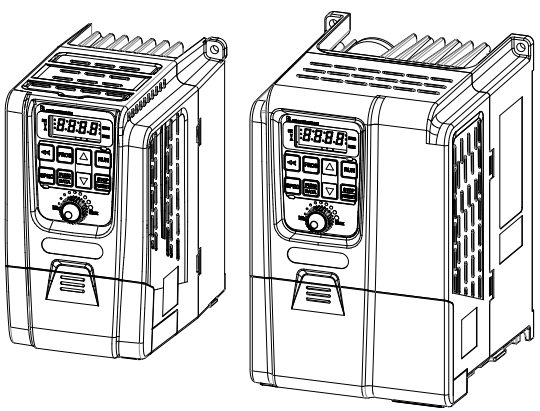
RHYMEBUS

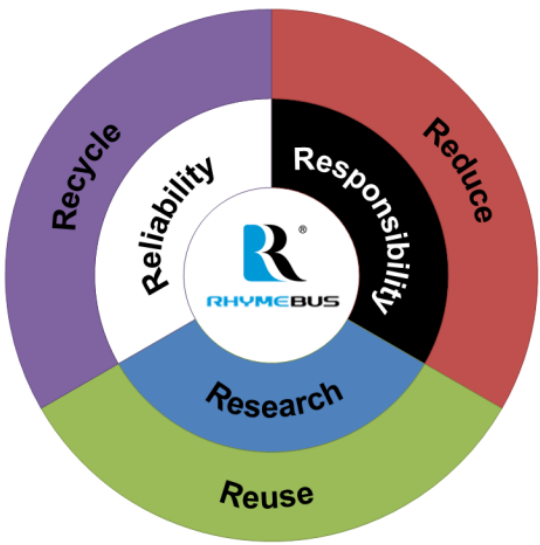
VARIABLE FREQUENCY DRIVE

Operation Manual



RM6E1 series

Quality • Satisfaction • Improvement • Innovation



PREFACE

Thank you for using RHYMEBUS RM6E1 series drive. For proper operations and safety purposes, please do read and follow specific instructions contained in this manual before using the product. The manual shall be placed on the top of the machine, and all the setup parameters and reference numbers must be properly recorded in Attachment 1 to facilitate future maintenance and repairs.

SAFETY PRECAUTION

Please read this manual thoroughly and pay attention to the safety precautions marked with " **DANGER** " or " **CAUTION** " before the installation, wiring, maintenance, or troubleshooting.

Only the qualified personnel may proceed with the installation, wiring, testing, troubleshooting, or other tasks.

※Qualified Personnel: Must be familiar with the fundamentals, structures, characteristics, operating procedures, and installation, and this personnel must read the manual in details and follow the steps of security measures to prevent possible dangers.

DANGER	User may cause the casualty or serious damages if user does not abide by the instructions of the manual to execute the tasks.
CAUTION	User may cause injuries to the people or damage the equipment if user does not abide by the instructions of the manual to execute the tasks.

※Although the " ⚠ " mark may indicate minor damages, serious damages or injuries may be possibly incurred if the caution is not under user's attention.

Installation

⚠ CAUTION
a. The installation shall take place only on top of the metal surface or any material with the fire resistant. Any place or location of high temperature, moist, oil and gas, cotton fiber, metal powder and erosive gas shall be avoided.
b. If the product specification indicates IP00 (the protective level of the equipment structure), any human contact is forbidden at the installation location to avoid the electric shock. The option of installing AC reactor(ACL) shall be very cautious.
c. Please note the surrounding temperature shall not exceed 50°C when the installation needs to be placed inside the control panel.
d. For the environment of storage and installation, please follow the instructions of the environmental conditions illustrated in the sections of the common specification of RM6E1.

Wiring

DANGER

a. Do Not conduct any wiring during the system power ON to avoid the electric shock.

b. R/L1,S/L2,T/L3 are power inputs (electric source terminals) and U/T1,V/T2,W/T3 are drive's outputs to a motor. Please Do Not connect these input and output terminals to terminals P⊕, N⊖, and PR.

c. Once the wiring is complete, the cover of the drive must be put back and must seal the drive to avoid other's accidental contact.

d. The drives have three specifications base on the input power source 100V / 200V / 400V, Do Not input the voltage exceed the specifications.

e. The grounding terminal(⏚) must be exactly grounded. Ground the drive in compliance with the NEC standard or local electrical code.

f. Please refer to the manual page 16 and 17 for the screwing torque of the wiring terminal.

g. Please refer to the national or local electric code for the appropriate spec of the cords and wires.

h. Please install an appropriate Molded Case Circuit Breaker (MCCB) or Fuse at each path of power lines to a drive.

i. Please install the thermal relay between the individual motor and the drive when using one drive to propel several motors.

j. Do Not connect power factor leading capacitor, surge absorber, or non-three-phase motor to the drive's U/T1, V/T2, or W/T3 side.

k. AC reactor(ACL) installation is required when the power capacity exceeds 500kVA or 10 times or more than the drive rated capacity.

l. Do Not touch the drive or performing any unwiring actions before drive indicator light turns off after the power off. Use a multi-meter with the DC voltage stage to measure the cross voltage between P⊕ and N⊖ terminals (The voltage must be less than 25V).

m. When the motor do the voltage-proof, insulation testing, unwiring the U/T1,V/T2,W/T3 terminal of drive at first.

CAUTION

a. The RM6E1 series outputs are designed to drive a three-phase induction motor. Do Not use for single-phase motor or using for other purposes.

b. The main circuit and control circuit must be wired separately; control circuit must use a shielded or twisted-pair shielded wires to avoid possible interferences.

Operation

DANGER

a. Do Not open or remove the cover while power is on or during the drive operation. Do close up the cover before powering on the drive. Do Not remove the cover except for wiring or periodic inspection when power off.

b. At the function F3.30= 1 or 3, the drive will automatically restart when the power is restored. Stay away from the motor and machine.

c. At the function F1.05=0 and F1.00=0 or 1 or 10, the STOP RESET key on the operation panel is ineffective. Please use an emergency stop switch separately for safe operations.

d. The drive can produce high frequency outputs. Before adjusting the frequency, please check the specs of motor carefully to prevent the motor from unexpected damages.

e. If any of the protective functions have been activated, and the start command is set to terminal control(F1.00=0 or 1 or 10), first remove the case and check the all run commands set to OFF. Then press the STOP RESET key to release the alarm.

CAUTION

a. Do Not touch the heat sink or brake resistors due to the high heat.

INTRODUCTIONS

Features

a. With the temperature management and fan control functions to increase the lifetime of cooling fan and saving the energy.

a. User can monitor the temperature of drive and setting the pre-alarm level to forecast the maintenance cycle of cooling fan.

b. Fan will be standby under idle speed, light-duty load or low surrounding temperature conditions.

b. Special function key(SPEC):
Programmable function key for forward/reverse running, jog speed, selection of primary/secondary frequency command…etc.

c. Allow RS-485 communication interface control (Modbus RTU communication protocol).

d. 6 sets of fault records:
Record 4 types of information under fault condition, respectively. (fault code, output current, DC bus voltage, output frequency)

e. Built-in dynamic braking unit(DBU); braking level and control function are adjustable.

f. Running hours and supply power time of drive can be saved and displayed.

g. Group design for the functions ease the function setting and management.

h. Sequential operation control and PID control function.

i. Provide 8 sets of monitor displays(three of displays can be defined as another extra displays).

j. Provide PTC sensor setting functions for preventing the motor from overheating.

k. Energy-saving selection for light-duty load.

l. Auto-torque boost function.

m. Provide 16 preset speeds control.

n. The analog input signal of filter can be adjusted.

o. The response time of digital input signal is adjustable(adjustable dead band detection).

p. Independent adjustment selection of V, F for analog input signal.

q. Two sets of motor overload protection function.

r. Programmable input and output terminals and two modes selection (SINK/SOURCE) for input signal.

s. User can connect KP-601 keypad(option) for remote control, parameters duplication and saving.

t. The switching frequency can be adjust between 800Hz ~ 16kHz.

TABLE OF CONTENTS

No Text on This Page

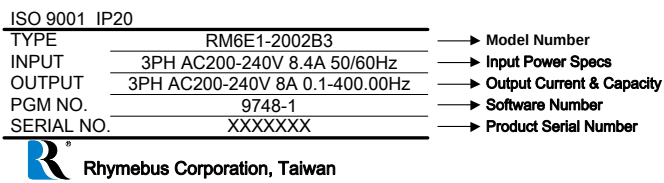
Chapter 1 Cautions Before Installation

1-1 Product Verification

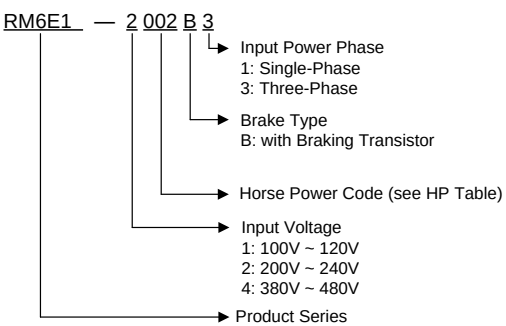
The product has passed the strictest quality test before shipped out from the factory. However, the product might possibly sustain minor damages due to the impact, shaking, vibration, and other factors during the transportation. Please make sure to verify the following items after receiving this product. If the product verification finds anything abnormal, please contact the agent immediately for the further assistance.

1-1-1 Confirmation of Appearance

1. Check up the drive's model number is identical with the shipping label on the carton.
2. Check up the appearance of the drive for any paint chipped off, smearing, deformation of shape, etc.
3. Check up the nameplate (as below figure) of the drive to verify the product descriptions with the order specification.



1-1-2 The description of nomenclature



HP (Horse Power) Table for Drive Horse Power Code Conversion

Horse power code	Horse power
0P5	0.5
001	1
1P5	1.5
002	2

Horse power code	Horse power
003	3
004	4
005	5
007	7.5

1-1-3 Confirmation of Accessories

One user manual is inclusive. Please verify other accessories inclusively such as braking resistor, AC reactor, etc..

※Please refer to the standard specifications to verify the product specifications with your requirements.

1-2 Standard Specifications

1-2-1 Single-Phase 100V Series

Model name (RM6E1-□□□□B1)	10P5	1001	1002	1003
Maximum applicable motor (HP / kW)	0.5 / 0.4	1 / 0.75	2 / 1.5	3 / 2.2
Rated output capability (kVA)	1.0	1.6	2.9	3.8
Rated output current (A)	2.5	4.2	7.5	10
Rated output voltage (V)	Three-phase 200~240V			
Range of output frequency (Hz)	0.1~400.00Hz			
Power source (ϕ , V, Hz)	Single-phase 100~120V 50/60Hz			
Input current (A)	9.1	15.3	30	40
Permissible AC power source fluctuation	88V~132V			
Overload protection	150% of drive rated output current for 1 min.			
Cooling method	Nature cooling	Fan cooling		
Applicable safety standards	—			
Protective structure	IP20		IP20	
Weight / Mass(kg)	1.1	1.2	—	—

1-2-2 Single-Phase 200V Series

Model name (RM6E1-□□□□B1)	20P5	2001	2002	2003
Maximum applicable motor (HP / kW)	0.5 / 0.4	1 / 0.75	2 / 1.5	3 / 2.2
Rated output capability (kVA)	1.1	1.9	2.9	3.8
Rated output current (A)	3	4.2	7.5	10
Rated output voltage (V)	Three-phase 200~240V			
Range of output frequency (Hz)	0.1~400.00Hz			
Power source (ϕ , V, Hz)	Single-phase 200~240V 50/60Hz			
Input current (A)	5.8	7.7	13.7	20
Permissible AC power source fluctuation	176V~264V			
Overload protection	150% of drive rated output current for 1 min.			
Cooling method	Nature cooling	Fan cooling		
Applicable safety standards	_			
Protective structure	IP20			
Weight / Mass(kg)	1.1	1.2	1.2	2.5

※Single-Phase 200V Series 3HP model is under development.

1-2-3 Three-Phase 200V Series

Model name (RM6E1-□□□□B3)	20P5	2001	21P5	2002
Maximum applicable motor (HP / kW)	0.5 / 0.4	1 / 0.75	1.5 / 1.1	2 / 1.5
Rated output capability (kVA)	1.1	1.6	2.3	3
Rated output current (A)	3	4.2	6	8
Rated output voltage (V)	Three-phase 200~240V			
Range of output frequency (Hz)	0.1~400.00Hz			
Power source (ϕ , V, Hz)	Three-phase 200~240V 50/60Hz			
Input current (A)	3.2	4.4	6.3	8.4
Permissible AC power source fluctuation	176V~264V			
Overload protection	150% of drive rated output current for 1 min.			
Cooling method	Nature cooling		Fan cooling	
Applicable safety standards	_			
Protective structure	IP20			
Weight / Mass(kg)	1.1	1.1	1.1	1.2

Model name (RM6E1-□□□□B3)	2003	2004	2005
Maximum applicable motor (HP / kW)	3 / 2.2	4 / 3	5 / 3.7
Rated output capability (kVA)	3.8	5	6.5
Rated output current (A)	10	13	17
Rated output voltage (V)	Three-phase 200~240V		
Range of output frequency (Hz)	0.1~400.00Hz		
Power source (ϕ , V, Hz)	Three-phase 200~240V 50/60Hz		
Input current (A)	11.5	15	19
Permissible AC power source fluctuation	176V~264V		
Overload protection	150% of drive rated output current for 1 min.		
Cooling method	Fan cooling		
Applicable safety standards	_		
Protective structure	IP20		
Weight / Mass(kg)	1.2	2.5	2.5

※Please refer to the page 140 for the single-phase application.

※Three-Phase 200V Series 4HP model is under development.

1-2-4 Three-Phase 400V Series

Model name (RM6E1-□□□□B3)	4001	4002	4003
Maximum applicable motor (HP / kW)	1 / 0.75	2 / 1.5	3 / 2.2
Rated output capability (kVA)	1.9	3	4.2
Rated output current (A)	2.5	4	5.5
Rated output voltage (V)	Three-phase 380~480V		
Range of output frequency (Hz)	0.1~400.00Hz		
Power source (ϕ , V, Hz)	Three-phase 380~480V 50/60Hz		
Input current (A)	2.8	4.4	6.1
Permissible AC power source fluctuation	332V~528V		
Overload protection	150% of drive rated output current for 1 min.		
Cooling method	Nature cooling	Fan cooling	
Applicable safety standards	_		
Protective structure	IP20		
Weight / Mass(kg)	1.1	1.2	1.2

Model name (RM6E1-□□□□B3)	4005	4007
Maximum applicable motor (HP / kW)	5 / 3.7	7.5 / 5.5
Rated output capability (kVA)	6.9	11
Rated output current (A)	9	14
Rated output voltage (V)	Three-phase 380~480V	
Range of output frequency (Hz)	0.1~400.00Hz	
Power source (ϕ , V, Hz)	Three-phase 380~480V 50/60Hz	
Input current (A)	10.3	16
Permissible AC power source fluctuation	332V~528V	
Overload protection	150% of drive rated output current for 1 min.	
Cooling method	Fan cooling	
Applicable safety standards	_	
Protective structure	IP20	
Weight / Mass(kg)	2.5	2.5

1-3 Common Specifications

1-3-1 The Features of Control and Operation

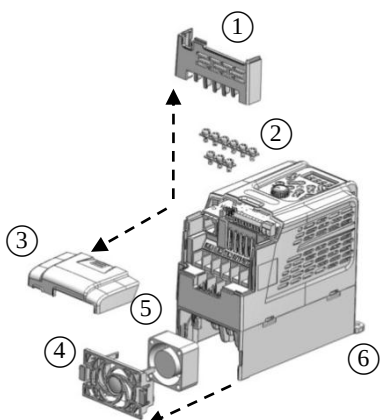
Control Characteristics	Control method	• Voltage vector sinusoidal PWM control(V/F control); • Switching frequency: 800Hz~16kHz
	Range of frequency setting	0.1~400.00Hz
	Resolution of frequency setting	• Operation panel: 0.01Hz • Analog signal: 0.06Hz / 60Hz
	Resolution of output frequency	0.01Hz
	Overload protection	150% of drive rated output current for 1 minute
	DC braking	• Start/stop braking time: 0~60.0sec • Stop braking frequency: 0.1~60Hz • Braking ability: 0~150% of inverter
	Braking torque	Approximately 20%(with the external braking resistor connected, braking torque is approximately 100%)
	V/F pattern	• V/F pattern (2 V/F points) • Square curve, 1.7th power curve, 1.5th power curve. • Output voltage adjustment of V/F pattern(Variable voltage (V) adjustment of V/F pattern for acceleration / deceleration).
	Acceleration/ deceleration time	• 0sec(coast to stop), 0.0~3200.0sec(Independent setting of the acceleration / deceleration). • The time setting range of the speed acceleration from 0 to 60Hz is 0.015sec ~ 19200000sec(222 days).
	Stall prevention	Stall prevention at acceleration / constant speed(the current level of stall prevention is 30~200%), Stall prevention at deceleration
	Other functions	Slip compensation, auto-torque compensation, auto-adjustment for output voltage stability, auto-operation for energy-saving, auto-adjustment of switching frequency, restart after instantaneous power failure, speed tracing, over-torque detection, DC braking, dynamic braking duty control, sequential operation control, counter function, PID control, Modbus communication, jump frequency, holding frequency, upper/lower limits of output frequency, 16-preset speeds, acceleration/deceleration switch, S-curve acceleration/deceleration, fan control, parameters duplication,motor overload detection

Operation Characteristics	Input	Start method	Command the drive via 6 programmable multi-function input terminals(X1~X6): Forward command / Reverse command, 3-wire start/stop control, 16 sets preset speed control. Communication control.
		Multi-function inputs	6 programmable input terminals: X1~X6 Response time:1~255 ms
			Refer to the chapter of function setting description for F5.19~F5.24.
		Analog inputs	1 set of analog inputs: AI(DC 0~10V / 2~10V or DC 0~20mA / 4~20mA) Analog filter (0~255, unit: 5ms), the dead band of Analog frequency, gain and bias are adjustable.
			Refer to the chapter of function setting description for F5.01, F5.02, F5.05~F5.08
	Output	Multi-function outputs	1-set programmable output terminal: Ta /Tb/ Tc
			Refer to chapter of function setting description for F5.26.
		Analog outputs	1 set of analog output: FM(DC 0~10V / 2~10V or DC 0~20mA / 4~20mA) gain and bias are adjustable. The gain and bias are adjustable.
			Refer to the chapter of function setting description for F5.12~F5.15.
Display	Build-in operation panel		4-digit 7-segment display unit, 8 status indicators, 8 buttons, 1 analog knob. 8 monitor modes: output frequency, frequency command, output voltage, DC voltage, output current, and three programmable monitor modes (see function F1.09~F1.11): terminal status, heat sink temperature, motor speed (RPM), machine speed (MPM), the phase of sequential operation control, the period of sequential operation control, counting value, current limit level, primary frequency command, secondary frequency command, PID command, PID feedback
	External keypad (KP-601)		Keypad KP-601 is available for external connection to the drive *Note 2
protection	Fault protection	Error trip messages of drive	Under voltage during operation(LE1), Drive over current(OC), Grounding fault(GF), Over voltage(OE), Drive overheat(OH), Motor overload(OL), System overload(OLO), Keypad interruption during copy(PAdF), IGBT module error(Fot)*Note 1, Drive overload(OL1), Drive current limit(OL2), Braking transistor overload(OL3), Motor overheat(OH2), PID feedback signal error(noFb), External fault(EF), Internal memory error(EEr1, EEr2), EEPROM error(EEr), A/D converter error(AdEr)

		Warning messages of drive	Power source under voltage(LE), Drive output interruption(bb), Coast to stop(Fr), Braking transistor is active (db), Keypad cable trip before connecting(Err_00), Keypad cable trip during operation(Err_01), System overload(OLO), Power source under voltage(Hv), Power source under voltage(LE), Drive overheat(OHt), Motor overheat(OH1), FWD/REV command input simultaneously(dtF)、Different software version inter-copy(wrF)、Modbus communication overtime(Cot)
	Cooling method		All models belong to fan cooling except single-phase 10P5,20P5 and three-phase 20P5, 2001, 4001
Environment	Atmosphere		Non-corrosive or non-conductive, or non-explosive gas or liquid, and non-dusty
	Surrounding temperature		-10°C (14°F) ~ +50°C (122°F) (Non-freezing and non-condensing)
	Storage temperature		-20°C (-4°F) ~ +60°C (149°F)
	Relative humidity		90% RH or less (No-condensing atmosphere)
	Vibration		Less than 5.9m/sec² (0.6G)
	Altitude		Less than 1000m (3280 ft.)

Note1: Only 3HP below(100V/200V series) have IGBT module error protection (Fot).
Note2: KP-601 is an optional accessory.

1-4 The Disassembled Sketch of RM6E1



① : Cover of main circuit
② : Screws of main circuit
③ : Cover of multi-function terminal
④ : The protection cover of fan
⑤ : Cooling fan
⑥ : Drive

No Text on This Page

Chapter 2 Installation and Confirmation

2-1 Basic Equipment

The drive needs the several components for the conjunctive operation. These components are called “basic equipment”, listed in the following:

2-1-1 Power Source: The voltage with three-phase or single-phase of the power source must meet the drive specifications.

2-1-2 MCCB or NFB: MCCB (Molded Case Circuit Breaker) or NFB (No Fuse Breaker) can withstand the inrush current at instant power-on and providing the overload and over-current protection to the drive.

2-1-3 Drive: The rated current of motors are different for the different pole or rated voltage. Please base on the rated voltage and rated current of motor to select drive. Do not select the drive only base on the horse power specification of motor. (please refer to the lists of standard specifications of drives)

2-1-4 Motor: The specifications of motor are determined from the requirement. Please be cautious to the motor rated current that must not exceed the drive current.

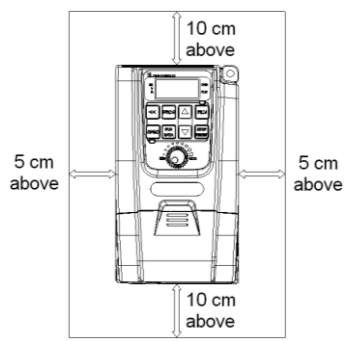
Note: RM6E1 is only used for three-phase induction motor control, and must not be used for single-phase motor.

2-2 Environmental Conditions

For the safe operation of the drive, please be cautious to the environmental conditions where the drive is going to be installed.

2-2-1 AC Power: AC power input must be complied with the AC power input specification of the drive.(see RM6E1 standard specifications)

2-2-2 Location: Due to the heat dissipating requirement during the drive operation, the drive must keep enough space for heat dissipation. Please keep the least clearance space when installation. (shown as below figure):



2-2-3 Arrangement: The fluent air ventilation inside the control panel/cabinet must be considered when a drive is installed inside. Please refer to as below figure 1:

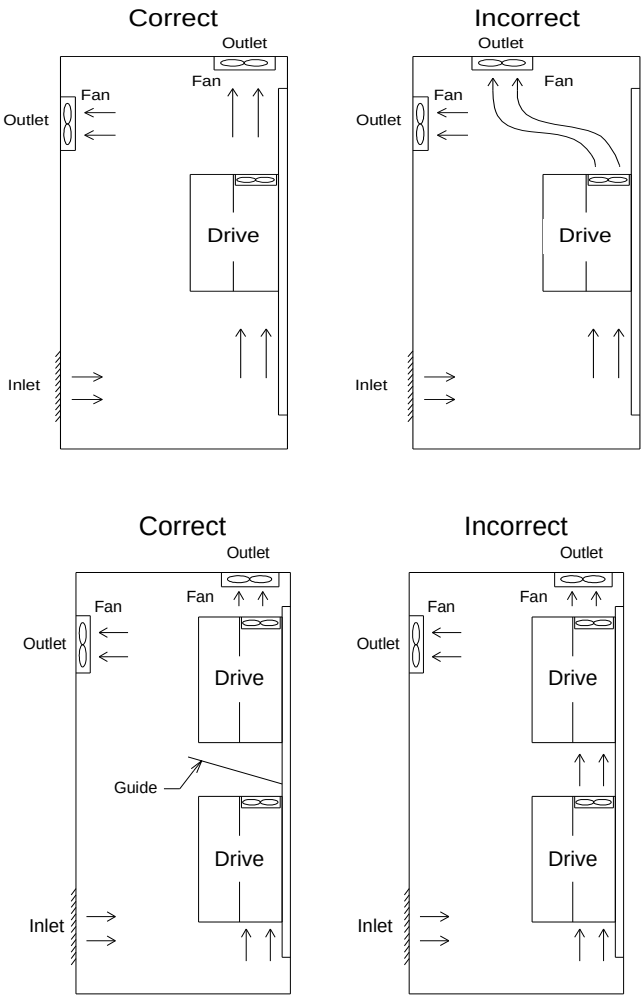


Figure 1: Drive mounting inside the cabinet/control panel

2-2-4 Specifications of Associated Accessories: The specifications of the accessories must be according to the specifications of the drive. Otherwise, the drive will be damaged and the lifetime of the drive will be shorten.

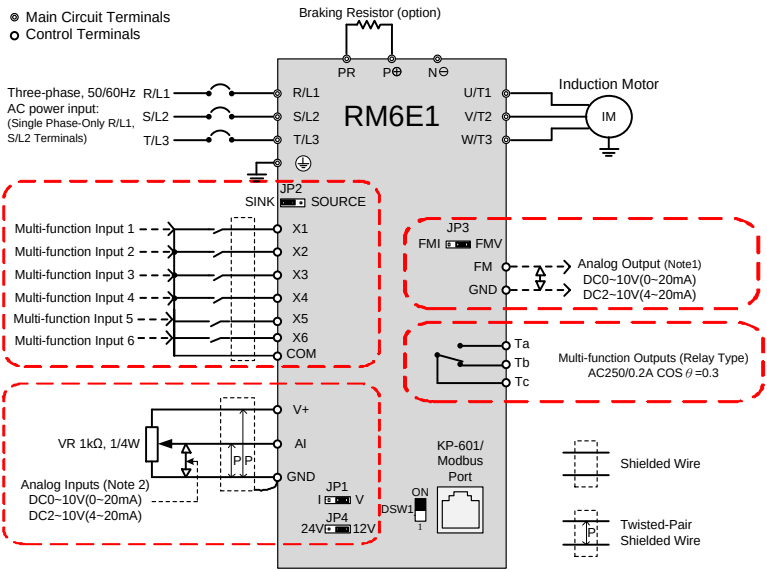
⚠ Do Not add any power factor leading capacitor(RC, LC or other capacitance component) between the drive and motor to avoid any accidents.

2-2-5 Cleaning of Environment: The installed location of drive must consider the ventilation, cleanliness and moisture.

2-2-6 Operator: Only the qualified personnel can perform the operation and troubleshooting.

2-3 Descriptions of Terminal and Wiring Diagram

2-3-1 Wiring Diagram



※JP1: I/V; AI signal selection
"I" position: AI-GND terminal is inputted with the current signal.
"V" position: AI-GND terminal is inputted with the voltage signal.

※JP2: SINK / SOURCE selection
The signal input selection of multi-function input terminal, please see the section "2-3-2 SINK / SOURCE Definition"

※JP3: FMI / FMV; FM signal selection
"FMI" position: Output current signal.
"FMV" position: Output voltage signal.

※JP4: 12V / 24V; V+ signal selection
"12V" position: Output DC12V between V+ and GND terminals..
"24V" position: Output DC24V between V+ and GND terminals.

※DSW1: The terminal resistor selection of Modbus communication(the internal resistance is 100Ω).

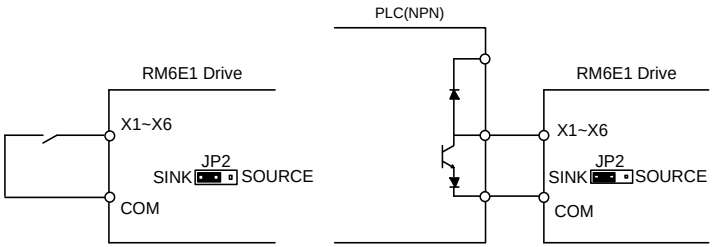
※Tightening torque of control terminal:
TB1: 1.5 kgf-cm (1.3 lb-in); TB2: 5.1 kgf-cm (4.4 lb-in)

※Be cautioned of the electrodes when connecting the power to P⊕, N⊖ terminals to avoid the damage of drive.

2-3-2 SINK / SOURCE Definition

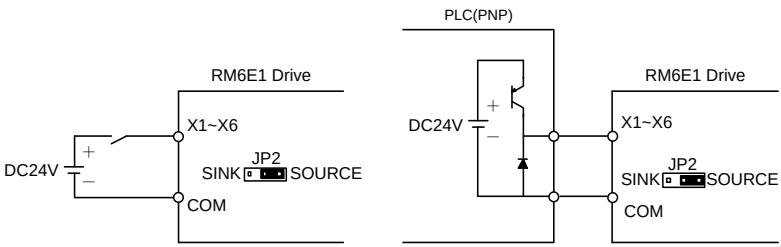
There are two ways of connection for multi-function input terminals:

a. JP2: "SINK" position



When JP2 is switched to "SINK" position and short-circuit the X1~X6 terminals with COM terminal, drive is activate.

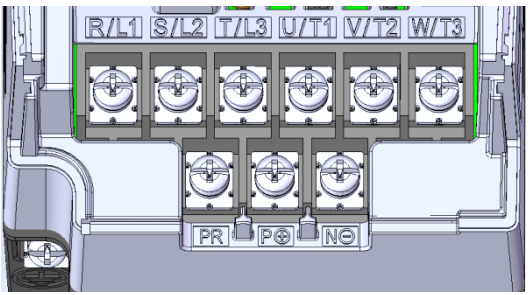
b. JP2: "SOURCE" position



When JP2 is switched to "SOURCE" position and the external power DC 24V (+) is connected to X1~X6, and DC 24V (-) is connected to COM, the drive is activate.

2-3-3 Description of Terminals

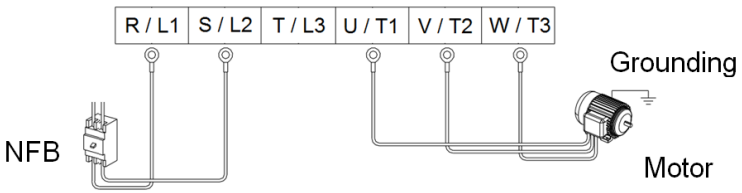
a. Terminals of Main Circuit



Type	Symbol	Function	Description
Power Source	R/L1,S/L2,T/L3	AC power source input terminals	Three-phase; sinusoidal power source input terminal. For the single-phase power source 110/220V, please connect only R/L1,S/L2 terminals.
Motor	U/T1,VT2,W/T3	Drive outputs to motor terminals	The terminals output three phase variable frequency and voltage to motor.
Power and Brake	P⊕,N⊖	Dynamic braking unit connecting terminal	The terminals between P⊕and N⊖ connect dynamic braking unit(option).
	P⊕,PR	External braking resistor connecting terminal	The terminals between P⊕and PR connect external braking resistor (option).
Grounding	⏚	Grounding terminal	Ground the drive in compliance with the NEC standard or local electrical code.

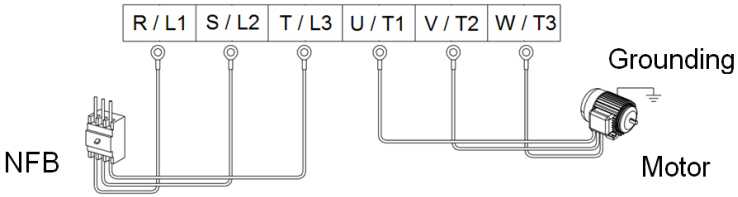
b. Main Circuit Connection

i. 100 / 200V single-phase AC power



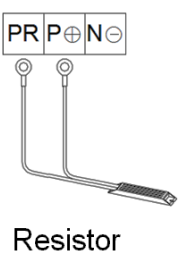
Model no. RM6E1-	Screw size of main circuit terminal	Tightening torque of main circuit terminal screw lb-in(kgf-cm)	Screw size of grounding terminal	Tightening torque of grounding terminal screw lb-in(kgf-cm)
10P5B1 1001B1	M3.5	8.5(9.8)	M4	15.6(18)
20P5B1 2001B1 2002B1				
1002B1 1003B1 2003B1	M4	15.6(18)	M4	15.6(18)

ii. 200 / 400V three-phase AC power



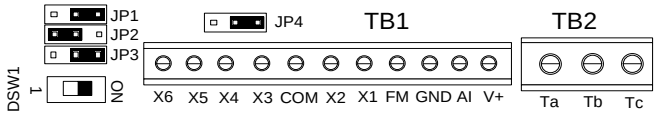
Model no. RM6E1-	Screw size of main circuit terminal	Tightening torque of main circuit terminal screw lb-in(kgf-cm)	Screw size of grounding terminal	Tightening torque of grounding terminal screw lb-in(kgf-cm)
20P5B3 2001B3 21P5B3 2002B3	M3.5	8.5(9.8)	M4	15.6(18)
4001B3 4002B3 4003B3				
2003B3 2004B3 2005B3	M4	15.6(18)	M4	15.6(18)
4005B3 4007B3				

iii. The wiring of braking resistor



c. Control Terminals

Control Terminal Mapping



Type		Symbol	Function	Description
Control circuit terminal	Control power	V+ *Note 3	Power terminal for analog input control	DC+12V position: Maximum supplied current is 20mA. DC+24V position: Maximum supplied current is 50mA.
		GND	Common terminal for analog input control	Common terminal for control power (12V/24V) and analog input terminal (AI).
	Input terminals	AI *Note 1	Analog signal input terminal	The function is set by F5.01. (default: frequency command) DC 0~10V / 2~10V (20kΩ) DC 0~20mA / 4~20mA (250Ω)
		X1	Multi-function input terminal 1	Short the terminal of X1 with COM and set the function F5.19. (default: forward command)
		X2	Multi-function input terminal 2	Short the terminal of X2 with COM and set the function F5.20. (default: reverse command)
		X3	Multi-function input terminal 3	Short the terminal of X3 with COM and set the function F5.21. (default: jog command)
		X4	Multi-function input terminal 4	Short the terminal of X4 with COM and set the function F5.22. (default: reset command)
		X5	Multi-function input terminal 5	Short the terminal of X5 with COM and set the function F5.23. (default: reset command)
		X6	Multi-function input terminal 6	Short the terminal of X6 with COM and set the function F5.24. (default: reset command)
		COM	Input/output common terminal	The common terminal of input control signal.
	Output terminals	FM *Note 2	Analog signal output terminal	The function is set by F5.12. (default: output frequency) DC 0~10V / 2~10V (1mAMax) DC 0~20mA / 4~20mA (500ΩMax)
		Ta	Multi-function output terminals	The function is set by F5.26 (default: fault detection). (capacity: AC250V, 0.2AMax, cosθ=0.3)
		Tb		The function is set by F5.26 (capacity: AC250V, 0.2AMax, cosθ=0.3)
		Tc		Common terminal for Ta,Tb

Note 1: V/I selection is set by JP1(default: V); please to p.13.

