EMERSON™
Industrial Automation

EV2100 Series Variable Speed Drive

User Manual

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CONTROL TECHNIQUES

EV2100 Series Variable Speed Drive
User Manual

Version V1.2
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BOM 31012390

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Preface

Thank you for using EV2100 series Variable Speed Drive (hereafter referred to as Drive) made by Emerson.

The Drive satisfies the high performance requirements by using a unique control method to achieve high torque, high accuracy and wide speed-adjusting range. Its anti-tripping function and capabilities of adapting to severe power system, temperature, humidity and dusty environment exceed those of similar product made by other companies, which improves the product's reliability noticeably;

Low noise and EMI can be achieved by applying optimized PWM technology and EMC design.

This manual provides information on installation, wiring, parameter setting, trouble-shooting, and daily maintenance. To ensure the correct installation and operation of the drive, please read this manual carefully before starting the drive and keep it in a safe place.

1.1 Unpacking Inspection

Upon unpacking, please check for:

Any damage occurred during transportation;

Check whether the rated values on the nameplate of the drive are in accordance with your order.

Our product is manufactured and packed at factory with great care. If there is any error, please contact us or distributors.

The user manual is subject to change without notifying the customers due to the continuous process of product improvements.

1.2 Model code explanation

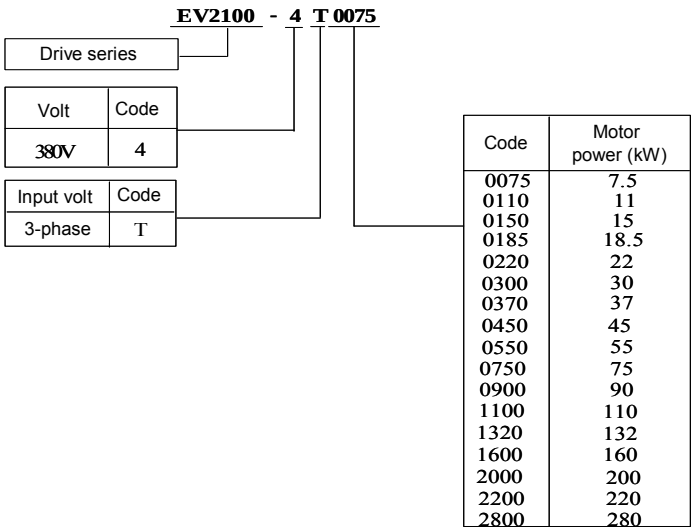


Fig. A-1 Explanations of Drive Models

The nameplate is located on the right hand side of the heatsink. A barcode on the plastic cover also contains the information of the drive, as shown in Fig.A-2.

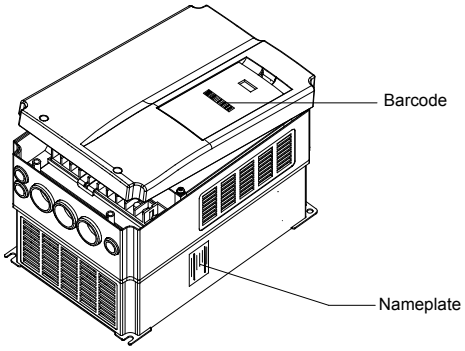


Fig. A-2 Locations of Nameplate and Barcode

Chapter 1 Safety Information

This chapter is for the safety related information of the Drive.

1.1 Safety

Danger — Operations without following instructions can cause personal injury or death.

Attention — Operations without following instructions can cause personal injury or damage to product or other equipment.

1.2 Notes for Installations

Danger

- Please install the drive on fire-retardant material.
- Keep the drive away from combustible materials
- Keep the drive away from explosive gas
- Only qualified personnel shall wire the drive
- Never wire the drive unless the input AC supply is totally disconnected
- The drive must be properly earthed to reduce electrical accident
- Install the cover before switching on the drive, to reduce the danger of electric shock and explosion.
- For drives that have been stored for longer than 2 years, increase its input voltage gradually before supplying full rated input voltage to it, in order to avoid electric shock and explosion
- Don't touch the live control terminals with bare hands
- Don’t operate the drive with wet hands
- Perform the maintenance job after confirming that the charging LED is off or the DC Bus voltage is below 36V.
- ·Only trained professionals can change the components, it is prohibited to leave wires or metal parts inside the drive so as to avoid the risk of fire.
- ·Parameter settings of the control board that has been changed must be revised, otherwise accidents may occur.
- ·The bare portions of the power cables must be bound with insulation tapes.

Attention

- Don’t carry the drive by its cover. The cover cannot support the weight of the drive and may drop.
- Please install the drive on a strong support, failing which the drive may fall off.
- Don’t install the drive in places where water pipes may leak onto it.
- Don't allow screws, washers and other metal foreign matters to fall inside the drive, otherwise there is a danger of fire or damage;
- Don't operate the drive if parts are not complete, otherwise there is a danger of a fire or human injury;
- Don't install the drive under direct sunshine, otherwise it may be damaged;
- Don’t short circuit P1/PB and terminal (-), otherwise there is a danger of fire or the drive may be damaged.
- Cable lugs must be connected to main terminals firmly
- Don’t apply supply voltage (AC 220V or higher) to control terminals except terminals TA, TB and TC.

1.3 Notes for Using EV2100

Pay attention to the following issues when using the drive.

1.3.1 About Motor and Load

Compared to the power frequency operation

The drive is a voltage type variable speed drive. The output voltage is in PWM wave with some harmonics. Therefore, temperature rise, noise and vibration of motor are higher.

Low Speed Constant Torque Operation

Driving a common motor at low speed for a long time, the drive's life will be reduced due to the deteriorating heat dissipation effect, so a special variable frequency motor is needed if long time operation with constant torque is required.

Motor's over-temperature protecting threshold

The drive can protect the motor from over-temperature. If the ratings of the driven motor are not in compliance with the drive, be sure to adjust the protective threshold to ensure the motor is properly protected.

Operation above 50Hz

If the motor operated above 50Hz, motor vibration, noise as well as bearing and mechanical devices sufficient should be taken into consideration.

Lubrication of mechanical devices

Over time, the lubricants in mechanical devices, such as gear box, geared motor, etc. when running at low speed, will deteriorate. Frequent maintenance is recommended.

The mechanical resonance point of load

The drive system may encounter mechanical resonance with the load when operating within certain band of output frequency. Skip frequencies have been set to avoid it.

Frequent startup/shutdown

The drive should be started and stopped via its control terminals. It is prohibited to start and stop the drive directly through input line contactors, which may damage the drive with frequent operations.

Insulation of Motors

Before using the drive, the insulation of the motors must be checked, especially, if it is used for the first time or if it has been stored for a long time. This is to reduce the risk of the Drive from being damaged by the poor insulation of the motor. Wiring diagram is shown in Fig. 1-1. Please use 500V insulation tester to measure the insulating resistance. It should not be less than 5MΩ.

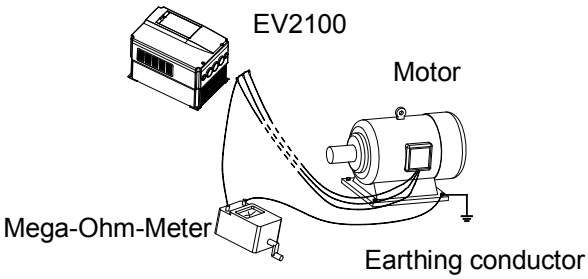


Fig. 1-1 Checking the insulation of motor

1.3.2 About Variable Speed Drive

Varistors or Capacitors Used to Improve the Power Factor

Don't connect any varistor or capacitor to the output terminals of the drive, because the drive's output voltage waveform is pulse wave, otherwise tripping or damaging of components may occur; in addition, don't install circuit breaker or contactor at the output side of the drive as shown in Fig.1-2.

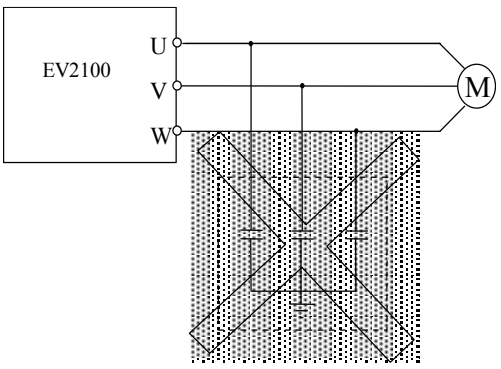


Fig. 1-2 Capacitors are prohibited to be used.

Circuit breakers connected to the output of the drive

If circuit breaker or contactor needs to be connected between the drive and the motor, be sure to operate these circuit breakers or contactor when the drive has no output, to avoid damaging of the drive.

Using outside the range of rated voltage

The drive is not suitable to be used out of the specified range of operation voltage. If needed, please use suitable voltage regulation device.

Change from 3-phase to 2-phase

It is not recommended to change the drive from 3-phase input to 2-phase input. If it is necessary to use on two phases, the phase-loss protection function of the drive should be disabled. The Drive must be derated for this operation. For motors at which power is above 37kW, if it is changed into 2-phase input, then the input phases must be at phase R and phase T, or else the drive will not work.

After the 3-phase input is changed into 2-phase input, bus-voltage and current ripple may increase, which not only influences the life of electrolytic capacitor but it also deteriorates the performance of the drive. The drive's operating current should be derated and should not exceed 67% of rated value.

Harmonic radiation

The product is not intended to be connected to low-voltage systems interfacing with the public supply at the low-voltage level, but to be connected to low-voltage systems interfacing with the public supply only at the medium- or high-voltage level.

Protection against lightning strike

There are transient surge suppressors inside the Drive which protects it against lighting strike.

Derating due to Altitude

Derating must be considered when the drive is installed at high altitude, greater than 1000m. This is because the cooling effect of Drive is deteriorated due to the thin air, as shown in Fig.1-3 that indicates the relationship between the elevation and rated current of the Drive.

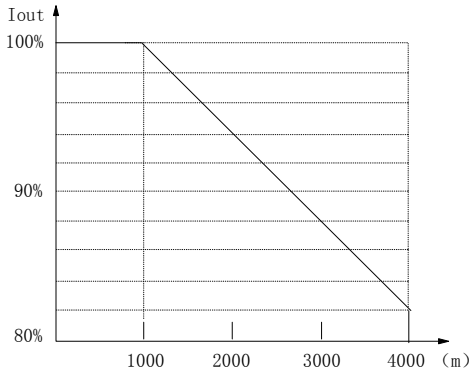


Fig. 1-3 Derating Drive's output current with altitude

1.4 Disposing Unwanted Drive

When disposing the Drive, pay attention to the following factors:

- The capacitors may explode when they are burnt.
- Poisonous gas may be generated when the plastic parts like front covers are burnt.
- Disposing method: Please dispose the Drive as industrial waste.

Chapter 2 Product Introduction

This chapter introduces the specification, model and structure of the drive.

2.1 Specifications

Table 2-1 General specifications

Item		Description
Input	Rated voltage & frequency	Three-phase,380V~440V; 50Hz/60Hz
	Permissible fluctuation range	Voltage:320V~460V;Voltage unbalance rate:<3%; Frequency:±5%
Output	Rated voltage	380V
	Frequency	0Hz~600Hz
	Over load ability	110% rated current for 1 minute, 150% rated current for 1 second
Main control functions	Modulation mode	Flux vector PWM modulation
	Speed range	1:100
	Starting torque	150% rated torque at 0.50Hz
	Steady accuracy of speed	≤±0.5% rated synchronous speed
	Accuracy of frequency	Digital setting: highest frequency×±0.01%;analog setting: highest frequency×±0.2%
	Setting frequency resolution	Digital setting:0.01Hz;analog setting: highest frequency×0.1%
	Torque boost	Auto torque boost, Manual torque boost 0.1%~30.0%
	V/F curve	4 modes: 1 V/F curve mode set by user and 3 kinds of torque-derating modes (2.0 order, 1.7 order, and 1.2 order)
	Acc/Dec curve	3 modes: linear Acc/Dec, S ramp Acc/Dec and auto Acc/Dec; Acc/Dec time (maximum: 60 hours) and unit (second or minute) are settable.
	Jog	Range of jog frequency: 0.20Hz~50.00Hz; Acc/Dec time of Jog operation: 0.1~60.0s, Interval of Jog operation is also settable.
	Multi-step speed running	Multi-step speed running can be realized by internal PLC or control terminal
	Internal PI	Be able to form simple control system easily
	Auto-energy saving operation	V/F curve is optimized automatically according to the load condition to realize energy-saving operation.
	Auto voltage regulation(AVR)	When source voltage changes, the modulation rate can be adjusted automatically, so that the output voltage is unchanged.
	Auto current limiting	Operating current is limited automatically to avoid frequent tripping of the drive.
	Auto adjusting of carrier frequency	Optional function. The carrier frequency can be adjusted automatically according to the load condition.
Operating function	Methods of inputting operating commands	Commands can be input by terminals and serial ports.
	Methods of setting up frequency	Digital setting; Analog voltage/current setup; pulse frequency setup; set via serial port and different setting modes are selectable
	Auxiliary frequency reference	Realize flexible fine tuning of auxiliary frequency.
	Pulse output terminal	0~50kHz pulse signal output. Signals like frequency setting and output frequency can be output.

Item		Description
	Analog output terminals	2 analog outputs of 0/4~20mA and 0/2~10V (selectable). Be able to output signals like reference frequency and output frequency.
Operation panel	LED display	Be able to display about 20 kinds of parameters such as frequency setting, output frequency, output voltage and current, etc.
	LCD display	Optional, Chinese/English display
	Parameter copy	Fast parameter copy can be realized by using LCD panel.
	Keys locking up and function selection	Be able to lock part or all the keys. Be able to define the functions of part of the keys to avoid wrong operation.
Protection function		Phase failure protection, Over current protection; Over voltage protection; Under voltage protection; Over heat protection; overload protection
Optional parts		LCD operation panel, remote mounted keypad, remote control cable and field bus adapter
Environment	Application environment	In-door, free from direct sunlight, dust, corrosive gas, combustible gas, oil mist, steam, water drop or salt
	Elevation	Lower than 1000m
	Ambient temperature	-10℃~+40℃(ambient temperature is within 40℃~50℃, deration is required)
	Humidity	Less than 95%RH, without condensation
	Vibration	Less than 5.9m/s^2 (0.6g)
	Storage temperature	-40℃~+70℃
Structure	Protection level	IP20
	Cooling	Fan cooling
Mount modes		Mounted on the wall or inside cabinet
Efficiency		For 55kW or below: ≥93%, 75kW or above: ≥95%

2.2 Product Series

Table 2-2 Variable Speed Drive series (55kW or below)

Drive model (55kW or below)	Rated capacity (kVA)	Rated input current (A)	Rated output current (A)	Motor power (kW)
EV2100-4T0075	11	20.5	17	7.5
EV2100-4T0110	17	26	25	11
EV2100-4T0150	21	35	32	15
EV2100-4T0185	24	38.5	37	18.5
EV2100-4T0220	30	46.5	45	22
EV2100-4T0300	40	62	60	30
EV2100-4T0370	50	76	75	37
EV2100-4T0450	60	92	90	45
EV2100-4T0550	72	113	110	55

Table 2-3 Variable Speed Drive series (75kW or above)

Drive model (75kW or above)	Rated capacity (kVA)	Rated input current (A)	Rated output current (A)	Motor power (kW)
EV2100-4T0750	100	157	152	75
EV2100-4T0900	116	180	176	90
EV2100-4T1100	138	214	210	110
EV2100-4T1320	167	256	253	132
EV2100-4T1600	200	307	304	160
EV2100-4T2000	250	385	380	200
EV2100-4T2200	280	430	426	220
EV2100-4T2800	342	525	520	280

2.3 Structure of drive

The structure of the drive is as shown in Fig.2-1.

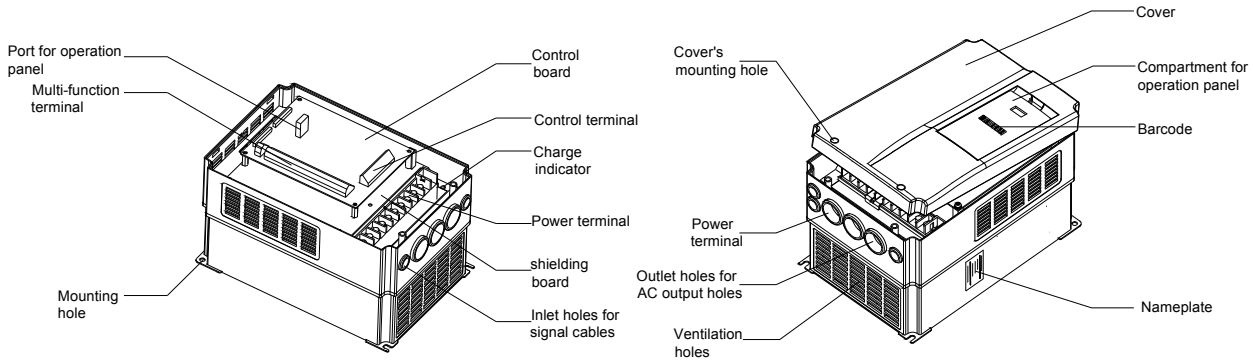


Fig. 2-1 Structure of drive

2.4 Outline and Gross Weight

2.4.1. Outline and gross weight

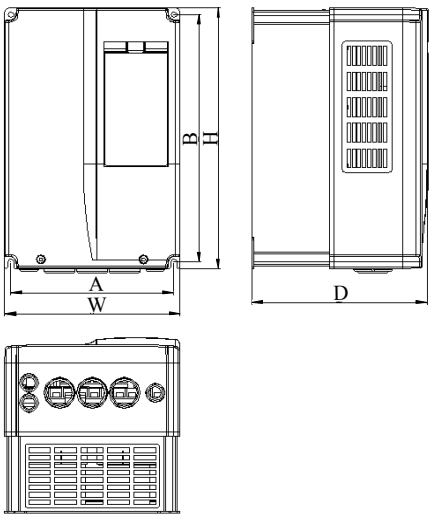


Fig. a EV2100-4T0075~ EV2100-4T0185

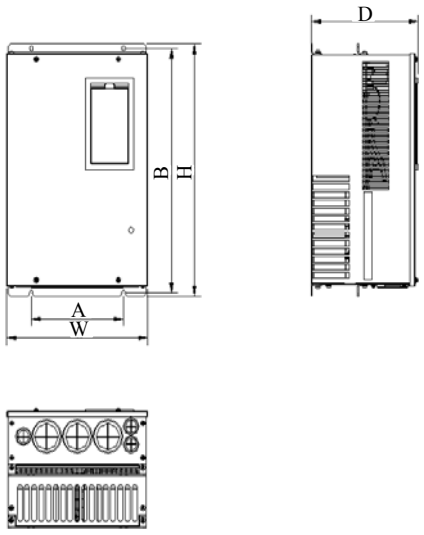


Fig. b EV2100-4T0220～ EV2100-4T0300

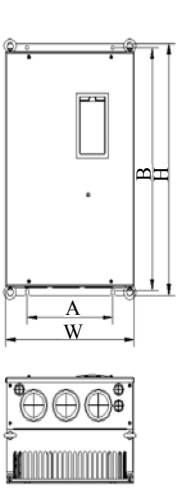


Fig. c EV2100-4T0370～ EV2100-4T0550

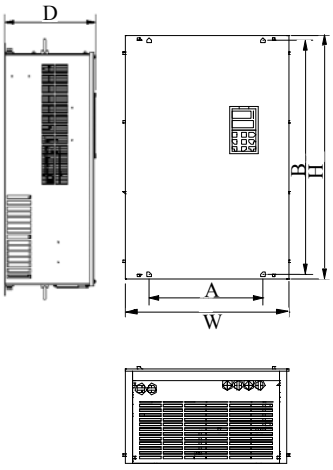


Fig. d EV2100-4T0750~ EV2100-4T01100

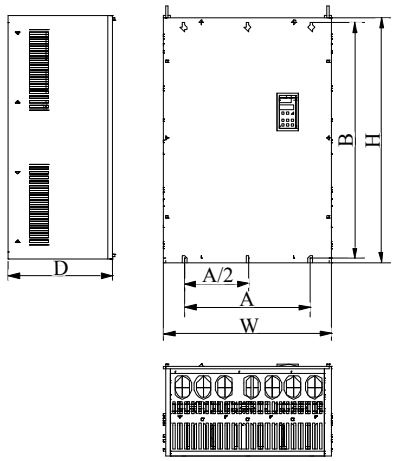


Fig. e EV2100-4T1320~ EV2100-4T2800

Fig. 2-2 Outline of the driver

Table 2-4 Mechanical parameters 1

Drive model	Motor (kW)	A (mm)	B (mm)	H (mm)	W (mm)	D (mm)	Diameter of mounting hole (mm)	Fig. Number	Gross weight (kg)
EV2100-4T0075	7.5	186	285	300	200	202	6.8	Fig. a	7.5
EV2100-4T0110	11								
EV2100-4T0150	15	236	365	380	250	209	6.8	Fig. a	12
EV2100-4T0185	18.5								
EV2100-4T0220	22	180	421	435	275	209	7	Fig. b	13
EV2100-4T0300	30								15
EV2100-4T0370	37	250	600	624	375	262	9	Fig. c	35
EV2100-4T0450	45								
EV2100-4T0550	55								38
EV2100-4T0750	75	300	747	770	468	301	10	Fig. d	50
EV2100-4T0900	90								90
EV2100-4T1100	110								

Table 2-5 Mechanical parameters 2

Drive model	Motor (kW)	A (mm)	B (mm)	H (mm)	W (mm)	D (mm)	Diameter of mounting holes (mm)	Fig. Number	Gross weight (kg)
EV2100-4T1320	132	370	855	880	530	370	14	Fig. e	100
EV2100-4T1600	160								
EV2100-4T2000	200								
EV2100-4T2200	220	520	975	1000	680	370	14	Fig. e	140
EV2100-4T2800	280								

Notes:

For 90kW drive or above, DC reactor is included in its standard configuration. The weight of DC reactor in the above table is not included in the gross weight. Outline and dimensions of DC reactor are as shown in Fig. 2-3.

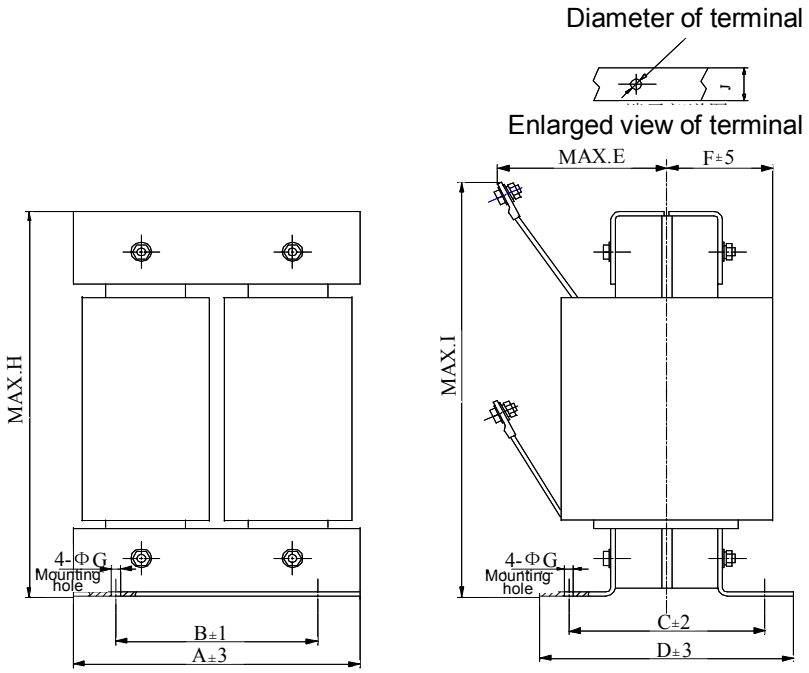


Fig. 2-3 Dimensions of DC reactor

Table 2-6 Mechanical Parameters of DC Reactor

Applicable drive (kW)	Model of DC reactor	Recommended size of copper (mm^2)	Size(mm)											Gross weight (kg)
			A	B	C	D	E	F	G	H	I	J	Diameter of terminal	
90	TDL-4DI01-0900	60	190	160	125	161	120	80	10	250	280	25	φ12	23
110	TDL-4DI01-1100	100												25
132	TDL-4DI01-1320	150	200	170	135	171	130	85	12	260	320	30		28
160	TDL-4DI01-1600		210	180						280				32
200	TDL-4DI01-2200	200	220	190	145	181	150	90		315	340	40	φ15	40
220		250												
280	TDL-4DI01-2800	325					160	95						45

Notes:

1. Columns B and C in Table 2-6 are the sizes of mounting holes of DC reactor.
2. DC reactor should be installed at the bottom of the cabinet if it is to be installed inside a cabinet. The clearance between reactor and the drive should be at least 35cm, and the reactor should be as far away from the air inlet port of the drive as possible.

2.4.2. Optional panel and mounting box

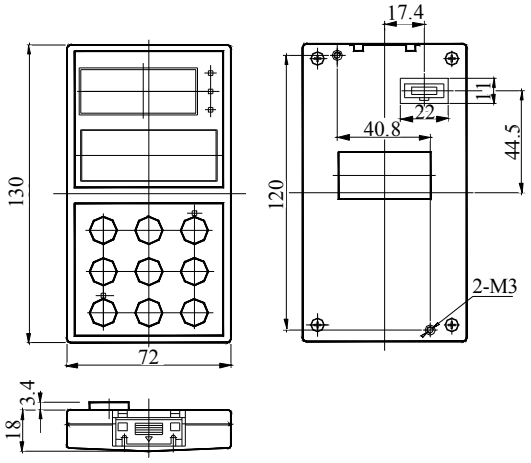


Fig. a Operation panel

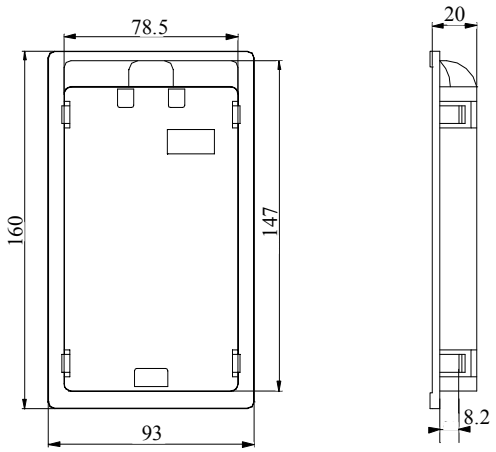


Fig. b Mounting box

Fig. 2-4 Operation panel and mounting box (mm)

2.5 Optional Parts

All the optional parts are given below, make additional orders if needed.

2.5.1 LCD Operational Panel

Model: TDP-LCD03

Language: Chinese/English optional

LCD operation panel can perform fast parameter copy.

Interface: As shown in Fig. 2-5, the interface is divided into main display area, operation instruction area and explanations for operation instructions.

Main display area: Display the status, parameters.

Operation display area: Display the next operation, if there are several operations for selection, the operation contents will be displayed in this area one by one.

Explanations for operations: Display the explanations for the “operation display area”

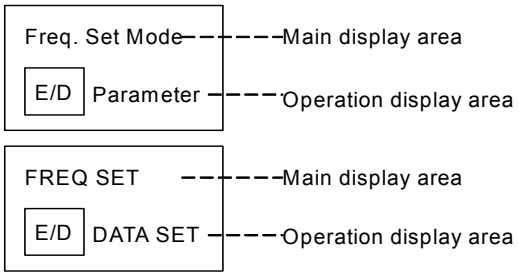


Fig. 2-5 LCD display interface

2.5.2 Communication Parts

Communication cables

1. Cables of operation panel

Model: TDC-CB0015 (1.5m)

TDC-CB0030 (3.0m)

The cables are used to connect the panel to the drive.

2. Communication cables of remote mounted keypad

Two models: FRC21W1 (3.0m) FRC21W2 (30m)

The cables are used to connect the remote mounted keypad to the drive.

Remote mounted keypad

Model: EVO-RC03

It uses the same structure with operation panel of the drive. It is easily to be installed and secured

and convenient for hand-held operation. Its display is similar to the operation panel.

RS485 communication mode is used between the drive and the remote mounted keypad. A 4-core cable is used to connect the drive and the keypad, and the maximum distance can be 1000m. Master/slave communication mode is used. The keypad is the master and the drive is the slave. Cable terminals can be secured by common screws, which makes it convenient for maintenance. One remote mounted keypad can control several drives by connecting the communication cables of 485+ and 485- of each drive to form a RS485 network.

Functions:

1. Be able to control the start, stop, jog operation, fault reset of slave drives and change the frequency settings and operation direction.

2. Identify the type of slave machine automatically. Be able to monitor the operating frequency, frequency setting, output voltage and current, analog close-loop feedback, analog close-loop setting and external counting value automatically.

Fieldbus adapter

Model: TDS-PA01

Be able to connect ENYDRIVE drive to PROFIBUS network via the TDS-PA01 fieldbus adapter. In the PROFIBUS network system, the drive operates as a slave.

Functions:

1. To send control commands to drive (such as: start, stop and jog);

2. To send speed or frequency reference signal to the drive;

3. To read operating status information and actual values from the drive;

4. To reset the drive when fault occurs in it.

Keypad Holder

Model: EVF-KB02

Chapter 3 Installation and Wiring

This chapter introduces the installation and wring of the Drive.

3.1 Installation Environment

Please mount the drive vertically inside a well-ventilated location.

When selecting mounting environment, the following issues should be taken into account:

Ambient temperature should be within the range of -10℃~+40℃. If the temperature is higher than 40℃, the drive should be derated and forced ventilation is required;

Humidity should be lower than 95% non-condensing

Mount in the location where vibration is less than 5.9m/s^2 (0.6g);

Mount in the location free of direct sunlight, dust, metal powder, corrosive gas or combustible gas.

If there are any special requirements for installation, please contact us for clarifications.

The requirements on mounting space and clearance are shown in Fig. 3-1 and Fig. 3-2.

When two Variable Speed Drives are mounted one on top the other, an air flow diverting plate should be fixed in between as shown in Fig. 3-3.

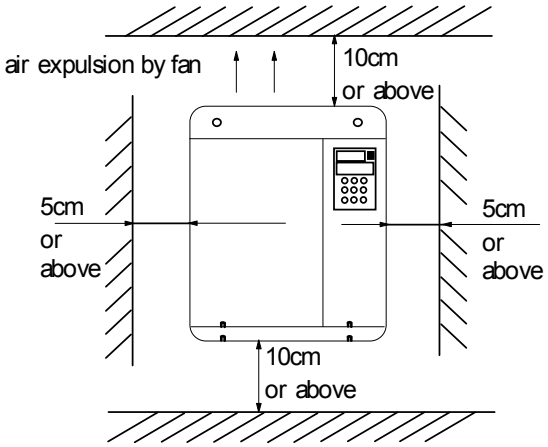


Fig. 3-1 Installation clearance (55kW or below)

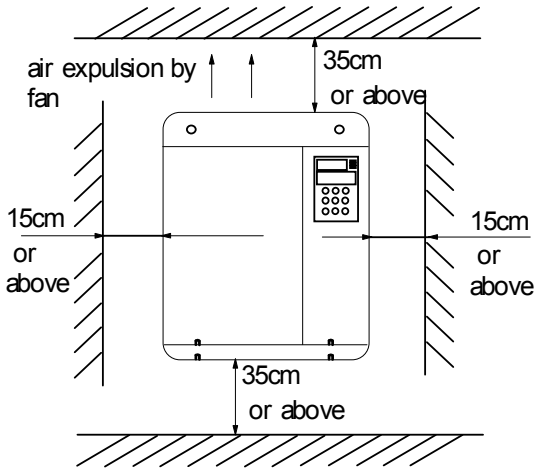


Fig. 3-2 Installation clearance (75kW or above)

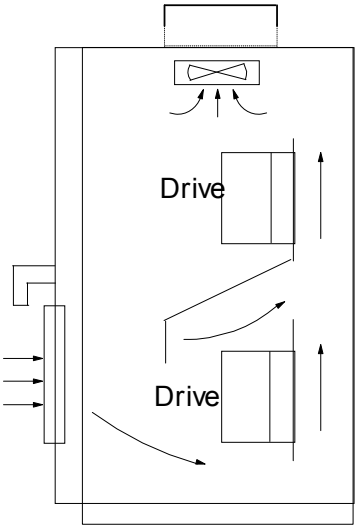


Fig. 3-3 Installation of several drives

3.2 Removing and Mounting of Parts

3.2.1 Removing and Installation of Operation Panel

Disassembly

Put your middle finger into the hole on the top of operation panel, press down the snapper and pull the panel outward as shown in. Figure 3-4.

Installation

Place the bottom edge of the operation panel at the hooks of the mounting groove and press down the snapper with your middle finger. Then press the panel inward to snap it in position as shown in Figure 3-4.

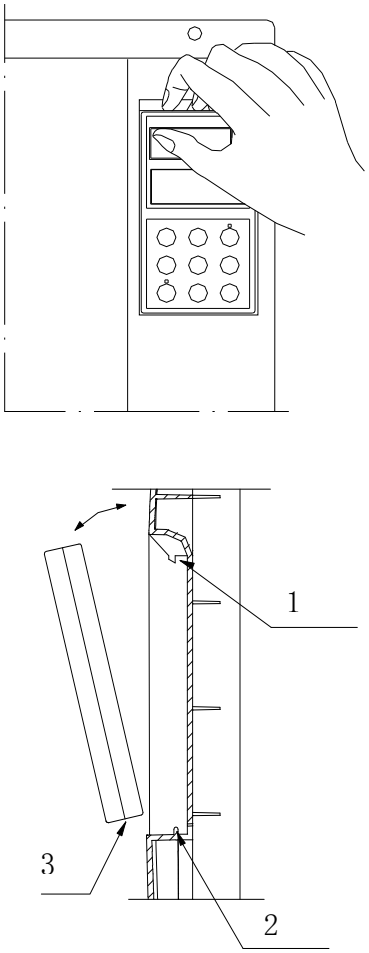


Fig. 3-4 Removing and Mounting of Operation Panel

Where: 1&2: holding clamp 3: panel

3.2.2 Removing and Mounting of Cover

The driver has two kinds of cover, plastic or metallic one. Follow the steps below to remove and mount the cover.

Removing and mounting of plastic covers

Removing of plastic cover:

1) Remove the operation panel

2) Remove two screws at bottom

3) Lift the bottom of cover up to 5~10 degrees, move it upward at least 10mm until the clamp are out of the slot on the cabinet, then remove the front panel.

Mounting of plastic cover:

1) Tilt the cover 5~10 degree;

2) Insert the top clamp into the slot at the top of the drive;

3) Mount the screws at the bottom part of the cover;

4) Install the operation panel

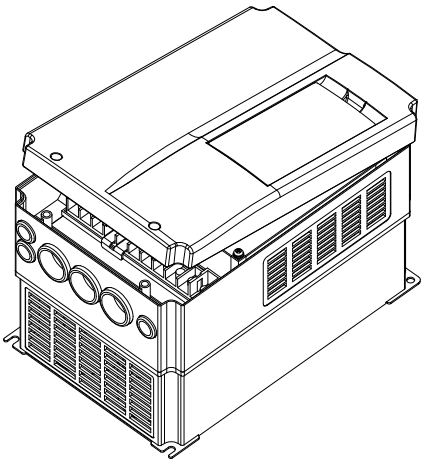


Fig. 3-5 Removing and installation of plastic cover

Note:

Pull out or insert the plastic cover gently, otherwise the mounting clamp may be damaged.

Procedures of removing and mounting the metal cover

Procedures of removing the metal cover:

1) Remove the operational panel;

2) Remove all the screws on the cover;

3) Take out the cover horizontally.

Procedures of installing the metal cover:

1) Mount the cover on the frame by screws;

2) Install the operation panel.

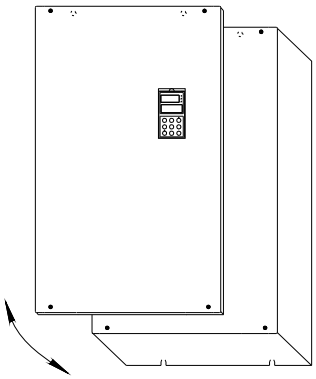


Fig. 3-6 Removing and mounting metal cover

3.3 Wire Connections of Drive

Danger

- Wiring can only be done after the drive's AC power is cut off and all the LEDs on the operation panel are off. Wait for at least 5mins before removing the panel.
- Wiring can only be done after confirming the charge indicator on the right bottom is off and the voltage between main circuit power terminals + and - is below DC36V.
- Wire connections can only be done by trained and authorized personnel.
- Check the wiring carefully before connecting emergency stopping or safety circuits.
- Check the drive's voltage level before supplying power to it, or human injuries and equipment damage may happen.

Attention

- Ensure that the drive's rated input voltage is in compliant with the AC supply voltage before using it.
- Dielectric strength test of the drive has been done in factory, so you need not do it again.
- See chapter 2 on connected braking resistor or braking kit.
- It is prohibited to connect the AC supply cables to the drive's terminals U, V and W.
- Grounding cables should be copper cables with section area bigger than 3.5mm^2, and the grounding resistance should be less than 10Ω.
- Leakage current exists in the drive. The total leakage current is bigger than 3.5mA, depending on the usage conditions. To ensure safety, the drive and the motor should be grounded, and a leakage current protector (RCD) should be used. It is recommended to choose B type RCD and set the leakage current at 300mA.
- The drive should be connected to the AC supply via a circuit breaker or fuse to provide input over-current protection or convenience for disconnecting the AC supply to maintain the drive.

Wire the drive according to Fig. 3-7 during commissioning:

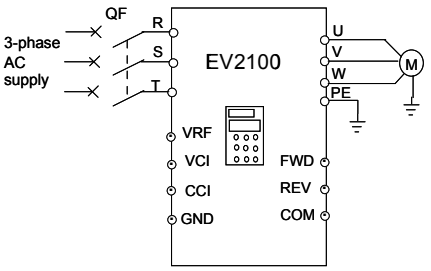


Fig. 3-7 Wiring

3.3.1 Wire Connections of Main Terminals

Connection between drive and optional parts

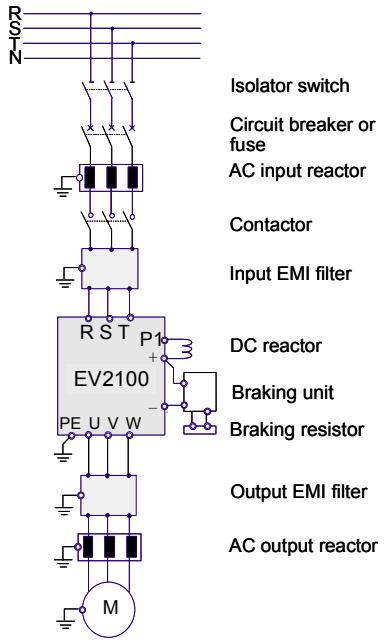


Fig. 3-8 Wire connection between the drive and optional parts

1). Isolation switch should be connected between the AC supply and the drive to ensure the safety of the maintenance engineer.

2). Circuit breaker (QF) or fuse should be connected between the AC supply and the drive to isolate the fault of other equipment. Refer to Table 3-1 for the selection of circuit breaker.

Table 3-1 Recommended capacity of circuit breaker and the cross sectional area of copper cable

Model EV2100	Input switch		Main circuit (mm^2)		Control circuit (mm^2)
	Circuit breaker QF(A)	Fuse (A)	Input cable	Output cable	Control terminal
4T0075	32	20	4	4	1
4T0110	40	32	6	6	1
4T0150	63	35	6	6	1
4T0185	63	50	6	6	1
4T0220	100	63	10	10	1
4T0300	100	80	16	16	1
4T0370	125	100	25	25	1
4T0450	160	125	25	25	1
4T0550	200	160	35	35	1
4T0750	250	200	70	70	1
4T0900	315	250	70	70	1
4T1100	400	315	95	95	1
4T1320	400	400	150	150	1
4T1600	630	450	185	185	1
4T2000	630	560	240	240	1
4T2200	800	630	150×2	150×2	1
4T2800	1000	800	185×2	185×2	1

Note:

1. Parameters in the table are recommended values.
2. The input protection fuses of inverters EV2100-4T0220 and EV2100-4T0300 are respectively the RT16-00 Series 63A and 80A products of Xi'an Fusegear Manufacture Company.

3) When a contactor is used for controlling the AC supply, don't use it to switch on or off the Variable Speed Drive.

4). DC reactor

DC reactor is required for the drive whose power is greater than EV2100-4T0900, for the drive whose power is lower than EV2100-4T0750, it is optional.

Under following conditions, a DC reactor should be used to reduce the impact of AC supply to the drive and to protect the drive and suppress the high-order harmonics.

① If a capacitor tank used for reactive power compensation or a SCR load shares the same AC supply with the drive, the harmonics caused by the SCR load or the capacitor tank when it is switched on or off may damage the drive's input rectifying circuit;

② When the unbalance rate of 3-phase AC supply of the drive is greater than 3%;

③If the input power factor of the drive is required to be greater than 0.93;

④ When a large capacity transformer is connected to the drive, the input current of the drive may damage the rectifying circuit. Generally, if the input

AC supply capacity of the drive is above 550KVA, or if the input AC supply capacity is 10 times that of the drive, a DC reactor is required to connect to the drive.

5) Input AC Line Reactor

A line reactor should be used if the distortion of power network is severe or the input current harmonic level is high even after a DC reactor has been connected to the drive. It can also be used to improve the AC input power factor of the drive.

6) Output AC Line Reactor

When the cables from the drive to motor are longer than 80m, multi-stranded cables and an AC line reactor should be used to suppress the high frequency harmonics. Thus, the motor insulation is protected against heat due to harmonics, leakage current is reduced and the drive will not trip frequently.

(7) Input EMI filter

An EMI filter can be used to suppress the high frequency noise generated by the drive's power cables.

8) Output EMI filter

An EMI filter can be used to suppress the drive's output noise and leakage current of cables.

9) Safety ground

Since there is leakage current inside the drive, to ensue safety, both the drive and the motor should be grounded, the grounding resistance should be less than 10Ω. The ground wire should be as short as possible. Please refer to the section of the earth wire in Table 3-2.

Note that the data in the above table apply when the conductor connected with the ground wire are made of the same metal, otherwise, please calculate the equivalent section based on the conductivity.

Table 3-2 Section of Ground Wire

Cable Section S (mm^2)	Min. section of ground wire Sp（mm^2）
S≤16	S
16＜S≤35	16
35＜S	S/2

Notes:

1. The drive can meet the requirements of IEC 61800-3 after EMI filter is installed.
2. Installation of input and output EMI filters must be as close to the drive as possible. Refer to *Section 3.4* for EMC installation instructions.
3. Refer to *Section 2.1 Universal Technical Specification* and *Appendix 2* for the recommended parameters of optional parts.

Wire Connections of Drive for Basic Operation

Models: EV2100-4T0075. EV2100-4T0110

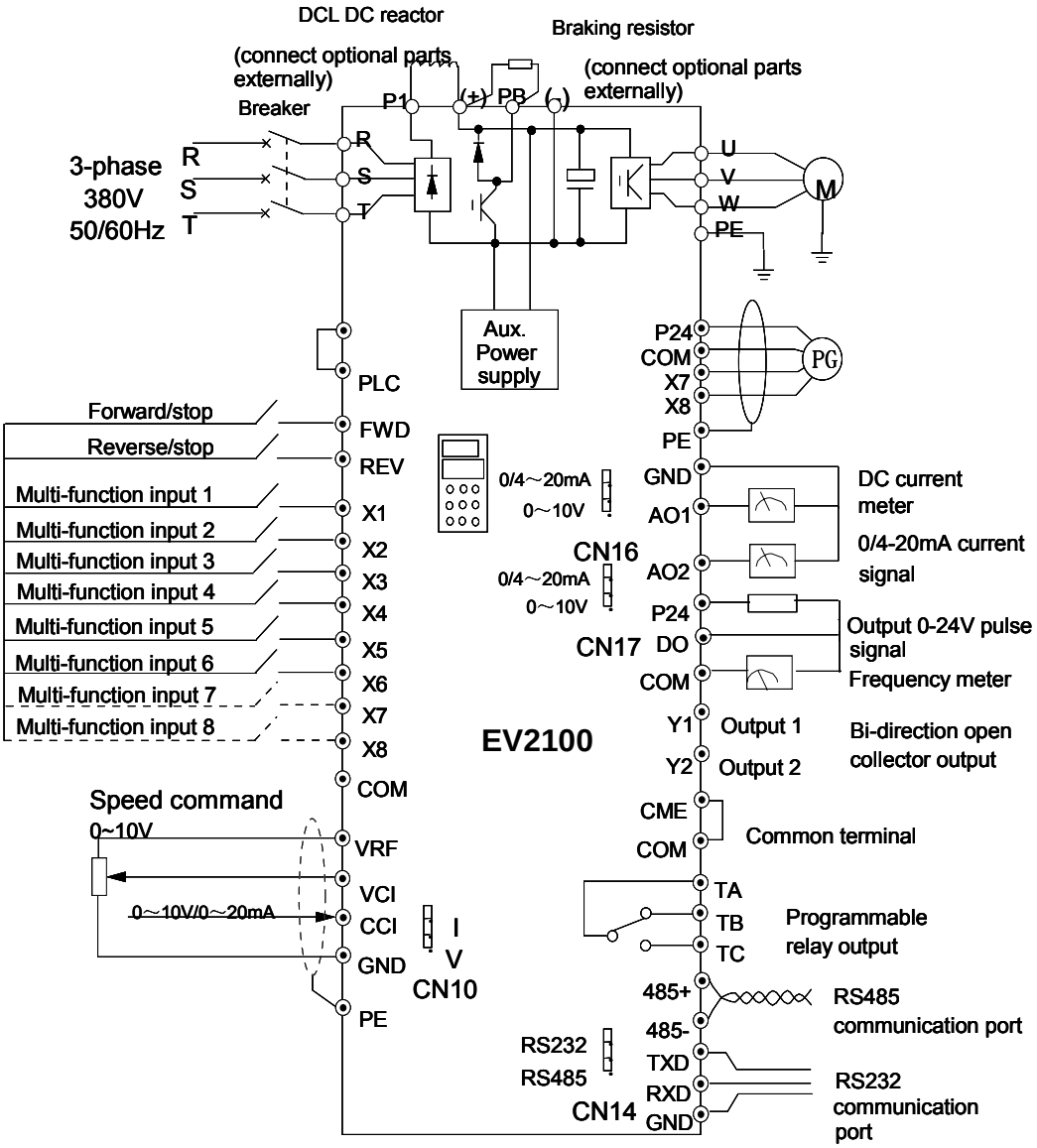


Fig. 3-9 Basic wiring 1

📖 **Notes:**

1. Terminal CCI can be input voltage or current signal by switching the jumper CN10 on control board;
2. The auxiliary power supply comes from the bus (+) and bus (-);
3. Built-in braking kit is installed and a braking resistor is required to be connected between (+) and PB;
4. In the above figure, "O" is the terminal in main circuit, and "⊙" is the control terminal;
5. Refer to *Section 3.3.2 Wiring of Control Circuit* for the using of control terminals.

