

# **EV1000 Series General Purpose Variable Speed Drive**

## **User Manual**

Version: V1.4

Revision Date: February 1, 2004

BOM: 31010988

---

Emerson Network Power provides customers with technical support. Users may contact the nearest Emerson local sales office or service center.

Copyright © 2004 by Emerson Network Power Co., Ltd.

All rights reserved. The contents in this document are subject to change without notice.

Emerson Network Power Co., Ltd.

Address: No.1 Kefa Rd., Science & Industry Park, Nanshan District  
518057, Shenzhen China

Homepage: [www.emersonnetworkpower.com.cn](http://www.emersonnetworkpower.com.cn)

Customer Service Hotline: 800-820-6510, (86) 21-23017141,  
(86) 755-86011668

E-mail: [support@emersonnetwork.com.cn](mailto:support@emersonnetwork.com.cn)



## Contents

Preface .....	1	4.1.1 The Drive's Control Modes.....	29
Chapter 1 Safety Information .....	2	4.1.2 Frequency Setting Methods ....	29
1.1 Danger and Warning Definitions .....	2	4.1.3 Drive's Operating Status .....	29
1.2 Notes for Installations .....	2	4.1.4 Operating Mode .....	29
1.3 Notes for Using the Drive.....	3	4.2 Operation Guide.....	30
1.3.1 About Motor and Load .....	3	4.2.1 Operation of LED Keypad .....	30
1.3.2 About Variable Speed Drive .....	3	4.2.2 Keypad Function Explanation .	31
1.4 Disposing Unwanted Drive .....	4	4.2.3 Indicator Description .....	31
Chapter 2 Specifications and Optional Parts ...	5	4.2.4 Parameter Setting Method .....	31
2.1 Specifications.....	5	4.2.5 Speed Setting .....	33
2.2 Product Series Introduction .....	7	4.2.6 How to Lock/Unlock Keypad ...	34
2.2.1 EV1000 Models .....	7	Chapter 5 Parameters .....	35
2.2.2 Ordering Information.....	7	5.1 Basic Parameters (F0) .....	35
2.2.3 Size .....	7	5.2 Reference Frequency (F1).....	38
2.2.4 LED Keypad Display Unit		5.3 Start/Brake Parameter (F2).....	39
TDP-LED02 Size.....	8	5.4 Auxiliary Operating Parameters (F3) .	42
2.3 Optional Parts .....	8	5.5 PLC Parameters (F4) .....	45
2.3.1 Braking Resistor .....	8	5.6 Close-loop Control (F5).....	48
2.3.2 LED Status Indicator Unit		5.7 Traverse Parameters (F6).....	52
TDP-LED03.....	9	5.8 Multi-function Terminal (F7) .....	54
2.3.3 TDP-LED02 Holders and Wires	9	5.9 Display Control (F8) .....	65
2.3.4 Communication Parts .....	10	5.10 Enhanced Function (F9).....	67
Chapter 3 Installation and Wiring.....	11	5.11 Reserved (FA).....	73
3.1 Installation .....	11	5.12 Communication (FF) .....	73
3.1.1 Installation Methods Compliant		5.13 Moter's Parameters (FH).....	74
With EMC Requirements.....	11	5.14 Protection (FL) .....	76
3.1.2 Noise Suppression .....	13	5.15 Operating Time (Fn).....	79
3.1.3 Using Surge Suppressor.....	15	5.16 Protection of Parameters (FP).....	79
3.1.4 Leakage current.....	15	Chapter 6 Troubleshooting.....	81
3.1.5 Applications of Power Filter ....	15	Chapter 7 Maintenance .....	86
3.1.6 AC Line Reactor Applications .	16	7.1 Routine Maintenance .....	86
3.2 Wiring .....	16	7.2 Periodic Maintenance.....	86
3.2.1 Overview.....	17	7.3 Replacing of Easily-worn Parts .....	87
3.2.2 Power Terminals.....	19	7.4 Storage of the Drive .....	87
3.2.3 Control Circuit Wiring.....	20	7.5 Warranty .....	88
3.2.4 Onsite Wiring Requirements...	27	Appendix 1 Parameter Set .....	89
3.2.5 Earthing .....	28	Appendix 2 Communication Protocol .....	135
Chapter 4 Operation Procedures .....	29	Appendix 3 Optional Parts.....	151
4.1 Definitions of Terms.....	29		



---

## Preface

Thank you for using EV1000 Series variable speed drive made by Emerson Network Power Co., Ltd.

EV1000 Series satisfies 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 network, temperature, humidity and dusty environment exceed those of similar product made by other companies, which improves the product's reliability noticeably;

EV1000 considers customers' needs and combines general-purpose function and industrial-oriented functions. It features PI control, simple PLC, flexible I/O terminals and pulse frequency setting, You can select whether to save the parameters upon poweroff or stop, bind frequency setting channel with command channel, zero frequency return difference control zero frequency hysteresis, main and auxiliary frequency setting, traverse operation, length control, etc. It is an integral, cost-effective and highly reliable solution for manufacturer in the related fields.

EV1000 Series can satisfy the customers' requirements on low noise and EMI by using optimized PWM technology and EMC design.

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

### Unpacking and 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 the factory with great care. If there is any error, please contact any of our distributors or us.

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

## Chapter 1 Safety Information

### 1.1 Danger and Warning

#### Definitions



Operations without following instructions can cause personal injury or death



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

### 1.2 Notes for Installations



Please install the drive on fire-retardant material such as metal.

- Keep the drive away from combustible materials.
- Keep the drive away from explosive gas.
- Only qualified personnel shall wire the drive.
- Note that the control terminal of EV1000 drive is of ELV (Extra Low Voltage) circuit, therefore, do not connect the control terminal with other devices directly. For example, before connecting the RS485 terminal with the PC's RS232 terminal, an adapter with isolating protections must be connected in between;
- Never wire the drive unless the input AC supply is totally disconnected; otherwise, there is danger of electric shock. During power-on, do not touch the cables, control terminals, radiator and the pore plate on the housing of the drive.
- 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.

- 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 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.
- When using optional parts, it is recommended to use those provided by Emerson Network Power, to secure safety.



- Don't carry the drive by its cover. Its cover cannot sustain the weight 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; there is a danger of a fire or human injury;
- Don't install the drive under direct sunshine; it may be damaged by heat;
- Don't short circuit P1/PB and terminal (-), 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 110V or higher) to the control terminals except terminals TA, TB and TC.

## 1.3 Notes for Using the Drive

Pay attention to the following issues when using EV1000 Series drive:

### 1.3.1 About Motor and Load

Compared to working at mains frequency, there will be some increase in temperature, noise and vibration in the motor. The EV1000 Series are voltage source inverters. Its output voltage is a PWM wave. Being non-sinusoidal, there will be some harmonics.

#### Low Speed Rotation with Constant Torque

When a standard motor is driven at low speed for a long time, there will be insufficient cooling for a self-ventilated motor. Overheating can result in insulation damaged. Special variable frequency motor is recommended for constant torque operation at low speed.

#### Motor's over-temperature protecting threshold

The drive can protect the motor from over-temperature. If the power rating of the drive is greater than the motor, be sure to adjust the protection parameters to ensure the motor is properly protected.

#### Operate above 50Hz

When running the motor above 50Hz, there will be increase in vibration and noise. The rate at which the torque is available from the motor is inversely proportionally to its increase in running speed. Ensure that the motor can still provide sufficient torque to the load.

### 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.

### Regenerative Energy

When lifting load, regenerative energy is produced, the drive will trip on overvoltage when it cannot absorb the regenerative energy of the load. Therefore, a proper braking unit is required.

### 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 to be set to avoid it.

### Frequent start and stop

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

### 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 winding. Wiring diagram is shown in Fig. 1-1. Please use 500V insulation tester to measure the insulation resistance. It should not be less than 5M $\Omega$ .

### 1.3.2 About Variable Speed Drive

Varistors for Surge Protection 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. Tripping

or damage to components may occur as shown in Fig.1-1.

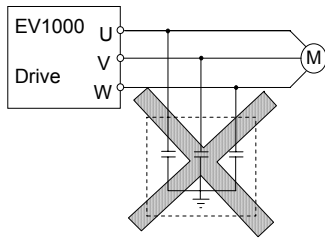


Fig. 1-1 Capacitors at output are prohibited

### 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 host communication function

When frequently modifying the parameters through host communication function, improper command will cause physical damage to the EEROM inside the drive. Please refer to Appendix 2.

### 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.

### Protection against lightning strike

There are transient surge suppressors inside the Drive which protects it against lightning 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 the Drive is less effective in the thin air. Fig.1-2 that shows the relationship between the altitude and rated current of the Drive.

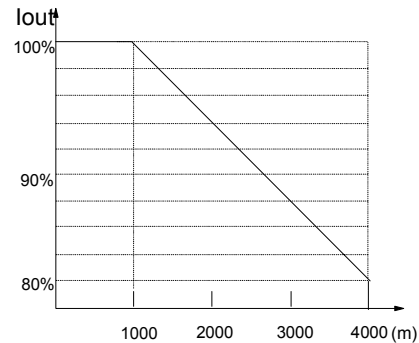


Fig. 1-2 Drive Derating at different altitudes.

## 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 Specifications and Optional Parts

### 2.1 Specifications

Table 2-1 EV1000 Specifications

Item	Description
Input	Rated voltage & frequency EV1000-4Txxxxx: 380V~440V; 50Hz/60Hz EV1000-2Sxxxxx: 200V~240V; 50Hz/60Hz
	Permissible fluctuation range Continuous fluctuation rate: $\leq \pm 10\%$ , short time fluctuation rate: $\leq -15\% \sim +10\%$ ; Voltage unbalance rate: $< 3\%$ ; Frequency: $\pm 5\%$
Output	Rated voltage EV1000-4Txxxxx: 0~380V/440V EV1000-2Sxxxxx: 0~200V/240V
	Frequency 0Hz~650Hz
	Over load ability G type: 150% rated current for 1 minute, 180% rated current for 3s/1s (380V/220V series) P type: 120% rated current for 1 minute
Main control functions	Modulation mode Flux vector PWM modulation
	Speed range 1:50
	Starting torque 150% rated torque at 1Hz
	Accuracy of speed at steady state $\leq \pm 1\%$ rated synchronous speed
	Accuracy of frequency Digital setting: highest frequency $\times \pm 0.01\%$ . Analog setting: highest frequency $\times \pm 0.2\%$
	Setting frequency resolution Digital setting: 0.01Hz. Analog setting: highest frequency $\times 0.1\%$
	Torque boost Auto torque boost, Manual torque boost 0.1%~30.0%
	V/F curve 4 modes: 1 self-defined V/F curve and 3 kinds of quadratic V/F modes (power exponent: 2.0, 1.7 and 1.2)
	Acc/dec curve 3 modes: linear, S curve and automatic acc/dec; 4 acc/dec time: unit (minute/second), 60 hours at most
	DC braking Start frequency: 0.00~60.00Hz, duration: 0.1~60.0s Threshold current: G type: 0.0~150.0%, P type: 0.0~130.0%
	Jog Jog frequency: 0.10~50.00Hz; Acc/Dec time: 0.1~60.0s. Jog interval adjustable
On-board PI controller Able to configure close-loop control system easily	

Item		Description
	Auto-energy saving operation	V/F curve is optimized automatically according to the load condition to perform energy-saving operation.
	Auto voltage regulation (AVR)	Constant output voltage even if electric network voltage fluctuates
	Auto current limiting	Operating current is limited automatically to avoid frequent tripping of the drive.
Customized functions	Traverse for textile motor	Traverse control, central Traverse adjustable
	Set length control	When reaching set length, the drive will stop
	Droop control	When many drives control single load
	Tone selection	Set the tone of the motor when it is running
	Immunity to transient power failure	The drive gives output even if power failure occurs
	Channel binding	Command channel can bind with frequency setting channel and switched synchronizingly
Operating function	Methods of inputting commands	Via keypad panel, terminals and serial ports.
	Methods of setting up frequency	Digital setting; Analog voltage/current setup; pulse setting, serial port
	Pulse output terminal	0~50kHz pulse signal output. Signals can be reference frequency and output frequency
	Analog output terminals	2 analog outputs of 0/4~20mA and 0~10V(selectable). Able to output signals like reference frequency and output frequency.
Control panel	LED keypad	Able to show 21 parameters, such as: frequency setting, output frequency, output power and current during operation; frequency setting.
	Keypad lock and key definition	Total lock or partially lock. Some keys' function definable.
Protection function		Phase loss failure, Over/Under current, Over/Under voltage protection, Over heat, and Overload protections
Optional parts		Flush mount faceplate for remote keypad, remote keypad cables and Profibus adapter
Environment	Operating environment	In-door, free from moisture, dust, corrodent or flammable gases, oil mist, vapor, water leakage or salt water.
	Altitude	Less than 1000m
	Ambient temperature	-10℃~+40℃( derating is required from 40℃ to 50℃, increase every 1℃ above 40℃, derate 2%, highest temperature allowed: 50℃ )
	Humidity	Less than 95%RH, no condensing
	Vibration	Less than 5.9m/s <sup>2</sup> (0.6g)
	Storage temperature	-40℃~+70℃

Item		Description
Enclosure	Protection level	IP20
	Cooling	Fan cooling
Mounting mode		Mounted in a cabinet

## 2.2 Product Series Introduction

### 2.2.1 EV1000 Models

Table 2-2 Drive series

Drive Model (G: contant torque; P:pump,fan load)	Rated Capacity (kVA)	Rated input current (A)	Rated output current (A)	Motor power (kW)
EV1000-2S0004G	1.0	5.3	2.5	0.4
EV1000-2S0007G	1.5	8.2	4.0	0.75
EV1000-2S0015G	3.0	14.0	7.5	1.5
EV1000-2S0022G	4.0	23.0	10.0	2.2
EV1000-4T0007G	1.5	3.4	2.3	0.75
EV1000-4T0015G	3.0	5.0	3.7	1.5
EV1000-4T0022G	4.0	5.8	5.0	2.2
EV1000-4T0037G	5.9	10.5	8.8	3.7
EV1000-4T0037P				
EV1000-4T0055G	8.9	14.6	13.0	5.5
EV1000-4T0055P				

### 2.2.2 Ordering Information

Refer to Fig. 2-1a and Fig. 2-1b

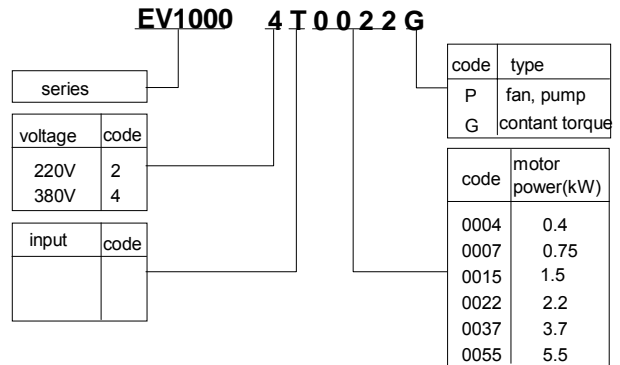


Fig. 2-1a Explanations of Drive Models

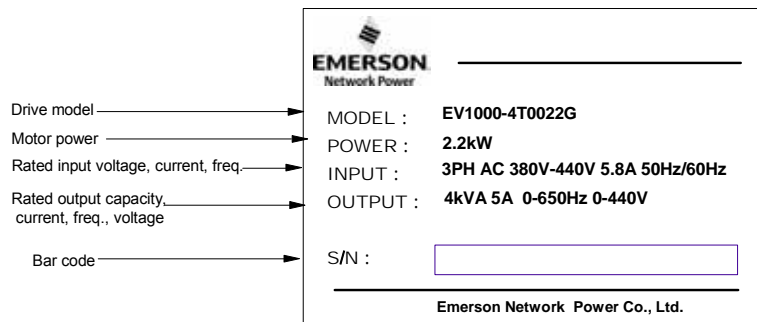


Fig. 2-1b EV1000 Drive Nameplate

### 2.2.3 Size

Please refer to Fig. 2-2 and Table 2-3.

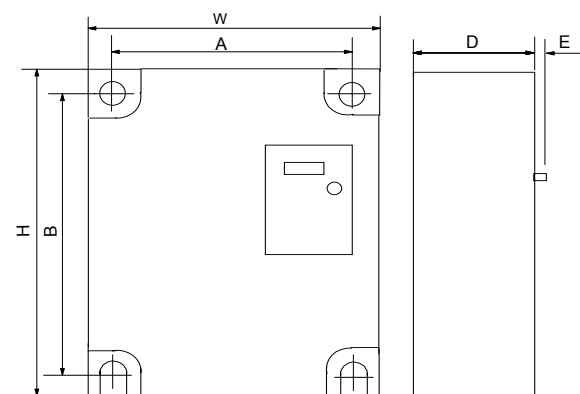


Fig. 2-2 EV1000 Drive Size

Table 2-3 Dimensions and Weights

Drive Model	Motor power (kW)	A (mm)	B (mm)	H (mm)	W (mm)	D (mm)	E (mm)	Diameter of mounting hole (mm)	Gross weight (kg)
EV1000-2S0004G	0.4	91	137	145	101	130	10	4	1.2
EV1000-2S0007G	0.75								
EV1000-2S0015G	1.5	120	170	180	130	146		4	1.8
EV1000-4T0007G	0.75								
EV1000-4T0015G	1.5								
EV1000-4T0022G	2.2	140	230	245	155	160		5	4.0
EV1000-2S0022G	2.2								
EV1000-4T0037G	3.7								
EV1000-4T0037P	3.7								
EV1000-4T0055G	5.5								
EV1000-4T0055P	5.5								

## 2.2.4 LED Keypad Display Unit

### TDP-LED02 Size

The LED keypad display unit TDP-LED02 (standard configuration) also applies to TD1000 series drives. Through it, operation and configuration of the drive can be done. Refer to its size in Fig. 2-3.

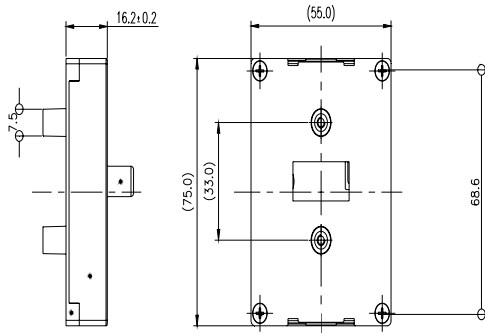


Fig. 2-3 LED keypad display unit

## 2.3.1 Braking Resistor

The drive is equipped with braking unit. If there is a need for energy-consuming braking, please select a braking resistor in Table 2-4. Please refer the wiring of braking resistor and the drive to Fig. 2-4. The wire specifications are listed in Table 3-2.

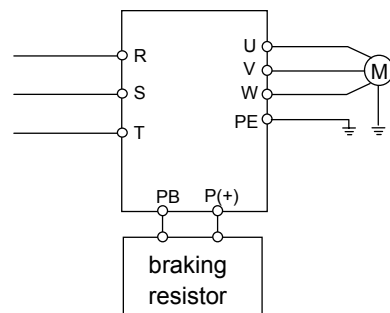


Fig. 2-4 Wiring the drive with braking resistor

## 2.3 Optional Parts

You may order the optional parts below from our company.

Table 2-3 Braking Resistor Specs

Model	Specs	Usage rate (%)	Torque (%)	Max. continuous work time (s)
EV1000-2S0004G	200 Ω/100W	10	100	10
EV1000-2S0007G	150 Ω/200W	10	100	10
EV1000-2S0015G	100 Ω/400W	10	100	10
EV1000-2S0022G	70 Ω/500W	10	100	10
EV1000-4T0007G	300 Ω/400W	10	100	10
EV1000-4T0015G	300 Ω/400W	10	100	10
EV1000-4T0022G	200 Ω/500W	10	100	10
EV1000-4T0037G	200 Ω/500W	10	100	10
EV1000-4T0037P	200 Ω/500W	10	100	10
EV1000-4T0055G	100 Ω/1000W	10	100	10
EV1000-4T0055P	100 Ω/1000W	10	100	10

**Note:**

If you have any special braking requirement, please contact the supplier or us.

## 2.3.2 LED Status Indicator Unit

### TDP-LED03

TDP-LED03 has no configuration or operation function, but it can indicate powerup, run or fault status of the drive by the red, green and yellow LEDs on it.

Refer to Fig. 2-5.

If you buy many EV1000 drives and plan to use terminal control mode after testing and no need to modify the parameters thereafter, you may order one TDP-LED02 display unit to do the test and for the rest, TDP-LED03 can satisfy your need as well. In this case, the frequency setting and operation control are done through terminals. You can know the status of the drive through TDP-LED03.

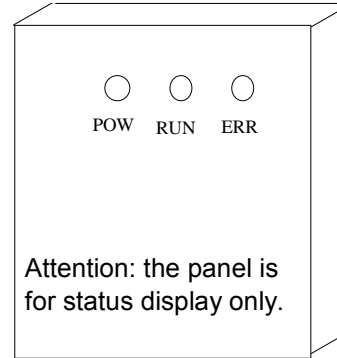


Fig. 2-5 TDP-LED03

TDP-LED03 indicators definitions:

Mark	Color of LED	MEANING
POW	RED	ON: drive standby
RUN	GREEN	ON: drive is running
ERR	YELLOW	ON: drive fault

**Note:**

TDP-LED03 and TDP-LED02 are of same sizes.

## 2.3.3 TDP-LED02 Holders and Wires

The holders and wires of TDP-LED02 LED display unit are matched, you should order them as a kit.

We provide 3 kinds of the wires:

TDC-CB00P6A (0.6m)

TDC-CB0015A (1.5m)

TDC-CB0030A (3.0m)

Holder model: TDF-KB01. Please refer to Figure 2-6.

**Note:**

- Both ends of TDP-LED02 wire should be secured by M3\*8 screw.
- When using the keypad separated from the drive, it is recommended to use the cable special for EV1000 drive, to avoid reverse connection.

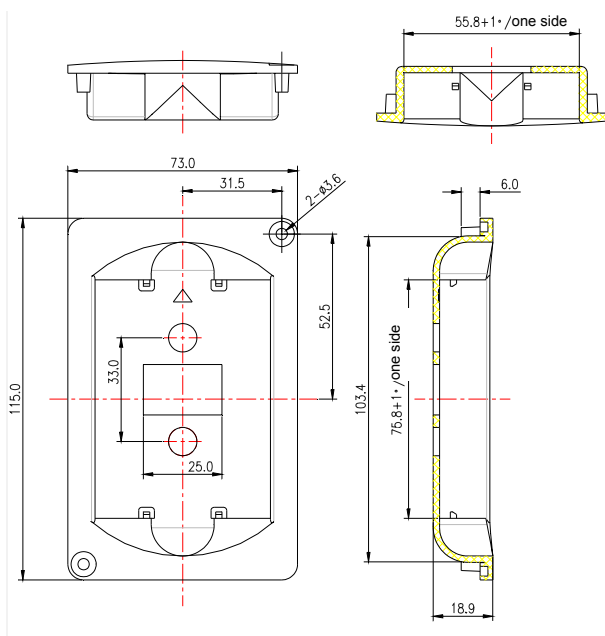


Fig. 2-6 TDF-KB01 Holders Dimensions

### 2.3.4 Communication Parts

#### 1. Flush Mount Faceplate for Remote Keypad

Model: TDO-RC02

RS485 serial communication mode is used between the drive and the remote control panel. A 4-core cable is used to connect the drive and the panel, and the maximum distance is up to 1000m. Master/slave communication mode is used. The panel is the master and the drive is the slave. One flush mount faceplate can control several drives by connecting the communication cables of 485+ and 485- of each drive to form a RS485 network.

Functions:

1. Able to control the start, stop, jog operation, fault reset of slaves and change the frequency settings and direction of rotation.
2. Identify the type of slave machine automatically. 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.

#### 2. Cable for the Flush Mount Faceplate

Model: FRC21W1 (3.0M)

FRC21W2 (30M)

For connecting the flush mount faceplate and the drive.

#### 3. Profibus Adapter

Model: TDS-PA01

Able to connect EV1000 drive to PROFIBUS network via the TDS-PA01. 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.

#### 4. DrvWindows Supervision Software

Version: DrvWindows V1.2

Applicable to the RS485 industrial control network made up of TD1000, EV1000, TD2000, TD2100, or EV2000. It can real-time monitor the status of the drive. It features friendly interface and easy operation.

Function: slave polling, frequency setting, run and stop control, function code query and modification.

## Chapter 3 Installation and Wiring

### 3.1 Installation

Please mount the drive vertically indoors, with good ventilative conditions.

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

Ambient temperature should be within the range of  $-10^{\circ}\text{C}\sim 40^{\circ}\text{C}$ . If the temperature is higher than  $40^{\circ}\text{C}$ , the Variable Speed Drive should be derated and forced heat dissipation is required;

Humidity should be lower than 95%, non-condensing

Mount in the location where vibration is less than  $5.9\text{m/s}^2$  (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. 3-2.

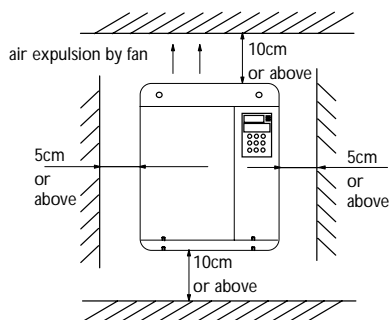


Fig. 3-1 Installation clearances

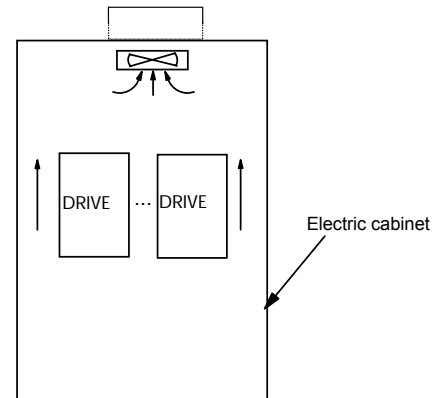


Fig. 3-2 Installation of several drives

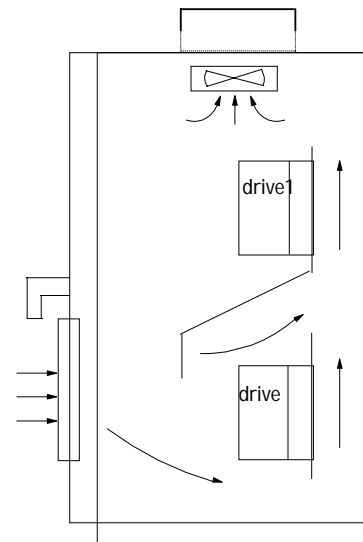


Fig. 3-2 Installation of one on top the other

#### 3.1.1 Installation Methods Compliant With EMC Requirements

In a traction system composed of the drive and a motor, if the drive, controllers and transducer are installed in one cabinet, the disturbance they generate should be depressed at the connection points, therefore, a noise filter and inrush reactor should be installed in the cabinet, so that EMC requirement is met inside it.

The drive is usually installed in a metal cabinet. The instruments outside the metal cabinet is

shielded and may be disturbed lightly. The cables are the main EMI source, if you connect the cables according to the manual, the EMI can be suppressed effectively.

In system design phase, to reduce EMI, insulating the noise source and using noise snubber are best choice. But the cost is considerable. If there

are a few sensitive devices on site, just install power line filter beside them is enough. Note that the drive and contactor are noise source, and the automatic devices, encoder and transducer are sensible to them.

Divide the system into several EMC areas, refer to Fig. 3-4.

### Hint:

1. After installing EMI filter and AC reactor, the drive can satisfy IEC 61800-3 standard.
2. The input/output EMI filter should be installed close to the drive as possible.
3. Refer to Appendix 3 for the specifications of optional parts.

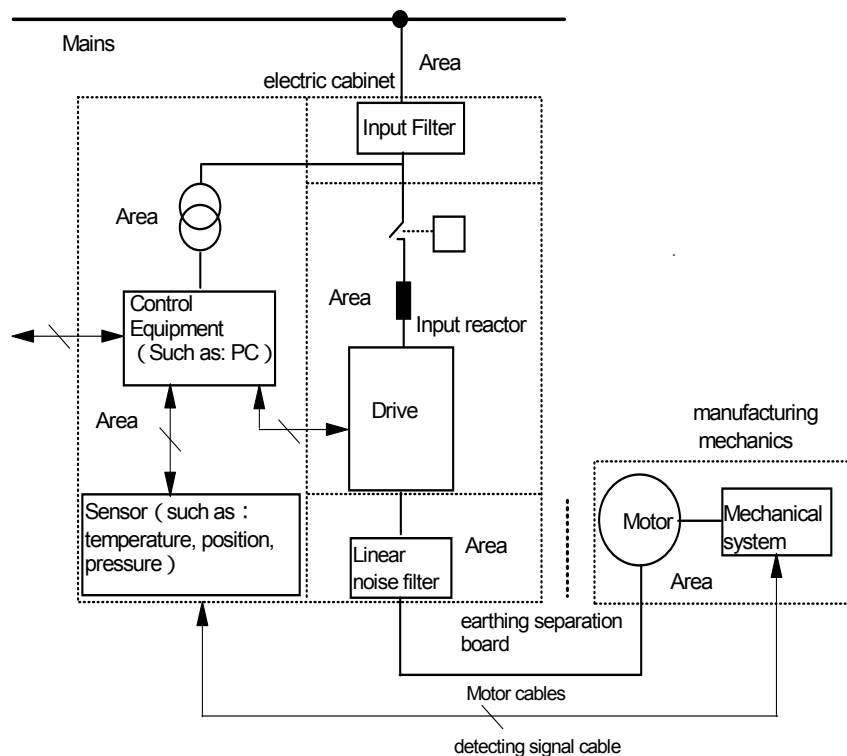


Fig. 3-4 Recommended System Layout

### Attention:

- Area I should be used to install transformers for control power supply, control system and sensor.
- Area II should be used for interface of signal and control cables with good immunity level.
- Area III should be used to install noise generating devices such as input reactor, drive, brake unit and contactor.
- Area IV should be used to install output noise filter.
- Area V should be used to install power source and cables connecting the RFI filter.
- Area VI should be used to install the motor and motor cables.
- Areas should be isolated in space, so that electro-magnetic decoupling effect can be achieved.



- The shortest 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.

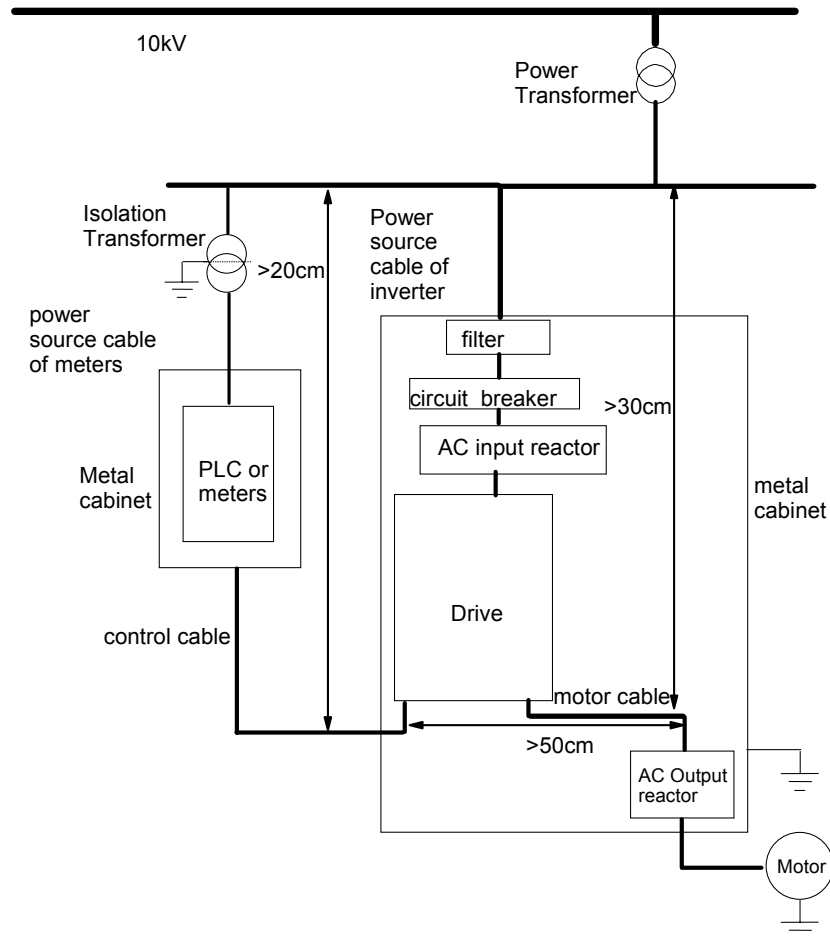


Fig. 3-5 Installation of the drive

### 3.1.2 Noise Suppression

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, wire connections, installation clearance and earthing methods.

Table 3-1 Method of Noise Suppression

Noise emission paths	Actions to reduce the noise
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.	Install noise filter at the input side of the drive, and use an isolation transformer or line filter to prevent the noise from disturbing the external equipment.
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.	<p>(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.</p> <p>(2)Install radio noise filter and linear noise filter(ferrite common-mode choke) at the input and output sides of the drive to suppress the emission noise of power lines.</p> <p>(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).</p>
If the signal cables are routed in parallel with the power cables or bundle these cables together, the induced electro-magnetic noise and induced ESD noise may disturb the signal cables.	Avoid this kind of routing. Other equipment sensible to EMI 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.

### 3.1.3 Using Surge Suppressor

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

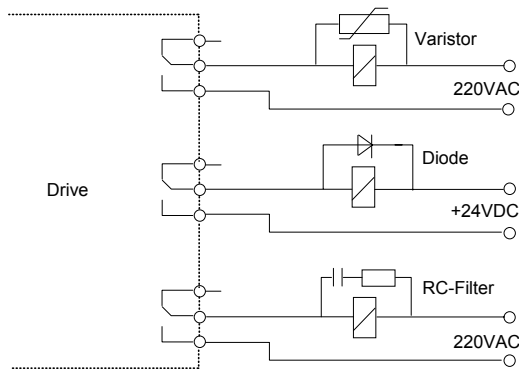


Fig. 3-6 Installation of Relay, contactor and electro-magnetic braking kit

### 3.1.4 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.

#### Ground leakage current

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

Suppressing methods:

Reduce the carrier wave frequency, but the motor noise may be higher.

Motor cables should be as short as possible;

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 outside through the distributed capacitors of the drive may false trigger the thermal relay, especially for the drive of which power rating is less than 7.5kW. When the cable is longer than 50m, the ratio of leakage current to motor rated current may increase to a level that can cause the external thermal relay to trigger unexpectedly.

Suppression methods:

Reduce the carrier wave frequency, but the motor audible noise is higher.

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.

### 3.1.5 Applications of Power Filter

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

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

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

### Common mistakes in using power line 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 filtering effect becomes ineffective.

#### 3. Bad earthing of filter

The filter's enclosure must be connected properly to the metal casing of the drive. In order to be earthed well, a special earthing terminal on the filter's enclosure should be used. If you use one cable to connect the filter to the case, the earthing is useless due to high frequency interference. When the frequency is high, so too is the impedance of cable, hence there is little bypass effect.

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

### 3.1.6 AC Line Reactor Applications

#### 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.

#### Output AC Line Reactor

When the cables from the drive to motor are longer than 80m, multi-strand cables and an AC line reactor should be used to suppress the high frequency harmonics. Thus, the motor insulation

is protected. At the same time, leakage current and unexpected trigger are reduced.

## 3.2 Wiring



- Wiring can only be done after the Variable Speed Drive's AC power is disconnected, all the LEDs on the operation panel are off and after waiting for at least 5 minutes. Then, you can remove the panel.
- Wiring job can only be done after confirming the Charge indicator inside the drive has extinguished 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.
- For the sake of safety, the drive and motor must be earthed because there is leakage current inside the drive.
- Check the Variable Speed Drive's voltage level before supplying power to it, otherwise human injuring or equipment damage may happen.



- Check whether the Variable Speed Drive's rated input voltage is in compliant with the AC supply voltage before using.
- Dielectric strength test of the drive has been done in factory and the user needs not do it again.
- Refer to chapter 2 on how to connect 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 cross-sectional area bigger than  $3.5\text{mm}^2$ , and the grounding resistance should be less than  $10\ \Omega$ .
- The drive should be connected to the AC supply via a circuit breaker or fuse to provide input over-current protection and also for maintenance purpose.

**Attention**

- The control terminals of the drive is of ELV (Extra Low Voltage) circuit. Do not touch them once energized;
- If the external device has touchable terminals of SELV (Safety Extra Low Voltage) circuit. Remember to connect isolating protections in between. Otherwise, the SELV circuit will be degraded to ELV circuit;
- When connecting the drive with PC, do choose RS485/232 adapters with isolating protections that measure up to safety requirements.

### 3.2.1 Overview

You should finish the power circuit and control circuit wiring.

First, remove the screws on the keypad, open the front door and then you will see the power terminals and control terminals.

For different models of the drive, the power terminals layout is different, which will be described in details later.

Beneath the keypad display unit, there are control terminal strip: CN5, CN6 and jumper CN16, CN17, CN10.

CN5 is for relay output; CN6 is for analog, digital I/O and communication interfaces.

CN16, CN17 and CN10 are jumpers, through which the output of voltage or current signal is set. The terminals will be described in details later.

The figure below is the systematic wiring of the drive.