Note 2: FMV/FMI selection is set by JP3 (default: FMV); please to p.13.

Note 3: 12V/24V selection is set by JP4 (default: 12V); please to p.13.

Note 4: Tightening torque of control terminals: TB1: 1.5 kgf-cm(1.3 lb-in) ; TB2: 5.1 kgf-cm(4.4 lb-in).

d. KP-601 Keypad / Modbus Port (RJ-45)

Type	Pin	Function	Description
Modbus(RS-485) /KP-601 communication	1	Communication transmission terminal (DX+)	Differential input of RS-485 *Note 1 Modbus (RS-485) communication only uses pin1, 2.
	2	Communication transmission terminal (DX-)	
	3	Power terminal of KP-601(+16V)	Only for KP-601 linking
	4	Auto-detect terminal of KP-601	Only for KP-601 linking
	5	Reserved	Reserved
	6		
	7	Common terminal of KP-601 power(0V)	Only for KP-601 linking
	8		

Note 1: The terminal resistor(100Ω) selection is set by DSW1(default: ON)

※KP-601 cables: Only used with 8-pin telephone cable (flat) and network cable (AMP)

- 8-pin telephone cable: The cable length must be within 5 meters.
- Network cable(AMP): The cable length can be over 5 meters (the longest length is 100 meters)

e. The length of Standard Connecting Cable for KP-601

There are 6 length specifications of network cable(AMP) for KP-601 keypad.(1M, 2M, 3M, 5M, 7M, 10M)

2-3-4 Wiring Cautions and Specifications

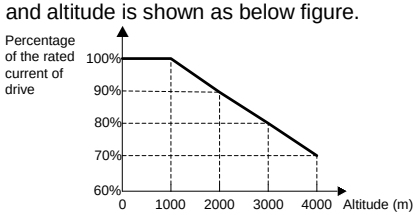
a.Wiring connection between drive and motor due to the variance of the rated power causes the variance of the current leakage. The setting of the switching frequency, rated power, and cable length is listed in the below table.

Rated power \ Cable length	10m	20m	30m	50m	100m	100m above
0.5HP~7.5HP	10kHz	7.5kHz	5kHz	2.5kHz	800Hz	800Hz

The switching frequency setting is set by F1.21

b.The cable length between the drive and motor must keep as short as possible. The parasitic capacitance effect is minor within 10 meters. The drive shall connect an AC reactor(ACL) on the side of drive output terminals (U/T1,V/T2,W/T3) and decrease the switching frequency if the motor cable is over 30m.

c.If the drive is used at the altitude over than 1000m, the relationship of drive's rated current and altitude is shown as below figure.



d.Recommended wire size and Molded Case Circuit Breaker(MCCB)

Single-phase 100V series

Model no. RM6E1-	Input current (A)	MCCB (A)	Input (R/L1,S/L2,T/L3) wire size (mm²/AWG)	Output (U/T1,V/T2,W/T3) wire size (mm²/AWG)	Grounding wire size (mm²/ AWG)	Control circuit wire size (mm²/AWG)
10P5B1	9.1	20	2.1/14	0.5/20	2.1/14	0.75~1.25/ 22~16
1001B1	15.3	40	3.3/12	0.8/18	3.3/12	
1002B1	30	50	8.4/8	1.3/16	8.4/8	
1003B1	40	60	8.4/8	2.1/14	8.4/8	

Single-phase 200V series

Model no. RM6E1-	Input current (A)	MCCB (A)	Input (R/L1,S/L2,T/L3) wire size (mm²/AWG)	Output (U/T1,V/T2,W/T3) wire size (mm²/AWG)	Grounding wire size (mm²/ AWG)	Control circuit wire size (mm²/AWG)
20P5B1	5.8	10	1.3/16	0.5/20	1.3/16	0.75~1.25/ 22~16
2001B1	9.1	20	2.1/14	0.8/18	2.1/14	
2002B1	13.7	40	3.3/12	1.3/16	3.3/12	
2003B1	20	40	5.3/10	2.1/14	5.3/10	

Three-phase 200V series

Model no. RM6E1-	Input current (A)	MCCB (A)	Input (R/L1,S/L2,T/L3) wire size (mm²/AWG)	Output (U/T1,V/T2,W/T3) wire size (mm²/AWG)	Grounding wire size (mm²/ AWG)	Control circuit wire size (mm²/AWG)
20P5B3	3.2	10	0.5/20	0.5/20	0.5/20	0.75~1.25/ 22~16
2001B3	4.4	10	0.8/18	0.8/18	0.8/18	
21P5B3	6.3	15	1.3/16	1.3/16	1.3/16	
2002B3	8.4	15	2.1/14	1.3/16	2.1/14	
2003B3	11.5	20	3.3/12	2.1/14	3.3/12	
2004B3	15	25	3.3/12	3.3/12	3.3/12	
2005B3	19	30	5.3/10	5.3/10	5.3/10	

Three-phase 400V series

Model no. RM6E1-	Input current (A)	MCCB (A)	Input (R/L1,S/L2,T/L3) wire size (mm²/AWG)	Output (U/T1,V/T2,W/T3) wire size (mm²/AWG)	Grounding wire size (mm²/ AWG)	Control circuit wire size (mm²/AWG)
4001B3	2.8	6	0.5/20	0.5/20	2.1/14	0.75~1.25/ 22~16
4002B3	4.4	10	0.8/18	0.5/20	2.1/14	
4003B3	6.1	15	1.3/16	0.8/18	2.1/14	
4005B3	10.3	15	2.1/14	2.1/14	2.1/14	
4007B3	16	25	5.3/10	3.3/12	5.3/10	

Note:

i. Please refer to the local electrical code with respect to the wiring(the loading and continuity, the wire capability for the current and temperature, the length of wiring, and the surrounding temperature must be all considered in order to add or reduce the size of the wire).

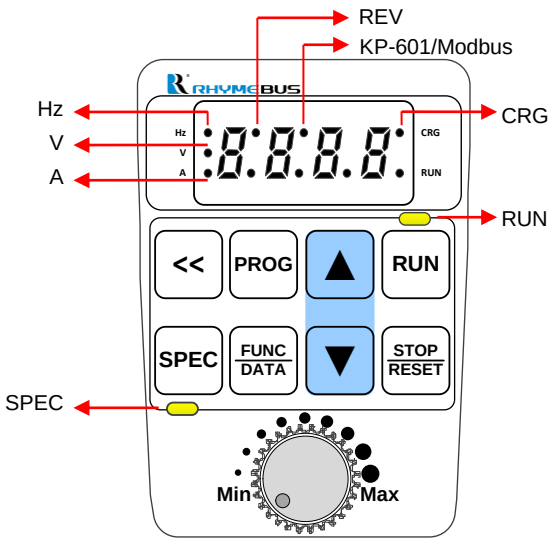
ii. Please use the cable that is suitable for 600V, 75℃ above.

iii. This table is only for reference.

No Text on This Page

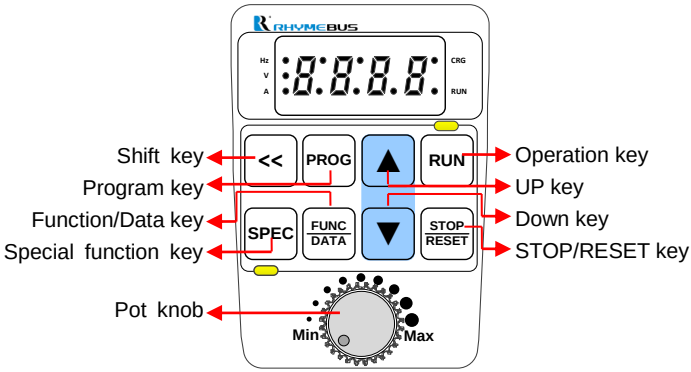
Chapter 3 The Setting of Operation Panel & Remote Controller

3-1 Functions of Operation Panel



3-1-1 Indicators of Operation Panel

Symbol	Name	Description
Hz	Frequency indicator	Indicating the unit of frequency
V	Voltage indicator	Indicating the unit of voltage
A	Current indicator	Indicating the unit of current
REV	Reverse rotation indicator	ON: Reverse OFF: Forward
KP-601/Modbus	KP/Modbus communication indicator	Blinking: Linking OFF: Non-linking
CRG	Power indicator	ON: Power ON OFF: No power input
RUN	Operation indicator	Blinking: Under acceleration or deceleration ON: Constant speed OFF: Stop
SPEC	Special key indicator	ON: SPEC under self-holding operation OFF: SPEC not under self-holding operation



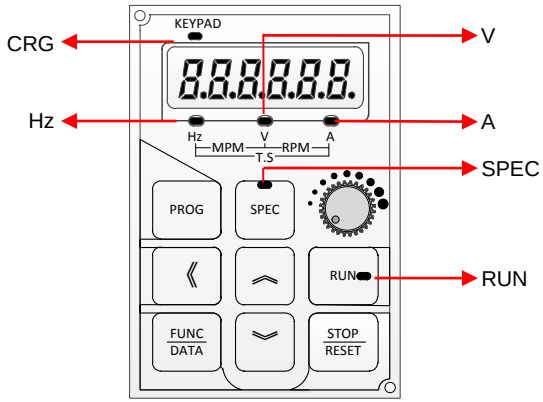
3-1-2 Keys of Operation Panel

Symbol	Name	Description
PROG	Program key	1.Enter the function setting mode. 2.Back to the monitor mode.
FUNC DATA	Function/Data key	1.Enter the parameter setting mode. 2.Back to the function setting mode. 3.Switch monitor mode.
▲	Up key	Changing the functions or parameters.
▼	Down key	
RUN	Operation key	Drive start key.
STOP RESET	Stop/Reset key	1.Drive stops (all outputs cut off). 2.Fault reset. 3.Stop key can be set as the emergency stop function when the operation command is set by external multi-function input terminals(see the description of F1.05).
SPEC	Special function key	This key function is programmable(see the description of F1.17 and F1.18).
<<	Shift key	1.Switch of function group and function numbers. 2.The shifting key for digits of parameter value setting. 3.When the setting of frequency command is over 100Hz above, pressing this key to set the value of second decimal.

3-1-3 Knob of Operation Panel

Symbol	Name	Description
	Pot knob	The knob can be set as the frequency command (see the description of F5.00).

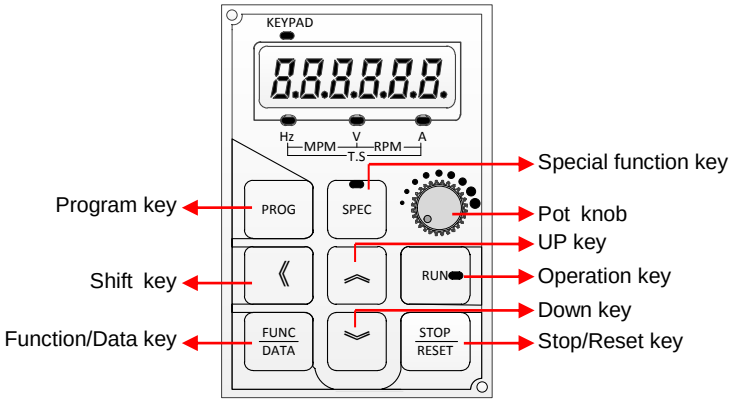
3-2 Functions of Remote Controller(KP-601 keypad)



3-2-1 Indicators of Keypad

Symbol	Name	Explanation
Hz	Frequency indicator	Indicating the unit of frequency
V	Voltage indicator	Indicating the unit of voltage
A	Current indicator	Indicating the unit of current
CRG	Power indicator	ON: Power ON OFF: No power input
RUN	Operation indicator	Blinking: Under acceleration or deceleration ON: Constant speed OFF: Stop
SPEC	Special key indicator	ON: SPEC under self-holding operation OFF: SPEC not under self-holding operation

Note: The monitor will display "—" for frequency and rotation speed, when the rotation direction of motor is reverse.



3-2-2 Keys of Keypad

Symbol	Name	Descriptions
PROG	Program key	1.Enter the function setting mode. 2.Back to the monitor mode.
FUNC DATA	Function/Data key	1.Enter the parameter setting mode. 2.Back to the function setting mode. 3.Switch to monitor mode.
^^	Up key	Up/down key of changing functions and parameters.
vv	Down key	
RUN	Operation key	Drive start key.
STOP RESET	Stop/Reset key	1.Drive stops (all outputs cut off). 2.Fault reset. 3.Stop key can be set as the drive emergency stop when the drive control is from the external input terminals(see F1.05 for the function setting).
SPEC	Special function key	This key function is programmable(see F1.17 and F1.18 for this key function setting).
<<	Shift key	1.Switch of function group and function numbers. 2.The shifting key for digits of parameter value setting.

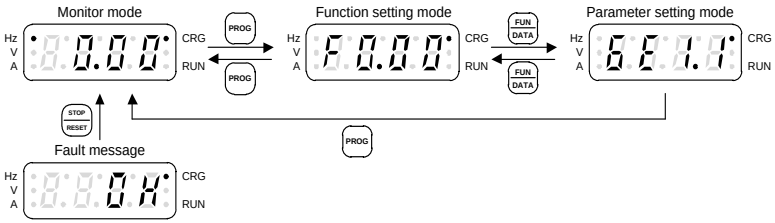
3-2-3 Knob of Operation Panel

Symbol	Name	Explanation
	Pot knob	The knob can be set as the frequency command (see F5.00 for the knob function setting).

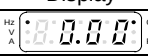
3-3 The Operation of the Operation Panel and Monitor Mode

3-3-1 The Operation of Operation Panel

The operation of the operation panel includes fault messages and three modes. The switching methods are shown as below figure:



The operation steps are shown in the below table (by default setting)

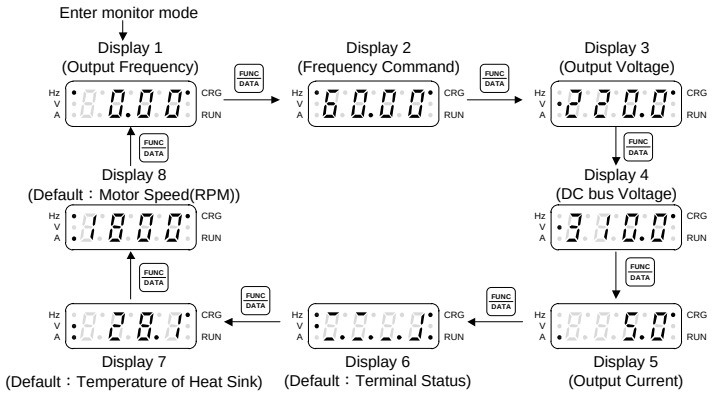
Operation Steps	Display
1.Start the drive and enter the main display.	
2.Press PROG key and enter the function setting mode.	
3.Press FUNC DATA key and enter the parameter setting mode.	
4.Press FUNC DATA key and return to the function setting mode.	
5.Press PROG key and return to the monitor mode.	

Fault message display:

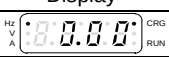
Operation Steps	Display
The fault message displayed during the drive operation	
1.After the error is troubleshooted, pressing STOP RESET key to clear the fault message and then return to the monitor mode.	

3-3-2 Monitor Mode

There are eight monitor modes can be selected in the monitor mode. User can determine one of eight monitor modes as the main display on the operation panel. And the monitor mode can be switched as shown in below figure:



The descriptions of monitor modes are shown in the below table(example by default setting)

Display	Descriptions	Display
Display 1	Output frequency (Hz, CRG: ON)	
Display 2	Frequency command (Hz, CRG: ON)	
Display 3	Output voltage (V, CRG: ON)	
Display 4	DC bus voltage (V, CRG: ON)	
Display 5	Output current (A, CRG: ON)	
Display 6	Terminal status (Hz, V, CRG, RUN: ON)	
Display 7	Heat sink temperature (V, A, CRG: ON)	
Display 8	Motor speed(RPM) (Hz, A, CRG: ON)	

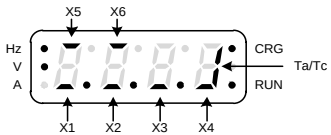
a. User can select the main display from eight monitor displays and switch to another monitor displays by FUNC DATA key under monitor mode. The selection of monitor displays can be set from F1.08.

b. User can determine one of the displays to be the main display according to the demand. If the user does not change the display back the main display after the setting is completed, the drive will automatically switch back to the main display after the operation panel is idle over 3 min.

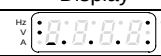
c. The display 6~8 are defined by F1.09~F1.11

3-3-3 The Status of Multi-function Terminals

The default setting of “Display 6” is the status of multi-function input terminals and the definition of each segment on the seven-segment display for 4 digits is shown as below figure:



The definition of display shown in the below table:

Display	Terminal	Status description
	X1	Multi-function input terminal “X1” is active.
	X2	Multi-function input terminal “X2” is active.
	X3	Multi-function input terminal “X3” is active.
	X4	Multi-function input terminal “X4” is active.
	X5	Multi-function input terminal “X5” is active.
	X6	Multi-function input terminal “X6” is active.
	Ta/Tb/Tc	Multi-function input terminal “Ta/Tb/Tc” is active.

3-3-4 The Function Setting Mode

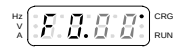
a.The selection of function group:

Operation Steps	Display
1.Press [PROG] key to enter function group setting mode under monitor mode and the function group in the display will be flashing.	
2.Press [▲] key to increase the function group number.	
3.Press [▼] key to decrease the function group number. See “Chapter 4 Parameter List” for the setting range of function groups.	

b.The switch of function group and function number:

Operation Steps	Display
1.Press [<<] key to switch the function number setting mode to function group setting mode when function group is flashing.	
2.Press [<<] key to switch the function group setting mode to function number setting mode when function number is flashing.	

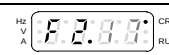
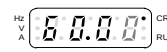
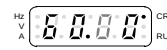
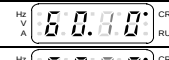
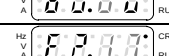
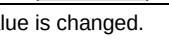
c.The selection of function number:

Operation Steps	Display
1.Press [<<] key to switch to the function number setting mode after the function group is selected. And the function number is flashing.	
2.Press [▲] key to increase the function number.	
3.Press [▼] key to decrease the function number. See "Chapter 4 Parameter List" for the setting range of function numbers.	

Note: The grey-color digits in above tables represent the flashing of the digits.

3-3-5 Parameter Setting Mode

The setting range of parameter is according to the function. The operation steps are shown in the below table:

Operation Steps	Display
1.The function setting mode: example F2.17(output frequency).	
2.Press [FUNC DATA] key in the function setting mode and enter parameter setting mode.	
3.Press [<<] key to shift the digit; Example: Shift the number to the last digit after the decimal point.	
4.Press [▲] key to increase 0.1 to the output frequency.	
5.Press [▼] key to decrease 0.1 to the output frequency.	
6.Press [FUNC DATA] key and return to function setting mode.	

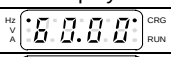
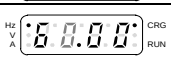
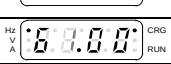
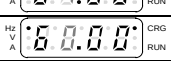
a.The digit of parameter value is flashing after the parameter value is changed. (grey-color digits in above table means digit flashing)

b.The setting range of F2.17 is 0.00~400.00Hz

3-3-6 The Operation in the Monitor Mode

Frequency command, motor speed(RPM), machine speed(MPM) are changeable under monitor mode. For example of frequency command change, the setting steps are shown in the following table.

The operation steps are shown in the below table:

Operation Steps	Display
1.In the monitor mode, the display is shown as right.	
2.Press [<<] key to shift the digit of frequency command.	
3.Press [<<] key to shift the digit of frequency command. Example: Change the digit of decimal value.	
4.Press [▲] key to increase 1 to the frequency command.	
5.Press [▼] key to decrease 1 to the frequency command.	
6.Press [FUNC DATA] key to save the setting value within 5sec, when completing setting of the rotation speed.	

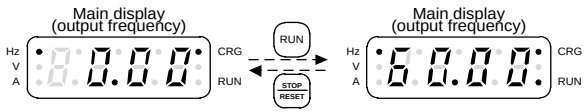
Note: grey-color digits in above table means digit flashing.

a.Use [▲] or [▼] key to control the rotation speed in the monitor mode.

b.Press [FUNC DATA] key to save the setting value within 5sec(the setting value is flashing), when the required rotation speed is set. If the setting value is not saved, the display will return to the monitor mode after 5sec and save the value automatically after 3 min. If the saving of the setting value is not completed and drive immediately powers off within 3 min, the setting value will recover to the original value before setting.(see F1.07 for the setting).

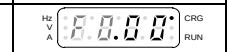
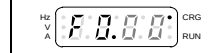
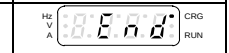
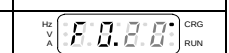
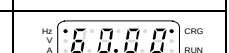
3-3-7 Start/Stop of the Drive

Press [RUN] and [STOP RESET] key to control the output of drive. Shown as below:

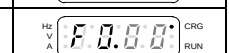
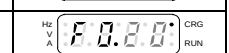
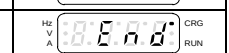
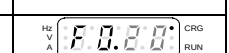
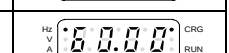


3-3-8 Save and Restore the Setting Value.

a.The operation steps of saving drive function setting are shown in the below table:

Operation Steps	Display
1.Press PROG key and enter the function setting mode.	
2.Press << key and switch to the function number setting mode.	
3.Press ▼ key to select F0.20.	
4.Press FUNC DATA key and enter the parameter setting mode.	
5.Press ▲ key and select the “SAv”.	
6.Press FUNC DATA key to save settings. The display of operation panel will display “End” after 2sec.	
7.After the panel displays ”End” for 1 sec, the display automatically returns to the function setting mode.	
8.Press PROG key and return to the monitor mode (frequency command).	

b.The operation steps of resuming drive function setting are shown in the below table:

Operation	Display
1.Press PROG key and enter the function setting mode.	
2.Press << key and switch to the function number setting mode.	
3.Press ▼ key to select F0.20.	
4.Press FUNC DATA key to enter the parameter setting mode.	
5.Press ▲ key and select the “rES”.	
6.Press FUNC DATA key to save the setting. The panel will display “End” after 2sec.	
7.After the panel displays ”End” for 1 sec, the display automatically returns to the function setting mode.	
8.Press PROG key and return to the monitor mode (frequency command).	

No Text on This Page

Chapter 4 Parameter List

Group List

Group	Function	
F0	System Parameters	System status Parameter locking Password protection Power source voltage setting Fault record Default setting
F1	Operation Parameters	Start command selection Frequency command selection Main display selection SPEC key setting Switching frequency Stop mode
F2	Frequency Parameters	Preset speed Multi-acceleration/deceleration time V/F pattern setting Jump frequency Upper/lower limits of output frequency
F3	Control Parameters	Holding frequency and time Stall prevention setting Motor slip compensation Automatic boost voltage range Current oscillation prevention AVR compensation DC braking Dynamic braking Drive operation after instantaneous power failure Speed tracing Current compensation
F4	Protection Parameters	Grounding fault protection Drive overload protection Motor overload protection Drive overheat protection Fan control Motor overheat protection Overload protection setting
F5	Multi-function parameters	Analog input Analog output Multi-function input Multi-function output UP/DOWN setting Counting mode Frequency detection
F6	Special parameters	Sequential operation control PID control Modbus communication

F0 System Parameters

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F0.00	Drive Information	0: Software version 1: Drive model number 2: Drive rated current 3: Drive running hours 4: Drive supply power time 5: Software checksum code	—	—	—	61
F0.01	Parameter Lock	0: Parameters are changeable 1: Parameters are locked	0, 1	—	0	61
F0.02	Parameter Password Setting	Set the password for the parameter protection	0~9999	1	0	61
F0.03	Parameter Password Unlock	Unlock the passwords for the parameters	0~9999	1	—	61
F0.04	Reserved	Reserved	—	—	—	
F0.05	Power Source	The value of setting according to the actual power source	100.0~120.0 *Note 3 190.0~240.0 *Note 4 340.0~480.0 *Note 5	0.1V	110.0 *Note 3 220.0 *Note 4 380.0 *Note 5	62
F0.08	Fault Record 1	0: Fault code 1: Output current at drive fault 2: DC bus voltage at drive fault 3: Output frequency at drive fault	—	—	—	62
F0.09	Fault Record 2		—	—	—	62
F0.10	Fault Record 3		—	—	—	62
F0.11	Fault Record 4		—	—	—	62
F0.12	Fault Record 5		—	—	—	62
F0.13	Fault Record 6		—	—	—	62
F0.19	Reserved	Reserved	—	—	—	
F0.20	Default Setting	0: Disable CLF: Clear fault records dF60: Default the factory setting of 60Hz dF50: Default the factory setting of 50Hz SAv: Store setting rES: Resume setting rdEE: Read the parameters from drive to digital keypad UrEE: Write the parameters from digital keypad to drive	—	—	0	62

Note: rdEE and UrEE functions are activation when connecting the KP-601 keypad.

The color as [ ] means functions can be set during the operation.

F1 Operation Parameters

<table>
<tr><th>Func.</th><th>Name</th><th colspan="3">Descriptions</th><th>Range of Setting</th><th>Unit</th><th>dF60</th><th>Page</th></tr>
<tr><td rowspan="13">F1.00</td><td rowspan="13">Start Command Selection</td><td></td><td>Start command</td><td>Rotation direction</td><td rowspan="13">0~11</td><td rowspan="13">—</td><td rowspan="13">3</td><td rowspan="13">64</td></tr>
<tr><td>0</td><td>FWD or REV command</td><td>FWD or REV command</td></tr>
<tr><td>1</td><td>FWD command</td><td>REV command</td></tr>
<tr><td>2</td><td rowspan="3">Operation panel</td><td>FWD, REV command</td></tr>
<tr><td>3</td><td>Forward</td></tr>
<tr><td>4</td><td>Reverse</td></tr>
<tr><td>5</td><td>Reverse command</td></tr>
<tr><td>6~7</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>8</td><td>Communication control</td><td>Communication control</td></tr>
<tr><td>9</td><td>Communication control</td><td>Reverse command</td></tr>
<tr><td>10</td><td>Forward command</td><td>Communication control</td></tr>
<tr><td>11</td><td>Operation panel</td><td>Communication control</td></tr>
<tr><td>F1.01</td><td>Primary Frequency Command Selection</td><td colspan="3">0: Frequency command by analog input selection (F1.03).
1: Frequency command by operation panel.
2: Motor rotation speed setting by operation panel.
3: Machine speed setting by operation panel.
4: Frequency command by multi-function input terminal as UP/DOWN command.
5: Frequency command by communication terminal.</td><td>0~5</td><td>—</td><td>1</td><td>66</td></tr>
<tr><td>F1.02</td><td>Secondary Frequency Command Selection</td><td colspan="3">0: Frequency command by analog input selection(F1.03).
1: Frequency command by operation panel.
2: Frequency command by multi-function input terminal as UP/DOWN command.</td><td>0~2</td><td>—</td><td>0</td><td>67</td></tr>
<tr><td>F1.03</td><td>Analog Input Selection</td><td colspan="3">0: Pot knob+ AI
1: Pot knob – AI
2: AI – Pot knob
3: Pot knob or AI(switch by multi-function input terminal)
4: Pot knob
5: AI</td><td>0~5</td><td>—</td><td>0</td><td>67</td></tr>
<tr><td>F1.04</td><td>“Pot knob” Command Source Selection</td><td colspan="3">0: From drive’s operation panel.
1: From external keypad(KP-601).</td><td>0, 1</td><td>—</td><td>0</td><td>67</td></tr>
</table>

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F1.05	Validity of STOP of the Operation Panel	0: Start command from the terminal, STOP key disabled. 1: Start command from the terminal, STOP key enabled.	0, 1	—	1	68
F1.06	Frequency Command Selection (operation panel)	0: In the monitor mode, frequency command cannot be changed. 1: In the monitor mode, frequency command is changeable.	0, 1	—	1	68
F1.07	Frequency Command Auto-Storing (operation panel)	0: In the monitor mode, the frequency command cannot be stored. 1: In the monitor mode, the frequency command can be stored automatically after 3 minutes.	0, 1	—	1	68
F1.08	Main Display Selection	Control panel have 8 display option 1: Output frequency 2: Frequency command 3: Output voltage 4: DC bus voltage 5: Output current 6: Display mode 6 (F1.09) 7: Display mode 7 (F1.10) 8: Display mode 8 (F1.11)	1~8	—	1	68
F1.09	Display Mode 6	0: Terminal status 1: Temperature of heat sink 2: Motor rotation speed(RPM) 3: Machine speed(MPM) 4: The sector of sequential operation control 5: The cycle of sequential operation control 6: Counting value 7: Current limit level 8: Primary frequency command 9: Secondary frequency command 10: PID command 11: PID feedback	0~11	—	0	69
F1.10	Display Mode 7		0~11	—	1	69
F1.11	Display Mode 8		0~11	—	2	69
F1.12	Number of Motor Poles	Determination of RPM display value.	2~10	2P	4P	69
F1.13	Machine Speed Ratio	Set the ratio of machine speed. This function determines MPM display value.	0.00~500.00	0.01	20.00	69
F1.14	Digits of Decimal Value (Machine Speed)	Select the digits of decimal values displaying the machine speed.	0~3	—	0	69

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F1.17	SPEC Key Setting	Same function as multi-function input	-28 ~ +28 *Note 7	—	0	69
F1.18	SPEC Key Self-Holding Function	0: Disable 1: Enable	0, 1	—	0	69
F1.19	Stop Mode	0: Ramp to stop + DC braking 1: Coast to stop 2: Coast to stop+ DC braking	0~2	—	0	70
F1.20	Reverse Prohibition	0: Reverse rotation allowed 1: Reversal rotation NOT allowed	0, 1	—	0	70
F1.21	Switching Frequency	The setting value is higher and the motor noise is lower.	0~6	—	2 *Note 8	70
F1.22	Overload Decrease Switching Frequency	0：The switching frequency will not be adjusted by the load of current. 1：The swithching frequency will be auto-adjusted according to the load of current.	0,1	—	1	71
F1.23	Number of Tolerance to Drive Fault	Set the number of tolerance to drive fault conditions when OC, faults are occurred during the certain time period.	0~16	1	0	71

The color as [ ] means functions can be set during the operation.

F2 Frequency Parameters

Func.	Name	Descriptions				Range of Setting	Unit	dF60	Page
F2.00	Primary Speed (Preset Speed 1)	Multi-speed level 4 command	Multi-speed level 3 command	Multi-speed level 2 command	Multi-speed level 1 command	0.00~ 400.00	0.01 Hz	50.00 *Note 1 60.00 *Note 2	72
		OFF	OFF	OFF	OFF				
F2.01	Preset Speed 2	OFF	OFF	OFF	ON	0.00~ 400.00	0.01 Hz	10.00	72
F2.02	Preset Speed 3	OFF	OFF	ON	OFF	0.00~ 400.00	0.01 Hz	20.00	72
F2.03	Preset Speed 4	OFF	OFF	ON	ON	0.00~ 400.00	0.01 Hz	30.00	72
F2.04	Preset Speed 5	OFF	ON	OFF	OFF	0.00~ 400.00	0.01 Hz	0.00	72
F2.05	Preset Speed 6	OFF	ON	OFF	ON	0.00~ 400.00	0.01 Hz	0.00	72
F2.06	Preset Speed 7	OFF	ON	ON	OFF	0.00~ 400.00	0.01 Hz	0.00	72
F2.07	Preset Speed 8	OFF	ON	ON	ON	0.00~ 400.00	0.01 Hz	0.00	72
F2.08	Preset Speed 9	ON	OFF	OFF	OFF	0.00~ 400.00	0.01 Hz	0.00	72
F2.09	Preset Speed 10	ON	OFF	OFF	ON	0.00~ 400.00	0.01 Hz	0.00	72
F2.10	Preset Speed 11	ON	OFF	ON	OFF	0.00~ 400.00	0.01 Hz	0.00	72
F2.11	Preset Speed 12	ON	OFF	ON	ON	0.00~ 400.00	0.01 Hz	0.00	72
F2.12	Preset Speed 13	ON	ON	OFF	OFF	0.00~ 400.00	0.01 Hz	0.00	72
F2.13	Preset Speed 14	ON	ON	OFF	ON	0.00~ 400.00	0.01 Hz	0.00	72
F2.14	Preset Speed 15	ON	ON	ON	OFF	0.00~ 400.00	0.01 Hz	0.00	72
F2.15	Preset Speed 16	ON	ON	ON	ON	0.00~ 400.00	0.01 Hz	0.00	72
F2.16	Jog Speed	Jog speed				0.00~ 400.00	0.01 Hz	6.00	72
F2.17	Reference Frequency of Accel/Decel Time	The frequency corresponding to accel/decel time.				0.01~ 400.00	0.01 Hz	50.00 *Note 1 60.00 *Note 2	73
F2.18	Primary Acceleration Time	The acceleration time of primary speed, preset speed 5~16, and jog speed.				0.0~ 3200.0	0.1 sec	5.0	73

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F2.19	Primary Deceleration Time	The deceleration time of primary speed, preset speed 5~16, and jog speed.	0.0~ 3200.0	0.1 sec	5.0	73
F2.20	Acceleration Time of Preset Speed 2	Acceleration time of preset speed 2	0.0~ 3200.0	0.1 sec	5.0	73
F2.21	Deceleration Time of Preset Speed 2	Deceleration time of preset speed 2	0.0~ 3200.0	0.1 sec	5.0	73
F2.22	Acceleration Time of Preset Speed 3	Acceleration time of preset speed 3	0.0~ 3200.0	0.1 sec	5.0	73
F2.23	Deceleration Time of Preset Speed 3	Deceleration time of preset speed 3	0.0~ 3200.0	0.1 sec	5.0	73
F2.24	Acceleration Time of Preset Speed 4	Acceleration time of preset speed 4	0.0~ 3200.0	0.1 sec	5.0	73
F2.25	Deceleration Time of Preset Speed 4	Deceleration time of preset speed 4	0.0~ 3200.0	0.1 sec	5.0	73
F2.26	Secondary Acceleration Time	Multi-function input terminals select the secondary acceleration time.	0.0~ 3200.0	0.1 sec	5.0	73
F2.27	Secondary Deceleration Time	Multi-function input terminals select the secondary deceleration time.	0.0~ 3200.0	0.1 sec	5.0	73
F2.28	Set S-curve for Accel/Decel Time	Set S-curve to slow the acceleration and deceleration at start and stop.	0.0~5.0	0.1 sec	0.0	74
F2.30	Limitation of Output Voltage	0: Output voltage of V/F pattern is not limited. 1: Output voltage of V/F pattern is limited (voltage compensation disabled).	0, 1	—	0	74
F2.31	V/F Pattern Selection	0: Linear 1: Energy saving mode (auto-adjust V/F according to the loads) 2: Square curve 3: 1.7th power curve 4: 1.5th power curve	0~4	—	0	75

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F2.32	Maximum Output Frequency	Maximum output frequency of drive	0.1~400.00	0.1Hz	50.0 *Note 1 60.0 *Note 2	75
F2.33	Starting Frequency	Starting frequency of drive's output frequency.	0.1~10.0	0.1Hz	0.5	76
F2.34	Starting Voltage	The voltage corresponds to the output starting frequency.	0.1~50.0 *Note 3,4 0.1~100.0 *Note 5	0.1Vac	8.0 *Note 3,4 12.0 *Note 5	76
F2.35	Base Frequency	The frequency corresponds to the base voltage in V/F pattern.	0.1~400.00	0.1Hz	50.0 *Note 1 60.0 *Note 2	76
F2.36	Base Voltage	The voltage corresponds to the base frequency in V/F pattern.	0.1~255.0 *Note 3,4 0.1~510.0 *Note 5	0.1Vac	220.0 *Note 3,4 380.0 *Note 5	76
F2.37	V/F Frequency 1	Frequency at the first point of V/F pattern	0.0~399.9	0.1Hz	0.0	76
F2.38	V/F Voltage 1	Voltage at the first point of V/F pattern	0.0~255.0 *Note 3,4 0.0~510.0 *Note 5	0.1Vac	0.0	76
F2.39	V/F Frequency 2	Frequency at the second point of V/F pattern.	0.0~399.9	0.1Hz	0.0	76
F2.40	V/F Voltage 2	Voltage at the second point of V/F pattern.	0.0~255.0 *Note 3,4 0.0~510.0 *Note 5	0.1Vac	0.0	76
F2.42	Jump Frequency 1	Avoid mechanical resonance point 1.	0.0~400.00	0.1Hz	0.0	77
F2.43	Jump Frequency 2	Avoid mechanical resonance point 2.	0.0~400.00	0.1Hz	0.0	77
F2.44	Jump Frequency 3	Avoid mechanical resonance point 3.	0.0~400.00	0.1Hz	0.0	77
F2.45	Jump Frequency Range	Set the range of the jump frequency 1, 2, 3.	0.0~25.5	0.1Hz	0.0	77
F2.47	Frequency Upper Limit	The upper limit of output frequency (1.00=maximum output frequency)	0.00~1.00	0.01	1.00	77
F2.48	Frequency Lower Limit	The lower limit of output frequency (1.00=maximum output frequency)	0.00~1.00	0.01	0.00	78

The color as [ ] means functions can be set during the operation.

