Preface

Thankyou for choosing SINEE's EM760 series inverter.

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The EM760 series inverter is a high-performance vector control inverter launched by SINEE, which integrates the synchronous motor drive and asynchronous motor drive. It supports three-phase AC asynchronous motors and permanent magnet synchronous motors, internationally advanced drive control technologies [such as the improved vector V/F control technology (VVF), speed sensorless vector control technology (SVC) and speed sensor vector control technology (FVC)], speed output and torque output, Wi-Fi access and background software debugging, expansions (such as I/O expansion cards, communication bus expansion cards and PG cards).

The standard EM 760 supports V/F control, SVC control, FVC control of asynchronous motors; it also supports V/F control and FVC control of permanent magnet synchronous motors. The non-standard version for synchronous motors also supports V/F control, SVC control, FVC control of asynchronous motors, as well as V/F control, SVC control and FVC control of permanent magnet synchronous motors.

The EM760 series high-performance vector inverter has the following features:

- Equipment of a built-in DC reactor (in case of an inverter of above 18.5kW) can reduce input current distortion, increase the power factor and promote the product reliability;
- High torque control accuracy: SVC/±5% rated torque, FVC/±3% rated torque;
- Wide speed range and high control accuracy: SVC/1:200 (±0.2%), FVC/1:1000 (±0.02%) rated speed;
- Low-frequency carrier: VVF/3Hz/150%, SVC/0.25Hz/150%, FVC/0Hz/180%;
- Protections against overvoltage stall, fast current limit, overload, overheat, off-load, overspeed, and so on;
- Support I/O expansion: 3-channel digital inputs, 2-channel relay outputs, 1-channel -10V~ 10V voltage input, 1-channel sensor input;
- Support communication bus expansion: standard configuration including 485 bus, optional PROFINET, CANopen and EtherCAT;
- Support various encoders: ABZ incremental, UVW incremental, UVW wire saver, rotary transformer and sine-cosine transformer;
- Support debugging by the mobile phone APP or monitoring of the inverter status;
- Support Wi-Fi module or serial port access;
- Rich and convenient PC background software functions.

Before using the EM760 series high-performance vector inverter, please read this guide carefully and keep it properly.

While connecting the inverter to motor for the first time, please select the motor type (asynchronous or synchronous) correctly and set the motor nameplate parameters: rated power, rated voltage, rated current, rated frequency, rated speed, motor connection, rated power factor, etc. In case of FVC drive control mode, it is required to select the optional PG card and set correct encoder parameters.

We are committed to continuously improving our products and product data, so the data provided by us maybe modified without prior notice.

For the latest changes and contents, please visit www.sinee.cn.

Safety precautions

Safety definition: Safety precautions are divided into the following two categories in this manual:

Danger: The dangers caused by nonconforming operations may include serious injuries and even deaths.

Note: The danger caused by nonconforming operations, including moderate or minor injuries and equipment damage.

During the installation, commissioning and maintenance, please read this chapter carefully, and follow the safety precautions herein. Our company will not be liable for any injury or loss arising from nonconforming operations.

Precautions

Before installation:

Danger	
1.	Do not install the product in the case of water in the package or missing or damaged components found in unpacking!
2.	Do not install the product in the case of inconsistency between the actual product name and identification on the outer package.

Attention	
1.	Handle the controller with care; otherwise, it maybe damaged!
2.	Never use the inverter damaged or with some parts missing; otherwise, injuries maybe caused!
3.	Do not touch the components of the control system with your hands; otherwise, there is a danger of static damage!

During installation:

Danger	
1.	Please install the inverter on a metal retardant object (e.g. metal) and keep it away from combustibles; otherwise, a fire maybe caused!
2.	Do not loosen the fixing bolts of components, especially those with red marks!

Attention	
1.	Never make wire connectors or screws fall into the inverter; otherwise, the inverter maybe damaged!
2.	Install the inverter in a place with little vibration and exposure to direct sunlight.
3.	When the inverter is installed a relatively closed cabinet or space, pay attention to the installation gap to ensure the effects of heat dissipation.

During wiring:

Danger
1. Follow the instructions in this manual, and appoint professional and electrical engineering personnel to complete wiring; otherwise, unexpected dangers maybe caused!
2. The inverter and power supply must be separated by a circuit breaker (recommendation: greater than or equal to and closest to twice the rated current); otherwise, a fire maybe caused!
3. Before wiring,make sure that the power supply is in the zero energy status; otherwise, electric shock maybe caused!
4. Never connect the input power supply to the output terminals (U, V, W) of the inverter. Pay attention to the marks of wiring terminals, and connect wires correctly! Otherwise, the inverter maybe damaged!
5. Make the inverter grounded correctly and reliably according to the standards; otherwise, electric shock and fire maybe caused!

Attention
1. Make sure that the lines meet the EMC requirements and local safety standards. For wire diameters, refer to the recommendations. Otherwise, an accident may occur!
2. Never connect the braking resistor directly between the DC bus and terminal. Otherwise, a fire may be caused!
3. Tighten the terminals with a screwdriver of specified torque; otherwise, there is a risk of fire.
4. Never connect the phase-shifting capacitor and LC/RC noise filter to the output circuit.
5. Do not connect the electromagnetic switch and electromagnetic contactor to the output circuit. Otherwise, the overcurrent protection circuit of the inverter will be enabled. In severe cases, the inverter maybe subject to internal damage.
6. Do not dismantle the connecting cable inside the inverter; otherwise, internal damage maybe caused to the inverter.

Before power-on:

Danger
1. Make sure that the voltage level of the input power supply is consistent with the rated voltage of the inverter; and the input terminals (R, S, T) and output terminals (U, V, W) of the power supply are connected correctly. Check whether there is short circuit in the peripheral circuits connected to the inverter and whether all connecting lines are tightened; otherwise, the inverter maybe damaged!
2. The withstand voltage test has been performed to all parts of the inverter, so it is not necessary to carry it out again. Otherwise, an accident maybe caused!

Attention
1. The inverter must not be powered on until it is properly covered; otherwise, electric shock maybe caused!
2. The wiring of all peripheral accessories must be inline with the instructions in this manual. All wires should be connected correctly according to the circuit connections in this manual. Otherwise, an accident may occur!

After power-on:

Danger

1. Never touch the inverter and surrounding circuits with wet hands; otherwise, electric shock may occur!
2. If the indicator is not ON and the keyboard has no response after power-on, immediately turn off the power supply. Never touch the inverter terminals (R, S, T) and the terminals on the terminal block with your hands or screwdriver; otherwise, electric shock maybe caused. Upon turning off the power supply, contact our customer service personnel.
3. At the beginning of power-on, the inverter automatically performs a safety test to external strong current circuits. Do not touch the inverter terminals (U, V, W) or motor terminals; otherwise, electric shock maybe caused!
4. Do not disassemble any parts of the inverter while it is powered on.

Attention

1. When parameter identification is required, please pay attention to the danger of injury during motor rotation; otherwise, an accident may occur!
2. Do not change the parameters set by the inverter manufacturer without permission; otherwise, the inverter maybe damaged!

During operation:

Danger

1. Do not touch the cooling fan, radiator and discharge resistor to feel the temperature; otherwise, burns may be caused!
2. Non-professional technicians must not test signals when the controller is in operation; otherwise, personal injury or equipment damage maybe caused!

Attention

1. Prevent any object from falling into the inverter in operation; otherwise, the inverter maybe damaged!
2. Do not start or stop the inverter by turning on or off the contactor; otherwise, the inverter maybe damaged!

During maintenance:

Danger

1. Never carry out repair and maintenance in the live state; otherwise, electric shock maybe caused!
2. Maintenance of the inverter must be carried out 10 min after the main circuit is powered off and the display interface of the keyboard is disabled; otherwise, the residual charge in the capacitor will do harm to the human body!
3. Personnel without professional training are not allowed to repair and maintain the inverter; otherwise, personal injury or inverter damage maybe caused!
4. The parameters must be set after the inverter is replaced. Plugs in all interfaces must be operated in the power-off status!
5. The synchronous motor generates electricity while rotating. Inverter maintenance and repair must be performed 10 min after the power supply is turned off and the motor stops running; otherwise, electric shock maybe caused!

Precautions

Motor insulation inspection

When the motor is used for the first time or after long-term storage or subject to regular inspection, its insulation should be checked to prevent the inverter from damage caused by failure of the motor winding insulation. During the insulation inspection, the motor must be disconnected from the inverter. It is recommended to use a 500V megohmmeter. The measured insulation resistance must not be less than 5 MΩ.

Thermal protection of motor

If the motor used does not match the rated capacity of the inverter, especially when the rated power of the inverter is greater than that of the motor, the motor must be protected by adjusting the motor protection parameters of the inverter or installing a thermal relay in front of the motor.

Operation above power frequency

This inverter can provide the output frequency of 0.00Hz to 600.00Hz / 0.0Hz to 3000.0Hz. When the motor needs to operate above the rated frequency, please consider the capacity of the mechanical device.

About motor heat and noise

Since the inverter outputs PWM waves, containing some harmonics, the temperature rise, noise and vibration of the motor will be slightly more than those in operation at the power frequency.

Presence of voltage-dependent device or capacitor increasing the power factor on output side

The inverter outputs PWM waves. If there is a capacitor increasing the power factor or voltage-dependent resistor for lightning protection on the output side, the inverter may be subjected to instantaneous overcurrent and even damage. Do not use these devices.

Use beyond rated voltage

The EM760 series open-loop vector inverter should not be used beyond the allowable working voltage range specified in this manual; otherwise, the components inside the inverter are prone to damage. If necessary, use the appropriate step-up or step-down device for voltage transformation.

Lightning impulse protection

The inverter of this series is equipped with a lightning overcurrent protector, which has certain capabilities in self-protection against induced lightning. Where lightning strikes occur frequently, a protective device should be added in front of the inverter.

Altitude and derating

In areas with an altitude of more than 1,000 m, where heat dissipation of the inverter is poor due to thin air, derating is required (derating by 1% per 100 m altitude increase to maximum 3,000 m; for ambient temperature above 40°C, derating by 5% per 1°C temperature rise to maximum 50°C). Contact us for technical advice.

Precautions for scrapping of inverter

Burning of the electrolytic capacitors of the main circuit and printed circuit board may result in explosion, and burning of plastic parts may generate toxic gases. Please dispose of the controller as a kind of industrial waste.

Table of Contents

Chapter 1 **Overview**

1.1 Model and Specification of EM760 Series Inverter

- Rated voltage of power supply: Three-phase AC 340-460V, three-phase AC 520V-690V;
- Applicable motor: Three-phase AC asynchronous motor and permanent magnet synchronous motor.

The model and rated output current of EM760 series inverter are shown below.

Table 1-1 EM760 series inverter models

Rated voltage of power supply	Model	Applicable motor power (kW)	Rated output current (A)
Three-phase AC 340~460V	EM760-0R7G/1R5P-3B	0.75/1.5	2.5/4.2
	EM760-1R5G/2R2P-3B	1.5/2.2	4.2/5.6
	EM760-2R2G/3R0P-3B	2.2/3.0	5.6/7.2
	EM760-4R0G/5R5P-3B	4.0/5.5	9.4/12
	EM760-5R5G/7R5P-3B	5.5/7.5	13/17
	EM760-7R5G/9R0P-3B	7.5/9.0	17/20
	EM760-011G/015P-3B	11/15	25/32
	EM760-015G/018P-3B	15/18.5	32/38
	EM760-018G/022P-3B	18.5/22	38/44
	EM760-022G/030P-3B	22/30	45/59
	EM760-030G/037P-3/3B	30/37	60/73
	EM760-037G/045P-3/3B	37/45	75/87
	EM760-045G/055P-3/3B	45/55	90/106
	EM760-055G/075P-3/3B	55/75	110/145
	EM760-075G/090P-3/3B	75/90	150/169
	EM760-090G/110P-3	90/110	176/208
	EM760-110G/132P-3	110/132	210/248
	EM760-132G/160P-3	132/160	253/298
	EM760-160G/185P-3	160/185	304/350
	EM760-200G/220P-3	200/220	380/410
	EM760-220G/250P-3	220/250	426/456
	EM760-250G/280P-3	250/280	465/510

	EM760-280G/315P-3	280/315	520/573
	EM760-315G/355P-3	315/355	585/640
	EM760-355G/400P-3	355/400	650/715
	EM760-400G/450P-3	400/450	725/810
	EM760C-450G/500P-3	450/500	820/900
	EM760C-500G/560P-3	500/560	900/1010
	EM760C-560G/630P-3	560/630	1010/1140
Three-phase AC 520~690V	EM760-018G/022P-6B	18.5/22	25/28
	EM760-022G/030P-6B	22/30	28/35
	EM760-030G/037P-6B	30/37	35/42
	EM760-037G/045P-6B	37/45	42/52
	EM760-045G/055P-6B	45/55	52/63
	EM760-055G/075P-6B	55/75	63/86
	EM760-075G/090P-6B	75/90	86/95
	EM760-090G/110P-6	90/110	95/120
	EM760-110G/132P-6	110/132	120/147
	EM760-132G/160P-6	132/160	147/175
	EM760-160G/185P-6	160/185	175/200
	EM760-185G/200P-6	185/200	200/221
	EM760-200G/220P-6	200/220	221/235
	EM760-220G/250P-6	220/250	235/270
	EM760-250G/280P-6	250/280	270/300
	EM760-280G/315P-6	280/315	300/330
	EM760-315G/355P-6	315/355	330/380
	EM760-355G/400P-6	355/400	380/426
	EM760-400G/450P-6	400/450	426/465
	EM760-450G/500P-6	450/500	465/540

* Correct selection of the inverter: The rated output current of the inverter is greater than or equal to the rated current of the motor, taking into account the overload capacity.

* The difference between the rated power of the inverter and that of the motor is usually recommended not to exceed two power segments.

* When the rated power of the inverter is greater than that of the motor, the motor parameters must be entered accurately to prevent the motor from damage as a result of overload.

The technical specifications of the EM760 series inverter are shown below.

Table 1-2 Technical Specifications for EM760 Inverter Series

Item		Specification
Power supply	Rated voltage of power supply	Three-phase 340V-10%~460V+10% (three-phase 380V) Three-phase 520V-15%~690V+10% (three-phase 660V) 50-60Hz ±5%; voltage unbalance rate: <3%
Output	Maximum output voltage	The maximum output voltage is the same as the input power voltage.
	Rated output current	Continuous output of 100% rated current
	Maximum overload current	G model: 150% rated current for 60s P model: 120% rated current for 60s (2kHz carrier; please derate for carriers above this level)
Basic control functions	Driving mode	V/F control (VVF) Speed sensorless vector control (SVC); Speed sensor vector control (FVC)
	Input mode	Frequency (speed) input, torque input
	Start and stop control mode	Keyboard, control terminal (two-line control and three-line control), communication
	Frequency control range	0.00~600.00Hz/0.0~3000.0Hz
	Input frequency resolution	Digital input: 0.01Hz Analog input: 0.1% of maximum frequency
	Speed control range	1:50 (VVF), 1:200 (SVC), 1:1000 (FVC)
	Speed control accuracy	±0.5% (VVF), ±0.2% (SVC), ±0.02% (FVC)
	Acceleration and deceleration time	0.01 s to 600.00 s / 0.1 s to 6,000.0 s / 1 s to 60,000 s
	Voltage/frequency characteristics	Rated output voltage: 20% to 100%, adjustable; fundamental frequency: 1Hz to 600Hz/3000Hz, adjustable
	Torque boost	Fixed torque boost curve, any V/F curve optional
	Starting torque	150%/3Hz (VVF), 150%/0.25Hz (SVC), 180%/0Hz (FVC)
	Torque control accuracy	±5% rated torque (SVC), ±3% rated torque (FVC)
	Self-adjustment of output voltage	When the input voltage changes, the output voltage will basically remain unchanged.
	Automatic current limit	Output current is automatically limited to avoid frequent overcurrent trips.
	DC braking	Braking frequency: 0.01 to maximum frequency Braking time: 0~30S Braking current: 0% to 150% rated current
	Signal input source	Communication, multi-speed, analog, high-speed pulse, etc.

Input and output function	Reference power supply	10.5V±0.5V/20mA
	Terminal control power	24V/200mA
	Digital input terminal	7 (standard X1 to X7) + 3 (extension card X8 to X10) digital multi-function inputs: X7 can be used as a high-speed pulse input terminal (F02.06 = 35/38/40); The remaining 9 channels (X1 to X6 and X8 to X10) can only be used as ordinary digital input terminals.
	Analog input terminal	3 (standard AI1 to AI3) + 1 (extension card AI4) analog inputs: One AI1: support 0 to 10V or -10 to 10V, optional through function code F02.62; Two AI2/AI3: support 0 to 10V or 0 to 20mA or 4 to 20mA, optional through function codes F02.63 and F02.64; One AI4: support 0 to 10V or -10 to 10V, optional through function code F02.65
	Digital output terminal	2 (standard Y1/Y2) open-collector multi-function outputs + 2 (R1: EA/EB/EC and R2: RA/RB/RC) relay multi-function outputs + 2 (extension card) (R3: RA3/RC3 andR4: RA4/RC4) relay multi-function outputs, max. current 50 mA for collector output; Relay contact capacity 250VAC/3A or 30VDC/1A, with EA-EC and RA-RC normally open, EB-EC and RB-RC normally closed; RA3-RC3, RA4-RC4 normally open
	Analog output terminal	Two (M1/M2) multi-function analog output terminals, with output of 0 to 10V or 0 to 20mA or 4 to 20mA, optional for selection by using function codes F03.34 and F03.35
Operation panel	LCD display	The standard LCD displays relevant information about the inverter.
	Parameter copying	Parameter settings of the inverter can be uploaded and downloaded for fast parameter copying.
Protection	Protective Function	Short circuit, overcurrent, overvoltage, undervoltage, phase loss, overload, overheat, overspeed, load loss, external fault, etc.
Use conditions	Location	Indoor, at an altitude of less than 1 km, free of dust, corrosive gases and direct sunlight
	Applicable environment	-10℃ to +50℃, derating by 5% per 1℃ increase above 40℃, 20% to 90%RH (non-condensing)
	Vibration	Less than 0.5g
	Storage environment	-40℃~+70℃
	Installation method	Wall-mounted, floor-standing electrical control cabinet, through-wall
Protection level		Standard IP21/IP20 (remove the plastic cover at the top of the plastic case)
Cooling method		Forced air cooling

1.2 Detailed Introduction to Running Status of EM760 series Inverter

1.2.1 Working status of inverter

The working status of EM760 series inverter is divided into: parameter setting status, normal running status, jog running status, self-learning running status, stop status, jog stop status and protection status.

- Parameter setting status: After being powered on and initialized, the inverter will be in the standby status with no trip protection or start command, and have no output.
- Normal running status: Upon receiving a valid start command (from the keyboard, control terminal and communication), the inverter will have the output based on the set input requirements, driving the motor to rotate.
- Jog running status: This is enabled by the keyboard, external terminal or communication, driving the motor to rotate at the jog input speed.
- Self-learning running status: This is enabled by the keyboard, detecting relevant parameters of the motor in the stationary or rotating status.
- Stop status: It is a process for the output frequency to decrease to zero according to the set deceleration time in the case of invalid operating commands.
- Jog stop status: It is a process for the output frequency to decrease to zero according to the jog deceleration time in the case of invalid jog operating commands.
- Protection status: Refer to the inverter status in the case of any protection.

1.2.2 Running mode of inverter

The running mode of the inverter refers to the control law of the inverter to drive the motor to rotate at the required speed and torque. The running mode includes:

- General open-loop space vector control - VVF control: suitable for applications where the speed is not changing fast and there are not high requirements for the accuracy of rotating speed, and most AC motor drives.
- Speed sensorless vector control-SVC control: advanced speed estimation algorithm, involving open-loop vector control and high control accuracy but no encoder.

Chapter 2 **Installation**

2.1 Product check

Danger
● **Never install the inverter damaged or with some parts missing.** Otherwise, injuries maybe caused.

When you receive the product, please check it against the table below.

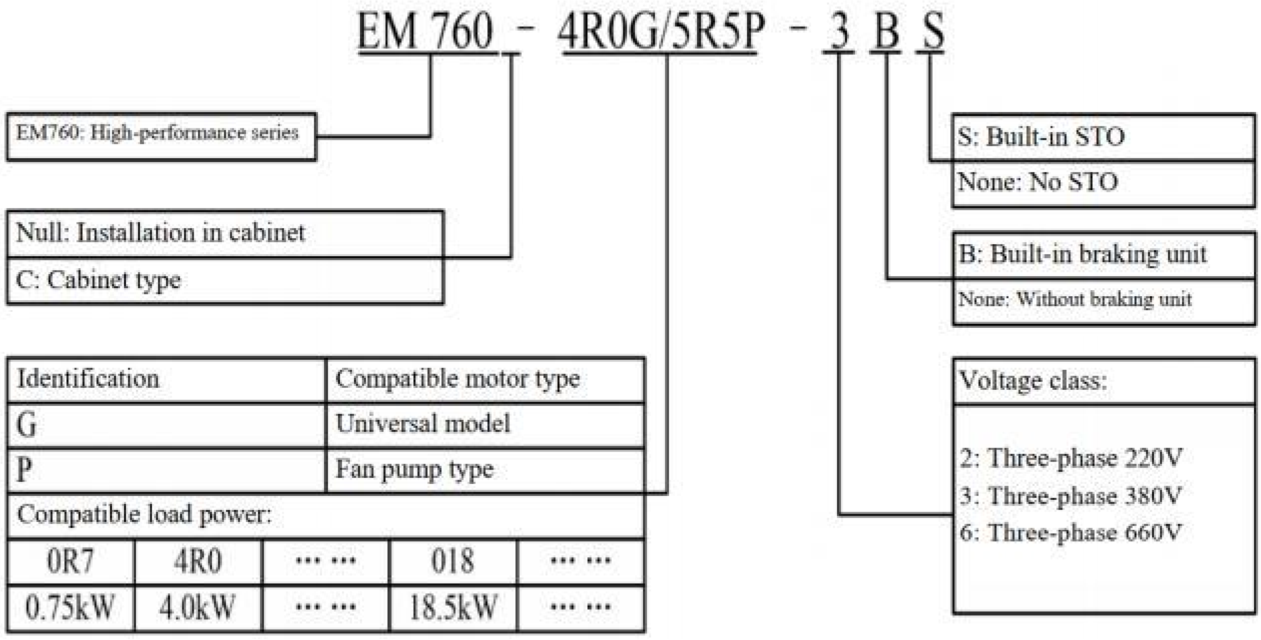
Table 2-1 Item to be confirmed

Item to be confirmed	Confirming methods
Check whether the product is consistent with the order.	Check the nameplate on the side face of the inverter.
Check whether any part is damaged.	Check the overall appearance for damage caused in transportation.
Check whether the fastened parts (e.g. screws) are loose.	If necessary, check the product with a screwdriver.

