

Preface

Thank you for purchasing MD320/MD320N series inverters.

This instruction manual describes how to properly use MD320/MD320N series inverter. Please read the instruction manual carefully before using (Before installation, operation, maintenance and inspection). Besides, please use the product after understanding the safety precautions.

Precautions

- The drawings presented in this instructions are sometimes shown without covers or protective guards. Always replace the equipment's cover or protective guard as specified first, and then operate the products in accordance with the instructions.
- The drawings presented in the instructions are typical examples and may not match the product you received.
- These instructions are subject to change due to product improvement, specification modification, specification modification.
- If you want to order the manual due to loss or damage, please contact our company agents in each region or our company customer service center directly.
- If there is still any problem during using the product, please contact our company customer service center directly.
- Our Service Hotline: 400-777-1260.

Introduction

The MD series of frequency converters is a new generation of modular, high performance frequency converters that represent the future of inverters. Compared with traditional inverters, in meeting the performance and function demands of customers, this series does not use multiple products (which add external manufacturing, sales, user and maintenance costs), but instead creates a modular design based on the specific needs of the customer, resulting in a customized platform that incorporates a single series of products that are a multi-module assemblies.

MD series inverter creates three new concepts in the future inverter sector:

- 1) It creates the three-layer modular structure standard of new generation of inverter. Refer to Figure 1 for the comparison between traditional inverter and MD series modular inverter;
- 2) It creates the physical standard for dividing the customer requirements according to such main modules as motor drive module, general functional module and specialized functional module as well as various sub-modules. Refer to Figure 2 for the schematic diagram for the modular structure of MD series inverter;
- 3) It leads the new industry trend of popularizing the vector control technology.

Such concepts will bring about profound influences on the inverter industry. The modular structure is described as follows:

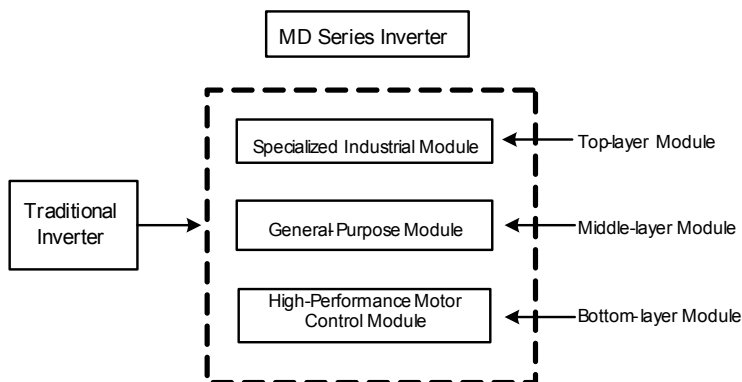


Fig. 1 Comparison between Traditional Inverter and MD Series Modular Inverter

1) The bottom-layer module of the MD series inverter is high-performance motor control module and consists of V/F, speed sensorless vector control (SVC) and vector control. It is mainly responsible for high performance control and overall protection of the motor, controlling the motor through sending running commands to multiple channels or performing close loop vector control through encoder interface.

2) The middle-layer module of MD series inverter is general functional module, which mainly includes some basic functions of the inverter, such as PID control, MS speed, and swing frequency and so on. According to the degree of complexity of functions, Inovance Technology provides two sub-modules for options of the customers, that is, MD320 functional module and MD300 functional module. Refer to Table 1 for the difference between the two modules.

Table 1 Difference between MD320 and MD300 Functional Modules

	MD320	MD300
Input/output terminal	Five DI (bidirectional input and one high-speed port), two AI, two DO (one high-speed port), one AO, and one relay (expandable I/O)	Four DI (unidirectional input and one high-speed port), two AI, one DO, one AO, and one relay
Control mode	SVC、VC、V/F	SVC、V/F
Analog setup mode	Straight line mode	Multiple-point fold line mode, which is easy to realize the functions of the injection molding machine
MS speed	Be able to realize 16S speed	Be able to realize 4S speed
PLC Simple PLC	Be able to realize 16S timing operation	None
Swing frequency and fixed-length control	Available	None
Main/auxiliary setup	Main/auxiliary reference of any channel	Only A12 can be auxiliary setup
Communication function	Via the expansion card	Via the specialized card
PID control	Available	None
Multiple-point V/F	Available	None

3) The top-layer module of MD series inverter is a specialized industry module and also a platform provided to satisfy the specialized industry demands, enabling the customers to either apply the existing solutions or perform secondary development according to their own needs. Refer to Figure 2 “MD Series Inverter Modular Structure Diagram” for the top-layer sub-modules.

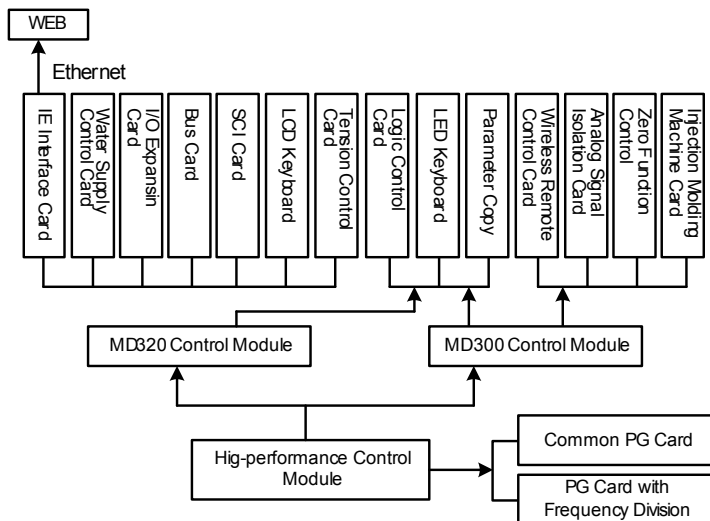


Fig. 2 MD Series Inverter Modular Structure Diagram

MD series inverter is particularly unique in respect of easy-to-use performance. The entire system has independent ventilation, which can be installed outside or inside the radiator cabinet; directly input DC bus terminal and DC powered fan that enable the standard products to be compatible with the DC bus running mode, perfect user password protection, shortcut menu design that makes the complex commission easier, standard RJ45 interface applied in the operation panel and the communication port that ensures reliability and greatly reduces the application cost, MODBUS bus protocol and expansion card that can be compatible with PROFIBUS, DeviceNet, CANopen and other bus controls, and functional expansion card with automatic identification function. All these features reflect that the MD series inverter strictly complies with the principle "Respect the Customers" during the design process.

This manual is a guide to the operations of MD series inverter and MD320 control module. For the use of MD300 control module, see the operation manual for details.

This manual provides the user with related precautions and instructions for the prototyping, installation, parameter setting, on-site commissioning, and routine Repair and Maintenance of inverter. In order to use this series of inverter correctly, please read this manual carefully prior to operation and keep it properly for future use. The supporting equipment customers shall distribute this manual together with the equipment to the final users.

Unpacking and inspection:

Please confirm carefully when unpacking the box:

- 1) If the model and inverter rated values on the nameplate are the same as your order. The box contains the equipment, certificate of conformity, user manual and warranty card.
- 2) If the product is damaged during the transportation. If there is any omission or damage, please contact our company or the supplier immediately.

First time use:

The users who use this product for the first time shall read this manual carefully. For any doubt on certain functions and performances, please contact the technical support personnel of our company for help so as to use this product properly.

With commitment to the constant improvement of the inverter products, our company may change the information provided without additional notice.



MD320 series inverter complies with the following international standards, and some products have passed the CE certification IEC/EN61800-5-1:2003 "Safety Regulations on Commissionable Electric Drive System" and IEC/EN 61800-3:2004 Commissionable Electric Drive System: Third Part: Electromagnetic Compatibility Standard and Specific Testing Method for the Product (Comply with IEC/EN61800-3 standard under correct installation and use as per Article 7.3.2 and 7.3.6)

MD320N:

MD320N series is an upgrade of the MD320 series in terms of external appearance and structural design. Its function is the same as MD320 series inverters.

The difference between MD320N series inverter and MD320 series inverter are as follows:

- 1) MD320N series inverter's enclosure are divided into three parts, it contains top- enclosure, middle- enclosure, and bottom- enclosure. The appearance color is light gray. MD320 series inverter's shell are divided into two parts, it contains upper cover plate and down cover plate. And there is no bottom-shell. The appearance color is blue.
- 2) MD320N series has a built-in radiator. There is bottom-enclosure wrapping, MD320 series radiator is externally installed.
- 3) MD320N series cooling fan is in the bottom-shell without screws, and easily installed. MD320 series cooling fan is in the radiator with screws.
- 4) MD320N series keyboard can be removing without screws fixed. MD320 series keyboard panel is installed on the cover plate.
- 5) MD320N series has a Fence-type Lead-Out Wires hole. MD320 series has a closed Lead-Out Wires hole with a Rubber Seal Ring.
- 6) The installation dimensions are different. See the MD320N series mounting dimension table for details.

Contents

Preface	1
Chapter 1 Safety and Precautions.....	10
1.1 Safety precautions.....	10
1.2 Precautions.....	13
Chapter 2 Product Information.....	18
2.1 Designation Rules.....	18
2.2 Nameplate.....	18
2.3 MD320 Inverter Series.....	19
2.4 Technical Specifications.....	21
2.5 Physical Appearance and Dimensions of Mounting Hole.....	23
2.6 Optional Parts.....	33
2.7 Routine Repair and Maintenance of inverter.....	35
2.8 Instructions on Warranty of Inverter.....	36
2.9 Prototyping Guide.....	37
2.10 Guide to Prototyping of Brake Components.....	37
Chapter 3 Mechanical and Electric Installation.....	42
3.1 Mechanical installation	42
3.2 Electrical Installation.....	45
Chapter 4 Operation and Display.....	60
4.1 Introduction to Operation and Display Interface.....	60
4.2 Description of Function Code Viewing and Modification Methods	61
4.3 Shortcut Menu Operation Mode.....	62
4.4 Extended Function Menu.....	64
4.5 Method of Viewing Status Parameter.....	64
4.6 Password Setting.....	65
4.7 Automatic Tuning of Motor Parameters.....	65
Chapter 5 Function Parameter Table.....	68
Chapter 6 Parameter Description.....	94
Group F0 Basic Function.....	94

Group F1 Motor Parameters.....	102
Group F3 V/F Control Parameters.....	107
Group F4 Input Terminal.....	110
Group F6 Start/Stop Control.....	124
Group F8 Auxiliary Function.....	132
Group FA Process Control PID Function.....	142
Group FB Swing Frequency, Fixed Length and Count.....	145
Group FC MS Speed Function and Simple PLC Function.....	147
Group FD Communication Parameters.....	153
Group FF Factory Parameters (Reserved).....	153
Group FP User Password.....	153
Chapter 7 EMC (Electromagnetic Compatibility).....	156
7.1 Definition.....	156
7.2 EMC Standard Description.....	156
7.3 EMC Guide.....	156
Chapter 8 Fault Diagnosis and Solution.....	160
8.1 Fault Alarm and Countermeasures.....	160
8.2 Common Fault and Resolution.....	173
Appendix: Card Description.....	176
Appendix A: Description of Common PG Card (MD32PG).....	176
Appendix B: Description of Long-line Drive PG Card (MD32PG3).....	181
Appendix C: Description of IO Expansion Card (MD32IO).....	182
Appendix D: Description of Communication Card (MD32MBS).....	186
Appendix E: Description of Parameter Copy Card (MDCP).....	188
Appendix F: MD320 serial communication protocol.....	189

Connection to peripheral devices

Three-phase AC power supply
Please use the power supply which is within the inverter specification

Electromagnetic Contactor

To insure the safety, please use electromagnetic contactor. Please do not use the electromagnetic contactor to start and stop the inverter, otherwise, it will reduce the lifetime of the inverter.

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To insure the safety, please use electromagnetic contactor. Please do not use the electromagnetic contactor to start and stop the inverter, otherwise, it will reduce the lifetime of the inverter.

AC Reactor

Suppress the high order harmonic to improve the power factor.

Input Side
Noise Filter

Brake Resistors (Optional)

Brake Unit (or Energy Feedback Unit) (Optional)
It can give full play to the regenerative capacity of the inverter, please use according to needs.

Inovance Inverter

DC Reactor (standard configuration)

Grounding
In order to prevent electric shock, the motor and inverter must be well grounded.

Output Side
Noise Filter

Motor drive

Grounding

Diagram for the connection to peripheral devices

- Do not install the capacitor or surge suppressor at the output side of the inverter, otherwise it may cause inverter failure or capacitor and surge suppressor damaged.
- The Inverter input / output (main circuit) contains harmonic components, it may interfere with inverter accessories communications equipment. Therefore, install anti-interference filter, make minimize interference.
- The details of peripheral equipments and accessories selection refer to the manual of peripheral equipments.



1

Safety and Precautions

Chapter 1 Safety and Precautions

Safety definition:

In this manual, safety precautions are divided into two types below:



Danger arising due to improper operations may cause severe hurt or even death.



Caution: Danger arising due to improper operations may cause moderate hurt or light hurt or equipment damage.

During the installation, commissioning and maintenance of the system, please make sure to follow the safety and precautions of this chapter. In case of a result of illegal operations, caused any harm and losses is nothing to do with the company.

1.1 Safety precautions

1.1.1 Before Installation:



Danger

- Do not use the damaged inverter or inverter with missing parts. Otherwise, there may be risk of injury.
- Use the motor with Class B or above insulation. Otherwise, there may be risk of electric shock.



Danger

- Carefully handled when loading, otherwise it may damage the inverter.
- Please don't use the damaged driver or missing parts inverter, there may be risk of injury.
- Do not touch the control system, otherwise it will cause static electricity.

1.1.2 During the Installation:



Danger

- Mount the inverter on incombustible surface like metal, and keep away from flammable substances. Otherwise it may cause fire.
- Do not loose the set screw of the equipment, especially the screws marked in RED.

**Caution**

- Do not drop the lead wire stub or screw in the inverter. Otherwise it may damage the inverter.
- Please install the driver in the place where there is no direct sunlight or no vibratory.
- When more than two inverters are to be installed in one cabinet, due attention shall be paid to the installation locations (refer to Chapter 3 Mechanical and Electrical Installation) to ensure the heat sinking effect.



1.1.3 During wiring:**Danger**

- Operation shall be performed by the professional engineering technician. Otherwise there will be danger of electric shock!
- There shall be circuit breaker between the inverter and power supply. Otherwise, there may be fire!
- Make sure the power is disconnected prior to the connection. Otherwise there will be danger of electric shock!
- The earth terminal shall be earthed reliably. Otherwise there may be danger of electric shock.



**Danger**

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- There shall be circuit breaker between the inverter and power supply. Otherwise, there may be fire!
- Make sure the power is disconnected prior to the connection. Otherwise there will be danger of electric shock!
- The earth terminal shall be earthed reliably. Otherwise there may be danger of electric shock.



1.1.4 Before Power-on:

 Caution
<ul style="list-style-type: none">● Please confirm whether the power voltage class is consistent with the rated voltage of the inverter and whether the I/O cable connecting positions are correct, and check whether the external circuit is short circuited and whether the connecting line is firm. Otherwise it may damage the inverter. The cover must be well closed prior to the inverter power-on. Otherwise electric shock may be caused.● The inverter is free from dielectric test because this test is performed prior to the delivery. Otherwise accident may occur.
 Danger
<ul style="list-style-type: none">● The cover must be well closed prior to the inverter power-on. Otherwise electric shock may be caused!● Whether all the external fittings are connected correctly in accordance with the circuit provided in this manual. Otherwise accident may occur!


1.1.5 Upon Power-on

 Danger
<ul style="list-style-type: none">● Do not open the cover of the inverter upon power-on. Otherwise there will be danger of electric shock!● Do not touch the inverter and its surrounding circuit with wet hand. Otherwise there will be danger of electric shock!● Do not touch the inverter terminals (including control terminal). Otherwise there will be danger of electric shock!● At power-on, the inverter will perform the security check of the external heavy-current circuit automatically. Thus, at this time please do not touch the terminals U, V and W, or the terminals of motor, otherwise there will be danger of electric shock.
 Danger
<ul style="list-style-type: none">● If parameter identification is required, due attention shall be paid to the danger of injury arising from the rotating motor. Otherwise accident may occur!● Do not change the factory settings at will. Otherwise it may damage the equipment!

1.1.6 During the operation:

 Danger
<ul style="list-style-type: none"> Do not touch the fan or discharge resistor to sense the temperature. Otherwise, you may get burnt! Detection of signals during the operation shall only be conducted by qualified technician. Otherwise, personal injury or equipment damage may be caused!
 Caution
<ul style="list-style-type: none"> During the operation of the inverter, keep items from falling into the equipment. Otherwise, it may damage the equipment! Do not start and shut down the inverter by connecting and disconnecting the contactor. Otherwise, it may damage the equipment!

1.1.7 During Repair

 Danger
<ul style="list-style-type: none"> Do not repair and maintain the equipment with power connection. Otherwise there will be danger of electric shock! be sure to conduct repair and maintenance after the charge LED indicator of the inverter is OFF. Otherwise, the residual charge on the capacitor may cause personal injury! The inverter shall be repaired and maintained only by the qualified person who has received professional training. Otherwise, it may cause personal injury or equipment damage! Carry out parameter setting after replacing the inverter, all the plug-ins must be plug and play when power outage.

1.2 Precautions**1.2.1 Motor Insulation Inspection**

When the motor is used for the first time, or when the motor is reused after being kept, or when periodical inspection is performed, it shall conduct motor insulation inspection so as to avoid damaging the inverter because of the insulation failure of the motor windings. The motor wires must be disconnected from the inverter during the insulation inspection. It is recommended to use the 500V megameter, and the insulating resistance measured shall be at least 5MΩ.

1.2.2 Thermal Protection of the Motor

If the ratings of the motor does not match those of the inverter, especially when the rated

power of the inverter is higher than the rated power of the motor, the relevant motor protection parameters in the inverter shall be adjusted, or thermal relay shall be mounted to protect the motor.

1.2.3 Running with Frequency higher than Standard Frequency

This inverter can provide output frequency of 0Hz to 300Hz. If the user needs to run the inverter with frequency of more than 50Hz, please take the resistant pressure of the mechanical devices into consideration.

1.2.4 Vibration of Mechanical Device

The inverter may encounter the mechanical resonance point at certain output frequencies, which can be avoided by setting the skip frequency parameters in the inverter.

1.2.5 Motor Heat and Noise

Since the output voltage of inverter is PWM wave and contains certain harmonics, the temperature rise, noise and vibration of the motor will be higher than those when it runs at standard frequency.

1.2.6 Voltage-sensitive Device or Capacitor Improving Power Factor at the Output Side

Since the inverter output is PWM wave, if the capacitor for improving the power factor or voltage-sensitive resistor for lightning protection is mounted at the output side, it is easy to cause instantaneous over current in the inverter, which may damage the inverter. It is recommended that such devices not be used.

1.2.7 Switching Devices like Contactors Used at the Input and Output terminal

If a contactor is installed between the power supply and the input terminal of the inverter, it is not allowed to use the contactor to control the startup/stop of the inverter. If use of such contactor is unavoidable, it shall be used with interval of at least one hour. Frequent charge and discharge will reduce the service life of the capacitor inside the inverter. If switching devices like contactor are installed between the output end of the inverter and the motor, it shall ensure that the on/off operation is conducted when the inverter has no output. Otherwise the modules in the inverter may be damaged.

1.2.8 Use under voltage rather than rated voltage

If the MD series inverter is used outside the allowable working voltage range as specified in this manual, it is easy to damage the devices in the inverter.

When necessary, use the corresponding step-up or step-down instruments to change the voltage.

1.2.9 Change Three-phase Input to Two-phase Input

It is not allowed to change the MD series three-phase inverter into two-phase one. Otherwise, it may cause fault or damage to the inverter.

1.2.10 Lightning Impulse Protection

The series inverter has lightning over current protection device, and has certain self-protection capacity against the lightning. In applications where lightning occurs frequently, the user shall install additional protection devices at the front-end of the inverter.

1.2.11 Altitude and Derating

In areas with altitude of more than 1,000 meters, the heat sinking effect of the inverter may turn poorer due to rare air. Therefore, it needs to derate the inverter for use. Please contact our company for technical consulting in case of such condition.

1.2.12 Certain Special Use

If the user needs to use the inverter with the methods other than the recommended wiring diagram in this manual, such as shared DC bus, please consult our company.

1.2.13 Note of Inverter Disposal

The electrolytic capacitors on the main circuit and the PCB may explode when they are burnt. Emission of toxic gas may be generated when the plastic parts are burnt. Please dispose the inverter as industrial wastes.

1.2.14 Adaptable Motor

- 1) The standard adaptable motor is four-pole squirrel-cage asynchronous induction motor. If such motor is not available, be sure to select adaptable motors in according to the rated current of the motor. In applications where drive permanent magnetic synchronous motor is required, please consult our company;
- 2) The cooling fan and the rotor shaft of the non-variable-frequency motor adopt coaxial connection. When the rotating speed is reduced, the cooling effect will be poorer. Therefore, a powerful exhaust fan shall be installed, or the motor shall be replaced with variable-frequency motor to avoid the over heat of the motor.
- 3) Since the inverter has built-in standard parameters of the adaptable motors, it is necessary to perform motor parameter identification or modify the default values so as to comply with the actual values as much as possible, or it may affect the running effect and protection performance;
- 4) The short circuit of the cable or motor may cause alarm or explosion of the inverter. Therefore, please conduct insulation and short circuit test on the newly installed motor and cable. Such test shall also be conducted during routine maintenance. Please note that the inverter and the test part shall be completely disconnected during the test.



2

Product Information

Chapter 2 Product Information

2.1 Designation Rules

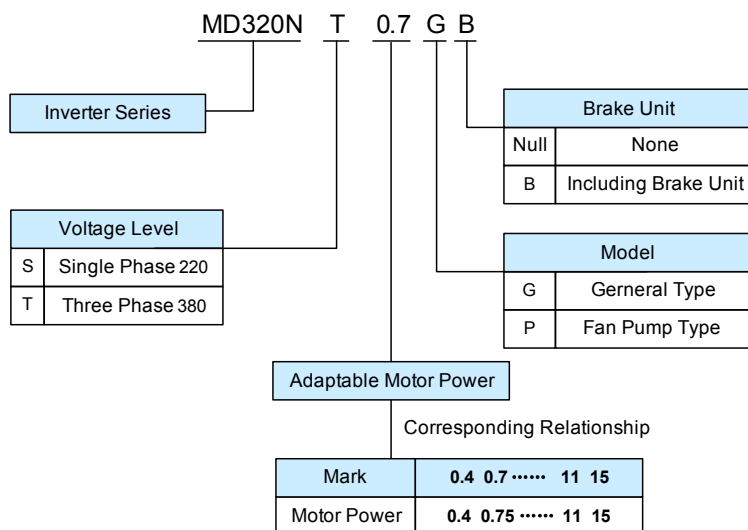


Fig.2-1 Designation Rules

Caution: The MD320N series is an upgrade of the MD320 series in terms of external appearance and structural design. Except for special notes on the MD320N, all the following information is appropriate for the MD320N series of products.

2.2 Nameplate

MODEL:	MD 320NT0.7G
POWER:	0.75kW
INPUT:	3 PH AC380V 3.4A 50Hz/60Hz
OUTPUT:	3 PH AC0V 2.3A 0Hz~300Hz
S/N:	<div style="border: 1px solid black; padding: 2px;">Barcode</div>
Shenzhen Inovance Technology Co., Ltd.	

Fig.2-2 Nameplate

2.3 MD320 Inverter Series

Table 2-1 MD320 Inverter Model and Technical Data

Inverter model	Power capacity (kVA)	Input current (A)	Output current (A)	Adaptable Motor (kW)	
Single-phase power supply: 200...240V, 50/60Hz					
MD320NS0.4	1.0	5.4	2.3	0.4	0.5
MD320NS0.7	1.5	8.2	4.0	0.75	1
MD320NS1.5	3.0	14.0	7.0	1.5	2
MD320NS2.2	4.0	23.0	9.6	2.2	3
Three-phase power supply: 380...480V, 50/60Hz					
MD320NT0.7	1.5	3.4	2.1	0.75	1
MD320NT1.5	3.0	5.0	3.8	1.5	2
MD320NT2.2	4.0	5.8	5.1	2.2	3
MD320NT3.7	5.9	10.5	9.0	3.7	5
MD320NT5.5	8.9	14.6	13.0	5.5	7.5
MD320NT7.5	11.0	20.5	17.0	7.5	10
MD320NT11	17.0	26.0	25.0	11.0	15
MD320NT15	21.0	35.0	32.0	15.0	20
MD320NT18.5	24.0	38.5	37.0	18.5	25
MD320NT22	30.0	46.5	45.0	22	30
MD320NT30	40.0	62.0	60.0	30	40
MD320NT37	57.0	76.0	75.0	37	50
MD320NT45	69.0	92.0	91.0	45	60
MD320NT55	85.0	113.0	112.0	55	70
MD320NT75	114.0	157.0	150.0	75	100
MD320NT90	134.0	180.0	176.0	90	125
MD320NT110	160.0	214.0	210.0	110	150
MD320NT132	192.0	256.0	253.0	132	200

Inverter model	Power capacity (kVA)	Input current (A)	Output current (A)	Adaptable Motor (kW)	
MD320NT160	231.0	307.0	304.0	160	250
MD320NT200	250.0	385.0	377.0	200	300
MD320NT220	280.0	430.0	426.0	220	350
MD320NT250	355.0	468.0	465.0	250	400
MD320NT280	396.0	525.0	520.0	280	450
MD320NT315	445.0	590.0	585.0	315.0	500
MD320NT355	500.0	665.0	650.0	355.0	—
MD320NT400	565.0	785.0	725.0	400.0	600
MD320NT450	630.0	883.0	820.0	450.0	—
Three-phase Power supply: 690V, 50/60Hz					
MD320-7T132	192.0	170.0	150.0	132	200
MD320-7T160	231.0	200.0	175.0	160	250
MD320-7T200	250.0	235.0	215.0	200	300
MD320-7T220	280.0	247.0	245.0	220	350
MD320-7T250	355.0	265.0	260.0	250	400
MD320-7T280	396.0	305.0	299.0	280	450
MD320-7T315	445.0	350.0	330.0	315	500
MD320-7T355	500.0	382.0	374.0	355	—
MD320-7T400	565.0	435.0	410.0	400	600
MD320-7T450	630.0	490.0	465.0	450	—
MD320-7T500	700.0	595.0	550.0	500	700
MD320-7T560	630.0	605.0	575.0	560	750

2.4 Technical Specifications

Table 2-2 MD320 Inverter Technical Specifications

Item		Specifications	
Individualized function	Maximum frequency	300Hz	
	Carrier frequency	0.5k to 16kHz; the carrier frequency will be automatically adjusted according to the load characteristics.	
	Input frequency resolution	Digital setting: 0.01Hz Analog setting: maximum frequency $\times 0.1\%$	
	Control mode	Open loop vector control (SVC) Close loop vector control (VC) V/F control	
	Startup torque	G model: 0.5Hz/150% (SVC); Hz/180%(VC) P model: 0.5Hz/100%	
	Speed adjustment range	1: 100 (SVC)	1: 1000 (VC)
	Speed stabilization precision	$\pm 0.5\%$ (SVC)	$\pm 0.02\%$ (VC)
	Torque control precision	$\pm 5\%$ (VC)	
	Overload capacity	G model: 150% rated current 60s; 180% rated current 1s. P model: 120% rated current 60s; 150% rated current 1s.	
	Torque hoist	Automatic torque hoist; manual torque hoist 0.1% to 30.0%	
	V/F curve	Three types: straight line, multiple point and square type	
	Speed-up and Speed-down curve	Straight line or S curve speed-up and speed-down mode; four kinds of speed-up and speed-down time; speed-up and speed-down time ranges between 0.0s to 3000.0s.	
	DC brake	DC brake frequency: 0.00Hz to maximum frequency; brake time: 0.0s to 36.0s, and brake current value: 0.0% to 100.0%.	
	Jog control	Jog frequency range: 0.00Hz to 50.00Hz; jog acceleration/deceleration time: 0.0s to 3000.0s.	
	Simple PLC and MS Speed Running	It can realize a maximum of 16 segments speed running via the built-in PLC or control terminal.	
	Built-in PID	It is easy to realize process-controlled close loop control system.	
	Auto voltage regulation (AVR)	It can keep constant output voltage automatically in case of change of mains voltage.	
	Torque limit and control	It can limit the torque automatically and prevent frequent over current tripping during the running process; the close loop vector mode can implement torque control.	

Item		Specifications
Individualized function	Peripherals self-detection upon power-on	It can conduct safety detections on the peripherals upon power-on, including earth and short circuit detections.
	Shared DC Bus Function	It can realize the function that multiple inverters share the DC bus.
	QUICK key	The user can freely define short-cut menus.
	MF.K Key	Programmable key: Select the command channel switching/forward and reverse rotations/jog operation.
	Textile swing frequency control	Multiple triangular-wave frequency control function
	Length control	Reference length control function
	Timing control	Timing control function: Setting time range between 0h to 65535 h.
Run	Running command channel	Three types of channels: operation panel reference, control terminal reference and serial communication port reference. These channels can be switched in various modes.
	Frequency source	There are totally ten types of frequency sources, such as digital reference, analog voltage reference, analog current reference, pulse reference and serial port reference. These frequency sources can be switched in various modes.
	Auxiliary frequency source	There are ten types of auxiliary frequency sources. It can implement micro tuning and synthesis of auxiliary frequency.
	Input terminal	There are five digital input terminals, one of which can be used as high-speed pulse input. (The number of digital input terminals can be expanded to ten) It can be compatible with active PNP or NPN input mode. There are two analog input terminals, one of which can be used only as voltage input, while the other can be used as voltage or current input. (It can expand one voltage input terminal)
	Output terminal	There is one high-speed pulse output terminal (can be selected as open collector mode), with square wave output of 0kHz to 50kHz. It can output such physical parameters as setting frequency and output frequency. One digital output terminal (can be expanded to two) One relay output terminal (can be expanded to two) One analog output terminal (can be expanded to two), with optional 0//4mA to 20mA or 0/2V to 10V. It can realize the output of such physical parameters as setting frequency and output frequency.

Item	Specifications
Display and Keyboard Operation	LED display
	It can display the parameters
	LED display
	It is an optional part, and can display operation contents Chinese/English.
	Parameter copy
	It enables the parameter copy unit to copy the parameters quickly.
Display and Keyboard Operation	Key locking and function selection
	It can lock the keys partially or completely and define the functional range of certain keys so as to prevent error operations.
	protection function
	It can implement power-on motor short-circuit detection, input/output phase loss protection, over current protection, over voltage protection, under voltage protection, over heat protection and overload protection.
	Optional parts
	LCD operation panel, multifunctional I/O expansion card, braking components, communication card, extension card, PG card, water supply card, etc.
Environment	Using Place
	Indoor, and be free from direct sunlight, dust, corrosive gas, combustible gas, oil smoke, vapor, drip or salt.
	Altitude
	Lower than 1,000 meters
	Ambient temperature
	-10℃ Celsius to +40 ℃ Celsius (derated when used in the ambient temperature of 40 ℃ Celsius to 50 ℃ Celsius)
Environment	Humidity
	Less than 95%RH, without condensing
	Vibration
	Less than 5.9 m/s ² (0.6g)
Environment	Storage temperature
	-20 Celsius to +60 Celsius

2.5 Physical Appearance and Dimensions of Mounting Hole

2.5.1 Physical Appearance

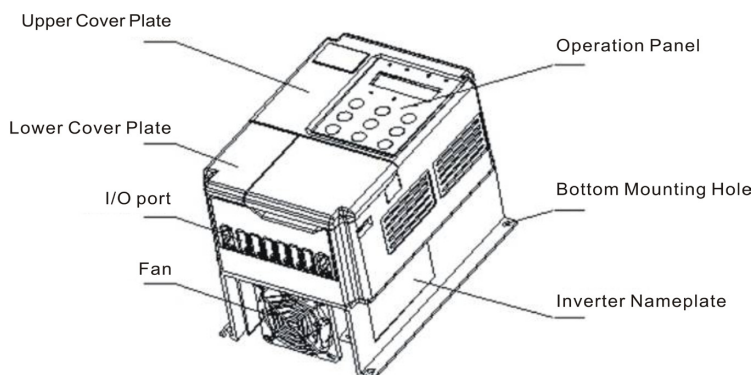


Fig.2-3Physical Appearance of Inverter

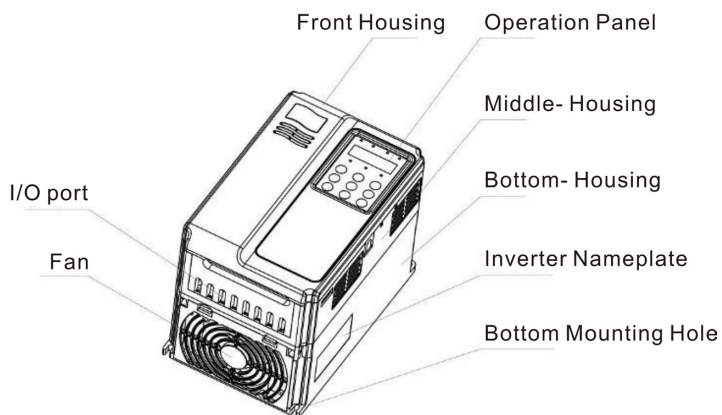


Fig.2-4 Physical Appearance of Inverter

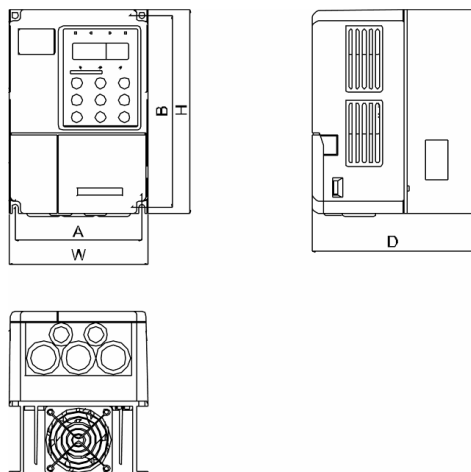


Fig. 2-5 Schematic Diagram for Physical Dimensions and Mounting Dimensions of 0.4kW ~ 5.5kW

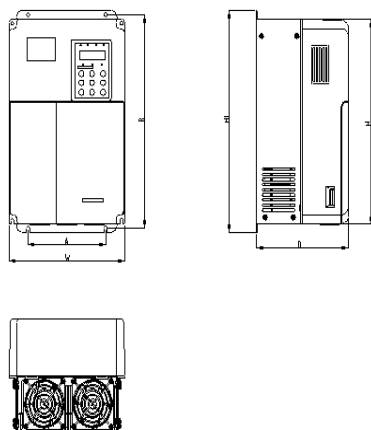


Fig. 2-6 Schematic Diagram for Physical Dimensions and Mounting Dimensions of 7.5kW~15kW

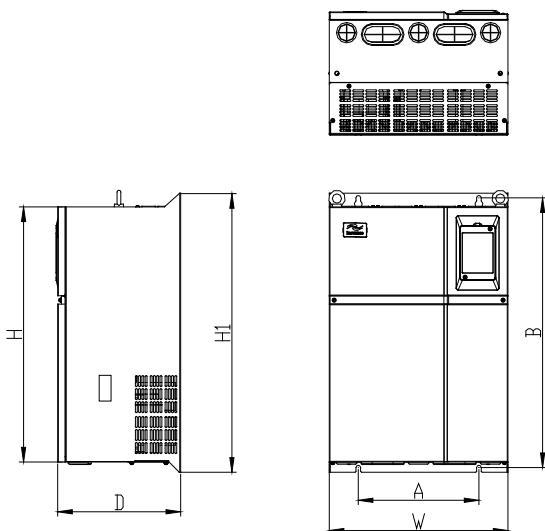


Fig. 2-7 Schematic Diagram for Physical Dimensions and Mounting Dimensions of 18.5kW~450kW

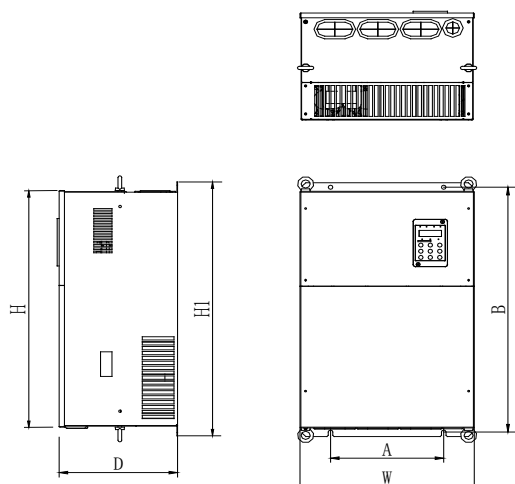


Fig. 2-8 MD320N Series Schematic Diagram for Physical Dimensions and Mounting Dimensions of 18.5kW~450kW

2.5.2 Physical Dimensions and Mounting Hole Dimensions

Table 2-3 Physical Dimensions and Mounting Hole Dimensions (mm)

Model	Mounting Hole mm		Physical Dimensions mm				Diameter of Mounting Hole mm	Weight (kg)
	A	B	H	H1	W	D		
MD320S0.4G	113	172	182	/	123	145	ø5.4	1.1
MD320S0.7G								
MD320S1.5G								
MD320S2.2G								
MD320T0.7GB								
MD320T1.5GB								
MD320T2.2GB	147	236	246	/	158	165	ø5.4	2.5
MD320T2.2GB (Build-in PG)Card								
MD320T3.7GB								
MD320T5.5PB								
MD320T5.5GB								
MD320T7.5PB								

Model	Mounting Hole mm		Physical Dimensions mm				Diameter of Mounting Hole mm	Weight (kg)
	A	B	H	H1	W	D		
MD320T7.5GB	150	335	322	348	224	177	ø6	7
MD320T11PB								
MD320T11GB ¹								
MD320T15PB ¹								
MD320T15GB ¹								
MD320T18.5PB								
MD320T18.5G MD320T22P	235	447	430	460	285	220	ø6.5	20
MD320T22G MD320T30P								
MD320T30G MD320T37P								
MD320T37G MD320T45P	250	598	573	620	380	262	ø10	34
MD320T45G MD320T55P								
MD320T55G MD320T75P								
MD320T75G MD320T90P	343	678	660	700	473	307	ø10	47
MD320T90G MD320T110P								
MD320T110G MD320T132P	449	905	880	930	579	375	ø10	90
MD320T132G MD320T160P								
MD320T160G								
MD320T200P MD320T200G MD320T220P	420	1030	983	1060	650	377	ø12	130
MD320T220G MD320T250P								
MD320T250G MD320T280P								
MD320T280G MD320T315P								

Model	Mounting Hole mm		Physical Dimensions mm				Diameter of Mounting Hole mm	Weight (kg)
	A	B	H	H1	W	D		
MD320T315G MD320T355P	520	1300	1203	1358	800	400	φ14	200
MD320T355G MD320T400P								
MD320T400G MD320T450P								
MD320-7T132GH MD320-7T160PH	320	1166	1090	1192	440	310	φ10	90
MD320-7T160GH MD320-7T200PH								
MD320-7T200GH MD320-7T220PH								
MD320-7T220GH MD320-7T250PH								
MD320-7T250GH MD320-7T280PH								
MD320-7T280G MD320-7T315P	420	1030	983	1060	650	377	φ12	130
MD320-7T315G MD320-7T355P								
MD320-7T355G MD320-7T400P								
MD320-7T400G MD320-7T450P	520	1300	1203	1358	800	400	φ14	200
MD320-7T450G MD320-7T500P								
MD320-7T500G MD320-7T560P								
MD320T110GH MD320T132PH	320	1166	1090	1192	440	310	φ10	90
MD320T132GH MD320T160PH								
MD320T160GH MD320T200PH								

Caution: The letter H which at the end of the model name refers to the narrow-body aircraft.