F3 Control Parameters

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F3.00	Holding Frequency	The drive accelerate to the holding frequency and running at constant speed.	0.0~400.00	0.1Hz	0.5	79
F3.01	Holding Time Interval	The drive runs at holding frequency by constant speed and running the time interval.	0.0~360.0	0.1sec	0.0	79
F3.03	Stall Prevention Level at the Acceleration	If stall is occurred during acceleration, the motor keeps running at the constant speed(200%: Off).	30%~200% of drive rated current	1%	170	79
F3.04	Stall Prevention Level at the Constant Speed	If stall is occurred at constant speed running, the motor speed is decreased(200%: Off).	30%~200% of drive rated current	1%	160	79
F3.05	Acceleration Time for Stall Prevention at the Constant Speed	Set the acceleration time for the stall prevention of the constant speed.	0.1~3200.0	0.1sec	5.0	79
F3.06	Deceleration Time for Stall Prevention at the Constant Speed	Set the deceleration time at the stall prevention of the constant speed.	0.1~3200.0	0.1sec	5.0	79
F3.07	Deceleration Stall Prevention	0: Deceleration stall prevention: Disabled 1: Deceleration stall prevention: Enabled	0, 1	—	1	79
F3.09	Motor Slip Compensation	According to the load condition, set the motor slip compensation for motor running at the constant speed (0.0: Off).	-59.9~60.0	0.1Hz	0.0	80
F3.10	Frequency Response Time of Motor Slip Compensation	Set the frequency response time of motor slip compensation. Unit: 5ms	1~255	1	40	80
F3.12	Automatic Boost Voltage Range	According to the load condition, adjust the output voltage of the V/F Pattern (0.0: Off).	0.0~25.5	0.1	1.0	80

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F3.13	Response Time of Automatic Boost Voltage	Set the response time of automatic boost voltage range.	1~255	1ms	60	81
F3.15	Voltage Compensation for Current Oscillation	Adjust the voltage according to the current oscillation.	0.00~2.55	0.01	0.10	81
F3.16	Response Time of Voltage Compensation for Current Oscillation	Adjust the response time of voltage compensation according to current oscillation(0: Off).	0~250	1	10	81
F3.18	Automatic Voltage Regulation (AVR)	0: Disable 1: Enable	0, 1	—	1	81
F3.19	Response Time of AVR	Set the response time of automatic voltage regulation.	0~255	1ms	50	81
F3.21	DC Braking Level	Set the current level of DC braking	0~150% of drive rated current	1%	50	81
F3.22	DC Braking Response Time	Adjust the response time according to DC braking.	1~255	1ms	10	82
F3.23	Time Interval of DC Braking at Start	Set the time interval for DC braking before drive starts.	0.0~60.0	0.1sec	0.0	82
F3.24	Time Interval of DC Braking at Stop	Set the time interval for DC braking at drive stops.	0.0~60.0	0.1sec	0.5	82
F3.25	DC Braking Frequency at Stop	Active frequency level of DC braking at stop.	0.1~60.0	0.1Hz	0.5	82
F3.27	Active Level of Dynamic Brake	Dynamic brake activates when the DC bus voltage is over the setting. Function disable setting: 100/200V series: 410 400V series: 820	350~410 *Note 3,4 700~820 *Note 5	1Vdc	390 *Note 3,4 780 *Note 5	82

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F3.28	Pulse Setting of Braking Transistor	Set the pulse width of drive baking signal.	10~90	1%	50	82
F3.30	Operation Selection at Instantaneous Power Failure	0: Drive cannot be restarted 1: Drive can be restarted 2: Ramp to stop (please refer to the F3.31~F3.35) 3: When the power is restored during the ramp to stop interval, the drive re-accelerates again	0~3	—	0	83
F3.31	The Voltage Level Setting at Power Failure	Set the voltage level of power source for ramp to stop. When the voltage of power input is lower than the setting level, drive ramps to stop.	75.0~96.0 *Note 3 150.0~192.0 *Note 4 300.0~384.0 *Note 5	0.1V	87.5 *Note 3 175.0 *Note 4 320.0 *Note 5	83
F3.32	Subtracted Frequency of Deceleration at Power Failure	When the power failure, the output frequency = drive's original output frequency - subtracted frequency.	0.0~20.0	0.1Hz	3.0	83
F3.33	Deceleration Time 1 at Power Failure	Set a deceleration time down to the turning frequency set in (F3.35).	0.0~3200.0	0.1sec	5.0	83
F3.34	Deceleration Time 2 at Power Failure	Set a deceleration time below the turning frequency set in (F3.35).	0.0~3200.0	0.1sec	5.0	83
F3.35	Turning Frequency at Power Failure	Set the turning frequency level at power failure that the deceleration time is switched from the F3.33 setting to the F3.34 setting.	0.0~400.00	0.1Hz	0.0	83
F3.37	The Current Level of Speed Tracing	When the current large than the tracing current, the output frequency is tracing downward.	0~200% of drive rated current	1%	150	84
F3.38	Delay Time for Speed Tracing	Set the output delay time before the speed tracing.	0.1~60.0	0.1sec	0.5	84
F3.39	The V/F Pattern of Speed Tracing	Set the percentage of V/F output voltage at the speed tracing.	0~100%	1%	100	84

The color as [ ] means functions can be set during the operation.

F4 Protection Parameters

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F4.00	Grounding Fault Protection (GF)	0: Disable 1: Enable(GF)	0, 1	—	1	85
F4.01	Grounding Detection Level	Detecting if the unbalanced current is over the setting level	30~100% of drive rated current	1%	70	85
F4.02	Grounding Detection Sensitivity	Detect the sensitivity of grounding.	1~255	1 time	10	85
F4.04	Reserved	Reserved	0, 1	—	1	85
F4.05	Accumulating Number of Over-Current Limitation at 200% Limitation	When the accumulating numbers of drive over current are over the accumulating numbers of current limits (F4.05), drive trips to OL2 protection. Unit: 250 times (0: disable)	0~255	1 time	0	85
F4.07	Motor 1 Overload Protection (OL)	0: Motor overload protection: Disabled 1: Motor overload protection: Enabled(OL) 2: Motor overload protection of independent cooling fans: Enabled(OL)	0~2	—	1	85
F4.08	Motor 1 Rated Current	Current setting according to the motor rated current.	10%~150% of drive rated current	0.1A	According to the rated current of motor	86
F4.09	Motor 1 No-Load Current	Current setting according to the motor's no-load condition	0~ motor rated current	0.1A	1/3 motor rated current	86
F4.10	Trip Time of Motor 1 Overload	Set the tripped time of motor when motor is overload(150% of Motor rated current).	0.5~10.0	0.1min	5.0	86
F4.12	Protection Level of Drive Overheat	Set the tripped level of drive when drive is overheat.	85~115	1℃	90 *Note 6	86
F4.13	Drive Overheat Pre-alarm Selection	0: Disable 1: Warning (OHt): Continuous operation (relay terminal outputs) 2: Warning (OHt): Reduce switching frequency operation (relay terminal outputs) 3: Warning (OHt): Stop operation (relay terminal outputs)	0~3	—	2	86

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F4.14	Drive Overheat Pre-alarm Level	Set the temperature level of warning alarm.	45~105	1℃	70	86
F4.15	Drive Overheat Dead Band	Set the temperature dead band of temperature warning and fan active level.	0.1~10.0	0.1℃	3.0	87
F4.17	Fan Control Selection	0: Forced air: Start the fan at power on. 1: Operation air: Start the fan at operation. 2: Temperature control: Fan activation according to temperature level	0~2	—	1	87
F4.18	Temperature Level of Fan Activation	Set the temperature level of fan activation.	25~60	1℃	50	87
F4.19	Minimum Operation Time of Fan	Set the minimum operation time of fans when the fan control is stopped.	0.1~25.0	0.1min	0.5	88
F4.21	PTC Overheat Warning Level (Motor Overheat Protection)	Set the temperature warning level(OH1) of PTC	0.0~10.0	0.1Vdc	1.2	88
F4.22	PTC Overheat Warning Disposal	0: Warning (OH1): Continue operation (relay terminal outputs) 1: Warning (OH1): Stop operation (relay terminal outputs)	0, 1	—	0	88
F4.23	PTC Overheat Trip Level	Set the overheat trip level of PTC	0.0~10.0	0.1V	2.4	88
F4.25	System Overload Detection (OLO)	0: Disable 1: Enable(OLO)	0, 1	—	0	89
F4.26	System Overload Detection Status	0: Detection during the constant speed only 1: Detection during the running only	0, 1	—	0	89
F4.27	Output Setting of System Overload	0: Drive is still running when the overload is detected 1: Drive is tripped when the overload is detected	0, 1	—	0	90
F4.28	System Overload Detection Level	Set the level of the current for overload detection	30%~200% of drive rated current	1%	160	90
F4.29	System Overload Detection Time	The output current is larger than the setting F4.28 and exceeds the time interval of the overload detection	0.1~300.0	0.1sec	0.1	90

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F4.36	Current Limit (I-limit)	Current over F4.36 × the rated current of drive during operation, the drive may adjust PWM ouput and limit output current.	30%~200% of drive rated current	1%	180	91
F4.37	Gain of I-limit	The gain of the current limitation response(P).	0.00~1.00	0.01	0.10	91
F4.38	Integration Time of I-limit	Lower integration time I setting value will result the current limitation response more fast but lower setting value would cause the effect of oscillating current.	0~10.0	0.1	0.6	91
F4.39	Selection of Current Limitation	0:Disable 1:Enable	0,1	—	0	91
F4.41	Motor 2 Overload Protection (OL)	0: Motor overload protection: Disabled 1: Motor overload protection: Enabled(OL) 2: Motor overload protection of independent cooling fans: Enabled(OL)	0~2	—	1	92
F4.42	Motor 2 Rated Current	Current setting according to the motor rated current.	10%~150% of drive rated current	0.1A	According to the rated current of motor	92
F4.43	Motor 2 No-Load Current	Current setting according to the motor's no-load condition	10%~150% of drive rated current	0.1A	According to the rated current of motor	92
F4.44	Trip Time of Motor 2 Overload	Set the tripped time of motor when motor is overload(150% of Motor rated current).	0.5~10.0	0.1min	5.0	92
F4.45	PID Feedback High Detection Setting	0: Disable 1: Warning, drive continuous operation. 2: Error, drive trip to stop.	0~2	—	0	92
F4.46	PID Feedback High Detection Level	Detect if the PID feedbackis higher than setting level	0~100	1%	100	92
F4.47	PID Feedback High Detection Time	Feedback signal is higher than setting level and reach the detection time, the drive will be activated.	0.0~25.5	0.1sec	2.0	92
F4.48	PID Feedback Low Detection Setting	0: Disable 1: Warning, drive continuous operation. 2: Error, drive trip to stop.	0~2	—	0	93
F4.49	PID Feedback Low Detection Level	Detect if the PID feedback is lower than setting level	0~100	1%	0	93
F4.50	PID Feedback Low Detection Time	If feedback signal is lower than setting level and reach the detection time, the drive will be activated.	0.0~25.5	0.1sec	10.0	93

F5 Multi-function Parameters

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F5.00	"Pot knob" Selection (Analog Input)	0: Analog input gain 1: Frequency command 2: Current limit 3: Variable voltage of V/F pattern	0~3	—	1	94
F5.01	AI Selection (Analog Input)	0: Analog input gain 1: Frequency command 2: Current limit 3: Variable voltage of V/F pattern 4: PTC temperature 5: PID feedback	0~5	—	1	94
F5.02	AI Input Source Selection	0:DC 4~20mA (2~10V) 1:DC 0~20 mA (0~10V)	0, 1	—	1	95
F5.03	Pot Gain (Analog Input)	Analog input of "Pot knob" gain	0.00~2.00	0.01	1.00	95
F5.04	"Pot knob" Bias (Analog Input)	Analog input of "Pot knob" bias	-1.00~1.00	0.01	0.00	95
F5.05	AI Gain (Analog Input)	Analog input of AI gain	0.00~2.00	0.01	1.00	95
F5.06	AI Bias (Analog Input)	Analog input of AI bias	-1.00~1.00	0.01	0.00	95
F5.07	Filter Setting of Analog Frequency	Filter the signal based on analog input setting.	0~255	—	20	96
F5.08	Analog Frequency Dead Band	When signal noise is large, appropriately increase the dead band to stabilize the frequency. But this will reduce the tuning linearity.	0.00~2.55	0.01Hz	0.00	96
F5.09	Acceleration Time of V	Set the acceleration time of the variable voltage of V/F pattern.	0.0~3200.0	0.1sec	5.0	96
F5.10	Deceleration Time of V	Set the deceleration time of the variable voltage of V/F pattern.	0.0~3200.0	0.1sec	5.0	97
F5.12	FM Analog Output Signal Selection	0: Output frequency (before slip compensation) 1: Output frequency (after slip compensation) 2: Frequency command 3: Output voltage 4: Output current 5: DC bus voltage 6: "Pot knob" analog input signal 7: AI analog input signal 8: PID command 9: PID feedback signal	0~9	—	0	97
F5.13	FM Analog Output Gain	Analog output adjustment ratio.	0.00~2.00	0.01	1.00	97

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F5.14	FM Analog Output Bias	Analog output adjustment offset.	-1.00~1.00	0.01	0.00	97
F5.15	FM Range Option	0:DC 4~20mA (2~10V) 1:DC 0~20 mA (0~10V)	0, 1	—	1	98
F5.19	Multi-function Input Terminal X1	0: Disable ±1: Jog command ±2: Secondary accel/decel command switching ±3: Multi-speed level 1 command ±4: Multi-speed level 2 command ±5: Multi-speed level 3 command ±6: Multi-speed level 4 command ±7: Reset command ±8: External fault command(EF) ±9: Interruption of output command (bb) ±10: Coast to stop command(Fr) ±11: Speed search from the maximum frequency ±12: Speed search from the frequency setting ±13: Holding command ±14: UP command ±15: DOWN command ±16: Clean UP/DOWN frequency command ±17: UP/DOWN command enter key ±18: Analog input source selection (Pot knob/AI) ±19: Primary and secondary frequency command option ±20: Start command of sequential operation control ±21: Pause command of sequential operation control ±22: Forward command ±23: Reverse command ±24: Stop command with 3-wire start/stop circuit ±25: DC braking enable (Stop) ±26: Counter input ±27: Counter clear ±28: Current limit enable ±29: Selection for motor switching ±30: PID switching(open-loopselection) ±31: PID integrator reset	-31 ~ +31 *Note 7	—	22	98
F5.20	Multi-function Input Terminal X2		-31 ~ +31 *Note 7	—	23	98
F5.21	Multi-function Input Terminal X3		-31 ~ +31 *Note 7	—	1	98
F5.22	Multi-function Input Terminal X4		-31 ~ +31 *Note 7	—	7	98
F5.23	Multi-function Input Terminal X5		-31 ~ +31 *Note 7	—	0	94
F5.24	Multi-function Input Terminal X6		-31 ~ +31 *Note 7	—	0	94
F5.25	Digital Input Response Time	When the input signal is under the setting time, program will not be activated.	1~255	1ms	10	103

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F5.26	Multi-function Output Setting of Ta/Tb/Tc Terminals	0: Disable ±1: Running detection ±2: Constant speed detection ±3: Zero speed detection ±4: Frequency detection ±5: Overload detection(OLO) ±6: Stall prevention detection ±7: Low voltage detection(LE) ±8: Braking transistor is active detection(db) ±9: Restart after instantaneous power failure detection ±10: Restart after fault condition detection ±11: Fault detection ±12: Start detection of sequential operation control ±13: One complete operation sector detection of sequential operation control ±14: One complete operation cycle detection of sequential operation control ±15: Pause command detection of sequential operation control ±16: Detection of counter value1 ±17: Detection of counter value2 ±18: Reverse detection ±19: NTC temperature warning detection (OHt) ±20: Fan operation detection ±21: PTC temperature warning detection (OH1) ±22: Feedback high detection ±23: Feedback low detection	-23~+23 *Note 7	—	11	103
F5.30	UP/DOWN Memory Selection	0: Erase UP/DOWN frequency command when power off 1: Store UP/DOWN frequency command when power off	0, 1	—	0	108
F5.31	UP/DOWN Frequency Calibration	0: 0.01Hz 1~8: ×0.05Hz 9: 0.5Hz 10~250: ×0.1Hz	0~250	—	0	109

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F5.32	UP/DOWN Calibrating Time	1~5: Terminal adjust the response time. Continuous acceleration or deceleration when over the setting time 6: Edge trigger	1~6	—	1	109
F5.33	UP/DOWN Frequency Adjustment	Adjust UP/DOWN frequency on keypad directly	0.00~400.00	0.01Hz	0.00	109
F5.35	Counting Mode	0: Up counting mode 1: Down counting mode	0, 1	—	0	110
F5.36	Counter Value 1	Set counter value 1 for sequential operation control cycle	0~9999	1	0	110
F5.37	Counter Value 2	Set counter value 2 for sequential operation control cycle	0~9999	1	0	110
F5.39	Constant Speed Detection Range	Set the bandwidth of constant speed detection range	0.0~10.0	0.1Hz	2.0	111
F5.40	Frequency Detection Range	Set the bandwidth of frequency detection range	0.0~10.0	0.1Hz	2.0	111
F5.41	Frequency Detection Level	Set the frequency detection level of multi-function terminal	0.0~400.00	0.1Hz	0.0	111

The color as [ ] means functions can be set during the operation.

F6 Special Parameters

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F6.00	Operation Mode for Sequential Operation Control	0: Sequential operation control disable. 1: Sequential operation control operates one cycle and stops. 2: Sequential operation control operates in circulation. 3: Sequential operation control operates one cycle and stops (by STOP key on the operation panel). 4: Sequential operation control operates in circulation (by STOP key on the operation panel).	0~4	—	0	112
F6.01	Cycle Times for Sequential Operation Control	1~9998: The number of cycle times of sequential operation control circulation. 9999: Infinite cycles of sequential operation control circulation.	1~9999	—	5	112
F6.02	Sequence of One Operation Cycle for Sequential Operation Control	0: Single direction 1: Dual direction	0, 1	—	0	112
F6.04	Hold Time Unit for Sequential Operation Control	0: Second 1: Minute 2: Hour	0~2	—	0	112
F6.05	Accel/Decel Time of Sector 1 of Sequential Operation Control	Set the accel/decel time of sector 1 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.06	Hold Time of Sector 1 of Sequential Operation Control	Set the hold time of sector 1 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.07	Accel/Decel Time of Sector 2 of Sequential Operation Control	Set the accel/decel time of sector 2 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.08	Hold Time of Sector 2 of Sequential Operation Control	Set the hold time of sector 2 of sequential operation control.	0.0~360.0	0.1sec	0.0	113

The color as ▭ means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F6.09	Accel/Decel Time of Sector 3 of Sequential Operation Control	Set the accel/decel time of sector 3 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.10	Hold Time of Sector 3 of Sequential Operation Control	Set the hold time of sector 3 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.11	Accel/Decel Time of Sector 4 of Sequential Operation Control	Set the accel/decel time of sector 4 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.12	Hold Time of Sector 4 of Sequential Operation Control	Set the hold time of sector 4 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.13	Accel/Decel Time of Sector 5 of Sequential Operation Control	Set the accel/decel time of sector 5 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.14	Hold Time of Sector 5 of Sequential Operation Control	Set the hold time of sector 5 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.15	Accel/Decel Time of Sector 6 of Sequential Operation Control	Set the accel/decel time of sector 6 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.16	Hold Time of Sector 6 of Sequential Operation Control	Set the hold time of sector 6 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.17	Accel/Decel Time of Sector 7 of Sequential Operation Control	Set the accel/decel time of sector 7 of sequential operation control.	0.0~360.0	0.1sec	0.0	113

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F6.18	Hold Time of Sector 7 of Sequential Operation Control	Set the hold time of sector 7 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.19	Accel/Decel Time of Sector 8 of Sequential Operation Control	Set the accel/decel time of sector 8 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.20	Hold Time of Sector 8 of Sequential Operation Control	Set the hold time of sector 8 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.21	Accel/Decel Time of Sector 9 of Sequential Operation Control	Set the accel/decel time of sector 9 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.22	Hold Time of Sector 9 of Sequential Operation Control	Set the hold time of sector 9 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.23	Accel/Decel Time of Sector 10 of Sequential Operation Control	Set the accel/decel time of sector 10 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.24	Hold Time of Sector 10 of Sequential Operation Control	Set the hold time of sector 10 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.25	Accel/Decel Time of Sector 11 of Sequential Operation Control	Set the accel/decel time of sector 11of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.26	Hold Time of Sector 11 of Sequential Operation Control	Set the hold time of sector 11 of sequential operation control.	0.0~360.0	0.1sec	0.0	113

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F6.27	Accel/Decel Time of Sector 12 of Sequential Operation Control	Set the accel/decel time of sector 12 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.28	Hold Time of Sector 12 of Sequential Operation Control	Set the hold time of sector 12 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.29	Accel/Decel Time of Sector 13 of Sequential Operation Control	Set the accel/decel time of sector 13 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.30	Hold Time of Sector 13 of Sequential Operation Control	Set the hold time of sector 13 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.31	Accel/Decel Time of Sector 14 of Sequential Operation Control	Set the accel/decel time of sector 14 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.32	Hold Time of Sector 14 of Sequential Operation Control	Set the hold time of sector 14 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.33	Accel/Decel Time of Sector 15 of Sequential Operation Control	Set the accel/decel time of sector 15 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.34	Hold Time of Sector 15 of Sequential Operation Control	Set the hold time of sector 15 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.35	Accel/Decel Time of Sector 16 of Sequential Operation Control	Set the accel/decel time of sector 16 of sequential operation control.	0.0~360.0	0.1sec	0.0	113

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F6.36	Hold Time of Sector 16 of Sequential Operation Control	Set the hold time of sector 16 of sequential operation control.	0.0~360.0	0.1sec	0.0	113
F6.37	Direction Control of Sequential Operation Control	Sequential operation control direction is defined with binary format. X_{16}~X_1 (Xn=0: forward；Xn=1: reverse) Xn: N_{th} operation direction	0~FFFF	—	0	113
F6.40	PID Control Selection	0: PID control disable 1: Forward control, D postposition 2: Reverse control, D postposition 3: Forward control, D preposition 4: Reverse control, D preposition	0~4	—	0	117
F6.41	Feedback Signal Detection	0: Open loop detection disable 1: Open loop detection enable (noFb)	0,1	—	1	118
F6.42	Feedback Signal Filter	Filter the feedback signal.	0~255	—	10	118
F6.43	PID Buffer Space	Set the buffer space of PID output value.	0~255	—	2	118
F6.44	Proportional Gain(P)	Set the gain value for discrepancy. (0.0: P control disabled).	0.0~25.0	0.1	1.0	118
F6.45	Integration Time(I)	Set the integration time for discrepancy. (0.0: I control disabled)	0.0~100.0	0.1sec	1.2	118
F6.46	Derivative Time(D)	Set the derivative time for discrepancy. (0.0: D control disabled)	0.00~2.50	0.01sec	0.00	118
F6.47	Integration Upper Limitation	Set the upper limitation value of integrator.	0~200% of maximum frequency	1%	100	118
F6.48	Integration Lower Limitation	Set the lower limitation value of integrator.	-100~100% of maximum frequency	1%	0	118
F6.49	Integrator Initialized Value	Set the initial value of the integrator before PID starts.	-100~100% of maximum frequency	1%	0	118
F6.50	PID Output Upper Limit	Set the PID control output frequency	0.00~1.00	0.01	1.00	118
F6.51	PID Compensation Gain	(PID command – PID feedback)* F6.51	0.1~8.0	—	1.00	119

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F6.52	Propotional Gain(P) Selection	0: postposition P 1: preposition P	0~1	—	1	119
F6.53	Feedback Signal Selection	0: Direct signal 1: Reverse signal	0~1	—	0	119
F6.54	Derivative Time of Feedback	Set the derivative time for feedback signal.	0.00~2.50	0.01sec	0.00	119
F6.55	Communication Address	The host uses the address to send and receive messages from the drive (0: Disable)	0~254	—	0	121
F6.56	Baud Rate	0: 4800bps 1: 9600bps 2: 19200bps 3: 38400bps	0~3	—	1	121

The color as [ ] means functions can be set during the operation.

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F6.57	Communication Protocol	0: 8,N,2 1: 8,E,1 2: 8,O,1 3: 8,N,1	0~2	—	1	121
F6.58	Communication Overtime (Cot)	When the data transmission during communication transmission is interrupted, has no data transmitting, or delays, drive displays “Cot” message (0.0: Communication overtime disable)	0.0~100.0	0.1sec	0.0	122
F6.59	Communication Overtime Disposal	0: Warning (Cot): Continue operation. 1: Warning (Cot): Ramp to stop 2: Warning (Cot): Coast to stop	0~2	—	0	122
F6.60	Multi-Function Input Selection	0: Multi-function inputs from multi-function terminals 1: Multi-function inputs from communication control	0, 1	—	0	122
F6.61	PID Sleep Selection	0:Disable 1:Enable	0~1	—	0	122
F6.62	PID Wakeup Initial Frequency	Setting the frequency for PID Wakeup Process (1.00=max.output frequency)	0.00~1.00	0.01	0.00	122
F6.63	PID Wakeup Delay Time	Setting the time for PID Wakeup Process	250	1sec	0	122
F6.64	PID Sleep Initial Frequency	Setting the frequency for PID Sleep Process (1.00=max.output frequency)	0.00~1.00	0.01	0.00	122
F6.65	PID Sleep Delay Time	Setting the time for PID Sleep Process	0~250	1sec	0	123
F6.66	PID Output lower limit	PID control for output frequency	0.00~1.00	0.01	0.00	123

(Note):

1. The default setting of 50Hz
2. The default setting of 60Hz
3. Specifications of 100V series
4. Specifications of 200V series
5. Specifications of 400V series

6. The default value is “105” for 2003B3/4005B3 models and the default value is “90” for remained models.
7. + : Represents a contact (Normal open), ─ : Represents b contact (Normal close)
   UP/DOWN control wiring must not exceed over 20m when multi-function terminals are used for UP/DOWN control.
8. When the setting value of switching frequency(F1.21) exceeds “4”, the drive must be de-rating for usage or selecting the higher capacity of drive.

The color as [ ] means functions can be set during the operation.

No Text on This Page

Chapter 5 Parameter Setting Description

F0 System Parameters

【F0.00】 Drive Information

a. The function can display the horse power and software version. Check if the capacity of drive corresponding to the drive by this function.

b. This manual and software version must be identical.
The drive with different software version cannot duplicate drive parameters, or the drive operation panel will display Wr_F.

c. The descriptions of LED indicators shows the different displays of the operation panel, and LED indicator displays are shown as below table.

d. The left 2th bits of drive model number for 110V/ 200V single-phase series displays ”S”.

Hz	V	A	
○	○	○	Software version
●	○	○	Drive model number
○	●	○	Drive rated current
●	●	○	Drive running hours
○	○	●	Drive supply power time(Hours)
●	○	●	Software checksum code

【F0.01】 Parameter Lock

a. Protect the parameter settings to prevent parameter settings from unexpected adjustments causing the system operated incorrectly.

b. The parameter setting as the following
0: Parameters are changeable
1: Parameters are not changeable

c. After locking the parameters, the user can not change the password by F0.02.

【F0.02】 Parameter Password Setting

a. Preventing any unqualified personnel from setting the invalid parameters.

b. To protect the parameter settings, select function F0.02 and set the protection password of parameters.
After setting the password by number 1~9999, the operation panel displays“0.0.0.”.
Parameters cannot be changed after setting the passwords.

【F0.03】 Parameter Password Unlock

a. Select the function F0.03 to disable the parameter password setting (F0.02).
If the input passwords are correct, the operation panel displays “U.L.0.0.“.
When user inputs wrong parameter passwords, the panel will display “P.W.F.1” at 1st time; and then display “P.W.F.2”(PWF2) at 2nd time, and display “P.W.F.3”(PWF3) at 3rd time.

b. If user inputs wrong parameter passwords for 3 times, the drive must be power off and restart to re-begin the password decoding process.

【F0.04】 Reserved

【F0.05】 Power Source

a. The power source setting as the following table

Power source specification	Range
100V series	100.0~120.0V
200V series	190.0~240.0V
400V series	340.0~480.0V

b. The power source setting must be according to the actual power source and the setting will affect the activation validity of LE, LE1 and the validity of V/F outputs.

【F0.08】 Fault Record 1

|

|

【F0.13】 Fault Record 6

a. Record the latest 6 times of fault messages.

b. The fault messages selection are listed as the following:
   0: Fault code
   1: Output current at drive fault
   2: DC bus voltage at drive fault
   3: Output frequency at drive fault

【F0.19】 Reserved

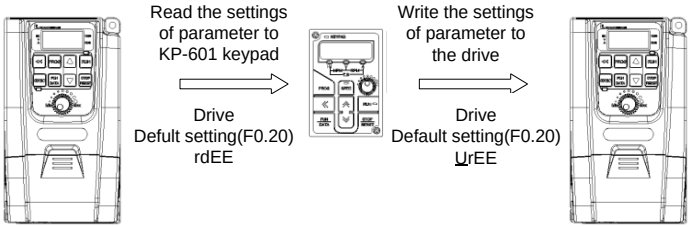
【F0.20】 Default Setting

a. Default settings are shown as the below table:

0.0.0	Disable
CLr	Clear fault records
dF60	Default the factory setting of 60Hz (All SAv setting will be clear)
dF50	Default the factory setting of 50Hz (All SAv setting will be clear)
SAv	Store setting
rES	Resume setting
rdEE	Read the parameters from drive to digital keypad
UrEE	Write the parameters from digital keypad to drive

b. After setting all parameters, select SAv to save all settings in case for restoring parameters.

c. For parameter duplication, KP-601 must be connected to the drive when rdEE and UrEE parameters for parameter duplication are used. This also can be applied for parameter duplication of multiple drives to save the setting time.



The drive parameter settings can be written to the keypad (KP-601), and these parameter settings in the keypad can be written to another drive as well. This duplication of parameter settings is suitable for multiple drives with same drive settings. Be caution of the software version (see parameter F0.00) – Drives must have the same software version to do all parameter inter-copy process.

F1 Operation Parameters

【F1.00】 Start Command Selection

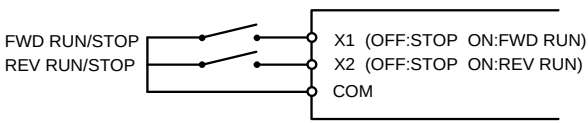
a. F1.00 = 0

(I) Motor forward and reverse directions are controlled by multi-function input terminals(X1~X6).

(II) Start and motor rotating direction commands are controlled by multi-function input terminals(X1~X6) for forward and reverse command.

(III) The motor stops running when the multi-function input terminals are set (closed) or open simultaneously.

Example: Parameter value: F5.19=22 (define X1 as forward command), F5.20=23 (define X2 as reverse command) and the drive control is shown as the below diagram.

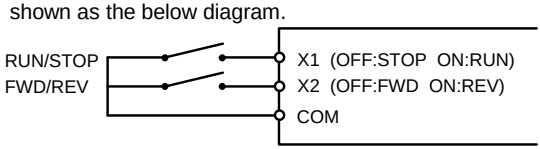


b. F1.00 = 1

(I) Motor forward and reverse directions are controlled by multi-function input terminals (X1~X6).

(II) Start command by forward command (defining X1~X6 as forward command) and motor rotating direction by reverse command (defining X1~X6 as reverse command).

Example: Parameter value: F5.19=22(define X1 as forward command), F5.20=23(define X2 as reverse command) and the drive control is shown as the below diagram.