In the case of any defect, contact the agent or our Marketing Department.

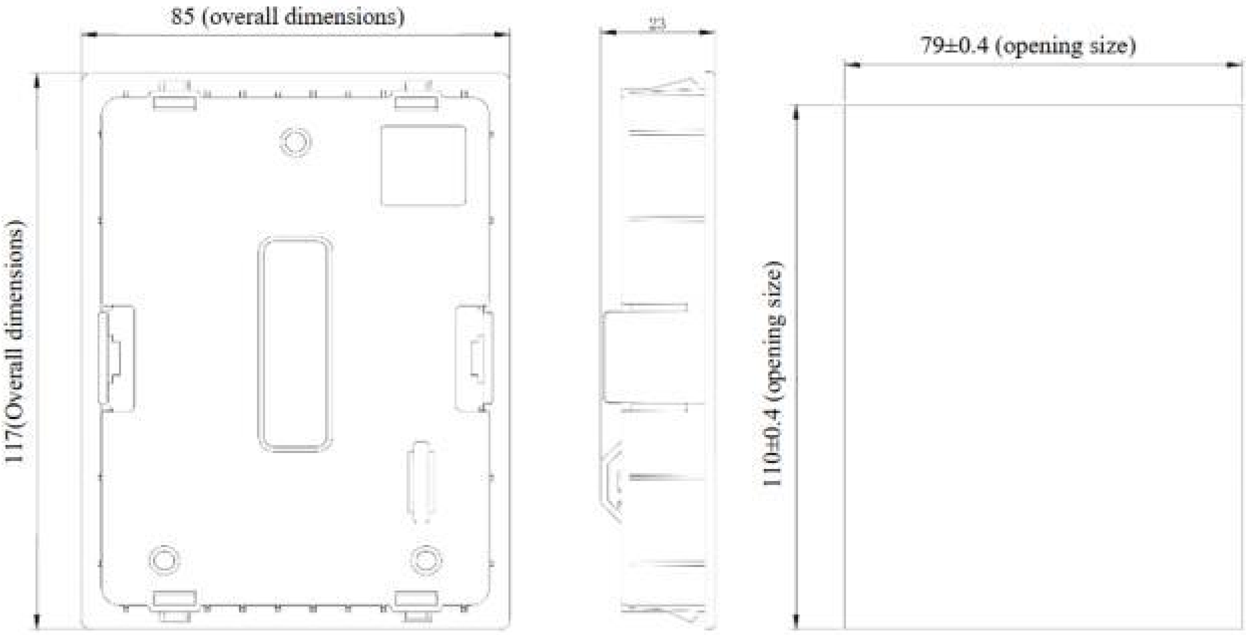
- **Nameplate**

- **Description of inverter model**



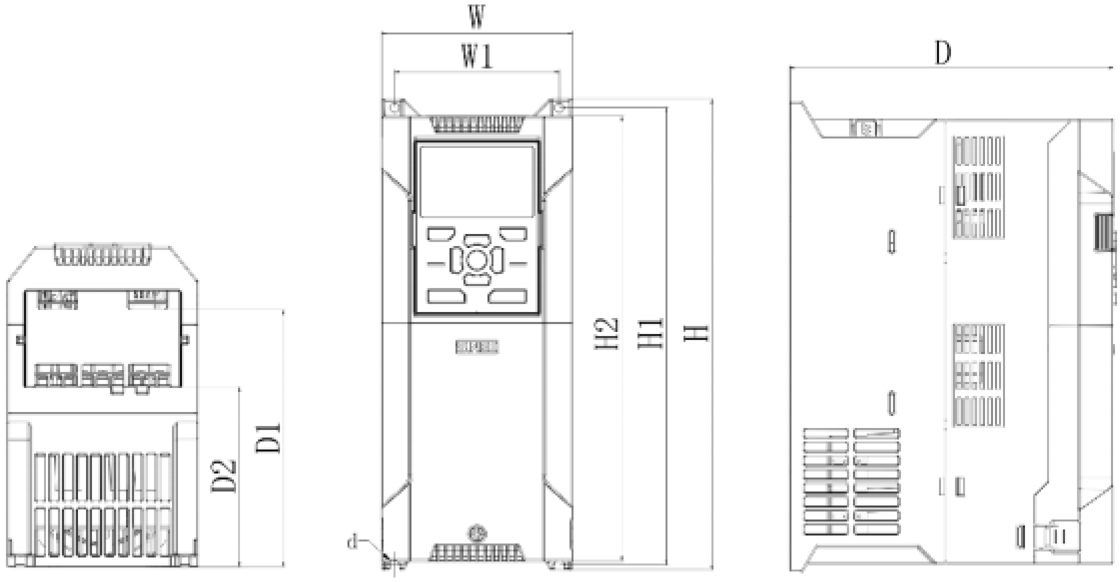
2.2 Outline dimensions and installation dimensions

EM760 inverters have 3 types of appearance and 13 installation sizes, and may be connected with external keyboards and trays. As shown in the picture and table below.

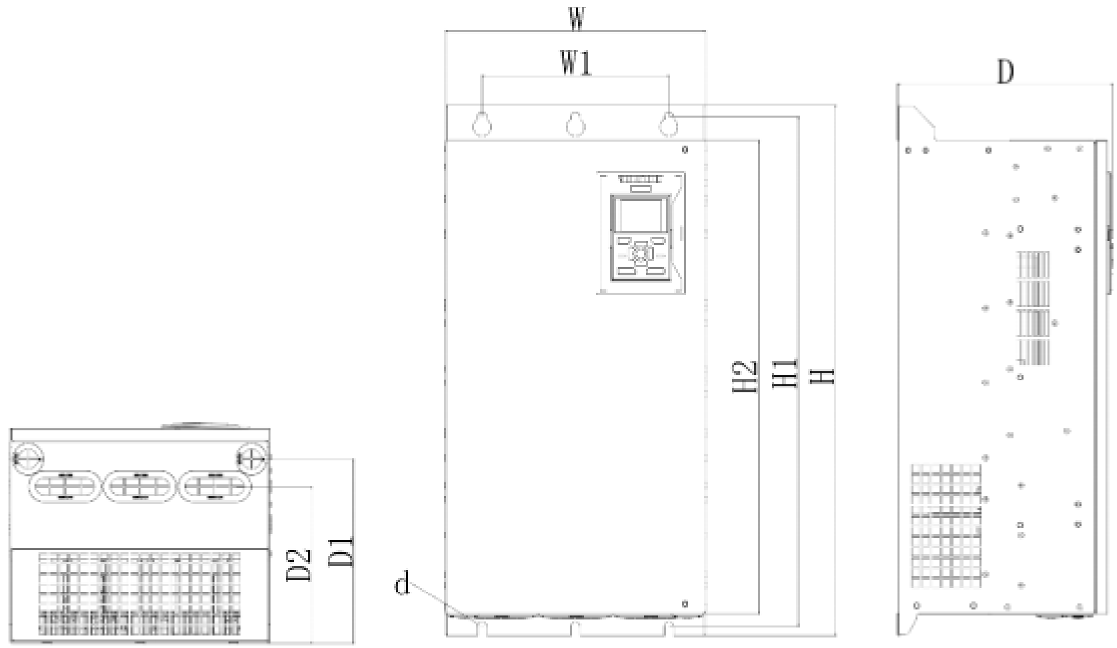


reference size of keyboard bracket opening

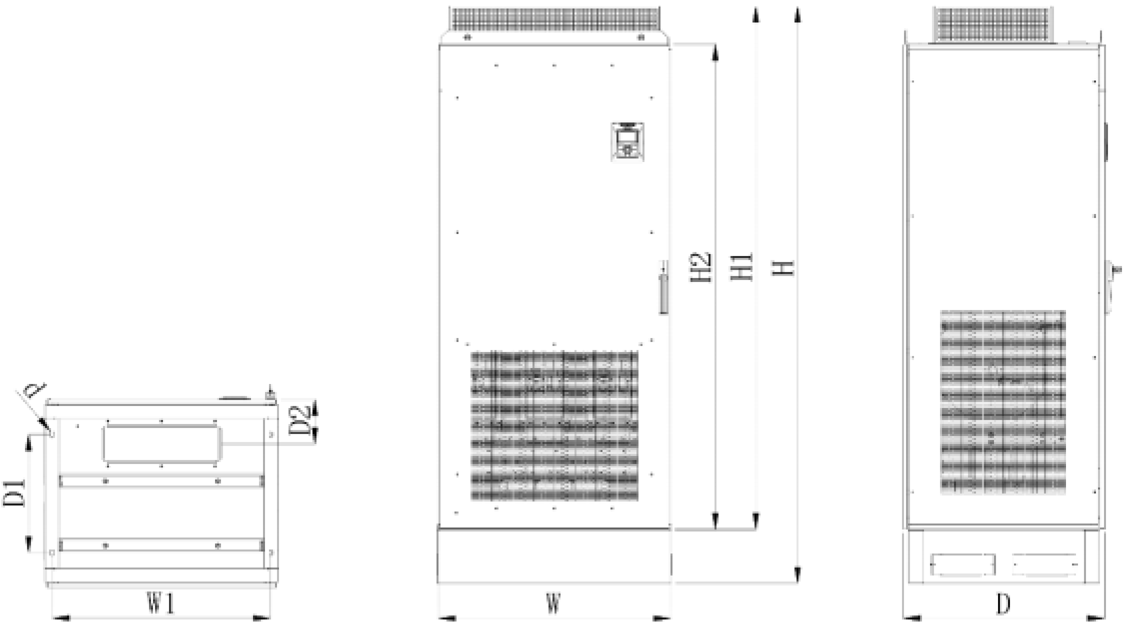
(a) Dimension of keyboard tray



(b) Appearance of 380V 0R7G/1R5P~022G/030P inverter



(c) Appearance of 380V 030G/037P~400G/450P, 660V 018G/022P~450G/500P inverter



(d) Appearance of 380V 450G/500P~560G/630P inverter

Fig. 2-1 Overall dimensions of EM760 Series Keyboard and Inverter

Table 2-2 Outer and installation dimensions of EM760 inverters

Specifications	W	W1	H	H1	H2	D	D1	D2	d	Appearance
EM760-0R7G/1R5P-3B	95	82	230	222	218	171	132	96	4.5	(b)
EM760-1R5G/2R2P-3B										
EM760-2R2G/3R0P-3B										
EM760-4R0G/5R5P-3B										
EM760-5R5G/7R5P-3B	110	95	275	267	260	187	146	105	5.5	
EM760-7R5G/9R0P-3B										
EM760-011G/015P-3B	140	124	297	289	280	207	163	120	5.5	
EM760-015G/018P-3B										
EM760-018G/022P-3B	190	171	350	340	330	220	173	128	7	
EM760-022G/030P-3B										
EM760-030G/037P-3/3B	254	200	484	465	440	221	180.5	158	9.5	(c)
EM760-037G/045P-3/3B										
EM760-018G/022P-6B										

EM760-022G/030P-6B										
EM760-030G/037P-6B										
EM760-045G/055P-3/3B	304	240	548	524	480	266	225	193	9.5	
EM760-055G/075P-3/3B										
EM760-037G/045P-6B										
EM760-045G/055P-6B										
EM760-055G/075P-6B										
EM760-075G/090P-3/3B	324	230	635	613	570	264	223	190	11.5	
EM760-075G/090P-6B										
EM760-090G/110P-6										
EM760-090G/110P-3	339	270	621	600	578	296	243	243	11.5	
EM760-110G/132P-3										
EM760-110G/132P-6										
EM760-132G/160P-6										
EM760-132G/160P-3	422	320	786	758	709	335	270	256	11.5	
EM760-160G/185P-3										
EM760-160G/185P-6										
EM760-185G/200P-6										
EM760-200G/220P-6										
EM760-200G/220P-3	441	320	1025	989	942	358	/	285	11.5	
EM760-220G/250P-3										
EM760-220G/250P-6										
EM760-250G/280P-6										
EM760-280G/315P-6										
EM760-250G/280P-3	560	450	1204	1171	1100	404	/	333	13	
EM760-280G/315P-3										
EM760-315G/355P-6										
EM760-355G/400P-6										
EM760-315G/355P-3	660	443	1597	1567	1504	434	375.5	323.5	13	
EM760-355G/400P-3										
EM760-400G/450P-3										

EM760-400G/450P-6										
EM760-450G/500P-6										
EM760C-450G/500P-3										
EM760C-500G/560P-3	805	756	2145	1945	1804	700	440	165	13	(d)
EM760C-560G/630P-3										

2.3 Installation Site Requirements and Management

Attention

1. **When carrying the inverter, hold its bottom.**
   If you hold the panel only, the body main fall to hit your feet.
2. **Install the inverter on non-flammable boards (e.g. metal).**
   If the inverter is installed on a flammable object, a fire may occur.
3. **When two or more inverters are installed in one control cabinet, please install a cooling fan and keep the air temperature below 50℃ at the air inlet.**
   Overheating may cause fire and other accidents.

2.3.1 Installation site

The installation site should meet the following conditions:

1. The room is well ventilated.
2. The ambient temperature should be -10°C to 50°C. When the plastic case is used at the ambient temperature above 40°C, remove the top baffle.
3. The controller should be free from high temperature and humidity (less than 90% RH) or rainwater and other liquid droplets.
4. Please install the inverter on a fire-retardant object (e.g. metal). Never install it on flammable objects (e.g. wood).
5. No direct sunlight.
6. There should be no flammable or corrosive gas and liquid.
7. There should be no dust, oily dust, floating fibers or metal particles.
8. The installation foundation should be secured and vibration-free.
9, Avoid electromagnetic interference and keep the controller away from interference sources.

2.3.2 Environment temperature

In order to improve the operational reliability, please install the inverter in a well-ventilated place. When it is used in a closed cabinet, a cooling fan or cooling air conditioner should be installed to keep the ambient temperature below 50°C.

2.3.3 Preventive measures

Take protective measures to the inverter during installation to prevent metal fragments or dust generated in drilling and other processes from falling into the inverter. Remove the protection after installation.

2.3.4 Installation Direction and Space

The EM760 inverters are equipped with cooling fans for forced air cooling. To ensure good cyclic cooling effects, the inverter must be installed in a vertical direction, and sufficient spaces must be reserved between the inverter and adjacent objects or baffles (walls). Refer to Fig. 2-2.

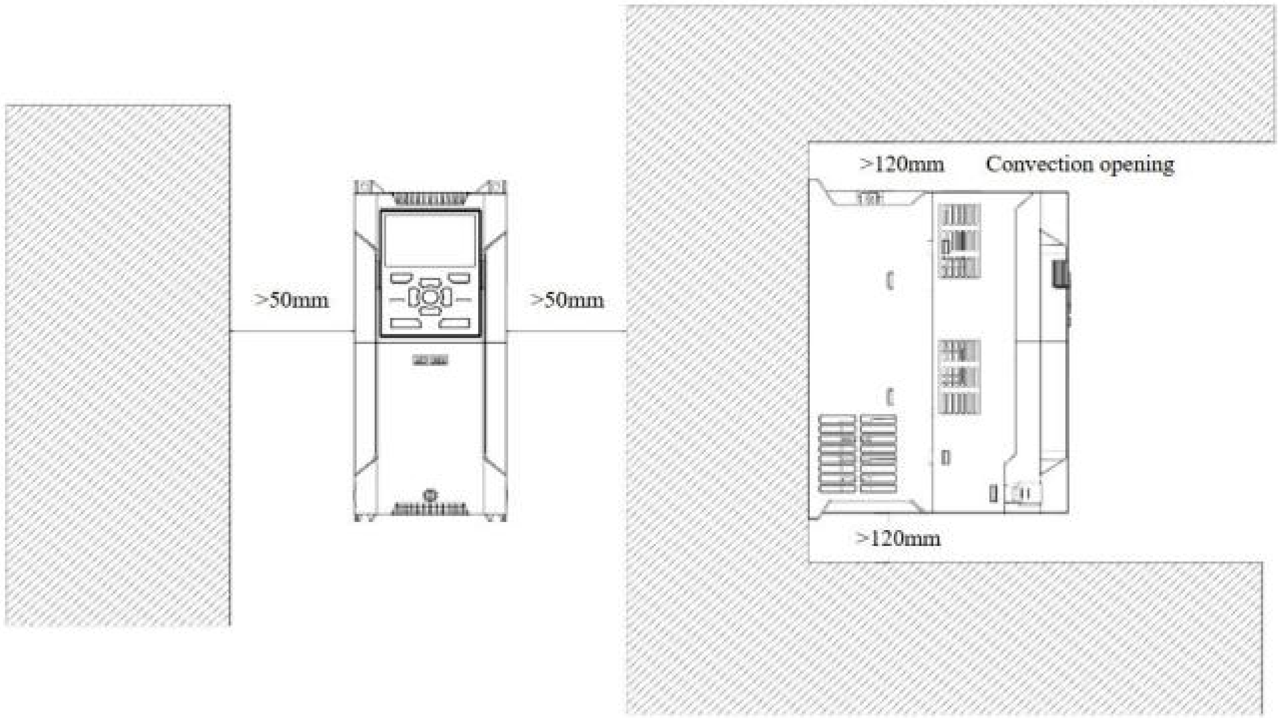


Fig. 2-2 Inverter installation direction and space

2.4 Panel removal and installation

Wiring of the main circuit, control circuit and expansion card for the EM760 Series requires removal of the top cover. When wiring is completed, install the wiring ducts and top cover in the reverse order of removal.

(1) EM760 380V series 0R7G/1R5P~022G/030P panel removal

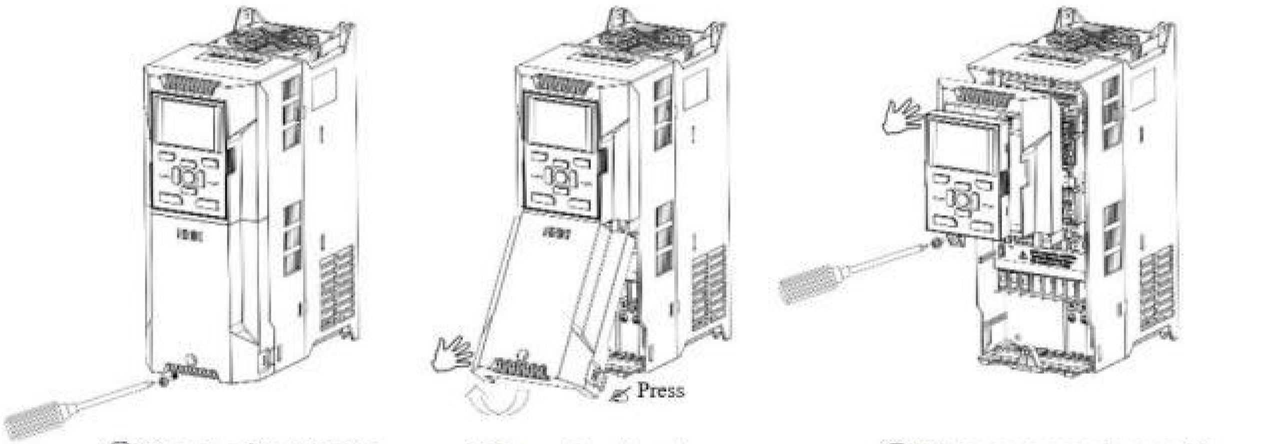


Fig. 2-3 Illustration of 380V 0R7G/1R5P~022G/030P panel removal

(2) Removal of EM760 380V series 030G/037P~400G/450P and 660V 075G/090P~450G/500P top cover

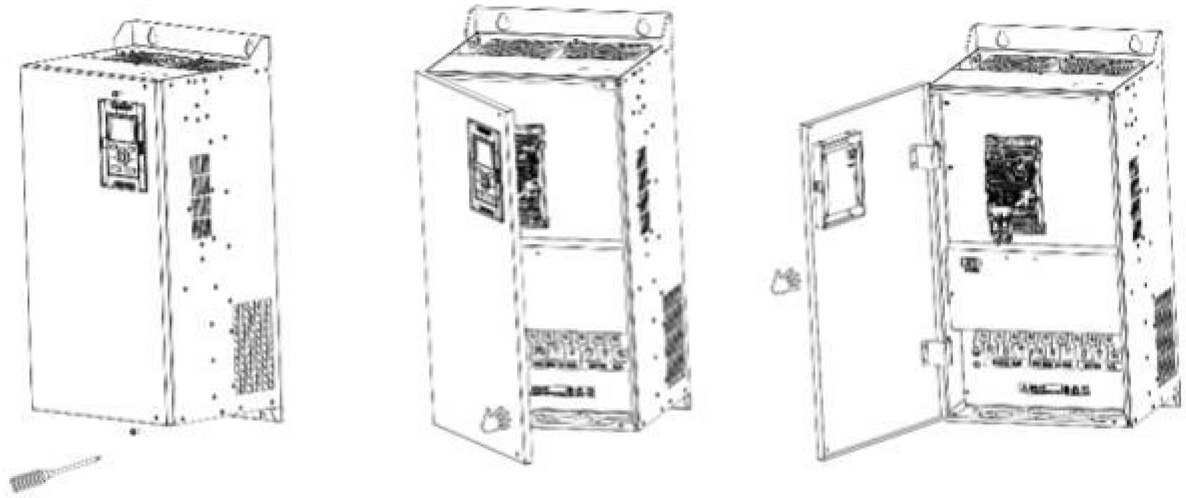


Fig. 2-4 Illustration of 380V 030G/037P~400G/450P and 660V 075G/090P~450G/500P panel removal

(3) Removal of EM760 660V 018G/022P~055G/075P top cover

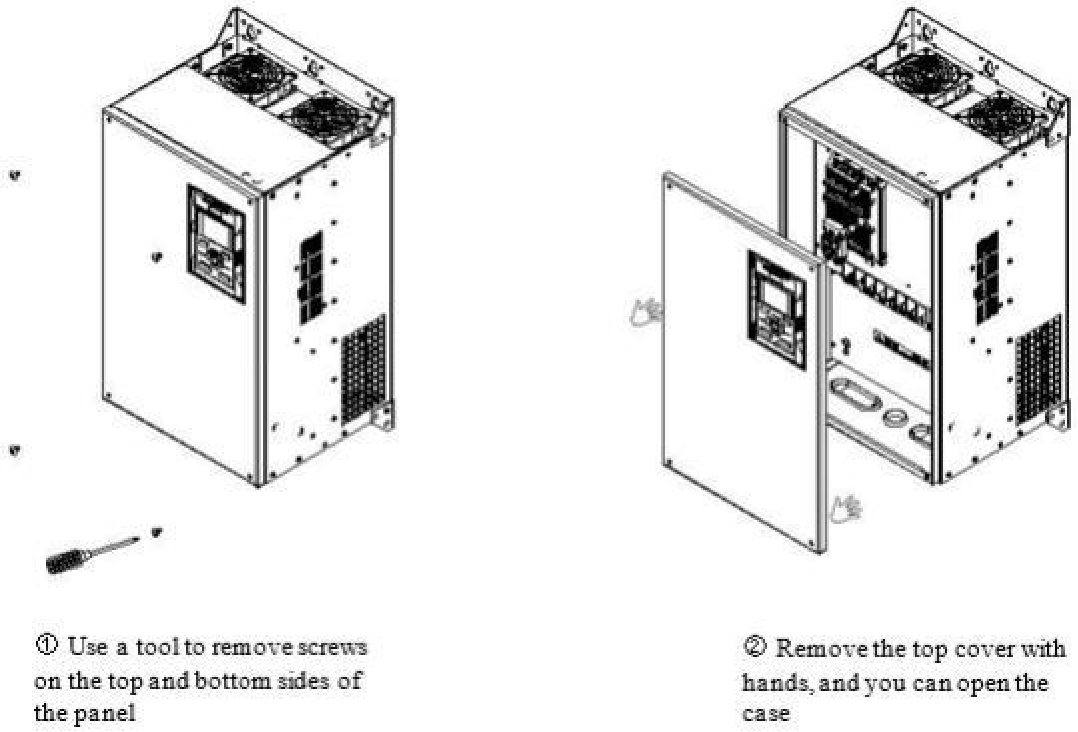


Fig. 2-5 Illustration of 660V 018G/022P~055G/075P panel removal

2.5 Through-wall installation

EM760 series 380V 0R7G/1R5P~160G/185P and 660V 018 G/022P~200G/220P support through-wall installation, which can realize dissipating 70% of the total heat generated out of the device (cabinet), so as to reduce heat accumulation. Besides, through-wall installation may also prevent entry of wood chips, paper scraps, dust, metal dust and other debris into the inverter and improve reliability of the inverter.