Applicable models: EV2100-4T0150~EV2100-4T0185 and EV2100-4T075~EV2100-4T2800

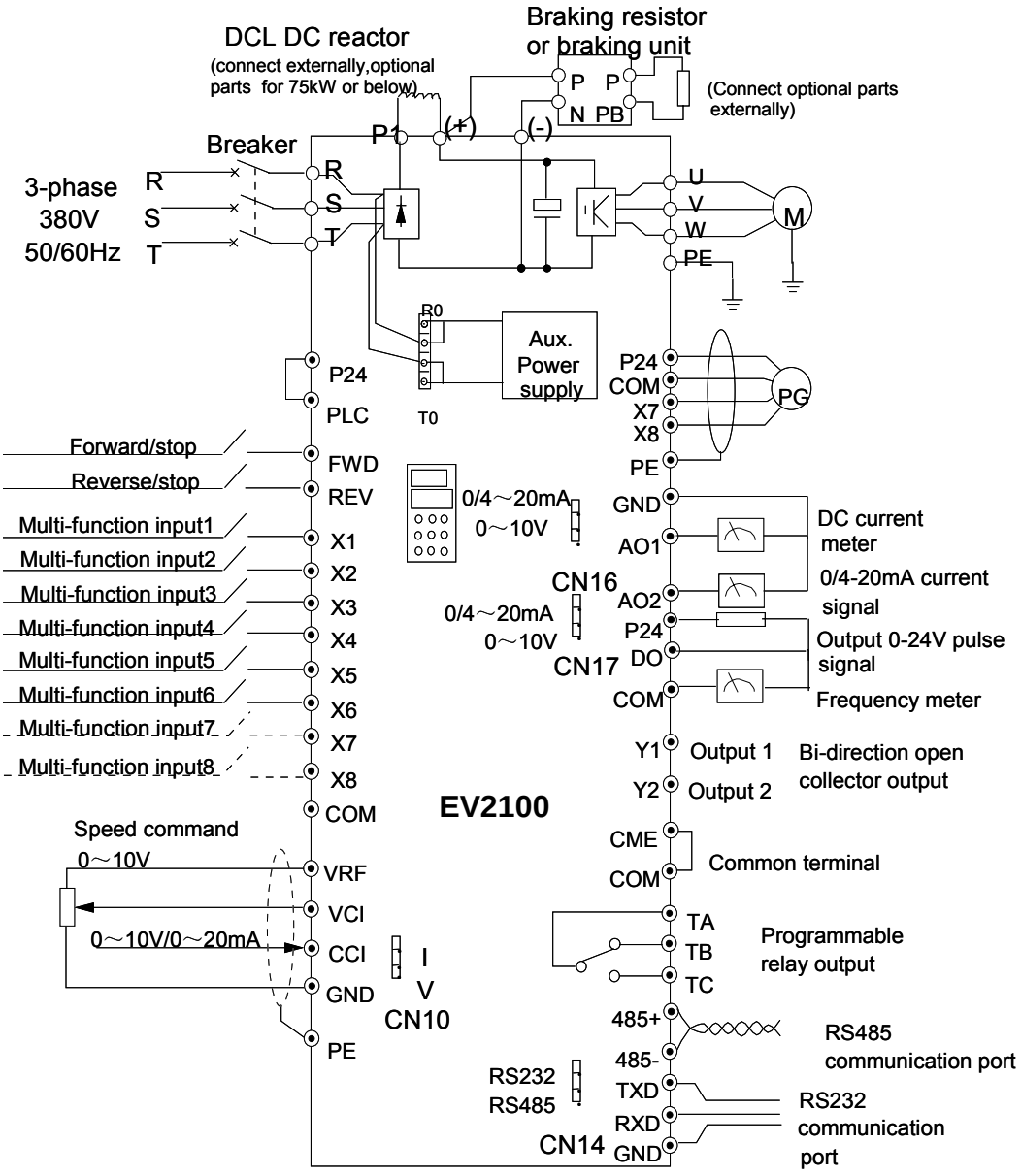


Fig. 3-10 Basic wiring 2

Notes:

1. Terminal CCI can be input voltage or current signal by switching the jumper CN10 on control board;
2. The auxiliary power supply's AC supply comes from R0 and T0 which are shorted with R and T of 3-phase input. If you want to use an external AC supply, the shorting bars between R and R0, T and T0 have to be removed before connecting the external AC supply via R0 and T0. Otherwise, short-circuit will occur.
3. It is prohibited to connect to the control power supply without disconnecting the short-circuit bar, so as to avoid short-circuit accident;
4. If external braking parts are needed, then braking kit and braking resistors should be included; Pay attention to the polarity of the braking kit when wiring;

5. In the above figure, "O" is the terminal in main circuit, and "⊙" is the control terminal;
6. Refer to *Section 3.3.2 Wiring of Control Circuit* for the using of control terminals.

Applicable models: EV2100-4T0220～EV2100-4T0550

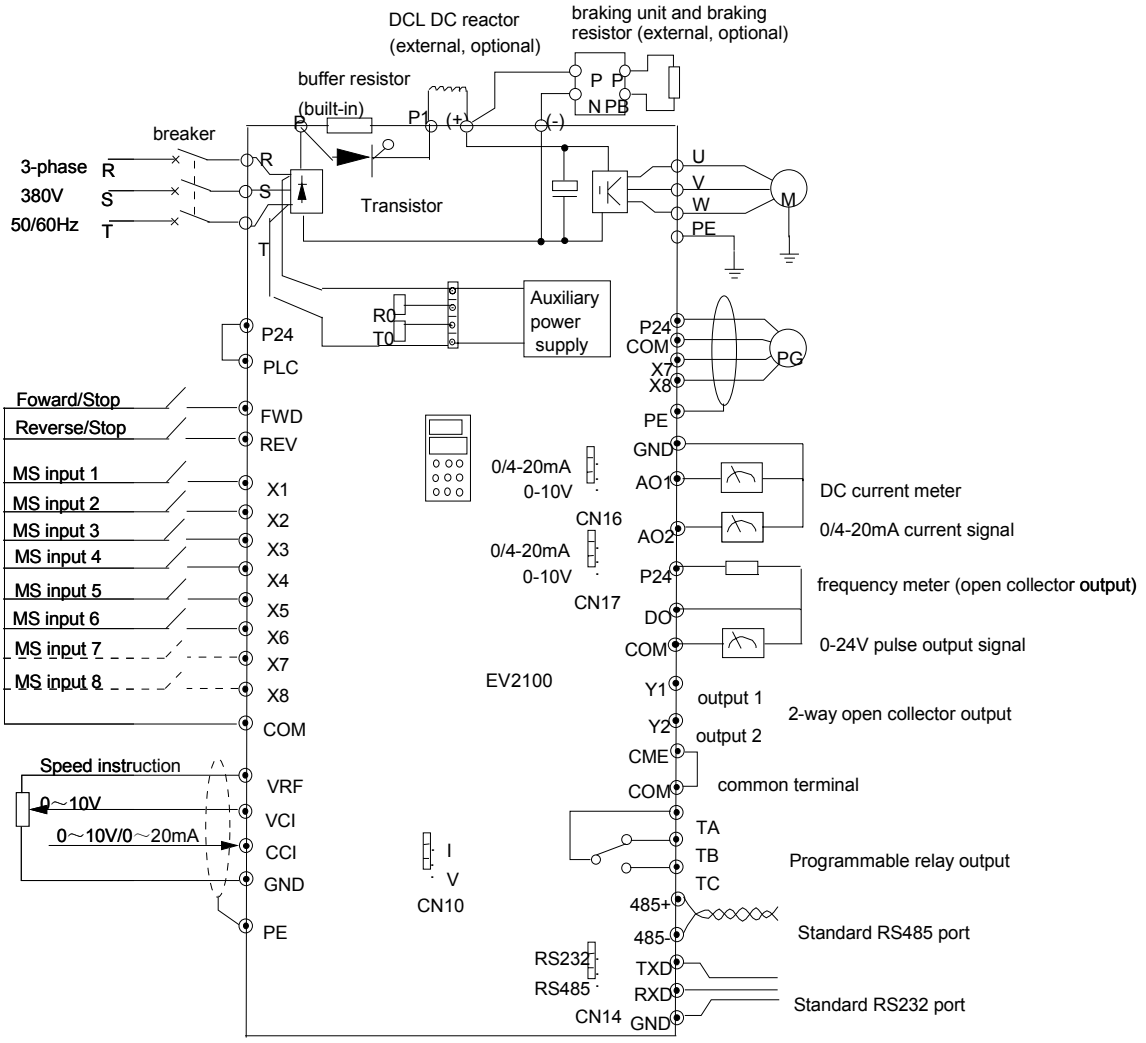


Fig. 3-11 Basic Wiring 3

Notes:

1. Terminal CCI can be input voltage or current signal by switching the jumper CN10 on control board;
2. The auxiliary power supply of EV2100-4T0220~EV2100-4T0300 is from bus (+) and (-)。
3. The auxiliary power supply of EV2100-4T0370~EV2100-4T0550 is from R and T. If you want to use an external AC supply, the jumper on CN4 should be connected to CN3 first, and then connect it to R0 and T0.
4. If external braking kit, the braking unit and braking resistors should be included; Pay attention to the polarity of the braking kit when wiring;
5. In the above figure, "O" is the terminal in main circuit, and "⊙" is the control terminal;
6. Refer to *Section 3.3.2 Wiring of Control Circuit* for the usage of control terminals.

Input/Output Terminals in Main Circuit

1) Applicable models:

EV2100-4T0075~EV2100-4T0185

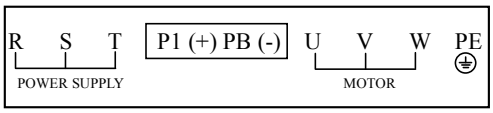


Table 3-3 Terminals of main circuit

Terminals	Function
R, S, T	3-phase 380V AC supply input terminals
P1, (+)	Reserved terminals for DC reactor, connected with copper bar before delivery.
(+), PB	Reserved terminals for braking resistor
(-)	Output terminal for DC Minus Bus
U, V, W	3-phase AC output terminals
PE	Earth terminal

Notes:

Terminals PB of EV2100-4T0150 and EV2100-4T0185 are suspended.

2) Applicable models:

EV2100-4T0220P~EV2100-4T0550

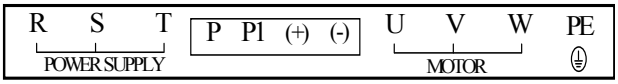


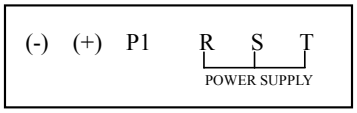
Table 3-4 Terminals of main circuit

Terminals	Function
R. S. T	3-phase 380V AC supply input terminals
P	Positive pole of the rectifying bridge
P1, (+)	Reserved terminals for DC reactor, connected by copper bar before delivery
(-)	Output terminal for DC Minus Bus
U. V. W	3-phase AC output terminals
PE	Earth terminal

3) Applicable models:

EV2100-4T0750

Top:



Bottom:

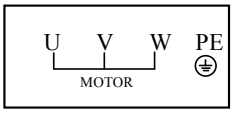


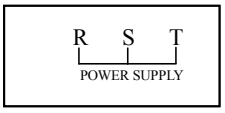
Table 3-5 Terminals of main circuit

Terminal	Function
R, S, T	3-phase 380V AC supply input terminals
P1, (+)	Reserved terminals for DC reactor
(-)	Output terminal for DC Minus Bus
U, V, W	3-phase AC output terminals
PE	Earth terminal

4) Applicable models:

EV2100-4T0900~EV2100-4T2800

TOP:



BOTTOM :

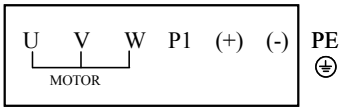


Table 3-6 Terminals of main circuit

Terminals	Function
R. S. T	3-phase 380V AC supply input terminals
P1. (+)	Reserved terminals for DC reactor
(-)	Output terminal for DC Minus Bus
U. V. W	3-phase AC output terminals
PE	Earth terminal

3.3.2 Wiring of Control Circuit

Terminals and jumpers of control board

Locations of terminals CN5, CN6 and CN7 and jumpers CN10, CN14, CN16 and CN17 are shown in Fig. 3-12.

Terminal functions are given in Table 3-7. Refer to table 3-8 for the functions and settings of jumpers. Wire the terminals and set the jumpers correctly before using the Drive. It is recommended to use cables bigger than 1mm^2 to connect to the terminals.

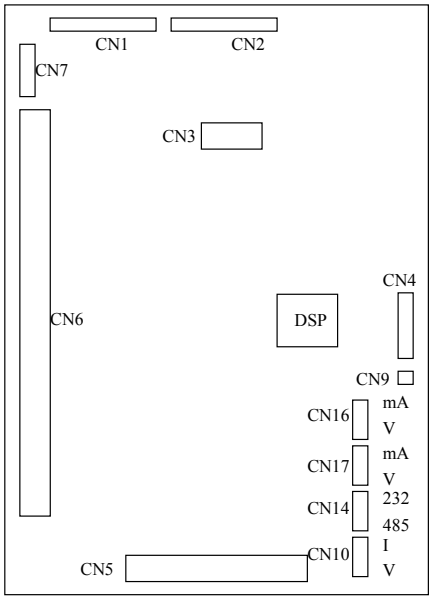


Fig. 3-12 Locations of jumpers on the control board

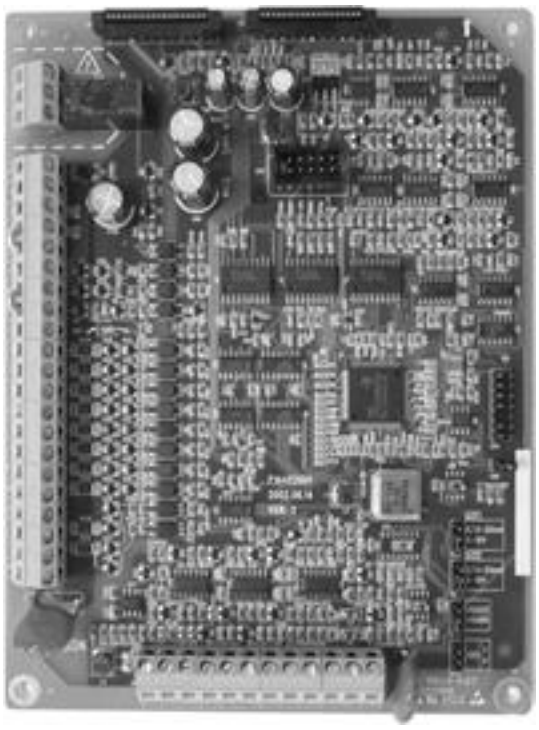


Fig. 3-13 Control board

Table 3-7 Functions of terminals provided to users

SN	Function
CN5	Analog input and output terminal, RS232 and RSRS485 communication port
CN6	Digital input/output terminal
CN7	Relay output terminal

Table 3-8 Functions of jumpers provided to users

SN	Function and settings	Factory settings
CN10	Used for selecting CCI current/voltage input I: 0/4~20mA current signal, V: 0~10V voltage signal	0~10V
CN14	Used for selecting communication ports (RS232 or RS485) RS232: Select RS232 port, RS485: Select RSRS485 port	RS485
CN16	Used for selecting the output signal (current or voltage) of analog output terminal AO1; 0/4~20mA: AO1 output current signal; 0~10V: A01 output voltage signal	0~10V
CN17	Used for selecting the output signal (current or voltage) of analog output terminal AO2; 0/4~20mA: AO2 output current signal; 0~10V: AO2 output voltage signal	0~10V

Wire connections of terminals on control board

1) Terminal CN5 on control board

Arrangements of terminals of CN5:

VRF	VCI	CCI	GND	AO1	AO2	GND	TXD	RXD	485+	485-	PE

Functions of terminals of CN5 are given in Table 3-9.

Table 3-9 Functions of the terminals

Category	Terminals	Name	Function		Specification
Communication	RS485+	RS485 communication port	RS485 +	RS232/RS485 can be selected by jumper CN14, RS485 mode is the default mode.	Standard RS-485 communication port, please use twisted-pair cable or shielded cable.
	RS485-		RS485 -		
	TXD	RS232 communication port	Transmitting pin (Reference ground: GND)		Standard RS232 communication port, 3-wire connection (only use TXD, RXD and GND). Maximum distance: 15m
	RXD		Receiving pin (reference ground: GND)		
Analog input	VCI	Analog input VCI	Be able to accept analog voltage input (Reference ground: GND)		Input voltage range:0~10V (input resistance:100kΩ) Resolution: 1/2000
Analog input	CCI	Analog input CCI	Be able to accept analog voltage/current input. Jumper CN10 can select voltage or current input mode, Voltage input mode is the default mode.(reference ground: GND)		Input voltage range:0~10V(input resistance:100kΩ) Input current range:0~20mA (input resistance:500Ω) Resolution: 1/2000
Analog output	AO1	Analog output 1	Be able to output analog voltage/current (total 12 kinds of signals). Jumper CN16 can select voltage or current input mode, Voltage input mode is the default mode. Refer to F7.26 for details. (reference ground: GND)		Output current range: 0/4~20mA Output voltage range:0/2~10V
	AO2	Analog output 2	Be able to output analog voltage/current (total 12 kinds of signals). Jumper CN17 can select voltage or current input mode, Voltage input mode is the default mode. Refer to F7.27 for details.(reference ground: GND)		
Power supply	VRF	+10V power supply	Provide +10V power supply		Maximum output current is 50mA
	GND	GND of +10V power supply	Reference ground of analog signal and 10V power supply		Isolated with COM and CME
Shielding layer	PE	GND of shielding layer	Terminal used for the earthing the shielding layer. The shielding layers of analog signal cable, RS485 communication cable and motor cable can be connected to the terminal.		Connected to PE inside the drive.

Wiring analog input terminal

①VCI can accept analog voltage signal input and wiring is shown below:

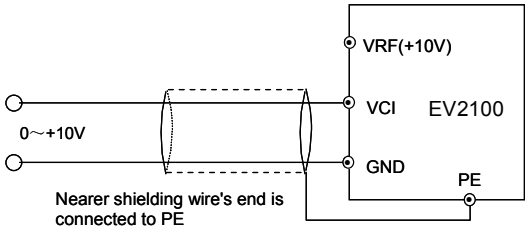


Fig. 3-14 Wiring terminal VCI

②CCI can accept analog signal input and the jumper can be used to select voltage input (0~10V)

and current input (0/4~20mA). The wiring is shown below:

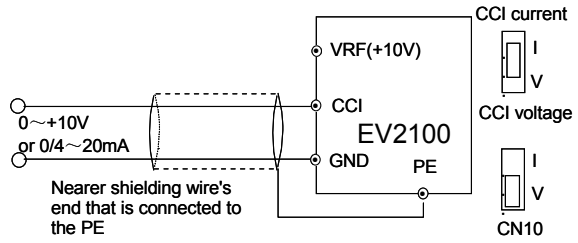


Fig. 3-15 Wiring CCI

Wiring connections analog output terminal

If the analog output terminals AO1 and AO2 are connected to analog meters, then various kinds of physical values can be indicated. The jumper can select current output (0/4~20mA) and voltage output (0/2~10V). The wiring is shown in Fig.3-16.

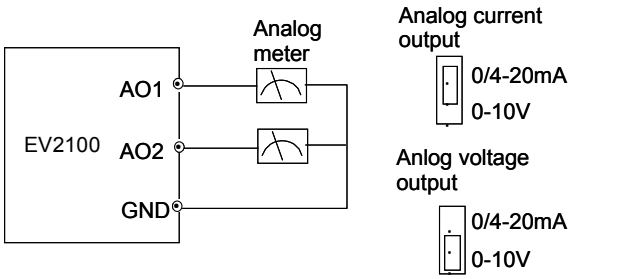


Fig. 3-16 Wiring analog output terminal

Notes:

1) When using analog input, a common mode inductor can be installed between VCI and GND or CCI and GND.

2) Analog input and output signals are easily disturbed by noise, so shielded cables must be used to transmit these signals and the cable length should be as short as possible.

Wiring of Serial Communication Port

Wire connections of serial communication port.

EV2100 drive provides two kinds of serial ports: RS232 and RS485 which can be selected by Jumper CN14.

Wire as following figures show, and a "single-master single slave" system or a "single-master multi-slaves" system can be formed. The drives in the network can be monitored and controlled remotely and automatically in real time by using a PC or PLC controller. Thus more complicated operation control can be realized (e.g. Unlimited multi-step PLC operation).

① The drive connects to the host via its RS232 port:

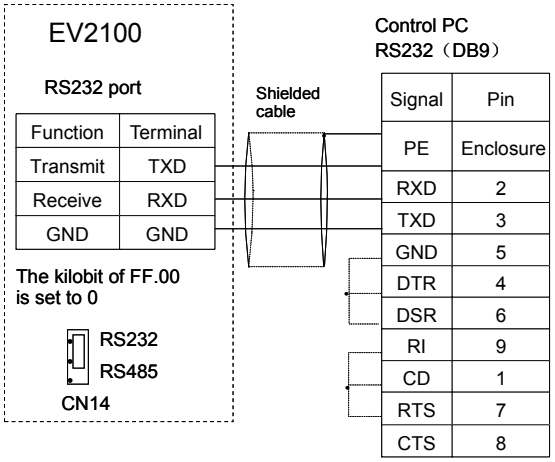


Fig. 3-17 RS232-RS232 communication cables

② Connection between the drive's RS485 port and the host PC:

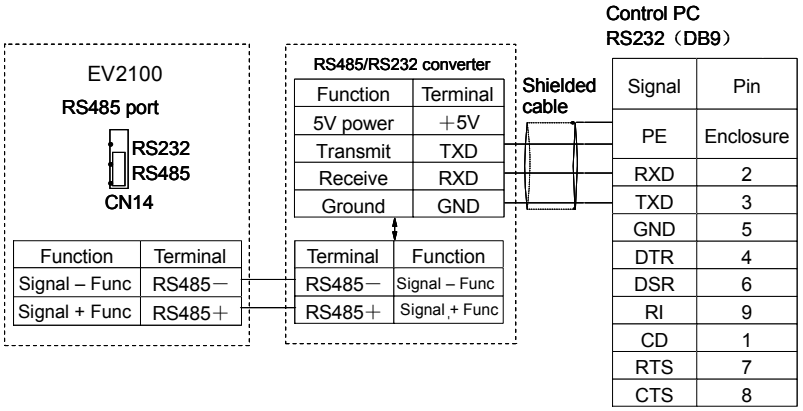


Fig. 3-18 RS485-(RS485/RS232)-RS232 communication cable

③ Connect the drive to the host PC via a MODEM: The kilobit of FF.00 is set to 1.

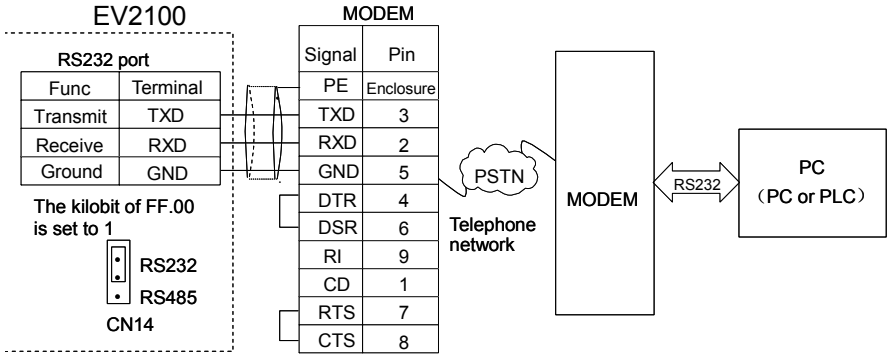


Fig. 3-19 Wiring of RS232-(MODEM-PSTN-MODEM)-RS232 communication

④The drive's RS485 port connects to PROFIBUS via the TDS-PA01 (field bus made by ENPC):

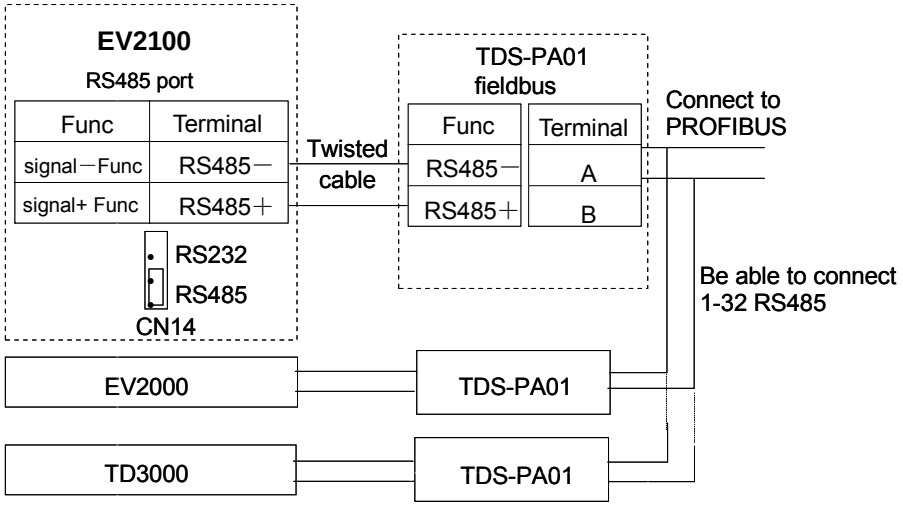


Fig. 3-20 Wire connections of RS485-(TDS-PA01)-PROFIBUS communication

If several drives are connected in the network via RS485, the disturbance to the communication system increases, so the wiring is especially important, you can connect the cables according to the figure below:

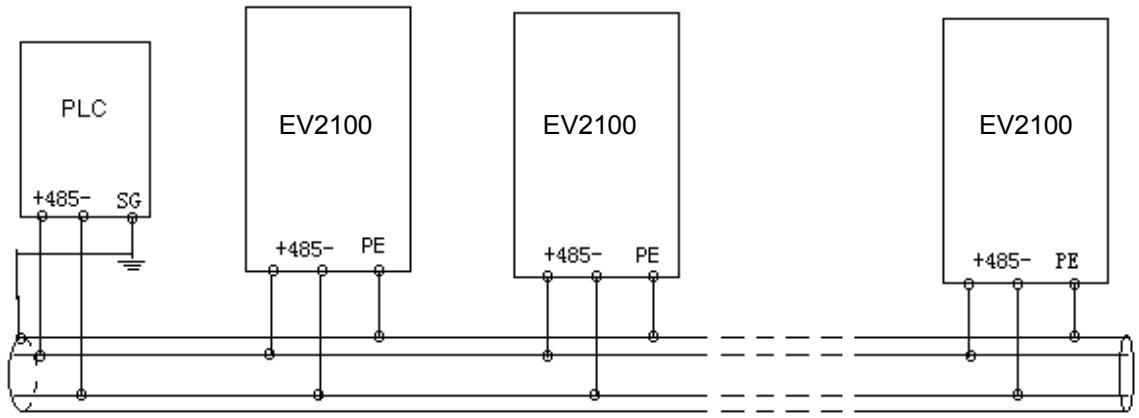


Fig. 3-21 Communication between PLC and the drive (the drive and motor are grounded well)

If the communication is still abnormal, then the following actions can be taken:

① Feed a separate AC supply to the PLC (or host PC) and isolate the AC supply;

② If RS485/RS232 conversion module is used, then the module should be powered by a separate power supply;

③ Mount magnetic core to the communication cable, reduce the carrier frequency if the field conditions permit.

2). Description of control terminals CN6 and CN7

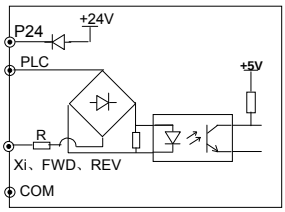
Layout of CN6:

P24	Y1	Y2	CME	COM	DO	P24	PLC	X1	X2	X3	X4	COM	X5	X6	FWD	REV	COM	X7	X8	PE

Layout of CN7:

TA	TB	TC

Table 3-10 Functions of terminals of CN6 and CN7

Category	Terminal	Name	Functions	Specifications
Operation control terminals	FWD	Terminal for inputting run forward operation command	See the explanations of F7 parameters for the commands of run forward and run reverse (common terminal: PLC)	Optical-isolator input input resistance: R=2kΩ Maximum input frequency:200Hz Input voltage range: 9~30V 
	REV	Terminal for inputting run reverse operation command		
Multi-function input terminal	X1	Multi -function input terminal 1	See *Section 5.8 Function of Terminals (Group F7)* for the programmable multi-function digital input terminal (Common terminal: PLC)	
	X2	Multi -function input terminal 2		
	X3	Multi -function input terminal 3		
	X4	Multi -function input terminal 4		
	X5	Multi -function input terminal 5		
	X6	Multi -function input terminal 6		
	X7	Multi -function input terminal 7	Terminals X7 and X8 can be used as common multi-function terminals (same with X1~X6), they can also be used as high speed pulse input port. See *Section 5.8 Function of Terminals (Group F7)* for details. (Common terminal: PLC)	Equivalent circuit of optical- isolator input is shown above. input resistance: R=2kΩ Max input frequency: 100kHz (single phase)/50kHz (dual phase) Input voltage range: 15~30V
	X8	Multi -function input terminal 8		
Multi-function output terminal	Y1	Open collector output terminal 1	Multi-function digital output terminal can be defined. See *Section 5.8 Function of Terminals (Group F7)* for details. (Common terminal: CME)	Optical-isolator output Operating voltage range:9~30V Max output current: 50mA Refer to the explanations of F7.10~F7.11 for the using methods.
	Y2	Open collector output terminal 2		
Multi-function output terminal	DO	Open collector pulse output terminal	Multi-function pulse signal output terminal can be defined. See *Section 5.8 Function of Terminals (Group F7)* for details. (Reference ground: COM)	Output frequency range: dependent on F7.32, and the Max frequency is 50kHz
Relay's output terminals	TA	Output terminals of relay	Multi-function relay output terminal can be defined. See *Section 5.8 Function of Terminals (Group F7)* for details.	TA-TB: normally closed, TA-TC: normally open Capacity of contacts: AC250V/2A(COSΦ=1) AC250V/1A(COSΦ=0.4),DC30V/1A Refer to the explanations of F7.12 for the using methods. Overvolt class of the input volt at relay output terminal: II.
	TB			
	TC			
Power supply	P24	+24V power supply	Provide +24V power supply for external equipment.	Maximum output current: 200mA
	PLC	Common terminal of multi-function input terminal	Common terminal of multi-function input terminal (short circuit with P24)	Common terminal of X1~X8., FWD and REV. PLC is isolated with P24.
	COM	Common terminal of +24V power supply	Total 3 common terminals, which are used in conjunction with other terminals.	COM is isolated with CME and GND.
	CME	Common terminal of Y1 and Y2 output	Common terminal of multi-function Y1 and Y2 output (Short circuit with COM by manufacturer)	

Category	Terminal	Name	Functions	Specifications
Shielding	PE	Shielded GND	Grounding terminal connected to shielding layer	Connected to PE inside the drive

Wire connections multi-function input terminals, terminals FWD and REV:

The driver multi-function input terminal uses a full-bridge rectifying circuit as shown in Fig. 3-23. PLC is the common terminal of terminals X1~X8, FWD and REV. The current flows through terminal PLC can be pulling current, and also the feeding current. Wire connections X1~X8, FWD and REV are flexible and the typical wiring is shown below:

1) Method 1 of connections (Dry contacts)

①If internal 24V power supply is used, the wiring is shown in Figure 3-22.

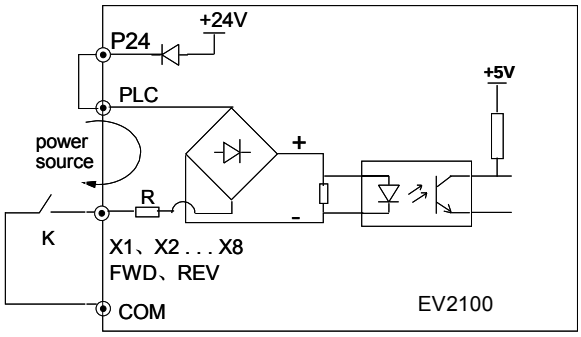


Fig. 3-22 Using internal 24V power supply

②If an external power supply is used, then use the Wire connections shown in Fig. 3-23. (Be sure to disconnect the cable between P24 and PLC)

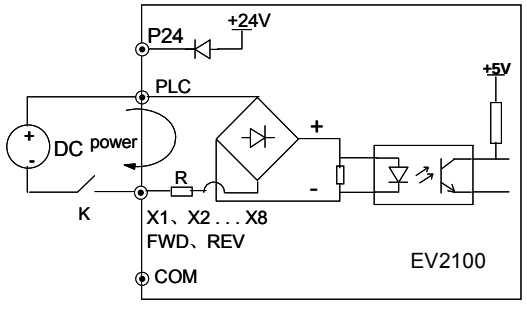


Fig. 3-23 Using an external supply

2). Method 2 of connections

①Drive's internal +24V power supply is used and the external controller uses NPN transistors whose common emitters are connected, as shown in Figure 3-24.

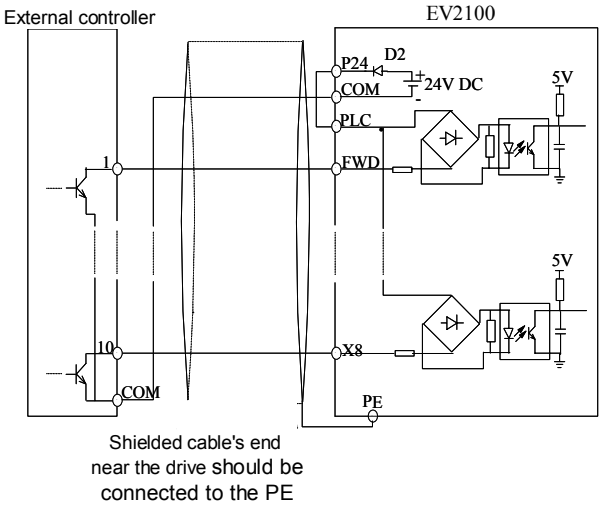


Fig. 3-24 Method 2 of connections (a)

②Drive's internal +24V power supply is used and the external controller uses PNP transistors whose common emitters are connected, as shown in Figure 3-25

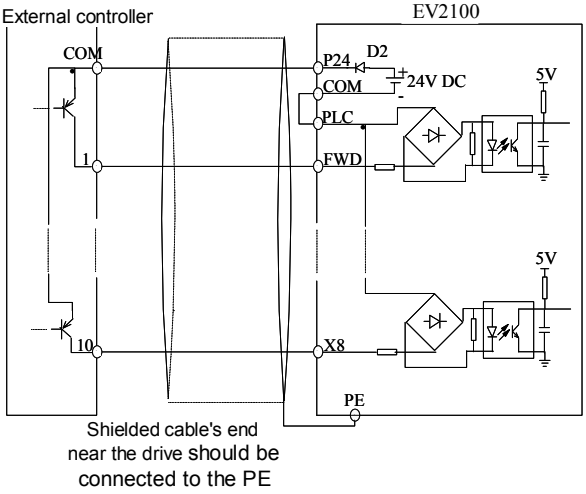


Fig. 3-25 Method 2 of connections (b)

③Use external power supply (be sure to remove the connecting wire between PLC and P24)::

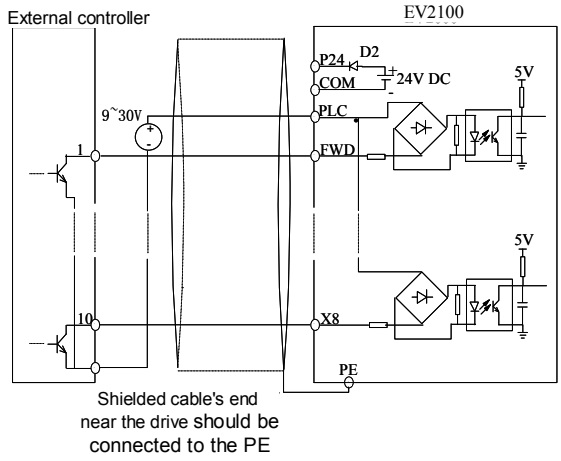


Fig. 3-26 Method 2 of connections(c)

④Use external power supply (be sure to remove the connecting wire between PLC and P24):

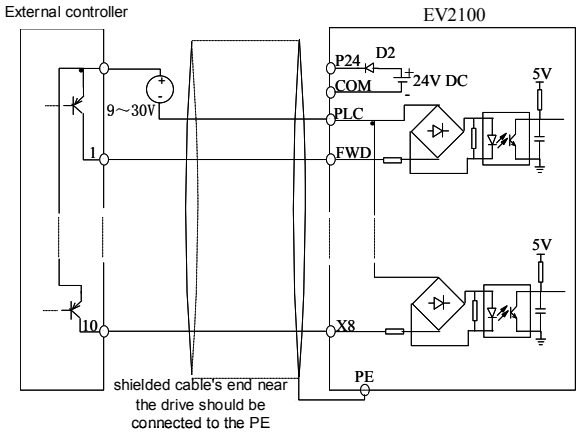


Fig. 3-27 Method 2 of connections (d)

Wire connections of multi-function output terminal

①Multi-function output terminals Y1 and Y2 can use the 24V power supply inside the drive and the wiring mode is shown in Figure 3-28.

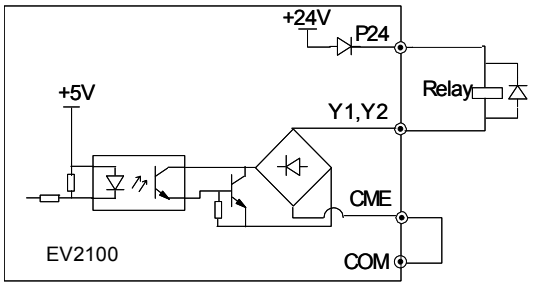


Fig. 3-28 Wire connections 1 of multi-function output terminal

②Multi-function output terminals Y1 and Y2 can also use the 9~30V power supply outside the drive and the wiring mode is shown in Fig.3-29.

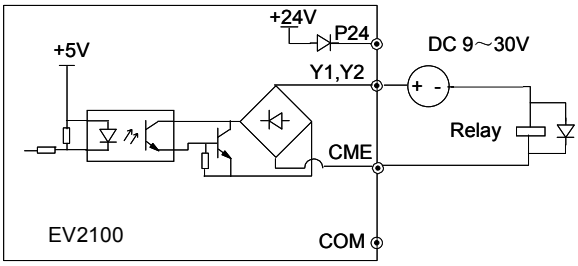


Fig. 3-29 Wire connections 2 of multi-function output terminal

③Pulse output terminal DO can use the 24V power supply inside the drive and the wiring is shown in Fig.3-30.

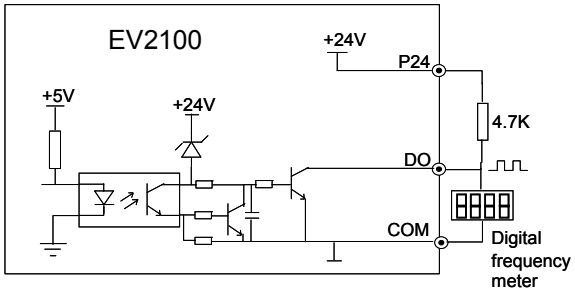


Fig. 3-30 Wiring 1 of output terminal DO

④Pulse output terminal DO can also use the external 9~30V power supply and the wiring is shown in Fig.3-31.

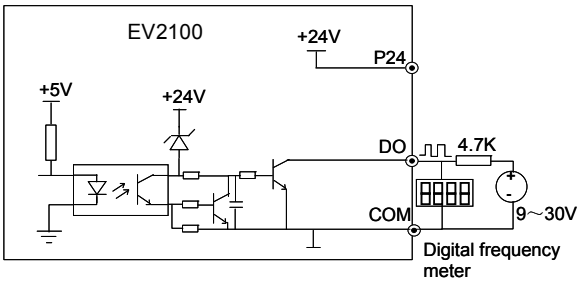


Fig. 3-31 Wiring 2 of output terminal DO

3) Wiring relay output terminals TA, TB and TC.

If the drive drives an inductive load (such as relay or contactor), then a surge suppressing circuit should be added, such as RC snub circuit (pay attention that the leakage current must be smaller than the holding current of the controlled relay or

contactor) and varistor or a free-wheeling diode (used in the DC electric-magnetic circuit and pay attention to the polarity during installation). Snubbing components should be as close to the coils of relay or contactor as possible.

Notes:

1. Don't short circuit terminals P24 and COM, otherwise the control board may be damaged.
2. Please use multi-core shielded cable or multi-stranded cable (above 1mm) to connect the control terminals.
3. When using a shielded cable, the shielded layer's end that is nearer to the drive should be connected to PE.
4. The control cables should be as far away (at least 20cm) from the main circuits and high voltage cables as possible (including power supply cables, motor cables, relay cables and cables of contactor). The cables should be vertical to each other to reduce the disturbance to minimum.
5. The resistors R in Fig. 3-27 and Fig.3-28 should be removed for 24V input relays, and the resistance of R should be selected according the parameters of relay for non-24V relay.

3.4 Installation Methods Compliant With EMC Requirements

The drive inevitably generates noise due to its high switching frequency, so relevant EMC problems must be solved so as to reduce the drive's disturbance to external equipment. This chapter deals with the installation methods compliant with EMC requirements from the aspects of noise suppression, field wiring, grounding, leakage current and the using of power filter. This chapter can be used as a reference for field installation.

3.4.1 Noise Suppressing

The noise generated by the drive may disturb the equipment nearby. The degree of disturbance is dependent on the drive system, immunity of the equipment, wiring, installation clearance and earthing methods.

1. Noise categories

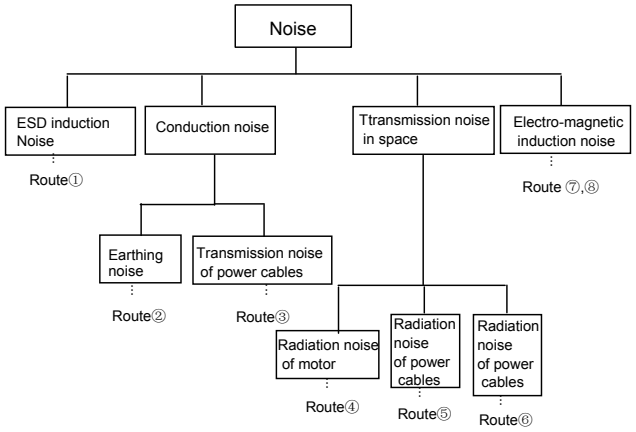


Fig. 3-32 Noise categories

Noise propagation paths

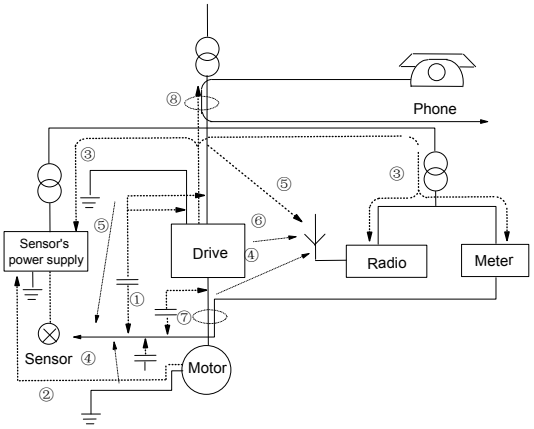


Fig. 3-33 Noise transmission paths

Basic methods of suppressing the noise

Table 3-11 Basic methods of suppressing the noise

Noise emission paths	Actions to reduce the noise
②	When the external equipment forms a loop with the drive, the equipment may suffer nuisance tripping due to the drive's earth leakage current. The problem can be solved if the equipment is not grounded.
③	If the external equipment shares the same AC supply with the drive, the drive's noise may be transmitted along its input power supply cables, which may cause nuisance tripping to other external equipment. Take the following actions to solve this problem: Install noise filter at the input side of the drive, and use an

Noise emission paths	Actions to reduce the noise
	isolation transformer or line filter to prevent the noise from disturbing the external equipment.
④⑤⑥	If the signal cables of measuring meters, radio equipment and sensors are installed in a cabinet together with the drive, these equipment cables will be easily disturbed. Take the actions below to solve the problem: (1)The equipment and the signal cables should be as far away as possible from the drive. The signal cables should be shielded and the shielding layer should be grounded. The signal cables should be placed inside a metal tube and should be located as far away as possible from the input/output cables of the drive. If the signal cables must cross over the power cables, they should be placed at right angle to one another. (2) Install radio noise filter and linear noise filter (ferrite common-mode choke) at the input and output of the drive to suppress the emission noise of power lines. (3) Motor cables should be placed in a tube thicker than 2mm or buried in a cement conduit. Power cables should be placed inside a metal tube and be grounded by shielding layer (Motor cable should be a 4-core cable, where one core should be connected to the PE of the drive and another should be connected to the motor's enclosure).
①⑦⑧	Don't route the signal cables in parallel with the power cables or bundle these cables together because the induced electro-magnetic noise and induced ESD noise may disturb the signal cables. Other equipment should also be located as far away as possible from the drive. The signal cables should be placed inside a metal tube and should be placed as far away as possible from the input/output cables of the drive. The signal cables and power cables should be shielded cables. EMC interference will be further reduced if they could be placed inside metal tubes. The clearance between the metal tubes should be at least 20cm.