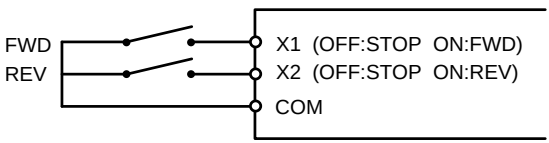
c. F1.00 = 2

(I) Motor rotating direction are controlled by multi-function input terminals (X1~X6).

(II) Start command by “RUN” key of the operation panel and the rotation direction by forward or reverse command defined by multi-function input terminals (X1~X6).

(III) The motor stops running when the multi-function input terminals (forward/reverse commands) are set closed or open simultaneously.

Example: Parameter value: F5.19=22(define X1 as forward command), F5.20=23(define X2 as reverse command) and the drive control is shown as the below diagram.



d. F1.00 = 3

(I) Start command by “RUN” key of the operation panel and the motor rotates at the forward direction (clockwise).

(II) Forward and reverse commands are disabled.

e. F1.00 = 4

(I) Start command by “RUN” key of the operation panel and the motor rotates at the reverse direction (counterclockwise)

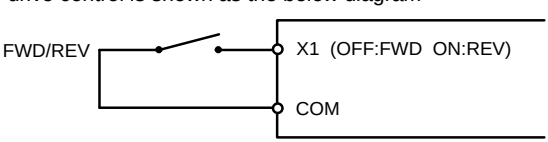
(II) Forward and reverse commands are disabled.

f. F1.00 = 5

(I) Multi-function input terminals (X1~X6) define as the reverse command and the motor runs at the reverse direction (counterclockwise).

(II) Start command by “RUN” key of the operation panel and the rotation direction is controlled by reverse command (defining multi-function input terminals as reverse command).

Example: Parameter value: F5.19=23 (define X1 as the reverse command) and drive control is shown as the below diagram



g. F1.00 = 6~7

Reserved

h. F1.00 = 8
(I) Start command and the motor rotating direction are controlled by communication.
(II) Forward and reverse commands are disabled.

i. F1.00 = 9
(I) Multi-function input terminals(X1~X6) define as the reverse command and the motor runs at the reverse direction (counterclockwise).
(II) Start command is given by communication control, and the motor rotating direction is defined by reverse command (defined by multi-function input terminals).

j. F1.00 = 10
(I) Multi-function input terminals(X1~X6) define as the reverse command and the motor runs at the reverse direction (counterclockwise).
(II) Start command is given by forward command (defined by multi-function input terminals) and the motor rotating direction is controlled by communication.
(III) Forward and reverse commands are disabled.

k. F1.00 = 11
(I) Start command by “RUN” key of the operation panel and the motor rotating direction by communication.
(II) Forward and reverse commands are disabled.

※F1.00 = 0 or 2
If the forward and reverse commands are active at the same time, the operation panel will display “------“ along with inter-flashing display value at monitor mode. If the forward and reverse commands are set (closed) simultaneously, the operation panel will be flashing to display “dtF” in the monitor mode.

※When the motor rotation direction is set to reverse, the output frequency will display “-“ and the reversed indicator will ON.

【F1.01】 Primary Frequency Command Selection
a. F1.01 = 0
The frequency is controlled by analog input terminal (select the analog input source: “Pot knob”, AI by defining function F1.03)
(I) “Pot knob”:
For the gain and bias ranges of frequency settings, please refer to functions F5.03 and F5.04.
(II) AI-GND:
For the gain and bias ranges of frequency settings, please refer to functions F5.05 and F5.06.

Select the input mode by JP1
JP1→I mode:
The range of input current is 4~20mA or 0~20mA (selection by function F5.02)
JP1→V mode:
The range of input voltage is 2~10V or 0~10V (selection by function F5.02)

b. F1.01 = 1
The frequency command can be set by function F2.00 using operation panel and by [▲][▼] key in the monitor mode as well.

c. F1.01 = 2
RPM command is set using the operation panel.

d. F1.01 = 3
MPM command is set using the operation panel.

e. F1.01 = 4
UP/DOWN command control.
Selection by multi-function input terminal X1~X6(UP command, DOWN command, Clear the frequency command by UP/DOWN, Confirm the frequency command by UP/DOWN).

f. F1.01 = 5
Frequency command is set by communication control.

※ F1.01 = 1~3
Press [▲] or [▼] key one time in the monitor mode. The value of the frequency command in the panel display will be blinking but not changed. Press [▲] or [▼] key again to change frequency command.

【F1.02】 Secondary Frequency Command Selection
Set functions F5.19~F5.24 as ±19, and switch the primary/secondary frequency command by multi-function input terminals.

The settings are listed as the following: (see the parameter description of F1.01)
0: Analog input setting
1: Operation panel setting
2: UP/DOWN setting

【F1.03】 Analog Input Selection
The settings are listed as below: (see the parameter description of F5.00~F5.01)
0: "Pot knob"＋AI
1: "Pot knob"－AI
2: AI－"Pot knob"
3: "Pot knob" or AI (switched by multi-function input terminals)
4: "Pot knob"
5: AI
※ "Pot knob" is on the operation panel, and AI is the analog input terminal.

【F1.04】"Pot knob" Command Source Selection
The settings are listed as below:
0: From drive's operation panel.
1: From external keypad (KP-601).

【F1.05】 Validity of STOP of the Operation Panel

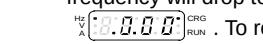
a. The settings are listed as below:

0: When the start command is controlled by multi-function terminal, the STOP key is disabled.

1: When the start command is controlled by multi-function terminal, the STOP key is enabled.

b. The operation of STOP key

(I) For emergency stop:

When the start command and the motor rotating direction of drive are controlled by multi-function input terminal (F1.00=0, 1 or 10), press “STOP” key on the operation panel during the drive operation and the drive output frequency will drop to 0.00Hz, and the operation panel will display  . To restart the drive is to release the start command and restart the drive again.

(II) For drive stop (natural stop):

When F1.00=2, 3 or 4, 11, start command is active by RUN key; stop command is active by STOP/RESET key.

【F1.06】 Frequency Command Selection (operation panel)

The settings are listed as below:

0: The frequency command cannot be changed in the monitor mode to avoid the fault occurred by changing the frequency in the monitor mode.

1: The frequency command can be changed in the monitor mode.

【F1.07】 Frequency Command Auto-Storing (operation panel)

The settings are listed as below:

0: The frequency command setting does not auto-store in the monitor mode.

1: The frequency command setting is auto-stored after 3 minutes in the monitor mode.

【F1.08】 Main Display Selection

a. The settings are listed as below:

1: Output frequency
2: Frequency command
3: Output voltage
4: DC bus voltage
5: Output current
6: Display mode 6 (F1.09)
7: Display mode 7 (F1.10)
8: Display mode 8 (F1.11)

b. Above display modes can be selected as the primary display and other display modes becomes secondary display modes.

c. When the drive is idle without any operation for 3 minutes, the secondary display will be automatically changed to the primary display mode.

【F1.09】 Display Mode 6
| |
【F1.11】 Display Mode 8
The settings are listed as below:
0: Terminal status
1: Temperature of heat sink
2: Motor rotation speed(RPM)
3: Machine speed(MPM)
4: The sector of sequential operation control
5: The cycle of sequential operation control
6: Counting value
7: Current limit level
8: Primary frequency command
9: Secondary frequency command
10: PID command
11: PID feedback

【F1.12】 Number of Motor Poles
a. The settings are listed as below:
2P, 4P, 6P, 8P, 10P
b. The rotation speed display in the monitor mode

$$\text{Motor speed(RPM)} = \frac{120}{\text{Motor poles number(F1.12)}} \times \text{Output frequency}$$

【F1.13】 Machine Speed Ratio
The machine speed display in the monitor mode

Machine speed = Machine speed ratio (F1.13) × Output frequency

【F1.14】 Digits of Decimal Value (Machine Speed)
Set the digits of decimal values (the range from 0~3 digits behind the decimal point) to display the higher resolution of machine speed for observation of machine speed.

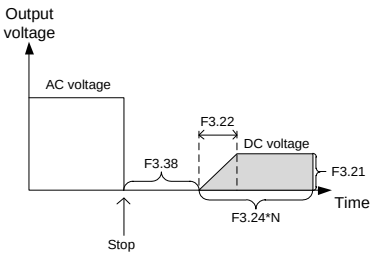
【F1.17】 SPEC Key Setting
The setting of SPEC key is similar as multi-function input setting; see the function F5.19 ~ F5.24 for SPEC key setting reference.

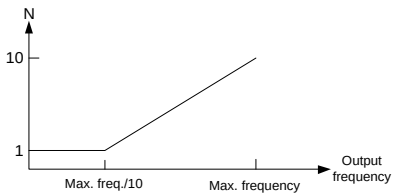
【F1.18】 SPEC Key Self-Holding Function
SPEC key self-holding function
0: Disable
1: Enable
Example: SPEC key is set as reverse command.
- Start command(F1.00) is set as 5 (Start the drive by operation panel)
- Set function F1.17 as 23 (reverse command)
- Set function F1.18 as 1 for holding operation and press “SPEC” key during the drive operation, and motor will run in reverse direction.

【F1.19】 Stop Mode

a. The settings are listed as below:
   0: Ramp to stop + DC braking (see functions F3.21 ~ F3.35)
   1: Coast to stop (inertia stop)
   2: Coast to stop + DC braking

b. When F1.19=2, the stop operation is shown in the below diagram:





c. When the output current is abnormal at DC braking, adjust the suitable time by function F3.38 to release the remained magnet of rotor and then to perform DC braking.

【F1.20】 Reverse Prohibition

The settings are listed as below:
   0: Reverse rotation allowed
   1: Reversal rotation NOT allowed

【F1.21】 Switching Frequency

a. The settings are listed in the below table:

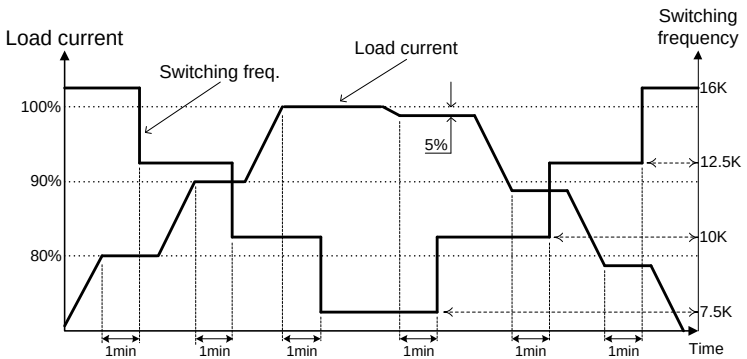
Setting Value	Switching frequency
0	800Hz
1	2.5kHz
2	5kHz
3	7.5kHz
4	10kHz
5	12.5kHz
6	16kHz

b. De-rate the output current of drive if the switching frequency setting value is over 4.

c. The higher switching frequency has less noise. But using higher switching frequency must consider the cable length between drive and motor and must be adjusted according the connection distance between drive and motor (see wiring installation in section 2-3-4)

d. Switching frequency limit: The limit of switching frequency will be auto-adjusted according to the load condition (see the below diagram for load condition vs. switching frequency auto-de-rating).

e. The setting value of switching frequency is higher and the motor noise is lower.



【F1.22】 Overload Decrease Switching Frequency

The settings are listed as below:

0：The switching frequency will not be adjusted by the load of current.

1：The swithching frequency will be auto-adjusted according to the load of current.

【F1.23】 Number of Tolerance to Drive Fault

a. Function: Set the number of tolerance to drive fault conditions when faults are occurred for OC, OE, GF during the certain time period. The drive will display fault message on the operation panel and restart again when the numbers of drive faults are over the designated tolerance value.

b. When the number of tolerance is set to 0, the drive will not restart after the fault occurs.

F2 Frequency Parameters

【F2.00】 Primary Speed (Preset Speed 1)
　　|　　　　|
【F2.15】 Preset Speed 16

【F2.16】 Jog Speed

a. Setting range: 0.00~400.00Hz

b. The settings are listed as below:
(I) Set the acceleration / deceleration time of multi-speed (F2.18~ F2.28)
(II) Set multi-function input terminals(F5.19~ F5.24)

c. Preset speed table

Jog speed command	Multi-speed level 4 command	Multi-speed level 3 command	Multi-speed level 2 command	Multi-speed level 1 command	Name
ON	×	×	×	×	Jog speed
OFF	OFF	OFF	OFF	OFF	Primary Speed (Preset Speed 1)
OFF	OFF	OFF	OFF	ON	Preset Speed 2
OFF	OFF	OFF	ON	OFF	Preset Speed 3
OFF	OFF	OFF	ON	ON	Preset Speed 4
OFF	OFF	ON	OFF	OFF	Preset Speed 5
OFF	OFF	ON	OFF	ON	Preset Speed 6
OFF	OFF	ON	ON	OFF	Preset Speed 7
OFF	OFF	ON	ON	ON	Preset Speed 8
OFF	ON	OFF	OFF	OFF	Preset Speed 9
OFF	ON	OFF	OFF	ON	Preset Speed 10
OFF	ON	OFF	ON	OFF	Preset Speed 11
OFF	ON	OFF	ON	ON	Preset Speed 12
OFF	ON	ON	OFF	OFF	Preset Speed 13
OFF	ON	ON	OFF	ON	Preset Speed 14
OFF	ON	ON	ON	OFF	Preset Speed 15
OFF	ON	ON	ON	ON	Preset Speed 16

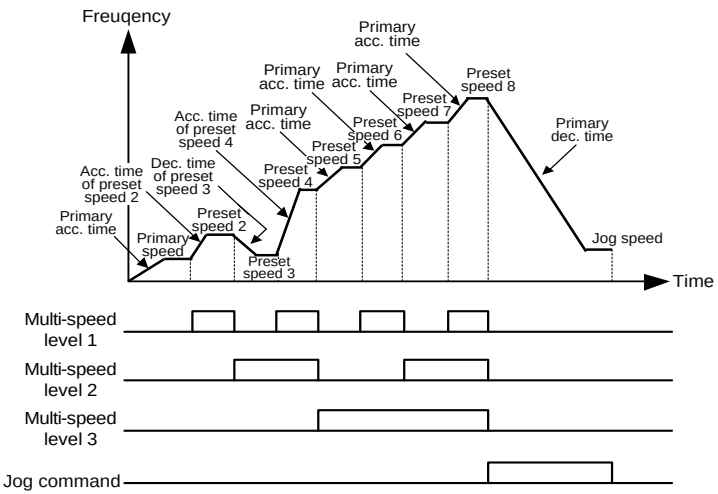
※ “×”: Don’t care.

※Jog speed has the highest priority. That is, when the jog speed is on, all other speed command are void.

※Jog speed and the multi-speed commands programmed by functions F5.19~ F5.24 to define multi-function input terminals (X1~X6) are given by input signals ON and OFF to the multi-function input terminals.

※ON: “a” contact (normal open) is set and “b” contact (normal close) is open.
OFF: “a” contact (normal open) is open and “b” contact (normal close) is set.

d. Multi-speed and acceleration/deceleration time



※The above illustration is an example of preset speed 1~8. The acceleration / deceleration time of preset speed 5~8 and jog speed are depend on the setting of primary acceleration / deceleration time.

※When the drive stops, and the jog command is ON, the motor is running at the jog speed – no start command is required.

※The analog input terminals (“Pot knob”, AI) are disabled at multi-speed setting (primary speed excluded).

※As for the accel/decel time, please see the parameter setting (F2.18~ F2.28).

【F2.17】 Reference Frequency of Acceleration/Deceleration Time
Set the corresponding frequency of accel/decel time.
The setting range: 0.01~400.00Hz

【F2.18/F2.19】 Primary Acceleration / Deceleration Time
　　|　　|
【F2.24/F2.25】 Acceleration / Deceleration Time of Preset Speed 4
【F2.26/F2.27】 Secondary Acceleration / Deceleration Time

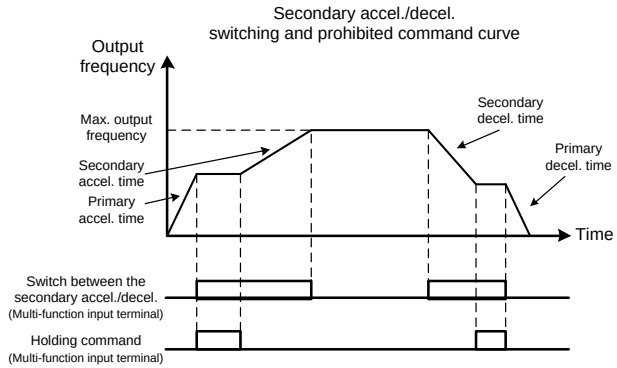
a. The acceleration/deceleration time of preset speed is the time that the frequency starting from 0Hz accelerates to the reference frequency of acceleration/deceleration time (F2.17). Multi-speed command can control the multi-speed and acceleration/ deceleration time of preset speeds. The setting range: 0.0~3200.0 sec.

b. The acceleration/deceleration time setting of primary speed, preset speed 5 ~ preset speed 16, and jog speed are set by primary acceleration/deceleration time

(F2.18/F2.19).

c. The secondary acceleration/deceleration time has the higher control priority, and the command is input by the multi-function input terminals.

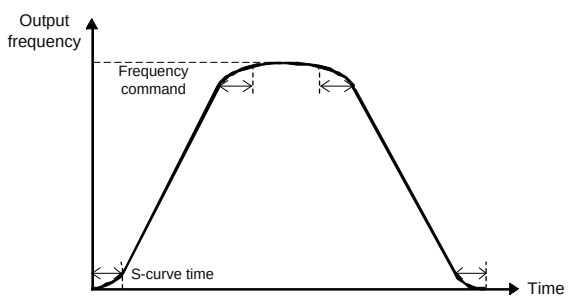
The illustration is shown as below:



d. The prohibition of acceleration/deceleration command are ineffective at the STOP command.

【F2.28】 Set S-curve for Accel/Decel Time

Setting the S-curve for the acceleration/deceleration time is to slow the acceleration and deceleration time at start and stop. For example: To ease the impact of the fallen object on the conveyor line or elevator.

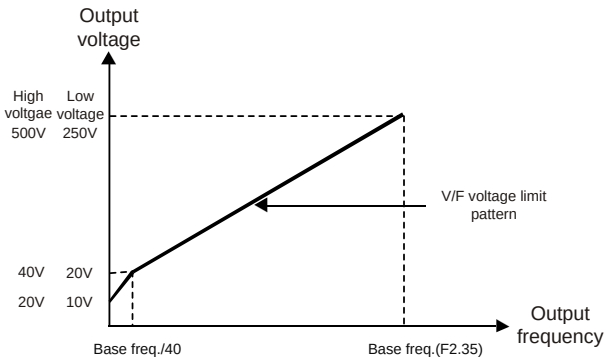


【F2.30】 Limitation of Output Voltage

a. The setting is as below:
0: V/F pattern output voltage: No limit
1: V/F pattern output voltage has the limit

b. The main purpose by setting “1” is to limit the output voltage of V/F pattern that cannot be over the limitation pattern.(100V/200V series with 250.0V; 400V series

with 500.0V) as below figure:



【F2.31】 V/F Pattern Selection

a. The settings are listed as below:

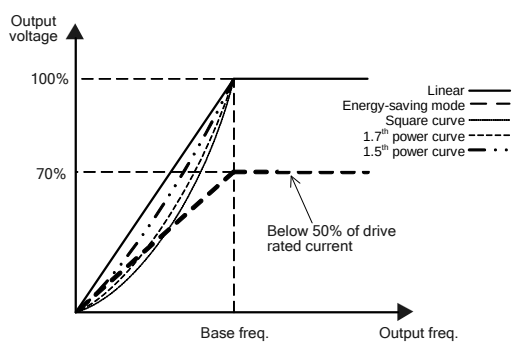
0: Linear

1: Energy saving mode (Auto-adjust V/F according to the loads)

2: Square curve

3: 1.7th power curve

4: 1.5th power curve



b. F2.31 = 1; When the load current is small, auto-adjusting the output voltage of drive can save the energy.

c. F2.31 = 2 ~ 4 can be used for fan, pump applications to save the energy.

【F2.32】 Maximum Output Frequency

Set the maximum operation frequency of the drive, and the setting range is 0.1~400.00Hz

【F2.33】 Starting Frequency
Set the starting frequency of the drive, and the setting range is 0.1~10.0Hz

【F2.34】 Starting Voltage
Set the output voltage of starting frequency to give more power to overcome the load inertia.
100V/200V series range: 0.1~50.0V
400V series range: 0.1~100.0V

【F2.35】 Base Frequency
Motor's base frequency. Set the frequency bases on the nameplate of motor. The setting range: 0.1~400.00Hz

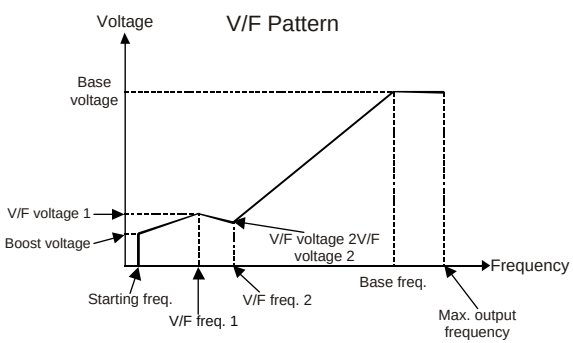
【F2.36】 Base Voltage
Set the base voltage bases on the nameplate of motor.
100V/200V series range: 0.1~255.0V
400V series range: 0.1~510.0V

【F2.37】 V/F Frequency 1
Frequency at the first point of V/F pattern. The setting range is 0.0~399.9Hz

【F2.38】 V/F Voltage 1
Voltage at the first point of V/F pattern
100V/200V series range: 0.0~255.0V
400V series range: 0.0~510.0V

【F2.39】 V/F Frequency 2
Frequency at the second point of V/F pattern(refer to the setting of F2.37)

【F2.40】 V/F Voltage 2
Voltage at the second point of V/F pattern(refer to the setting of F2.38)



※The interrelationships are as follows:

(I) Base frequency＞V/F frequency 2＞V/F frequency 1＞Start frequency

(II) V/F frequency 2＜V/F frequency 1, the V/F frequency (voltage) 2 have no effect

(III) When V/F frequency 1 and 2＜Starting frequency, the V/F frequency (voltage) 1 and 2 have no effect

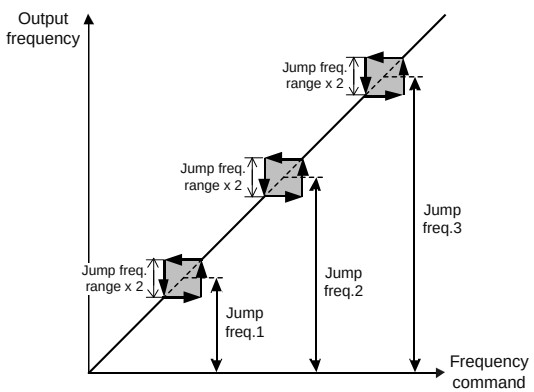
(IV) No limitation between F2.34, F2.36, F2.38, F2.40

【F2.42】 Jump Frequency 1
|
【F2.44】 Jump Frequency 3

In order to avoid the mechanical resonance, these parameters allow resonant frequency to be jumped. The setting range is 0.0~400.00Hz

【F2.45】 Jump Frequency Range

There are three sets of jump frequency and one type of jump frequency interval. The setting range is 0.0~25.5Hz



【F2.47】 Frequency Upper Limit

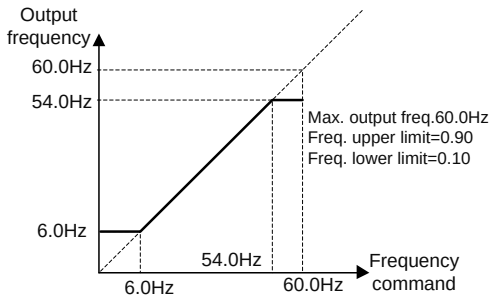
Set the ratio of the frequency upper limit (1.00=maximum output frequency), and the setting range is 0.00~1.00

Output frequency upper limit = Frequency upper limit (F2.47) × Maximum output frequency (F2.32)

【F2.48】 Frequency Lower Limit

Set the ratio of the frequency lower limit (1.00=maximum output frequency), and the setting range is 0.00~1.00

Output frequency lower limit = Frequency lower limit (F2.48) × Maximum output frequency (F2.32)



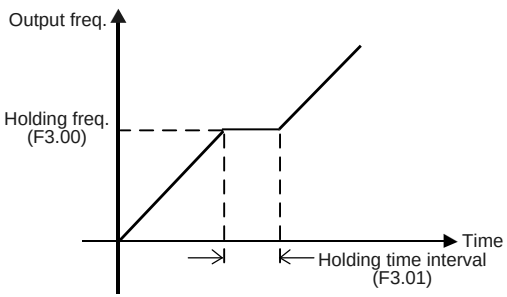
F3 Control Parameters

【F3.00】 Holding Frequency

The drive accelerates to the holding frequency and then operating in constant speed. The setting range is 0.00~400.00Hz

【F3.01】 Holding Time Interval

The operation time of drive running at the holding frequency, and the setting range is 0.0~360.0sec. Using the frequency setting and holding time is to prevent the over slip of motor causing over-current and stall.



【F3.03】 Stall Prevention Level at the Acceleration

If stall is occurred during acceleration, the motor keeps running at the constant speed (200%: Off), and the setting range is 30%~200% of drive's rated current

【F3.04】 Stall Prevention Level at the Constant Speed

If stall is occurred at constant speed running, the motor decelerates (200%: Off), and the setting range is 30%~200% of drive's rated current

【F3.05】 Acceleration Time for Stall Prevention at the Constant Speed

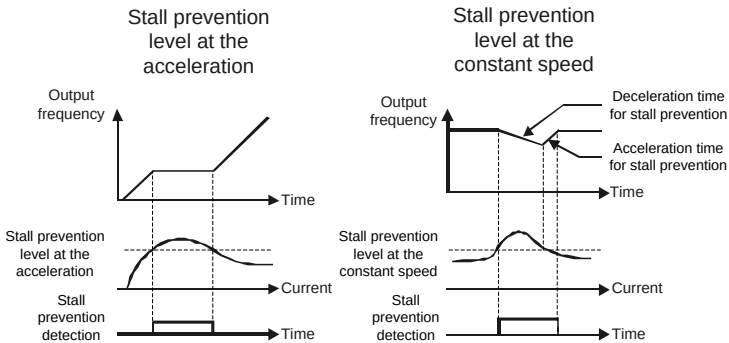
Setting the acceleration time for the stall prevention of the constant speed, and the setting range is 0.1~3200.0 sec.

【F3.06】 Deceleration Time for Stall Prevention at the Constant Speed

Setting the deceleration time at the stall prevention of the constant speed, and the setting range is 0.1~3200.0 sec.

【F3.07】 Deceleration Stall Prevention

0: Deceleration stall prevention: Disabled
1: Deceleration stall prevention: Enabled



a. The function of the stall prevention during the deceleration is to maintain a constant speed when the deceleration is stalling.

b. When connecting a dynamic brake unit, F3.07 function can be disabled according to the operation requirement

c. If the DC bus voltage of the drive is higher than the dynamic brake voltage level when drive stops, the operation panel or external keypad will display “Hv”. “RUN” key of the operation panel and digital keypad can’t start the drive. If the DC bus voltage is less than the dynamic brake voltage level, the drive will be automatically recovered and the display will be back to the main display.

【F3.09】 Motor Slip Compensation

a. The slip of motor is variable depending on the load. When the load current is over the level of slip compensation, the drive will compensate the output frequency to output constant speed. The setting range is -59.9~60.0Hz.

b. Compensation frequency:

$$\text{Freq. compensation} = \frac{\text{Loading current} - (\text{no load current (F4.09)})}{\text{Rated current(F4.08)} - (\text{no load current (F4.09)})} \times \text{Slip compensation(F3.09)}$$

【F3.10】 Frequency Response Time of Motor Slip Compensation

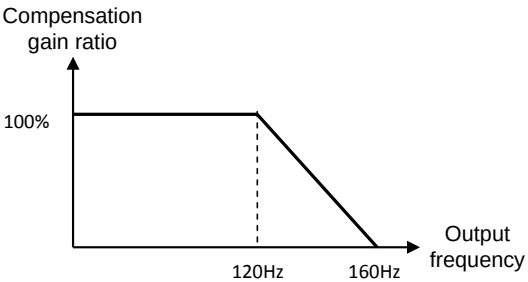
a. Setting the frequency response time of motor slip compensation. The unit is 5ms.

b. Decreasing the setting value when the response time is too slow. When the response time of motor slip compensation is too fast causing the rotational speed unstable, increasing the setting value. The setting range is 1~255

【F3.12】 Automatic Boost Voltage Range

a. This function bases on the load condition to boost the output voltage and to prevent any insufficient voltage at heavy-duty load. If the setting value is too high, this may result over compensation voltage and over output current to motor. The setting range is 0.0~25.5

b. When the output frequency of drive is over 120Hz, the de-rating curve of compensation is shown as below figure:



c. Adjust the function F3.12 to the lowest value of the current consumption (highest power factor). Commonly, the setting value of F3.12 is within 0~3 for common loads. Over adjustment can cause the motor temperature increased and over current.

【F3.13】 Response Time of Automatic Boost Voltage

a. Set the response time of automatic boost voltage with the unit: 1ms.

b. Increase the response time when the motor is vibrating. And decrease the response time when the response of motor is too low. The setting range is 1~255.

【F3.15】 Voltage Compensation for Current Oscillation

Adjust the compensation voltage for the current oscillation, and the setting range is 0.00~2.55

【F3.16】 Response Time of Voltage Compensation for Current Oscillation

Response time of voltage compensation for current oscillation is with the unit of 5ms. When driving the motor, motor's specification or mechanical load can cause the current oscillation and even can cause over current to drive. Properly adjusting the response time can suppress the current oscillation. The setting range is 0~250.

【F3.18】 Automatic Voltage Regulation (AVR)

a. Function: When the power source is fluctuation, the drive will adjust output voltage automatically to stabilize the V/F output control.

b. When AVR is set to "0", the reference voltage bases on the setting of power source voltage (F0.05).

c. Setting range: 0: Disable 1: Enable

【F3.19】 Response Time of AVR

Set the response time of AVR. The setting range is 0~255.

【F3.21】 DC Braking Level

a. Set the current level of DC braking.

b. The setting range is 0~150% of drive rated current.

【F3.22】 DC Braking Response Time

According to the DC braking conditions to adjust the response time. The setting range is 0~255.

【F3.23】 Time Interval of DC Braking at Start

Set the DC braking for motor random running at start. The setting range is 0.0~60.0.

【F3.24】 Time Interval of DC Braking at Stop

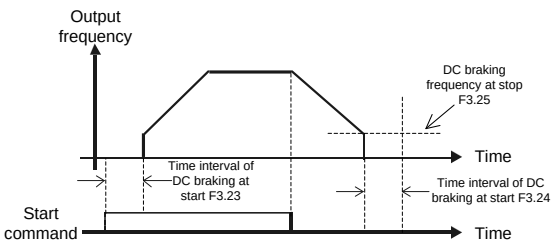
a. The setting of time interval of DC braking is to avoid inertial run of motor at stop.

b. Set the DC braking of ramp to stop. The setting range is 0.0~60.0 sec.

【F3.25】 DC Braking Frequency at Stop

a. Set the DC braking frequency at stop. The setting range is 0.1~60.0.

b. If changing the setting value of frequency below the starting frequency(F2.33), the drive will stop by DC braking, and the DC Braking Frequency at Stop(F3.25) will be not active.



【F3.27】 Active Level of Dynamic Brake

a. The motor will exert the regenerated voltage to the drive causing the DC bus voltage increased during the motor decelerates or the inertial load of the motor during deceleration. Through the braking resistor can convert the electricity to energy to consume. Otherwise the drive will trip to OE(over voltage).

b. The braking transistor is active when the DC bus voltage is over the active level of dynamic braking.

c. The setting range: 100/200V series: 350~410V（410V: Disable）
400V series: 700~820V（820V: Disable）

【F3.28】 Pulse Setting of Braking Transistor

a. Set the pulse width of braking signal. The setting range is 10~90%

b. Set the value to adjust braking capability.

c. Be caution of whether the wattage and temperature of braking resistor is proper.

【F3.30】 Operation Selection at Instantaneous Power Failure

a. The settings are listed as below:

0: Drive cannot be restarted at instantaneous power failure.

1: Drive can be restarted at instantaneous power failure.
(see the function description of the restart after instantaneous power failure detection of multi-function output setting (F5.26))

2: Ramp to stop

3: When the power is restored during the ramp to stop interval, the drive is restarted and re-accelerated again.

b. The drive cannot be started with generator power restart simultaneously at power off. The drive must be started after the generator restarts.

c. The ramp to stop function is applicable for the inertial load. Adjusting setting values of functions F3.32~F3.34 can make re-generative energy from motor during the motor ramp to stop feedback to the drive; meanwhile, the motor decelerates to stop.

【F3.31】 The voltage Level Setting at Power Failure

a. When the voltage level of power source is lower than the voltage level setting of F3.31, the motor will be decelerating for ramp to stop.

b. The settings are listed as below:
100V series range: 75.0~96.0V
200V series range: 150.0~192.0V
400V series range: 300.0~384.0V

【F3.32】 Subtracted Frequency of Deceleration at Power Failure

a. When the motor is decelerating for ramp to stop during the power failure, the output frequency=drive's original output frequency – subtracted frequency(F3.32)

b. Setting range: 0.0~20.0Hz.

【F3.33】 Deceleration Time 1 at Power Failure

Set the deceleration time when the drive output frequency is greater than turning frequency (F3.35). Setting range: 0.0~3200.0sec.

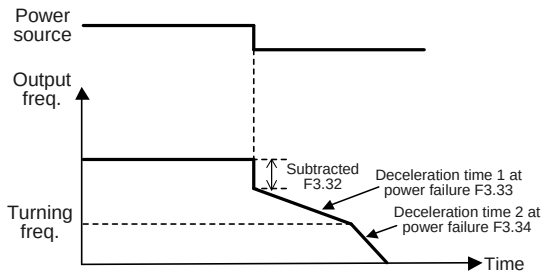
【F3.34】 Deceleration Time 2 at Power Failure

Set the deceleration time when the output frequency is less than turning frequency (F3.35). Setting range: 0.0~3200.0sec.

【F3.35】 Turning Frequency at Power Failure

Set the turning frequency for the two sections of deceleration time is to set the turning point of two deceleration operations(F3.33 and F3.34).
Setting range: 0.0~400.00Hz.

Deceleration to stop at power failure



【F3.37】 The Current Level of Speed Tracing

a. When the drive current is greater than the current level of speed tracing (F3.37), the output frequency is tracing downwardly to reach the current level of speed tracing. The setting range is 0~200% of drive rated current.

b. The speed tracing function is mainly used for tracing the speed for the drive restart after instantaneous power failure/flying start, the drive fault restart, or the speed tracing command is given by the input terminal.

c. See the function description of F5.19~F5.24 multi-function input terminals for speed tracing.