The bracket for through-wall installation is available as an optional part for purchase. If it is needed, please contact us.

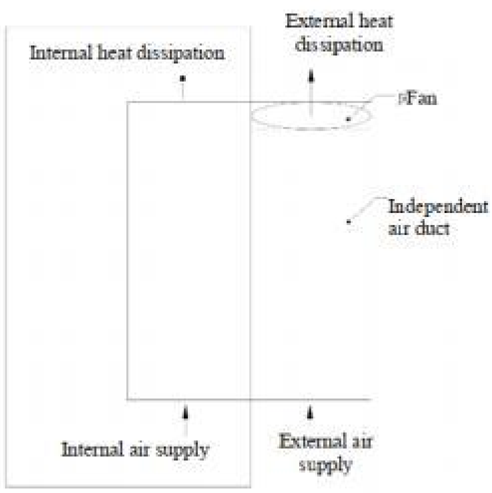


Fig. 2-5 Through-wall installation

Table 2-3 Number of screws and opening dimension for EM760 series 0R7G/1R5P~160G/185P through-wall installation

Frequency converter model	Bracket installation screws	Through-wall installation screws	Opening size (L×W)
EM760-0R7G/1R5P~4R0G/5R5P-3B	2×M4	6×M6	235mm×100mm
EM760-5R5G/7R5P~7R5G/9R0P-3B	2×M4	6×M6	280mm×115mm
EM760-011G/015P~015G/018P-3B	2×M4	6×M6	300mm×145mm
EM760-018G/022P~022G/030P-3B	4×M4	6×M6	355mm×195mm
EM760-030G/037P~037G/045P-3/3B EM760-018G/022P~030G/037P-6B	14×M5	6×M8	500mm×265mm
EM760-045G/055P~055G/075P-3/3B EM760-037G/045P~055G/075P-6B	14×M5	6×M8	550mm×320mm
EM760-075G/090P-3/3B EM760-075G/090P~090G/110P-6/6B	14×M5	6×M10	645mm×340mm
EM760-090G/110P~110G/132P-3 EM760-110G/132P~132G/160P-6	14×M5	6×M10	630mm×350mm
EM760-132G/160P~160G/185P-3 EM760-160G/185P~200G/220P-6	13×M6	6×M10	715mm×440mm

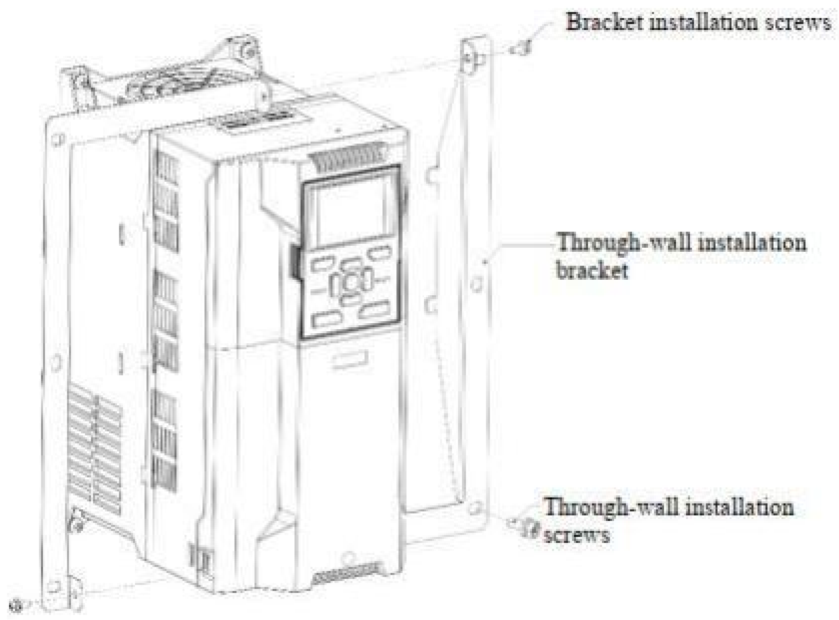


Fig. 2-6 Through-wall installation diagram of 380V 0R7G/1R5P~022G/030P

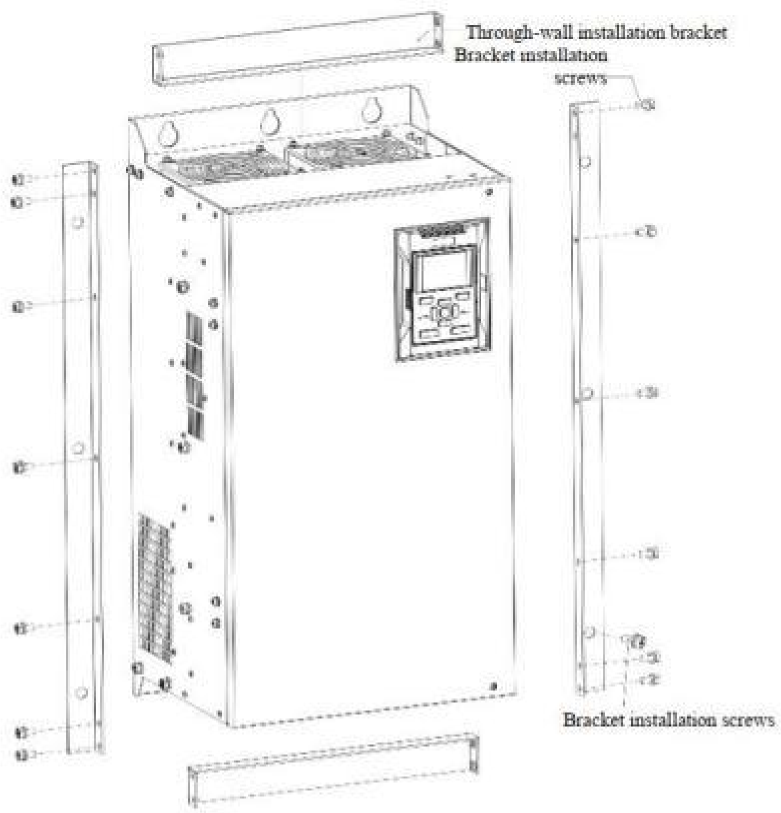


Fig. 2-7 Through-wall installation diagram of 380V 030G/037P~110G/132P and 660V 018G/022P~132G/160P

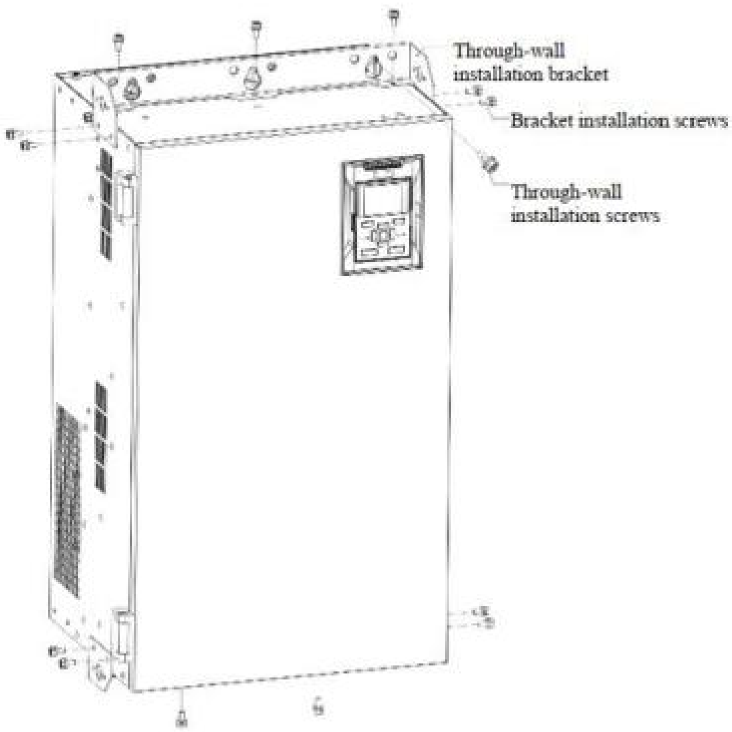


Fig. 2-8 Through-wall installation diagram of 380V 132G/160P~160G/185P and 660V 160G/185P~200G/220P-6