Table 2-4 Physical Dimensions and Mounting Hole Dimensions (mm)

Model	Mounting Hole mm		Physical Dimensions mm				Diameter of Mounting Hole mm	Weight (kg)
	A	B	H	H1	W	D		
MD320NS0.4G	113	172	186	/	125	164	ø5.0	1.1
MD320NS0.7G								
MD320NS1.5G								
MD320NS2.2G								
MD320NT0.7GB								
MD320NT1.5GB								
MD320NT2.2GB								
MD320NT3.7GB	148	236	248	/	160	183	ø5.0	2.5
MD320NT5.5PB								
MD320NT5.5GB								
MD320NT7.5PB								
MD320NT7.5GB	190	305	322	/	208	192	ø6	6.5
MD320NT11PB ⁺								
MD320NT11GB ⁺								
MD320NT15PB ⁺								
MD320NT15GB ⁺								
MD320NT18.5PB								
MD320NT18.5G	235	447	432	463	285	228	Ø6.5	20
MD320NT22P								
MD320NT22G								
MD320NT30P								
MD320NT30G								
MD320NT37P	260	580	549	600	385	265	Ø10	32
MD320NT37G								
MD320NT45P								
MD320NT45G								
MD320NT55P								
MD320NT55G								
MD320NT75P								

Model	Mounting Hole mm		Physical Dimensions mm				Diameter of Mounting Hole mm	Weight (kg)
	A	B	H	H1	W	D		
MD320NT75G	343	678	660	700	473	307	Ø10	47
MD320NT90P								
MD320NT90G								
MD320NT110P								
MD320NT110G	449	903	880	930	579	380	Ø10	90
MD320NT132P								
MD320NT132G								
MD320NT160P								
MD320NT160G								
MD320NT200P	420	1030	983	1060	650	377	Ø12	130
MD320NT200G								
MD320NT220P								
MD320NT220G								
MD320NT250P								
MD320NT250G								
MD320NT280P								
MD320NT280G								
MD320NT315P								
MD320NT315G	520	1300	1203	1358	800	400	Ø16	200
MD320NT355P								
MD320NT355G								
MD320NT400P								
MD320NT400G								
MD320NT450P								

2.5.3 Physical Dimensions of External Keyboard

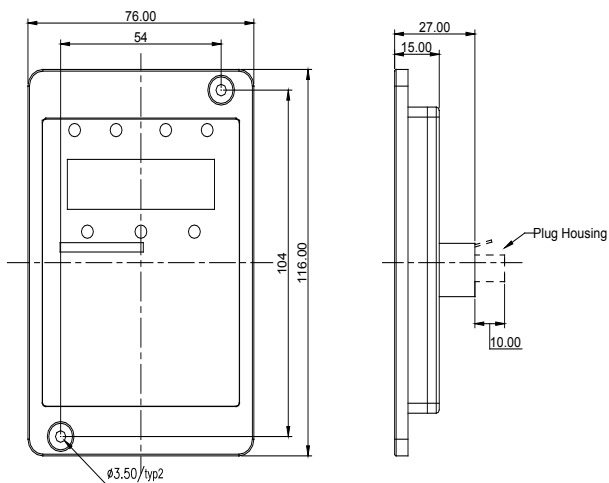


Fig.2-9 Schematic Diagram for Physical Dimensions of External Keyboard
Mounting Hole Dimensions of External Keyboard

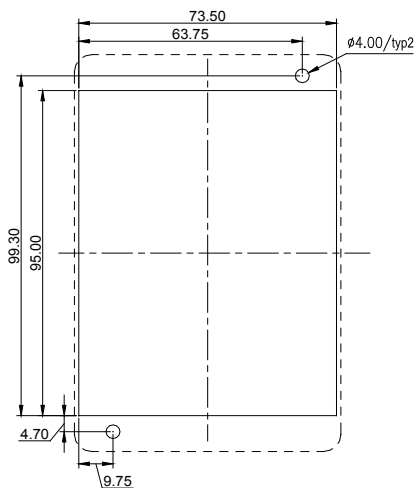


Fig.2-10 Schematic Diagram for Mounting Hole Dimensions of External Keyboard

2.5.4 Schematic Diagram for Dimensions of External DC Reactor

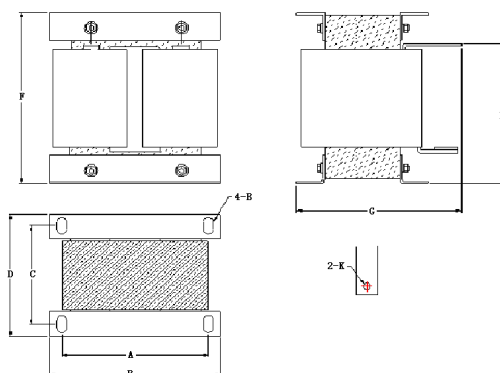


Fig. 2-11 Schematic Diagram for Dimensions of External reactor

Table 2-5 Adaptable Inverter Model

Adaptable Inverter Model	A	B	C	D	E	F	G	Mounting holes	Connection Diameter Hole of the copper medal
MD320T75G/90P/ 90G/110P/110G /132P	160	190	125	161	192	255	195	10*15	Ø12
MD320T132G/160P /160G	160	190	125	161	192	255	195	10*15	Ø12
MD320T200P/200G /220P/220G/250P	190	230	93	128	250	325	200	13*18	Ø15
MD320T250G/280P /280G/315P	190	230	93	128	250	325	200	13*18	Ø15
MD320T315G/355P/ 355G/400P/400G /450P	224	250	135	165	260	330	235	12*20	Ø14

Caution: For special requirements, the user can customize non-standard products.

*External DC reactor installation mode:

MD320 series inverter of more than 75kW produced by Shenzhen Inovance Technology Co.,

Ltd all employs standard external DC reactor, which is packed in independent wooden box and delivered together with the inverter. When mounting the inverter, the user needs to remove the short circuit bus between the terminals P and (+) of the main circuit of the inverter and then connect the DC reactor between P and (+). There is no polarity between the reactor terminal and the inverter terminals P and (+). After the DC reactor is mounted, the short circuit bus between P and (+) will not be used.

2.6 Optional Parts

If the user needs such optional parts, please specify when placing the order.

Table 2-6 MD320 Inverters Optional Parts

Name	Model	Function	Remarks
Built-in brake unit	The letter "B" attached behind the product model	Single-phase slave built-in brake unit of 0.4kW ~ 2.2kW (standard) Three-phase slave built-in brake unit of 0.75kW ~ 15kW (standard)	Built-in brake unit of 18.5kW to 30kW (optional)
External brake unit	MDBU	External brake unit of over 37kW	If 75kW or above is required, it can employ the parallel mode.
Energy feedback unit	MDFB	The inverter is energy saving product which can feed the electric energy back to AC power grid.	
Multi-pump water supply control card	MD32WS	It can realize constant pressure water supply system with multi-pump water supply system, and has multiple optional water supply modes as well as standby function and fire control function.	Built-in clock
I/O expansion card	MD32IO	It can add five digital inputs, one analog voltage input, one relay output, one digital output and one analog signal output.	
MODBUS Communication card	MD32MBS	RS485 communication interface and RS232 communication interface	RJ45 is compatible with the terminal interface.
PROFIBUS-DP bus card	MD32PFS	PROFIBUS-DP bus interface	
DeviceNet bus card	MD32DCT	DeviceNet bus interface	
CANopen bus card	MD32CAN	CANopen bus interface	

Name	Model	Function	Remarks
Common PG card 1	MD32PG	Rotary encoder interface card	15V power supply, push-pull or open collector output encoder is adaptable
Common PG card 2	MD32PGD	Rotary encoder interface card with frequency division output	
Long cable drive PG	MD32PG3	It is applicable to the differential-mode encoder.	It is applied in the situation with synchronous motor and induction motor close loop control
External LED operation panel	MDKE	External LED display and operation keyboard	MD series general-purpose RJ45 interface
External LCD operation panel	MD32KC	External LCD display and operation keyboard	RJ45 interface
Parameter copy unit	MDCP	Parameter copy	MD series general-purpose RJ45 interface
EPS commercial power synchronization card	MD32EPS	EPS mains synchronization	The output voltage of the inverter is synchronous with the mains supply of the inverter.
Extended cable	MDCAB	Standard 8-core network cable, and it can be connected with MDKE, MD32KC and MDCP.	3m are standard.
Rectifier unit	MFRU	It is used when the inverter shares the bus and has energy saving function.	
Rotation speed tracking card	MF32STC1	When the inverter stops driving the motor and the motor is in coast to stop status, it can acquire the rotation speed and rotation direction through the combination of this hardware circuit and software, thus better controlling the motor.	Add three cables from U, V and W output to the rotation speed tracking card input.

2.7 Routine Repair and Maintenance of inverter

2.7.1 Routine Repair

The influence of the ambient temperature, humidity, dust and vibration will cause the aging of the devices in the inverter, which may cause potential fault of the inverter or reduce the service life of the inverter. Therefore, it is necessary to carry out routine and periodical maintenance on the inverter.

Routine inspection Items include:

- 1) Whether there is any abnormal change in the running sound of the motor;
- 2) Whether the motor has vibration during the running;
- 3) Whether there is any change to the installation environment of the inverter;
- 4) Whether the inverter cooling fan works normally;
- 5) Whether the inverter has over temperature;

Routine cleaning:

The inverter shall be kept clean all the time.

The dust on the surface of the inverter shall be effectively removed, so as to prevent the dust entering the inverter. Especially the metal dust is not allowed.

The oil stain on the inverter cooling fan shall be effectively removed.

2.7.2 Periodic Inspection

Please perform periodic inspection on the places where the inspection is a difficult thing.

Periodic inspection Items include:

- 1) Check and clean the air duct periodically;
- 2) Check if the screws are loosened;
- 3) Check if the inverter is corroded;
- 4) Check if the wire connector has arc signs;
- 5) Main circuit insulation test

Remainder: When using the megameter (DC 500V megameter recommended) to measure the insulating resistance, the main circuit shall be disconnected with the inverter. Do not use the insulating resistance meter to control the insulation of the circuit. It is not necessary to conduct the high voltage test (which has been completed upon delivery).

2.7.3 Replacement of Vulnerable Parts for Inverter

The vulnerable parts of the inverter include cooling fan and filter electrolytic capacitor, whose service life depends on the operating environment and maintenance status. General service life is shown as follows:

Part name	Service Life
fan	2 to 3 years
electrolytic capacitor	4 to 5 years

The user can determine the year of replacement according to the operating time.

1) Cooling fan

Possible reason for damage: Bearing is worn and blade is aging.

Judging criteria: Whether there is crack on the blade and whether there is abnormal vibration noise upon startup.

2) Filter electrolytic capacitor

Possible reason for damage: Input power supply in poor quality, high ambient temperature, frequent load jumping, and electrolyte aging.

Judging criteria: Whether there is liquid leakage and whether the safe valve has projected, and measure the static capacitance, and the insulating resistance.

2.7.4 Storage of Inverter

Upon acquiring the inverter, the user shall pay attention to the following points regarding the temporary and long-term storage of the inverter:

- 1) Pack the inverter with original package and place back into the packing box of our company.
- 2) Long-term storage will degrade the electrolytic capacitor. Thus, the product shall be powered up once every 2 years, each time lasting at least five hours. The input voltage shall be increased slowly to the rated value with the regulator.

2.8 Instructions on Warranty of Inverter

Free warranty only applies to the inverter itself.

- 1) Our company will provide 18-month warranty (starting from the leave-factory date as indicated on the barcode) for the failure or damage under normal use conditions. If the equipment has been used for over 18 months, reasonable repair expenses will be charged.
- 2) Reasonable repair expenses will be charged for the following situations within 18 months:

- a) The equipment is damaged because the user fails to comply with the requirements of the user's manual;
- b) Damage caused by fire, flood and abnormal voltage; 3) Damage caused when the inverter is used for abnormal function.

The service expenses will be calculated according to the standard of the manufacturer. If there is any agreement, the agreement shall prevail.

2.9 Prototyping Guide

Three control modes are available, namely, V/F, SVC and VC.

When selecting inverter, it must firstly make clear the technical requirements of the system for variable frequency speed adjustment and specific details regarding the applications and load characteristics of the inverter, and select the model and determine the operating mode through taking into overall consideration the adaptable motor, output voltage, rated output current and other factors.

The basic principle is that the rated load current of the motor shall not exceed the rated current of the inverter. Generally, the selection is based on the adaptable motor capacity as specified in the instruction manual. Please pay attention to comparison between the rated currents of motor and inverter. The overload capacity of the inverter only affects the startup and brake process. In case short-time overload occurs during the running process, variation of load speed may arise. If the requirement for the speed precision is relatively high, it can consider increasing the level.

Fan and pump type: Their requirements for the overload capacity are relatively low. Since the load torque is proportional to the speed, the load is relatively light (except Roots fan) when running at low speed. In addition, this type of load has no special requirements for the rotation precision. Thus, square torque V/F is selected.

Constant torque load: Most of loads have constant torque characteristics, but the requirements for rotation speed and dynamic performance are low. Extruding machine, agitator, belt conveyer, transporting trolley in the factory, and translational unit of crane are the examples. It can select MS V/F running mode when performing prototyping test.

The controlled object has certain dynamic and static index requirements: This kind of load requires harder mechanical characteristics at low speed in order to satisfy the dynamic and static index requirements of the process for the control system. It can select SVC control mode.

The controlled object has higher dynamic and static index requirements: It can employ VC control mode in applications where the requirements for speed adjustment precision and dynamic performance index are relatively high and there is high precision synchronous control. Elevator, paper making and plastic thin film processing product line are the examples.

2.10 Guide to Prototyping of Brake Components

(*): Table 2-5 Inverter Brake Components Prototyping Table provides data for reference, and the user can select different resistance and power according to the actual needs (but the resistance shall not be lower than the recommended value, and the power may be higher than the recommended value). The selection of brake resistor shall be determined in accordance with the power generated by the motor in the actual application system and is associated with the system

inertia, speed-down time and energy of potential load. Thus, the user needs to select based on the actual needs. The higher the system inertia, the shorter the speed-down time required, and more frequent the brake is, and then it needs to select higher power and lower resistance value for the brake resistor.

2.10.1 Selection of resistance value

Renewable electric energy consumption is almost the braking resistor when braking.

According to the formula $U^2/R=P_b$,

U refers to stable Braking system of Brake voltage. (Different system has different brake voltage. Generally select 700V for the system 380VAC).

P_b represents the Braking power.

2.10.2 Selection of Braking Resistor Power

Theoretically, braking resistor power is consistent with braking Power.

According to the formula braking power, $0.7 \cdot P_r = P_b \cdot D$,

P_r refers to the resistor power,

D refers to braking frequency. (Which is the regeneration process in the proportion of the entire working process). For example, the braking frequency of elevator is between 20%~30%, the winding and unwinding is between 20%~30%. The centrifuge is between 50%~60%, Occasional brake load is 5%. The General selection is 10%.

Table 2-7 MD320 Inverter Brake Components Prototyping Table

Inverter Model	Recommended Power of Brake Resistor	Recommended Resistance Value of Brake Resistor	Braking Unit	Remarks
MD320S0.4	80W	$\geq 200\Omega$	Built-in, optional	The letter "B" is attached behind the Inverter model.
MD320S0.7	80W	$\geq 150\Omega$		
MD320S1.5	100W	$\geq 100\Omega$		
MD320S2.2	100W	$\geq 70\Omega$		
MD320T0.7	150W	$\geq 300\Omega$	Built-in as standard	No special specification
MD320T1.5	150W	$\geq 220\Omega$		
MD320T2.2	250W	$\geq 200\Omega$		
MD320T3.7	300W	$\geq 130\Omega$		
MD320T5.5	400W	$\geq 90\Omega$		
MD320T7.5	500W	$\geq 65\Omega$		
MD320T11	800W	$\geq 43\Omega$		
MD320T15	1000W	$\geq 32\Omega$		

Inverter Model	Recommended Power of Brake Resistor	Recommended Resistance Value of Brake Resistor	Braking Unit	Remarks
MD320T18.5	1300W	$\geq 25\Omega$	Built-in, optional	The letter "B" is attached behind the Inverter model.
MD320T22	1500W	$\geq 22\Omega$		
MD320T30	2500W	$\geq 16\Omega$		
MD320T37	3.7 kW	$\geq 16.0\Omega$	Externally connected	MDBU-35-B
MD320T45	4.5 kW	$\geq 16\Omega$	Externally connected	MDBU-35-B
MD320T55	5.5 kW	$\geq 8\Omega$	Externally connected	MDBU-70-B
MD320T75	7.5 kW	$\geq 8\Omega$	Externally connected	MDBU-70-B
MD320T90	4.5 kW×2	$\geq 8\Omega \times 2$	Externally connected	MDBU-70-B×2
MD320T110	5.5 kW×2	$\geq 8\Omega \times 2$	Externally connected	MDBU-70-B×2
MD320T132	6.5 kW×2	$\geq 8\Omega \times 2$	Externally connected	MDBU-70-B×2
MD320T160	16kW	$\geq 2.5\Omega$	Externally connected	MDBU-210-B
MD320T200	20 kW	$\geq 2.5\Omega$	Externally connected	MDBU-210-B
MD320T220	22 kW	$\geq 2.5\Omega$	Externally connected	MDBU-210-B
MD320T250	12.5 kW×2	$\geq 2.5\Omega \times 2$	Externally connected	MDBU-210-B×2
MD320T280	14kW×2	$\geq 2.5\Omega \times 2$	Externally connected	MDBU-210-B×2
MD320T315	16kW×2	$\geq 2.5\Omega \times 2$	Externally connected	MDBU-210-B×2
MD320T355	17kW×2	$\geq 2.5\Omega \times 2$	Externally connected	MDBU-210-B×2
MD320T400	14 kW×3	$\geq 2.5\Omega \times 3$	Externally connected	MDBU-210-B×3
MD320T450	15kW×3	$\geq 2.5\Omega \times 3$	Externally connected	MDBU-210-B×3

Caution: ×2 refers to two braking unit paralleled with their respective brake resistor; the meaning of ×3 is the same with ×2.



3

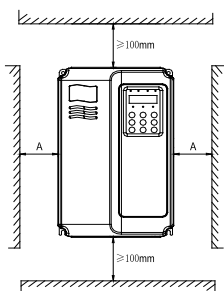
Mechanical and Electric Installation

Chapter 3 Mechanical and Electric Installation

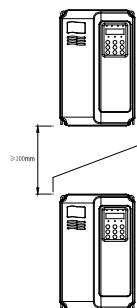
3.1 Mechanical installation

3.1.1 Installation environment:

- 1) Ambient temperature: The ambient temperature exerts great influences on the service life of the inverter and is not allowed to exceed the allowable temperature range (-10 °C Celsius to 50 °C Celsius).
- 2) The inverter shall be mounted on the surface of incombustible articles, with sufficient spaces nearby for heat sinking. The inverter is easy to generate large amount of heat during the operation. The inverter shall be mounted vertically on the base with screws.
- 3) The inverter shall be mounted in the place without vibration or with vibration of less than 0.6G, and shall be kept away from such equipment as punching machine.
- 4) The inverter shall be mounted in locations free from direct sunlight, high humidity and condensate.
- 5) The inverter shall be mounted in locations free from corrosive gas, explosive gas or combustible gas.
- 6) The inverter shall be mounted in locations free from oil dirt, dust, and metal powder.



Single Unit Installation Diagram



Installation Diagram of Upper and Down Parts

When Single Unit Installation: When the inverter power is not higher than 22kW, the A size can be omitted. When the inverter power is higher than 22kW, the A size shall be higher than 50mm.

When Installation of Upper and Lower Parts: When installing the upper and lower parts of the inverter, the insulating splitter is required.

Power Level	Mounting Dimension	
	B	A
$\leq 15\text{kW}$	$\geq 100\text{mm}$	No requirements
18.5kW—30kW	$\geq 200\text{mm}$	$\geq 50\text{mm}$
$\geq 37\text{kW}$	$\geq 300\text{mm}$	$\geq 50\text{mm}$

Fig.3-1 MD320 Inverter Installation Diagram

3.1.2 Heat dissipation shall be taken into account during the mechanical installation. Please pay attention the following items:

- 1) Install the inverter vertically so that the heat may be expelled from the top. However, the equipment cannot be installed upside down. If there are multiple inverters, parallel installation is a better choice. In applications where the upper and lower parts of the inverter need to be installed, please refer to Fig.3-1 "MD320 Inverter Installation Diagram" and install an insulating splitter.
- 2) The mounting space shall be as indicated as the above figure, so as to ensure the heat dissipation space of the inverter. However, the heat dissipation of other devices in the cabinet shall also be taken into account.
- 3) The installation bracket must be flame retardant.
- 4) In the applications where there are metal dusts, it is recommended to mount the radiator outside the cabinet. In this case, the space in the sealed cabinet shall be large enough.

3.1.3 Removing and mounting the lower cover plate

The MD series inverter of less than 15kW employs plastic enclosure. Please refer to Figure 3-2 and Figure 3-3 for removing the down cover plate of the plastic enclosure. The hooker of the lower cover plate is easy to pull out with tools by forces inside.

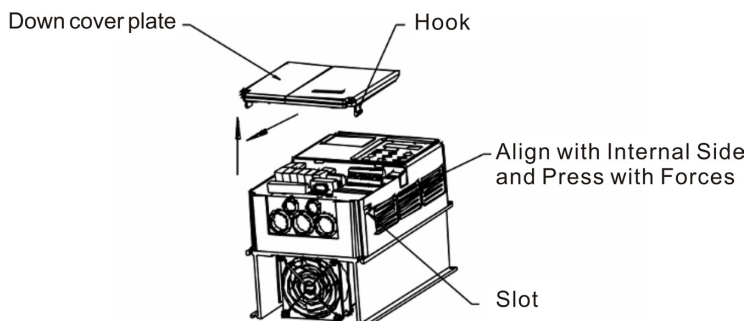


Fig.3-2 Removing the Lower Cover Plate of Plastic Enclosure

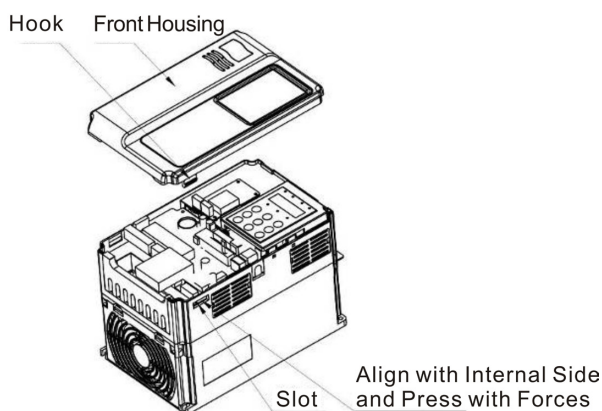



Fig.3-3 Removing the Down Cover Plate of Plastic Enclosure

The MD series inverter of more than 18.5kW employs sheet-metal enclosure. Please refer to Figure 3-4 for removing the lower cover plate of the sheet-metal enclosure. It is easy to loosen the screws of the upper cover plate with tools.

 Danger
<ul style="list-style-type: none"> When removing the down cover plate, be sure to avoid the falling of the down cover, which may cause human injury or damage to the equipment.

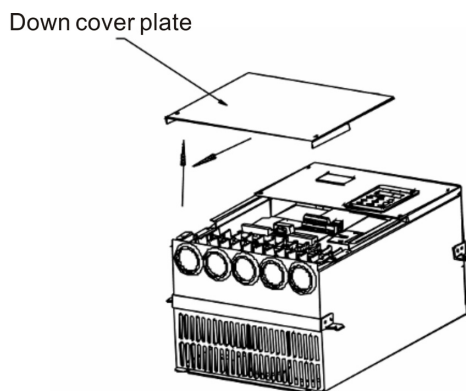


Fig.3-4 Removing the Lower Cover Plate of Sheet-Metal Enclosure

3.2 Electrical Installation

3.2.1 Guide to the external electrical parts:

Table 3-1 Guide to Prototyping of External Electrical Parts of MD320 Inverter

Inverter Model	Circuit Breaker (MCCB) (A)	Recommended Contactor (A)	Recommended Conducting Wire of Main Circuit at the Input Side (mm)	Recommended Conducting Wire of Main Circuit at the Output Side (mm)	Recommended Conducting Wire of Control Circuit (mm)
MD320S0.4G	16	10	2.5	2.5	1.0
MD320S0.7G	16	10	2.5	2.5	1.0
MD320S1.5G	20	16	4.0	2.5	1.0
MD320S2.2G	32	20	6.0	4.0	1.0
MD320T0.7G	10	10	2.5	2.5	1.0
MD320T1.5G	16	10	2.5	2.5	1.0
MD320T2.2G	16	10	2.5	2.5	1.0
MD320T3.7G	25	16	4.0	4.0	1.0
MD320T5.5 G/7.5P	32	25	4.0	4.0	1.0
MD320T7.5 G/11P	40	32	4.0	4.0	1.0
MD320T11 G/15P	63	40	4.0	4.0	1.0
MD320T15G/18.5P	63	40	6.0	6.0	1.0
MD320T18.5G /22P	100	63	6	6	1.5
MD320T22G /30P	100	63	10	10	1.5
MD320T30G /37P	125	100	16	10	1.5
MD320T37G /45P	160	100	16	16	1.5
MD320T45G /55P	200	125	25	25	1.5
MD320T55G/75P	200	125	35	25	1.5

Inverter Model	Circuit Breaker (MCCB) (A)	Recommended Contactor (A)	Recommended Conducting Wire of Main Circuit at the Input Side (mm)	Recommended Conducting Wire of Main Circuit at the Output Side (mm)	Recommended Conducting Wire of Control Circuit (mm)
MD320T75G /90P	250	160	50	35	1.5
MD320T90G /110P	250	160	70	35	1.5
MD320T110G /132P	350	350	120	120	1.5
MD320T132G /160P	400	400	150	150	1.5
MD320T160G /200P	500	400	185	185	1.5
MD320T200G /220P	600	600	150*2	150*2	1.5
MD320T220G /250P	600	600	150*2	150*2	1.5
MD320T250G /280P	800	600	185*2	185*2	1.5
MD320T280G /315P	800	800	185*2	185*2	1.5
MD320T315G /355P	800	800	150*3	150*3	1.5
MD320T355G /400P	800	800	150*4	150*4	1.5
MD320T400G /450P	1000	1000	150*4	150*4	1.5
MD320 7T***	Refer to parameters of rated current of 380V system alike.				

Caution: The electrical installation of MD320N series is the same as MD320 series.

Table 3-2 Instruction for the Use of External Electrical Parts of MD320

Part Name	Mounting Location	Function Description
Circuit breaker	Front end of input circuit	Disconnect the power supply when the equipment at the lower part is over current.
Contactor	Between the circuit breaker and the inverter input side	Connection and disconnection of inverter. Frequent power-on and power-off operations on the inverter shall be avoided.

Part Name	Mounting Location	Function Description
AC input reactor	side of the inverter	<ul style="list-style-type: none"> Improve the power factor of the input side; Eliminate the higher harmonics of the input side effectively and prevent other equipment from damaging due to distortion of voltage wave. Eliminate the input current unbalance due to unbalance between the power phases.
EMC Input filter	Input side of the inverter	<ul style="list-style-type: none"> Reduce the external conduction and radiation interference of the inverter. Decrease the conduction interference flowing from the power end to the inverter and improve the anti-interference capacity of the inverter.
DC reactor	MD series inverter adopts DC reactor of more than 7.5G as standard.	<ul style="list-style-type: none"> Improve the power factor of the input side; Improve the whole efficiency and thermal stability of the inverter. Eliminate the impact of higher harmonics of the input side on the inverter and reduce the external conduction and radiation interference.
AC output reactor	Between the inverter output side and the motor. close to the inverter	<p>The inverter output side generally has higher harmonics. When the motor is far from the inverter, since there are many distributed capacitors in the circuit, certain harmonics may cause resonance in the circuit and bring about the following two impacts:</p> <ul style="list-style-type: none"> Degrade the motor insulation performance and damage the motor for the long run. Generate large leakage current and cause frequent inverter protection. <p>In general, the distance between the inverter and the motor exceeds 100 meters. Installation of output AC reactor is recommended.</p>

3.2.3 Connections

Schematic Diagram for Single-phase Inverter Connection:

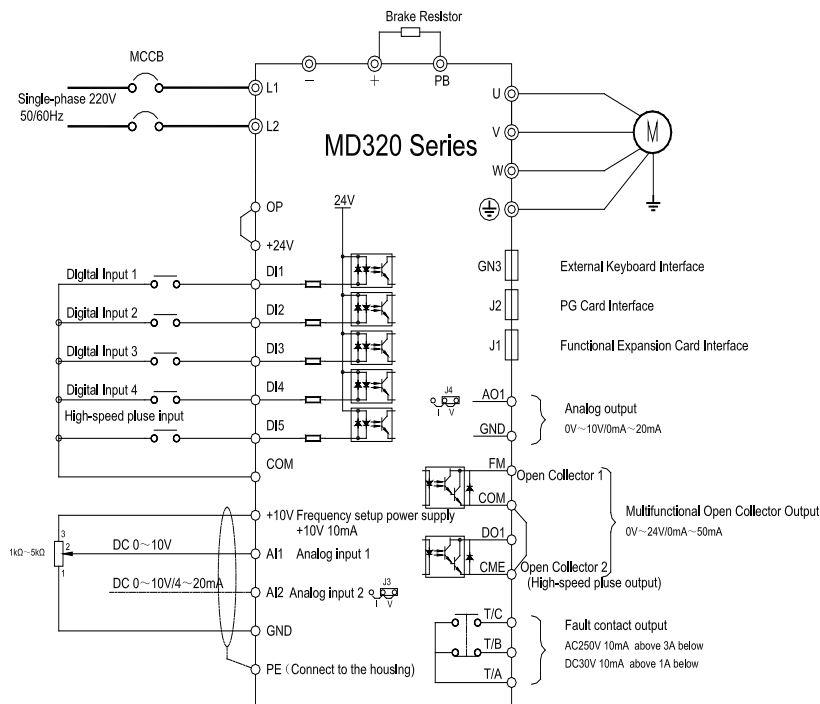


Fig.3-5 Schematic Diagram for Single-phase inverter Connection

Precautions are as follows:

1. Terminal © refers to Main circuit terminal, Terminal ○ refers to control circuit terminal.
2. There is 0.4kW~2.2kW Build-in brake unit optional.
3. B which is followed the product model represents Self-braking unit.
4. Braking resistor's selection is based on the user demand. See the prototyping Guide of braking resistor for details.
5. Signal lines and power line must be separated alignments, if you want to control cables and power cable cross, let them cross by 90 degree angle. It is best to choose shielded twisted-pair cabling for analogue signal, the selection of power cable is shield three-core cable(The specification should enlarge a file as much as the ordinary electric cables),or follow the inverter user manual.

Schematic Diagram for Three-phase Inverter Connection:

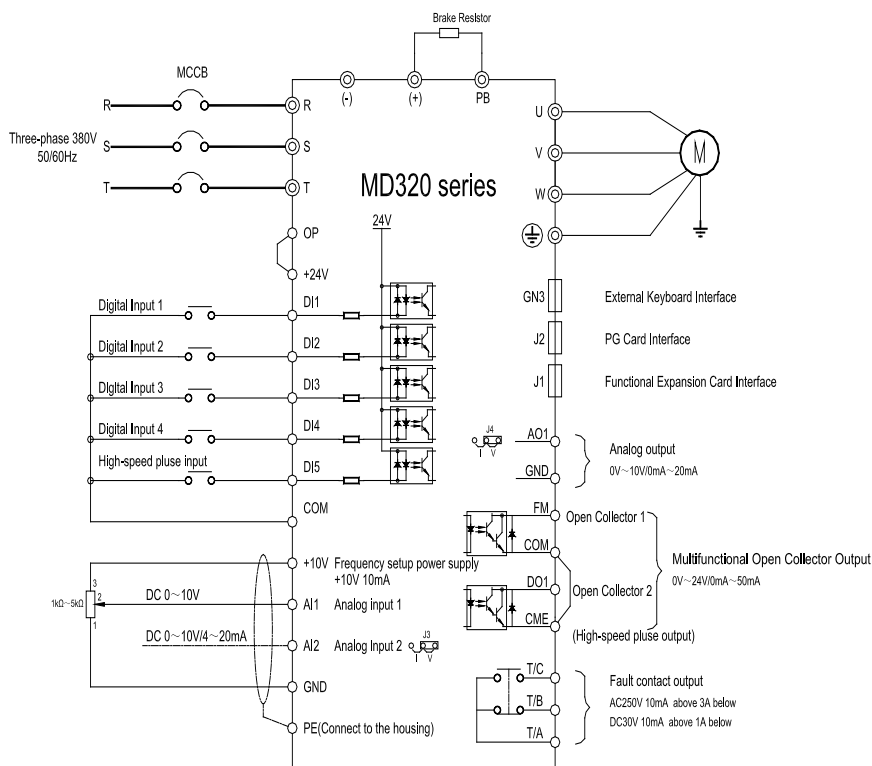


Fig. 3-6 Schematic Diagram for Three-phase Inverter Connection

Precautions are as follows:

1. Terminal © refers to the main circuit terminal, Terminal ○ refers to the control circuit terminal.
2. The 0.75kW~15kW Auto unit is the standard configuration.
3. 7.5kW~55kW is build-in DC reactor.
4. The selection of the braking resistor is according to the user need. See the prototyping Guide of braking resistor for details.

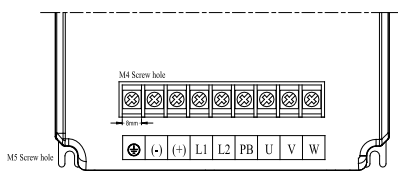
3.2.4 Main Circuit Terminals and Connections

**Danger**

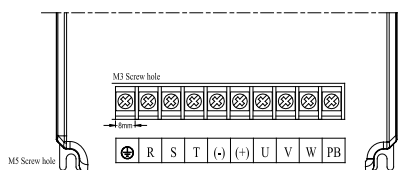
1. Make sure that the power switch is in OFF status prior to perform wiring connection. Otherwise there may be danger of electric shock!
2. Only the qualified and trained personnel can perform wiring connection. Otherwise it may cause equipment and human injuries!
3. It shall be earthed reliably. Otherwise there may be danger of electric shock or fire!

**Note**

1. Make sure that the rated value of the input power supply is consistent with that of the inverter. Otherwise it may damage the inverter!
2. Make sure that the motor matches the inverter. Otherwise it may damage the motor or generate inverter protection!
3. Do not connect the power supply to the terminals of U, V and W. Otherwise it may damage the inverter!
4. Do not directly connect the brake resistor between the DC bus terminals (+) and (-). Otherwise it may cause fire!



MD320	Largest Cable Size of Power Terminal		Torque
	mm ²	AWG	
S0.4G	2.5	14	14±0.5
S0.7G	2.5	14	14±0.5
S1.5G	4.0	12	14±0.5
S2.2G	6.0	10	14±0.5



MD320	Largest Cable Size of Power Terminal		Torque
	mm ²	AWG	
T0.7G	2.5	14	10±0.5
T1.5G	2.5	14	10±0.5
T2.2G	2.5	14	10±0.5

	Largest Cable Size of Power Terminal		Torque
	mm ²	AWG	
	4.0	12	14±0.5
	4.0	12	14±0.5

	Largest Cable Size of Power Terminal		Torque
	mm ²	AWG	
	4.0	12	28±0.5
	4.0	12	28±0.5

MD320	Largest Cable Size of Power Terminal		Torque
	mm ²	AWG	
	4.0	12	14±0.5

MD320	Largest Cable Size of Power Terminal		Torque
	mm ²	AWG	
	4.0	12	28±0.5

MD320	Largest Cable Size of Power Terminal		Torque
	mm ²	AWG	
	4.0	12	28±0.5


MD320	Largest Cable Size of Power Terminal		Torque
	mm ²	AWG	
	6.0	10	28±0.5

Fig.3-7Diagram for Driver main circuit power terminal

1) Instructions of main circuit terminals of single-phase inverter:

Terminals	Name	Description
L1、L2	Input terminal of single-phase power supply	single-phase 220V power connection point
(+), (-)	Negative and positive terminals of DC bus	Shared DC Bus input point
(+), PB	Connecting terminal of brake resistor	Connect the brake resistor
U、V、W	Output terminal of inverter Output terminal of inverter	Connect the three-phase motor
	Earth terminal	Earth terminal

2) Description of main circuit terminals of three-phase inverter

Terminals	Name	Description
R、S、T	Input terminal of three-phase power supply	AC input single-phase power connection point
(+), (-)	Negative and positive terminals of DC bus	Shared DC bus input point (connection point of external brake unit of more than 37kW)
(+), PB	Connecting terminal of brake resistor	Connection point of Brake resistor of less than 30kW
P、(+)	Connection terminal of external reactor	Connection point of external reactor
U、V、W	Output terminal of inverter	Connect the three-phase motor
	Earth terminal	Earth terminal

1) Precautions on Wiring:

A) Input power L1, L2 or R, S and T:

The cable connection at the input side of the inverter has no phase sequence requirement.

