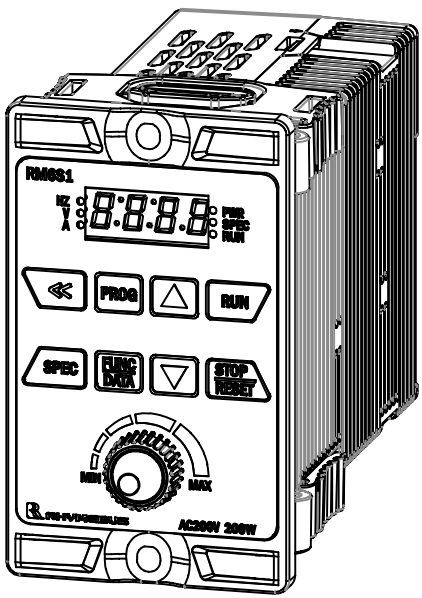
RHYMEBUS

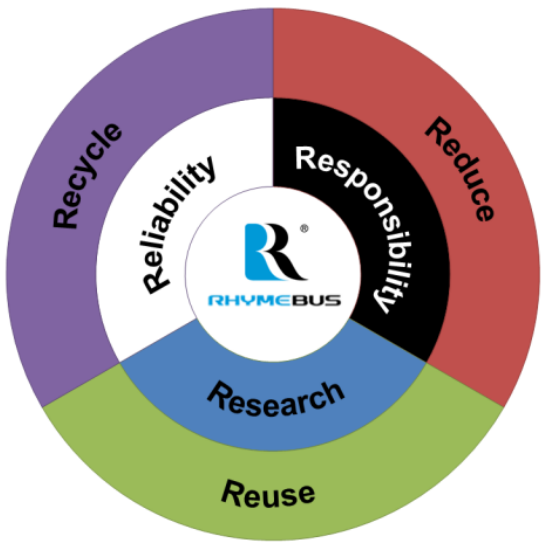
AC MOTOR DRIVE

Operation Manual



RM6S1 series

Quality • Satisfaction • Improvement • Innovation



Rhymebus Corporation

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PREFACE

Thank you for using RHYMEBUS RM6S1 series drive. The simple manual version shall be placed on the top of the machine. For ensure customer operations and safety purposes, this version offer completely information and instruction of the product, please do read and follow specific instructions before using the product.

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. 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 RM6S1.

Atmosphere	Non-corrosive or non-conductive, or non-explosive gas or liquid, and non-dusty
Surrounding temperature	-10°C~+45°C (14°F~122°F) (Non- condensing and non-freezing)
Storage temperature	-20℃～+60℃(-4°F~140°F)
Relative humidity	90% RH or less (No-condensing atmosphere)
Vibration	Less than 5.9m/sec² (0.6G)
Altitude	Less than 1000m (3280 ft.)

Wiring

DANGER

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

b. L1, L2, are power inputs (electric source terminals) and U,V,W are drive's outputs to a motor. 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.

c. The drives have three specifications base on the input power source 200V, Do Not input the voltage exceed the specifications.

d. The grounding terminal(⏚) must be exactly grounded. The grounding method must compliance with the NEC standard or local electrical code.

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

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

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

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

i. Do Not touch the drive or performing any unwiring actions in the 5 minutes before drive indicator light turns off after the power off.

j. When the motor do the voltage-proof, insulation testing, unwiring the U,V,W terminal of drive at first.

CAUTION

a. The RM6S1 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 due to the high heat.

Feature

1. **The drive has temperature management and setting pre-alarm level to forecast over temperature.**
2. **Communication function RS-485 Modbus RTU.**
3. **Special function key (SPEC): Cable set (in parameter) to realize FWD/REV running, jog speed, and other multi-function operation.**
4. **Built-in knob (Pot) for speed adjustment.**
5. **The switching frequency can be adjusted between 800Hz~ 16 kHz.**
6. **Provide 8 sets of monitor displays. (Frequency, speed, voltage, current and 13 kind of options available)**
7. **Counter function.**
8. **To support external PTC for motor overheat protection.**
9. **User can connect KP-601A keypad (option) for remote control,parameters duplication and saving.**
10. **Detachable Buckles design for installation.**
11. **Six sets of fault record.**
    (fault record, current, voltage,frequency)
12. **Simple parameter group and complete parameter group.**
13. **Parameter lock and parameter password functions.**

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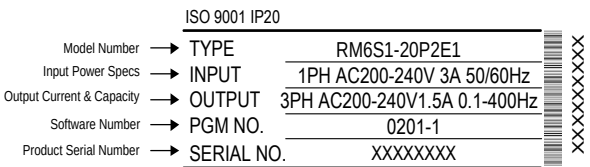
Chapter 1 Cautions Before Installation

1-1 Product Verification

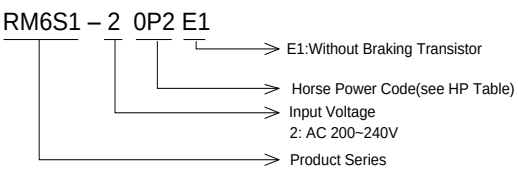
The product has passed the strictest quality test before shipped out from the factory. However, the product might possibly sustain minor damages due to the impact, shaking, vibration, and other factors during the transportation. Please make sure to verify the following items after receiving this product. 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



1-1-3 Confirmation of Accessories

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

Code	Power	Horse Power
0P1	0.125 kW	0.17 HP
0P2	0.2 kW	0.25 HP

1-2 Standard Specifications

1-2-1 Single-Phase 100V Series

Model name (RM6S1-□□□□E1)	20P1	20P2
Maximum applicable motor (HP/W)	0.17/125	0.25HP/200
Rated output capability (VA)	400	600
Rated output current (A)	1	1.5
Rated output voltage (V)	Three-phase 200~240V	
Range of output frequency (Hz)	0.1~400.00Hz	
Power source (ψ, V, Hz)	Single-phase, 200~240V, 50 / 60Hz	
Input current (A)	2	3
Permissible AC power source fluctuation	176V~264V 50/60 Hz ±5%	
Overload protection	150% of drive rated output current for 1 min	
Applicable safety standards	-	
Cooling method	Nature cooling	
Protection structure	IP20	
Weight (kg)	0.4	

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

1-3 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(0.01~99.99Hz/100.0~400.0Hz) 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 rated current
	Braking torque	About 20%
	Acceleration / Deceleration time	0sec(coast to stop), 0.0-3200.0sec(Indepensent setting of the acceleration/deceleration.)
	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)
	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, Over-torque detection, DC braking, Counter function, Modbus(RS-485)communication, Jump frequency, upper/lower limits of output frequency,8-preset speeds, S-curve acceleration/deceleration, Temperature management, Parameters duplication.
Operation Characteristics	Frequency setting signal	Operation panel(including KP keypad): ▲、▼ Analog signal: (DC 0-10V)/0~100% Digital signal：Jog speed,8-preset speeds Modbus(RS-485) communication
	Operation signal	Operation panel(including KP keypad): RUN, STOP Digital signal: FWD/REV rotation control Modbus(RS-485) communication
	Multi-function inputs	3 programmable input terminals: X1-X3 Response time (1~255,unit 1ms)
		Refer to the chapter of F_5.19~F_5.21 setting description.
	Analog inputs	1 set of analog input: VI (0-10V) Analog filter (0~255，unit 5ms),the dead band of analog frequency, gain and bias are adjustable.

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 only use for 200~240V.

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.

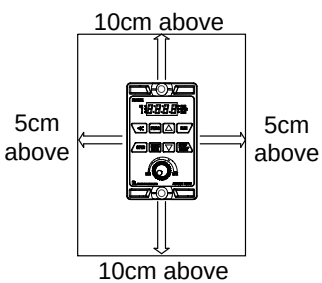
2-1-3 Drive: The rated current of motors are different for the different pole or rated voltage. Please base on the rated voltage and rated current of motor to select drive. Do not select the drive only base on the horse power specification of motor. (please refer to the lists of standard specifications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

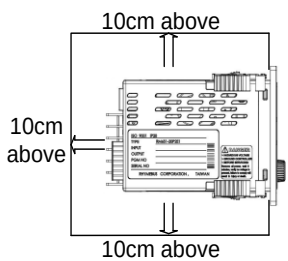
2-1-4 Motor: The specifications of motor are determined from the requirement. Please be cautious to the motor rated current that must not exceed the drive current.

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.

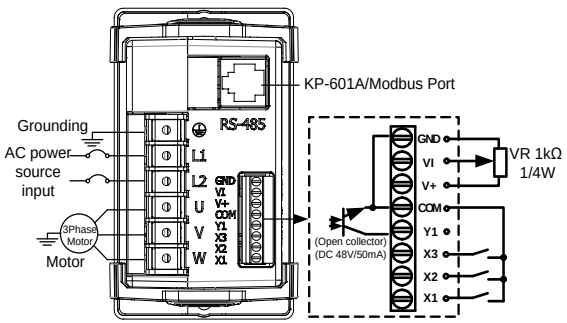
- **AC Power:** AC power input must be complied with the AC power input specification of the drive.(see RM6S1 standard specifications)
- **Location:** Due to the heat dissipating requirement during the drive operation, the drive must keep enough space for heat dissipation. Please keep the least clearance space when installation. (shown as below figure)





2-3 Basci Wiring

2-3-1 Descriptions of Terminal and Wiring Diagram



2-3-2 Description of Terminals

Type		Symbol	Function	Description
Terminal of Main Circuit	Power Source	L1,L2	AC power source input terminals	For the single-phase power source 200V~240V.
	Motor	U,V,W	Drive outputs to motor terminals	The terminals output three phase variable frequency and voltage to motor.
	Grounding	⏚	Grounding terminal	Grounding resistance must be below 100Ω.

2-3-3 Control Terminals

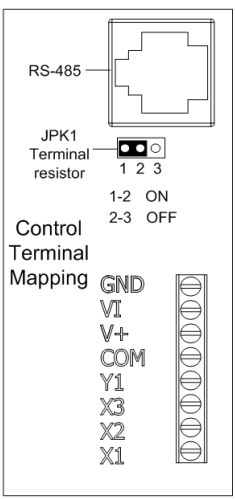
Type		Symbol	Function	Description
Control Circuit Terminal	Multi-function input terminal	X1	Input terminal 1	Short the terminal of input with COM and set the function F5.19~F5.21
		X2	Input terminal 2	
		X3	Input terminal 3	
	Multi-function output terminal	Y1	Output terminal 1	Short the detected parameter with COM and set the function F5.26
		COM	Input/output common ports	The common port of input/output control signal
	Control power	V+	Power terminal for control signal	DC+12 output. Maximum current output 20mA
		VI	Analog input terminal	DC 0~10V
		GND	Common terminal for analog input control	Common terminal for control power (V+) and analog input terminal(AI).

2-3-4 Modbus Port (RS-485)/ Keypad-601A

Type	Pin	Function	Description
Modbus(RS-485) /KP601A Communication	1	Communication transmission terminal (DX+)	Modbus (RS-485) communication uses pin1, 2.
	2	Communication transmission terminal (DX-)	
	3	Power terminal of KP (+13V)	Only for KP-601A linking
	4	Auto-detect terminal of KP	Only for KP-601A linking
	5、6	Reversed	Reversed
	7	Common ports terminal of KP power(0V)	Only for KP-601A linking
	8		

Note1: The terminal resistor (100Ω)slection is set by JPK1 (default setting : ON) and user has to remove the frame to select the terminal resistor.