2.6 Introduction of components

Components of EM760 4.0kW_560kW

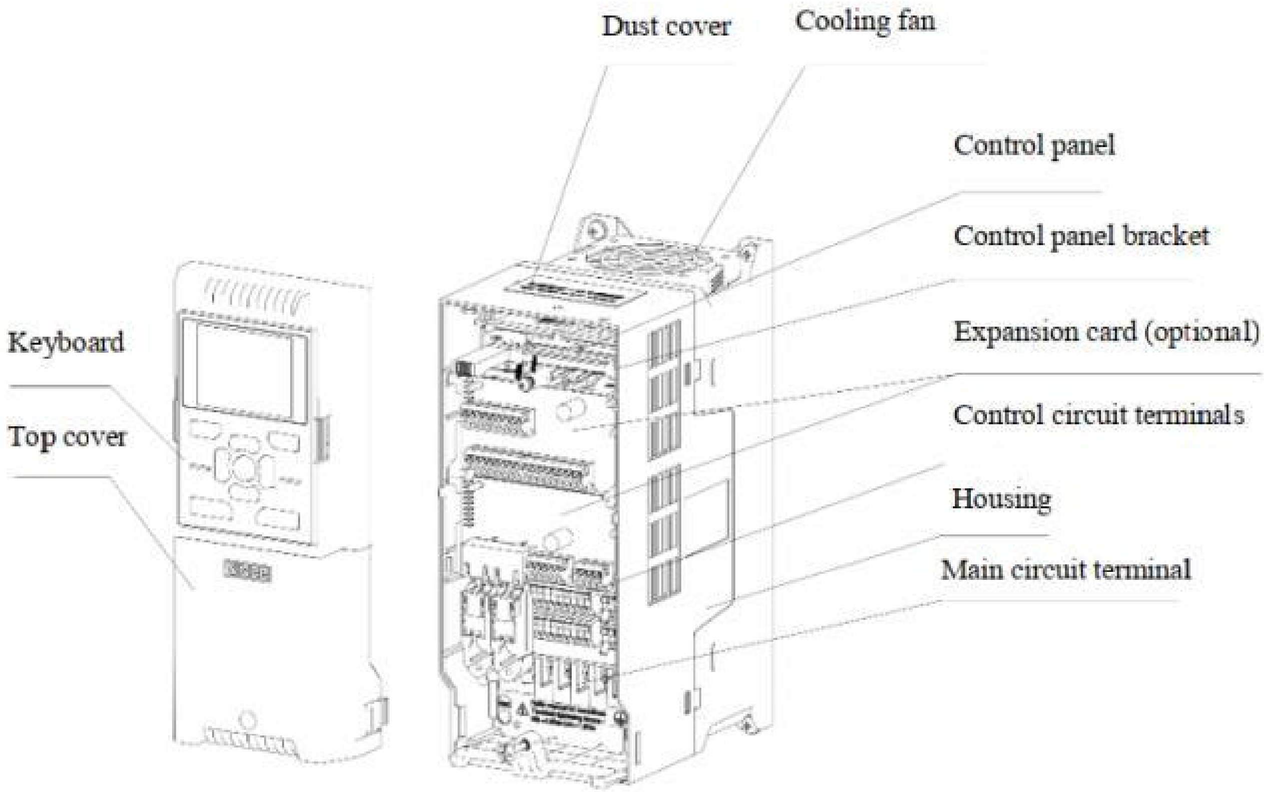


Fig. 2-9 Components of 380V 0R7G/1R5P~4R0G/5R5P inverter

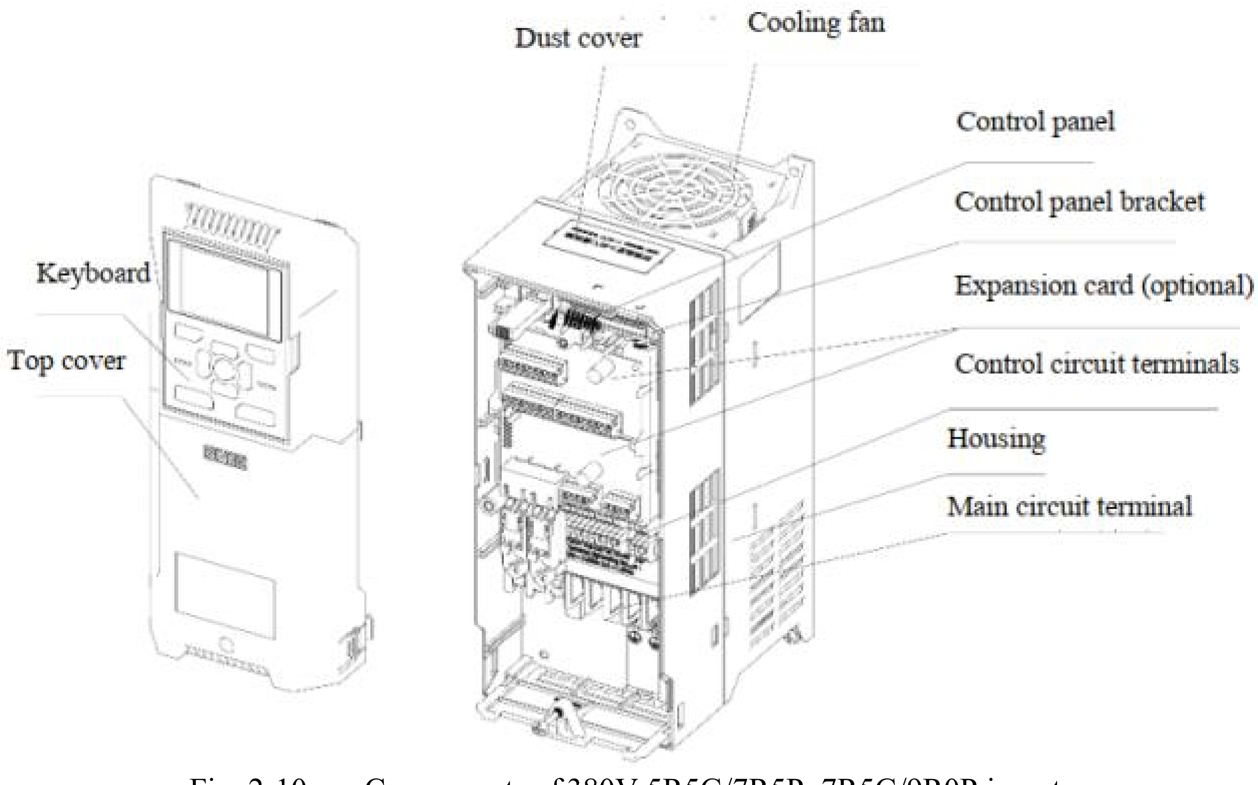


Fig. 2-10 Components of 380V 5R5G/7R5P~7R5G/9R0P inverter

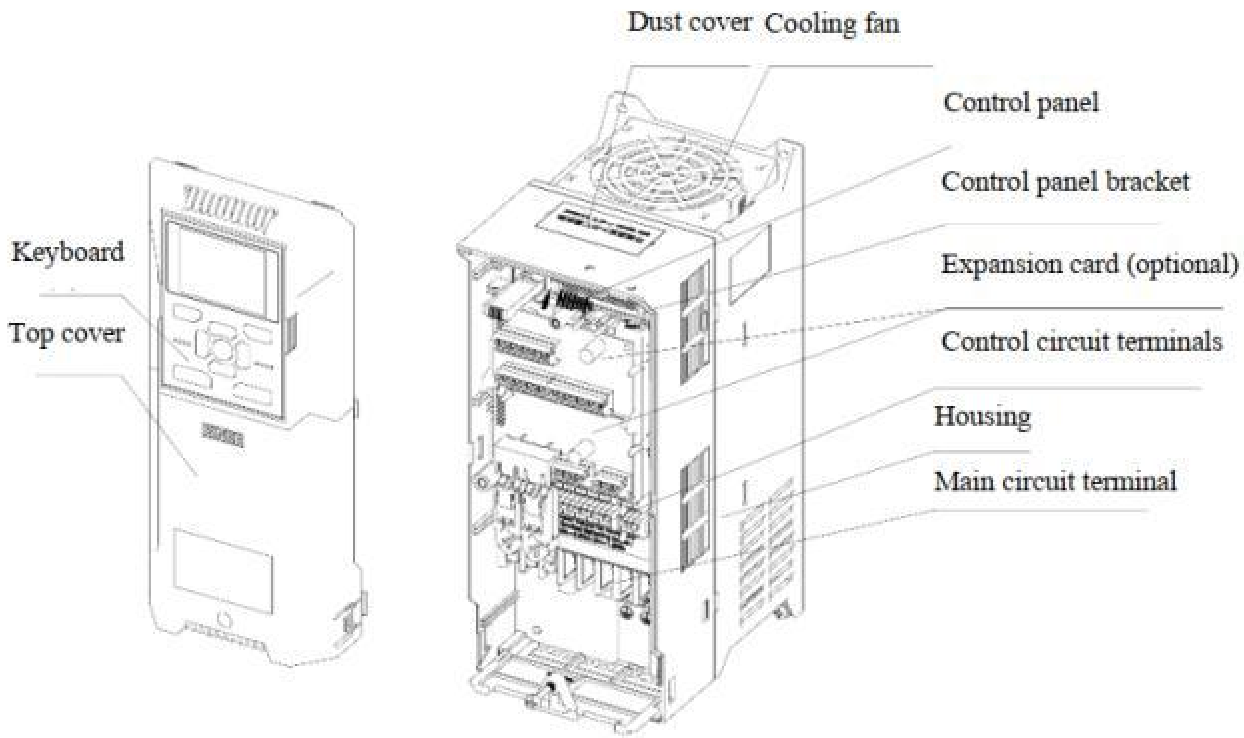


Fig. 2-11 Components of 380V 011G/015P~015G/018P inverter

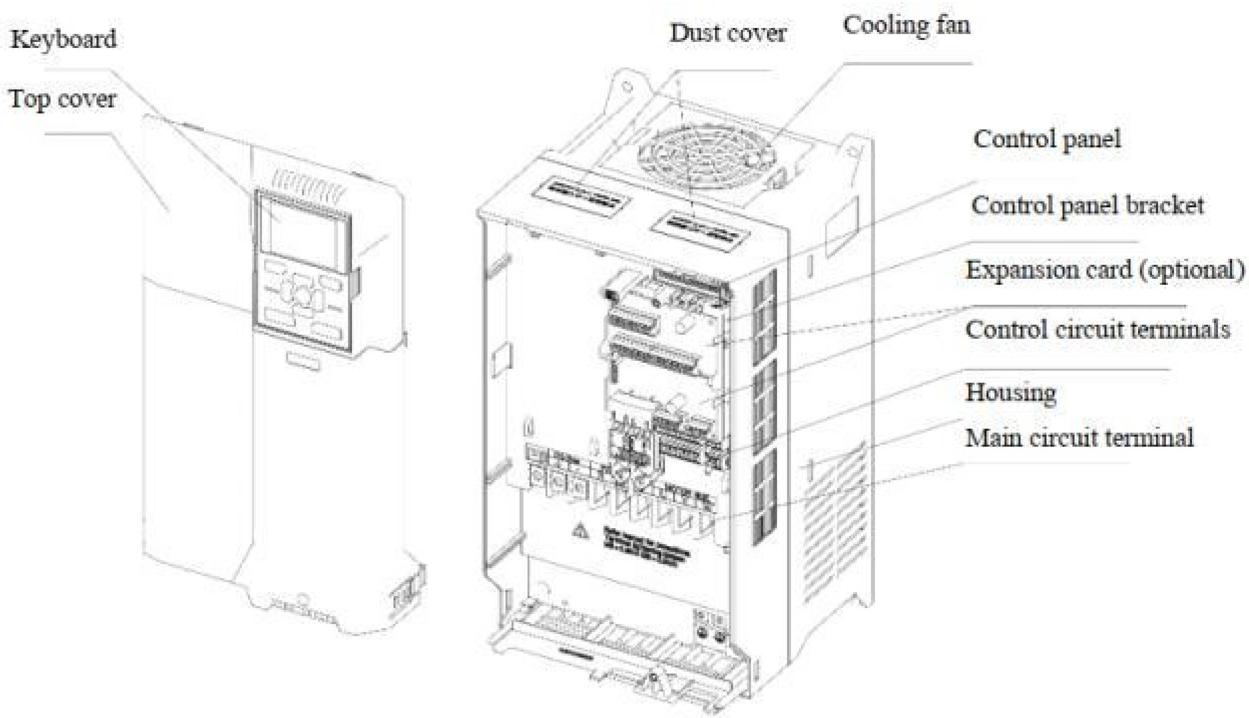


Fig. 2-12 Components of 380V 018G/022P~022G/030P inverter

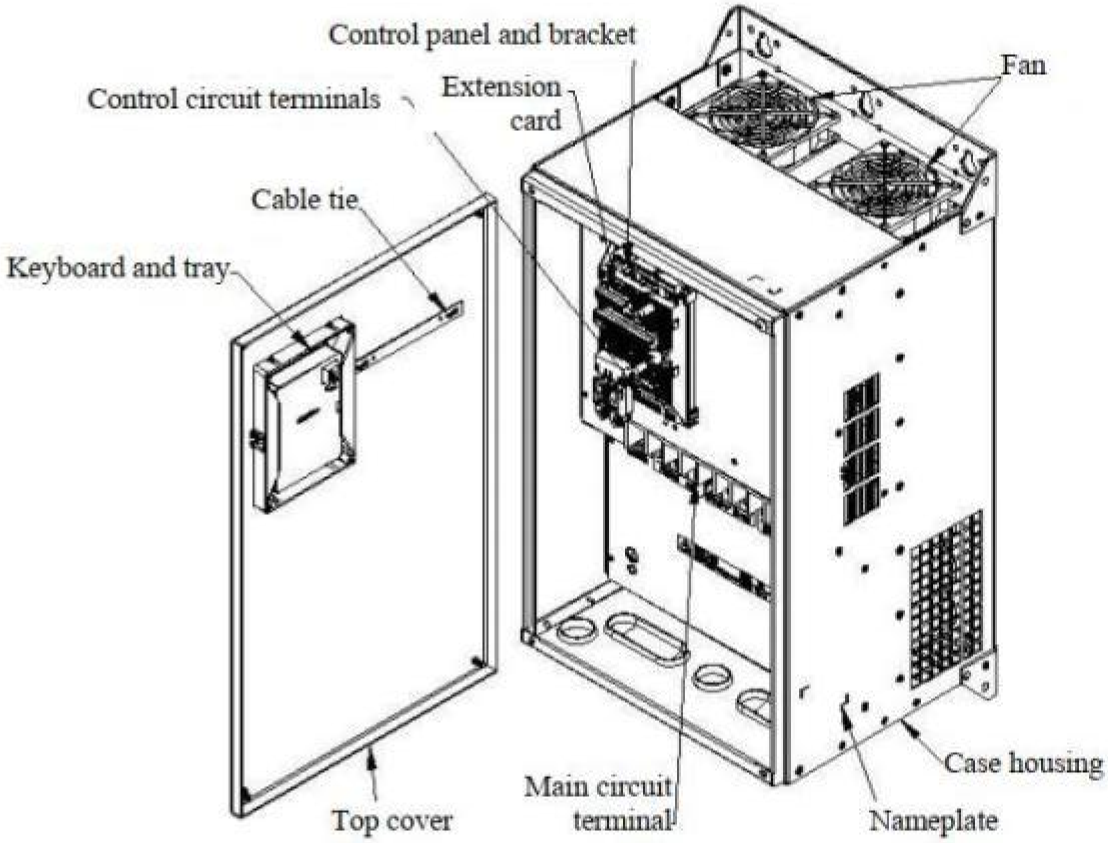


Fig. 2-13 Components of 380V 030G/037P~037G/045P and 660V 018G/022P~030G/037P inverters

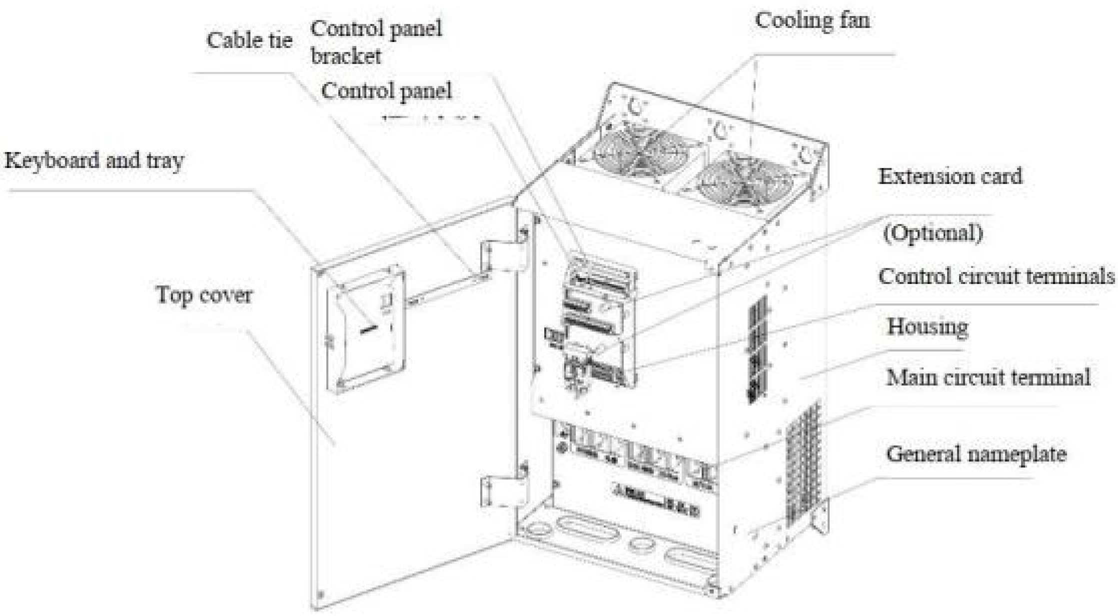


Fig. 2-14 Components of 380V 045G/055P~055G/075P and 660V 037G/045P~055G/075P inverters

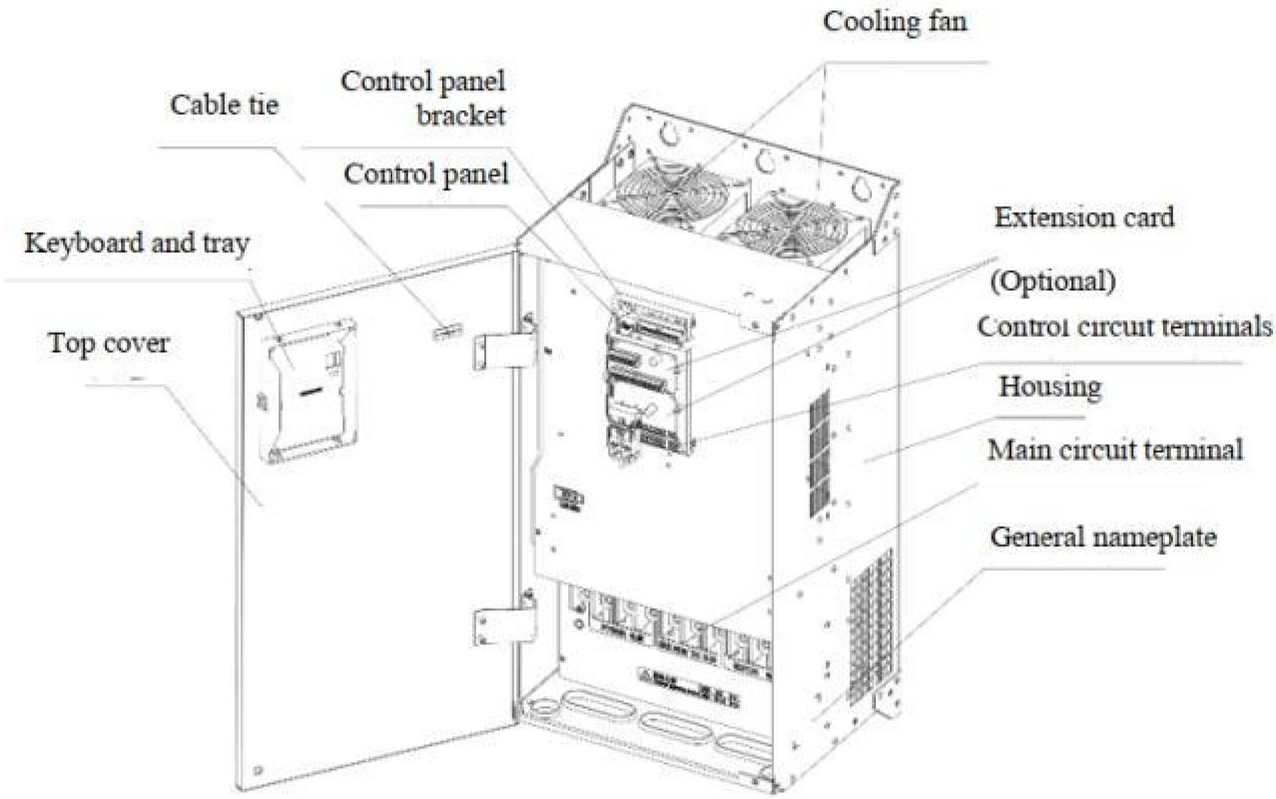


Fig. 2-15 Components of 380V 075G/090P and 660V 075G/090P~090G/110P inverters

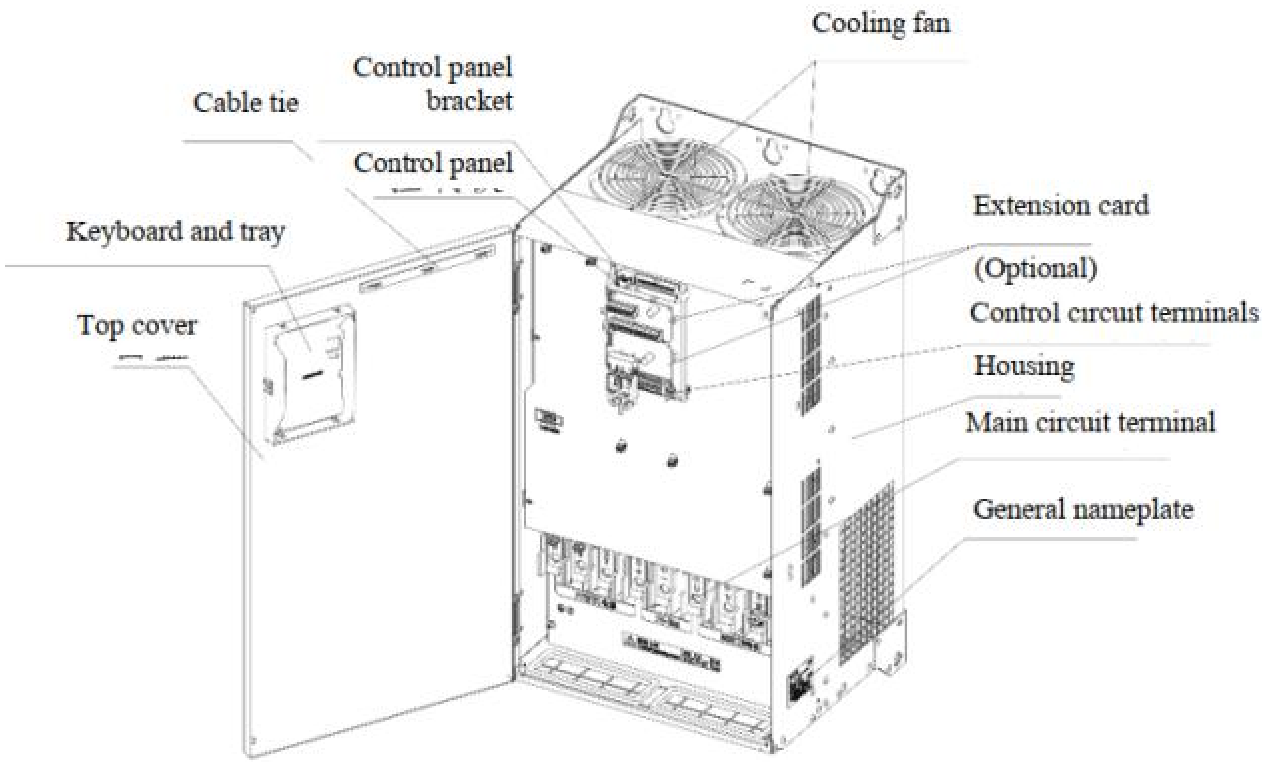


Fig. 2-16 Components of 380V 090G/110P~110G/132P and 660V 110G/132P~132G/160P inverters

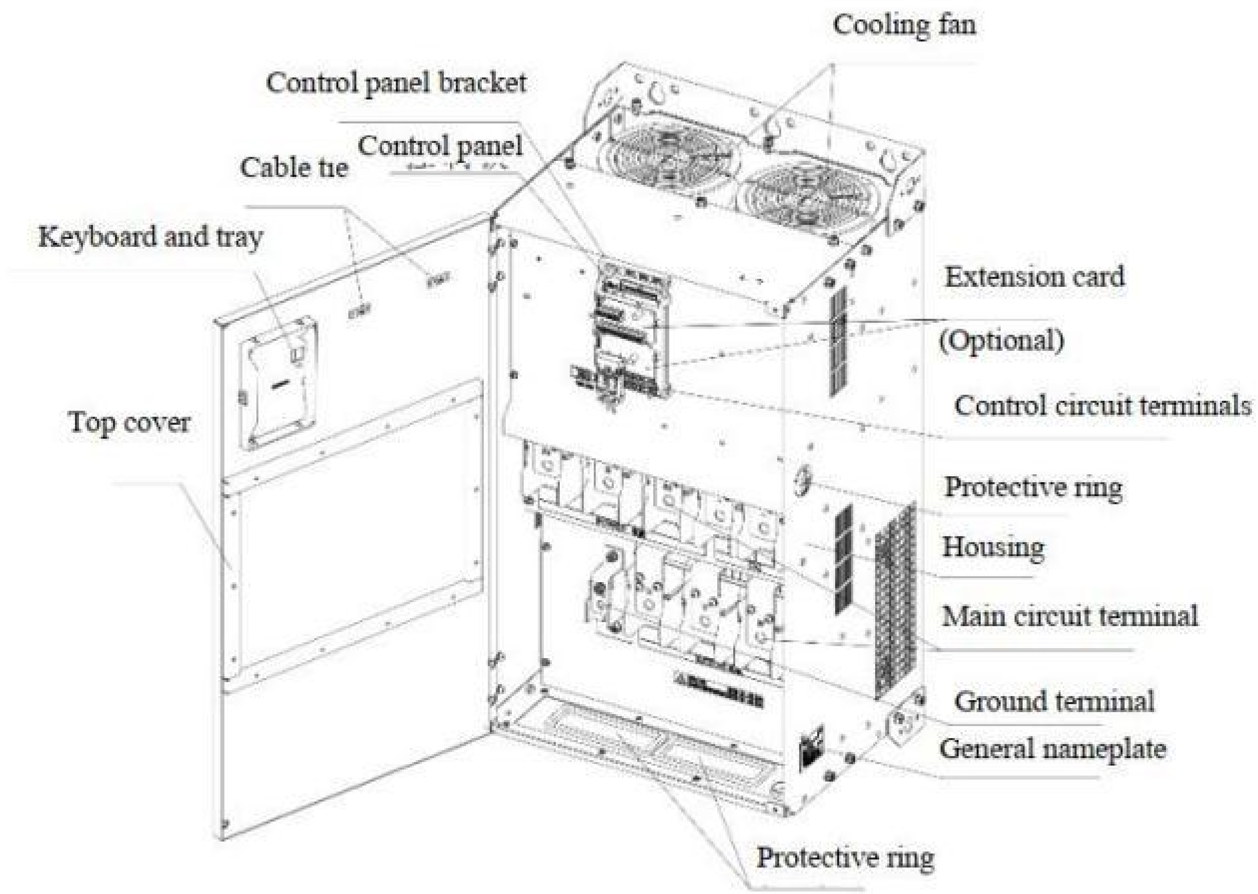


Fig. 2-17 Components of 380V 132G/160P~160G/185P and 660V 160G/185P~200G/220P inverters

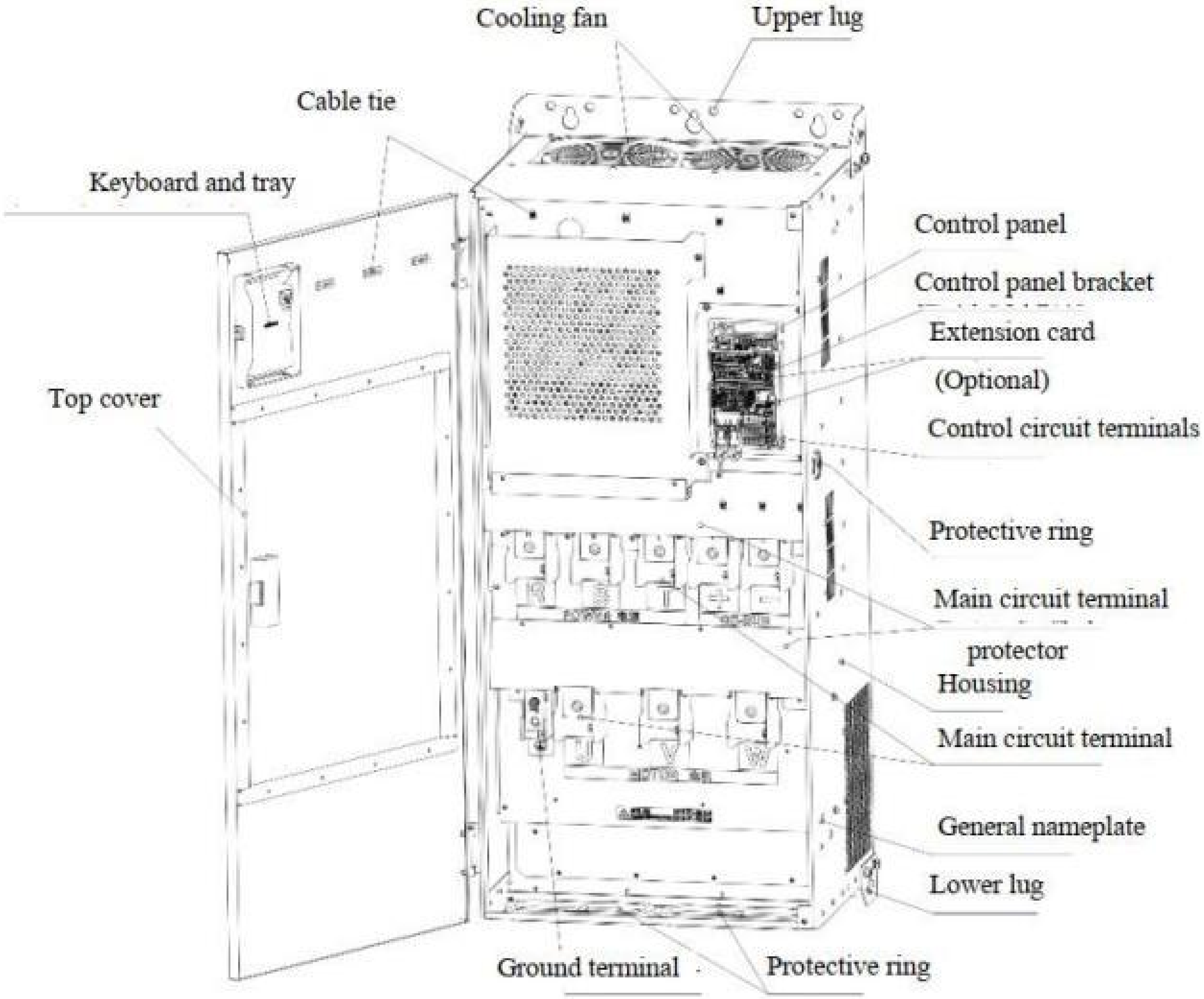


Fig. 2-18 Components of 380V 200G/220P~220G/250P and 660V 220G/250P~280G/315P inverters

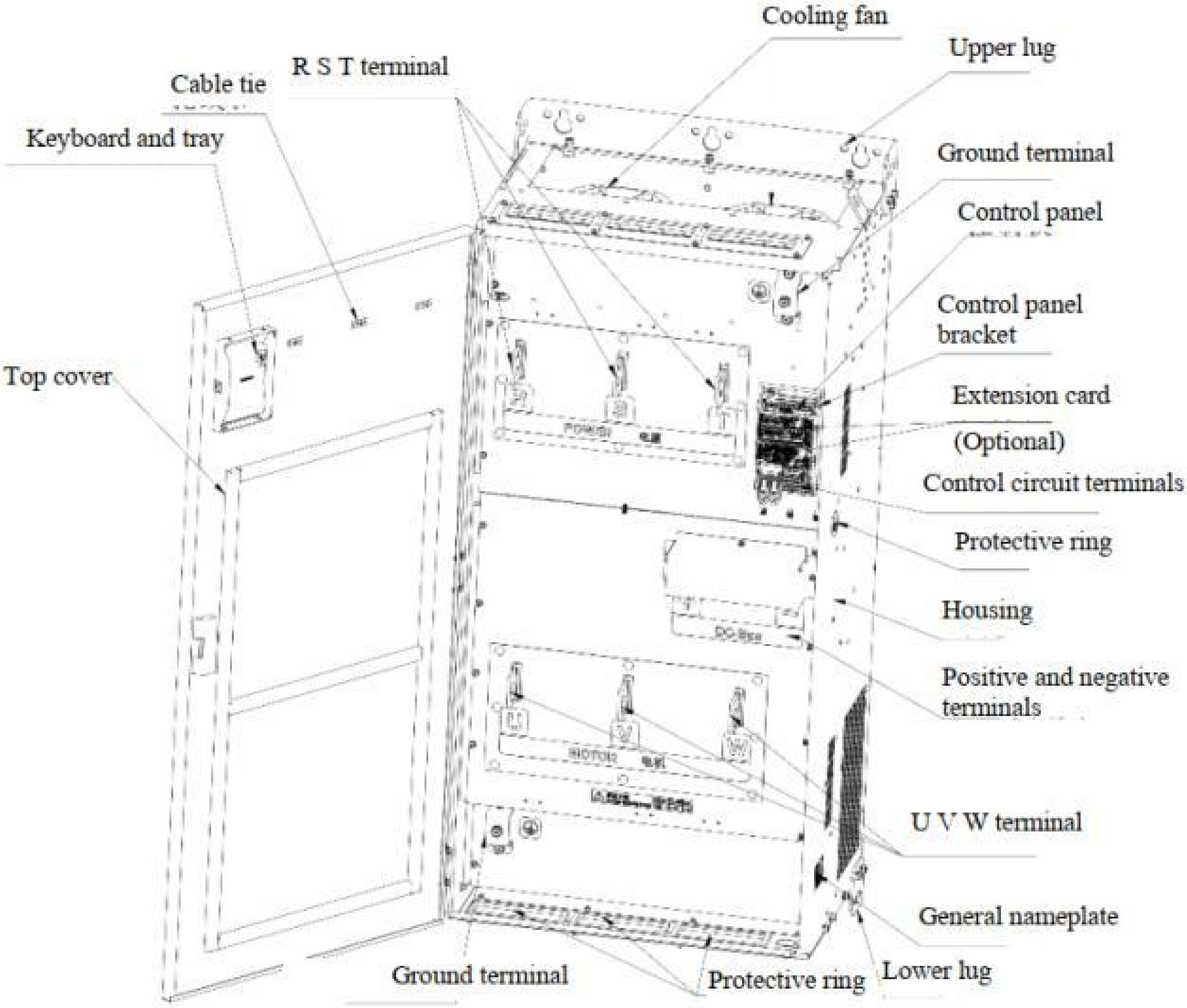


Fig. 2-19 Components of 380V 250G/280P~280G/315P and 660V 315G/355P~355G/400P inverters