3.4.2 Field Wire Connections

Control cables, input power cables and motor cables should be installed separately, and enough clearance should be left among the cables, especially when the cables are laid in parallel and the cable length is big. If the signal cables must go through the power cables, they should be vertical to each other.

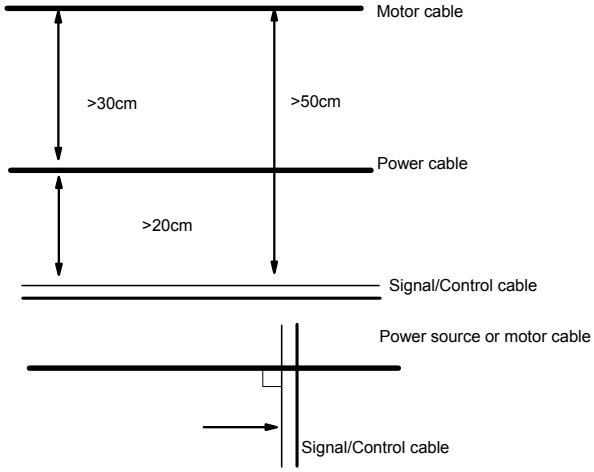


Fig. 3-34 Wire connections

The motor cables should be derated if they are too long or their cross sectional area (CSA) is too big. The drive's cables should be the cables with specified CSA (See Table 3-1) because the capacitance of the cable to ground is in proportional to the cable's CSA. If the cable with big CSA is used, its current should be reduced.

Shielded/armoured cable: High frequency low impedance shielded cable should be used. For example: Copper net, aluminum net or iron net.

Generally, the control cables should be shielded cables and the shielding metal net must be connected to the metal enclosure of the drive by cable clamps.

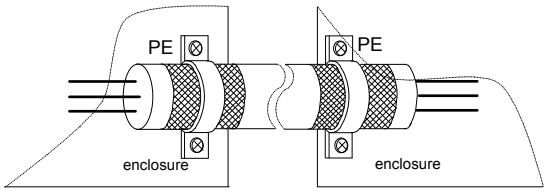


Fig. 3-35 Correct shielding method of shielding layer

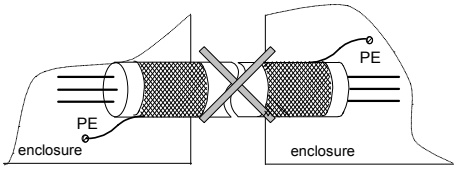


Fig. 3-36 Incorrect earthing method of shielding layer

3.4.3 Earthing

Independent earthing poles (best)

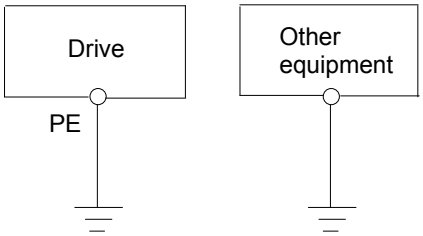


Fig. 3-37 Earthing diagram 1

Shared earthing pole (good)

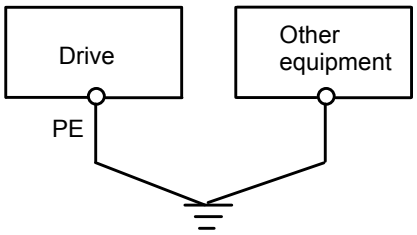


Fig. 3-38 Earthing diagram 2

Shared earthing cable (not good)

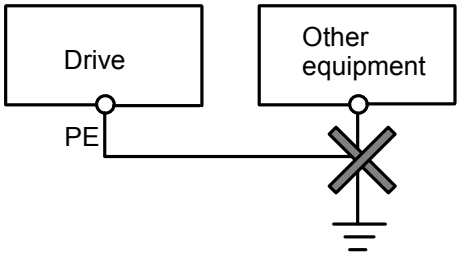


Fig. 3-39 Earthing diagram 3

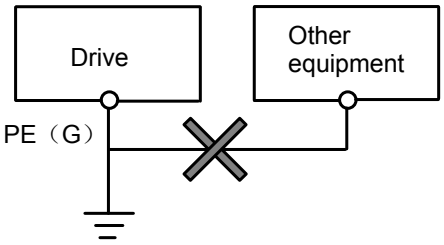


Fig. 3-40 Earthing diagram 4

Besides, pay attention to the following points:

1) In order to reduce the earthing resistance, flat cable should be used because the high frequency impedance of flat cable is smaller than that of round cable with the same CSA.

2) For 4-core motor cable, the end of one cable should be connected to the PE of the drive, and the other end should be connected to the motor's enclosure. If the motor and the drive each has its own earthing pole, then the earthing effect is better.

3) If the earthing poles of different equipment in one system are connected together, then the leakage current will be a noise source that may disturb the whole system. Therefore, the drive's earthing pole should be separated with the earthing pole of other equipment such as audio equipment, sensors and PC, etc.

4) In order to reduce the high frequency impedance, the bolts used for fixing the equipment can be used as the high frequency terminal. The paints on the bolt should be cleaned.

5) The earthing cable should be as short as possible, that is, the earthing point should be as close to the drive as possible.

6) Earthing cables should be as far away from the I/O cables of the equipment that is sensitive to noise, and also should be as short as possible.

3.4.4 Installation Requirements of Relay, Contactor and Electro-magnetic Braking Kit

The devices such as relay, contactor and electro-magnetic braking kit, which may generate great noises, should be installed outside of the drive cabinet and should be installed with surge suppressors.

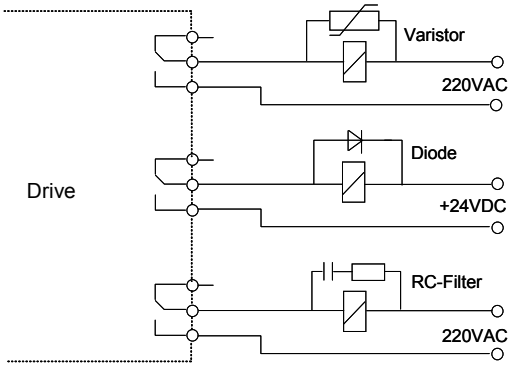


Fig. 3-41 Relay, contactor and electro-magnetic braking kit

3.4.5 Leakage Current

Leakage current may flow through the drive's input and output capacitors and the motor's capacitor. The leakage current value is dependent on the distributed capacitance and carrier wave frequency. The leakage current includes ground leakage current and the leakage current between lines.

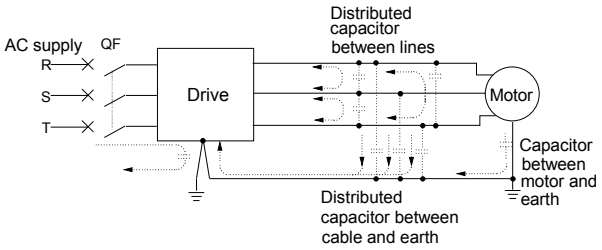


Fig. 3-42 Flowing path of leakage current

Ground leakage current

The ground leakage current can not only flow into the drive system, but also other equipment via earthing cables. It may cause the leakage current circuit breaker and relays falsely activated. The higher the drive's carrier wave frequency, the bigger the leakage current, also, the longer the motor cable, the greater the leakage current,

Suppressing methods:

1) Reduce the carrier wave frequency, but the motor noise may be louder;

2) Motor cables should be as short as possible;

3) The drive and other equipment should use leakage current circuit breaker designed for protecting the product against high-order harmonics/surge leakage current;

Leakage current between lines

The line leakage current flowing through the distribution capacitors of the drive out side may cause the thermal relay falsely activated, especially for the drive whose power is lower than 7.5kW. When the cable is longer than 50m, the ratio of leakage current to motor rated current may be increased that can cause the wrong action of external thermal relay very easily.

Suppressing methods:

1) Reduce the carrier wave frequency, but the motor noise may become louder;

2) Install reactor at the output side of the drive.

In order to protect the motor reliably, it is recommended to use a temperature sensor to detect the motor's temperature, and use the drive's over-load protection device (electronic thermal relay) instead of an external thermal relay.

3.4.6 Correct EMC Installation

Divide the installation space into different areas

In driving system, the drive, control equipment and sensors are installed in the same cabinet, the noise should be suppressed at the main connecting points with the RFI filter and input reactor installed in cabinet to satisfy the EMC requirements.

The most effective but expensive measure to reduce the interference is to isolate the noise source and the noise receiver, which should be considered in mechanical/system design phase. In driving system, the noise source can be drive, brake unit and contactor. Noise receiver can be automation equipment, coder and sensor.

The mechanical/system is divided into different EMC area according to its electrical characteristics. The recommended installation positions are shown in the following figure:

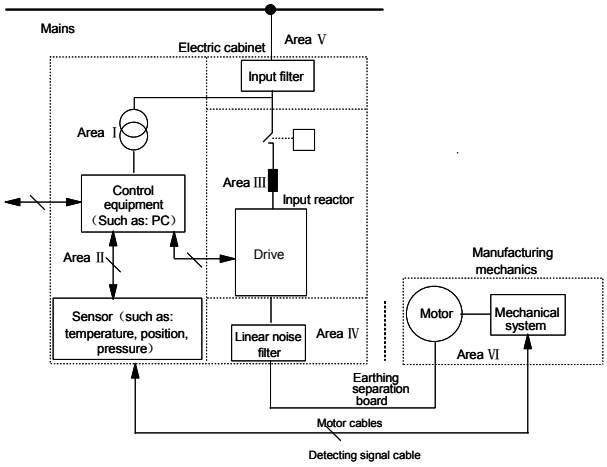


Fig. 3-43 Recommendation of Installation space

Attention:

Area Ⅰ should be used to install transformers of control power supply, control system and sensor.

Area Ⅱ should be used for interfaces of signal and control cables, correct immunity level is required.

Area Ⅲ should be used to install noise sources such as input reactor, the drive, brake unit and contactor.

Area Ⅳ should be used to install output noise filter and the wires of filter.

Area Ⅴ should be used to install power source and cable connecting parts of RFI filter.

Area Ⅵ should be used to install motor and motor cables.

Areas should be isolated in space, so that electro-magnetic decoupling effect can be achieved.

The minimum distance between areas should be 20cm.

Earthing bars should be used for decoupling among areas, the cables from different area should be placed in different tubes.

The filter should be installed at the interfaces between different areas if necessary.

Bus cable (such as RS485) and signal cable must be shielded

Electrical installation of the drive

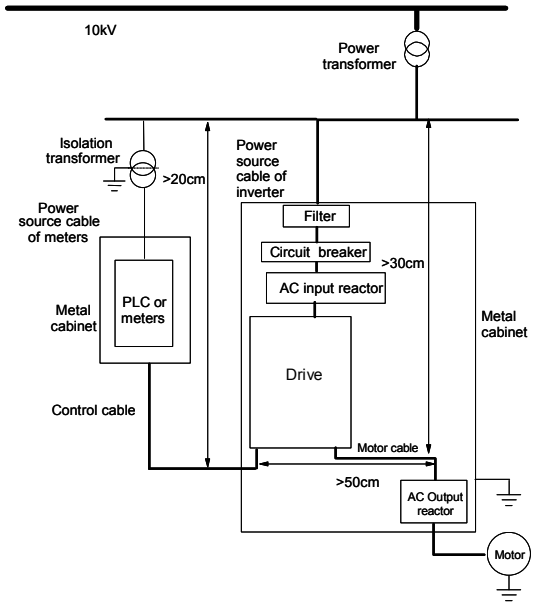


Fig. 3-44 Installation of the drive

Motor cable should be earthed at the drive side, if possible, the motor and drive should be earthed separately;

Motor cable and control cable should be shielded or armored. The shield must be earthed and avoid entangling at cable end to improve high frequency noise immunity.

Assure good conductivity among plates, screw and metal case of the drive; use tooth-shape washer and conductive installation plate;

Generally, if there are some sensitive equipment, it is more cost-effective to install the power filter at sensitive equipment side.

3.4.7 Application of Power Line Filter

Power source filter should be used in the equipment that may generate strong EMI or the equipment that is sensitive to the external EMI. The power source filter should be a two-way low pass filter through which only 50Hz current can flow and high frequency current should be rejected.

Function of power line filter

The power line filter ensures the equipment can satisfy the conducting emission and conducting sensitivity in EMC standard. It can also suppress the radiation of the equipment.

It can prevent the EMI generated by equipment from entering the power cable, and prevent the EMI generated by power cable from entering equipment.

Common mistakes in using power cable filter

1. Too long power cable

The filter inside the cabinet should be located near to the input power source. The length of the power cables should be as short as possible.

2. The input and output cables of the AC supply filter are too close

The distance between input and output cables of the filter should be as far apart as possible, otherwise the high frequency noise may be coupled between the cables and bypass the filter. Thus, the filter will become ineffective.

3. Bad earthing of filter

The filter's enclosure must be earthed properly to the metal case of the drive. In order to be earthed well, make use of a special earthing terminal on the filter's enclosure. If you use one cable to connect

the filter to the case, the earthing is useless for high frequency interference. When the frequency is high, so is the impedance of cable, hence there is little bypass effect.

The filter should be mounted on the enclosure of equipment. Ensure to clear away the insulation paint between the filter case and the enclosure for good earthing contact.

3.4.8 EMI of the Drive

The drive's operating theory decides that its EMI is unavoidable. The drive is usually installed in a metal cabinet, the instruments outside the metal cabinet is disturbed by the drive lightly. The cables are the main EMI source, if you connect the cables according to the manual, the EMI can be suppressed effectively.

If you install the drive and other control equipment in one cabinet, the area rule must be observed. Pay attention to the isolation between different area, cable layout and shielding.

Chapter 4 Operation Instructions

This chapter introduces the operation instructions of the drive.

4.1 Notice

Please read this section carefully. It will help you to understand and use the functions to be discussed correctly.

4.1.1 The Drive's Control Command Channel

It defines the physical channels by which drive receives operating commands like START, STOP, FWD, REV, JOG and others. There are 3 types of control command channel:

Panel control: The drive is controlled by RUN, STOP and JOG keys on the operation panel;

Terminal control: The drive is controlled by terminals FWD, REV and COM (2-wire mode), or by terminal Xi (3-wire mode);

Serial port control: The operations such as START and STOP can be controlled by host PC.

The control command channel can be selected by parameter F0.03, PANEL/REMOTE key and ENTER/DATA key on the operation panel and multi-function input terminal (No.27, 28 and 29 of F7.00~F7.07).

> 🕮 **Warning:**
>
> The user must ensure that the selected control command channel is suitable for the application. Wrong selection of control mode may cause damage to equipment or human injury!

4.1.2 Frequency Setting Channel

In common operating modes, the drive has 6 channels to input reference frequency, the reference frequency can be input by:

▲ and ▼ keys on the panel;

Terminals UP/DN;

Serial port;

Analog VCI;

Analog CCI;

Pulse terminal (PULSE)

Frequency setting method: The output frequency is determined by calculation of the above 6 frequency setting methods, which involves the concept of main and auxiliary reference frequency.

Main reference frequency: set by F0.00, multi-speed (MS), PLC or close loop control.

The main reference frequency is determined by the priority of running mode. The priority level is Jog>close loop>PLC>MS (multi-speed)>common running, e.g. if the drive is running in MS mode, the primary reference frequency is MS frequency.

Auxiliary reference frequency: set by F9.01~F9.04.

Present frequency: the sum of main and auxiliary frequency multiply a factor, which is set in F9.05 and F9.06. Please refer to F9.05, F9.06 and Fig. 5-59 in Chapter 5.

4.1.3 Operating Status

There are 3 operating status: stopping, operating and motor parameter auto-tuning.

Stopping status: After the drive is switched on and initialized, if no operating command is accepted or the stopping command is executed, then the drive enters stopping status.

Operating status: The drive enters operating status after it receives the operating command.

Motor parameters auto-tuning status: If there is an operating command after FH.09 is set to 1 or 2, the drive then enters motor parameters auto-tuning status, and then enters stopping status after auto-tuning process is over.

4.1.4 Operating Modes

The drive has 5 operating modes which can be sequenced according to the priority: Jog>Close loop operation>PLC operation>Multi-step speed operation>Common operation, as shown in Fig. 4-1.

Jog operation:

When the drive is in stopping status, if received jog command (e.g. pressed on the JOG key on the panel), it will operate according to Jog frequency. See explanations of F3.13~F3.16 for details.

Close-loop operation:

If the close-loop operating function is enabled (F5.00=1), the drive will select the close-loop operation mode, that is, it will perform PI regulation according to the reference and feedback values (See explanations of Parameter F5). Close-loop operating function can be disabled by a multi-function terminal (No.20 function), and the drive will operate with a lower priority mode.

PLC operation:

If PLC function is enabled (once first digit of F4.00 is set to a non-zero value), the drive will select PLC operating mode and will operate in the pre-defined operating mode (see explanation of parameter F4). The PLC function can be disabled by a multi-function terminal (No. 21 function), and the drive will operate with a lower priority mode.

Multi-step (MS) speed operation:

Select MS frequency 1~7(F3.23~F3.29, F7.00~F7.07) to start MS speed operation by the ON/OFF combinations of the multi-function terminals (No.1, 2, and 3). Noted: if the terminals can not be all “OFF” or else it is common operation mode.

Common operation:

Common operation is the open-loop operation mode.

The operating logic of the drive is shown in Fig. 4-1:

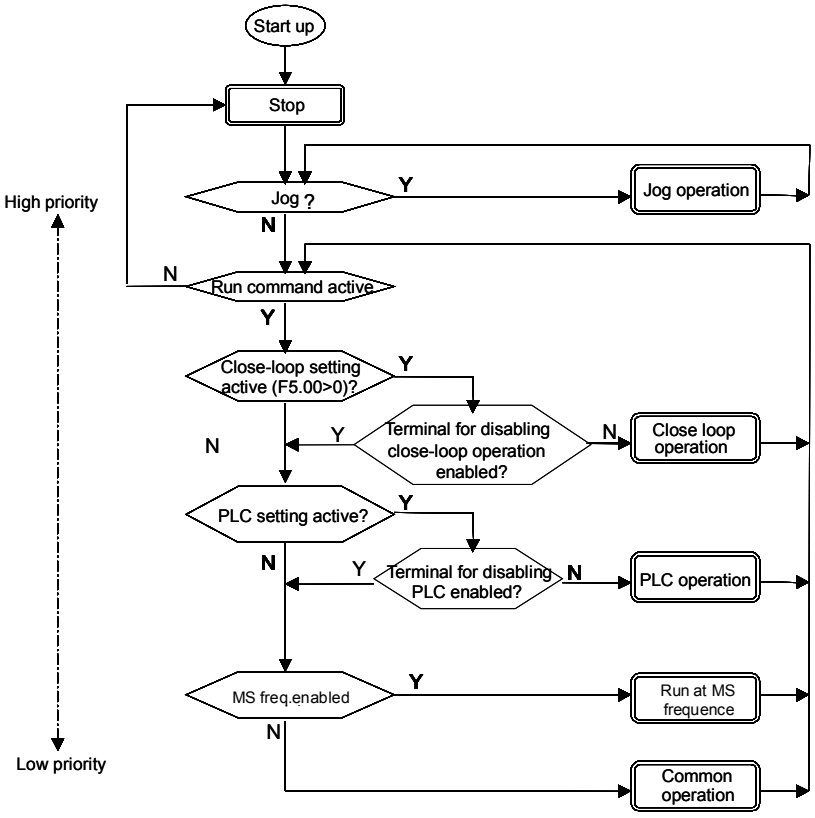


Fig. 4-1 Operating status of the drive

Five operating modes provide 5 basic frequency sources. Except the Jog operating frequency, other 4 frequency sources can be superposed by the auxiliary frequency to tune the final output frequency.

4.2 Operating Instructions

4.2.1 Operation Panel Using Guide

The operation panel is used to setup the drive and display parameters. There are two types of operation panels, LED display and LCD display. The LED display is the standard operation panel. The LCD operation panel is an optional accessory. It can display in English and Chinese characters, with description for the displayed data. The outlines, dimensions and operating methods of these two types of operation panels are the same, as shown in Fig.4-2.

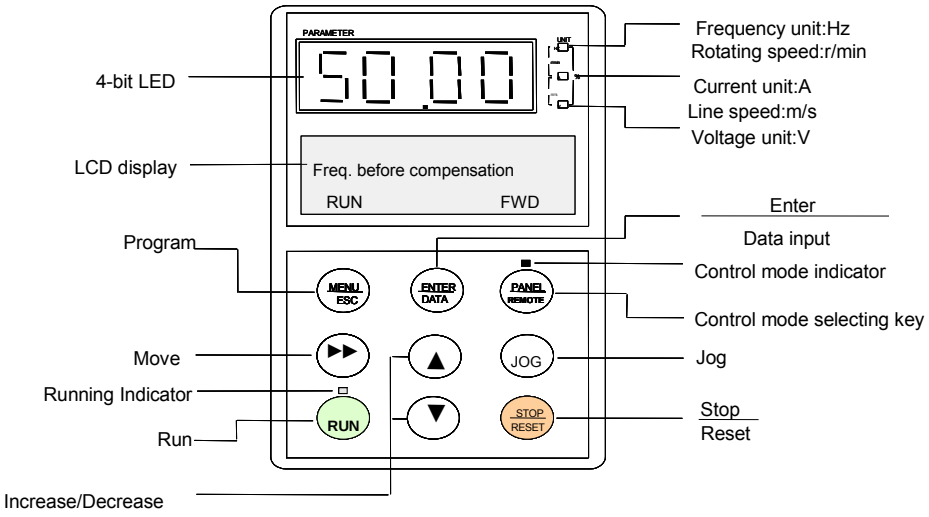


Fig. 4-2 Illustration of operation panel

⚠ Attention Operation panel of the drive is not compatible with the panel of other Emerson drives!.

4.2.2 Function of Keys

There are 9 keys on the operation panel of the drive and the functions of each key are shown in Table 4-1.

Table 4-1 Function of operation panel

Key	Name	Function
MENU/ESC	Program/ exit	Enter or exit programming status
ENTER/DATA	Function/ data	Enter next level menu or confirm data
▲	Increase	Increase data or parameter
▼	Decrease	Decrease data or parameter
▶▶	Shift	In editing status, pressing this key to modify data. In other status, this key is used to scroll through the parameters.
PANEL/ REMOTE	Control command channel selection	Select control command channel, press ENTER/DATA to enter
JOG	Jog key	In panel control mode, press this
		key to start Jog operation.
RUN	Run key	In panel control mode, press this key to run the drive.
STOP/RESET	Stop/reset	Press this key to stop or reset the drive.

Notes:

Functions of RUN, JOG, STOP/RESET and PANEL/REMOTE are also limited by F9.07.

4.2.3 Function Descriptions of LED and Indicators

The operation panel consists of a 4-digit eight segments display, 3 unit indicators and 2 status indicators as shown in Fig. 4-3. The LED segments can display the status parameters, function parameters and fault codes of the drive. These 3

unit indicators have 7 different combinations and each combination corresponds to one type of unit. The relationship between the combination of the indicators and the unit is shown in Fig. 4-3:

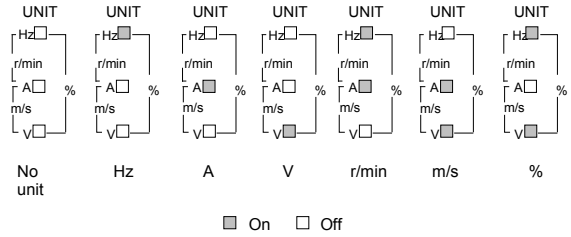


Fig. 4-3 Unit represented by combination of the indicators

Two status indicators: Operating status indicator is above the RUN key. The control command channel indicator is above the PANEL/REMOTE key, and the functions of these indicators are shown in Table 4-2.

Table 4-2 Functions of status indicators

Indicator	Display status	Current status of the drive
Operating status indicator	Off	Stopping status
	On	Running status
Control command channel indicator	On	Panel control status
	Off	Terminal control status
	Flash	Serial port control status

4.2.4 Display of the Operation Panel

The operation panel of the drive can display the parameters in stopping, operating, editing and alarming state.

1. Parameters displayed in stopping status

When the drive in stop status, the panel will display the parameters in stopping status, as shown in Fig. 4-4. The unit indicator on the right indicates the unit of the parameter.

Other parameters can be displayed by pressing ▶▶ key (see F8.03).

2. Parameters displayed in operating status

When the drive receives operating command, it starts running and its panel will display the parameters in operating status, as shown in Fig. 4-4c. The unit indicator at right indicates the unit of the parameter.

Other parameters can be displayed by pressing ▶▶ key (see F8.01 and F8.02).

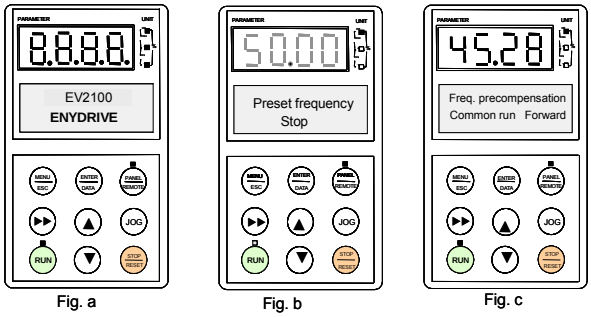


Fig. a
Initialize at power on, all LED turns on

Fig. b
Stopping state, Stopping information is displayed ; RUN indicator turns off

Fig. c
Running state, running information is displayed; RUN indicator turns on

Fig. 4-4 Displayed during initialization, STOP, operation

3. Parameter displayed in alarm status

When the drive detects a fault signal, the panel will display the fault code. The code will flash as shown in Fig. 4-5;

Reference frequency can be viewed by pressing the ▶▶ key in stopping status. Fault information can be checked by pressing MENU/ESC key. The drive can be reset by pressing the STOP/RESET key, or sending the reset commands via the control terminal or serial port. The fault code will not disappear until the fault is cleared.

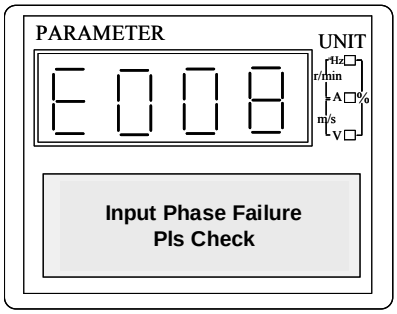


Fig. 4-5 Parameter displayed in alarm status

4. Parameter configuration status

When the drive is in stopping, operating or alarming status, pressing MENU/ESC can configure the parameter. If there is pass code for the drive, refer to FP.00 and Fig.4-13 for configuration. Configuring status can be displayed in 3-level menu as shown in Fig 4-6, they are: parameter group→parameter number→parameter value. You can enter the sub-menus by pressing

ENTER/DATA. In parameter value menu, press ENTER/DATA to save the settings, and press MENU/ESC to exit current menu.

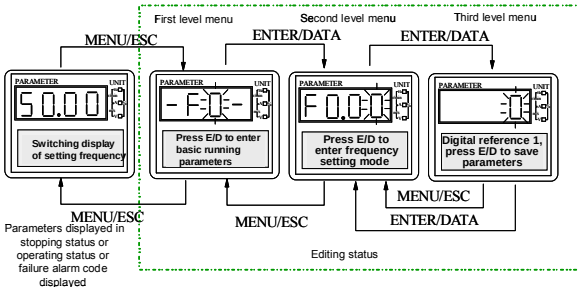


Fig. 4-6 Programming display status of the operation panel

4.2.5 Operation Panel using instruction

Various operations can be performed for the drive via the operation panel. The examples in point are as follows:

Switching display of status parameter:

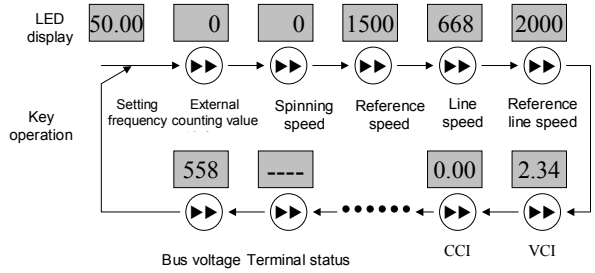


Fig. 4-7 Operation example for displaying parameters in stopping status

(The switching method of operating status is the same as above.)

Function code parameter setting: (The following is an example for modifying and setting the function code F3.13 from 5.00Hz into 6.50Hz. The bold number in Fig. 4-8 indicates the flashing bit.)

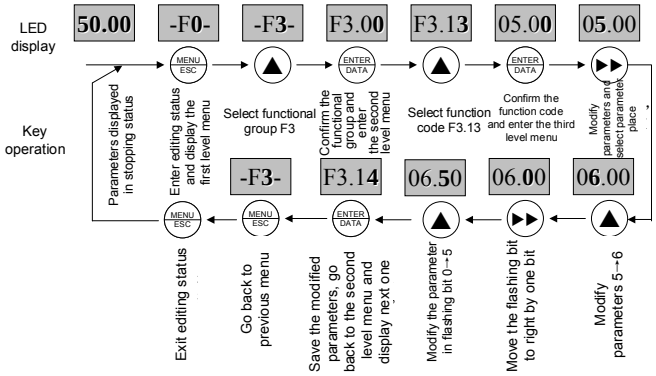


Fig.4-8 Operation example of editing parameters

In the third level menu, if the parameter has no flashing bit, it indicates this function code cannot be modified. The possible reasons are as follows:

1) This function code is an unchangeable parameter, such as actual detection parameter, running record parameter, etc.

2) This function code cannot be modified in operating status. It can be modified only after the drive is stopped.

3) The parameter is protected. When the function code FP.01 is set as 1 or 2, it cannot be modified. It is a kind of parameter protection against misoperation. To edit the function code parameter, please set the function code FP.01 as 0 first.

Reference frequency adjustment of common operation: (The following is an example for modifying the reference frequency from 50.00Hz to 40.00Hz.)

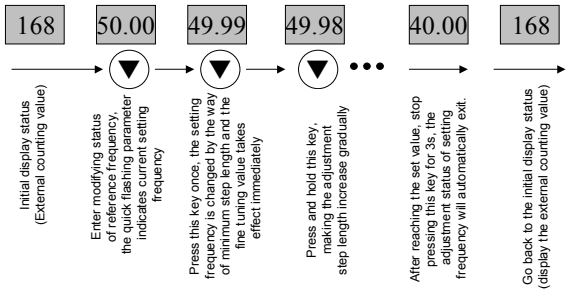


Fig.4-9 Operation example for adjusting setting frequency

This method is applicable to the adjustment of reference frequency parameter with its initial display status as non-operation spinning speed, reference speed, line speed or reference line speed.

When the initial status is spinning speed, reference speed, line speed or reference line speed, reference speed or line speed can be directly modified and displayed in real time via pressing ▲ or▼ key. To directly modify the reference frequency, it can be modified only after switching into the setting frequency display status via ►► key.

Switching of running command channel:

Before the operation, the F9.07 shall be set as x1x (stopping switching enabled) or x2x (stopping and running switching both enabled)

Press PANEL/REMOTE key, the PANEL/REMOTE indicator will be on when the running command channel of the operation panel is selected. Press PANEL/REMOTE key again, its indicator will be off when the terminal running command channel is selected. Press PANEL/REMOTE key a third time, its indicator will flash when the serial port running command channel is selected.

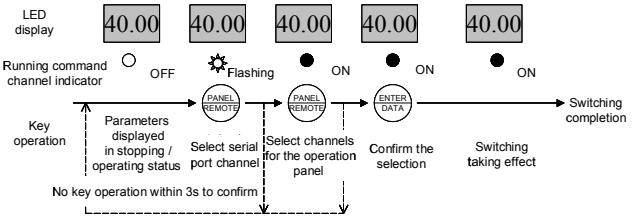


Fig 4-10 Operation example for switching running command channel

Running and stopping operation: (Assuming that the running command channel is the serial port channel and in stopping status), then F9.07 will be set as 01x or 02x.)

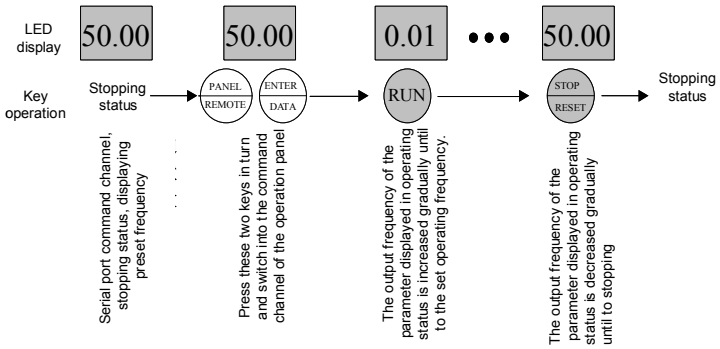


Fig. 4-11 Operation example for running and stopping

Jog running operation: (Assuming that the current running command channel is operation panel and in stopping status.)

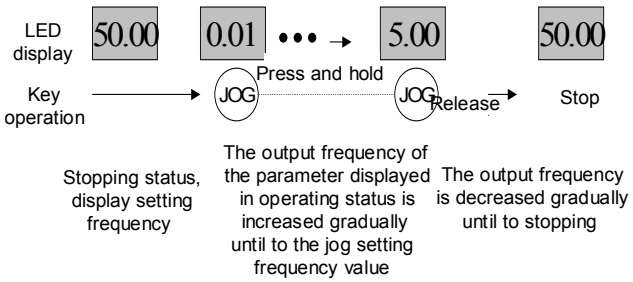


Fig. 4-12 Operation example for jog running

Verification and unlocking operation of user password: (Assuming that the set value of "user password" FP.00 is 1368. The bold number in Fig. 4-13 indicates the flashing bit.)

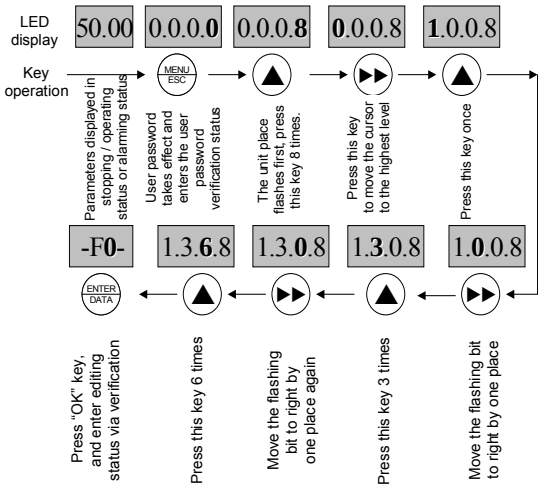


Fig. 4-13 Operation example for unlocking user password

Locking operation of the operation panel keys: (The following is the operation example for setting the hundreds place of the function code F9.07 first and then locking the keys.)

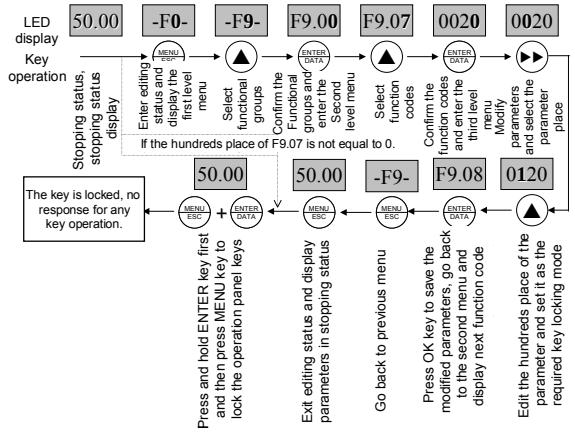


Fig. 4-14 Operation example for unlocking the operation panel keys

Unlocking operation of the operation panel keys: (Assuming that the keys on the operation panel are locked.)

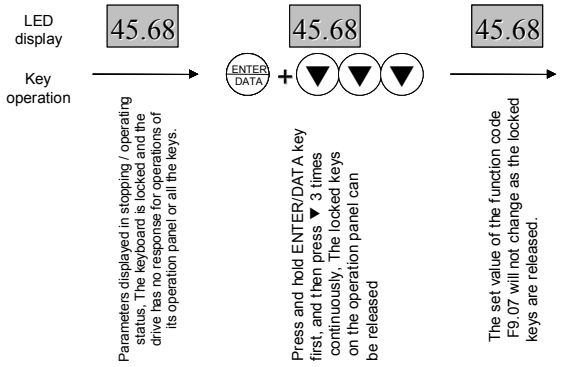


Fig. 4-15 Operation example for unlocking the operation panel keys

Note: Even if the set value of the hundreds place of F9.07 is unequal to 0 (the operation panel is allowed to be locked), each time when the drive powers up, the operation panel is in unlocked status.

4.3 First time start-up

4.3.1 Checking before Start-up

Please connect the drive according to *Section 3.3* and refer to Fig. 3-7.

4.3.2 First Time Start up operation

After checking the wiring and AC supply, switch on the circuit breaker of the drive to supply AC power to it. The drive's panel will display "8.8.8.8." at first, and then the contactor closes. If the LED displays the setting frequency, the drive initialization is completed.

If the LED on the PANEL/REMOTE is on, the drive is in panel control mode.

Procedures of first-time start-up:

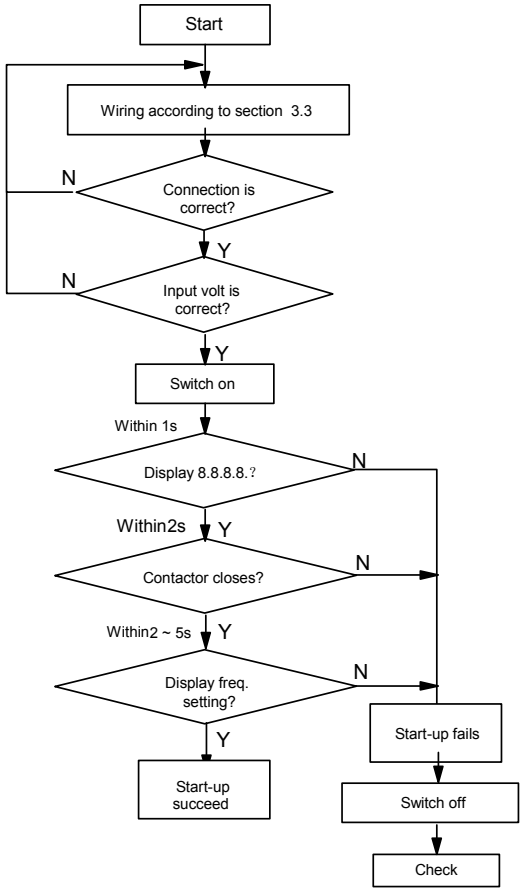


Fig. 4-16 Procedures of first time drive start up

Chapter 5 Parameter Function Introductions

This chapter introduces the parameter functions of the drive.

Notes:

The values in "【】" are the default parameter value.

5.1 Basic Operating Parameters (Group F0)

F0.00 Reference frequency selector	Range:0~5 【0】

0: digital input 1

To set the reference frequency via ▲ and ▼ keys on the panel.

Initial frequency is the value of F0.02 and it can be adjusted via ▲ and ▼ keys on the panel.

1: digital input 2

To set the reference frequency via terminal UP/DN

Initial frequency is the value of F0.02 and it can be adjusted via terminal UP/DN.

2: digital input 3

To set the reference frequency via serial port

Initial frequency is the value of F0.02 and it can be adjusted via serial port.

3: VCI analog input (VCI-GND)

The reference frequency is set by analog voltage input via terminal VCI and the input voltage range is DC 0~10V.

4: CCI analog input (CCI-GND)

The reference frequency is set by analog voltage or current input via terminal CCI and the input range is DC 0~10V (if jumper CN10 is placed at "V" side) or DC0~20mA (if jumper CN10 is placed at "I" side).

5: Pulse input (PULSE)

Set the reference frequency by pulse input via pulse terminal (can only be input via terminal X7 or X8, see the definitions of F7.06~F7.07). Input pulse signal: voltage range: 15~30V; frequency range: 0~50.0kHz.

Note:

Frequency calculating methods of channel 3, 4 and 5 are decided by F1.00~F1.11, please refer to section 5.2.

F0.01 Digital frequency control	Range: 00~11 【00】

Only valid when F0.00=0, 1 or 2.

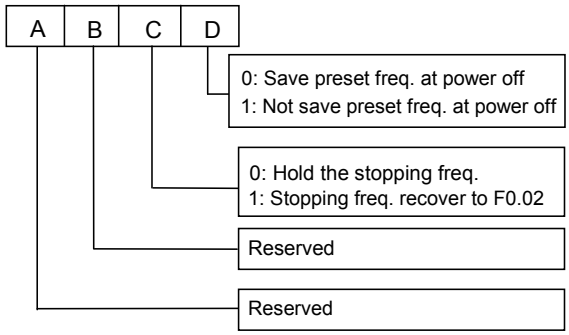


Fig. 5-1 LED setting

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place of LED:

0 (setting frequency can be saved at power off): When the drive is switched off or under voltage fault occurs, the setting of F0.02 will be refreshed to the present frequency value.

1 (setting frequency can not be saved at power off): When the drive is switched off or under voltage fault occurs, the setting of F0.02 will not be changed.

Ten's place of LED:

0 (Maintaining the setting frequency in stopping status): When the drive is stopping, the setting frequency is the final frequency value.

1 (setting frequency is refreshed to the setting of F0.02): When the drive is stopping, the setting frequency will be refreshed to the setting of F0.02 automatically.

F0.02 Set the operating frequency in digital mode	Range: Lower limit of frequency ~upper limit of frequency【 50.00Hz】

When the reference frequency is set in digital mode (F0.00＝0, 1, 2), this setting of F0.02 is the drive's initial frequency value.

F0.03 Input operating commands selector	Range: 0. 1. 2 【0】

The drive has 3 operating command selector

0: Panel control: Input operating commands via panel

Start and stop the drive by pressing RUN, STOP and JOG key on the panel.

1: Terminal control: Input operating commands via terminals

Use terminals FWD, REV, JOGF and JOGR to start and stop the drive.

2: Serial port control: Input commands via serial port

Use serial port to start and stop the drive.

> 🕮 **Note**
>
> Please be careful that during operating, the control modes can be changed through F0.03 or terminals or PANEL/REMOTE key.

F0.04 Running direction setup	Range: 0, 1 【0】

This function is active in panel control mode and serial port control mode, and inactive in terminal control mode.

0: Forward

1: Reverse

F0.05 Max output frequency	Range: Max{50.00,F0.12 upper limited frequency}~600.00Hz【50.00Hz】
F0.06 Basic operating frequency	Range:1.00~600.00Hz 【50.00Hz】
F0.07 Max output voltage	Range:1~480V 【drive's rating values】

Max output frequency is the highest permissible output frequency of the drive, as shown in Fig. 5-2 as f_{max};

Basic operating frequency is the Min frequency when the drive outputs the max voltage, as shown in Fig. 5-2 as f_b

Max output voltage is the drive's output voltage when the drive outputs basic operating frequency, normal equivalent to motor rating voltage, as shown in Fig. 5-2 as V_{max}

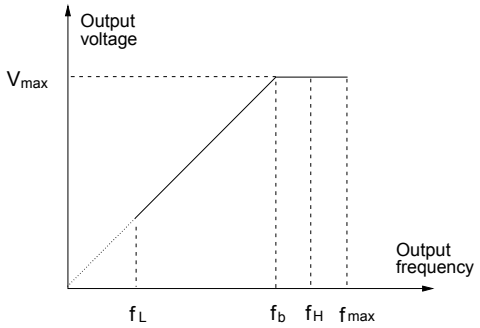


Fig. 5-2 Characteristic parameters

The f_H and f_L are defined by F0.12 and F0.13 as upper limit of frequency and lower limit of frequency respectively.

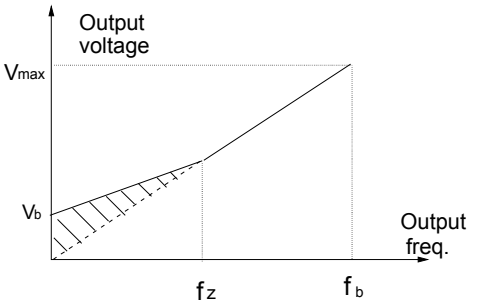
> 🕮 **Note:**
>
> Please set fmax, fb and Vmax according to motor parameters, otherwise the equipment may be damaged.

F0.08	Reserved

Reserved.

F0.09 Torque boost	Range:0~30.0％【0.0％】

In order to compensate the torque drop at low frequency, the drive can boost the voltage so as to boost the torque. If F0.09 is set to 0, auto torque boost is enabled and if F0.09 is set non-zero, manual torque boost is enabled, as shown in Fig. 5-3.



V_b : Manual torque boost Vmax: Max output voltage
f_z : Cut-off freq. for torque boost
f_b : Basic operating freq.

Fig. 5-3 Torque boost (shadow area is the boosted value)

Note:

1. Wrong parameter setting can cause overheat or over-current protection of the motor.
2. Refer to F0.21 for definition of fz.
3. When the drive drives a synchronous motor，manual torque boost function is recommended to be used and V/F curve should be adjusted according to the motor parameters.