Note2: The cable material of KP-601A must be use CAT-5e 24AWG above.
The cable lenth must be within 5 meters(the longest lenth is 100 meters)



2-4 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.

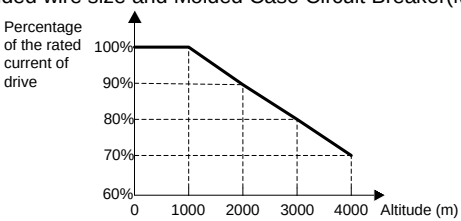
Cable length /	10m	20m	30m	50m	100m	100m above
Seithching Frequency	10kH*z	7.5kHz	5kHz	2.5kHz	800Hz	800Hz

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,V,W) 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 between drive's rated current and altitude are shown as below figure.

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



Model no. RM6S1	Input current (A)	MCCB (A)	Input (R,S) wire size (mm²/AWG)	Output (U,V,W) wire size (mm²/AWG)	Grounding wire size (mm²/AWG)
20P1	1.7	3	1.25/15	0.75~1.25	1.25/15
20P2	3	5	1.25/15	0.75~1.25	1.25/15

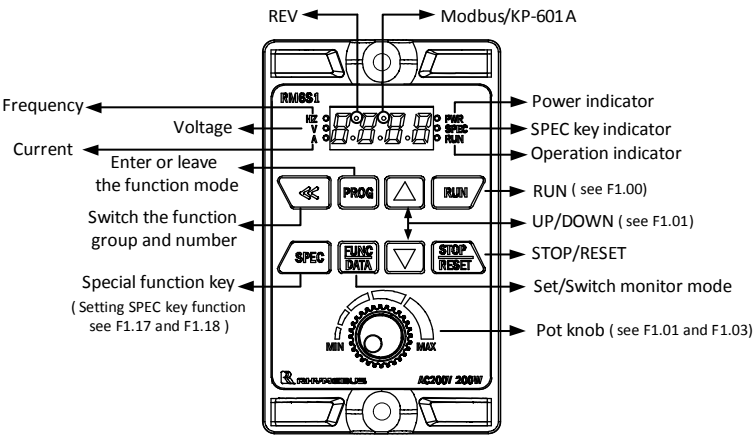
Note:

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.

Chapter 3 The Setting of Operation Panel & Remote Controller

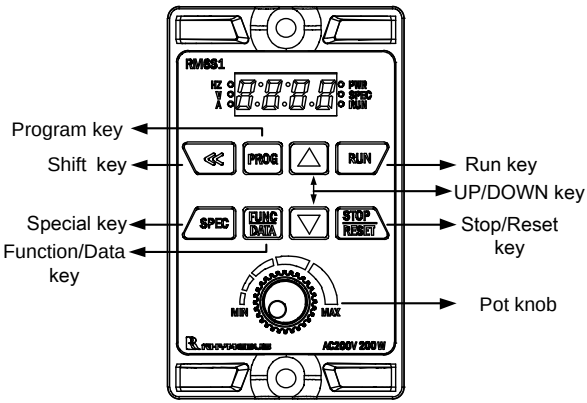
3-1 Function of Operation Panel



3-1-1 Description of indicator

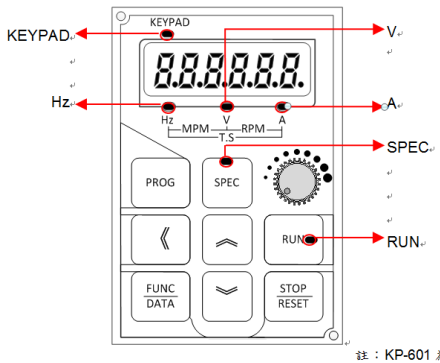
Symbol	Name	Explanation
Hz	Frequency indicator	Indicating the unit of frequency
V	Voltage indicator	Indicating the unit of voltage
A	Current indicator	Indicating the unit of current
REV	Reverse rotation indicator	ON: Reverse OFF: Forward
KP/ModBus	KP-601A/ModBus communication indicator	Blinking: Linking OFF: Non-linking
PWR	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 Function of Key



Symbol	Name	Descriptions
PROG	Program key	1.Enter the function setting mode. 2.Back to the monitor mode.
FUN DATA	Function/Data key	1.Enter the parameter setting mode. 2.Back to the function setting mode. 3.Switch monitor mode.
▲ ▼	Up/Down key	Up/down key of changing functions and parameters.
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 the function group and function numbers. 2.The shifting key for digits of parameter value setting.
	Pot Knob	Setting the frequency command is available(see F5.00)

3-2 Fuctions of Remote Controller (KP-601A keypad)



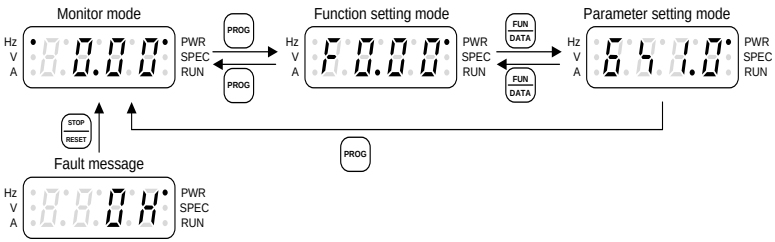
Symbol	Name	Explanation
Hz	Frequency indicator	Indicating the unit of frequency
V	Voltage indicator	Indicating the unit of voltage
A	Current indicator	Indicating the unit of current
KEYPAD	KP indicator	Blinking: Linking OFF: Non-linking
RUN	Operation indicator	Blinking: Under acceleration or deceleration ON: Constant speed OFF: Stop
SPEC	Special key indicator	ON: SPEC under self-holding operation OFF: SPEC not under self-holding operation

Note: When the drive is reversing that the frequency show negative number.

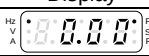
3-3 The Operation of Operation Panel and Monitor Mode

3-3-1 The Operation of Operation Panel

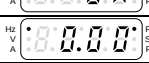
The operation of operation panel includes fault message and three modes. The switching methods are shown as below figure:



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

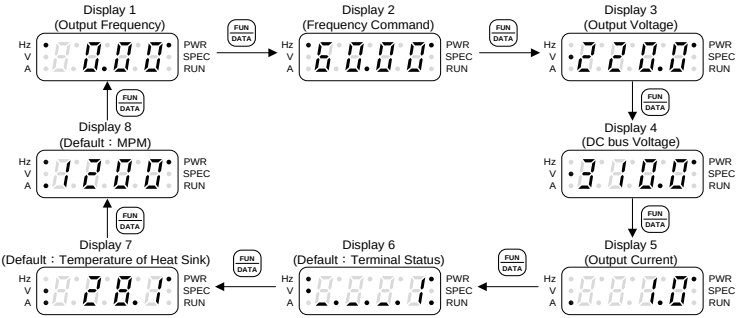
Operation Steps	Display
1.Start the drive and enter the main display.	
2.Press PROG key and enter the function setting mode.	
3.Press FUN DATA key and enter the parameter setting mode.	
4.Press FUN DATA key and return to the function setting mode.	
5.Press PROG key and return to the monitor mode.	

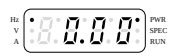
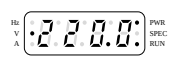
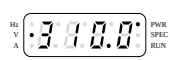
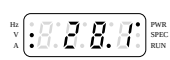
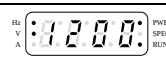
Fault message display:

Operation Steps	Display
The fault message displayed during the drive operation	
1.Press STOP RESET key and 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:



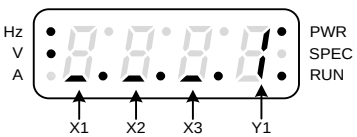
Display	Description	Display
Display1 (Main Display)	Hz: On (Output Frequency)	
Display2	Hz: On (Frequency Command)	
Display3	V: On (Output Voltage)	
Display4	V: On (DC bus Voltage)	
Display5	A: On (Output Current)	
Display6	Hz、A: On (Default value: terminal status)	
Display7	V、A: On (Default value: heat sink temperature)	
Display8	Hz、V: On (Default value MPM)	

※ Press FUNC DATA key of the main display and switch to the mode (1~8)

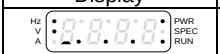
a. Select one of eight monitor modes to be the main display and switch to the mode (1~8) by FUN/DATA key in the monitor mode. The monitor mode setting can also be set by F1.08.
b. User can basically determine which the display mode to be as the main display in the monitor mode according to user's demand. If 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 mins.
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 in the monitor mode is the status of multi-function input terminals and the definition of each segment on the 7-segments display for 4 digits is shown as below figure:

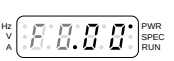
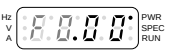


The definition of display shown in the below table:

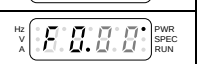
Display	Terminal	Status description
	X1	Multi-function input terminal "X1" is active.
	X2	Multi-function input terminal "X2" is active.
	X3	Multi-function input terminal "X3" is active.
	Y1	Multi-function output terminal is active.

3-3-4 The Function Setting Mode

a.The selection of function group:

Operation Steps	Display
1.Press PROG key in the monitor mode and enter function group setting mode. 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 function group / function number swapping:

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

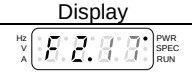
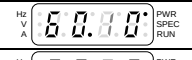
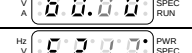
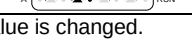
c.The selection of function number:

Operation Steps	Display
1.Press [<<] key to swap 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 [FUN 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 [FUN 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 in the 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: Example: frequency command.	
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 [FUN DATA] key to save the setting value within 5 secs, when completing setting of the rotation speed.	

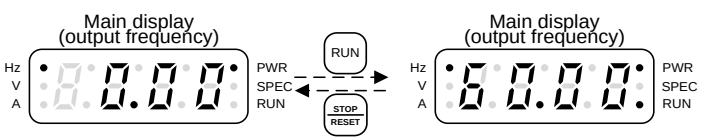
Note: grey-color digits in above table means digit flashing.

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

b.Press [FUN DATA] key to save the setting value within 5 secs(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 5 secs and save the value automatically after 3 mins. If the saving of the setting value is not completed and drive immediately powers off within 3 mins, the setting value will recover to the original value before setting.(see F1.07 for the setting).

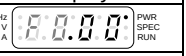
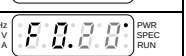
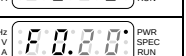
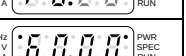
3-3-7 To Start/Stop the Drive

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

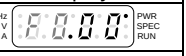
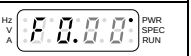
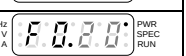
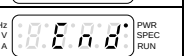
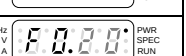
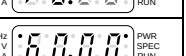


3-3-8 Save and Restore the Setting Value.

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 FUN DATA key and enter the parameter setting mode.	
5.Press ▲ key and select the “SAv”.	
6.Press FUN DATA key to save settings. The display of operation panel will display “End” after 2 secs.	
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 FUN DATA key to enter the parameter setting mode.	
5.Press ▲ key and select the “rES”.	
6.Press FUN DATA key to save the setting. The panel will display “End” after 2 secs.	
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).	