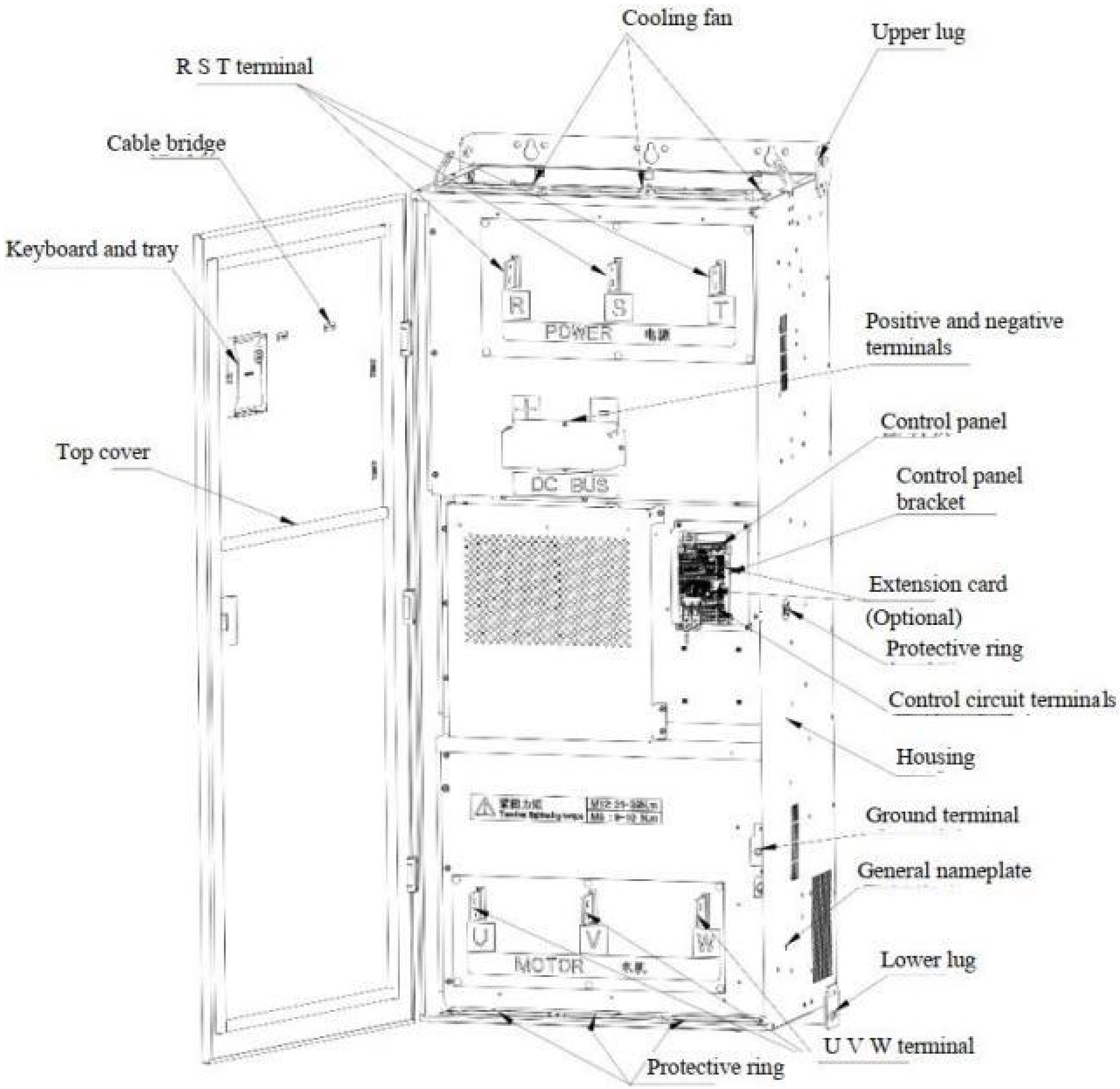


Fig. 2-20 Components of 380V 315G/355P~400G/450P inverter

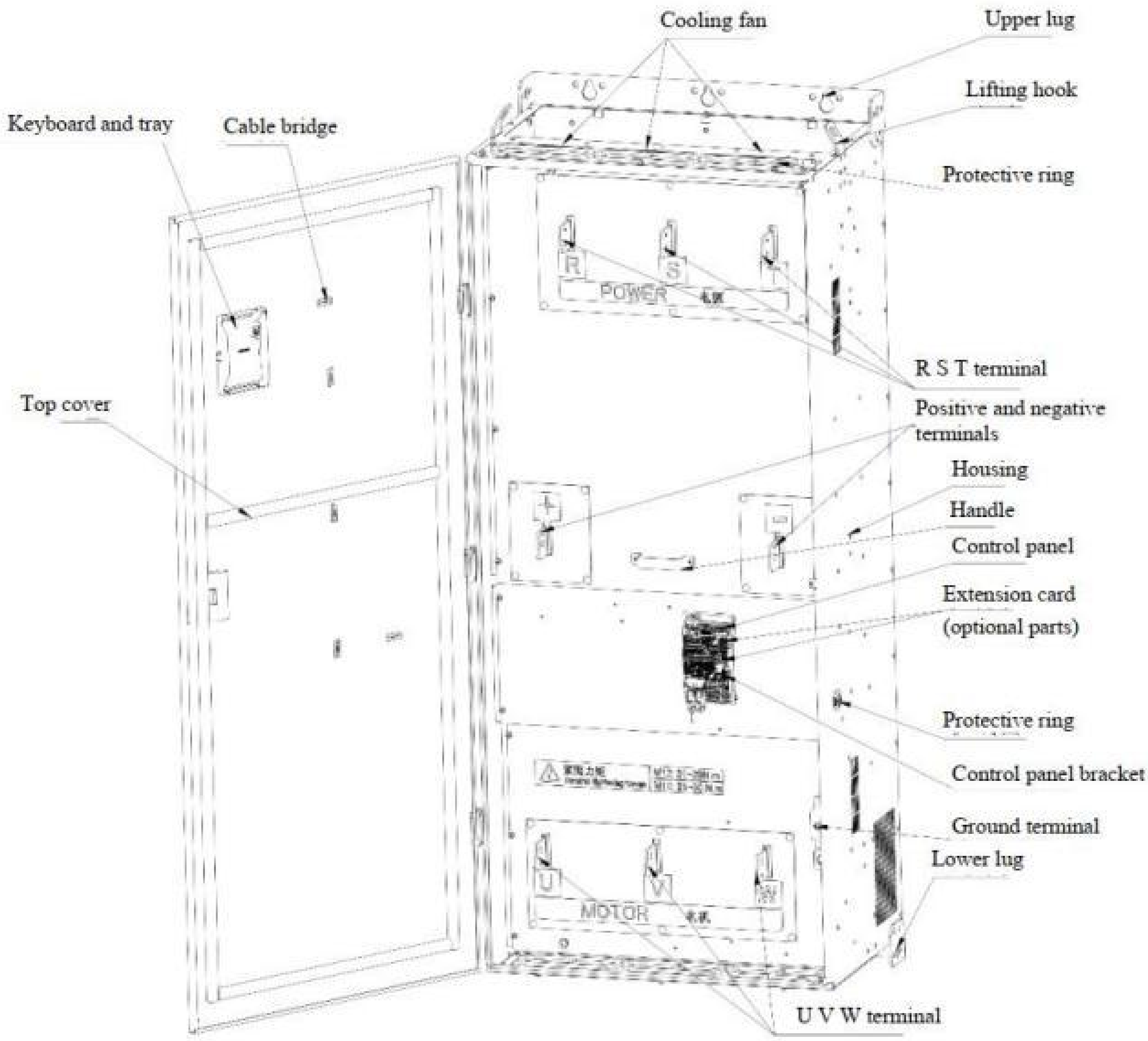


Fig. 2-21 Components of 660V 400G/450P~450G/500P inverter

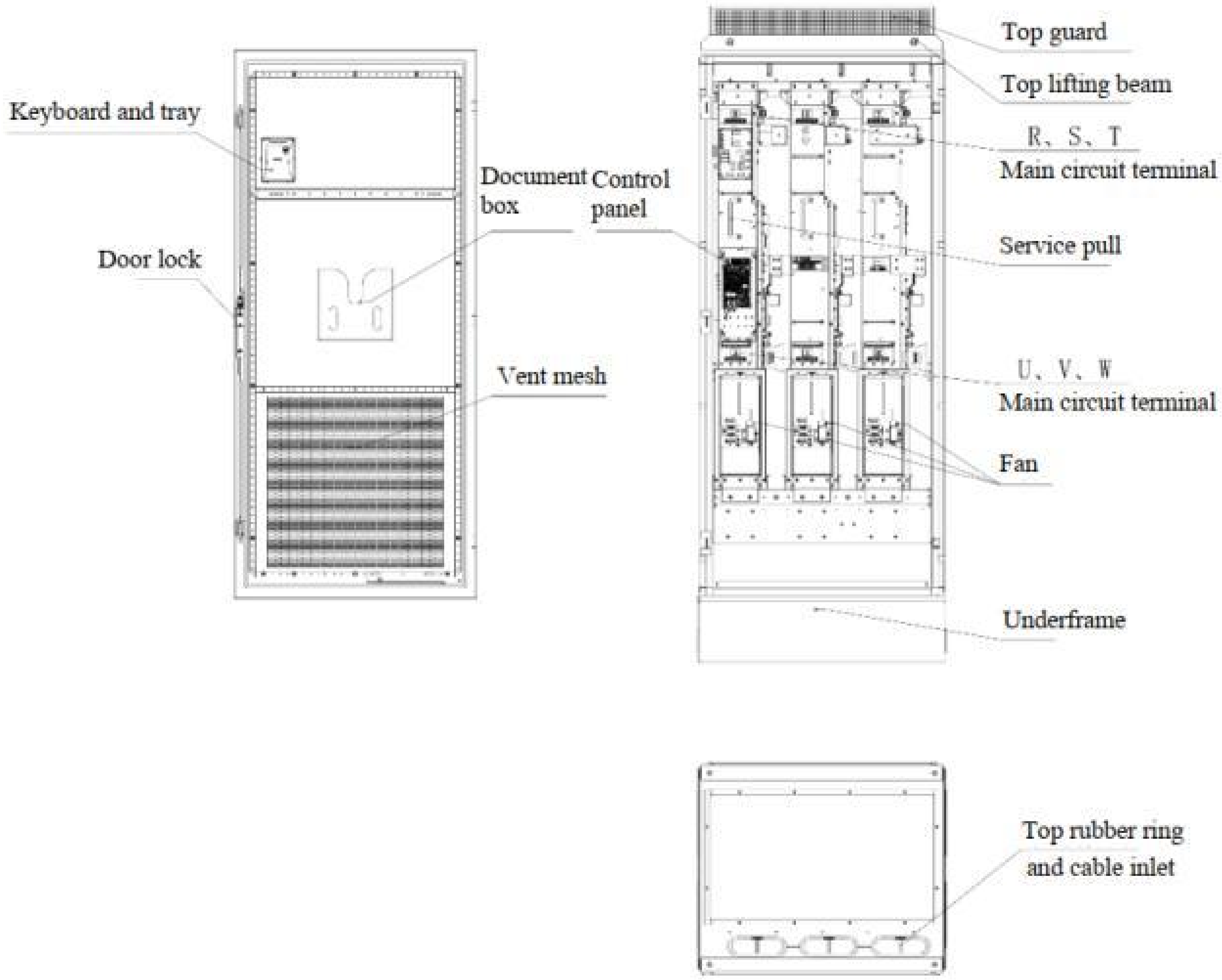


Fig. 2-22 Components of 380V 450G/500P~560G/630P inverter

Chapter 3 **Wiring**

3.1 Connection of Peripheral Device

The standard connection between the EM760 series inverter and peripheral devices is shown below.

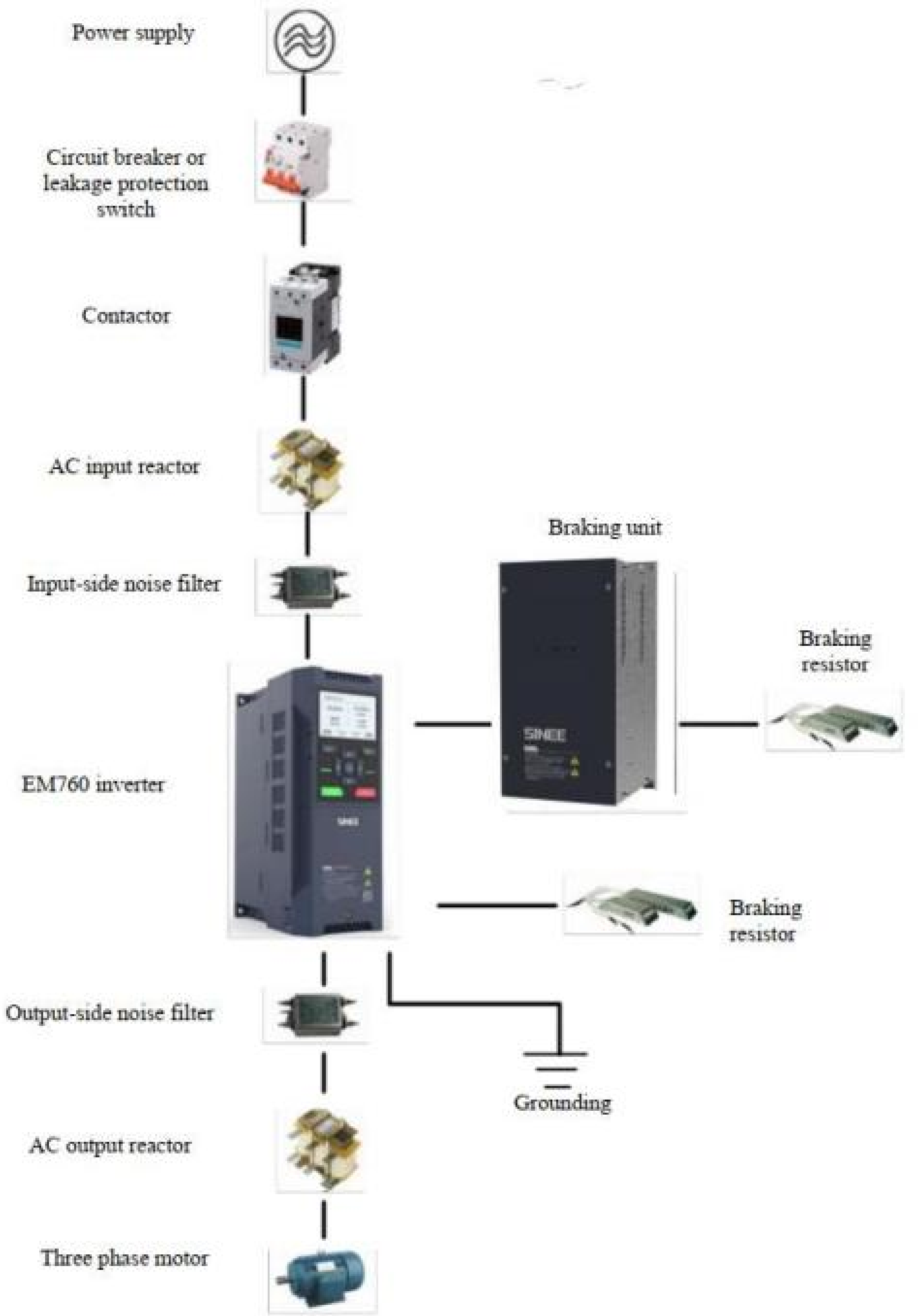


Fig. 3-1 Connection of Inverter and Peripheral Devices

Instructions on peripheral electrical elements

Item	Description
Circuit breaker or leakage protection switch	To be installed between power supply and inverter input side. Circuit breaker or leakage protection switch: Cuts off power supply upon overcurrent in downstream devices and thus prevents accidents.
Contactor	Connects/disconnects the inverter. Frequently powering on/off or directly starting an inverter with the contactor frequency should be avoided.
AC input reactor	Increases power factor of input side. Effectively eliminates high-order harmonics on the input side to prevent damage to other devices arising from voltage wave distortion. Eliminates input current imbalance arising from imbalance between power supply phases.
Input-side noise filter	Reduces outward conduction and radiated interference of the inverter and conduction interference from power supply to the inverter, and increases the resistance against interference of the inverter.
Output-side noise filter	Connect a noise filter on the output side of the inverter to reduce inductive interference and radio interference.
AC output reactor	Generally, the output side of the inverter involves many high-order harmonics. If the motor is separated faraway from the inverter, due to the great distributed capacitance in the circuit, a certain harmonic might give rise to resonance in the loop, resulting in two problems: 1. Damaging insulation performance of the motor, or even the motor perse if the issue persists. 2. Producing considerable leakage current and causing frequent protection in the inverter. Installation of output reactor can give protection to motor insulation and reduce bearing current.
Motor	Please select the matched motor as per the recommendations.
Braking unit	For products whose model name doesn't contain the letter B, please select our braking unit (BR100) and the recommended braking resistors. The motor consumes regenerated energy through the braking resistors during deceleration.
Braking resistor	For products whose model name contains the letter B, please select braking resistors optionally. The motor consumes regenerated energy through the braking resistors during deceleration.
Note: For selection of electrical peripherals, please refer to "3.2.4 Input side wiring of main circuit" and "3.2.5 Output side wiring of main circuit".	

3.2 Wiring of Main Circuit Terminal

Lines incoming and outgoing of main power terminal

1. 380V 0R7G/1R5P~220G/250P bottom-in-bottom-out wiring.
2. 380V 250G/280P~560G/630P top-in-bottom-out / bottom-in-bottom-out wiring.
3. 660V 018G/022P~280G/315P bottom-in-bottom-out wiring.
4. 660V 315G/355P~450G/500P top-in-bottom-out / bottom-in-bottom-out wiring.

3.2.1 Composition of main circuit terminal

The main circuit terminal of the EM760 series inverter consists of the following parts:

- Three-phase AC power input terminals: R, S, T
- Earth terminal: ⏚
- DC bus terminals: ⊕,⊖
- Terminals of dynamic braking resistor: PB, ⊕
- Motor terminals: U, V, W

The layout of main circuit terminals is shown below.