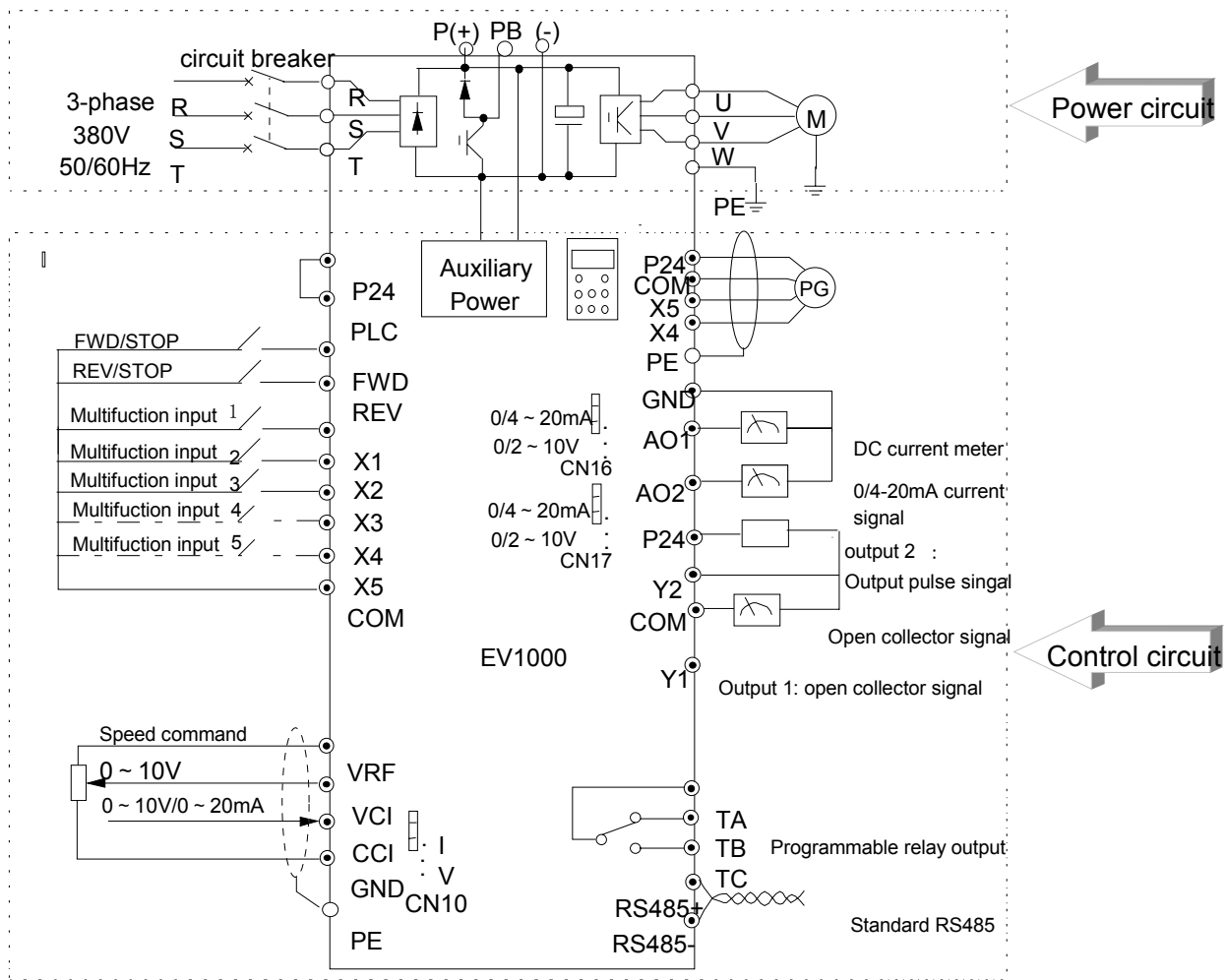


Fig. 3-7 Systematic Wiring Diagram

**Hint:**

1. In the above Figure., “O” is the terminal in power circuit, and “ ” is the control terminal;
2. Terminal CCI can input voltage or current signal by switching the jumper CN10 on control board;
3. Built-in braking kit is installed and a braking resistor is required to be connected between P(+) and PB;
4. Refer to section 3.2.3 for the using of control terminals.
5. MCCB must be installed at the input side of each drive in the cabinet.
6. Refer the cable section area and MCCB capacity to Table 3-2.

Table 3-2 Recommended MCCB Capacity and Copper Cable Section Area

Model	MCCB Circuit breaker (A)	Power Circuit ( mm <sup>2</sup> )				Control cable (mm <sup>2</sup> )
		Input cable	Braking line	Output cable	Earth cable	
EV1000-2S0004G	16	1.5	1.0	1.0	2.5	1
EV1000-2S0007G	20	2.5	1.0	1.0	2.5	1
EV1000-2S0015G	32	4	1.5	2.5	2.5	1
EV1000-2S0022G	50	6	1.5	2.5	2.5	1
EV1000-4T0007G	10	1.0	1.0	1.0	2.5	1
EV1000-4T0015G	16	1.5	1.0	1.5	2.5	1
EV1000-4T0022G	16	1.5	1.5	1.5	2.5	1
EV1000-4T0037G	25	2.5	1.5	2.5	2.5	1
EV1000-4T0037P	25	2.5	1.5	2.5	2.5	1
EV1000-4T0055G	32	4	2.5	4	2.5	1
EV1000-4T0055P	32	4	2.5	4	2.5	1

**Note:**

If the control circuit uses multi-strand cable, the single-core cable section area can be 0.5mm<sup>2</sup>.

## 3.2.2 Power Terminals

## 1. EV1000-2S0004G, EV1000-2S0007G

The power terminal layout is shown in the figure below:

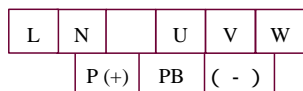


Table 3-3 Definitions of Power Terminals

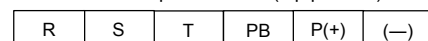
Mark	Definition
L、N	1-phase AC 220V input
P(+)、PB	External braking resistor
P(+)、(-)	DC positive, negative bus input
U、V、W	3-phase AC outputs
PE	Protective earth (on the heater)

**Note:**

The tightening torque is 14kgf.cm. Protective earth wire should be connected to the heater's screw marked with ⊕.

## 2. EV1000-4T0007G, EV1000-4T0015G, EV1000-4T0022G EV1000-2S0015G

Input terminals (top position)



Output terminal (bottom)

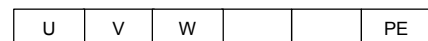


Table 3-4 Definitions of Power Terminals

Mark	Definition
R、S、T	3-phase AC inputs
P(+)、PB	External braking resistor
P(+)、(-)	DC bus inputs
U、V、W	3-phase AC outputs
PE	Protective earth

**Note:**

The tightening torque should be 17kgf.cm. For EV1000-2S0015G, power cable can be connected to any two of R, S, T.

- 3. EV1000-4T0037G, EV1000-4T0037P,
- EV1000-4T0055G, EV1000-4T0055P,
- EV1000-2S0022G

P(+)	PB	R	S	T	U	V	W
------	----	---	---	---	---	---	---

Table 3-5 Definitions of Power Terminals

Mark	Definition
R、S、T	3-phase AC input
P(+)、PB	External braking resistor
U、V、W	3-phase output
PE	Protective earth (on the heater)

**Note:**

The tightening torque is 17kgf.cm. Protective earth wire should be connected to the heater's screw marked with ⊕. For EV1000-2S0022G, power cable can be connected to any two of R, S, T.

### 3.2.3 Control Circuit Wiring

#### 1. Control Terminals and Jumpers

Refer the layout to Fig. 3-8. control terminal function is listed in Table 3-6; Jumper's function in Table 3-7. Be sure to set the jumper and wire the terminals properly. It is recommended to use cable of section area bigger than 1mm<sup>2</sup>.

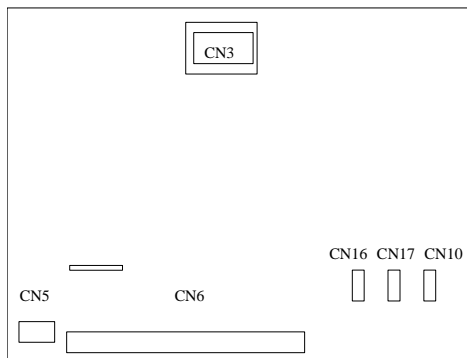


Fig. 3-8 Layout of Control Terminals and Jumpers

Table 3-6 Function of Control Terminals

Mark	Function
CN5	Relay outputs
CN6	Analog I/O, digital I/O

Table 3-7 Jumpers' Function

Mark	Function & Setting	Default
CN10	CCI current/voltage input selection I: 0/4~20mA current signal V: 0~10V voltage signal	0~10V
CN16	AO1 current/voltage input selection 0/4~20mA: AO1 current signal 0/2~10V: AO1 voltage signal	0~10V
CN17	AO2 current/voltage input selection 0/4~20mA: AO2 current signal 0/2~10V: AO2 voltage signal	0~10V

#### 2. Jumper Usage

CN10 jumper usage:

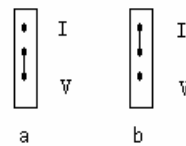


Fig. a means that 0~10V analog voltage input is selected; Fig. b means that 0/4~20mA analog current input is selected.

CN16 or CN17 jumper usage:

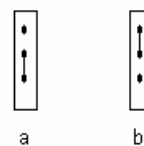


Fig. a means that 0~10V analog voltage output is selected; Fig. b means that 0/4~20mA analog current output is selected.





### 3. CN5 Terminals Wiring

The layout of CN5 is shown in the figure below:

TA	TB	TC
----	----	----

TA-TB: normally closed; TA-TC: normally open

Contact capacity: 250VAC/2A (COS  $\phi$  =1), 250VAC/1A (COS  $\phi$  =0.4), 30V<sub>DC</sub> /1A

TA, TB and TC can be defined as multi-functional digital output signals. Please refer to Section 5.8.

If there are inductive loads, such as: electro-magnetic relay and contactor, surge snubber circuit, e.g. RC circuit, varistor, fly-wheel diode (pay attention to the polarity when used in a DC circuit), should be installed. Note that the leakage current should be less than the current in the contactor or relay. The components in the snubber circuit should be installed near to the relay or contactor coil.

### 4. CN6 Wiring

CN6 Terminal strip layout:

P24	X1	X2	X3	COM	X4	X5		VRF	VCI	CCI	GND
P24	PLC	Y1	Y2	COM	FWD	REV	AO1	AO2	GND	+RS485-	



#### Hint:

The “+RS485-” in the above figure means RS485+ and RS485-.

Table 3-8 CN5, CN6 Terminal Function Table

Category	Terminals	Name	Function	Specification
Communication	RS485+	RS485 communication port	RS485 +	Standard RS-485 communication port, please use twisted-pair cable or shielded cable.
	RS485-		RS485 -	
Analog input	VCI	Analog input VCI	analog voltage input (reference ground: GND)	Input voltage range:0~10V (input resistance:100k $\Omega$ ) resolution:1/2000
	CCI	analog input CCI	accept analog voltage/current input. Jumper CN10 can select voltage or current input mode, Voltage input mode is the default.(reference ground: GND)	Input voltage range:0~10V (input resistance:100k $\Omega$ ) Input current range:0~20mA (input resistance:500 $\Omega$ ) resolution:1/2000

Category	Terminals	Name	Function	Specification
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
	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)	Output voltage range: 0/2~10V
Digital Input	X1~X3	multi-functional digital inputs X1~X3	Can be defined as multi-functional digital inputs, see Section 5.8 Reference ground: COM	Optical-isolator 2-way input input resistance: 2k $\Omega$ maximum input frequency: 200Hz Input voltage range: 9~30V
	X4~X5	multi-functional digital inputs X4~X5	Having the same function as X1~X3, besides, it can be defined as high-speed pulse inputs. see Section 5.8. Reference ground: COM	Optical-isolator 2-way input Single way max. input frequency: 100kHz, 2-way max. input frequency: 50kHz Max. reference pulse frequency: 50Hz Input voltage range: 9~30V Input impedance: 620 $\Omega$
	FWD	Run forward command	Optical-isolator two-way input programmable terminal, max. input frequency: 200Hz	
	REV	Reverse run command	Optical-isolator two-way input programmable terminal, max. input frequency: 200Hz	
	PLC	Common terminal	Common terminal for multi-functional inputs	
	P24	+24V supply	Providing +24V power supply	Output: +24V, Setpoint accuracy: $\pm 10\%$ Max. output current: 200mA (150mA for model 2S0007G and 2S0004G)
	COM	+24V common terminal	Isolated internally with GND	Isolated internally with GND
Digital output	Y1	Open collector output 1	Programmable terminals, defined as multi-function digital outputs, see Section 5.8.	Optical-isolator output: 24V <sub>DC</sub> /50mA
	Y2	Open collector output 2	Programmable terminals, defined as multi-function digital outputs, see Section 5.8.	Optical-isolator output: 24V <sub>DC</sub> /50mA

Category	Terminals	Name	Function	Specification
Power supply	VRF	+10V power supply	Provide +10V power supply	Output: +10V, Setpoint accuracy: $\pm 10\%$ Max. output current: 100mA
	GND	GND of +10V power supply	reference ground of analog signal and 10V power supply	
Others	TA/TB/TC	Relay output	TA, TB and TC can be defined as multi-functional digital output signals. Please refer to Section 5.8.	TA-TB: normally closed; TA-TC: normally open Contact capacity: 250VAC/2A (COS $\phi = 1$ ), 250VAC/1A (COS $\phi = 0.4$ ), 30V <sub>DC</sub> /1A

1) Analog Input Terminal Wiring

① Terminal VCI receives analog voltage input, the wiring diagram is as follows:

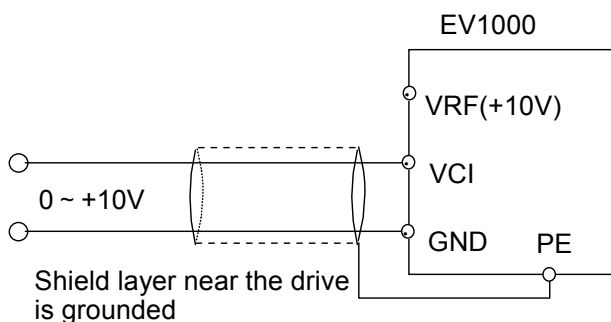


Fig. 3-9 VCI Wiring Diagram

② Terminal CCI receives analog signal. Select current or voltage signal by setting jumper. Refer to the figure below:

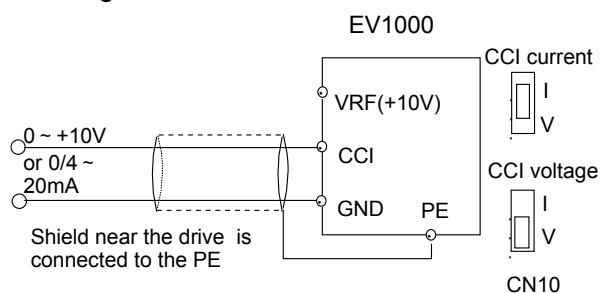


Fig. 3-10 CCI Wiring Diagram

2) Analog Output Terminal Wiring

If the analog output terminal AO1 and AO2 are connected with analog meter, it can measure many parameters. The jumpers for AO1 and AO2 are CN16 and CN17.

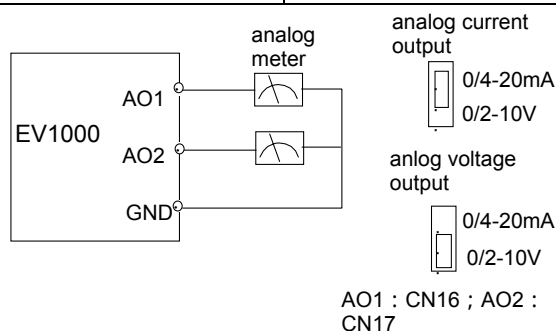


Fig. 3-11 Analog Output Terminal Wiring

**Hint:**

1. When using analog input, you should install capacitor-filter or common-mode inductor between VCI and GND, or between CCI and GND.
2. Analog I/O signals are sensible to interference, ensure to use shielded cable and ground it properly. The cable length should be as short as possible.

3) Serial Communication Port Connection

The drive can be connected to the host with RS485 port directly.

Fig. 3-9 shows the connection of the drive with the host with RS232 port.

Fig. 3-13 shows the connection of the drive to PROFIBUS system via TDS-PA01 PROFIBUS adapter.

Using above wiring method, you can build a "single-master single slave" system or a "single-master multi-slaves" system. The drives in the network can be monitored, and be controlled remotely and automatically in real time by using a PC or PLC controller. Thus more complicated operation control can be realized.

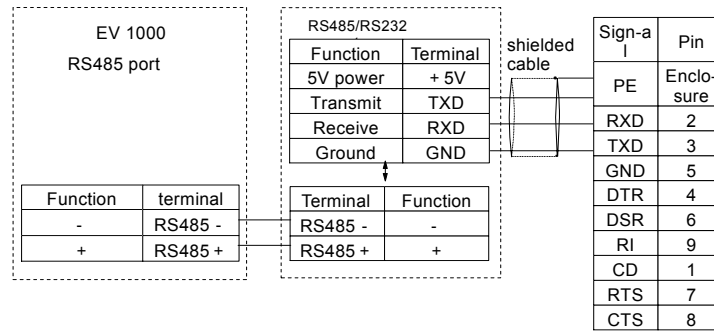


Fig. 3-12 RS485- ( RS485/RS232 ) -RS232 communication cable

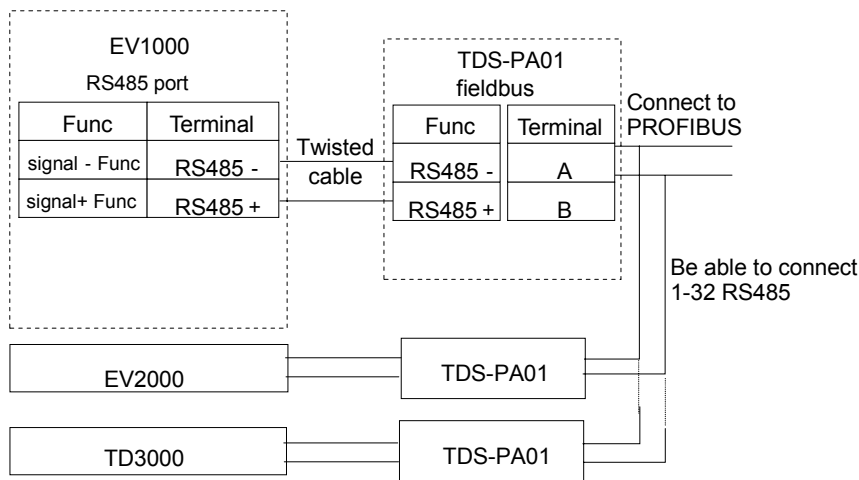


Fig. 3-13 RS485- ( TDS-PA01 ) -PROFIBUS Wiring Diagram

Precautions for communication port connection:

- The PE terminal of each drive should be earthed at a nearby grounding point;
- The GND terminal of each drive should be connected together;
- RS485 communication uses shielded cables, which is earthed at one side. The earth wire of the shielded cable is connected to RS485 communication module (PE).

If the above standard wiring methods cannot meet the requirements, you can take the actions below:

- Use isolated RS485 communication module;
- If the noise is transmitted through the GND line to the drive or other devices, which results in malfunction of them, you may disconnect the GND lines.

4) Multi-function Input Terminal and FWD, REV

Wiring

The multi-function input terminals use full-bridge rectifying circuit, as the below figure shows. PLC is the common terminal for X1~X5, FWD and REV. The PLC terminal can sink or source current. Wire connections X1~X5, FWD and REV is flexible and the typical wiring is shown below:

① Connection method 1

It is default to use the drive's internal power source 24V, i.e. PLC connected with P24.

If you want to use external power supply, make sure to remove the wire between PLC and P24.

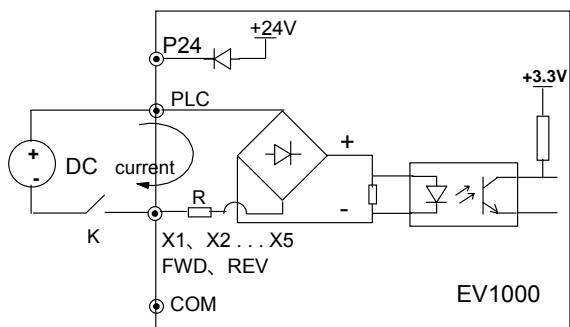


Fig. 3-14 External Power Supply Wiring Diagram

② Connection Method 2

Drive's internal +24V power supply is used and the external controller uses PNP transistors whose common emitters are connected, as shown in Fig. 3-15.

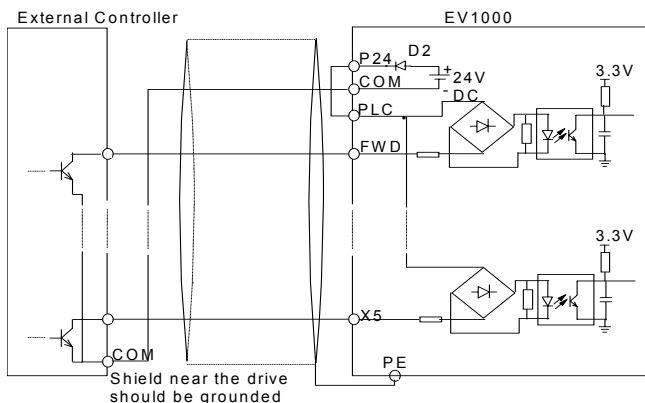


Fig. 3-15 Internal +24V Wiring Diagram (source)

Drive's internal +24V power supply is used and the external controller uses PNP transistors whose common emitters are connected, as shown in Fig. 3-16.

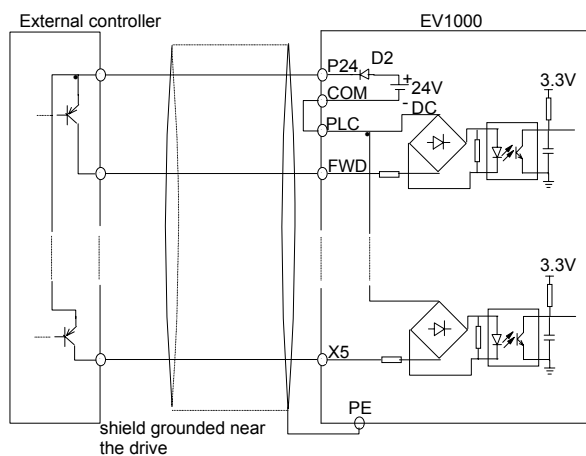


Fig. 3-16 Internal +24V Wiring Diagram (drain)

When using External power supply, remember to disconnect PLC and P24.

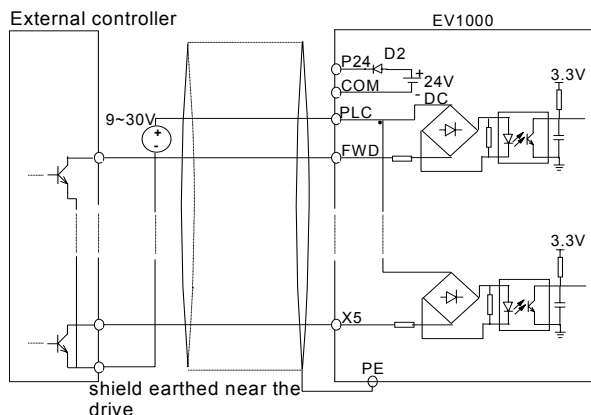


Fig. 3-17 External Power Supply Wiring (Source)

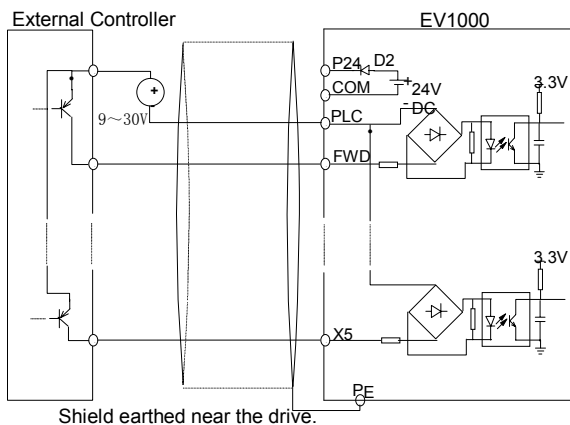


Fig. 3-18 External Power Supply Wiring (drain)

5) Multi-function Output Terminal Wiring

① Terminal Y1 can use the internal 24V power supply, see the figure below:

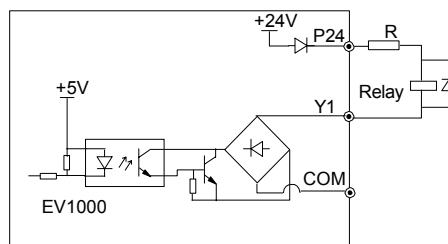


Fig. 3-19 Multi-function Output Terminal Wiring 1

② Terminal Y1 can also use external power (9~30V) supply.

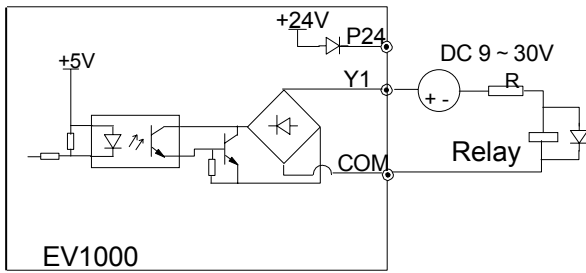


Fig. 3-20 Multi-function Output Terminal Wiring 2

③ When Terminal Y2 is used as digital pulse frequency output, it can also use the internal 24V power supply.

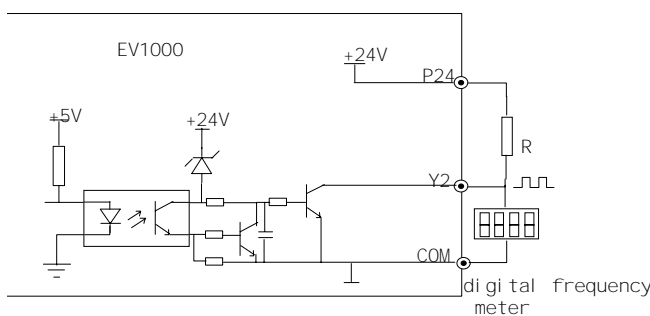


Fig. 3-21 Terminal Y2 Wiring 1

④ When Terminal Y2 is used as digital pulse frequency output, it can also use the external power supply (9~30V).

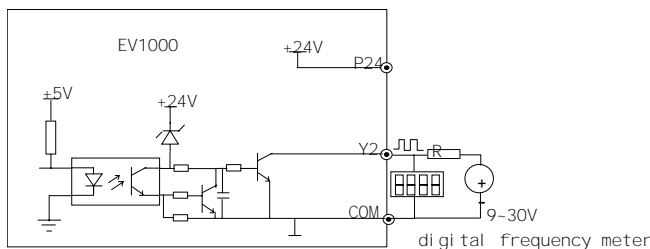


Fig. 3-22 Terminal Y2 Wiring 2

**Note:**

1. Don't short terminals P24 and COM, otherwise the control board may be damaged.
2. Please use multi-core shielded cable or multi-strand 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) as possible from the main circuits and high voltage cables (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.

**3.2.4 Onsite Wiring Requirements**

To avoid mutual EMI disturbance, the control cables, power cable and motor cable should be installed as apart as possible, especially when they are routed in parallel for rather long distance. If the signal cable must cross the power cable or motor cable, keep them at right angle to each other.

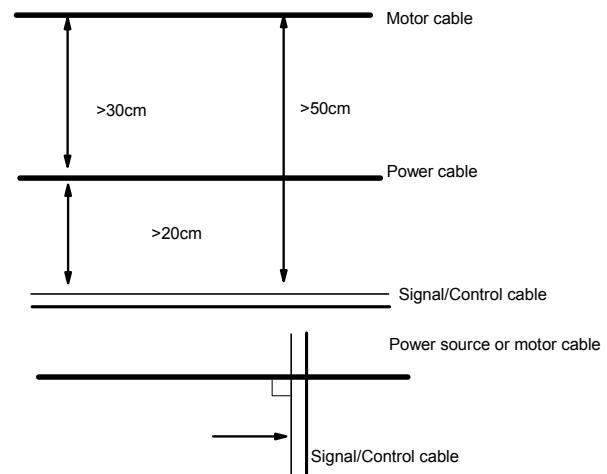


Fig. 3-23 Cable Routing Schematic Diagram

If the section area of the motor cable is too big, the motor should derate. Refer the drive's cable specs in Table 3-2. Since the larger the section area of cables, the greater their capacitance to the ground, therefore, the output current should derate 5% with increasing every category of cable section area.

Shielded/armored cable: high-frequency low-impedance shielded cable should be used, such as woven copper mesh, aluminum mesh or metal mesh.

The control cable should be shielded, and the clamps at both ends of the metal mesh should be connected to the earth terminal of the drive enclosure.

Use conductive plate and dentate pad to clear away the paint between the screws and metal casing, to ensure good conductivity.

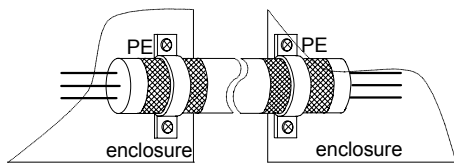


Fig. 3-24 Correct Shield Layer Earthing

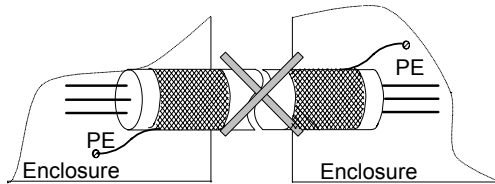


Fig. 3-25 Incorrect Shield Layer Earthing

### 3.2.5 Earthing

Independent earthing pole (Recommended)

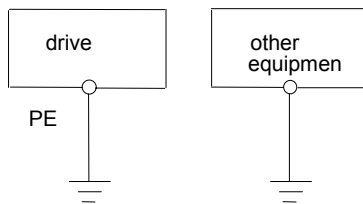


Fig. 3-26 Earthing Diagram 1

Shared earthing pole (acceptable)

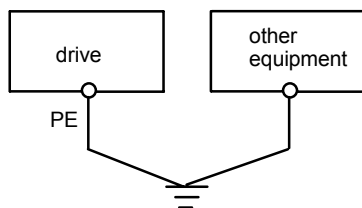


Fig. 3-27 Earthing Diagram 2

Shared earthing lines (not allowed)

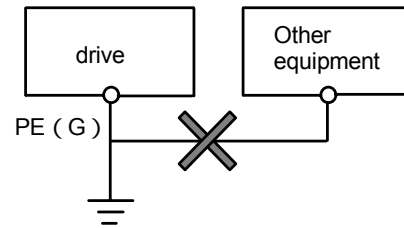
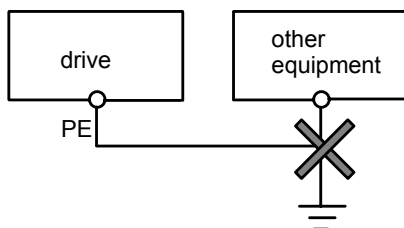


Fig. 3-28 Earthing Diagram 3

Besides, pay attention to the following points:

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.

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.

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.

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.

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

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



## Chapter 4 Operation Procedures

### 4.1 Definitions of Terms

In the follow-up sections, you may encounter the terms describing the control, running and status of drive many times. 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 Modes

It defines the methods by which drive receives operating commands like START, STOP, FWD, REV, JOG and others.

Keypad control: The drive is controlled by **RUN**, **STOP** and **JOG** keys on the LED keypad;

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

Host control: The operations such as START and STOP is controlled by host PC.

The control modes can be selected by parameter F0.03, multi-function input terminals (function No. 27, 28 and 29 of F7.00).

#### 4.1.2 Frequency Setting Methods

There are 7 methods to set frequency, they are:

▲ and ▼ key on the keypad;

Terminal UP/DN;

Serial communication port;

Analog VCI;

Analog CCI;

Terminal (PULSE);

Potentiometer on the keypad.

How to select the frequency setting methods, please refer to F0.00.

#### How to set Frequency

The output frequency is decided after calculating the values from one or more of the 7 frequency setting channels, which involves the concept of main and auxiliary reference frequency.

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

The main reference frequency is decided 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.

Preset 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. 5-58 in chapter 5.

#### 4.1.3 Drive's Operating Status

There are 3 operating status: stop, operating and motor parameter tuning.

Stop: After the drive is switched on and initialized, if no operating command is received or the stop command is executed, then the drive enters stop status.

Operating: after receiving run command, the drive begins to operate.

Motor parameter tuning: If FH.09 is set at 1 or 2, after giving RUN command, the drive will enter motor parameter tuning status, and then it will stay in stop status.

#### 4.1.4 Operating Mode

The drive has 5 kinds of operating modes which can be arranged in the sequence of "Jog>Close

loop operation>PLC>MS>Simple operation” according to the priority.

Jog:

When the drive is in stop status, it will operate according to Jog frequency after it receives the Jog operation command (See F3.13~F3.16).

Close-loop operation:

If the close-loop operating function is enabled (F5.00=1), the drive will select the close-loop operation mode, meaning that 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 multi-function terminal (function No. 20), and the drive will then select other operating mode of lower priority level.

PLC running:

PLC function is enabled if the one's place of

F4.00 setting is a non-zero value. The drive will run according to the preset mode, see F4 function group. It can be disabled by multi-function terminal (function No.21).

MS Running:

Select multi-frequency 1~7 (F3.23~F3.29) by the combination of multi-function terminal (function No. 1, 2, 3), which is not zero.

Simple Running: open-loop operation.

The above 5 operating modes determine 5 frequency setting sources. Except Jog, the other four frequency setting can be adjusted or combined with auxiliary frequency. The frequency of PLC, MS and simple running can also be adjusted by traverse.

## 4.2 Operation Guide

### 4.2.1 Operation of LED Keypad

LED keypad display unit is to receive command and display parameters.

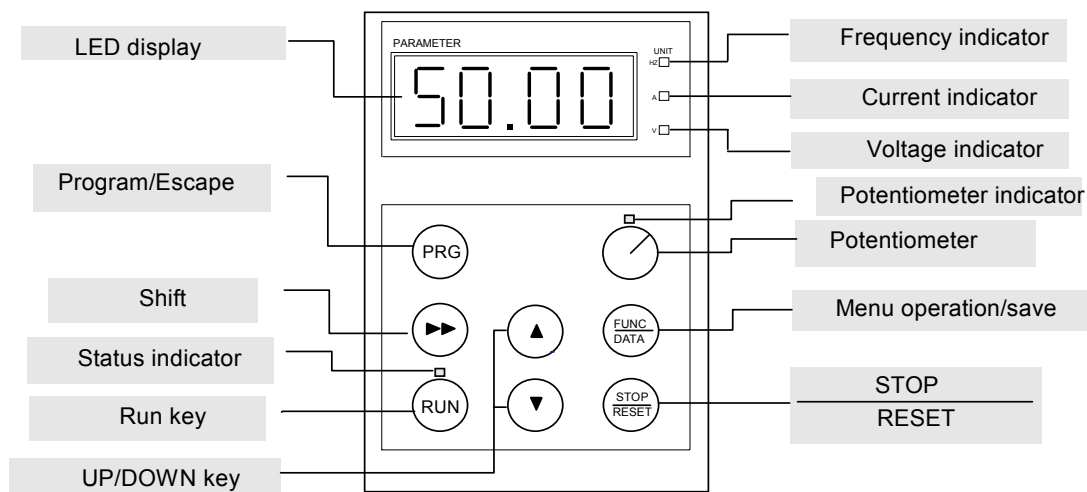


Fig. 4-1 LED Keypad Display Unit

When using the keypad separated from the drive, it is recommended to use the cable special for EV1000 drive, to avoid reverse connection.

## 4.2.2 Keypad Function Explanation

There are 7 keys on the LED keypad display unit, refer the function of each key in Table 4-1.

Table 4-1 Key's Function

Key	Name	Function
PRG	Program key	To shift between stop state and program state
FUNC/DATA	Function/data key	To shift between function code menus, confirm modification
▲	Increase key	To increase data or function code number
▼	Decrease key	To decrease data or function code number
▶▶	Shift key	To scroll over the displayed parameters, such as voltage, frequency; to select the digit to be modified
RUN	Run key	In the keypad operating mode, press the key to start running
STOP/RESET	Stop/Reset	In keypad mode, stop the drive or reset in case of alarm or fault; Terminal control mode: reset in case of alarm or fault.
/	Potentiometer	Set frequency

## 4.2.3 Indicator Description

Function of the Indicators on the keypad:

Indicator	Meaning	Color	Mark
Frequency indicator	ON: current LED display is frequency	Green	Hz
Current indicator	ON: current LEDdisplay is current	Green	A
Voltage indicator	ON: current LEDdisplay is voltage	Green	V
Potentiometer indicator	Set frequency by the potentiometer	Green	None
Status indicator	ON: the drive is running	Green	RUN

Implication of the combination of indicators:

Indicator combination	Meaning
Hz+A	Both ON: set speed (r/min) Both flash: actual speed
A+V	Both ON: set line speed (m/s) Both flash: actual line speed
Hz+V	Both ON: set percentage (%) Both flash: actual percentage

If all the above indicators (A, V, Hz) go out, it means the displayed parameter has no unit.

## 4.2.4 Parameter Setting Method

### 1. Parameter System

The EV1000 series drive has 17 function group: F0~F9, FA, FF, FH, FL, Fn, FP and FU. Each function group includes many parameter, which is presented as function group number + parameter number, e.g. F5.08.