Chapter 4 Parameter List

Group List (default value: F0.18=0)

	Simple Parameter Group List (F0.18=0)	
Group	Function	
F0	System Parameters*(Simple)	
F1	Control Setting(Simple) Main Display Setting(Simple) SPEC Key Setting Stop Mode Switching Frequency Setting(Simple)	
F2	Frequency Parameters	Preset speed and jog seed. Acceleration/deceleration. V/F pattern setting. Upper/lower limits of output frequency.
F4	Protection Parameters	Motor overload protection
F5	Multi-function Parameters	Multi-function input Multi-function output

	Complete Parameter Group List (F0.18=1)	
Group	Function	
F0	System Parameters	
F1	Control Setting Main Display Setting SPEC Key Setting Stop Mode Switching Frequency Setting	
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. AVR compensation. DC Breaking. Drive operation after instantaneous power failure. Speed tracing.
F4	Protection Parameters	Drive overload protection Motor overload protection Drive overheat protection Fan control Overload protection setting
F5	Multi-function Parameters	Analog input Multi-function input Multi-function output UP/DOWN setting Counting mode Frequency detection
F6	Special parameters	Modbus communication

4-2 Complete Parameter Group List

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	—	—	—	33
F0.01	Parameter Lock	0: Parameters are changeable 1: Parameters are locked	0, 1	—	0	33
F0.02	Parameter Password Setting	Set the password for the parameter protection	0~9999	1	0	33
F0.03	Parameter Password Unlock	Unlock the passwords for the parameters	0~9999	1	—	33
F0.04	Reserved	Reserved	—	—	—	
F0.05	Power Source	The value of setting according to the actual power source	190.0~240.0	0.1V	220.0	34
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	—	—	—	34
F0.09	Fault Record 2		—	—	—	34
F0.10	Fault Record 3		—	—	—	34
F0.11	Fault Record 4		—	—	—	34
F0.12	Fault Record 5		—	—	—	34
F0.13	Fault Record 6		—	—	—	34
F0.18	Parameter Display Selection	0: Simple parameter 1:Complete parameter	0,1		0	32
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	34

F1 Operation Parameters

Func.	Name	Descriptions			Range of Setting	Unit	dF60	Page
F1.00	Start Command Selection		Start command	Rotation direction	0~11	—	3	35
		0	FWD or REV command	FWD or REV command				
		1	FWD command	REV command				
		2	Operation panel	FWD, REV command				
		3		Forward				
		4		Reverse				
		5		Reverse command				
		6~7	Reserved	Reserved				
		8	Communication control	Communication Control				
		9	Communication control	Reverse command				
		10	Forward command	Communication Control				
		11	Operation panel	Communication Control				
F1.01	Primary Frequency Command Selection	0: Frequency command by analog input selection (F1.03). 1: Frequency command by operation panel. 2: RPM command 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.			0~5	—	1	37
F1.02	Secondary Frequency Command Selection	0: Frequency command by analog input selection. 1: Frequency command by operation panel. 2: Frequency command by multi-function input terminal as UP/DOWN command.			0~2	—	0	38
F1.03	Analog Input Selection	0: Pot knob+ VI 1: Pot knob –VI 2:VI – Pot knob 3: Pot knob or VI(switch by multi-function input terminal) 4: Pot knob 5: VI			0~5	—	0	38
F1.04	“Pot knob” Command Source Selection	0: From drive’s operation panel. 1: From external keypad(KP-601A).			0, 1	—	0	38

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	39
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	39
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	39
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	39
F1.09	Display Mode 6	0: Terminal status 1: Temperature of heat sink 2: Motor rotation speed(RPM) 3: Machine speed(MPM) 4: Reserved 5: Reserved 6: Counting value 7: Current limit level 8: Primary frequency command 9: Secondary frequency command 10: Reserved 11: Reserved	0~11	—	0	40
F1.10	Display Mode 7		0~11	—	1	40
F1.11	Display Mode 8		0~11	—	3	40
F1.12	Number of Motor Poles	Determination of RPM display value.	2~10	2P	4P	40
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	40
F1.14	Digits of Decimal Value (Machine Speed)	Select the digits of decimal values displaying the machine speed.	0~3	—	0	40

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 3	—	0	40
F1.18	SPEC Key Self-Holding Function	0: Disable 1: Enable	0, 1	—	0	40
F1.19	Stop Mode	0: Ramp to stop + DC braking 1: Coast to stop 2: Coast to stop+ DC braking	0~2	—	0	41
F1.20	Reverse Prohibition	0: Reverse rotation allowed 1: Reversal rotation NOT allowed	0, 1	—	0	41
F1.21	Switching Frequency	The setting value is higher and the motor noise is lower.	0~6	—	2 *Note 4	41
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	44
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	42

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	0.01Hz	50.00 *Note 1 60.00 *Note 2	43
		OFF	OFF	OFF	OFF				
F2.01	Preset Speed 2	OFF	OFF	OFF	ON	0.00~ 400.00	0.01Hz	10.00	43
F2.02	Preset Speed 3	OFF	OFF	ON	OFF	0.00~ 400.00	0.01Hz	20.00	43
F2.03	Preset Speed 4	OFF	OFF	ON	ON	0.00~ 400.00	0.01Hz	30.00	43
F2.04	Preset Speed 5	OFF	ON	OFF	OFF	0.00~ 400.00	0.01Hz	0.00	43
F2.05	Preset Speed 6	OFF	ON	OFF	ON	0.00~ 400.00	0.01Hz	0.00	43
F2.06	Preset Speed 7	OFF	ON	ON	OFF	0.00~ 400.00	0.01Hz	0.00	43
F2.07	Preset Speed 8	OFF	ON	ON	ON	0.00~ 400.00	0.01Hz	0.00	43
F2.16	Jog Speed	Jog speed				0.00~ 400.00	0.01Hz	6.00	43
F2.17	Reference Frequency of Accel/Decel Time	The frequency corresponding to accel/decel time.				0.01~ 400.00	0.01Hz	50.00 *Note 1 60.00 *Note 2	44
F2.18	Primary Acceleration Time	The acceleration time of primary speed, preset speed 5~8, and jog speed.				0.0~ 3200.0	0.1 sec	5.0	44

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 5~8, and jog speed.	0.0~ 3200.0	0.1 sec	5.0	44
F2.20	Acceleration Time of Preset Speed 2	Acceleration time of preset speed 2	0.0~ 3200.0	0.1 sec	5.0	44
F2.21	Deceleration Time of Preset Speed 2	Deceleration time of preset speed 2	0.0~ 3200.0	0.1 sec	5.0	44
F2.22	Acceleration Time of Preset Speed 3	Acceleration time of preset speed 3	0.0~ 3200.0	0.1 sec	5.0	44
F2.23	Deceleration Time of Preset Speed 3	Deceleration time of preset speed 3	0.0~ 3200.0	0.1 sec	5.0	44
F2.24	Acceleration Time of Preset Speed 4	Acceleration time of preset speed 4	0.0~ 3200.0	0.1 sec	5.0	44
F2.25	Deceleration Time of Preset Speed 4	Deceleration time of preset speed 4	0.0~ 3200.0	0.1 sec	5.0	44
F2.26	Secondary Acceleration Time	Multi-function input terminals select the secondary acceleration time.	0.0~ 3200.0	0.1 sec	5.0	44
F2.27	Secondary Deceleration Time	Multi-function input terminals select the secondary deceleration time.	0.0~ 3200.0	0.1 sec	5.0	44
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	45
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	45
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	46

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	0.1~400.0	0.1Hz	50.0 *Note 1 60.0 *Note 2	46
F2.33	Starting Frequency	Starting frequency of drive's output frequency.	0.1~10.0	0.1Hz	0.5	47
F2.34	Starting Voltage	The voltage corresponds to the output starting frequency.	0.1~50.0	0.1V	8.0	47
F2.35	Base Frequency	The frequency corresponds to the base voltage in V/F pattern.	0.1~400.0	0.1Hz	50.0 *Note 1 60.0 *Note 2	47
F2.36	Base Voltage	The voltage corresponds to the base frequency in V/F pattern.	0.1~255.0	0.1V	220.0	47
F2.37	V/F Frequency 1	Frequency at the first point of V/F pattern	0.0~399.9	0.1Hz	0.0	47
F2.38	V/F Voltage 1	Voltage at the first point of V/F pattern	0.0~255.0	0.1V	0.0	47
F2.39	V/F Frequency 2	Frequency at the second point of V/F pattern.	0.0~399.9	0.1Hz	0.0	47
F2.40	V/F Voltage 2	Voltage at the second point of V/F pattern.	0.0~255.0	0.1V	0.0	47
F2.42	Jump Frequency 1	Avoid mechanical resonance point 1.	0.0~400.0	0.1Hz	0.0	48
F2.43	Jump Frequency 2	Avoid mechanical resonance point 2.	0.0~400.0	0.1Hz	0.0	48
F2.44	Jump Frequency 3	Avoid mechanical resonance point 3.	0.0~400.0	0.1Hz	0.0	48
F2.45	Jump Frequency Range	Set the range of the jump frequency 1, 2, 3.	0.0~25.5	0.1Hz	0.0	48
F2.47	Frequency Upper Limit	The upper limit of output frequency (1.00=maximum output frequency)	0.00~1.00	0.01	1.00	48
F2.48	Frequency Lower Limit	The lower limit of output frequency (1.00=maximum output frequency)	0.00~1.00	0.01	0.00	49

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.	0.0~400.0	0.1Hz	0.5	50
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	50
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	50
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	50
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	50
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	50
F3.07	Deceleration Stall Prevention	0: Deceleration stall prevention: Disabled 1: Deceleration stall prevention: Enabled	0, 1	—	1	50
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	51
F3.10	Frequency Response Time of Motor Slip Compensation	Set the frequency response time of motor slip compensation. Unit: 5ms	1~255	1	40	51
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	51

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	52
F3.18	Automatic Voltage Regulation (AVR)	0: Disable 1: Enable	0, 1	—	1	52
F3.19	Response Time of AVR	Set the response time of automatic voltage regulation.	0~255	1ms	50	52
F3.21	DC Braking Level	Set the current level of DC braking	0~150% of drive rated current	1%	50	52
F3.22	DC Braking Response Time	Adjust the response time according to DC braking.	1~255	1ms	10	52
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	52
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	52
F3.25	DC Braking Frequency at Stop	Active frequency level of DC braking at stop.	0.1~60.0	0.1Hz	0.5	53
F3.27	Active Level of Overvoltage During Deceleration	DC bus voltage is over the setting. Function disable setting: 100/200V series: 410	350~410	1Vdc	390	53

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

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
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	53
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.	150.0~192.0	0.1V	175.0	54
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	54
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	54
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	54
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.	0.0~400.0	0.1Hz	0.0	54
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	54
F3.38	Delay Time for Speed Tracing	Set the output delay time before the speed tracing.	0.1~60.0	0.1sec	0.5	55
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	55

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

F4 Protection Parameters

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F4.07	Motor 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	56
F4.08	Motor 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	56
F4.09	Motor No-Load Current	Current setting according to the motor's no-load condition	0~ motor rated current	0.1A	1/3 motor rated current	56
F4.10	Trip Time of Motor Overload	Set the tripped time of motor when motor is overload(150% of Motor rated current).	0.5~10.0	0.1min	5.0	56
F4.12	Protection Level of Drive Overheat	Set the tripped level of drive when drive is overheat.	85~115	1℃	90	56
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	56