F0.10 Acc time 1	Range:0.1~3600s(min)【6.0s/20.0s】
F0.11 Dec time 1	Range:0.1~3600s(min)【6.0s/20.0s】

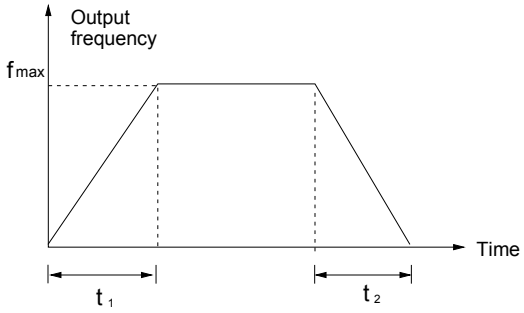


Fig. 5-4 Acc/Dec time definition

Acc time is the time taken for the motor to accelerate from 0Hz to the maximum frequency (as set in F0.05), as t_1 in Fig. 5-4. Dec time is the time taken for the motor to decelerate from maximum frequency (F0.05) to 0Hz, as t_2 in Fig. 5-4.

The drive has defined 4 types of Acc/Dec time. Here only Acc/Dec time 1 is defined, and Acc/Dec time 2~4 will be defined in F3.17~F3.22, please refer to *Section 5.4 Auxiliary operating parameters (Group F4)*.

Note:

1. Unit (second/minute) of Acc/Dec time 1~4 can be configured by F9.09, and the default unit is second.
2. For the drive of 37kW or above, the default setting of Acc/Dec time is 20.0s.

F0.12 upper limit of frequency	Range: Lower limit of frequency ~Max output frequency【50.00Hz】
F0.13 lower limit of frequency	Range:0~upper limit of frequency 【0.00Hz】

F0.12 and F0.13 define the upper and lower limit of frequencies respectively, as shown in Fig. 5-2 as f_H and f_L.

Notes:

Actual output frequency is possible to exceed ±2.5Hz in the bus-voltage control process.

F0.14 V/F curve setting	Range: 0~3【0】
F0.15 V/F frequency value F3	Range: F0.17~F0.06【0.00Hz】
F0.16 V/F voltage value V3	Range: F0.18~100.0%【0.0%】
F0.17 V/F frequency value F2	Range: F0.19~F0.15【0.00Hz】
F0.18 V/F voltage value V2	Range: F0.20~F0.16【0.0%】
F0.19 V/F frequency value F1	Range: 0~F0.17【0.00Hz】
F0.20 V/F voltage value V1	Range:0~F0.18【0.0%】

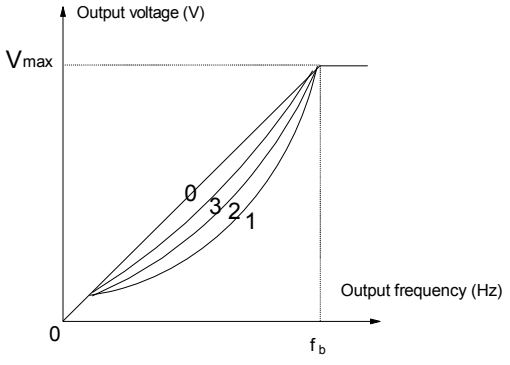
This group of parameters defines the V/F setting of the drive so as to satisfy the requirements of different loads. 3 pre-defined curves and one user-defined curve can be selected according to the setting of F0.14.

If F0.14 is set to 1, a 2nd power curve is selected, as shown in Fig. 5-5 curve 1;

If F0.14 is set to 2, a 1.7 power curve is selected, as shown in Fig. 5-5 curve 2;

If F0.14 is set to 3, a 1.2 power curve is selected, as shown in Fig. 5-5 curve 3;

The above curves are suitable for the variable-torque loads such as fan & pumps. You can select the curves according to the actual load so as to achieve best energy-saving effects.



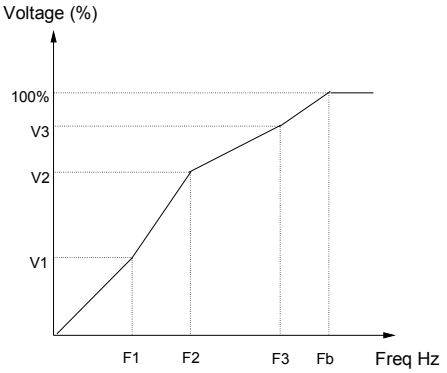
V_{max} : Max output voltage(F0.07)

f_b : Basic operating frequency(F0.06)

Fig. 5-5 Torque-reducing curve

If F0.14 is set to 0, V/F curve can be defined via F0.15~F0.20, as shown in Fig. 5-6. The V/F curve can be defined by connecting 3 points of (V1, F1), (V2, F2) and (V3, F3), to adapt to special load characteristics.

Default V/F curve is a direct line as show in Fig. 5-5 as curve 0.



V1~V3: Voltage of sections 1~3
F1~F3: Freq of sections 1~3
Fb: Basic operating freq. of F0.06

Fig. 5-6 Customized V/F curve

F0.21 Cut-off point used for manual torque boost	Range:0~50%【10.0%】

F0.21 defines the ratio of the cut-off frequency used for manual torque boost to the basic operating frequency (defined by F0.06), as shown in Fig. 5-3 as fz. This cut-off frequency adapts to any V/F curve defined by F0.14.

5.2 Parameters of Reference Frequency (Group F1)

F1.00 Reference frequency curve selection	Range:000~111【000】
F1.01 Gain of reference frequency selector	Range:0.00~9.99【1.00】
F1.02 Reference time constant of filter	Range:0.01~50.00s【0.50s】
F1.03 Max input pulse frequency	Range:0.1~50.0kHz【10.0kHz】
F1.04 Min reference of curve 1	Range:0.0%~F1.06【0.0%】
F1.05 Frequency corresponding to the Min reference of curve 1	Range:0.0~F0.05【0.00Hz】
F1.06 Max reference of curve 1	Range:F1.04~100.0%【100.0%】
F1.07 Frequency corresponding to the Max reference of curve 1	Range:0.0~F0.05Hz【50.00Hz】
F1.08 Min reference of curve 2	Range:0.0%~F1.10【0.0%】
F1.09 Frequency corresponding to the Min reference of curve 2	Range:0.0~F0.05【0.00Hz】
F1.10 Max reference of curve 2	Range:F1.08~100.0%【100.0%】
F1.11 Frequency corresponding to the Max reference of curve 2	Range:0.0~F0.05【50.00Hz】

When VCI or CCI or pulse input (PULSE) is selected, the relationship between reference and the preset frequency is given below:

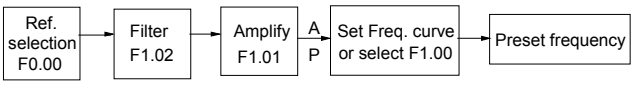
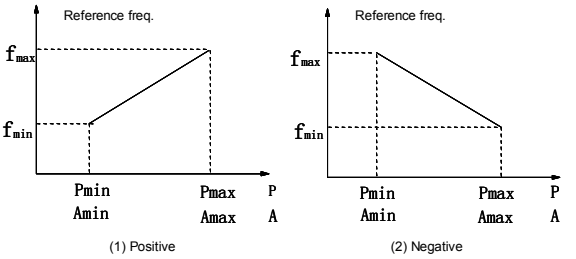


Fig. 5-7 Relationship between reference and the preset frequency

Reference frequency signal is filtered and amplified, and then its relationship with the preset frequency is determined by Curve 1 or 2. Curve 1 is defined by F1.04~F1.07, and curve 2 is defined by F1.08~F1.11. Positive and negative characteristics are shown in Fig. 5-8.



P: pulse terminal input
Pmin Amin: Min. reference
fmin: Freq. corresponding to Min reference

A: Reference of analog signal of VCI OR CCI
Pmax Amax: Max. reference
fmax: Freq. corresponding to Max reference

Fig. 5-8 Output frequency characteristic curve

Analog input value (A) is a percentage without unit, and 100% corresponds to 10V or 20mA. Pulse frequency (P) is also a percentage without unit, and 100% corresponds to the Max pulse frequency defined by F1.03.

F1.02 defines the time constant of the filter used by the reference selector. The input signal is filtered and the bigger the time constant, the higher the immunity level, but the response time is prolonged with the increase of the time constant. That is, the smaller the time constant, the shorter the response time, but the lower the immunity level.

F1.00 is used to select the output frequency curve when VCI, CCI or PULSE input is selected, as shown in Fig.5-9.

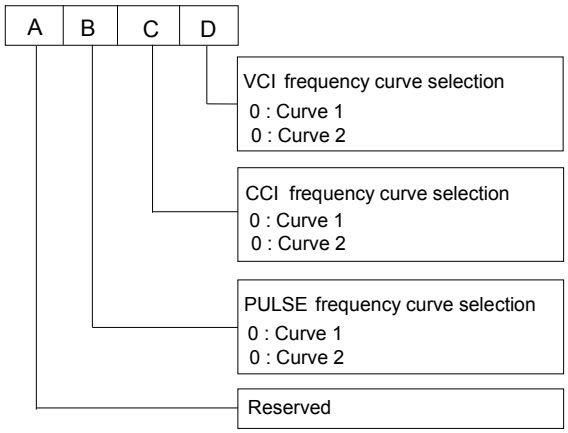


Fig. 5-9 Frequency curve selection

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

For example, the requirements are:

①Use the pulse signal input via terminal to set the reference frequency;

②Range of input signal frequency: 1kHz~20kHz;

③1kHz input signal corresponds to 50Hz reference frequency, and 20kHz input signal corresponds to 5Hz reference frequency;

According to the above requirements, the parameter settings are:

①F0.00=5, select pulse input to set the reference frequency;

②F7.06=45, input pulse signal via terminal X7;

③F1.00=100, select curve 2;

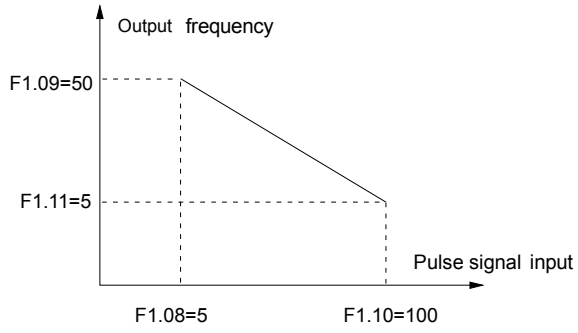
④F1.03=20.0kHz, set the Max input pulse frequency to 20kHz;

⑤F1.08=1÷20×100%=5.0%, the minimum reference of curve 1 is actually the percentage of 1kHz to 20kHz (F1.03);

⑥F1.09=50.00Hz, set the frequency that corresponds to the Min reference (1kHz pulse signal);

⑦F1.10=20÷20×100%=100.0%, the Max reference of curve 2 is actually the percentage of 20kHz to 20kHz (F1.03);

⑧F1.11=5.00Hz, set the frequency that corresponds to the Max reference (20kHz pulse signal);



F0.00=5, F1.00=100, F1.03=20, F7.06=45

Fig. 5-10 Pulse signal input

5.3 Starting and Braking Parameters (Group F2)

F2.00 Starting mode	Range: 0. 1【0】

0: Start from the starting frequency

Start at the preset starting frequency (F2.01) within the holding time of starting frequency (F2.02).

1. Start on the fly

Search and catch the motor's running direction and speed, start the rotating motor smoothly without impact, as shown in Fig. 5-11.

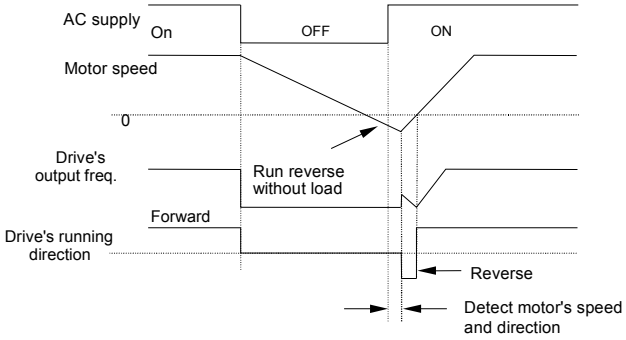


Fig. 5-11 Start on the fly

Note:

1. Starting mode 1 is suitable for starting the motor that is running forward or reverse with large inertia load when the drive stops.
2. The starting performance of starting mode 1 is dependent on the motor's parameters. Please set the parameter group FH correctly.

3. Starting mode 0 is recommended when the drive drives a synchronous motor.

F2.01 Starting frequency	Range:0.20~60.00Hz【0.50Hz】
F2.02 Starting frequency holding time	Range:0.0~10.0s【0.0s】

Starting frequency is the initial frequency when the drive starts, as shown in Fig. 5-12 as f_S; Starting frequency holding time is the time during which the drive operates at the starting frequency, as shown in Fig. 5-12 as t_1

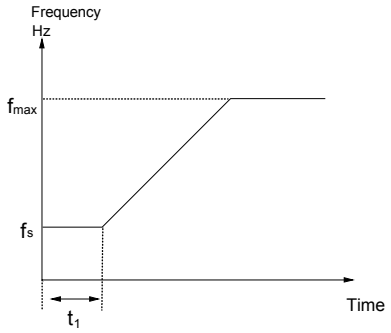


Fig. 5-12 Starting frequency and starting time

Note:

Starting frequency is not restricted by the lower limit of frequency.

F2.03~F2.04	Reserved

F2.05 Acc/Dec mode	Range: 0. 1. 2【0】

0: Linear Acc/Dec mode

Output frequency increases or decreases according to a constant rate, as shown in Fig. 5-13.

1: S ramp Acc/Dec

Output frequency increases or decreases according to a S-ramp curve, as shown in Fig. 5-14.

2: Auto Acc/Dec mode

The drive can maintain its output current below the current limiting threshold (see FL.07) automatically complete the Acc or Dec process according to the load condition.

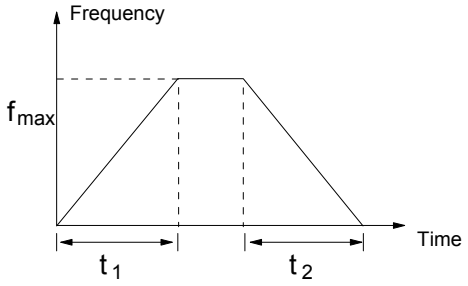


Fig. 5-13 Linear Acc/Dec

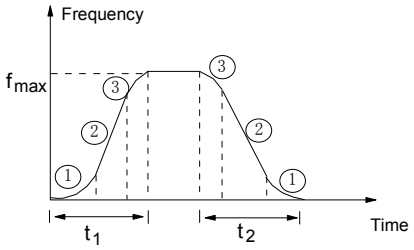


Fig. 5-14 S-ramp Acc/Dec

Note:

In auto Acc/Dec mode, settings of F0.10, F0.11 and F3.17~F3.22 are invalid.

F2.06 Starting time of S ramp	Range:10~50%【20.0%】
F2.07 Rising time of S ramp	Range:10~80%【60.0%】

F2.06 and F2.07 are only active when the Acc/Dec mode is S-ramp Acc/Dec mode (F2.05=1), and F2.06+F2.07≤90%.

Starting process of S-shape curve is shown in Fig. 5-14 as "①", where the change rate of output frequency increases from 0;

Rising process of S-shape curve is shown in Fig. 5-14 as "②", where the output frequency's changing rate is constant;

Ending process of S-shape curve is shown in Fig. 5-14as "③", where the changing rate of output frequency decreases to 0;

S-ramp Acc/Dec mode is suitable for the conveying load such as elevator and conveying belt.

F2.08 Stopping mode	Range:0, 1, 2【0】

0: Dec-to-stop

After receiving the stopping command, the drive reduces its output frequency according to the Dec time, and stops when the frequency decreases to 0.

1: Coast-to-stop

After receiving the stopping command, the drive stops outputting power immediately and the motor stops under the effects of mechanical inertia.

Refer to the introductions of F2.09~F2.12 for the functions of DC injection braking.

F2.09~F2.12	Reserved

F2.13 Dynamic braking selection	Range: 0, 1 [0]

0: Dynamic braking is disabled

1: Dynamic braking is enabled

Note:

For users who need to use this function, please seek the technical support. Please make sure that this parameter is set properly according to the field conditions, otherwise the control performance may be affected.

F2.14 Ratio of working time of braking kit to drive's total working time	Range:0.0~ 100.0%【2.0%】

This function is effective for the drive with built-in braking resistor.

Note:

Resistance and power of the braking resistor must be taken into consideration when setting these parameters.

5.4 Auxiliary Operating Parameters (Group F3)

F3.00 Anti-reverse running function	Range: 0. 1【0】

0: disabled

1: enabled

Note:

This function is effective in all control modes.

F3.01 Hold time of run reverse/forward	Range:0~3600s【0.0s】

The hold time is the transition time at zero frequency when the drive switching its running direction as shown in Fig. 5-15 as t_1.

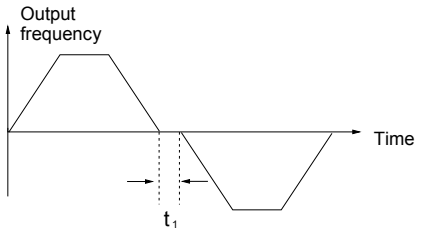


Fig. 5-15 Hold time of zero frequency

F3.02~F3.04	Reserved

Reserved.

F3.05 auto energy-saving function	Range: 0. 1【0】

0: disabled

1: enabled

When the motor operates without load or with light load, the drive can adjust its output voltage by detecting the load current to achieve the energy-saving effects.

Note:

This function is especially useful for the fan & pump loads.

F3.06 AVR function	Range: 0，1，2【2】

0: disabled

1: enabled all the time

2: disabled in deceleration

AVR means automatic voltage regulation.

The function can regulate the output voltage and make it constant. Therefore, generally AVR function should be enabled, especially when the input voltage is higher than the rated voltage.

In Dec-to-stop process, if AVR function is disabled, the Dec time is short but the current is big. If AVR function is enabled all the time, the motor decelerates steadily, the current is small but the Dec time is prolonged.

F3.07 Gain of slip compensation	Range:0.0~300.0%【100.0%】
F3.08 Limit of slip compensation	Range:0.0~250.0%【200.0%】
F3.09 Compensation time constant	Range:0.1~25.0s【2.0s】

The motor's slip changes with the load torque, which results in the variance of motor speed. The drive's output frequency can be adjusted automatically through slip compensation according

to the load torque. Therefore the change of speed due to the load change is reduced as shown in Fig. 5-16.

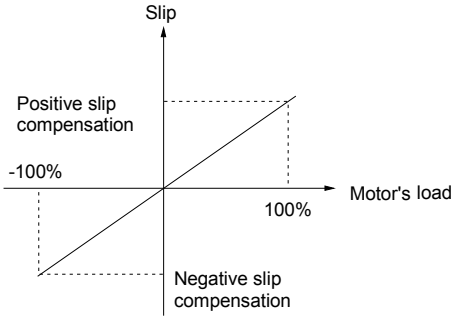


Fig. 5-16 Auto slip compensation

Motoring status: Increase the gain of slip compensation gradually when the actual speed is lower than the reference speed (F3.07).

Regenerating status: Increase the gain of slip compensation gradually when the actual speed is higher than the reference speed (F3.07).

Range of slip compensation: limit of slip compensation (F3.08) × rated slip (FH.08)

Note:

The value of automatically compensated slip is dependent on the motor's rated slip, therefore the motor's rated slip must be set correctly (FH.08).

F3.10 Carrier wave frequency	Range:0.7~15.0kHz【depend on drive model】

Table 5-1 Drive's type and carrier wave frequency (CWF)

CWF / Type	**Highest** (kHz)	**Lowest** (kHz)	**Default** (kHz)
7.5kW~55kW	15	3	8
75kW~110kW	10	1	3
132kW~280kW	6	0.7	2

Table 5-2 CWF characteristics

CWF	Decrease	Increase
Motor's noise	↑	↓
Leakage current	↓	↑
Disturbance	↓	↑

Note:

1. In order to achieve better control performances, the ratio of carrier frequency to the maximum operating frequency of the drive should not be less than 36.
2. There may be a mis current display if carrier frequency is too low.

F3.11 Auto adjusting of CWF	Range: 0. 1【1】

0: disabled

1: enabled

When this function is enabled, the drive can adjust the CWF automatically according to the internal temperature of the drive. At this time, the drive's actual Max CWF is restricted by F3.10.

F3.12 Motor tone adjustment	Range:0~10【0】

F3.12 can be used to adjust the motor's tone, and is only effective for the CWF below 6kHz.

If this parameter is set to 0, the function is disabled.

F3.13 Jog operating frequency	Range:0.10~50.00Hz【5.00Hz】
F3.14 Interval of Jog operation	Range:0.0~100.0s【0.0s】
F3.15 Acc time of Jog operation	Range:0.1~60.0s【6.0s/20.0s】
F3.16 Dec time of Jog operation	Range:0.1~60.0s【6.0s/20.0s】

F3.13~F3.16 define the relevant parameters of Jog operation.

As shown in Fig. 5-17, t_1 and t_3 are the actual Acc time and Dec time respectively. t_2 is the Jog operating time; t_4 is the interval of Jog operation(F3.14); f_1 is the Jog operating frequency(F3.13).

Actual Acc time t_1 can be determined by the following formula, so does the actual Dec time t_3 of jog operation.

$$t_1 = \frac{F3.13 \times F3.15}{F0.05}$$

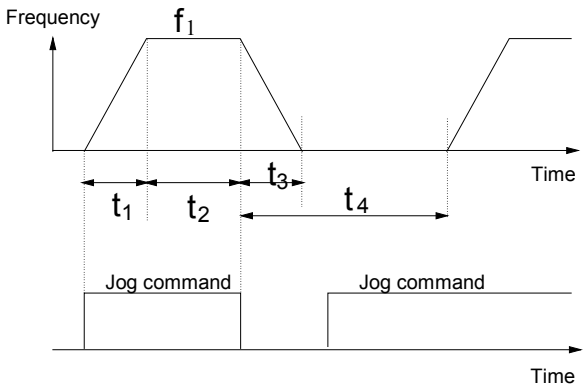


Fig. 5-17 Jog operating parameters

Interval of Jog operation (F3.14) is the interval from the time when the last Jog operation command is ended to the time when the next Jog operation command is executed.

The jog command sent during the interval will not be executed. If this command exists until the end of the interval, it will be executed.

Note:

1. In Jog operation process, the drive starts according to starting mode 0 and stops according to stopping mode 0. The unit of Acc/Dec time is second.
2. Jog operation can be controlled by panel, terminals and serial port.

F3.17 Acc time 2	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.18 Dec time 2	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.19 Acc time 3	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.20 Dec time 3	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.21 Acc time 4	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.22 Dec time 4	Range: 0.1~3600s(min) 【6.0s/20.0s】

Three types of Acc/Dec time can be defined, and the drive's Acc/Dec time 1~4 can be selected by different combinations of control terminals, refer to the introductions of F7.00~F7.07 for the definitions of terminals used to select Acc/Dec time.

Note:

1. Acc/Dec time 1 is defined in F0.10 and F0.11.
2. For the drive of 37kW or above, default Acc/Dec time is 20.0s.

F3.23 Multi step frequency 1	Range: Lower limit of frequency ~upper limit of frequency【5.00Hz】
F3.24 Multi step frequency 2	Range: Lower limit of frequency ~upper limit of frequency【10.00Hz】
F3.25 Multi step frequency 3	Range: Lower limit of frequency ~upper limit of frequency【20.00Hz】
F3.26 Multi step frequency 4	Range: Lower limit of frequency ~upper limit of frequency【30.00Hz】
F3.27 Multi step frequency 5	Range: Lower limit of frequency ~upper limit of frequency【40.00Hz】
F3.28 Multi step frequency 6	Range: Lower limit of frequency ~upper limit of frequency【45.00Hz】
F3.29 Multi step frequency 7	Range: Lower limit of frequency ~upper limit of frequency【50.00Hz】

These frequencies will be used in simple PLC operation and multi-step speed operation, refer to the introductions of F7.00~F7.07 and group F4 parameters.

F3.30 Skip frequency 1	Range:0.00~600.00Hz【0.00Hz】
F3.31 Range of skip frequency 1	Range:0.00~30.00Hz【0.00Hz】
F3.32 Skip frequency 2	Range:0.00~600.00Hz【0.00Hz】
F3.33 Range of skip frequency 2	Range:0.00~30.00Hz【0.00Hz】
F3.34 Skip frequency 3	Range:0.00~600.00Hz【0.00Hz】
F3.35 Range of skip frequency 3	Range:0.00~30.00Hz【0.00Hz】

F3.30~F3.35 define the output frequency that will cause resonant with the load, which should be avoided. Therefore, the drive will skip the above frequency as shown in Fig. 5-18. Up to 3 skip frequencies can be set.

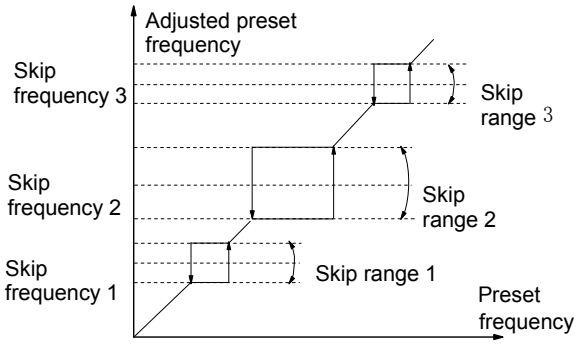


Fig. 5-18 Skip frequency and skip range

5.5 PLC Operating Parameters (Group F4)

Simple PLC function can enable the drive change its operating frequency and directions automatically according to the operating time to satisfy the manufacturing requirements. Before, this function is realized by PLC, now the drive itself can realize such function, as shown in Fig. 5-19.

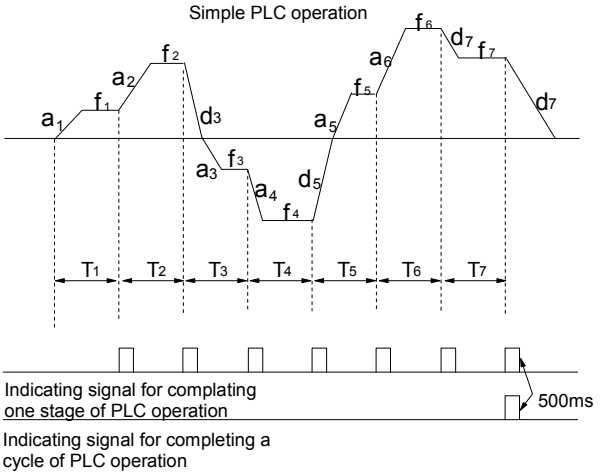


Fig. 5-19 Simple PLC operation

In Fig. 5-19, a_1~a_7 and d_1~d_7 are the Acc time and Dec time in different stages. f_1~f_7 and T_1~T_7 will be defined in the following parameters.

Bi-direction open-collector output terminals Y1 and Y2 or the relay that output the 500ms pulse can indicate the completion of PLC operation, refer to the introductions of F7.10~F7.12.

F4.00 Simple PLC operation mode	Range: 0000~1123【0000】

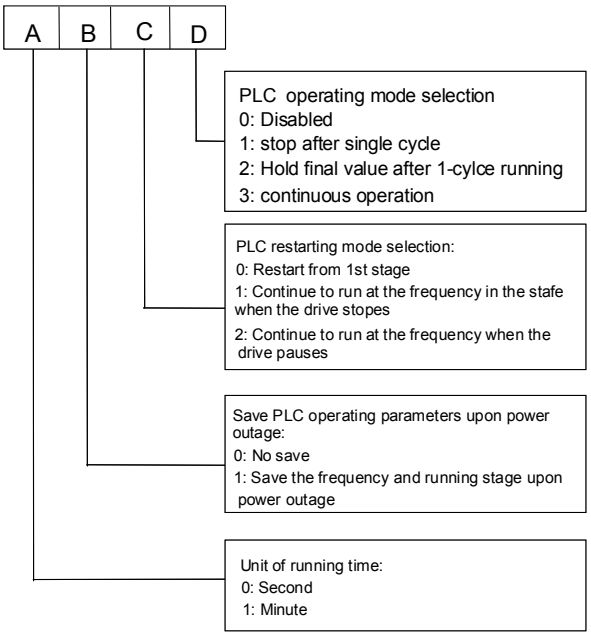


Fig. 5-20 Simple PLC operation mode

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place: PLC operation mode

0: disabled

PLC operation mode is disabled.

1: Stop after single cycle

As shown in Fig. 5-21, the drive stops automatically after one cycle of operation and will start when receiving RUN command again.

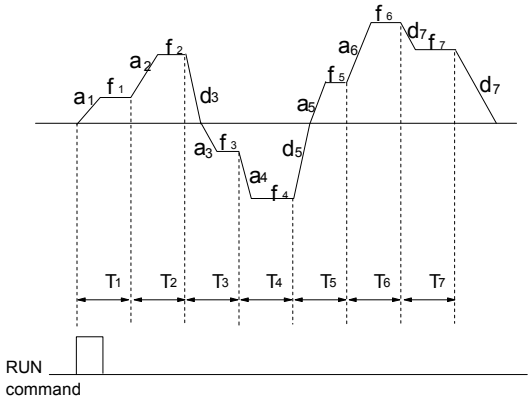


Fig. 5-21 Stop after single cycle of PLC

2: Hold the final value after single cycle of operation

As shown in Fig. 5-22, the drive will maintain the operating frequency and direction of last stage after completing one cycle of operation.

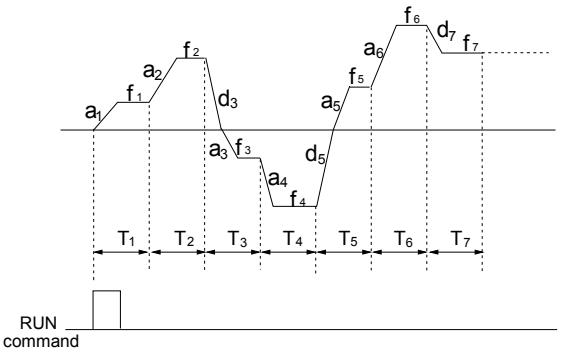


Fig. 5-22 Maintain the frequency after single cycle

3: Continuous operation

As shown Fig. 5-23, the drive will start next cycle of operation automatically after completing one cycle of operation until receiving STOP command.

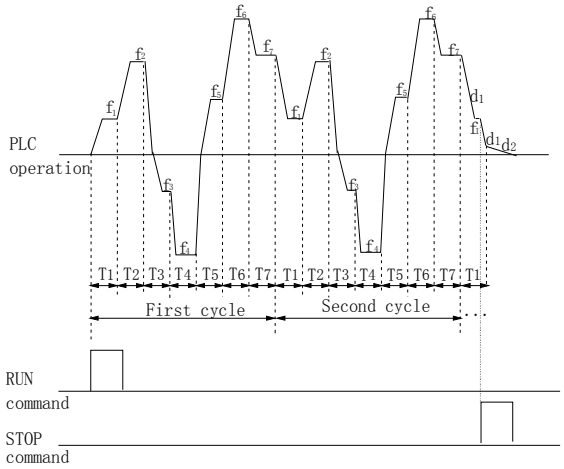


Fig. 5-23 Continuous operation of PLC

Tens' place: Restart after PLC operation pause

0: Operate from first cycle

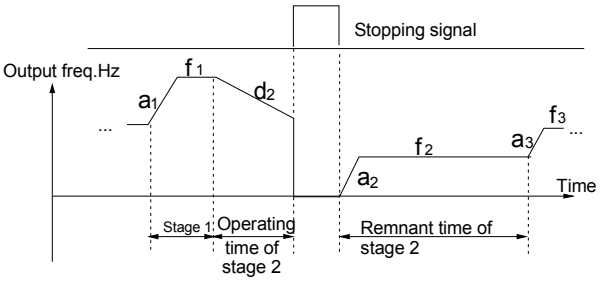
If the drive stops during PLC operation due to receiving STOP command, fault or power failure, it will run from the first stage after restarting.

1: Continue from the stage where the drive stops

When the drive stops during PLC operation due to receiving STOP command or fault, it will record the operating time and will continue from the stage where the drive stops after restart at the frequency defined for this stage, as shown in Fig. 5-24.

2: Continue to operate at the frequency when the drive stops

When the drive stops during PLC operation due to receiving STOP command or fault, it will record the operating time and the current frequency. It will continue running at the recorded frequency from the stage where it just stops upon restart, as shown in Fig. 5-24.

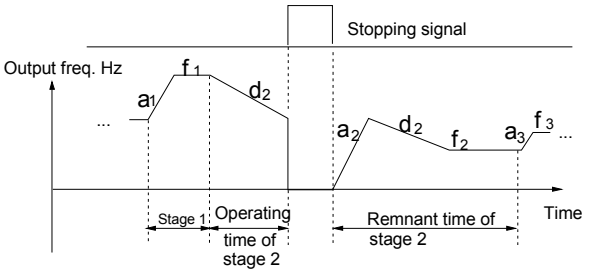


a 1: Acc time of stage 1
a 3: Acc time of stage 3
f 1: Freq. of stage 1
f 3: Freq. of stage 3
a 2: Acc time of stage 2
d 2: Dec time of stage 2
f 2: Freq. of stage 2

Fig. 5-24 PLC restart mode 1

Note:

The difference between mode 1 and mode 2 is that in mode 2, the drive can record the operating frequency when the drive stops and will run at the recorded frequency after restart.



a 1: Acc time of stage 1
a 3: Acc time of stage 3
f 1: Freq. of stage 1
f 3: Freq. of stage 3
a 2 : Acc time of stage 2
a 2 : Dec time of stage 2
f 2 : Freq. of stage 2

Fig. 5-25 PLC starting mode 2

Hundred's place: Store the PLC status after power failure

0: Not save

The drive does not save the PLC operating status after power failure and start operating in first stage after restart.

1: Save

Memorize the operating parameters of PLC operation after power failure, including the operating stage, operating frequency, and operating time. The drive will continue to operate in the mode defined by the ten's place.

Thousand's place: time unit

0: Second

1: Minute

This unit is only valid for defining the PLC operating time. The unit of Acc/Dec time in PLC operation is determined by F9.09.

Note:

1. The stage is ineffective if the time of this stage of PLC operation is set to 0.
2. PLC function can be paused, disabled, cleared the memorized parameters by terminals. Refer to group F7 parameters for function definition.

F4.01 Stage 1 setting	Range: 000~323【000】
F4.02 Time of stage 1	Range: 0~6500s(min)【20.0s】
F4.03 Stage 2 setting	Range: 000~323【000】
F4.04 Time of stage 2	Range: 0~6500s(min)【20.0s】
F4.05 Stage 3 setting	Range: 000~323【000】
F4.06 Time of stage 3	Range: 0~6500s(min)【20.0s】
F4.07 Stage 4 setting	Range: 000~323【000】
F4.08 Time of stage 4	Range: 0~6500s(min)【20.0s】
F4.09 Stage 5 setting	Range: 000~323【000】
F4.10 Time of stage 5	Range: 0~6500s(min)【20.0s】
F4.11 Stage 6 setting	Range: 000~323【000】
F4.12 Time of stage 6	Range: 0~6500s(min)【20.0s】
F4.13 Stage 7 setting	Range: 000~323【000】
F4.14 Time of stage 7	Range: 0~6500s(min)【20.0s】

F4.01, F4.03, F4.05, F4.07, F4.09, F4.11 and F4.13 are used to configure the operating frequency, direction and Acc/Dec time of each PLC operating stage. These functions are all selected by digits, as shown in Fig.5-26. The 7 stages of PLC can correspond to MS or close loop running.

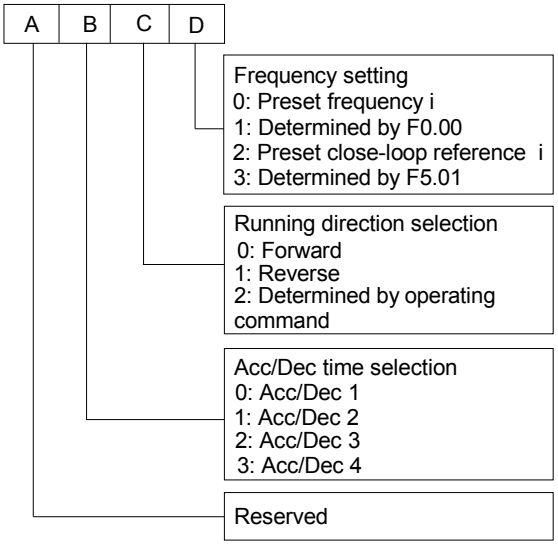


Fig. 5-26 Settings of PLC stage I (i=1~7)

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Units' place for setting stage i:

0: Select preset frequency i, for example: if i=3 stage 3 frequency is multistep reference 3. Please refer to F3.23~F3.29 for definitions of preset frequencies.

1: The frequency is determined by parameter F0.00

2: Preset close-loop reference i, for example: if i=2 stage 2 frequency is multistep close loop reference 2. Please refer to F5.20~F5.26 for definitions of preset close-loop reference.

3: Determined by Parameter F5.01

PLC can realize close-loop operation in a certain stage. Close-loop reference selectors can be preset close-loop reference i or determined by parameter F5.01; and the feedback is determined by F5.02. When the reference selector is determined by parameter F5.01, the terminals can be selected via preset close-loop reference. See F7.00~F7.07 and F5.20~F5.26 for details.

Note:

When the PLC operating direction is determined by operating commands, the direction of the motor can be controlled by external terminals. For example: to run forward by closing

FWD-COM terminal, and run reverse by closing REV-COM. If no command is given, the drive will run in the direction of last stage.

5.6 Close-loop Control Parameters (Group F5)

The analog close-loop control cable connection diagram is as shown in Fig. 5-27.

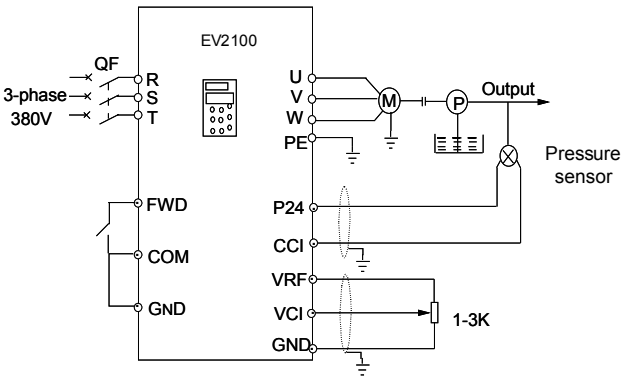


Fig. 5-27 Analog feedback control system with internal PI

Analog feedback control system:

An analog feedback control system uses a pressure sensor as the feedback sensor of the internal PI.

As shown in Fig. 5-27, pressure reference (voltage signal) is input via terminal VCI, while the feedback pressure value is input into terminal CCI in the form of 0(4)~20mA current signal. The reference signal and feedback signal are detected by the analog channel. The start and stop of the drive can be controlled by terminal FWD.

Note:

1. The reference can also be input via panel or serial port.

Operating principles of internal PI of the driver is shown in diagram below.

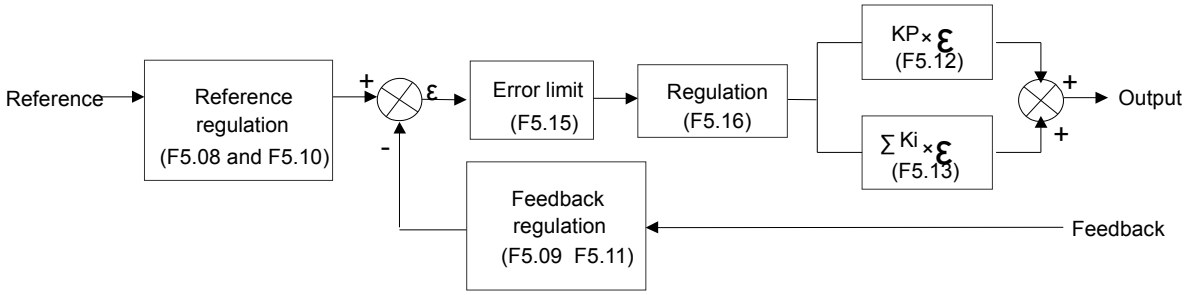


Fig. 5-28 PI control diagram

In the above Fig., KP: proportional gain; Ki: integral gain In Fig. 5-28, refer to F5.01~F5.15 for the definitions of close-loop reference, feedback, error limit and proportional and Integral parameters.

There are two features of internal PI of the drive:

The relationship between reference and feedback can be defined by F5.08~F5.11.

For example: In Fig. 5-27, if the reference is analog signal of 0~10V, the controlled value is 0~1MP, and the signal of pressure sensor is 4~20mA, then the relationship between reference and feedback is shown in Fig. 5-29.

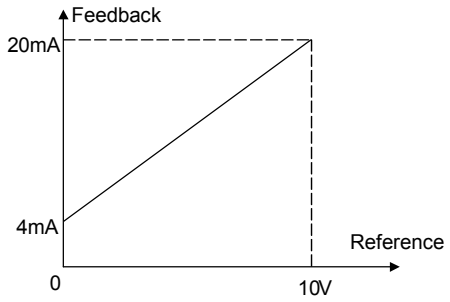


Fig. 5-29 Reference and feedback

The reference value is a 0~10V signal (10V corresponds to 100%); and the feedback value is 4mA~20mA (20mA corresponds to 100%).

In Fig 5-29, “reference regulation” and “feedback regulation” mean that the reference value and

feedback value are converted from current or voltage value to percentage values, so that feedback value can be added to or subtracted from the reference value.

Close-loop reference is selected via F5.16 to satisfy different application requirements.

If the motor's speed is required to increases with the reference speed, this kind of control characteristic is called positive characteristic. If the motor speed is required to decrease when the reference value increases, this control characteristic is called negative characteristic.

Please refer to Fig. 5-30 and F5.16.

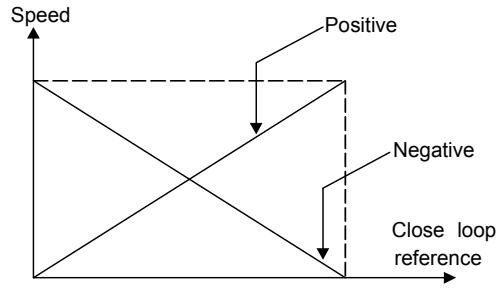


Fig. 5-30 Close-loop control characteristic

After the control type is determined, follow the procedures below to set close loop parameters.

① Determine the close-loop reference and feedback channel (F5.01 and F5.02);

② The relationship between close-loop reference and feedback value (F5.08~F5.11) should be defined for close-loop control;

③ Determine the close-loop regulation characteristic. If the reference increases and motor speed decreases, the close-loop is negative characteristic. (F5.16=1)

④ Set up the integral regulation function and close-loop frequency presetting function (F5.17~F5.19);

⑤ Adjust the close-loop filtering time, sampling cycle, error limit and gain (F5.12~F5.15).

F5.00 Close-loop control function	Range: 0, 1 【0】

0: disabled

1: enabled

F5.01 Reference selector	Range: 0, 1, 2【1】

0: digital input

Take the value of F5.05:

1: VCI analog voltage input (0~10V)

2: CCI analog input

Analog input range: 0~10V (Jumper CN10 is on side V), or 0~20mA (Jumper CN10 is onside I).

F5.02 Feedback selector	Range:0~5【1】

0: VCI 0~10V analog voltage input

1: CCI analog input

2: VCI＋CCI

3: VCI-CCI

4: Min {VCI, CCI}

5: Max {VCI, CCI}

Settings of jumper CCI are the same as above. When current input is selected, the signal will be converted into voltage signal by the formula:

Voltage value (V) = current value (mA)/2;

F5.03 Reference filter	Range:0.01~50.00s【0.50s】
F5.04 Feedback filter	Range:0.01~50.00s【0.50s】

Both the reference signal and feedback signal carry noise. These signals can be filtered by setting the time constant of filter (F5.03 and F5.04). The bigger the time constant, the better the immunity capability, but the response becomes slow. The smaller the time constant, the faster the response, but the immunity capability becomes weak.

F5.05 Digital setting of reference	Range:0.00~10.00V【0.00】

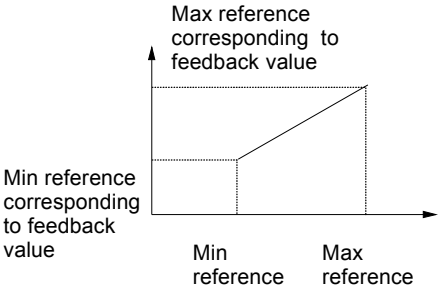
When analog feedback is used (F5.02=0~5), this function can realize digital setting of reference via panel or serial port.

F5.06~F5.07	Reserved

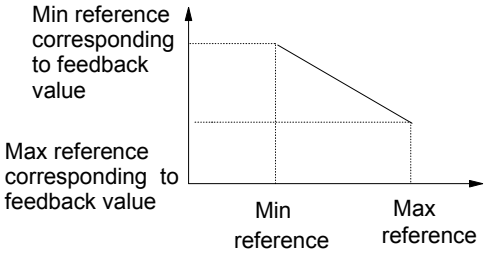
Reserved.

F5.08 Min reference	Range:0.0%~ F5.10【0.0%】
F5.09 Feedback value corresponding to the Min reference	Range:0.0~ 100.0%【20.0%】
F5.10 Max reference	Range:F5.08~ 100.0%【100.0%】
F5.11 Feedback value corresponding to the Max reference	Range:0.0~ 100.0%【100.0%】

F5.08~F5.11 define the relationship between the close-loop reference and feedback value. The setting is the ratio (percentage value) of input and feedback value to reference (10V or 20mA).



(1) Positive regulation of feedback



(2) Negative regulation of feedback

Fig. 5-31 Relationship between feedback and reference

F5.12 Proportional gain K_P	Range:0.000~9.999【0.050】
F5.13 Integral gain Ki	Range:0.000~9.999【0.050】
F5.14 Sampling cycle T	Range:0.01~50.00s【0.50s】

The bigger the proportional gain of K_P, the faster the response, but oscillation may easily occur.

If only proportional gain K_P is used in regulation, the error cannot be eliminated completely. To eliminate the error, please use the integral gain Ki to form a PI control system. The bigger the Ki, the faster the response, but oscillation may easily occur if Ki is too big.

The sampling cycle T refers to the sampling cycle of feedback value. The PI regulator calculates once in each sampling cycle. The bigger the sampling cycle, the slower the response.