## 2. Menu Structure and Parameter

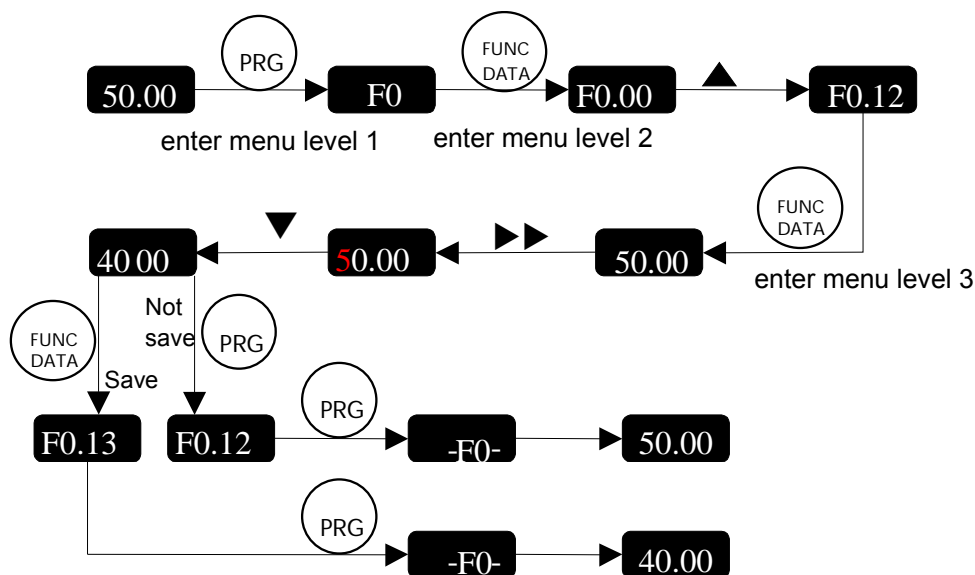
When setting parameter through LED keypad display unit, function group is listed in menu level 1, parameter in menu level 2, and settings of parameters in menu level 3. See Appendix 1.

## 3. Examples of Parameter Setting

The setting of parameter is presented in decimal (DEC) and hexadecimal (HEX) format. If it is set in hexadecimal format, each digit of the setting is independent to one another, which can be 0~F. The re are at most 4 digits, they are: one's place, ten's place, hundred's place and thousand's place. You may select certain digit by pressing **▶▶** key, and use **▲** and **▼** key to increase or decrease values.

Example 1: To change the frequency from 50Hz to 40Hz (F0.12: 50.00→40.00)

1. Press **PRG** key to enter programming state, the LED displays F0.
2. Press **FUNC/DATA** key, "F0.00" is displayed. Press **▲** key until "F0.12" is displayed.
3. Press **FUNC/DATA** key, you will see 50.00.
4. Press **▶▶** key, to move the cursor to the digit "5".
5. Press **▼** key once, to change the digit to "4".
6. Press **FUNC/DATA** key to save the modification and you will see the next parameter F0.13.
7. Press **PRG** key to exit the programming state.



Example 2: Settings of HEX format.

Take F8.01 (Display parameter during running) for example. Suppose you hope to display: reference setting, actual speed, set speed, actual line speed and set line speed.

Since each digit is mutually independent, you may set them separately. First you should decide the binary value, and then convert it into hex format. The conversion of binary value to HEX value is shown in Table 5-11.

1. Set one's place.

Refer to the figure below. Reference Frequency is decided by the BIT2 of the one's place of F8.01. If BIT2=1, it means the parameter will be displayed. For those parameters you don't want to display, you may set the corresponding bit at Zero. Therefore, it turns out to be "0100", after converting to HEX value, it is 4. So, you should set the one's place at 4.

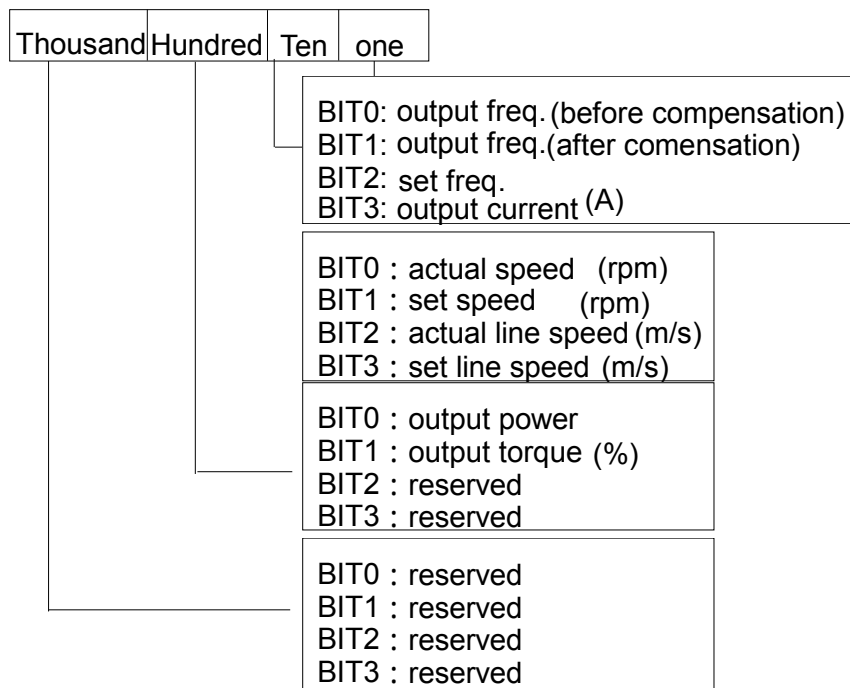
## 2. Set Ten's place

Similarly, set the corresponding bit at "1" for those parameters you want to display, you will get "1111", i.e. "F".

## 3. Set Hundred's and Thousand's place

Since no parameters related to hundred's and thousand's place are required to display, so they are set at zero.

From the above, F8.01 is set at 00F4.



Under menu level 3, if no digit of a parameter is blinking, it means it is unchangeable. The possible reasons are:

The parameter is unchangeable, such as measured parameters, operation log, etc;

The parameter can be changed at stop state only;

The parameter is protected. When FP.01=1 or 2, the parameter is protected. You should set FP.01=0 to allow the modification.

### 4.2.5 Speed Setting

If the initial state is actual speed, set speed, actual line speed or set line speed, you may press ▲ or ▼ key to change the set speed and set line speed real-time. If you want to change the reference setting, press ►► key to shift the LED display to frequency then change it.

#### 4.2.6 How to Lock/Unlock Keypad

**Lock Keypad:** Set the hundred's place of F9.07 at non-zero value. Press **FUNC/DATA** key and **PRG** key at the same time, thus the keypad is locked.

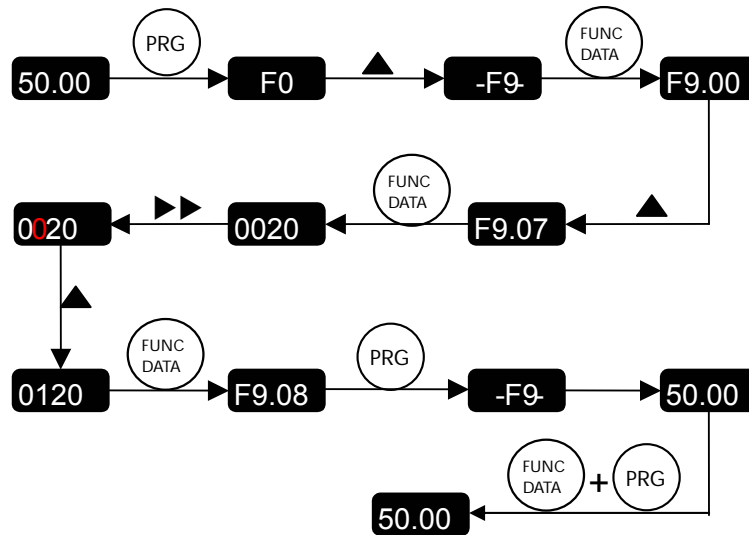


Fig.4-2 Lock LED Keypad Display Unit

**Unlock:** at stop or operating state, press **FUNC/DATA** key, and then press ▼ three times. Note that the operation will not change the value of F9.07.

**Note:**

Even though the hundred's place of F9.07 is not zero (allow to lock the keypad), every time the drive is powered up, the keypad is not locked.

## Chapter 5 Parameters

### Note:

The contents in the “【】” are factory default.

### 5.1 Basic Parameters (F0)

F0.00	Frequency setting method	Range: 0~6 【6】
-------	--------------------------	----------------

0: digital setting 1, set by ▲ or ▼ key.

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

1: digital setting 2, set by terminal UP/DN

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

2: digital setting 3, set through serial port

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

3: VCI analog setting (VCI-GND)

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

4: CCI analog setting (CCI-GND)

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

5. Terminal Pulse Setting

The reference frequency is set by terminals X4 or X5, see F7.03~F7.04. The input pulse range: 15~30V, 0~50.0kHz.

6. Keypad Analog Setting

The reference frequency is set by the potentiometer on the keypad. Range: 0~max. output frequency (F0.05).

### Note:

For method 3, 4 and 5, the frequency calculation curve is given in F1.00~F1.11, please refer to 5.2.

F0.01 Digital Frequency Control	Range: 00~11 【00】
---------------------------------	-------------------

Valid only when F0.00=0, 1, 2.

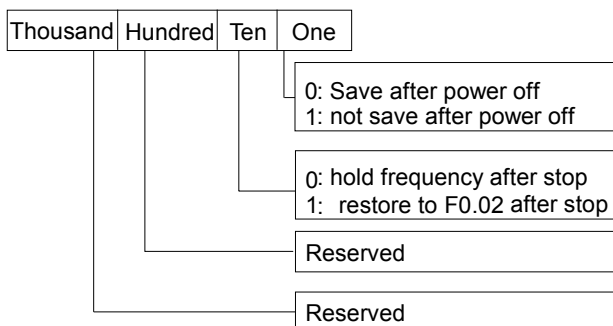


Fig. 5-1 F0.01 Setting

One's place of F0.01:

0: when the drive is powered off or at undervoltage state, update F0.02 by the actual frequency at that time.

1: when the drive is powered off or at undervoltage state, F0.02 remains unchanged.

Ten's place of F0.01:

0: the reference frequency when the drive stops will be saved.

1: The reference frequency will restore to F0.02 when the drive stops.

F0.02	Frequency digital setting	Range: lower limit~upper limit 【50.00Hz】
-------	---------------------------	--

When the frequency is set in digital mode (F0.00 = 0, 1, 2), F0.02 is the initial reference frequency.

F0.03	Control mode	Range: 0, 1, 2 【0】
-------	--------------	--------------------

EV1000 has 3 control mode:

0: LED keypad display unit

Use **RUN** and **STOP** key on the keypad to control

the drive.

1: Terminal control: Input operating commands via terminals

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

2: Serial port control: Input operating commands via serial port

Use serial port to start and stop the drive.

#### Note:

Note that during operating process, the control modes can be changed by changing the setting of F0.03. Be careful if you want to do so.

F0.04 Running Direction	Range: 0, 1 【0】
-------------------------	-----------------

The function applies to keypad control and serial port control, but not terminal control mode.

0: Forward

1: Reverse

F0.05 Max. output frequency	Range: Max {50.00, F0.12 upper limit}~650.00Hz 【50.00Hz】
F0.06 Base frequency	Range: 1.00~650.00Hz 【50.00Hz】
F0.07 Max. output voltage	Range: 1~480V 【drive's rated】

The max. frequency refers to the allowed max. output frequency of the drive. Refer to the  $f_{max}$  in Fig. 5-2;

Base frequency normally corresponds with the rated frequency of the motor. It is the Min frequency when the drive outputs the highest voltage, as shown in Fig. 5-2 as  $f_b$

Max output voltage is the drive's output voltage when the drive outputs base frequency, as shown in Fig. 5-2 as  $V_{max}$ . This corresponds to the rated voltage of the motor.

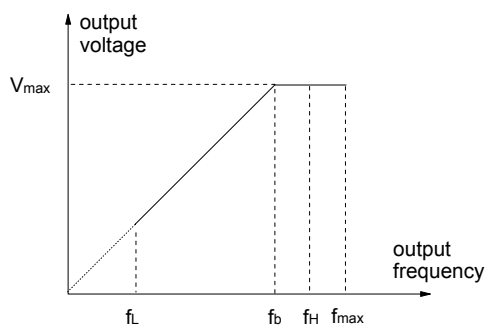


Fig. 5-2 Characteristic Parameters Definition

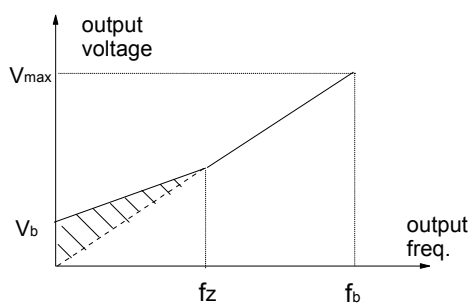
The  $f_H$  and  $f_L$  are defined by F0.12 and F0.13 as upper limit and lower limit of frequency respectively.

#### Note:

Please set  $f_{max}$ ,  $f_b$  and  $V_{max}$  according to motor parameters on its nameplate. Failing to do so may damage the motor.

F0.08 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 increase the torque. If F0.09 is set to 0, auto torque boost is enabled and if set at non-zero, manual torque boost is enabled, as shown in Fig. 5-3.



$V_b$  : manual torque boost       $V_{max}$  : Max output voltage  
 $f_z$  : cut-off freq. for torque boost  
 $f_b$  : basic operating freq.

Fig. 5-3 Torque boost (shadow area: boost value)



**Note:**

1. Wrong parameter setting can cause overheating of the motor or triggers the over-current protection of the drive.
2. Refer to F0.21 for definition of fz.
3. When using synchron motor, you should select manual torque boost, and adjust V/F curve according to the motor parameters and application.

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

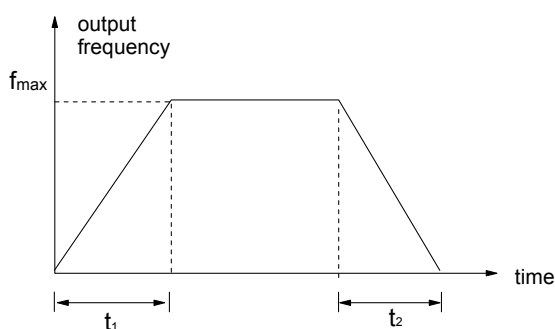


Fig. 5-4 Acc/Dec time definition

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

Dec time is the time taken for the motor to decelerate from maximum frequency (F0.05) to 0 Hz, see  $t_2$  in Fig. 5-4.

EV1000 has four pair of acc/dec time. Here we only introduce acc/dec 1. Please find acc/dec time 2~4 in section 5.4: F3.17~F3.22.

**Hint:**

The unit of acc/dec 1~4 can be selected by F9.09, the options are: minute, second. The default is second.

F0.12	Upper limit of freq.	Range: upper limet~max. output frequency 【50.00Hz】
F0.13	Lower limit of frequency	Range: 0~upper limet of frequency 【0.00Hz】

Please refer  $f_H$  and  $f_L$  in Fig. 5-2.

**Note:**

It is possible for the actual output frequency to fluctuate within  $\pm 2.5\text{Hz}$  in the bus-voltage control process.

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

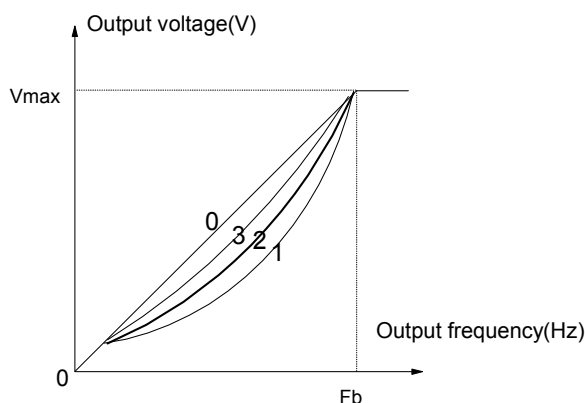
This group of parameters defines the V/F setting modes so as to satisfy the requirements of different loads. Three fixed curves and one user-defined curve can be selected according to the setting of F0.14.

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

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

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

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



Vmax : Max output voltage(F0.07)  
Fb : Basic operating frequency(F0.06)

Fig. 5-5 Torque-reducing curve

If F0.14 is set to 0, you can define a curve by F0.15~F0.20, i.e. a polygonal line defined by 3 points (V1, F1), (V2, F2), (V3, F3), to satisfy the needs of special loads, as shown in Fig. 5-6.

The default is a straight line, shown in Fig. 5-5 as curve 0.

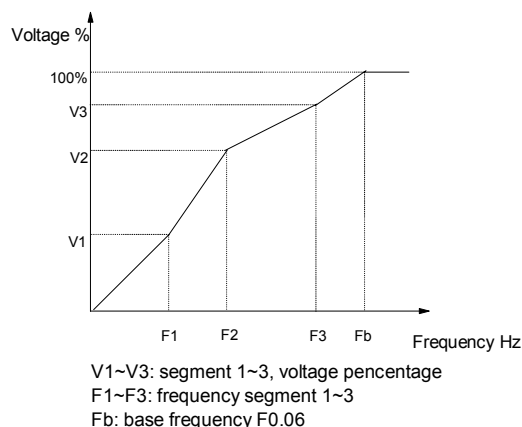


Fig. 5-6 User Defined V/F Curve

F0.21 Manual torque boost cutoff point	Range: 0~50% 【10.0%】
--	----------------------

F0.21 defines the ratio of the cut-off frequency used for manual torque boost to the base 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 Reference Frequency (F1)

F1.00 Freq. Curve selection	Range: 000~111 【000】
F1.01 Gain of reference frequency selector	Range: 0.00~9.99 【1.00】
F1.02 Filter constant	Range: 0.01~50.00s 【0.50s】
F1.03 Max. input pulse freq.	Range: 0.1~50.0kHz 【10.0kHz】
F1.04 Ratio of Min. input of curve 1 to F1.03	Range: 0.0%~100.0% 【0.0%】
F1.05 Frequency corresponds to min. input if curve 1	Range: 0.0~650.0Hz 【0.00Hz】
F1.06 Ratio of Max. input of curve 1 to F1.03	Range: 0.0%~100.0% 【100.0%】
F1.07 Frequency corresponds to max. input of curve 1	Range: 0.0~650.0Hz 【50.00Hz】
F1.08 Ratio of Min. input of curve 2 to F1.03	Range: 0.0%~100.0% 【0.0%】
F1.09 Frequency corresponds to min. input	Range: 0.0~650.0Hz 【0.00Hz】
F1.10 Ratio of Max. input of curve 2 to F1.03	Range: 0.0%~100.0% 【100.0%】
F1.11 Frequency corresponds to max. input	Range: 0.0~650.0Hz 【50.00Hz】

When selecting VCI and CCI or PULSE input as open loop setting method, the process is shown in Fig. 5-7.

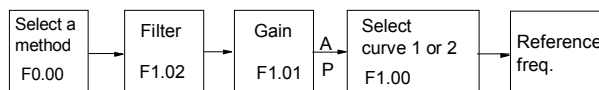


Fig. 5-7 The process of setting reference freq.

After the input passes through the filter and gain processor, the relationship of its value and reference frequency is determined by curve 1 or curve 2, which are decided by F1.04~F1.07 and

F1.08~F1.11 respectively. Both of them can work as positive or negative logic, as shown in Fig. 5-8.

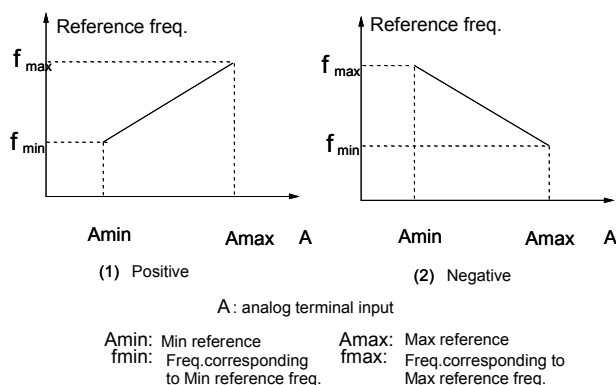


Fig. 5-8 Reference Freq. Curve

When the analog input A is 100%, it is a 10V or 20mA signal and the reference frequency is the maximum; when the pulse input is 100%, it corresponds to F1.03 (max. input pulse frequency).

F1.02 defines the filter time. The longer the time, the stronger the immunity to disturbance, the slower the response, and vice versa.

F1.00 is to select the reference frequency curve of VCI, CCI and PULSE setting method, see

Fig. 5-9.

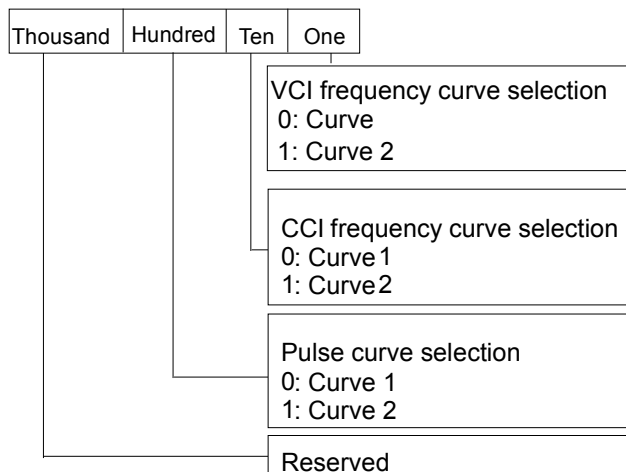


Fig. 5-9 Frequency Curve Selection

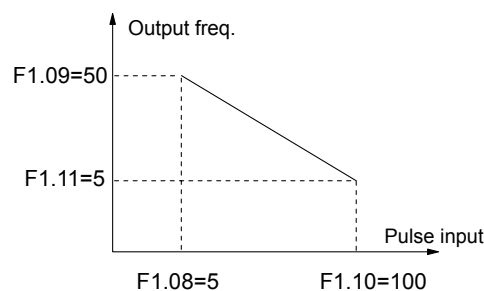
Suppose you want to:

- ① set reference frequency by terminal pulse signal;
- ② input signal range: 1kHz~20kHz;

- ③ 1kHz input for reference frequency 50Hz, 20kHz input for reference frequency 5Hz;

To meet the above requirement, you should set:

- ① F0.00=5, set terminal pulse mode;
- ② F7.03=45, input pulse signal from X4;
- ③ F1.00=100, select curve 2;
- ④ F1.03=20.0kHz, set max. pulse frequency at 20kHz;
- ⑤  $F1.08=1 \div 20 \times 100\% = 5.0\%$ , to set the ratio of min input of curve 2 (1kHz) to F1.03 (20kHz);
- ⑥ F1.09=50.00Hz; reference frequency corresponds to min. input.
- ⑦  $F1.10=20 \div 20 \times 100\% = 100.0\%$ , to set the ratio of max. input of curve 2 (1kHz) to F1.03 (20kHz)
- ⑧ F1.11=5.00Hz, to set the reference frequency corresponding to max. input.



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

Fig. 5-10 Frequency Set By Pulse Signal

### 5.3 Start/Brake Parameter (F2)

F2.00 Start mode	Range: 0, 1 【0】
------------------	-----------------

F2.00=0: start at start frequency (F2.01)

The drive is started at start frequency and in preset time F2.02.

F2.00=1: brake first and then start at start frequency

DC brake first, (refer to F2.03 and F2.04), and then start in the manner of F2.00=0.

**Note:**

1. Start mode 1 applies to small-inertia motor when the drive stops, the motor is still rotating. For large-inertia load, do not restart until the motor stops.
2. When driving synchronized motor, it is recommended to use start mode 0.

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

Start frequency refers the frequency at which the drive starts, as shown in Fig. 5-11 as  $f_s$ ; start frequency hold time refers the time within which the drive runs at start frequency during startup, as shown in Fig. 5-11 as  $t_1$ :

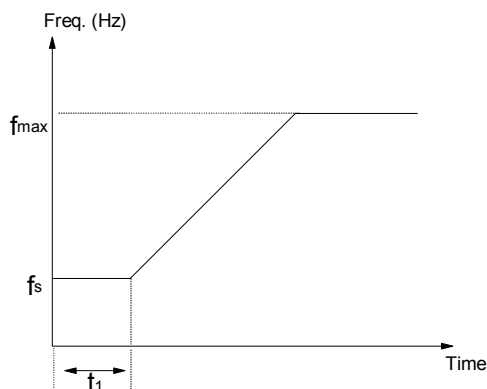


Fig. 5-11 Relation of Start Freq. and Start Time

**Note:**

The start frequency is not limited by lower limit of the frequency.

F2.03 DC brake current at startup	Range: depending on model 【0.0%】
F2.04 DC brake time at startup	Range: depending on model 【0.0s】

F2.03 and F2.04 are valid only when you set F2.00=1, that is, braking before starting. See Fig. 5-12.

DC brake current at startup is determined by drive model, for G type: 0~150% of drive's rated current (max. current among the 3 phases), P type: 0~130% of drive's rated current (max. current among the 3 phases).

If the brake time at startup is set at 0.0s, no brake process.

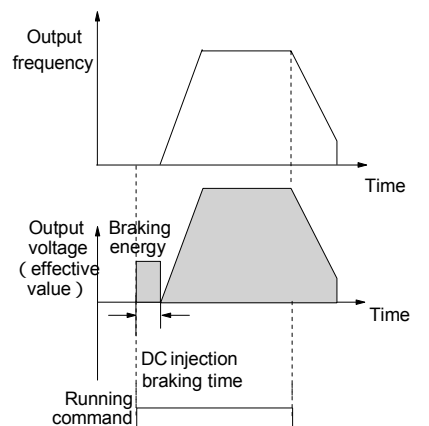


Fig. 5-12 Start Mode 1

F2.05 Acc/Dec mode	Range: 0, 1, 2 【0】
--------------------	--------------------

F2.05=0: linear Acc/Dec

The output frequency increase or decrease according to a fixed slope, see Fig. 5-13.

F2.05=1: S curve Acc/Dec

The output frequency increase or decrease according to S curve, see Fig. 5-14.

F2.05=2: automatic Acc/Dec

The output current of the drive is limited below the current limiting level according to the load, see FL.07. The Acc/Dec is done smoothly.

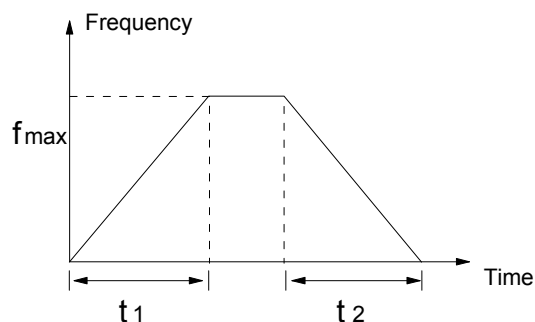


Fig. 5-13 Linear Acc/Dec Curve

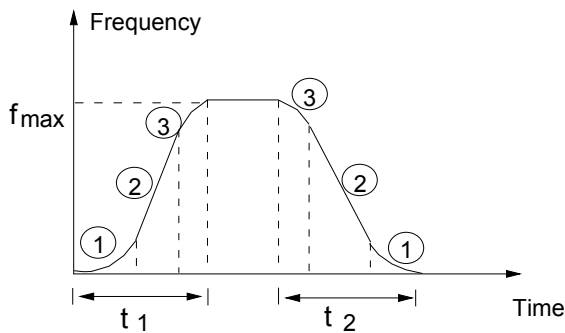


Fig. 5-14 Acc/Dec S Curve

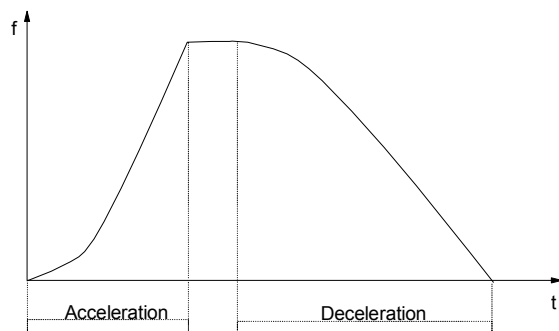


Fig. 5-15 Auto Acc/Dec

**Note:**

In auto Acc/Dec mode, the Acc/Dec time (F0.10, F0.11, F3.17 ~ F3.22) becomes invalid.

F2.06 S curve start time	Range: 10~50% 【20.0%】
F2.07 S curve rising time	Range: 10~80% 【60.0%】

F2.06 and F2.07 are valid only when F2.05=1 (S curve mode) and  $F2.06+F2.07 \leq 90\%$ .

S curve start time is illustrated in Fig. 5-14 as ①, the change rate of output frequency is increasing from 0.

S curve rising time is illustrated in Fig. 5-14 as ②, the change rate remains the same.

S curve end time is illustrated in Fig. 5-14 as ③. The change rate decreases to 0.

S curve Acc/Dec is suitable to the start and stop of elevator, conveyer, etc.

F2.08 Stop mode	Range: 0, 1, 2 【0】
-----------------	--------------------

0: decelerate to stop

When the drive receives Stop command, it will

reduce output frequency to zero and stop within preset deceleration time.

**1. Coast to stop**

When the drive receives Stop command, it will stop outputting frequency and stop gradually relying on load inertia.

**2: Deceleration+DC braking**

When the drive receives Stop command, it will reduce output frequency within preset Dec time. When it arrives at the frequency threshold of DC braking, the DC braking begins. Please refer to F2.09~F2.12.

F2.09 Frequency threshold of DC brake	Range: 0.00~60.00Hz 【0.00Hz】
F2.10 DC brake delay time	Range: 0.00~10.00s【0.00s】
F2.11 DC brake current	Range: Depending on model 【0.0%】
F2.12 DC brake time at stop	Range: Depending on model 【0.0s】

DC braking delay time is the period from arriving at frequency threshold (F2.09) to starting braking.

During the period, there is no output from the drive. This function can prevent current overshoot of high power motor at startup.

The braking current is different depending on drive's model, G type: 0~150% of drive's rated current (max. current among the 3 phases), P type: 0~130% of drive's rated current (max. current among the 3 phases).

If the brake time at stop is set at 0.0s, there is no braking process.

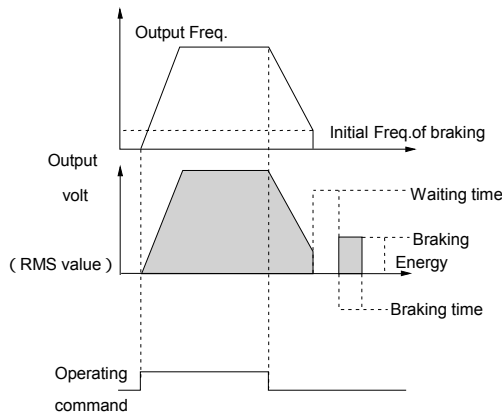


Fig. 5-15 Deceleration +DC braking Process

F2.13 Dynamic braking	Range: 0, 1 【0】
-----------------------	-----------------

0: disabled  
1: enabled

**Note:**

Please set this parameter properly according to your needs, otherwise, the control performance will be suffered.

F2.14 Ration of braking time to total operating time	Range: 0.0~100.0% 【2.0 %】
--	---------------------------

The max. continuous dynamic braking time is calculated with 100s as a cycle.

**Note:**

The resistance and power of the braking resistor should be considered.

### 5.4 Auxiliary Operating Parameters (F3)

F3.00 Anti-reverse setting	Range: 0, 1 【0】
----------------------------	-----------------

0: reverse allowed  
1: reverse not allowed

**Note:**

The function is effective to all command giving method, including keypad, terminal and serial port.

F3.01 FWD/REV transition time	Range: 0~3600s 【0.0s】
-------------------------------	-----------------------

It refers to the time period when the drive's

rotation changes from FWD to REV or REV to FWD, see Fig. 5-16 as  $t_1$ .

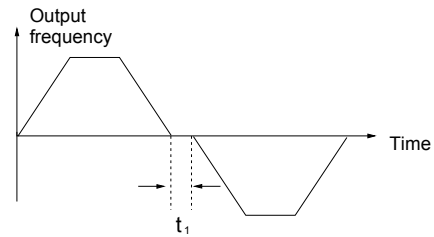


Fig. 5-16 Transition time from FWD to REV

F3.02~F3.04	RESERVED
-------------	----------

F3.05 Auto energy saving	Range: 0, 1 【0】
--------------------------	-----------------

0: disabled  
1: enabled

The drive can detect load current and adjust voltage accordingly to save energy.

**Note:**

This function is preferable to the load such as fan and pump.

F3.06 AVR Function	Range: 0, 1, 2 【2】
--------------------	--------------------

0: disabled  
1: always enabled  
2: disabled during decelerating

AVR: auto voltage adjustment. This function can keep constant output voltage when the input voltage deviates from rated value. Therefore, the function should be enabled all the time especially when the input voltage is higher than the rated value.

If AVR is disabled during deceleration, the Dec time is shorter but the current is higher, otherwise, the motor decelerates smoothly with lower current, but the Dec time is longer.

F3.07 Slip compensation gain	Range: 0.0~300.0% 【100.0%】
F3.08 Slip compensation limit	Range: 0.0~250.0% 【200.0%】
F3.09 Compensation time	Range: 0.1~25.0s 【2.0s】

The change in motor torque will affect motor slip and result in speed change. Through slip compensation, the output frequency can be adjusted according to motor load torque, so as to reduce speed change caused by load change. See Fig. 5-17.

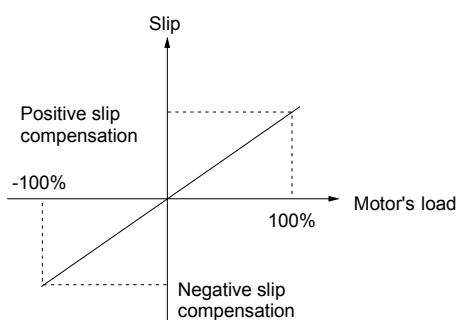


Fig. 5-17 Auto Slip Compensation

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

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

Slip compensation range: 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 (CWF)	Range: 0.7~15.0kHz 【Depending on model】
------------------------------------	--

Table 5-1 Relation of Model and Carrier Freq.

Model	CWF	Default ( kHz )
EV1000-2S0007G		8
Others		10

Table 5-2 Carrier Freq. and Performance

Performance	CWF	Decreasing	Increasing
Motor noise		↑	↓
Leakage current		↓	↑
Interference		↓	↑

#### Note:

- To get the best control effect, the ratio of carrier wave frequency to the max. operating frequency of the drive should be lower than 36.
- The displayed current might have error when the carrier frequency is lower.

F3.11 CWF auto adjustment	Range: 0、1 【1】
---------------------------	----------------

0: Disabled

1: Enabled

When CWF auto adjustment is enabled, the drive can adjust CWF automatically according to the temperature inside the drive.

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

If CWF is set under 6kHz, tuning this parameter can change the tone of operating motor.

If it is set at 0, the function is disabled.

F3.13 Jog frequency	Range: 0.10~50.00Hz 【5.00Hz】
F3.14 Jog interval	Range: 0.0~100.0s 【0.0s】
F3.15 Jog Acc time	Range: 0.1~60.0s 【6.0s】
F3.16 Jog Dec time	Range: 0.1~60.0s 【6.0s】

F3.13~F3.16 define parameters related to jog.

As Fig.5-18 shows,  $t_1$  and  $t_3$  are actual jog Acc and Dec time;  $t_2$  is jog time;  $t_4$  is the interval

between jog (F3.14),  $f_1$  is jog frequency (F3.13). Actual jog Acc and Dec time are calculated by the formula below:

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

$$t_3 = \frac{F3.13 \times F3.16}{F0.05}$$

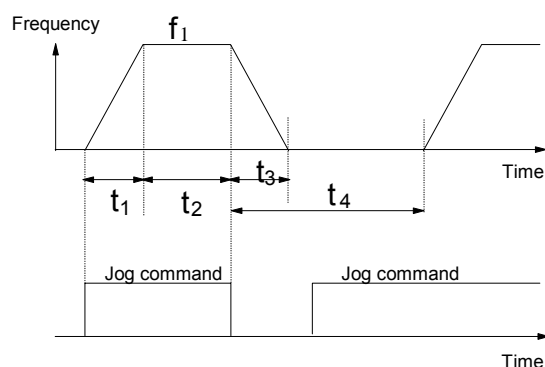


Fig. 5-18 Jog Parameters Illustration

Interval of Jog operation (F3.14) is the period between two executed jog commands. The jog command sent during the interval is invalid, and the drive continues to operate at zero frequency. If this command exist 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 terminals and serial port.

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

Three kinds 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 F7.00~F7.07 for the definitions of terminals used to select Acc/Dec time.

#### Note:

Acc time 1 and Dec time 1 is defined in F0.10 and F0.11 respectively.

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

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

F3.30 Skip freq.	Range: 0.00~650.00Hz 【0.00Hz】
F3.31 Skip freq. 1 range	Range: 0.00~30.00Hz 【0.00Hz】
F3.32 Skip freq. 2	Range: 0.00~650.00Hz 【0.00Hz】
F3.33 Skip freq. 2 range	Range: 0.00~30.00Hz 【0.00Hz】
F3.34 Skip freq. 3	Range: 0.00~650.00Hz 【0.00Hz】
F3.35 Skip freq. 3 range	Range: 0.00~30.00Hz 【0.00Hz】



F3.30~F3.35 are used to skip the mechanical resonant frequency of load.

The drive's preset frequency can skip some frequency as shown in Fig. 5-19. Three skip frequency at most can be set.