【F3.38】 Delay Time for Speed Tracing

Set the output delay time before the speed tracing.
The setting range is 0.1~60.0 sec.

【F3.39】 The V/F Pattern of Speed Tracing

Set the percentage of V/F output voltage for the speed tracing.
The setting range is 0~100%.

F4 Protection Parameters

【F4.00】 Grounding Fault Protection (GF)

The settings are listed below:

0: Disable

1: Enable(GF)

【F4.01】 Grounding Detection Level

a. Detecting if the unbalanced current is over the setting level, then trip to GF protection.

b. The setting range is 30~100% of drive rated current.

【F4.02】 Grounding Detection Sensitivity

The drive trip to GF when the detection times over the setting value of F4.02 within 60sec. The setting range for F4.02: 1~255 times

【F4.04】 Reserved

【F4.05】 Accumulating Number of Over-Current at 200% Limitation

a. Drive deactivates the PWM voltage to suppress the current when the drive output current is over the drive rated current 200%.

b. When the accumulating numbers of drive over current are over the accumulating numbers of current limits (F4.05), drive trips to OL2 protection.

c. The setting range: 0~255；The unit: 250 times (0: disable)

【F4.07】 Motor 1 Overload Protection (OL)

a. The motor overload protection is listed as below :

0: Motor overload protection: Disabled

1: Motor overload protection: Enabled (OL)

2: Motor overload protection of motor independent cooling fans: Enabled (OL)

b. Motor overload protection is to avoid the motor operating in the overload condition for a long time causing damages to motor. Disabling the motor overload protection may possibly damage the motor.

【F4.08】 Motor 1 Rated Current

Motor rated current : Bases on the motor nameplate to set the value of F4.08. The setting range: 10~150% of drive rated current ; Unit: Amp.

【F4.09】 Motor 1 No-Load Current

Motor No-Load Current: about 1/3 of motor rated current. The setting range: 0~motor rated current ; Unit: Amp.

【F4.10】 Trip Time of Motor 1 Overload

a. When the drive output current is over the motor rated current (F4.08), OL protection is activated for trip time counting (F4.10).

b. The drive output current reaches 150% of the motor rated current (F4.08) and continuously operates over the setting time(F4.10), the drive trips to OL protection.

c. This function is to set the protection time when motor is overloaded. The setting range: 0.5~10.0 min.

【F4.12】 Protection Level of Drive Overheat

The heat sink protection level of the drive reaches the protection level (F4.12), the drive trips to OH protection. The setting range is 85~115℃.

【F4.13】 Drive Overheat Pre-alarm Selection

a. The settings are listed as below:
   0: Disable
   1: Warning (OHt): Continuous operation. (relay terminal outputs)
   2: Warning (OHt): Drive de-rates the switching frequency automatically every 5 minutes. (relay terminal outputs).
   3: Warning (OHt): Drive trips to “OHt” protection and stop, and the cooling fans activate. After the temperature decreases lower than “drive overheat dead band (F4.15)”, drive starts to operate again. (relay terminal outputs)

b. For relay terminal outputs, please see the function setting F5.26

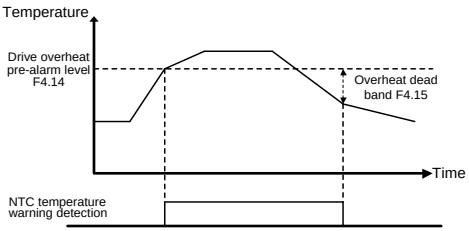
【F4.14】 Drive Overheat Pre-alarm Level

Set the overheat pre-alarm level (OHt) of drive. The temperature of drive will increase when the cooling fans is damage or the heat sink is covered by foreign objects. User can maintain the cooling fans of drive in advance. The setting range is 45~105℃

【F4.15】 Drive Overheat Dead Band

When the drive heat sink temperature is over the pre-alarm level, the drive displays " OHt " until the temperature drops below the drive overheat dead band (F4.15).

The setting range: 0.1~10℃



【F4.17】 Fan Control Selection

a. Function: Increase the lifetime of drive cooling fans, save energy and extend the maintenance cycle time of heat sink.

b. The settings are listed as below:

0: Forced air cooling
Start and continuously operate the cooling fans of drive when power ON.

1: Operation air cooling
Cooling fans of drive is start when the drive is operation. Cooling fans will stop when the drive disable and after waiting at the minimum operation time (F4.19).

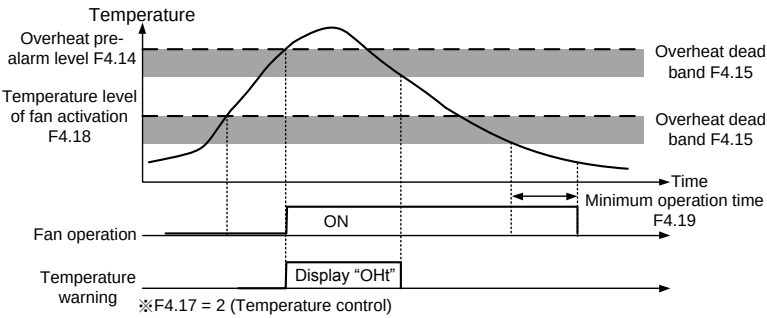
2: Temperature control
Drive cooling fans activate when the drive temperature is over the temperature level of fan activation (F4.18). Cooling fans will stop when the temperature of drive drops below the overheat dead band of drive(F4.15) after waiting at the minimum operation time (F4.19).

【F4.18】 Temperature Level of Fan Activation

Set the temperature level for drive cooling fans startup, and the setting range is 25~60℃

【F4.19】 Minimum Operation Time of Fan

Set the minimum operation time of drive cooling fans activation, and then according to the setting of F4.17 to set the operation method of cooling fan. The setting range is 0.1~25 min.



【F4.21】 PTC Overheat Warning Level (Motor Overheat Protection)

a. Motor overheat protection is to prevent the motor from motor long-time running at low speed causing damages to motor from motor overheat. PTC temperature sensor installation to detect the motor temperature is required, and PTC sensor signal inputs to AI terminal for motor PTC temperature (see function F5.01~F5.02 for PTC signal input setting).

b. The setting range is 0.0~10.0V

【F4.22】 PTC Overheat Warning Disposal

a. "OH1" on the panel display will be blinking when the motor temperature is over PTC overheat warning level (F4.21). The disposal methods with PTC overheat warning are listed as below:
0: Warning(OH1): continue operation (relay terminal outputs)
1: Warning (OH1): stop operation (relay terminal outputs)

b. Please see function F5.26 for relay terminal output setting

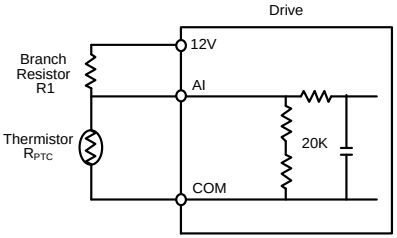
【F4.23】 PTC Overheat Trip Level

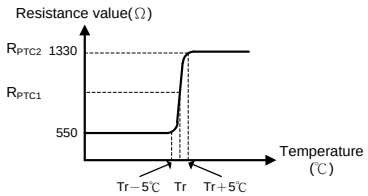
a. "OH2" on the panel display will be blinking when the temperature is over PTC overheat trip level (F4.23) and the motor will coast to stop. Press RESET key on the operation panel to clear the fault when the temperature is down below the warning level.

b. Setting range: 0.0~10.0V

c. PTC overheat trip level (F4.23) must be higher than PTC overheat warning level (F4.21).

d. Insert JP1 jumper to the position V.





PTC temp – resistance characteristics curve

$$\text{Warning level} = 12V \times \frac{(R_{PTC1}//20K)}{[R_1+(R_{PTC1}//20K)]}$$

$$\text{Trip level} = 12V \times \frac{(R_{PTC2}//20K)}{[R_1+(R_{PTC2}//20K)]}$$

R_{PTC1}：Resistance value 1 of PTC (warning level)；

R_{PTC2}：Resistance value 2 of PTC (trip level)；

//：parallel

Example：Select a standard PTC resistor as detector. When the temperature of motor rose, the resistance of PTC will rise and trip the drive to stop depending on the trip level(1330Ω). The setting and figure process of trip level as below:

Resistance value 2 of PTC(R_{PTC2})=1330Ω (trip level)
Branch resistance(R1)=2.7KΩ
1330//20000=(1330×20000)÷(1330+20000)=1247.4
12×1247.4÷(2700+1247.4)=3.79V≒3.8V… …F4.23=3.8

【F4.25】 System Overload Detection(OLO)

a. The settings are listed as below:
0: Disable
1: Enable (OLO)

b. System overload detection is to prevent the system from any possible damages caused by system overload. The detection level (F4.28) and time (F4.29) can be set based on operation requirements.

【F4.26】 System Overload Detection Status

The settings are listed as below:
0: Detection at constant speed only.

1: Detection at operation: Including the system overload at acceleration, deceleration or constant speed.

【F4.27】 Output Setting of System Overload

The settings are listed as below:

0: Drive continues running after the system overload is detected

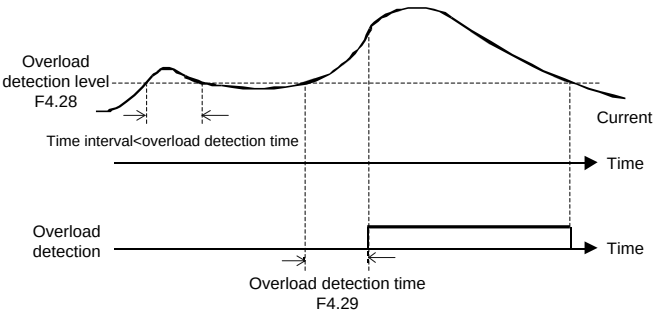
1: Drive trips after the system overload is detected.

【F4.28】 System Overload Detection Level

Setting the level of current for system overload detection, and the setting range is 30~200% of drive rated current.

【F4.29】 System Overload Detection Time

a. The detection of system overload is shown in the below chart:



b. The operation panel displays “OLO”, when the system overload time is over the setting value of system overload detection time (F4.29).

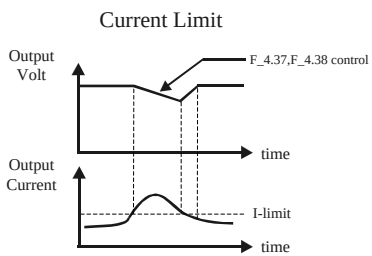
c. Setting range: 0.1~300.0sec.

【F4.36】Current Limit (I-limit)
Current over F4.36 × the rated current of drive during operation, the drive may adjust PWM ouput and limit output current.

【F4.37】Gain of I-limit
The gain of the current limitation response(P). Higher P setting value will result the current limitation response more fast but higher setting value would cause the effect of oscillating current.

【F4.38】Integration Time of I-limit
Integration time of I-limit. Lower integration time I setting value will result the current limitation response more fast but lower setting value would cause the effect of oscillating current.

【F4.39】Selection of Current Limitation
0:Disable
1:Enable



【F4.41】 Motor 2 Overload Protection (OL)

a. The motor overload protection is listed as below :
0: Motor overload protection: Disabled
1: Motor overload protection: Enabled (OL)
2: Motor overload protection of motor independent cooling fans: Enabled (OL)

b. Motor overload protection is to avoid the motor operating in the overload condition for a long time causing damages to motor. Disabling the motor overload protection may possibly damage the motor.

【F4.42】 Motor 2 Rated Current

Motor rated current : Bases on the motor nameplate to set the value of F4.08. The setting range: 10~150% of drive rated current ; Unit: Amp.

【F4.43】 Motor 2 No-Load Current

Motor No-Load Current: about 1/3 of motor rated current. The setting range: 0~motor rated current ; Unit: Amp.

【F4.44】 Trip Time of Motor 2 Overload

a. When the drive output current is over the motor rated current (F4.08), OL protection is activated for trip time counting (F4.10).

b. The drive output current reaches 150% of the motor rated current (F4.08) and continuously operates over the setting time(F4.10), the drive trips to OL protection.

c. This function is to set the protection time when motor is overloaded. The setting range: 0.5~10.0 min.

【F4.45】PID Feedback High Detection Setting

0: Disable

1: Warning, drive continuous operation.

2: Error, drive trip to stop.

【F4.46】PID Feedback High Detection Level

0: Disable
1: Warning, drive continuous operation.
2: Error, drive trip to stop.

【F4.47】PID Feedback High Detection Time

Feedback signal is higher than setting level and reach the detection time, the drive will be activated.

Setting range:0.0~25.5 sec

【F4.48】PID Feedback Low Detection Setting
0: Disable
1: Warning, drive continuous operation.
2: Error, drive trip to stop.

【F4.49】PID Feedback Low Detection Level

Detect if the PID feedback is lower than setting level

【F4.50】PID Feedback Low DetectionTime

Feedback signal is lower than setting level and reach the detection time, the drive will be activated.

Setting range:0.0~25.5 sec.

F5 Multi-function Parameters

【F5.00】 "Pot knob" Selection (Analog Input)

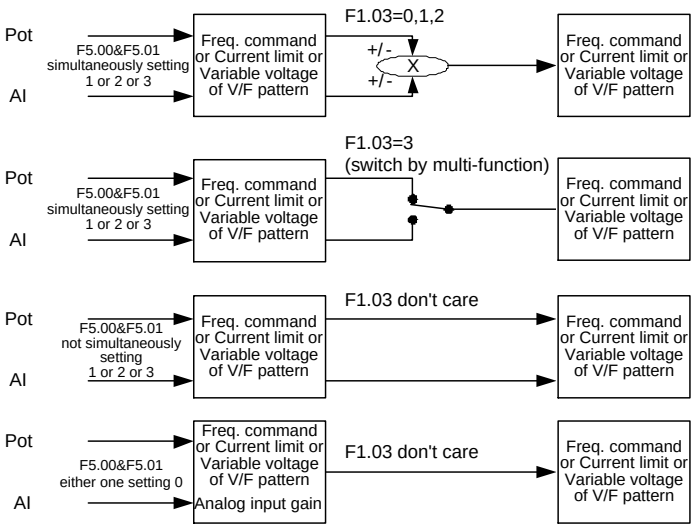
The settings are listed as below:

0: Analog input gain
1: Frequency command
2: Current limit
3: Variable voltage of V/F pattern

【F5.01】 Analog Input AI Selection

The settings are listed as below:

0: Analog input gain
1: Frequency command
2: Current limit
3: Variable voltage of V/F pattern
4: PTC temperature
5: PID feedback



※When F1.01 is set to "0", the frequency command inputs from analog input terminals, function F5.00 or F5.01 must set to "1"; otherwise, the frequency command is 0.0Hz.

※When F5.00 and F5.01 are simultaneously setting 1 or 2 or 3, the function F1.03 = 0 or 1 or 2 will be activated.

※When F5.00(F5.01) is set to "0", the gain adjustment must be with F5.00(F5.01)=1 or 2 or 3.

【F5.02】 AI Input Source Selection

a.The settings are listed as below:

0: DC 4~20mA(2-10V)

1: DC 0~20mA(0-10V)

b. AI-GND analog input terminal

(1) Insert JP1 jumper to V position

The range of AI is 0~10V or 2~10V; Range is set by function F5.02

(2) Insert JP1 jumper to I position

The range of AI is 0~20 mA or 4~20mA; Range is set by function F5.02

【F5.03】 "Pot knob" Gain (Analog Input)

The "Pot knob" gain range setting, and the setting range is 0.00~2.00.

【F5.04】 "Pot knob" Bias (Analog Input)

The "Pot knob" bias range setting, and the setting range is -1.00~1.00.

【F5.05】 AI Gain (Analog Input)

The AI gain range setting, and the setting range is 0.00~2.00.

【F5.06】 AI Bias (Analog Input)

The AI gain range setting, and the setting range is -1.00~1.00.

a. Analog input terminals:

1. Pot knob

2. AI－GND 4~20mA(2~10V) or 0~20mA(0~10V)

b. Max. frequency command= Max. output frequency (F2.32) x Analog input gain (F5.03 or F5.05)

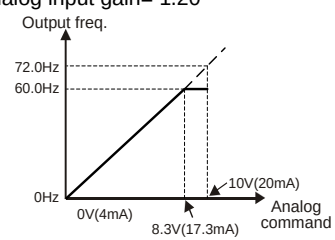
c. Freq. bias value= Max. output frequency (F2.32) x Analog input bias (F5.04 or F5.06)

d. Frequency command:

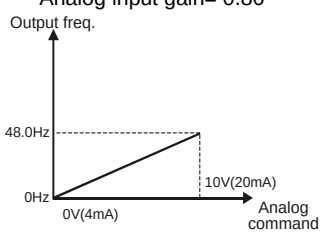
$$\text{Freq.command} = \frac{\text{Analog command}}{\text{10V (or 20mA)}} \times (\text{Max. freq. command} - \text{freq. bias}) + \text{freq. bias}$$

Example: Analog input bias= 0.00

Max. output frequency= 60.0Hz
Analog input gain= 1.20

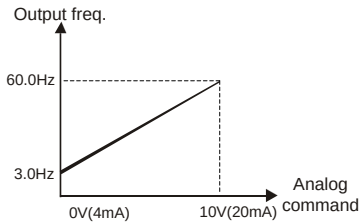


Max. output frequency= 60.0Hz
Analog input gain= 0.80

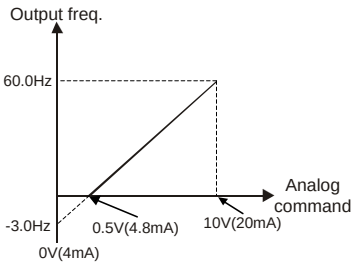


Example: Analog input gain= 1.00

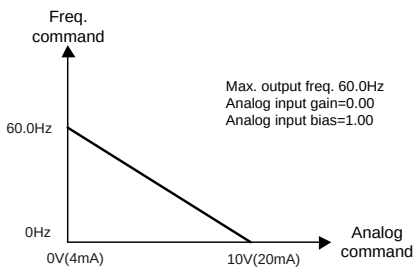
Max. output frequency= 60.0Hz
Analog input gain= 0.05



Max. output frequency= 60.0Hz
Analog input gain= -0.05



Example: Inverse control application



【F5.07】 Filter Setting of Analog Frequency

a. “Pot knob” or AI is set for frequency command control (F1.01=0): signal filtering

b. Higher setting value of F5.07 reacts to the slow response. F5.07 = 0: no filtering. The setting range is 0~255.

【F5.08】 Analog Frequency Dead Band

When the variation of the analog input frequency is over the setting of analog frequency dead band (F5.08), the drive output frequency will be active according to analog frequency command. Increasing the setting of analog frequency dead band can stabilize the frequency command but decrease the frequency calibration sensitivity. F5.08 function must be used along with F5.07 function setting.
The setting range is 0.00~2.55Hz

【F5.09】 Acceleration Time of V

a. Adjust V/F voltage(Variable voltage (V) of V/F pattern) from analog input terminal when F5.00 or F5.01 = 3.

b. Setting the acceleration time of drive from zero voltage to the base voltage (F2.36). The setting range is 0.0~3200.0.

【F5.10】 Deceleration Time of V

a. Adjusting V/F voltage(Variable voltage (V) of V/F pattern) from analog input terminal when F5.00 or F5.01 = 3

b. Setting the deceleration time of drive from zero voltage to base voltage (F2.36). The setting range is 0.0~3200.0.

【F5.12】 FM Analog Output Signal Selection

The output signal selections of FM analog output terminal are as below:

0: Output frequency(before slip compensation)
1: Output frequency(after slip compensation)
2: Frequency command
3: Output voltage
4: Output current
5: DC bus voltage
6: "Pot knob" input signal(analog)
7: AI input signal(analog)
8: PID command
9: PID feedback

【F5.13】 FM Analog Output Gain

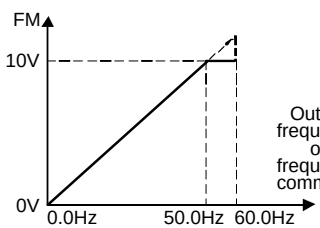
The analog output gain adjustment. The setting range is 0.00~2.00.

【F5.14】 FM Analog Output Bias

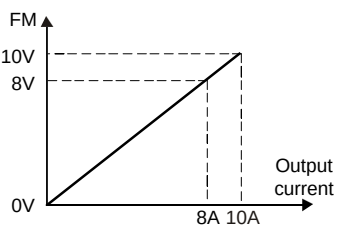
The analog output bias adjustment. The setting range is 0.00~2.00.

Example: Graph of analog output

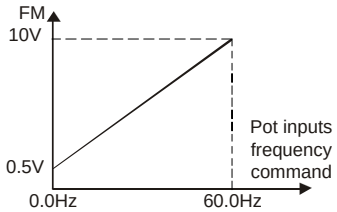
Max. output freq. = 60.0Hz
FM function setting = 0,1,2,8,9
FM gain = 1.20
FM bias = 0.00



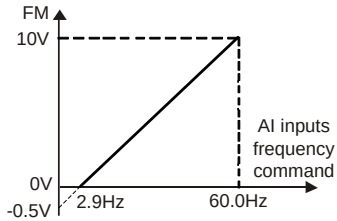
Drive rated current = 8A
FM function setting = 4
FM gain = 0.80
FM bias = 0.00



Max. output freq. = 60.0Hz
FM function setting = 6
FM gain = 1.00
FM bias = 0.05



Max. output freq. = 60.0Hz
FM function setting = 7
FM gain = 1.00
FM bias = -0.05



【F5.15】 FM Range Option

a. The settings are listed as below :
0:DC 4~20mA(2-10V)
1:DC 0~20mA(0-10V)

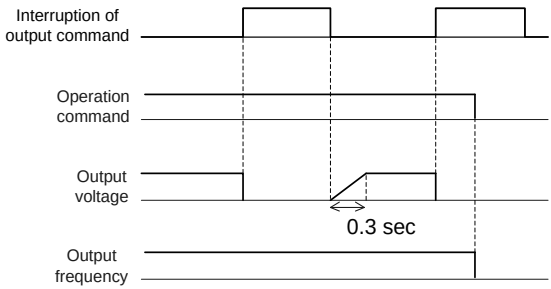
b. FM-GND analog input terminal
1. JP3 inserts in FMV position:
FM outputs 0~10V or 2~10V; the setting range is defined by function F5.15
2. JP3 inserts in FMI position:
FM outputs 0~20 mA or 4~20mA; the setting range is defined by function F5.15

【F5.19】 Multi-function Input Terminal X1
| |
【F5.24】 Multi-function Input Terminal X6

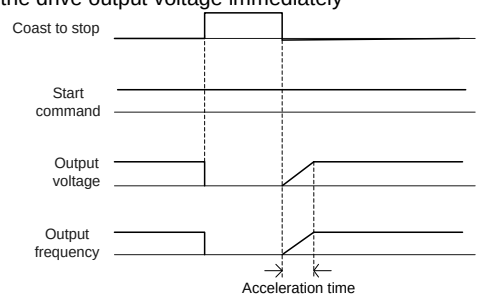
a. “＋” represents a contact(normal open)
“－” represents b contact(normal close)

b. The settings of multi-function terminals X1 ~X6 are listed as below:
±1: Jog command (see the function descriptions of F2.16)
±2: Secondary acceleration / deceleration command switching(see the function description of F2.26 and F2.27)
±3: Multi-speed level 1 command(see the function description of F2.00 ~ F2.15 for multi-speed setting)
±4: Multi-speed level 2 command(see the function description of F2.00 ~ F2.15 for multi-speed setting)
±5: Multi-speed level 3 command(see the function description of F2.00 ~ F2.15 for multi-speed setting)
±6: Multi-speed level 4 command(see the function description of F2.00 ~ F2.15 for multi-speed setting)
±7: Reset command
Setting the reset command to reset the drive fault.
±8: External fault command (EF)
Drive in operation: accept the external fault command to trip the drive.
Drive stop: Disable

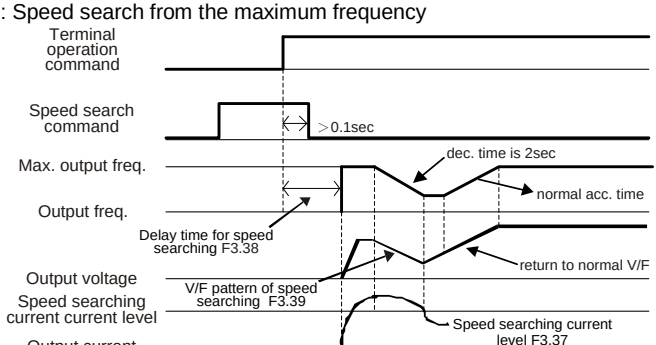
±9: Interruption of output command (bb)
Interrupt the output voltage of the drive



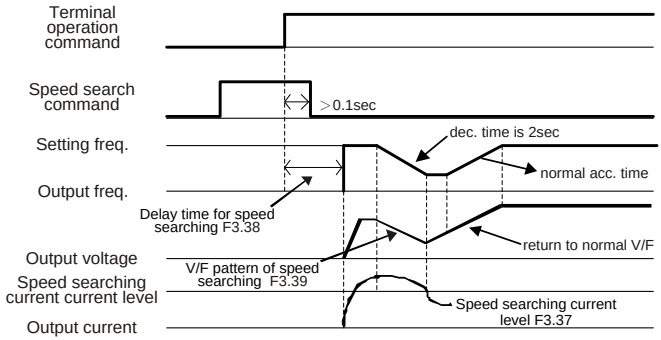
±10: Coast to stop command(Fr)
Interrupt the drive output voltage immediately



±11: Speed search from the maximum frequency



±12: Speed search from the frequency setting



±13: Holding command(refer to the description of multi- acc/dec time)

±14: UP command
Frequency setting stepping increase

±15: DOWN command
Frequency setting stepping decrease

±16: Clean UP/DOWN frequency command
The frequency command is cleaned to 0.00Hz

±17: UP/DOWN command enter key

(1) Setting the UP/DOWN command enter key for multi-function input terminals X1~X6. UP/DOWN command enter key must be set to activate UP/DOWN command (±14 and ±15) when one of multi-function input terminals X1~X6 is defined as UP/DOWN command enter key.

Open (Multi-function Input Terminal): UP/DOWN commands to change the input frequency command and the output frequency is not changed with the variation of frequency commands.

Short (Multi-function Input Terminal): The output frequency accelerates/decelerates to the frequency command setting.

(2) If one of multi-function input terminals X1~X6 is not defined as UP/DOWN command enter key, the drive output frequency is controlled by UP/DOWN command.

±18: Analog input source selection("Pot knob"/AI)
Setting the function F1.03 (Analog Input Selection) to 3 ("Pot knob" or AI)

Set to 18	a contact ; "Pot knob" is the analog input source
	b contact ; AI is the analog input source
Set to -18	a contact ; AI is the analog input source
	b contact ; "Pot knob" is the analog input source

±19: Primary and secondary frequency command option

Set to 19	a contact ; The frequency command = Primary frequency command(F1.01)
	b contact ; The frequency command = Secondary frequency command(F1.02)
Set to -19	a contact ; The frequency command = Secondary frequency command(F1.02)
	b contact ; The frequency command = Primary frequency command(F1.01)

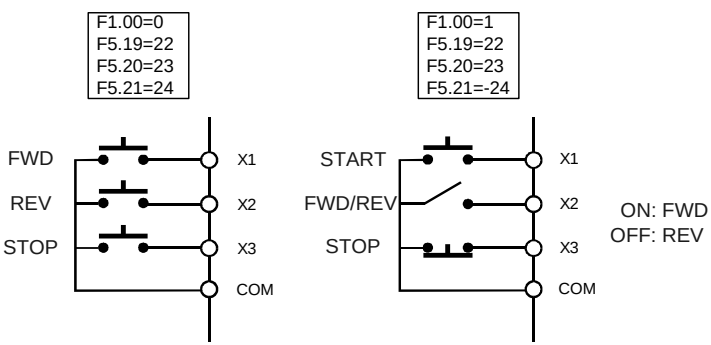
±20: Start command of sequential operation control
When the function F6.00 is not set to 0 (sequential operation control) and the start command of sequential operation control sets ON, the drive output frequency is based on the frequency command setting of sequential operation control for the drive operation. If the start command of sequential operation control is set to OFF, the sequential operation control stops.

±21: Pause command of sequential operation control can temporarily pause the drive operation during sequential operation control. After pause command is clear, drive operation continues with sequential operation control.

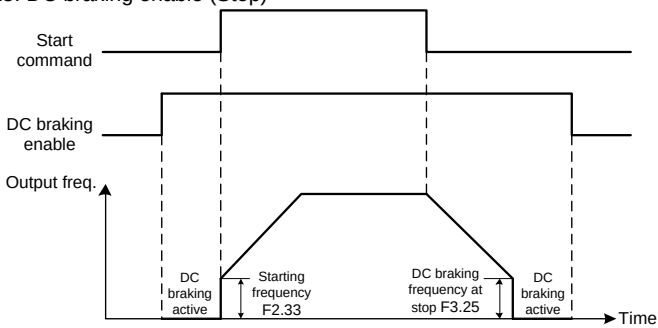
±22: Forward command
See the function setting of F1.00 for setting forward command.

±23: Reverse command
See the function setting of F1.00 for setting reverse command.

±24: Stop command of 3-wire start/stop circuit



±25: DC braking enable (Stop)



(1) When the drive stops and DC braking command is ON, DC braking is active to stop the motor.

(2) The setting value of output current must be according to the function setting of F3.21, when the DC braking is active.

(3) When the start or jog command is active, DC braking command will be clear, and the motor will run to the setting frequency.

(4) The drive output frequency decreases to the setting value of F3.25(DC Braking Frequency at Stop) when the start or jog command is inactive.

±26: Counter input

(1) Using external triggering signal from multi-function input terminal to activate drive countering function.

(2) Selecting the input voltage of counter between 4V and 13V.

(3) External triggering signal: the signal can be from optoelectronic sensor or approximate switch to drive

±27: Counter clear
Clear the counting value

±28: Current limit enable

(1) The multi-function input terminal is activation and either F5.00 or F5.01 is set to 2.
   a. Current limit enable
   b. Monitoring the value in the monitor mode(range: 1~150).

(2) Multi-function input terminal inactive
   a. ”Current limit enable” is disable.
   b. The setting value is same as function F3.04 (range: 30~200) in the monitor mode.

±29: Selection for motor switching
±30: PID Switching (open-loop selection)
±31: PID Integrator reset

【F5.25】 Digital Input Response Time

a. Setting the input response time of multi-function terminals (X1~X6) .(digital debouncing)

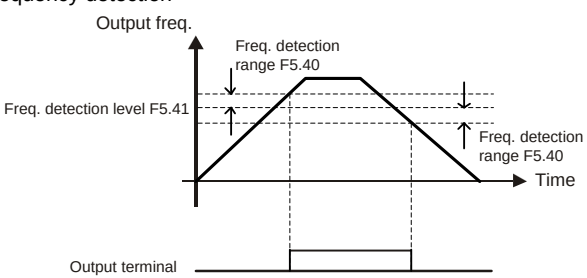
b. If the signal length of digital inputs is smaller than the digital input response time, drive software will reject the input signal and do no process to input signal.

【F5.26】 Multi-function Output Setting of Ta/Tb/Tc Terminals

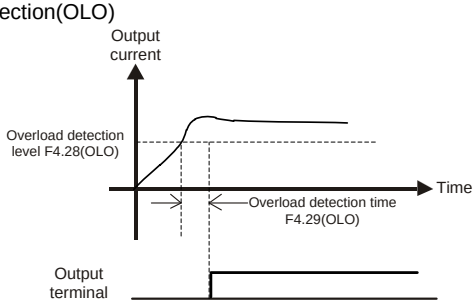
a. Ta/Tb/Tc: Relay type output terminals.
Maximum output specifications of Ta/Tb/Tc: AC250V, 0.2AMax, cosθ=0.3

b. "＋": Represents a contact (normal open),
"－": Represents b contact (normal close)

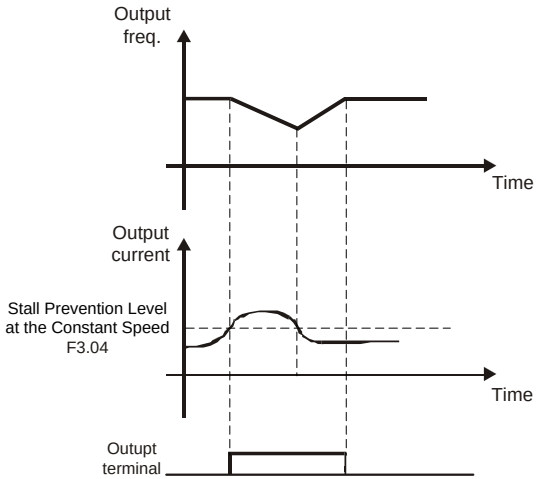
c. Setting the function for output terminals Ta/Tb/Tc is listed as below:
±1: Running detection
Detection at drive start
±2: Constant speed detection
Detection at constant speed
±3: Zero speed detection
Detecting at drive zero speed and no detect during the DC braking.
±4: Frequency detection



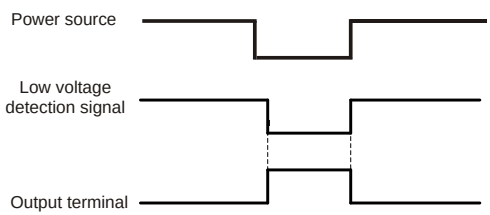
±5: Overload detection(OLO)



±6: Stall prevention detection



±7: Low voltage detection(LE)

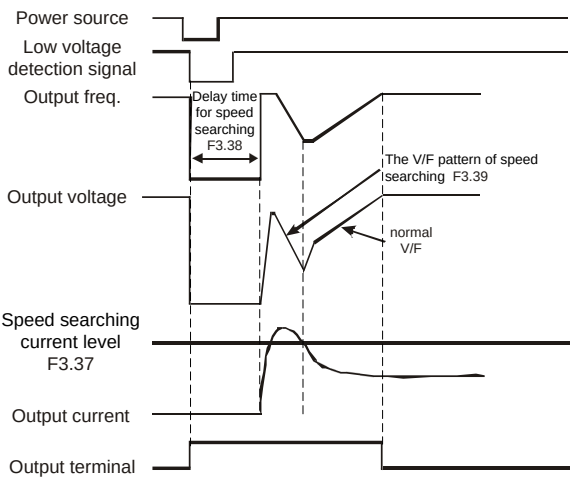


±8: Braking transistor is active detection(db)

Detection when the DC bus voltage of drive is higher than the dynamic brake voltage.