B) DC bus (+) and (-) terminals:

Note that the (+) and (-) terminals of DC bus have residual voltage right after power-on. It needs to wait until the CHARGE indicator is OFF and make sure that the voltage is less than 36V prior to wiring connection. Otherwise there may be danger of electric shock.

When selecting external brake unit for the inverter of more than 37kW, the poles of (+) and (-) shall not be connected reversely, or it may damage the inverter and even cause fire.

The wiring length of the brake unit shall not exceed 10 meters. Twisted wires or pair wires shall be used and connected in parallel.

Do not connect the brake resistor directly to the DC bus, or it may damage the inverter and even cause fire.

C) Connecting terminals (+) and PB of brake resistor:

The connecting terminals of the brake resistor are effective only for the inverter of less than 30kW with built-in brake unit.

The prototype of brake resistor can refer to the recommended value and the wiring length shall be less than 5 meters. Otherwise it may damage the inverter.

D) Connecting terminals P and (+) of external reactor:

For the inverter of more than 75kW with external reactor, when assembling, remove the connector between terminals P and (+) and connect a reactor instead.

E) Terminals U, V, W at the output side of the inverter:

The inverter output side cannot connect to the capacitor or surge absorber. Otherwise, it may cause frequent inverter protection and even damage the inverter.

In case the motor cable is too long, it may generate electrical resonance easily due to the impact of distributed capacitance, thus damaging the motor insulation or generating higher leakage current to invoke over current protection of the inverter. When the length of motor cable is longer than 100 meters, it needs to install a AC output reactor.

F) Earth terminal PE:

This terminal shall be earthed reliably, with resistance of earth cable of less than 0.1Ω. Otherwise, it may cause fault or damage the inverter.

Do not share the earth terminal and zero line of the power supply.

3.2.5 Control terminal and connection

1) Control terminals and connection:

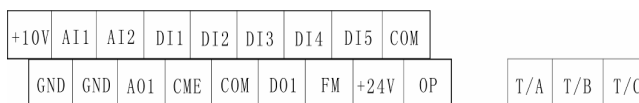


Fig.3-8 Layout of Control Circuit Terminals

2) Function description of control terminal:

Table 3-3 Description of Control Terminal Function of MD320 Inverter

Type	Terminal Symbol	Terminal Name	Function Description
Power Supply	+10V-GND	External 10V power supply	Provide +10V power supply for external- units, and the maximum output current is 10mA. It is generally used as the operating power supply for the external potentiometer. The potentiometer resistance range is 1kΩ~ 5kΩ.
	+24V-COM	External 24V power supply	Provide +24V power supply for external units. It is generally used as the operating power supply for digital input/output terminals and the external sensor. The maximum output current is 200mA.
	OP	External power input terminal	Connect to 24V by default upon delivery When external signal is used to drive DI1 ~ DI5, OP needs to connect to the external power supply and disconnect from the +24V power terminal

Type	Terminal Symbol	Terminal Name	Function Description
Analog Input	AI1-GND	Analog input terminal 1	1. Input Voltage range: DC 0V to 10V 2. Input resistance: 100k Ω
	AI2-GND	Analog input terminal 2	1. Input range: DC 0V ~ 10V/4mA ~ 20mA, which is determined by J3 jumper on the control board. 2. Input impedance: It is 100k Ω at the time of voltage input and 500 Ω at the time of current input.
Digital input	DI1-COM	Digital input 1	1. Optical coupling isolation, compatible with dual polarity input 2. Input resistance: 3.3k Ω 3. Voltage range for level input: 9V ~ 30V
	DI2-COM	Digital input 2	
	DI3-COM	Digital input 3	
	DI4-COM	Digital input 4	
	DI5-COM	High-speed pulse input terminal	In addition to the characteristics of DI1 to DI4, it can also be used as the high-speed pulse input channel. Maximum input frequency is 50kHz.
Analog Output	AO1-GND	Analog output 1	The voltage or current output is determined by the J4 jumper on the control board. Output voltage range: 0V ~ 10V. Output current range: 0mA ~ 20mA.
Digital output	DO1-CME	Digital output 1	Optical coupling isolation, dual polarity open collector output Output voltage range: Output current range: Caution: The CME and COM is internally insulated, but they have been short circuited externally (DO1 is driven by +24V by default prior to delivery). When DO1 needs to be driven by the external power, the short circuited between CME and COM must be disconnected.
	FM-COM	High-speed pulse output	It is limited by functional code F5-00 "FM Terminal Output Mode Selection". When it is used as high-speed pulse output, the maximum frequency can reach 50kHz; When it is used as open collector output, it is same as DO1 in terms of specifications.

Type	Terminal Symbol	Terminal Name	Function Description
Relay Output	T/A-T/B	Normally closed terminal	AC250V, 3A, $\cos\phi=0.4$. DC 30V, 1A Contact driving capacity: AC250V, 3A, $\cos\phi=0.4$. DC 30V, 1A
	T/A-T/C	Normally open terminal	
Auxiliary Interface	J1	Functional expansion card interface	28-core terminal and interface with optional cards (I/O expansion card, multiple pump water supply expansion card, extension card, MODBUS communication card and various bus cards)
	CN3	External keyboard interface	external keyboard and parameter copy unit interface

3) Description of Connection of control terminals:

A. Analog input terminal:

Since the weak analog voltage signal is easy to suffer external interferences, it needs to employ shielded cable generally and the length shall be no longer than 20 meters, as shown in Fig. 3-9. In case the analog signal is subject to severe interference, and analog signal source side shall be installed with filter capacitor or ferrite magnetic core, as shown in Fig.3-10.

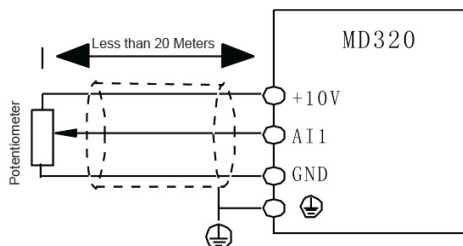


Fig.3-9 Schematic Diagram for Connection of Input Terminal of Analog Signal

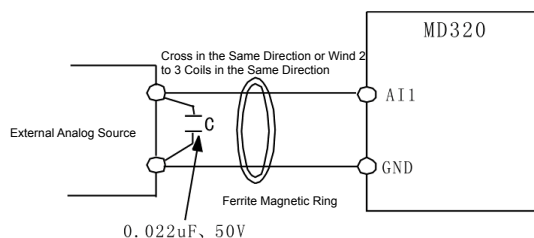


Fig.3-10 Schematic Diagram for Connection of Terminal of analog Input

B. Digital input terminal:

It needs to employ shielded cable generally, with cable length of no more than 20 meters.

When active driving is adopted, necessary filtering measures shall be taken to prevent the interference to the power supply.

It is recommended to use the contact control mode.

C. DI Terminal Connection:

1. Connection with dry contact sharing the negative pole

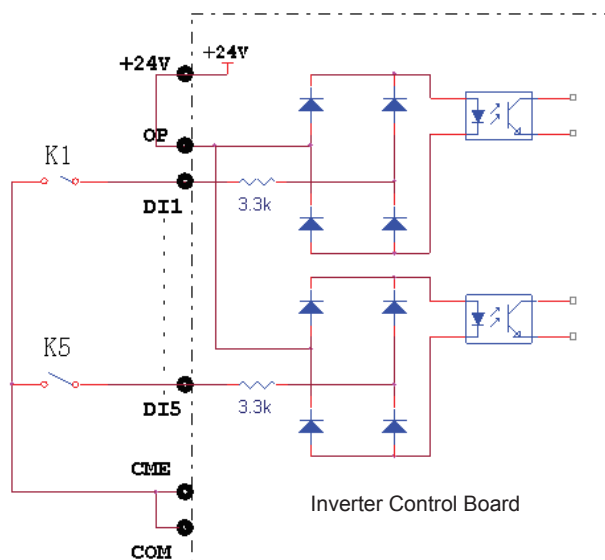


Fig.3-11 Connection with dry contact sharing the negative pole

This is the most commonly used connection mode. If external power supply is used, it must remove the short circuit copper bars between +24V and OP and between COM and CME respectively, and connect the positive pole of external power supply to OP and negative pole to CME.

2. Connection with dry contact sharing the positive pole

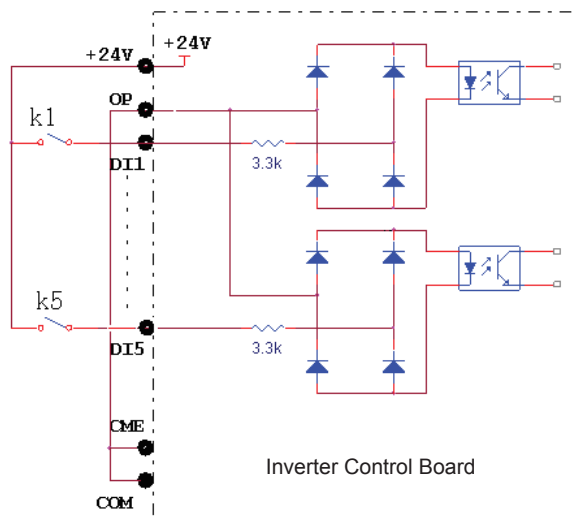


Fig.3-12 Connection with dry contact sharing the positive pole

In this connection mode, it must remove the short circuit copper bar between +24V and OP and then connect OP with CME. If external power supply is used, it must also remove the short circuit copper bar between CME and COM.

3. Source Electrode Connection

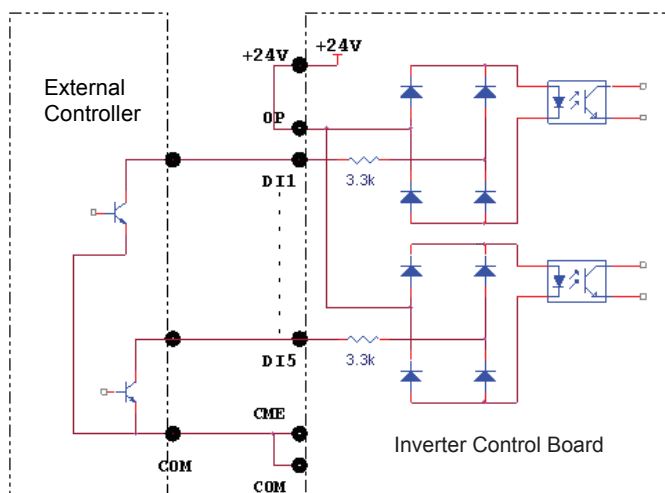


Fig.3-13 Source Electrode Connection

This is one of the most commonly used connection mode. If external power supply is used, it must remove the short circuit copper bars between +24V and OP and between COM and CME respectively, and connect the positive pole of external power supply to OP and negative pole to CME.

4. Drain Electrode Connection

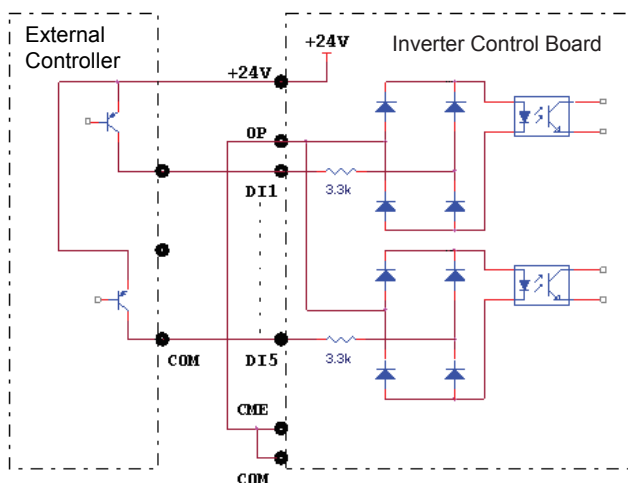


Fig.3-14.Drain Connection

In this connection mode, it must remove the short circuit copper bar between +24V and OP and connect OP with the public tend of the external controller and OP with CME. If external power supply is used, it must also remove the short circuit copper bar between CME and COM.

D. Digital output terminal:

When the digital output terminal needs the drive relay, absorption diode shall be installed at the two sides of the relay coil. Otherwise it may damage DC 24 power supply easily.

Caution: The absorption diode shall be installed with correct polarity, as shown in Fig.3-15. Otherwise, when there the digital output terminal has output, the DC 24V power supply and output circuit will be damaged immediately.

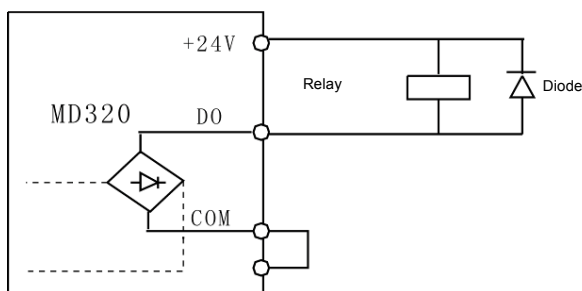


Fig.3-15 Schematic diagram for connection of digital output terminal



4

Operation and Display

Chapter 4 Operation and Display

4.1 Introduction to Operation and Display Interface

With the operation panel, it can perform such operations on the inverter as function parameter modification, inverter working status monitoring and inverter running control (startup and stop). Refer to Fig.4-1 for the physical appearance and functional zone of the operation panel.

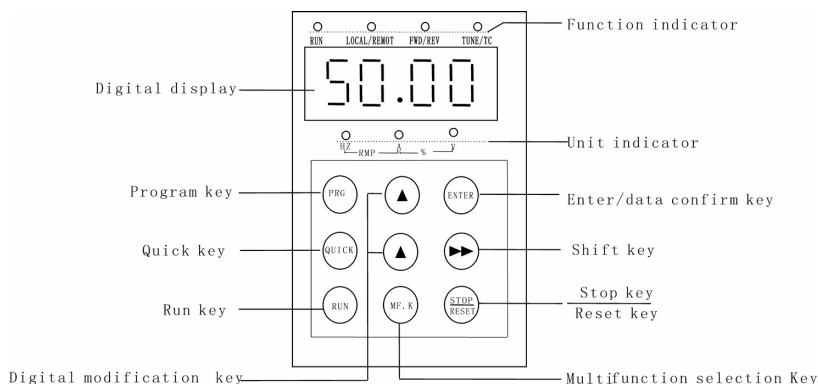


Fig.4-1 Operation Panel Diagram

1) Description of Function LED Indicator:

RUN: When it is OFF, it indicates the inverter is in stop status; when it is ON, it indicates the inverter is in rotation status.

LOCAL/REMOTE: It is the LED indicator for keyboard operation, terminal operation and remote operation (communication control). When it is OFF, it indicates the keyboard operation control status; when it is ON, it indicates the terminal operation control status; when it flashes, it indicates the remote operation control status.

FWD/REV: It is the LED indicator for forward/reverse rotation. When it is OFF, it indicates the inverter is in forward rotation status; when it is ON, it indicates the inverter is in reverse rotation status.

TUNE/TC: It is the LED indicator for tuning. When it is ON it indicates the torque control status; when it is OFF, it indicates the speed control status.

2) Units of LED indicator description:

Hz refers to the unit of frequency

A refers to the unit of current

V refers to the unit of voltage.

RPM refers to the unit of rotation speed unit

3) Digital display zone:

Five-digit LED display, able to display setup frequency, output frequency, various monitoring data and alarm code.

% refers to percentage

4) Keyboard button description

Table 4-1 Keyboard Function

Button	Name	Function
PRG	Programming key	Entry and exit of primary menu, deletion of shortcut parameter
ENTER	Confirmation key	Enter the menu interfaces level by level, and confirm the set parameters.
∧	Increase key	Increase of the data or function code
∨	Decrease key	Decrease of the data or function code
»	Shift key	Select the displayed parameters in turn on the stop display interface and running display interface, and select the modification digit of parameters when modifying parameters.
RUN	Running key	It is used to start the running of the inverter under keyboard control mode.
STOP/RES	Stop/reset	Press this button to stop the running in the running status and reset the operation in the fault alarm status. These button characteristics are limited by the function code F7-02.
MF.K	Multi-function selection key	According to F7-15, take function switching selection.

4.2 Description of Function Code Viewing and Modification Methods

The operation panel of the MD320 inverter adopts three-level menu structure to carry out operations such as parameter setting.

The three-level menu includes function parameter set (level 1 menu)→Function code (level 2 menu)→Function code setup value (level 3 menu). Refer to Fig.4-2 for the operation procedure.

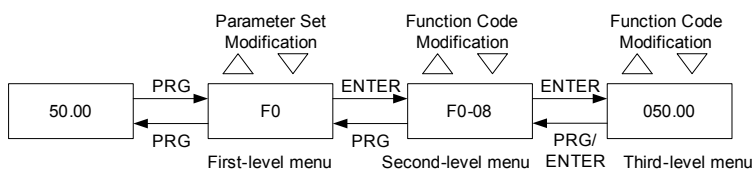


Fig.4-2 Operation Procedure of Three-level Menu

Caution: When operating on level 3 menu, press PRG key or ENTER key to return to level 2 menu. The difference between PRG key and ENTER key is described as follows: Pressing ENTER KEY will save the setup parameter and return to the level 2 menu and then automatically shift to the next function code, while pressing PRG key will directly return to level 2 menu without saving the parameter, and it will return to the current function code.

Example: Modify the function code F3-02 from 10.00Hz to 15.00Hz. (The bold-type work indicates the flashing bit.)

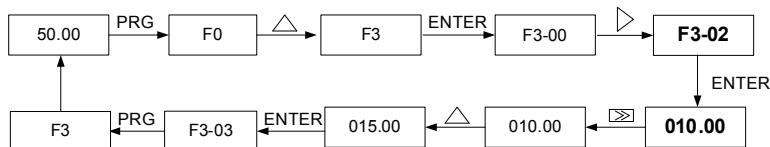


Fig.4-3 Example of parameter editing operation

In level 3 menu, if the parameter has no flashing bit, it indicates that the function code cannot be modified. The possible reasons include:

- 1) The function code is an unchangeable parameter, such as actual detection parameter, running record parameter, etc.
- 2) The function code cannot be modified in running status. It can be modified only after the unit is stopped.

4.3 Shortcut Menu Operation Mode

The shortcut menu is set to facilitate the user to quickly view and modify the commonly used function parameters. In the shortcut menu, the parameter is displayed in the form of "Uf3-02", which indicates the function parameter F-02. Parameter modification in the shortcut menu has the same effect as the operation in the common programming status.

The shortcut menu can contain 16 function parameters at most. If there are 16 parameters and the user wants to add more, it will display "FULL". If "NULL" is displayed when entering the menu, it indicates that the shortcut menu is null. The shortcut menu operation is limited by the function code F7-03. When F7-3 is set to "0", addition or deletion operation can be performed on the shortcut menu. When F7-03 is set to "1", the parameter option is locked and addition or deletion operation is inactive.

The shortcut menu has stored the 16 common parameters by default for the convenience of the user:

F0-01: Controm mode

F0-02: Command source selection

F0-03: Main frequency source selection F0-07: Frequency source selection

F0-08: Preset frequency

F0-17: Acceleration time

F0-18: Deceleration time

F3-00: V/F curve setup

F3-01: Torque boost

F4-00: DI1 terminal function selection

F4-01: DI2 terminal function selection F4-02: DI3 terminal function selection

F5-04: DO1 output selection

F5-07: AO1 output selection

F6-00: Startup mode

F6-10: Stop mode

The user can edit the shortcut menu in accordance with the actual needs.

1) Add shortcut parameter item:

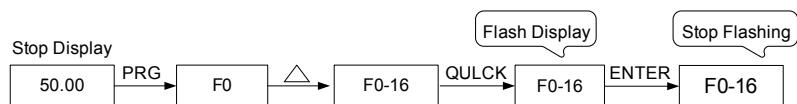


Fig.4-4 Example of Adding Shortcut Parameter Item

Caution: When pressing QUICK key during the programming of level 2 menu, the display flashes and prompts whether to save the parameter into shortcut menu. Press ENTER key for confirmation, the display stops flashing, and the operation is completed. Press PRG key to cancel, the display stops flashing, and the operation is cancelled.

2) Modification of shortcut parameters

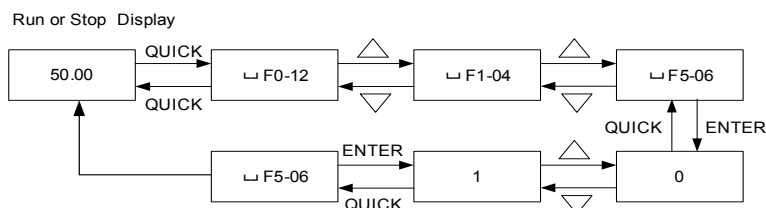


Fig.4-5 Example of Modification of Shortcut Parameters

Caution: In Stop or running display interface, press QUICK key to enter shortcut key, and select different shortcut parameters with UP/DOWN key. Then press ENTER key to enter next level of menu. At this time the modification method of shortcut parameter is the same as that of the parameters in common level 3 menu. To return to the upper level display, press QUICK key, and the modified parameters will not be saved. \

3) Delete shortcut parameter item:

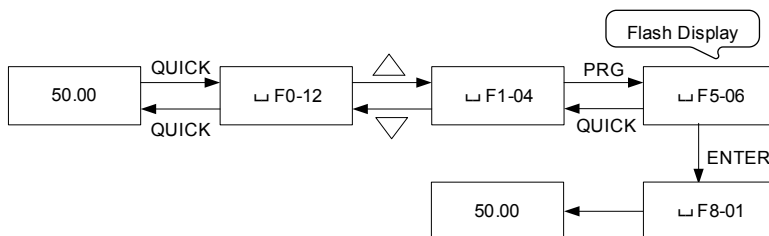


Fig.4-6 Deletion of Shortcut Menu

Caution: Press PRG key in shortcut menu, the display flashes and prompts whether to delete the parameter. Press ENTER key for confirmation, the display stops flashing and the deletion operation is completed. Press QUICK key, the display stops flashing, and the deletion operation is canceled. If the last shortcut parameter is deleted, "null" will be displayed upon deletion, indicating that the shortcut menu is null.

4.4 Extended Function Menu

Upon completion of effective installation of functional expansion cards like water supply card and extension card, the inverter can automatically identify the card type and extend group H menu to the standard menu for user to perform parameter setting. Group F menu operation is the same as that.

4.5 Method of Viewing Status Parameter

In stop or running status, it can display multiple status parameters. It can select whether to display the parameter through the function codes F7-04 (running parameter) and F7-05 (stop parameter) in accordance with the binary bits. For the meanings of the binary bits, refer to Chapter 6 F7-04 and F7-05 Function

In the stop status, there are totally sixteen stop status parameters for selection, namely, setup frequency, bus voltage, DI input status, DO output status, analog input AI1 voltage, analog input AI2 voltage, analog input AI3 voltage, actual numerical value, actual length, PLC running step, and six reserved parameters. The displaying of the selected parameters may be switched by the button sequence.

In the running status, five running status parameters are always displayed, namely, setup frequency, bus voltage, output voltage, and output current, and other sixteen parameters, namely, output power, output torque, DI input status, DO output status, analog input AI1 voltage, analog input AI2 voltage, analog input AI3 voltage, actual numerical value, actual length, line speed, PID setup, PID feedback and four reserved parameters are displayed in accordance with the selection of F7-04 (converted into binary system). The displaying of the selected parameters may be switched by the button sequence.

When the inverter is restarted upon power shutdown, the displayed parameters are the parameters selected before the power shutdown.

4.6 Password Setting

The inverter provides user password protection function. When FP-00 is set to non-zero value, it indicates the user password, and the password protection turns valid after exiting the function code editing status. When pressing PRG key again, "-----" will be displayed, and common menu cannot be entered until user password is input correctly.

To cancel the password protection function, enter with password and set FP-00 to "0".

The user password protection for the parameter items in the shortcut men depends on the status of F7-03, and is inactive for the parameter values.

4.7 Automatic Tuning of Motor Parameters

To select the vector control running mode, it must input the nameplate parameter of the motor accurately prior to the running of the inverter. The MD320 inverter will select standard motor parameters matching the nameplate parameter. Since the vector control mode relies highly on the motor parameters, it must acquire the accurate parameters of the controlled motor to ensure the good control performance.

The procedures for the automatic tuning of motor parameters are described below:

First, select the command source (F0-02) as the command channel of the operation panel.

Second, input the following parameters in accordance with the actual motor parameters:

F1-01: Rated motor power

F1-02: Rated motor voltage

F1-03: Rated motor current

F1-04: Rated motor frequency

F1-05: Rated rotation speed of motor

If the motor is completely disconnected from the load, select "2" (complete tuning) in F1.11, and press RUN key on the keyboard panel, then the inverter will automatically calculate the following parameters:

F1-06: Rotor resistance

F1-07: rotor resistance

F1-08: Leakage inductive reactance F1-09: mutual inductive reactance

F1-10: No-load excitation current

Finally, complete the automatic tuning of motor parameters.

If the motor cannot be completely disconnected with the load, select "1" for F1-11 (static tuning), and then press RUN key on the keyboard panel.

The inverter measures rotor resistance, rotor resistance and leakage inductive reactance in sequence but does not measure the mutual inductive reactance and no-load current of the motor, which can be calculated by the user based on the motor nameplate. The motor nameplate parameters used in the calculation include rated voltage U , rated current I , rated frequency f and power factor η :

The calculation methods of the no-load current and mutual inductive reactance of the motor are described below. " L_o " refers to mutual inductive reactance of the motor.

$$\text{No-load Current } I_o = I \cdot \sqrt{1 - \eta^2}$$

$$\text{Mutual Inductance Calculation } L_m = \frac{U}{2\sqrt{3} \pi f \cdot I_o} - L_o$$

Where, I_o refers to no-load current, L_m refers to mutual inductance, while L_o refers to leakage inductance.



5

Function Parameter Table

Chapter 5 Function Parameter Table

If FP-00 is set to non-zero value, it means parameter protection password is set, and the parameter menu cannot be entered until correct password is input. To cancel the password, it needs to set FP-00 to "0".

The parameters in the shortcut menu are free from password protection.

The symbols in the function table are described as follows:

"☆": It indicates that the parameter setup value can be modified when the inverter is in stop status and running status.

"★": It indicates that the parameter setup value cannot be modified when the inverter is in the running status.

"●": It indicates that the numerical value of the parameter is the actually measured value, which cannot be modified.

"*": It indicates this parameter is "Factory default parameter" and can be set only by the manufacturer.

Function Parameter Table

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
Group F0 Basic Function Group						
F0-00	Model display	Model display	1: G model (constant torque load model) 2: P model (fan and pump load model)	1	Model dependent	●
F0-01	Control mode	Control mode	0: Speed sensorless vector control (SVC) 1: Speed sensor vector control (VC) V/F control 2: V/F control	1	0	★
F0-02	Command source selection	Command source selection	0: Operation panel running command channel (LED OFF) 1: Terminal command channel (LED ON) 2: serial port command channel (LED flashes)	1	0	☆
F0-03	Main frequency source X selection	Main frequency source X selection	0: Digital setup UP and DOWN adjustment (non-recorded) 1: Digital setup UP and DOWN adjustment (recorded) 2: AI1 3: AI2 4: AI3 5: PULSE setup (DI5) 6: MS speed 7: PLC 8: PID 9: Communication setup	1	1	★
F0-04	Auxiliary Frequency source Y selection	Auxiliary Frequency source Y selection	0: Digital setup UP and DOWN adjustment (non-recorded) 1: Digital setup UP and DOWN adjustment (recorded) 2: AI1 3: AI2 4: AI3 5: PULSE setup (X5) 6: MS speed 7: PLC 8: PID 9: Communication setup	1	0	★

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F0-05	Auxiliary Frequency source Y range selection	Y range selection	0: Relative to maximum frequency 1: Relative to frequency source X	1	0	☆
F0-06	Auxiliary Frequency source Y	Auxiliary Frequency source Y	0%~100%	1%	100%	☆
F0-07	Frequency source selection	Frequency source selection	0: Main frequency source X 1: Main frequency source X plus auxiliary frequency source Y 2: Switching between main frequency source X and auxiliary frequency source Y 3: Switching between main frequency source X and (main frequency source X plus auxiliary frequency source Y) 4: Switching between main frequency source Y and (main frequency source X plus auxiliary frequency source Y)	1	0	☆
F0-08	Preset frequency	Preset frequency	0.00Hz ~ maximum frequency F0-10	0.01Hz	50.00Hz	☆
F0-09	Running direction	Running direction	0: Direction is consistent 1: Direction is reverse	1	0	★
F0-10	Maximum frequency	Maximum frequency	50.00Hz~300.00Hz	1	50Hz	★
F0-11	Frequency source upper limit	Frequency source upper limit	0: F0-12 setup 1: AI1 2: AI2 3: AI3 4: PULSE setup 5: communication setup	1	0	★
F0-12	Frequency upper limit	Frequency upper limit	Frequency lower limit of F0-14 ~ maximum frequency of F0-10	0.01Hz	50.00Hz	☆
F0-13	Frequency upper limit offset	Frequency upper limit offset	0.00Hz ~ maximum frequency of F0-10	0.01Hz	0.00Hz	☆
F0-14	Frequency lower limit	Frequency lower limit	0.00Hz~Frequency upper limit of F0-12	0.01Hz	0.00Hz	☆
F0-15	Carrier frequency	Carrier frequency	0.5kHz~16.0kHz	0.1kHz	Model dependent	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F0-16	Carrier frequency adjustment selection	Carrier frequency adjustment selection	0: Fixed PWM, carrier frequency temperature adjustment inactive 1: Random PWM, carrier frequency temperature adjustment inactive 2: Fixed PWM, carrier wave temperature adjustment valid 3: Random PWM, carrier frequency temperature adjustment enabled	1	2	☆
F0-17	Speed-up time 1	Speed-up time 1	0.0s~6500.0s	0.1s	20.0s	☆
F0-18	Speed-down time 1	Speed-down time 1	0.0s~6500.0s	0.1s	20.0s	☆
Group F1 Motor Parameters						
F1-00	motor type selection	motor type selection	0: Common asynchronous motor 1: Variable frequency asynchronous motor 2: Permanent magnetic synchronous motor	1	0	★
F1-01	rated power	rated power	0.4kW~1000.0kW	0.1kW	Model dependent	★
F1-02	rated voltage	rated voltage	0V~440V	1V	380V	★
F1-03	rated current	rated current	0.01A~655.35A	0.01A	Model dependent	★
F1-04	rated frequency	rated frequency	0.00 ~ maximum frequency	0.01Hz	50.00Hz	★
F1-05	rated rotation speed	rated rotation speed	0rpm~30000rpm	1rpm	1460rpm	★
F1-06	stator resistance	stator resistance	0.001Ω~65.535Ω	0.001Ω	Model dependent	☆
F1-07	rotor resistance	rotor resistance	0.001Ω~65.535Ω	0.001Ω	Model dependent	☆
F1-08	leakage inductive reactance	leakage inductive reactance	0.01mH~655.35mH	0.01mH	Model dependent	☆
F1-09	mutual inductive reactance	mutual inductive reactance	0.1mH~6553.5mH	0.1mH	Model dependent	☆
F1-10	no-load current	no-load current	0.01A~650.00A	0.01A		☆
F1-11	Tuning selection	Tuning selection	0: No operation 1: Static tuning 2: Complete tuning	1	0	★

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F2 Vector Control Parameters						
F2-00	speed loop proportional gain 1	Speed loop P1	0~100	1	30	☆
F2-01	speed loop integration time 1	Speed loop I1	0.01s~10.00s	0.01s	0.50s	☆
F2-02	switching frequency 1	Switching frequency 1	0.00~F2-05	0.01Hz	5.00Hz	☆
F2-03	speed loop proportional gain 2	Speed loop P2	0~100	1	20	☆
F2-04	Speed loop integration time 2	Speed loop I2	0.01s~10.00s	0.01s	1.00s	☆
F2-05	switching frequency 2	2 switching frequency 2	F2-02~Max.frequency	0.01Hz	10.00Hz	☆
F2-06	Slip compensation coefficient	Slip coefficient	50%~200%	1%	100%	☆
F2-07	Time constant of speed loop filter	Speed loop filter	0.000s~0.100s	0.001s	0.000s	☆
F2-08	Torque control	Torque control	0:Active 2:Inactive	1	0	☆
F2-09	Torque upper limit source	Torque upper limit source	0: F2-10 1: AI1 2: AI2 3: AI3 4: PULSE setup 5: Communication setup Analog input scale corresponds to F2-10.	1	0	☆
F2-10	Torque upper limit	Torque upper limit	0.0%~200.0%	0.1%	150.0%	☆
F2-11	Encoder pulse number	Encoder pulse number	1~65535	1	1024	★
F2-12	Reserved	Reserved	0~65535	1	0	★
F3 V/F Control Parameters						

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F3-00	V/F curve setup	V/F curve setup	0: Straight V/F curve 1: Multiple-point V/F curve 2: Square V/F curve	1	0	★
F3-01	Torque boost	Torque boost	0.0: (automatic)0.1% to 30.0%	0.1%	1.0%	☆
F3-02	Cutoff frequency of torque boost	frequency of torque boost	0.00 ~ maximum frequency	0.01Hz	50.00Hz	★
F3-03	V/F frequency point 1	V/F frequency 1	0.00Hz ~ rated motor frequency	0.01Hz	0.00Hz	★
F3-04	V/F voltage point 1	V/F voltage 1	0.0%~100.0%	0.1%	0.0%	★
F3-05	V/F frequency point 2	V/F frequency 2	0.00Hz ~ rated motor frequency	0.01Hz	0.00Hz	★
F3-06	V/F voltage point 2	V/F voltage 2	0.0%~100.0%	0.1%	0.0%	★
F3-07	V/F frequency point 3	V/F frequency 3	0.00Hz ~ rated motor frequency	0.01Hz	0.00Hz	★
F3-08	V/F voltage point 3	V/F voltage 3	0.0%~100.0%	0.1%	0.0%	★
F3-09	Slip compensation coefficient	Slip compensation coefficient	0.0%~200.0%	0.1%	0.0%	☆
F3-10	AVR selection	AVR selection	0:inactive 1: Active 2:Inactive only at speed-down time	1	2	☆
F3-11	Oscillation suppression gain	Oscillation suppression gain	0~100	1	Model dependent	☆
F4 Input terminal						

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F4-00	DI1 terminal function selection	DI1 terminal selection	0: No function 1: Forward rotation (FWD) 2: Reverse rotation (REV) 3: Three-line mode running control 4: Forward rotation Jog (FJOG) 5: Reverse rotation Jog (RJOG) 6: Terminal UP 7: Terminal DOWN 8: Coast to stop 9: Fault reset (RESET) 10: Pause 11: External fault normally open input 12: MS speed terminal 1 13: MS speed terminal 2 14: MS speed terminal 3 15: MS speed terminal 4 16: Speed-up/Speed-down selection terminal 1 17: Speed-up/Speed-down selection terminal 2 18: Main frequency source switching 19: UP and DOWN setup clear (terminal and keyboard)	1	1	★
F4-01	DI2 terminal function selection	DI2 terminal selection		1	4	★
F4-02	DI3 terminal function selection	DI3 terminal selection		1	9	★
F4-03	DI4 terminal function selection	DI4 terminal selection		1	12	★
F4-04	DI5 terminal function selection	DI5 terminal selection		1	13	★
F4-05	DI6 terminal function selection (on I/O expansion card)	DI6 terminal selection		1	0	★
F4-06	DI7 terminal function selection (on I/O expansion card)	DI7 terminal selection		1	0	★
F4-07	DI8 terminal function selection (on I/O expansion card)	DI8 terminal selection		1	0	★
F4-08	DI9 terminal function selection (on I/O expansion card)	DI9 terminal selection		1	0	★

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F4-09	D20 terminal function selection (on I/O expansion card)	DI10 terminal selection	20: Running command switching terminal 21: Acceleration/deceleration inactive 22: PID Pause 23: PLC status reset 24: Swing frequency pause 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inactive 30: PULSE (pulse) frequency input (enabled only for DI5) 31: Reserved 32: DC brake command 33: External fault normally closed input 34: Frequency setup enabled terminal (this terminal is enabled by default) If this terminal function is set, the enabling time of modification will be controlled by this enabled terminal when performing frequency modification. 35: PID action direction reverse terminal If this terminal is enabled, PID action direction is opposite to the direction set in FA-03. 36: External stop terminal When it is in the keyboard control mode, this terminal can be used to stop, which is similar to STOP key on the keyboard. 37: Control command switching terminal 2 It is used for the switching between the terminal control and communication control. When this terminal is enabled, if F0-02 is set to terminal control, it will switch to the communication control, and vice versa.	1	0	★