F5.15 Error limit	Range:0.0~20%【2.0%】

It defines the max. deviation of the output from the reference, as shown in Fig. 5-18. PI regulator stops operation when the feedback value is within this range. Setting this parameter correctly is helpful to improve the system output accuracy and stability.

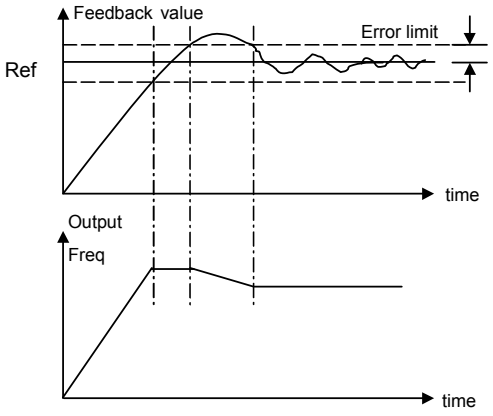


Fig. 5-18 Error limit

F5.16 Close-loop regulation characteristic	Range:0. 1【0】

0: Positive

Set F5.16 to 0 if the motor speed is required to be increased with the increase of the reference.

1: Negative

Set F5.16 to 1 if the motor speed is required to decrease with the increase of the reference.

F5.17 Integral regulation selection	Range: 0, 1【0】

0: Stop integral regulation if the frequency reaches the upper and lower limits

1: Continue the integral regulation if the frequency reaches the upper and lower limits

It is recommended to disable the continuing integral regulation for the system that requires fast response.

F5.18 Preset close-loop frequency	Range:0.00~600.00Hz【0.00Hz】
F5.19 Holding time of preset close-loop frequency	Range:0.0~3600s【0.00s】

This function can make the close-loop regulation enter stable status quickly.

If the close-loop function is enabled, the frequency will increase to the preset close-loop frequency (F5.18) within the Acc time, and then the drive will start close-loop operation after operating at the preset frequency for certain time(defined by F5.19).

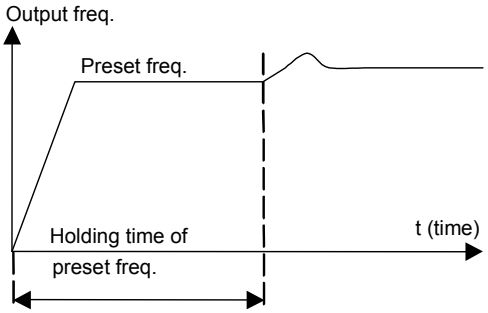


Fig. 5-33 Preset frequency of close-loop operation

Note:

You can disable the function by set both F5.18 and F5.19 to 0.

F5.20 Preset close-loop reference 1	Range:0.0~10.00V 【0.00V】
F5.21 Preset close-loop reference 2	Range:0.0~10.00V 【0.00V】
F5.22 Preset close-loop reference 3	Range:0.0~10.00V 【0.00V】
F5.23 Preset close-loop reference 4	Range:0.0~10.00V 【0.00V】
F5.24 Preset close-loop reference 5	Range:0.0~10.00V 【0.00V】
F5.25 Preset close-loop reference 6	Range:0.0~10.00V 【0.00V】
F5.26 Preset close-loop reference 7	Range:0.0~10.00V 【0.00V】

Among the close-loop reference selectors, besides the 3 selectors defined by F5.01, the voltage value defined by F5.20~F5.26 can also be used as the close-loop reference.

Voltage of preset close-loop reference 1~7 can be selected by terminals, refer to F7.00~F7.07 function 30~32 for details. These functions can also be used in conjunction with PLC operating functions, see introductions to group F4 parameters for details.

The priority preset close-loop reference control is higher than the reference selectors defined by F5.01.

5.7 Reserved (Group F6)

F6.00~F6.07	Reserved

Reserved.

5.8 Function of Terminals (Group F7)

F7.00 Multi-function terminal X1	Range:0~43【0】
F7.01 Multi-function terminal X2	Range:0~43【0】
F7.02 Multi-function terminal X3	Range:0~43【0】
F7.03 Multi-function terminal X4	Range:0~43【0】
F7.04 Multi-function terminal X5	Range:0~43【0】
F7.05 Multi-function terminal X6	Range:0~43【0】
F7.06 Multi-function terminal X7	Range:0~47【0】
F7.07 Multi-function terminal X8	Range:0~48【0】

The functions of multi-function input terminal X1~X8 are extensive. You can select functions of X1~X8 according to your application by setting F7.00~F7.07. Refer to Table 5-3.

Table 5-3 Multi-function input selection

Setting	Functions
0	No function
1	Preset frequency 1
2	Preset frequency 2
3	Preset frequency 3
4	Acc/Dec time 1
5	Acc/Dec time 2
6	External fault signal normally-open input
7	External fault signal normally-close input
8	RESET signal
9	Forward jog operation
10	Reverse jog operation
11	Coast-to-stop(FRS)
12	Frequency ramp up (UP)
13	Frequency ramp down(DN)
14	Pause the PLC operation
15	Acc/Dec prohibit
16	3-wire operation control
17	External interrupt signal normally-open input
18	External interrupt signal normally-close input
19	Reserved
20	Close-loop disabled
21	PLC disabled
22	Frequency selector 1
23	Frequency selector 2
24	Frequency selector 3
25	Frequency reference is input via terminal CCI
26	Reserved
27	Terminal control mode is enabled

Setting	Functions
28	Control channel selector 1
29	Control channel selector 2
30	Preset multistep close-loop reference 1
31	Preset multistep close-loop reference 2
32	Preset multistep close-loop reference 3
33	Reserved
34	Reserved
35	External stop command
36	Reserved
37	Drive operation prohibiting
38	Reserved
39	Reserved
40	Auxiliary reference frequency clearing
41	Reset PLC stopping status
42	Counter's zero-clearing signal input
43	Counter's trig signal input
44	Reserved
45	Pulse input
46	Single-phase speed measuring input
47	Speed measuring input SM1(only set for X7)
48	Speed measuring input SM2(only for X8)

Introductions to functions listed in Table 5-4:

1~3: multistep speed input terminal

Up to 8 speed references can be set through different ON/OFF combinations of terminals K_3, K_2 and K_1.

Table 5-4 On/Off combinations of terminals

K_3	K_2	K_1	Frequency setting
OFF	OFF	OFF	Common operating frequency
OFF	OFF	ON	Preset frequency 1
OFF	ON	OFF	Preset frequency 2
OFF	ON	ON	Preset frequency 3
ON	OFF	OFF	Preset frequency 4
ON	OFF	ON	Preset frequency 5
ON	ON	OFF	Preset frequency 6
ON	ON	ON	Preset frequency 7

The reference frequency will be used in MS speed operation and simple PLC operation. Take MS speed operation for example:

Definitions of terminals X1, X2 and X3:

After setting F7.00 to 1, F7.01 to 2 and F7.03 to 3, terminals X1, X2 and X3 can be used in MS speed operation, as shown in Fig. 5-194.

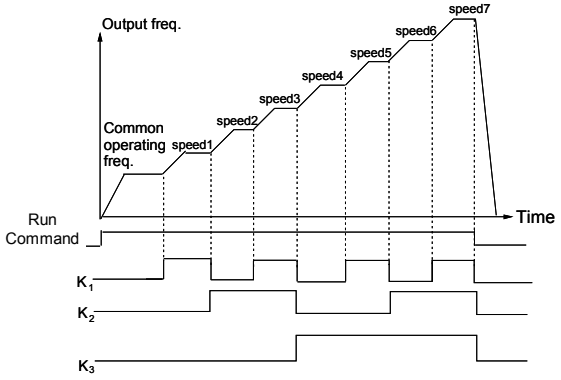


Fig. 5-194 Multi-step operation

In Fig. 5-35, terminal control is selected. The operating direction can be controlled by K_4 and K_5. Common operating frequency and preset frequency 1~7 can be selected through different On/Off combinations of K_1, K_2 and K_3.

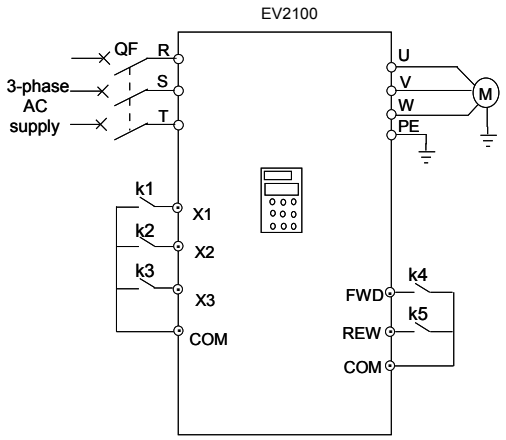


Fig. 5-35 Wiring for multi-speed operation

4~5: selecting Acc/Dec time

Table 5-5 Acc/Dec time selection

Terminal 2	Terminal 1	Acc/Dec time selection
OFF	OFF	Acc time 1/Dec time 1
OFF	ON	Acc time 2/Dec time 2
ON	OFF	Acc time 3/Dec time 3
ON	ON	Acc time 4/Dec time 4

Through the On/Off combinations of terminals, Acc/Dec time 1~4 can be selected.

6~7: external fault signal input (normally-open/close input)

If the setting is 6~7, the fault signal of external equipment can be input via the terminal, which is convenient for the drive to monitor the external equipment. Once the drive receives the fault signal, it will display "E015". The fault signal has

two inputting modes: normally-open and normally-close input.

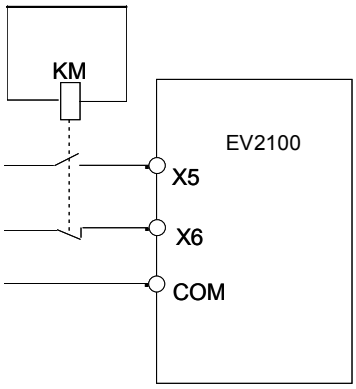


Fig. 5-36 Normally-open/close input

As shown in Fig. 5-36, X_5 is normally-open contact and X_6 is normally-close command. KM is the relay for inputting external fault signal.

8: external reset signal input

If the setting is 8, the drive can be reset via this terminal when the drive has a fault. The function of this terminal is the same with that of RESET on the panel.

9~10: jog operation signal input (JOGF/JOGR)

If the setting is 9~10, this terminal can enable jog operation. JOGF is for inputting forward jog command and JOGR is for reverse jog command. Jog frequency, interval and Acc/Dec time of jog operation are defined in F3.13~F3.16.

11: Coast-to-stop

If the setting is 11, the function of the terminal is the same with that defined by F2.08. It is convenient for remote control.

12~13: Frequency ramp UP/DN

If the setting is 12~13, the terminal can be used to increase or decrease frequency. Its function is the same with ▲ and ▼ keys on the panel, which enables remote control. This terminal is enabled when F0.00=1 or F9.01=2. Increase or decrease rate is determined by F7.09.

14: Pausing PLC operation:

If the setting is 14, the terminal is used to pause the PLC operation and the drive operates at zero frequency when the terminal is enabled. There is no timing of PLC operation. If the terminal is disabled, the drive will start on the fly and continue the PLC operation. Refer F4.00~F4.14 to how to use this terminal.

15: Acc/Dec prohibiting command

If the setting is 15, the terminal can make the motor operate at present speed without being influenced by external signal (except stopping command).

> 🕮 **Note:**
>
> This terminal is disabled in normal Dec-to-stop process.

16: 3-wire operation control.

Refer to F7.08, operation mode 2 and 3 (3-wire operation mode 1 and 2).

17~18: external stopping signal input (Normally-open/close input)

During operating, the drive stops its output and operates at zero frequency when it receives external STOP signal. Once the signal is removed, the drive will start on the fly and resume normal operation.

There are two inputting modes of external stopping signal: normally-open and normally-close input. As shown in Fig. 5-36, X_5 is normally-open contact and X_6 is normally-close contact.

> 🕮 **Note:**
>
> Different with No. 6~7 functions, the external stopping signal will not trigger alarm and the drive can resume normal operation after the signal is removed.

19: Reserved

20: Disabling close-loop function

If the setting is 20, the terminal can be used to realize the flexible switching between close-loop operation and low level operating mode (refer to section 4.1.4 for details).

> 🕮 **Note:**
>
> The switching between operation modes is enabled only in close-loop operation (F5.00=1).

When the drive is switched to low level operating mode, its start/stop, operating direction, ACC/Dec time should be compliant with corresponding operating modes.

21: Disabling PLC

If the setting is 21, the terminal is used to realize the flexible switching between PLC operation and low level operating mode.

> 🕮 **Note:**
>
> The switching between operation modes can be enabled only in PLC operation (unit's place of F4.00 is not 0).

When the drive is switched to low level operating mode, its start/stop, operating direction, ACC/Dec time should be compliant with corresponding operating modes accordingly.

22~24: Terminals 1~3 for reference frequency selector.

Different ON/OFF combinations of terminals 1, 2 and 3 can select different reference frequency selectors as shown in Table 5-6. The drive will act to the command from the terminal or F0.00, whichever comes late.

Table 5-6 Frequency selector

Terminal 3	Terminal 2	Terminal 1	Freq. selector
OFF	OFF	OFF	Hold the setting
OFF	OFF	ON	Digital setting 1
OFF	ON	OFF	Digital setting 2
OFF	ON	ON	Digital setting 3
ON	OFF	OFF	VCI analog input
ON	OFF	ON	CCI analog input
ON	ON	OFF	PULSE terminal input
ON	ON	ON	PULSE terminal input

25: Frequency reference is input via terminal CCI forcibly

If the setting is 25, the frequency reference will be input via terminal CCI forcibly. The frequency selector will be changed to the previous one if this terminal function is disabled.

26: Reserved

27: Terminal control mode is forcibly enabled

When this terminal function is enabled, the operating command is input through this terminal forcibly, and the drive will be controlled in previous control mode if FWD/REV terminal function is disabled.

28~29: On/Off combinations of terminals 1 and 2 for different control modes selection

Table 5-7 Control modes

Terminal 2	Terminal 1	Control modes
OFF	OFF	Hold the control mode
OFF	ON	Panel control mode
ON	OFF	Terminal control mode
ON	ON	Serial port control mode

The control modes can be selected by the different On/Off combinations of terminals 1 and 2.

30~32: Selecting preset close-loop reference frequencies via On/Off combinations of terminals 1~3.

Table 5-8 Preset close-loop reference selection

Terminal 3	Terminal 2	Terminal 1	Preset close-loop reference selection
OFF	OFF	OFF	Close-loop reference is decided by F5.01
OFF	OFF	ON	Preset close-loop reference 1
OFF	ON	OFF	Preset close-loop reference 2
OF	ON	ON	Preset close-loop reference 3
ON	OFF	OFF	Preset close-loop reference 4
ON	OFF	ON	Preset close-loop reference 5
ON	ON	OFF	Preset close-loop reference 6
ON	ON	ON	Preset close-loop reference 7

The preset close-loop references in Table 5-10 can be selected by the different On/Off combinations of terminals 1~3.

33~34: Reserved

35: External stopping command

This stopping command is active in all control modes. When terminal 35 is enabled, the drive will stop in the mode defined in F2.08.

36: Reserved

37: Disabling the drive's operation

If terminal 37 is enabled, the drive that is operating will coast to stop and is prohibited to restart. This function is mainly used in application with requirements of safety protection.

38: Reserved

39: Reserved

40: Clear the setting of auxiliary reference frequency

This function is only active for auxiliary reference frequency (F9.01=1, 2 and 3). When terminal 40 is enabled, the auxiliary frequency is cleared to zero and the reference is determined by main reference frequency.

41: Reset the stopping status of PLC operation

In stopping status of PLC operation, the memorized PLC operating information (operating stage, operating time, operating frequency, etc.) will be cleared when this terminal is enabled. See Group F4 parameters.

42: Clearing the counter to zero

When the setting is 42, this terminal is used to clear the counter to zero in conjunction with terminal 43.

43: Counter triggering signal input

When the setting is 43, this terminal is used to input pulse signal to the internal counter of the drive. The highest pulse frequency is 200Hz. The present counting value can be saved at power off. See F7.33 and F7.34 for details.

44: Reserved

45: pulse signal input

Only valid for multi-function input terminals X7 and X8. The terminal is used to input pulse signal as frequency reference. See Group F1 parameters for the relationship between input pulse frequency and the reference frequency.

46: Single-phase speed measuring input

Only valid for multi-function input terminals X7 and X8. See section 3.3.2 for input characteristic instruction. The speed control accuracy is ±0.1%. Single-phase speed feedback control can be realized by using this terminal and PG.

47: Speed measuring input SM1

48: Speed measuring input SM2

Only valid for multi-function input terminals X7 and X8. See section 3.3.2 for input characteristic instruction. The speed control accuracy is ±0.1%. Dual-phase speed feedback control can be realized by using this terminal and PG.

Note:

When the drive is performing motor auto-tuning, No. 45~47 functions of X7 are disabled automatically.

F7.08 FWD/REV operating modes setup	Range:0~3【0】

This parameter defines four operating modes controlled by external terminals.

0: 2-wire operating mode 1

K_2	K_1	Running command
0	0	Stop
1	0	Run reverse
0	1	Run forward
1	1	Stop

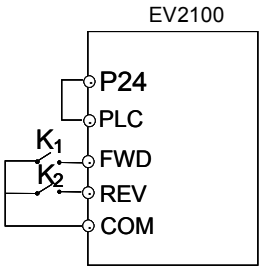


Fig. 5-37 2-wire operating mode 1

1: 2-wire operating mode 2

K_2	K_1	Running command
0	0	Stop
1	0	Stop
0	1	Run forward
1	1	Run reverse

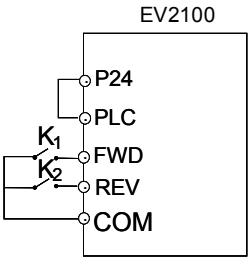


Fig. 5-38 2-wire operating mode 2

2: 3-wire operating mode 1

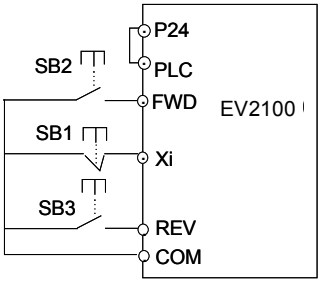


Fig. 5-39 3-wire operating mode 1

Where:

SB1: Stop button

SB2: Run forward button

SB3: Run reverse button

Terminal Xi is the multi-function input terminal of X_1~X_8. At this time, the function of this terminal

should be defined as No.16 function of “3-wire operation”.

3: 3-wire operation mode 2

K	Running direction
0	Forward
1	Reverse

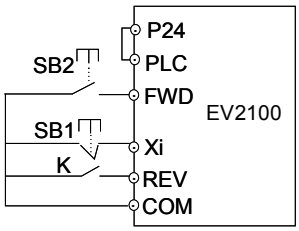


Fig. 5-40 3-wire operating mode 2

Where:

SB1: Stop button

SB2: Run button

Terminal Xi is the multi-function input terminal of X_1~X_8. At this time, the function of this terminal should be defined as No.16 function of “3-wire operation”.

> **Note:**
>
> In terminal control mode, for 2-wire operating mode 1 and 2, although the terminal is enabled, the drive will not run forward or reverse when the drive stops due to the STOP command from terminal function 11 or 35 (see F7.00~F7.07), PLC stop after single cycle, stop due to the arrival of fixed length, pressing STOP key. If you need to start the drive again, enable FWD/REV again. However, when the drive stops due to a fault, it will start immediately if the terminal FWD/REV is enabled and the fault is cleared.

F7.09 UP/DN rate	Range:0.01~99.99Hz/s 【1.00Hz/s】

F7.09 is used to define the change rate of reference frequency that is changed by terminal UP/DN.

F7.10 Bi-direction open-collector output terminal Y1	Range:0~17 【0】
F7.11 Bi-direction open-collector output terminal Y2	Range:0~17 【1】
F7.12 Output functions of relay	Range:0~17 【16】

Refer to *Section 3.3.2 Wiring of Control Circuit* for the output characteristics of Y1 and Y2 that are bi-direction open-collector output terminal and the relay’s output terminal. Table 5-9 shows the functions of the above 3 terminals. One function can be selected repeatedly.

Table 5-9 Functions of output terminals

Setting	Function
0	Drive running signal (RUN)
1	Frequency arriving signal (FAR)
2	Frequency detection threshold (FDT1)
3	Frequency detection threshold (FDT2)
4	Overload signal (OL)
5	Low voltage lock-up signal (LU)
6	External fault stop command (EXT)
7	Upper limit of frequency (FHL)
8	Lower limit of frequency (FLL)
9	Zero-speed running
10	Completion of simple PLC operation
11	PLC cycle completion indication
12	Preset counting value arriving
13	Specified counting value arriving
14	Preset operating time arriving indication
15	Drive ready (RDY)
16	Drive fails
17	Extended function 1 of host

In Table 5-9:

0: Drive running signal (RUN)

When the drive is in operating status, there will be running indication signal output by this terminal.

1: Frequency arriving signal (FAR)

See F7.13.

2: Frequency detection threshold (FDT1)

See F7.14~F7.15.

3: Frequency detection threshold (FDT2)

See F7.16~F7.17.

4: Overload signal (OL)

The terminal outputs the indicating signal if the drive’s output current is higher than the value defined by FL.05 and the overload time is longer than the time defined by FL.06. This function is usually used in overload pre-alarm. See Fig. 5-66.

5: Low voltage lock-up signal (LU)

The terminal outputs the indicating signal if the DC bus voltage is lower than the low voltage limit, and the LED displays “P.oFF”.

6: External stopping command (EXT)

The terminal outputs the indicating signal if the drive outputs tripping signal caused by external fault (E015).

7: Upper limit of frequency (FHL)

The terminal outputs the indicating signal if the preset frequency is higher than upper limit of frequency and the operating frequency reaches the upper limit of frequency.

8: Lower limit of frequency (FLL)

The terminal outputs the indicating signal if the preset frequency is lower than lower limit of frequency and the operating frequency reaches the lower limit of frequency.

9: Zero-speed running

The terminal outputs the indicating signal if the drive's output frequency is 0 and the drive is in operating status.

10: Completion of simple PLC operation

The terminal outputs the indicating signal (single pulse signal, 500ms width) if the present stage of PLC operation is finished.

11: PLC cycle completion indication

The terminal outputs the indicating signal (signal pulse, 500ms width) if one cycle of PLC operation is finished.

12: preset counting value arriving

13: specified counting value arriving

Refer to F7.33~F7.34 for terminals 12 and 13.

14: preset operating time arriving indication The terminal outputs the indicating signal if the drive's total operating time (Fn.01) reaches preset operating time (Fn.00).

15: drive ready (RDY)

If RDY signal is output, it means the drive has no fault, DC bus voltage is normal, stop command is disabled and it can receive starting command.

16: Drive fails

The terminal outputs the indicating signal if the drive has faults.

17: extended function 1 of host

The output signal of terminal Y1, Y2 or TC is directly controlled by a serial port. Refer to the communicating protocol of the drive.

F7.13 Range of frequency arriving signal (FAR)	Range:0.00~600.00Hz 【2.50Hz】

As shown in Fig. 5- 41 if the drive's output frequency is within the detecting range of preset frequency, a pulse signal will be output.

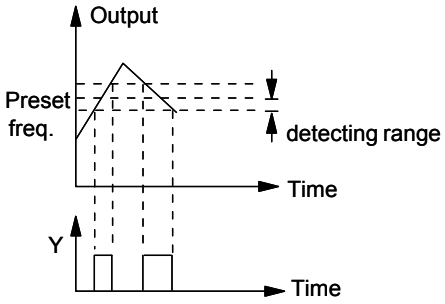


Fig. 5-41 Frequency arriving signal

F7.14 FDT1 level	Range: 0.00~600.00Hz【50.00Hz】
F7.15 FDT1 lag	Range: 0.00~600.00Hz【1.00Hz】
F7.16 FDT2 level	Range: 0.00~600.00Hz【25.00Hz】
F7.17 FDT2 lag	Range: 0.00~600.00Hz【1.00Hz】

F7.14~F7.15 is a complement to the No.2 function in Table 5-9. F7.16~F7.17 is a complement to the No.3 function in Table 5-9. Their functions are the same. Take F7.14~F7.15 for example: when the drive's output frequency reaches a certain preset frequency (FDT1 level), it outputs an indicating signal until its output frequency drops below a certain frequency of FDT1 level (FDT1 level-FDT1 lag), as shown in Fig. 5-202.

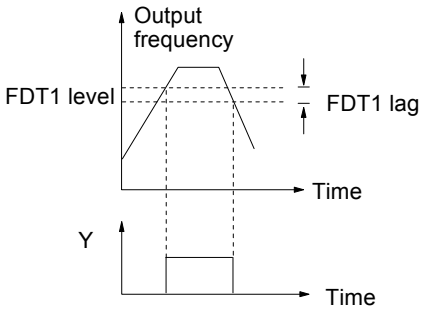


Fig. 5-202 FDT level

F7.18~F7.25	Reserved

Reserved.

F7.26 Functions of terminal AO1	Range:0~11【0】
F7.27 Functions of terminal AO2	Range:0~11【3】
F7.28 Functions of terminal DO	Range:0~11【0】

AO1 and AO2 are analog output terminals, and DO is pulse output terminals.

Refer to section 3.3.2 Wiring of Control Circuit for the output characteristics of AO1 and AO2, their analog output ranges are defined by F7.29.

Pulse frequency range of DO: 0~Max output pulse frequency (defined by F7.32).

The relationship between the displaying range and the output values of AO1, AO2 and DO are given in Table 5-10.

Table 5-10 Displaying range of output terminals

Setting	Functions	Range
0	Output frequency before slip compensation	0~Max output frequency
1	Output frequency after slip compensation	0~Max output frequency
2	Preset frequency	0~Max output frequency
3	Output current	0~2 times of drive's rated current
4	Output current	0~2 times of motor's rated current
5	Output torque	0~2 times of motor's rated torque
6	Output voltage	0~1.2 times of drive's rated voltage
7	Bus voltage	0~800V
8	VCI	0~10V
9	CCI	0~10V/0~20mA
10	Output power	0~2 times of rated power
11	Extended function of host 2	0~65535

If the extended function 2 of host 2 is enabled, the output signal of terminal Y1, Y2 or TC is directly controlled by a serial port. "65535" corresponds to the Max output of 10V (or 20mA). Refer to the communication protocol of the drive for details.

For example:

AO1 outputs 4~20mA, which indicates bus voltage 0~800V.

The settings:

①F7.26=7, output bus voltage;

②F7.29=01, output of terminal AO1 is 4~20mA;

③F7.30=100%, output gain is 100%;

④AO1 jumper of CN16 short circuited at 0/4-20mA side.

> 🕮 **Note:**
>
> If terminal X8 selects functions of 44~46, DO is disabled automatically

F7.29 Analog output range selection	Range:00~11【00】

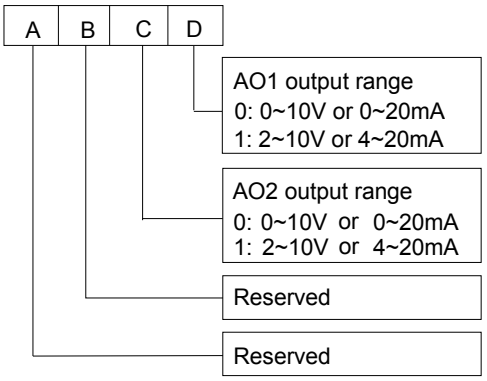


Fig. 5-43 analog output offset settings

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

F7.29 is used to select analog output ranges of AO1 and AO2.

F7.30 Output gain of AO1	Range:0.0~200.0%【100.0%】
F7.31 Output gain of AO2	Range:0.0~200.0%【100.0%】

As to the analog output of AO1 and AO2, you can adjust the output gain to change the measuring range or calibrate the meter.

> 🕮 **Note:**
>
> Changing the settings of F7.30 and F7.31 will influence the analog output.

F7.32 Maximum output frequency of DO	Range:0~50.0kHz【10.0KHz】

F7.32 defines the permissible maximum frequency of DO, refer to F7.28.

F7.33 Preset counting value	Range: F7.34~9999【0】
F7.34 Specified counting value	Range: 0~F7.33【0】

F7.33 and F7.34 are complements for No. 12 and 13 functions in Table-5-9.

It defines after Xi receives the number of pulse F7.33, the relay or Yi (bi-direction open-collector output terminal) will output an indicating signal.

For example: as shown in Fig. 5-44, when the eighth pulse signal is received by terminal Xi, Y1 outputs an indicating signal. At this time F7.33=8.

When Xi receives the number of pulse F7.34, Yi will give a signal which will last until F7.33 arrives.

As shown in Fig. 5-44, when Xi receives the 5th pulse, Y2 outputs an indicating signal. It lasts until X1 receives the 8th pulse. In this case, F7.34=5, F7.33=8. F7.34 is invalid if it is bigger than F7.33.

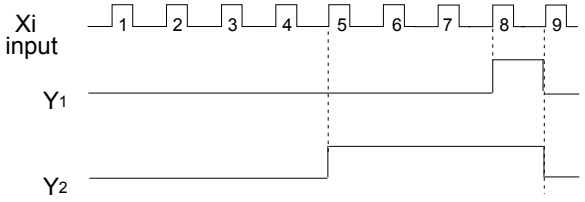


Fig. 5-44 Preset and specified pulse number

F7.35 Terminal's positive and negative logic	Range:000~FFF【000】

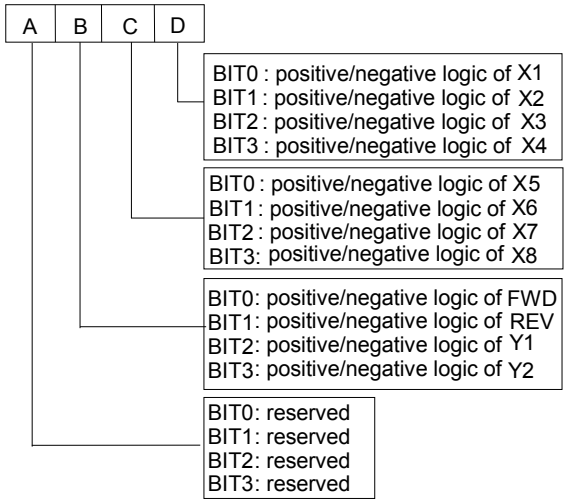


Fig. 5-45 Terminal's positive and negative logic

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

F7.35 defines the terminal's positive and negative logic

Positive logic: Terminal Xi is enabled if it is connected to the common terminal; disabled if it is disconnected to the common terminal.

Negative logic: Terminal Xi is disabled if it is connected to the common terminal; enabled if it is disconnected to the common terminal.

If the bit is set at 0, it means positive logic; if set at 1, it means negative logic.

For example:

If X1~X8 are required to be positive logic, terminals FWD and REV are required to be negative logic, terminal Y1 is positive logic and terminal Y2 is negative logic, then the settings:

Logic status of X4~X1 is 0000, and the hex value is 0, display of LED unit's place is 0; Logic status of X8~X5 is 0000, and the hex value is 0, display of LED ten's place is 0; Logic status of Y2, Y1, REV and FWD is 1011, and the hex value is B, display of LED hundred's place is 0, so F7.35 should be set at "0B00". Refer to Table 5-11.

Table 5-11 Conversion of binary code and hex value

Binary settings				Hex value (Displaying of LED)
Bit3	Bit2	Bit1	Bit0	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

Note:

Default setting of all the terminals is positive logic.

5.9 Display (Group F8)

F8.00 Language selection	Range:0~1【0】

0: Chinese

1: English

F8.00 is only valid for LCD panel.

F8.01 Displayed parameter group 1 during operation	Range:000~3FFH 【3FFH】

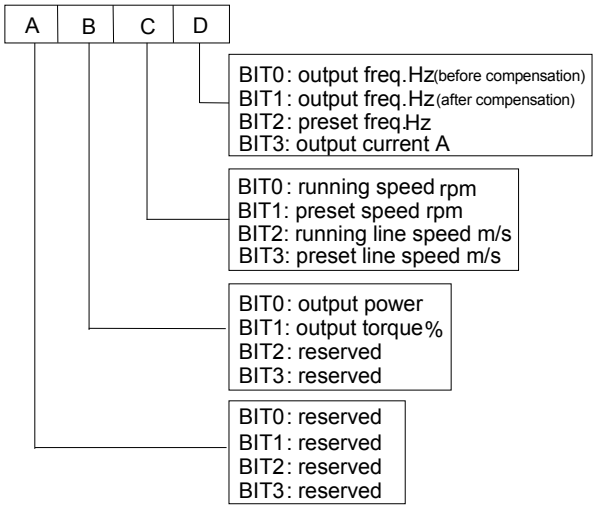


Fig. 5-46 LED displayed parameter group 1 in operation

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

F8.01 and F8.02 define the parameters that can be displayed by LED in operating status.

If Bit is 0, the parameter will not be displayed;

If Bit is 1, the parameter will be displayed.

For example, Unit place of LED (Bit0) is to display the "output frequency before compensation", if Bit0=0, the parameter will not be displayed, if Bit0=1, the parameter will be displayed.

See F7.35 for the relationship between the values of each Bit and the displayed value of LED.

F8.02 Displayed parameter group 2 during operation	Range:000~0FFH 【000H】

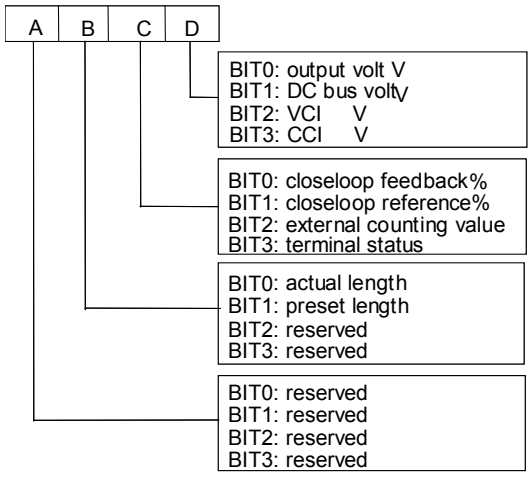


Fig. 5-47 Operating parameter 2 displayed by LED

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

The displayed terminal information includes status of terminal X1~X8, bi-direction open-collector output terminals Y1 and Y2, and relay output terminal TC. The status of terminals are indicated by the "On" or "Off" of LED. If the LED turns on, that means the terminal is enabled, and the terminal is disabled if the LED turns off, as shown in Fig.5-48:

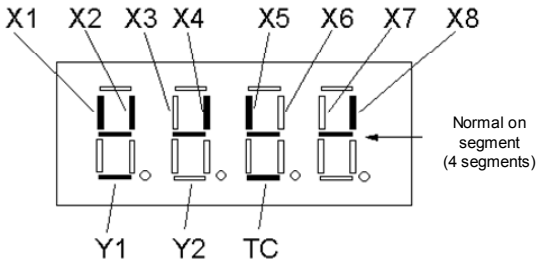


Fig. 5-48 Terminal status

In Fig.5-48, the LEDs display that terminals X1, X2, X4, X5 and X8 are enabled, terminals X3, X6 and X7 are disabled, terminals Y1 and TC are enabled and terminal Y2 is disabled. The central four LEDs are always on for the convenience of observation.

Note:

When the rotating speed and line speed are displayed, these values can be revised by

pressing ▲ and ▼ directly (no need to switch to frequency displaying status).
When F8.01 and F8.02 are all set to 0, the frequency before compensation will be displayed.
Press ▶▶ key to scroll through the parameters during operation.

F8.03 Parameters displayed at STOP state	Range:0000~0FFFH【1FFH】

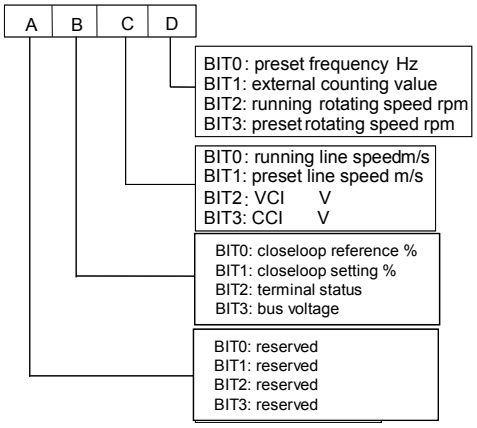


Fig. 5-49 Stopping parameters displayed by LED

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

F8.03 defines the parameters that can be displayed by LED in STOP status.

If Bit is 0, the parameter will not be displayed,

if Bit is 1, the parameter will be displayed.

For example, Bit0 decides whether to display the "preset frequency", if Bit0=0, the parameter will not be displayed, if Bit0=1, the parameter will be displayed.

When setting this parameter, see Table 5-12 for conversion of binary code and HEX value.

Note:

When the rotating speed and line speed are displayed, these values can be revised by pressing ▲ and ▼ directly (no need to change to frequency displaying status).
When the setting of F8.03 is 0, the preset frequency will be displayed.

Press ▶▶ key to scroll through the parameters set when the drive stops.

F8.04 Rotating Speed display coefficient	Range:0.1~999.9%【100.0%】

F8.04 is used to correct the error of displayed rotating speed and it has no influence on actual speed.

F8.05 Line speed display coefficient	Range:0.1~999.9%【1.0%】

F8.05 is used to correct the error of displayed line speed and it has no influence on actual speed.

F8.06 Close-loop analog parameter display coefficient	Range:0.1~999.9%【100.0%】

F8.06 is used to correct error between actual physical value (pressure or flow) and reference or feedback values (voltage or current). It has no influence on close-loop PI regulation.

5.10 Enhanced Functions (Group F9)

F9.00 Control mode bundled with frequency selector	Range:000~666【000】

F9.00 can bundle 3 control modes with 6 reference frequency selectors, that is, if a control mode is selected, then a frequency selector (such as panel input, analog VCI input) will be selected automatically.

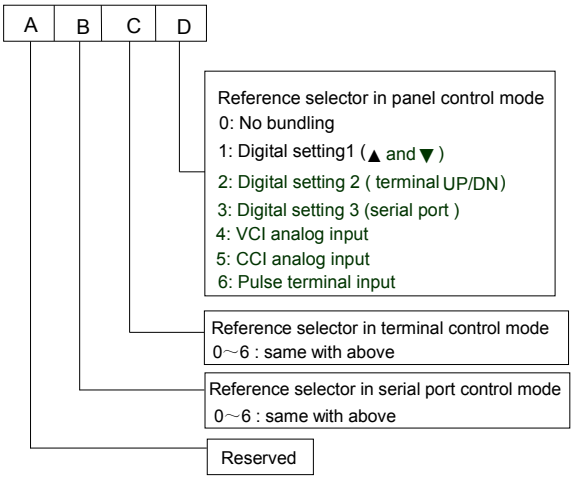


Fig. 5-210 Control mode is bundled to frequency selector

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

The reference frequency selector is defined by F0.00, see *Section 5.1 Basic Operating Parameters (Group F0)* for details.

Different control modes can be bundled to one reference frequency selector.

Synchronic switch with bundled mould can be realized by following method:

Method 1: change F0.03 “Control modes selector”;

Method 2: use PANEL/REMOTE or ENTER/DATA;

Method 3: use the terminals that can select control modes (Functions of terminals X1~X8 should be set to No. 28 and 29 functions.)

For example:

In order to realize remote and local control, it requires that:

①Control modes selection: The control modes can be selected by terminal remotely or by PANEL/REMOTE locally;

②If panel control mode is used, press RUN to run the drive and press STOP to stop the drive. The preset frequency can be adjusted by pressing ▲ and ▼.

③If terminal control mode is used, connect FWD terminal to run forward and connect REV terminal to run reverse. The preset frequency is adjusted via VCI.

④Terminal control mode is enabled after the drive is switched on.

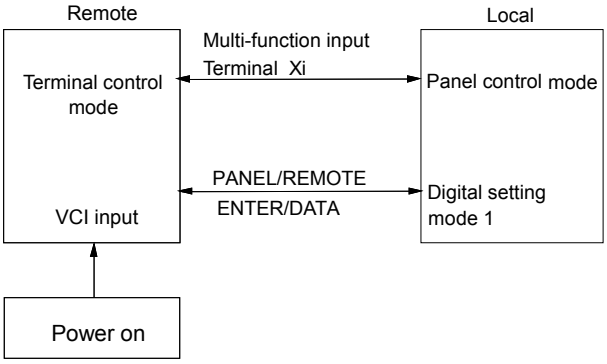


Fig. 5-51 Remote and local control

Set the parameters below to realize remote and local control:

Set F0.03=1 to select terminal control mode and remote control is enabled after the drive is switched on;

Set F7.00=28, F7.01=29, to select multi-function input terminal X1 and X2 to input operating commands;

Set F7.08=1, to select 2-wire control mode 2. The drive run forward when FWD is enabled, and run reverse when REV is enabled;

Set F9.07=020 to enable PANEL/REMOTE;

Set F9.00=041, then terminal control mode is bundled to VCI analog reference, and the panel control mode is bundled to digital reference setting 1.

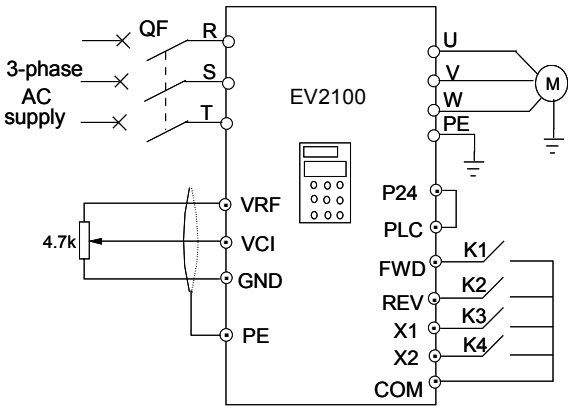


Fig. 5-52 Remote and local control connection

Note:

The parameter is default 000, that is, the frequency selector is not bundled with control mode.

F9.01 Auxiliary reference frequency selector	Range: 0~12【0】
F9.02 Auxiliary analog reference frequency coefficient	Range: 0.00~9.99【1.00】
F9.03 Initial auxiliary digital reference frequency	Range: 0.00~600.0Hz【0.00Hz】
F9.04 Auxiliary digital reference frequency control	Range: 000~111【000】

The preset frequency of the driver is calculated based on the main reference frequency and auxiliary reference frequency. F9.01~F9.04 define the auxiliary reference frequency selector. Fig. 5-53 shows the process of operation.

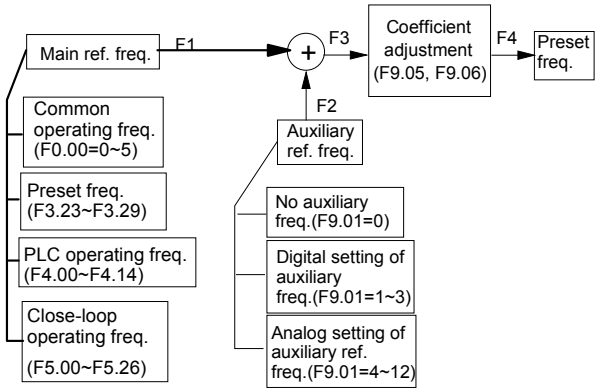


Fig. 5-53 Preset frequency

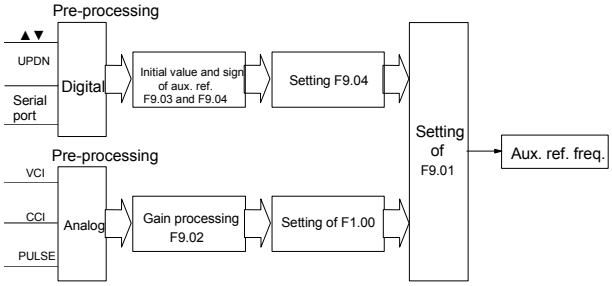


Fig. 5-54 Auxiliary reference frequency selector

Auxiliary reference frequency is controlled by F9.01~F9.04. F9.01 defines the auxiliary reference frequency selector.

Table 5-12 Auxiliary reference frequency selector

SN	Reference selector	Features
0	No auxiliary reference frequency	Zero
1	Digital setting 1, set the reference by ▲ and ▼	Reference is set by F9.03, base on F9.04 setting up the changed frequency will be saved in F9.03 upon power outage.
2	Digital setting 2, set the reference by terminal UP/DN	
3	Digital setting 3, set the reference by serial port	
4	VCI analog input	Determined by actual input analog value, see F1.00 for frequency curves
5	CCI analog input	
6	PULSE terminal input	
7	- VCI analog input	
8	- CCI analog input	
9	- PULSE terminal input	
10	VCI-5	Determined by actual input analog value, see F1.00 for frequency curves
11	CCI-5	
12	PULSE-0.5×F1.03	

If digital setting 3 is selected, and the frequency reference is input via the serial port, then the auxiliary frequency can be changed by setting F9.03 through the host.

