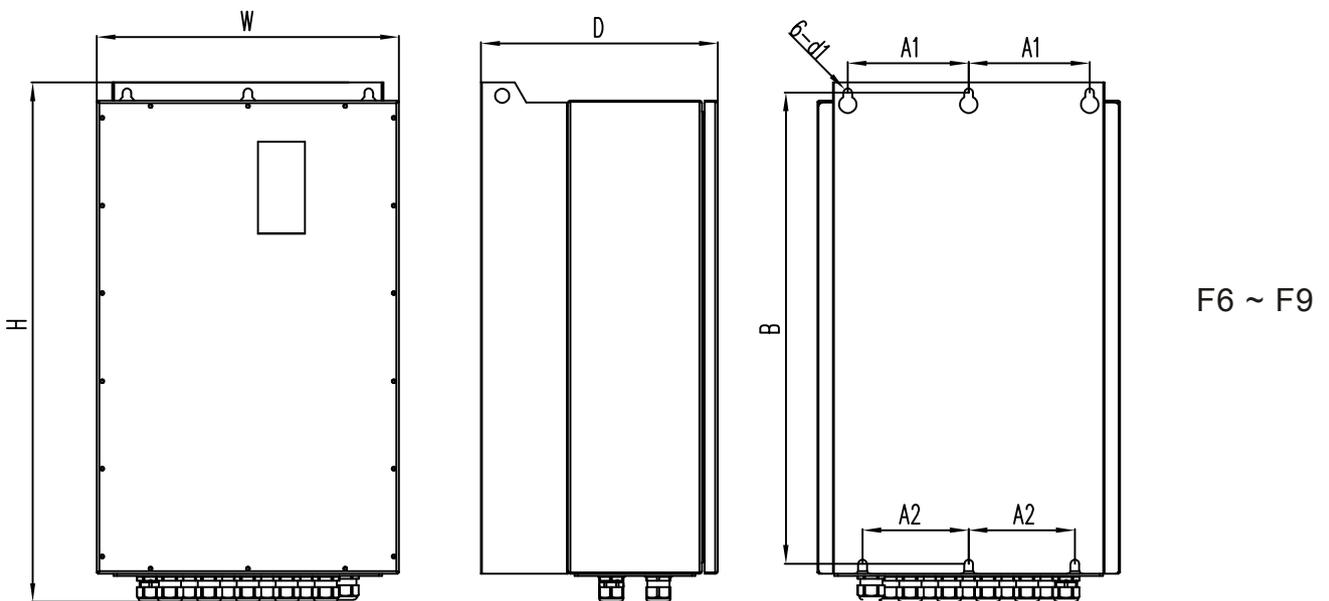
■ A1 Detailed Block Diagram



9.7 Mounting Dimensions



Frame	Dimensions (mm)							Model Name
	W	H	D	A1	A2	B	d1	
F4	290	470	235	170	170	412	13	YD3030T4N-IP54
F5	400	720	265	240	240	647	13	YD337P5T4N-IP54



Frame	Dimensions (mm)							Model Name
	W	H	D	A1	A2	B	d1	
F6	450	780	353	180	158	707	13	YD3055T4N-IP54
F7	500	840	395	200	158	767	13	YD3093T4N-IP54
	500	840	395	200	158	767	13	YD3132T4N-IP54
F8	570	1048	410	200	158	967	13	YD3160T4N-IP54
F9	690	1131	410	260	158	1047	13	YD3315T4N-IP54

No	Model Name	Rated Power(kW)
1	YD3030T4N-IP54	30
2	YD337P5T4N-IP54	37.5
3	YD3055T4N-IP54	55
4	YD3093T4N-IP54	75-93
5	YD3132T4N-IP54	110-132
6	YD3160T4N-IP54	160
7	YD3315T4N-IP54	315

Frame	Dimensions (mm)			Install Size (mm)			
	W	H	D	A1	A2	B	d1
F4	290	470	235	170	170	412	13
F5	400	720	265	240	240	647	13
F6	450	780	353	180	158	707	13
F7	500	840	395	200	158	767	13
	500	840	395	200	158	767	13
F8	570	1048	410	200	158	967	13
F9	690	1131	410	260	158	1047	13

Wuxi YOLICO Electric Co., Ltd.
Address: No.98, Meiyuan Zha Lane, Binhu District.Wuxi City, Jiangsu Province
Tel: +86-0510-85161131 / 85161132

Fax: +86-0510-85161139

Website: www.yolico.com