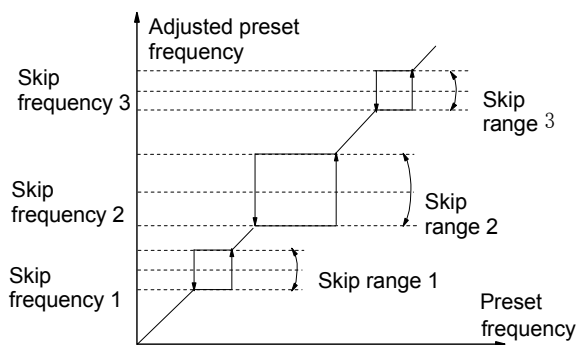


Fig. 5-19 Skip Frequency and Its Range

### 5.5 PLC Parameters (F4)

Simple PLC is a multi-speed generator, through which, the drive can change frequency and direction according to the running time. This function is realized through PLC (programmable controller) before, now the drive can do it by itself. See Fig. 5-20.

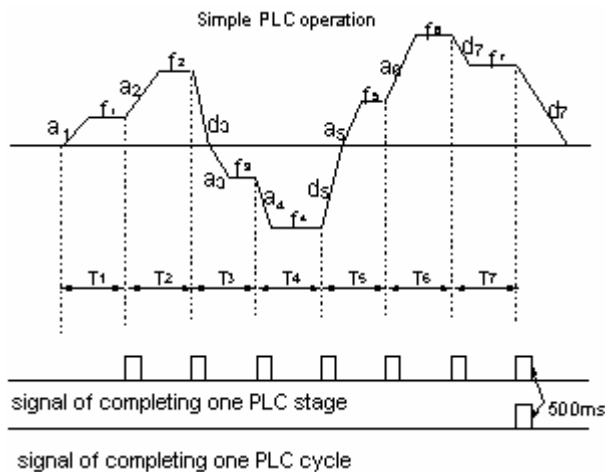


Fig. 5-20 Simple PLC operation

In Fig. 5-20, a<sub>1</sub>~a<sub>7</sub>, d<sub>1</sub>~d<sub>7</sub> are the Acc and Dec time of the respective stage; f<sub>1</sub>~f<sub>7</sub> and T<sub>1</sub>~T<sub>7</sub> will be defined in later parameters.

The PLC stage and PLC cycle are indicated by the 500mS signals from output terminals Y1 and

Y2 of open collector output or relay output. See F7.10~F7.12.

F4.00 Simple PLC mode	Range: 0000~1123 【0000】			
Thous	Hund	Ten	One	PLC running mode selection 0: disabled 1: stop after single cycle 2: retain value after 1 cycle 3: continuous
				PLCrunning after interrupt 0: start from first stage 1: start from the stage frequency where the drive stop 2: start from the frequency when it stops
				Save PLC status after poweroff 0: not save 1: save the stage and frequency at poweroff
				time unit 0: second 1: minute

Fig. 5-21 Simple PLC Running Mode

One's place of F4.00, PLC running mode selection

0: Disabled

The PLC function is disabled.

1: stop after a single cycle

As Fig.5-22 shows, the drive stops after a single cycle automatically. It will start given another Run command.

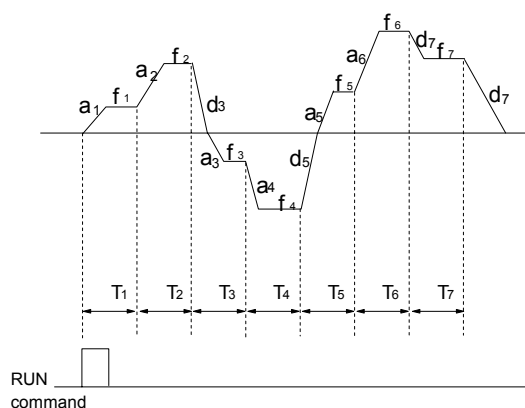


Fig. 5-22 Stop After a Single PLC Cycle

2: Maintain value of the last stage after 1 cycle

As Fig. 5-23 shows, the drive holds the frequency and direction of the last stage after single cycle.

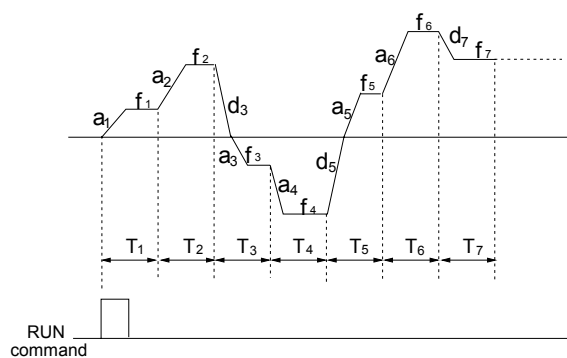


Fig. 5-23 Maintain Last Stage After Single Cycle

3: Continuous cycle.

The drive continue running cycle after cycle until Stop command is received.

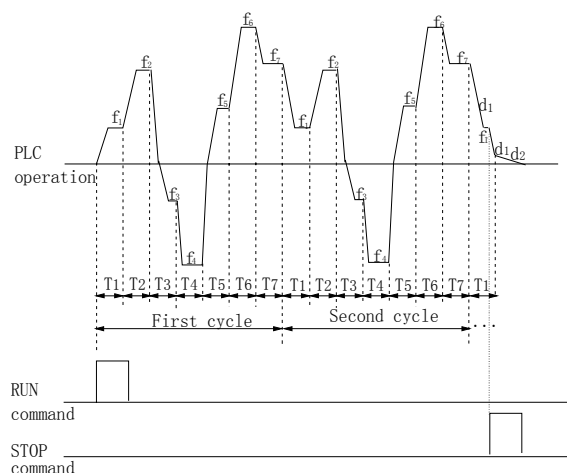


Fig. 5-24 PLC Continuous Cycle

Ten's place of F4.00: Restart mode after PLC interruption

0: start from the first stage

The drive restarts from the first stage of PLC after interrupts, such as Stop command, fault or poweroff.

1: continue from the stage frequency where the drive stops

When the drive stops caused by Stop command or fault, it can record the time that it has undergone in the current stage. After receiving Run command, it will run at the preset frequency of the stage for the remaining time of the stage, as Fig. 5-25 shows.

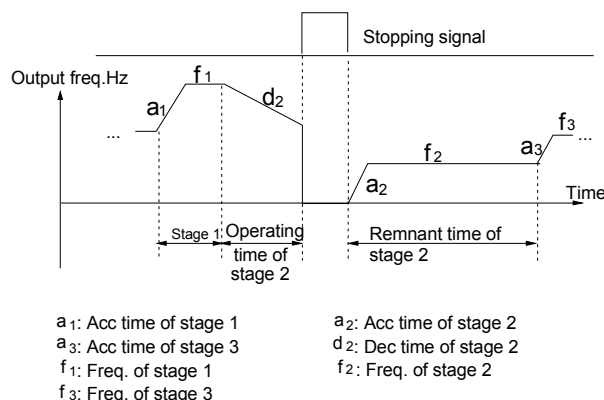


Fig. 5-25 PLC Restart Mode 1

2: Start from the frequency where it stops

When the drive stops caused by Stop command or fault, it can record both the time it has undergone in the current stage and the very frequency when the drive stops. It will pick up the recorded frequency and run for the remaining time of the stage. See Fig. 5-26.

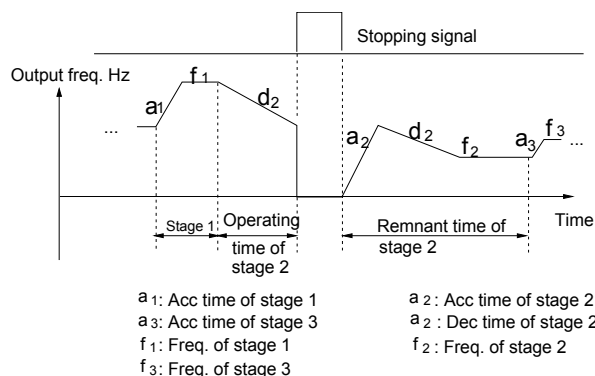


Fig. 5-26 PLC Start Mode 2

**Note:**

The difference between PLC start mode 1 and mode 2 is that in mode 2, the drive can record the operating frequency when the drive stops and continue to operate at the recorded frequency after restart.

Hundred's place of F4.00: Save PLC state after poweroff

0: not save

The PLC state will not be saved when poweroff, and the drive will start from the first stage after powerup.

1: save

The PLC state, including the stage, frequency, run

time will be saved when poweroff, and the drive will start according to the setting of ten's place of F4.00 after powerup.

Thousand's place: Selection of 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. A stage is ineffective if its run time is set to 0.
2. You can use terminals to pause and disable PLC operation, and clear the memorized parameters. See F7 parameters.

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

F4.01, F4.03, F4.05, F4.07, F4.09, F4.11 and F4.13 are to set frequency, direction, Acc/Dec time of PLC stages. See Fig. 5-27:

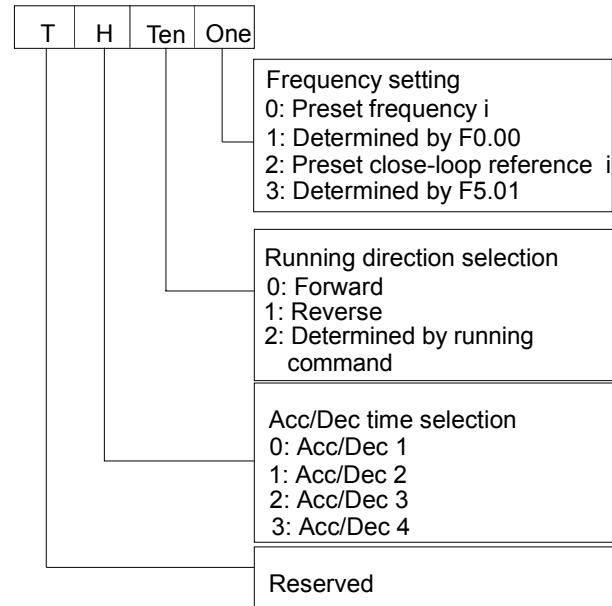


Fig. 5-27 PLC Stage i setting (i=1~7)

One's place:

0: select MS frequency i, e.g. i=3, means the frequency for stage 3 is MS frequency 3, see F3.23~F3.29.

1: the frequency is determined by F0.00

2: MS close loop setting I, e.g. i=2, the frequency of stage 2 is MS close loop setting 2. See F5.20~F5.26.

3: Determined by 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 setting method is determined by F5.01, the terminals can be selected via close-loop input. See F7.00~F7.07 and F5.20~F5.26 for details

#### Note:

When the PLC operating direction is determined by operating commands, the motor's operating direction can be changed by external command. For example, Running forward can be ordered by terminal FWD-COM. The direction is decided by running command and if it cannot be determined, the drive will runs in the direction of last operating stage.

## 5.6 Close-loop Control (F5)

Usually, the close loop control can be divided into two types: analog close loop and pulse close loop according to feedback. Fig. 5-28 and Fig. 5-29 are analog and pulse close loop control wiring diagram.

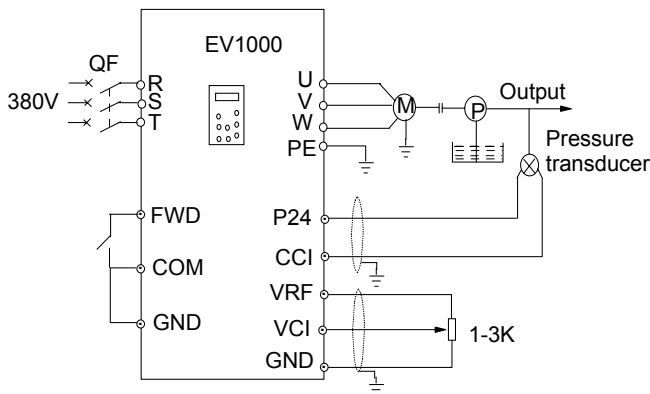


Fig. 5-28 Build-in PI Analog Feedback Control

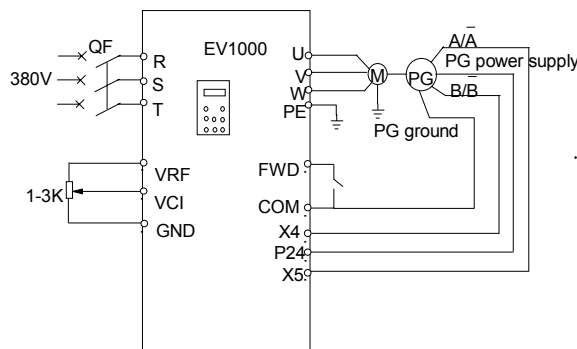


Fig. 5-29 PG Speed Close Loop Control System  
Analog feedback control system:

An analog feedback control system can be formed by a pressure transducer as the feedback sensor of the internal PI.

As shown in, pressure reference (voltage signal) is input via terminal VCI, while the feedback pressure value is input to terminal CCI in the form of 0~20mA 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.

The above system can also use a TG (speed measuring generator) as speed close speed-loop control

PG speed close-loop control:

A speed close-loop control system can be formed by external control terminals X<sub>4</sub> and X<sub>5</sub>, and pulse generator (PG).

As shown in Fig. 5-29, close speed-loop input can come from a potentiometer in the form of voltage signal via terminal VCI, while the feedback value of the close loop is input by PG in pulse mode via terminal X<sub>4</sub> and X<sub>5</sub>. The start and stop of the drive can be controlled by terminal FWD.

In Fig. 5-29,

A and B are PG's dual phase quadrature output; P24 is connected to the power source of PG;

Speed reference is the voltage signal of 0~10V. The voltage signal corresponds to synchronous speed  $n_0$  which, in turn, corresponds to 0~Max frequency (F0.05). P is the number of poles of motor (FH.00).

$$n_0 = 120 \times f_{\max} / P$$

Refer to function No. 47~48 of F7.00~F7.04 for the functions of input terminals X<sub>4</sub>, X<sub>5</sub>.

### Note:

1. The reference can also be input via keypad or serial port;
2. Dual-phase input can improve the speed measurement accuracy, while single phase input wiring is simple;
3. Dual-phase pulse can only be input in quadrature mode;
4. If PG is supplied from terminal P24, then the max load current of optical PG must be less than 100mA.

The mechanism of the build-in PI is shown in the figure below.

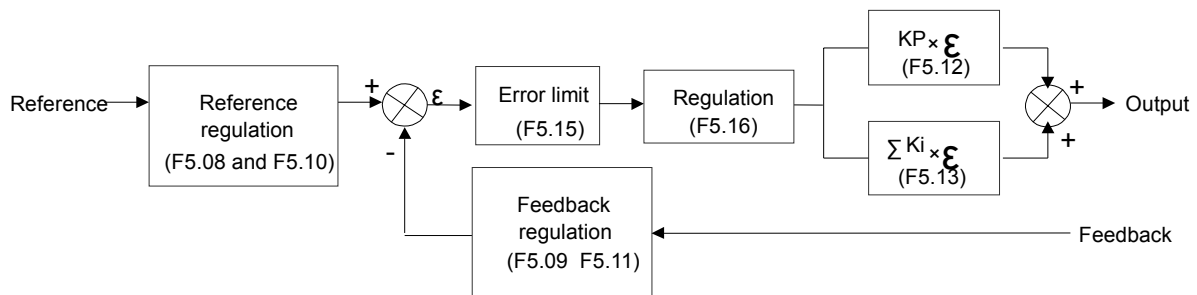


Fig. 5-30 PI Working Mechanism

Where:

KP: proportional gain; Ki: integral gain. In Fig. 5-30, 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:

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

For example: In Fig. 5-2828, if the reference is 0~10V analog signal, the expected controlled value is 0~1MP, and the pressure signal is 4~20mA, then the relationship between reference and feedback is shown in Fig. 5-31.

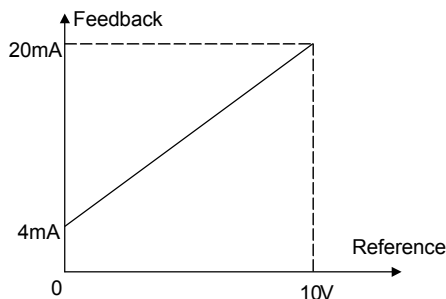


Fig. 5-31 Reference (Input) and Feedback

The reference value is based on 10V (i.e. 10V means 100% input); and the feedback value is based on 20mA (20mA corresponds to 100% output).

Close-loop characteristic is selected through F5.16 to satisfy different applications.

In order to meet the control requirements, the motor's speed should be increased with reference speed. This kind of control characteristic is called positive response. If the motor speed is required to be decreased when the reference value is

increased, this control characteristic is called negative response.

See Fig. 5-32. F5.16 defines the two characteristics.

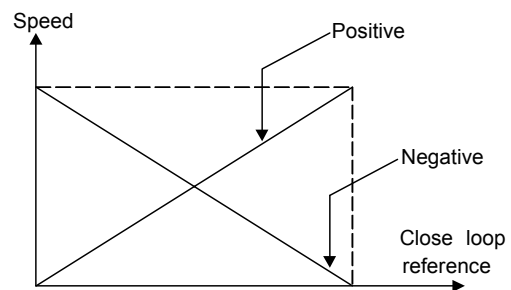


Fig. 5-32 Close-loop Control Characteristics

After the system type is determined, the following procedures can be used to determine the close loop parameters:

- Determine the close-loop reference and feedback channel(F5.01 and F5.02);
- Define the relationship between close-loop reference and feedback value (F5.08~F5.11);
- Determine the speed reference of speed close-loop control and the number of revolutions of PG (F5.06~F5.07);
- Determine the close-loop regulation characteristic, that is, if the motor speed decreases while the input reference increases, then the close-loop control characteristic should be set to negative (F5.16=1);
- Set integral regulation and close-loop frequency (F5.17~F5.19);
- Adjust close-loop filter time, sampling

cycle, bias limit and gain factor  
(F5.12~F5.15).

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

0: disabled

1: enabled

F5.01 Reference input method	Range: 0~4 【1】
------------------------------	----------------

0: digital setting

Take the value of F5.05 (set analog close loop feedback, F5.02=0~5) ;

Take the value of F5.06, (set pulse close loop feedback, F5.02=6).

1: VCI (0~10V)

2: CCI

Pay attention to the setting of jumper CN10.

3: Keypad

4: PULSE

#### Note:

The motor speed is controlled by pulse feedback. Given analog input 10V (20mA) or max. input frequency F1.03, the output pulse will be max. frequency F0.05, which corresponds to the motor synchronous speed  $n_0$  ( $n_0 = 120f_{max}/P$ ).

F5.02 Feedback method	Range: 0~6 【1】
-----------------------	----------------

0: VCI analog voltage 0~10V

1: CCI analog input

2: VCI+CCI

3: VCI-CCI

4: Min {VCI,CCI}

5: Max {VCI, CCI}

When current input is selected, the signal will be converted to voltage signal, whose value is determined by the formula:  $V_{out}=mA/2$ ;

F5.02=6, pulse

It can be single-phase or 2-phase PG close loop feedback. Please refer to multi-function input

terminal X4, X5 (F7.03~F7.04).

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

Both the input signal and feedback signal have some noise signals. These signals can be filtered by setting the time constant of filter (settings of 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 reference input	Range: 0.00~10.00V 【0.00】
-------------------------------	---------------------------

When analog feedback is selected (F5.02=0~5), this function allows parameter setting from keypad or serial port.

F5.06 Speed close-loop setting	Range: 0~39000rpm【0 rpm】
--------------------------------	--------------------------

When PG pulse feedback is selected (F5.02=6), speed can be set through keypad or serial port.

F5.07 Pulse number per revolution of encoder	Range: 1~9999 【1024】
--	----------------------

Please set this parameter according to the characteristics of the pulse encoder.

F5.08 Min. input	Range: 0.0%~F5.10 【0.0%】
F5.09 Feedback of min. input	Range: 0.0~100.0% 【20.0%】
F5.10 Max. input	Range: F5.08~100.0% 【100.0%】
F5.11 Feedback of max. input	Range: 0.0~100.0% 【100.0%】

F5.08~F5.11 define the relation of analog close loop input and feedback. The values of the above parameters are percentage of input or feedback value to reference value (10V or 20mA or F1.03).

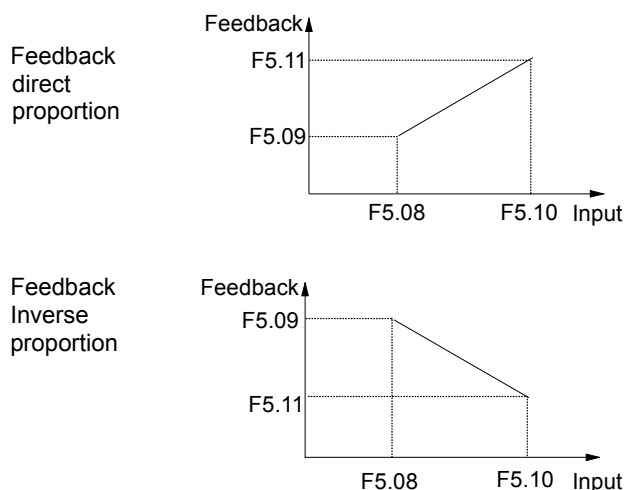


Fig. 5-33 Relation of Input and Feedback

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

The bigger the proportional gain  $K_p$ , the faster the response, but oscillation may occur easily if  $K_p$  is too big.

If only proportional gain  $K_p$  is used in regulation, the error cannot be eliminated completely.

Therefore, it is preferred to use the integral gain  $K_i$  to form a PI control system. The bigger the  $K_i$ , the faster the response, but oscillation may occur if  $K_i$  is too big.

F5.04 refers to the sampling cycle of feedback value. The PI regulator calculate once in each sampling cycle. The bigger the sampling cycle the slower the response.

F5.15 Error limit	Range: 0.0~20% 【2.0%】
-------------------	-----------------------

F5.15 is the max. error between system output and the close-loop reference, as shown in Fig. 5-34. PI regulator stops operation when the feedback error is within this range. Setting this parameter correctly is helpful to improve the system output accuracy and stability.

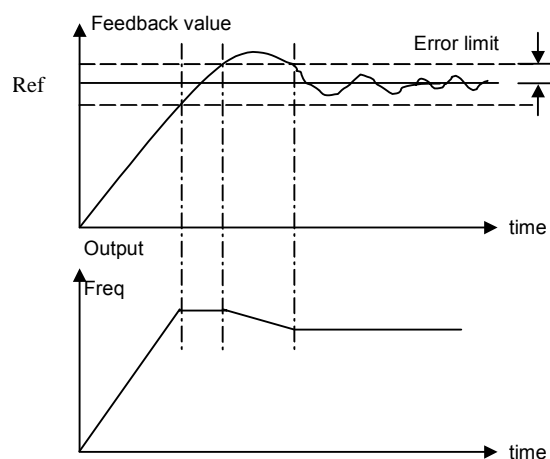


Fig. 5-34 Error Limit Schematic Diagram

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

0: Positive logic

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

1: Negative logic

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

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

0: Stop integral regulation when the frequency reaches the upper or lower limits

1: Continue the integral regulation when the frequency reaches the upper or lower limits

It is recommended to set the parameter at 0 for the system that requires fast response.

F5.18 Preset frequency	Range:0.00~650.00Hz 【0.00Hz】
F5.19 Preset frequency hold time	Range: 0.0~3600s 【0.00s】

The above parameters are helpful for the close loop control to enter stable state quickly.

After close-loop running is started, the drive will accelerate to the preset frequency F5.18 within the accelerate time, and hold the frequency for a period of time (F5.19), and then run according to close-loop characteristic.

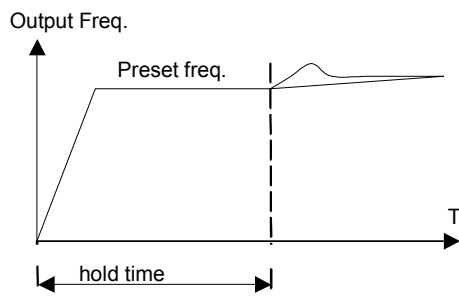


Fig. 5-35 Close-loop preset frequency

 **Note:**

If you don't need preset frequency, just set F5.18 and F5.19 at 0.

F5.20 MS close-loop setting 1	Range: 0.0~10.00V 【0.00V】
F5.21 MS close-loop setting 2	Range: 0.0~10.00V 【0.00V】
F5.22 MS close-loop setting 3	Range: 0.0~10.00V 【0.00V】

F5.23 MS close-loop setting 4	Range: 0.0~10.00V 【0.00V】
F5.24 MS close-loop setting 5	Range: 0.0~10.00V 【0.00V】
F5.25 MS close-loop setting 6	Range: 0.0~10.00V 【0.00V】
F5.26 MS close-loop setting 7	Range: 0.0~10.00V 【0.00V】

Besides the 3 close-loop setting methods defined in F5.01, the MS close-loop voltage setting F5.20~F5.26 can also be used.

MS close-loop setting 1~7 can be selected through external terminals, please refer to F7.00~F7.04 (function No. 30~32). It can also be used with simple PLC close-loop, see F4 parameters.

The MS close-loop setting has priority over the methods defined in F5.01.

## 5.7 Traverse Parameters (F6)

Traverse function applies to textile and chemical fiber industry, or others that requires lateral movement or rolling. The typical application is shown in Fig. 5-36.

The drive works as follows:

The drive accelerates to preset traverse frequency F6.02 and stay at it for a period of time (F6.03). Next, It will arrive at central frequency within Acc time, and then it will operate according to traverse amplitude (F6.04), skip frequency (F6.05), traverse cycle (F6.06) and rise time (F6.07) one cycle after another until the Stop command is received. It will then decelerate to stop within Dec time.



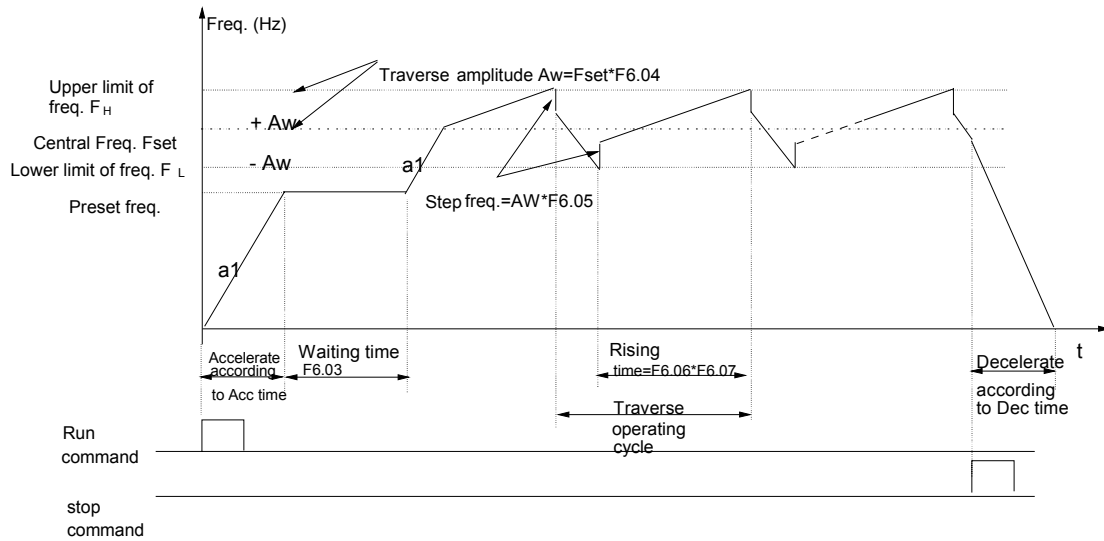


Fig. 5-36 Traverse Operation

The central frequency is the frequency of simple operation, MS running or PLC.

The traverse is invalid for jog or close-loop running.

When both PLC and traverse are enabled, the traverse is invalid when transferring to another PLC stage.

The output frequency begins to traverse after arriving at the PLC preset frequency within Acc/Dec time.

When receiving Stop command, the drive will stop according to PLC Dec time.

F6.00 Traverse function selection	Range: 0~1 【0】
-----------------------------------	----------------

0: disabled

1: enabled

F6.01 Traverse mode	Range: 0000~1111 【0000】
---------------------	-------------------------

This parameter is to set the operating mode of traverse. Refer to the figure below.

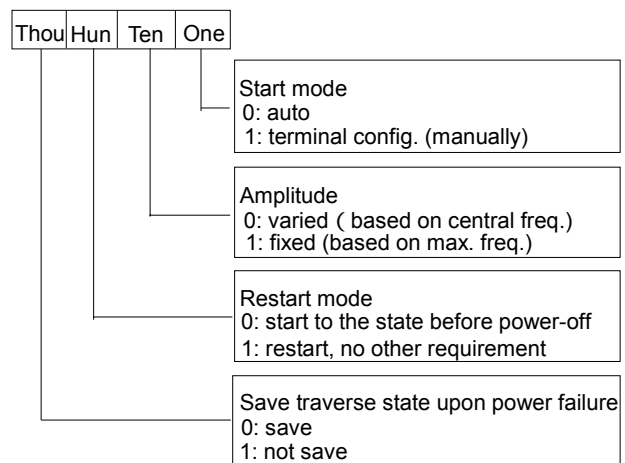


Fig. 5-37 Traverse Mode Setting

One's place of F6.01: transfer mode

0: auto

The drive will stay at traverse preset frequency (F6.02) for a period of time (F6.03), and then begin traverse automatically.

1: terminal configuration (manually)

When multi-function terminal is enabled and the

corresponding parameter is set at 33, the drive will enter traverse mode. If the terminal is disabled, the drive will exit traverse mode and stay at preset frequency F6.02.

Ten's place of F6.01: amplitude control

0: varied amplitude

The traverse amplitude changes with central frequency. The change rate is defined in F6.04.

1: fixed amplitude

The traverse amplitude is determined by max. frequency and F6.04.

Hundred's place of F6.01: start/stop mode

0: start to the state before stop

1: just restart, no other requirement

Thousand's place of F6.01: save traverse state upon power failure

This function is valid only when the hundred place of F6.04 is set at 0.

0: save

1: not save

#### **Note:**

You can set any of F7.00~7.04 at 34 to reset the traverse state.

F6.02 Preset traverse frequency	Range: 0.00Hz~650.0Hz 【0.00Hz】
F6.03 Preset traverse frequency hold time	Range: 0.0~3600.0s 【0.0s】

F6.02 defines the frequency before entering traverse state.

When the traverse start mode (F6.01) is set at "auto", F6.03 specifies the time period that the drive run at preset traverse frequency. F6.03 is invalid if F6.01 set at "manually start". Please refer to Fig. 5-36.

F6.04 Traverse amplitude	Range: 0.0~50.0% 【0.0%】
--------------------------	-------------------------

Varied amplitude:  $AW = \text{central frequency} \times F6.04$

Fixed amplitude:  $AW = \text{max. frequency}$

F0.05×F6.04

#### **Note:**

The traverse frequency is limited by upper and lower limit of frequency. Improper setting of the frequency limit will result in faults.

F6.05 Step freq.	Range: 0.0~50.0% (of amplitude) 【0.0%】
------------------	---

Refer to Fig. 5-36. If it is set at 0, then there will be no step frequency.

F6.06 Traverse cycle	Range: 0.1~999.9s 【10.0s】
----------------------	---------------------------

It defines the period of traverse operation including rising time and falling time.

#### **Note:**

Under traverse mode, auto Acc/Dec is not allowed, otherwise, the traverse cycle will become abnormal.

F6.07 Rise time of triangular wave	Range: 0~100.0% 【50.0%】
------------------------------------	-------------------------

It defines the rising time of traverse operation that equals to  $F6.06 \times F6.07$  (s) and falling time,  $F6.06 \times (1 - F6.07)$  (s). Please refer to Fig. 5-36.

#### **Note:**

You may choose S curve Acc/Dec mode during traverse operation, which can help the running more smoothly.

## 5.8 Multi-function Terminal (F7)

F7.00 Function of multi-function terminal X1	Range: 0~43 【0】
F7.01 Function of multi-function terminal X2	Range: 0~43 【0】
F7.02 Function of multi-function terminal X3	Range: 0~43 【0】
F7.03 Function of multi-function terminal X4	Range: 0~47 【0】
F7.04 Function of multi-function terminal X5	Range: 0~48 【0】
F7.05~ F7.07	Reserved

The multi-function terminals can realize various functions. You may assign functions to them by setting parameters F7.00~F7.04. Please refer to Table 5-3. Take X1~X3 for example in the following description.

Table 5-3 Functions of Multi-function Terminals

Setting	Functions
0	No function
1	MS frequency 1
2	MS frequency 2
3	MS frequency 3
4	Acc/Dec time 1
5	Acc/Dec time 2
6	External fault normally-open input
7	External fault normally-close input
8	RESET signal
9	Forward jog
10	Reverse jog
11	Coast-to-stop(FRS)
12	Frequency increase (UP)
13	Frequency decrease (DN)
14	PLC operation pause
15	Acc/Dec prohibit
16	3-wire operation control
17	External interrupt signal normally-open input
18	External interrupt signal normally-close input
19	DC injection braking command (DB)
20	Disable close-loop
21	Disable PLC
22	Frequency setting method 1
23	Frequency setting method 2
24	Frequency setting method 3
25	Reference freq. is input via terminal CCI
26	Reserved

Setting	Functions
27	Terminal control mode is forcibly enabled
28	Control mode 1
29	Control mode 2
30	MS close-loop mode 1
31	MS close-loop mode 2
32	MS close-loop mode 3
33	Start traverse operation
34	Reset the traverse operating status
35	External stop command
36	Reserved
37	Drive operation prohibiting
38	Reserved
39	Clear length
40	Clear auxiliary reference frequency
41	Reset PLC Stop status
42	Clear counter's record
43	Signal of triggering counter
44	Input the signal of length
45	Pulse input
46	Single-phase speed measuring
47	Speed measuring input SM1(only for X4)
48	Speed measuring input SM2(only for X5)

The functions are explained as follows:

### 1~3: MS terminals

If any three of F7.00~F7.04 are set at 1, 2, 3 respectively, Up to 8 segments of speed can be defined through the combination of the ON and OFF state of the 3 terminals.

Table 5-4 MS Speed

X <sub>3</sub>	X <sub>2</sub>	X <sub>1</sub>	Freq.
OFF	OFF	OFF	Common freq.
OFF	OFF	ON	MS freq. 1
OFF	ON	OFF	MS freq. 2
OFF	ON	ON	MS freq. 3

X <sub>3</sub>	X <sub>2</sub>	X <sub>1</sub>	Freq.
ON	OFF	OFF	MS freq. 4
ON	OFF	ON	MS freq. 5
ON	ON	OFF	MS freq. 6
ON	ON	ON	MS freq. 7

The MS frequency will be used in MS running and simple PLC operation. Let's see an example:

Set the parameters corresponding to X1, X2 and X3: F7.00=1, F7.01=2, F7.02=3, then X1, X2 and X3 are used to perform MS running. See Fig. 5-38.

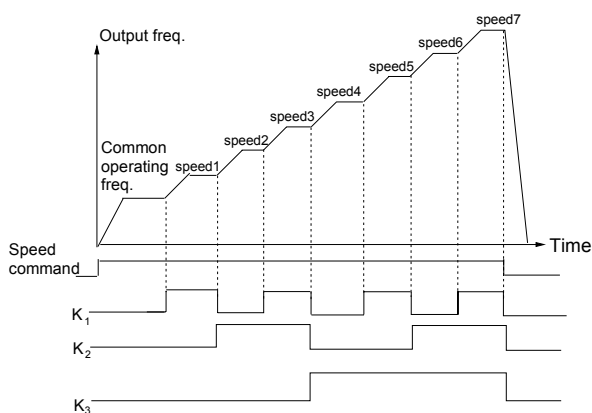


Fig. 5-38 MS Running

Fig. 5-39 illustrated the wiring of terminal control of MS running. K<sub>4</sub> and K<sub>5</sub> control the running direction. The combination of K<sub>1</sub>, K<sub>2</sub> and K<sub>3</sub> can enable common running or MS running with 1~7 speeds.

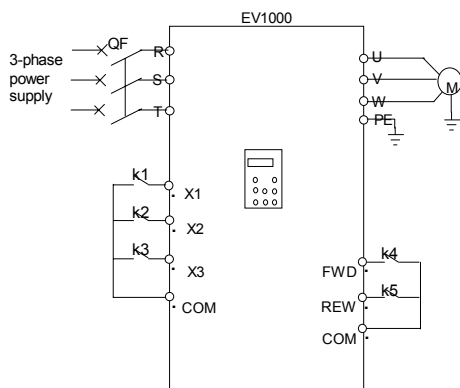


Fig. 5-39 Wiring of MS Running

**4~5: Acc/Dec time terminals**

Table 5-5 Acc/Dec Time Defined by Terminal State Commination

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

By combination of the ON/OFF state of Terminal 1 and 2, you can get 4 groups of Acc/Dec time.

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

If the setting is 6~7, fault signal of external equipment can be input via the terminal, which is convenient for the drive to monitor the fault of external equipment. Once the drive receives the fault signal, it will display "E015". The fault signal has two input modes, i.e. normally-open and normally-close.

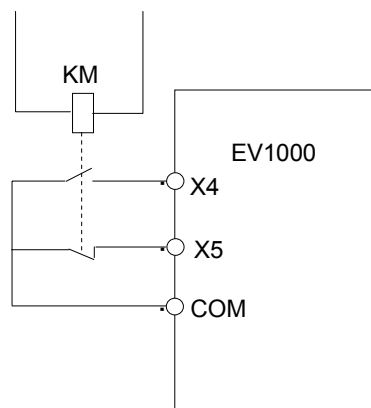


Fig. 5-40 Normally-open/close input

In Fig. 5-40, X4 is normally open input and X5 normally close input. KM is external fault relay.