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
			38: PID integration pause terminal When this terminal is enabled, the PID integration action pauses, but the proportional adjustment and differential adjustment still has function. 39: switching terminal of frequency source X and preset frequency When this terminal is enabled, the frequency source X can be replaced with preset frequency (F0-08). 40: switching terminal of frequency source y and preset frequency When this terminal is enabled, the frequency source y can be replaced with preset frequency (F0-08).			
F4-10	DI terminal filter time	DI filter time	1~10	1	4	☆
F4-11	Terminal command mode	Terminal command mode	0. Two-line mode 1 1. Two-line mode 2 2. Three-line mode 1 3. Three-line mode 2	1	0	★
F4-12	Change rate of terminals UP/DOWN	Change rate of terminals UP/DOWN	0.01 Hz/s~100.00Hz/s	0.01 Hz/s	1.00Hz/s	☆
F4-13	AI1 minimum input	AI1 minimum input	0.00V~10.00V	0.01V	0.00V	☆
F4-14	AI1 minimum input corresponding setup	AI1 minimum setup	-100.0%~100.0%	0.1%	0.0%	☆
F4-15	AI1 maximum input	AI1 maximum input	0.00V~10.00V	0.01V	10.00V	☆
F4-16	AI1 maximum input corresponding setup	AI1 maximum setup	-100.0%~100.0%	0.1%	100.0%	☆
F4-17	AI1 input filter time	AI1 input filter time	0.00s~10.00s	0.01s	0.10s	☆
F4-18	AI2 minimum input	AI2 minimum input	0.00V~10.00V	0.01V	0.00V	

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F4-19	AI2 minimum input corresponding setup	AI2 minimum setup	-100.0%~100.0%	0.1%	0.0%	☆
F4-20	AI2 maximum input	AI2 maximum input	0.00V~10.00V	0.01V	10.00V	☆
F4-21	AI2 maximum input corresponding setup	AI2 maximum setup	-100.0%~100.0%	0.1%	100.0V	☆
F4-22	AI2 input filter time	AI2 filter time	0.00s~10.00s	0.01s	0.10s	☆
F4-23	AI3 minimum input (on IO expansion card)	AI3 minimum input	0.00V~10.00V	0.01V	0.00V	☆
F4-24	AI3 minimum input corresponding setup (on IO expansion card)	AI3 minimum setup	-100.0%~100.0%	0.1%	0.0%	☆
F4-25	AI3 maximum input (on IO expansion card)	AI3 maximum input	0.00V~10.00V	0.01V	10.00V	☆
F4-26	AI3 maximum input corresponding setup (on IO expansion card)	AI3 maximum setup	-100.0%~100.0%	0.1%	100.0%	☆
F4-27	AI3 input filter time (on IO expansion card)	AI3 filter time	0.00s~10.00s	0.01s	0.10s	☆
F4-28	PULSE (pulse) input minimum frequency	Pulse minimum frequency	0.00kHz~50.00kHz	0.01 kHz	0.00kHz	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F4-29	PULSE (pulse) input minimum frequency corresponding setup	Pulse minimum setup	-100.0%~100.0%	0.1%	0.0%	☆
F4-30	PULSE (pulse) input maximum frequency	Pulse maximum frequency	0.00kHz~50.00kHz	0.01 kHz	50.00kHz	☆
F4-31	PULSE (pulse) input maximum frequency corresponding setup	Pulse maximum setup	-100.0%~100.0%	0.1%	100.0%	☆
F4-32	PULSE (pulse) input filter time	Pulse filter time	0.00s~10.00s	0.01s	0.10s	☆
Group F5 Output Terminal						
F5-00	FM terminal output mode selection	FM terminal mode	0: Pulse output 1: Open collector digital value output (FMR)	1	0	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F5-01	FMR output selection	FMR output selection	0: No output 1: Inverter is running	1	0	★
F5-02	Control board relay (T/A-T/B-T/C) output selection	Control board RELAY1 output selection	2: Fault output 3: Frequency level detection FDT output 4: Frequency arrival 5: In zero speed operation	1	2	☆
F5-03	selection of expansion card RELAY (P/A-P/B-P/C)	selection of expansion card RELAY2	6: Motor overload pre-warning 7: Inverter overload pre-warning 8: Setup counting value arrival 9: Designated counting value arrival	1	0	☆
F5-04	DO1 output selection	DO1 output selection	10: Length arrival 11: PLC circulation completion 12: Running time arrival 13: Frequency limiting 14: Torque limiting 15: Ready for running 16: AI1 larger than AI2 16: Reserved 17: Frequency upper limit arrival 18: Frequency lower limit arrival 19: Under voltage status output 20: communication reference	1	1	☆
F5-05	Expansion card DO2 output selection	DO2 output selection		1	4	☆
F5-06	FMR output selection	FMR output selection	0: Running frequency 1: Setup frequency	1	0	☆
F5-07	AO1 output selection	AO1 output selection	2: Output current 3: Output torque 4: Output power 5: Output voltage 6: Pulse input 7: AI1 8: AI2 9: AI3(expansion card) 10: Length 11: Counting value 12: Communication reference 13: Reserved 14: Reserved 15: Reserved 16: To be confirmed		0	☆
F5-08	Expansion card AO2 output selection	AO2 output selection			1	☆
F5-09	Max frequency of FMP output	maximum frequency	0.1kHz~50.0kHz	0kHz	50.0kHz	☆
F5-10	AO1 offset coefficient	AO1 offset	-100.0%~100.0%	0.1%	0.0%	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F5-11	AO1 gain	AO1 gain	-10.00~10.00	0.01	1.00	☆
F5-12	AO2 offset coefficient (on IO expansion card)	AO offset	-100.0%~100.0%	0.1%	0.0%	☆
F5-13	AO2 gain (on IO expansion card)	AO2 gain	-10.00~10.00	0.01	1.00	☆
Group F6 Start/Stop Control						
F6-00	Start mode	Start mode	0: Direct start 1: Speed tracking restart	1	0	☆
F6-01	Rotation speed tracking mode	Rotation speed tracking mode	0: Beginning from stop frequency 1: Beginning from zero speed 2: Beginning from maximum frequency	1	0	★
F6-02	Rotation speed tracking speed	Rotation speed tracking speed	1~100	1	20	☆
F6-03	Start frequency	Start frequency	0.00 Hz~10.00Hz	0.01Hz	0.00Hz	☆
F6-04	Start frequency holding time	Start holding time	0.0s~36.0s	0.1s	0.0s	★
F6-05	DC brake current at start	Brake current at start	0%~100%	1%	0%	★
F6-06	DC brake time at start	Brake time at start	0.0s~36.0s	0.1s	0.0s	★
F6-07	speed-up/speed-down mode	speed-up/speed-down mode	0: Straight speed-up/speed-down 1: S-curve speed-up/speed-down	1	0	★
F6-08	Start segment time of S curve	Start segment of S curve	0.0%~40.0%	0.1%	30.0%	★
F6-09	End segment time of S curve	Start segment of S curve	0.0%~40.0%	0.1%	30.0%	★
F6-10	Stop mode	Stop mode	0: Speed-down to stop 1: Free stop	1	0	☆
F6-11	DC brake beginning frequency at stop	Brake frequency at stop	0.00Hz ~ maximum frequency	0.01Hz	0.00Hz	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F6-12	DC brake waiting time at stop	Brake waiting at stop	0.0s~36.0s	0.1s	0.0s	☆
F6-13	DC brake current at stop	DC brake current at stop	0%~100%	1%	0%	☆
F6-14	DC brake time at stop	DC brake time at stop	0.0s~36.0s	0.1s	0.0s	☆
F6-15	Brake use ratio	Brake use ratio	0%~100%	1%	100%	☆
Group F7 Keyboard and Display						
F7-00	LCD language selection	Language selection	0: Chinese 1: English	1	0	☆
F7-01	MF.K Key function selection	MF.K Key function selection	0: MF.K inactive 1: Switching between operation panel command channel and remote command channel (terminal command channel or serial port communication command channel) 2: Switching between forward rotation and reverse rotation 3: Forward rotation Jog	1	0	★
F7-02	STOP/RESET key function	STOP key function	0: Active only in the keyboard control mode 1: STOP key enabled in the terminal control mode 2: STOP key fault reset function active in the terminal control mode 3: STOP key stop and fault reset function active in the terminal control mode	1	0	☆
F7-03	QUICK parameter lockout	Parameter lockout	0: QUICK parameter lockout inactive 1: QUICK parameter lockout active	1	0	☆
F7-04	LED operation display parameter	Operation display	0~65535	1	0	☆
F7-05	LED stop display parameter	Stop display	1~65535	1	255	☆
F7-06	Load speed display coefficient	Load speed coefficient	0.0001~6.5000	0.0001	1.0000	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F7-07	1 Radiator temperature 1	Radiator temperature 1	0.0℃~100℃	1℃	-	●
F7-08	Radiator temperature 2	Radiator temperature 2	0.0℃~100℃	1℃	-	●
F7-09	Accumulated running time	Accumulated running time	0h~65535h	1	-	●
F7-10	1 Software version No.1	Software version No.1	-	-	-	●
F7-11	Software version No.2	Software version No.2	-	-	-	●
Group F8 Auxiliary Function						
F8-00	Jog running frequency	Jog running frequency	0.00Hz ~ maximum frequency	0.01Hz	2.00Hz	☆
F8-01	Jog speed-up time	Jog speed-up time	0.0s~6500.0s	0.1s	20.0s	☆
F8-02	Jog speed-down time	Jog speed-down time	0.0s~6500.0s	0.1s	20.0s	☆
F8-03	Speed-up time 2	Speed-up time 2	0.0s~6500.0s	0.1s	20.0s	☆
F8-04	Speed-down time 2	Speed-down time 2	0.0s~6500.0s	0.1s	20.0s	☆
F8-05	Speed-up time 3	Speed-up time 3	0.0s~6500.0s	0.1s	20.0s	☆
F8-06	Speed-down time 3	Speed-down time 3	0.0s~6500.0s	0.1s	20.0s	☆
F8-07	Speed-up time 4	Speed-up time 4	0.0s~6500.0s	0.1s	20.0s	☆
F8-08	Speed-up time 4	Speed-up time 4	0.0s~6500.0s	0.1s	20.0s	☆
F8-09	Skip frequency 1	Skip frequency 1	0.00Hz ~ maximum frequency	0.01Hz	0.00Hz	☆
F8-10	Skip frequency 2	Skip frequency 2	0.00Hz ~ maximum frequency	0.01Hz	0.00Hz	☆
F8-11	Skip frequency amplitude 1	Skip frequency amplitude 1	0.00Hz ~ maximum frequency	0.01Hz	0.01Hz	☆
F8-12	Forward/ reverse rotation dead-zone time	Forward/ reverse rotation dead-zone time	0.0s~3000.0s	0.1s	0.0s	☆
F8-13	Reverse control	Reverse control	0: Reverse rotation enabled 1: Reverse rotation disable	1	0	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F8-14	Setup frequency lower than frequency lower limit action	Frequency lower limit action	0: Run with frequency lower limit 1: Stop 2: Zero speed operation	1	0	☆
F8-15	Droop control	Droop control	0.00Hz~10.00Hz	0.01Hz	0.00Hz	☆
F8-16	Over modulation enabled	Over modulation enabled	0: Over modulation inactive 1: Over modulation active	1	1	☆
F8-17	Set running time	Set running time	0h~65535h	1h	65535h	☆
F8-18	Start protection selection	Start protection selection	0: No protection 1: Protection	1	0	☆
F8-19	Frequency detection value (FDTlevel)	FDT level	0.00 ~ maximum frequency	0.01Hz	50.00Hz	☆
F8-20	Frequency detection hysteresis (FDT-hysteresis)	FDT hysteresis	0.0% ~ 100.0%(FDT level)	0.1%	5.0%	☆
F8-21	Frequency arrival detection width	Frequency arrival width	0.0 ~ 100.0% (maximum frequency)	0.1%	0.0%	☆
F8-22	Earth short circuit protection detection upon power-on	Earth short circuit protection detection upon power-on	0: Inactive 1: Active	1	1	☆
F8-23	Running time to action selection	Running time to action selection	0: Continue running 1: Stop	1	0	★
Group F9 Fault and Protection						
F9-00	Motor overload protection selection	Overload protection selection	0: Inactive 1: Active	1	1	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F9-01	Motor overload protection gain	Overload protection coefficient	0.20~10.00	0.01	1.00	☆
F9-02	Motor overload pre-warning coefficient	Overload pre-warning coefficient	50%~100%	1%	80%	☆
F9-03	Stall gain over voltage	Stall gain over voltage	0(no stall over voltage) to 100	1	0	☆
F9-04	Stall protection voltage over voltage	Stall point over voltage	120%~150%	1%	130%	☆
F9-05	Stall gain over current	Stall gain over current	0~100	1	20	☆
F9-06	Stall protection current over current	Stall point over current	100%~200%	1%	150%	☆
F9-07	Transient stop/ non-stop function	Transient stop/ non-stop function	0: Inactive 1: Active	1	0	☆
F9-08	Transient stop/ non-stop frequency falling rate	Transient stop/ non-stop frequency falling rate	0.00Hz/s ~ maximum frequency/s	0.01Hz/s	10.00Hz/s	☆
F9-09	Fault auto reset times	Fault auto reset times	0~3	1	0	☆
F9-10	(T/A-T/B-T/C) Faulty rely action selection during the fault auto reset		0: No action 1: Action	1	0	☆
F9-11	Fault auto reset interval	Fault auto reset interval	0.1s~100.0s	0.1s	1. 0s	☆
F9-12	Input phase-failure protection selection	Input phase-failure selection	0: Inactive 1: Active	1	1	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F9-13	Output phase-failure protection selection	Output phase-failure selection	0: Inactive 1: Active	1	1	☆
F9-14	The first fault type	The second fault type 1	0: No fault 1: Inverter unit protection (ERR01) 2: Speed-up over current(ERR02) 3: Speed-down over current(ERR03) 4: Constant speed over current (ERR04) 5: Speed-up over voltage(ERR05) 6: Speed-down over voltage(ERR06) 7: Constant speed over voltage(ERR07) 8: Control power supply fault(ERR08) 9: Under voltage failure (ERR09) 10: Inverter overload (ERR10) 11: Motor overload (ERR11) 12: Input phase failure (ERR12) 13: Output phase failure (ERR13) 14: Radiator over heat(ERR14) 15: External fault(ERR15) 16: Communication fault (ERR16) 17: Contactor fault(ERR17) 18: Current detection fault(ERR18) 19: Motor tuning fault (ERR19) 20: PG fault(ERR20) 21: Data overflow (ERR21) 22: Inverter hardware fault(ERR22) 23: Motor to earth short circuit fault(ERR23) 24: Reserved (ERR24)	—	—	●
F9-15	The second failure type	The second failure type 2		—	—	●
F9-16	The last failure type	The third fault type		—	—	●
F9-17	Frequency upon fault	Frequency upon fault	—	—	—	●
F9-18	Current upon fault	Current upon fault	—	—	—	●
F9-19	Bus voltage upon fault	Bus voltage upon fault	—	—	—	●

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
F9-20	Input terminal upon fault	Input terminal upon fault	—	—	—	●
F9-21	Output terminal upon fault	Output terminal upon fault	—	—	—	●
Group FA PID Function						
FA-00	PID setup source	PID setup source	0: FA-01 1: AI1 2: AI2 3: AI3 4: PULSE setup (DI5) 5: Communication setup	1	0	☆
FA-01	PID keyboard setup	PID setup	0.0%~100.0%	0.1	50.0%	☆
FA-02	PID feedback source	PID feedback source	0: AI1 1: AI2 2: AI3 3: AI1-AI2 4: PULSE setup (DI5) 5: Communication setup	1	0	☆
FA-03	PID action direction	PID action direction	0: Positive action 1: Reverse action	1	0	☆
FA-04	PID setup feedback range	PID range	0~65535	1	1000	☆
FA-05	Proportional gain P	Proportional gain P	0. 0~100. 0	0. 1	20. 0	☆
FA-06	Integration time I	Integration time I	0.01s~10.00s	0.01s	2.00s	☆
FA-07	Differential time D	Differential time D	0.000s~10.000s	0.01s	0.00s	☆
FA-08	Cutoff frequency of PID reverse rotation	Cutoff frequency of reverse rotation	0.00 ~ maximum frequency	0.01Hz	2. 00Hz	☆
FA-09	Deviation limit	Deviation limit	0.0%~100.0%	0.1%	0.0%	☆
FA-10	Differential amplitude	Differential amplitude	0%~100%	1%	5%	☆
Group FB Swing Frequency, Fixed Length and Count						
FB-00	Swing setup mode	Swing setup mode	0: Relative to the central frequency 1: Relative to maximum frequency	0. 01	0. 00	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
FB-01	Swing frequency amplitude	Swing frequency amplitude	0.0%~100.0%	0.1%	0.0%	☆
FB-02	Kick frequency amplitude	Kick frequency amplitude	0.0%~50.0%	0.1%	0.0%	☆
FB-03	Swing frequency cycle	Swing frequency cycle	0.1s~3000.0s	0.1s	10.0s	☆
FB-04	Time constant of triangular wave boost	Time constant of triangular wave boost	0.1%~100.0%	0.1%	50.0%	☆
FB-05	Setup length	Setup length	0m~65535m	1m	1000m	☆
FB-06	Actual length	Actual length	0m~65535m	1m	0m	☆
FB-07	Number of pulses each meter	Number of pulses each meter	0.1~6553.5	0.1	100.0	☆
FB-08	Setup counting value	Setup counting value	1~65535	1	1000	☆
FB-09	Designated counting value	Designated counting value	1~65535	1	1000	☆
Group FC MS speed and PLC						
FC-00	MS speed 0	MS speed 0	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-01	MS seed 1	MS seed 1	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-02	MS speed 2	MS speed 2	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-03	MS speed 3	MS speed 3	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-04	MS speed 4	MS speed 4	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-05	MS speed 5	MS speed 5	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-06	MS speed 6	MS speed 6	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-07	MS speed 7	MS speed 7	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-08	MS speed 8	MS speed 8	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
FC-09	MS speed 9	MS speed 9	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-10	MS speed 10	MS speed 10	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-11	MS speed 11	MS speed 11	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-12	MS speed 12	MS speed 12	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-13	MS speed 13	MS speed 13	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-14	MS speed 14	MS speed 14	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-15	MS speed 15	MS speed 15	Negative maximum frequency to maximum frequency	0.1Hz	0.0Hz	☆
FC-16	PLC running mode	PLC mode	0:Stop upon completion 1:Keep final value upon completion of one-time running 2:Constant circulation	1	0	☆
FC-17	PLC power-failure recoeded selection	PLC recoeded	0: Power failure non-recorded 1: Power failure recorded	0	0	☆
FC-18	Running time of zero-segment of PLC	Zero-segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-19	Speed-up/ speed-down time selection of zero-segment of PLC	Speed-up/ speed-down of zero-segment	0~3	1	0	☆
FC-20	First segment running time of PLC	First -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-21	First -segment speed-up/ speed-down time selection of PLC	First -segment speed-up/ speed-down	0~3	1	0	☆
FC-22	Second -segment running time of PLC	Second -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
FC-23	Second segment speed-up/speed-down time selection of PLC	Second segment speed-up/speed-down	0~3	1	0	☆
FC-24	Third segment running time of PLC	Third -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-25	Third -segment speed-up/speed-down time selection of PLC	Third -segment speed-up/speed-down	0~3	1	0	☆
FC-26	Forth -segment running time of PLC	Forth -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-27	Forth segment speed-up/speed-down time selection of PLC	Four-segment speed-up/speed-down	0~3	1	0	☆
FC-28	Fifth segment running time of PLC	Fifth segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-29	Fifth -segment speed-up/speed-down time time selection of PLC	Fifth -segment speed-up/speed-down time	0~3	1	0	☆
FC-30	Sixth-segment running time of PLC	Sixth -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-31	Sixth -segment speed-up/speed-down time time	Sixth -segment speed-up/speed-down time	0~3	1	0	☆
FC-32	Seventh-segment running time of PLC	Seventh -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
FC-33	Seventh -segment speed-up/ speed-down time selection of PLC	Seventh -segment speed-up/ speed-down	0~3	1	0	☆
FC-34	Eighth-segment running time of PLC	Eighth -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-35	Eighth -segment speed-up/ speed-down time selection of PLC	Eighth -segment speed-up/ speed-down	0~3	1	0	☆
FC-36	Ninth-segment running time of PLC	Ninth -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-37	Ninth -segment speed-up/ speed-down time selection of PLC	Ninth -segment speed-up/ speed-down	0~3	1	0	☆
FC-38	Tenth-segment running time of PLC	Tenth -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-39	Tenth -segment speed-up/ speed-down time selection of PLC	Tenth -segment speed-up/ speed-down	0~3	0.1s (h)	0.0s (h)	☆
FC-41	Eleventh-segment running time of PLC	Eleventh -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
FC-41	Eleventh -segment speed-up/ speed-down time selection of PLC	Eleventh -segment speed-up/ speed-down	0~3	1	0	☆
FC-42	Twelfth-segment running time of PLC	Twelfth -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-43	Twelfth -segment speed-up/ speed-down time selection	Twelfth -segment speed-up/ speed-down	0~3	1	0	☆
FC-44	Thirteenth-segment running time of PLC	Thirteenth -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-45	Thirteenth -segment speed-up/ speed-down time selection of PLC	Thirteenth -segment speed-up/ speed-down	0~3	1	0	☆
FC-46	Fourteenth-segment running time of PLC	Fourteenth -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-47	Fourteenth -segment speed-up/ speed-down time selection of PLC	Fourteenth -segment speed-up/ speed-down	0~3	1	0	☆
FC-48	Fifteenth-segment running time of PLC	Fifteenth -segment time	0.0s(h)~6553.5s(h)	0.1s (h)	0.0s (h)	☆
FC-49	Fifteenth -segment speed-up/ speed-down time selection of PLC	Fifteenth -segment speed-up/ speed-down	0~3	1	0	☆

Function code	Name	LED display	Set range	Minimum unit	Factory default value	Modification description
FC-50	Running time of PLC	Time unit selection	0: s(s) 1: h(h)	1	0	☆
Group FD Communication Parameters						
FD-00	Baud rate	Baud rate	0: 300BPS 1: 600BPS 2: 1200BPS 3: 2400BPS 4: 4800BPS 5: 9600BPS 6: 19200BPS 7: 38400BPS	1	5	☆
FD-01	Data format	Data format	0: No parity check 1: Even parity check 2: Odd parity check	1	0	☆
FD-02	Local address	Local address	1 to 247, and 0 is the broadcast address.	1	1	☆
FD-03	response delay	response delay	0ms~20ms	1	2	☆
FD-04	Communication timeout time	Communication timeout time	0.0(inactive), and 0.1 ~ 60.0.0s	0.1s	0.0	☆
FD-05	communication protocol selection	communication protocol selection	0: Non-standard MODBUS protocol 1: Standard MODBUS protocol	1	0	☆
Group FE Reserved Function Group						
Group FF Factory Parameters						
FF-00	Manufacturer password	Manufacturer password	Reserved	Reserved	Reserved	*
Group F User Password						
FP-00	User password	User password	0~65535	1	0	☆
FP-01	Parameter initialization	Parameter initialization	0: No operation 1: Restore factory default setup value 2: Clear the fault record	1	0	★



6

Parameter Description

Chapter 6 Parameter Description

Group F0 Basic Function

F0-00	Model display		Factory default value	Model dependent
	Setup range	0	G model (constant torque load model)	
		1	P model (fan and pump load model)	

This parameter is provided only for the user to view the factory default model and cannot be modified.

1: It is applicable to the constant torque load of the designated rated parameters.

2: It is applicable to the variable torque loads (fan and pump loads) of the designated rated parameters.

F0-01	Control mode		Factory default value	0
	Setup Range	0	Speed sensorless vector control	
		1	Speed sensor vector control (VC)	
		2	V/F control	

0: None-speed sensor vector control refers to open loop vector. It is applicable to the general high-performance control applications where one inverter can only drive one motor. The examples include machine tool, centrifugal machine, wire drawing machine and injection molding machine.

1: Speed sensor vector control refers to close loop vector. It must be added with encoder and PG card and is applicable to the applications where high-precision speed control or torque control is required. One inverter can only drive one motor loads, such as paper-making machine, lifting machine and elevator.

2: V/F control

It is applicable to the applications where the load requirements are rather low or one inverter drives multiple motors, such as fan and pump loads. It can be used in the applications where one inverter drives multiple motors.

Prompt: Motor parameter identification must be conducted when selecting the vector control mode. Only when correct motor parameters are provided can the vector control mode be fully made use of. Better performance can be achieved by adjusting the speed regulator parameters (group F2).

F0-02	Command Source Selection		Factory default value	0
	Setup Range	0	Operation panel command	
		1	Terminal command channel	
		2	Serial port communication command channel	

Select the channel for inverter control command.

The inverter control command includes start, stop, forward rotation, reverse rotation and Jog.

0: Operation panel command channel ("LOCAL/REMOT" LED OFF);

Perform running command control with keys on the operation panel, such as RUN, STOP/RES keys.

1: terminal command channel ("LOCAL/REMOT" LED ON)

Perform running command control by the multifunctional input terminals such as FWD, REV, JOGF, JOGR, etc.

2: serial port command channel ("LOCAL/REMOT" LED flashes)

The running command is sent by the host computer via the communication mode. When selecting this item, it must be used together Modbus RTU of Shenzhen Inovance Technology Co., Ltd.

F0-03	Main frequency source X selection		Factory default value	0
	Setup Range	0	Digital setup UP and DOWN (non-recorded)	
		1	Digital setup UP and DOWN (recorded)	
		2	AI1	
		3	AI2	
		4	AI3	
		5	PULSE setup (DI5)	
		6	MS speed	
		7	PLC	
		8	PID	
		9	Communication setup	

Select the input channel for main reference frequency of the inverter. There are ten types of main reference frequency channels:

0: Digital setup (non-recorded)

The initial value is the value of F0-08 "Digital Setup Preset Frequency".

It can change the setup frequency value of the inverter through the keys "▲" and "▼" of the keyboard (or UP and DOWN of multifunctional input terminals).

"Non-recorded" means that the setup frequency value is recovered to the value of F0-08 "Digital Setup Preset Frequency" in case of inverter power failure.

1: Digital setup (recorded)

The initial value is the value of F0-08 "Digital Setup Preset Frequency".

It can change the setup frequency value of the inverter through the keys "▲" and "▼" of the

keyboard (or UP and DOWN of multifunctional input terminals).

“Recorded” means that the setup frequency upon restart of inverter due to power failure remains the same.

2:AI1 3:AI2 4:AI3

It means that the frequency is determined by the analog input terminal. Standard unit provides two analog input terminals, and optional I/O expansion card can provide one analog input terminal (AI3). AI1 and AI3 refer to voltage input of 0 to 10V. AI2 can be used as either voltage input of 0V to 10V or current input of 4mA to 20mA, which can be selected by the J3 jumper on the control board.

5: Pulse given (DI5)

The frequency setup is given by the terminal pulse.

Pulse reference signal specification: voltage range of 9V to 30V and frequency range of 0kHz to 50kHz.

Caution: Pulse given can only be input from the multifunctional input terminal DI5.

6. MS speed

Select MS speed running mode. It needs to set Group F4 “Input Terminal” and Group FC “MS Speed and PLC” parameters to determine the relative relationship between the reference signal and the reference frequency.

7: Select simple PLC mode. When the frequency source is simple PLC, it needs to set Group FC “MS Speed and PLC” parameters to determine the reference frequency.

8: PID

Select process PID control. In this case, it needs to set Group FA “PID Function”. The running frequency of the inverter is that after PID functions. For the meanings of PID reference source, reference quantity and feedback source, please refer to Group A “PID Function”.

9: Communication reference

It means that the main frequency source is given by the host computer via the communication mode.

F0-04	Auxiliary Frequency source Y selection		Factory default value	0
	Setup Range	0	Digital setup UP and DOWN (non-recorded)	
		1	Digital setup UP and DOWN (recorded)	
		2	AI1	
		3	AI2	
		4	AI3	
		5	PULSE setup (DI5)	
		6	MS speed	
		7	PLC	
		8	PID	
		9	Communication setup	

When the auxiliary frequency source is used as independent frequency reference channel (i.e. frequency source switching from X to Y"), it is used in the same way as the main frequency source X.

When the auxiliary frequency source is used as overlap reference (i.e. frequency source selection switching from X plus Y or X to X plus Y), it has special points as follows:

1. When the auxiliary frequency source is digital reference, the preset frequency (F0-08) has no action, and it needs to adjust the main reference frequency through the keys "▲" and "▼" of the keyboard (or UP and DOWN of multifunctional input terminals).
2. When the auxiliary frequency source is analog input reference (AI1, AI2 and AI3) or pulse input reference, 100% of input setup is relative to the auxiliary frequency source range (refer to F0-05 and F0-06). To adjust the main reference frequency, it needs to set the corresponding setup range of analog input to "-n% to n%" (refer to F4-13 and F4-26).
3. When the frequency source is pulse input reference, it is similar to the analog value.

Prompt: There is difference between the auxiliary frequency source Y selection and the main frequency source X setup value. That is to say, the main and auxiliary frequency sources cannot use the same frequency reference channel.

F0-05	Auxiliary Frequency source Y relative value selection		Factory default value	0
	Setup Range	0	Relative to maximum frequency	
		1	Relative to frequency source X	
F0-06	Auxiliary Frequency source Y		Factory default value	0
	Setup Range		0% to 100%	

When the frequency source selection is frequency overlap reference (F0-07 is set to 1 or 3), it is used to determine the adjustment range of auxiliary frequency source. F0-05 is used to determine the relative object of that range. If it is relative to maximum frequency X, that range will vary with the main frequency X.

F0-07	Frequency source selection		Factory default value	0
	Setup Range	0	Main frequency source X	
		1	Main frequency source X plus auxiliary frequency source Y	
		2	Switching between main frequency source X and auxiliary frequency source Y	
		3	Switching between main frequency source X and (main frequency source X plus auxiliary frequency source Y)	
		4	Switching between main frequency source Y and (main frequency source X plus auxiliary frequency source Y)	

This parameter is used to select the frequency reference channel. Frequency reference is realized through combination of main frequency source X and auxiliary frequency source Y.

When 1 is selected, the frequency source "main frequency source X plus auxiliary frequency source Y" can realize frequency overlapping function.

When 2 is selected, it can switch between the main frequency source X and auxiliary frequency source Y via the multifunctional input terminal "Frequency Source Switching".

When 3 is selected, it can switch between the main frequency source X and (main frequency source X plus auxiliary frequency source Y) via the multifunctional input terminal "Frequency Source Switching".

When 4 is selected, it can switch between the auxiliary frequency source Y and (main frequency source X plus auxiliary frequency source Y) via the multifunctional input terminal

"Frequency Source Switching".

In this way, it can realize mutually switching between the frequency reference modes, such as switching between PID running and common running, switching between simple PLC and common running, switching between pulse setup and analog setup, and switching between analog setup and common running.

F0-08	Preset frequency		Factory default value	50.00Hz
	Setup Range	0.00 to maximum frequency (active when the frequency source selection mode is digital setup)		

When the main frequency source is selected as "Digital setup" or "Terminals UP/DN", this function code is the initial value of frequency digital setup of the inverter.

F0-09	Running direction		Factory default value	0
	Setup Range	0	Direction is consistent	
		1	Direction is reverse	

Through modifying this function code, it can change the rotary direction of the motor without changing any other parameters. The role of this function code is to adjust any two lines of the motor (U, V and W) and further change the rotary direction of the motor.

Prompt: After parameter initialization, the motor running direction will restore to the original status. This action shall be carefully performed in the applications where the rotary direction of the motor is not allowed to change upon system commissioning.

F0-10	Maximum frequency		Factory default value	50.00 Hz
	Setup Range	50.00Hz to 300.00Hz		
F0-11	Frequency source upper limit		Factory default value	0
	Setup Range	0	F0-12 setup	
		1	AI1	
		2	AI2	
		3	AI3	
		4	PULSE setup	
		5	Communication setup	

It is used to define the source of frequency upper limit. The frequency upper limit can be sourced from either digital setup (F0-12) or analog input channel. When the analog input is used to set the frequency upper limit, 100% of analog input setup is relative to F0-12.

For example, in case of torque control, the speed control is inactive. To avoid occurrence of broken materials, it can use the analog value to set the frequency upper limit. When the inverter runs at the frequency upper limit, the torque control is inactive, and the inverter continues running with frequency upper limit.

F0-12	Frequency upper limit		Factory default value	50.00Hz
	Setup Range	Frequency lower limit F0-11 to maximum frequency F0-10		
F0-13	Frequency upper limit offset		Factory default value	0.00Hz
	Setup Range	0.00Hz to maximum frequency F0-10		

When the frequency upper limit is analog value reference, this parameter is used as analog value offset.

Its reference value is F0-12. The addition of offset frequency and analog setup value of frequency upper limit is used as the final setup value of frequency upper limit.

F0-14	Frequency lower limit	Factory default value	0.00Hz
	Setup range	0.00Hz to frequency upper limit F0-12	

The inverter starts from the start frequency. If the reference frequency is lower than frequency lower limit during the running process, the inverter will keep running under frequency lower limit until it stops or the reference frequency is higher than the frequency lower limit.

F0-15	Carrier frequency	Factory default value	Model dependent
	Setup range	0.5kHz~16.0kHz	

This function is used to adjust the carrier frequency of the inverter. By adjusting the carrier frequency, the motor noise can be reduced, and the resonance of the mechanical system can be avoided, so that the leakage current to the earth and the interference of the inverter can be reduced.

When the carrier frequency is low, the output current higher harmonic component will increase, the motor loss will increase, and the motor temperature rise will also increase.

When the carrier frequency is high, the motor loss is reduced, and the motor temperature is decreased, but the inverter loss and temperature rise will increase and so will the interference.

The adjustment of carrier frequency will have influences on the following performances:

Carrier frequency	Low to high
Motor noise	high to low
Output current waveform	poor to good
Motor temperature rise	high to low
inverter temperature rise	Low to high
Leakage current	low to high
External radiation interference	low to high

F0-16	Carrier frequency adjustment selection		Factory default value	0
	Setup range	0	Fixed PWM, and carrier frequency temperature adjustment inactive.	
		1	Random PWM, and carrier frequency temperature adjustment inactive.	
		2	Fixed PWM, and carrier frequency temperature adjustment active.	
		3	Random PWM, and carrier frequency temperature adjustment active.	

Two PWM carrier frequency adjustment modes, fixed and random, are provided. The random PWM motor noise has wide frequency range, while the fixed PWM motor noise has fixed frequency.

When the carrier wave temperature adjustment is active, the inverter can automatically adjust the carrier frequency according to its temperature. This function can reduce the possibility of overheating alarm of the inverter.

F0-17	Speed-up time 1		Factory default value	20.0s
	Setup range	0.0s~6500.0s		
F0-18	Speed-down time 1		Factory default value	20.0s
	Setup range	0.0s~6500.0s		

Speed-up time 1 refers to the time "t1" required for the inverter to speed up from 0Hz to the maximum output frequency (F0-10).

Speed-down time 1 refers to the time "t2" required for the inverter to Speed down from the maximum output frequency (F0-10) to 0Hz, as shown in the following figure:

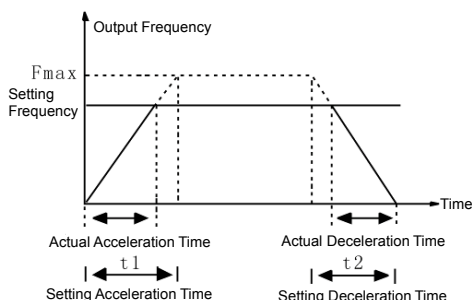


Fig.6-1 Schematic diagram for acceleration/deceleration time

Pay attention to the difference between the actual acceleration/deceleration time and the setup acceleration/deceleration time.

There are totally four groups of acceleration/deceleration time for selection.

Group 1: F0-17 and F0-18;

Group 2: F8-03 and F8-04;

Group 3: F8-05 and F8-06;

Group 4: F8-07 and F8-08;

It can select acceleration/deceleration time via the multifunctional digital input terminals (F4-00 to F4-08).

Group F1 Motor Parameters

F1-00	Motor type selection		Factory default value	0
	Setup range	0	common asynchronous motor	
		1	Variable frequency asynchronous motor	
		2	Permanent magnetic synchronous motor (reserved)	
F1-01	Rated power		Factory default value	model dependent
	Setup range	0.4kW ~1000.0kW		
F1-02	Rated voltage		Factory default value	380V
	Setup range	0V~ 440V		
F1-03	Rated current		Factory default value	model dependent
	Setup range	0.00A~ 655.35A		
F1-04	Rated Frequency		Factory default value	model dependent
	Setup range	0.00Hz~ maximum frequency		
F1-05	Rated rotation speed		Factory default value	1460rpm
	Setup range	0rpm ~ 30,000rpm		



Caution

1. Please set the parameters according to the nameplate parameters of the motor.
2. It needs accurate motor parameters to ensure the excellent control performance of the vector control. Accurate parameter identification comes from the correct setting of the rated motor parameters.
3. To ensure the control performance, please carry out motor configurations in accordance with the standard adaptable motor of the inverter. If there is huge difference between the motor power and the power of standard adaptable motor, the control performance of the inverter will decrease obviously.

F1-06	Stator resistance		Factory default value	Model dependent
	Setup range	0.001Ω~ 65.535Ω		
F1-07	Rotor resistance		Factory default value	model dependent
	Setup range	0.001Ω~ 65.535Ω		
F1-08	Leakage inductive reactance		Factory default value	model dependent
	Setup range	0.01mH ~ 655.35mH		
F1-09	Mutual inductive reactance		Factory default value	model dependent
	Setup range	0.1mH ~ 6553.5mH		
F1-10	No-load current		Factory default value	model dependent
	Setup range	0.01A~ 650.00A		

When the automatic tuning of the motor is normally completed, the setup values of F1-06 to F1-10 will be automatically updated.

Each time when the rated power of the motor F1-01 is changed, the inverter will automatically recover the parameter values of F1-06 to F1-10 to the default standard motor parameters. (Four-pole Y series asynchronous motor)

If it is impossible to tune the motor on the site, the user can manually input the parameters by referring to the known parameters of the motors of the same type.