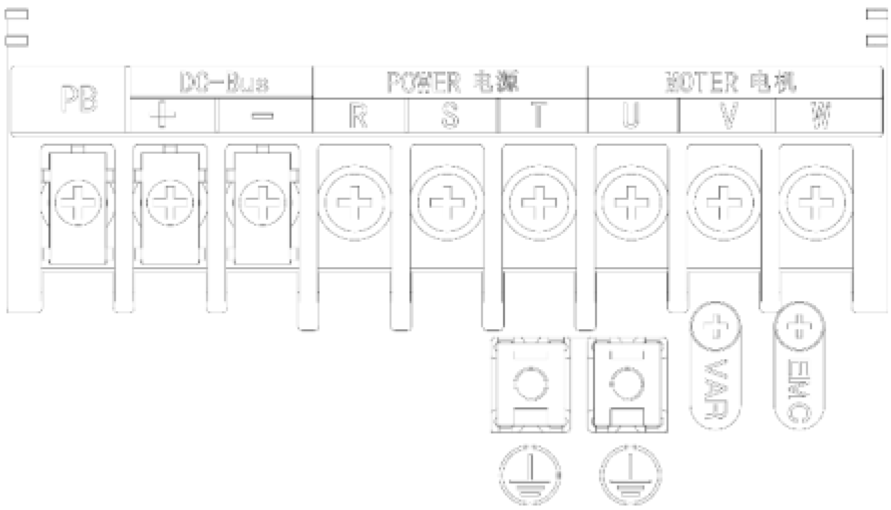


Fig. 3-2 380V 0.75-22kW main circuit terminal

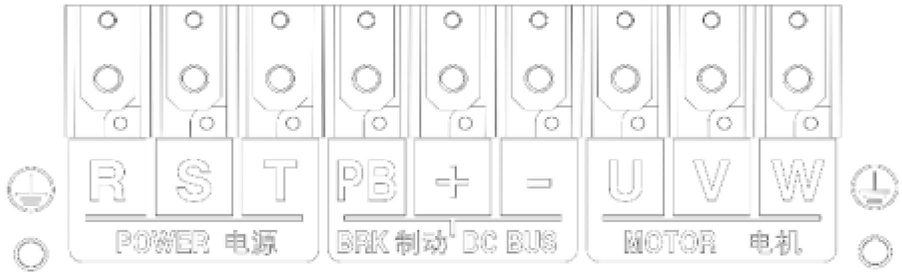


Fig. 3-3 380V 30-75kW, 660V 18-30 and 75-90kW main circuit terminals (the -3/-6 series have no PB terminal)

Fig. 3-3 660V 37-55kW main circuit terminal

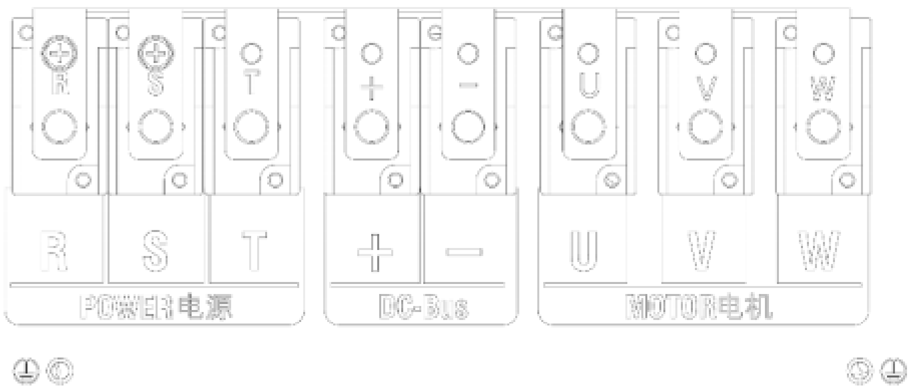


Fig. 3-4 380V 90-110kW and 660V 110-132kW main circuit terminal

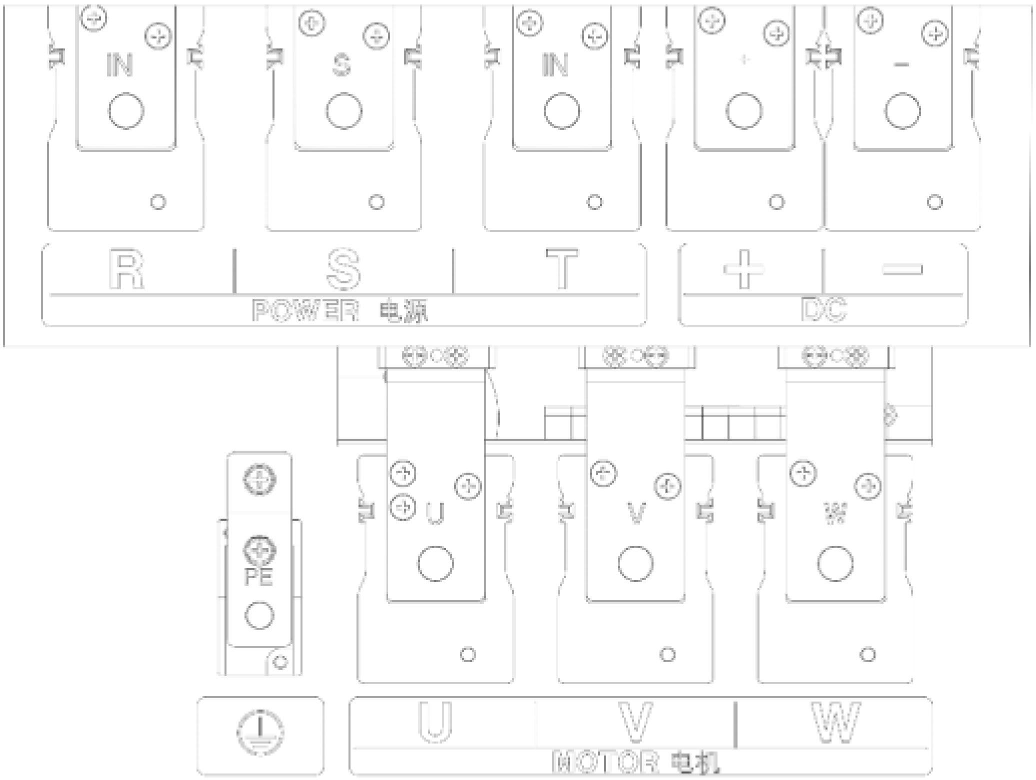


Fig. 3-5 380V 132-220kW and 660V 160-280kW main circuit terminal

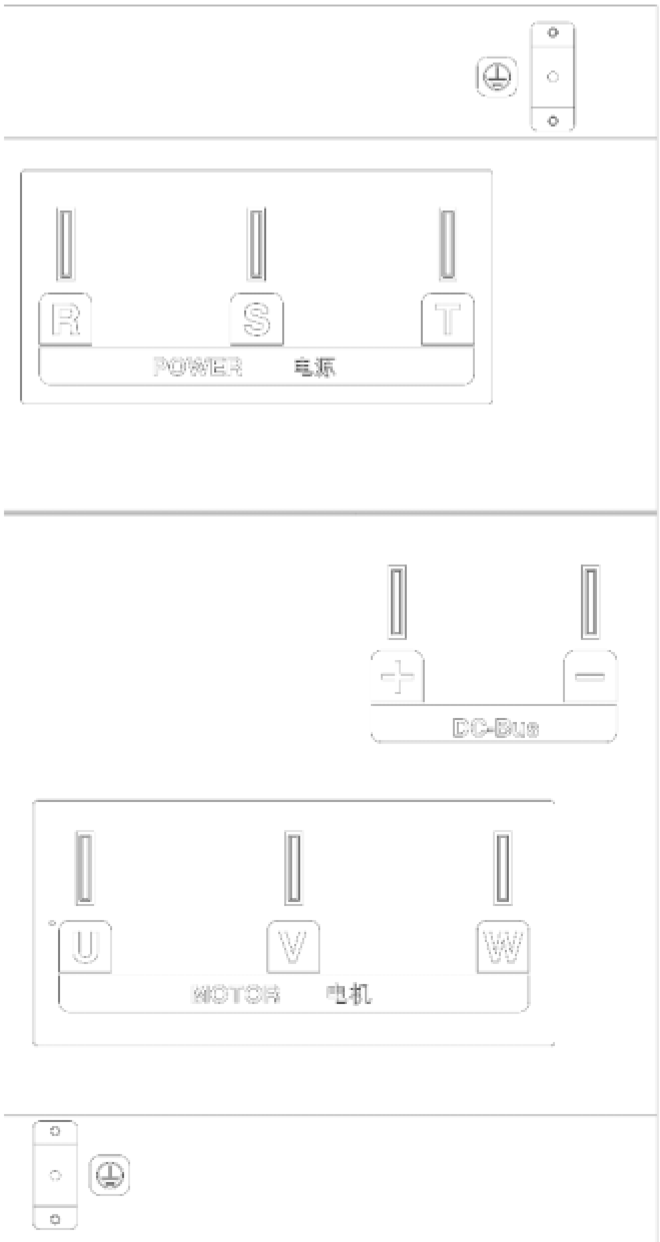


Fig. 3-6 380V 250-400kW and 660V 315-450kW main power terminal

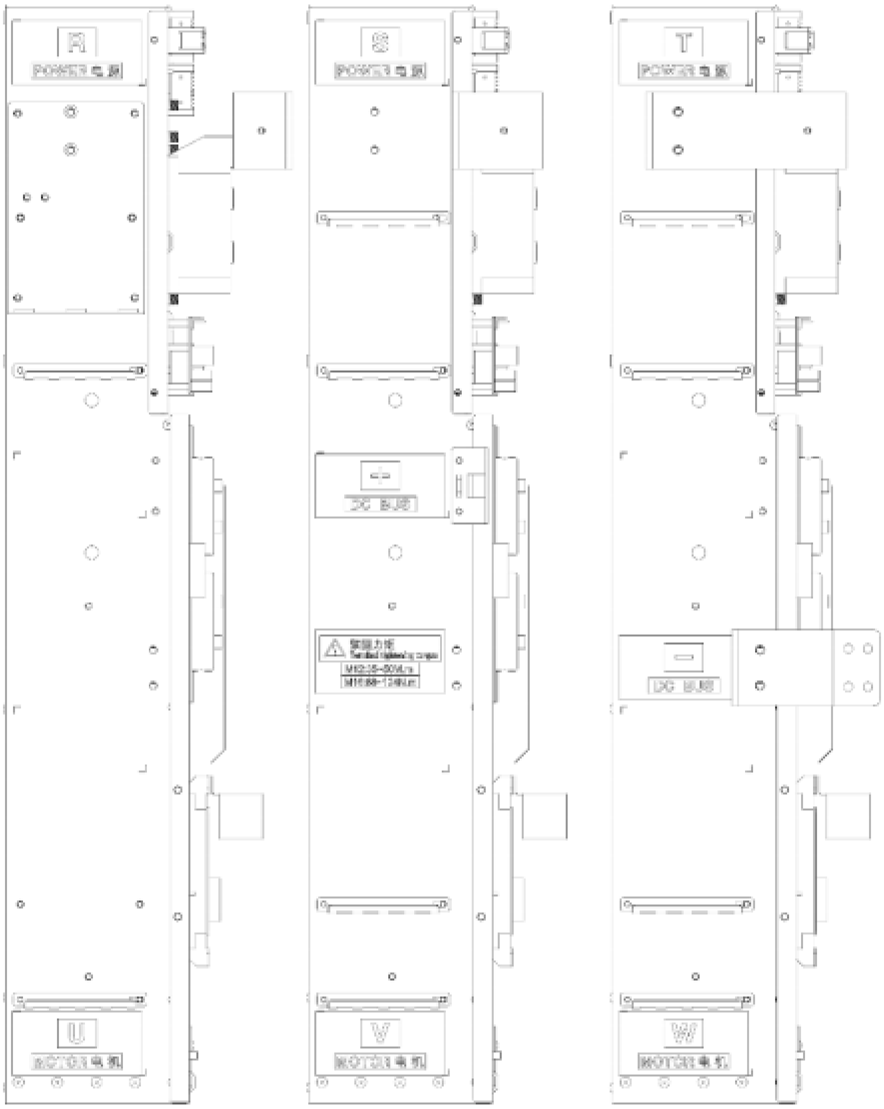


Fig. 3-7 380V 450-560kW main power terminal

3.2.2 Functions of main circuit terminals

Table 3-1 Functions of main circuit terminals

Terminal label	Function description
R, S, T	AC power input terminal, connected to three-phase AC power supply
U, V, W	AC output terminal of the inverter, connected to three-phase AC motor
⊕⊖	Positive and negative terminals of the internal DC bus, connected to external braking unit
⊕, PB	Braking resistor terminal, with one end connected to ⊕ and the other to PB
⏚	Grounding terminal, connected to earth

3.2.3 Standard wiring diagram of main circuit

The standard wiring diagram of the main circuit of the EM760 series inverter is shown below.

- EM760-0R7G/1R5P-3B~ EM760-075G/090P-3B　　EM760-030G/037P-3~ EM760C-560G/630P-3

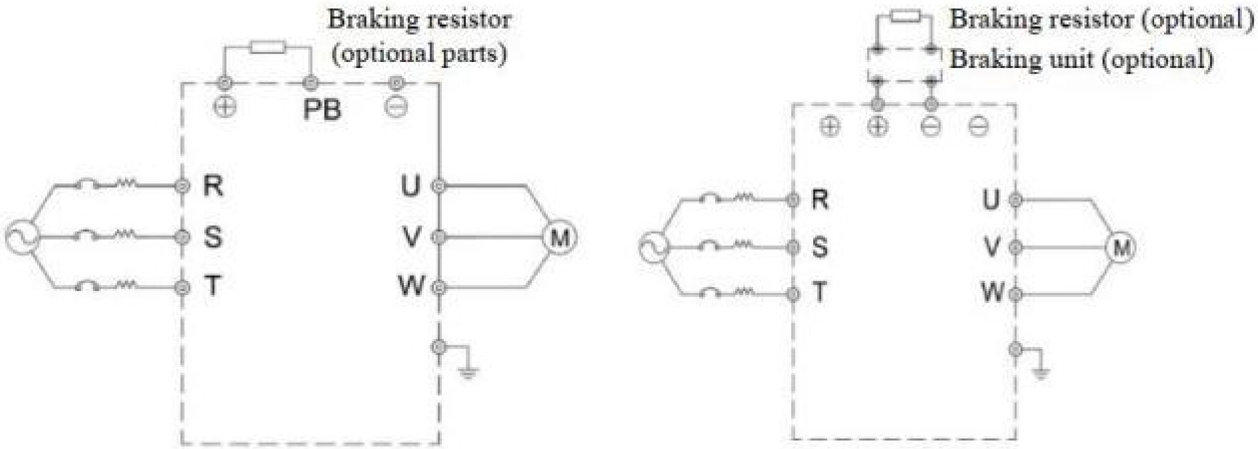


Fig. 3-8 Standard wiring of main circuit

3.2.4 Input side wiring of main circuit

3.2.4.1 Installation of circuit breaker

Install the air circuit breaker (MCCB) corresponding to the inverter between the power supply and input terminal.

- The MCCB capacity should be 1.5-2 times the rated current of the inverter.
- The time characteristics of the MCCB must meet the requirements for overheat protection (150% rated current/1 minute) of the inverter.
- When the MCCB is used with multiple inverters or other devices, connect the protection output relay contact of the inverter in series to the power contactor coil, as shown below, to disconnect the power supply according to the protection signal.

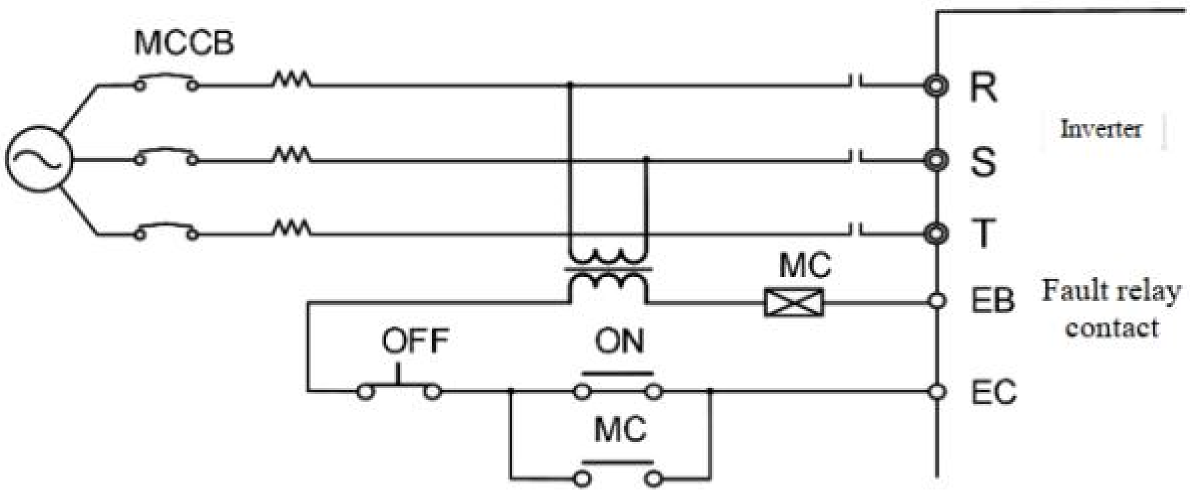


Fig. 3-9 Connection of Input Circuit Breaker

3.2.4.2 Installation of leakage circuit breaker

Since the inverter outputs high-frequency PWM signals, a high-frequency leakage current will be generated. Please use the dedicated leakage circuit breaker with the current sensitivity above 30 mA. If an ordinary leakage circuit breaker is used, use a leakage circuit breaker with the current sensitivity above 200 mA and action time of more than 0.1 s.

3.2.4.3 Installation of electromagnetic contactor

Connect the electromagnetic contactor that matches the power of the inverter, as shown in Fig. 3-9 Connection of Input Circuit Breaker.

- Do not control the operation and stop of the inverter via the electromagnetic contactor on the incoming line side. Frequent use of this method is an important cause of damage to the inverter. The frequency of operation and stop of the electromagnetic contactor on the incoming line side must not exceed once every 30 min.
- After the power supply is restored, the inverter will not run automatically.

3.2.4.4 Connection with terminal block

The phase sequence of the input power supply is unrelated to that (R, S, T) of the terminal block, so that the terminals of the input power supply can be connected arbitrarily.

3.2.4.5 Installation of AC reactor

When a large-capacity (above 600KVA) power transformer is connected, or the input power supply is connected to a capacitive load, a high inrush current will be generated, which will cause damage to the rectifier part of the inverter. In this case, please connect a three-phase AC reactor (optional) to the input side of the inverter. This will not only suppress the peak current and voltage, but also improve the power factor of the system.

3.2.4.6 Installation of surge suppressor

When an inductive load (electromagnetic contactor, solenoid valve, solenoid coil, electromagnetic circuit breaker, etc.) is connected near the inverter, please install a surge suppressor.

3.2.4.7 Installation of noise filter on power supply side

The noise filter is used to suppress the noise that invades the inverter from the power cable, and the impact of inverter noise on the power grid.

- Use a dedicated noise filter for the inverter. Ordinary noise filters do not have good effects, so they are not used usually.
- The correct and incorrect installations of the noise filter are shown below.

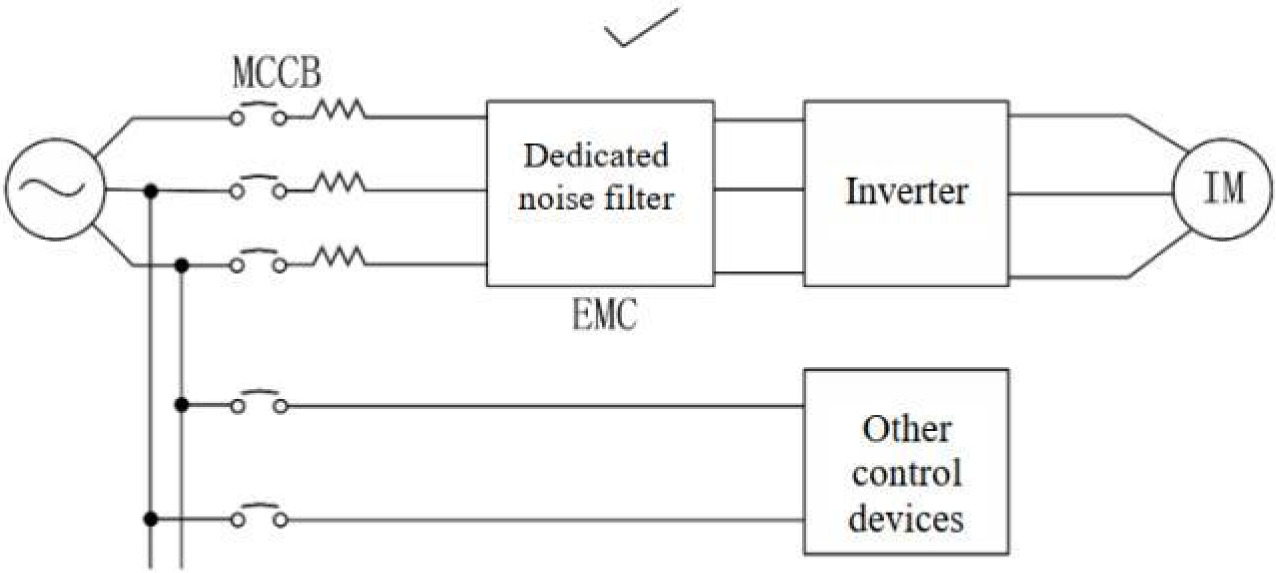
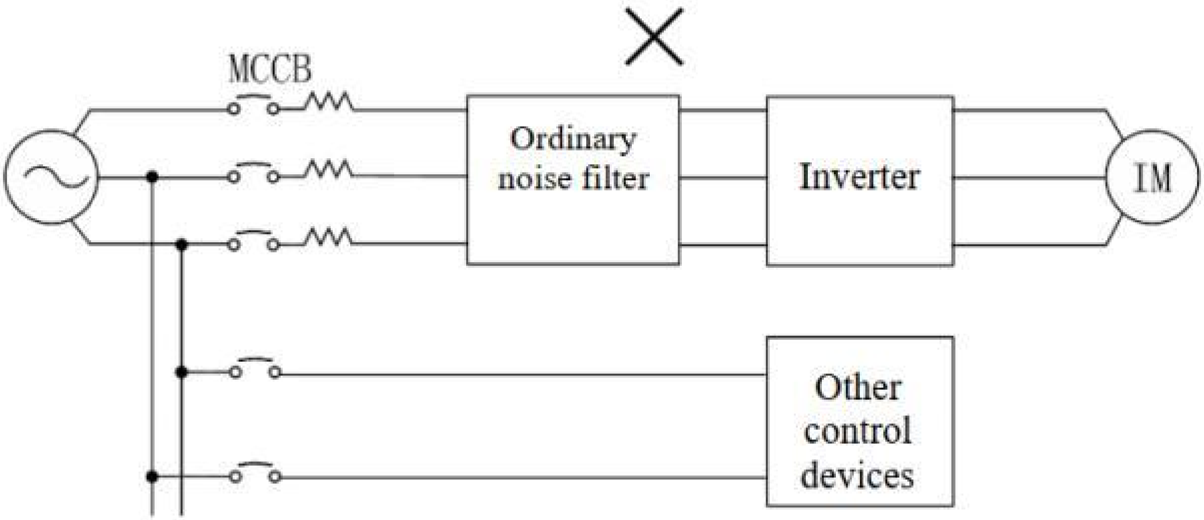
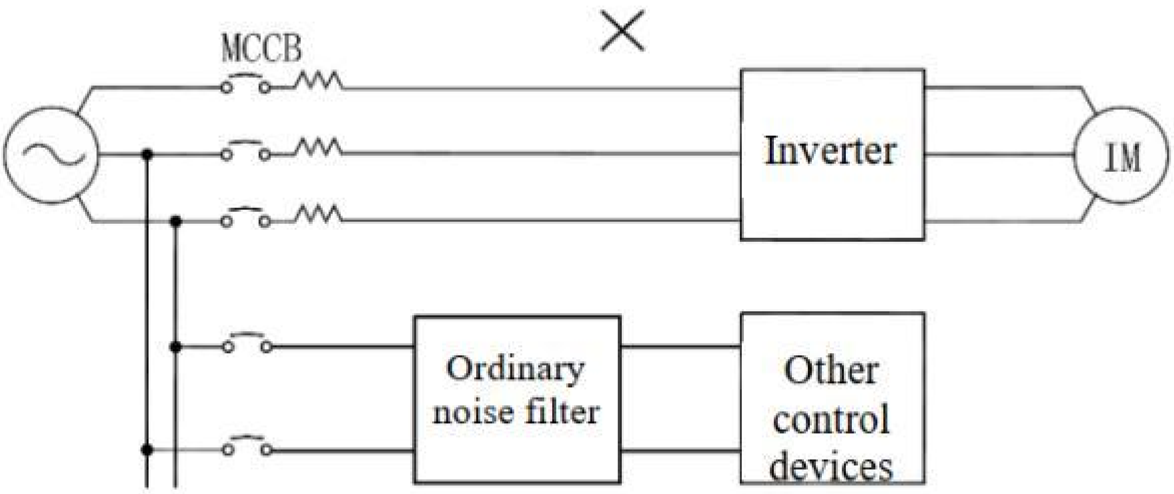


Fig. 3-10 Correct Installation of Noise Filter



(a)



(b)

Fig. 3-11 Incorrect Installation of Noise Filter

3.2.5 Output side wiring of main circuit

3.2.5.1 Wiring of inverter and motor

Connect the output terminals (U, V, W) of the inverter to those (U, V, W) of the motor.