When selecting VCI-5 or CCI-5 to input auxiliary reference frequency, the 5V analog input should be used as a central point, from 0 to 5V, the reference frequency drops with the increase of voltage, while from 5 to 10V, the frequency increases with voltage. For example, as shown in Fig. 5-55:

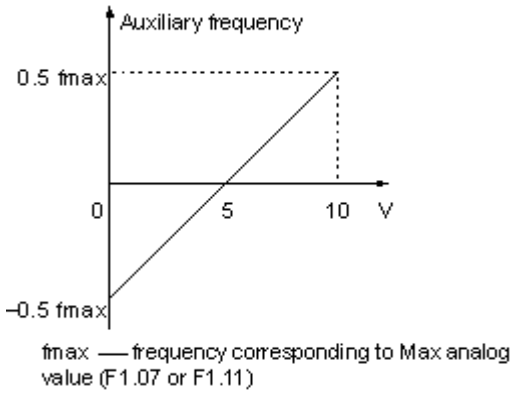


Fig. 5-55 VCI-5/CCI-5 as auxiliary ref. setting method

When using PULSE-0.5×F1.03 to determine auxiliary reference frequency, one half of F1.03 (Max pulse input frequency) is the central point. Within 0~0.5×F1.03 pulse frequency, the reference frequency decreases with the increase of pulse frequency; within 0.5×F1.03~F1.03, the reference frequency increases with pulse frequency. For example, as shown in Fig. 5-56:

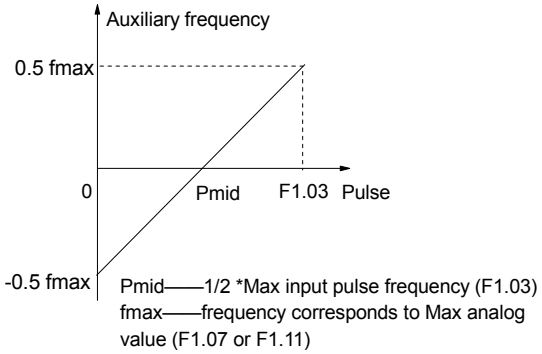


Fig. 5-56 PULSE-0.5×F1.03 as auxiliary ref. setting method

F9.02: Coefficient of analog auxiliary reference

Only valid when F9.01=4~12. First, use F9.02 to calculate the gain and then calculate the auxiliary reference frequency by the frequency curve defined by F1.00.

F9.03: initial value of digital reference frequency

Only valid when F9.01=1~3. F9.03 defines the initial values of digital reference frequency when F9.01=1~3.

F9.04: digital auxiliary reference frequency control

Only valid when F9.01=1~3, as shown in Fig.5-57.

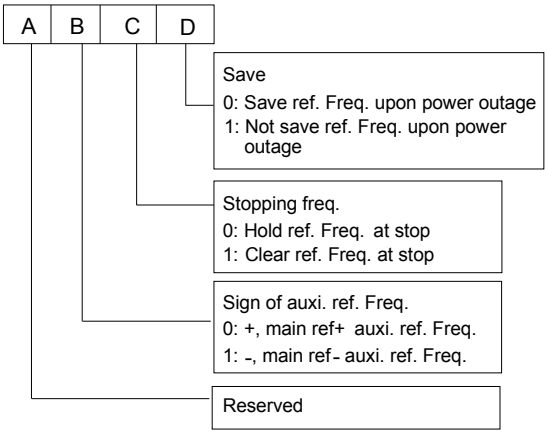


Fig. 5-57 Digital auxiliary reference frequency control

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place: parameter-saving function at power outage

0: Save the auxiliary reference frequency at power outage

The auxiliary frequency will be stored in F9.03 at power outage. The sign of auxiliary reference frequency is saved in F9.04.

1: not save the auxiliary frequency at power outage

Ten's place: Processing of frequency at power-off

0: Hold the auxiliary reference frequency after stop

1: Clear the preset frequency after stopping

Hundred's place: Sign of reference frequency

0: Plus

Preset frequency = main reference frequency + auxiliary reference frequency.

1: Minus

Preset frequency = main reference frequency + auxiliary reference frequency

Note:

When the inputting mode of auxiliary reference frequency, such as input via panel, terminal or serial port is the same with that of main reference frequency, the auxiliary frequency is invalid.

F9.05 Frequency adjustment selector	Range:0~2【0】
F9.06 Adjustment coefficient of preset frequency	Range:0.0%~200.0%【100.0%】

F9.05 and F9.06 define the adjustment of preset frequency as shown in Fig. 5-55.

0: Disabled

No adjustment is done to the preset frequency, F4=F3

1: adjust based on max. output frequency F5

Preset frequency (F4) =F3+F0.05× (F9.06-100%)

2: adjust based on the main reference frequency

Preset frequency (F4) =F3+F3× (F9.06-100%) =F3×F9.06.

F9.07 Function of keys	Range: 000~422【000】

F9.07 defines the functions of PANEL/REMOTE and STOP/RESET key, and the locking up function of panel.

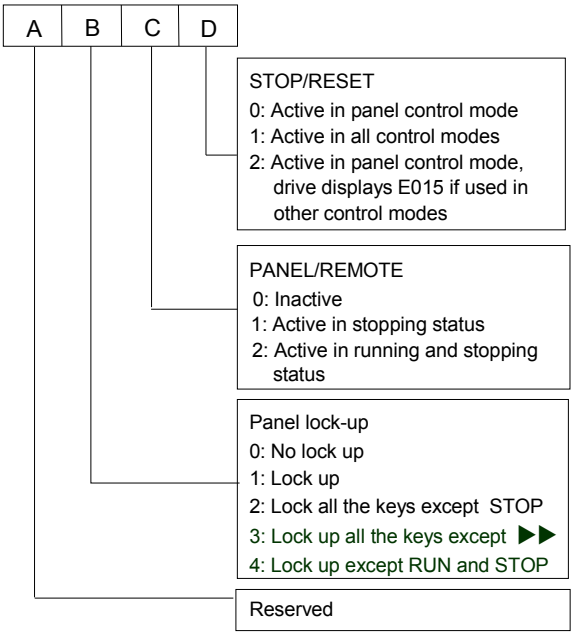


Fig. 5-58 Functions of keys

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place: STOP/RESET function selector

This Bit defines in which modes the key is valid for stopping the drive

0: Enabled only in panel control mode

1: Enabled in panel control mode, terminal and serial control modes. The drive stops in the defined manner when this key is pressed.

2: Enabled in panel control mode, terminal and serial control modes.

In panel control mode, the drive stops in defined manner when this key is pressed. But, in terminal and serial control modes, the drive will alarms and display fault code of E015 and coasts to stop.

The STOP/RESET key is valid for all control modes when resetting a fault.

Ten's place: PANEL/REMOTE function selector

0: PANEL/REMOTE is disabled.

1: PANEL/REMOTE is enabled only in stopping state, not valid for operating state.

2: PANEL/REMOTE can be used to select the control mode both in operating status and stopping status.

Switching sequence of running command channel

Press the key to switch the control mode, and the LED will indicate the mode accordingly. When panel/control mode is selected, the LED turns on; when terminal control mode is selected, the LED turns off; when serial port control mode is selected, the LED flashes.

> 🕮 **Note:**
>
> After selecting a control mode by using PANEL/REMOTE, be sure to press ENTER/DATA key to confirm within 3 seconds.

Hundred's place: Panel lock up

0: Not lock any key on the panel.

1: Locking up function is enabled and all keys on the panel are locked up.

2: Except STOP/RESET, other keys are locked up.

3: Except ▶▶, other keys are locked up.

4: Except RUN and STOP, all other keys are locked up.

After setting the parameter, you have to do certain operation on the keypad to lock the panel. Please refer to Fig. 4-14. Unlock method refer to Fig. 4-15.

F9.08 Fan control mode	Range: 0, 1【0】

0: Auto stopping mode

The fan runs all the time when the drive is operating. After the drive stops, its internal temperature detecting program will be activated to stop the fan or let the fan continue to run according to the IGBT's temperature.

1: The fan operates continuously.

The fan operates continuously after the drive is switched on.

F9.09 Unit of Acc/Dec time	Range: 0. 1【0】

F9.09 decides the unit of Acc/Dec time.

0: Second

1: Minute

This function is active for all the Acc or Dec process except Jogging process.

Up to 60 hours' Acc/Dec time can be set, suitable for the application with a requirement of long Acc/Dec time.

> 🕮 **Note:**
>
> It is recommended to select "second" as the unit.

F9.10	Reserved

Reserved.

F9.11 Overshoot enabling	Range: 0, 1【1】

When the AC supply voltage is lower than 85% of rated input voltage for a long time or the drive has driven a heavy load for a long time, the drive can increase its output voltage by increasing the utilization rate of DC bus voltage. F9.11 decides whether to enable the overshoot function.

0: disabled

1: enabled

> 🕮 **Note:**
>
> When overshoot function is enabled, output current harmonics will increase.

F9.12 Threshold of zero-frequency operation	Range: 0.00~600.00Hz 【0.00Hz】
F9.13 Hysteresis of zero-frequency operation	Range: 0.00~600.00Hz 【0.00Hz】

F9.12 and F9.13 are used to set the zero-frequency operation hysteresis.

Take CCI current reference for example, see Fig.5-59:

Starting process

After the running command is sent out, once CCI input current reaches or exceeds the preset value of Ib, or the preset frequency reaches fb, the motor will start and the frequency will accelerate to a certain value corresponding to the CCI input current.

Stopping process:

The drive will not stop immediately when the CCI input current is reduced to Ib. It will stop its output when the CCI input current drops to Ia and the corresponding frequency is fa.

"fa" is the zero-frequency operation threshold defined by F9.12. "fb-fa" is the hysteresis of zero-frequency operation defined by F9.13.

This function can enable the drive to enter dormant state so as to save energy, besides; the drive will not start at the threshold of zero-frequency operation if the hysteresis is set properly.

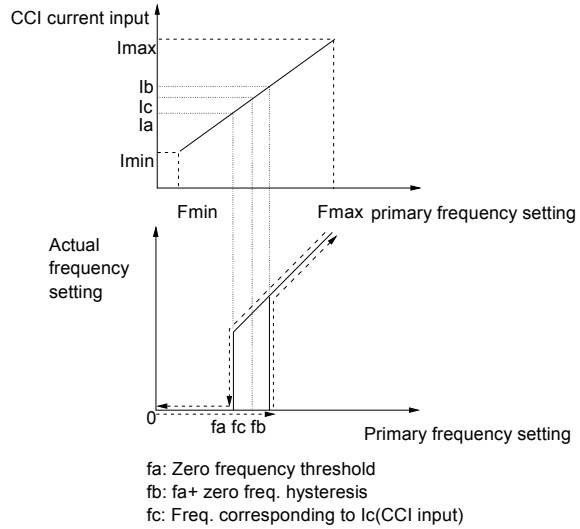


Fig. 5-59 Hysteresis of zero-frequency operation

F9.14 ~F9.19	Reserved

Reserved

F9.20 Trip-free operation	Range: 0, 1【0】
F9.21 Frequency decrease rate at voltage compensation	Range:0.00~99.99Hz/s 【10.00Hz/s】

Trip-free operating function enables the drive to perform low-voltage compensation when the voltage drops or instantaneous under-voltage occurs. The drive can continue to operate without tripping by reducing its output frequency and feedback energy via motor.

If F9.20 is set to 0, this function is disabled.

If F9.20 is set to 1, this function is enabled and low-voltage compensation is activated.

If F9.21 (frequency decrease rate at voltage compensation) is set too big, the feedback energy of motor will be too large and over-voltage protection might be activated; If F9.21 is set too small, the feedback energy of motor will be too small to achieve voltage compensation effect. So, please set F9.21 according to load inertia and the actual load.

> 🕮 **Note:**
>
> This function is active only for the drive of 18.5kW or below.

F9.22 Restart after power failure	Range: 0, 1【0】
F9.23 Delay time for restart after power failure	Range:0.0~10.0s【0.5s】

F9.22 and F9.23 decide whether the drive starts automatically and the delay time for power on after drive is stop due to power outage in different control modes.

If F9.22 is set to 0, the drive will not run automatically after power recover.

If F9.22 is set to 1, when the drive is powered on after power failure, it will wait certain time defined by F9.23 and then start automatically depending on the current control mode and the drive's status before power failure. See

Table **5-13**.

Table 5-13 Restarting conditions

Setting of F9.22	Status before power off	Control modes				
		Panel	Serial port	3-wire modes 1 and 2, 2-wire modes 1	2-wire modes2	
		Without control command				With
0	Stop	0	0	0	0	0
	Run	0	0	0	0	0
1	Stop	0	0	0	0	1
	Run	1	1	1	0	1

Note:

Table 5-13 shows the drive's action under different conditions. "0" means the drive enters ready status and "1" means the drive start operation automatically.

When using the panel or serial port or 3-wire modes 1 and 2 to start or stop the drive, the command signal is in pulse mode and there is no operating command when the drive is switched on.

If there is a stopping command, the drive will stop first.

When the function of restart after power failure is enabled, the drive will start on the fly after power on if it is not switched off totally (that is, the motor still runs and drive's LED displays "P.OFF"). It will start in the starting mode defined in F2.00 after power on if it is switched off totally (LED turns off).

5.11 Reserved (Group FA)

FA.00~FA.11	Reserved

5.12 Communication Parameters (Group FF)

FF.00 Communication configuration	Range:0000~1127H 【0005】

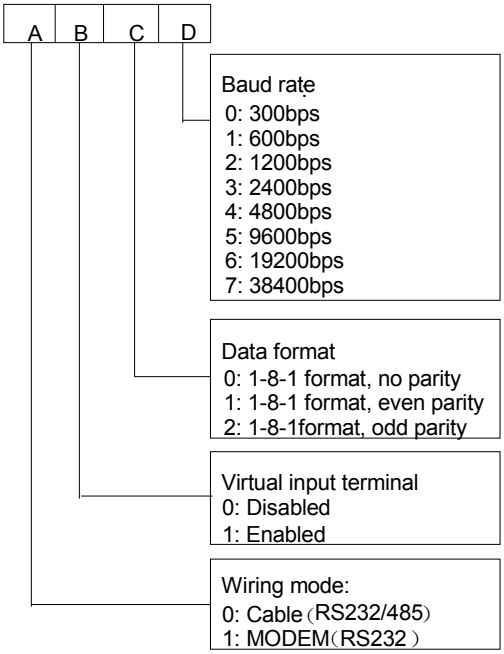


Fig. 5-60 Communication parameters

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

FF.00 is used to set the parameters of serial communication.

Virtual terminal is used by the host PC to send commands. Each Bit of the data represents one terminal. Bit0~12 represent the status of virtual terminal X1~X8, FWD, REV, YI, Y2 and TC respectively. Please refer to Table A-8 of Appendix 3. The actual terminal is disabled if the virtual terminal is enabled. The virtual terminal is equivalent to the actual terminal.

The setting of thousand's place does not affect the communication process. If FF.00 is set to MODEM (RS232) mode, the MODEM will be initialized via the RS232 port each time when the drive is switched on, so that the MODEM can answer the call automatically after it receives 3 ringing signals. See *Section 3.3.2 Wring of Control Circuit* for the wiring of remote control circuit formed by dialed circuits.

FF.01 Local address	Range:0~127【1】

In serial communication, FF.01 is used to identify the drive's address.

Note: "127" is the broadcast address. When the address is set to broadcast address, the drive can

receive and execute the command sent by control PC, but will not answer the PC.

FF.02 Time threshold for judging communication status	Range:0~1000.0s【0.0s】

If the drive has not detected the communication signal from the serial port for certain time, it will judge that communication failure occurs. The time threshold is defined by FF.02.

If FF.02 is set to 0, the drive will not detect the communication signal of serial port and this function is disabled.

FF.03 Host PC response delay	Range:0~1000ms【5ms】

It refers to the time from drive receiving the host PC command to returning response frame to it.

5.13 Motor Parameters (Group FH)

FH.00 Number of poles of motor	Range: 2~14【4】
FH.01 Rated power	Range:0.4~999.9kW【dependent on drive's model】
FH.02 Rated current	Range:0.1~999.9A 【dependent on drive's model】

FH.00, FH.01 and FH.02 are used to set the motor's parameters.

In order to ensure the control performance, please set FH.00~FH.02 with reference to the values on the motor's nameplate.

The motor's power should match that of the drive. Generally the motor's power is allowed to be lower than that of the drive by 20% or bigger by 10%, otherwise the control performance cannot be ensured.

FH.03 Current without load I0	Range:0.1~999.9A【dependent on drive's model】
FH.04 Resistance of stator %R1	Range:0.0~50.00%【dependent on drive's model】
FH.05 Leakage inductance %Xl	Range:0.0~50.00%【dependent on drive's model】
FH.06 Resistance of rotor %R2	Range:0.0~50.00%【dependent on drive's model】
FH.07 Mutual inductance %Xm	Range:0.0~2000.0%【dependent on drive's model】

See Fig. 5-61 for the above parameters.

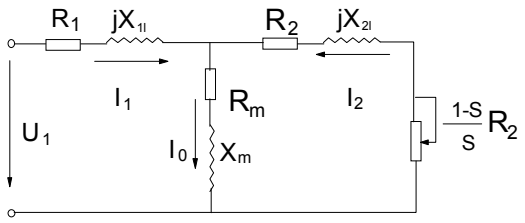


Fig. 5-61 Motor's equivalent circuit

In Fig. 5-61, R_1, X_{1l}, R_2, X_{2l}, X_m and I_0 represent stator's resistance, stator's leakage inductance, rotor's resistance, rotor's leakage inductance, mutual inductance and current without load respectively. The setting of FH.05 is the sum of stator's leakage inductance and rotor's inductance.

The settings of FH.04 ~FH.07 are all percentage values calculated by the formula below:

$$\%R = \frac{R}{V/\left(\sqrt{3}\cdot I\right)}\times 100\%$$

R: Stator's resistance or rotor's resistance that is converted to the rotor's side;

V: Rated voltage;

I: Motor's rated current

Formula used for calculating inductance (leakage inductance or mutual inductance):

$$\%X = \frac{X}{V/\left(\sqrt{3}\cdot I\right)}\times 100\%$$

X: sum of rotor's leakage inductance and stator's leakage inductance (converted to stator's side) based on base frequency or the mutual inductance;

V: Rated voltage;

I: Motor's rated current

If motor's parameters are available, please set FH.04 ~FH.07 to the values calculated according to the above formula.

If the drive performs auto-tuning of motor's parameters, the results will be written to FH.03~FH.07 automatically.

After motor power (FH.01) is changed, the drive will change FH.02~FH.07 accordingly.

FH.08 Rated slip frequency	Range: 0.00~20.00Hz【0.00Hz】

Motor's rated slip frequency can be calculated by the motor's rated speed (nameplate value):

Rated slip frequency = motor's rated frequency (e.g. basic frequency F0.06) × (motor's synchronous speed-motor's rated speed) ÷motor's synchronous speed

Where: motor's synchronous speed = motor's rated frequency×120÷number of motor's poles (FH.00)

After setting the slip frequency, the slip compensation will be enabled by F3.07~F3.09.

FH.09 Auto-tuning	Range:0~2【0】

The function can enable auto tuning of motor's parameters and write the results in the related parameters automatically.

0: Auto-tuning is disabled

1: Stationary auto-tuning

Values on the motor's nameplate parameter (FH.00~FH.02) must be input correctly before starting auto-tuning.

When starting auto-tuning to a standstill motor, the stator's resistance (%R1), rotor's resistance (%R2) and the leakage inductance (%X1) will be detected and written into FH.04, FH.05 and FH.06 automatically.

2: Rotating auto-tuning

When starting a rotating auto-tuning, the motor is in standstill status at first, and the stator's resistance (%R1), rotor's resistance (%R2) and the leakage inductance (%X1) will be detected, and then the motor will start rotating, mutual inductance (%Xm) and unload current (I_0) will be detected. All the above parameters will be saved in FH.04, FH.05, FH.06, FH.07 and FH.03 automatically.

After auto-tuning, FH.09 will be set to 0 automatically.

Auto-tuning procedures:

1. Set the "F0.06 basic operating frequency" and "F0.07 Max output voltage" correctly according to the motor's parameter;

2. Set the FH.00, FH.01 and FH.02 correctly;

3. If FH.09 is set to 2, Acc time (F0.10) and Dec time (F0.11) should be set correctly. Remove the load from the motor and check the safety;

4. Set FH.09 to 1 or 2, press ENTER/DATA, and then press RUN to start auto-tuning;

5. When the operating LED turns off, that means the auto-tuning is completed.

Note:

When setting FH.09 to 2, Acc/Dec time can be increased if over-current or over-voltage fault occurs in the auto-tuning process;

When setting FH.09 to 2, the motor's load must be removed first before starting rotating auto-tuning;

The motor must be in standstill status before starting the auto-tuning, otherwise the auto-tuning cannot be executed normally;

In some applications, for example, the motor cannot break away from the load or if you have no special requirement on motor's control performance, you can select stationary auto-tuning. You can also give up the auto-tuning. At this time, please input the values on the motor's nameplate correctly (FH.00~FH.02).

If the auto-tuning cannot be applied and the correct motor's parameters are available, the user should input the values on the motor's nameplate correctly (FH.00~FH.02), and then input the calculated values (FH.03~FH.07). Be sure to set the parameters correctly.

If auto-tuning is not successful, the drive will alarm and display fault code E024.

FH.10 Motor's stabilization factor	Range:0~255【dependent on drive's model】

FH.10 is used to suppress the oscillation caused by the drive and the motor. If the drive's output current changes frequently at constant load, you can reduce the oscillation by adjusting the parameter.

FH.11~FH.21	Reserved

Reserved

5.14 Protective Function (Group FL)

FL.00 Motor overload protection mode selection	Range: 0, 1, 2【1】

0: Disabled

The overload protection is disabled. Be careful to use this function because the drive will not protect the motor when overload occurs;

1: Common mode (with low speed compensation)

Since the cooling effects of common motor deteriorates at low speed (below 30Hz), the motor's overheat protecting threshold should be lowered, which is called low speed compensation.

2: Variable frequency motor (without low speed compensation)

The cooling effects of variable frequency motor are not affected by the motor's speed, so low speed compensation is not necessary.

FL.01 Motor's overload protection coefficient	Range:20.0~110.0%【100.0%】

In order to apply effective overload protection to different kinds of motors, the Max output current of the drive should be adjusted as shown in Fig. 5-62.

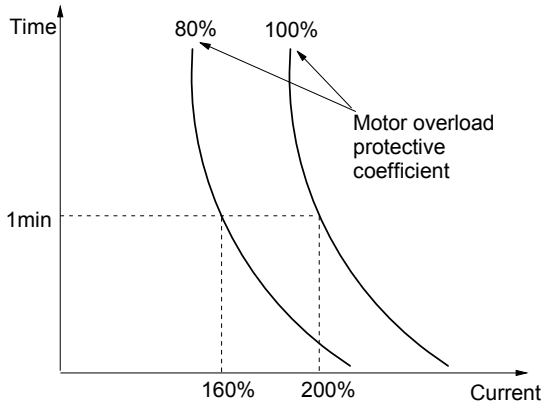


Fig. 5-62 Motor's overload protection coefficient

Use the following coefficient to calculate the coefficient:

$$\text{Motor overload protection coefficient} = \frac{\text{motor rated current}}{\text{drive's rated output current}} \times 100\%$$

Generally, the Max load current is the motor's rated current.

> 🕮 **Note:**
>
> If the motor's rated current does not match that of the drive, motor's overload protection can be realized by setting FL.00~FL.01.

FL.02 Protection of Over-voltage at stall	Range: 0, 1【1】
FL.03 Over-voltage point at stall	Range:120~150%【140.0%】

0: Disabled

1: Enabled

During deceleration, the motor's decelerate rate may be lower than that of drive's output frequency due to the load inertia. At this time, the motor will feed the energy back to the drive, resulting in the voltage rise on the drive's DC bus. If no measures taken, the drive will trip due to over voltage.

During the deceleration, the drive detects the bus voltage and compares it with the over voltage point at stall defined by FL.03. If the bus voltage exceeds the stall overvoltage point, the drive will stop decreasing its output frequency. When the bus voltage is lower than the point, the deceleration continues, as shown in Fig. 5-63.

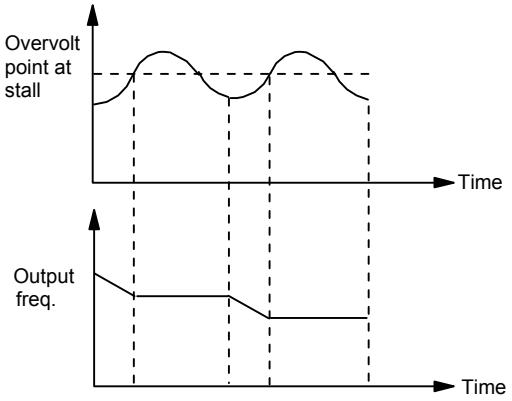


Fig. 5-63 Over-voltage at stall

> 🕮 **Note:**
>
> 1) The drive will alarm and display E015 when it is in the status of over-voltage at stall for more than 1 minute.
>
> 2) If the stall point is set too low, recommended to prolong the Acc and Dec time properly.

FL.04 Overload pre-alarm detection mode	Range:000~111000】
FL.05 Overload pre-alarm detection threshold	Range:20~150%【130.0%】
FL.06 Overload pre-alarm detection time	Range:0.0~60.0s【5.0s】

The drive has protection over drive and motor overload. See Table 2-1 for drive overload protection, and FL.00 and FL.01 for motor overload protection. FL.04~FL.06 can monitor the overload condition before overload protection happens.

FL.04 defines overload pre-alarm detection mode selector, protection action selector and the threshold selector.

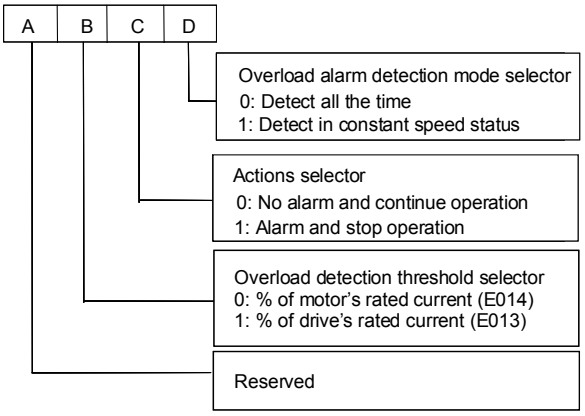


Fig. 5-64 Settings of FL.04

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place: overload pre-alarm detection mode selector

0: overload pre-alarm function is active all the time when the drive is operating

1: overload pre-alarm function is active all the time when the motor is operating at constant speed

Ten's place: Actions selection for overload pre-alarm

0: The drive does not alarm and continue to run when detecting active overload signal

1: The drive alarms and stops when detecting active overload signal

Hundred's place: overload detection threshold selection

0: ratio of load current to motor's rated current (display fault code of E014)

1: ratio of load current to drive's rated current (display fault code E013)

FL.05 defines the current threshold for overload pre-alarm protection. The setting range is a percentage value of rated current, please refer to FL.04.

FL.06 defines the time during which the drive current exceeds FL.05. If the status remains after this period of time, the drive will output pre-alarm signal.

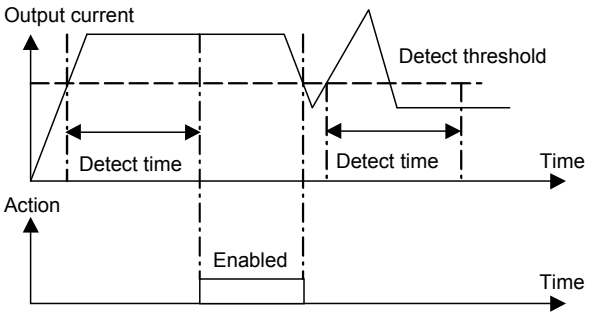


Fig. 5-65 Overload pre-alarm function

Note:

1. Overload pre-alarm detection threshold should be lower than the overload protection threshold;
2. During the overload detection time, if the drive's current is smaller than FL.05, the drive will time again for FL.06 and will not alarm.

FL.07 Auto current limiting threshold	Range:20.0~200.0%【110%】
FL.08 Frequency decrease rate when current limiting	Range:0.00~99.99Hz/s【10.00Hz/s】
FL.09 Auto current limiting selection	Range:0~1【1】

Auto current limiting function is used to limit the load current under the value defined by FL.07 in operation. Therefore the drive will not trip due to surge over-current. This function is especially useful for the applications with big load inertia or significant change of load.

FL.07 defines the threshold of auto current limiting. It is a percentage of the drive's rated current. It is 110% by default.

FL.08 defines the decrease rate of output frequency when the drive is in auto current limiting status.

If FL.08 is set too small, overload fault may occur. If it is set too big, the frequency will change too sharply and therefore, the drive may be in generating status for long time, which may result in overvoltage protection.

Auto current limiting function is always active in Acc or Dec process. Whether the function is active in constant speed operating process is decided by FL.09.

FL.09＝0, Auto current limiting function is disabled in constant speed operating process;

FL.09＝1, Auto current limiting function is enabled in constant speed operating process;

In auto current limiting process, the drive's output frequency may change; therefore, it is recommended not to enable the function when the drive's output frequency is required stable.

When the auto current limiting function is enabled, if FL.07 is set too low, the output overload capacity will be impaired.

FL.10 Auto reset times	Range:0~10【0】
FL.11 Reset interval	Range:2.0~20.0s【5.0s】

Auto reset function can reset the fault in preset times and interval. When FL.10 is set to 0, it means "auto reset" is disabled and the protective device will be activated in case of fault.

Note:

The IGBT protection (E010) and external equipment fault (E015) cannot be reset automatically.

During the reset interval, the drive stops output and operates at zero frequency. It will restart on the fly after reset.

Be careful in using auto-reset function, otherwise it may lead to human injury or equipment damage.

FL.12 Protective action 1	Range: 000~111【000】
FL.13 Protective action 2	Range: 0000~3211【0000】

Under some abnormal conditions, the drive can be set to ignore them and continue to operate without alarm or taking protective action through FL.12 and FL.13.

FL.12 defines the protective actions when communication fault, contactor fault or EEPROM fault occurs.

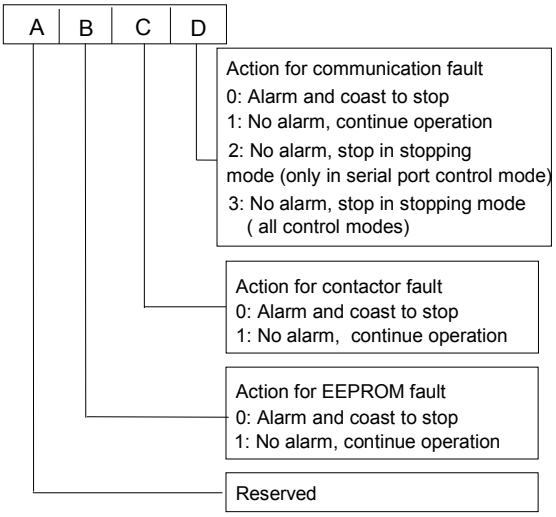


Fig. 5-66 Protective action 1

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

FL.13 defines the protective actions when the drive is in under-voltage status, auto reset interval and fault lock-up status.

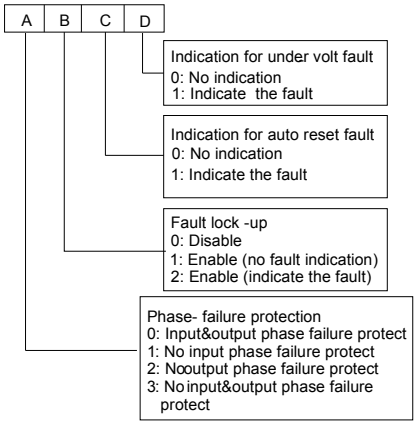


Fig. 5-67 Protective action 2

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

⚠ Attention Please set FL.12 and FL.13 carefully, otherwise human injury or equipment damage may occur.

FL.14 Type of third latest fault	Range:0~24【0】
FL.15 Type of second latest fault	Range:0~24【0】
FL.16 Type of the latest fault	Range:0~24【0】
FL.17 DC Bus Voltage at last fault	Range:0~999V【0V】
FL.18 Output current at last fault	Range:0~999.9A

	【0.0A】
FL.19 Frequency at last fault	Range:0.00~600.00Hz【0.00Hz】

The driver has 24 types of protective alarms and it can memorize the types of latest 3 faults (FL.14~FL.16), and the voltage, current and frequency (FL.17~FL.19) of latest fault.

See chapter 6 for the detailed descriptions of alarms.

5.15 Drive Parameters (Group Fn)

Fn.00 Preset operating time	Range:0~65.535k hours【0】
Fn.01 Total operating time	Range:0~65.535k hours【0】
Fn.02 Temperature of heatsink 1	Range: 0~100℃【0】
Fn.03 Temperature of heatsink 2	Range: 0~100℃【0】

When the total operating time reaches the preset operating time (Fn.00), the drive can output an indicating signal. See F7.10~F7.12 for details.

Fn.01 records the actual operating time from first use of the drive to the present.

Temperature of heatsink 1 is the temperature of IGBT modules. Different IGBT modules have different over-temperature threshold.

Temperature of heatsink 2 is the temperature of rectifier. The drive of 55kW or below does not detect this temperature.

Temperature display range: 0~100℃; accuracy: 5%

5.16 Protection of Parameters (Group FP)

FP.00 User's password	Range: 0000~9999【0000】

User's password can prevent unauthorized persons from checking and modifying the functional parameters.

Set FP.00 to 0000 if the user's password is unnecessary.

If the user's password is necessary, input a 4-digit none-zero figure, press ENTER/DATA to confirm. If not pressing any key within 5 minutes, the password will become effective.

Changing the password:

Press MENU/ESC, input the primary password, select FP.00 (at this time FP.00＝0000), input new password and press ENTER/DATA to confirm. The password will become effective if not pressing any key within 5 minutes.

> 🕮 **Note:**
>
> Please memorize the password.

FP.01 Parameter write-in protection	Range:0~2【1】

FP.01 is used to protect the parameter settings:

0: All parameters are allowed modifying;

1: only F0.02 and FP.01 can be modified;

2: only FP.01 can be modified.

> 🕮 **Note:**
>
> The factory setting of FP.01 is 1. If you want to modify parameters, FP.01 must be set to 0. After the modification, set the parameter back to 1 or 2. When this parameter is set to 0 and then all the parameters are restored to factory settings, it will still be 0.

FP.02 Parameter initialization	Range:0~2【0】

0: No operation

1: Clear memory

When FP.02 is set to 1, the fault records of FL.14~FL.19 will be cleared.

2: Restore to factory settings

If FP.02 is set to 2, the parameters before FL.12 (except FH.00) are restored to factory settings.

FP.02 will be changed to 0 automatically after clearing the memory or restoring to factory settings.

FP.03 Parameter copy	Range:0~3【0】

FP.03 is only valid for LCD panel.

0: No action

1: parameters upload

2: parameters download

3: parameters download (except the parameters related to drive type)

Note:

1. For LCD panel, you must upload parameters to the panel's memory first, otherwise, there will be no data in the memory. Once the data are uploaded, they will exist permanently.
2. Before downloading the parameters to the drive, the drive will check the version and integrity of the parameters stored in the panel. The operation cannot proceed if no data in the memory, incompleteness of the parameters, or the parameter set is incompliant with the version of the drive (e.g. number of parameters), an error signal will be indicated.
3. After the download, the parameters in the panel are still available for copying to other drives.

FP.04	Reserved

Chapter 6 Troubleshooting

Table 6-1 listed the possible faults of the drive. Once a fault occurs, you may check it against the table and record detailed phenomena before seeking service from your supplier.

Table 6-1 Faults and actions

Fault code	Fault categories	Possible reasons of fault	Actions
E001	Over-current during acceleration	Too short Acc time	Prolong the Acc time
		V/F curve is not suitable.	Check and adjust V/F curve, adjust torque boost or set the motor parameters correctly to ensure the normal auto torque boost.
		The rotating motor re-start after the drive stops instantly.	Set F2.00 to “start on fly” function
		Low AC supply voltage	Check the drive’s input AC supply
		Drive power is too small	Select a higher power drive
E002	Over-current during deceleration	Too short Dec time	Prolong the Dec time
		The load generates energy or the load inertial is too big	Connect suitable braking kit
		Drive power is too small	Select a higher power drive
E003	Over-current in constant speed operation	Sudden change of load	Reduce the change of the load
		Too short Acc/Dec time	Prolong Acc/Dec time
		Abnormal load	Check the load
		Low AC supply voltage	Check the AC supply voltage
		Drive power is too small	Select a higher power drive
E004	Over voltage during acceleration	Abnormal AC supply voltage	Check the AC supply voltage
		Too short Acc time	Prolong the Acc time
		The rotating motor re-start after the drive stops instantly.	Set F2.00 to “start on fly” function
E005	Over voltage during deceleration	Too short Dec time (with reference to regenerated energy)	Prolong the Dec time
		The load generates energy or the load inertial is too big	Connect suitable braking kit
E006	Over voltage in constant-speed operation	Abnormal AC supply voltage	Check the AC supply voltage
		Too short Acc/Dec time	Prolong the Acc/Dec time
		Abnormal change of input voltage	Install input reactor
		Too big load inertia	Connect suitable braking kit
E007	Drive’s control power supply over voltage	Abnormal AC supply voltage	Check the AC supply voltage or seek service
E008	Input phase loss	Any of phase R, S and T cannot be detected	Check the wiring and installation Check the AC supply voltage
E009	Output phase loss	Any of Phase U, V and W cannot be detected	Check the drive’s output wiring Check the cable and the motor
E010	Protections of IGBT module	Instantaneous over-current	Refer to E001~E003
		Short-circuit among 3-phase output or line-to-ground short circuit	Rewiring
		Vent is obstructed or fan does not work	Clean the vent or replace the fan
		Ambient over-temperature	Lower the ambient temperature

Fault code	Fault categories	Possible reasons of fault	Actions
		Wires or connectors of control board are loose	Check and rewiring
		Current waveform distorted due to output phase loss	Check the wiring
		Auxiliary power supply is damaged or IGBT driving voltage is too low	Seek service
		Short-circuit of IGBT bridge	Seek service
		Control board is abnormal	Seek service
E011	IGBT module's heatsink overheat	Ambient over-temperature	Lower the ambient temperature
		Vent obstructed	Clean the vent
		Fan does not work	Replace the fan
		IGBT module is abnormal	Seek service
E012	Rectifier's heatsink overheat	Ambient over-temperature	Lower the ambient temperature
		Vent obstructed	Clear the vent
		Fan does not work	Replace the fan
E013	Drive overload	Too short Acc time	Prolong the Acc time
		Improper V/F curve	Adjust V/F curve or torque boost value
		The rotating motor restart after the drive stops instantly.	Set F2.00 to start of fly mode
		Low AC supply voltage	Check the AC supply voltage
		Too heavy load	Select a higher power drive
E014	Motor over-load	Improper V/F curve	Adjust V/F curve and torque boost value
		Low AC supply voltage	Check the AC supply voltage
		Common motor has operated with heavy load at low speed for a long time.	Use a special motor if the motor is required to operate at low speed for a long time.
		Improper motor's overload protection threshold	Modify the motor's overload protection threshold.
		Motor block or load changes fast	Check the load
E015	Emergent stop or external equipment fails	STOP is pressed in non-panel control mode	Check the definition of STOP function in F9.07 and the operating mode
		STOP pressed when the drive is in stall status	Check the definition of STOP function in F9.07
		The drive will report E015 fault if it is in stall status for 1 minute	Set FL.02 and FL.03 properly
		Terminal used for stopping the drive in emergent status is closed	Disconnect the terminal if the external fault is cleared
E016	EEPROM R/W fault	R/W fault of control parameters	Press STOP/RESET to reset Seek service
E017	RS232/RS485 communication failure	Wrong baud rate setting	Set the baud rate correctly
		Serial port communication error	Press STOP/RESET to reset, seek service
		Improper settings of alarm parameters	Modify FF.02, FF.03 and FL.12
		Host PC does not work	Check the host PC; Check the wiring
E018	Contactor not closed	Low AC supply voltage	Check the AC supply voltage
		Contactor damaged	Replace the contactor in main circuit and seek service
		Buffer resistor is damaged	Replace the buffer resistor and seek service
		Control circuit is damaged	Seek service
		Input phase loss	Check the wiring of R, S, T.

Fault code	Fault categories	Possible reasons of fault	Actions
E019	Current detection circuit fail	Wires or connectors of control board are loose	Check and re-wire
		Auxiliary power supply is damaged	Seek service
		Hall sensor is damaged	Seek service
		Amplifying circuit is abnormal	Seek service
E020	System disturbance	Severe disturbance	Press STOP/RESET to reset or install power filter at the input side of the drive.
		R/W fault of DSP in main control board	Press STOP/RESET to reset Seek service
E021	Reserved	Reserved	Reserved
E022	Reserved	Reserved	Reserved
E023	Parameter copy error	Panel's parameters are not complete or the version of the parameters are not the same with that of main control board	Update the panel's parameters and version again. First set FP.03 to 1 to upload the parameters and then set FP.03 to 2 or 3 to download the parameters.
		Panel's EEPROM is damaged	Seek service
E024	Auto-tuning fails	Improper settings of parameters on the nameplate	Set the parameters correctly according to the nameplate
		Overtime of auto-tuning	Check the motor's wiring

Table 6-2 Abnormal phenomena and action

Phenomena	Conditions	Possible reasons of fault	Actions
No response of operation panel	Part of the keys or all the keys are disabled	Panel is locked up	In stopping status, first press ENTER/DATA and hold on, then press ▼ 3 times continuously to unlock the panel
			Power-on the drive after it shuts down completely
		Panel's cables are not well connected.	Check the wiring
		Panel's keys are damaged	Replace operation panel or seek service
Parameters cannot be changed	Operating status cannot be changed	Parameter not allowed changing during operation	Change the parameter at STOP state
	Part of parameters cannot be changed.	FP.01 is set to 1 or 2	Set FP.01 to 0
		Parameter is actually detected, not allowed changing	These parameters cannot be changed.
	MENU/ESC is disabled	Panel is locked up	See "No response of operation panel"
	Parameter not displayed when pressing MENU/ESC. Instead, "0.0.0.0." is displayed	User's password is required	Input correct user's password
			Seek service
The drive stops during operating process	The drive stops and its "RUN" LED is off, while there is no "STOP" command	Fault alarm occurs	Find the fault reason and reset the drive
		Single cycle of PLC operation is completed	Check the parameter settings of PLC
		Communication between host or remote mounted keypad and the drive fails	Check the communication circuits and the settings of FF.02, FF.03 and FL.12
		AC supply is interrupted	Check the AC supply condition
		Control mode is changed	Check the setting of relevant parameters
		Logic of control terminal changes	Check the settings of F7.35
	Motor stops when there is no stopping command, while the drive's "RUN" LED is on and operates at zero frequency	Auto-reset upon a fault	Check the setting of auto-reset and fault reason
		PLC operation pauses	Check the terminal used for inputting signal of PLC operation pause
		Stopping command is input from external terminal	Check the setting of this external terminal and fault reason
		Stops at zero-frequency	Check the settings of F9.12 and F9.13
		Preset frequency is 0	Check the frequency setting
		Skip frequency is set incorrectly	Check the setting of skip frequency
The drive stops during operating process.	Motor stops without stopping command, while the drive's "RUN" LED is on and operates at zero frequency	Positive logic: close loop feedback value >reference Negative logic: close loop feedback value <reference	Check the close-loop reference and feedback
		Frequency adjust is set to 0	Check the settings of F9.05 and F9.06
		Low-voltage compensation is applied when the drive restarts after power failure, besides, the AC supply voltage is too low	Check the settings of restart after power failure and the AC supply voltage

Phenomena	Conditions	Possible reasons of fault	Actions
The drive does not work	The drive does not work and its “RUN” LED is off when the “RUN” key is pressed.	Terminal used for coasting to stop is enabled	Check the terminal used for coasting to stop
		The terminal used to prohibit the running of the drive is enabled.	Check the terminal for prohibit the running of drive
		Terminal used for stopping the drive is enabled	Check the terminal used for stopping the drive
		In 3-wire control mode, the terminal used to control the 3-wire operation is not closed.	Set and close the terminal
		Fault alarm occurs	Clear the fault
		Virtual terminal of host is set incorrectly	Disable the function of this terminal or set it properly via the host or change the settings of F7.35
		Positive and negative logic of input terminal are not set correctly	Check the settings of F7.35
“POWEROFF” is reported when the drive begin to run immediately after power-on.	Transistor or contactor disconnected and overload	Since the transistor or contactor is disconnected, the bus voltage drops at heavier load, therefore, the drive displays POWEROFF, not E018 message.	Run the drive until the transistor or contactor is connected.

Chapter 7 Maintenance

Many factors such as ambient temperature, humidity, dust, vibration, internal component aging, wear and tear will give rise to the occurrence of potential faults. Therefore, it is necessary to conduct routine maintenance to the drives.

> 🕮 **Note:**
>
> 1. As safety precautions, before carrying out check and maintenance of the drive, please ensure that:
> 2. The drive has been switched off;
> 3. The charging LED lamp inside the drive is off.
> 4. Use a volt-meter to test the voltage between terminals (+) and (-) and the voltage should be below 36V.

7.1 Daily Maintenance

The drive must be operated in the environment specified in the Section 2.1. Besides, some unexpected accidents may occur during operation. You should maintain the drive conditions according to the table below, record the operation data, and find out problem in the early stage.

Table 7-1 Daily checking items

Items	Instructions			Criterion
	Items	Cycle	Checking methods	
Operating environment	Temperature and humidity	Any time	Thermometer and hygrometer	-10℃~+40℃, derating at 40℃~50℃
	Dust and water dripping		Visual inspection	No water dripping
	Gas		Visual inspection	No strange smell
Drive	Vibration and heating	Any time	Touch the case	Stable vibration and proper temperature
	Noise		Listen	No abnormal sound
Motor	Heating	Any time	Touch by hand	No overheat
	Noise		Listen	Low and regular noise
Operating status parameters	Output current	Any time	Current meter	Within rated range
	Output voltage		Volt-meter	Within rated range
	Internal temperature		Thermometer	Temperature rise is smaller than 35℃

7.2 Periodical Maintenance

Customer should check the drive every 3 months or 6 months according to the actual environment.

> 🕮 **Note:**
>
> 1. Only trained personnel can dismantle the drive to replace or repair components;
> 2. Don't leave metal parts like screws or pads inside the drive; otherwise the equipment may be damaged.

General Inspection:

1. Check whether the screws of control terminals are loose. If so, tighten them with a screwdriver;
2. Check whether the main circuit terminals are properly connected; whether the copper busbar are over heated;
3. Check whether the power cables and control cables are damaged, check especially for any wear on the cable tube;

4. Check whether the insulating tapes around the cable lugs are stripped;

5. Clean the dust on PCBs and air ducts with a vacuum cleaner;

6. For drives that have been stored for a long time, it must be powered on every 2 years. When supplying AC power to the drive, use a voltage regulator to raise the input voltage to rated input voltage gradually. The drive should be powered for 5 hours without load.