F1-11	Tuning selection		Factory default value	0
	Setup range	0	No operation	
		1	Static tuning	
		2	Complete tuning	

be conducted because it is not easy to disconnect the motor from the load.

Action description: Set the function code to 1 and press RUN key for confirmation, and then the inverter will conduct static tuning.

2. Complete tuning

To ensure the dynamic control performance of the inverter, please select rotary tuning. During the rotary tuning, the motor must be disconnected with the loads (i.e. no-load).

Upon selection of rotary tuning, the inverter will conduct static tuning at first. Upon completion of static tuning, the motor will accelerate to 80% of the rated motor frequency in accordance with the setup acceleration time of F0-17 and maintain for certain period of time. Then the motor will decelerate to zero speed in accordance with the setup acceleration time of F0-18, and by this time the rotary tuning is completed.

Action description: Set the function code to 2 and press RUN key for confirmation, and then the inverter will conduct rotary tuning.

Tuning operation description:

When F1-11 is set to 1 or 2, press ENTER key and "TUNE" will be displayed and flashes. Press RUN key to conduct parameter tuning, and at this time the displayed "TUNE" stops flashing. After the tuning is completed, the display will return to the stop status interface. The tuning process can be stopped by pressing the STOP key.

When the tuning is completed, the value of F1-11 will automatically restore to 0.

Caution: Tuning is active only in the keyboard control mode. It is recommended that the acceleration/deceleration time adopt the factory default value.

Group F2 Vector Control Parameters

Group F2 function code is active only for the vector control. That is to say, when F0-01=0 or 1, it is active, and when F0-01=2, it is inactive.

F2-00	Speed loop proportional gain 1		Factory default value	30
	Setup range	0~100		
F2-01	Speed loop integration time 1		Factory default value	0.50s
	Setup range	0.01s ~ 10.00s		
F2-02	Switching frequency 1		Factory default value	5.00Hz
	Setup range	0.00~ F2-05		
F2-03	Speed loop proportional gain 2		Factory default value	15
	Setup range	0~100		
F2-04	Speed loop integration time 2		Factory default value	1.00s
	Setup range	0.01s ~ 10.00s		
F2-05	Switching frequency 2		Factory default value	10.00Hz
	Setup range	F2-02 ~ maximum frequency		

F2-00 and F2-01 are PI adjustment parameters when the running frequency is lower than switching frequency 1 (F2-02). F2-00 and F3-01 are PI adjustment parameters when the running frequency is higher than switching frequency 2. PI parameter of frequency channel between the switching frequency 1 and switching frequency 2 is linear switching between two groups of PI parameters, as shown in the figure below:

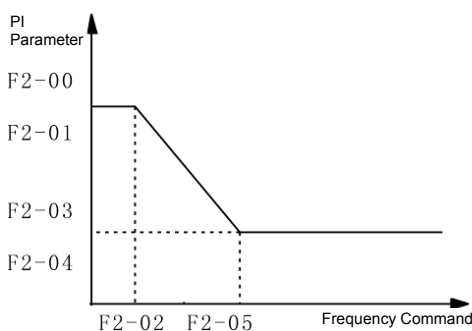


Fig.6-2 Schematic diagram of PI parameter

The speed dynamic response characteristics of the vector control can be adjusted by setting the proportional coefficient and integration time of the speed regulator. Increasing the proportional gain or reducing the integration time can accelerate the dynamic response of the speed loop. However, if the proportional gain is too large or the integration time is too short, it will cause the oscillation of the system.

Recommended adjustment method:

If the factory default parameters cannot meet the requirements, the relevant parameter values can be subject to fine tuning.

Increase the proportional gain while ensuring no oscillation to the system, and then reduce the integration time to ensure that the system has quick response characteristics and small overshoot.

Caution: Improper PI parameter setting may cause too large speed overshoot. Voltage fault may occur when the overshoot drops.

F2-06	Slip compensation coefficient		Factory default value	100%
	Setup range	50%~200%		

For the speed sensorless vector control, this parameter is used to adjust the speed stabilizing precision of the motor. When the speed is too low due to heavy load of motor, this parameter needs to be enlarged or this parameters needs to be reduced.

For the speed sensor vector control, this parameter can adjust the output current of the inverter carrying the same load.

F2-07	Time constant of speed loop filter		Factory default value	0.000s
	Setup range	0.000s~0.100s		

In the vector control mode, the output of speed loop regulator is torque current command. This parameter is used to filter the torque command. This parameter needs no adjustment generally and this filter time can be increased in case of huge speed fluctuation. In case of oscillation of motor, this parameter shall be reduced properly.

The time constant of speed loop filter is low, and the output torque of the inverter may vary greatly, but the response is quick.

F2-08	Torque control		Factory default value	0
	Setup range	0	Inactive	
		1	Enabled	

0: Torque control is inactive, and the inverter performs command speed control. In case of speed control, the inverter outputs frequency in accordance with the setup frequency command, and the output torque automatically matches the load torque, but the output torque is limited by the torque upper limit (refer to F2-09 and F2-10). When the load torque is higher than the setup torque upper limit, the output torque of the inverter is limited, and the output frequency will be different from the setup frequency.

1: Torque control is enabled, and the inverter performs torque control. In case of torque control, the inverter outputs torque in accordance with the setup torque command, and the output frequency automatically matches the load speed, but the output frequency is limited by the frequency upper limit (refer to F0-12). When the load speed is higher than the setup frequency upper limit, the output frequency of the inverter is limited, and the output torque will be different from the setup torque.

In case of torque control, the torque command is the torque upper limit, and set by the torque upper limit source (F2-09).

It can perform switching between torque control and speed control via the multifunctional input terminals.

In case of torque control, the output frequency of the inverter automatically tracks the change of the load speed, but the change of the output frequency is affected by the setup acceleration/deceleration time. If it needs to quicken the tracking speed, the acceleration/deceleration time shall be shortened.

When the setup torque of the inverter is higher than the load torque, the output frequency of the inverter will rise; when the output frequency of the inverter reaches the frequency upper limit, the inverter will keep running with the frequency upper limit.

When the setup torque of the inverter is lower than the load torque, the output frequency of the inverter will fall; when the output frequency of the inverter reaches the frequency lower limit, the inverter will keep running with the frequency lower limit.

F2-09	Torque upper limit source		Factory default value	0
	Setup range	0	F2-10	
		1	AI1	
		2	AI2	
		3	AI3	
		4	PULSE setup	
		5	Communication setup	
F2-10	Torque upper limit		Factory default value	150%
	Setup range	0%~ 200%		

In the speed control mode, F2-09 is used to select the setup source of torque upper limit. When setting via the analog value, 100% of the analog input setup corresponds to F2-10, and the setup 100% corresponds to the rated torque of the motor matching the inverter.

In the torque control mode, torque upper limit source is the torque setup source. Torque upper limit is the torque setup command.

F2-11	Encoder pulse number		Factory default value	1024
	Setup range	0 ~ 65535		

It is used to set the number of pulses of each turn of encoder.

Caution: When the inverter controls the speed sensor vector control, it must set the pulse number of the encoder correctly, or the motor will run abnormally. If normal operation cannot be realized after correct pulse number of the encoder is set, exchange the connecting positions of Phase A and Phase B of the encoder.

Group F3 V/F Control Parameters

This group of function code is enabled only for the V/F control (F0-01=2) and is inactive for the vector control.

V/F control is applicable to the general loads such as fan and pump or the applications where one inverter drives multiple motors or the inverter power is one level lower or higher than the motor power.

F3-00	V/F curve setup		Factory default value	0
	Setup range	0	Straight V/F curve	
		1	Multiple-point V/F curve	
		2	Square V/F curve	

The fan and pump loads may select square V/F control.

0: Straight V/F curve. It is suitable for common constant torque load.

1: Multiple-point V/F curve. It is suitable for the special loads such as dehydrator and centrifugal

machine.

2: Square V/F curve. It is suitable for the centrifugal loads such as fan and pump.

F3-01	Torque boost	Factory default value	1.0%
	Setup range	0.0% ~ 30%	
F3-02	Cutoff frequency of torque boost	Factory default value	50.00Hz
	Setup range	0.00Hz~ maximum output frequency	

To compensate the low frequency torque characteristics of V/F control, it can boost the output voltage of the inverter at the time of low frequency.

If the torque boost is set to be too large, the motor may be over heat, and the inverter may be over current. In general, the torque boost shall not exceed 8.0%.

Adjusting this parameter effectively can avoid over current upon startup. For the relatively large loads, it is recommended to increase this parameter. For the small loads, this parameter value may be reduced.

When the torque boost is set to 0.0, the inverter will adopt auto torque boost.

Cutoff frequency of torque boost: Under this frequency, the torque boost is enabled. If it exceeds this setup frequency, the torque boost is inactive. Refer to Fig.6-3 for details.

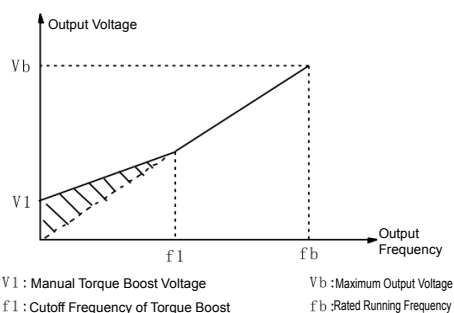


Fig.6-3 Schematic Diagram for Manual Torque Boost

F3-03	V/F frequency F1	Factory default value	0.00Hz
	Setup range	0.00Hz ~ rated motor frequency	
F3-04	V/F voltage V1	Factory default value	0.0%
	Setup range	0.0%~ 100.0%	
F3-05	V/F frequency F2	Factory default value	0.00Hz
	Setup range	V1 ~ rated motor frequency	
F3-06	V/F voltage V2	Factory default value	0.0%
	Setup range	F1 ~ 100.0%	
F3-07	V/F frequency F3	Factory default value	0.00Hz
	Setup range	V2 ~ rated motor frequency	
F3-08	V/F voltage V3	Factory default value	0.0%
	Setup range	F2 ~ 100.0%	

Six parameters of F3-03 to F3-08 define MS V/F curve.

The setup value of V/F curve is generally set in accordance with the load characteristics of the motor.

Caution: $V1 < V2 < V3$ and $F1 < F2 < F3$. In case of low frequency, higher setup voltage may cause over heat and even burning of the motor and stall over current or current protection of the inverter.

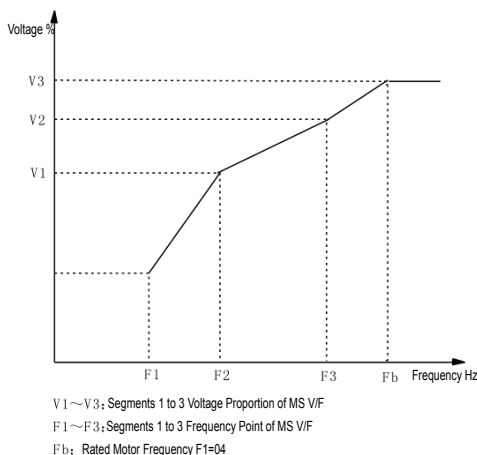


Fig.6-4 Schematic Diagram for V/F Curve Setup

F3-09	Slip compensation coefficient	Factory default value	0.0%
	Setup range	0% ~ 200.0%	

It is enabled only for V/F control. Setting this parameter can compensate the slip in the V/F control mode due to load and reduce the change of rotation speed of the motor following the load change. In general, 100% corresponds to the rated slip of the motor with rated load. Slip coefficient adjustment can refer to the following principles: When the load is rated load and the slip compensation coefficient is set to 100%, the rotation speed of the motor in the inverter is close to the given speed.

F3-10	AVR(Automatic Voltage Regulation)		Factory default value	2
	Setup range	0	Inactive	
		1	Enabled	
		2	Inactive only at the time of deceleration	

In the V/F control mode, when it needs fast stop and there is no brake resistor, selecting "Inactive only at the time of deceleration" can greatly reduce the possibility of over voltage fault alarm. When there is brake resistor or it has not need for fast deceleration, select "Active".

F3-11	Oscillation suppression gain	Factory default value	
	Setup range	0 ~100	

Select "0" for this gain when the motor has no oscillation. Only when the motor has obvious oscillation and cannot run normally can this gain be properly increased. The bigger the gain is, the better oscillation suppression result will be. The method of selecting this gain is to select the smallest one on the premise that there is effective oscillation suppression measure, so as to ease the negative effect on the VF operation.

Group F4 Input Terminal

The standard unit of MD320 series inverter has five multifunctional digital input terminals (DI5 of which can be used as high-speed pulse input terminal) and two analog input terminals. If the system needs more input/output terminals, optional multifunctional input/output expansion card can be used.

The multifunctional input/output expansion card has 5 multifunctional digital input terminals (DI6 to DI10) and 1 analog input terminal (AI3).

F4-00	DI1 terminal function selection	Factory default value	1 (Forward rotation)
F4-01	DI2 terminal function selection	Factory default value	4 (Forward rotation-Jog)
F4-02	DI3 terminal function selection	Factory default value	9 (fault- reset)
F4-03	DI4 terminal function selection	Factory default value	12 (MS speed 1)

F4-04	DI5 terminal function selection	Factory default value	13 (MS speed 2)
F4-05	DI6 terminal function selection	Factory default value	0
F4-06	DI7 terminal function selection	Factory default value	0
F4-07	DI8 terminal function selection	Factory default value	0
F4-08	DI9 terminal function selection	Factory default value	0
F4-09	DI10 terminal function selection	Factory default value	0

This parameter is used to set the functions of the multifunctional digital input terminals.

Setup value	Function	Description
0	No function	Even when there is signal input, the inverter still has no action. The no operation function can be set on the unused terminals so as to prevent error action.
1	Forward rotation (FWD)	Control the forward rotation and reverse rotation of the inverter via the external terminals.
2	Reverse rotation (REV)	
3	Three-line mode running control	This terminal is used to confirm that the inverter running mode is three-line control mode. For detailed description, please refer to F4-11 three-line control mode function code.
4	Forward rotation Jog (FJOG)	FJOG refers to Jog forward rotation, while RJOG refers to Jog reverse rotation. For details regarding frequency and Jog acceleration/deceleration time during the Jog running, refer to F8-00, F8-01 and F8-02 function codes.
5	Reverse rotation Jog (RJOG)	

Setup value	Function	Description
6	Terminal UP	When the frequency is given by the external terminals, it is used as increment and decrement commands of frequency modification. When the frequency source is set to digital setup, it can be used to adjust the setup frequency.
7	Terminal DOWN	
8	Free stop	The inverter locks the output, and the motor stop process is beyond the inverter control. It is the general method adopted when there is huge load and no requirement for the stop time. This mode is the same as the meaning of coast to stop as described in F6-10.
9	Fault reset (RESET)	External fault reset function. It is the same as the function of RESET key on the keyboard. Using this function can realize long-distance fault reset.
10	Running pause	The inverter decelerates to stop, but all the running parameters are all in the memory status, such as PLC parameter, swing frequency parameter and PID parameter. After this signal disappears, the inverter restores to the status before stopping.
11	External fault normally open input	After the external fault signal is sent to the inverter, the inverter reports fault and stops.
12	MS speed terminal 1	It can realize 16S speed through the combination of digital status of these four terminals. Refer attached table 1 for the MS speed function description.
13	MS terminal 2	
14	MS speed terminal 3	
15	MS terminal 4	
16	Speed-up/speed-down time selection terminal 1	It can select four types of speed-up/speed-down time through the combination of digital status of these two terminals.
17	Speed-up/speed-down time selection terminal 2	

Setup value	Function	Description
18	Frequency source switching	<p>When the frequency source selection (F0-07) is set to 2, it performs switching between main frequency source X and auxiliary frequency source Y via this terminal.</p> <p>When the frequency source selection (F0-07) is set to 3, it performs switching between main frequency source X and (main frequency X plus auxiliary frequency source Y) via this terminal.</p> <p>When the frequency source selection (F0-07) is set to 4, it performs switching between auxiliary frequency source X and (main frequency X plus auxiliary frequency source Y) via this terminal.</p>
19	UP and DOWN setup clear (terminal and keyboard)	When the frequency reference is digital frequency reference, this terminal can be used to clear the frequency value modified by UP/DOWN and thus restore the reference frequency to the setup value of F0-08.
20	Running command switching terminal	<p>When the command source (F0-02) is set to 1, it performs switching between terminal control and keyboard control via this terminal.</p> <p>When the command source (F0-02) is set to 2, it performs switching between communication control and keyboard control via this terminal.</p>
21	Speed-up/speed-down inactive	Protect the inverter from affecting by the external signals (except stop command), and maintain the current frequency.
22	PID Pause	PID is inactive temporarily, and the inverter maintains the current frequency output.
23	PLC status reset	PLC pauses during the execution process. When it resumes running, it can effectively restore to the initial status of simple PLC via this terminal.
24	Swing frequency pause	The inverter output with central frequency. Swing frequency pauses.

Setup value	Function	Description
25	Counter input	The input terminal of counting pulse.
26	Counter reset	Clear the counter status.
27	Length count input	Input terminal of length counting.
28	Length reset	Length clear
29	Torque control inactive	The torque control of inverter is inactive.
30	PULSE (pulse) frequency input (enabled only for DI5)	It is pulse input terminal.
31	Reserved	
32	Brake command	This terminal is enabled, and the inverter directly switches to the DC brake status.
33	External fault normally closed input	After the external fault signal is sent to the inverter, the inverter reports fault and stops.

Attached Table 1 MS Speed Function Description

K ₄	K ₃	K ₂	K ₁	Frequency Setup	Corresponding Parameter
OFF	OFF	OFF	OFF	MS speed 0	FC-0
OFF	OFF	OFF	ON	MS speed 1	FC-01
OFF	OFF	ON	OFF	MS speed 2	FC-02
OFF	OFF	ON	ON	MS speed 3	FC-03
OFF	ON	OFF	OFF	MS speed 4	FC-04
OFF	ON	OFF	ON	MS speed 5	FC-05
OFF	ON	ON	OFF	MS speed 6	FC-06
OFF	ON	ON	ON	MS speed 7	FC-07
ON	OFF	OFF	OFF	MS speed 8	FC-08
ON	OFF	OFF	ON	MS speed 9	FC-09
ON	OFF	ON	OFF	MS speed 10	FC-10
ON	OFF	ON	ON	MS speed 11	FC-11
ON	ON	OFF	OFF	MS speed 12	FC-12
ON	ON	OFF	ON	MS speed 13	FC-13
ON	ON	ON	OFF	MS speed 14	FC-14
ON	ON	ON	ON	MS speed 15	FC-15

Attached Table 2 MS Speed Function Description

Terminal 2	Terminal 1	Speed-up/speed-down time selection	Corresponding Parameter
OFF	OFF	Speed-up time 1	F0-17 and F0-18
OFF	ON	Speed-up time 2	F8-03, F8-04
ON	OFF	Speed-up time 3	F8-05 and F8-06
ON	ON	Speed-up time 4	F8-07 and F8-08

F4-10	DI filter time		Factory default value	4
	Setup range	0 ~ 10		

It is used to set the sensitivity of DI terminal. If the digital input terminal is vulnerable to interferences and may cause error action, it can increase this parameter value to enhance the anti-interference capability. However, this operation will reduce the sensitivity of DI terminal.

F4-11	Terminal command mode		Factory default value	0
	Setup range	0	Two-line mode 1	
		1	Two-line mode 2	
		2	Three-line mode 1	
		3	Three-line mode 2	

This parameter defines four different modes of controlling the operation of the inverter via the external terminals.

0: Two-line running mode 1: This mode is the most commonly used two-line mode. The forward/reverse rotation of the motor is decided by the commands of FWD and REV terminals.

K1	K2	Running Command
0	0	Stop
1	0	Forward Rotation
0	1	Reverse Rotation
1	1	Stop

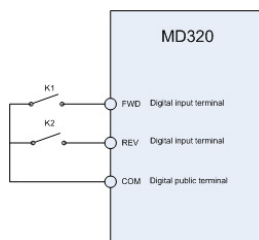


Fig.6-5 Two-line Running Mode 1

1: Two-line running mode 2: When this mode is adopted, REV is enabled terminal. The direction is determined by the status of FWD.

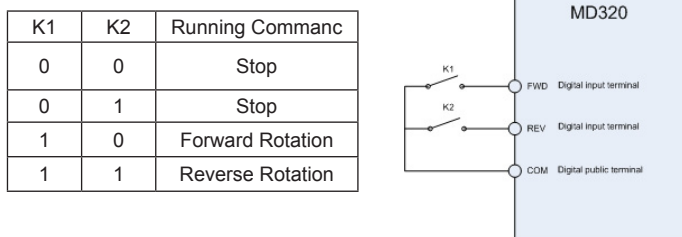


Fig.6-6 Three-line Running Mode 2

2: Three-line running mode 1: In this mode, DI_n is enabled terminal, and the direction is controlled by FWD and REV respectively. However, the pulse is enabled through disconnecting the signal of DI_n terminal when the inverter stops.

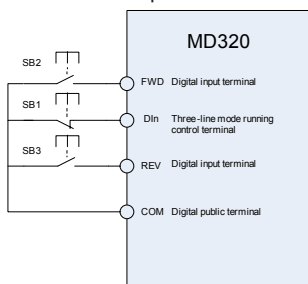


Fig.6-7 Three-line Running Mode 1

Where,

SB1: Stop button

SB2: Forward rotation button

SB3: Forward rotation button

DI_n is multifunctional input terminals of DI1 to DI5 (DI1 to DI10 if multifunctional input and output expansion card is selected). In this way, it shall define the corresponding terminal functions as No.3 function "Three-line Mode Running Control".

3: Three-line running mode 2: In this mode, DI_n is enabled terminal, and the running command is given by FWD, while the direction is determined by the status of REV. Stop command is performed through disconnecting the DI_n signal.

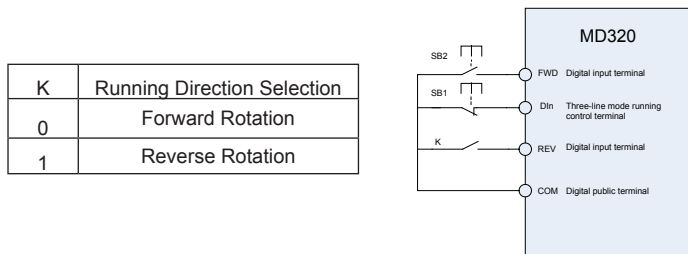


Fig.6-8 Three-line Running Mode 2

Where,

SB1: Stop button

SB2: Running button

DIn is multifunctional input terminals of DI1 to DI5 (DI1 to DI10 if multifunctional input and output expansion card is selected). In this way, it shall define the corresponding terminal functions as No.3 function "Three-line Mode running Control".

F4-12	Terminal UP/DOWN Speed	Factory default value	1.00Hz/s
	Setup range	0.01Hz/s ~ 100.00Hz/s	

Terminals UP/DOWN is used to adjust the change rate when setting the frequency.

F4-13	AI1 minimum input	Factory default value	0.00V
	Setup range	0.00V ~ 10.00V	
F4-14	AI1 minimum input corresponding setup	Factory default value	0.0%
	Setup range	-100.00% ~ 100.0%	
F4-15	AI1 maximum input	Factory default value	10.00V
	Setup range	0.00V ~ 10.00V	
F4-16	AI1 maximum input corresponding setup	Factory default value	100.0%
	Setup range	-100.00% ~ 100.0%	
F4-17	AI1 input filter time	Factory default value	0.10s
	Setup range	0.00s ~ 10.00s	

The above function codes define the relationship between the analog input voltage and analog input setup value. When the analog input voltage exceeds the setup maximum input or minimum input range, the excess part will be calculated as maximum input or minimum input.

When the analog input is current input, 1mA current equals to 0.5V voltage.

In difference applications, 100% of analog input corresponds to different nominal values. Refer to all the application parts for details.

Several setting examples are shown in the following figures:

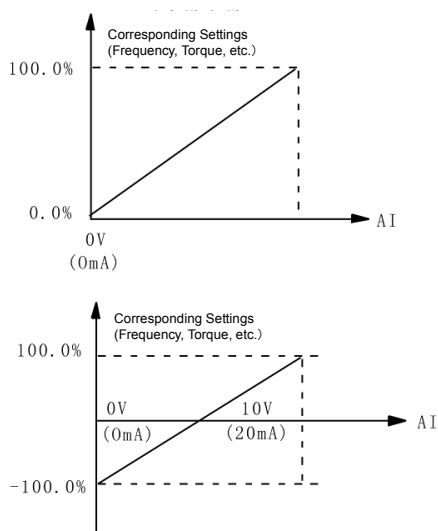


Fig.6-9 Corresponding Relationship between Analog Reference and Setting

F4-18	AI2 minimum input		Factory default value	0.00V
	Setup range	0.00V ~ 10.00V		
F4-19	AI2 minimum input corresponding setup		Factory default value	0.0%
	Setup range	-100.00% ~ 100.0%		
F4-20	AI2 maximum input		Factory default value	10.00V
	Setup range	0.00V ~ 10.00V		
F4-21	AI2 maximum input corresponding setup		Factory default value	100.0%
	Setup range	-100.00% ~ 100.0%		
F4-22	AI2 input filter time		Factory default value	0.10s
	Setup range	0.00s~ 10.00s		
F4-23	AI3 minimum input		Factory default value	0.00V
	Setup range	0.00V ~ 10.00V		
F4-24	AI3 minimum input corresponding setup		Factory default value	0.0%
	Setup range	-100.00% ~ 100.0%		
F4-25	AI3 maximum input		Factory default value	10.00V
	Setup range	0.00V ~ 10.00V		

F4-26	AI3 maximum input corresponding setup	Factory default value	100.0%
	Setup range	-100.00%~ 100.0%	
F4-27	AI3 input filter time	Factory default value	0.10s
	Setup range	0.00s~ 10.00s	

The method of setting AI2 function is similar to that of setting AI1 function.

MD320 inverter standard unit provides two analog input ports.

If AI3 is used, it needs to configure additional multifunctional input and output expansion card.

F4-28	PULSE (pulse) input minimum frequency	Factory default value	0.00kHz
	Setup range	0.00kHz~50.00kHz	
F4-29	PULSE (pulse) input minimum frequency corresponding setup	Factory default value	0.0%
	Setup range	-100.00%~ 100.0%	
F4-30	PULSE (pulse) input maximum frequency	Factory default value	50.00kHz
	Setup range	0.00kHz~50.00kHz	
F4-31	PULSE (pulse) input maximum frequency corresponding setup	Factory default value	100.0%
	Setup range	-100.00%~ 100.0%	
F4-32	PULSE (pulse) input filter time	Factory default value	0.10s
	Setup range	0.00s ~ 10.00s	

This group of function code defines the corresponding relationship when the pulse is used as frequency setup mode.

The pulse frequency input can only be input via DI5 channel. The applications of this group of function are similar to those of AI1 function.

Group F5 Output Terminal

The standard unit of MD320 series inverter has one multifunctional digital output terminals, one multifunctional relay output terminal, one FM terminal (can be used as either high-speed pulse output terminal or collector open output), and one multifunctional analog output terminal. If it needs to add relay output terminals and analog output terminals, optional multifunctional input/

output expansion card can be used.

The multifunctional input and output expansion card has additional one multifunctional relay output terminal (relay 2), one multifunctional digital output terminal (DO2) and one multifunctional analog output terminal (AO2).

F5-00	FM terminal output mode selection		Factory default value	0
	Setup range	0	Pulse output (FMP)	
		1	Collector open output (FMR)	

FM terminal is programmable multiplexing terminal.

It can be used as high-speed pulse output (FMP), with maximum frequency of 50 kHz. Refer to F5-06 for relevant functions of FMP.

It can also be used as collector open output terminal (FMR). Refer to F5-01 for FMR function.

F5-01	FMR output selection (collector open output terminal)	Factory default value	0
F5-02	Control board RELAY 1 output selection (T/A-T/ B-T/C)	Factory default value	2
F5-03	Expansion card RELAY 1 output selection (P/A-P/ B-P/C)	Factory default value	0
F5-04	DO1 output selection (collector open output terminal)	Factory default value	1
F5-05	Expansion card DO2 output selection	Factory default value	4

Caution: RELAY 1 and RELAY2 refer to TA/TB/TC;

Multifunctional output terminal function selection is as follows:

Setup value	Function	Description
0	no output	The output terminals does not have any function.
1	Inverter is running	It indicates the inverter is running, and there is output frequency (can be zero), and ON signal will output at this time.

Setup value	Function	Description
2	Fault output	When the inverter is faulty, it outputs ON signal.
3	Frequency level detection FDT arrival	Please refer to F8-19 and F8-20 for details.
4	Frequency arrival	Please refer to F8-21 for details.
5	in zero speed operation	When the inverter output frequency is less than the start frequency, it outputs ON signal.
6	Motor overload pre-warning	Judgment will be made according to the pre-warning parameter value before the motor electronic thermal protection is enabled. If it exceeds the pre-warning value, it will output ON signal. Motor overload parameters are set in F9-00 to F9-02.
7	Inverter overload pre-warning	After it is found that the inverter is overloaded, pre-warning will be invoked 10 seconds before the occurrence of protection. And ON signal will be output.
8	Setup counting pulse arrival	When the counting value reaches the setup value of FB-08, it outputs ON signal.
9	Designated counting pulse arrival	When the counting value reaches the setup value of FB-09, it outputs ON signal. Refer to Group B function description for the counting function.
10	Length arrival	When the measured actual length exceeds the setup value of FB-05, it outputs ON signal.
11	PLC circulation complete-on	When the simple PLC has been running for one cycle, it outputs a pulse signal with width of 250ms.
12	Run time arrival	When the accumulated running time of the inverter exceeds the setup time F8-17, it outputs ON signal.
13	Frequency limiting	When the setup frequency exceeds the frequency upper limit and frequency lower limit, and the output frequency of the inverter reaches the frequency upper limit and frequency lower limit, it outputs ON signal.
14	Torque limiting	When the torque limiting function is enabled, the stall protection function is automatically enabled and the output frequency is automatically changed. Meanwhile, it outputs ON signal, indicating that it is outputting torque limit. This output signal can be used to reduce load or display overload status signal on the monitoring device.

Setup value	Function	Description
15	Ready for running	When the main circuit and control circuit power supply are connected, the inverter protection function is inactive, and the inverter is in running status, it output ON signal.
16	AI1>AI2	When the analog input AI1 value is higher than AI2 value, it outputs ON signal.
17	Frequency upper limit arrival	When the running frequency reaches frequency upper limit, it outputs ON signal.
18	Frequency lower limit arrival	When the running frequency reaches frequency lower limit, it outputs ON signal.
19	Under voltage status output	When the inverter is in under voltage status, it outputs ON signal.
20	Communication setup	Refer to the communication protocol for relevant descriptions.

F5-06	FMR output selection (Pulse output terminal)	Factory default value	0
F5-07	A01 output selection (Analog output terminal 1)	Factory default value	0
F5-08	A02 output selection (Analog output terminal 2)	Factory default value	1

The standard output of analog output (zero offset is 0 and gain is 1) is 0mA to 20mA (or 0V to 10V), and the output range of FMP is between 0Hz and setup value of F5-09.

The corresponding value range that it indicates is shown in the table below:

Setup value	Function	Range
0	Running frequency	0 to maximum output frequency
1	Setup frequency	0 to maximum output frequency
2	Output current	0 to 2 times of the motor rated current
3	Output torque	0 to 2 times of the motor rated torque
4	Output power	0 to 2 times rated power
5	Output voltage	0 to 1.2 times of the rated voltage of the inverter
6	PULSE input PULSE input	0.1kHz to 50.0kHz
7	AI1	0V to 10V
8	AI2	0V to 10V/0 to 20mA
9	AI3	0V to 10V
10	Length	0 to maximum setup length
11	Counting value	0 to maximum counting value
12	Communication setup	

F5-09	FMP output maximum frequency	Factory default value	50.0kHz
	Setup range	0.1kHz~ 50.0kHz	

When the FM terminal is selected as pulse output, it can output maximum frequency of the pulse.

F5-10	AO1 offset coefficient	Factory default value	0.0%
	Setup range	-100.0% ~ 100.0%	
F5-11	AO1 gain	Factory default value	1.00
	Setup range	-10.00~ 10.00	
F5-12	AO2 offset coefficient	Factory default value	0.00%
	Setup range	-100.0%~ 100.0%	
F5-13	AO2 gain	Factory default value	1.00
	Setup range	-10.00~ 10.00	

If "b" represents zero offset, k represents gain, Y represents actual output, and X represents standard output, the actual output is: $Y=kX+b$;

AO1 and AO2 zero offset coefficients 100% corresponds to 10V(20mA).

Standard output refers to 0 to maximum analog output corresponding to the output of 0 to 10V(20mA).

It is generally used to correct the zero drift of the analog output and the output amplitude deviation. It can also be defined as any necessary output curve.

For example, If the analog output is the running frequency, it is expected to output 8V(16mA) when the frequency is 0, and output 3V(6mA) at the maximum frequency, the gain shall be set to "-0.50", and the zero offset shall be set to "80%".

Group F6 Start/Stop Control

F6-00	Start mode		Factory default value	0
	Setup range	0	Direct start (When the DC brake time is non-zero value, perform DC braking prior to start.	
		1	Rotation speed tracking restart	

0: Direct start

If the DC brake time is set to 0, start at the start frequency.

When the DC brake time is non-zero value, perform DC braking prior to start. It is applicable to the applications where reverse rotation is likely to occur when small loads are started.

1: Rotation speed tracking restart

The inverter judges the rotation speed and director of the motor firstly and then starts at the frequency of the tracked rotation speed of the motor. The rotating motor will be started smoothly without surge.

It is applicable to the restart upon transient power failure of large loads.

To ensure the performance of rotation speed tracking restart, it needs to set the motor parameters accurately. (Group F1)

F6-01	Rotation speed tracking mode		Factory default value	0
	Setup range	0	Beginning from stop frequency	
		1	Beginning from zero speed	
		2	Beginning from maximum frequency	

To complete the rotation speed tracking process within the shortest time, select the mode of inverter tracking motor rotation speed:

0: To track from the frequency upon power failure, it generally selects this mode.

1: This mode is used to track from zero frequency and restart upon long period of time of power failure.

2: This mode is used to track from the maximum frequency and applicable to the general power generating loads.

F6-02	Rotation speed tracking fastness and slowness	Factory default value	20
	Setup range	1~ 100	

When it is in the mode of rotation speed tracking restart, select the fastness and slowness of the rotation speed tracking. The higher this parameter value is, the faster the tracking speed is. But too high value may result in unreliable tracking.

F6-03	Startup frequency	Factory default value	0.00Hz
	Setup range	0.00Hz~ 10.00Hz	
F6-04	Start frequency retention time	Factory default value	0.0s
	Setup range	0.0s~ 36.0s	

To ensure the torque at the start of inverter, it needs to set a proper start frequency. In addition, to set up flux at the time of motor start, it needs to start acceleration after the start frequency is kept for a certain period of time. The start frequency value F6-03 is not limited by the frequency lower limit.

When the frequency reference value (frequency source) is lower than the start frequency, the inverter cannot be started and is in the standby status.

When the forward rotation and reverse rotation is being switched each other, the start frequency retention time is inactive. The retention time is not included in the acceleration time but in the running time of simple PLC.

Example 1:

F0-03=0 Frequency source is digital reference

F0-08=2.00Hz Digital setup frequency is 2.00Hz.

F6-03=5.00Hz Start frequency is 5.00Hz.

F6-04=2.0s Start frequency retention time is 2.0s.

At this time, the inverter is in the standby status, and the output frequency of the inverter is 0Hz.

Example 2:

F0-03=0 Frequency source is digital setup.

F0-08=10.00Hz Digital setup frequency is 10.00Hz.

F6-03=5.00Hz Start frequency is 5.00Hz.

F6-04=2.0s Start frequency retention time is 2.0s.

At this time, the inverter accelerates to 5Hz and further to reference frequency of 10Hz in 2s.

F6-05	DC brake current at start	Factory default value	0%
	Setup range	0% ~ 100%	
F6-06	DC brake time at start	Factory default value	0.0s
	Setup range	0.0s~ 36.0s	

DC brake at start s generally used when the motor is restarted after it stops completely.

If the start mode is direct start, the inverter firstly performs DC brake in accordance with the DC brake current at start, and then start running after the setup DC brake time at start. If the DC brake time is set to 0, the inverter directly starts without passing through the DC brake.

The higher the DC brake current is, the higher the brake force is.

DC brake current at start refers to the percentage of rated current of the inverter.

F6-07	Speed-up/speed-down mode			Factory default value	0
	Setup range	0	Straight speed-up/speed-down		
		1	S-curve speed-up/speed-down		

It is used to select the frequency change mode during the inverter start and stop process.

0: Straight speed-up/speed-down

The output frequency increases or decreases along the straight line. The speed-up/speed-down time varies with the setup acceleration/ deceleration time. The MD320 series inverter provides four types of speed-up/speed-down time. It can select speed-up/speed-down time via the multifunctional digital input terminals (F4-00 to F4-08).

1: S-curve speed-up/speed-down

The output frequency increases or decreases along the S curve. S curve is generally used in the applications where start and stop processes are relatively flat, such as elevator and conveyor belt. Refer to F6-08 and F6-09 for the meanings of the parameters.

F6-08	Start segment proportion of S curve	Factory default value	30.0%
	Setup range	0.0% ~ 40.0%	
F6-09	End segment proportion of S curve	Factory default value	30.0%
	Setup range	0.0%~ 40.0%	

t1 in the following figure is the parameter set in F6-08, within which the output frequency change slope increases gradually. t2 is the time defined in F6-03, with which the slope of the output frequency change gradually decreases to 0. Within the time between t1 and t2, the slope of the output frequency change remains fixed.