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	56
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	57
F4.17 ~ F4.19	Reserved	Reserved				
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	57
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	57
F4.23	PTC Overheat Trip Level	Set the overheat trip level of PTC	0.0~10.0	0.1V	2.4	57
F4.25	System Overload Detection (OLO)	0: Disable 1: Enable(OLO)	0, 1	—	0	58
F4.26	System Overload Detection Status	0: Detection during the constant speed only 1: Detection during the running only	0, 1	—	0	58
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	59
F4.28	System Overload Detection Level	Set the level of the current for overload detection	30%~200% of drive rated current	1%	160	59
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	59
F4.36	Current Limit (I-limit)	Current over current limit level	30%~200% of drive rated current	1%	180	59
F4.37	Gain of I-limit	Current limit control - P	0.00～1.00	0.01	0.10	59
F4.38	Integration Time of I-limit	Current limit control - I	0～10.0	0.1	0.6	59
F4.39	Selection of Current Limitation	0：Disable 1：Enable	0，1	—	0	59

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

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	60
F5.01	VI Selection (Analog Input)	0: Analog input gain 1: Frequency command 2: Current limit 3: Variable voltage of V/F pattern 4: PTC temperature	0~4	—	1	60
F5.02	VI Input Source Selection	0: 2~10V 1: 0~10V	0, 1	—	1	61
F5.03	Pot Gain (Analog Input)	Analog input of "Pot knob" gain	0.00~2.00	0.01	1.00	61
F5.04	"Pot knob" Bias (Analog Input)	Analog input of "Pot knob" bias	-1.00~1.00	0.01	0.00	61
F5.05	VI Gain (Analog Input)	Analog input of VI gain	0.00~2.00	0.01	1.00	61
F5.06	VI Bias (Analog Input)	Analog input of VI bias	-1.00~1.00	0.01	0.00	61
F5.07	Filter Setting of Analog Frequency	Filter the signal based on analog input setting.	0~255	—	20	62
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	62
F5.09	Acceleration Time of V/F	Set the acceleration time of the variable voltage of V/F pattern.	0.0~3200.0	0.1sec	5.0	62
F5.10	Deceleration Time of V/F	Set the deceleration time of the variable voltage of V/F pattern.	0.0~3200.0	0.1sec	5.0	63

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

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
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: Reserved ±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: Reserved ±21: Reserved ±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	-28 ~ +28 *Note 3	—	22	63
F5.20	Multi-function Input Terminal X2		-28 ~ +28 *Note 3	—	23	63
F5.21	Multi-function Input Terminal X3		-28 ~ +28 *Note 3	—	1	63
F5.25	Digital Input Response Time	When the input signal is less than the setting time, program will not be activated.	1~255	5ms	10	58

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

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F5.26	Multi-function Output Setting of Ta/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: Over voltage detection during deceleration (db) ±9: Restart after instantaneous power failure detection ±10: Restart after fault condition detection ±11: Fault detection ±12: Reserved ±13: Reserved ±14: Reserved ±15: Reserved ±16: Detection of counter value1 ±17: Detection of counter value2 ±18: Reverse detection ±19: NTC temperature warning detection (OHt) ±20: Reserved ±21: PTC temperature warning detection (OH1)	-21~+21 *Note 3	—	11	67
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	70
F5.31	UP/DOWN Frequency Calibration	0: 0.01Hz 1~8: ×0.05Hz 9: 0.5Hz 10~250: ×0.1Hz	0~250	—	0	70

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	70
F5.33	UP/DOWN Frequency Adjustment	Adjust UP/DOWN frequency on keypad directly	0.00~400.00	0.01Hz	0.00	71
F5.35	Counting Mode	0: Up counting mode 1: Down counting mode	0, 1	—	0	71
F5.36	Counter Value 1	Set counter value 1 for sequential operation control cycle	0~9999	1	0	71
F5.37	Counter Value 2	Set counter value 2 for sequential operation control cycle	0~9999	1	0	71
F5.39	Constant Speed Detection Range	Set the bandwidth of constant speed detection range	0.0~10.0	0.1Hz	2.0	72
F5.40	Frequency Detection Range	Set the bandwidth of frequency detection range	0.0~10.0	0.1Hz	2.0	72
F5.41	Frequency Detection Level	Set the frequency detection level of multi-function terminal	0.0~400.0	0.1Hz	0.0	72

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

F6 Special Parameters

Func.	Name	Descriptions	Range of Setting	Unit	dF60	Page
F6.55	Communication Address	The host uses the address to send and receive messages from the drive (0: Disable)	0~254	—	0	73
F6.56	Baud Rate	0: 4800bps 1: 9600bps 2: 19200bps	0~2	—	1	73
F6.57	Communication Protocol	0: 8,N,2 1: 8,E,1 2: 8,O,1	0~2	—	1	73
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	73
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	74
F6.60	Multi-Function Input Selection	0: Multi-function inputs from multi-function terminals 1: Multi-function inputs from communication control	0, 1	—	0	74

(Note):

1. The default setting of 50Hz
2. The default setting of 60Hz
3. + : 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.
4. 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.

Chapter 5 Parameter Setting Description

5-1 (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 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“0.00”.
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 “0.0.0.0“.
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 4 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

【F0.18】 Parameter Display Selection
0: Simple parameter list
1: Complete parameter list

【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-601A 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.

5-2 (F1) Operation Parameters

【F1.00】 Start Command Selection

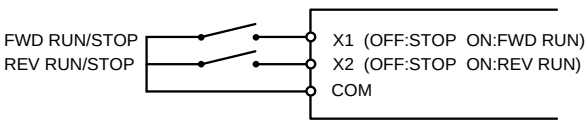
a. F1.00 = 0

(I) Motor forward and reverse directions are controlled by multi-function input terminals(X1~X3).

(II) Start and motor rotating direction commands are controlled by multi-function input terminals(X1~X3) 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.

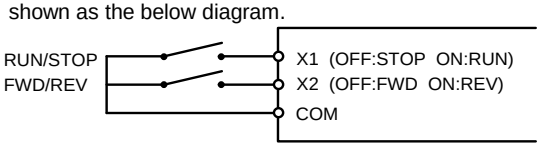


b. F1.00 = 1

(I) Motor forward and reverse directions are controlled by multi-function input terminals (X1~X3).

(II) Start command by forward command (defining X1~X3 as forward command) and motor rotating direction by reverse command (defining X1~X3 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.



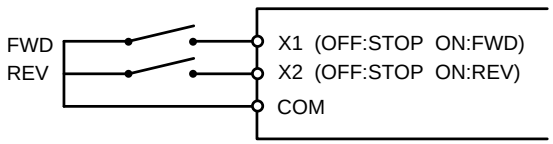
c. F1.00 = 2

(I) Motor rotating direction are controlled by multi-function input terminals (X1~X3).

(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~X3).

(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)

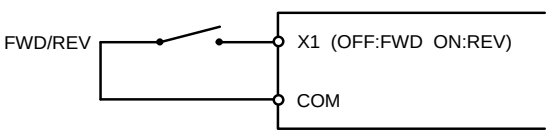
(II) Forward and reverse commands are disabled.

f. F1.00 = 5

(I) Multi-function input terminals (X1~X3) 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~X3) 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~X3) 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”, VI 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) VI-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~X4(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~F5.22 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"＋VI
1: "Pot knob"－VI
2: VI－"Pot knob"
3: "Pot knob" or VI (switched by multi-function input terminals)
4: "Pot knob"
5: VI
※ "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-601A).

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

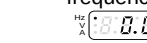
a. The settings are listed as below:

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: Reserved
5: Reserved
6: Counting value
7: Current limit level
8: Primary frequency command
9: Secondary frequency command
10: Reserved
11: Reserved

【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 ~ F5.21 for SPEC key setting reference.

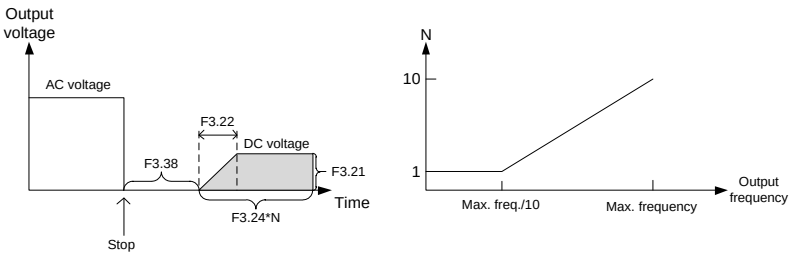
【F1.18】 SPEC Key Self-Holding Function
SPEC key self-holding function
0: Disable
1: Enable

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:

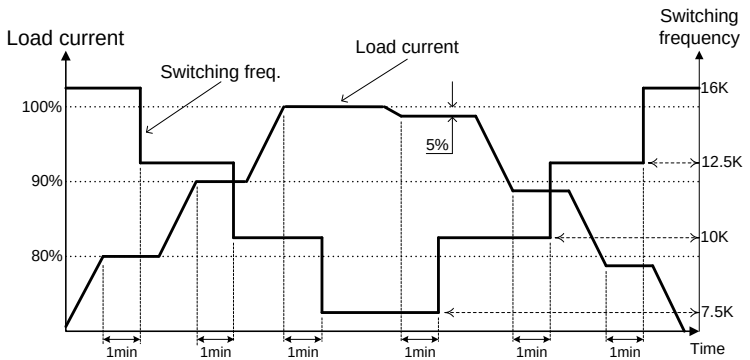
Setting Value	Switching frequency
0	800Hz
1	2.5kHz
2	5kHz
3	7.5kHz
4	10kHz
5	12.5kHz
6	16kHz

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 the Switching Frequency

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

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

【F1.23】 Number of Tolerance to Drive Fault (Maximum :0~16 times)

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.

5-3 (F2) Frequency Parameters

【F2.00】 Primary Speed (Preset Speed 1)
 | |
【F2.07】 Preset Speed 8

【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~ F5.22)

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

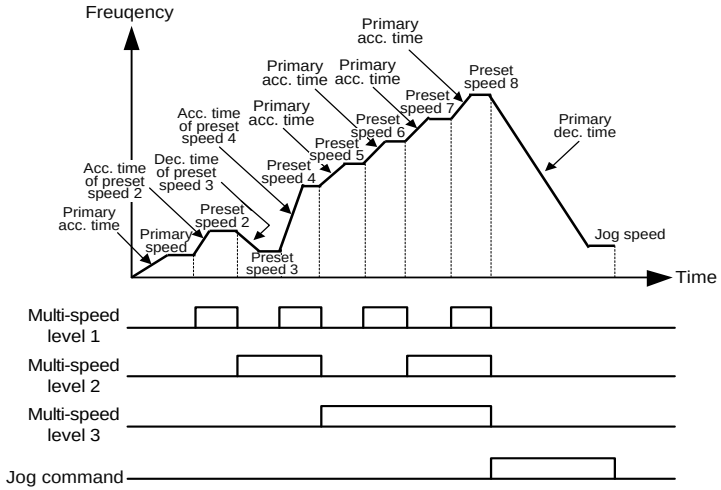
※ “×”: Don’t care.