7. Before performing insulation tests, all main circuit input/output terminals should be short-circuited with conductors. Then proceed insulation test to the ground. Insulation test of single main circuit terminal to ground is forbidden; otherwise the drive might be damaged. Please use a 500V Mega-Ohm-Meter.

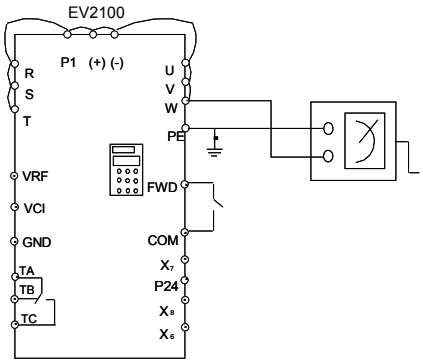


Fig. 7-1 Insulation test of drive

8. Before the insulation test of the motor, disconnect the motor from the drive to avoid damaging it.

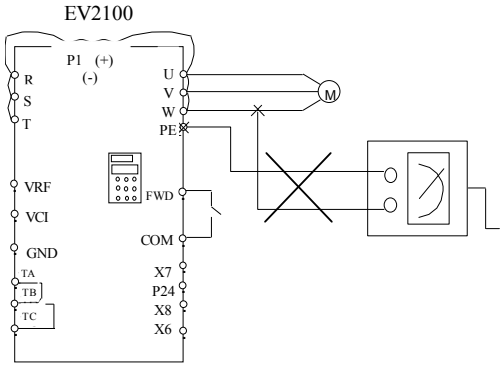


Fig. 7-2 Insulation test of motor

Note:

Dielectric strength test of the drive has already been conducted in the factory. Do not do the test again, otherwise, the internal components might be damaged.

7.3 Replacing Wearing Parts

The wearing components of drive are: cooling fan and electrolytic capacitors of filters. Their lifetime depends largely on their application environment and preservation. Normally, lifetime is:

Components	Life
Fan	30,000~40,000 hours
Electrolyte capacitor	40,000~50,000 hours
Relay TA/TB/TC	About 100,000 times

You can decide the time when the components should be replaced according to their service time.

1. Cooling fan

Possible reason of damages: wear of the bearing, aging of the fan vanes.

Criteria:

After the drive is switched off, check if abnormal conditions such as crack exist on fan vanes and other parts. When the drive is switched on, check if drive running is normal, and check if there is any abnormal vibration.

2. Filter electrolytic capacitors

Possible reason of damages: high ambient temperature, aging of electrolyte and large pulse current induced by rapid changing loads.

Criteria: Check if there is any leakage of liquids. Check if the safety valve protrudes. Measure static capacitance and insulation resistance.

3. Relay TA/TB/TC

Possible reason of damages: corrosion or frequent actions.

Criteria: Switch failure

7.4 Storage

The following points must be followed for the temporary and long-term storage of drive:

1. Store in locations free of high temperature, humidity, dust, metal powder, and with good ventilation.

2. Long-term storage will cause the deterioration of electrolytic capacitors. Therefore, the drive must be switched on once for a test within 2 years at least for 5 hours. The input voltage must be boosted gradually by the voltage regulator to the rated value.

7.5 Warranty

The drive will offer warranty service in the case of the following situations:

1. The warranty clause is only confined to the drive;

2. Emerson will take the responsibility of 18 months defects liability period for any faults or damages under the normal operation conditions. After 18 months, maintenance will be charged;

3. Even within 18 months, maintenance would be charged under the following conditions:

① Damages incurred to the drive due to incorrect operation, which are not in compliance with “User Manual”;

② Damages incurred to the drive due to fire, flood, abnormal voltage and so on;

③ Damages incurred to the drive due to the improper use of drive functions;

4. Service fee will be charged according to the actual costs. If there are any maintenance contracts, the contract prevail.

Appendix Ⅰ Parameters

The drive's parameters are organized in functional groups. Each group has several parameters that are identified by "Group No. + Function Code. For example, "F5.08" belongs to group 5 and its function code is 8.

For the convenience of setting, parameter group number corresponds to the first level menu, parameter sub-group corresponds to the second level menu and parameter value corresponds to the third level menu.

The parameter descriptions are listed below.

The 1st column "function code" is the number of function parameter group and parameter. The 2nd column "name" is the full name of function parameter. The 3rd column "LED display" is the brief instruction of the function parameter names on LED display of the operation panel. The 4th column "setting range" is the valid setting range of the function parameters, displayed on LED display of the operation panel. The 5th column "minimum unit" is the minimum unit of the function parameter setting. The 6th column "leave-factory setting" is the leave-factory set value of the function parameters. The 7th column "change" is the change attribute of the function parameters (i.e. whether any change and its conditions is allowed or not) and the instructions are as follows:

"O" denotes the parameters can be modified during operation or at STOP state;

"×" denotes the parameters cannot be modified during operating;

"*" denotes the parameters are actually detected and cannot be revised;

"-" denotes the parameters are defaulted by factory and cannot be modified;

(When you try to modify some parameters, the system will check their modification property automatically to avoid mis-modification.)

Parameter settings are expressed in decimal (DEC) and hexadecimal (HEX). If the parameter is expressed in hexadecimal, the bits are independent to each other. The value of the bits can be 0~F.

1. In the tables, "LCD display" is available only for the drive with LCD keypad

2. "Factory settings" means the default value of the parameter. When the parameters are initialized, they will resume to the factory settings. But the actual detected or recorded parameters cannot be initialized;

3. The parameters can be protected against unauthorized modifications by password. After the user's password is set up (FP.00 is not set to zero), you are required to input password when you press MENU/ESC to enter menu. For the parameters exclusive for factory use, you cannot change them.

After the password is set, if no keypad operation within 5 minutes, the modification of parameters will be protected by password. You can modify the password at any time if password protection is unlocked. The last input password is valid.

The user's password can be disabled by setting FP.00 to 0.

The above rules should be observed when changing the password or setting the parameters via the serial port.

⚠Attention

It is defaulted that no parameters except frequency settings are allowed changing. If you need change them, please first set FP.01 (parameter write-in protection) from 1 to 0.

Table A-1 Parameters

Group F0: Basic Operating Parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F0.00	Reference frequency selector	FREQ SET MODE	0:Digital input 1:set the reference via ▲ and ▼ keys on panel 1:Digital input 2:set the reference via terminal UP/DN 2:Digital input 3:set the reference via serial port 3:Set the reference via VCI 4:Set the reference via CCI 5:Set the reference via PULSE terminal	1	0	○
F0.01	Digital frequency control	DIGITAL FREQ CTR	Unit's place of LED: 0:Frequency value can be saved at power off 1:Frequency value can not be saved at power off Ten's place of LED: 0:Stopping frequency holding 1:Stopping frequency recovery F0.02 Note : Only for F0.00=0,1,2	1	00	○
F0.02	Set operating frequency in digital mode	RUN FREQ SET	F0.13~F0.12 (Only for F0.00=0, 1, 2)	0.01Hz	50.00Hz	○
F0.03	Input operating commands selector	RUN COMMAND SELE	0:Input via panel:(LED turns on); 1:Input via terminal:(LED off); 2:Inpuy via serial port:(LED flashes)	1	0	○
F0.04	Running direction setup	RUN DIRECTION	0: Run forward 1: Run reverse	1	0	○
F0.05	Maximum output frequency	MAX OUTPUT FREQ	Max{50.00,upper limit of frequency F0.12}~600.0Hz	0.01Hz	50.00Hz	×
F0.06	Basic operation frequency	BASE RUN FREQ	1.00~600.0Hz	0.01Hz	50.00Hz	×
F0.07	Max output voltage	MAX OUTPUT VOLT	1~480V	1V	Drive's rated value	×
F0.08	Reserved	Reserved		--	1	×
F0.09	Torque boost	TORQ BOOST	0.0:(auto) 0.1%~30.0%	0.1%	0.0%	○
F0.10	Acc time 1	ACC TIME1	0.1~3600 Note: Default unit is second; Unit of Acc/Dec time is defined by F9.09	0.1	7.5kW~ 30kW: 6.0s 37kW~ 280kW: 20.0s	○
F0.11	Dec time 1	DEC TIME1				
F0.12	Upper limit of frequency	UPPER FREQ LIMIT	Lower limit of frequency ~Maximum output frequency	0.01Hz	50.00Hz	○
F0.13	Lower limit of frequency	LOWER FREQ LIMIT	0.00~upper limit of frequency	0.01Hz	0.00Hz	○
F0.14	V/F curve setting	V/F CURVE MODE	0: User-defined V/F curve(decided by F0.15~F0.20) 1: Torque-stepdown characteristic curve 1 (2.0nd power) 2: Torque-stepdown characteristic curve 2 (1.7 power) 3: Torque-stepdown characteristic curve 3 (1.2 power)	1	0	×
F0.15	V/F frequency value F3	V/F FREQ3	F0.17~F0.06	0.01Hz	0.00Hz	×
F0.16	V/F voltage value V3	V/F VOLT3	F0.18~100.0%	0.1%	0.0%	×
F0.17	V/F frequency value F2	V/F FREQ2	F0.19~F0.15	0.01Hz	0.00Hz	×
F0.18	V/F voltage value V2	V/F VOLT2	F0.20~F0.16	0.1%	0.0%	×
F0.19	V/F frequency value F1	V/F FREQ1	0.00~F0.17	0.01Hz	0.00Hz	×
F0.20	V/F voltage value V1	V/F VOLT1	0~F0.18	0.1%	0.0%	×
F0.21	Cut-off point of manual torque boost	BOOST RANGE	0.0~50.0% (ratio of cut-off frequency to setting of F0.06)	0.1%	10.0%	○

Group F1: Reference frequency parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F1.00	Selection of frequency reference curve	REF CURVE SELE	Units place of LED:VCI frequency curve selection 0:Curve 1 1:Curve 2 Ten's place of LED:CCI frequency curve selection 0:Curve 1 1:Curve 2 Hundred's place of LED: Pulse frequency curve selection 0:Curve 1 1:Curve 2	1	000	○
F1.01	Gain of reference selector	REF CHAN GAIN	0.00~9.99	0.01	1.00	○
F1.02	Reference time constant of filter	FILTER CONST	0.01~50.00s	0.01s	0.50s	○
F1.03	Maximum input pulse frequency	MAX INPUT PULSE	0.1~50.0k	0.1k	10.0k	○
F1.04	Minimum reference of curve 1	MIN REF1	0.0%~F1.06 (Ratio between Min reference 1 and base value of 10V/20mA/F1.03)	0.1%	0.0%	○
F1.05	Frequency corresponding to Min. reference 1	REF1 LOW FREQ	0.00~F0.05	1	0.00Hz	○
F1.06	Max reference 1	MAX REF1	F1.04~100.0% (Ratio between Max reference 1 and base value of 10V/20mA/F1.03)	0.1%	100.0 %	○
F1.07	Frequency corresponding to Max reference 1	REF1 HIGH FREQ	0.00~F0.05	1	50.00Hz	○
F1.08	Min reference 2	MIN REF2	0.0%~F1.10 (Ratio between Min reference 2 and base value of 10V/20mA/F1.03)	0.1%	0.0%	○
F1.09	Frequency corresponding to Min reference 2	REF2 LOW FREQ	0.00~F0.05	1	0.00Hz	○
F1.10	Max reference 2	MAX REF2	F1.08~100.0% (Ratio between Max reference and base value of 10V/20mA/F1.03)	0.1%	100.0 %	○
F1.11	Frequency corresponding to Max reference2	REF2 HIGH FREQ	0.00~F0.05	1	50.00Hz	○

📖 Note:

In order to be simple, all the analog value is expressed by voltage value. The formula that converts the current (mA) into voltage (V) is: Voltage (V) =Current (mA)/2.

Group F2: Starting and Braking Parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F2.00	Start mode	START MODE	0:start at start frequency 1:Start on the fly(including direction judgment), start at start frequency when speed is zero Note: Starting process includes switching on the drive for the first time, recover of AC supply after power failure, reset upon external fault and coast-to-stop	1	0	×
F2.01	Start frequency	START FREQ	0.20~60.00Hz	0.01Hz	0.50Hz	○
F2.02	Start frequency holding time	HOLD TIME	0.0~10.0s	0.1s	0.0s	○
F2.03	Reserved	Reserved	-	-	0	×
F2.04	Reserved	RESERVED	-	-	0	×
F2.05	Accelerating/decelerating mode selection	ACC/DEC MODE	0:Linear Accelerating / decelerating mode 1:S ramp accelerating / decelerating 2:Auto Accelerating/decelerating	1	0	×
F2.06	Start time of S curve	S CURVE START SEC	10.0%~50.0%(Acc/Dec time) F2.06+F2.07≤90%	0.1%	20.0%	○
F2.07	Rising time of S curve	S CURVE UP	10.0%~80.0%(Acc/Dec time) F2.06+F2.07≤90%	0.1%	60.0%	○
F2.08	Stopping Mode	STOP MODE	0: Dec to stop 1: Coast to stop	1	0	×
F2.09	Reserved	RESERVED	-	-	0	×
F2.10	Reserved	RESERVED	-	-	0	×
F2.11	Reserved	RESERVED	-	-	0	×
F2.12	Reserved	RESERVED	-	-	0	×
F2.13	Dynamic braking	BRAK UNIT SELE	0: Dynamic braking is not used 1: Dynamic braking is used	1	0	×
F2.14	Ratio of working time of braking kit to drive's total working time	UTILITY OF BRAK UNIT	0.0~100.0% Note: valid for the built-in braking kit of 7.5/11kW drive and dynamic braking should be applied in Dec process	0.1%	2.0%	×

Group F3: Auxiliary parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F3.00	Anti-reverse running function	RUN REV DISABLE	0:Run reverse enabled 1:Run reverse disabled	1	0	×
F3.01	Run reverse/forward dead time	FWD/REV DEAD TIME	0~3600s	0.1s	0.0s	○
F3.02	Reserved	RESERVED	-	-	0	*
F3.03	Reserved	RESERVED	-	-	0	*
F3.04	Reserved	RESERVED	-	-	0	*
F3.05	Auto energy saving operation	ENERGY-SAVING OPR	0:disabled 1:enabled	1	0	×
F3.06	AVR function	AVR FUNC	0: disabled 1:enabled 2: disabled in decelerating process	1	2	×
F3.07	Gain of Slip compensation	SLIP COMPENSATION GAIN	0.0%~300.0%	0.1%	100.0%	○
F3.08	Slip compensation limit	SLIP COMPENSATION LIMIT	0.0%~250.0%	0.1%	200.0%	○
F3.09	Compensation time	COMPENSATION TIME CONST	0.1~25.0s	0.1s	2.0s	×
F3.10	Carrier frequency adjustment	CARRIER FREQ	7.5kW～55kW: 15k～3k	0.1kHz	8.0kHz	○
			75kW～110kW: 10k～1k		3.0kHz	
			132kW～280kW: 6k～0.7k		2.0kHz	
F3.11	Carrier frequency auto-tuning	CARRIER FREQ REGULATION SELE	0:disabled 1:Enabled	1	1	○
F3.12	Motor tone adjustment	MOTOR TUNING	0~10	1	0	○
F3.13	Jog frequency	JOG OPR FREQ	0.10~50.00Hz	0.01Hz	5.00Hz	○
F3.14	Jog interval	JOG INTERVAL TIME	0.0~100.0s	0.1s	0.0s	○
F3.15	Acc time of Jog operation	JOG ACC TIME	0.1~60.0s	0.1	7.5:~30:6.0s 37~280:20.0s	○
F3.16	Dec time of Jog operation	JOG DEC TIME				
F3.17	Acc time 2	ACC TIME2	0.1~3600 Note: Default unit is second; unit of Acc/Dec time is decided by F9.09	0.1	7.5:~30:6.0s 37~280:20.0s	○
F3.18	Dec time 2	DEC TIME2				
F3.19	Acc time 3	ACC TIME3				
F3.20	Dec time 3	DEC TIME3				
F3.21	Acc time 4	ACC TIME4				
F3.22	Dec time 4	DEC TIME4				
F3.23	Multi stage frequency 1	MULTIBAND FREQ 1	F0.13 (Lower limit of frequency) ~F0.12(upper limit of frequency)	0.01Hz	5.00Hz	○
F3.24	Multi stage frequency 2	MULTIBAND FREQ 2			10.00Hz	
F3.25	Multi stage frequency 3	MULTIBAND FREQ 3			20.00Hz	
F3.26	Multi stage frequency 4	MULTIBAND FREQ 4			30.00Hz	
F3.27	Multi stage frequency 5	MULTIBAND FREQ 5			40.00Hz	
F3.28	Multi stage frequency 6	MULTIBAND FREQ 6			45.00Hz	
F3.29	Multi stage frequency 7	MULTIBAND FREQ 7			50.00Hz	

Group F3: Auxiliary parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F3.30	Skip frequency 1	SKIP FREQ1	0.00~600.0Hz	0.01Hz	0.00Hz	×
F3.31	Range of skip frequency 1	SKIP FREQ BAND1	0.00~30.00Hz	0.01Hz	0.00Hz	×
F3.32	Skip frequency 2	SKIP FREQ2	0.00~600.0Hz	0.01Hz	0.00Hz	×
F3.33	Range of skip frequency 2	SKIP FREQ BAND2	0.00~30.00Hz	0.01Hz	0.00Hz	×
F3.34	Skip frequency 3	SKIP FREQ3	0.00~600.0Hz	0.01Hz	0.00Hz	×
F3.35	Range of skip frequency 3	SKIP FREQ BAND3	0.00~30.00Hz	0.01Hz	0.00Hz	×

Group F4: Operating Parameters						
Para	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F4.00	PLC operation mode selection	PLC OPR MODE	Unit's place of LED: PLC operation mode 0:disabled 1:Stop after operating for 1 cycle 2: Holding at the final value after single cycle of operation 3:Operate continuously Ten's place of LED: Restarting mode after stopping 0:Run again from stage1 1:Continue to run from the stopping stage 2:Operate at the time and frequency when the drive stops or fault occurs Hundred's place of LED: Save at power off 0:Not saving 1:Save the time and frequency at power off Thousand's place of LED: selecting the unit of time 0:second 1:Minute	1	0000	×
F4.01	Stage1 setup	STAGE 1 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 1(F3.23) 1:Decided by F0.00 parameter 2:Close loop reference 1(F5.20) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.02	Operating time in Stage1	STAGE 1 TIME	0.0 ~ 6500	0.1	20.0	○
F4.03	Stage2 setup	STAGE 2 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 2(F3.24) 1:Decided by F0.00 parameter 2:Close loop reference 2(F5.21) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.04	Operating time in Stage2	STAGE 2 TIME	0.0 ~ 6500	0.1	20.0	○
F4.05	Stage3 setup	STAGE 3 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 3(F3.25) 1:Decided by F0.00 parameter 2:Close loop reference 3(F5.22) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.06	Operating time in Stage3	STAGE 3 TIME	0.0 ~ 6500	0.1	20.0	○
F4.07	Stage4 setup	STAGE 4 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 4(F3.26) 1:Decided by F0.00 parameter 2:Close loop reference 4(F5.23) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.08	Operating time in Stage 4	STAGE 4 TIME	0.0 ~ 6500	0.1	20.0	○

Group F4: Operating Parameters						
Para	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F4.09	Stage5 setup	STAGE 5 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 5(F3.27) 1:Decided by F0.00 parameter 2:Close loop reference 5(F5.24) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.10	Operating time in Stage5	STAGE 5 TIME	0.0 ~ 6500	0.1	20.0	○
F4.11	Stage 6 setup	STAGE 6 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 6(F3.28) 1:Decided by F0.00 parameter 2:Close loop reference 6(F5.25) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.12	Operating time in Stage 6	STAGE 6 TIME	0.0 ~ 6500	0.1	20.0	○
F4.13	Stage 7 setup	STAGE 7 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 7(F3.29) 1:Decided by F0.00 parameter 2:Close loop reference 7(F5.26) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.14	Operating time in Stage 7	STAGE 7 TIME	0.0 ~ 6500	0.1	20.0	○

Group F5: Close-loop control parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F5.00	Close-loop function selection	CLOSELOOP FUNC SELE	0:disabled 1:enabled	1	0	×
F5.01	Reference selection	REF CHAN SELE	0:Digital input; (i.e. F5.05) 1:VCI(0~10V); 2: CCI;	1	1	○
F5.02	Feedback selection	FEEDBACK CHAN SELE	0:VCI (0~10V) 1:CCI (analog input) 2:VCI+CCI 3:VCI-CCI 4:Min{VCI,CCI} 5:Max{VCI,CCI}	1	1	○
F5.03	Filter of reference	REF FILTER CONST	0.01~50.00s	0.01s	0.50s	○
F5.04	Filter of feedback	FEEDBACK FILTER CONST	0.01~50.00s	0.01s	0.50s	○
F5.05	Digital setting of reference	DIGITAL REF	0.00V~10.00V	0.01	0.00	○
F5.06	Reserved	RESERVED	-	-	0	*
F5.07	Reserved	RESERVED	-	-	0	*
F5.08	Min reference	MIN REF	0.0%~(F5.10) (Ratio of Min reference to base value of 10V/20mA)	0.1%	0.0	○
F5.09	Feedback value corresponding to the Min reference	MIN FEEDBACK	0.0~100.0% (Ratio of Min reference to base value of 10V/20mA)	0.1%	20.0%	○
F5.10	Max reference	MAX REF	(F5.08)~100.0% (Ratio of Max reference to base value of 10V/20mA)	0.1%	100.0%	○
F5.11	Feedback value corresponding to the Max reference	MAX FEEDBACK	0.0~100% (Ratio of Max reference to base value of 10V/20mA)	0.1%	100.0%	○
F5.12	Proportional gain KP	PROPORTION GAIN	0.000~9.999	0.001	0.050	○
F5.13	Integral gain Ki	INTEGRATION GAIN	0.000~9.999	0.001	0.050	○
F5.14	Sampling cycle	SAMPLE CYCLE	0.01~50.00s	0.01s	0.50s	○
F5.15	Error Limit of deviation	ERROR LIMIT	0.0~20.0%(corresponding to close loop reference)	0.1%	2.0%	○
F5.16	Close loop regulation characteristic	CLOSELOOP FEATURE	0:Positive 1:Negative Note: reference has no connection with speed	1	0	×
F5.17	Integral regulation selection	INTEGRATION SELE	0: Stop the Integral regulation when the frequency reaches the upper limit or lower limit. 1: Continue the Integral regulation when the frequency reaches the upper limit or lower limit.	1	0	×
F5.18	Close-loop preset frequency	CLOSELOOP PRESET FREQ	0.00~600.0Hz	0.01Hz	0.00Hz	○
F5.19	Holding time of close-loop preset frequency	PRESET HOLD TIME	0.0~3600s	0.1s	0.0s	×
F5.20	Preset close-loop reference 1	CLOSELOOP REF1	0.00V~10.00V	0.01V	0.00V	○
F5.21	Preset close-loop reference 2	CLOSELOOP REF2	0.00V~10.00V	0.01V	0.00V	○
F5.22	Preset close-loop reference 3	CLOSELOOP REF3	0.00V~10.00V	0.01V	0.00V	○
F5.23	Preset close-loop reference 4	CLOSELOOP REF4	0.00V~10.00V	0.01V	0.00V	○
F5.24	Preset close-loop reference 5	CLOSELOOP REF5	0.00V~10.00V	0.01V	0.00V	○
F5.25	Preset close-loop reference 6	CLOSELOOP REF6	0.00V~10.00V	0.01V	0.00V	○
F5.26	Preset close-loop reference 7	CLOSELOOP REF7	0.00V~10.00V	0.01V	0.00V	○

Group F6: Reserved Parameters						
Para.	**Name**	**LCD Display**	**Setting Range**	**Unit**	**Factory Setting**	**Modif.**
F6.00~F6.07	Reserved	Reserved	-	-	0	*

Group F7: Terminal Function Parameters						
Para.	**Name**	**LCD Display**	**Setting Range**	**Unit**	**Factory setting**	**Modif**
F7.00	Function of multi-function terminal X1	TERMINAL X1 FUNC	0:No function 1:Preseting frequency 1 2:Preseting frequency 2 3:Preseting frequency 3 4:Setting Acc/Dec time 1 5:Setting Acc/Dec time 2 6:Normally open input terminal for external fault signal 7:Normally open input terminal for external fault signal 8:Terminal for external reset signal (RESET) 9:Terminal for inputting Jog running forward command 10:Terminal for inputting Jog running reverse command 11:Coast to stop (FRS) 12:Terminal for inputting command of increasing frequency (UP) 13:Terminal for inputting command of decreasing frequency (DN) 14: Terminal for inputting command of pausing PLC operation 15: Terminal for inputting command of disabling Acc/Dec 16: Terminal for 3-wire operation control 17: Normally open contacts for input external interruption 18: Normally closed contacts for input external interruption 19:DC injection braking at stop 20:close loop inactive 21:PLC inactive 22:reference frequency input channel 1 23:reference frequency input channel 2 24:reference frequency input channel 3 25:Frequency reference is input via terminal CCI forcibly 26:Reserved 27:Terminal control mode is forcibly enabled 28:Command input channel 1 29:Command input channel 2 30:Multi-voltage terminal 1 31:Multi-voltage terminal 2 32:Multi-voltage terminal 3 33:Start of traverse operation 34:Clear the traverse operation status 35:external stopping command(valid for all control mode) 36:Reserved 37:Drive operation disabled 38:Reserved 39:Clear the length 40:Clear the auxiliary reference frequency 41:Clear the memorized information at the stop process of PLC operation 42:Counter clearing signal input 43:Counter trigger signal input 44:Length data input 45:Pulse frequency input 46:Single phase speed measuring input 47:speed measuring input SM1(only for X7) 48:speed measuring input SM2(only for X8)	1	0	×
F7.01	Function of multi-function terminal X2	TERMINAL X2 FUNC				
F7.02	Function of multi-function terminal X3	TERMINAL X3 FUNC				
F7.03	Function of multi-function terminal X4	TERMINAL X4 FUNC				
F7.04	Function of multi-function terminal X5	TERMINAL X5 FUNC				
F7.05	Function of multi-function terminal X6	TERMINAL X5 FUNC				
F7.06	Function of multi-function terminal X7	TERMINAL X7 FUNC				
F7.07	Function of multi-function terminal X8	TERMINAL X7 FUNC				

Group F7: Terminal Function Parameters						
Para.	**Name**	**LCD Display**	**Setting Range**	**Unit**	**Factory setting**	**Modif**
F7.08	FWD/REV running mode setup	OPR CTR MODE	0: 2-wire operation mode 1 1: 2-wire operation mode 2 2:3-wire control mode 13:3-wire control mode 2	1	0	×
F7.09	UP/DN speed	UP/DN SPEED	0.01~99.99Hz/s	0.01Hz/s	1.00Hz/s	○
F7.10	Bi-direction open collector output terminal Y1	Y1 FUNC SELE	0:Running signal(RUN) 1:frequency arriving signal(FAR) 2:frequency detection threshold (FDT1) 3:frequency detection threshold (FDT2) 4:overload signal(OL) 5:low voltage signal(LU) 6:external fault stop signal(EXT) 7:frequency high limit(FHL) 8:frequency low limit(FLL) 9:zero-speed running 10:Completion of simple PLC operation 11:PLC cycle completion indication 12:preset counting value arriving 13:specified counting value arriving 14:reference length arriving indication 15:drive ready (RDY) 16:drive fault 17:extended function 1 of host	1	0	×
F7.11	Bi-direction open collector output terminal Y2	Y2 FUNC SELE		1	1	×
F7.12	Function selection of output relay	RELAY OUTPUT		1	16	×
F7.13	FAR range	FAR RANGE	0.00~600.0Hz	0.01Hz	2.50Hz	○
F7.14	FDT1 level	FDT1 LEVEL	0.00~600.0Hz	0.01Hz	50.00Hz	○
F7.15	FDT1 lag	FDT1 LAG	0.00~600.0Hz	0.01Hz	1.00Hz	○
F7.16	FDT2 level	FDT2 LEVEL	0.00~600.0Hz	0.01Hz	25.00Hz	○
F7.17	FDT2 lag	FDT2 LAG	0.00~600.0Hz	0.01Hz	1.00Hz	○
F7.18~F7.25	Reserved	RESERVED	-	-	0	*
F7.26	Functions of terminal AO1	ANALOG OUTPUT1	0: Output frequency before slip compensation (0~Max output frequency) 1:Output frequency after slip compensation (0~Max output frequency) 2:Preset frequency (0~Max output frequency) 3:Output current (0~2 times of drive's rated current) 4:Output current (0~2 times of motor's rated current) 5:Output torque (0~2 times of motor's rated torque) 6:Output voltage (0~1.2 times of drive's rated voltage) 7:Bus voltage (0~800V) 8:VCI (0~10V) 9:CCI (0~10V/0~20mA) 10:Output power (0~2 times of rated power) 11:Extended function of host 2(0~65535)	1	0	○
F7.27	Functions of terminal AO2	ANALOG OUTPUT2		1	3	○
F7.28	Functions of terminal DO(no output when F7.07=44~46)	DIGITAL OUPUT		1	0	○
F7.29	Analog output range	ANALOG OUTPUT OFFSET	Unit's place of LED: AO1 offset selection 0: 0~10V or 0~20mA 1: 2~10V or 4~20mA Ten's place of LED: AO2 offset selection 0:0~10V or 0~20mA 1: 2~10V or 4~20mA	1	00	○
F7.30	AO1 output gain	A01 CALIB	0.0~200.0%	0.1%	100.0%	○
F7.31	AO2 output gain	A02 CALIB	0.0~200.0%	0.1%	100.0%	○

Group F7: Terminal Function Parameters						
Para.	**Name**	**LCD Display**	**Setting Range**	**Unit**	**Factory setting**	**Modif**
F7.32	Maximum output frequency of DO	MAX OUTPUT PULSE	0.1~50.0 (up to 50k)	0.1	10.0k	○
F7.33	Preset counting value	SET COUNT VALUE	F7.34~9999	1	0	○
F7.34	Specified counting value	SPECIFIED COUNT VALUE	0~F7.33	1	0	○
F7.35	Terminal's positive and negative logic	TERMINAL ENABLE STATE	Binary setting: Positive logic: Terminal Xi is enabled if it is connected to corresponding common terminal, and disabled if it is disconnected; Negative logic: Terminal Xi is disabled if it is connected to corresponding common terminal, and enabled is it is disconnected; Unit's place of LED: Bit0~Bit3:X1~X4 Ten's place of LED: Bit0~Bit3:X5~X8 Hundred's place of LED: Bit0~Bit1:FWD. REV, Bit2~Bit3:Y1. Y2	1	000	○

Group F8: Display Parameters						
Para.	**Name**	**LCD Display**	**Setting Range**	**Unit**	**Factory Setting**	**Modif.**
F8.00	Language selection (Chinese/ English)	LANGUAGE SELECT	0:Chinese 1:English Note: This function is only applicable for LCD panel	1	0	○
F8.01	Parameter group 1 displayed during operation	OPR DISPLAY1 (Not flash, ▲ and ▼ keys are valid only in frequency and speed displaying status; The status will be saved at power off)	Binary settings: 0:No display; 1:Display Unit's place of LED: Bit0: Output frequency (Hz) (before compensation) Bit1: Output frequency (Hz) (after compensation) Bit2: Reference frequency (Hz flashes) Bit3:Output current(A) Ten's place of LED: Bit0:Spinning speed(R/MIN) Bit1:Reference speed(R/MIN flashes) Bit2: Line speed(M/S) Bit3:Reference line speed(M/S flashes) Hundred's place of LED: Bit0:Output power Bit1:Output torque(%) Note: The frequency before compensation will be displayed if all the Bits are 0.	1	3FF	○
F8.02	Parameter group 2 displayed during operation	OPR DISPLAY2 (nor flash; the status will be saved at power off)	Binary settings: 0:No display; 1:Display Unit's place of LED: Bit0:Output voltage(V) Bit1:Bus voltage Bit2:VCI(V) Bit3:CCI(V) Ten's place of LED: Bit0: Analog close loop feedback (%) Bit1: Analog close loop frequency (%) Bit2: External counting value(no unit) Bit3: Terminal status(no unit)	1	000	○
F8.03	Parameter displayed at STOP state	STOP DISPLAY (flashes, ▲ and ▼ key are valid in frequency displaying status; the status will be saved at power off)	Binary settings: 0:No display; 1:Display Unit's place of LED: Bit0: Reference frequency(Hz) Bit1: External counting value(no unit) Bit2: Spinning speed(R/MIN) Bit3: Reference speed(R/MIN) Ten's place of LED: Bit0: Line speed(M/S) Bit1: Reference line speed(M/S) Bit2: VCI(V) Bit3: CCI(V) Hundred's place of LED: Bit0: Analog close loop feedback (%) Bit1: Analog close loop setup (%) Bit2: Terminal status (no unit) Bit3: Bus voltage Note: The reference frequency will be displayed in default if all the Bits are 0	1	1FF	○
F8.04	Coefficient of displayed speed	SPEED FACTOR	0.1~999.9% Spinning speed = actual spinning speed*F8.04(PG) Spinning speed= 120*operating Frequency/FH.00*F8.04(non PG) Reference speed = close loop reference speed*F8.04(PG) Reference speed= 120*reference frequency/FH.00*F8.04(non PG)) Note: No influence to actual speed	0.1%	100.0%	○
F8.05	Coefficient of displayed line speed	LINE SPEED FACTOR	0.1~999.9% Line speed = running frequency*F8.05(non PG)) Line speed = spinning speed*F8.05(PG) Reference line speed = reference frequency*F8.05(non PG)) Reference line speed=reference speed*F8.05(PG) Note: No influence to actual speed	0.1%	1.0%	○
F8.06	Coefficient of displayed analog close loop parameter/ feedback	CLOSELOOP DISPLAY FACTOR	0.1~999.9% Note: Analog close loop reference/feedback displaying range:0~999.9	0.1%	100.0%	○

Group F9: Enhanced Functional Parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F9.00	Control mode is bundled to frequency selector	FREQ-COMMAND ATTACHING	Unit's place of LED: Select the frequency reference selector in panel control mode 0:No bundling 1:Digital setting 1(set via ▲ and ▼) 2:Digital setting 2(set via terminal UP/DN) 3:Digital setting 3(set via serial port) 4:Set the reference via VCI 5:Set the reference via CCI 6:Set in pulse mode via terminals Ten's place of LED: Select the frequency reference selector in terminal control mode 0: No bundling 1:Digital setting 1(set via ▲ and ▼) 2:Digital setting 2(set via terminal UP/DN) 3:Digital setting 3(set via serial port) 4:Set the reference via VCI 5:Set the reference via CCI 6:Set in pulse mode via terminals Hundred's place of LED: Select the frequency reference selector in serial port control mode 0: No bundling 1:Digital setting 1(set via ▲ and ▼) 2:Digital setting 2(set via terminal UP/DN) 3:Digital setting 3(set via serial port) 4:Set the reference via VCI 5:Set the reference via CCI 6:Set in pulse mode via terminals	1	000	○
F9.01	Auxiliary reference selector	AUX REF	0:No auxiliary reference frequency; 1:Digital setting 1, set by ▲ and ▼(given by F9.03 directly); 2:Digital setting 2, set by terminal UP/DN (given by F9.03 directly); 3:Digital setting 3, set by serial port(given by F9.03 directly); 4:Set the reference via VCI 5:Set the reference via CCI 6:Set in pulse mode via terminals 4:Set the reference via VCI 5:Set the reference via CCI 9:Set in pulse mode via terminals 10:VCI-5; 11:CCI-5; 12:PULSE-0.5×F1.03 Note: Disabled together with main reference selector frequencies in items 4~12 use the setting of F1.00.	1	0	○
F9.02	Auxiliary reference analog coefficient	AUX REF FACTOR	0.00~9.99(only for F9.01=4~12)	0.01	1.00	○
F9.03	Initial auxiliary digital frequency	AUX FREQ	0.00~600.0Hz	0.01	0.00Hz	○
F9.04	Auxiliary frequency control	AUX FREQ CTR	Unit's place of LED: Saving control 0:Saving auxiliary frequency at power off 1:Not saving auxiliary frequency at power off Ten's place of LED: 0:Holding auxiliary frequency at stop 1:Clearing auxiliaryfrequency at stop Hundred's place of LED: polarities of frequency 0:Positive 1:Negative Note: Only valued at F9.01=1, 2 or 3	1	000	○
F9.05	Frequency adjustment	FREQ ADJ	0:Disabled 1:Percentage of F005 2:Percentage of present frequency	1	0	○
F9.06	Adjustment coefficient of reference frequency	ADJ FACTOR	0.0%~200.0%	0.1%	100.0%	○

Group F9: Enhanced Functional Parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
F9.07	Function of keys	KEY FUNC SELE	Unit's place of LED:STOP/RESET key's function selection 0:Valid in panel control mode 1:Valid in all control mode 2:Coast to stop with E015 in non-panel control mode, stop in stopping mode in panel control mode Ten's place of LED: function of PANEL/REMOTE key 0:Inactive 1:Stopping status active 2:Valid in stopping and running modes Hundred's place of LED: Keypad locking function 0:No locking 1:Locked 2:All the keys except the STOP/RESET key are locked 3:All the keys except the SHIFT key are locked 4:All the keys except the RUN and STOP/RESET keys are locked	1	000	×
F9.08	Cooling fan control	FAN CTR	0:Auto stopping mode 1:Fan operate continuously when power is on Note: Continue to operate for 3 minutes	1	0	×
F9.09	Unit of Accelerating/decelerating time	ACC/DEC UNIT	0: Second 1: Minute	0	0	×
F9.10	Reserved	RESERVED	-	-	0	*
F9.11	Overshoot enabled	OVER MODULATION ENABLE	0:Disabled 1:Enabled	1	1	×
F9.12	Zero-frequency operation threshold	ZERO FREQ THRESHOLD	0.00~600.00Hz	0.01Hz	0.00Hz	○
F9.13	Zero-frequency hysteresis	ZERO FREQ HYSTERESIS	0.00~600.00Hz	0.01Hz	0.00Hz	○
F9.14~F9.19	Reserved	RESERVED	-	-	0	*
F9.20	Trip-free operating function	NO STOP DURING P.OFF	0: Disabled 1: Enabled (low voltage compensation) (Valid for the drive below 18.5kW)	1	0	×
F9.21	Frequency decrease rate at voltage compensation	FREQ SLOW RATE 1	0.00~99.99Hz/s	0.01Hz/S	10.00Hz/s	○
F9.22	Function of restart after power failure	RESTART AFTER POFF	0:Disabled 1:Enabled	1	0	×
F9.23	Delay time for restart after power failure	DELAY TIME BEFORE RESTART	0.0~10.0s	0.1s	0.5s	○

Group FA: Reserved Parameters						
Parameter	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modification**
FA.00~FA.11	Reserved	RESERVED	-	-	0	*

Group FF: Communication Parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
FF.00	Communication configuration	COMM CONFIG	Unit's place of LED: Baud rate selection 0:300bps 1:600bps 2:1200bps 3:2400bps 4:4800bps 5:9600bps 6:19200bps 7:38400bps Ten's place of LED: Data format 0:1-8-1 format, no parity 1:1-8-1 format, Even parity 2:1-8-1 format, Odd parity Hundred's place of LED: virtual input terminal 0:Disabled 1: Enabled Thousand's place of LED: wiring mode 0:Direct connection via cable (RS232/485) 1: MODEM (RS232)	1	0005	×
FF.01	Local address	LOCAL ADDR	0~126,127 is the broadcasting address	1	1	×
FF.02	Time threshold for judging the communication status	TIMEOUT SETTING	0.0~1000s	0.1	0.0s	×
FF.03	Delay for responding to control PC	SCI REPLY DELAY	0~1000ms	1	5ms	×

Group FH: Motor Parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
FH.00	Number of polarities of motor	MOTOR POLARITY NUM	2~14	2	4	×
FH.01	Rated power	RATED POWER	0.4~999.9kW	0.1kW	Dependent on drive's model	×
FH.02	Rated current	RATED CURR	0.1~999.9A	0.1A	Dependent on drive's model	×
FH.03	Current without load	CURR WITH NO LOAD	0.1~999.9A	0.1A	Dependent on drive's model	×
FH.04	Resistance of stator R1	STATOR RESIS R1	0.00%~50.00%	0.01%	Dependent on drive's model	○
FH.05	Leakage inductance Xl	LEAKAGE INDUC Xl	0.00%~50.00%	0.01%	Dependent on drive's model	○
FH.06	Resistance of rotor R2	ROTOR RESIS R1	0.00%~50.00%	0.01%	Dependent on drive's model	○
FH.07	Mutual inductance Xm	MUTUAL INDUC Xm	0.0%~2000%	0.1%	Dependent on drive's model	○
FH.08	Rated slip	RATED SLIP	0.00~20.00Hz	0.01Hz	0.00Hz	○
FH.09	Auto tuning	PARA AUTOSET	0:Disabled 1:Enabled (motor in standstill state) 2:Enabled (motor is running)	1	0	×
FH.10	Motor stabilization factor	MOTOR STEAD FACTOR	0~255	1	Dependent on drive's model	○
FH.11 ~ FH.21	Reserved	RESERVED	-	-	0	*

Group FL: Protection Parameters						
Para.	**Name**	**LCD display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
FL.00	Motor overload protection mode selection	OVERLOAD PROTECTION	0:Disabled 1:Common motor (with low speed compensation) 2:Variable frequency motor (without low speed compensation)	1	1	×
FL.01	Motor overload protection coefficient setup	THERMAL RELAY	20.0~110.0%	0.1%	100.0%	×
FL.02	Over voltage at stall	OVERVOLT STALL	0:Disabled (when braking resistor is mounted) 1:Enabled	1	1	×
FL.03	Over voltage point at stall	STALL OVERVOLT REF	120.0~150.0%Udce	0.1%	140.0%	×
FL.04	Overload detection setup	OVERLOAD DETECT	Unit's place of LED: 0:Detect all the time 1:Detect only at constant speed running Ten's place of LED: alarm selection 0: Drive will not alarm, and continue to operate 1: Drive alarms and stops Hundred's place of LED: selection of detected value 0: % of rated current of motor(E014) 1: % of rated current of drive(E013)	1	000	×
FL.05	Overload detection threshold	OVERLOAD LIMIT	20.0%~200.0%	0.1%	130.0%	×
FL.06	Overload detection time	OVERLOAD DETECT TIME	0.0~60.0s	0.1s	5.0s	×
FL.07	Auto current limiting threshold	CURR LIMIT	20.0%~200.0%	0.1%	110%	×
FL.08	Frequency decrease rate in current limiting	FREQ SLOW RATE 2	0.00~99.99Hz/s	0.01 Hz/s	10.00 Hz/s	○
FL.09	Auto current limiting action selection	AUTO CURR LIMIT	0:Invalid at constant speed 1:Valid at constant speed Note: Acceleration and deceleration are valid	1	1	×
FL.10	Auto reset times	AUTO RESET TIMES	0~10, "0" means auto reset function is disabled Note: No auto reset function for module protection and external equipment fault.	1	0	×
FL.11	Reset interval	RESET INTERVAL	2.0~20.0s/time	0.1s	5.0s	×
FL.12	Protective action 1	PROTECTION ACTION 1	Unit's place of LED: Protective action triggered by communication failure 0:Alarm and coast to stop 1:No alarm and continue running 2:No alarm and stop in stopping mode(only in serial port control mode) 3: No alarm and stop in stopping mode(in all control modes) Ten's place of LED: Protective action triggered by contactor failure 0:Alarm and coast to stop 1:No alarm and continue running Hundred's place of LED: Protective action triggered by EEPROM fault 0:Alarm and coast to stop 1:No alarm and continue	1	001	×
FL.13	Protective action 2	PROTECTION ACTION 2	Unit's place of LED: Protective action triggered by under voltage 0:Disabled 1:Enabled (under voltage is considered as a fault) Ten's place of LED: Fault indication during auto-reset interval enabled 0:Disabled 1:Enabled Hundred's place of LED: fault locking function selection 0:Disabled 1:Enabled (fault indication is disabled) 2:Enabled (fault indication is enabled) Thousand's place of LED: Phase failure function enabled 0:Input and output phase failure protective function enabled 1:Input phase failure protective function disabled 2:Output phase failure protective function disabled 3:Input and output phase failure protective function disabled	1	0000	×

Group FL: Protection Parameters						
Para.	**Name**	**LCD display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
FL.14	Type of third latest fault	1st fault	0:No fault 1:Over-current in accelerating process(E001) 2:Over-current in decelerating process (E002) 3:Over-current in constant-speed running process (E003) 4:Over-voltage in accelerating process (E004) 5:Over-voltage in decelerating process (E005) 6:Over-voltage in constant-speed running process (E006) 7:Control power supply over voltage(E007) 8:Input phase failure(E008) 9:Output phase failure(E009) 10:IGBT protection(E010) 11:IGBT Heatsink over-temperature (E011) 12:Rectifier Heatsink over-temperature (E012) 13:Drive overload (E013) 14:Motor overload (E014) 15:Emergent stop (E015) 16:EEPROM w/r error (E016) 17:serial port communication fault(E017) 18:contactor fault(E018) 19:current detection circuit fault (E019) (hall sensor or amplify circuit fault) 20:system disturbance (E020) 21:Reserved 22:Reserved 23:Paremeter copy fault (E023) 24:auto- tuning fault (E024) Note: ①E010 can be reset after 10 seconds;	1	0	*
FL.15	Type of second latest fault	2nd fault				
FL.16	Type of latest fault	3rd FAULT				
FL.17	DC Bus Voltage at the last fault	VOLT AT FAULT	0~999V	1V	0V	*
FL.18	Current at the last fault	CURR AT FAULT	0.0~999.9A	0.1A	0.0A	*
FL.19	Frequency at the last fault	FREQ AT FAULT	0.00Hz~600.0Hz	0.01 Hz	0.00Hz	*

Group Fn: Drive's Parameters						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
Fn.00	Preset operating time	ENGAGE RUN TIME	0~65.535K hours	0.001k hours	0	○
Fn.01	Total operating time	TOTAL RUN TIME	0~65.535K hours	0.001k hours	0	*
Fn.02	Temperature of heatsink 1	HEATSINK1 TEMP	0.0~100.0℃	0.1	0℃	*
Fn.03	Temperature of heatsink 2	HEATSINK2 TEMP	0.0~100.0℃	0.1	0℃	*

Group FP: Parameter Security Functions						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
FP.00	User's password	USER PASSWORD	0:No password Others: Protected by Password	0	0	○
FP.01	Selection of parameter write-in states	PARA PROTECTION	0: Modifying all parameters is enabled 1: Modifying other parameters is disabled except F0.02 and FP.01 2: Modifying other parameters is disabled except FP.01	1	1	○
FP.02	Parameter initialization	PARA INITIALIZE	0: Parameter modification enabled state 1: clear the memorizing information (FL.14~19) 2: Recover the factory settings (before FL.12)	1	0	×
FP.03	Parameter copy	PARA COPY	0:disabled 1:parameter upload 2:parameter download 3:parameter download (except the parameters related to the drive itself) Note: Only valid to LCD panel;	1	00	×
FP.04	Reserved	RESERVED	-	-	0	*

Group FU: Factory Settings						
Para.	**Name**	**LCD Display**	**Setting range**	**Unit**	**Factory setting**	**Modif.**
FU.00	Factory password	FACTORY PASSWORD	****	1	Factory password	-

Appendix Ⅱ Parameters of Recommended Accessories

Notes: Our company does not supply reactor and EMI filter, so you should order them separately. The following models have been tested on our drive. You can contact us or the supplier if you need them.