**8: Reset**

If any of F7.00~F7.04 is set at 8, the drive can be reset via the terminal when the drive has a fault. The function of this terminal is the same with the **RESET** key on the keypad.

**9~10: External jog command (JOGF/JOGR)**

If any of F7.00~F7.04 is set at 9~10, the terminal can enable the jog operation. JOGF is terminal for forward jog command and JOGR is

terminal for reverse jog operation command. Jog frequency, jog interval and jog Acc/Dec time are defined in F3.13~F3.16.

#### 11: Coast to stop

This function is the same with F2.08, however, it is realized by terminal and convenient for remote control.

#### 12~13: Frequency increase (UP)/decrease (DN)

If the setting is 12~13, the terminal can be used to increase or decrease frequency instead of ▲ and ▼ keys on the panel for remote control. This terminal is valid when F0.00=1 or F9.01=2. Increasing or decreasing rate is determined by F7.09.

#### 14: Pause command for simple PLC

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, but the running time is not counted. If the terminal is disabled, the drive will start at start frequency and continue the PLC operation. Refer to F4.00~F4.14 for the use of this terminal.

#### 15: Acc/Dec prohibit

The motor is immune to any external command except Stop command and maintain the present speed.

#### Note:

This function is disabled during normal decelerating to stop.

#### 16: 3-wire operation control.

Refer to F7.08 .

#### 17~18: External interrupt signal normally-open input

When the drive receives an interrupt signal during running, it will stop outputs and run at zero frequency. Once the signal removed, the drive will resume previous running at start frequency.

As Fig. 5-40 shows, there are X4, normally open contacts and X5, normally closed contact.

#### Note:

Different from function 6 ~ 7, the external interrupt signal will not cause alarm, and the drive will resume previous running once the signal removed.

#### 19: DC Braking (DB)

If the setting is 19, the terminal can be used to perform DC injection braking to the motor that is running for emergency stop and accurate location. Initial braking frequency, braking delay time and braking current are defined by F2.09~F2.11. Braking time is decided by the bigger value between F2.12 and the period that the terminal is effective.

#### 20: Disable close-loop

If the setting is 20, the terminal can be used to realize the flexible switching between close-loop operation and low level operating mode.

#### Note:

The switching between operation modes is possible when the drive is in close-loop mode (F5.00=1).

When the drive is switched to low level operating mode, its start/stop, operating direction, ACC/Dec time are shifted to the corresponding operating modes accordingly.

#### 21: Disable 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 is possible only when the drive is in PLC operation (the one'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 are shifted to the corresponding operating modes accordingly.

#### 22~24: Reference frequency setting method

Through the combination of the ON/OFF state of X1, X2 and X3, you can select different frequency setting method, which will come into effect regardless of F0.00.

Table 5-6 Frequency Setting Mode Selection

X3	X2	X1	Mode
OFF	OFF	OFF	None
OFF	OFF	ON	Digital setting1
OFF	ON	OFF	Digital setting 2
OFF	ON	ON	Digital setting 3
ON	OFF	OFF	VCI analog setting
ON	OFF	ON	CCI analog setting
ON	ON	OFF	PULSE
ON	ON	ON	LED keypad

**25: Frequency reference is input via terminal CCI**

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

**26: Not used****27: Terminal control mode is enabled**

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

**28~29: Control mode selection X1~X2**

Table 5-7 Control Mode Selection

X2	X1	Control mode
OFF	OFF	None
OFF	ON	LED keypad
ON	OFF	Terminal
ON	ON	Serial port

The selection of control mode is realized by the combination of ON/OFF state of any two of X1~X5. In the above table, you should set F7.00=28, F7.01=29.

30~32: MS close-loop terminal (3 terminals of

X1~X5)

Table 5-8 MS Close-loop Setting Selection

X3	X2	X1	MS close-loop reference
OFF	OFF	OFF	By F5.01
OFF	OFF	ON	MS Close-loop setting 1
OFF	ON	OFF	MS Close-loop setting 2
OF	ON	ON	MS Close-loop setting 3
ON	OFF	OFF	MS Close-loop setting 4
ON	OFF	ON	MS Close-loop setting 5
ON	ON	OFF	MS Close-loop setting 6
ON	ON	ON	MS Close-loop setting 7

The various MS close-loop setting is realized by the combination of ON/OFF state of terminal X1~X3.

**33: Start traverse operation**

If the traverse operation is set to be manual start, then traverse function is enabled if this function is selected. Refer to F6.

**34: Traverse reset**

If traverse operation is enabled, closing the terminal can clear the information about traverse status no matter the drive is in auto or manual start mode. Traverse operation continues after this terminal is disconnected. See F6.

**35: external Stop command**

This Stop command is valid to all control modes. When this function is enabled, the drive will stop as specified F2.08.

**36: Reserved****37: Prohibit drive from operating**

If this function is enabled, the drive that is operating will coast to stop and the drive ready to run will be prohibited to start. This function is mainly used as safety protection.

**38: Reserved****39: Clear the length information**

The setting of F9.15 (length) will be cleared to

zero.

#### 40: Clear the setting of auxiliary reference frequency

This function is valid for auxiliary reference frequency (F9.01=1, 2 and 3) to clear it to zero, so that the reference frequency is determined solely by main reference.

#### 41: Reset PLC state

When the drive stops in PLC mode, the memorized PLC operating information (operating stage, operating time, operating frequency, etc.) will be cleared.

#### 42: clear the counter to zero

This function is to clear the counter to zero and is used in conjunction with function 43.

#### 43: Input signal to trigger the counter

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

#### 44: input the signal of length

This function is only effective to multi-function input terminals X4 and X5. The terminal is used in fixed-length control. Length is calculated by input pulses. See F9.14~F9.19 for details.

#### 45: pulse frequency input

This function is effective only to multi-function input terminals X4 and X5. The terminal is used to input pulse signal that is used as frequency reference. Refer to F1 parameters for the relationship between input pulse frequency and the reference frequency.

#### 46: Single-phase speed measuring input

This function is effective only to multi-function input terminals X4 and X5. See section 3.2.3 for input characteristics. The speed control accuracy is  $\pm 0.1\%$ . Single-phase speed feedback control can be realized by using this terminal and PG.

#### 47: Speed measuring input SM1

#### 48: Speed measuring input SM2

This function is effective only to multi-function input terminals X4 and X5. See section 3.2.3 for input characteristics. The speed control accuracy is  $\pm 0.1\%$ . 2-phase speed feedback control can be realized by using this terminal and PG.

#### Note:

When the drive is in motor auto-tuning status, No. 44~47 functions of X4 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

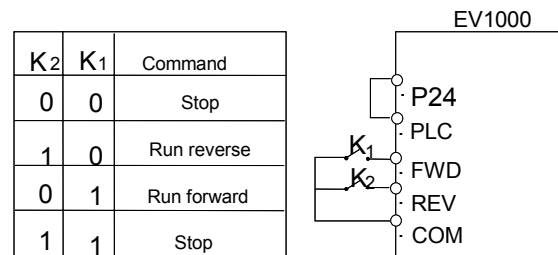


Fig. 5-41 2-wire operating mode 1

1: 2-wire operating mode 2

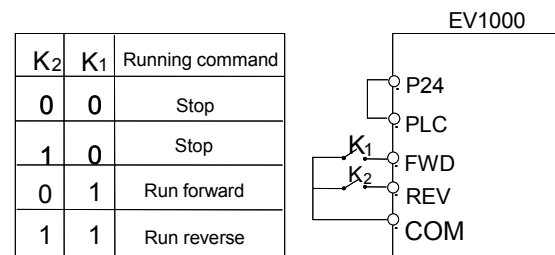


Fig. 5-42 2-wire operating mode 2

2: 3-wire operating mode 1

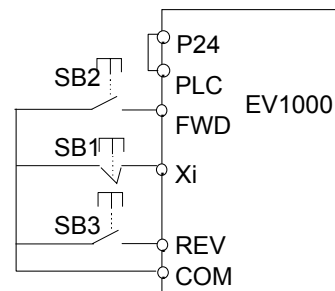


Fig. 5-43 3-wire operating mode 1

Where:

SB1: Stop button

SB2: Run forward button

SB3: Run reverse button

Terminal Xi is the multi-function input terminal of X<sub>1</sub>~X<sub>5</sub>. For this case, the corresponding parameter should be set at 16 (3-wire operation).

3: 3-wire operation mode 2

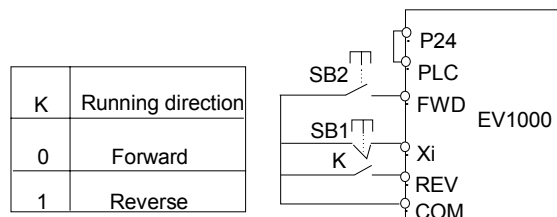


Fig. 5-44 3-wire operation mode 2

Where:

SB1: Stop button

SB2: Run button

Terminal Xi is the multi-function input terminal of X<sub>1</sub>~X<sub>5</sub>. For this case, the corresponding parameter should be set at 16 (3-wire operation).

#### Note:

In terminal control mode, for 2-wire operating mode 1 and 2, although the terminal is effective, the drive will not run if there is external stop command. If you want to start the drive, you should activate FWD/REV terminal again, e.g. set any of F7.00~F7.04 at 11 or 35, PLC stop after single cycle, stop after preset length arrival, Stop key pressed (see F9.07). 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】
-------	------------	-------------------------------------

To define the increase/decrease rate when using UP/DN terminal to change reference frequency.

F7.10	Open collector output terminal Y1	Range: 0~19 【0】
F7.11	Open collector output terminal Y2	Range: 0~32 【1】
F7.12	Relay output function	Range: 0~19 【16】

Refer to section 3.3.2 for the output characteristics of Y1, Y2 and the relay's output terminal. Table 5-9 shows the functions of the above 3 terminals. Note that one function can be selected repeatedly.

F7.11=20~32, Y2 is the output pulse frequency, range: 0~max. pulse frequency (F7.32). The relation between the output pulse frequency and the parameters it presents are shown in 20~32 in the table below. The extended function 2 of host is to control Y2 by serial port directly. The max setting of F7.32 is 65535. See Appendix 2.

Table 5-9 Parameter Setting and Function of Output Terminals

Setting	Function
0	Drive running signal (RUN)
1	Frequency arrival 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 Stop command (EXT)
7	Higher 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 arrival
13	Specified counting value arrival
14	Preset length arrival
15	Drive ready (RDY)
16	Drive fails
17	Extended function 1 of host
18	Upper and lower limits of traverse frequency
19	Preset operation time out



Setting	Function	Range
20	Freq. before slip compensation	0~Max. output freq.
21	Freq. after slip compensation	0~Max. output freq.
22	Preset freq.	0~Max. output freq.
23	Output current	0~2 times of drive's rated current
24	Output current	0~2 times of drive's rated current
25	Output torque	0~2 times of moter's rated torque
26	Output voltage	0~1.2 times of drive's rated voltage
27	Bus voltage	0~800V
28	VCI	0~10V
29	CCI	0~10V/0~20mA
30	Output power	0~2 times of rated power
31	Extended function 2 of host	0~65535
32	Potentiometer setting	0~10V

The explanation of output signal is shown in Table 5-9.

#### 0: Drive running signal (RUN)

This signal will be given if the drive is running.

#### 1: Frequency arrival 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 signal will be given if the drive's output

current is bigger 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 for overload pre-alarm. See Fig.5-73.

#### 5: Low voltage lock-up signal (LU)

The signal will be given when 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: Higher limit of frequency (FHL)

The signal is given 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 signal is given if the preset frequency is higher than lower limit of frequency and the operating frequency reaches the lower limit of frequency.

#### 9: Zero-speed running

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

#### 10: Completion of simple PLC operation stages

The signal is given (pulse, 500ms) if the present stage of PLC operation is finished.

#### 11: PLC cycle completion indication

The signal (pulse, 500ms) is given if one cycle of PLC operation is finished.

#### 12: preset counting value arrival

#### 13: reference length arrival

Refer to F7.33~F7.34.

#### 14: preset length arrival

The signal is given if the setting of F9.15 (actual length) is bigger than F9.14 (preset length). The length counting terminal is the one whose parameter (F7.03 or F7.04) is set at 44.

15: drive ready (RDY)

The RDY signal is output when the drive has no fault, its DC bus voltage is normal, the Start Prohibit function is disabled. It is ready to start.

16: Drive fails

The signal is given 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 communication protocol of EV1000.

18: Upper and lower limits of traverse frequency.

The signal will be given if the range of traverse frequency calculated based on central frequency is higher than upper limit of frequency (F0.12) or lower than the lower limit of frequency (F0.13), as shown in Fig.5-45.

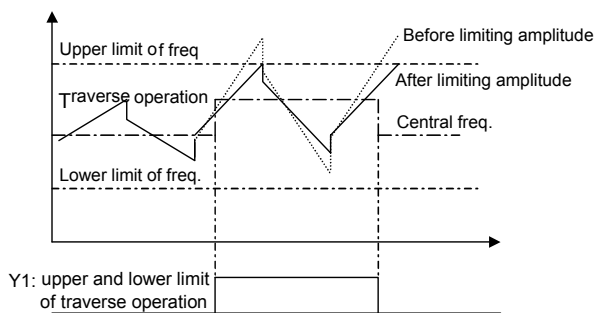


Fig. 5-45 Limiting the Amplitude of Traverse

19: preset operating time out

The signal is given if the drive's total operating time (Fn.01) reaches preset operating time (Fn.00).

**Note:**

When F7.04 is set at 44 ~ 46, the pulse output function of Y2 is disabled automatically.

F7.13 Freq. arrival detection range (FAR)	Range: 0.00~650.00Hz 【2.50Hz】
---	----------------------------------

As shown in Fig. 5-46, if the drive's output frequency is within the detecting range of preset frequency, a pulse signal will be output. It is complementary to No.1 function in Table 9-1.

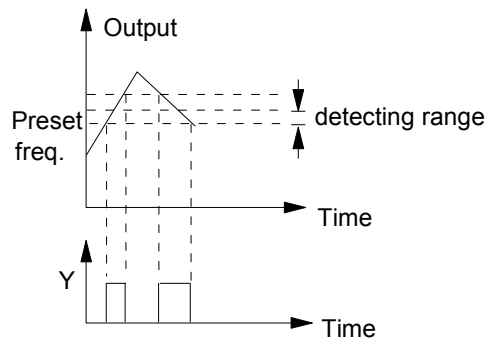


Fig. 5-46 Freq. Arrival Signal Output

F7.14 FDT1 level	Range: 0.00~650.00Hz 【50.00Hz】
F7.15 FDT1 lag	Range: 0.00~650.00Hz 【1.00Hz】
F7.16 FDT2 level	Range: 0.00~650.00Hz 【25.00Hz】
F7.17 FDT2 lag	Range: 0.00~650.00Hz 【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 same. Take F7.14~F7.15 for example: when the drive's output frequency reaches FDT1 level, it outputs an indicating signal until its output frequency drops below FDT1 level (FDT1 level-FDT1 lag). As shown in Fig. 5-47.

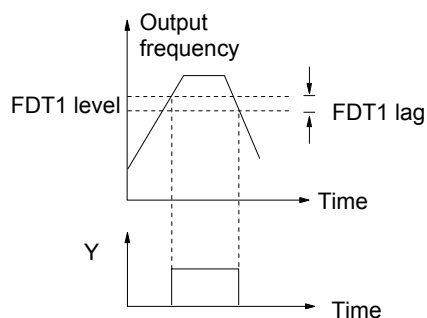


Fig. 5-47 Frequency Detection

F7.18~F7.25	Reserved
-------------	----------

These parameters are not used.

F7.26 AO1 output function	Range: 0~12 【0】
---------------------------	-----------------

F7.27 AO2 output selection	Range: 0~12 【3】
F7.28 Reserved	

AO1 and AO2 are analog output terminals.

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

Refer to Table 5-10 for the function of F7.26 and F7.27.

Table 5-10 Signals from AO1 and AO2

Setting	Function	Range
0	Output freq. before compensation	0~max. output freq.
1	Output freq. after compensation	0~max. output freq.
2	Preset freq.	0~max. output freq.
3	Output current	0~2 times of drive's rated current
4	Output current	0~2 times of drive'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 2 of host	0~65535
12	Setting of potentiometer	0~10V

Using extended function 2 of host, AO1 and AO2 output can be controlled by serial port directly. If F7.26 or F7.27 is set at 11, the output of AO1 or AO2 "65535" corresponds to max. analog output

10V (20mA). Please refer to Appendix 2.

Suppose you want:

AO1 outputs 4~20mA, which means the bus voltage is 0~800V.

You should do the following configuration:

- ① F7.26=7, output signal presenting bus voltage;
- ② F7.29=01, AO1 output: 4~20mA;
- ③ F7.30=100%, output gain 100%;
- ④ Select 0/4-20mA of CN16 jumper.

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

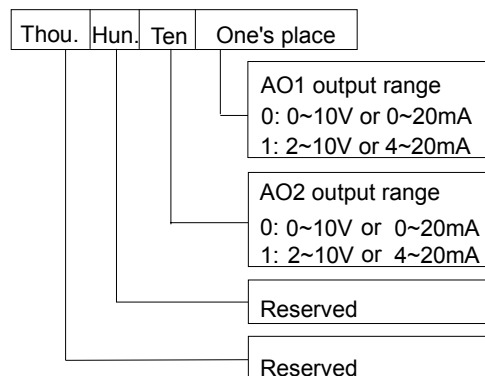


Fig. 5-48 Analog Output Type Selection

The parameter is to select the output type, i.e. voltage or current, of AO1 and AO2.

CN16 jumper is for AO1, "I" represents current, "V" represents voltage.

CN17 jumper is for AO2, "I" represents current, "V" represents voltage.

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

You can change the measurement range or calibrate error of AO1 and AO2 outputs by adjusting the output gain.

#### Note:

The parameter will come into effect immediately while you change it.

F7.32 Max output pulse freq. of Y2	Range: 0~50.0kHz 【10.0KHz】
------------------------------------	----------------------------

It defines the max. pulse frequency from terminal Y2. Refer to F7.12.

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 complementary to Function No.12 and No.13 in Table 5-9.

When the number of pulses defined by F7.33 are input from Xi, Yi or relay will output an indicating signal.

Suppose F7.33=8, as Fig. 5-49 shows, when 8 consecutive pulses are input from Xi, Y1 will output an indicating signal.

When the number of pulses defined by F7.34 are input from Xi, Yi or relay will output an indicating signal which will last until the number of pulses defined by F7.33 are input.

Suppose F7.34=5, F7.33=8, as Fig. 5-49 shows, when 5 consecutive pulses are input from Xi, Y2 will output an indicating signal and it holds the signal until the 8th pulse passes. Note that if F7.34 is bigger than F7.33, then F7.34 is invalid.

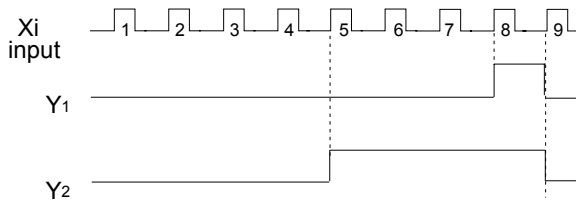


Fig. 5-49 Preset counting value and specified counting value

F7.35 Positive or negative logic of terminal	Range: 000~FFFH 【000H】
--	------------------------

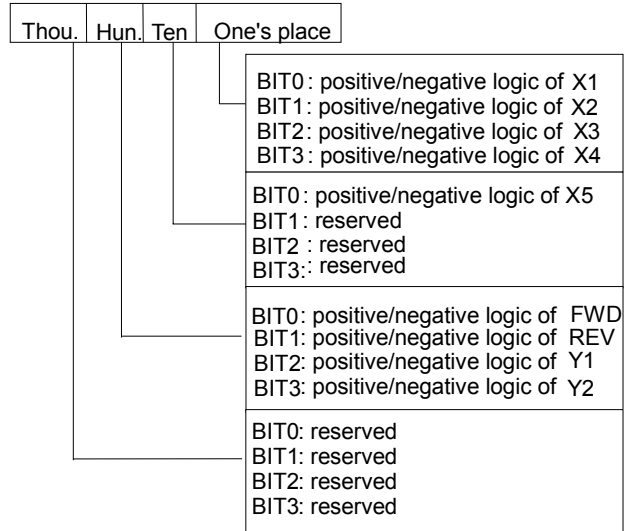


Fig. 5-50 Positive or Negative Logic of Terminal

The parameter defines the positive or negative logic of terminals, where positive logic refers that the terminal Xi is enabled when it connects with the common terminal and disabled if disconnected; negative logic is the opposite of positive logic.

If the bit is set at “0”, it means positive logic, and “1” for negative logic.

Suppose you require X1~X5 to be positive logic, FWD and REV negative logic, Y1 positive logic and Y2 negative logic, you should set the one's place at 0, ten's place at 0, hundred's place at (1011)<sub>2</sub>, i.e B(Hex). Therefore, F7.35 should be set at 0B00.

The conversion from binary code to Hex value is shown in Table 5-13.

Table 5-11 Conversion from Binary to Hex

Binary				Hex (LED display)
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

Binary				Hex (LED display)
BIT3	BIT2	BIT1	BIT0	
0	1	1	0	6
0	1	1	1	7
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:**

1. Factory setting of all the terminals is positive logic.
2. When Y2 is set to output pulse, i.e. F7.11 is set at 20~32, the logic definition is invalid.

### 5.9 Display Control (F8)

F8.00 Accumulated length	Range: 0.0~999.9km 【0】
--------------------------	------------------------

This parameter records the accumulated length value. If No.39 function in Table 5-3 (clear length) is enabled, the length will be added to this parameter, but if F9.15 (actual length) is changed to 0 manually, the previous record before the modification will not be added.

If you change this parameter, you just modify the history record, no other effect.

F8.01 LED displayed parameter selection 1	Range: 000~3FFH 【3FFH】
---	------------------------

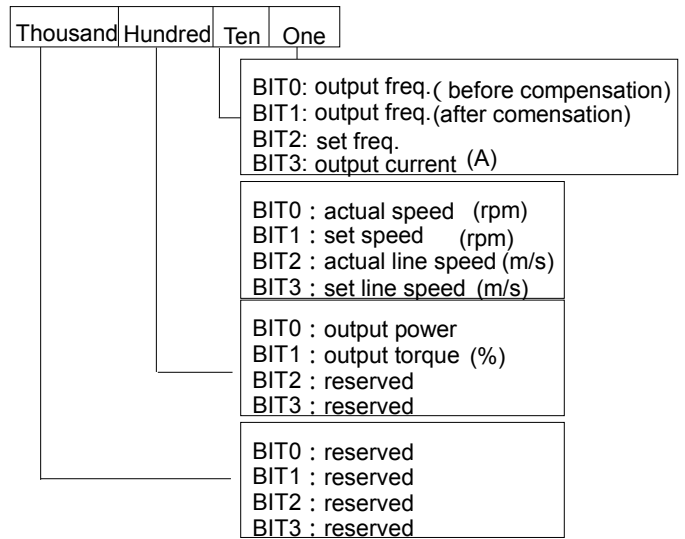


Fig. 5-51 LED Displayed Parameter 1 Setting

F8.01 and F8.02 define the parameters that can be displayed by LED when the drive is operating. If Bit is set at 0, the parameter will not be displayed;

If Bit is set at 1, the parameter will be displayed.

As to the conversion of binary format to Hex format, please refer to Table 5-11. You may press **▶▶** key to scroll through the parameters.

F8.02 LED displayed parameter selection 2	Range: 000~3FFH 【000H】
---	------------------------

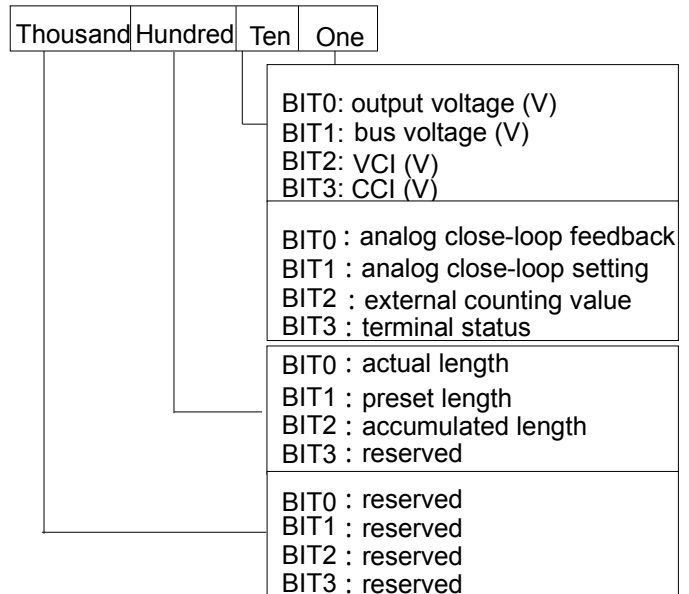


Fig. 5-52 LED Displayed Parameter 1 Setting

The displayed terminal information includes status of terminal X1~X5, 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.5-53:

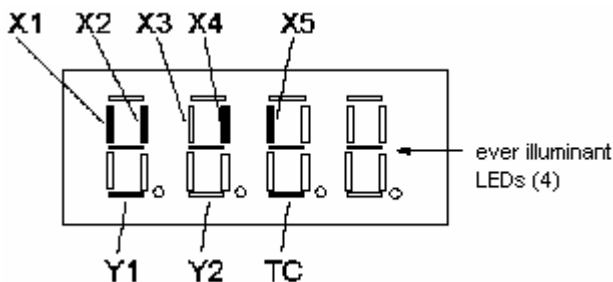


Fig. 5-53 Terminal Status Indication

In Fig.5-53, X1, X2, X4, X5, Y1 and TC are enabled, X3 and Y2 disabled. There are four LEDs are always illuminate for the convenience of observation.

**Note:**

1. When the rotating speed and line speed are displayed, these values can be modified by pressing **▲** and **▼** in real time (no need to shift to frequency display status).
2. When F8.01 and F8.02 are all set to 0, the frequency before compensation will be displayed.
3. You may press **▶▶** key to scroll through the parameters that has been set to display in F8.01 and F8.02 when the drive is operating.

F8.03 Displayed Parameter at Stop state	Range: 0000~3FFFH 【1FFH】
---	-----------------------------

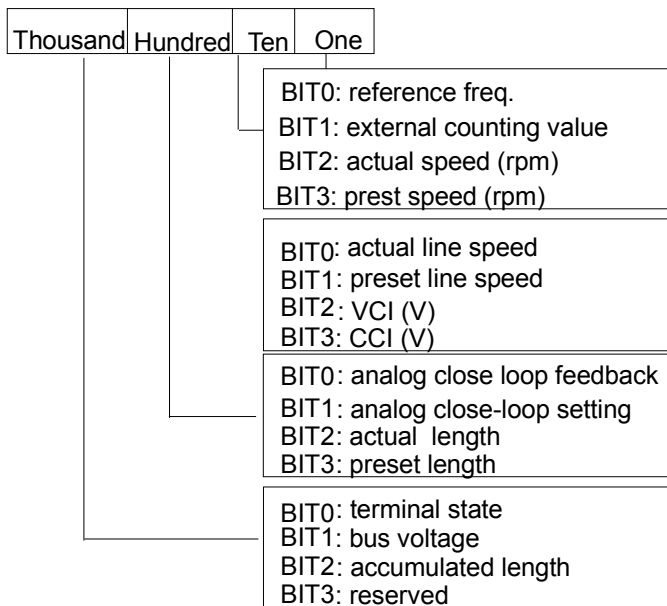


Fig. 5-54 Parameter Displayed at Stop State

F8.01 and F8.02 define the parameters that can be displayed by LED when the drive is operating. If Bit is set at 0, the parameter will not be displayed;

If Bit is set at 1, the parameter will be displayed.

As to the conversion of binary format to Hex format, please refer to Table 5-11. You may press **▶▶** key to scroll through the parameters.

**Note:**

1. When the rotating speed and line speed are displayed, these values can be changed by pressing **▲** and **▼** in real time (no need to change to frequency displaying status).
2. When the setting of F8.03 is 0, the preset frequency will be displayed.

F8.04 Rotating speed display factor	Range: 0.1~999.9% 【100.0%】
-------------------------------------	----------------------------

It is used to calibrate the error of rotating speed display. It has no effect on the actual speed.

F8.05 Line speed factor	Range: 0.1~999.9% 【1.0%】
-------------------------	--------------------------

It is used to calibrate the error of line speed display. It has no effect on the actual speed.

F8.06 Close-loop parameter display factor	Range: 0.1~999.9%
---	-------------------

	【100.0%】
--	----------

It is used to calibrate the error between preset or feedback parameters and the actual ones. It has no effect on close-loop PI regulation. the actual speed.

## 5.10 Enhanced Function (F9)

F9.00 Operating command bundled with freq. setting method	Range: 000~777 【000】
---	----------------------

This function defines the combination of 3 operating command and 7 frequency setting method, so that they can be switched at the same time.

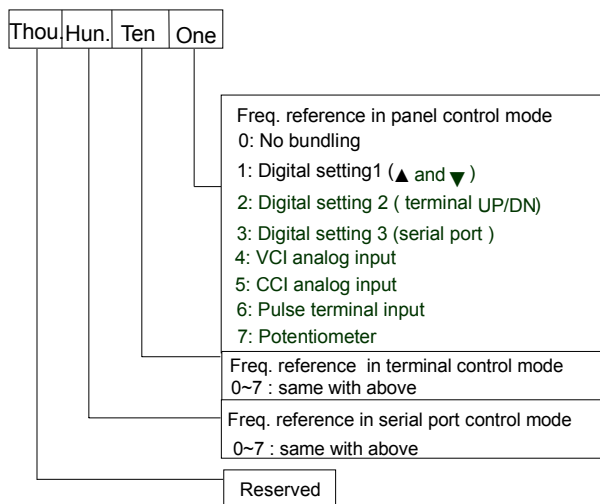


Fig. 5-55 Operating command bundled with freq. Setting method

The reference frequency setting method is defined by F0.00, see section 5.1 for details.

Different control modes can bundle to one reference frequency setting method.

You may follow the methods below to change control command and frequency setting method simultaneously.

Method 1: Change F0.03;

Method 2: use terminal X1~X5 function No. 28 and 29.

For example:

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

① Control modes selection: The control modes can be selected by terminal remotely or by F0.03 locally;

② If keypad (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 ▼.

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

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

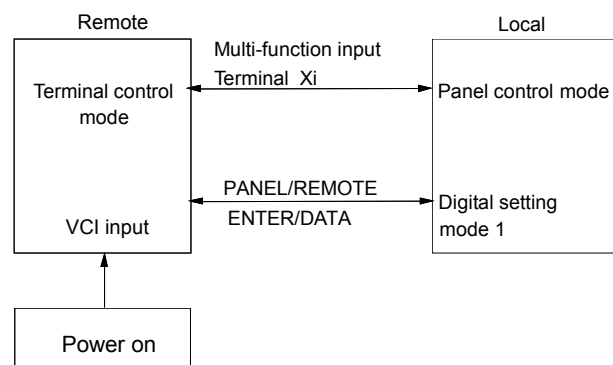


Fig. 5-56 Local and Remote Control

To meet the above requirements,

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

Set F7.00=28, and 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 F9.00=041, then terminal control mode is bundled to VCI analog input, and the panel control mode is bundled to digital setting 1.

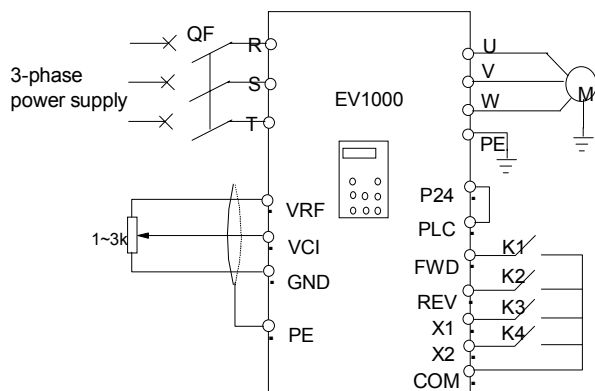


Fig. 5-57 Wiring for Remote and Local Control

**Note:**

If factory setting is 000, no bundling of operating command and frequency setting method.

F9.01 Auxiliary freq. setting method	Range: 0~13 【0】
F9.02 Auxiliary reference factor	Range: 0.00~9.99 【1.00】
F9.03 Digital auxiliary ref.	Range: 0.00~650.0Hz 【0.00Hz】
F9.04 Digital auxiliary ref. control	Range: 000~111 【000】

The preset frequency is the final result of the combination of main frequency and auxiliary frequency. F9.01~F9.04 are for auxiliary frequency. Fig.5-57 shows the course of frequency combination.

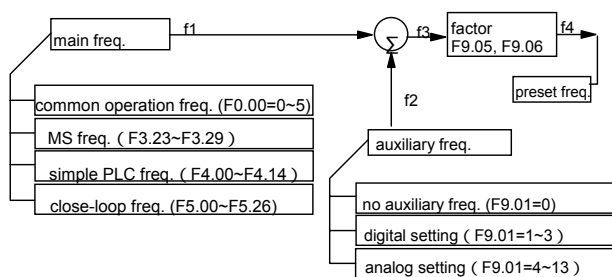


Fig. 5-58 Preset Freq. Calculation Method

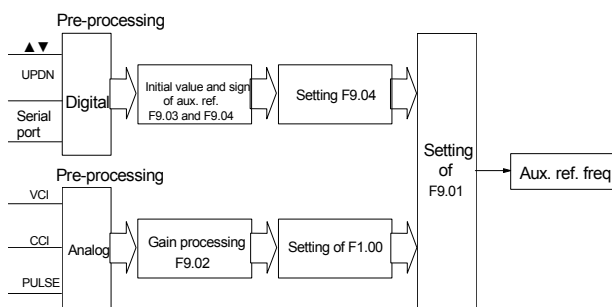


Fig. 5-59 Auxiliary Frequency Processing

Table 5-12 Auxiliary Freq. Setting Method

Setting	Description	Note
0	No auxiliary freq.	Auxiliary freq.=0
1	Digital setting 1, adjust by ▲ and ▼	Set by F9.03. Whether the frequency before power failure will be saved depending the setting of F9.04.
2	Digital setting 2, adjust by UP/DN	
3	Digital setting 3, set by serial port	
4	VCI analog setting	Depend on actual input. Refer to F1.00.
5	CCI analog setting	
6	Terminal PULSE	
7	- VCI analog setting	
8	- CCI analog setting	
9	-Terminal PULSE	
10	VCI-5	
11	CCI-5	
12	PULSE-0.5×F1.03	
13	Potentiometer	

Select digital setting 3, you may set F9.03 via



serial port to change auxiliary frequency.

If VCI-5 or CCI-5 is selected, take 5V input as the point corresponding to zero frequency, 0~5V input corresponds to negative output, 5~10V input corresponds to positive output. See Fig.5-60.

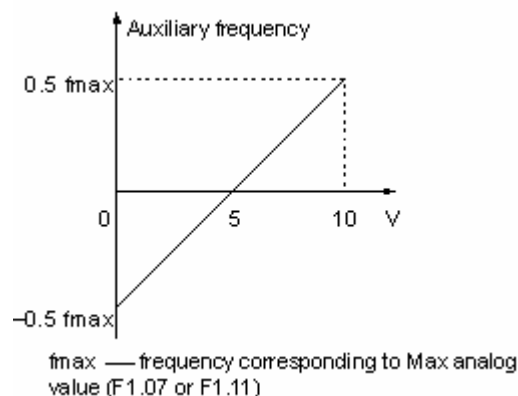


Fig. 5-60 Frequency Setting Via VCI-5 or CCI-5

If PULSE-0.5×F1.03 is taken as auxiliary frequency setting method, one half of F1.03 (max. pulse freq.) as the point corresponding to zero frequency, 0~0.5 times of F1.03 input corresponds to negative output, 0.5~1 times of F1.03 input corresponds to positive output. See Fig.5-61.

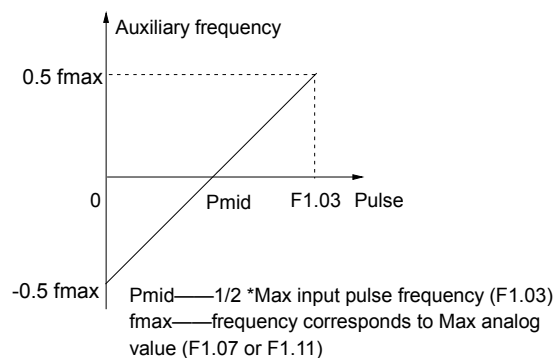


Fig. 5-61 PULSE-0.5×F1.03 As Freq. Input

F9.02: Analog auxiliary reference factor

It is valid when F9.01=4~12. The auxiliary reference undergoes F9.02 gain calculation first, and then output according to F1.00.

F9.03: initial value of digital auxiliary reference

It is valid when F9.01=1~3. It is the initial setting of any of the 3 method.

F9.04: digital auxiliary reference control

It is valid when F9.01=1~3. See Fig. 5-62.

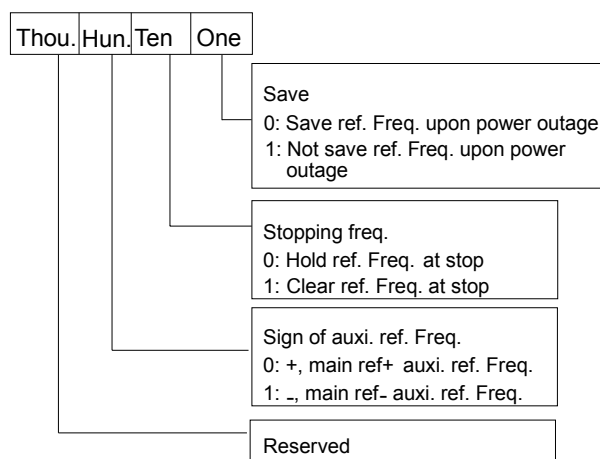


Fig. 5-62 Digital Auxiliary Freq. Setting

One's place of F9.04

0: save the auxiliary freq. at power off

The auxiliary frequency will be saved in F9.03, and the sign of the freq. saved in F9.04.