※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~ F5.22 to define multi-function input terminals (X1~X3) 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”, VI) 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

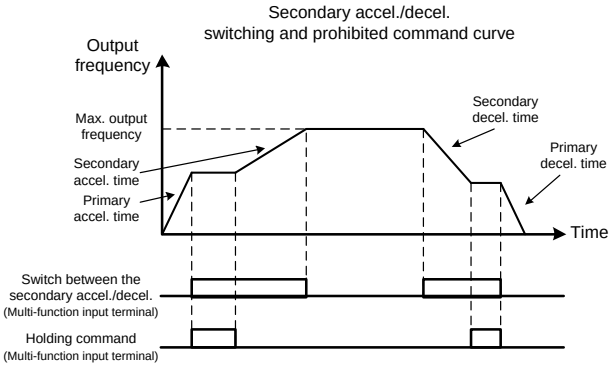
【F2.18/F2.19】 Primary Acceleration / Deceleration Time
| |
【F2.24/F2.25】 Acceleration / Deceleration Time of Preset Speed 4
【F2.26/F2.27】 Secondary Acceleration / Deceleration Time

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.

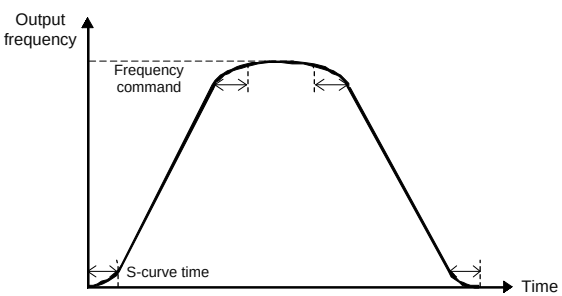
The illustration is shown as below:



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

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

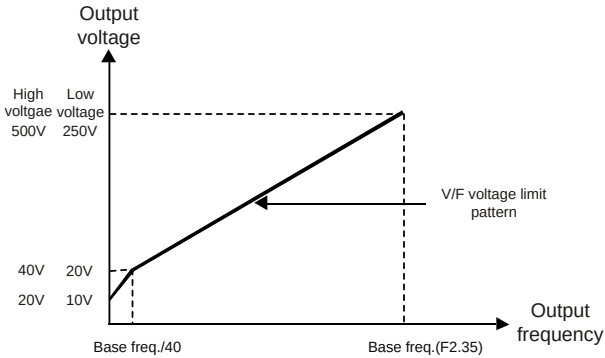
Setting the S-curve for the acceleration/deceleration time is to slow the acceleration and deceleration time at start and stop. For example: To ease the impact of the fallen object on the conveyor line or elevator.



【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:

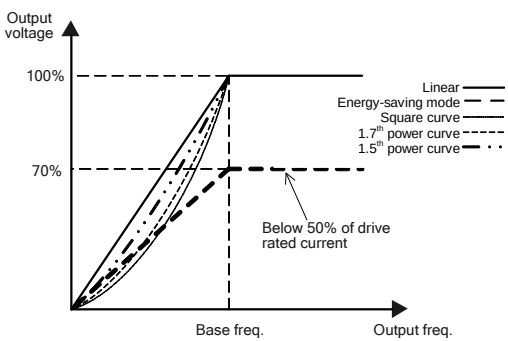
0: Linear

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 0.1~400.0Hz

【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: 0.1~400.0Hz

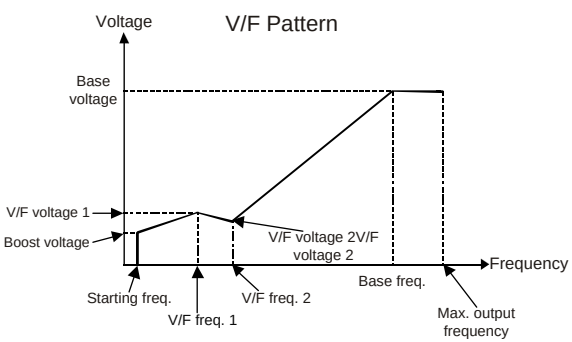
【F2.36】 Base Voltage
Set the base voltage bases on the nameplate of motor.
100V/200V series range: 0.1~255.0V
400V series range: 0.1~510.0V

【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

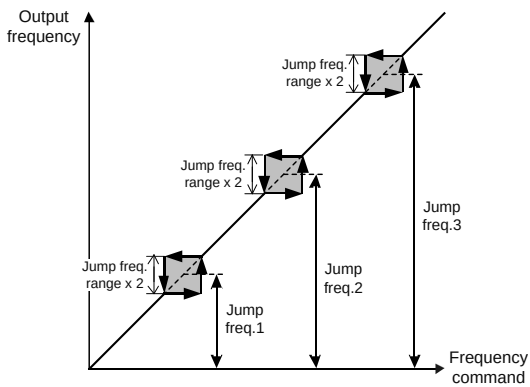
(IV) No limitation between F2.34, F2.36, F2.38, F2.40

【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 0.0~400.0Hz

【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 (0.00~1.00)

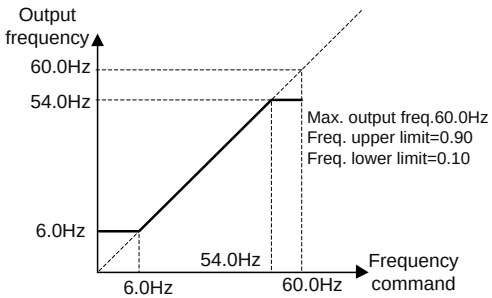
Set the ratio of the frequency upper limit (1.00=maximum output frequency), and the setting range is 0.00~1.00

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

【F2.48】 Frequency Lower Limit (0.00~1.00)

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

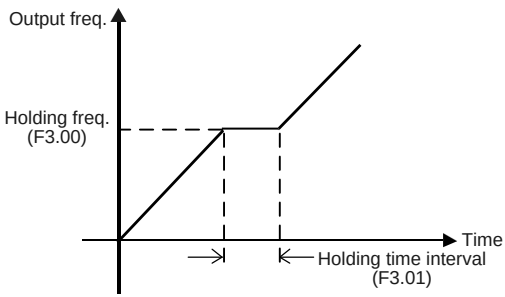
Output frequency lower limit = Frequency lower limit (F2.48) × Maximum output frequency (F2.32)



5-4 (F3) Control Parameters

【F3.00】 Holding Frequency (0.0~400.0Hz)
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 (0.0~360.0sec)
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.



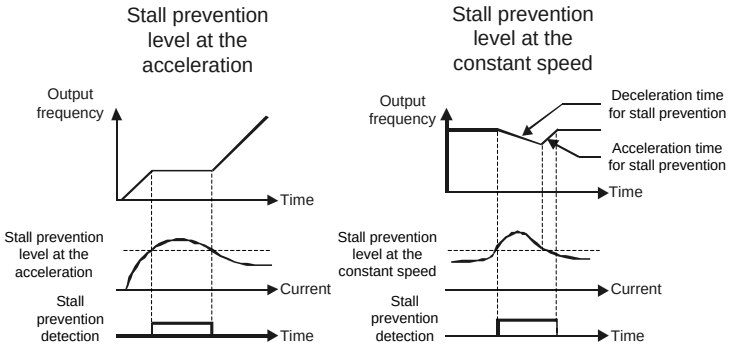
【F3.03】 Stall Prevention Level at the Acceleration
If stall is occurred during acceleration, the motor keeps running at the constant speed (200%: Off), and the setting range is 30%~200% of drive's rated current

【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 (-59.9~60.0Hz)

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

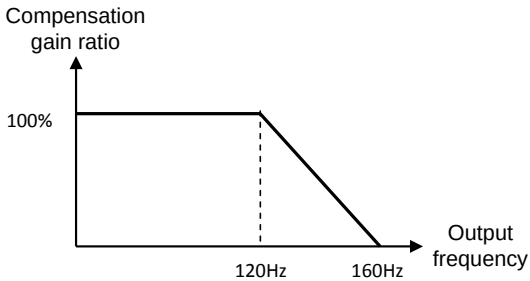
a. Setting the frequency response time of motor slip compensation. The unit is 5ms.

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.

【F3.18】 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 0~255ms.

【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 0~255ms.

【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 sec.

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

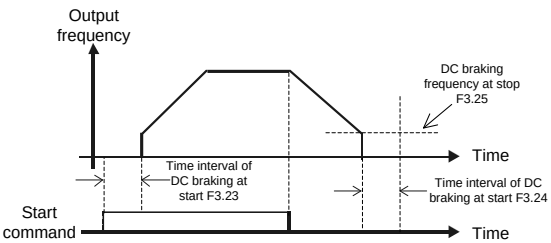
a. The setting of time interval of DC braking is to avoid inertial run of motor at stop.

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 0.1~60.0Hz.

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 Overvoltage During Deceleration

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. Set 410V : CLOSE

【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.

【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.

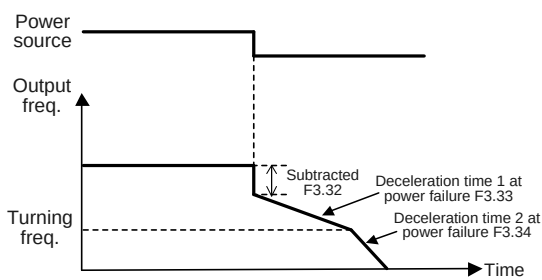
【F3.34】 Deceleration Time 2 at Power Failure

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: 0.0~400.0Hz.

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~F5.22 multi-function input terminals for speed tracing.

【F3.38】 Delay Time for Speed Tracing
Set the output delay time before the speed tracing. Please refer to multi-input terminal X1~X3.
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%.

5-5 (F4) Protection Parameters

【F4.07】 Motor 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 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 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 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)

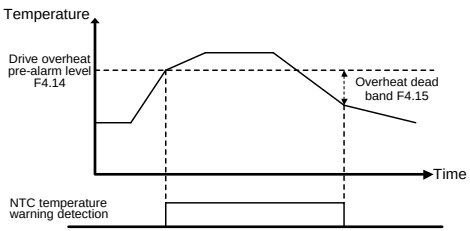
b. For relay terminal outputs, please see the function setting F5.26

【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℃



【F4.21】 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

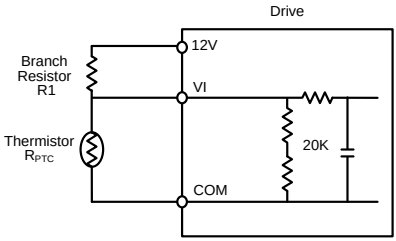
【F4.23】 PTC Overheat Trip Level

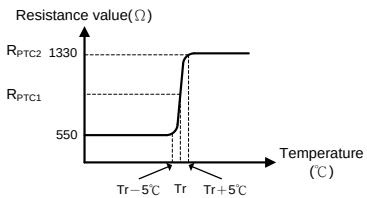
a. "OH2" on the panel display will be blinking when the temperature is over PTC overheat trip level (F4.23) and the motor will coast to stop. Press RESET key on the operation panel to clear the fault when the temperature is down below the warning level.

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

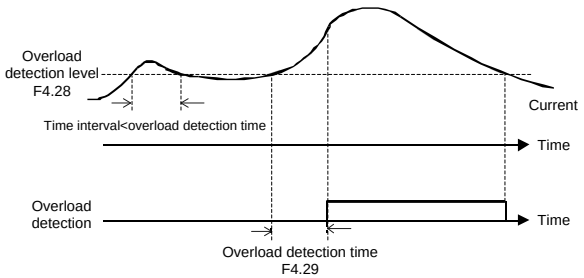
The settings are listed as below:
0: Detection at constant speed only.