During operation, check whether the motor rotates forward when a forward rotation command is sent. If the motor rotates reversely, exchange any two wires of the output terminals (U, V, W) of the inverter.

3.2.5.2 Prohibition of connection of the power cable to output terminal

Never connect the power cable to output terminal. When the voltage is applied on the output terminal, the internal components of the inverter maybe damaged.

3.2.5.3 Prohibition of short circuit or grounding of output terminal

Do not directly touch the output terminals, or short-circuit the output cable and inverter housing; otherwise, electric shock and short circuit may be caused. In addition, never short-circuit the output cable.

3.2.5.4 Prohibition of use of phase-shifting capacitor

Do not connect a phase-shifting advanced electrolytic capacitor or LC/RC filter to the output circuit; otherwise, the inverter maybe damaged.

3.2.5.5 Prohibition of use of electromagnetic switch

Do not connect the electromagnetic switch or electromagnetic contactor to output circuit. Otherwise, such devices will enable overcurrent and overvoltage protection and even damage the internal components of the inverter in severe cases.

When an electromagnetic contactor is used to switch the PF power supply, make sure that switching is not performed until the inverter and motor are shut down.

3.2.5.6 Installation of noise filter on output side

Connect a noise filter on the output side of the inverter to reduce inductive interference and radio interference.

- Inductive interference: Electromagnetic induction will lead to noise of the signal line and malfunction of controls.
- Radio interference: The high-frequency electromagnetic waves emitted by the inverter itself and cables will cause interference to nearby radio devices and noise in signal reception.
- The noise filter installation on the output side is shown below.

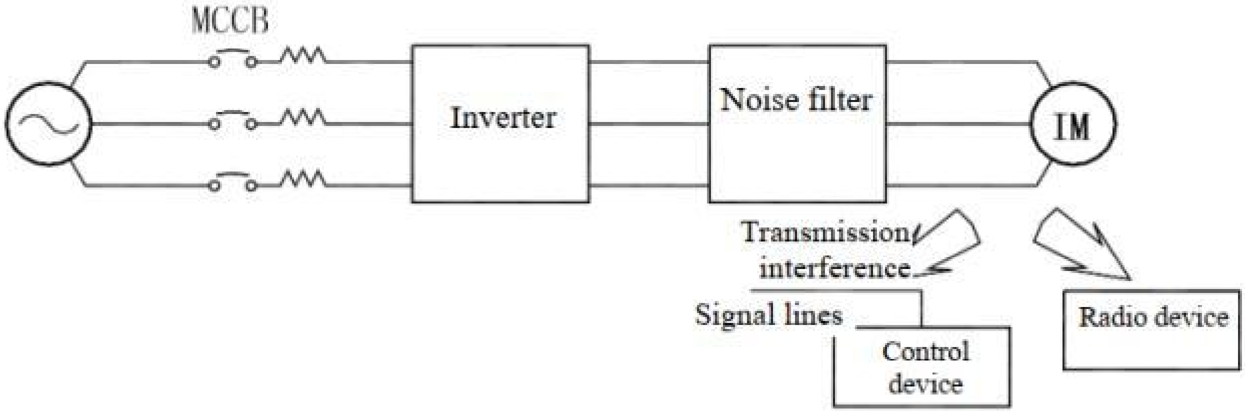


Fig. 3-12 Noise Filter Installation on Output Side

3.2.5.7 Solution to inductive interference

To suppress the inductive interference on the output side, all output cables can be laid in the grounded metal tubes, in addition to the aforesaid installation of the noise filter. When the distance between the output cable and signal line is greater than 30 cm, the impact of inductive interference will decrease significantly, as shown below.

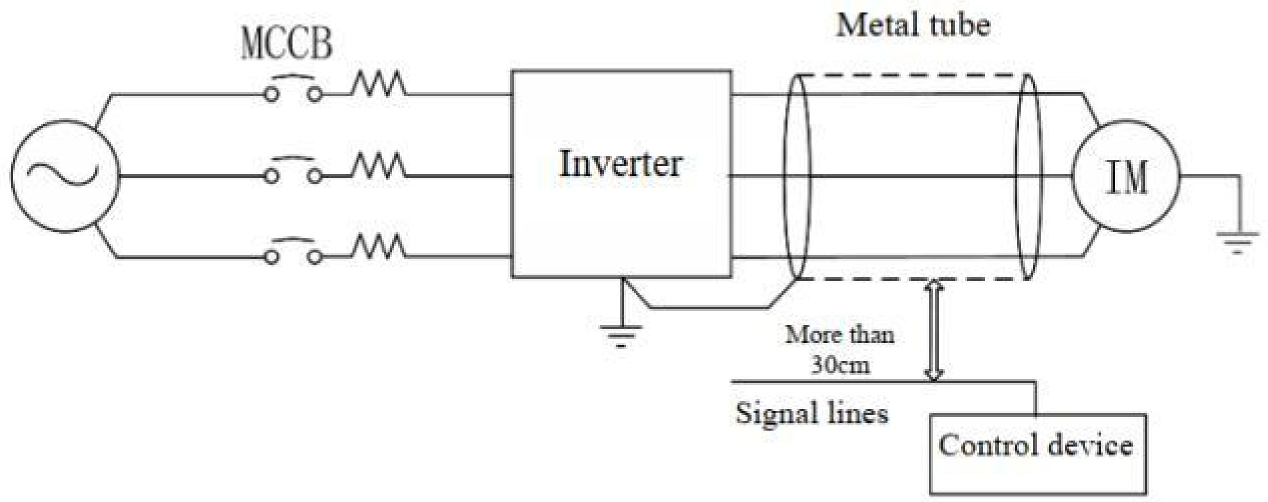


Fig. 3-13 Solution to inductive interference

3.2.5.8 Solution to RF interference

The input cable, output cable and inverter itself generates RF interference, which can be reduced by installing noise filters on the input and output sides and shielding the inverter body with an iron box, as shown below.

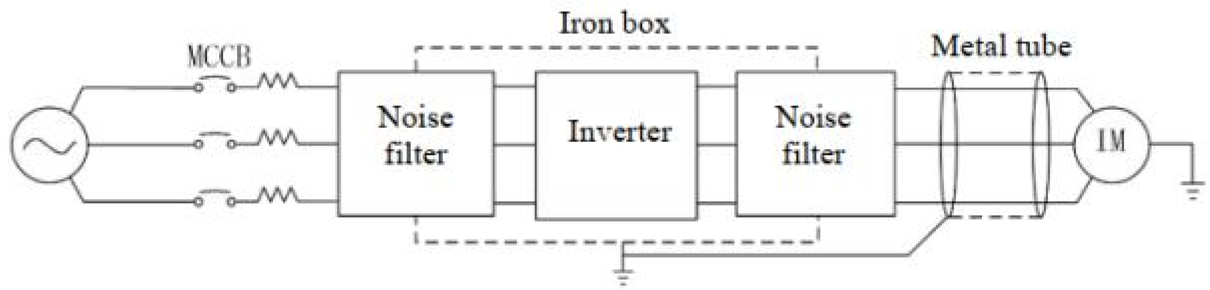


Fig. 3-14 Solution to RF interference

3.2.5.9 Wiring distance between inverter and motor

The longer the wiring distance between the inverter and motor, the higher the carrier frequency and the higher harmonic leakage current in the cable. This will adversely affect the inverter and nearby devices. Refer to Table 3-2 to adjust the carrier frequency and reduce the high-frequency leakage current.

- When the motor wiring distance exceeds 50 m, connect the output terminals (U, V, W) of the inverter with the dedicated AC reactor (phase capacity: the same as that of the inverter) for inverter output.

Table 3-2 Wiring Distance and Carrier Frequency between Inverter and Motor

Wiring distance between inverter and motor	<50m	<100m	>100m
Carrier frequency	Below 10kHz	Below 8kHz	Below 5kHz
Function code F00.23	10.0	8.0	5.0

3.2.6 Cable and screw dimensions of main circuit

The cable and screw dimensions of the main circuit are shown below.

Frequency converter model	Terminal Symbol	Terminal Screw	Tightening Torque (N.m)	Wire diameter (mm²)	Wire Type
EM760-0R7G/1R5P-3B	PB, +, -, R, S, T, U, V, W	M4	1.5~2.0	1.5	750V wire
EM760-1R5G/2R2P-3B					
EM760-2R2G/3R0P-3B				2.5	
EM760-4R0G/5R5P-3B				4	
EM760-5R5G/7R5P-3B				6	
EM760-7R5G/9R0P-3B					
EM760-011G/015P-3B		M5	2.3~2.5	10	
EM760-015G/018P-3B					
EM760-018G/022P-3B					
EM760-022G/030P-3B				16	
EM760-030G/037P-3/3B	R, S,T, PB, +, -, U, V, W	M6	4.0~5.0	16	
EM760-037G/045P-3/3B				25	
EM760-045G/055P-3/3B		M8	9.0~11.0	35	
EM760-055G/075P-3/3B					
EM760-075G/090P-3/3B				50	
EM760-090G/110P-3	R, S,T, +, -, U, V, W	M10	17.0~22.0	70	
EM760-110G/132P-3				95	
EM760-132G/160P-3	R, S,T, +, -, U, V, W	M12	31.0~39.0	95	
EM760-160G/185P-3					
EM760-200G/220P-3				120	
EM760-220G/250P-3				150	
EM760-250G/280P-3				2*150	
EM760-280G/315P-3					
EM760-315G/355P-3				4*120	
EM760-355G/400P-3					
EM760-400G/450P-3				4*150	
EM760C-450G/500P-3		M16	88.0~124.0	4*185	
EM760C-500G/560P-3					
EM760C-560G/630P-3					

660 V Cable Dimensions and Terminal Screw Specifications

Frequency converter model	Terminal Symbol	Terminal Screw	Fastening torque (N.m)	Wire Diameter (mm^2)	Wire Type
EM760-018G/022P-6B	R, S,T, PB, +, -, U, V, W	M6	4.0~5.0	10	1000V Wire
EM760-022G/030P-6B				10	
EM760-030G/037P-6B				10	
EM760-037G/045P-6B		M6	4.0~5.0	16	
EM760-045G/055P-6B				16	
EM760-055G/075P-6B				25	
EM760-075G/090P-6B	R, S,T, PB, +, -, U, V, W	M8	9.0~11.0	25	
EM760-090G/110P-6	R, S,T, +, -, U, V, W	M8	9.0~11.0	25	
EM760-110G/132P-6	R, S,T, +, -, U, V, W	M10	17.0~22.0	35	
EM760-132G/160P-6					
EM760-160G/185P-6	R, S,T, +, -, U, V, W	M12	31.0~39.0	50	
EM760-185G/200P-6				70	
EM760-200G/220P-6				70	
EM760-220G/250P-6				95	
EM760-250G/280P-6				95	
EM760-280G/315P-6				120	
EM760-315G/355P-6				150	
EM760-355G/400P-6				185	
EM760-400G/450P-6				2*70	
EM760-450G/500P-6				2*95	

Note:

1: The specifications of the wire are dependent on its voltage drop. Under normal circumstances, the voltage drop calculated by the following formula should be less than 5V.

Voltage drop = $\sqrt{3}$* wire resistivity (Ω/KM) * wire length (m) * rated current (A) * 10^{-3}

2: If the wire is in a plastic slot, it should be enlarged by one level.

3: The wire should be crimped to the round terminal suitable for the wire and terminal screw.

4: The specification of the ground wire should be the same as that of the power cable smaller than 16 mm^2. When the power cable is 16 mm^2 or larger,the ground wire should not be smaller than 1/2 of the power cable.

3.2.7 Ground wire

- The ground terminal ⏚ must be grounded.
- The ground wire must not be shared by the welding machine and power devices.
- Select the ground wire according to the technical specifications for electrical equipment, and minimize the length of the ground wire connected to the grounding point.
- Where two or more inverters are used, the ground wires must not form a loop. The correct and incorrect grounding methods are shown below.

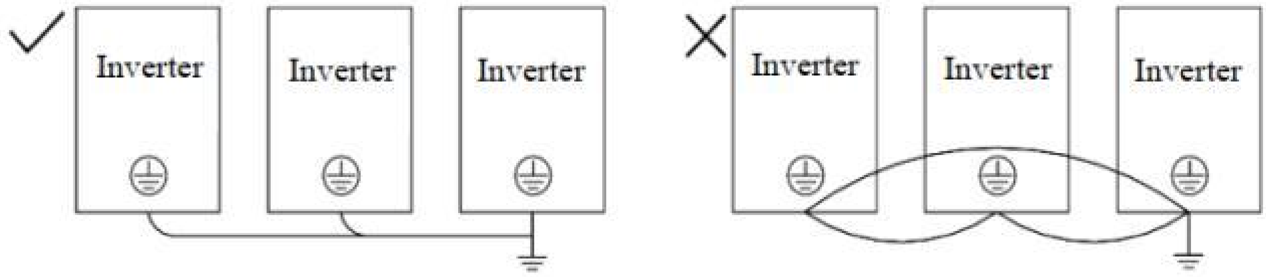


Fig. 3-15 Connection of Ground Wire

3.2.8 Installation and wiring of braking resistor and braking unit

Refer to Chapter 9 for the selection and wiring of the braking resistor and braking unit.

For the inverter with a built-in braking unit, connect the braking resistor between the inverter terminal (+) and PB terminal. For the inverter with no built-in braking unit, connect the terminals (+ and -) of the braking unit to those (+ and -) of the DC bus of the inverter, and the braking resistor to the PB+ and PB- terminals of the braking unit. Refer to the user manual of the BR100 braking unit for more information.

3.3 Wiring of Control Circuit Terminal

3.3.1 Composition of control circuit terminal

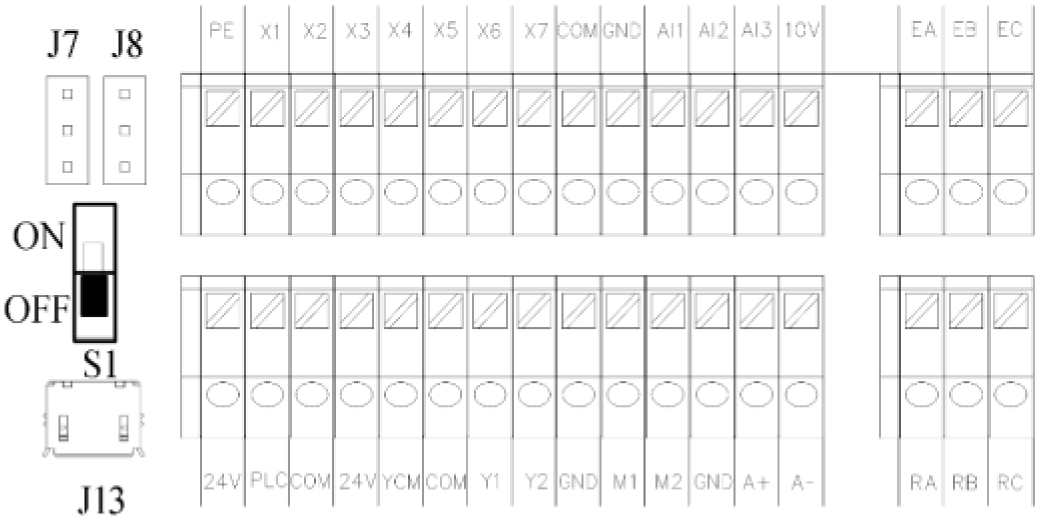


Fig. 3-16 Layout of Control Circuit Terminals

3.3.2 Functions and wiring of control circuit terminals

Table 3-3 Functions of control circuit terminals

Category	Terminal label	Terminal name	Terminal function description
Auxiliary power supply	10V-GND	+10V power supply	Supply +10.5±0.5V power to external devices. Maximum output current: 20mA
	24V-COM	+24V power supply	Supply +24V power to external devices. It is usually used as the working power supply for digital input and output terminals and also the power supply for external devices. Maximum output current: 200mA
	PLC	Multi-functional common input terminal	Delivery with default connection to 24V When an external power source drives the digital input terminal, it is required to disconnect the 24V terminal and connect the external power source
Analog input	AI1-GND	Analog input terminal 1	Input voltage range: DC -10~ 10V/0~ 10V, optional for selection by using function code F02.62
	AI2-GND	Analog input terminal 2	Input range: DC 0~ 10V/0~20mA/4~20mA; AI2 can be selected by using function code F02.63; AI3 can be selected by using function code F02.64
	AI3-GND	Analog input terminal 3	
Digital input port	X1-COM	Multi-function input terminal 1	Optocoupler isolation, compatible with NPN and PNP bipolar input Input impedance: 4kΩ Input voltage range: 9-30V
	X2-COM	Multi-function input terminal 2	
	X3-COM	Multi-function input terminal 3	
	X4-COM	Multi-function input terminal 4	
	X5-COM	Multi-function input terminal 5	
	X6-COM	Multi-function input terminal 6	
	X7-COM	High-speed pulse input terminal	Apart from using as a multi-functional input terminal, it can also be used as a high-speed pulse input terminal; the maximum response frequency: 100kHz, Input voltage: 12-30V, Input impedance: 2 kΩ
Analog output	M1-GND	Analog output terminal 1	Output range: DC 0~ 10V/0~20mA/4~20mA; M1 can be selected by using function code F03.34; M2 can be selected by function code F03.35
	M2-GND	Analog output terminal 2	Output range: DC 0~ 10V/0~20mA/4~20mA, optional for selection by using function code F03.35
Multi-function output	Y1-YCM	Open output terminal of collector	Optocoupler isolation, open output of the collector Maximum output voltage: DC30V, Output current: 50mA
	Y2-COM	High-speed pulse output terminal	Optocoupler isolation, open output of the collector Maximum output voltage: DC30V Maximum output current: 50mA As a high-speed pulse output, the maximum output frequency is: 100kHz
Relay output	R1: EA-EB-EC	Relay output terminal	EA-EC: normally open; EB-EC: normally closed
	R2: RA-RB-RC		RA-RC: normally open RB-RC: normally closed
Communication	A+	RS-485 communication terminal	positive terminal of 485 differential signal
	A-		negative terminal of 485 differential signal

Shield	PE	Shield earthing	Used for earthing of the terminal wiring shielding layer

3.3.3 Wiring of analog input terminal

3.3.3.1 Wiring of AI1, AI2 and AI3 terminals with analog voltage signal:

When analog voltage signal input is selected for terminal AI1 and the function code is set to F02.62(0/3), corresponding input is (0~10V/-10~10V)

When analog voltage signal input is selected for terminal AI2 and the function code is set to F02.63(0), corresponding input is (0~10V)

When analog voltage signal input is selected for terminal AI3 and the function code is set to F02.64(0), corresponding input is (0~10V)

When the analog voltage input signal is powered by an external power source, wiring of AI1, AI2 and AI3 are performed as shown in the following figure (a).

When the analog voltage input signal is a potentiometer, the wiring of AI1, AI2 and AI3 terminals is as shown in Figure (b).