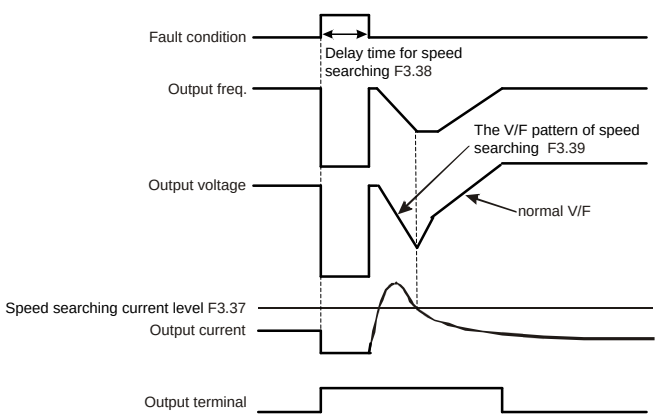
±9: Restart after instantaneous power failure detection
Enable when F3.30 is set to 1.

Restart after instantaneous power failure detection

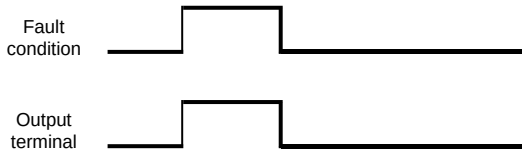


±10: Restart after fault condition detection

Restart after fault condition detection



±11: Fault detection



±12: Start detection of sequential operation control
Detection when sequential operation control starts.

±13: One complete operation sector detection of sequential operation control
After one complete operation phase of sequential operation control, Ta/Tb/Tc terminals will output the detection signal for 0.1 seconds.

±14: One complete operation cycle detection of sequential operation control
After one complete operation cycle of sequential operation control, Ta/Tb/Tc terminals will output the detection signal for 0.1 seconds.

±15: Pause command detection of sequential operation control
Ta/Tb/Tc terminal outputs detection signal when the pause command is given during sequential operation control.

±16: Detection of counter value 1
Detection when the counting value is equal to the setting value of F5.36

±17: Detection of counter value 2
Detection when the counting value is equal to the setting value of F5.37

±18: Reverse detection
Detection when the drive runs at reversed direction.

±19: NTC temperature warning detection (OHt)
Detection when the drive temperature sensed by thermal detector(NTC) is higher than the temperature warning level (F4.14).

±20: Fan operation detection

±21: PTC temperature warning detection (OH1)
Detection when the motor temperature sensed by PTC detector is higher than the PTC temperature warning level (F4.21).

±22: PID Feedback High Detection

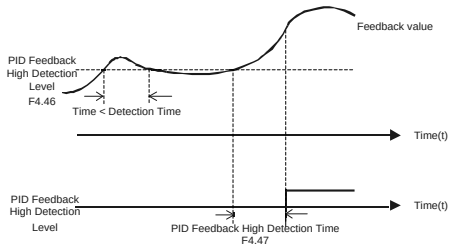
PID Forward Control

When F4.45=1, PID feedback value > F4.46 setting level and exceed F4.47 setting time, the keypad will show ”FbHi” and continuous operation.
When F4.45=2, the keypad shows ”FbHi” and drive trip to stop.

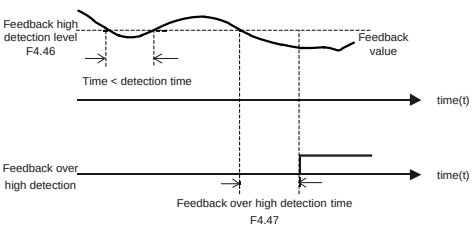
PID Reverse Control

When F4.45=1, PID feedback value < F4.46 setting level and exceed F4.47 setting time, the keypad will show ”FbHi” and continuous operation.
When F4.45=2, the keypad shows ”FbHi” and drive trip to stop.

< PID Feedback High Detection,PID Forward>



< PID Feedback High Detection,PID Reverse>



±23: PID Feedback Low Detection

PID Forward Control

When F4.48=1, PID feedback value < F4.49 setting level and exceeds F4.50 setting time, the keypad will show ”FbLo” and continuous operation.

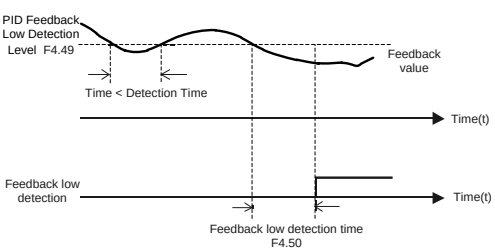
When F4.48=2, the keypad shows ” FbLo” and drive trip to stop.

PID Reverse Control

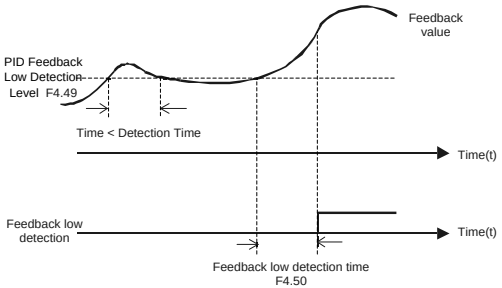
When F4.48=1, PID feedback value > F4.49 setting level and exceeds F4.50 setting time, the keypad will show ”FbLo” and continuous operation.

When F4.48=2, the keypad shows ” FbLo” and drive trip to stop.

< PID Feedback Low Detection,PID Forward>



< PID Feedback High Detection,PID Reverse>



【F5.30】 UP/DOWN Memory Selection

0: Erasing the frequency command setting in memory to 0.00Hz when power is interrupted.

1: Storing the frequency command setting to function F5.30 when power is interrupted.

【F5.31】 UP/DOWN Frequency Calibration

The calibrating range of frequency command of UP/DOWN command

Setting Value	Unit	The Calibrating Range of Frequency Command
0:	0.01Hz	0.01Hz
1~8:	×0.05Hz	Setting 8 to calibrate frequency command.
9:	0.05Hz	0.05Hz
10~250:	×0.1Hz	Setting 250 to calibrate frequency command.

【F5.32】 UP/DOWN Calibrating Time

1~5: The response time of terminal calibration (unit: second)

If UP/DOWN terminal (see F5.19~5.24 for UP/DOWN terminal setting) is set to ON/OFF over the response time of terminal calibration, motor will continue accelerating/decelerating to the maximum/minimum running speed (frequency) – ON for acceleration operation and OFF for deceleration operation.

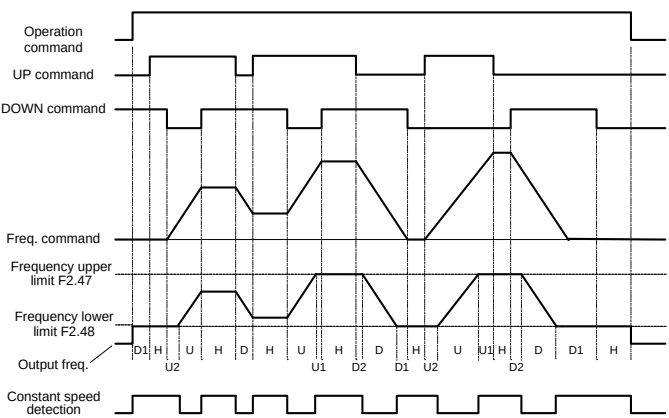
6: Edge trigger

The trigger mode uses the input signal edge as the trigger signal without being controlled by the trigger response time. The signal responding time is 30ms.

【F5.33】 UP/DOWN Frequency Adjustment

Frequency command is directly adjusted by keypad. The setting value of frequency command will be stored to function F5.33 after 5 seconds when using UP/DOWN command to set the frequency command.

UP/DOWN time chart:



U=UP (acceleration) status
D=DOWN (deceleration) status
H=HOLD (constant speed) status
U1=UP status bounded at the upper limit of the frequency
U2=UP status bounded at the lower limit of the frequency
D1=DOWN status bounded at the lower limit of the frequency
D2=DOWN status bounded at the upper limit of the frequency

【F5.35】 Counting Mode

The settings are listed as below :

0: Up counting mode

1: Down counting mode

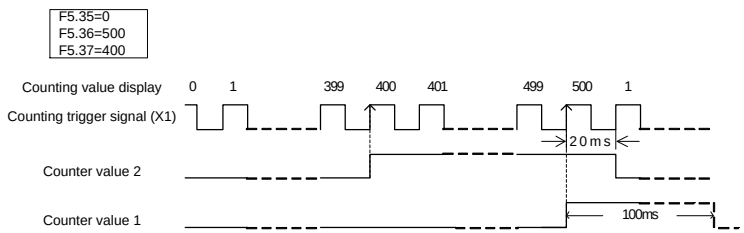
【F5.36】 Counter Value 1

Setting the number of counting value to conduct the relay outputs for 100ms; The setting of counting value: 0~9999 times(see the setting of counting value detection in 5.26).

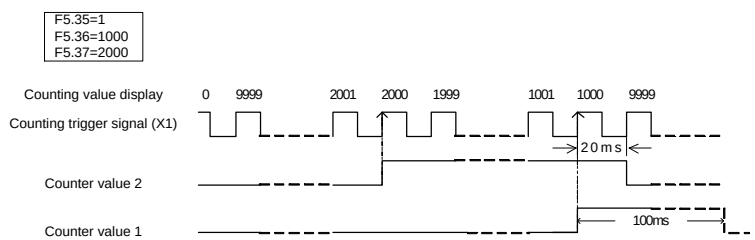
【F5.37】 Counter Value 2

Setting the number of counting value to conduct the relay outputs until complete the cycle. The counter setting value: 0~9999 times(see the setting of counting value detection in 5.26).

Up counting mode:



Down counting mode:



※The cycle of triggering signal cannot be less than 20ms(＜50Hz)

※The detection signal of multi-function output terminal must remain at least for 100ms.

【F5.39】 Constant Speed Detection Range
Setting range: 0.0~10.0Hz; see the constant speed detection setting of multi-function output terminal (F5.26)

【F5.40】 Frequency Detection Range
Setting range: 0.0~10.0Hz; see the frequency detection setting of multi-function output terminal (F5.26)

【F5.41】 Frequency Detection Level
Setting range: 0.0~400.00Hz; see the frequency detection setting of multi-function output terminal (F5.26)

F6 Special Parameters

【F6.00】Operation Mode for Sequential Operation Control

The operation mode settings are listed as below:

0: Sequential operation control disable

1: Sequential operation control operates one cycle and stops

2: Sequential operation control operates in circulation

3: Sequential operation control operates one cycle and stops (by STOP key on the operation panel)

4: Sequential operation control operates in circulation (by STOP key on the operation panel)

【F6.01】Cycle Times for Sequential Operation Control

The settings are listed as below:

1~9998: The number of circulation of sequential operation control.

9999: Infinite circulation of sequential operation control

【F6.02】 Sequence of One Operation Cycle for Sequential Operation Control

The setting is as below:

Setting	Descriptions
0	Single direction ■ One cycle sequence: ‖ 1 → 2 → …… →15→16 ‖ ■ Circulating operation sequence: → ‖ 1 → 2 → …… →15→16 ‖ →
1	Dual direction ■ One cycle sequence: ‖ 1 → 2 → ……→15→16→15→ …… → 2 → 1 ‖ ■ Circulating operation sequence: → ‖ 1 → 2 → …… →15→16→15→ …… → 2 → 1 ‖ →

【F6.04】 Hold Time Unit for Sequential Operation Control

a. The settings are listed as below:

0: Second

1: Minute

2: Hour

b. Setting the unit of hold time of 16 sectors of sequential operation control.

【F6.05/ F6.06】Accel/Decel time/hold time of sector 1 of Sequential Operation Control
|
【F6.35/ F6.36】Accel/Decel time/hold time of sector 16 of Sequential Operation Control

a. The operation speed of each sector of sequential operation control is defined by function F2.00~F2.15

b. One sector of the sequential operation control is defined by the summation of the acceleration time and the hold time.

c. The accel/decel time of sequential operation control is the time between two hold time of two sectors in sequential operation control.

d. The hold time of sequential operation control is defined as the remaining time of when operation speed reaches the setting speed.

e. If the hold time of one sector of sequential operation control is set to 0.0, sequential operation control will skip this sector with setting as 0.0 and directly operate at the next sector.

f. The operating sector and cycle times of sequential operation control can be displayed in the monitor mode (see function setting F1.09~F1.11).

g. The sequential operation control is selected by F6.00.

h. The start command of sequential operation control is controlled by multi-function input terminal.

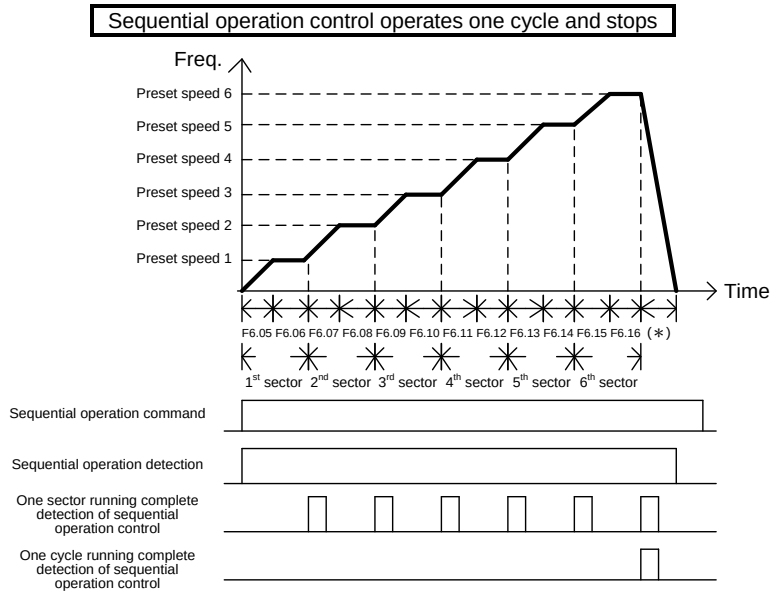
i. The pause command of sequential operation control is controlled by multi-function input terminal. The function of sequential operation control will be paused when the pause command is ON. After the pause command is clear, sequential operation control restarts the operation.

j. The detection of sequential operation control has functions: start detection, one complete operation sector detection, one complete operation cycle detection, pause command detection, and reverse detection of sequential operation control.

【F6.37】 Direction Control of Sequential Operation Control
The direction control of sequential operation control is used with binary representation.

=> $X_{16}X_{15}X_{14}X_{13}X_{12}X_{11}X_{10}X_9$ $X_8X_7X_6X_5X_4X_3X_2X_1$
Xn=0: Forward；Xn=1: Reverse
n=1~16 mean the operation direction of nth sector

Example:
F6.37 = 55(hexadecimal)
= 00000000,01010101(binary)
=> The sector of 1st, 3rd, 5th, 7th running at reverse direction
The sector of 2nd , 4th, 6th, 8th~16th running at forward direction



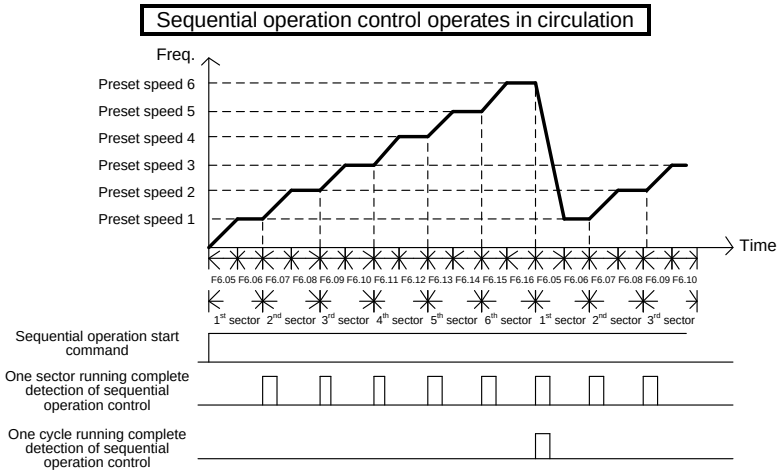
(1) Description of sequential operation control operates one cycle and stops
When the start command of sequential operation control is ON, the drive operation is based on all function settings and automatically stops after completing 16th sector sequential operation. Changing the start command from OFF to ON to restart the drive again.

(2) If the start command of sequential operation control is set to OFF during operation time of sequential operation control, the stop time setting is set by F2.19.

(3) The stop time is set by function F2.19 for the sequential operation control operates one cycle and stops function.

(4) Above chart is an example using 6 sectors of sequential operation control operating one cycle and stops.

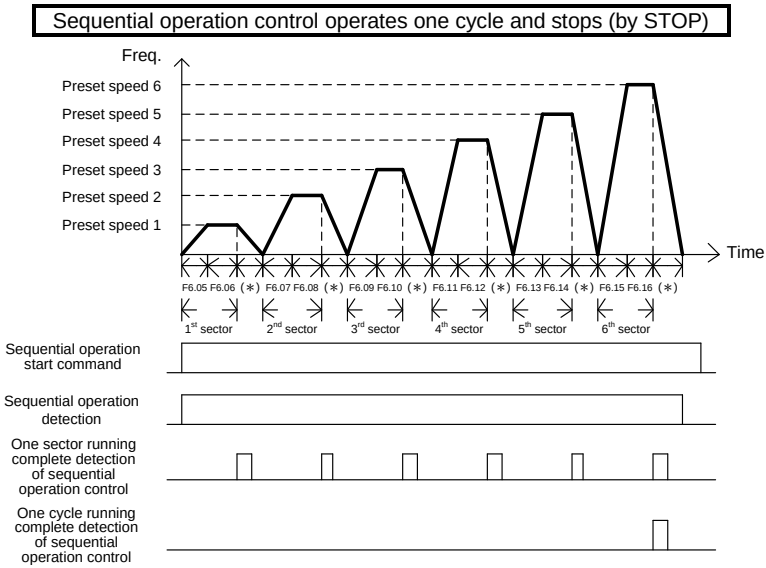
(5)＊: Setting the deceleration time to stop by function F2.19.



(1) Description of sequential operation control operates in circulation
When the start command of sequential operation control is ON, the drive operation is based on all function settings and restarted from 1st sector to 16th sector sequential operation and carry on. The sequential operation control in circulation will stop only when the start command of sequential operation control is OFF.

(2) If the start command of sequential operation control is OFF during sequential operation, the stop time is set by function F2.19.

(3) Above chart is an example using 6 sectors of sequential operation control operating in circulation.



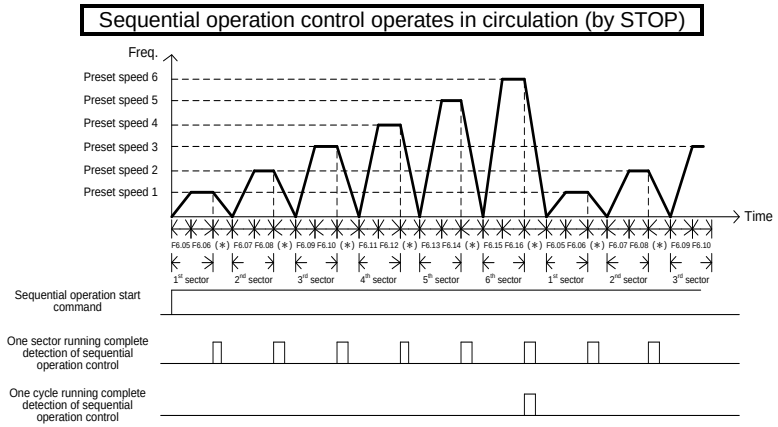
(1) Description of sequential operation control operates one cycle and stops(by STOP) When the start command of sequential operation control is ON, the drive operation is based on all function settings, and sequential operation stops and restarts between two sectors. And drive operation will automatically stops after completing 16 sector operations.

(2) If the start command of sequential operation control is OFF during the operation, the stop time is set by function F2.19.

(3) The deceleration time between two sectors is the stop time of current sector.

(4) Above chart is an example using 6 sectors of sequential operation control operating one cycle and stops (by STOP).

(5) ∗: Indicating the stop time of the current sector.



(1) Description of sequential operation control operates in circulation (by STOP)
When the start command of sequential operation control is ON, the drive is operation is based on all function settings and sequential operation stops and restarts between two sectors. Sequential operation will run through each sector till 16 sector complete and automatically restarts running from 1st sector. The sequential operation will stop only when the start command of sequential operation control is OFF.

(2) If the start command of sequential operation control is OFF during the operation time, the stop time is set by function F2.19.

(3) The deceleration time between two sectors is the stop time of current sector.

(4) Above chart is an example using 6 sectors of sequential operation control operating in circulation (by STOP).

(5)＊: Indicating the stop time of the current sector.

【F6.40】 PID Control Selection

a. The settings are listed as below:
0: PID control disable.
1: Forward control
2: Reverse control
3: Forward control, preposition D control
4: Reverse control, preposition D control

b. Forward control: When the system actual value is less than the setting value, the drive is accelerating.

Reverse control: When the system actual value is less than the setting value, the drive is decelerating.
Example: Air conditioning control for constant temperature.

【F6.41】 Feedback Signal Detection

a. The settings are listed as below:
   0: Open loop detection disable
   1: Open loop detection enable (noFb)

b. Applicable for the 4~20mA output feedback signal. When the drive detects 0mA from output feedback signal - the signal wire cutoff, the drive stops running and displaying ”noFb” on the operation panel.

【F6.42】 Feedback Signal Filter

If the feedback signal has the signal interference, increase filtering value can suppress the signal interference. The higher filtering value can result slow response of feedback signal.

【F6.43】 PID Buffer Space

Filtering the frequency command after adding P, I, D setting value. Higher setting value of F6.43 will slow down the drive output.

【F6.44】 Proportional Gain(P)

This proportional gain is to compensate the gain for the deviation value of proportional setting. Higher gain value may easily cause system to vibrate, but lower gain value may result the slow reaction of drive.

【F6.45】 Integration Time(I)

This integration time is to compensate the stable deviation of the system;
The integration time setting is according to the response time of the system feedback.

【F6.46】 Derivative Time(D)

This derivative time is to compensate the variance of deviation value.
Higher derivative time setting of deviation value will result higher compensation to system.

【F6.47】 Integration Upper Limitation

【F6.48】 Integration Lower Limitation

【F6.49】 Integrator Initialized Value

a. Function F6.49 is to set the initial value of the staring frequency of integrator to accumulate and subtract this initial value according to the deviation value. The upper/lower limitation of frequency is set by function F6.47 and F6.48.

b. Freq. upper limitation= Integration upper limitation(F6.47) x Max. output freq.(F2.32)
   Freq. lower limitation= Integration lower limitation(F6.48) x Max. output freq.(F2.32

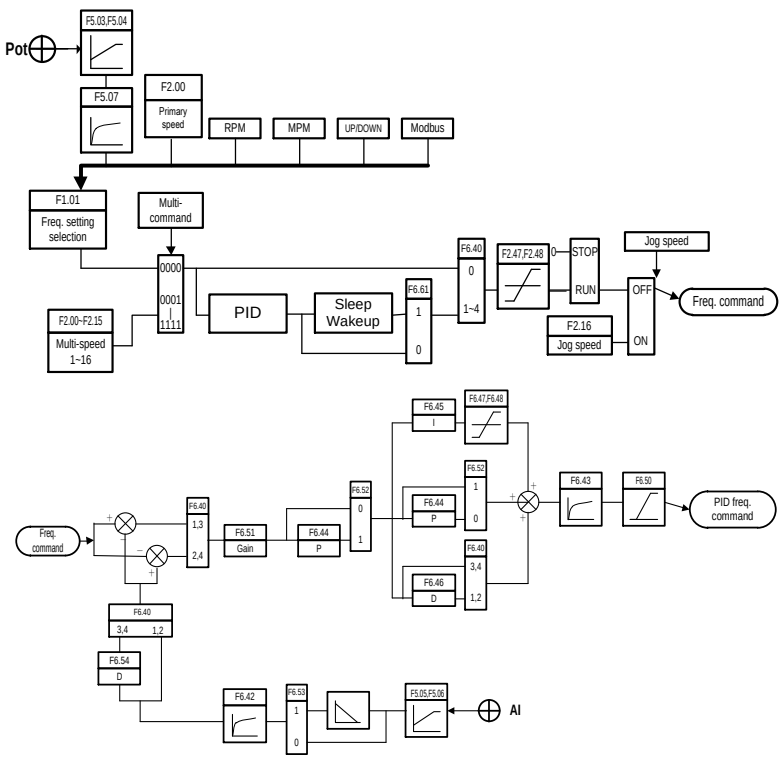
【F6.50】 PID Output Upper Limit

Set the PID control output frequency

【F6.51】PID Compensation Gain
(PID command – PID feedback)*F6.51
【F6.52】Propotional Gain(P) Selection
0: postposition P
1: preposition P
【F6.53】Feedback Signal Selection
0: Direct signal
1: Reverse signal
【F6.54】Derivative Time of Feedback
Set the derivative time for feedback signal.
Setting range:0.00~2.50 sec.

PID function description

The setting of PID is set by F1.01 and F5.01. The actual value of PID is inputted by AI terminal.

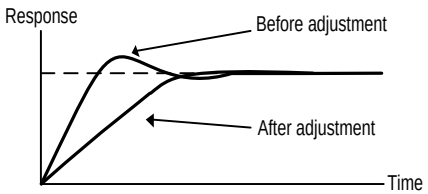


PID adjustment method

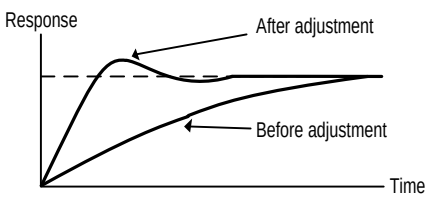
The system response can be adjusted by P, I, D to improve system efficiency. Over setting PID can cause system oscillated, and PID adjusting steps are listed as below:

Increasing the value of proportional gain(P)
Decreasing the value of integration time(I)
Increasing the value of derivative time(D)

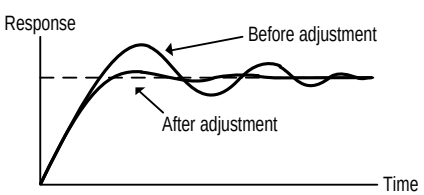
(1) Suppressing the over-tuning
Increase the integration time (I) and decrease the derivative time(D).



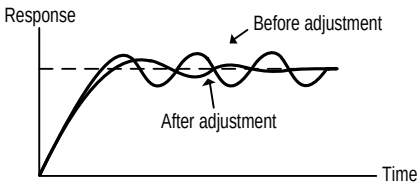
(2) Stabilizing system in advance
Decrease the integration time (I) and increase the derivative time (D).



(3)Reducing the oscillation in the short period
When the oscillation happens in the cycle that longer than the setting time of integration, the integration setting is too strong causing the system oscillation. Increasing the time of integration to stabilize the system and reduce the oscillation.



(4) Reducing the oscillation of continuous period
If the system appears the continuous oscillation caused by higher derivative value, shortening the derivative time can reduce the system oscillation.



【F6.55】 Communication Address

a. When using RS-485 communication interface to monitor the drive, each drive must be assigned with its communication address, and the same address number cannot be assigned to other drives once this address is defined already. Setting range: 0~254; maximum sets of drive connection: 31 sets in parallel.

b. 00—No communication control.

【F6.56】 Baud Rate

Setting the transmission rate of communication (bps: bit/sec); The baud rate of the drive must be same as the host device for communication control.

0：4800bps
1：9600bps
2：19200bps
3：38400bps

【F6.57】 Communication Protocol

a. Serial communication between the host and drive is using non-synchronous data transmission. 1 frame = 11bits
[8,N,2 for RTU]：1 start bit，8 data bits，2 stop bits
[8,E,1 for RTU]：1 start bit，8 data bits，1 even parity bit，1 stop bit
[8,O,1 for RTU]：1 start bit，8 data bits，1 odd parity bit，1 stop bit
[8,N,1 for RTU]：1 start bit，8 data bits，1 stop bit

b. Please see the communication protocol of 6-3

【F6.58】Communication Overtime (Cot)

a. Setting the detection time when communication timeout

b. The communication overtime happens only when the data transmission during communication transmission is interrupted, has no data transmitting, or delays. “Cot” time setting can monitor the communication status between device and can detect if there is communication failure.

c. The settings are listed as below:
0.0: Communication overtime detection disabled
0.1~100.0: Setting the detection time to detect the communication linking status between drive and host device.

【F6.59】Communication Overtime Disposal

Setting the disposal of drive when communication overtime.
0: Warning (Cot): Continue operation.

1: Warning (Cot): Ramp to stop

2: Warning (Cot): Coast to stop

※Start command is required to restart the drive after the drive is completely stopped.

※The overtime warning display will automatically disappear after the communication is uplinked and functional again.

【F6.60】Multi-Function Input Selection

The settings are listed as below:
0: Multi-function inputs from multi-function terminals

1: Multi-function inputs from communication control

【F6.61】PID Sleep Selection
0:Disable
1:Enable

【F6.62】PID Wakeup Initial Frequency
Setting the frequency for PID Wakeup Process
(1.00=max.output frequency)
Setting range:0~250 sec

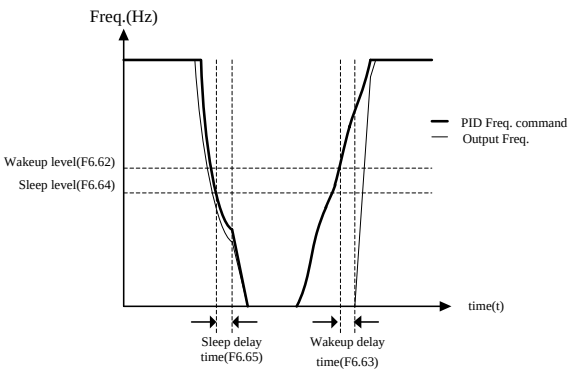
【F6.63】PID Wakeup Delay Time
Setting the time for PID Wakeup Process

【F6.64】PID Sleep Inital Frequency
Setting the frequency for PID Sleep Process
(1.00=max.output frequency)

【F6.65】PID Sleep Delay Time
Setting the time for PID Sleep Process
Setting range:0~250 sec

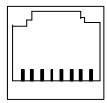
【F6.66】PID Output Lower Limit
PID control for output frequency. Setting range:0.00~1.00

PID sleep and wakeup selection is used to make the motor start and stop automatically.
When PID frequency command < F6.64 (PID Sleep Initial Frequency) and the time reach F6.65 (PID Sleep Delay Time), the drive will be in sleep mode and the motor will decelerate to stop.
When the PID frequency command > (PID Wakeup Initial Frequency) and reach F6.63(PID Wakeup Delay Time), the drive will restart.



Chapter 6 Communication Description

6-1 KP-601 / Modbus Port (RJ-45)



8 ◄— 1

Type	Pin	Function	Description
Modbus(RS-485)/ KP-601 communication	1	Communication transmission terminal (DX+)	Differential input of RS-485 *Note 1 Modbus (RS-485) communication only uses pin1, 2.
	2	Communication transmission terminal (DX-)	
	3	Power terminal of KP-601(+16V)	Only for KP-601 linking
	4	Auto-detect terminal of KP-601	Only for KP-601 linking
	5	Reserved	Reserved
	6		
	7	Common ports of KP-601 power(0V)	Only for KP-601 linking
	8		

Note 1: The terminal resistor(100Ω) selection is set by DSW1(Default setting: ON)

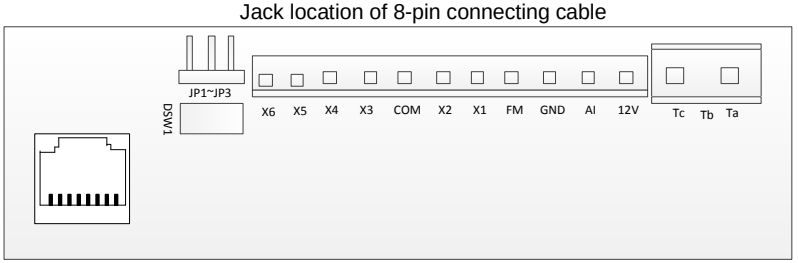
Note 2: When using multiple sets of drive, connect all the DX＋, DX－ terminals of each drive by series, and connect the shielded net of the connection wire to FG terminal.

Note 3: The function of terminal resistor is to terminate the electric signal and avoid the reflective signal to interfere the signal. Switch DSW1 to “ON” position of the first and last drive and switch to “1” position for other drives. The default value is “ON” position.

Note 4: The cable length from the controllers(PC, PLC) to the last drive cannot exceed 500m.

Note 5: Max. controller number are 31 sets.

Jack location of 8-pin connecting cable



6-2 The Setting of Communication Parameter

●F6.55 Communication Address：00~254（00—Disable）

●F6.56 Baud Rate：
0: 4800bps
1: 9600bps
2: 19200bps

●F6.57 Communication Format：
0: 8,N,2 for RTU
1: 8,E,1 for RTU
2: 8,O,1 for RTU
3: 8,N,1 for RTU

●F6.58 Communication Overtime (Cot)：
0.0: No overtime detection
0.1~100.0sec: The setting of overtime detection

●F6.59 Communication Overtime Disposal：
0: Warning (Cot): Continue operation
1: Warning (Cot): Ramp to stop
2: Warning (Cot): Coast to stop

●F6.60 Multi-Function Input Selection：
0: Multi-function inputs from multi-function terminals
1: Multi-function inputs from communication control

6-3 Communication Protocol

Serial data transmission is an asynchronous serial data transmission: 1 frame = 11 bits (3 types of format shown in below figures)

● 8,N,2: 1 start bit，8 data bits，2 stop bits

START	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	STOP	STOP

● 8,E,1: 1 start bit，8 data bits，1 even parity bit，1 stop bit

START	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	EVEN PARITY	STOP

● 8,O,1: 1 start bit，8 data bits，1 odd parity bit，1 stop bit

START	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	ODD PARITY	STOP

6-4 Message Format

Address (Drive)	OP Code	Data n	…	Data 1	Data 0	CRC 0	CRC1	END
Drive Address No. (1 Byte)	Operation Message (1 Byte)	Data Message (Data length "n": depending on OP Code)				CRC Checksum		No Transmitting ≧10ms

●**Address:** Drive address number for host to control

00H: The host broadcasts messages to all receivers (drives). All receivers only receive the message but has no messages returned to the host.

01H~FEH: The host designates the receiver (drive) by defining the drive address number.