1: not save the auxiliary freq. at power off

Ten's place of F9.04

0: maintain the auxiliary freq. if the drive stops

1: preset frequency is cleared if the drive stops

Hundred's place of F9.04: sign of auxiliary freq.

0: (+) positive sign.

Preset freq. is the sum of main freq. and auxiliary freq.

1: (+) negative sign

Preset freq. is the result of main freq. minus auxiliary freq.

#### Note:

When the inputting mode of auxiliary reference frequency is the same with that of main reference frequency, the auxiliary reference frequency setting is invalid.

F9.05 Preset freq.adjust mode	Range: 0~2 【0】
F9.06 Factor for calculating preset freq.	Range: 0.0%~200.0% 【100.0%】

F9.05 defines how to calculate the preset frequency. Refer to Fig. 5-57.

0: disabled

No additional summing operation to the sum of main freq. and auxiliary freq. See Fig. 5-58.

1: regulate based on max. output freq. (F005)

Preset freq.  $f_4=f_3+F0.05 \times (F9.06-100\%)$

2: regulate based on current output freq. (F005)

Preset freq.  $f_4=f_3+f_3 \times (F9.06-100\%)=f_3 \times F9.06$

F9.07 STOP/RESET key's function and keypad lock

Range: 000~402 【000】

This function defines the function of STOP/RESET key and keypad lock selection.

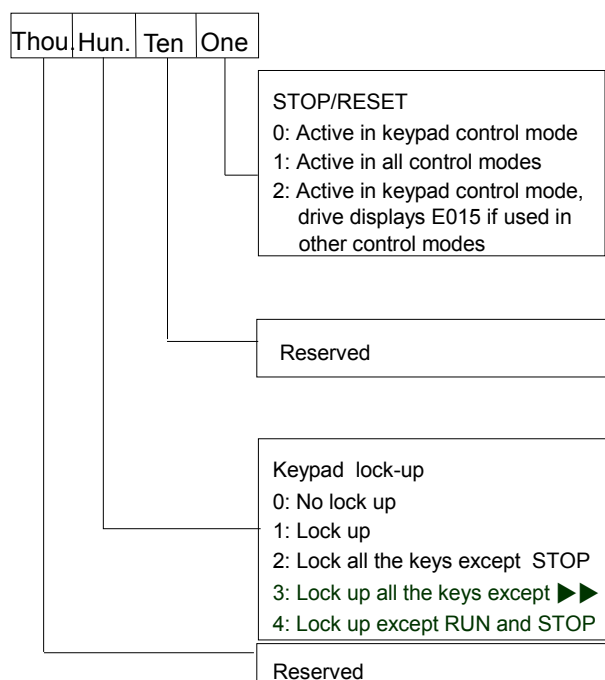


Fig. 5-63 Stop/Reset Key's Function and Keypad Lockup

One's place: STOP/RESET key's function

It is to set the usage and function of STOP/RESET key when you want to stop the drive.

0: effective when keypad control is selected.

1: effective for keypad, terminal and serial port control. Press this key and the drive will stop in specified manner.

2: effective for keypad, terminal and serial port control. In keypad control mode, press this key

and the drive will stop in specified manner. But in terminal or serial port control mode, pressing this key will trigger E015 alarm and the drive will coast to stop.

STOP/RESET can be used to reset a fault in all control mode.

Ten's place: reserved

Hundred's place: lock up keypad selection

You can select to lock all or part of the keys.

0: not lock the keypad.

1: lock all keys on the keypad.

2: lock all keys on the keypad except STOP/RESET key.

3: lock all keys on the keypad except ►► key.

4: lock all keys on the keypad except RUN and STOP key.

Keypad locking method: press FUNC/DATA key and PRG key at the same time for 3 seconds.

Unlocking method: press FUNC/DATA key and hold it, press ▼ key three times (within 3 seconds).

F9.08 Reserved

F9.09 Acc/Dec time unit Range: 0, 1 【0】

0: second

1: minute

It is valid for all acceleration or deceleration except jog and traversing operation.

The Acc/Dec time can be as long as 60 hours.

#### Note:

It is recommended to select Second as time unit.

F9.10 Droop control

Range: 0.00~10.00Hz  
【0.00Hz】

The function applies to the occasion that many drives control a single load for equalizing power distribution. As Fig. 5-64 shows, 5 drives are driving a conveyer of 5 motors.

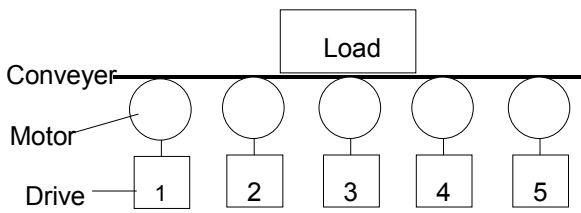


Fig. 5-64 Droop Control

When some drive's load is too heavy, it will reduce output power to shirk part of the load according to F9.10. You may adjust the value gradually. Refer to Fig.5-65 for the relation of load and output frequency.

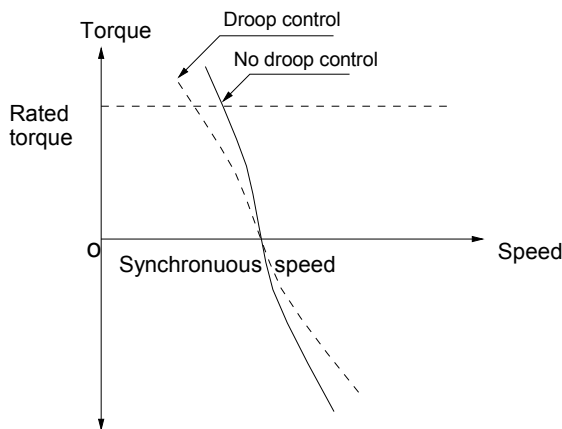


Fig. 5-65 Droop Control Effect

F9.11 High usage of bus voltage	Range: 0、1 【1】
---------------------------------	----------------

When the electric network voltage is much lower (under 15% of rated voltage) or the drive works with a heavy load for long time, it will boost its bus voltage usage rate to increase output voltage.

0: disabled

1: enabled

**Note:**

If F9.11 is enabled, the output harmonic components will increase slightly.

F9.12 Zero freq. threshold	Range: 0.00~650.00Hz 【0.00Hz】
F9.13 Zero freq. hysteresis	Range: 0.00~650.00Hz 【0.00Hz】

The above two parameters are to set zero

frequency hysteresis control.

Take analog CCI for example, see Fig.5-66:

Startup process:

When the Run command is given out, only after CCI current arrives at  $I_b$  and the corresponding frequency reaches  $f_b$ , does the drive start and accelerate to the preset frequency.

Stop:

During operation, if CCI current reduces to  $I_b$ , the drive will not stop until it reaches  $I_a$  and the corresponding frequency becomes  $f_a$ , where  $f_a$  is the threshold of zero frequency defined by F9.12. The difference between  $f_b$  and  $f_a$  is zero frequency hysteresis, defined by F9.13.

This function can realize dormancy to save energy. In addition, the frequent start and stop at threshold frequency can be avoided.

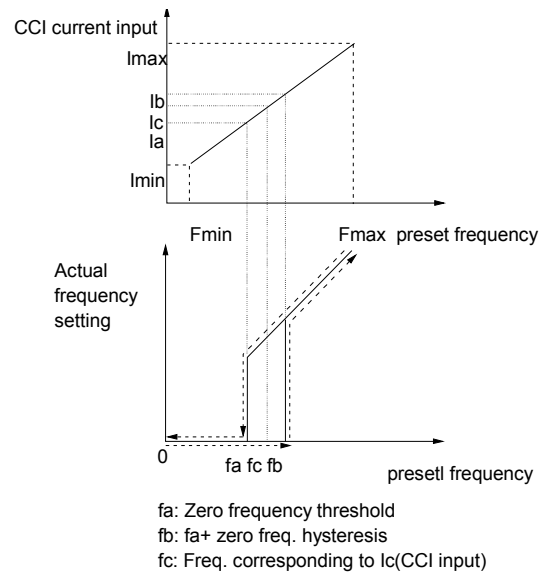


Fig. 5-66 Zero Freq. Hysteresis

F9.14 Preset length	Range: 0.000~65.535km 【0.000km】
F9.15 Actual length	Range: 0.000~65.535km 【0.000km】
F9.16 Length factor	Range: 0.001~30.000 【1.000】
F9.17 Length calibrate	Range: 0.001~1.000 【1.000】

F9.18 Shaft circumference	Range: 0.01~100.00cm 【10.00cm】
F9.19 Pulse per revolution	Range: 1~9999 【1】

The above parameters are used for length control, i.e. the drive will stop when arriving certain length.

The counting pulse is input from X4 or X5 which is defined as function No. 44, refer to F7.03~F7.04.

The length is calculated based on F9.19 and F9.18.

Calculated length = number of counting pulse ÷ number of pulse per revolution × shaft circumference

After correcting the calculated length by F9.16 and F9.17, the actual length is obtained.

Actual length = calculated length × F9.16 ÷ F9.17

When the actual length (F9.15) ≥ preset length (F9.14), the drive will stop automatically. You must clear the actual length record or modify the setting of it to a value smaller than F9.14, or the drive cannot be started.

#### Note:

The actual length can be cleared by multi-function input terminal, i.e. to set the corresponding parameter of Xi at 39. The actual length and pulse number can be calculated only after this terminal is disconnected. Actual length (F9.15) will be saved after power off automatically.

Function of stop at fixed length is disabled if F9.14 is set to 0, but the calculated length is still effective.

Application of stop at fixed length:

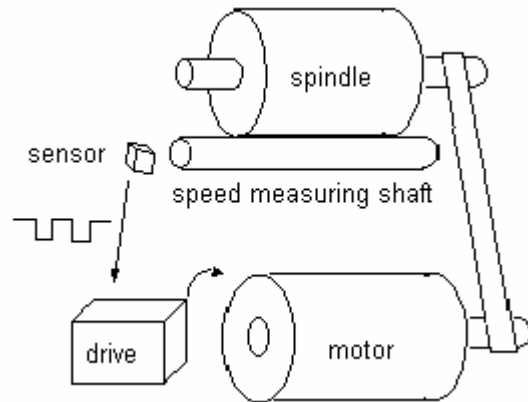


Fig. 5-67 Application of Stop at Fixed Length

In Fig. 5-67, the drive drives the motor, and the motor, in turn, drives the spindle through the conveyer. The shaft that contact with the spindle can measure the line speed of it which will be transmit to the drive by the sensor in the form of pulse. The drive will calculate the length based on the number of pulses it received. When the actual length ≥ preset length, the drive will give Stop command automatically to stop the spinning. The operator can remove the spindle and close the “Clear Length” terminal (set any of F7.00~7.04 at 39). The drive is then ready for the next spindle process.

F9.20 Low voltage compensation (trip-free)	Range: 0, 1 【0】
F9.21 Freq. decrease rate during voltage compensation	Range: 0.00~99.99Hz/s 【10.00Hz/s】

F9.20 is to select whether to enable low voltage compensation in case of voltage drop or undervoltage by reducing output frequency to get energy feedbacked from the load, so that the drive will not trip.

F9.20=0, disabled

F9.20=1, enabled

If the setting of F9.21 is set too big, the feedback energy of motor will be more than expected and may cause over-voltage protection; if the setting of F9.21 is set to small, the feedback energy of motor is not enough, hence trip might occur. It is

recommended to set F9.21 according to load and its inertia.

F9.22 Conditions of restart after power failure	Range: 0, 1 【0】
F9.23 Restart delay after power failure	Range: 0.0~10.0s 【0.5s】

F9.22 and F9.23 are to set how the drive restarts after power failure given different control mode.

F9.22=0, not auto restart.

F9.22=1, the drive will auto restart if the Start condition can be satisfied after a period of time specified by F9.23.

In fact, whether to auto restart depends on F9.22, drive's state at power failure and control mode. Refer to Table 5-13.

Table 5-13 Conditions of Restart after Power-on

F9.22	State before power off	Control mode at power-on					
		Keypad	Serial port	Terminal 1 and 2, 3-wire		Terminal 1 and 2, 2-wire	
				None	None	None	Yes
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 is ready to start, and "1" means auto start.
- When the control mode is keypad or serial port or 3-wire terminal 1 and 2, there is no RUN command at power on.
- If there is a Stop command, the drive will not start.
- When restart is allowed, the drive will start according to F2.00.

## 5.11 Reserved (FA)

FA.00~FA.11	Reserved
-------------	----------

## 5.12 Communication (FF)

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

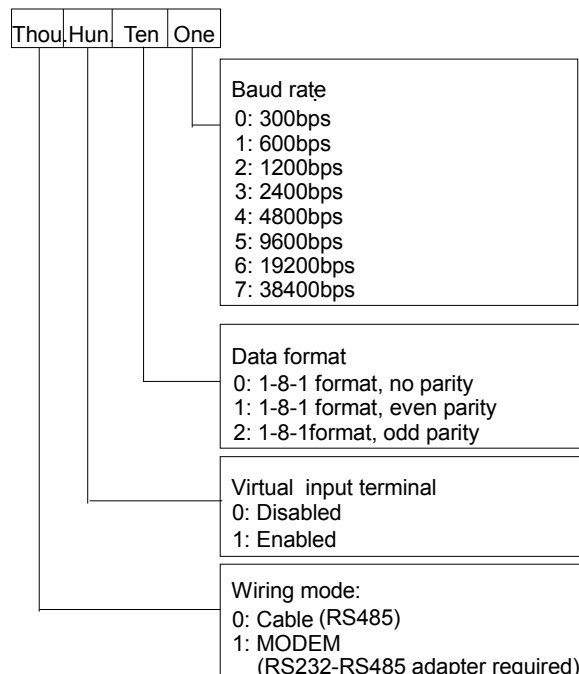


Fig.5-68 Communication Configuration

This parameter sets the communication mode.

Virtual terminal is set by host command to simulate the actual terminal. Each bit of the command represents the state of corresponding terminal. Please refer to Appendix 2. When the virtual terminal, which function the same as the actual one, is effective, the actual terminal is disabled.

The setting of the thousand's place does not affect the communication. When MODEM mode is selected, every time the drive is powered on, the MODEM will be initialized through the RS485 port, so that it can response automatically after receiving 3 ring signals for remote control. Remember that a RS485-RS232 adapter is needed.

FF.01 Local address	Range: 0~127 【1】
---------------------	------------------

During serial communication, the parameter can identify local drive's address.

**Note:**

"127" is the broadcasting address. When it is set so, the slave can receive and execute the command by host, but will not answer back.

FF.02 Communicate timeout detect	Range: 0~1000.0s 【0.0s】
----------------------------------	-------------------------

When the communication signal is lost for a period longer than the setting of this parameter, the drive deems that communication fault occurs.

When it is set at 0, the drive will not detect the communication status.

FF.03 Response delay	Range: 0~1000ms 【5ms】
----------------------	-----------------------

Response delay refers to the time from the drive receiving and executing the command of the host to returning reply frame to the host.

### 5.13 Motor's Parameters (FH)

FH.00 Motor's poles	Range: 2~14 【4】
FH.01 Rated power	Range: 0.4~999.9kW 【Depending on model】
FH.02 Rated current	Range: 0.1~999.9A 【Depending on model】

FH.00~FH.02 are to set motor's parameters. Be sure to input the values according to motor's nameplate.

**Note:**

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 $I_0$	Range: 0.1~999.9A 【Depending on model】
FH.04 Stator resistance %R1	Range: 0.0~50.00% 【Depending on model】
FH.05 Leakage inductance %Xl	Range: 0.0~50.00% 【Depending on model】

FH.06 Rotor resistance %R2	Range: 0.0~50.00% 【Depending on model】
FH.07 Mutual inductance %Xm	Range: 0.0~2000.0% 【Depending on model】

Please refer the above parameters to Fig. 5-69.

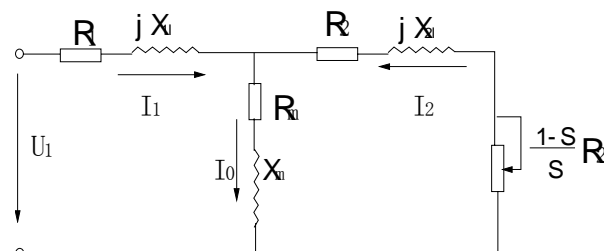


Fig. 5-69 Motor's Equivalent Circuit

In Fig. 5-6868,  $R_1$ ,  $X_{l1}$ ,  $R_2$ ,  $X_{l2}$ ,  $X_m$  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.

Formula used for calculating stator's resistance or rotor's resistance:

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

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

V: rated voltage;

I: motor's rated current

Formula for calculating (leakage inductance or mutual inductance):

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

X: the sum of leakage inductance of stator and rotor, or mutual inductance. The rotor's inductance has been converted to the stator's side;

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, then the settings of FH.03~FH.07 after the auto-tuning process will be updated.

After motor power(setting of FH.01) is changed, the drive will set FH.02~FH.07 to corresponding parameters.

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 (on the nameplate):

Rated slip frequency = motor's rated frequency (i.e. basic operating 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】
-------------------	----------------

FH09 can be used to measure and write-in the motor's parameters automatically.

0: Auto-tuning is disabled

1: Stationary auto-tuning (Start auto-tuning to a standstill motor)

Before starting auto-tuning, values on the motor's nameplate must be input correctly (FH.00~FH.02).

When starting auto-tuning to a standstill motor, the stator's resistance (%R1), rotor's resistance (%R2) and the leakage inductance (%X1) will be measured and the measured values will be written into FH.04, FH.05 and FH.06 automatically.

FH.09=2: rotating auto-tuning

When starting a rotating auto-tuning, at first, the motor is in standstill status, and the stator's resistance (%R1), rotor's resistance (%R2) and the leakage inductance (%X1) will be measured, and then the motor begins to rotate, mutual inductance (%XM),  $I_0$  will be measured and written into 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 feature;
- 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 and remove the load from the motor and check the safety;
- 4) Set FH.09 to 1 or 2, press **FUNC/DATA**, and then press **RUN** to start auto-tuning;
- 5) When the operating LED turns off, that means the auto-tuning is over.

#### Note:

When setting FH.09 to 2, you may increase Acc/Dec time 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 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;

If it is inconvenient to start auto-tuning (e.g. the motor cannot break away from the load), or you don't require much on motor's control performance, you can use stationary auto-tuning or even disable the function. You may input the values on the motor's nameplate correctly (FH.00~FH.02).

If the auto-tuning function is unavailable and there is motor's parameters on the nameplate, you should input the values correctly (FH.00~FH.02), and then input the calculated values (FH.03~FH.07). Please set the parameters correctly.

If auto-tuning is not successful, the drive alarms and displays fault E024.

FH.10 Motor stabilization factor	Range: 0~255 【 Depending on model 】
----------------------------------	--

FH.10 is used to suppress the oscillation caused by the drive and the motor. If the drive's output current changes constantly at fixed load, the oscillation can be reduced by adjusting FH.10.

FH.11~FH.21 Reserved

## 5.14 Protection (FL)

FL.00 Motor overload protection mode	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 in case of overload;

1: Common motor (with low speed compensation)

Since cooling conditions of common motor deteriorates at low speed, the motor's thermal protection threshold should also be adjusted. The "Low Speed" here refers to the operating frequency lower than 30Hz.

2: Variable frequency motor (without low speed compensation)

The cooling effect of variable frequency motor is not affected by the motor's speed, so low speed compensation is not necessary.

FL.01 Motor overload protection factor	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. 5-70.

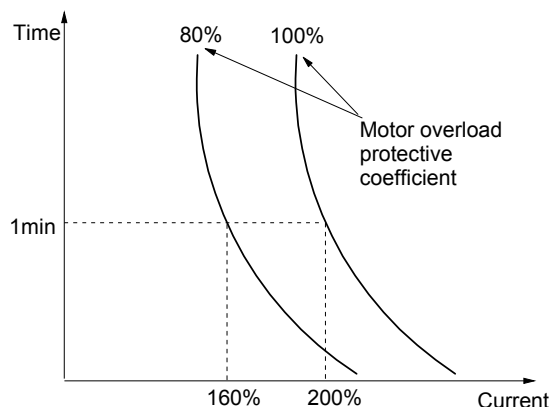


Fig. 5-70 Motor's overload protection coefficient

The efficient is calculated by the formula below:

$$\text{Motor overload protection coefficient} = \frac{\text{motor rated current}}{\text{inverter's rated output current}} \times 100\%$$

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, adjust FL.00~FL.01 to perform overload protection.

FL.02 Stall overvoltage	Range: 0, 1 【1】
FL.03 Stall overvoltage point	Range: Depending on model point

FL.02=0, function disabled

FL.02=1, enabled

The setting of FL.03 is given in the table below:

Model	Range	Default
380V	120.0%~150.0%	140.0%
220V	110.0%~130.0%	120.0%

When the drive is decelerating, the motor's decreasing rate may be lower than that of the drive's output frequency due to the inertia of load. At this time, the motor will feed the energy back to the drive, resulting in voltage rise on the drive's DC bus, which will cause overvoltage trip.

Function of FL.02: during the deceleration, the drive detects the bus voltage and compares it with the stall over voltage point defined by FL.03. If the bus voltage exceeds FL.03, the drive will stop



reducing its output frequency. When the detected bus voltage is lower than the point, the deceleration will continue. Please refer to in Fig. 5-71.

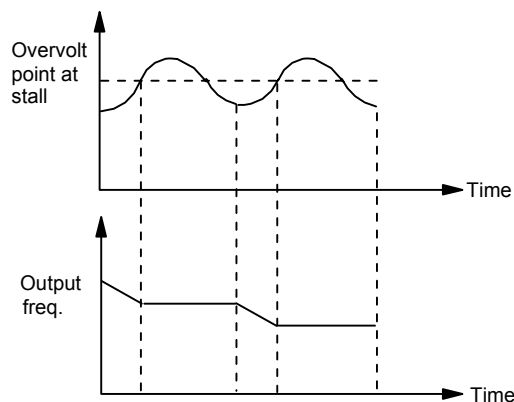


Fig. 5-71 Stall Overvoltage

#### Note:

1. The drive will alarm and display “E015” if it has been in stall over-voltage status for more than 1 minute.
2. If the stall point is set too low, you should prolong the Acc and Dec time properly.
3. If the stall point is set too high, it is useless for overvoltage protection.

FL.04	Overload detection config	Range: 000~111 【000】
FL.05	Overload detection threshold	Range: Depending on model
FL.06	Overload alarm delay	Range: 0.0~60.0s 【5.0s】

EV1000 has overload protection over motor and drive. 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 acts.

FL.04 defines the overload detection mode, action mode and reference current.

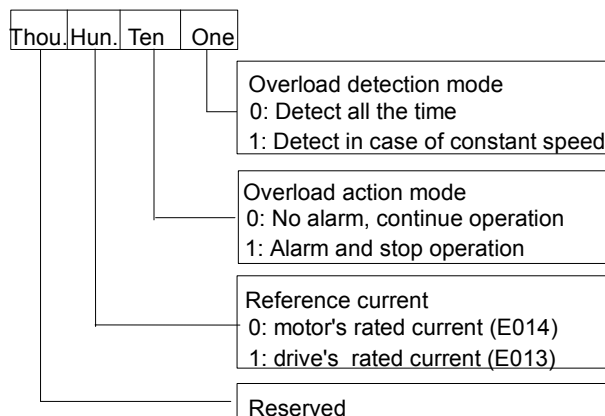


Fig. 5-72 Overload Detection Configuration

One's place of FL.04: overload detection mode

0: the detection is done as long as the drive is operating.

1: the detection is done only when the drive works at constant speed.

Ten's place of FL.04: action mode

0: The overload is ignored, no alarm.

1: During “Overload Alarm Effective Period”, the drive will alarm and stop operation. The “Overload Alarm Effective Period” means the drive's operating current has exceeds FL.05 and whose duration has exceed overload alarm delay (FL.06).

Hundred's place of FL.04: reference current

0: the overload detection threshold (FL.05) is set based on motor's rated current. Fault code E014.

1: the overload detection threshold (FL.05) is set based on drive's rated current. Fault code E013.

FL.05 defines the threshold for overload alarm. It is a percentage of either drive's or motor's rated current. Refer to setting of the hundred's place of FL.04. The setting of FL.05 also relates to the type of the drive. Please refer the table below:

Type	Setting Range	Default
G	20.0%~180.0%	130.0%
P	20.0%~130.0%	120.0%

Overload alarm delay FL.06, please refer to Fig. 5-73.

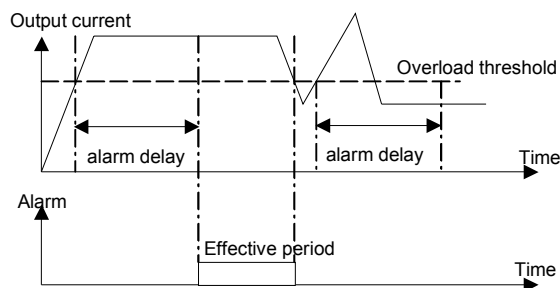


Fig. 5-73 Overload Detection and Alarm

### Note:

1. Overload detection threshold should be lower than the overload protection threshold;
2. During the overload alarm delay period, if the drive's current becomes lower than overload detection threshold, no alarm will be triggered.

FL.07 Auto current limiting threshold	Range: Depending on model threshold
FL.08 Freq.decrease rate rate during current limiting	Range: 0.00~99.99Hz/s 【10.00Hz/s】
FL.09 Action mode of auto current limiting	Range: 0~4 【2】

Auto current limiting function is used to limit the load current under the preset current in real time to avoid trip due to over-current. This function is especially useful for the applications of larger load inertia or sharp change of load.

FL.07 defines the threshold for current limiting. Its setting is a percentage of drive's rated current  $I_e$ .

Type	Setting Range	Default
G	20.0%~180.0%	150.0%
P	20.0%~130.0%	110.0%

FL.08 defines the decreasing 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 FL.08 is set too big, the drive may be in energy generation status for long time that may result in overvoltage protection.

The action mode of auto current limiting function is decided by FL.09.

FL.09=0: disabled;

FL.09=1: auto current limiting is effective during acceleration or deceleration but ineffective at constant speed, no silencing function;

FL.09=2: effective all the time, no silencing function;

FL.09=3: auto current limiting is effective during acceleration or deceleration but ineffective at constant speed, with silencing function;

FL.09=4: effective all the time, with silencing function.

Because the output frequency might change during current limiting, the function should be used for applications that require constant speed and stable frequency output.

FL.10 Auto reset times	Range: 0~10 【0】
FL.11 Auto reset interval	Range: 2.0~20.0s 【5.0s】

Auto Reset function can reset a fault according to the preset FL.10 and FL.11. If FL.10 is set to 0, auto reset is disabled. Protective action will be taken if a fault occurs.

### Note:

Overcurrent protection and external fault (E015) cannot be reset automatically.

During the reset interval, the drive's stops operation and restarts on the fly when the reset is finished.

Be careful when using auto-reset function, otherwise human injure or material loss may occur.

FL.12 Protective action mode 1	Range: 000~101 【000】
FL.13 Protective action mode 2	Range: 0000~1211 【0000】

The fault alarm and protective action can be prohibited by setting FL.12 and FL.13, so that the drive can continue working.

FL.12 defines the protective action in case of communication and E<sup>2</sup>PROM error.

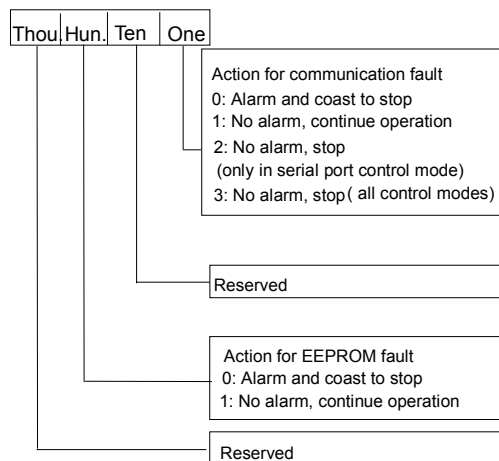


Fig. 5-74 Protective Action Mode 1 Setting

FL.13 defines the action mode for undervoltage, auto reset interval fault lockup and output phase loss.

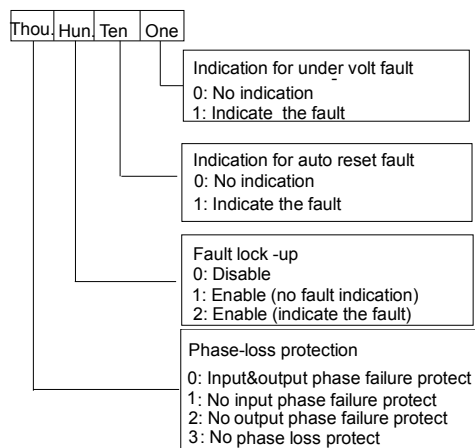


Fig. 5-74 Protective Action Mode 2 Setting

**⚠ Attention** Please be careful when using FL.12 and FL.13, otherwise human injure or material loss may occur.

FL.14 Fault type of the first time	Range: 0~24 【0】
FL.15 Fault type of the second time	Range: 0~24 【0】
FL.16 Fault type of the third time (latest)	Range: 0~24 【0】
FL.17 Bus voltage at the last fault	Range: 0~999V 【0V】

FL.18 Output current at the last fault	Range:0~999.9A 【0.0A】
FL.19 Freq. at the last fault	Range:0.00~650.00Hz 【0.00Hz】

EV1000 has 24 kinds of alarms. It can memorize the types of 3 latest faults (FL.14~FL.16), and the voltage, current and frequency (FL.17~FL.19) of the most recent fault.

See chapter 6 for the detailed introductions to the alarm.

## 5.15 Operating Time (Fn)

Fn.00 Preset operating time	Range: 0~65.535kh 【0】
Fn.01 Total operating time	Range: 0~65.535kh 【0】
Fn.02	Reserved
Fn.03	Reserved

If the accumulated operating time has amount to Fn.00, the drive will give out an indicating signal. Please refer to F7.10~F7.12.

Fn.01 is the total accumulated operating time from delivery till now.

## 5.16 Protection of Parameters (FP)

FP.00 User password	Range: 0000~9999 【0000】
---------------------	-------------------------

User's password can prevent unauthorized persons from checking and modifying the parameters.

Set FP.00 to 0000 if the user's password is not necessary.

If you want to set the user's password, input a 4-digit number, press **FUNC/DATA** to confirm. If not pressing any key within 5 minutes, the password will become effective.

Changing the password:

Press **PRG**, input the old password, and then select **FP.00** (at this time  $FP.00=0000$ ), input new password and press **FUNC/DATA** to confirm. The password will become effective if not pressing any key within 5 minutes.

 **Note:**

Please learn the password by heart.

FP.01 Write-in protection	Range: 0~2 【1】
---------------------------	----------------

FP.01 is to set the mode of write-in protection of parameters.

0: All parameters are allowed to be changed;

1: No parameters can be changed except the F0.02 and FP.01;

2: No parameters can be changed except FP.01.

 **Note:**

The factory setting of FP.01 is 1. If you need modify parameters, FP.01 must be set to 0; and then set it to 1 or 2 after modification to protect these parameters.

FP.02 Parameter initialization	Range: 0~2 【0】
--------------------------------	----------------

0: disabled

1: clear fault record

Clear the contents of FL.14~FL.19.

2: restore to factory defaults

If FP.02 is set at 2, the parameters listed before FL.14 except FH.00 and FH.08 will be restored to factory defaults.

After the initialization, the parameter will change to 0 automatically.

FP.03~FP.04	Reserved
-------------	----------

## Chapter 6 Troubleshooting

All the possible faults of EV1000 have been given in Table 6-1. Fault code range is E001~E024. You can user can check the faults according to the following table and record detailed fault phenomena before seeking service. Please contact the sales distributor when you need technical supports.

Table 6-1 Fault Information and Diagnosis

Fault code	Fault descriptions	Possible reasons	Actions
E001	Over-current in Acc process	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 works well.
		The rotating motor re-starts after the drive stops instantly.	Start when the motor stops
		Low AC supply voltage	Check the drive's input AC supply
		Drive power is too small	Select a higher power drive
E002	Over-current in Dec process	Too short Dec time	Prolong the Dec time
		Negative-torque load or the load inertia is too high	Connect suitable braking device
		Too low drive's power	Select the drive with larger capacity
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
		Too low drive's power	Select the drive with larger capacity
E004	Over voltage in Acc process	Abnormal AC supply voltage	Check the AC supply voltage
		Too short Acc/Dec time	Prolong the Acc time
		The drive is re-started with a rotating motor	Start when the motor stops
E005	Over voltage in Dec process	Too short Dec time (with reference to generated energy)	Prolong the Dec time
		Negative-torque load or the load inertia is too high	Use suitable dynamic braking device

Fault code	Fault descriptions	Possible reasons	Actions
E006	Over voltage in constant-speed operating process	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 high load inertia	Use suitable dynamic braking device
E007	Over voltage of drive's control power supply	Abnormal AC supply voltage	Check the AC supply voltage or seek service
E008	Reserved	Reserved	Reserved
E009	Output phase loss	Output phase failure among Phase U, V and W	Check the drive's output wiring Check the cable and the motor
E010	Reserved	Reserved	Reserved
E011	Rectifier's heatsink overheat	Ambient over-temperature	Lower the ambient temperature
		Obstruction of ventilation channel	Clear the ventilation channel
		Fan does not work	Replace the fan
		Inverter fault	Seek service
E012	Reserved	Reserved	Reserved
E013	Drive overload	Too short Acc time	Prolong Acc time
		Too large DC braking energy	Reduce DC braking current, prolong braking time
		Improper V/F curve	Adjust V/F curve or torque boost value
		The drive is re-started with a rotating motor	Start when the motor stops
		Low AC supply voltage	Check the AC supply voltage
		Too heavy load	Select the drive with larger power
E014	Motor Overload	Improper V/F curve	Set V/F curve and torque boost value correctly
		Low AC supply voltage	Check the AC supply voltage
		Common moter operating at low speed, large load for long time	Select special motor for such operating condition
		Incorrect setting of motor overload protection factor	Correct the setting
		Moter blocked or load sudden change	Check the load

Fault code	Fault descriptions	Possible reasons	Actions
E015	Emergency stop or external equipment fails	Press <b>STOP</b> key when operating at non-keypad mode	Check the present operating mode
		Press <b>STOP</b> when the drive is in stall status	Set the operating parameters correctly
		The drive will report E015 fault if it is in stall status for 1 minute	Set the operating parameters correctly
		Terminal used for stopping the drive in an emergency is closed	Disconnect the terminal if the external fault is cleared
E016	E <sup>2</sup> PROM R/W fault	R/W fault of control parameters	Press <b>STOP/RESET</b> to reset Seek service
E017	RS232/RS485 communication failure	Wrong baud rate setting	Set the baud rate correctly
		Serial port communication error	Press <b>STOP/RESET</b> to reset Seek service
		Host PC does not work	Check whether the host PC is working or not; Check the wiring
		Improper setting of alarm conditions	Modify FF.02, FF.0, FL.12
E018	Reserved	Reserved	Reserved
E019	Current detection circuit is faulty	Wires or connectors of control board are loose	Check and re-wire
		Auxiliary power supply is damaged	Seek service
		Current detection circuit fault	Seek service
E020	System disturbance	Severe disturbance from outside	Press <b>STOP/RESET</b> to reset or install power filter at the input side of the drive.
E021	Reserved	Reserved	Reserved
E022	Reserved	Reserved	Reserved
E023	Reserved	Reserved	Reserved
E024	Tuning fault	Input motor parameters wrong	Re-input moter parameter according to the nameplate
		Tuning overtime	Check motor cables and limit it within 100m.