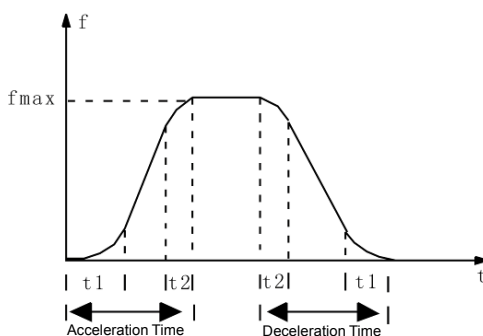


Fig.6-10 Schematic Diagram for S curve Acceleration/Deceleration

F6-10	Stop mode		Factory default value	0
	Setup range	0	Speed-down to stop	
		1	Free to stop	

0: Speed-down to stop

After the stop command is enabled, the inverter reduces the output frequency in accordance with the deceleration mode and the defined acceleration/deceleration time, and will stop after the frequency reduces to zero.

1: Free stop

After the stop command is enabled, the inverter will terminate the output immediately. The load will coast to stop according to the mechanical inertia.

F6-11	DC brake beginning frequency at stop		Factory default value	0.00Hz
	Setup range		0.00Hz ~maximum frequency	
F6-12	DC brake waiting time at stop		Factory default value	0.0s
	Setup range		0.0s~ 36.0s	
F6-13	DC brake current at stop		Factory default value	0%
	Setup range		0%~ 100%	
F6-14	DC brake time at stop		Factory default value	0.8s
	Setup range		0.0s~ 36.0s	

DC brake beginning frequency at stop: During the acceleration to stop, when it reaches this frequency, the DC brake process at stop begins.

DC brake waiting time at stop: Prior to the beginning of DC brake at stop, the inverter stops output and starts DC brake upon this delay. It is used to prevent the over current fault caused by DC brake beginning when the speed is relatively high.

DC brake current at stop: It refers to the added DC brake quantity. The higher this value is, the better the DC brake effect is.

DC brake time at stop: It refers to the added time of the DC brake quantity. When this value is zero, it indicates there is no DC brake process, and the inverter will stop according to the setup decoration to stop process.

F6-15	Brake use ratio		Factory default value	100%
	Setup range	0% ~ 100%		

It is enabled for the inverter with built-in brake unit. It can be used to adjust the brake effect of the brake unit.

Group F7 Keyboard and Display

F7-00	LCD language selection		Factory default value	0
	Setup range	0	Chinese	
		1	English	

It is active for the LCD keyboard. It is used to select the character mode of LCD display.

F7-01	MF.K Key function selection		Factory default value	0
	Setup range	0	MF.K Key function inactive	
		1	Switching between operation panel command channel and remote command channel (terminal command channel or serial port communication command channel)	
		2	Switching between forward rotation and reverse rotation	
		3	Forward rotation Jog command	

MF.K Key refers to multifunctional key. It can set and define the function of MF.K key on the keyboard via this parameter. It can perform switching via this key both in the stop and running process.

0: This key has no function.

1: Switching between keyboard command and remote operation. It refers to switching of command source, switching from the current command source to the keyboard control (local operation). If the current command source is keyboard control, this command is inactive.

2: Switching between forward rotation and reverse rotation

It can switch the direction of the frequency command via the MF.K key on the keyboard. It is enabled only in the operation panel command channel.

3: Forward rotation Jog

It can realize forward rotation Jog (FJOG) via the MF.K key on the keyboard.

F7-02	STOP/RESET key function		Factory default value	0
	Setup range	0	Inactive only in the keyboard control mode	
		1	STOP key enabled in the terminal control mode	
		2	STOP reset function active in the terminal control mode	
		3	STOP key stop and fault reset function active in the terminal control mode	
F7-03	QUICK parameter lockout		Factory default value	0
	Setup range	QUICK parameter lockout inactive. The parameter items in the shortcut menu can be added, reduced or modified at this time.		
		1: QUICK parameter lockout inactive. The parameter items in the shortcut menu cannot be modified at this time, but the related parameter contents can be modified.		

	LED operation display parameter	Factory default value	255																
F7-04	<p>Setup range: 1~65535</p>	<p>Meanings or lower Eight Digits</p> <table><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr></table> <p>reserved reserved DI input State DO output State AI1 voltage(V) AI2 voltage(V)Current(mA) AI3 voltage(V) Numerical value input</p> <p>Meaning of higher 8 digits</p> <table><tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td></tr></table> <p>Length input Loading speed PID setting PID feedback PLC steps(tested by pulse input) Linear speed reserved reserved</p> <p>If the above parameters need to be displayed during the operation, set the corresponding positions to 1, and change the binary numbers into decimal numbers and set them in F7-01.</p>	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8	
7	6	5	4	3	2	1	0												
15	14	13	12	11	10	9	8												
F7-05	<p>Setup range: 1 ~ 65535</p>	<p>LED stop display parameter</p> <p>Factory default value</p> <p>0</p> <p>Meanings of Lower Eight Digits</p> <table><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr></table> <p>Setting frequency (Hz) Bus voltage (V) DI input State DO output State AI1 voltage (V) AI2 voltage (V) Current (mA) AI3 voltage Numerical value input</p> <p>Meanings of Higher Eight Digits</p> <table><tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td></tr></table> <p>Length input PLC step Reserved Reserved Reserved Reserved Reserved Reserved</p> <p>If the above parameters need to be displayed during the stop, set the corresponding positions to 1, and change the binary numbers into decimal numbers and set them in F7-05.</p>	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8	
7	6	5	4	3	2	1	0												
15	14	13	12	11	10	9	8												

F7-06	Load speed display coefficient		Factory default value	1.000
	Setup range	0.0001~6.5000	The output frequency of the inverter and the load speed are relative through this parameter. It is set when the load speed needs to be displayed.	
F7-07	Radiator temperature of inverter module		Factory default value	
	Setup range	0.0℃~ 100.0℃	Display the temperature of inverter module IGBT, and the over temperature protection value of the inverter module IGBT varies with the model.	
F7-08	Radiator temperature of rectifier module		Factory default value	
	Setup range	0.0℃~ 100.0℃	Display the temperature of inverter module IGBT, and the over temperature protection value of the inverter module IGBT varies with the model.	
F7-09	Accumulated running time		Factory default value	0h
	Setup range	0h ~ 65535h	Display the accumulated running time of the inverter till now. When this time reaches the setup running time (F8-17), the multifunctional digital output of the inverter (DO and F5-04) performs action.	
F7-10	Software version No.1		Factory default value	
	Setup range		Management software version No. of the control board	

F7-11	Software version No.2	Factory default value
	Setup range	Software version No. of the motor control board

Group F8 Auxiliary Function

F8-00	Jog running frequency	Factory default value	2.00Hz
	Setup range	0.00Hz ~ maximum frequency	
F8-01	Jog speed-up time	Factory default value	20.00s
	Setup range	0.00s~ 6500.0s	
F8-02	Jog speed-down time	Factory default value	20.00s
	Setup range	0.00s~ 6500.0s	

It is used to define the reference frequency and speed-up/speed-down time of the inverter when jogging. The Jog process is started and stopped according to the start mode 0 (F6-00, direct start) and the stop mode 0 (F6-10, speed-down time to stop).

The Jog speed-up time means the time required for the inverter to accelerate from 0Hz to the maximum output frequency (F0-10).

The Jog speed-down time means the time required for the inverter to decelerate from the maximum output frequency (F0-10) to 0Hz.

F8-03	Speed-up time 2	Factory default value	20.00s
	Setup range	0. 0s~ 6500.0s	
F8-04	Speed-down time 2	Factory default value	20.00s
	Setup range	0.0s~ 6500.0s	
F8-05	Speed-up time 3	Factory default value	20.00s
	Setup range	0.0s~ 6500.0s	
F8-06	Speed-down time 3	Factory default value	20.00s
	Setup range	0.0s~ 6500.0s	

F8-07	Speed-up time 4	Factory default value	20.00s
	Setup range	0.0s~ 6500.0s	
F8-08	Speed-down time 4	Factory default value	20.00s
	Setup range	0.0s ~ 6500.0s	

Speed-up/speed-down time can select F0-17 and F0-18 and above three types of speed-up/speed-down time. Their meanings are the same, and refer to F0-17 and F0-18 for the relevant descriptions.

It can select speed-up/speed-down time 1 to 4 during the inverter running process via the different combination of multifunctional digital input terminal DI. Please refer to F4-01 to F4-05.

F8-09	Skip frequency 1	Factory default value	0.00Hz
	Setup range	0.00Hz~ maximum frequency	
F8-10	Skip frequency 2	Factory default value	0.00Hz
	Setup range	0.00Hz~ maximum frequency	
F8-11	Skip frequency amplitude 1	Factory default value	0.00Hz
	Setup range	0.00~ maximum frequency	

When the setup frequency is within the skip frequency range, the actual running frequency will be in the skip frequency boundary close to the setup frequency.

It can make the inverter run away from the mechanical resonance point of the load through setting the skip frequency. This inverter can set two skip frequency points. If the two skip frequencies are set to zero, this function will be inactive.

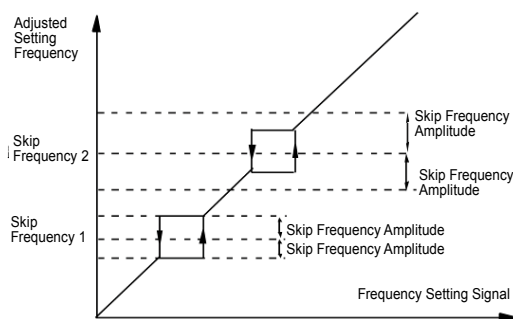


Fig.6-11 Schematic Diagram of Skip Frequency

F8-12	Forward/Reverse rotation dead-zone time	Factory default value	0.00s
	Setup range	0.00s~ 3000.0s	

During the setting of forward/reverse rotation of the inverter, the transition time at the output zero frequency position is shown in the following figure:

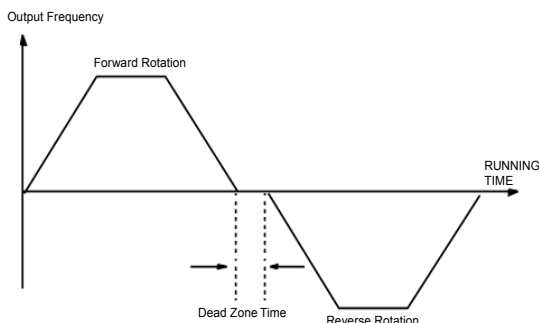


Fig.6-12 Schematic diagram for Forward/ Reverse Rotation Dead-zone Time

F8-13	Reverse control	Factory default value	0
	Setup range	0	Reverse rotation active
		1	Reverse rotation inactive

When this parameter is set to 0, it can perform reverse rotation control on the inverter with the keyboard, terminal or communication.

When this parameter is set to 1, the reverse rotation control function is enabled and has nothing to do with the command source selection. That is to say, the reverse control function is inactive at the time of keyboard, terminal and communication controls.

F8-14	Setup frequency lower than frequency lower limit action		Factory default value	0
	Setup range	0	Run with frequency lower limit	
		1	stop	
		2	Running with zero speed	

It is used to select the running status of the inverter when the setup frequency is lower than the frequency lower limit.

In order to avoid that the motor always runs with low speed, it can use this function to stop.

F8-15	Droop control	Factory default value	0.00Hz
	Setup range	0.00Hz~ 10.00Hz	

When multiple inverters drive the same load, the unbalanced load distribution due to difference speed causes the inverter with faster speed to carry heavier load. The droop control characteristics cause the speed droop change along with the addition of load, which can lead to balanced load distribution.

This parameter is used to adjust the frequency change value of the inverter with droop speed.

F8-16	Over modulation active		Factory default value	1
	Setup range	0	Over modulation inactive	
		1	Over modulation enabled	

Over modulation function means that the inverter can improve the output voltage by adjusting the use ratio of the bus voltage when the input voltage is relatively low or the inverter always works under heavy load. When the over modulation is enabled, the output current harmonics will slightly increase.

This function can select whether the over modulation function is enabled.

F8-17	Setup running time	Factory default value	0h
	Setup range	0h to 65535h	

It is sued to preset the running time of the inverter.

When the accumulated running time (F7-09) reaches this setup running time, the multifunctional digital DO of the inverter outputs the signal of running time arrival.

F8-18	Start protection selection		Factory default value	0
	Setup range	0	No protection	
		1	Protection	

This function code is used to improve the safety protection coefficient. If it is set to 1, it has two roles: first, if the running command exists upon inverter power-on, it must cancel the running command to remove the running protection status.

Second, if the running command exists upon inverter fault reset, it must cancel the running command to remove the running protection status.

In this way, it can prevent the automatic running of the motor under unexpected conditions.

F8-19	Frequency detection value (FDT level)	Factory default value	50.00Hz
	Setup range	0.00Hz~ maximum frequency	

F8-20	Frequency detection hysteresis (FDT hysteresis)	Factory default value	5.0%
	Setup range	0.0%~ 100.0%(FDT level)	

It is used to set the detection value of output frequency and hysteresis value upon removing of the output action.

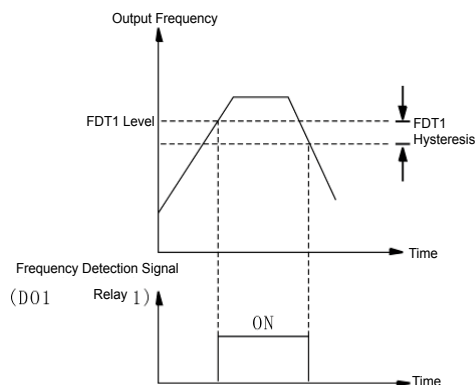


Fig.6-13 Schematic Diagram of FDT Level

F8-21	Frequency arrival detection amplitude	Factory default value	0.0%
	Setup range	0.00~ 100% maximum frequency	

When the output frequency of the inverter reaches the setup frequency value, this function can be used to adjust the detection amplitude, as shown the following figure.

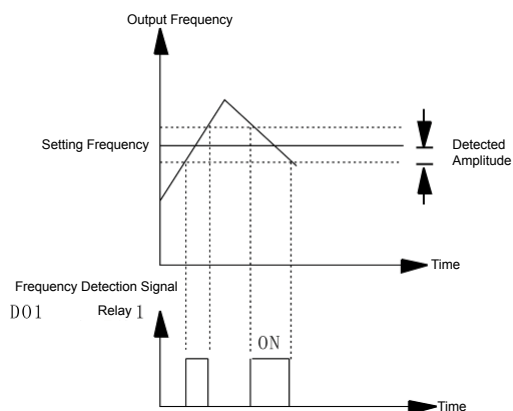


Fig.6-14 Schematic Diagram for Detection Amplitude

F8-22	Earth short circuit protection detection upon power-on		Factory default value	1
	Setup range	0:Inactive 1: Active		

It can select whether the inverter checks the motor for earth short circuit failure upon power-on. If this function is active, the inverter has short-time output at the instance of power-on.

F8-23	Running time to action selection		Factory default value	0
	Setup range	0: Continue running 1: Stop		

Group F9 Fault and Protection

F9-00	Motor overload protection selection		Factory default value	1
	Setup range: 0: Inactive 1:Active	0: The inverter has no overload protection for the motor, and thermal relay is installed before the motor. 1: The inverter has overload protection function for the motor. Refer to F9-01 for the protection value.		
F9-01	Motor overload protection gain		Factory default value	1.00
	Setup range: 0.20 ~ 10.00	The motor overload protection is inverter time-lag curve; $220\% \times (F9-01) \times$ rated motor current: one minute; $150\% \times (F9-01) \times$ rated motor current: 60 minutes.		

F9-02	Motor overload pre-warning coefficient		Factory default value	80%
	Setup range	50%~100%	The reference for this value is the motor overload current. When the inverter detects that the output current reaches (F9-02)× motor overload current and lasts time as specified by the reverse time-lag curve, it outputs pre-warning signal from DO or relay.	
F9-03	Stall gain over voltage		Factory default value	0
	Setup range	0 to 100 (no stall over voltage)	<p>It adjusts the inverter's capacity in suppressing the stall over voltage. The bigger the value is, the stronger the suppressing capacity is.</p> <p>For the load with small inertia, the value should be small. Otherwise, the dynamic response of the system will be slow.</p> <p>For the load with large inertia, the value should be large. Otherwise, the suppressing result will be poor, and over voltage fault may occur.</p>	
F9-04	Stall protection voltage over voltage		Factory default value	130%
	Setup range	120% to 150%	Select the protection point for function of stall over voltage. When the value is exceeded, the inverter starts executing the protection function for stall over voltage.	

F9-05	Stall gain over current		Factory default value	20
	Setup range	0~100	<p>It adjusts the inverter's capacity in suppressing the stall over current. The bigger the value is, the stronger the suppressing capacity is.</p> <p>For the load with small inertia, the value should be small. Otherwise, the dynamic response of the system will be slow.</p> <p>For the load with large inertia, the value should be large. Otherwise, the suppressing result will be poor, and over voltage fault may occur.</p>	
F9-06	Stall protection current over current		Factory default value	150%
	Setup range	100%~200%	<p>Select the protection point for function of stall over current. When the value is exceeded, the inverter starts executing the protection function for stall over current.</p>	

F9-07	Transient stop non-stop function		Factory default value	0
	Setup range	0:Inactive 1:Active	This function means that the inverter will not stop upon transient power failure. In case of transient power failure or sudden reduction in voltage, the inverter will reduce the output speed and compensate the reduced voltage with the load feedback energy, so as to ensure the inverter continues running within short period of time.	
F9-08	Transient stop non-stop frequency falling rate		Factory default value	10.00Hz/s
F9-09	Fault auto reset times		Factory default value	0
	Setup range	0 to 3	When the inverter selects fault auto reset, it is used to set the times of auto reset. If this value is exceeded, the inverter will stop because of failure and wait for maintenance.	
F9-10	Fault rely action selection during the fault auto reset		Factory default value	1
	Setup range: 0: No action 1: Action	After the failure auto reset function is selected, this parameter can be set to determine if it needs the action of the faulty relay so as to shield the fault alarm caused and ensure the continuous operation of the equipment during the failure reset.		
F9-11	Fault auto reset interval		Factory default value	1.0s
	Setup range: 0.1s ~ 100.0s		The waiting time of the inverter from the fault alarm to auto reset.	

F9-12	Input phase failure protection selection		Factory default value	1
	Setup range	0:Inactive 1:Active	Select whether to provide protection for input phase failure. Only the MD series inverter of G model with over 18.5kW can have input phase loss protection function, and the P model with 18.5kW has not such function no matter whether F9-10 is set to 0 or 1.	
F9-13	Output phase failure protection selection		Factory default value	1
	Setup range	0:Inactive 1:Active	Select whether to provide protection for output phase failure.	
F9-14	First fault type			0~24
F9-15	Second fault type			
F9-16	Most recent fault type			

It is used to record the fault types of inverter for the most recent three times: 0 indicates no fault, while 1 to 24 indicates ERR01 to ERR24. Refer to Chapter 7 for details.

F9-17	Frequency upon fault	Display the frequency upon fault for the most recent one time.
F9-18	Current upon fault	Display the current upon fault for the most recent one time.
F9-19	Bus voltage upon fault	Display the bus voltage upon fault for the most recent one time.

F9-20	Input terminal status upon fault	<p>This value is a decimal number. Display the status of all the digital input terminals upon fault for the most recent one time, with sequence of:</p> <table><tr><td>BIT9</td><td>BIT8</td><td>BIT7</td><td>BIT6</td><td>BIT5</td><td>BIT4</td><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td></tr></table> <p>DI10..... DI1</p> <p>It will be displayed in decimal number converted from each digit status.</p> <p>When the input terminal is ON, the corresponding value is 1.</p> <p>When the input terminal is OFF, the value is 0.</p> <p>It can know the details regarding digital output signal via this value.</p>	BIT9	BIT8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
BIT9	BIT8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0			
F9-21	Output terminal upon fault	<p>Display the status of all the digital input terminals upon fault for the most recent one time, with sequence of:</p> <table><tr><td>BIT4</td><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td></tr></table> <p>DO2 DO1 REL2 REL1 FMP</p> <p>It will be displayed in decimal number converted from each digit status.</p> <p>When the input terminal is ON, the corresponding value is 1.</p> <p>When the input terminal is OFF, the value is 0.</p> <p>It can know the details regarding digital output signal via this value.</p>	BIT4	BIT3	BIT2	BIT1	BIT0					
BIT4	BIT3	BIT2	BIT1	BIT0								

Group FA Process Control PID Function

PID control is a general method of process control. It adjusts the output frequency through proportional, integral and differential calculations of the difference between the feedback signal of the controlled quantity and the signal of the target quantity, and constitutes the feedback system so as to stabilize the controlled quantity at the target quality. It is applicable to such process controls as flow control, pressure control and temperature control. The basic principle framework of control is shown as follows:

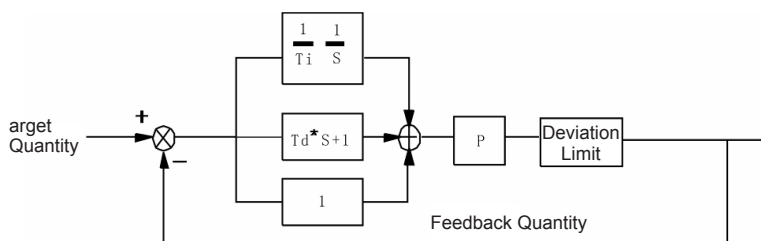


Fig. 6-15 Process PID Principle Framework

FA-00	PID reference source		Factory default value	0
	Setup range	0	FA-01	
		1	AI1	
		2	AI2	
		3	AI3	
		4	PULSE (DI5)	
		5	Communication setup	

When the frequency source selects PID, i.e. F0-03 or F0-04=8, this group of function is enabled. (Please refer to F0-03 and F0-04).

This parameter decides the target quantity reference channel of the process PID.

The setup target quantity of the process PID is relative value, and the setup 100% is relative to the 100% of feedback signal of the controlled system.

The PID range (FA-04) is not essential because the system will always calculate according to the relative value (0 to 100%) no matter how the range is set. However, if PID range is set, it can view the actual values relative to the reference and feedback of PID via the display parameters on the keyboard.

FA-01	PID keyboard reference		Factory default value	50.0%
	Setup range	0.0% to 100.0%		

When FA-00=0 is selected, the target source is keyboard reference. It needs to set this parameter. The benchmark value of this parameter is system feedback quantity.

FA-02	PID feedback source		Factory default value	0
	Setup range	0	AI1	
		1	AI2	
		2	AI3	
		3	AI1 to AI2	
		4	PULSE(DI5)	
		5	Communication setup	

This parameter is used to select the PID reference channel.

FA-03	PID action direction		Factory default value	0
	Setup range	0	Positive action	
		1	Reverse action	

Positive action: When the feedback signal is higher than the PID reference, it needs to reduce the output frequency of the inverter to balance the PID. The winding tension PID control is the example.

Reverse action: When the feedback signal is higher than the PID reference, it needs to increase the output frequency of the inverter to balance the PID. The unwinding tension PID control is the example.

FA-04	PID reference feedback range		Factory default value	1000
	Setup range	0~65535	PID reference feedback range is a non-dimensional unit. It is used to display the PID reference an	
FA-05	Proportional gain P		Factory default value	20.0
	Setup range	0.0~100.0		
FA-06	Integration time I		Factory default value	2.00s
	Setup range	0.01s~10.00s		
FA-07	Differential time D		Factory default value	0.000s
	Setup range	0.00~10.000		

Proportional gain P: It decides the adjustment intensity of the whole PID regulator. The higher the P is, more powerful the adjustment intensity is. When this parameter is 100, indicating the deviation between PID feedback quantity and the reference quantity is 100%, the adjustment amplitude of the PID regulator on the output frequency command is maximum frequency (the integral and differential functions are neglected).

Integration time I: It decides the speed of PID regulator adjusting the deviation between the PID feedback quantity and the reference quantity. Integration time is the time within which the integration regulator (the proportional and differential functions are neglected) performs continuous adjustment and the adjustment quantity reaches maximum frequency (F0-09) when the deviation between the PID feedback quantity and reference quantity is 100%. The shorter the integration time is, more powerful the adjustment intensity is.

Differential time D: It decides the intensity of PID regulator adjusting the change rate of deviation between the PID feedback quantity and the reference quantity. Differential time is the time within which if the feedback quantity changes 100%, the adjustment quantity reaches maximum frequency (F0-09) (proportional and integral functions are neglected). The longer the differential time is, more powerful the adjustment intensity is.

FA-08	Cutoff frequency of reverse rotation		Factory default value	2.00Hz
	Setup range	0.00 ~ maximum frequency		
FA-09	Deviation limit		Factory default value	0.01%
	Setup range	0. 0%~ 100.0%		

Deviation limit: When the PID feedback deviation is within this range, the PID stops adjustment;

FA-10	Differential amplitude		Factory default value	5%
	Setup range	0%~ 100%		

Group FB Swing Frequency, Fixed Length and Count

The swing frequency function is applicable to the textile and chemical fiber fields and the applications where traversing and winding functions are required.

The swing frequency function means that the output frequency of the inverter swings up and down with the setup frequency (frequency command is selected by F0-07) as the center. The trace of running frequency at the time axis is shown in the figure below, of which the swing amplitude is set by FB-00 and FB-01. When FB-01 is set to 1, indicating the swing amplitude is 0, the swing frequency is disabled.

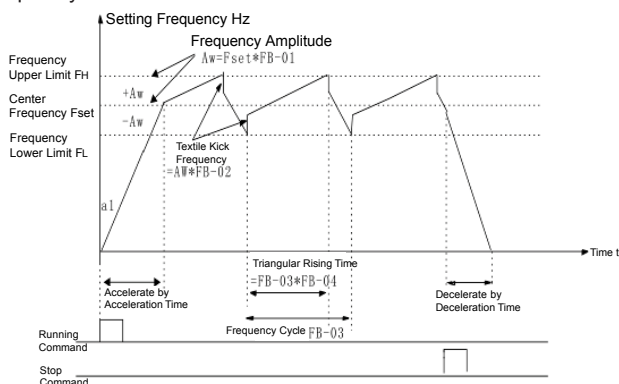


Fig.6-16 Skip Frequency Working Diagram

FB-00	Swing frequency setup mode		Factory default value	0
	Setup range	0	Relative to the central frequency	
		1	Relative to maximum frequency	

This parameter is used to select the benchmark quantity of the swing amplitude.

0: Relative to the central frequency (F0-07 frequency source selection), and it is variable swing amplitude system. The swing amplitude varies with the central frequency (setup frequency).

1: Relative to the maximum frequency (F0-10 maximum output frequency), and it is fixed swing amplitude system. The swing amplitude is fixed.

FB-01	Swing frequency amplitude	Factory default value	0.0%
	Setup range	0.0% to 100.0%	
FB-02	Kick frequency amplitude 1	Factory default value	0.0%
	Setup range	0.0% to 50.0%	

This parameter is used to determine the values of swing amplitude and kick frequency. The swing frequency is limited by the frequency upper limit and frequency lower limit.

The swing amplitude is relative to the central frequency (variable swing amplitude, select FB-00=0): swing amplitude AW=frequency source F0-07 times swing amplitude FB-01.

The swing amplitude is relative to the maximum frequency (fixed swing amplitude, select FB-00=1): swing amplitude AW=maximum frequency F0-12 times swing amplitude FB-01.

Kick frequency=swing amplitude AW times kick frequency amplitude FB-02. That is the value of kick frequency relative to the swing amplitude when the swing frequency is running.

If the swing amplitude relative to the central frequency (variable swing amplitude, select FB-00=0) is selected, the kick frequency is a variable value.

If the swing amplitude relative to the maximum frequency (fixed swing amplitude, select FB-00=1) is selected, the kick frequency is a fixed value.

FB-03	Swing frequency cycle	Factory default value	10.0s
	Setup range	0.0s ~ 3000.0s	
FB-04	Time constant of triangular wave boost	Factory default value	50.0%
	Setup range	0.0% ~ 100.0%	

Swing frequency cycle: It refers to the time of a complete cycle of swing frequency.

FB-04 Time constant of triangular wave boost is relative to FB-03 swing frequency cycle.

Triangular wave boost time =swing frequency cycle FB-03 × time constant of triangular wave boost FB-04 (unit: s)

Triangular wave falling time =swing frequency cycle FB-03 × (1-time constant of triangular wave boost FB-04 (unit: s)

FB-05	Setup length	Factory default value	1000m
	Setup range	0m~65535m	
FB-06	Actual length	Factory default value	0m
	Setup range	0m~ 65535m	
FB-07	Number of pulses each meter	Factory default value	100.0
	Setup range	0.1~ 6553.5	

The setup length, actual length and number of pulses each meter are mainly used for fixed length control.

The length is calculated via the pulse signal input by the digital input terminal, and it needs to set the corresponding input terminal to length count input terminal. It needs to use DI5 input generally when the pulse frequency is relatively high.

Actual length=length count input number of pulses/number of pulses each meter

When the actual length FB-06 exceeds the setup length FB-05, the multifunctional digital output terminal "Length Arrival Terminal" will output ON signal (refer to F5-04 function code).

FB-08	Setup counting value		Factory default value	1000
	Setup range	1 ~ 65535		
FB-09	Designated counting value		Factory default value	1000
	Setup range	1 ~ 65535		

The counting value is input to the terminal input pulse signal via the counter in the digital input terminal.

When the counting value reaches the setup counting value, the digital output terminal will output signal of setup counting value arrival. The counter will stop counting.

When the counting value reaches the designated counting value, the digital output terminal will output signal of designated counting value. The counter will continue counting till the "setup counting value" is reached.

The designated counting value FB-09 shall not exceed the setup counting value FB-08.

This function is as shown the following figure:

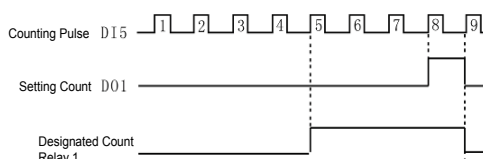


Fig.6-17 Schematic Diagram for Setup Counting Value Reference and Designated Counting Value Reference

Group FC MS Speed Function and Simple PLC Function

Simple PLC function is to perform automatic control on the MS frequency logic through a built-in programmable controller (PLC) of the inverter. It can set running time, running direction and running frequency so as to meet the process requirements.

This series of inverter can implement 16-segment variable control and has four types of acceleration/deceleration time for selection.

When the setup PLC completes one cycle, it can output one ON signal via the multifunctional output terminals DO1 and DO2 or multifunctional relay 1 and relay 2. Refer to F5-02 to F5-05

for details.

When the frequency source selections F0-07, F0-03 and F0-04 are determined as MS speed running mode, it needs to set FC-00 to FC-15 to determine its characteristics.

FC-00	MS speed 0		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-01	MS speed 1		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-02	MS speed 2		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-03	MS speed 3		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-04	MS speed 4		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-05	MS speed 5		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-06	MS speed 6		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-07	MS speed 7		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-08	MS speed 8		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-09	MS speed 9		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-10	MS speed 10		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-11	MS speed 11		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-12	MS speed 12		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-13	MS speed 13		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		
FC-14	MS speed 14		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		

FC-15	MS speed 15		Factory default value	0.0Hz
	Setup range	Negative maximum frequency to maximum frequency		

When the frequency source parameters F0-07, F0-03 and F0-04 are determined as PLC running mode, it needs to set FC-00 to FC-15, FC-16, FC-17 and FC-18 to FC-49 to determine its characteristics.

Caution: The symbols of FC-00 to FC-15 determine the running direction of simple PLC. If they are negative values, it indicates reverse direction.

The simple PLC is as shown in the following figure:

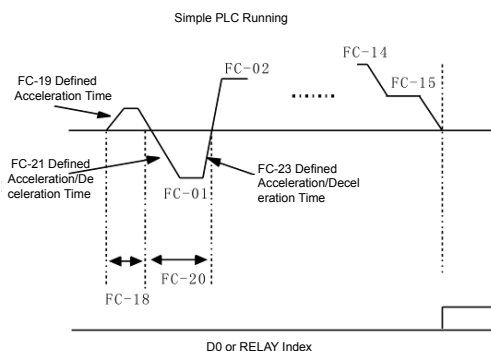


Fig.6-18 Schematic Diagram of Simple PLC

FC-16	PLC running mode		Factory default value	0
	Setup range	0	Stop upon completion of one-time running	
		1	Keep final value upon completion of one-time running	
		2	Constant circulation	
FC-17	PLC power-failure memory selection		Factory default value	0
	Setup range	0	Power failure without memory	
		1	Power failure with memory	

0: Stop upon completion of one-time running

The inverter will automatically stop upon completion of one single cycle, and will not restart until another running command is given.

1: Keep final value upon completion of one-time running

The inverter will automatically keep the running frequency and direction of last one segment upon completion of one single cycle.

2: Constant circulation

The inverter will automatically start next one cycle upon completion of one cycle, and will not stop until stop command is given.

PLC power failure with memory means the running phase and frequency of PLC before power failure is memorized.

FC-18	Running time of zero-segment of PLC		Factory default value	0.0s(h)
	Setup range: 0.0s(h)~6553.5s(h)			
FC-19	Speed-up/speed-down time of Zero-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-20	One-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-21	Speed-up/speed-down time of first-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-22	Second-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-23	Speed-up/speed-down time of second-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-24	Third-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-25	Third-segment speed-up/speed-down time of PLC		Factory default value	0
	Setup range	0~3		
FC-26	Fourth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-27	Speed-up/speed-down time of Fourth-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-28	Fifth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-29	Speed-up/speed-down time of fifth-segment of PLC		Factory default value	0
	Setup range	0~3		

FC-30	Sixth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-31	Speed-up/speed-down time of sixth-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-32	Seventh-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-33	Speed-up/speed-down time of seventh-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-34	Eighth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-35	Speed-up/speed-down time of eighth-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-36	Ninth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-37	Speed-up/speed-down time of Ninth-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-38	Tenth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0 s(h)~6553.5s(h)		
FC-39	Speed-up/speed-down time of tenth-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-40	Eleventh-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-41	Speed-up/speed-down time of eleventh-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-42	Twelfth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		

FC-43	Speed-up/speed-down time of twelfth-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-44	Thirteenth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-45	Speed-up/speed-down time of thirteenth-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-46	Fourteenth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-47	Speed-up/speed-down time of fourteenth-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-48	Fifteenth-segment running time of PLC		Factory default value	0.0s(h)
	Setup range	0.0s(h)~6553.5s(h)		
FC-49	Speed-up/speed-down time of fifteenth-segment of PLC		Factory default value	0
	Setup range	0~3		
FC-50	PLC Running Time Unit Selection		Factory default value	0
	Setup range	0	s	
		1	h	

Group FD Communication Parameters

Refer to MD320 Serial Communication Protocol for details.

Group FF Factory Parameters (Reserved)

Group FP User Password

FP-00	user password		Factory default value	0
	Setup range	0 to 65535		

Any non-zero number can be set, and then the password protection function will be enabled.

000: Clear the previous setup user password and disable the password protection function.

Upon setup and validation of the user password, when the user enters the parameter setting status again, the user can view the parameters only and cannot modify the parameter if the password is incorrect. Please remember the setup user password correctly. If the password is set wrongly or forgotten, please contact the manufacturer.

FP-01	Parameter initialization		Factory default value	0
	Setup range	0	No operation	
		1	Restore the factory default setup value	
		2	Clear the fault record	

1: The inverter restores all the parameters except the parameters in Group F1 to the factory default ones.

2: The inverter clears the recent fault records



7

EMC Guide

Chapter 7 EMC (Electromagnetic Compatibility)

7.1 Definition

Electromagnetic compatibility is the ability of the electric equipment to run in the electromagnetic interference environment and implement its function stably without interferences on the electromagnetic environment.

7.2 EMC Standard Description

In accordance with the requirements of the national standard GB/T12668.3, the inverter needs to comply with electromagnetic interference and anti- electromagnetic interference requirements.

The existing products of our company apply the latest international standard—IEC/EN61800-3: 2004 (Adjustable speed electrical power drive systems part 3:EMC requirements and specific test methods), which is equivalent to the national standard GB/T12668.3.

IEC/EN61800-3 assesses the inverter in terms of electromagnetic interference and anti-electronic interference. Electromagnetic interference mainly tests the radiation interference, conduction interference and harmonics interference on the inverter (required for the inverter for civil use)Anti-electromagnetic interference mainly tests the conduction interference rejection, radiation interference rejection, surge interference rejection, fast and mutable pulse group interference rejection, ESD interference rejection and power low frequency end interference rejection (specific test items including: 1. Interference rejection tests of input voltage sag, interrupt and change; 2. Phase conversion interference rejection test; 3. Harmonic input interference rejection test; 4. Input frequency change test; 5. Input voltage unbalance test; 6. input voltage fluctuation test).

The tests shall be conducted strictly in accordance with the above requirements of IEC/ EN61800-3, and the products of our company are installed and used according to Section 7.3 and have good electromagnetic compatibility in general industry environment.

7.3 EMC Guide

7.3.1 Harmonic Effect

Higher harmonics of power supply may damage the inverter. Thus, at some places where mains quality is rather poor, it is recommended to install AC input reactor.

7.3.2 Electromagnetic Interference and Installation Precautions

There are two kinds of electromagnetic interferences, one is interference of electromagnetic noise in the surrounding environment on the inverter, and the other is interference of inverter on the surrounding equipment.

Installation precautions:

- 1) The earth wires of the Inverter and other electric products shall be well grounded;
- 2) The power input and output power cables of the inverter and weak current signal cables (e.g. control line) shall not be arranged in parallel and vertical arrangement is preferable.
- 3) It is recommended that the output power cables of the inverter employ shield cables or steel pipe shielded cables and that the shielding layer be earthed reliably. The lead cables of the equipment suffering interferences are recommended to employ twisted-pair shielded control cables, and the shielding layer shall be earthed reliably.
- 4) When the length of motor cable is longer than 100 meters, it needs to install output filter or reactor.