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.
Setting range: 30~200% rated current of drive.

【F4.37】Gain of I-limit (0.0~10.0)
The gain of the current limitation response(P). Higher P setting value will cause the current limitation response more fast, however, higher setting value would cause the oscillating current.

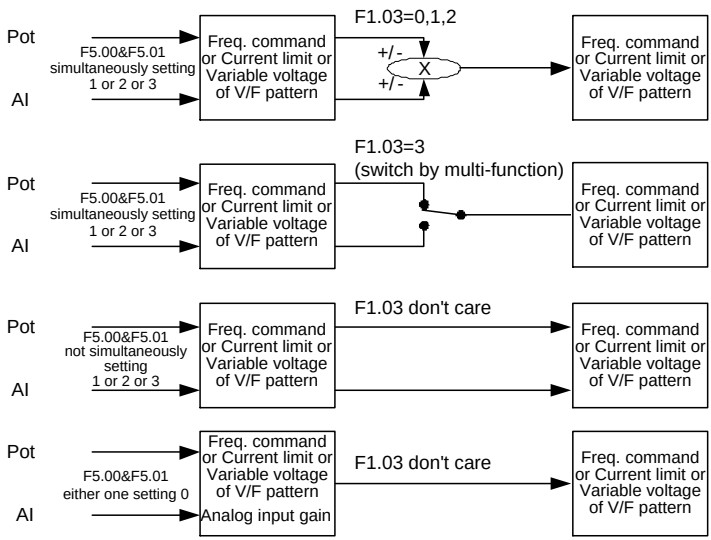
【F4.38】Integration Time of I-limit (0.0~10.0)
Integration time of I-limit. Lower setting value of integration time(I) will cause the limitation of current response more fast , however, lower setting value would cause the oscillating current.

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

5-6 (F5) Multi-function Parameter

【F5.00】Analog Input Pot Selection
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 VI 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



※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 or1 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】 VI Input Source Selection
The settings are listed as below:
0: 2-10V
1: 0-10V

【F5.03】 Pot Gain (Analog Input)
The Pot gain range setting, and the setting range is 0.00~2.00.

【F5.04】 Pot Bias (Analog Input)
The Pot bias range setting, and the setting range is -1.00~1.00.

【F5.05】 VI Gain (Analog Input)
The VI gain range setting, and the setting range is 0.00~2.00.

【F5.06】 VI Bias (Analog Input)
The VI bias range setting, and the setting range is -1.00~1.00.
a. Analog input terminals:
1. Pot knob
2. VI－GND 2~10V or 0~10V

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

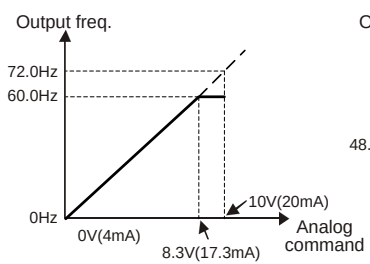
c. Freq. bias value= Max. output frequency (F2.32) x Analog input bias (F5.04 or F5.06)

d. Frequency command:

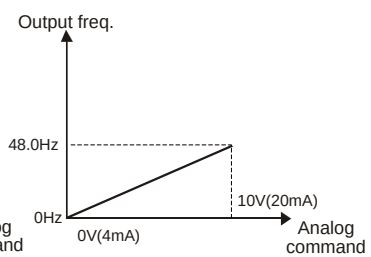
$$\text{Freq.command} = \frac{\text{Analog command}}{10\text{V}} \times (\text{Max. freq. command} - \text{freq. bias}) + \text{freq. bias}$$

Example: Analog input bias= 0.00

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



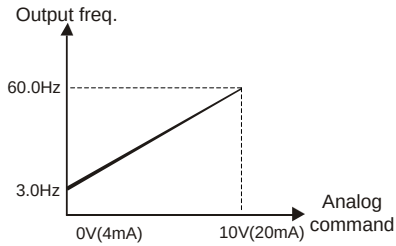
Max. output frequency= 60.0Hz
Analog input gain= 0.80



Example: Analog input gain= 1.00

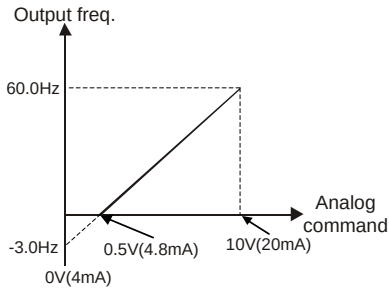
Max. output frequency= 60.0Hz

Analog input gain= 0.05

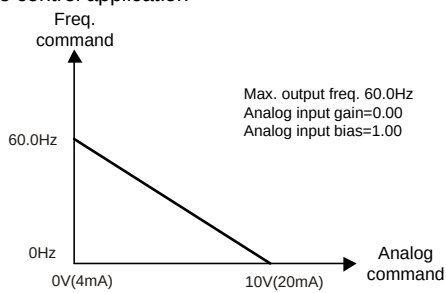


Max. output frequency= 60.0Hz

Analog input gain= -0.05



Example: Inverse control application



【F5.07】 Filter Setting of Analog Frequency

a. Pot or VI 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.

【F5.19】 Multi-function Input Terminal X1

|

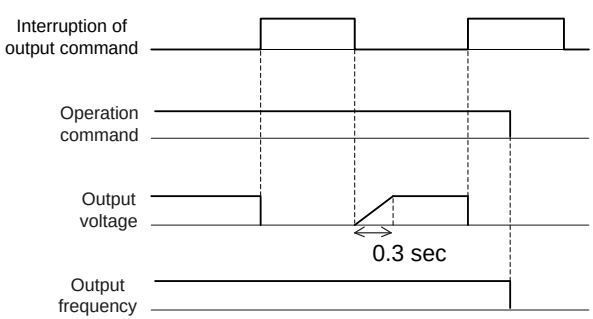
【F5.21】 Multi-function Input Terminal X3

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

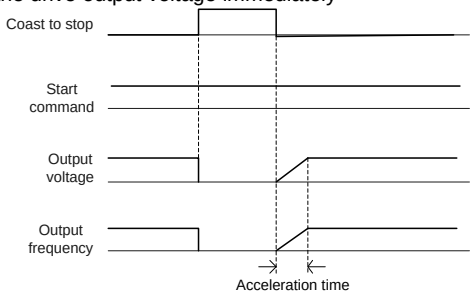
b. The settings of multi-function terminals X1 ~X3 are listed as below:

±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 ~ F2.07 for multi-speed setting)
±4: Multi-speed level 2 command(see the function description of F2.00 ~ F2.07 for multi-speed setting)
±5: Multi-speed level 3 command(see the function description of F2.00 ~ F2.07 for multi-speed setting)
±6: Multi-speed level 4 command(see the function description of F2.00 ~ F2.07 for multi-speed setting)
±7: Reset command
Setting the reset command to reset the drive fault.

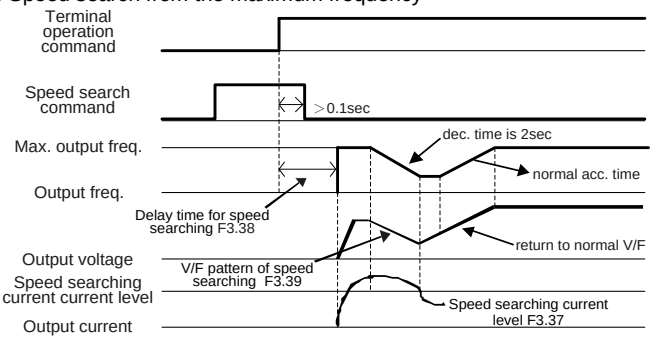
±8: External fault command (EF)
Drive in operation: accept the external fault command to trip the drive.
Drive stop: Disable
±9: Interruption of output command (bb)
Interrupt the output voltage of the drive



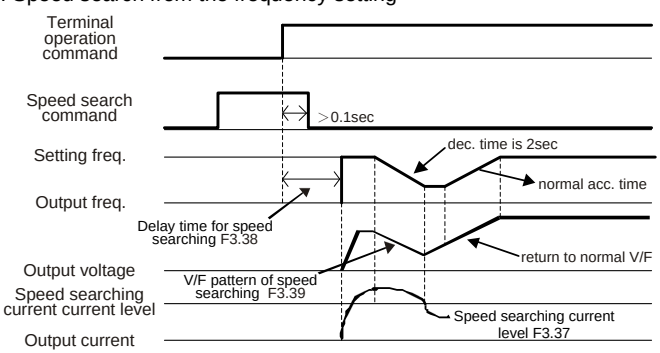
±10: Coast to stop command(Fr)
Interrupt the drive output voltage immediately



±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~X3. UP/DOWN command enter key must be set to activate UP/DOWN command (±14 and ±15) when one of multi-function input terminals X1~X3 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~X3 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/VI)
Setting the function F1.03 (Analog Input Selection) to 3 (Pot or VI)

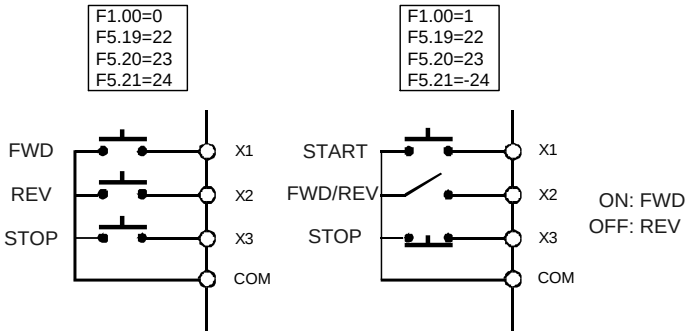
Set to 18	a contact ; Pot is the analog input source
	b contact ; VI is the analog input source
Set to -18	a contact ; VI is the analog input source
	b contact ; Pot is the analog input source

±19: Primary and secondary frequency command option

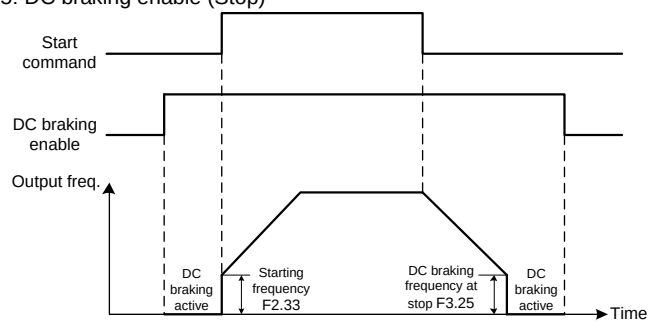
Set to 19	a contact ; The frequency command = Primary frequency command(F1.01)
	b contact ; The frequency command = Secondary frequency command(F1.02)
Set to -19	a contact ; The frequency command = Secondary frequency command(F1.02)
	b contact ; The frequency command = Primary frequency command(F1.01)

±20: Reserved
±21: Reserved
±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.