Table 6-1 Operation Related Faults and Counteractions

Phenomena	Conditions	Possible reasons of fault	Actions to take
No response of keys	Part of the keys or all the keys are disabled	Keypad locked	In stop or operating state, keep pressing <b>FUNC/DATA</b> key, when pressing <b>▼</b> key three times. Power off the drive and then power on again.
		Panel's cables are not well connected.	Check the wiring
		Panel's keys are damaged	Replay operation panel or seek service
LED no display	No LED segment illuminates	Not power on.	Power on
		Keypad cable reverse connected	Immediately remove the keypad and connect it again correctly. If the problem persists, please connect our technical support person.
Parameter setting cannot be changed	Cannot be changed during operating	Parameter modification property is ×	Settings of parameters can be changed in stop status
	Settings of part of parameters cannot be changed.	Set FP.01 to 1 or 2	Set FP.01 to 0
		Parameter's modification property is *	The parameters cannot be changed by user.
		No parameter but "0.0.0.0." is displayed when pressing <b>MENU/ESC</b> .	User's password is required
Drive does not run	Press RUN key, the drive does not run and RUN indicator is off.	"Coast to stop" terminal effective	Check "coast to stop" terminal
		"Operation prohibition" terminal effective	Check "operation prohibition" terminal
		"External stop" terminal effective	Check "external stop" terminal
		Preset length arrives	Check length setting or delete actual length value
		In 3-wire control mode, the control terminal not closed.	Close the control terminals
		Alarm due to fault	Clear the fault
		Improper setting of host virtual terminals	Cancel the virtual terminal function or reconfigure it, or modify F7.35
		Incorrect input terminal logic	Check F7.35 setting



Phenomena	Conditions	Possible reasons of fault	Actions to take
Unexpected stops during running	The drive stops automatically without STOP command. The RUN indicator goes out.	Alarm occurs	Find out the reason and reset.
		Single cycle of PLC finishes	Check PLC configuration
		Preset length arrives	Clear the actual length value or set F9.14 at 0
		Interruption of the communication between the drive and host or flush mount faceplate	Check communication cables and FF.02, FF.03, FL.12 settings
		Power failure	Check the power supply
		Command input method changed	Check the command input method and corresponding parameter
		Positive/negative logic of control terminal changed	Check F7.35.
	The drive stops automatically without STOP command. The RUN indicator is still on, zero-frequency running	Auto reset of fault	Check reason of fault and the auto reset function
		Simple PLC pause	Check PLC pause function (terminal)
		Interrupt signal feedback from external devices	Check the configuration of external interrupt and faulty external devices
		Stop at zero-frequency	Check F9.12 and F9.13
		Reference frequency is 0	Check the reference frequency
		Skip frequency	Check skip frequency
		Positive logic, close loop feedback > reference frequency Negative logic, close loop feedback < reference frequency	Check the close loop setting and feedback
		Frequency adjustment is set at 0	Check F9.05 and F9.06
Restart low voltage compensation function enabled, and low supply voltage	Check the configuration of restart and the input voltage		

## 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:

As safety precautions, before carrying out check and maintenance of the drive, please ensure that :

The drive has been switched off;

The charging LED lamp in the drive is off, which can be seen after removing the cover.

### 7.1 Routine Maintenance

The drive must be operated in the environment specified in the Section 2.1. Besides, some unexpected accidents may occur during operation. The user should perform the routine maintenance to ensure a good operation environment according to the table below. A good way to prolong the lifetime of the drive is to record the routine operation data, find out and clear faults in the early stage.

Table 7-1 Daily Checking Items

Object	Item	Method	Criterion
Environment	Temperature humidity	Thermometer, hygrometer	-10℃~+40℃. Derate if at 40℃~50℃
	Dust, water and leakage	observe	No sign of leakage
	Vibration	Vibration meter	Less than 5.9m/s <sup>2</sup> (0.6g)
	Gas	Smell	No strange smell
Drive	Heat	Touch the casing	Normal air flow
	Sound	Listen	No strange sound
	Output current	Clamp meter	Within rated range
	Output voltage	Voltage meter	Within rated range
Motor	Heat	Touch	No overheat
	Sound	Listen	No strange sound

### 7.2 Periodic Maintenance

You should check the drive every 3 months or 6 months according to the actual environment.

### Note:

1. Only trained personnel can dismantle the drives for repairing or device replacement;
2. Don't leave metal parts like screws or pads in the drive, otherwise the equipment may be damaged.

**General Inspection:**

- Whether screws of control terminals are loose. If so, tighten them with a screwdriver;
- Whether the main circuit terminals are properly connected; whether the mains cables are over heated;
- Whether the power cables and control cables are damaged, check especially for any wear on the cable insulation
- Whether the insulating tapes around the cable lugs are stripped;
- Clean the dust on PCBs and air ducts with a vacuum cleaner;
- 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 driving a motor load.
- 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 prohibited. The drive can be damaged by such a test. Please use a 500V Mega-Ohm-Meter.
- If performing insulation test to the motor, be sure to disconnect the cables between the drive and it. Otherwise, the drive might be damaged.

 **Hint:**

Dielectric test of the drive has already been done in the factory. It is not necessary for the user to do dielectric test again in order to avoid potential damage of its internal components.

## 7.3 Replacing of Easily-worn

### Parts

The easily-worn parts of the drive are cooling fan and electrolytic capacitor, whose life has close relation with the environment and maintenance.

Refer to the table below.

Part	Life
Fan	30~40 thousand hours
Electrolytic capacitor	40~50 thousand 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 cause 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 exists 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. Electrolytic capacitors

Possible cause of damages: high ambient temperature, aging of electrolyte and large pulse current induced by rapid changing loads.

Criteria: Check if frequent over-current or over-voltage failures occur during drive start-up with load. Check if there is any leakage of liquids (electrolytes). Check if the safety valve protrudes. Measure static capacitance and insulation resistance.

#### 3. Relay TA/TB/TC

Possible cause of damages: erosion, frequent operation.

Criteria: ON/OFF malfunction.

## 7.4 Storage of the Drive

The following points must be followed for the temporary and long-term storage of drive:

- 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 for a test within 2 years, for at least 5 hours. The input voltage must be applied gradually with a voltage regulator to the rated value.

## 7.5 Warranty

ENP will offer warranty service in the case of the following situations:

1. The warranty clause is confined only to the drive;
2. ENP will take the responsibility of 18 months defects liability period for any faults or damages under the normal operation conditions as of manufacture date. 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 mis-operations 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 prevails.

## Appendix 1 Parameter Set

EV1000 Series drive's parameters are organized in groups. Each group has several parameters that are identified by "Group No.+ Parameter SN.". Parameter F X.YZ denotes that the parameter belongs to group "X" and its SN is "YZ". For example, "F5.08" belongs to group 5 and its SN is 8.

For the convenience of setting the parameters, the group number corresponds to the menu level, 1, parameter number corresponds to menu level 2 and parameters of parameter correspond to the menu level 3.

The setting of parameter is presented in decimal (DEC) and hexadecimal (HEX) format. If it is set in hexadecimal format, each digit of the setting is independent to one another.

### Explanation of the columns in Parameter Table:

The "LCD display" in third row refers to the parameter's name displayed by LED; The "setting range" in fourth row is the valid ranges of parameter settings; The "minimum unit" is the min. value of the parameter; The "factory setting" in sixth row is the primary factory settings; The "modification" in seventh row is the properties of modification (that is, whether it is allowed to be modified and conditions for modification):

"O" denotes the parameters can be revised when the drive is in operating or stop status;

"×" denotes the parameters can not be revised when the drive is operating;

"\*" denotes the parameters are actually detected and can not be revised;

"-" denotes the parameters that are set by factory and the user cannot modify it;

(The drive has already set the "auto-checking" function to the modification property of each parameter, so as to avoid wrong modification by

the user.)

The drive provides passwords to protect the parameters against unauthorized modifications. After the user's password is set (that is, the settings of FP.00 are not zero), the drive will require you to input the password before the user press the **MENU/ESC** to edit the parameter settings, otherwise you cannot set the parameters. For the parameters set by factory, you can only set the parameters after inputting factory password (you should not change the settings of the parameters set by factory because the drive may operate abnormally or may be damaged if the parameters are not set correctly).

After setting the password, please don't press the keys within 5 minutes so as to enable the password. If the password is input correctly and the keys have not been pressed for longer than 5 minutes, the drive will be locked by the password again. The user's password can be changed any time if the password protection is not locked up. The password that is input last time is valid.

The user's password can be disabled by setting FP.00 to 0. If FP.00 is not set to 0, then the parameters will be protected by the password.

The above rules should be observed when changing the password and parameter' settings via the serial port.



It is defaulted that no parameters except F0.02 are allowed changing. If you need change them, please first set FP.01(parameter write-in protection) from 1 to 0.

Table 1 Parameter Set

Group 0: Basic Operating Parameters					
Para.	Name	Range	Min unit	Default	Modification
F0.00	Frequency setting method	0: digital setting 1, set by ▲ or ▼ key. 1: digital setting 2, set by terminal UP/DN 2: digital setting 3, set through serial port 3: VCI analog setting ( VCI-GND) 4: CCI analog setting ( CCI-GND) 5. Terminal Pulse Setting 6. Keypad potentiometer	1	0	○
F0.01	Digital Frequency Control	One's place of F0.01: 0: reference frequency saved upon power failure. 1: reference frequency saved upon power failure. Ten's place of F0.01: 0: reference frequency saved when the drive stops. 1: The reference frequency will restore back to F0.02 when the drive stops.	1	00	○
F0.02	Frequency digital setting	F0.13~F0.12 (when F0.00=0, 1, 2)	0.01Hz	50.00Hz	○
F0.03	Control mode	0: LED keypad control 1: terminal control 2: serial port	1	0	○
F0.04	Running Direction	0: Forward 1: Reverse	1	0	○
F0.05	Max. output freq.	Max {50.00, F0.12}~650.0Hz	0.01Hz	50.00Hz	×
F0.06	Base frequency	1.00~650.0Hz	0.01Hz	50.00Hz	×
F0.07	Max. output voltage	1~480V	1V	Drive's rating	×

Group 0: Basic Operating Parameters					
Para.	Name	Range	Min unit	Default	Modification
F0.08	Reserved	-	-	-	-
F0.09	Torque boost	0: (auto) 0.1%~30.0%	0.1%	0.0%	○
F0.10	Acc time 1	0.1~3600	0.1	6.0s	○
F0.11	Dec time 1	(default unit is second, other options refer to F9.09)			
F0.12	Upper limit of freq.	F0.13~F0.05	0.01Hz	50.00Hz	×
F0.13	Lower limit of freq.	0.00~F0.12	0.01Hz	0.00Hz	×
F0.14	V/F curve	0: user-defined V/F curve, based on F0.15~F0.20 1: curve1, a 2-order curve 2: curve 2, a 1.7-order curve 3: curve 3, a 1.2-order curve	1	0	×
F0.15	V/F freq. F3	F0.17~F0.06	0.01Hz	0.00Hz	×
F0.16	V/F voltage V3	F0.18~100.0%	0.1%	0.0%	×
F0.17	V/F freq. F2	F0.19~F0.15	0.01Hz	0.00Hz	×
F0.18	V/F voltage V2	F0.20~F0.16	0.1%	0.0%	×
F0.19	V/Ffreq. F1	0.00~F0.17	0.01Hz	0.00Hz	×
F0.20	V/F voltage V1	0~F0.18	0.1%	0.0%	×
F0.21	Manual torque boost cutoff point	0.0~50.0% (based on F0.06)	0.1%	10.0%	○

Group 1: Reference Frequency					
Para.	Name	Range	Unit	Default	Modification
F1.00	Freq. Curve selection	One's place of F1.00: VCI curve selection 0: curve 1 1: curve 2  Ten's place of F1.00: CCI curve selection 0: curve 1 1: curve 2  Hundred's place of F1.00: PULSE curve selection 0: curve 1 1: curve 2	1	000	○
F1.01	Gain of reference frequency selector	0.00~9.99	0.01	1.00	○
F1.02	Filter time	0.01~50.00s	0.01s	0.50s	○
F1.03	Max. input pulse freq.	0.1~50.0k	0.1k	10.0k	○
F1.04	Ratio of Min. input of curve 1 to F1.03	0.0%~F1.06	0.1%	0.0%	○
F1.05	Frequency corresponds to min. input of curve 1	0.00~F0.05	1	0.00Hz	○
F1.06	Ratio of Max. input of curve 1 to F1.03	F1.04~100.0%	0.1%	100.0%	○
F1.07	Frequency corresponds to max. input of curve 1	0.00~F0.05	1	50.00Hz	○



Group 1: Reference Frequency					
Para.	Name	Range	Unit	Default	Modification
F1.08	Ratio of Min. input of curve 2 to F1.03	0.0%~F1.10	0.1%	0.0%	○
F1.09	Frequency corresponds to min. input of curve 2	0.00~F0.05	1	0.00Hz	○
F1.10	Ratio of Max. input of curve 2 to F1.03	F1.08~100.0%	0.1%	100.0%	○
F1.11	Frequency corresponds to max. input of curve 2	0.00~F0.05	1	50.00Hz	○

Note: All the analog value in the table is shown in volt, it can be converted to current by the formula:  $V=mA/2$ .

Group 2: Start/Brake Parameters					
Para.	Name	Range	Unit	Default	Modification
F2.00	Start mode	0: start at start frequency (F2.01) 1: brake first and then start at start frequency Note: start course can refer to the start after first power-on, power recovery, fault reset and coast to stop.	1	0	×
F2.01	Start freq.	0.20~60.00Hz	0.01Hz	0.50Hz	○
F2.02	Start freq. hold time	0.0~10.0s	0.1s	0.0s	○

Group 2: Start/Brake Parameters					
Para.	Name	Range	Unit	Default	Modification
F2.03	DC brake current at startup	G type: 0.0~150.0% of drive's rated current (max. among phases) P type: 0.0~130.0% of drive's rated current (max. among phases)	0.1%	0.0%	○
F2.04	DC brake time at startup	0.0: disabled, 0.1~60.0s	0.1s	0.0s	○
F2.05	Acc/Dec mode	0: linear 1: S curve 2: auto	1	0	×
F2.06	S curve start time	10.0%~50.0% (Acc/Dec time) F2.06+F2.07≤90%	0.1%	20.0%	○
F2.07	S curve rising time	10.0%~80.0% (Acc/Dec time) F2.06+F2.07≤90%	0.1%	60.0%	○
F2.08	Stop mode	0: decelerate to stop 1: coast to stop 2: decelerate to stop+ DC brake	1	0	×
F2.09	Frequency threshold of DC braking	0.00~60.00Hz	0.01Hz	0.00Hz	○
F2.10	DC brake delay	0.00~10.00s	0.01s	0.00s	○

Group 2: Start/Brake Parameters					
Para.	Name	Range	Unit	Default	Modification
F2.11	DC brake current	G type: 0~150% of drive's rated current (max. among the 3 phases), P type: 0~130% of drive's rated current (max. current among the 3 phases).	0.1%	0.0%	○
F2.12	DC brake time at stop	0.0: disabled 0.1~60.0s	0.1s	0.0s	○
F2.13	Dynamic braking	0: disabled 1: enabled	1	0	×
F2.14	Ration of braking time to total operating time	0.0~100.0%	0.1%	2.0%	×

Group 3: Auxiliary Operating Parameters					
Para.	Name	Range	Unit	Default	Modification
F3.00	Anti-reverse setting	0: reverse allowed 1: reverse not allowed	1	0	×
F3.01	FWD/REV transition time	0~3600s	0.1s	0.0s	○
F3.02	Reserved	-	-	0	*
F3.03	Reserved	-	-	0	*
F3.04	Reserved	-	-	0	*
F3.05	Auto energy saving	0: disabled 1: enabled	1	0	×
F3.06	AVR function	0: disabled 1: always enabled 2: disabled during decelerating	1	2	×
F3.07	Slip compensation gain	0.0%~300.0%	0.1%	100.0%	○

Group 3: Auxiliary Operating Parameters					
Para.	Name	Range	Unit	Default	Modification
F3.08	Slip compensation limit	0.0%~250.0%	0.1%	200.0%	○
F3.09	Compensation time	0.1~25.0s	0.1s	2.0s	×
F3.10	Carrier wave frequency (CWF)	0.7k~15k	0.1kHz	10.0kHz (EV1000-2S0007G:8kHz)	○
F3.11	CWF auto adjustment	0: Disabled 1: Enabled	1	1	○
F3.12	Motor tone	0~10	1	0	○
F3.13	Jog frequency	0.10~50.00Hz	0.01Hz	5.00Hz	○
F3.14	Jog interval	0.0~100.0s	0.1s	0.0s	○
F3.15	Jog Acc time	0.1~60.0s	0.1	6.0s	○
F3.16	Jog Dec time				
F3.17	Acc time 2	0.1~3600 (default unit: S, refer to F9.09)	0.1	6.0s	○
F3.18	Dec time 2				
F3.19	Acc time 3				
F3.20	Dec time 3				
F3.21	Acc time 4				
F3.22	Dec time 4				
F3.23	MS freq. 1	F0.13~ F0.12	0.01Hz	5.00Hz	○
F3.24	MS freq. 2			10.00Hz	
F3.25	MS freq. 3			20.00Hz	
F3.26	MS freq. 4			30.00Hz	

Group 3: Auxiliary Operating Parameters					
Para.	Name	Range	Unit	Default	Modification
F3.27	MS freq. 5	F0.13~ F0.12	0.01Hz	40.00Hz	
F3.28	MS freq. 6			45.00Hz	
F3.29	MS freq. 7			50.00Hz	
F3.30	Skip freq. 1	0.00~650.0Hz	0.01Hz	0.00Hz	×
F3.31	Skip freq. 1 range	0.00~30.00Hz	0.01Hz	0.00Hz	×
F3.32	Skip freq. 2	0.00~650.0Hz	0.01Hz	0.00Hz	×
F3.33	Skip freq. 2 range	0.00~30.00Hz	0.01Hz	0.00Hz	×
F3.34	Skip freq. 3	0.00~650.0Hz	0.01Hz	0.00Hz	×
F3.35	Skip freq. 3 range	0.00~30.00Hz	0.01Hz	0.00Hz	×

Group 4: PLC Parameters					
Para.	Name	Range	Unit	Default	Modification
F4.00	Simple PLC mode	One's place of F4.00, PLC running mode selection 0: Disabled 1: stop after a single cycle 2: Maintain value of the last stage after 1 cycle 3: continuous cycle Ten's place of F4.00: Restart mode after PLC interruption 0: start from the first stage 1: continue from the stage frequency where the drive stops 2: Start from the frequency where it stops Hundred's place of F4.00: Save PLC state after poweroff 0: not save 1: save Thousand's place: Selection of time unit 0: Second 1: Minute	1	0000	×

Group 4: PLC Parameters					
Para.	Name	Range	Unit	Default	Modification
F4.01	Stage 1 setting	One's place of F4.01: 0: select MS frequency 1, (F3.23) 1: decided by F0.00 2: MS close loop setting 1 (F5.20) 3: decided by F5.01  Ten's place of F4.01: running direction 0: forward 1: reverse 2: depends on Run command  Hundred's place of F4.01: Acc/Dec time selection 0: Acc/Dec time 1 1: Acc/Dec 2 2: Acc/Dec 3 3: Acc/Dec 4	1	000	○
F4.02	Stage 1 run time	0.0~6500	0.1	20.0	○

Group 4: PLC Parameters					
Para.	Name	Range	Unit	Default	Modification
F4.03	Stage 2 setting	One's place of F4.03: 0: select MS frequency 2, (F3.24) 1: decided by F0.00 2: MS close loop setting 2 (F5.21) 3: decided by F5.01  Ten's place of F4.03: running direction 0: forward 1: reverse 2: depends on Run command  Hundred's place of F4.03: Acc/Dec time selection 0: Acc/Dec time 1 1: Acc/Dec 2 2: Acc/Dec 3 3: Acc/Dec 4	1	000	○
F4.04	Stage 2 run time	0.0~6500	0.1	20.0	○



Group 4: PLC Parameters					
Para.	Name	Range	Unit	Default	Modification
F4.05	Stage 3 setting	One's place of F4.05: 0: select MS frequency 3, (F3.25) 1: decided by F0.00 2: MS close loop setting 3 (F5.22) 3: decided by F5.01  Ten's place of F4.05: running direction 0: forward 1: reverse 2: depends on Run command  Hundred's place of F4.05: Acc/Dec time selection 0: Acc/Dec time 1 1: Acc/Dec 2 2: Acc/Dec 3 3: Acc/Dec 4	1	000	○
F4.06	Stage 3 run time	0.0~6500	0.1	20.0	○

Group 4: PLC Parameters					
Para.	Name	Range	Unit	Default	Modification
F4.07	Stage 4 setting	One's place of F4.07: 0: select MS frequency 4, (F3.26) 1: decided by F0.00 2: MS close loop setting 4 (F5.23) 3: decided by F5.01  Ten's place of F4.07: running direction 0: forward 1: reverse 2: depends on Run command  Hundred's place of F4.07: Acc/Dec time selection 0: Acc/Dec time 1 1: Acc/Dec 2 2: Acc/Dec 3 3: Acc/Dec 4	1	000	○
F4.08	Stage 4 run time	0.0~6500	0.1	20.0	○

Group 4: PLC Parameters					
Para.	Name	Range	Unit	Default	Modification
F4.09	Stage 5 setting	One's place of F4.09: 0: select MS frequency 5, (F3.27) 1: decided by F0.00 2: MS close loop setting 5 (F5.24) 3: decided by F5.01  Ten's place of F4.09: running direction 0: forward 1: reverse 2: depends on Run command  Hundred's place of F4.09: Acc/Dec time selection 0: Acc/Dec time 1 1: Acc/Dec 2 2: Acc/Dec 3 3: Acc/Dec 4	1	000	○
F4.10	Stage 5 run time	0.0~6500	0.1	20.0	○

Group 4: PLC Parameters					
Para.	Name	Range	Unit	Default	Modification
F4.11	Stage 6 setting	One's place of F4.11: 0: select MS frequency 6, (F3.28) 1: decided by F0.00 2: MS close loop setting 6 (F5.25) 3: decided by F5.01  Ten's place of F4.11: running direction 0: forward 1: reverse 2: depends on Run command  Hundred's place of F4.11: Acc/Dec time selection 0: Acc/Dec time 1 1: Acc/Dec 2 2: Acc/Dec 3 3: Acc/Dec 4	1	000	○
F4.12	Stage 6 run time	0.0~6500	0.1	20.0	○

Group 4: PLC Parameters					
Para.	Name	Range	Unit	Default	Modification
F4.13	Stage 7 setting	One's place of F4.13: 0: select MS frequency 7, (F3.29) 1: decided by F0.00 2: MS close loop setting 7 (F5.26) 3: decided by F5.01  Ten's place of F4.13: running direction 0: forward 1: reverse 2: depends on Run command  Hundred's place of F4.13: Acc/Dec time selection 0: Acc/Dec time 1 1: Acc/Dec 2 2: Acc/Dec 3 3: Acc/Dec 4	1	000	○
F4.14	Stage 7 run time	0.0~6500	0.1	20.0	○

F5: Close-loop Control					
Para.	Name	Range	Unit	Default	Modification
F5.00	Close loop control	0: disabled 1: enabled	1	0	×
F5.01	Reference input method	0: digital setting Take the value of F5.05 if F5.02=1~5; Take the value of F5.06, if F5.02=6. 1: VCI (0~10V) 2: CCI Pay attention to the setting of jumper CN10. 3: Keypad 4: PULSE  Note: for speed close loop control, the analog input 10V or max. input pulse freq. F1.03 corresponds to the synch speed of F0.05.	1	1	○
F5.02	Feedback method	0: VCI analog voltage 0~10V 1: CCI analog input 2: VCI+CCI 3: VCI-CCI 4: Min {VCI,CCI} 5: Max {VCI, CCI} 6: pulse (PG close-loop single-phase or 2-phase feedback decided by terminal)	1	1	○
F5.03	Input filter	0.01~50.00s	0.01s	0.50s	○
F5.04	Feedback filter	0.01~50.00s	0.01s	0.50s	○
F5.05	Digital reference input	0.00V~10.00V	0.01	0.00	○
F5.06	Speed close loop setting	0~39000rpm	1	0	○

F5: Close-loop Control					
Para.	Name	Range	Unit	Default	Modification
F5.07	Pulse number per revolution of encoder	1~9999	1	1024	○
F5.08	Min. input	0.0%~(F5.10) (percentage of the min. input to 10V/20mA or F1.03 (max. pulse freq.))	0.1%	0.0	○
F5.09	Feedback of min. input	0.0~100.0%, (percentage of the min. input to 10V/20mA)	0.1%	20.0%	○
F5.10	Max. input	(F5.08)~100.0%(percentage of the max. input to 10V/20mA or F1.03 (max. pulse freq.))	0.1%	100.0%	○
F5.11	Feedback of max. input	0.0~100% (percentage of the max. input to 10V/20mA)	0.1%	100.0%	○
F5.12	Proportional gain Kp	0.000~9.999	0.001	0.050	○
F5.13	Integral gain Ki	0.000~9.999	0.001	0.050	○
F5.14	Sampling cycle T	0.01~50.00s	0.01s	0.50s	○
F5.15	Error limit	0.0~20.0% (based on close-loop reference)	0.1%	2.0%	○
F5.16	Close-loop regulation characteristic	0: Positive logic 1: Negative logic Note: it is the relationship between reference and speed.	1	0	×
F5.17	Integral regulation	0: Stop integral regulation when the frequency reaches the upper or lower limits 1: Continue the integral regulation when the frequency reaches the upper or lower limits	1	0	×
F5.18	Preset frequency	0.00~650.0Hz	0.01Hz	0.00Hz	○

F5: Close-loop Control					
Para.	Name	Range	Unit	Default	Modification
F5.19	Preset frequency hold time	0.0~3600s	0.1s	0.0s	×
F5.20	MS close-loop setting 1	0.00V~10.00V	0.01V	0.00V	○
F5.21	MS close-loop setting 2	0.00V~10.00V	0.01V	0.00V	○
F5.22	MS close-loop setting 3	0.00V~10.00V	0.01V	0.00V	○
F5.23	MS close-loop setting 4	0.00V~10.00V	0.01V	0.00V	○
F5.24	MS close-loop setting 5	0.00V~10.00V	0.01V	0.00V	○
F5.25	MS close-loop setting 6	0.00V~10.00V	0.01V	0.00V	○
F5.26	MS close-loop setting 7	0.00V~10.00V	0.01V	0.00V	○



Group 6: Traverse Operating Parameter					
Para.	Name	Range	Unit	Default	Modification
F6.00	Traverse function selection	0: disabled 1: enabled	1	0	×
F6.01	Traverse mode	One's place of F6.01: transfer mode 0: auto (according to F6.03) 1: terminal configuration (manually) Ten's place of F6.01: amplitude control 0: varied amplitude 1: fixed amplitude Hundred's place of F6.01: start/stop mode 0: start to the state before stop 1: just restart, no other requirement Thousand's place of F6.01: save traverse state upon power failure 0: save 1: not save	1	0000	×
F6.02	Preset traverse frequency	0.00Hz~650.0Hz	0.01Hz	0.00Hz	○
F6.03	Preset traverse frequency hold time	0.0~3600.0s	0.1s	0.0s	○
F6.04	Traverse amplitude	0.0~50.0%(based on central freq.)	0.1%	0.0%	○
F6.05	Step freq.	0.0~50.0%(based on F6.04)	0.1%	0.0%	○
F6.06	Traverse cycle	0.1~999.9s	0.1s	10.0s	○
F6.07	Rise time of triangular wave	0.0~100.0%(traverse cycle)	0.1%	50.0%	○

Note: ① The central frequency of traverse operation is default as present reference frequency. The traverse setting becomes invalid for close-loop and jog.

Group 7: Multi-function Terminals					
Para.	Name	Range	Unit	Default	Modification
F7.00	Function of multi-function terminal X1	0: No function 1: MS frequency 1 2: MS frequency 2 3: MS frequency 3			
F7.01	F7.01 Function of multi-function terminal X2	4: Acc/Dec time 1 5: Acc/Dec time 6: External fault normally-open input 7: External fault normally-close input	1	0	×
F7.02	Function of multi-function terminal X3	8: RESET signal 9: Forward jog (JOGF) 10: Reverse jog (JOGR) 11: Coast-to-stop(FRS) 12: Frequency increase (UP) 13: Frequency decrease (DN)			

Group 7: Multi-function Terminals						
Para.	Name	Range	Unit	Default	Modification	
F7.03	Function of multi-function terminal X4	14: PLC operation pause				
		15: Acc/Dec prohibit				
		16: 3-wire operation control				
		17: External interrupt signal normally-open input				
		18: External interrupt signal normally-close input				
		19: DC injection braking command (DB)				
		20: Disable close-loop				
		21: Disable PLC		1	0	×
		22: Frequency setting method 1				
		23: Frequency setting method 2				
		24: Frequency setting method 3				
		25: Reference freq. is input via terminal CCl				
		26: Reserved				
		27: Enable terminal control mode				
		28: Control mode 1				
		29: Control mode 2				
		30: MS close-loop mode 1				
		31: MS close-loop mode 2				
		32: MS close-loop mode 3				
		33: Start traverse operation				
34: Reset the traverse operating status						
35: External stop command						

Group 7: Multi-function Terminals					
Para.	Name	Range	Unit	Default	Modification
F7.04	Function of multi-function terminal X5	36: Reserved 37: Drive operation prohibiting 38: Reserved 39: Clear length 40: Clear auxiliary reference frequency 41: Reset PLC Stop status 42: Clear counter's record 43: Signal of triggering counter 44: Input the signal of length 45: Pulse input 46: Single-phase speed measuring 47: Speed measuring input SM1(only for X4) 48 Speed measuring input SM2(only for X5)	1	0	×
F7.05	Reserved	-	-	-	-
F7.06	Reserved	-	-	-	-
F7.07	Reserved	-	-	-	-
F7.08	FWD/REV operating modes setup	0: 2-wire operating mode 1 1: 2-wire operating mode 2 2: 3-wire operating mode 1 3: 3-wire operating mode 2	1	0	×
F7.09	UP/DN rate	0.01~99.99Hz/s	0.01Hz/s	1.00Hz/s	○

Group 7: Multi-function Terminals					
Para.	Name	Range	Unit	Default	Modification
F7.10	Open collector output terminal Y1	0: Drive running signal (RUN) 1: Frequency arrival 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 Stop command (EXT)	1	0	×
F7.11	Open collector output terminal Y2	7: Higher 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 arrival 13: Specified counting value arrival	1	1	×

Group 7: Multi-function Terminals					
Para.	Name	Range	Unit	Default	Modification
F7.12	Relay output function	14: Preset length arrival 15: Drive ready (RDY) 16: Drive fails 17: Extended function 1 of host 18: Upper and lower limits of traverse frequency 19: Preset operation time out 20: Freq. before slip compensation (0~Max. output freq.) 21: Freq. after slip compensation (0~Max. output freq.) 22: Preset freq. (0~Max. output freq.) 23: Oupput current (0~2 times of drive's rated current) 24: Oupput current (0~2 times of motor's rated current) 25: Output torque (0~2 times motor's rated torque ) 26: Output voltage (0~1.2 times drive's rated voltage) 27: Bus voltage (0~800V) 28: VCI (0~10V) 29: CCI (0~10V/0~20mA) 30: Output power (0~2 times rated power) 31: Extended function 2 of host 2 (0~65535) 32: Potentiometer setting Note: 20~32 are special for Y2.	1	16	×

Group 7: Multi-function Terminals					
Para.	Name	Range	Unit	Default	Modification
F7.13	Freq. arrival detection range (FAR)	0.00~650.0Hz	0.01Hz	2.50Hz	○
F7.14	FDT1 level	0.00~650.0Hz	0.01Hz	50.00Hz	○
F7.15	FDT1 lag	0.00~650.0Hz	0.01Hz	1.00Hz	○
F7.16	FDT2 level	0.00~650.0Hz	0.01Hz	25.00Hz	○
F7.17	FDT2 lag	0.00~650.0Hz	0.01Hz	1.00Hz	○
F7.18~ F7.25	Reserved	-	-	0	*
F7.26	AO1 output function	0: Output freq. before compensation (0~max. output freq.) 1: Output freq. after compensation (0~maxoutput freq.) 2: Preset freq. (0~max. output freq.) 3: Output current (0~2 times of drive's rated current) 4: Output current (0~2 times of motor's rated current)	1	0	○

5: Output torque (0~2 times motor's 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 rated power)

11: Extended function 2 of host (0~65535)

12: Setting of potentiometer (0~10V)

Group 7: Multi-function Terminals					
Para.	Name	Range	Unit	Default	Modification
F7.27	AO2 output function		1	3	○
F7.28	Reserved	-	-	-	-
F7.29	Analog output range	One's place of F7.29: AO1 bias 0: 0~10V or 0~20mA 1: 2~10V or 4~20mA Ten's place of F7.29: AO2 bias 0: 0~10V or 0~20mA 1: 2~10V or 4~20mA	1	00	○



Group 7: Multi-function Terminals					
Para.	Name	Range	Unit	Default	Modification
F7.30	AO1 output gain	0.0~200.0%	0.1%	100.0%	○
F7.31	AO2 output gain	0.0~200.0%	0.1%	100.0%	○
F7.32	Y2 max. pulse freq.	0.1~50.0 kHz	0.1	10.0k	○
F7.33	Preset counting value	F7.34~9999	1	0	○
F7.34	Specified counting value	0~F7.33	1	0	○
F7.35	Positive or negative logic of terminal	<p>Positive logic: Xi connects with common terminal is valid, otherwise invalid.</p> <p>Negative logic: Xi connects with common terminal is invalid, otherwise valid.</p> <p>One's place of F7.35: BIT0~BIT3: X1~X4</p> <p>One's place of F7.35: BIT0: X5 BIT1~BIT3: Reserved</p> <p>Hundred's place of F7.35: BIT0~BIT1: FWD、REV BIT2~BIT3: Y1、Y2</p>	1	000	○

Group 8: Display Control Parameters					
Para.	Name	Range	Unit	Default	Modification
F8.00	Accumulated length	0~999.9km Note: This parameter can be viewed or cleared only.	0.1km	0	○
F8.01	LED displayed parameter selection 1	Binary code implication: 0: not displayed 1: displayed One's place BIT0: output freq. (Hz) (before compensation) BIT1: output freq. (Hz) (after compensation) BIT2: reference freq. (Hz indicator blink) BIT3: output current (A) Ten's place BIT0: rotating speed (r/min) BIT1: preset rotating speed (r/min indicator blink) BIT2: actual line speed (m/s) BIT3: preset line speed (m/s indicator blink) Hundred's place: BIT0: output power BIT1: output torque (%) Note: if the setting is 0, the default display is operating freq. before compensation.	1	3FF	○

Group 8: Display Control Parameters					
Para.	Name	Range	Unit	Default	Modification
F8.02	LED displayed parameter selection 2	Binary code implication: 0: not displayed 1: displayed One's place BIT0: output voltage (V) BIT1: bus voltage BIT2: VCI (V) BIT3: CCI (V) Hundred's place BIT0: analog close-loop feedback (%) BIT1: Analog close-loop setup (%blink) BIT2: external counter value (no unit) BIT3: terminal status (no unit) Hundred's place: BIT0: actual length BIT1: preset length BIT2: accumulated length	1	000	○

Group 8: Display Control Parameters					
Para.	Name	Range	Unit	Default	Modification
F8.03	Displayed Parameter at Stop state	Binary code implication: 0: not displayed 1: displayed One's place BIT0: reference frequency ( Hz) BIT1: external counter value (no unit) BIT2: rotating speed (r/min) BIT3: preset rotating speed ( r/min) Ten's place: BIT0: actual line speed ( m/s) BIT1: preset 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: actual length BIT3: preset length Thousand's place: BIT0: terminal state (no unit) BIT1: bus voltage BIT2: accumulated length Note: if the setting is 0, the default display is operating freq. before compensation.	1	1FF	○

Group 8: Display Control Parameters					
Para.	Name	Range	Unit	Default	Modification
F8.04	Rotating speed display factor	0.1~999.9% Mechanical speed=measured speed×F8.04 ( PG) Mechanical speed =120×actual freq.÷FH.00×F8.04 (non-PG) Preset speed=preset close-loop speed×F8.04 (PG) Preset speed=120×ref. Freq.÷FH.00×F8.04 (non-PG) Note: it has no effect on actual speed.	0.1%	100.0%	○
F8.05	Line speed factor	0.1~999.9% Line speed=actual freq.×F8.05 (non-PG) Line speed=mechanical speed×F8.05 ( PG) Preset line speed=preset freq.×F8.05 (non-PG) Preset line speed=preset speed×F8.05 ( PG) Note: it has no effect on actual speed.	0.1%	1.0%	○
F8.06	Close-loop analog display factor	0.1~999.9% Note: close-loop analog input/feedback display range: 0~999.9	0.1%	100.0%	○

Group 9: Enhanced Function					
Para.	Name	Range	Unit	Default	Modification
F9.00	Operating command bundled with freq. setting method	<p>One's place: in keypad control mode</p> <p>0: no binding</p> <p>1: digital setting 1 (adjust by ▲ and ▼ key)</p> <p>2: digital setting 2 (adjust by terminal UP/DN)</p> <p>3: digital setting 3 (adjust by serial port )</p> <p>4: VCI analog setting</p> <p>5: CCI analog setting</p> <p>6: Terminal pulse setting</p> <p>7: Potentiometer</p> <p>Ten's place: in terminal control mode</p> <p>0~7: the same with the above.</p> <p>Hundred's place: in serial port control mode</p> <p>0~7: the same with the above.</p>	1	000	○

Group 9: Enhanced Function					
Para.	Name	Range	Unit	Default	Modification
F9.01	Auxiliary freq. setting method	0: No auxiliary freq. 1: Digital setting 1, adjust by ▲ and ▼ 2: Digital setting 2, adjust by UP/DN 3: Digital setting 3, set by serial port 4: VCI analog setting 5: CCI analog setting 6: terminal pulse setting 7: - VCI analog setting 8: - CCI analog setting 9: - terminal pulse setting 10: VCI-5 11: CCI-5 12: PULSE-0.5×F1.03 13: Potentiometer Note: it is invalid if it is the same with main freq. setting method For the setting of 4~12, it depends on F1.00	1	0	○
F9.02	Auxiliary reference factor	0.00~9.99 (only for F9.01=4~12)	0.01	1.00	○
F9.03	Digital auxiliary ref.	0.00~650.0Hz	0.01	0.00Hz	○

Group 9: Enhanced Function					
Para.	Name	Range	Unit	Default	Modification
F9.04	Digital auxiliary ref. control	One's place: save auxiliary freq. at power-off 0: save 1: not save  Ten's place: 0: maintain the aux. Freq. after stop 1: clear the aix. Freq. after stop  Hundred's place: 0: positive sign 1: negative sign  Note: valid when F9.01=1, 2, 3.	1	000	○
F9.05	Preset freq.adjust mode	0: disabled 1: adjust based on F005 2: adjust based on current freq.	1	0	○
F9.06	Factor for calculating preset freq.	0.0%~200.0%	0.1%	100.0%	○



Group 9: Enhanced Function					
Para.	Name	Range	Unit	Default	Modification
F9.07	STOP/RESET key's function and keypad lock	<p>One's place: STOP/RESET key function</p> <p>0: valid only in keypad control mode</p> <p>1: valid in keypad, terminal, serial port mode, to stop the drive in specified manner</p> <p>2: to stop the drive in keypad control mode in specified manner, for other control mode, display E015 fault and coast to stop</p> <p>Ten's place: Reserved</p> <p>Hundred's place: keypad lockup</p> <p>0: disabled</p> <p>1: all keys locked</p> <p>2: all keys locked except STOP/RESET</p> <p>3: all keys locked except ►►</p> <p>4: all keys locked except RUN, STOP/RESET</p>	1	000	×
F9.08	Reserved	-	-	-	-
F9.09	Acc/Dec time unit	<p>0: second</p> <p>1: minute</p>	0	0	×
F9.10	Droop control	0.00~10.00Hz	0.01Hz	0.00Hz	○
F9.11	High usage of bus voltage	<p>0: disabled</p> <p>1: enabled</p>	1	1	×
F9.12	Zero freq. threshold	0.00~650.00Hz	0.01Hz	0.00Hz	○
F9.13	Zero freq. hysteresis	0.00~650.00Hz	0.01Hz	0.00Hz	○
F9.14	Preset length	0.000 (function disabled)~65.535 ( km)	0.001 (km)	0.000 ( km)	○

Group 9: Enhanced Function					
Para.	Name	Range	Unit	Default	Modification
F9.15	Actual length	0.000~65.535 ( km) (save after power off)	0.001 ( km)	0.000 ( km)	○
F9.16	Length factor	0.001~30.000	0.001	1.000	○
F9.17	Length calibration	0.001~1.000	0.001	1.000	○
F9.18	Shaft circumference	0.01~100.00 ( cm)	0.01 ( cm)	10.00 ( cm)	○
F9.19	Pulse per revolution	1~9999	1	1	○
F9.20	Low voltage compensation	0: disabled 1: enabled (low voltage compensation)	1	0	×
F9.21	Freq. decrease rate during voltage compensation	0.00~99.99Hz/s	0.01Hz/s	10.00Hz/s	○
F9.22	Conditions of restart after power failure	0: disabled 1: enabled	1	0	×
F9.23	Restart delay after power failure	0.0~10.0s	0.1s	0.5s	○

 **Note:**

Actual length (km) = counting value × F9.18 ÷ F9.19 × F9.16 ÷ F9.17 ÷ 100 ÷ 1000.