7.3.3 Handling method for the interferences of the surrounding equipment on the inverter:

The electromagnetic interference on the inverter is generated because plenty of relays, contactors and electromagnetic brakes are installed near the inverter. When the inverter has error action due to the interferences, the following measures can be taken:

- 1) Install surge suppressor on the devices generating interference;
- 2) Install filter at the input end of the inverter. Refer to Section 7.3.6 for the specific operations.
- 3) The lead cables of the control signal cable of the inverter and the detection line employ shielded cable and the shielding layer shall be earthed reliably.

7.3.4 Handling method for the interferences of inverter on the surrounding equipment:

These interferences include two types: one is radiation interference of the inverter, and the other is conduction interference of the inverter. These two types of interferences cause the surrounding electric equipment to suffer electromagnetic or electrostatic induction. The surrounding equipment hereby produces error action. For different interferences, it can be handled by referring to the following methods:

- 1) For the measuring meters, receivers and sensors, their signals are generally weak. If they are placed nearby the inverter or together with the inverter in the same control cabinet, they are easy to suffer interference and thus generate error actions. It is recommended to handle with the following methods: Put in places far away from the interference source; do not arrange the signal cables with the power cables in parallel and never bind them together; both the signal cables and power cables employ shielded cables and are well earthed; install ferrite magnetic ring (with suppressing frequency of 30 to 1,000MHz) at the output side of the inverter and wind it 2 to 3 cycles; install EMC output filter in more severe conditions.
- 2) When the equipment suffering interferences and the inverter use the same power supply, it may cause conduction interference. If the above methods cannot remove the interference, it shall install EMC filter between the inverter and the power supply (refer to Section 7.3.6 for the prototyping operation); The surrounding equipment is separately earthed, which can avoid the interference caused by the leakage current of the inverter's earth wire when common earth mode is adopted.

- 3) The surrounding equipment is separately earthed, which can avoid the interference caused by the leakage current of the inverter's earth wire when common earth mode is adopted.

7.3.5 Leakage current and handling

There are two forms of leakage current when using the inverter. One is leakage current to the earth, and the other is leakage current between the cables.

- 1) Factors influencing the leakage current to the earth and the solutions:

There are distributed capacitance between the lead cables and the earth. The larger the distributed capacitance is, the larger the leakage current will be. The distributed capacitance can be reduced by effectively reducing the distance between the inverter and the motor. The higher the carrier frequency is, the larger the leakage current will be. The leakage current can be reduced by reducing the carrier frequency. However, reducing the carrier frequency may result in addition of motor noise. Note that additional installation of reactor is also an effective method to remove the leakage current.

The leakage current may increase following the addition of circuit current. Therefore, when the motor power is high, the corresponding leakage current will be high too.

- 2) Factors of producing leakage current between the cables and solutions:

There is distributed capacitance between the output cables of the inverter. If the current passing the lines has higher harmonic, it may cause resonance and thus result in leakage current. If thermal relay is used, it may generate error action.

The solution is to reduce the carrier frequency or install output reactor. It is recommended that thermal relay not be installed before the motor when using the inverter, and that electronic over current protection function of the inverter be used instead.

7.3.6 Precautions for Installing EMC input filter at the input end of power supply

- 1) When using the inverter, please follow its rated values strictly. Since the filter belongs to Classification I electric appliances, the metal enclosure of the filter shall be large and the metal ground of the installing cabinet shall be well earthed and have good conduction continuity. Otherwise there may be danger of electric shock and the EMC effect may be greatly affected.
- 2) Through the EMC test, it is found that the filter ground must be connected with the PE end of the inverter at the same public earth. Otherwise the EMC effect may be greatly affected.
- 3) The filter shall be installed at a place close to the input end of the power supply as much as possible.



8

Fault Diagnosis and Solution

Chapter 8 Fault Diagnosis and Solution

8.1 Fault Alarm and Countermeasures

MD320 inverter has 24 pieces of warning information and protection function. In case of abnormal fault, the protection function will be invoked, the inverter will stop output, and the faulty relay contact of the inverter will start, and the fault code will be displayed on the display panel of the inverter. Before consulting the service department, the user can perform self-check according to the prompts of this chapter, analyze the fault cause and find out t solution. If the fault is caused by the reasons as described in the dotted frame, please consult the agents of inverter or our company directly.

Among the 21 pieces of warning information, Err22 is hardware over current or over voltage signal. In most cases, the hardware over voltage fault will cause Err22 alarm.

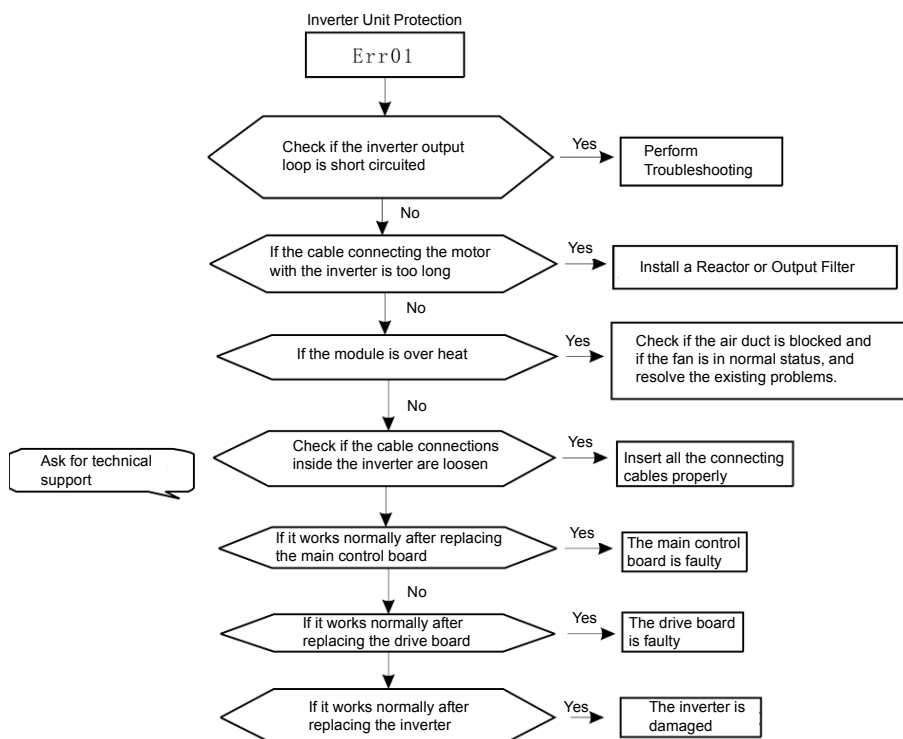


Fig.8-1 Inverter unit protection (ERR01)

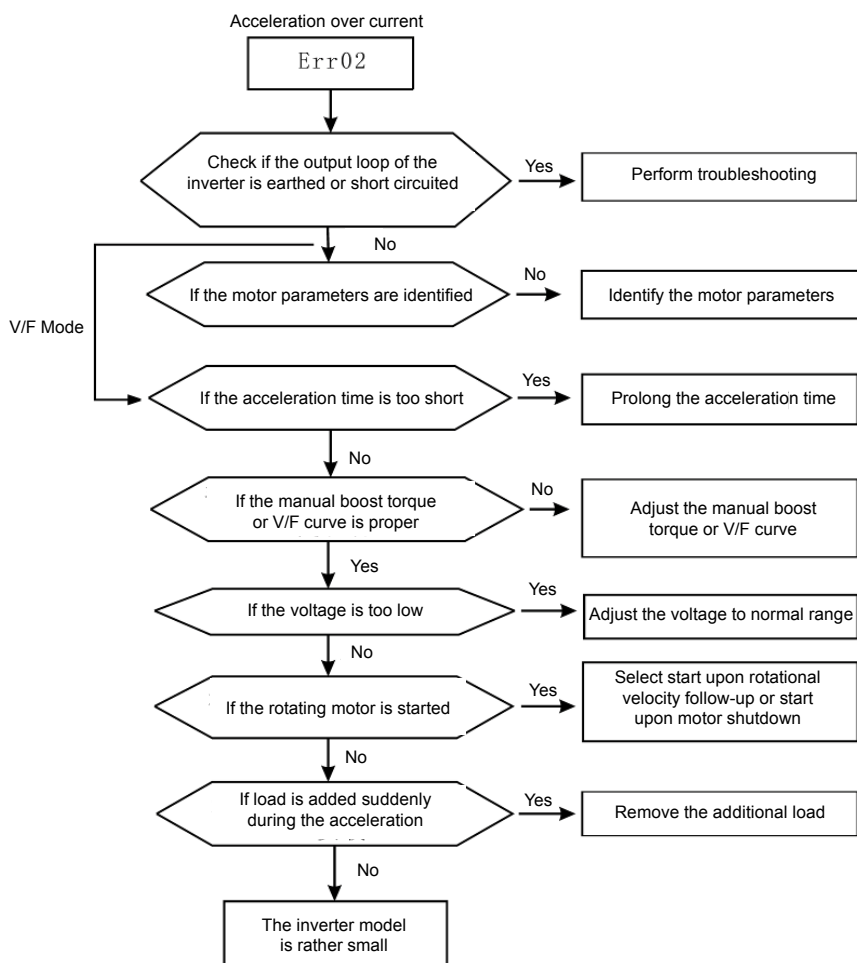


Fig.8-2 Acceleration over current (ERR02)

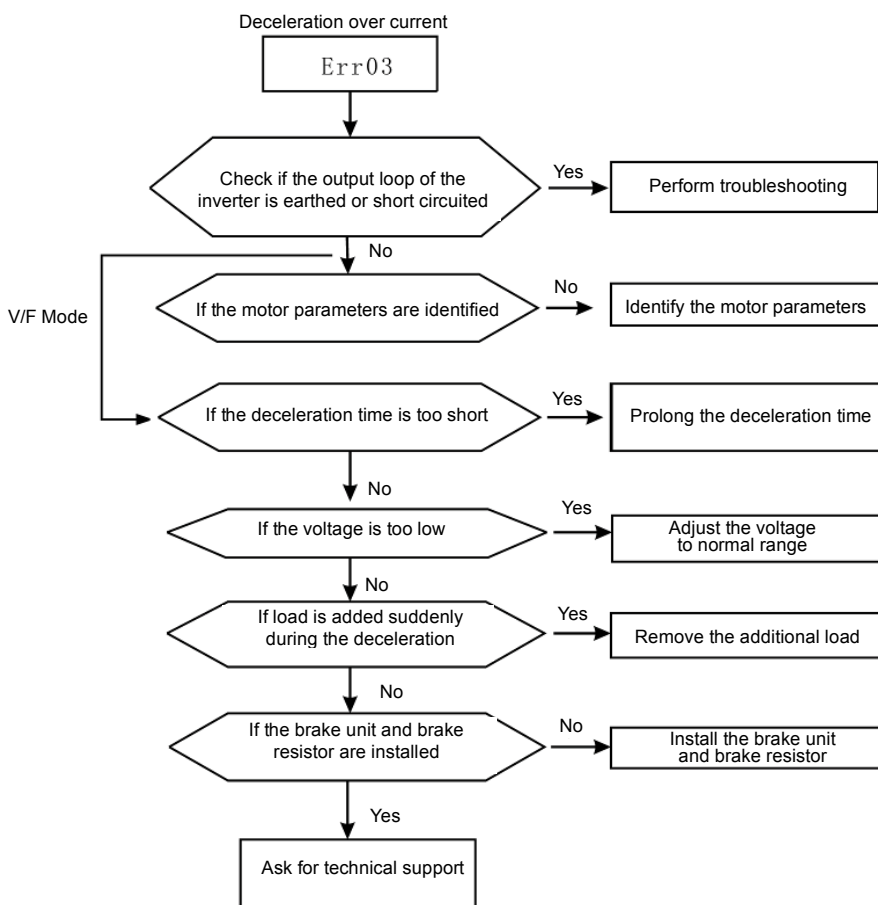


Fig.8-3 Deceleration over current (ERR03)

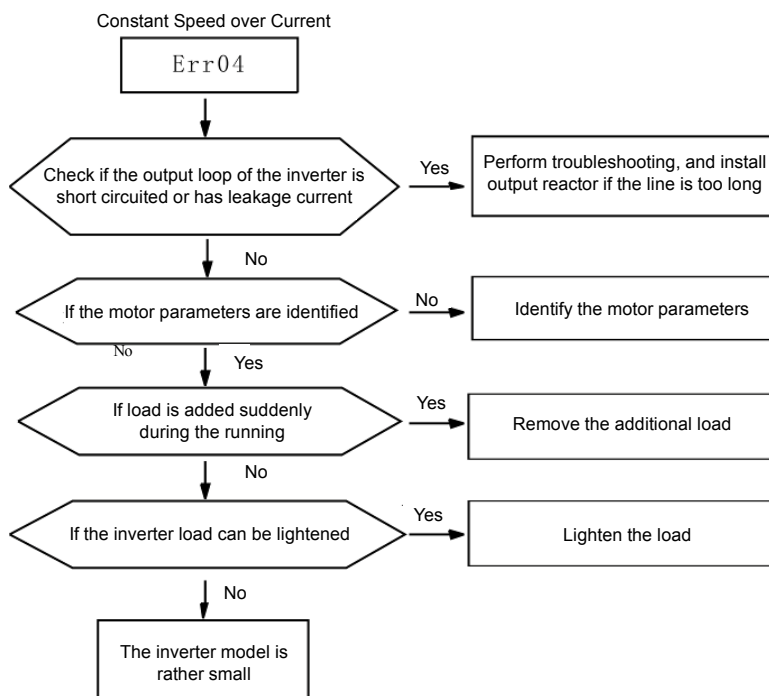


Fig.8-4 Constant speed over current (ERR04)

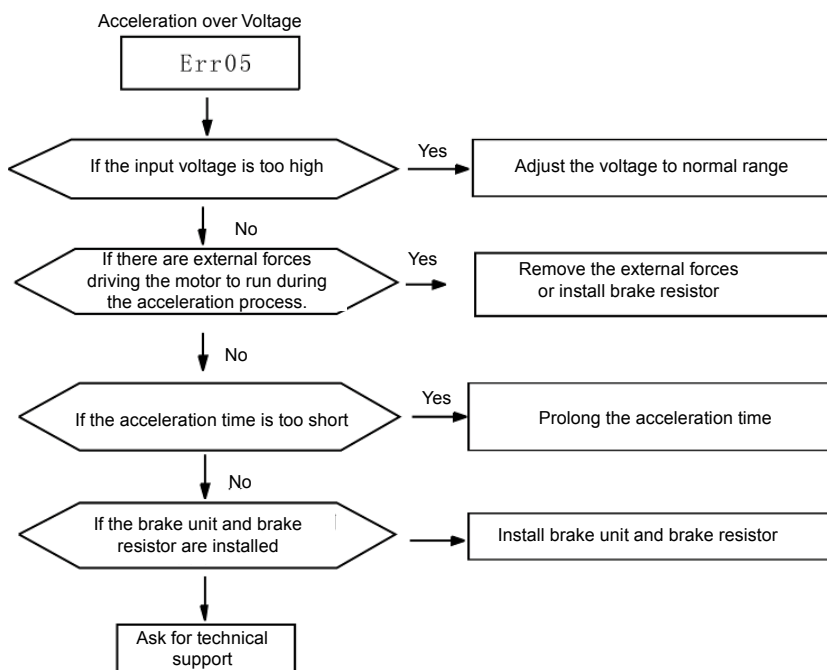


Fig.8-5 Acceleration over voltage(ERR05)

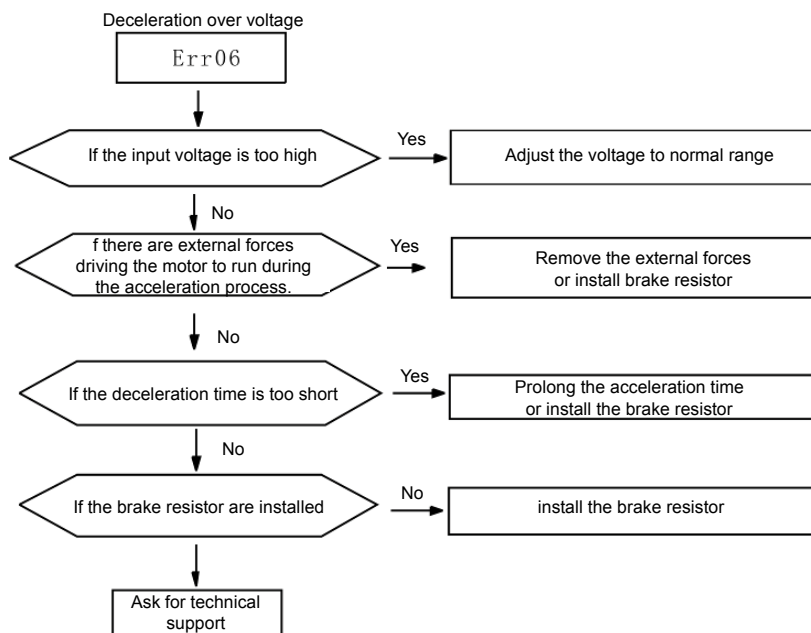


Fig.8-6 Deceleration over voltage (ERR06)

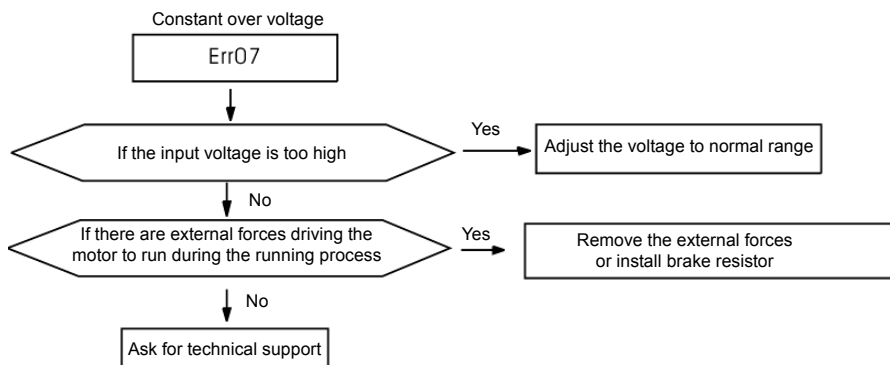


Fig.8-7 Constant speed over voltage(ERR07)

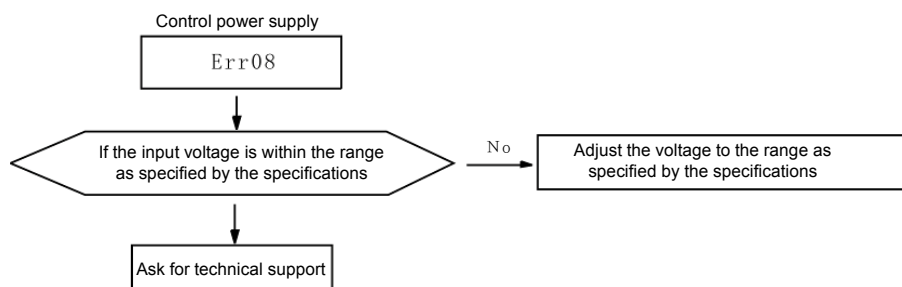


Fig.8-8 Control power supply fault(ERR08)

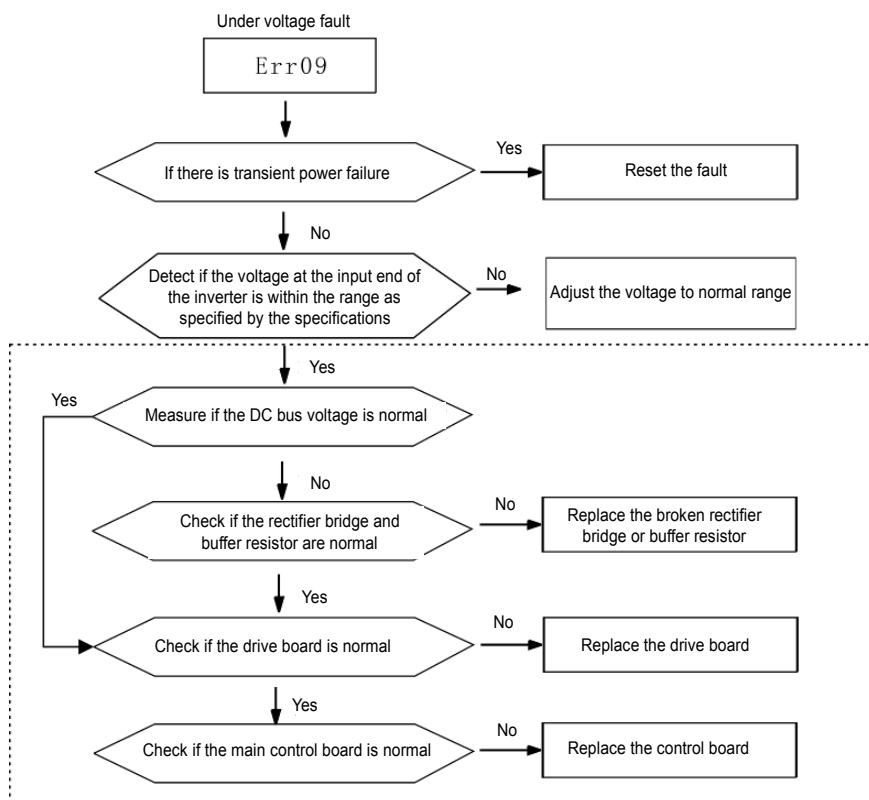


Fig.8-9 Under voltage fault(ERR09)

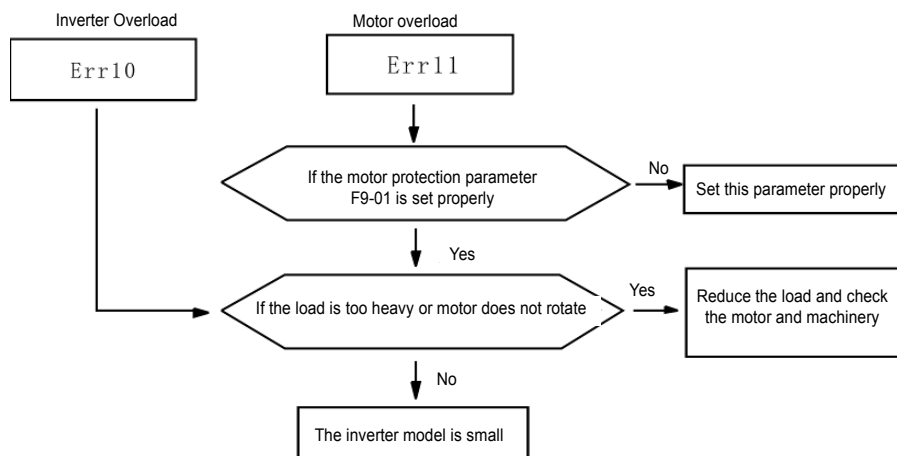


Fig.8-10 Inverter/Motor overload (ERR10/ERR11)

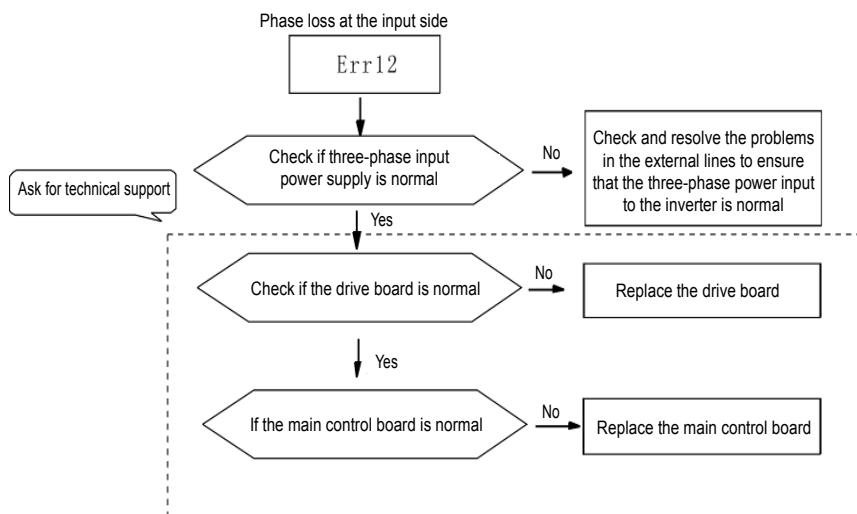


Fig.8-11 Phase loss at input side(ERR12)

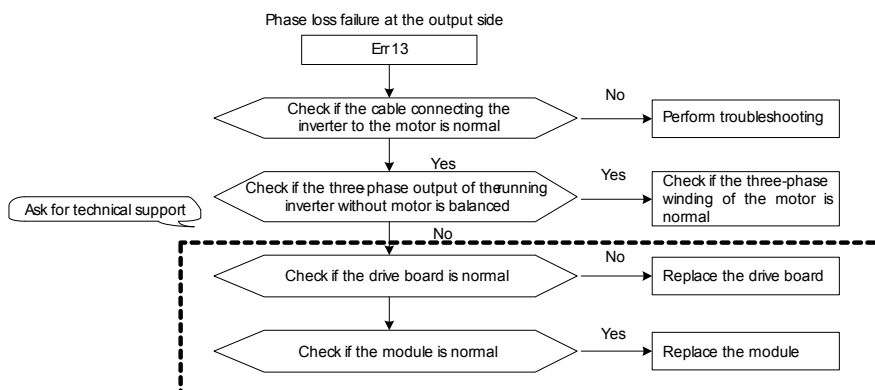


Fig.8-12 Phase failure at output side(ERR13)

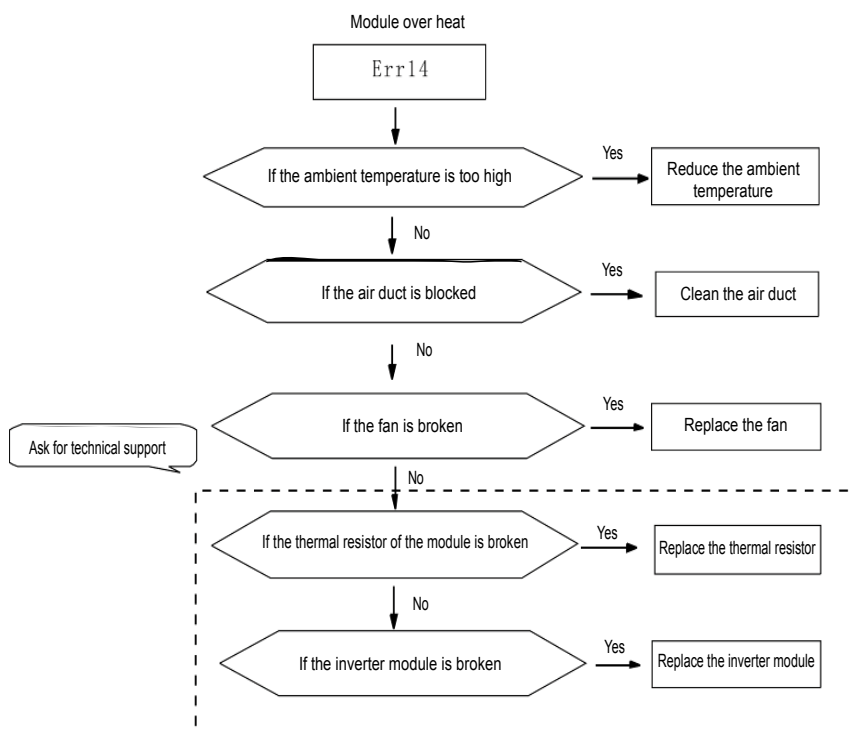


Fig.8-13 Module overheating (ERR14)

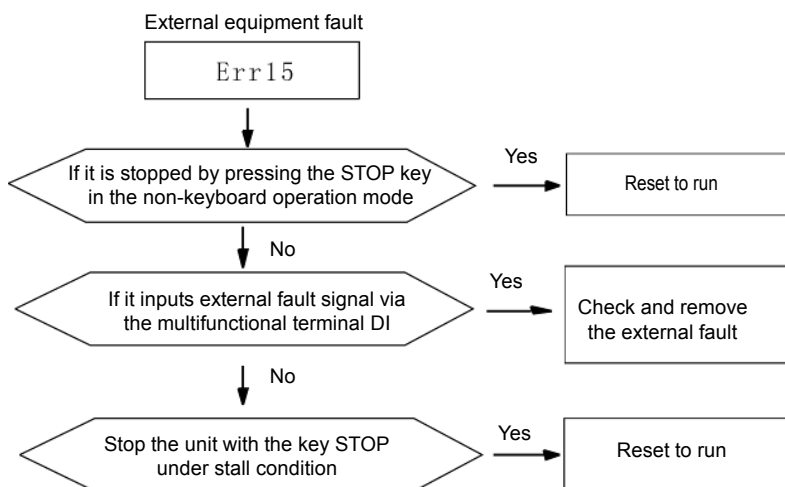


Fig.8-14 External equipment fault(ERR15)

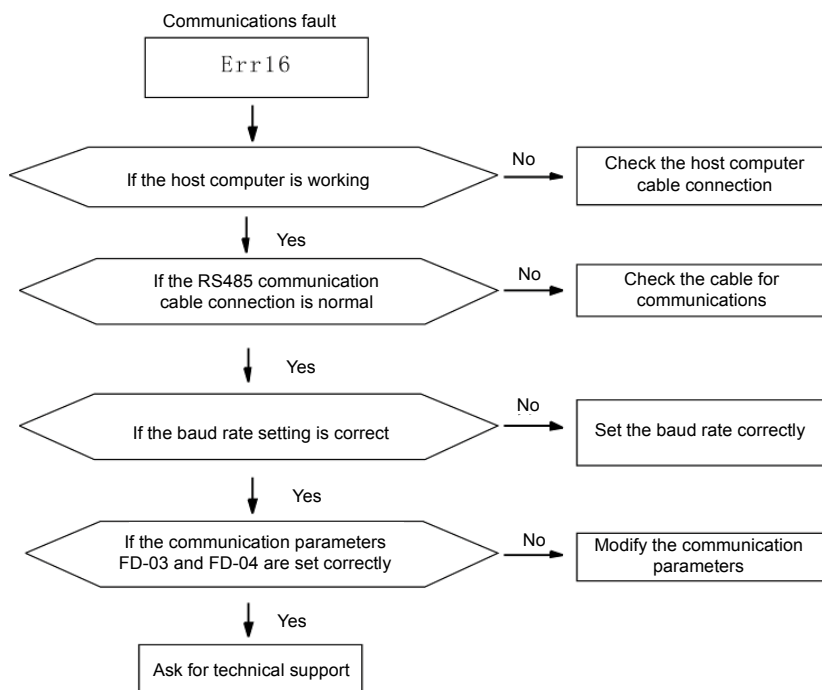


Fig.8-15 Communication fault (ERR16)

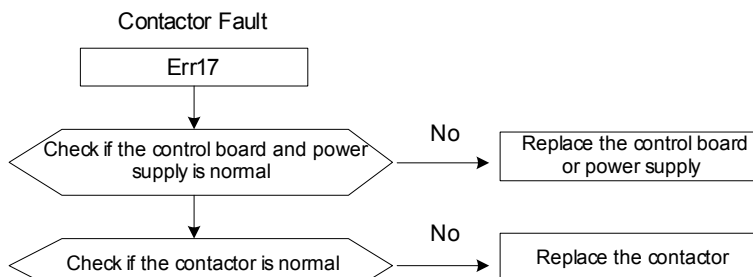


Fig.8-16 Contactor fault (Err17)

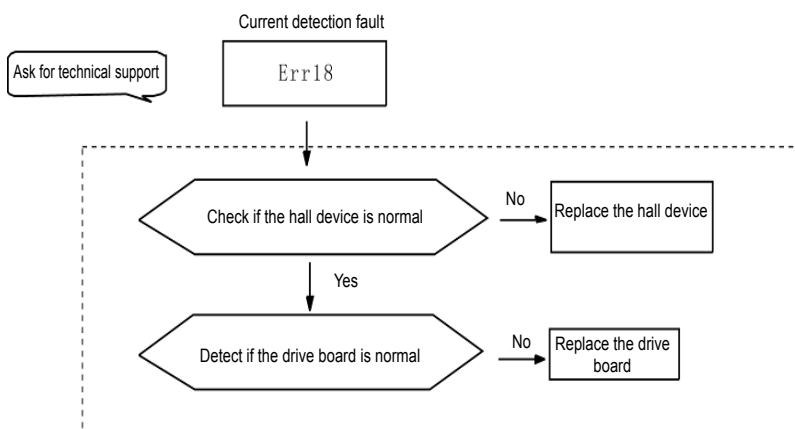


Fig.8-17 Current detection fault (ERR18)

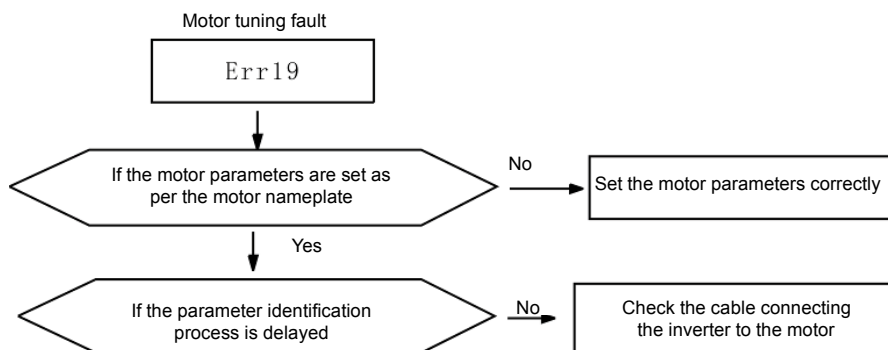


Fig.8-18 Motor tuning fault (ERR19)

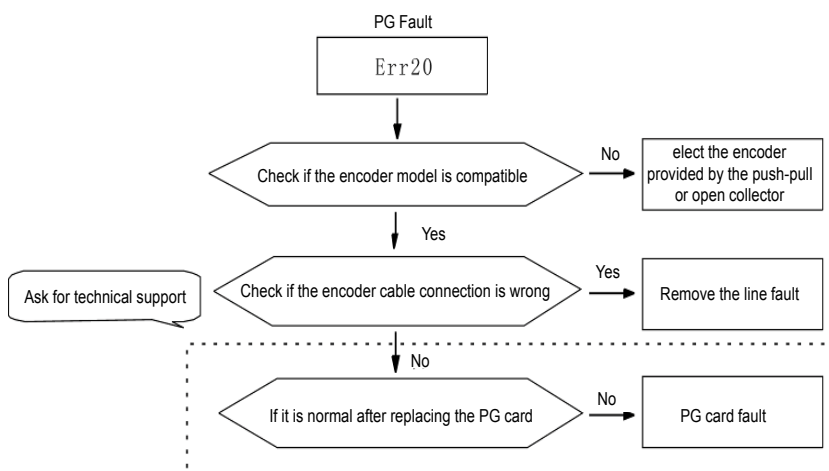


Fig.8-19 PG fault (ERR20)

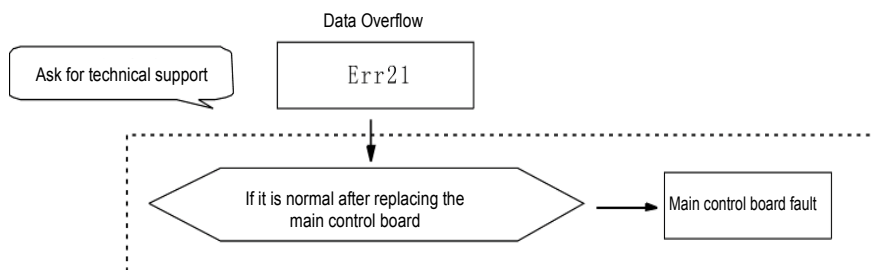


Fig.8-20 Data overflow (ERR21)

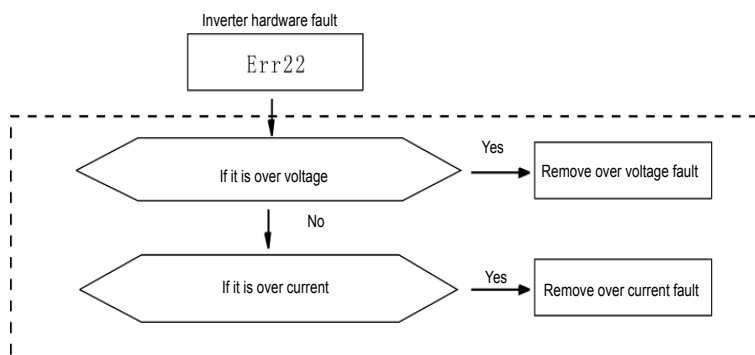


Fig.8-21 Inverter hardware fault(ERR22)

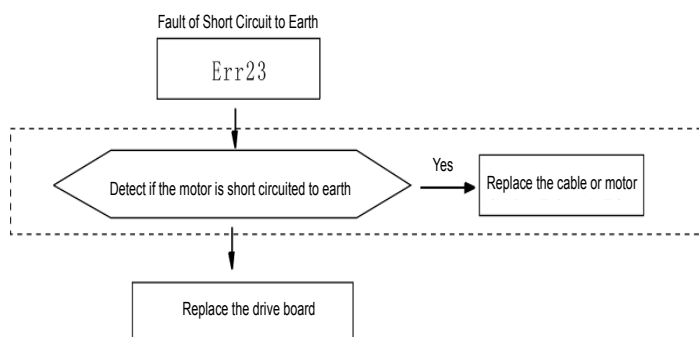


Fig.8-22 Earth short circuit fault(ERR23)

8.2 Common Fault and Resolution

During the inverter using process, the following faults may occur. Please conduct simple fault analysis by referring to the methods below:

Table8-1 Common Fault and Resolution

No.	Fault Phenomenon	Possible Cause	Solution
1	No display upon power-on	<ol style="list-style-type: none"> 1. The inverter has no input power supply. 2. 8-core bus connecting with the drive board and control board is in poor contact. <p>The internal parts of the inverter are damaged.</p>	<ol style="list-style-type: none"> 1. Check the input power supply. 2. Plug/unplug the 8-core bus once again. 3. Consult the manufacturer.
2	HC is displayed upon power-on	<ol style="list-style-type: none"> 1. 4-core bus connecting with the drive board and control board is in poor contact. <p>Other parts of the inverter are damaged.</p>	<ol style="list-style-type: none"> 1. Plug/unplug the 4-core bus once again. <p>Consult the manufacturer.</p>
3	"ERR23" alarm is displayed upon power-on.	<ol style="list-style-type: none"> 1. The motor or the output line is short circuited to the earth. <p>The inverter is damaged.</p>	<ol style="list-style-type: none"> 1. Measure the insulation of the motor and output line with magneto-ohmmeter. <p>Consult the manufacturer.</p>
4	The inverter displays normally upon power-on, but "HC" is displayed upon running and stops immediately.	The fan is either damaged or blocked.	Replace the fan.
5	ERR14 (module over heat) fault is frequently reported.	<ol style="list-style-type: none"> 1. The carrier frequency is set too high. 2. The fan is damaged or the air duct is blocked. <p>The internal parts (thermal coupler or others) of the inverter are damaged.</p>	<ol style="list-style-type: none"> 1. Reduce the carrier frequency (F0-15). 2. Replace the fan and clear the air duct. <p>Consult the manufacturer.</p>
6	The motor does not rotate upon Inverter running.	<ol style="list-style-type: none"> 1. The motor is either damaged or blocked. 2. The parameters are set improperly (mainly Group F1 motor parameters). 	<ol style="list-style-type: none"> 1. Replace the motor or remove the mechanical fault. 2. Check and reset Group F1 parameters.