●**OP Code(Operation Code):** The operation of the host to the drive

03H- Read multi-registers
06H- Write to single register
08H- Receiver detection
10H- Write to multi-registers

●**Data:** Including start register, several registers, data length (maximum 8 data), data content (maximum 16 bits)

Note: Data length – 1 byte, others – 1 word(2 bytes)

●**CRC Checksum:** Cyclical Redundancy Check performs XOR and bit shifting operations for all hexadecimal values in the message to generate the checksum code to verify the communication validity. Checksum is to sum all message bits for 16-bit CRC calculations. (See CRC Checksum)

●**Message Length:** Message length is listed in between maximum and minimum values. Message lengths of OP code 03H and 10H are dependent on the number of registers required in one message. (See Operation Code(OP Code) Description)

OP Code	Description	Instruction Code		Return Code	
		Min(bytes)	Max(bytes)	Min(bytes)	Max(bytes)
03H	Read multi-registers	8	8	7	21
06H	Write to single register	8	8	8	8
08H	Drive Detection	8	8	8	8
10H	Write to multi-registers	11	25	8	8

●Operation Code(OP Code) Description:

※03H (Read multi-registers):

Example: Read data from registers 2101H and 2102H of the drive 1

Message Code (Host to Drive)

Address	OP Code	Starting Register		Register Numbers to Readout		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	03H	21H	01H	00H	02H	9FH	C4H

This example shows the host to read the drive data from 2 registers of the drive. The host identifies drive 1 by calling the drive address (02H) with the “read” operation command (03H) to read the drive data from the registers (2101H – starting register) to the register (2102H – Register Numbers to Readout defines the numbers of register for data readouts).

Return Code (Drive to Host)

Address	OP Code	Data Bytes	2101H(Register) Data		2102H(Register) Data		CRC Checksum	
			MSB	LSB	MSB	LSB	LSB	MSB
02H	03H	04H	55H	00H	17H	70H	D6H	EBH

The host reads registers 2101H and 2102H of drive (02H) (drive status and speed command). After the drive receives the host’s command, the drive returns 4 bytes data (2101H=5500H and 2102H=1770H) to the host.

Caution: The host cannot simultaneously broadcast 03H OP code to drives when multiple drives connected or all drives reject host’s OP code.

※06H (Write to single register)

Example: Write a data (1770H) into the drive register (2001H)

Message Code (Host to Drive)

Address	OP Code	Drive Register		Register Data		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	06H	20H	01H	17H	70H	DDH	EDH

This example shows the host to write the data (1770H) to the register (2001H) of the drive. The host identifies drive 1 by calling the drive address (02H) with the “write” operation command (06H) to write the data (1770H) into the register (2001H).

Return Code (Drive to Host)

Address	OP Code	Drive Register		Register Data		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	06H	20H	01H	17H	70H	DDH	EDH

The host writes data 1770H into the drive register 2001H. After receiving data from the host and writing data into drive’s registers, the drive returns the original receiving message to the host. OP code-06H of the host can synchronously broadcast to all drives but has no return code to the host.

※08H (Drive detection): Only use when testing the communication

OP code – 08H is to detect if the drive is correctly receiving the data from the host. The main purpose of using this OP code is to ensure the host data to be correctly sent to the drive.

Example: Verify the data (0000H and AA55H) to be correctly received by the drive.

Message Code (Host to Drive)

Address	OP Code	Data 1		Data 2		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	08H	00H	00H	AAH	55H	5EH	A7H

The host sends OP-code (08H) to verify the data 0000H and AA55H to be correctly received by the drive.

Return Code (Drive to Host)

Address	OP Code	Data 1		Data 2		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	08H	00H	00H	AAH	55H	5EH	A7H

The drive returns the same message to the host to confirm the data well received from the host. Data 1 must be 0000H but Data 2 can be any values.

Note: The host cannot simultaneously broadcast 08H OP code to all drives when multiple drives connected or drives reject drive's OP codes.

※10H (Write to multi-registers)

When multiple data need to write into the drive from the host, the host can define how many registers and data to be written into the drive.
This example is illustrating 2 data (1011H and 1770H) from the host to be written into 2 drive registers (2000H and 2001H).

Message Code (Host to Drive)

Address	OP Code	Starting Register		Register Number to Write		Data Length	Data 1		Data 2		CRC Checksum	
		MSB	LSB	MSB	LSB		MSB	LSB	MSB	LSB	LSB	MSB
02H	10H	20H	00H	00H	02H	04H	10H	11H	17H	70H	3FH	FBH

The host calls the drive 1 by defining the drive address (02H) with the write to multi-registers OP code (10H) to write 2 data (1011H and 1770H) into the drive registers (2000H and 2001H) which are defined by calling starting register (2000H) with "register number to write" (0002H). In this example, if user has 4 data to write to 4 drive registers, the message code can be as follows:

a. Starting register: 2000H (still)
b. Register number to write: 0004H

Then, 4 data will be sequentially written into 4 registers starting from 2000H, 2001H, 2002H, to 2003H.

Return Code (Drive to Host)

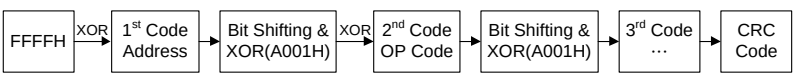
Address	OP Code	Starting Register		Register Numbers to Write		CRC Checksum	
		MSB	LSB	MSB	LSB	LSB	MSB
02H	10H	20H	00H	00H	02H	4AH	3BH

The host writes 2 data (1011H and 1770H) with total data length 4 byte to 2000H and 2001H registers of drive. The drive receives and writes the data to the registers, and then returns the message to the host. The host can synchronously broadcast all drives to write multi-data to multi-registers in order to change the data synchronously.

6-5 CRC Checksum Algorithm

CRC checksum code is to verify the message validity during the communication and its algorithm is to apply each code in the message to perform XOR and bit shifting operations to generate the CRC code.

Here is the checksum algorithm diagram to generate CRC code.



The following example of showing how CRC code is generated.

Example: To generate CRC code D140 from Address Code: 02H and OP Code: 03H

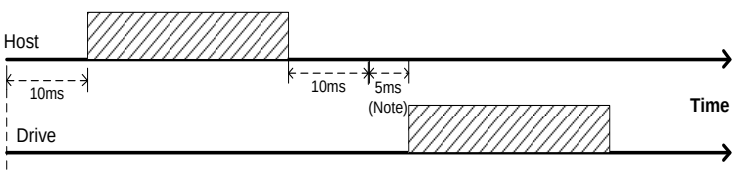
```
                1 1 1 1  1 1 1 1  1 1 1 1  1 1 1 1
First Code 02H                    0 0 0 0  0 0 1 0   XOR
                1 1 1 1  1 1 1 1  1 1 1 1  1 1 0 1
MOVE 1          0 1 1 1  1 1 1 1  1 1 1 1  1 1 1 0 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 1 0 1  1 1 1 1  1 1 1 1  1 1 1 1
MOVE 2          0 1 1 0  1 1 1 1  1 1 1 1  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 1 0 0  1 1 1 1  1 1 1 1  1 1 1 0
MOVE 3          0 1 1 0  0 1 1 1  1 1 1 1  1 1 1 1 | 0
MOVE 4          0 0 1 1  0 0 1 1  1 1 1 1  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 0 0 1  0 0 1 1  1 1 1 1  1 1 1 0
MOVE 5          0 1 0 0  1 0 0 1  1 1 1 1  1 1 1 1 | 0
MOVE 6          0 0 1 0  0 1 0 0  1 1 1 1  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 0 0 0  0 1 0 0  1 1 1 1  1 1 1 0
MOVE 7          0 1 0 0  0 0 1 0  0 1 1 1  1 1 1 1 | 0
MOVE 8          0 0 1 0  0 0 0 1  0 0 1 1  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 0 0 0  0 0 0 1  0 0 1 1  1 1 1 0
Second Code 03H                   0 0 0 0  0 0 1 1
                1 0 0 0  0 0 0 1  0 0 1 1  1 1 0 1
MOVE 1          0 1 0 0  0 0 0 0  1 0 0 1  1 1 1 0 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 1 1 0  0 0 0 0  1 0 0 1  1 1 1 1
MOVE 2          0 1 1 1  0 0 0 0  0 1 0 0  1 1 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 1 0 1  0 0 0 0  0 1 0 0  1 1 1 0
MOVE 3          0 1 1 0  1 0 0 0  0 0 1 0  0 1 1 1 | 0
MOVE 4          0 0 1 1  0 1 0 0  0 0 0 1  0 0 1 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 0 0 1  0 1 0 0  0 0 0 1  0 0 1 0
MOVE 5          0 1 0 0  1 0 1 0  0 0 0 0  1 0 0 1 | 0
MOVE 6          0 0 1 0  0 1 0 1  0 0 0 0  0 1 0 0 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 0 0 0  0 1 0 1  0 0 0 0  0 1 0 1
MOVE 7          0 1 0 0  0 0 1 0  1 0 0 0  0 0 1 0 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 1 1 0  0 0 1 0  1 0 0 0  0 0 1 1
MOVE 8          0 1 1 1  0 0 0 1  0 1 0 0  0 0 0 1 | 1
                1 0 1 0  0 0 0 0  0 0 0 0  0 0 0 1
                1 1 0 1  0 0 0 1  0 1 0 0  0 0 0 0
CRC :             D        1        4        0
```

The following example of using C language to create a sample program for CRC checksum algorithm

Example: C language sample program

```
unsigned char *data;     // Message pointer
unsigned char length;       // Message length
unsigned int crc_chk(unsigned char *data,unsigned char length)
{
 int i;
 unsigned int reg_crc=0xffff;
 while(length--)
  {
    reg_crc^=*data++;
    for(i=0;i<8;i++)
        if(reg_crc&0x01)
           reg_crc=(reg_crc>>1)^0xa001;
        else
           reg_crc=reg_crc>>1;
  }
}
```

6-6 Processing Time of Communication Transmission



The communication waits for 10ms to start the communication transmission after the drive powers on or the communication function of the drive changes. The drive needs 5ms processing time to return the message to the host after the message are received from the host. If the host only broadcasts to the drive, the host can start sending the message code after 5ms.

Note: if the message code is to “Read” or “Write” the parameter, the drive needs 100ms processing time to return the message to the host.

6-7 Communication Troubleshooting

1. When error occurs at the communication network, the drive provides the self-testing function to identify where error occurs. Please check communication function settings to verify the validity of functions.

2. When the host receives returned error messages from a drive, the host sends the invalid operation command to drive. The following table is the error message format.

Address	OP Code	Error Code	CRC Checksum	
			LSB	MSB
02H	1xxxxxxxB	xxH	xxH	xxH

OP code sets MSB (bit7) as 1 for the original command message, but error code gives different values according to different types of errors. The below table is describing types of error code:

Error Code	Error Type	Descriptions
0 0	Serial communication format error	Parity error of serial communication
0 1		Data frame error of serial communication
0 2		Over-bit error of serial communication
0 3	Modbus OP code error	OP code is not in either 03H,06H,08H, or 10H
0 4	Modbus CRC error	CRC checksum error
0 5	Modbus data range error	1. Data length in transmission not matched with the protocol 2. Data range over the register length at “write”
0 6	Modbus register characteristics error	Registers writes into read-only registers
0 7	Modbus register error	No-defined registers

6-8 Drive Registers and Command Code

●Registers – Write Operation

Reg. No.	Name	Description	
AGnnH (see **Note4**)	Function setting	Drive function setting/monitoring; G: function group; nn: function number Example: F1.20=A114H	
2000H	Operation command 1	b0~b1	00: No use
			01: Stop
			10: Start
			11: JOG command
		b2~b3	Reserved
		b4~b5	00: No use
			01: Forward command
			10: Reverse command
			11: Rotation direction change command
		b6~b7	00: Primary accel/decel time
			01: Second accel/decel time
			10: Third accel/decel time
			11: Fourth accel/decel time
		b8~bA	000: Primary speed (communication)
			001: Preset speed 1
			010: Preset speed 2
			011: Preset speed 3
			100: Preset speed 4
			101: Preset speed 5
			110: Preset speed 6
			111: Preset speed 7
		bB	Reserved
		bC~bD	00: No use
			01: b6~bA functions *Note 1
			10: Enable operation command 2 resister.
			11: Disable 01 and 10
		bE~bF	Reserved
2001H	Frequency command	Primary frequency is set by communication (unit: 0.01Hz)	
2002H	Operation command 2	b0	1: External fault command
		b1	1: Reset command
		b2	1: Jog command
		b3	1: Output interruption command
		b4	1: Coast to stop command
		b5	1: Secondary accel/decel command
		b6	1: Accel/decel prohibition command
		b7	1: Select analog input source
		b8	1: DC braking enable
		b9	1: Secondary frequency selection
		bA~bF	Reserved

●**Registers – Read Operation**

Reg. No.	Name	Description	
2100H	Drive error code	00H	No error
		01H	Drive over current (OC)
		02H	Over voltage (OE)
		03H	Drive overheat (OH)
		04H	Drive overload (OL1)(OL2)
		05H	Motor overload (OL)
		06H	External fault (EF)
		07H	Short protection (SC)
		08H	A/D converter error (AdEr)
		09H	Reserved
		0AH	Reserved
		0BH	Reserved
		0CH	Reserved
		0DH	Grounding fault (GF)
		0EH	Under voltage during operation (LE1)
		0FH	EEPROM error (EEr)
		10H	Reserved
		11H	Drive output interruption (bb)
		12H	System overload (OLO)
		13H	Reserved
		14H	Reserved
		15H	Coast to stop (Fr)
2101H	Drive status 1	b0~b7	Reserved
		b8	1: Frequency control by communication
		b9	1: Frequency control by analog inputs
		bA	1: Operation command by communication
		bB	1: Parameter locking
		bC	1: Drive running status
		bD	1: Jog running status
		bE	1: Forward indication
		bF	1: Reverse indication
2102H	Frequency command	Monitor drive's frequency command (unit: 0.01Hz)	
2103H	Output frequency	Monitor drive's output frequency(unit: 0.01Hz)	
2104H	Output current	Monitor drive's output current(unit: 0.1A)	
2105H	DC bus voltage	Monitor drive's DC bus voltage(unit: 0.1V)	
2106H	Output voltage	Monitor drive's AC output voltage(unit: 0.1V)	
2107H	Frequency of multi-speed	Monitor drive's frequency of multi-speed *Note 2	
2108H	Reserved		
2109H	Reserved		
210AH	Reserved		
210BH	Reserved		
210CH	Reserved		
210DH	Reserved		
210EH	Reserved		

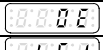
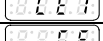
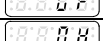
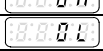
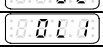
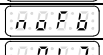
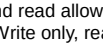
210FH	Reserved		
2300H	I/O terminal status	b0	Reserved
		b1	Reserved
		b2	1: X1 terminal operation
		b3	1: X2 terminal operation
		b4	1: X3 terminal operation
		b5	1: X4 terminal operation
		b6	1: X5 terminal operation
		b7	1: X6 terminal operation
		b8	1: Y1 terminal detection
		b9	Reserved
		bA	Reserved
		bB	Reserved
		bC	1: Primary speed by analog input
		bD	1: Primary speed by operation panel
		bE	1: Primary speed by UP/DOWN command
		bF	1: Primary speed by communication
2301H	Drive status 2	b0	Reserved
		b1	1: Constant speed
		b2	1: Zero speed
		b3	1: Frequency detection
		b4	1: System overload
		b5	1: Stall prevention
		b6	Reserved
		b7	1: Braking action
		b8	Reserved
		b9	Reserved
		bA	1: Error signal
		bB~bF	Reserved
2302H	Reserved		
2303H	Fault record 1	Fault record 1 *Note 3	
2304H	Fault record 2	Fault record 2 *Note 3	
2305H	Fault record 3	Fault record 3 *Note 3	
2306H	Fault record 4	Fault record 4 *Note 3	
2307H	Fault record 5	Fault record 5 *Note 3	

Note:

1. When the function is enabled, multi-function command –Multi-speed 1, 2, 3, will be inactive.

2. 0: Analog
   1: Primary speed
   2~16: Multi-speed 2~16
   17: Jog speed
   18: UP/DOWN command
   19: Frequency command of sequential operation control
   21: Communication

3. Fault record table

Error code	Drive display	Description
01H	 (AdEr)	A/D converter error
02H	 (Fot)	IGBT module error
03H	 (EEr1)	Internal memory error
08H	 (OC)	Drive over current
0CH	 (OE)	Over voltage
0DH	 (LE1)	Under voltage during operation
0EH	 (GF)	Grounding fault
0FH	 (OH)	Drive overheat
10H	 (OL)	Motor overload
11H	 (OL1)	Drive overload
12H	 (OLO)	System overload
13H	 (EF)	External fault
14H	 (PAdF)	Keypad interruption during copy
16H	 (ntcF)	Thermal sensor fault
17H	 (OH2)	Motor overheat
18H	 (noFb)	PID feedback signal error
19H	 (OL2)	Drive current limit

4.AGnnH—Write and read allowed
2000H~2002H—Write only, read prohibited
2100H~210FH—Read only, write prohibited

6-9 Programming Examples – Register and Command

6-9-1 Access Drive Function Setting – Write Operation

Write a single register to access drive function setting:

a. Set function F2.00 (primary speed) = 30 Hz
b. Speed setting is directly input by function setting
c. Drive register used: AGnnH ➔ F2.00: G = 2; nn = 00 (decimal value) = 00H(Hex). F2.00 = A200H register
d. Speed = 30Hz ➔ 30.00Hz(resolution: 0.01Hz) ➔ 30.00 x 100 = 3000 (decimal) = 0BB8H (hex)
e. The host controls only one drive(drive 1)

Code to write to drive register from the host (CRC exclusive)

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	A2H	00H	0BH	B8H

6-9-2 Host Control to Drive – Write Operation

When the host control by Modbus communication, user can simply create an icon or active key/button to activate the drive. The following examples shows how to program the communication control.

1. Start the drive:

a. Create an icon or active button/key on the host for “Drive Start”
b. Program the host with the following code for “Drive Start”
c. The drive register to be written for start operation: 2000H
d. The register data for start operation: 0002H

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	20H	00H	00H	02H

2. Forward rotation command:

a. Create an icon or active button/key on the host for “Forward”
b. Program the host with following code for “Forward” rotation control
c. The drive register to be written for forward command: 2000H
d. The register data for forward command: 0010H

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	20H	00H	00H	10H

3. Speed Setting (frequency command) – without using drive function setting:

Set the speed to be 30.05Hz (resolution: 0.01Hz)

a. The drive register to be written for Speed setting(frequency command): 2001H
b. Convert 30.05Hz to hexadecimal value:
30.05 x 100 (by the resolution) = 3005 (decimal) = 0BBDH

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	20H	01H	0BH	BDH

4.Primary Acceleration/Deceleration Time Setting:

Set the acceleration/deceleration time = 1.5 seconds (resolution: 0.1 seconds)

a. Set F2.18 (Primary accel time) = 1.5 seconds
Convert F2.18 to hexadecimal value for generating register number: 18 (decimal) = 12H
Convert 1.5 seconds to hex value: 1.5 x 10 (by resolution) = 15 (decimal) = 000FH

b. Set F2.19 (Primary decel time) = 1.5 seconds
Convert F2.19 to hex value: 19 (decimal) = 13H

c. Select primary accel/decel time command: register: 2000H, register data = 00 (b6,b7)

Set the acceleration time F2.18 = 1.5 seconds

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	A2H	12H	00H	0FH

Set the deceleration time F_020 = 1.5 seconds

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	A2H	13H	00H	0FH

Select primary acceleration/deceleration time

Address	OP Code	Drive Register		Register Data	
		MSB	LSB	MSB	LSB
01H	06H	20H	00H	00H	00H

6-9-3 Host Control to Drive – Read Operation

1. Drive Error Trips (Fault Code):

Example: Drive error trips due to “GF” (grounding fault) and the fault message displayed at the host.

a. The host sends the below codes to access the drive register to monitor drive faults (read only one register data)
-Drive register: 2100H
-Number of register to read: 1 ➔ 0001H

Message Code (Host to Drive)

Address	OP Code	Drive Register		Register Numbers to Readout	
		MSB	LSB	MSB	LSB
01H	03H	21H	00H	00H	01H

b. The drive returns the fault code to the host when “GF” occurs:
-GF code: 0DH

Return Code (Drive to Host)

Address	OP Code	Data Byte	2100H(Register) Data	
			MSB	LSB
01H	03H	04H	00H	0DH

c. Program the host to convert register data 000DH to “GF” message

2. Drive Frequency Output Readout:

Example: If the drive frequency outputs = 40.65Hz, read the data output from the drive and display 40.05Hz in the host.

a. The host sends the below codes to access the drive register to read out the frequency output data (read only one register data)
-Drive register: 2103H
-Number of register to read: 1 ➔ 0001H

Message Code (Host to Drive)

Address	OP Code	Drive Register		Register Numbers to Readout	
		MSB	LSB	MSB	LSB
01H	03H	21H	03H	00H	01H

b. The drive returns the frequency output readouts to the host
-Output frequency readouts from the drive (2103H register data):

Return Code (Drive to Host)

Address	OP Code	Data Byte	2103H(Register) Data	
			MSB	LSB
01H	03H	04H	0FH	E1H

c. Program the host to convert register data 0FE1H (Hex value) = 4065 (Decimal value)

d. Display the output frequency (resolution = 0.01): 4065/100 = 40.65 (unit in Hz)

No Text on This Page

Chapter 7 Operation Procedures and Fault Protection

7-1 Operation Procedures

DANGER
1. Do Not remove wires when the internal indicator of the drive remains ON.

CAUTION
1. Check if the shield of wire is broken after wiring is completed to avoid electric leakage or short circuit. 2. Screws on the terminal must be fastened.

A. Verify and check the compatibility between power source, voltage, motor, and drive.

B. Connect the power to drive R/L1, S/L2, T/L3 (three-phases) or R/L1, S/L2 terminals(single-phase).

C. Set all required parameters and functions after power is ON and measure the output voltage of the drive at U/T1, V/T2, W/T3 terminals to verify if the output voltage and current are valid. Press "STOP RESET" when completing all verifications.

D. Switch off the power and wait for drive's power indicators off, and then connect drive's U/T1, V/T2, W/T3 terminals to the motor.

E. Operate the motor with the drive by low speed after power on to verify the validity of the motor rotation direction and then to slowly increase the motor speed.

F. Motor start or stop must be controlled by drive control signal instead of switching the power on/off. The lifetime of the drive will be significantly reduced if the invalid operation using the switch control of the power is applied to motor control.

G. Because the starting current of motor is 6~8 times of rated current, Do NOT install the magnetic contactor between the drive and motor for the motor operation.

H. When using the single-phase power source to drive the three-phase drive (not the standard type of single-phase power input), first confirm the horsepower of motor, and then calculate the motor rated current by multiplying the motor rated current by 2 to gain the drive rated current. The drive selection for this single-phase power must have the rated current equal to the calculated drive rated value.

Formula: Motor rated current **×** 2 = drive rated output current

Example:

a. Drive selection:

Motor specification: 220VAC, 1HP ; rated current: 3.1A

Drive rated current=3.1 (A) × 2 = 6.2 (A)

Drive specifications: 230VAC, 1HP drive = 4.2A(continuous current)
2HP drive = 8A(continuous current)

⇨ Select 2HP drive for 1HP AC motor.

b. Connect the wires of single-phase power with R/L1,S/L2 terminals.

c. Parameter setting:
Please reset above parameters. If the parameters are not modified, the motor and drive could be possibly damaged.

F4.08 (Motor Rated Current)=3.1A
(the setting must be based on the motor rated current)

F4.28 (Overload Detection Level)=80
(the half of the default setting value 160%)

F3.04 (Stall Prevention Level at the Constant Speed)=80
(the half of the default setting value 160%)

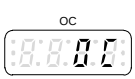
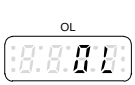
7-2 Fault Protection Display and Troubleshooting

A: Description:

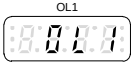
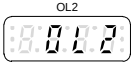
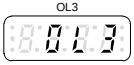
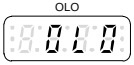
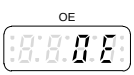
The drive has well protection functions to protect drive and motor when faults occur. When the fault occurs, the drive trips by the protection functions and display the fault message on operation panel. After the fault is troubleshooted, reset the drive by pressing "STOP RESET" of the drive operation panel or by the external operation reset signal to the drive multi-function input terminals.

B: Protection and Troubleshooting List:

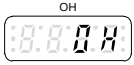
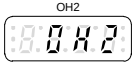
Drive error trip message

Display	Description	Cause	Troubleshooting
	**IGBT module error**	●Error on the drive power system. ●Drive outputs fault current. ●High temperature on IGBT module.	Return the drive to repair when reset command from multi-function input terminal or "STOP RESET" are useless.
	**Grounding fault** ●The three-phase output current is unbalance and exceeding the detection level of grounding fault. ●Grounding fault detection level: F4.01.	The output terminal of the drive is short or grounding.	●Check the insulation value of motor. ●Check the shield of motor's wire.
	**Drive over current** ●The drive current during the operation exceeds 220% of drive's rated current.	●The output terminals of drive are short. ●The load is too heavy. ●The acceleration time is too short. ●Drive is immediately restarted during coast to stop. ●Use special motor.	●Check wires of U/T1,V/T2,W/T3 terminals to verify if there is short between terminals. ●Check the motor and drive compatibility. ●Check the motor operated in over-rated running.
	**Motor overload** ●Operation current exceeds 150% of motor's rated current and reaches the motor overload protection time. ●Active time: F4.10.	●Motor is overloaded. ●The voltage setting of V/F pattern is too high or too low. ●The current setting of motor's rated current is invalid.	●Check the load of motor. ●Check if the acceleration or deceleration time is too short. ●Check if V/F setting is proper. ●Check if the rated current setting is valid.

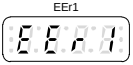
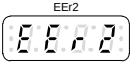
Drive error trip message

Display	Description	Cause	Troubleshooting
OL1 	**Drive overload** ●Operation current exceeds 150% of drive's rated current and continues for 1minute.	●Motor overload. ●The voltage setting of V/F pattern is too high or too low. ●Drive capacity is too small.	●Check the load of motor if overload. ●Check if the acceleration or deceleration time is too short. ●Check if V/F setting is proper. ●Select the higher capacity of drive.
OL2 	**Drive current limit** ●Operation current exceeds 200% of drive's rated current.	●Motor overload. ●Acceleration time is too short. ●Immediate restart after coast to stop.	●Check the motor and drive compatibility. ●Check if the motor is operated in over-rating condition.
OL3 	**Braking transistor overload**	The frequent braking action causes the temperature of the braking transistor too high.	Increase the deceleration time.
OLO 	**System overload** ●Load is too heavy and the operation current reaches the active level. ●Detection level: F4.28 ●Detection time: F4.29	— — —	Check the usage of mechanical equipment.
OE 	**Over voltage** ●The internal DC bus voltage is over the protection level. ●100V/200V series: About DC410V ●400V series: About DC820V	The deceleration time of motor is too short causing the regeneration voltage too high on DC bus.	●Increase the setting value of deceleration time ●Use high torque braking method. ●Add dynamic brake unit to reduce regenerate voltage.
		Power source is too high.	Check if the input power is within drive's rated range.

Drive error trip message

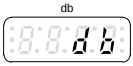
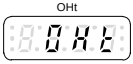
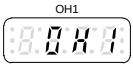
Display	Description	Cause	Troubleshooting
LE1 	**Under voltage during operation** The internal DC bus voltage is below 70% of power source for 200V/400V series drive or 50% of power source for 100V series drive.	●Phase failure of input power. ●Instantaneous power off. ●Voltage variation of power source is too high. ●Motor with instant overload causes the high voltage drop.	Increase the power capacity by selecting higher capacity drive to avoid the voltage drop of the power cord.
ntcF 	**Thermal sensor fault**	Drive thermal sensor (NTC) is fault.	Please call customer service for drive repair.
OH 	**Drive overheat** ●The temperature of drive's heat sink reaches the trip level. ●Trip level: F4.12	●The surrounding temperature is too high. ●The heat sink has foreign body. ●The cooling fan of drive is fault.	●Improve the ventilation. ●Clean the dust on the heat sink. ●Return the drive to replace the cooling fan.
OH2 	**Motor overheat** ●The internal temperature of motor is over the trip level. ●Trip level: F4.23	Motor is overheat.	●Check if the motor load is too heavy. ●Check if the accel./decel. time is too short. ●Check if V/F setting is proper.
noFb 	**PID feedback signal error**	The feedback signal wire tripped.	Check the feedback signal wire.
AdEr 	**A/D converter error**	— — —	Please call customer service for drive repair.
EF 	**External fault**	The multi-function terminal receives the external fault signal.	Clear the external fault and then press "STOP RESET" key.
PAdF 	**Keypad interruption during copy**	●The connecting wire of the keypad is loosen. ●The keypad jack of the drive is oxidized.	Check the connecting wire of keypad.

Drive error trip message

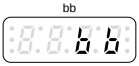
Display	Description	Cause	Troubleshooting
EEr 	**EEPROM error**	●EEPROM data write fault. ●EEPROM component defected.	●Please reset all parameters to default value and restart the drive. ●Return the drive to repair, when the fault cannot be eliminated.
EEr1 	**Internal memory error**	CPU RAM is malfunction.	Please call customer service for drive repair.
EEr2 	**Internal memory error**	The software checksum is incorrect.	Please call customer service for drive repair.

Drive warning message

*Drive will stops output when displaying below messages. After the fault conditions are troubleshooted, the drive will recover to normal condition.

Display	Description	Cause	Troubleshooting
OLO 	**System overload** ●Load is too heavy and the operation current reaches the active level. ●Detection level: F4.28 ●Detection time: F4.29	— — —	Check the usage of mechanical equipment.
Hv 	**Power source over voltage** The internal DC bus voltage of drive is over the protection level during stop.	Power source voltage is too high.	Check if the input power is within drive's rated range.
db 	**Braking transistor is active** ●The internal DC bus voltage of drive is over the protection level. ●Setting level:F3.27	The deceleration time of motor is too short causing the regenerate voltage too high on DC bus.	●Increase the setting value of "deceleration time". ●Use high torque braking method. ●Add dynamic brake unit to reduce regenerate voltage
LE 	**Power source under voltage**	The voltage of power source is too low.	Check if the voltage of power source is normal.
OHt 	**Drive overheat** ●The temperature of drive's heat sink reaches the protection level. ●Setting level: F4.12	●The surrounding temperature is too high. ●The heat sink has foreign body. ●The cooling fan of drive is fault.	●Improve the ventilation. ●Clean the dust on the heat sink. ●Return the drive to replace the cooling fan.
OH1 	**Motor overheat** ●The internal temperature of motor is over the warning level. ●Warning level: F4.21	Motor is over heat.	●Check if the motor load is too heavy. ●Check if the accel./decel. time is too short. ●Check if V/F setting is proper.

Drive warning message

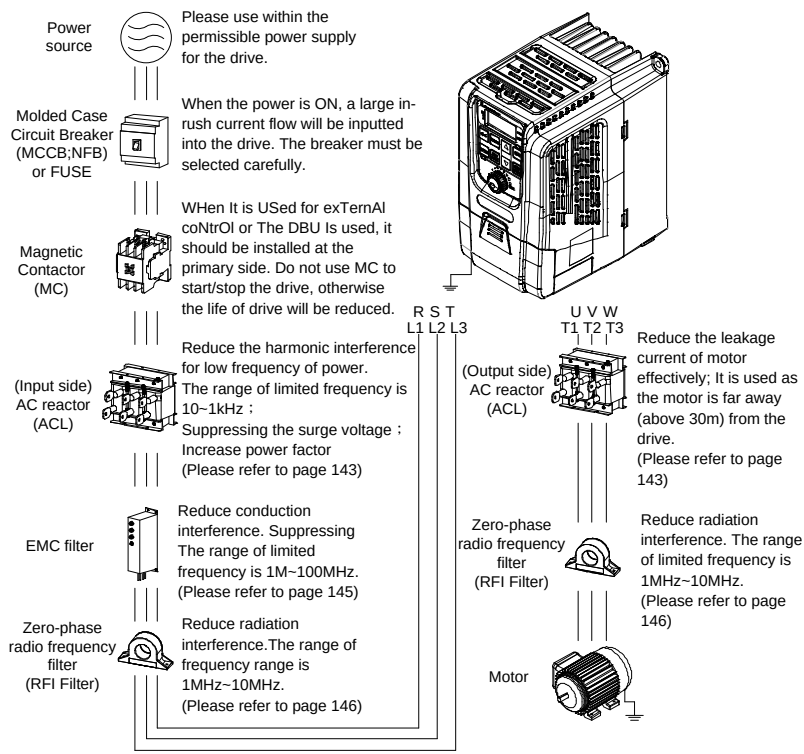
Display	Description	Cause	Troubleshooting
bb 	**Drive output interruption**	Drive stops the output when the output interruption command is activated.	Clear drive output interruption command.
Fr 	**Coast to stop**	Drive stops the output when the coast to stop command is activated.	Clear “coast to stop” command.
dtF 	**Forwad/reverse command input simultaneously**	Input the forward/reverse command to one of X1~X6 terminals simultaneously.	Check the control command.
 Inter-display with frequency command	**No input of forward/reverse command**	— — —	Check rotation direction command.
WrF 	**Different software version inter-copy**	The software version of drives is different.	Check up the software version is corresponded.
Cot 	**Modbus communication overtime**	●Communication wire is loosen or connecting wire is incorrect. ●Communication setting of host and receiver are different.	●Check the wiring of communication wire. ●Check the communication setting.
Err 00  *Err 01* 	**Err 00: Keypad cable trip before connecting.** **Err 01: Keypad cable trip during operation.**	●The connecting wire of the keypad is loosen. ●The keypad jack of the drive is oxidized.	Check the wire between the keypad and drive.

No Text on This Page

Appendix A Peripheral Equipment of Drive

⚠ CAUTION

1. When the drive requires the following equipment, please select the proper external equipment. The incorrect system setup will result the failure of drive, reduce the of drive's service life time, and even damage the drive.
2. The surrounding temperature will influence drive's service life time. Please monitor the temperature to avoid of exceeding the temperature specifications, especially as drive installed at a closed place. In addition, the control signal should be far away from main loop to avoid of the signal interference.
3. The motor and drive should be grounded well to avoid of electric shocks. Motor's grounding must connect to drive's grounding terminal.