Group FA: Reserved					
Para.	Name	Range	Unit	Default	Modification
FA.00~FA.11	Reserved	-	-	0	*

Group FF: Communication Parameters					
Para.	Name	Range	Unit	Default	Modification
FF.00	Communication config	One's place: baud rate 0: 300BPS 1: 600BPS 2: 1200BPS 3: 2400BPS 4: 4800BPS 5: 9600BPS 6: 19200BPS 7: 38400BPS  Ten's place: data format 0: 1-8-1 format, no parity 1: 1-8-1 format, even parity check 2: 1-8-1 format, odd parity check  Hundred's place: virtual input terminal 0: disabled 1: enabled  Thousand's place: connection mode 0: direct connection (RS485) 1: MODEM (RS485-RS232 adapter required)	1	0005	×
FF.01	Local address	0~126, 127 broadcast address	1	1	×
FF.02	Communcation time out detect	0.0~1000s	0.1	0.0s	×
FF.03	Response delay	0~1000ms	1	5ms	×

Group FH: Motor's Parameters					
Para.	Name	Range	Unit	Default	Modification
FH.00	Motor's poles	2~14	2	4	×
FH.01	Rated power	0.4~999.9kW	0.1kW	Depending on model	×
FH.02	Rated current	0.1~999.9A	0.1A	Depending on model	×
FH.03	Current without load $I_0$	0.1~999.9A	0.1A	Depending on model	×
FH.04	Stator resistance %R1	0.00%~50.00%	0.01%	Depending on model	○
FH.05	Leakage inductance %Xl	0.00%~50.00%	0.01%	Depending on model	○
FH.06	Rotor resistance %R2	0.00%~50.00%	0.01%	Depending on model	○
FH.07	Mutual inductance %Xm	0.0%~2000%	0.1%	Depending on model	○
FH.08	Rated slip frequency	0.00~20.00Hz	0.01Hz	0.00Hz	○
FH.09	Auto tuning	0: disabled 1: auto tuning (motor stop) 2: auto tuning (motor rotating)	1	0	×
FH.10	Motor stabilization factor	0~255	1	Depending on model	○
FH.11~FH.21	Reserved	-	-	0	*

Group FL: Protection Parameters					
Para.	Name	Range	Unit	Default	Modification
FL.00	Motor 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 factor	20.0~110.0%	0.1%	100.0%	×
FL.02	Stall over voltage	0: disabled (when braking resistor installed) 1: enabled	1	1	×
FL.03	Stall over voltage point	380V: 120.0~150.0% 220V: 110.0~130.0%	0.1%	140.0% 120.0%	×
FL.04	Overload detection config	One's place of FL.04: overload detection mode 0: the detection is done as long as the drive is operating. 1: the detection is done only when the drive works at constant speed. Ten's place of FL.04: action mode 0: The overload is ignored, no alarm. 1: During "Overload Alarm Effective Period", the drive will alarm and stop operation. Hundred's place of FL.04: reference current 0: the overload detection threshold (FL.05) is set based on motor's rated current. Fault code E014. 1: the overload detection threshold (FL.05) is set based on drive's rated current. Fault code E013.	1	000	×

Group FL: Protection Parameters					
Para.	Name	Range	Unit	Default	Modification
FL.05	Overload detection threshold	G type: 20.0%~180.0% P type: 20.0%~130.0%	0.1%	130.0% 120.0%	×
FL.06	Overload alarm delay	0.0~60.0s	0.1s	5.0s	×
FL.07	Auto current limiting threshold	G type: 20.0%~180.0% P type: 20.0%~130.0%	0.1%	150.0% 110.0%	×
FL.08	Freq.decrease rate rate during current limiting	0.00~99.99Hz/s	0.01Hz/s	10.00Hz/s	○
FL.09	Action mode of auto current limiting	0: disabled; 1: effective during acceleration or deceleration but ineffective at constant speed, no silencing function; 2: effective all the time, no silencing function; 3: effective during acceleration or deceleration but ineffective at constant speed, with silencing function; 4: effective all the time, with silencing function.	1	2	×
FL.10	Auto reset times	0~10, 0: disabled Note: for external device fault, no auto reset function	1	0	×
FL.11	Auto reset interval	2.0~20.0s	0.1s	5.0s	×

Group FL: Protection Parameters					
Para.	Name	Range	Unit	Default	Modification
FL.12	Protective action mode 1	One's place: action if communication fault 0: alarm and coast to stop 1: not alarm and continue the operation 2: not alarm and stop in specified manner (only for serial port control mode) 3: not alarm and stop in specified manner (all control modes)  Ten's place: Reserved  Hundred's place: E <sup>2</sup> PROM fault action 0: alarm and coast to stop 1: not alarm and continue the operation	1	001	×
FL.13	Protective action mode 2	One's place: undervoltage fault indication 0: disabled 1: enabled  Ten's place: auto reset interval fault indication 0: disabled 1: enabled  Hundred's place: fault lockup 0: disabled 1: enabled (without fault indication) 2: enabled (with fault indication)  Thousand's place: output phase loss action 0: disabled 1: enabled	1	0000	×

Group FL: Protection Parameters					
Para.	Name	Range	Unit	Default	Modification
FL.14	Fault type of the first time	0: not fault 1: overcurrent during acceleration (E001) 2: overcurrent during deceleration (E002)			
FL.15	Fault type of the second time	3: overcurrent during constant-speed running (E003) 4: overvoltage during acceleration (E004) 5: overvoltage during deceleration (E005) 6: overvoltage during constant-speed running ( E006) 7: drive's control power supply overvoltage (E007) 8: Reserved			
FL.16	Fault type of the third time (latest)	9: output phase loss (E009) 10: Reserved 11: heatsink overheat (E011) 12: Reserved 13: drive overload (E013) 14: motor overload (E014) 15: emergency stop or external device fault (E015) 16: E <sup>2</sup> PROM fault (E016) 17: RS485 communication fault (E017) 18: Reserved 19: current-detection circuit fault (E019) 20: System disterbed ( E020) 21: Reserved 22: Reserved 23: Reserved 24: Auto tuning fault ( E024)	1	0	*



Group FL: Protection Parameters					
Para.	Name	Range	Unit	Default	Modification
FL.17	Bus voltage at the last fault	0~999V	1V	0V	*
FL.18	Output current at the last fault	0.0~999.9A	0.1A	0.0A	*
FL.19	Freq. at the last fault	0.00Hz~650.0Hz	0.01Hz	0.00Hz	*

Group Fn: Operating Time					
Para.	Name	Range	Unit	Default	Modification
Fn.00	Preset operating time	0~65.535K hours	0.001k hour	0	○
Fn.01	Total operating time	0~65.535K hours	0.001k hour	0	*
Fn.02	Reserved	-	-	-	-
Fn.03	Reserved	-	-	-	-

FP: Protection of Parameters					
Para.	Name	Range	Unit	Default	Modification
FP.00	User password	0: no password other number: user's password	0	0	○

FP: Protection of Parameters					
Para.	Name	Range	Unit	Default	Modification
FP.01	Write-in protection	0: All parameters are allowed to be changed; 1: No parameters can be changed except the F0.02 and FP.01; 2: No parameters can be changed except FP.01.	1	1	○
FP.02	Parameter initialization	0: disabled 1: clear fault record Clear the contents of FL.14~FL.19. 2: restore to factory defaults (parameters listed before FL.14, excluding F0.08 and FH.00)	1	0	×
FP.03	Reserved	-	-	-	-
FP.04	Reserved	-	-	-	-

FU: Factory Password					
Para.	Name	Range	Unit	Default	Modification
FU.00	Factory password	****	1	Factory setting	-

## Appendix 2 Communication Protocol

### 1. Networking Mode

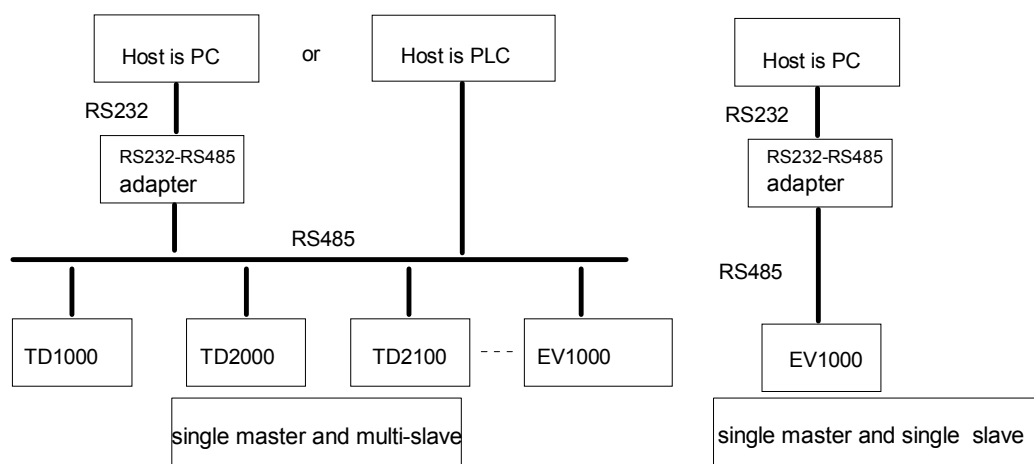


Fig. 1 Networking Diagram

### 2. Communication Mode

RS485: asynchronous, semi-duplex

Default: 8-N-1, 9600bps. See Group FF for parameter settings.

- 1) The drive is a slave device. Communication is in 'point to point' mode. The slave will not response to the command sent by the master drive in broadcast address.
- 2) Users can set the drive's current address, baud rate and data format by using slave' keypads or using the serial communication mode.
- 3) The slave can report the current fault information when it responses to the polling done by the master drive.

### 3. Protocol Format

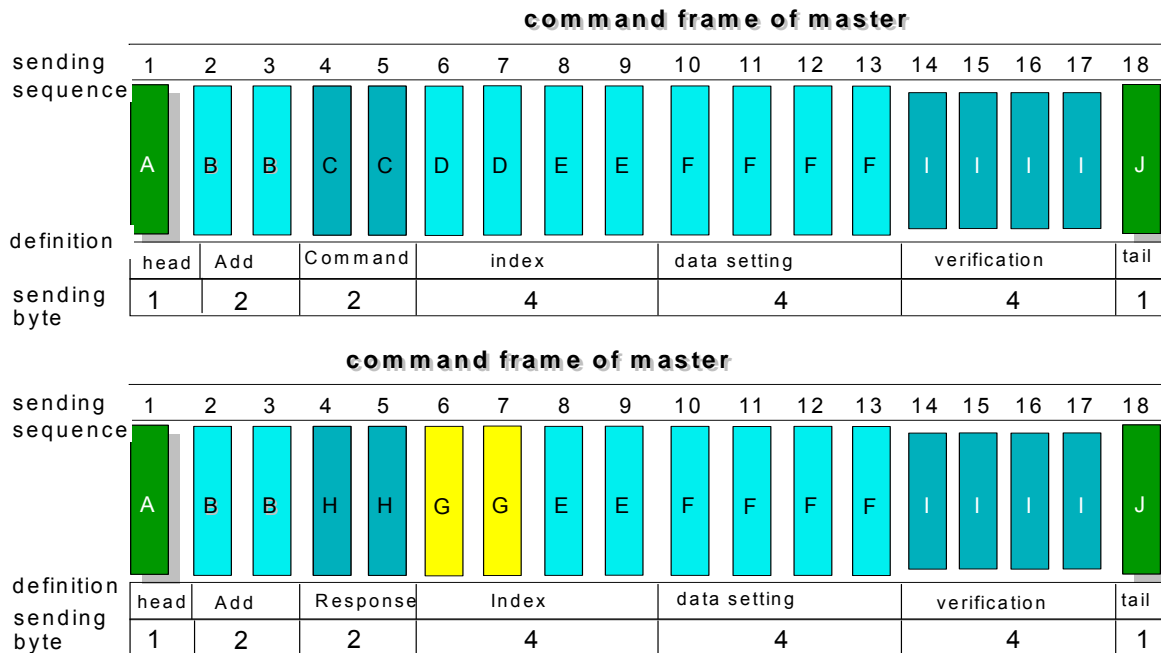


Fig. 2 Protocol Format

In the above figure, where:

“Configuration data section” and “operation data section” may not exist in the concrete protocol frame. They are labeled with “NULL” in the protocol list.

In the protocol, the effective characters are: ~, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F and hex ODH. and the lower-case ASCII letters such as a, b, d, e, f are invalid.

The frame for effective command has 14 or 18 bytes. Sometimes, the response frame has 10 bytes. For example, with an invalid command or data overflow, the response frame has 10 bytes.

EV 1000 Series only supports commands of Group 3 and 4 ‘temporarily’ so as to support the basic operating functions of the host software you developed before. If you develop new host communication software, please use Group 6 and 7 commands instead of Group 3~4..

#### 4. Explanations of Format

##### 1) Head of Frame

“~” (That is hex number of 7E.) Single byte.

##### 2) Address of Slave

Definition of Data: the slave’s address. Two bytes, ASCII format.

Configuration range: “00”~”7F”. “7F” is communication broadcast address. The factory-setting of the drive is 01.

##### 3) Response of Slave to Master Drive’s Command

Definition of Data: The response of slave to the command sent by the Master Drive. Two Bytes. ASCII Format.

Classification of Parameters:

Command Code =00: Master drive asks Slave to feed back the current status (ready or not ready) and control status.

Table 2 Response Code of Command Code "00"

Response ASCII	Meaning		
	Slave staus	Host contol allowed	Frequency setting allowed
10	Not ready	/	
11	Ready	YES	YES
12	Ready	YES	NO
13	Ready	NO	YES
14	Ready	NO	NO
20	Frame error		

**Command Code 01~07**

Response Code "00" means:

Communication and control of slave computer is normal. The changes of parameters are valid. The password is correct.

Response Code "20" means:

The frame verified to be incorrect. The data of "Command Section" and "Index Section overflow.

Incorrect Frame length/there are characters which are not ASCII besides frame head and frame tail.

Note: Report whether the response code is related to the current configuration status of the slave. Refer to the notes of "command code = 5". When reporting the response code, data in "command section", "index section" and "operation data section" will not be reported.

Frame length: 10 bytes

Response Code=30 means:

The control command to the slave is inactive. The changes of parameters are invalid. The data in "configuration/operation data" section overflow. The password is incorrect.

Note: Report whether the response code is related to the current configuration status of the slave. Refer to the notes of "command code = 5". When reporting the response code, data in "command section", "index section" and "operation data section" will be reported according to the requirements of the protocol.

**4) Index Section**

Data: Auxiliary index bytes and command index bytes are included.

For master drive, auxiliary index and command index are used to cooperate with the master computers to accomplish operating functions.

For slave computers, auxiliary index is used to report malfunction status code. The command code will not be changed but reported directly.

Data type: Hex, four bytes. ASCII format.

Command code uses the lower two bytes, data range: "00"~"FF".

Auxiliary code uses the higher two bytes, data range: 00~FF.

The malfunction status of the slave will take up "auxiliary index" byte, to see table 2.

Table 3 Fault Type

Fault Index	Description	Fault Index	Description
01	Overcurrent when accelerating	02	Overcurrent when decelerating
03	Overcurrent at constant speed	04	Overvoltage when accelerating
05	Overvoltage when decelerating	06	Overvoltage at constant speed

Fault Index	Description	Fault Index	Description
07	Control power supply overvoltage	08	Reserved
09	Phase loss at input side	10	Reserved
11	Heatsink overheat	12	Reserved
13	Drive overload	14	Motor overload
15	External device fault or emergency stop	16	E <sup>2</sup> PROM damaged
17	Serial communication fault	18	Reserved
19	Current detection circuit fault	20	System interference
21	Reserved	22	Reserved
23	Reserved	24	Self-tuning fault

## 6) Frame Tail

Hex OD, Single byte.

## 5) Checksum

Meaning of Data: Frame check. Four bytes. ASCII.

Calculation method: To sum up the ASCII values of all the bytes from "slave address" to "operation data".

## 5. Command list of protocols

In the following table, frame head 7E, frame tail OD, address and checksum are omitted. The format is ASCII character.


 **Note** For those parameters that are constantly modified, such as reference frequency, Acc/Dec time, MS frequency, close loop setting, auxiliary frequency set by serial port, please use command 08 to avoid damaging E<sup>2</sup>PROM. If command 07 is used, when the write-in times exceed the life to the E<sup>2</sup>PROM (about 100 thousand times), it will be unavailable and then E016 alarm will occur.

Table 4 Protocol Command List

Name	Host Command	Secondary index	Command Index	Data Range	Host control ( C lanuguage, character string format, slave address 01 )	Data accuracy	Description
Inquire slave status	00	00	00	None	~010000000181\r	1	See table 2
Read Slave Status	Present actual frequency	01	00	00	None	~010100000182\r	0.01 Hz
	Reference frequency	01	00	01	None	~010100010183\r	0.01 Hz
	Output voltage	01	00	02	None	~010100020184\r	1V
	Output current	01	00	03	None	~010100030185\r	0.1A
	Parameter (on unit)	01	00	04	None	~010100040186\r	1

Name		Host Command	Secondary index	Command Index	Data Range	Host control ( C lanuguage, character string format, slave address 01 )	Data accuracy	Description
Read Slave Parameter	Set speed	01	00	05	None	~010100050187\r	1rpm	
	Actual line speed	01	00	06	None	~010100060188\r	0.01 m/Min	
	Set line speed	01	00	07	None	~010100070189\r	0.01 m/Min	
	Close loop feedback of analog close loop control	01	00	08	None	~01010008018A\r	0.01V	
	Close loop setting of analog close loop control	01	00	09	None	~01010009018B\r	0.01V	
	External counter value	01	00	0A	None	~0101000A0193\r	1	
	Output torque	01	00	0B	None	~0101000B0194\r	0.1%	
	I/O status	01	00	0C	None	~0101000C0195\r	1	Bit0~4: X1~X5, Bit5~7 reserved Bit8~14: Y1, Y2, TC, fan, braking signal, FWD, REV



Name		Host Command	Secondary index	Command Index	Data Range	Host control ( C lanuguage, character string format, slave address 01 )	Data accuracy	Description
	Present status	01	00	0D	None	~0101000D0196\r	1	
	Frequency after compensation	01	00	14	None	~010100140187\r	0.01 Hz	
Operating control	Slave power-on	02	00	00	None	~010200000183\r	None	
	Slave actual frequency	02	00	01	0Hz~upper limit	~0102000103E80264\r	0.01 Hz	Reference frequency =10.00Hz
	Slave power-on with reference frequency given	02	00	02	0Hz~upper limit	~0102000203E80265\r	0.01 Hz	Reference frequency =10.00Hz
	Slave power-on, forward	02	00	03	None	~010200030186\r	None	
	Slave power-on, reverse	02	00	04	None	~010200040187\r	None	

Name		Host Command	Secondary index	Command Index	Data Range	Host control ( C lanuage, character string format, slave address 01 )	Data accuracy	Description
Operating control	Slave power-on, forward, with reference frequency given	02	00	05	0Hz~upper limit	~0102000503E80268\r	0.01 Hz	Reference frequency =10.00Hz
	Slave power-on, reverse, with reference frequency given	02	00	06	0Hz~upper limit	~0102000603E80269\r	0.01 Hz	Reference frequency=10.00Hz
	Slave stops	02	00	07	None	~01020007018A\r	None	
	Slave jog	02	00	08	None	~01020008018B\r	None	
	Slave jog, forward	02	00	09	None	~01020009018C\r	None	
	Slave jog, reverse	02	00	0A	None	~0102000A0194\r	None	
	Slave stop jogging	02	00	0B	None	~0102000B0195\r	None	
	Slave fault reset	02	00	0C	None	~0102000C0196\r	None	

Name	Host Command	Secondary index	Command Index	Data Range	Host control ( C lanuguage, character string format, slave address 01 )	Data accuracy	Description	
Operating control	Slave coast to stop	02	00	0D	None	~0102000D0197\r	None	
	Slave emergency stop	02	00	0E	None	~0102000E0198\r	None	
	Set analog output AO1	02	00	13	0~FFFF	~0102001333330253\r	0~65535 correspond to 0~100%	Set AO1 output: 20%
	Set analog output AO2	02	00	14	0~FFFF	~0102001433330254\r	0~65535 correspond to 0~100%	Set AO2 output: 20%
	Set digital output Y2	02	00	15	0~FFFF	~0102001533330255\r	0~65535 correspond to 0~100%	Set Y2 output: 20%*F7.32 Hz
	Percentage of frequency (reserved)	02	00	16	0~7D0	~0102001603E8026A\r	0.1%	Percentage of frequency: 100%

Name		Host Command	Secondary index	Command Index	Data Range	Host control ( C lanuguage, character string format, slave address 01 )	Data accuracy	Description
	Set analog control terminal status	02	00	17	0~FFFF	~01020017FFFF02A3\r	1	bit0~4: virtual terminal X1~X5, BIT8~12, FWD, REV, Y1, Y2, TC
Read parameter (temporary)	Frequency digital setting F0.02	03	00	01	None	~010300010185\r	0.01 Hz	
	Rotation direction setting F0.04	03	00	03	None	~010300030187\r	1	
	Acc time 1: F0.10	03	00	09	None	~01030009018D\r	0.1s	
	Dec time 1: F0.11	03	00	0A	None	~0103000A0195\r	0.1s	
	Digital setting F5.05	03	00	66	None	~010300660190\r	0.01V	
	Digital frequency setting F0.02	04	00	01	0~upper limit	~0104000103E80266\r	0.01 Hz	
	Rotation direction F0.04	04	00	03	0、1	~0104000300010249\r	1	
	Acc time 1 F0.10	04	00	09	0~8CA0	~0104000903E8026E\r	0.1s	

Name		Host Command	Secondary index	Command Index	Data Range	Host control ( C lanuguage, character string format, slave address 01 )	Data accuracy	Description
Read parameter (temporary)	Dec time 1 F0.11	04	00	0A	0~8CA0	~0104000A03E80276\r	0.1s	
	Digital setting F5.05	04	00	66	0~03E8	~0104006603E80271\r	0.01V	
	Speed close loop setting F5.06	04	00	6C	0~9858	~0104006C03E8027E\r	1rpm	
Config/query	Slave response type	05	00	00	0~7	~010500000007024D\r	1	
	Inquire slave model and software version	05	00	01	0~FFFF	~010500010187\r	1	
Read parameters	06	See table 6	None	See table 6				
Set parameters	07 (08)	See table 7	0~FFFF	See table 7				

Table 5 Status Word's Meaning

Bit	Meaning		
	Description	0	1
bit0	Stop/run status	Stop	Run
bit1	Undervoltage flag	Normal	undervoltage
bit2~6	Reserved		
bit7	Count value arrives	Invalid	Valid
bit8	Preset count value arrive flag	Invalid	Valid
bit9	Traverse mode	No	Yes
bit10	FWD/REV status	Forward	Reverse
bit11	PI close loop	No	Yes
bit12	Simple operating mode	No	Yes
bit13	Jog	No	Yes
bit14	PLC mode	No	Yes
bit15	MS mode	No	Yes

The "read parameter" command applies to all parameters of EV1000 series except user password.

Table 6 Reading Slave's Parameter Values

Function	Read all slave parameter values except user password and factory password.						
Meaning	Head	Address	Command	Command index	Operating data	Checksum	Tail
Host command	7EH	ADDR	06	See the remark	None	BCC	0DH
Number of bytes	1	2	2	4	0	4	1
Slave response	7EH	ADDR	00	See the remark	Parameter setting	BCC	0DH
Number of bytes	1	2	2	4	4	4	1
Remark	Command index=(function group number + SN) in HEX format, e.g. the command index for reading F1.11 is "010B", that of F9.16 is "0910"; that of FF.01 is "0F01", that of FP.02 is "1302"						
	Function group number (decimal format and hex format)						
	Function group	Decimal	Hex	Function group	Decimal	Hex	
	F0	0	00H	F8	8	08H	
	F1	1	01H	F9	9	09H	
	F2	2	02H	FA	10	0AH	
	F3	3	03H	FF	15	0FH	
	F4	4	04H	FH	16	10H	
	F5	5	05H	FL	17	11H	
	F6	6	06H	Fn	18	12H	
F7	7	07H	FP	19	13H		
Effective data	0~FFFF(0~65535)						
Example	~0106010B019A\r to read F1.11 value						

Set parameter (Hex: function group No. + SN)

Using this command can set all the parameters of EV1000, except those whose property is "\*" and FP.02~FP.04. See Appendix 1.

When setting a bit of the parameter, make sure the validity of it, e.g. when setting F9.00, the operating data of the frame is ASCII code, it can be 0000 or 0777 or 0543, but not 0128 or 1000. If it is set incorrectly, you may not get the expected response. If a parameter is protected by password, you should input it first.

Table 7 Slave Parameter Setting

Function	To set slave parameter						
Meaning	Head	Address	Command	Command index	Operating data	Checksum	Tail
Command	7EH	ADDR	07 (08)	See remark	Parameter	BCC	0DH
Bytes	1	2	2	4	4	4	1
Slave response	7EH	ADDR	00	See remark	Parameter	BCC	0DH
Bytes	1	2	2	4	4	4	1
Remark	Command index=(function group number + SN) in HEX format, e.g. the command index for setting F1.11 is "010B", that of F9.16 is "0910"; that of FF.01 is "0F01", that of FP.02 is "1302"						
	Function group number (decimal format and hex format)						
	Function group	Decimal	Hex	Function group	Decimal	Hex	
	F0	0	00H	F8	8	08H	
	F1	1	01H	F9	9	09H	
	F2	2	02H	FA	10	0AH	
	F3	3	03H	FF	15	0FH	
	F4	4	04H	FH	16	10H	
	F5	5	05H	FL	17	11H	
	F6	6	06H	Fn	18	12H	
F7	7	07H	FP	19	13H		
Effective data	0~FFFF(0~65535)						
Example	~01071301000024D\r set FP.01=0, parameter modification allowed						



Note: the usage of command group 7 and 8 is the same. For those parameters that are changed frequently, you may use command group 8 if not required to save to E<sup>2</sup>PROM considering its service life.

## 6. Example of Program

Routine (Turbo C 2.0): send RUN, STOP, SET FREQUENCY command (set F0.00=2, F0.03=2 first)

```
#include <dos.h>
#include <bios.h>
#include <conio.h>
#include <stdio.h>

#define COM1          0          /*serial port 1*/
#define COM2          1          /* serial port 2*/
#define SET_COMPARA   0          /*set port parameter*/
#define DEFAULT_BAUD  0xE3      /*8-N-1,9600bps*/
#define PORT_ADDR     0x3F8     /* serial port 1 address 3F8H*/
#define delaytime     100       /*100ms delay*/
char run_inverter[20]="~010200000183\r"; /*drive run command*/
char stop_inverter[20]="~01020007018A\r"; /*drive stop command*/
void send_comd(char *sendstr,char *display_type); /*send command*/
void checksum(char *sendstr,char result_sum[]); /* calculate checksum*/

main()
{
    char sum_of_cmd[5],buf[25]; /*4-byte checksum and
                                character string*/

    char set_frequency[25]="010200010BB8"; /*set 30.00Hz */
    bioscom(SET_COMPARA,DEFAULT_BAUD,COM1); /*set COM1,8-N-1,9600bps*/
    send_comd(run_inverter,"HEX"); /*send Run command, display
                                    HEX format*/

    printf("\nPress anykey to set frequency to 30.00Hz ...");

    while(!kbhit()); /*wait for keypad input */
    getch(); /*clear the character*/
    checksum(set_frequency,sum_of_cmd); /*calculate command
                                        checksum*/

    sprintf(buf,"~%s%s\r",set_frequency,sum_of_cmd);
```

```

strcpy(set_frequency,buf);                               /*combine frame*/
send_comd(set_frequency,"HEX");                          /*set 30.00Hz, HEX display*/
printf("\nPress anykey to stop ...");
while(!kbhit());                                         /*wait for keypad input*/
send_comd(stop_inverter,"ASCII");                        /*send Stop command, ASCII
dispaly*/
}
void send_comd(char *sendstr,char *display_type)
{
    unsigned int i;
    char buf[5];                                          /*for display buffer*/
    printf("\nSend(%s):",display_type);
    for(i=0;i<strlen(sendstr);i++){                       /*send frame command*/
        outportb(PORT_ADDR,sendstr[i]);
        delay(delaytime);                                 /*delaytime for finish sending
command*/
        if(display_type[0]!='H')                          /*determine display format*/
            {printf("%02x ",sendstr[i]);}                 /*HEX format*/
        else{printf("%c",sendstr[i]);}                     /*ASCII format*/
    }
}
void checksum(char *sendstr,char result_sum[])
{
    unsigned int i,sum=0;
    static char sum_string[5];                            /*calculatethe sum of bytes*/
    for(i=0;i<strlen(sendstr);i++)sum+=(unsigned int)sendstr[i];
    sprintf(sum_string,"%04x",sum);
    for(i=0;i<4;i++)
        result_sum[i]=toupper(sum_string[i]);            /*covert to capital letter/
*/tail of character string*/
    result_sum[i]=0x0;
}
/*return checksum ASCII
character string*/

```

## Appendix 3 Optional Parts

Note: You should buy optional parts, such as reactor, EMI filter. The following models have been proved compatible with the drive. If you need them, please contact us.

### 1. Input/output reactor

AC input reactor: TDL-4AI01-0015, where “0015” is power level, the denotation is the same with that of the drive.

AC output reactor: TDL-4AO01-0015, where “0015” is power level, the denotation is the same with that of the drive.

Table 8 EV1000 Input Reactor Model

Drive	Input Reactor Model
EV1000-2S0004G	TDL-2AI01-0004
EV1000-2S0007G	TDL-2AI01-0007
EV1000-2S0015G	TDL-2AI01-0015
EV1000-2S0022G	TDL-2AI01-0022
EV1000-4T0007G	TDL-4AI01-0007
EV1000-4T0015G	TDL-4AI01-0015
EV1000-4T0022G	TDL-4AI01-0022
EV1000-4T0037G/P	TDL-4AI01-0037
EV1000-4T0055G/P	TDL-4AI01-0055

Table 9 EV1000 Output Reactor Model

Drive	Input Reactor Model
EV1000-2S0004G	TDL-2AO01-0004
EV1000-2S0007G	TDL-2AO01-0007
EV1000-2S0015G	TDL-2AO01-0015
EV1000-2S0022G	TDL-2AO01-0022
EV1000-4T0007G	TDL-4AO01-0007
EV1000-4T0015G	TDL-4AO01-0015
EV1000-4T0022G	TDL-4AO01-0022
EV1000-4T0037G/P	TDL-4AO01-0037
EV1000-4T0055G/P	TDL-4AO01-0055

2. EMI Filter

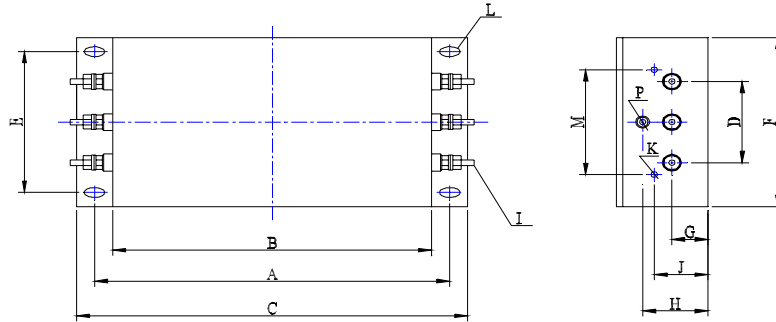


Fig. 3 EMI Filter Dimensions

Table 10 EMI Filter Dimensions and Weight

Drive	Filter model	Size [mm]														Gross weight [kg]	
		A	B	C	D	E	F	G	H	I	J	K	M	N	P		L
EV1000-2S0004G	DL-5EBT1	184	160	202	42	60	86	18	58	M4	38	-	-	-	M4	6.4×9.4	1.7
EV1000-4T0007G																	
EV1000-4T0015G																	
EV1000-4T0022G	DL-10EBT1	184	160	202	42	60	86	18	58	M4	38	-	-	-	M4	6.4×9.4	1.7
EV1000-2S0007G																	
EV1000-4T0037G/P	DL-20EBT1	243	220	261	58	70	100	25	90	M6	58	M4	74	49	M6	6.4×9.4	3.6
EV1000-4T0055G/P																	
EV1000-2S0015G																	
EV1000-2S0022G	DL-25EBT1	243	220	261	58	70	100	25	90	M6	58	M4	74	49	M6	6.4×9.4	3.6



Emerson Network Power Co. Ltd.

### Maintenance Record

Customer Company:	
Address:	
Zip Code:	Contact person:
Tel:	Fax:
Machine SN:	
Power:	Model:
Contract No:	Date of purchase:
Service provider:	
Contact person:	Tel:
Maintenance person:	Tel:
Date of service:	
Customer's opinion about the service: <b>Excellent      Satisfactory      Acceptable      Unsatisfactory</b>	
Other comments:	
Signature:                      DD      MM      YYYY	
Customer Service Center Visit Record:	
<input type="checkbox"/> by phone call <input type="checkbox"/> by questionnaire	
Others:	
Signature of technical support engineer:                      DD      MM      YYYY	

Note: The form becomes invalid if the customer cannot be revisited.

## Warranty Agreement

1. The scope of warranty is confined to the drive only.
2. Warranty period is 18 months, ENP conducts free maintenance and repair services to the drive that has fault or damage under the normal operation conditions.
3. The warranty period starts from the date the product is delivered, and the user, distributor and the manufacturer should negotiate under special conditions.
4. Even within 18 months, maintenance should also be charged in case of the following situations:
  - Damages incurred to the drive due to mis-operations which are not in compliance with the User Manual;
  - Damages incurred to the drive due to fire, flood, abnormal voltage, etc;
  - Damages incurred to the drive due to the improper use of drive functions.
  - Damage or fault caused by not using our standard optional accessories.
5. The service fee will be charged according to the actual costs. If there are any maintenance contracts, priority will be put to the contract.
6. Please keep this paper and show this paper to the maintenance unit when the product needs to be repaired.
7. If you have any other question, please contact the distributor or our company directly.

**Variable Speed Drive Service Dept.**

**Emerson Network Power Co., Ltd.**

Customer Service Hotline: 800-820-6510, (86) 21-23017141, (86) 755-86011668

Address: No. 1, Kefa Rd., Science & Industry Park, Nanshan, 518057, Shenzhen, PRC

To Customers:

Thank you for choosing our products. To improve the product and provide better service for you, could you please fill in the form after the product has been operated for 1 month, and mail or fax it to our Customer Service Center? We will send you an exquisite souvenir upon receiving the complete Product Quality Feedback Form. Furthermore, if you can give us some advices on improving the product and service quality, you will be awarded a special gift. Thank you very much!

**Emerson Network Power Co., Ltd.**

**Product Quality Feedback Form**

Customer name		Tela	
Address		Zip code	
Model		Date of use	
Machine SN			
Appearance or structure			
Performance			
Package			
Material			
Quality problem during usage			
Suggestion about improvement			

Address: No. 1, Kefa Rd., Science & Industry Park, Nanshan, 518057, Shenzhen, PRC  
Tel: (86) 755-86010808