【F5.25】 Digital Input Response Time (1~255*5ms)

a. Setting the input response time of multi-function terminals (X1~X3) .(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/Tc Terminals

a. Output terminal

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

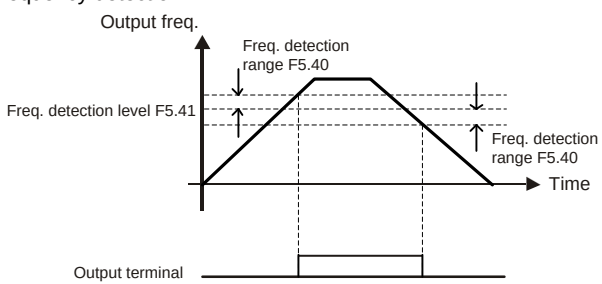
c. Setting the function for output terminals Y1 is listed as below:

±1: Running detection
Detection at drive start

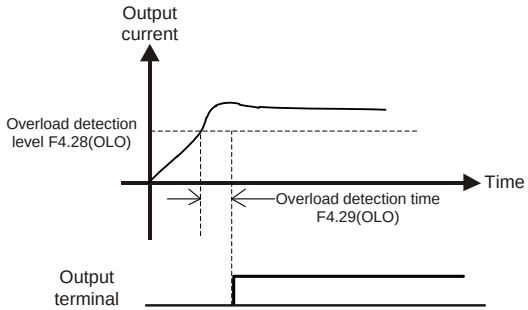
±2: Constant speed detection
Detection at constant speed

±3: Zero speed detection
Detecting at drive zero speed and no detect during the DC braking.

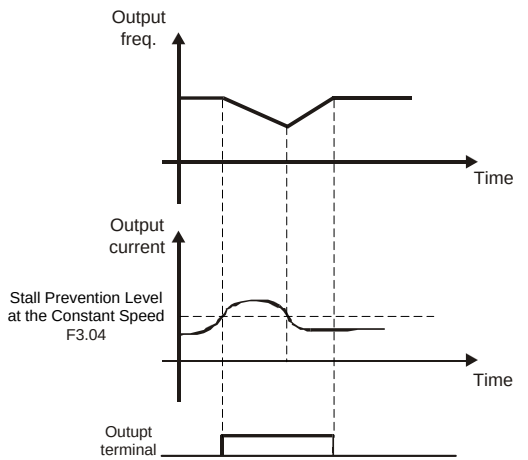
±4: Frequency detection



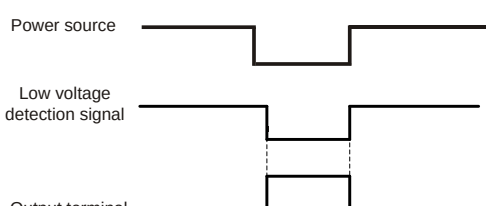
±5: Overload detection(OLO)



±6: Stall prevention detection



±7: Low voltage detection(LE)



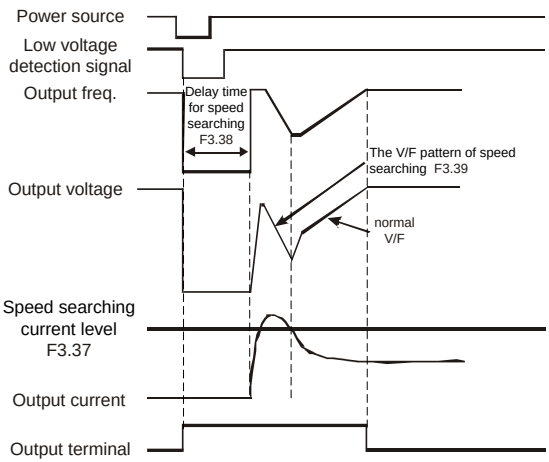
±8: Braking transistor is active detection(db)

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

±9: Restart after instantaneous power failure detection

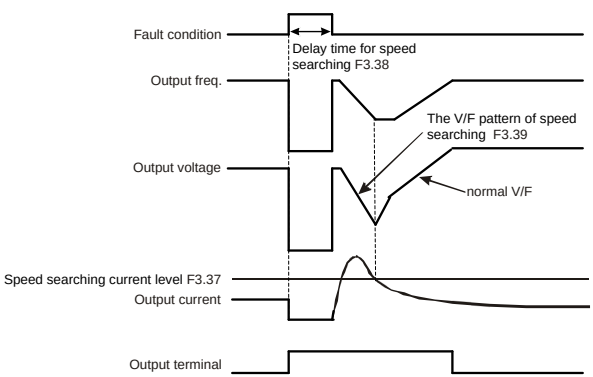
Enable when F3.30 is set to 1.

Restart after instantaneous power failure detection



±10: Restart after fault condition detection

Restart after fault condition detection



±11: Fault detection

±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).

±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).

【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.

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.

【F5.32】 UP/DOWN Calibrating Time

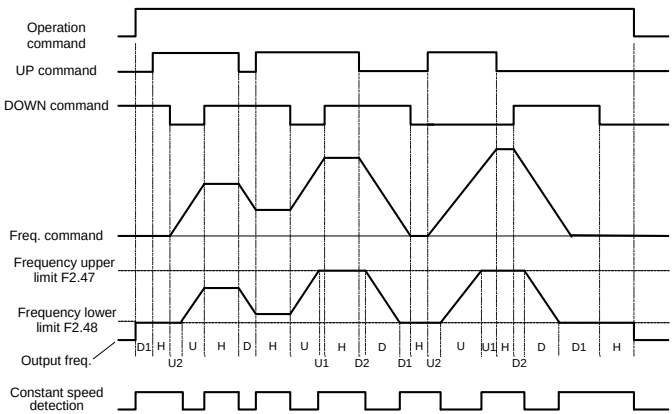
1~5: The response time of terminal calibration (unit: second)
If UP/DOWN terminal (see F5.19~5.22 for UP/DOWN terminal setting) is set to ON/OFF over the response time of terminal calibration, motor will continue accelerating/decelerating to the maximum/minimum running speed (frequency) – ON for acceleration 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

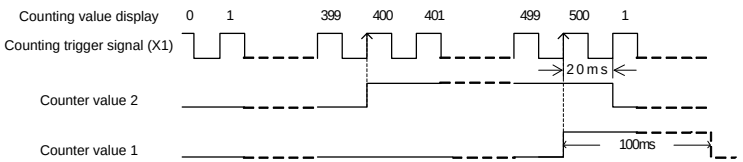
Setting the number of counting value to conduct the relay outputs for 100ms; The setting of counting value: 0~9999 times(see the setting of counting value detection in 5.26).

【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).

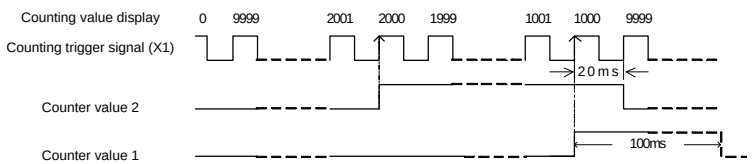
Up counting mode:

F5.35=0
F5.36=500
F5.37=400



Down counting mode:

F5.35=1
F5.36=1000
F5.37=2000



※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: 0.0~400.0Hz; see the frequency detection setting of multi-function output terminal (F5.26)

5-7 (F6) Special Parameters

【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

【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

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

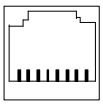
The settings are listed as below:

0: Multi-function inputs from multi-function terminals

1: Multi-function inputs from communication control

Chapter 6 Communication Description

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



8 ◄— 1

Type	Pin	Function	Description
Modbus(RS-485)/ KP-601A 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-601A(+16V)	Only for KP-601A linking
	4	Auto-detect terminal of KP-601A	Only for KP-601A linking
	5	Reserved	Reserved
	6		
	7	Common ports of KP-601A power(0V)	Only for KP-601A linking
	8		

Note 1: The terminal resistor(100Ω) selection is set by JPK1 (Default setting: ON)

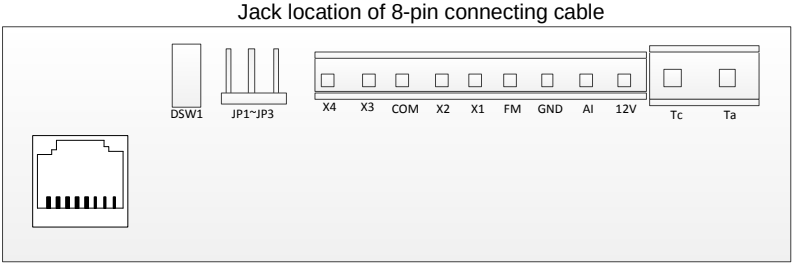
Note 2: When using multiple sets of drive, connect all the DX＋, DX－ terminals of each drive by series, and connect the shielded net of the connection wire to FG terminal.