No.	Fault Phenomenon	Possible Cause	Solution
7	DI terminal disabled	<ol style="list-style-type: none"> 1. The parameter is set wrongly. 2. The short circuit copper bar between OP and +24V is loosen. 3. Control board fault. 	<ol style="list-style-type: none"> 1. Check and reset Group F4 related parameters. 2. Reconnect the cables. 3. Consult the manufacturer.
8	In the close loop vector control mode, the motor speed is always low.	<ol style="list-style-type: none"> 1. The PG is damaged or cable connection is wrong. 2. The internal parts of the inverter are damaged. 	<ol style="list-style-type: none"> 1. Replace the PG and reconfirm the cable connection. 2. Consult the manufacturer.
9	The inverter frequently reports over current fault and over voltage fault.	<ol style="list-style-type: none"> 1. The motor parameters are set wrongly. 2. Acceleration/deceleration time is improper. 3. Load fluctuates. 	<ol style="list-style-type: none"> 1. Reset Group F1 parameters or perform motor tuning. 2. Set proper acceleration/deceleration. 3. Consult the manufacturer.
10	ERR17 alarm is reported upon power-on.	The soft start contactor is not switched on.	<ol style="list-style-type: none"> 1. Check if the contactor cables are loosened; 2. Check if the contactor has fault; 3. Check if the 24V power supply of the contactor has fault; 4. Consult the manufacturer.



9

Appendix

Appendix: Card Description

Appendix A: Description of Common PG Card (MD32PG)

A.1 Model and Specifications

A.1.1 Model

Shenzhen Inovance Technology Co., Ltd provides two kinds of PG card matching the MD320 inverter. Refer to Appendix A: Table 1 PG Card Model Description for details.

Appendix A: Table 1 PG Card Model Description

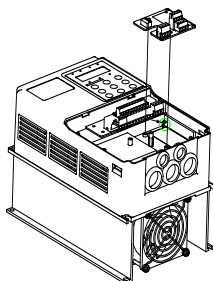
Model	Function
MD32PG	Rotary encoder interface card
MD32PGD	Rotary encoder interface card with frequency division output

A.1.2 Technical Specification

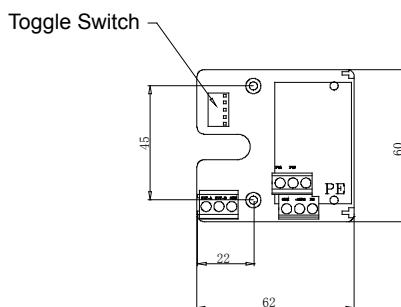
Appendix A: Table 2 PG Card Technical Specification

	Function	Response speed	Output Impedance	Output current	Frequency division range
+15PG, COM	Providing encoder power supply	---	---	300mA	---
PGA, PGB	Encoder signal access	0kHz~80kHz	---	---	---
OUT-A, OUT-B	Frequency division signal output	0kHz~80kHz	Open collector output.	100mA	4 to 62 (even number)

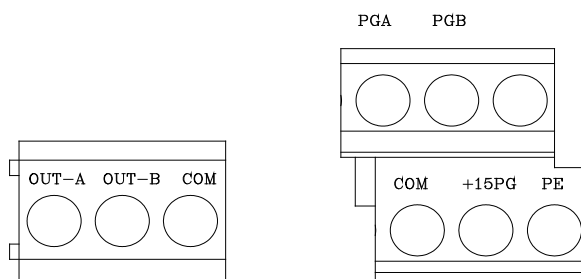
A.1.3 Dimensions and Installation



Appendix A: Fig.1 PG Card Installation



Appendix A: Fig.2 PG Card Dimension



Appendix A: Fig.3 PG Card Terminal Definition

A.2 Instruction for use

A.2.1 Function

It must select PG card when the user has needs for speed sensor vector control. The standard configurations of the PG card include processing circuits of two orthogonal encoder signals, encoder signal able to receive open collector output or push-pull collector output, and encoder power supply (fixed at +15V output). In addition to the standard configurations, the enhanced PG card can divide the input encoder signal and output processing circuits of two orthogonal signals. Please select according to the actual needs.

A.2.2 Terminal and Toggle Description

The PG card has 9 user terminals. Refer to Section 1.3 for details. Among these terminals, +15PG and COM are working power output of encoder, PGA and PGB are signal input terminal of encoder, OUT-A, OUT-B and COM are frequency division signal output terminal, and PE is shielded cable terminal (Since the PE is not earthed inside the PG card, the user can connect it to the earth based on the actual needs).

In the PG card with frequency division, the frequency division coefficient is determined by the toggle switch on the PG card. The toggle switch has 5 digits. The frequency division coefficient

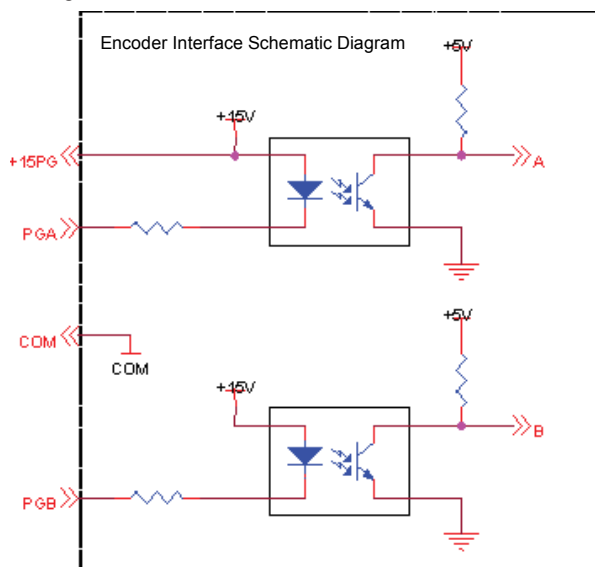
can be determined by multiplying its binary number with 2. "1" on the toggle switch is the binary lower bit, while "5" is the higher bit. When the toggle switch is switched to ON, the bit is enabled and indicates "1". Otherwise, it indicates "0". The frequency division coefficient is as shown in the table below:

Appendix A: Table 3 Terminal and Toggle Description

	Binary number	Frequency division coefficient
0	00000	no output
1	00001	no output
2	00010	2*2
...
i	...	$i*2$
31	11111	31*2

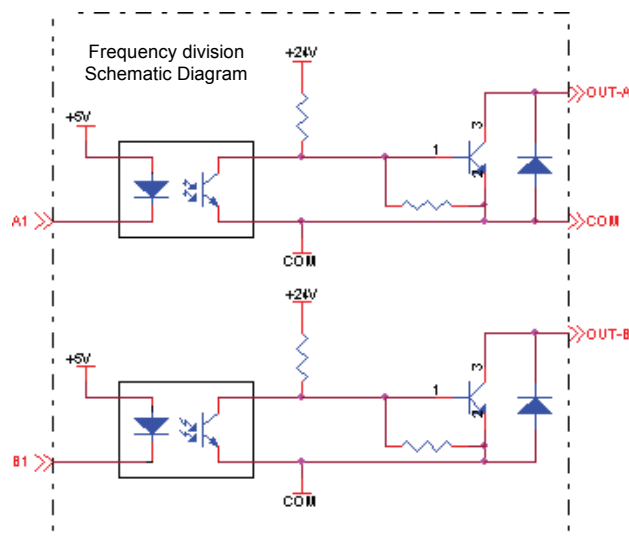
A.2.3 Principle Schematic Diagram

1. Schematic Diagram for Encoder Interface



Appendix A: Fig.4 Schematic Diagram for Encoder Interface

2. Schematic Diagram for Frequency Division Interface



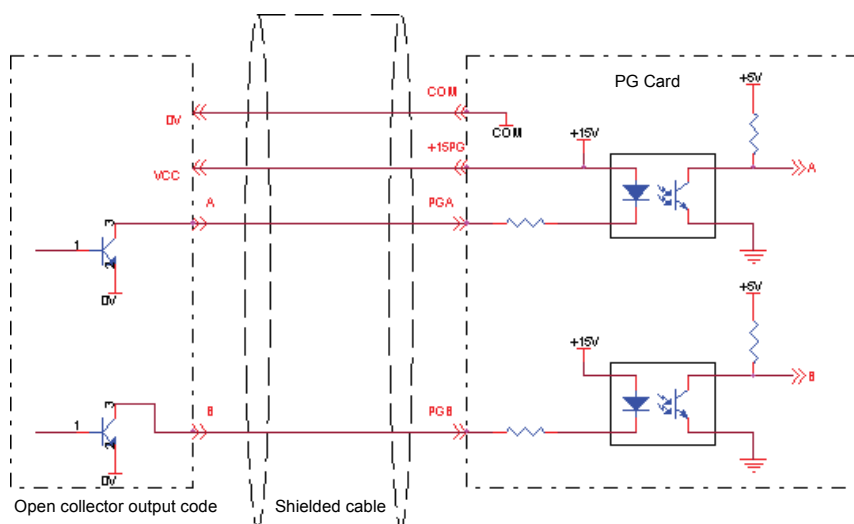
Appendix A: Fig.5 Schematic Diagram for Frequency Division Interface

A.2.4 Precautions

1. The PG card signal cables and the power cables shall be arranged separately, and parallel wiring is not allowed;
2. To avoid interferences on the encoder signal, please select the shielded cable as the PG card signal cable;
3. The shielding layer of the shielded cable of the encoder shall be earthed (e.g. the PE end of inverter) and must be earthed at single end so as to avoid interferences on the signal;
4. The length of shielded cable of the encoder shall be less than 80 meters.
5. If the frequency division output of the PG card is connected to external user power supply, the voltage shall be less than 30V, or it will damage the PG card.

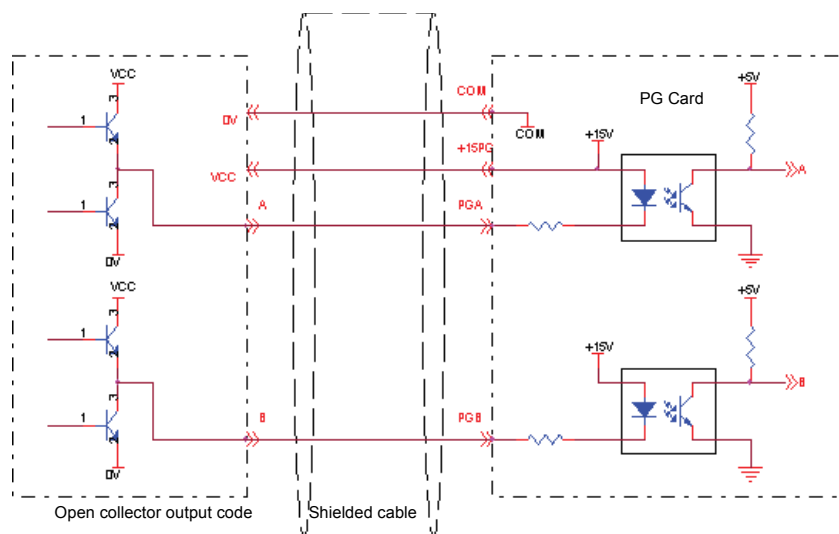
A.3 Application Connection

1. Schematic Diagram for the Connection of Collector Output Encoder



Appendix A: Fig.6 Schematic Diagram for the Connection of Collector Output Encoder

2. Schematic Diagram for the Connection of Push-Pull Output Encoder



Appendix A: Fig.7 Schematic Diagram for the Connection of Push-Pull Output Encoder

Appendix B: Description of Long-line Drive PG Card (MD32PG3)

This PG card is connected to the adapter of Inovance inverter as differential encoder. It can be applied in the situation with synchronous motor and induction motor close loop control.

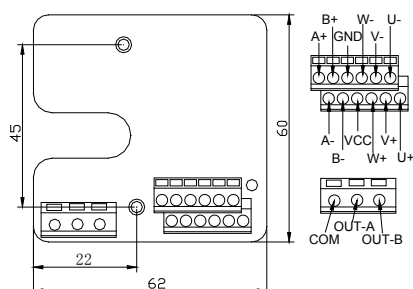
1. When the synchronous motor is applied, it can connect to the UVW encoder of the rotor magnetic role, and the number of poles of the UVW encoder shall be equal to that of the synchronous motor. Only when the number of poles is equal can they be used together.
2. When the induction motor is applied, it connects to the common differential encoder, and the UVW terminal needs no cable connection at this time.
3. It must use the encoder with operating power supply of 5V.
4. PG card terminal description:

Appendix B: Table 1 PG Card Terminal Description

	Function	Response speed	Maximum current	Remarks
+5V, COM	Operating power supply of encoder			
A+, A-, B+, B-,	A/B signal of encoder	0 to 80kHz	---	
U+, U-, V+, V-, W+, W-,	UVW position signal of encoder	0 to 10kHz	---	When the common encoder is applied, this terminal has no cable connection.
OUT-A, OUT-B	A/B signal output	0 to 80kHz	100mA	Open collector signal

Caution:

1. It must use the encoder with operating power supply of 5V.
2. The UVW encoder can also be used as common encoder.



Appendix B: Fig.1 Schematic Diagram for Differential PG Card Structure

Appendix C: Description of IO Expansion Card (MD32IO)

C.1 Overview

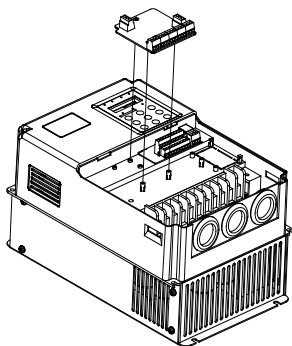
MD32IO card is I/O expansion card launched by Shenzhen Inovance Technology Co., Ltd to support the use of MD320 series inverter.

It can add five digital inputs, one analog voltage signal input, one relay signal output, one digital signal output and one analog signal output. Meanwhile, IO expansion card has communication function and supports RS-485 communication mode.

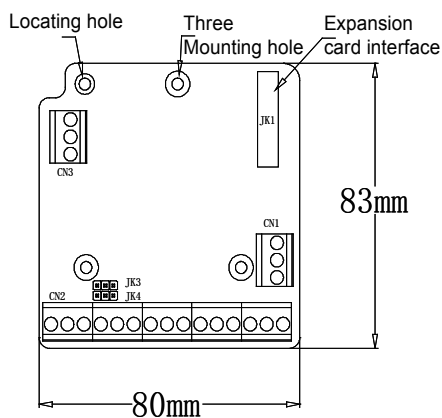
C.2 Mechanical Installation and Control Terminal Function

C.2.1 Refer to Fig.1, Fig.2 and Fig.3 of Appendix C respectively for the installation mode, physical dimensions, jumper interface and CN3 signal definition.

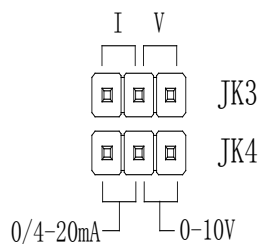
1. Installation shall be conducted when the inverter is completely disconnected from power supply.
2. Align the expansion card interface of I/O expansion card with the locating hole of the control board of the inverter.
3. Tighten with screws.



Appendix C: Fig. 1 IO Installation Mode



Appendix C: Fig.2 Physical Dimensions



Appendix C: Fig.3 Jumper Terminal

C.2.2 Description of Control Terminal Function:

Appendix C: Table 1 Control Terminal Function

Type	Terminal Symbol	Terminal name	Function description
Power supply	+10V-GND	+10V-GND	Provide +10V power supply for external units, with maximum output current of 10mA. It is generally used as the operating power supply for the external potentiometer. The potentiometer resistance range is 1kΩ to 10kΩ.
	+24V-COM	External +24V power supply	Provide +24V power supply for external units. It is generally used as the operating power supply for digital input/output terminal and the external sensor. The maximum output current is 200mA.
	OP	Operating power terminal of IO port	Prior to delivery, the OP is connected to "+24V" with short circuit copper bar. When it needs external power supply, OP shall be connected with the external power supply, and the short circuit copper bar shall be removed.
Analog Input	AI3-GND	Analog input terminal 3	1. Input voltage range: DC 0V to 10V/4mA to 20mA, which is determined by JK3 jumper on the expansion card (the factory default value is 0V to 10V). 2. Input impedance: It is 100kΩ at the time of voltage input and 500Ω at the time of current input.
Functional digital input terminal	DI6-COM	Digital input 6	1. Optical coupling isolation, compatible with dual polarity input 2. Input impedance: 3.3KΩ 3. Voltage range for level input: 9V to 30V
	DI7-COM	Digital input 7	
	DI8-COM	Digital input 8	
	DI9-COM	Digital input 9	
	DI10-COM	Digital input 10	
Analog out	AO2-GND	Analog output 2	The voltage or current output is determined by the JK4 jumper on the expansion card (the factory default value is voltage output). Output voltage specification: 0V to 10V Output current specification: 0mA to 20mA

Type	Terminal Symbol	Terminal name	Function description
Digital output	DO2-CME	Digital output 2	Optical coupling isolation, dual polarity open collector output Output voltage range: 0V to 24V Output current range: 0mA to 50mA Caution: The digital output ground CME and digital input ground COM are internally isolated. The users must make them short circuit externally. When DO2 needs to be driven by the external power supply, the connection between CME and COM must be disconnected.
Relay output (RELAY 2)	P/A- P/B	Normally closed terminal	Contact driving capacity: AC250V, 3A, $\cos\phi=0.4$. DC 30V, 1A Contact driving capacity: AC250V, 3A, $\cos\phi=0.4$. DC 30V, 1A
	P/A- P/C	Normally open terminal	
Communication	CN3	Communication terminal	The input/output signal terminal for RS-485 communication
Auxiliary interface	JK1	Control panel interface	28-core terminal, connecting to control board of MD320 series inverter

Appendix D: Description of Communication Card (MD32MBS)

Communication card of Shenzhen Inovance Technology Co., Ltd is specially designed for the MD320 series inverter to provide remote serial port communication function.

D.1 Instruction for use

D.1.1 Model

Appendix D: Table 1 Communication Card Model Description

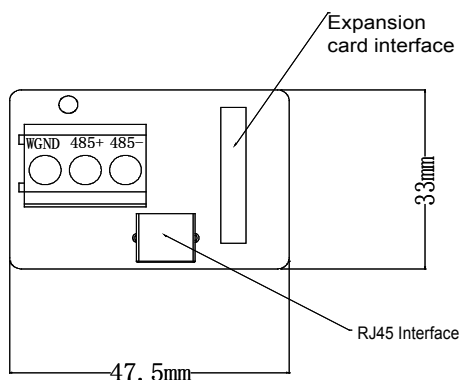
Name	Model	Function
RS-232 Communication card	MD32-232	RS-232 Communication interface card
RS-485 Communication card	MD32-485	RS-485 Communication interface card

D.1.2 Function and Terminal Connection

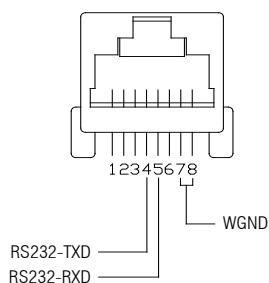
Communication card is divided into RS-232 communication interface card and RS-485 communication interface card and serves as the expansion card special for the MD320 inverter of Shenzhen Inovance Technology Co., Ltd, which can provide RS-232 and RS-485 communication modes respectively. Their electric parameters comply with the international standard, and the user can select RS-232 communication card or RS-485 communication card according to the actual needs so as to implement the function of controlling the inverter running and parameter setting in the serial port mode.

Refer to MD320 Serial Communication Protocol for the details regarding the communication card, which is available on the website of www.inovance.cn or from the local representative office or agent.

Description of RS-232 communication card: The physical structure and connecting mode are as shown in Appendix D: Fig.1 Physical Structure and Connecting Mode, while RJ45 interface signal definition is as shown in Appendix D: Fig.2 RS-232 Signal Definition.

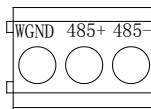


Appendix D: Fig.1 Physical Structure and Connection Mode



Appendix D: Fig.2 RS-232 Signal Definition

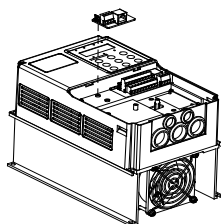
Description of RS-485 communication card: The physical structure and connecting mode are as shown in the following figure. RS-485 communication mode provides two types of connections, which are mutually connected. The user can freely select the communication line connections based on the actual needs. The physical structure and connecting mode are as shown in Appendix D: Fig.1 Physical Structure and Connecting Mode, while the interface signal definitions of the two connecting modes are as shown in Appendix D: Fig.3 RS-485 Signal Definition.



Appendix D: Fig.3 RS-485 Signal Definition

D.1.3 Installation Mode

- 1) Installation shall be conducted when the inverter is completely disconnected from power supply.
- 2) Align the communication card with the expansion card interface of the control board of the inverter.
- 3) Tighten the communication card with screws, as shown in Appendix D: Fig.4 Installation Mode with Tightening Screws.



Appendix D: Fig.4 Installation Mode with Tightening Screws

D.1.4 Precautions

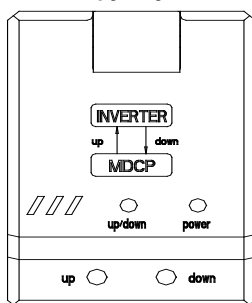
- 1) In order to avoid external interferences on the communication signal, it is recommended that

the twisted-pair cables be employed for the communication connection and parallel cables be avoided as much as possible.

2) It is preferable to select the shielded cable as RS-232 signal cable.

Appendix E: Description of Parameter Copy Card (MDCP)

E.1 Schematic Diagram for Parameter Copy Keyboard



E.2 Definition of Parameter Copy Card

Up-upload parameter: It is to upload the parameters in the parameter copy keyboard to the inverter.

Down-download parameter: It is to download the parameters in the inverter to the parameter copy keyboard.

E.3 Connection

Connect the parameter copy keyboard to the external keyboard interface of the control board with the external lead cable attached.

E.4 Description of Parameter Copy Operation Process

For the inverters with the same parameter setting requirements, it can reduce the workload of the parameter setting through the parameter copy keyboard while increasing the accuracy of the parameter setting and reducing the possibility of human errors.

It needs to configure the parameters of one inverter firstly, and then download (down) these parameters to the parameter copy keyboard, and finally upload (up) to other inverters with the parameter copy keyboard.

When downloading parameters, press "down" key for nearly 3 seconds, and the "up/down" indicator will be ON, indicating the parameter download starts. The parameter download is not completed until the "up/down" indicator is OFF.

When uploading parameters, press "up" key for nearly 3 seconds, and the "up/down" indicator will flash, indicating the parameter upload starts. The parameter upload is not completed until the "up/down" indicator is OFF.

E.5 Precautions for Parameter Copy

- a) Parameter download or upload is inactive during the inverter running process.
- b) The inverter running is disabled during the process of parameter download or upload.
- c) Only the inverter with minimum software version 1.61 of MD320 control board can use the parameter copy keyboard.
- d) During the parameter download or upload process, if the connecting cable of the keyboard is unplugged or loosen, the inverter will report ERR21 protection.

If operation is not completed normally during the parameter download or upload, please check if the inverter software version is over 1.61 or if the connecting cable is loosen, and repeat the parameter download or upload.

Appendix F MD320 serial communication protocol

MD320 series of inverter provides RS232/RS485 communication interface, and adopts MODBUS communication protocol. User can carry out centralized monitoring through PC/PLC to get operating requirements.

F.1 About Protocol

This serial communication protocol defines the transmission information and use format in the series communication and it includes master-polling (or broadcasting) format, master coding method and the content includes function code of action, transferring data and error checking. The response of slave is the same structure, and it includes action confirmation, returning the data and error checking etc. If slave takes place the error while it is receiving the information or cannot finish the action demanded by master, it will send one fault signal to master as a response.

F.2 Application Methods

The inverter will be connected into a "Single-master Multi-slave" PC/PLC control net with RS232/RS485 bus.

F.3 Bus structure

(1) Interface mode

RS232/RS485 Hardware interface

(2) Transmission mode

There provide asynchronous series and half-duplex transmission mode. At the same time, just one can send the data and the other only receives the data between master and slave. In the series asynchronous communication, the data is sent out frame by frame in the form of message.

(3) Topological mode

In Single-master system, the setup range of slave address is 0 to 247. Zero refers to broadcast communication address. The address of slave must be exclusive in the network. That is one condition of one slave machine.

F.4 Protocol description

C320 series inverter communication protocol is a kind of serial master-slave communication protocol, in the network, only one equipment, and master can build a protocol, (Named as "Inquire/Command"). Other equipments, slave's response "Inquire/Command" of master only by providing the data or doing the action according to the master's "Inquiry/Command". Here, master is Personnel Computer, Industrial Machine or Programmable logical controller, and the slave is inverter. Master not only visits some slave, but also sends the broadcast information to all the slaves. For the single master "Inquiry/Command", all of slaves will return a signal that is a response; for the broadcast information provided by master, slave needs not feedback a response to master machine.

F.5 Communication data structure

ModBus protocol communication data format of MD320 series of inverter is shown as following:

(In RTU mode, messages start with a interval of at least 3.5 character times. This is most easily implemented as a multiple of character times at the baud rate that is being used on the network (shown as T1-T2-T3-T4 in the figure below). The first field then transmitted is the device address. The allowable characters transmitted for all fields are hexadecimal 0 ... 9, A ... F. Networked devices monitor the network bus continuously, including during the silent intervals. When the first field (the address field) is received, each device decodes it to find out if it is the addressed device. Following the last transmitted character, a similar interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval)

The entire message frame must be transmitted as a continuous stream. If a silent interval of more than 1.5 character times occurs before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message.

Similarly, if a new message begins earlier than 3.5-character times following a previous message, the receiving device will consider it a continuation of the previous message. This will set an error, as the value in the final CRC field will not be valid for the combined messages. A typical message frame is shown below.

RTU frame format

START Frame Start	3.5-character time
Slave addr.	Communication addr. : 1 to 247
Command Code	03: Read slave parameters 06: Write slave parameters
DATA (N-1)	Data: Function code parameter address, the number of function code parameter, Function code parameter, etc.
DATA (N-2)	
.....	
DATA0	

CRC CHK High Order	Detection Value: CAC value
CRC CHK Low order	
END	3.5-character time

Command code: 03H reads N words. (There are 12 characters can be read at the most.)

For example: The inverter start address F002 of the slave 01 continuously reads two consecutive values.

Master command information

ADR	01H
CMD	03H
Start Address High order	F0H
Start Address Low order	02H
Register Number High order	00H
Register Number Low order	02H
CRC CHK Low order	CRC CHK values are to be calculated
CRC CHK high order	

Slave responding information

When FD-05 set to 0

ADR	01H
CMD	03H
Byte Number	00H
The low Order number of byte	04H
Data F002H high order	00H
Data F002H low order	00H
Data F003H high order	00H
Data F003H high order	01H
CRC CHK low order	CRC CHK values are to be calculated
CRC CHK high order	

When FD-05 set to 1

ADR	01H
CMD	03H

The Number of byte	04H
Data F002H high order	00H
Data F002H low order	00H
Data F003H high order	00H
Data F003H low order	01H
CRC CHK low order	CRC CHK values are to be calculated
CRC CHK high order	

Command Code: 06H, write a word

For example: Write 5000 (1388H) into F00AH which slave address is 02H.

Master command information

ADR	02H
CMD	06H
Data Address high order	F0H
Data Address low order	0AH
Data content high order	13H
Data content low order	88H
CRC CHK low order	CRC CHK values are to be calculated
CRC CHK high order	

Slave responding information

ADR	02H
CMD	06H
Data Address high order	F0H
Data Address low order	0AH
Data Content high order	13H
Data Content low order	88H
CRC CHK low order	CRC CHK values are to be calculated
CRC CHK high order	

CRC Checking

In RTU mode, messages include an error-checking field that is based on a CRC method. The CRC field checks the contents of the entire message. The CRC field is two bytes, containing a 16-bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message,

and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error results.

The CRC is started by 0xFFFF. Then a process begins of applying successive eight-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit, do not apply to the CRC.

During generation of the CRC, each eight-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next eight-bit byte is exclusive ORed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

```
unsigned int crc_chk_value(unsigned char *data_value, unsigned char length)
{
    unsigned int crc_value=0xFFFF;
    int i;
    while(length--)
    {
        crc_value^=*data_value++;
        for(i=0;i<8;i++)
        {
            if(crc_value&0x0001)
            {
                crc_value=(crc_value>>1)^0xa001;
            }
            else
            {
                crc_value=crc_value>>1;
            }
        }
    }
}
```

```

        return(crc_value);
    }

```

The chapter is about communication contents, it's used to control the inverter operation, the status of the inverter and related parameter setup.

Read and write function-code parameters (Some functional code is not changed, only for the manufacturer use.)

The mark rules of Function code parameters address:

The group number and mark of function code is the parameter address for indicating the rules.

High order bytes: F0 to FF

Low order bytes: 00 to FF

For example: F3-12, address indicates to F30C.

Caution:

Group F1: Only for reading parameter, can not be changed parameters

Group FF: Either the parameter can not be read, nor be changed. Some parameters can not be changed during operation, some parameters regardless of what kind of state the inverter in, the parameters can not be changed. Change the function code parameters, pay attention to the scope of the parameters, units, and relative instructions.

Besides, due to EEPROM be frequently stored, it will reduce the lifetime of EEPROM. In the communication mode, and some function code needn't be stored as long as change the RAM value. To achieve this function, change high order F of the function code into zero.

Corresponding function code addresses are indicated below:

High byte: 00~0F

Low byte: 00~FF

For example: Function code F3-12 can not be stored into EEPROM, address indicates to be EEPROM.

This address can only act writing RAM, it can not act reading, when act reading, it is invalid address.

Group FH function parameters:

Some models with extended function, such as MD330 or the models with water supply card, which increase group FH parameters, the communication address of group FH parameter is D0** (non-stored) E0** (stored).

For example: FH-05, it indicates D005H or E005H. FH-20, it indicates D014H or E014H.

Stop/start parameter

Parameter addr.	Parameter description
1000	Communication setup value(-10000 to 10000)(Decimal)
1001	Running frequency
1002	Bus voltage
1003	Output voltage
1004	Output voltage
1005	Output power
1006	Output torque
1007	Running speed
1008	DI input flag
1009	DO output flag
100A	AI1 voltage
100B	AI2 voltage
100C	AI3 voltage
100D	Counting value input
100E	Length value input
100F	Load speed
1010	PID setup
1011	PID feedback
1012	PLC process
1013	

Caution:

Communication setting value is the percentage of relative value, and 10,000 correspond to 100.00%, -10000 correspond to -100.00%.

On the frequency dimension of the data, the percentage is the percentage of relative maximum frequency (F0-10). To the torque dimension data, the percentage is relative twice percentage of the inverter rated torque.

Control command input to inverter (write-only)

Command Word Address	Command Function
2000	0001: Forward operation
	0002: Reverse operation
	0003: Forward jog
	0004: Reverse jog
	0005: Free stop
	0006: Speed-down stop
	0007: Fault reset

Read inverter status :(read-only)

Status Word Address	Status Word Function
3000	0001: Forward operation
	0002: Reverse operation
	0003: Stop

Parameters locking password checksum: (If the return is the 8888H, it indicates the password checksum pass)

Password Address	Contents of Input password
4000	*****

Parameter locking command :(write-only)

Address of locking password command	Contents of locking password command
5000	0001: lock system command code

Digital output terminal control: (write-only)

Address of locking password command	Contents of locking password command
6000	BIT0: DO1 output control
	BIT1: DO2 DO2 output control
	BIT2: RELAY1 RELAY1 output control
	BIT3: RELAY2 RELAY2 output control
	BIT4: FMR FMR output control

Analog output AO1 control: (write-only)

Address of locking password command	Contents of locking password command
7000	0~7FFF refers to 0% to 100.00%

Analog output AO2 control: (write-only)

Locking password command address	Locking password command contents
9000	0~7FFF refers to 0% to 100.00%

Pluse output control: (write-only)

Address locking password command	Contents locking password command
A000	0 to 7FFF (decimal) refers to 0% to 100.00%

Inverter fault description:

Inverter fault address	Inverter fault information
8000	0000: No fault 0001: Inverter unit protection 0002: Speed-up over current 0003: Speed-down over current 0004: Constant over current 0005: Speed-up over voltage 0006: Speed-down over voltage 0007: Constant over voltage 0008: Control power supply fault 0009: Under voltage fault 000A: Inverter overload 000B: Motor overload 000C: Input phase failure 000D: Output phase failure 000E: Radiator overheating 000F: External equipment fault 0010: Communication fault 0011: Contactor fault 0012: Current detection fault 0013: Motor tuning fault 0014: PG Fault

Description data of communication fault information (fault code)

Communication fault address	Fault function description
8001	0000: No fault 0001: Password error 0002: Command 0003: CRC checksum error 0004: Invalid address 0005: Invalid address 0006: Parameter change invalid 0007: The system is locked

Group FD Communication parameter description

FD-00	Baud rate		Factory default value	5
	Setup range	0	300BPS	
		1	600BPS	
		2	1200BPS	
		3	2400BPS	
		4	4800BPS	
		5	9600BPS	
		6	19200BPS	
		7	38400BPS	

This parameter is used to set the the data transfer rate between host computer and the inverter. Please note that baud rate of the host computer and the inverter must be consistent. Otherwise, communication is impossible. The higher baud rate is, the faster communication is.

FD-01	Data format		Factory default value	0
	Setup range	0	No check:Data format<8,N,2>	
		1	Even parity Check :data format <8,E,1>	
		2	Odd Parity Check : data format<8,O,1>	

The host computer and inverter setup data format must be consistent, otherwise, communication is impossible.

FD-02	Local Address		Factory default value	1
	Setup range	1~247,0 is broadcast address		

When the local address is set to 0, that is, broadcast address, it can realize the broadcast function of host computer.

FD-03	Response delay		Factory default value	10ms
	Setup range	0~20ms		

Response delay: It refers to the interval time from the inverter finishes receiving data to sending data to the host machine. If the response delay is less than the system processing time, then the response based on the time delay of the system processing time. If the response delay is more than the system processing time, after the system processes the data, it should be delayed to wait until the response delay time is up, then sending data to host machine.

FD-04	Communication timeout		Factory default value	0.0 s
	Setup range	0.0 s (inactive), 0.1~60.0s		

When the function set to 0.0 s, the communication timeout parameter is inactive.

When the function code set to RMS, if the interval time between the communication and the next communication is beyond the communication timeout, the system will report communication failure error (Err16). At normal circumstances, it will be set as inactive. If in the continuous communication system, set the second parameter, you can monitor the communication status.

FD-05	Communication protocol selection		Factory default value	0
	Setup range	0	Non-standard MODBUS protocol	
		1	Standard MODBUS protocol	

FD-05=1 : Select standard MODBUS protocol

FD-05=0 : When reading the command, the slave return is one byte than the standard MODBUS protocol's, for details refer to communications Data Structure of this protocol.



Warranty Agreement

1. The warranty period of the product is 18 months (refer to the barcode on the equipment body). During the warranty period, if the product fails or is damaged under the condition of normal use by following the instruction, Our Company will be responsible for free maintenance.
2. Within the warranty period, maintenance will be charged for the damages caused by the following reasons:
 - a. The damage caused by improper use or repair/modification without prior permission;
 - b. The damage caused by fire, flood, abnormal voltage, other disasters and second disaster;
 - c. The hardware damage caused by dropping or transportation upon the procurement.
 - d. The damage caused by the improper operation;
 - e. The damage or failure caused by the trouble out of the equipment (e.g. external device)
3. If there is any failure or damage to the product, please correctly fill out the Product Warranty Card in detail.
4. The maintenance fee is charged according to the newly adjusted Maintenance Price List by our company.
5. In general, the warranty card will not be re-issued. Please keep the card and present it to the maintenance personnel when asking for maintenance.
6. If there is any problem during the service, please contact the agent of our company or our company directly.
7. This agreement shall be interpreted by Shenzhen Inovance Technology Co., Ltd.

Shenzhen Inovance Technology Co., Ltd.

Service Department

Address: Block E, Hongwei Industry Park, Liuxian Road, Baocheng No. 70 Zone, Bao'an District, Shenzhen

Service Hotline: 400-777-1260

P.C.: 518101

Website: www.inovance.cn



Product Warranty Card

Customer information	Add. of unit:	
	Name of unit:	Contact person:
	P.C.:	Tel.:
Product information	Product model:	
	Body barcode (Attach here):	
	Name of agent (Attach here):	
Failure information	(Maintenance time and content):	
	Maintenance personnel:	