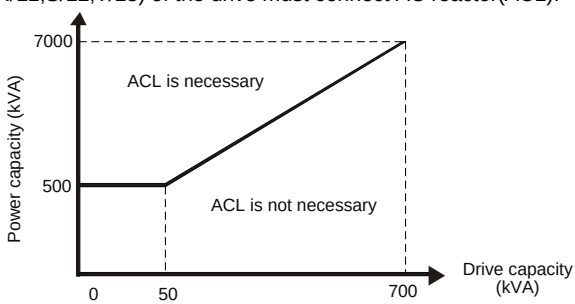


Appendix B Selection of AC Reactor(ACL)

⚠ CAUTION
Due to the ACL possibly produce the heat in use, please Do NOT touch the ACL and caution the environment conditions.

a. Suppress the harmonic current of power and improving the power factor are the main function of the ACL. Connect the ACL at the power source input terminal of drive that also can suppress the surge voltage to protect the drive.

b. When the power capacity is over 500kVA or more than ten times of the rated capacity of the drive, add the ACL (as the figure below) is necessary. The input terminal(R/L1,S/L2,T/L3) of the drive must connect AC reactor(ACL).



c. When one of the heater (with the SCR), air compressor, high-frequency equipment, or welding machine is installed at the same power source site, the harmonic current will interfere the drive. Thus, add the ACL at the input terminal (R/L1,S/L2,T/L3) of drive is required.

d. When multiple drives of high horse power are used, due to harmonic wave exerted, adding ACL at the input terminal (R/L1,S/L2,T/L3) of drives is required to prevent the drives from the possible interference and power quality deterioration.

e. When the cable length between drive and motor exceeds 30 meters or the drive control multiple motors in parallel, please add ACL at the output terminal(U/T1, V/T2, W/T3) of the drive.

f. The power factor is above 75% by adding ACL in power source input site (R/L1,S/L2,T/L3) of drive.

g. Please select suitable specification of ACL according to motor capacity. The ACL specification lists are as below:

AC 200V Series

Drive Model	Input(R/L1,S/L2,T/L3)		Output(U/T1,V/T2,W/T3)	
	(mH)	(A)	(mH)	(A)
RM6E1-20P5B3 RM6E1-2001B3 RM6E1-21P5B3 RM6E1-2002B3 RM6E1-2003B3 RM6E1-2004B3	0.45	15	0.45	15
RM6E1-2005B3 RM6E1-2007B3	0.2	30	0.13	50

AC 400V Series

Drive Model	Input(R/L1,S/L2,T/L3)		Output(U/T1,V/T2,W/T3)	
	(mH)	(A)	(mH)	(A)
RM6E1-4001B3 RM6E1-4002B3 RM6E1-4003B3 RM6E1-4005B3	0.45	15	0.45	15
RM6E1-4007B3	0.2	30	0.2	30

h. The outline dimensions of AC reactor(ACL)

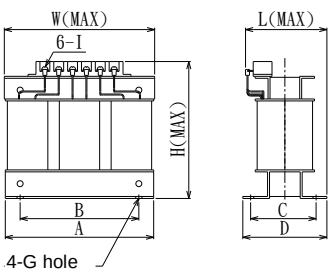


Figure A

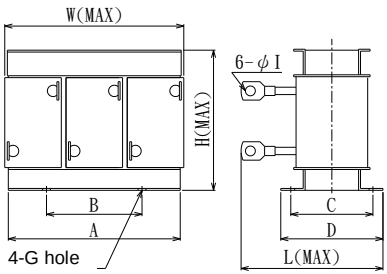


Figure B

ACL	Figure	A	B	C	D	W (MAX)	L (MAX)	H (MAX)	G	I	Weight (kg)
0.45mH/15A	A	150	80	66	85	152	97	146	16×8	M4	4.0
0.2mH/30A	B	150	80	66	85	152	127	130	16×8	6	4.2
0.13mH/50A	B	150	80	68	85	152	134	131	16×8	6	4.6

(unit:mm)

Appendix C Selection of EMC Filter

ElectroMagnetic Interference(EMI) is a major bother of drive. Drive will generate high-frequency / low-frequency noise to interfere the peripheral equipment by radiation or conduction during running. In many countries especially in Europe have the strict limit for the AC motor drive generated the electromagnetic interference. By installing the EMC filter can reduce much electromagnetic(conduction) interference from drive.

⚠ CAUTION

(1) Keep all grounding connections as short as physically possible.
(2) Use the largest area as grounding conductor, for example the cabinet wall.
(3) The filter must be mounted on the same panel as the drive.

Recommending specification of EMC filter

Select an EMC filter in accordance with the model number of drive to suppress drive's electromagnetic(conduction) interference.

Drive model number	EMC filter model number	EMC filter rated current / phase
RM6E1-10P5B1	FN2090-10-06	10A / 1ϕ
RM6E1-1001B1	FN2090-20-06	20A / 1ϕ
RM6E1-1002B1	FN2410-32-33	32A / 1ϕ
RM6E1-1003B1	FN2410-45-33	45A / 1ϕ
RM6E1-20P3B1	FN2090-4-06	4A / 1ϕ
RM6E1-20P5B1	FN2090-10-06	10A / 1ϕ
RM6E1-2001B1	FN2090-10-06	10A / 1ϕ
RM6E1-2002B1	FN2090-20-06	20A / 1ϕ
RM6E1-2003B1	FN2090-30-08	30A / 1ϕ
RM6E1-20P5B3	FN3270H-10-44	10A / 3ϕ
RM6E1-2001B3	FN3270H-10-44	10A / 3ϕ
RM6E1-21P5B3	FN3270H-10-44	10A / 3ϕ
RM6E1-2002B3	FN3270H-10-44	10A / 3ϕ
RM6E1-2003B3	FN3270H-20-44	20A / 3ϕ
RM6E1-2004B3	FN3270H-20-44	20A / 3ϕ
RM6E1-2005B3	FN3270H-20-44	20A / 3ϕ
RM6E1-4001B3	FN3270H-10-44	10A / 3ϕ
RM6E1-4002B3	FN3270H-10-44	10A / 3ϕ
RM6E1-4003B3	FN3270H-10-44	10A / 3ϕ
RM6E1-4005B3	FN3270H-10-44	10A / 3ϕ
RM6E1-4007B3	FN3270H-20-44	20A / 3ϕ

Note:
1. The leakage current of FN2090 series approximately 0.5mA ~ 1.02mA
2. The leakage current of FN2410 series approximately 3.4mA
3. The leakage current of FN3270 series approximately 26.4mA ~ 59.5mA

Appendix D Zero-Phase Radio Frequency Filter Selection

Please read this manual carefully to understand the correct and safety operations before using the product to prevent possible personnel injuries caused by false operations.

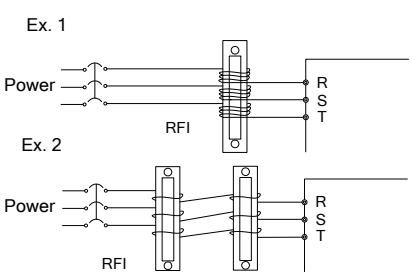
⚠ CAUTION
(1) Do Not touch zero-phase radio frequency filter to prevent the scald burn from the extreme high temperature when power is on, just off, or during the operation. (2) While lift up product, please note the weight of product and move it with proper method to avoid possible injuries.(Please be more cautions to the sharp parts). (3) Wiring or inspection must be done by qualified professional technicians.

By installing the RFI filter(s), it can reduce the radio frequency interference generated by drive.
Because the RFI filter is constructed by ferrite core, it is not related to the capacity and voltage of drive.

1. Specification of product:

Environmental Condition	Applied Model	RM6E1
	Use Place	(1) Clean place without high temperature, high humidity, and flammable gases. (2) If the zero-phase radio frequency filter is installed inside the power distribution panel, the around temperature should not exceed the range(-10~ +50℃). (3) The heat will be generated in the zero-phase radio frequency filter, so the space should be reserved for heat dissipation.
	Ambient Temperature	-10 ~ +50℃(no condensation)
	Ambient Humidity	90%RH(no dew)
	Ambient Gas	No corrosive gas, and no flammable gas
	Vibration	5.9m/ sec^2(0.6G) below

2. Wiring for RFI: Connect the RFI filter in accordance with the following wiring diagram.
(1) Install the RFI filter at the power source site of the drive

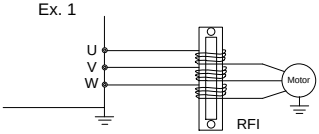


Pass all 3-phase power cords through RFI filter in same direction with same coil number, and then connect to the power input terminal of the drive. Caution: Do Not exceed 4 coils to prevent overheat of RFI filter.

(Note)
Either the ground wire or the four-core cable with ground wire cannot pass through RFI filter; otherwise the filtration effect will be reduced.

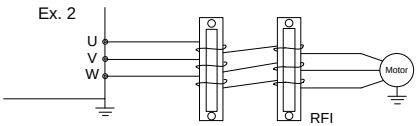
(2) Install the RFI filter at the output site of the drive

Ex. 1



Pass all 3-phase power cords through RFI filter in same direction with same coil number, and then connect to motor terminals of the drive. Caution: Do Not exceed 4 coils to prevent overheat of RFI filter.

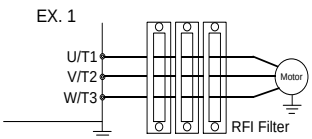
Ex. 2



(Note)
Either the ground wire or the four-core cable with ground wire cannot pass through RFI filter; otherwise the filtration will be reduced.

(3) If the power cords are too thick to be winded, pass the power cords through RFI filter directly, and connect two or more RFI in series.

EX. 1



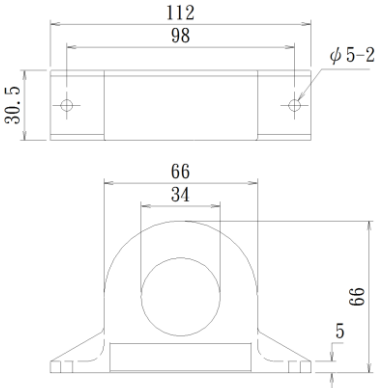
Pass all 3-phase power cords through RFI filter in same direction with same coil number, and then connect to motor terminals of the drive.

(Note)
Either the ground wire or the four-core cable with ground wire cannot pass through RFI filter; otherwise the filtration will be reduced.

3. Recommend to use power cords as many as possible of coil number. If the RFI filter is overheated, please reduce the coil number to reduce temperature.

Wire Size (mm²)	Coil Number of 3-Phase Wire	Selected Model
2/3.5	4	RFI-01
5.5	3	
8/14	2	
22	1	

4. Outline dimensions of RFI-01:



(unit: mm)

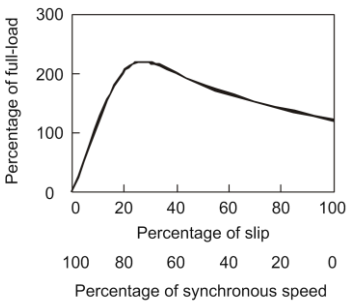
Appendix E Selection of Motor

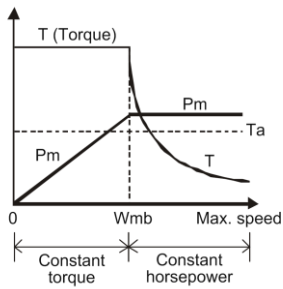
a. Standard Motor

a. Must be used the 3-phase induction motor as load.

b. Motor cannot run at the low-speed operation for a long time because the cooling fan speed can be decreased as well as the motor temperature can be increased. For the long-time and low-speed operation, use the variable-frequency motor with the independent cooling fan.

c. Standard 3-phase induction motor (NEMA B) characteristics as follows:





d. When the motor speed exceeds the rated speed(50/60HZ), the torque will be decreased while the motor speed increasing.

e. Check the motor insulation. The standard requirement is 500V (or 1000V) / 100MΩ above.

b. Special Motors

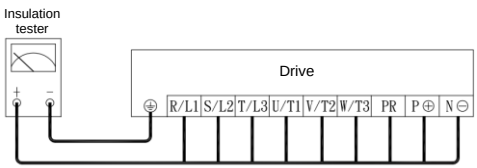
a. Synchronous Motor: The higher starting current than the standard motor; lower V/F; the larger drive capacity required.

b. Submersible Motor: The higher rated current than standard motor; Be caution of the setting of V/F pattern, the minimum speed limit (approx. 30Hz), and insulation quality. During the installation, be cautious of the insulation resistance for motor (including wiring). Add ACL to drive's output terminal.

c. Explosion-proof Motor: Drive does not have the explosion-proof mechanism. Be attentive to installation safety.

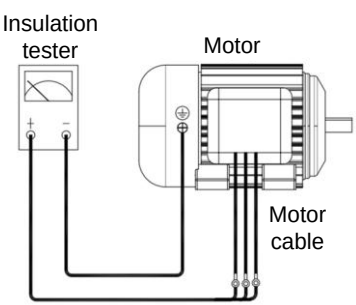
c.Insulation Measurement of Drive and Motor

1. Measure the drive insulation impedance
   a. Please extremely cautious the following steps to test the main circuit insulation of drive. Any incaution operations while testing the drive insulation may possibly harm operating personnel and cause serious damages to drive.
   b. Remove all wiring at power terminal (main circuit) and control circuit terminal before the testing is performed. Please follow the below diagram to wire all power terminals in parallel with an insulation tester for drive insulation test.
   c. Using an insulation tester with DC500V to test the insulation value of drive. The drive insulation impedance must be greater than 20MΩ. If drive insulation impedance is below 20MΩ, replace a drive and contact the customer support for repair service of drive.



Drive Insulation Impedance Measurement

2. Measure the motor insulation impedance
   a. Remove the U/T1, V/T2, W/T3 cables of motor from the drive before measuring the motor insulation impedance, and then measure the motor insulation impedance (including motor cables) using the insulation tester with DC500V. The motor insulation impedance (including motor cables) must be greater than 20MΩ.
   b. If motor insulation impedance is less than 20MΩ, Do Not connect motor with a drive or the drive lifetime may be shorten or the drive may be possibly damaged due to insufficient motor insulation.
   c. Please follow the below connection diagram for motor insulation test. Motor cables must be connected in parallel to the insulation tester with DC500V to test the insulation, and the motor insulation impedance must be greater than 20MΩ to connect the drive.



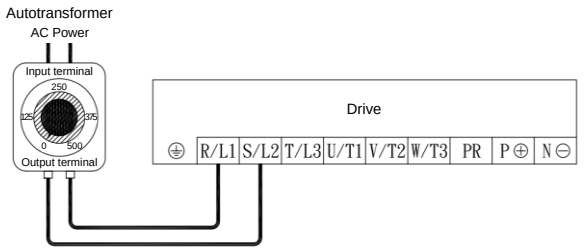
Motor Insulation Impedance Measurement (Including Motor Cables)

Appendix F Instruction of Drive Charging

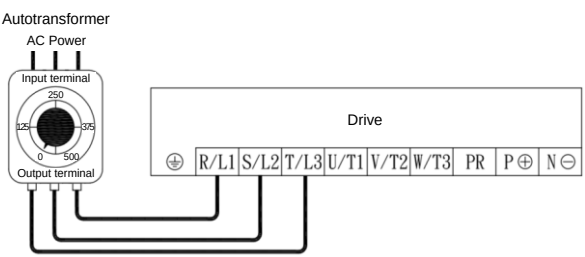
⚠ CAUTION
If the drive is unused or stored in the storage over 1 year, the surface of aluminum foil of electrolytic capacitor within the drive will be oxidized and cracked causing the L and C value up. This is the common characteristics of capacitor. Therefore, with directly applying the voltage and high current to drive after the drive is placed for a long time, the drive may be damaged due to the oxide film cracked.

A. If the drive is stored or non-used (no power ON) over 1 year, it is necessary to charge the drive by autotransformer for 30 minutes from 0 volt to the half of drive's rated voltage and then to apply drive rated voltage to charge the drive for another 30 minutes.

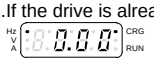
B. When charging the internal capacitor of drive, the wiring between the autotransformer and terminals (R/L1, S/L2) of drive is shown as below:



Drive connection diagram with autotransformer to charge drive for single-phase model of drives.



Drive connection diagram with autotransformer to charge drive for three-phase model of drives.

Note: 1.If the drive is already applied with drive rated voltage and doesn't display  on the display of the operation panel, please contact the customer service for repair service.

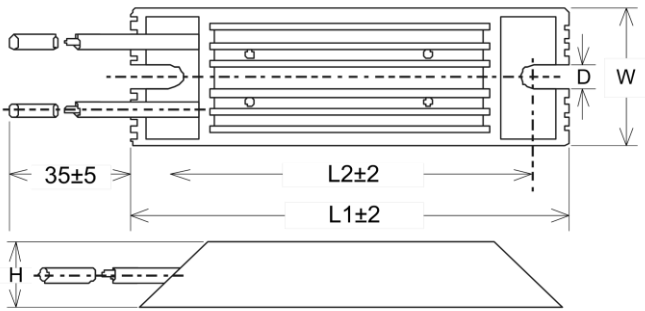
2.If the three-phase autotransformer is unavailable, selecting single-phase autotransformer to charge the internal capacity of three-phase series drive is feasible.

Appendix G Dynamic Brake and Resistor

a. RM6E1 full series are built-in the braking transistor.

b. Braking resistor outline (option)

Aluminum Case Resistor



c. Braking resistor specification

Model	Specification	Dimensions(mm)					Max. Weight (g)
		L1	L2	W	H	D	
MHL100-100	100W/100Ω	165	150	40	20	5.3	200
MHL100-400	100W/400Ω	165	150	40	20	5.3	200
MHL500-40	500W/40Ω	335	320	60	30	5.3	1100

※Notes:

1. When the braking is frequently applied, please increasing the resistor wattage and installing the cooling fan to prevent the resistor from overheating.
2. Aluminum case resistors have the better thermal performance. Please select 1.2 times rated power resistor by using general wirewound type resistor.
3. Please use the heat-resistant wire for the brake resistor wiring.

⚠ DANGER
When the dynamic brake is fault, the braking transistor maybe turn on for full cycle. Add the thermal protection device to cut off the power at high temperature to avoid the drive burnout (refer to page 162 for the wiring of braking resistor).

d. Braking Resistor List

AC 100V Series

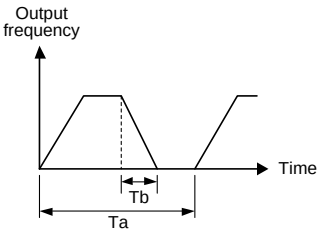
Drive Model	Minimum Specification	Standard Braking Resistor	Approximate Braking Torque (10%ED)
RM6E1-10P3B1	400Ω	MHL100-400*1pc	120
RM6E1-10P5B1	100Ω	MHL100-100*1pc	280
RM6E1-1001B1			180
RM6E1-1002B1			95
RM6E1-1003B1	40Ω	MHL500-40*1pc	180

AC 200V Series

Drive Model	Minimum Specification	Standard Braking Resistor	Approximate Braking Torque (10%ED)
RM6E1-20P3B1 RM6E1-20P3B3	400Ω	MHL100-400*1pc	120
RM6E1-20P5B1 RM6E1-20P5B3	100Ω	MHL100-100*1pc	170
RM6E1-2001B1 RM6E1-2001B3			90
RM6E1-2002B1 RM6E1-2002B3			75
RM6E1-2003B1 RM6E1-2003B3	40Ω	MHL500-40*1pc	160
RM6E1-2004B3			140
RM6E1-2005B3			105

AC 400V Series

Drive Model	Minimum Specification	Standard Braking Resistor	Approximate Braking Torque (10%ED)
RM6E1-40P5B3	400Ω	MHL100-400*1pc	240
RM6E1-4001B3			145
RM6E1-4002B3	200Ω	MHL100-400*2pcs in parallel	180
RM6E1-4003B3	133Ω	MHL100-400*3pcs in parallel	180
RM6E1-4005B3	100Ω	MHL100-400*4pcs in parallel	160
RM6E1-4007B3	80Ω	MHL500-40*2pcs in parallel	125



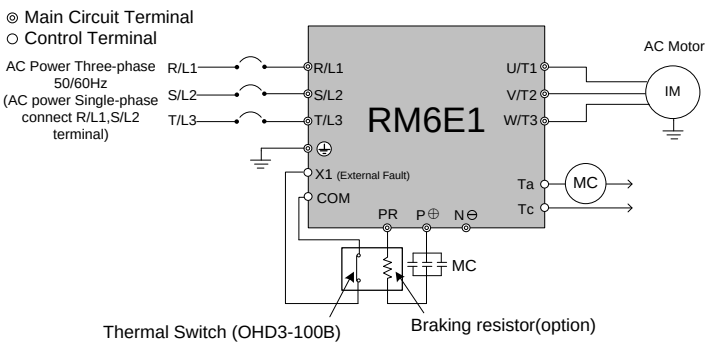
Note:

1. %ED (Effective Duty Cycle) = Tb/Ta*100% (continuous operation time Tb<15 sec).The definition is shown as above figure.
2. Above wattages of table is defined at 10%ED.
3. The active level of dynamic braking for RM6E1 series, please refer to the description of F3.27.

e. The Wiring of Braking Resistor

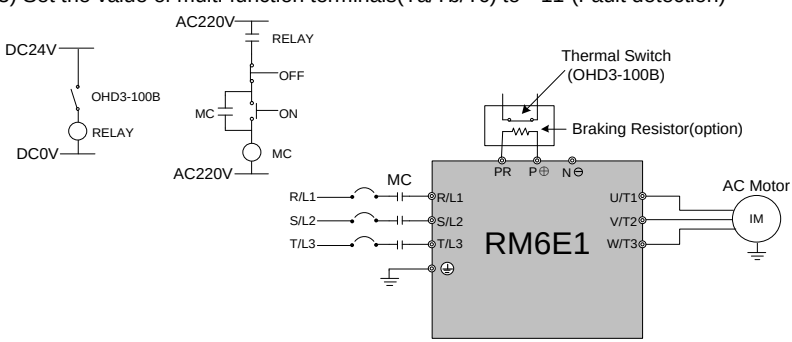
DANGER

Strongly recommend to install the thermal switch for the brake protection to prevent the brake from any possible damages caused by the overheating on the braking resistor. Please refer to the figure 1 and 2 for the wiring diagram.



(Figure 1)

(1) Use the thermal switch to monitor the temperature of the braking resistor and generate an external fault signal to the multi-function terminals(one of X1~X6)to stop the drive when the braking resistor is overheated and interrupt the connection of magnet contactor(MC) by output terminals Ta/Tb/Tc.
(2) Set the value of multi-function terminals(one of X1~X6) to "-8"(External fault)
(3) Set the value of multi-function terminals(Ta/Tb/Tc) to "-11"(Fault detection)



(Figure 2)

When the drive power is controlled by the magnet contactor(MC), use the thermal switch to control the magnet contactor(MC). When the braking resistor is overheating, the contactor(MC) will be interrupted.

Appendix H Outline Dimension Drawings

(1) Outline Dimension of Keypad

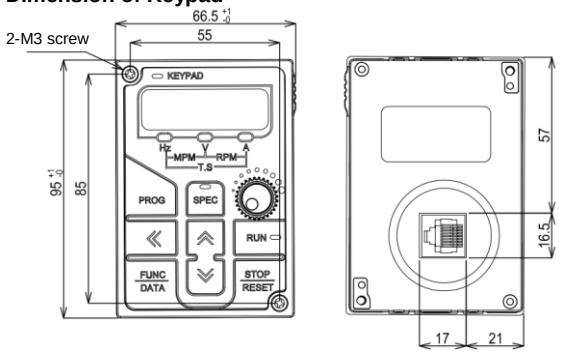


Figure 1: KP-601 keypad (unit: mm)

※The length specifications of connecting cable for KP-601, please refer to p.19

(2) Overall Dimensions of Drive

Model：RM6E1-10P5B1 ~ RM6E1-1001B1;RM6E1-20P5B1 ~ RM6E1-2002B1;
RM6E1-20P5B3 ~ RM6E1-2003B3;RM6E1-4001B3 ~ RM6E1-4003B3

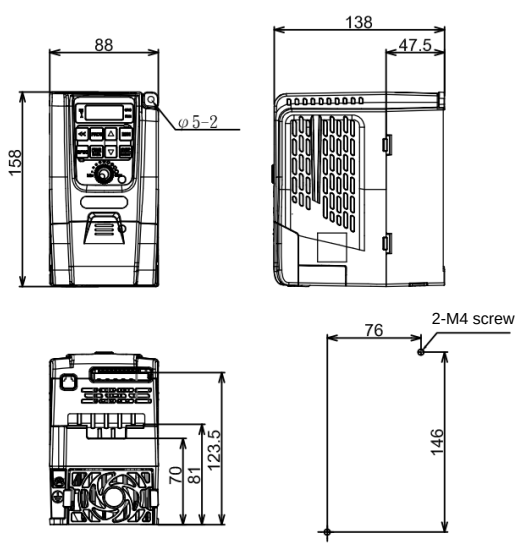


Figure 2: Drive (unit: mm)

※The size base on the actual object.

Model：RM6E1-1002B1 ~ RM6E1-1003B1;RM6E1-2003B1;
RM6E1-2004B3 ~ RM6E1-2005B3;RM6E1-4005B3 ~ RM6E1-4007B3

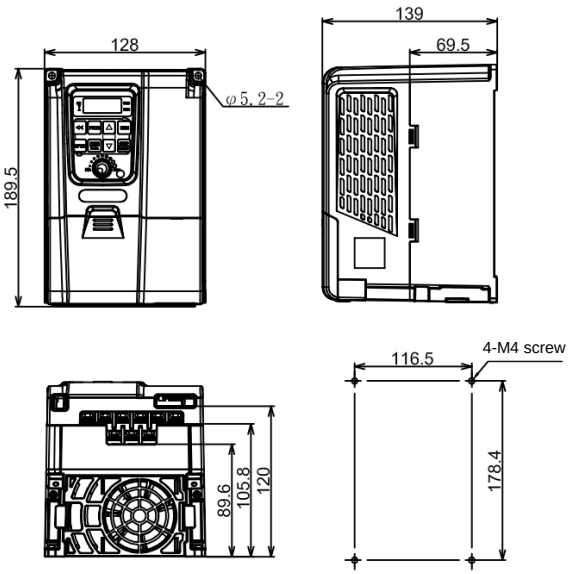


Figure 3：Drive (Unit: mm)

※The size base on the actual object.

No Text on This Page

Attachment 1 Setting Memo

Function Setting	Descriptions	Default	Actual Setting Value
F0.00		–	
F0.01		0	
F0.02		0	
F0.03		–	
F0.04		–	
F0.05		110.0 (100V Series) 220.0 (200V Series) 380.0 (400V Series)	
F0.08		–	
F0.09		–	
F0.10		–	
F0.11		–	
F0.12		–	
F0.13		–	
F0.19		–	
F0.20		0	

Function Setting	Descriptions	Default	Actual Setting Value
F1.00		3	
F1.01		1	
F1.02		0	
F1.03		0	
F1.04		0	
F1.05		1	
F1.06		1	
F1.07		1	
F1.08		1	
F1.09		0	
F1.10		1	
F1.11		2	
F1.12		4P	
F1.13		20.00	
F1.14		0	
F1.17		1	
F1.18		0	
F1.19		0	
F1.20		0	
F1.21		2	
F1.22		1	
F1.23		0	

Function Setting	Descriptions	Default	Actual Setting Value
F2.00		50.00 (60.00)	
F2.01		10.00	
F2.02		20.00	
F2.03		30.00	
F2.04		0.00	
F2.05		0.00	
F2.06		0.00	
F2.07		0.00	
F2.08		0.00	
F2.09		0.00	
F2.10		0.00	
F2.11		0.00	
F2.12		0.00	
F2.13		0.00	
F2.14		0.00	
F2.15		0.00	
F2.16		6.00	
F2.17		50.00 (60.00)	
F2.18		5.0	
F2.19		5.0	
F2.20		5.0	
F2.21		5.0	
F2.22		5.0	
F2.23		5.0	

Function Setting	Descriptions	Default	Actual Setting Value
F2.24		5.0	
F2.25		5.0	
F2.26		5.0	
F2.27		5.0	
F2.28		0.0	
F2.30		0	
F2.31		0	
F2.32		50.00 (60.00)	
F2.33		0.5	
F2.34		8.0 (100V Series) 8.0 (200V Series) 12.0 (400V Series)	
F2.35		50.00 (60.00)	
F2.36		220.0 (100V Series) 220.0 (200V Series) 380.0 (400V Series)	
F2.37		0.0	
F2.38		0.0	
F2.39		0.0	
F2.40		0.0	
F2.42		0.0	
F2.43		0.0	
F2.44		0.0	
F2.45		0.0	
F2.47		1.00	
F2.48		0.00	
F3.00		0.5	
F3.01		0.0	

Attachment 1 Setting Memo

Function Setting	Descriptions	Default	Actual Setting Value
F3.03		170	
F3.04		160	
F3.05		5.0	
F3.06		5.0	
F3.07		1	
F3.09		0.0	
F3.10		40	
F3.12		1.0	
F3.13		60	
F3.15		0.10	
F3.16		10	
F3.18		1	
F3.19		50	
F3.21		50	
F3.22		10	
F3.23		0.0	
F3.24		0.5	
F3.25		0.5	
F3.27		390 (100V Series) 390 (200V Series) 760 (400V Series)	
F3.28		10	
F3.30		0	
F3.31		87.5 (100V Series) 175.0 (200V Series) 320.0 (400V Series)	
F3.32		3.0	
F3.33		5.0	
F3.34		5.0	
F3.35		0.0	
F3.37		150	
F3.38		0.5	
F3.39		100	
F4.00		1	

Function Setting	Descriptions	Default	Actual Setting Value
F4.01		70	
F4.02		10	
F4.04		—	
F4.05		0	
F4.07		1	
F4.08		Rated current of motor	
F4.09		1/3 rated current of motor	
F4.10		5.0	
F4.12		90 (Note 1)	
F4.13		2	
F4.14		70	
F4.15		3.0	
F4.17		1	
F4.18		50	
F4.19		0.5	
F4.21		1.2	
F4.22		0	
F4.23		2.4	
F4.25		0	
F4.26		0	
F4.27		0	
F4.28		160	
F4.29		0.1	
F4.36		180	
F4.37		0.10	
F4.38		0.6	
F4.39		0	
F4.41		1	
F4.42		Rated current of motor	
F4.43			

Function Setting	Descriptions	Default	Actual Setting Value
F4.44		5.0	
F4.45		0	
F4.46		100	
F4.47		2.0	
F4.48		0	
F4.49		0	
F4.50		10.0	
F5.00		1	
F5.01		1	
F5.02		1	
F5.03		1.00	
F5.04		0.00	
F5.05		1.00	
F5.06		0.00	
F5.07		20	
F5.08		0.00	
F5.09		5.0	
F5.10		5.0	
F5.12		0	
F5.13		1.00	
F5.14		0.00	
F5.15		1	
F5.19		22	
F5.20		23	
F5.21		1	
F5.22		7	
F5.23		0	
F5.24		0	
F5.25		10	
F5.26		11	
F5.30		0	
F5.31		0	
F5.32		1	
F5.33		0.00	
F5.35		0	

Function Setting	Descriptions	Default	Actual Setting Value
F5.36		0	
F5.37		0	
F5.39		2.0	
F5.40		2.0	
F5.41		0.0	
F6.00		0	
F6.01		5	
F6.02		0	
F6.04		0	
F6.05		0.0	
F6.06		0.0	
F6.07		0.0	
F6.08		0.0	
F6.09		0.0	
F6.10		0.0	
F6.11		0.0	
F6.12		0.0	
F6.13		0.0	
F6.14		0.0	
F6.15		0.0	
F6.16		0.0	
F6.17		0.0	
F6.18		0.0	
F6.19		0.0	
F6.20		0.0	
F6.21		0.0	
F6.22		0.0	
F6.23		0.0	
F6.24		0.0	
F6.25		0.0	
F6.26		0.0	
F6.27		0.0	
F6.28		0.0	
F6.29		0.0	
F6.30		0.0	

Attachment 1 Setting Memo

Function Setting	Descriptions	Default	Actual Setting Value
F6.31		0.0	
F6.32		0.0	
F6.33		0.0	
F6.34		0.0	
F6.35		0.0	
F6.36		0.0	
F6.37		0	
F6.40		0	
F6.41		0	
F6.42		10	
F6.43		2	
F6.44		1.0	
F6.45		1.2	
F6.46		0.00	
F6.47		100	
F6.48		0	
F6.49		0	
F6.50		1.00	
F6.51		1.00	
F6.52		1	
F6.53		0	
F6.54		0.00	
F6.55		0	
F6.56		1	
F6.57		1	

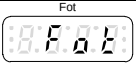
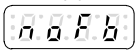
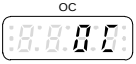
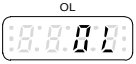
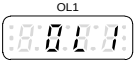
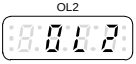
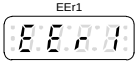
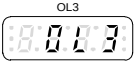
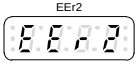
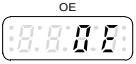
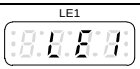
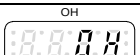
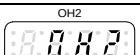
Function Setting	Descriptions	Default	Actual Setting Value
F6.58		0.0	
F6.59		0	
F6.61		0	
F6.62		0.00	
F6.63		0	
F6.64		0.00	
F6.65		0	
F6.66		0.00	

Note:

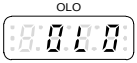
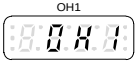
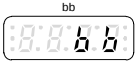
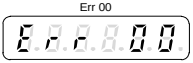
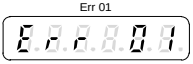
1. The default value is “105” for 2003B1/2003B3~2005B3/4005B3~4007B3 models and the default value is “90” for remained models.

Attachment 2 Fault Displays

Error Trip Messages of Drive

Display	Description	Display	Description
Fot 	IGBT module error	noFb 	PID feedback signal error
GF 	Grounding fault	AdEr 	A/D converter error
OC 	Drive over current	EF 	External fault
OL 	Motor overload	PAdF 	Keypad interruption during copy
OL1 	Drive overload	EEr 	EEPROM error
OL2 	Drive current limit	EEr1 	Internal memory error
OL3 	Braking transistor overload	EEr2 	Internal memory error
OLO 	System overload	–	–
OE 	Over voltage	–	–
LE1 	Under voltage during operation	–	–
ntcF 	Thermal sensor fault	–	–
OH 	Drive overheat	–	–
OH2 	Motor overheat	–	–

Warning Messages of Drive

Display	Description	Display	Description
OLO 	System overload	–	–
Hv 	Power source over voltage	–	–
db 	Braking transistor is active	–	–
LE 	Power source under voltage	–	–
OHt 	Drive overheat	–	–
OH1 	Motor overheat	–	–
bb 	Drive output interruption	–	–
Fr 	Coast to stop	–	–
dtF 	Forwad/reverse command input simultaneously	–	–
WrF 	Different software version inter-copy	–	–
Cot 	Modbus communication overtime	–	–
Err 00 	Keypad cable trip before connecting	–	–
Err 01 	Keypad cable trip during operation	–	–