1. AC/DC Reactor

AC input reactor and output reactor

1. Model description

AC input reactor: TDL-4AI01-0300, where 0300 denotes the power rating, similar to the power rating of the drive.

AC output reactor: TDL-4AO01-0300, where 0300 denotes the power rating, similar to the power rating of the drive.

2. Sizes

The sizes of AC input reactor and output reactor are classified into three types, as shown in Fig. A-1 ~ Fig. A-3. See Table A-2 ~ Table A-4 for the details.

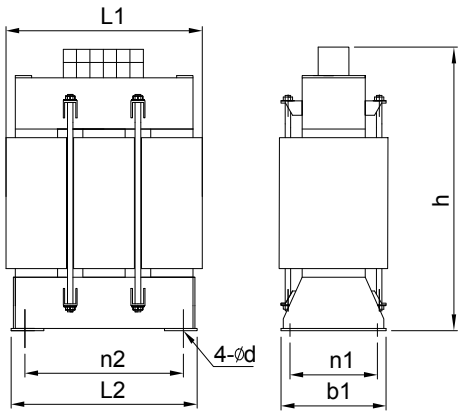


Fig. A-1 Outline of 3-phase AC input and output reactor (a)

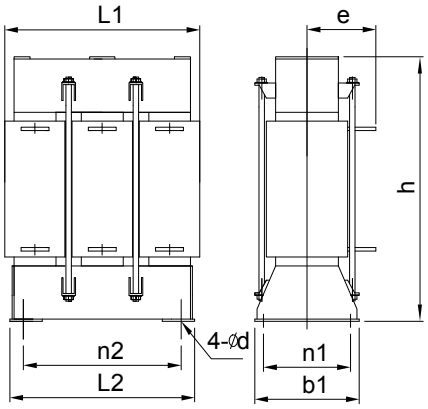


Fig. A-2 Outline of 3-phase AC input and output reactor (b)

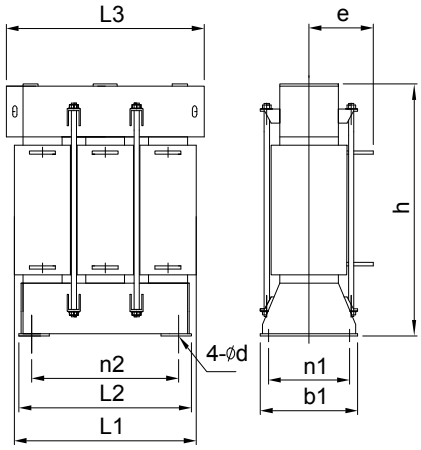


Fig. A-3 Outline of 3-phase AC input and output reactor (c)

3. Parameters of 3-phase AC input reactor (TDL-4AI01-XXXX)

Table A-2 Parameters of 380V series 3-phase AC input reactor (2%)

Drive's power (kW)	Reactor model	Reactor product code	Fig. No.	Outline dimension (mm)						Installation dimension (mm)			Weight (kg)	PC (W)	Pm (W)
				L_3	L_1	L_2	B_1	h	e	n_2	n_1	d			
7.5	TDL-4AI01-0075	K119-ER04	Fig. A-1		120	106	80	100		80	60	6.5	2.1	7	25
11		K119-ER05			120	106	80	100		80	75	6.5	3.0	8	30
15	TDL-4AI01-0150	K119-ER06			130	120	80	125		90	70	6.5	4.5	9	40
18.5		K119-ER07			165	148	80	135		120	70	6.5	6.0	12	55
22	TDL-4AI01-0220	K119-ER08	Fig. A-1		165	148	80	135		120	70	6.5	6.0	12	55
30		K119-ER09			165	148	80	135		120	70	6.5	6.3	12	55
37	TDL-4AI01-0370	K119-ER10			165	148	80	135		120	70	6.5	7.5	15	60
45		K119-ER11			165	148	80	135		120	70	6.5	7.8	15	60
55	TDL-4AI01-0550	K119-ER12	Fig. A-2		190	170	80	160	70	140	70	6.5	10	20	70
75		K119-ER13			190	170	80	160	70	140	70	6.5	11	20	70
90	TDL-4AI01-0900	K119-ER14			190	170	100	160	70	140	80	6.5	12	25	80
110		K119-ER15			215	200	120	200	90	170	100	6.5	22	50	130
132	TDL-4AI01-1320	K119-ER16			215	200	140	200	100	160	120	6.5	26	56	150
160		K119-ER17			215	200	140	200	100	160	120	6.5	26	56	150
200	TDL-4AI01-1600	K119-ER18	Fig. A-3	280	245	226	150	240	110	185	125	13	40	85	188
220	TDL-4AI01-2200	K119-ER19		280	245	226	150	240	110	185	125	13	40	85	188
		K119-ER20		280	245	226	150	240	110	185	125	13	40	85	188

Table A-3 Parameters of 380V series 3-phase AC input reactor (4%)

Drive's power (kW)	Reactor model	Reactor product code	Fig. No.	Outline dimension (mm)						Installation dimension(mm)			Weight (kg)	PC (W)	Pm (W)
				L_3	L_1	L_2	B_1	h	e	n_2	n_1	d			
7.5	TDL-4AI01-0075	K119-EM28	Fig. A-1		130	120	80	125		90	70	6.5	4.5	9	40
11		K119-EM29			165	148	80	135		120	70	6.5	6.0	12	55
15	TDL-4AI01-0150	K119-EM30			165	148	80	135		120	70	6.5	6.0	12	55
18.5		K119-EM31			165	148	80	135		120	70	6.5	7.5	15	60
22	TDL-4AI01-0220	K119-EM32			165	148	80	135		120	70	6.5	7.5	15	60
30		K119-EM33	Fig. A-2		190	170	80	160	70	140	70	6.5	10	15	60
37	TDL-4AI01-0370	K119-EM34			190	170	100	160	70	140	80	6.5	12	20	70
45		K119-EM35			215	200	120	200	90	170	100	6.5	22	25	80
55	TDL-4AI01-0550	K119-EM36			215	200	120	200	90	170	100	6.5	22	50	130
75		K119-EM37			215	200	140	200	100	160	120	6.5	26	50	130
90	TDL-4AI01-0900	K119-EM38	Fig. A-3	280	245	226	150	240	110	185	125	13	40	56	150
110		K119-EM39		280	245	226	150	240	110	185	125	13	40	85	188
132	TDL-4AI01-1320	K119-EM40		310	280	256	150	260	110	220	125	13	50	85	188
160		K119-EM41		310	280	256	150	260	110	220	125	13	50	120	240
200	TDL-4AI01-1600	K119-EM42		310	280	256	150	260	110	220	125	13	50	120	240
220	TDL-4AI01-2200	K119-EM43		360	330	308	170	310	120	265	150	13	80	120	240
280		K119-EM44		360	330	308	170	310	120	265	150	13	80	170	360

4. Parameters of 3-phase AC output reactor (TDL-4AO01-XXXX)

Table A-4 Parameters of 380V series 3-phase AC output reactor

Drive's power (kW)	Reactor model	Reactor product code	Fig. No.	Outline dimension (mm)						Installation dimension (mm)			Weight (kg)	PC (W)	Pm (W)
				L3	L1	L2	B1	h	e	n2	n1	d			
7.5	TDL-4AO01-0075	K220-EM05	Fig. A-1		130	120	80	125		90	70	6.5	4.5	9	40
11															
15	TDL-4AO01-0150	K220-EM07			165	148	80	135		120	70	6.5	6.0	12	55
18.5															
22	TDL-4AO01-0220	K220-EM08			165	148	80	135		120	70	6.5	7.5	15	60
30		K220-EM09			165	148	80	135		120	70	6.5	7.5	15	60
37	TDL-4AO01-0370	K220-EM10	Fig. A-2		190	170	80	160	70	140	70	6.5	10	20	70
45		K220-EM11			190	170	100	160	70	140	80	6.5	12	25	80
55	TDL-4AO01-0550	K220-EM12			190	170	100	160	70	140	80	6.5	12	25	80
75		K220-EM13			190	170	100	160	70	140	80	6.5	12	25	80
90	TDL-4AO01-0900	K220-EM14			215	200	120	200	90	170	100	6.5	22	50	130
110		K220-EM15			215	200	120	200	90	170	100	6.5	23	50	132
132	TDL-4AO01-1320	K220-EM16			215	200	120	200	90	170	100	6.5	24	50	133
160		K220-EM17			215	200	120	200	90	170	100	6.5	24	50	135
200	TDL-4AO01-1600	K220-EM18			215	200	140	200	100	160	120	6.5	26	56	150
220	TDL-4AO01-2200	K220-EM19			215	200	140	200	100	160	120	6.5	26	56	151
280		K220-EM20	Fig. A-3	280	245	226	150	240	110	185	125	13	40	85	190

DC reactor

1. Model description

TDL-4DI01-0300, where 0300 denotes the power rating, similar to the power rating of the drive.

2. Sizes

The sizes of DC reactor are classified into two types, as shown in Fig. A-4 ~ Fig.A-5. See Table A-5 for the details.

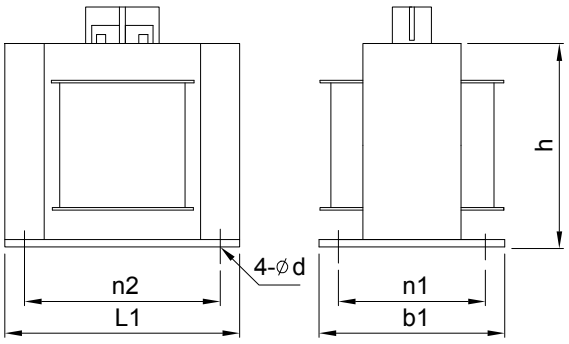


Fig. A-4 Outline of DC reactor (a)

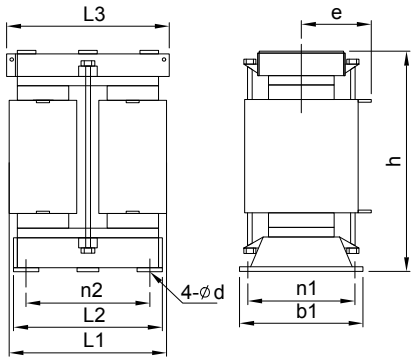


Fig. A-5 Outline of DC reactor (b)

3. Parameters of DC reactor (TDL-4DI01-XXXX)

The 90kW and larger drives with standard configurations have DC reactor. The models and parameters for reactors applicable to 75kW or below drives are listed below.

Table A-5 Parameters of 380V series DC reactor

Drive's power (kW)	Reactor model	Reactor product code	Fig. No.	Outline dimension (mm)			Installation dimension(mm)			Weight(kg)	PC (W)	Pm (W)
				L_1	b_1	h	n_2	n_1	d			
15	TDL-4DI01-0150	K424-EM02	Fig.A-4	114	100	98	100	80	6.5	4	15	23.5
18.5												
22	TDL-4DI01-0220	K424-EM04		134	100	114	120	80	6.5	6.8	24	30.6
30												
37	TDL-4DI01-0370	K424-EM05		134	120	114	120	100	6.5	8	28	33.2
45		K424-EM06		134	140	114	120	100	6.5	10	33	42.8
55	TDL-4DI01-0550	K424-EM07	Fig.A-5	134	140	114	120	100	6.5	10	33	42.8
75		K425-EM10		135	120	225	100	80	6.5	14	36	63.7

2. 380V Series EMI Filter

1. Model description

DL-20EBT1, where DL denotes the power filter series of Changzhou Jianli Electronic Co., Ltd., 20 denotes the rated current, EB denotes the 3-phase 3-wire system, while T1 and K1 denotes the internal circuit structure.

2. Sizes

The sizes of EMI filter are shown in Fig. A-6. See Table A-6 for the details.

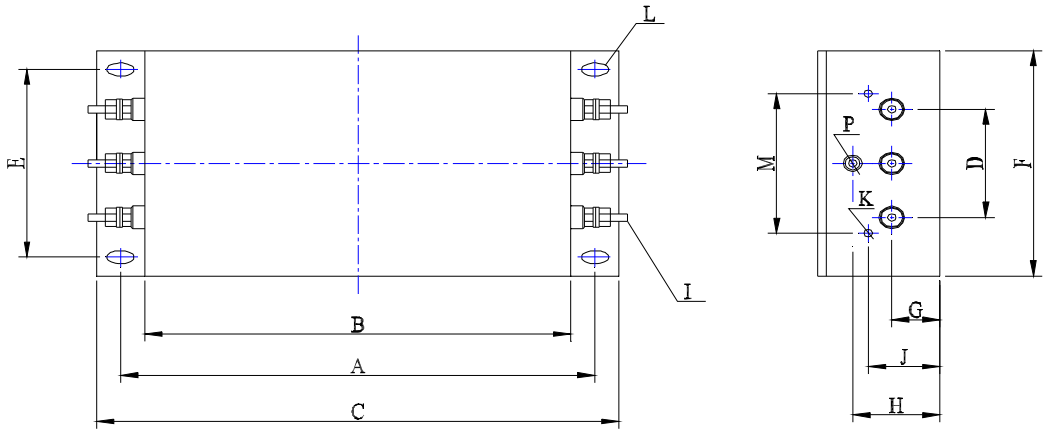


Fig. A-6 Outline of EMI

3. Parameters of 380V series EMI filter (DL-XXEBX1)

Table A-6 Mechanical parameters of EMI filter

Drive's power (kW)		Filter model	Dimension (mm)															Weight (kg)
			A	B	C	D	E	F	G	H	I	J	K	M	N	P	L	
7.5	11	DL-20EBT1	243	220	261	58	70	100	25	90	M6	58	M4	74	49	M6	6.4×9.4	3.5
15	18.5	DL-35EBT1	243	220	261	58	70	100	25	90	M6	58	M4	74	49	M6	6.4×9.4	4.0
22	30	DL-50EBT1	243	220	261	58	70	100	25	90	M6	58	M4	74	49	M6	6.4×9.4	4.0
37	45	DL-80EBT1	354	320	384	66	155	185	30	90	M8	62	M4	86	56	M8	6.4×9.4	8.5
55		DL-100EBK1	354	320	384	66	155	185	30	90	M8	62	M4	86	56	M8	6.4×9.4	9.0
75	90	DL-150EBK1	354	320	384	66	155	185	30	90	M8	62	M4	86	56	M8	6.4×9.4	9.5
110		DL-200EBK1	354	320	384	66	190	220	35	100	M8	62	M4	86	61	M8	6.4×9.4	13.0

3. Manufacturer Information

AC/DC reactor

Hua Shenglong Electrical Co., Ltd.

Address (head office): 3-20#, Yellow River Road, Economic and Technological Development Zone, Qinhuangdao City, Hebei Province

Postal Code: 066004

Address (Changzhou branch): Furong Industrial park, Wujin District, Changzhou City

Postal Code: 213118

Telephone: (86-519) 8651555 Fax: (86-519) 8651777

Website: www.hslec.com

E-mail: whb2415@163.com

EMI filter

Changzhou Jianli Electronic Co., Ltd.

Address: 272#, Qingtan Road, Changzhou City, Jiangsu Province, P.R.China

Postal code: 213015

Telephone: (86-0519) 6972136 6973215 6984439 Fax: (86-0519) 6960580

Website: www.cnfilter.com

E-mail: jianli@cnfilter.com

Appendix Ⅲ Communication Protocol

1 Networking Construction

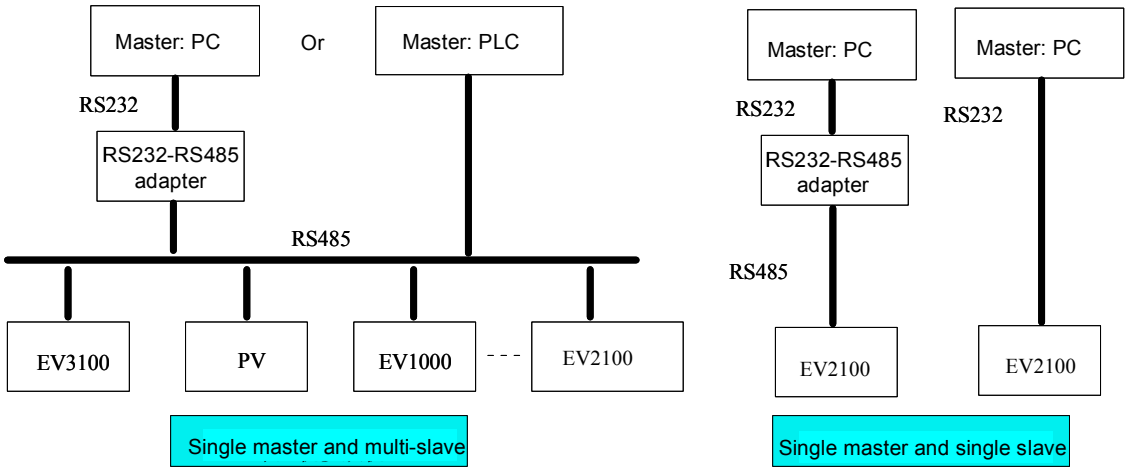


Fig. A-7 Networking diagram of drives

2 Interfaces

RS485 or RS232: asynchronous, semi-duplex

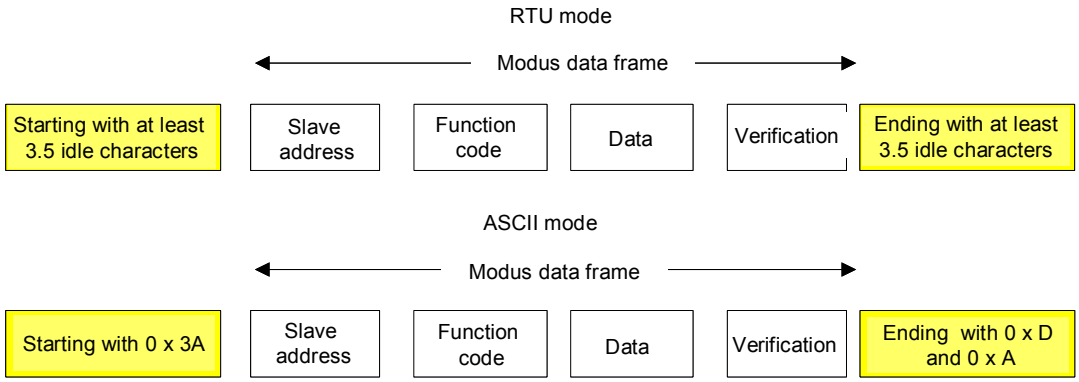
Default: 8-N-2, 19200bps. See Group FF for parameter settings.

3 Communication Modes

1. The communication protocol of the drive is Modbus protocol, which does not only support common register reading/writing, but also expands some commands to manage the drive function codes.
2. The drive is a slave in the network. It communicates in “point to point” mode. The drive will not response to the command sent by the master via broadcast address.
3. In the multiple-unit communication or long-distance communication, it is recommended that the signal earthing of the master station be connected with the signal earthing “GND” to enhance its immunity to interference.
4. EV2100 provides two interfaces: RS232 and RS485. Pay attention that the Jumper CN14 should be in correct position.

4 Protocol Format

The Modbus protocol can support both RTU mode and ASCII mode, and its corresponding frame format is shown as follows:



The Modbus adopts the “Big Endian” encoding mode, which sends the high bytes first and then sends the low bytes.

RTU mode: In this mode, the larger value between the function code setting value and the Modbus internal convention value shall be selected as the idle time between frames. The minimum idle time value between frames under the Modbus internal convention is as follows: the idle time that the frame head and frame trail pass the bus shall not be less than that of 3.5 bytes to define the frame. The data verification adopts CRC-16 and the checksum includes the whole information. The high and low bytes of the checksum can only be sent after their exchanging. Please refer to the example after the protocol for the detailed CRC verification. Please note: At least 3.5 characters of the BUS idle time shall be kept between the frames and it doesn’t need to accumulate the start and end idle time.

The following is the data frame of 002 parameter which the request frame reads from No.1 unit:

Address	Function code	Register address		Number of bytes read		Checksum	
0x01	0x03	0x00	0x02	0x00	0x01	0x25	0xCA

The following is the response frame of No.1 unit:

Address	Function code	Number of bytes responded	Register content		Checksum	
0x01	0x03	0x02	0x13	0x88	0xB5	0x12

In the ASCII mode, the frame head is “0x3A” and the frame trail is “0x0D” or “0x0A” by default. The frame trail can be set by the user as well. In this mode, except for the frame head and frame trail, all the other data bytes are sent in the ASCII mode. The 4 high bytes will be sent first, and then the 4 low bytes. In the ASCII mode, the data has 7 bits. For “A” to “F”, their capital letter in the ASCII code will be used. The data is verified by the LRC and the verification involves information from slave address to data. The checksum is equivalent to the complement of the character sum of all the data in the check.

The examples of Modbus data frame in the ASCII mode are as follows:

The command frame formats of writing 4000 (0xFA0) into the internal register 002 of No.1 slave are as shown below:

LRC verification = complement of (01+06+00+02+0x0F+0xA0) =0x48

	Frame head	Address		Function code		Register address				Content written				LRC verification		Frame trail	
Character	:	0	1	0	6	0	0	0	2	0	F	A	0	4	8	CR	LF
ASCII	3A	30	31	30	36	30	30	30	32	30	46	41	30	34	38	0D	0A

With the function codes, the drive can set different response delays to meet the specific application demands of various master stations. For the RTU mode, the actual time of response delay shall be not less than the interval of 3.5 characters and for the ASCII mode, the actual time of response delay shall be not less than 1ms.

5. Protocol functions

The main function of the Modbus is reading/writing parameters. Different function codes determine different operation requests. The Modbus protocol of the drive supports the following function code operations:

Function code	Meaning of function code
0x03	Read the function code parameters and operating status parameters of the drive
0x06	Change single function code or control parameter of the drive and the parameter values will not be saved after power off
0x08	Line diagnosis
0x10	Change multiple function codes or control parameters of the drive and the parameter values will not be saved after power off
0x41	Change single function code or control parameter of the drive and the parameter values will be saved after power off
0x42	Manage function code

All the function code parameters, control parameters and status parameters of the drive are mapped as the read/write registers. The read/write features and range of the function code parameter follow the drive user manual. The group number of the drive function code is mapped as the high byte of the register address and the group internal index is mapped as the low byte of the register address. The control parameter and status parameter of the drive are virtual function code groups of the drive. The correspondence between the group numbers of the function codes and the high bytes of the register address mapped are as shown below:

Group F0: 0x00; Group F1: 0x01; Group F2: 0x02; Group F3: 0x03; Group F4: 0x04; Group F5: 0x05; Group F6: 0x06; Group F7: 0x07; Group F8 Group: 0x08; Group F9: 0x09; Group FA: 0x0A; Group Fb: 0x0B; Group FC: 0x0C; Group Fd: 0x0D; Group FE: 0x0E; Group FF: 0x0F; Group FH: 0x10; Group FL: 0x11; Group Fn: 0x12; Group FP: 0x13;Group FU: 0x14; control parameter group of the drive: 0x32; status parameter group of the drive: 0x33.

For example, if the register address of the function code parameter F03.02 of the drive is 0x302, then the register address of the function code parameter FF.01 of the drive is 0xF01.

As the format of the whole data frame has been detailed in the above text, the following text will focus on the format and meanings of the function codes and data of the Modbus protocol. These two parts constitute the Modbus application layer protocol data unit. Any reference to application layer protocol data unit to below refers to such two parts. The introduction to the frame format below is based on RTU mode. For the ASCII mode, the length of the application-layer protocol data unit shall be doubled.

The application-layer protocol data units of reading the parameter of the drive are as follows:

Request formats:

Application-level protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x03
Start register address	2	0x0000~0xFFFF
Number of registers	2	0x0001~0x0004

Response formats:

Application-level protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x03
Number of bytes read	1	2*Number of registers
Content read	2*Number of registers	

If the operation request is rejected, the response will be error code and abnormal code. Error code equals to function code +0x80, abnormal code shows the error cause in detail. Examples for abnormal codes:

Abnormal code	Meaning of abnormal code
0x1	Invalid function code
0x2	Invalid register address.
0x3	Data error (the data is beyond the upper/lower range).
0x4	Slave operation failure, including the error caused by that the data is within the upper/lower range, but it is invalid.
0x5	The command is valid and in process. It is mainly used to save the data into the nonvolatile memory cell.
0x6	The salve is busy, please try again later. It is mainly used to save the data into the nonvolatile memory cell.
0x18	Information frame error, including information length error and verification error
0x20	Parameters can not be changed.
0x22	Password required for parameters.

The application-level protocol data units of changing the parameters of single drive are as follows:

Request formats:

Application-level protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x06
Register address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

Response formats:

Application-level protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x06
Register address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

If the operation request is rejected, the response will be error code and unexpected code. Error code equals to function code +0x80. Please refer to the above text for the abnormal code details.

The application-layer protocol data units of line diagnosis are as follows:

Request formats:

Application-level protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x08
Subfunction code	2	0x0000~0x0030
Data	2	0x0000~0xFFFF

Response formats:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x08
Subfunction code	2	0x0000~0x0030
Data	2	0x0000~0xFFFF

If the operation request is rejected, the response will be error code and abnormal code. The error code is 88H. Please refer to the above text for the abnormal code details.

The subfunctions supported by the line diagnosis are as follows:

Subfunction code	Data (request)	Data (response)	Meaning of subfunctions
0x0001	0x0000	0x0000	Reinitialize the communication: make the no-response mode become invalid
	0xFF00	0xFF00	Reinitialize the communication: make the no-response mode become invalid
0x0003	"New frame trail" and "00" respectively occupy high byte and low byte.	"New frame trail" and "00" respectively occupy high byte and low byte.	Setting the frame trail of ASCII mode. The "new frame trail" will replace the original line feeds and it can not be saved upon power off. (Note: The "new frame trail" shall not be neither larger than 0x7F, nor be equivalent to 0x3A.)
0x0004	0x0000	No response	Set the no-response mode, the slave only responds to "the request of reinitializing the communication". This function is mainly used to isolate the slave with failure.
0x0030	0x0000	0x0000	Setting the slave not to respond to invalid or wrong commands.
	0x0001	0x0001	Setting the slave to respond to invalid and wrong commands.

The application-layer protocol data units of changing the function codes and status parameters of multiple drives are as follows:

Request formats:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x10
Start register address	2	0x0000~0xFFFF
Number of registers in operation	2	0x0001~0x0004
Number of bytes of register content	1	2*Number of registers in operation
Register content	2*Number of registers in operation	

Response formats:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x10
Start register address	2	0x0000~0xFFFF
Number of registers in operation	2	0x0001~0x0004

This command is used to change the content of the continuous data units from the start register address. The register address is mapped as the function code parameter and control parameters etc. of the drive. For the specific the mapping relationship, please refer to the definition of mapping relationship of the register address in the following text. If the operation request is rejected, abnormal responses are mentioned as above text.

When saving several register parameters, the drive will save from the register of lowest address to the register of highest address. The save operation is either successful or returns from the first failed save address.

The function code 0x41 is used to change the function codes or control parameters of the drive and save the values into the nonvolatile memory cell. Its command format is the similar to that of 0x06. The only difference is as follows: the parameter value changed under the 0x06 command will not be saved upon power off, but the parameter value changed under the 0x41 command will be saved. Some control parameters can not be saved into the nonvolatile memory cell. So for these parameters, the function codes 0x41 and 0x06 have the same operation effect. These parameters will be detailed in the following text.

The management of the drive function codes includes reading the upper/lower limit of the parameter, reading the parameter features, reading the maximum group internal index of the function code menu, reading the next/previous function group number, reading current display status parameter index and displaying the next status parameter. The parameter features include the read/write features, units and scaling relations of the parameter. These commands are used to remote change the function code parameters of the drive. The application-level protocol data units of the function code management are as follows:

Request formats:

Application-level protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x42
Subfunction code	2	0x0000~0x0007
Data	2	The specific range depends on the drive types.

Response formats:

Application-level protocol data unit	Data length (number of bytes)	Value or range
Function code	1	0x42
Subfunction code	2	0x0000~0x0007
Data	2	0x0000~0xFFFF

If the operation request is rejected, the response will be error code and abnormal code. If the operation is failed, the abnormal response will occur. Please refer to the above text for the abnormal response codes.

The subfunctions supported by the function code management are as follows:

Subfunction code	Data (request)	Data (response)	Meaning of subfunctions
0x0000	The function code group number and group internal index occupy the high byte and the low byte respectively	Upper limit of the function code parameter	Upper limit of the read/write function code parameter
0x0001	The function	Lower limit	Lower limit of

Subfunction code	Data (request)	Data (response)	Meaning of subfunctions
	code group number and group internal index occupy the high byte and the low byte respectively	of the function code parameter	the read/write function code parameter
0x0002	The function code group number and group internal index occupy the high byte and the low byte respectively	For specific features of the function code, please refer to the following description.	Features of the read/write function code parameter
0x0003	The function code group number occupies the high byte and the low byte is “00”.	Maximum group internal index	Maximum read/write group internal index
0x0004	The function code group number occupies the high byte and the low byte is “00”.	The next function code group number occupies the high byte and the low byte is “00”.	Read the next function code group number
0x0005	The function code group number occupies the high byte and the low byte is “00”.	The previous function code group number occupies the high byte and the low byte is “00”.	Read the previous function code group number
0x0006	0x3300	Current status parameter index	Read the current status parameter index
0x0007	0x3300	Next status parameter index	Show the next status parameter

The status parameter group can not be changed. It cannot support reading the upper/lower operations.

The length of the function code parameter feature is 2 bytes and its bit definition is as follows:

Feature parameter (Bit)	Value	Meaning
Bit2~Bit0	000B	No decimals
	010B	One decimal
	011B	Two decimals
	100	Three decimals
	Others	Reserved
Bit3	Reserved	
Bit5~Bit4	00B	Change the step length to 1
	Others	Reserved
Bit7~Bit6	01B	Changeable
	10B	Unchangeable upon operation
	11B	The parameter is set by the manufactures and can not be changed by the user.
	00B	Actual parameter, unchangeable
Bit11~Bit8	0000B	Other units or no units
	0001B	The unit is Hz
	0010B	The unit is A
	0011B	The unit is V
	0100B	The unit is r/min
	0101B	Reserved
	0110B	The unit is percentage (%)
	Others	Reserved
Bit12	1	Change the upper limit according to the restriction of 4 bytes.
	0	Change the upper limit according to the restriction of the characters.
Bit15~Bit13	Reserved	

The control parameters of the drive can realize the start, stop, running frequency setting and other functions of the drive and be able to obtain its operating parameters, output current and output torque of the drive by searching its status parameters. The specific control parameters and status parameters of the drive are as follows:

Register address	Parameter name	Whether to be saved upon power off
0x3200	Control command character	No
0x3201	Main setting	Yes
0x3202	Setting running frequency	Yes
0x3203	Digital closed loop reference	Yes
0x3204	Impulse closed loop reference	Yes
0x3205	Analog output AO1 setting	No
0x3206	Analog output AO2 setting	No
0x3207	Digital output DO setting	No
0x3208	Frequency scale setting	No
0x3209	Virtual terminal control setting	No
0x320A	Setting acceleration time 1	Yes
0x320B	Setting deceleration time 1	Yes
Register address	Parameter name	
0x3300	Running status character 1	
0x3301	Actual running value of current main setting	
0x3302	Slave model	
0x3303	Drive model	
0x3304	Software version	
0x3305	Current running frequency	
0x3306	Output current	
0x3307	Output voltage	
0x3308	Output power	
0x3309	Rotating speed in running	
0x330A	Reserved	

Register address	Parameter name	Whether to be saved upon power off
0x330B	Analog closed loop feedback	
0x330C	Bus voltage	
0x330D	External counter	
0x330E	Output torque	
0x330F	Status of digital input/output terminal: BIT0~14=X1~X8, Y1, Y2, TC, FAN, BRAKE, FWD, REV	
0x3310	Reserved	
0x3311	Running frequency after compensation	
0x3312	The 1st running failure	
0x3313	The 2nd running failure	
0x3314	The 3rd (the latest one) running failure	
0x3315	Setting running frequency	
0x3316	Setting running rotation speed	
0x3317	Analog closed loop reference	
0x3318	Reserved	
0x3319	VCI	
0x331A	CCI	
0x331B	Reserved	
0x331C	Setting acceleration time 1	
0x331D	Setting deceleration time 1	
0x331E	Command reference channel: 0: Panel control 1: Terminal control 2. Serial port control	
0x331F	Running status character 2	
0x3320	Frequency reference channel: 0: Digital reference 1, keyboard ∧∨ adjustment 1: Digital reference 2: terminal UP/DN adjustment 2: Digital reference 3 : Serial port 3: VCI analog reference 4: CCI analog reference 5: Terminal PULSE reference	

Note: The coding rules for the slave models are as follows: for the range from 0 to 9999, the hundred's and thousand's places are used to identify different drive series, such as TD, EV, etc. The ten's and unit's place are used to identify drive series such as 1000 Series, 2000 Series, 3000 Series or 3100 Series. For example, the salve model of TDXXXX series drive is 0*1000+0*100+XXXX/100; the salve model of EVXXXX series drive is 1*1000+0*100+XXXX/100; the salve model of EV2100 series drive is 1*1000+0*100+XXXX/100+1.

The definition of the drive control word bit is as follows:

Control word (bit)	Value	name	Function description
Bit2,1,0	111B	Running commands	Start the drive
	110B	Stop in mode 0	Stop according to the set deceleration time
	101B	Stop in mode 1	Stop freely
	011B	Stop in mode 2	Reserved
	100B	Stop for external failure	Stop freely and the drive displays external failure
	Others	No command	
Bit3	1	Run reversely	Set the running command when the running direction is valid (invalid for the jog command)
	0	Run forward	
Bit4	1	Jog forward	
	0	Jog-forward stops	
Bit5	1	Jog reversely	
	0	Reserved Jog stops	
Bit6	1	Enable acceleration/deceleration	Reserved
	0	Disable acceleration/deceleration	
Bit7	1	The control of the host PCis valid	The control word is valid sent downward by the host PC
	0	The control of the host PC is invalid	The control word is invalid sent downward by the host PC
Bit8	1	The main setting is valid	Enable the main setting
	0	The main setting is invalid	Disable the main setting
Bit9	1	The failure reset is valid	
	0	The failure reset is invalid	
Bit15~Bit10	000000B	Reserved	

Note: The jog running reference (Bit4 and Bit5) shall not be valid with the control word Bit0 to Bit2 at the same time!

The definition of the drive status word 1 is as follows:

Status word (bit)	Value	Description	Remarks
Bit0	1	Drive runs	
	0	Drive stops	
Bit1	1	Drive runs reversely	
	0	Drive runs forward	
Bit2	1	Meet the main setting	
	0	Fail to meet the main setting	
Bit3	1	Enable the communication control	
	0	Disable the communication control	
Bit7~4	0000B	Reserved	
Bit15~8	00~0xFF	Failure code	0: means the drive is normal; Non-zero: means there is any failures. Please refer to the user

Status word (bit)	Value	Description	Remarks
			manual of the related drive series for the specific meaning of the failure code. For example, the failure code for the motor overload E014 is 0x0E, and the undervoltage is 0x1F.

The definition of the drive status word 2 is as follows:

Status word (bit)	Value	Description
Bit0	1	Jog running
	0	Non-jog running
Bit1	1	Closed loop running
	0	Non- closed loop running
Bit2	1	PLC running
	0	Non-PLC running
Bit3	1	Multi-step frequency running
	0	Non-multi-step frequency running
Bit4	1	Common running
	0	Non-common running
Bit5:	1	Reserved
	0	Reserved
Bit6	1	Undervoltage
	0	No undervoltage
Others		Reserved

6 Cautions

1. For the data frame of the ASCII code format, if the frame length is an even number, then this frame will be discarded.

2. The drive can not be communicated while restoring parameters to default values and identifying the parameters, its communication will resume normal after finishing them.

3. The internal parameter of the drive FH.09 and FP.03 cannot be changed by communication setting.

4. The user password can be verified by writing FP.00. When the verification password is successfully verified, then the upper unit can have the authority to access the drive parameter. After accessing, you can close this access authority by writing the invalid password into FP.00.

5. The same setting of several multiple-functional input terminal functions may result in dysfunction, therefore the user shall avoid this situation while changing the multiple-functional input terminal functions via the MODBUS protocol.

7. CRC verification

For the purpose of improving speed, CRC-16 is often realized through the table. The following is the C language source code for realizing CRC-16. Please note: The final results have exchanged high and low bytes, that is, the result is the CRC checksum to be sent.

```
unsigned short CRC16 ( unsigned char *msg, unsigned char length)        /* The function returns the CRC as a unsigned short type */
{
    unsigned char uchCRCHi = 0xFF ;                                     /* high byte of CRC initialized */
    unsigned char uchCRCLo = 0xFF ;                                     /* low byte of CRC initialized */
    unsigned uIndex ;                                                   /* index into CRC lookup table */
    while (length--)                                                    /* pass through message buffer */
    {
        uIndex = uchCRCLo ^ *msg++ ;                                    /* calculate the CRC */
        uchCRCLo = uchCRCHi ^ (crcvalue[uIndex] >>8);
        uchCRCHi =crcvalue[uIndex]&0xff;
     }
     return (uchCRCHi | uchCRCLo<<8) ;
}
                                                                        /* Table of CRC values */
const unsigned int  crcvalue[ ] = {
0x0000,0xC1C0,0x81C1,0x4001,0x01C3,0xC003,0x8002,0x41C2,0x01C6,0xC006,0x8007,0x41C7,
0x0005,0xC1C5,0x81C4,0x4004,0x01CC,0xC00C,0x800D,0x41CD,0x000F,0xC1CF,0x81CE,0x400E,
0x000A,0xC1CA,0x81CB,0x400B,0x01C9,0xC009,0x8008,0x41C8,0x01D8,0xC018,0x8019,0x41D9,
0x001B,0xC1DB,0x81DA,0x401A,0x001E,0xC1DE,0x81DF,0x401F,0x01DD,0xC01D,0x801C,0x41DC,
0x0014,0xC1D4,0x81D5,0x4015,0x01D7,0xC017,0x8016,0x41D6,0x01D2,0xC012,0x8013,0x41D3,
0x0011,0xC1D1,0x81D0,0x4010,0x01F0,0xC030,0x8031,0x41F1,0x0033,0xC1F3,0x81F2,0x4032,
0x0036,0xC1F6,0x81F7,0x4037,0x01F5,0xC035,0x8034,0x41F4,0x003C,0xC1FC,0x81FD,0x403D,
0x01FF,0xC03F,0x803E,0x41FE,0x01FA,0xC03A,0x803B,0x41FB,0x0039,0xC1F9,0x81F8,0x4038,
0x0028,0xC1E8,0x81E9,0x4029,0x01EB,0xC02B,0x802A,0x41EA,0x01EE,0xC02E,0x802F,0x41EF,
0x002D,0xC1ED,0x81EC,0x402C,0x01E4,0xC024,0x8025,0x41E5,0x0027,0xC1E7,0x81E6,0x4026,
0x0022,0xC1E2,0x81E3,0x4023,0x01E1,0xC021,0x8020,0x41E0,0x01A0,0xC060,0x8061,0x41A1,
0x0063,0xC1A3,0x81A2,0x4062,0x0066,0xC1A6,0x81A7,0x4067,0x01A5,0xC065,0x8064,0x41A4,
0x006C,0xC1AC,0x81AD,0x406D,0x01AF,0xC06F,0x806E,0x41AE,0x01AA,0xC06A,0x806B,0x41AB,
0x0069,0xC1A9,0x81A8,0x4068,0x0078,0xC1B8,0x81B9,0x4079,0x01BB,0xC07B,0x807A,0x41BA,
0x01BE,0xC07E,0x807F,0x41BF,0x007D,0xC1BD,0x81BC,0x407C,0x01B4,0xC074,0x8075,0x41B5,
0x0077,0xC1B7,0x81B6,0x4076,0x0072,0xC1B2,0x81B3,0x4073,0x01B1,0xC071,0x8070,0x41B0,
0x0050,0xC190,0x8191,0x4051,0x0193,0xC053,0x8052,0x4192,0x0196,0xC056,0x8057,0x4197,
0x0055,0xC195,0x8194,0x4054,0x019C,0xC05C,0x805D,0x419D,0x005F,0xC19F,0x819E,0x405E,
0x005A,0xC19A,0x819B,0x405B,0x0199,0xC059,0x8058,0x4198,0x0188,0xC048,0x8049,0x4189,
0x004B,0xC18B,0x818A,0x404A,0x004E,0xC18E,0x818F,0x404F,0x018D,0xC04D,0x804C,0x418C,
0x0044,0xC184,0x8185,0x4045,0x0187,0xC047,0x8046,0x4186,0x0182,0xC042,0x8043,0x4183,
0x0041,0xC181,0x8180,0x4040}
```

If the CRC checksum of each byte to be sent is computed online, it will take a longer time, but it can save the program space occupied by the table. The code for computing CRC online is as follows:

```
unsigned int crc_check(unsigned char *data,unsigned char length)
```

```
 {
       int i;
       unsigned crc_result=0xffff;
   while(length--)
 {
       crc_result^=*data++;
            for(i=0;i<8;i++)
       {
             if(crc_result&0x01)
                    crc_result=(crc_result>>1)^0xa001;
            else
                    crc_result=crc_result>>1;
       }
 }
  return (crc_result=((crc_result&0xff)<<8)|(crc_result>>8));
}
```

8 Application examples

To start No.5 drive and make it rotate forward with a speed of 50.00HZ (expressed as 5000 internally), the command is as follows:

	Address	Function code	Register address	Number of registers	Number of bytes of register content	Register content	Checksum
Request	0x05	0x10	0x3200	0x0002	0x04	0x01C7,0x1388	0x16A9
Response	0x05	0x10	0x3200	0x0002	None	None	0x4EF4

The No.5 drive stops at its fastest speed:

	Address	Function code	Register address	Register content	Checksum
Request	0x05	0x06	0x3200	0x00C3	0xC6A7
Response	0x05	0x06	0x3200	0x00C3	0xC6A7

No.5 drive jog-forward:

	Address	Function code	Register address	Register content	Checksum
Request	0x05	0x06	0x3200	0x00D0	0x876A
Response	0x05	0x06	0x3200	0x00D0	0x876A

No.5 drive jog-stop:

	Address	Function code	Register address	Register content	Checksum
Request	0x05	0x06	0x3200	0x00C0	0x86A6
Response	0x05	0x06	0x3200	0x00C0	0x86A6

No.5 drive failure reset:

	Address	Function code	Register address	Register content	Checksum
Request	0x05	0x06	0x3200	0x0180	0x86C6
Response	0x05	0x06	0x3200	0x0180	0x86C6

Read the running frequency of No.5 drive and the response running frequency is 50.00HZ:

	Address	Function code	Register address	Number of registers or Number of read bytes	Register content	Checksum
Request	0x05	0x03	0x3301	0x0001	None	0xDB0A
Response	0x05	0x03	None	0x02	0x1388	0x44D2

Change the acceleration time 1 (i.e. function code F0.10) of No.5 drive to be 10.0s, which can not be saved upon power off.

	Address	Function code	Register address	Register content	Checksum
Request	0x05	0x06	0x000A	0x0064	0xA9A7
Response	0x05	0x06	0x000A	0x0064	0xA9A7

Read the output current of No.5 drive and the response output current is 30.0A:

	Address	Function code	Register address	Number of registers or Number of read bytes	Register content	Checksum
Request	0x05	0x03	0x3306	0x0001	None	0x6ACB
Response	0x05	0x03	None	0x02	0x12C	0x49C9

Read the deceleration time (i.e. F0.11) of No.5 drive and the response deceleration time is 6.0s:

	Address	Function code	Register address	Number of registers or Number of read bytes	Register content	Checksum
Request	0x05	0x03	0x000B	0x0001	None	0xF4C4
Response	0x05	0x03	None	0x02	0x003C	0x4995

9. Scaling relations of the drive

A) Scaling of the frequency is 1:100

To make the drive run at 50Hz, the main setting shall be 0x1388 (5000).

B) Scaling of time is 1:10

To make the acceleration time of the drive to be 30S, the function code shall be set to 0x012c (300).

C) Scaling of current is 1:10

If the feedback current of the drive is 0x012C, the present current shall be 30A.

D) The output power is its absolute value.

E) For others (such as terminal input/output), please refer to the Drive User Manual.