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

●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

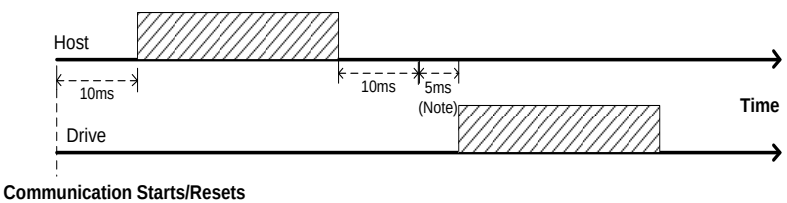
```
                1 1 1 1  1 1 1 1    1 1 1 1  1 1 1 1
First Code 02H                      0 0 0 0  0 0 1 0   XOR
                1 1 1 1  1 1 1 1    1 1 1 1  1 1 0 1
MOVE 1          0 1 1 1  1 1 1 1    1 1 1 1  1 1 1 0 | 1
                1 0 1 0  0 0 0 0    0 0 0 0  0 0 0 1
                ---------------------------------------
                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	Reserved
		b7	Reserved
		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)

Chapter 7 Operation Procedures and Fault Protection

7-1 Operation Procedures

DANGER
1. Do Not touch the drive or performing any unwiring actions in the 5 minutes before drive indicator light turns off after the power off.

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 L1, 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, V, W 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, V, W 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.

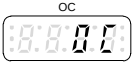
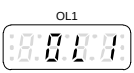
7-2 Fault Protection Display and Troubleshooting

A: Description:

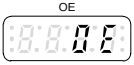
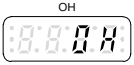
The drive has well protection functions to protect drive and motor when faults occur. When the fault occurs, the drive trips by the protection functions and display the fault message on operation panel. After the fault is troubleshooted, reset the drive by pressing "STOP RESET" of the drive operation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

B: Protection and Troubleshooting List:

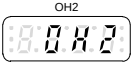
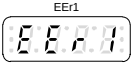
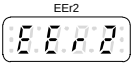
Drive error trip message

Display	Description	Cause	Troubleshooting
OC 	**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,V,W terminals to verify if there is short between terminals. ●Check the motor and drive compatibility. ●Check the motor operated in over-rated running.
OL 	**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.
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.

Drive error trip message

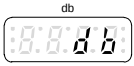
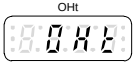
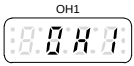
Display	Description	Cause	Troubleshooting
OLO 	**System overload** ●Load is too heavy and the operation current reaches the active level. ●Detection level: F4.28 ●Detection time: F4.29	— — —	Check the usage of mechanical equipment.
OE 	**Over voltage** ●The internal DC bus voltage is over the protection 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.
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.

Drive error trip message

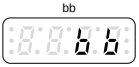
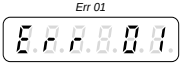
Display	Description	Cause	Troubleshooting
OH2 	**Motor overheat** ●The internal temperature of motor is over the trip level. ●Trip level: F4.23	Motor is overheat.	●Check if the motor load is too heavy. ●Check if the accel./decel. time is too short. ●Check if V/F setting is proper.
EF 	**External fault**	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.
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 	**Over voltage detection during deceleration** ●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: F4.14	●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~X4 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.

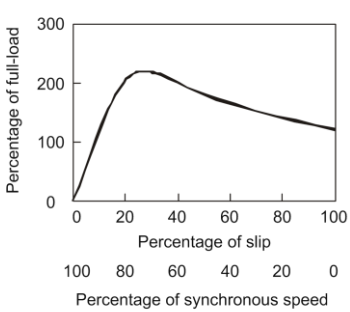
Appendix A Selection of Motor and Measurement of Insulation

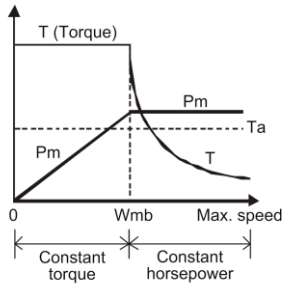
a. Standard Motor

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:



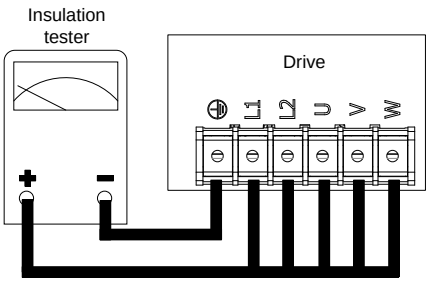


d. When the motor speed exceeds the rated speed(50/60HZ), the torque will be decreased while the motor speed increasing.

e. Check the motor insulation. The standard requirement is 500V (or 1000V) / 100MΩ above.

b.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.



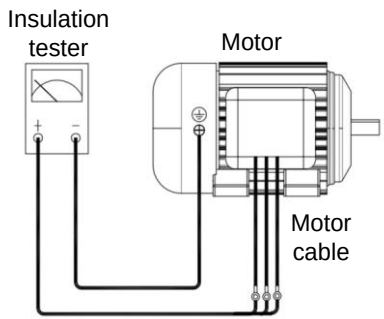
Drive Insulation Impedance Measurement

2. Measure the motor insulation impedance

a. Remove the U, V, W 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.



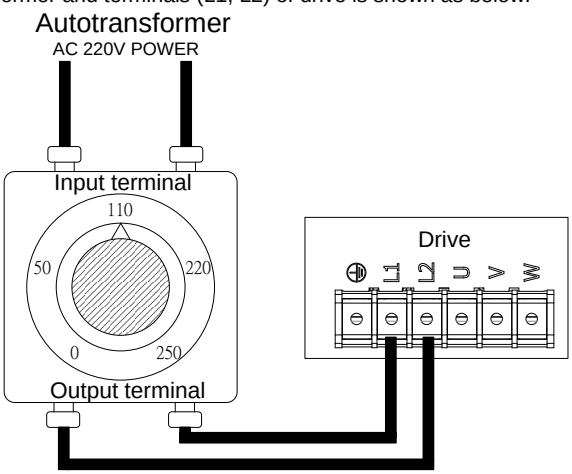
Motor Insulation Impedance Measurement (Including Motor Cables)

Appendix B Instruction of Drive Charging

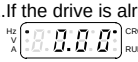
⚠ CAUTION
If the drive is unused or stored in the storage over 1 year, the surface of aluminum foil of electrolytic capacitor within the drive will be oxidized and cracked causing the L and C value up. This is the common characteristics of capacitor. Therefore, with directly applying the voltage and 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 (L1, L2) of drive is shown as below:



Drive connection diagram with autotransformer to charge drive for single-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

Appendix C Outline Dimension Drawings

(1) Outline Dimension of Keypad

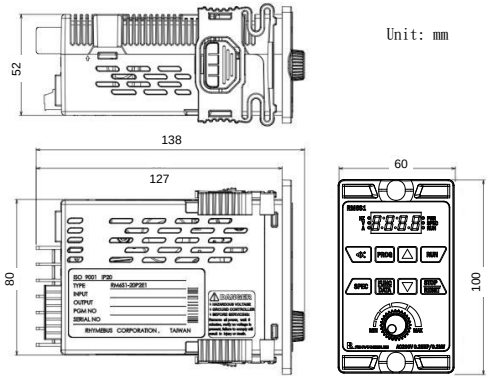
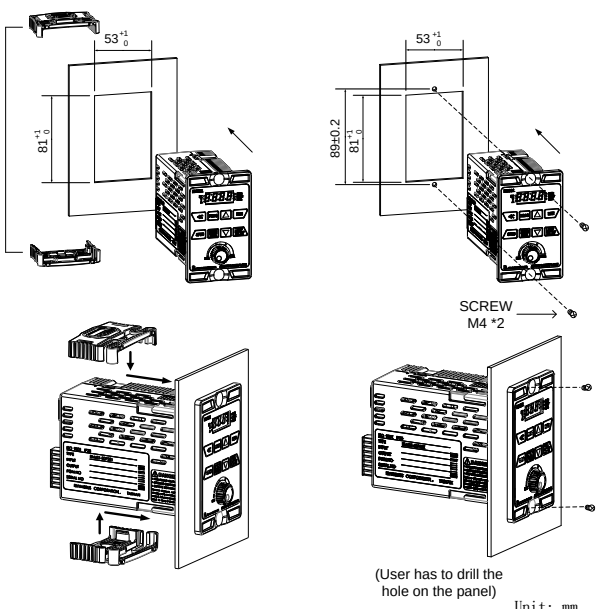


Figure 1: KP-601A keypad (unit: mm)

(2) Overall Dimensions of Drive

Fixation 1: Detachable Buckle (Standard Fixation)

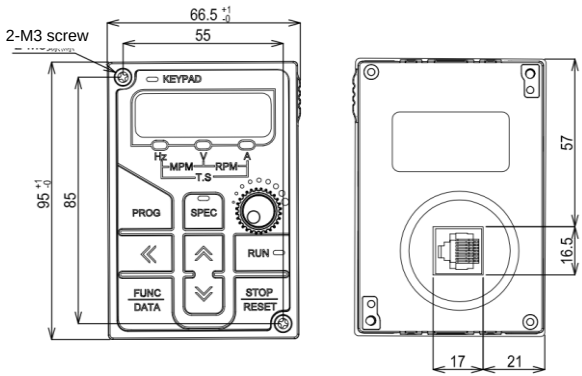
Fixation 2: Screw Fixing (Using for Vibrant Environment)



Note

(3) Purchase Accessories

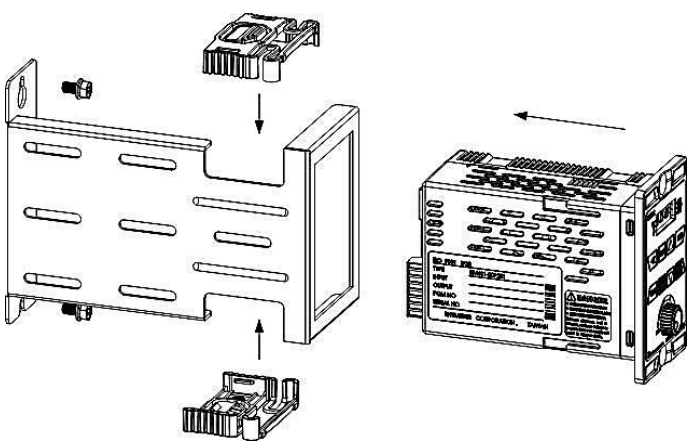
(a) Outline Dimension of Remote Controller(KP-601A)



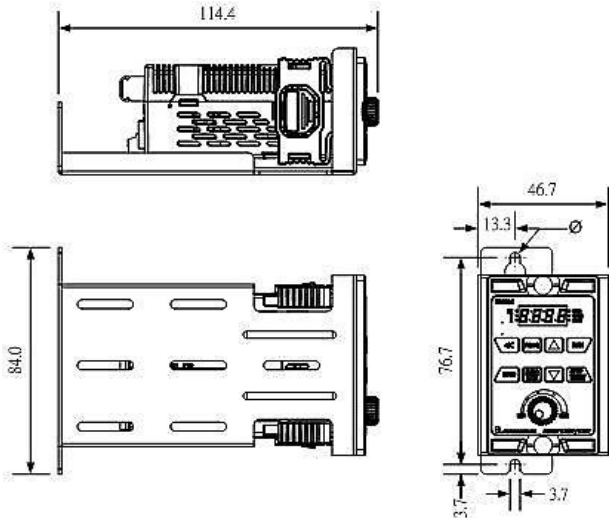
※KP-601A cables: Only used with 8-pin telephone cable (flat) and network cable (AMP)

- 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). Our company standard is 1M,2M,3M,5M,7M,10M.

(b) Overall Dimensions of Drive



Note



Note

Appendix D Selection of Filter

(1) Selection of EMC Filter

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

⚠ 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 interference.

EMC filter model number	EMC filter rated current / phase
FN2090-4-06	4A / 1 ϕ

(2) Zero-Phase Radio Frequency Filter Selection (RFI-01)

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.

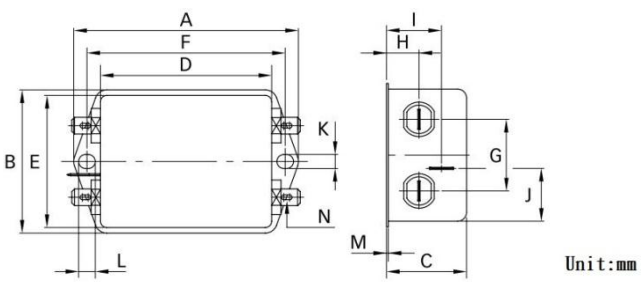
Note

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

RFI Zero-Phase Radio Frequency Filter Mode	RFI-101

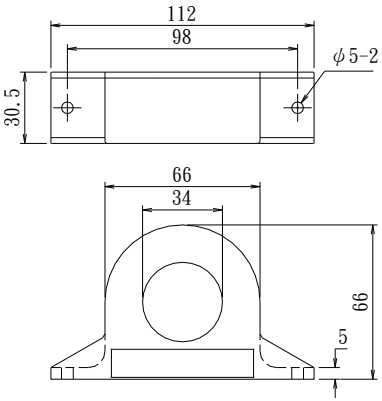
(3) Dimension of Filter (FN2090-4-06)



A	B	C	D	E	F	G
85	54	30.3	64.8	49.8	75	27
H	**I**	**J**	**K**	**L**	**M**	**N**
12.3	20.8	19.9	5.3	6.3	0.7	6.3*0.8

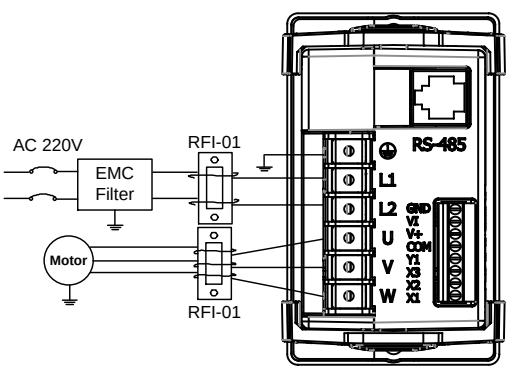
Note

(4) Dimension of RFI-01:



Unit:mm

(5) Installation of Filter and RFI-01



Pass 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 cables with ground wire cannot pass through RFI filter; otherwise the filtration will be reduced.

Note