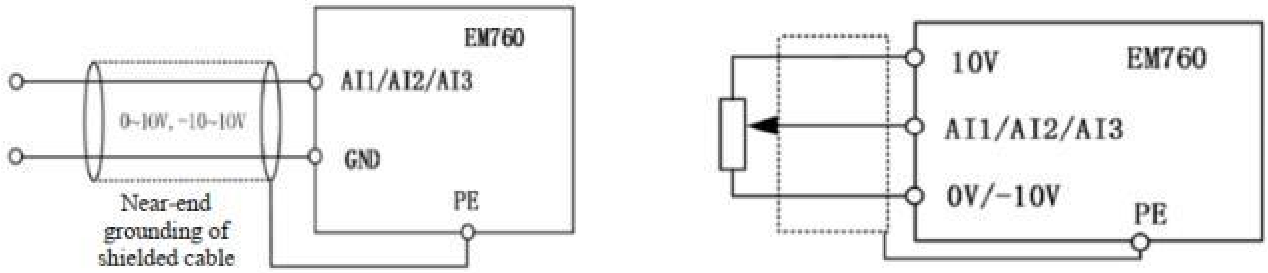
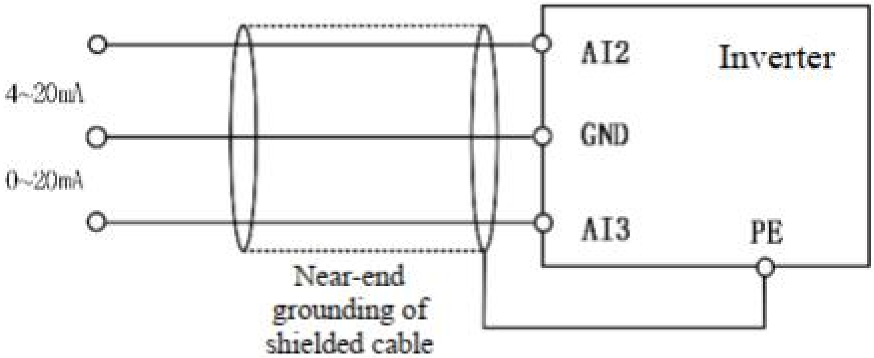


Fig. 3-17 Wiring diagram - analog input voltage signals

3.3.3.2 Wiring of AI2 and AI3 terminals with analog current signal input:

When analog current signal input is selected for terminals AI2 and AI3, and the function code is setto F02.63(1/2) and F02.64 (1/2)

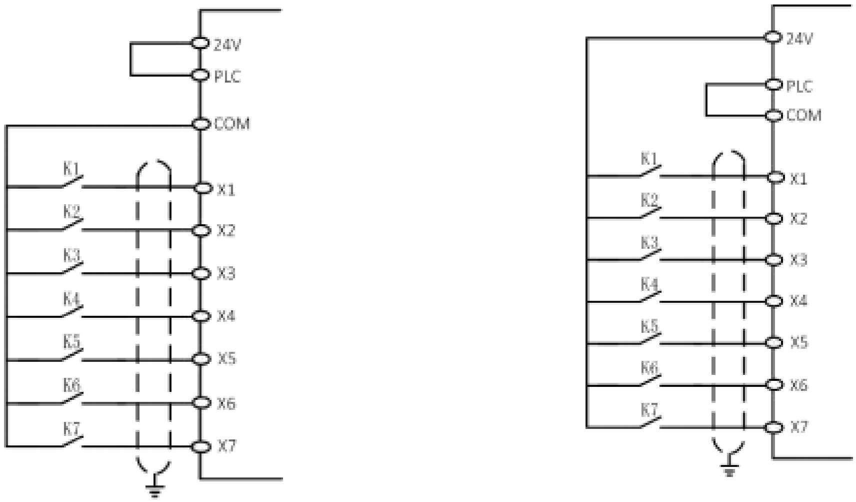


3.3.4 Wiring of multi-function input terminal

The multi-functional input terminal of the EM760 inverter has a full-bridge rectifier circuit. The PLC terminal is a common terminal of X1 to X7, through which the current may be forward (NPN mode) or reverse (PNP mode). Thus, the external connection of the terminals X1 to X7 is flexible. Typical wiring is shown below:

A. Use of internal power supply (+ 24Vdc) in NPN mode

B. Use of internal power supply (+ 24Vdc) in PNP mode



C. Use of external power supply in NPN mode D. Use of external power supply in PNP mode

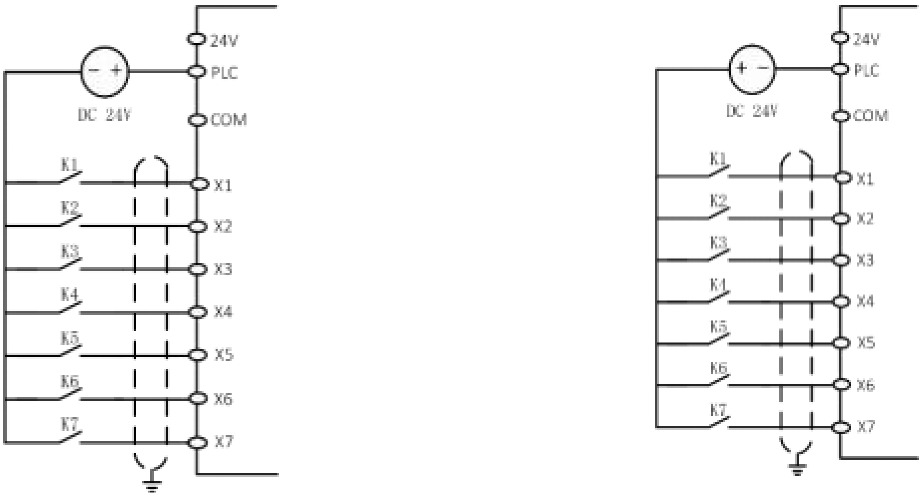


Fig. 3-18 Wiring Diagram of Multi-function Input Terminals

Note: When an external power source is used, do remove the short connection line between the 24V power source and the PLC terminal.

3.3.5 Wiring of multi-function output terminals

The multi-function output terminals Y1 and Y2 can be powered on by the internal 24V power supply of the inverter or an external power supply, as shown below:

a: Use of internal power supply b: Use of external power supply

Fig. 3-19 Wiring of Multi-function Output Terminals

Note: The relay wire package must include anti-parallel diodes. The components of the absorption circuit should be installed close to both ends of the relay or contactor coil.

3.3.6 Wiring of analog output terminals

The analog output terminals (M1 and M2) can be connected with external analog meters to represent multiple physical quantities, which are optional for selection by using F03.34 or F03.35.

3.3.7 Wiring of 485 communication terminals

The communication terminals A+ and A- are the RS485 communication interfaces of the inverter. The online control of the host (PC or PLC controller) and inverter is performed through the connection and communication with the host. Connections of the RS485 and RS485/RS232 adapters to EM760 inverter are shown below.

- Direct connection of the RS485 terminal of a single inverter to the host for communication:

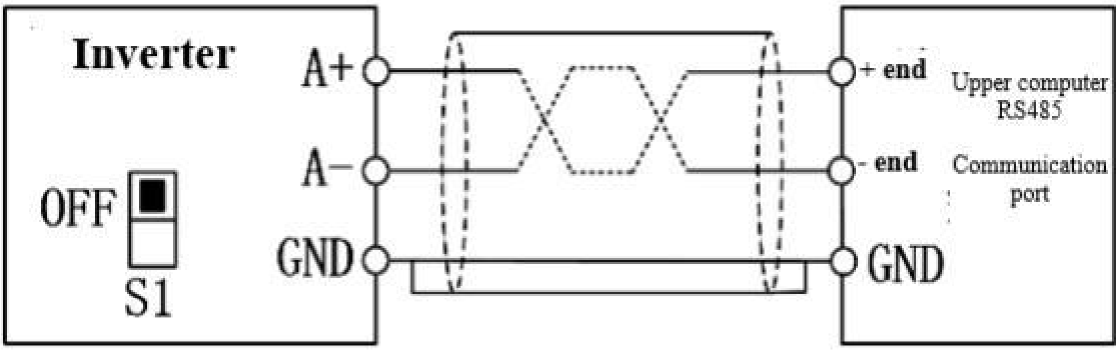


Fig. 3-20 Communication Terminal Wiring of Single Inverter

- Connection of the RS485 terminals of multiple inverters to host for communication:

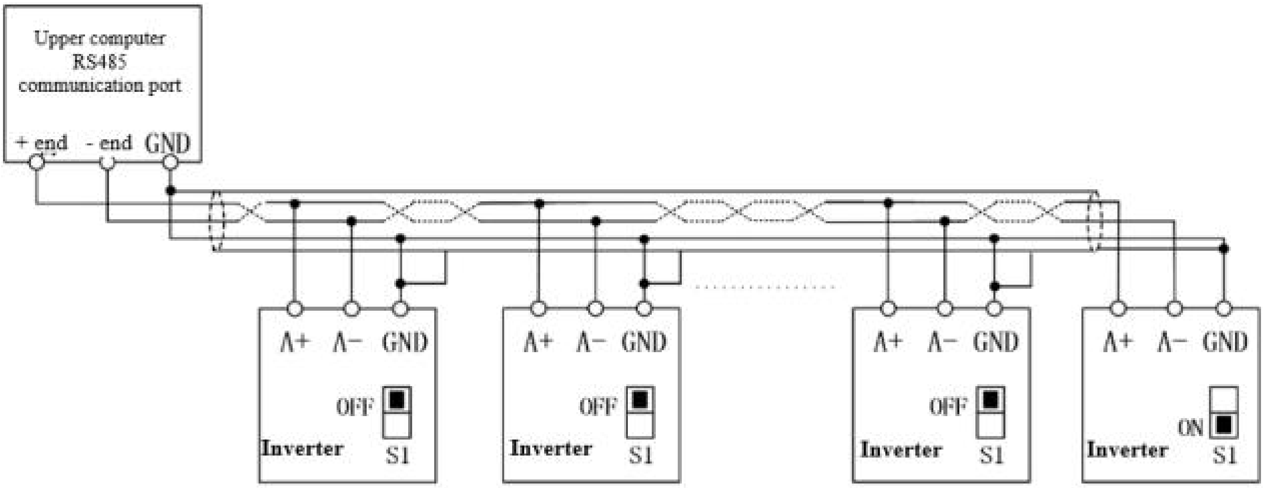


Fig. 3-21 Wiring of Communication Terminals of Multiple Inverters

Connection to the host via RS485/RS232 adapter for communication:

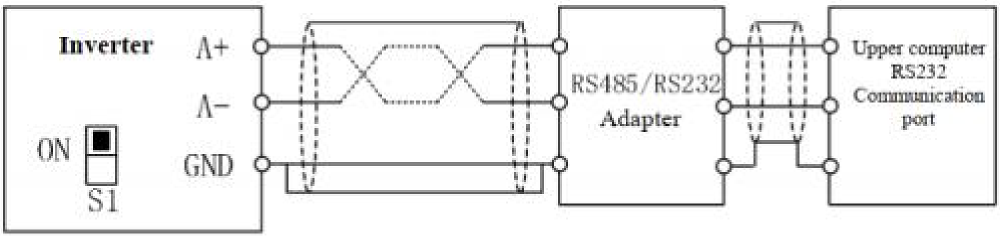


Fig. 3-22 Wiring of communication terminals

3.3.8 Standard Wiring Diagram of Control Circuit

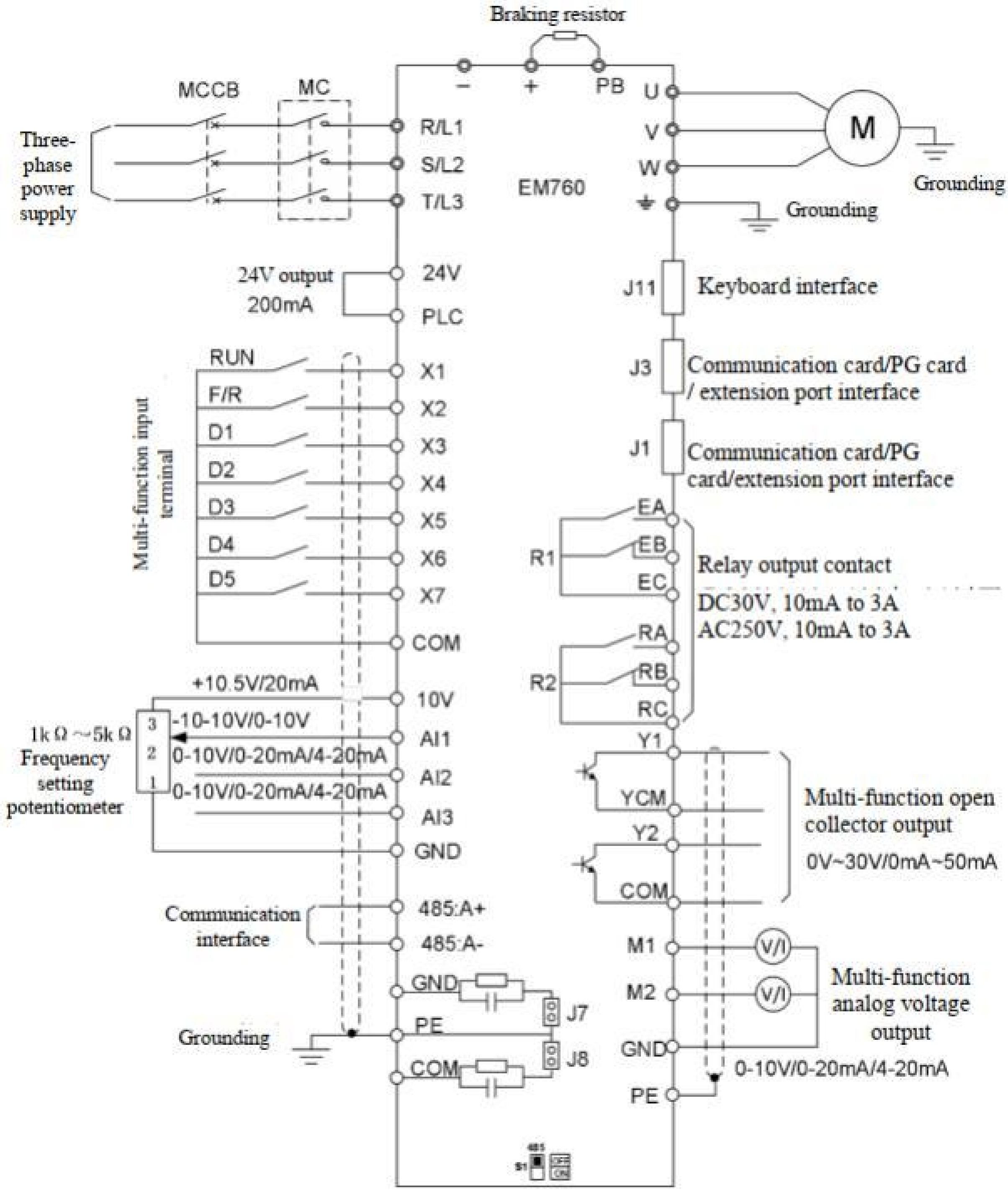


Fig. 3-23 Standard Wiring Diagram of Control Circuit

3.4 Extension wiring of keyboard

1) The external keyboard port is an RJ45 port, with an ordinary network cable (plug connection according to EIA/TIA568B) used as the extension line.

2) Connect RJ45 port of the keyboard to RJ45 port on the keyboard mounting plate by using a network cable.

3) The keyboard extension cable should be no longer than 30m. When Cat5E wire is used in sound electromagnetic environments, an extension cable of up to 50m may be purchased from the company.

3.5 Connection test

After wiring, check the following items.

- Check whether wiring is incorrect.
- Check whether there are screws, terminals and wire scraps inside the inverter.
- Check whether the screws are loose.
- Check whether the exposed wire at the stripped end of the terminal is in contact with other terminals.

Chapter 4 KEYBOARD OPERATIONS

4.1 Keyboard Functions

Structure of LCD keyboard

Control panel of EM760 inverters: LCD keyboard.

The LED keyboard consists of an LCD display, nine operation keys, and two status indicators.

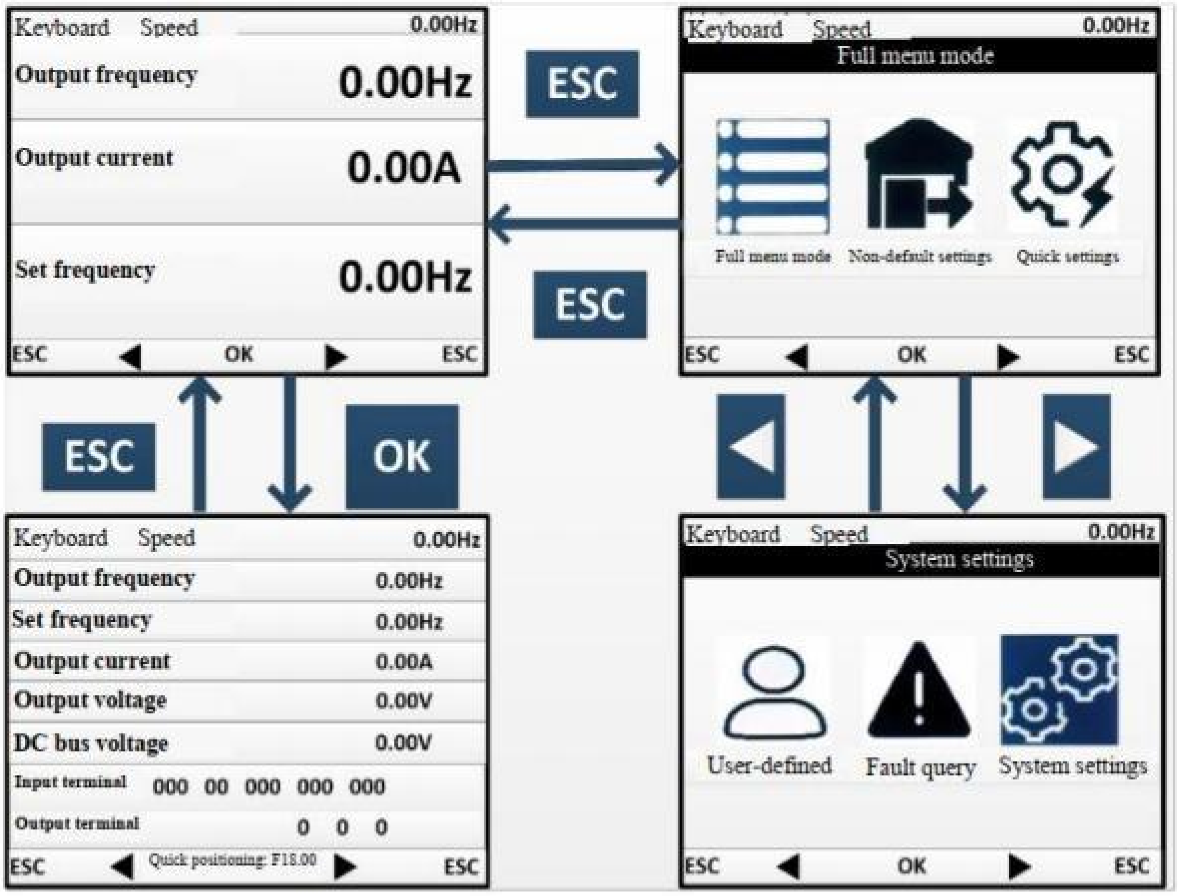
Users can perform parameter setting, status monitoring and start/stop of the inverter via the keyboard.

4.2 LCD Keyboard Operation

The LCD keyboard menu is divided into monitoring (Level 0), menu mode selection (Level 1), the function code selection (Level 2) and the detailed function code (Level 3) from low to high. The menu levels are represented by numbers in subsequent text of this manual.

Menu mode selection has 6 options: **full menu mode** displays all function codes; **user-defined mode** displays only function codes of user group F11; **non-default mode** displays only the function codes that differ from the default settings; **fault query** allows the user to view the latest three fault records saved; **guide mode** allows setting motor parameters-related function codes in order for self-learning operation; **system setting** allows setting the brightness, backlight time, language and view of the software version

When the keyboard is powered on, it shows the level 1 menu,i.e. the monitoring interface (main monitor), by default. On the monitoring interface (main monitor) press the LEFT key to switch the function code displayed in the second line and press the RIGHT key to switch the function code displayed in the third line; the function codes for switching is set by using F12.33-F12.37; in the level 1 menu, press the ESC key to enter level 0 menu; in the level 0 menu, use the LEFT key and the RIGHT key to select a different menu mode. In the level 0 menu, press the ESC key togo back to the main monitoring interface of level 1 menu. The procedure for menu mode selection is shown in the figure below.



4.2.1 Full menu mode

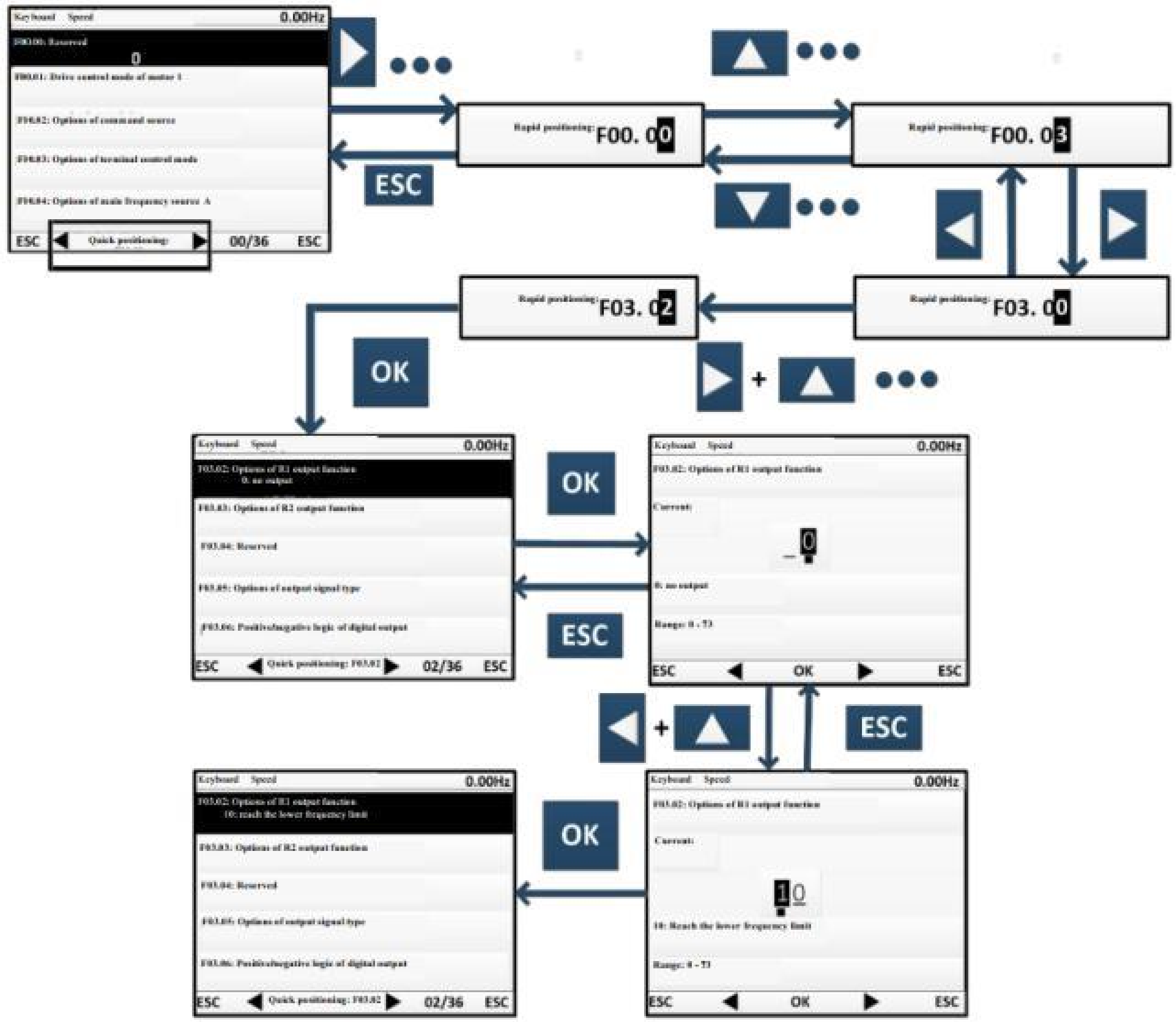
In the full menu mode, press the ENTER key OK to enter the Level 2 menu and select any function code. Then press the ENTER key OK to enter the Level 3 menu and view or modify the function code. Except for a few special ones, the function codes needed by general users can be modified.

In all menu modes, the user needs to press the ENTER key OK to save parameter modifications.

In the Level 3 menu, press the ESC key ESC to abandon parameter modifications: if the function code is equal to the unmodified value, directly exit the Level 3 menu and go back to the Level 2 menu; otherwise, the unmodified value will be restored and displayed, and the user can press the ESC key ESC to exit the Level 3 menu and go back to the Level 2 menu.

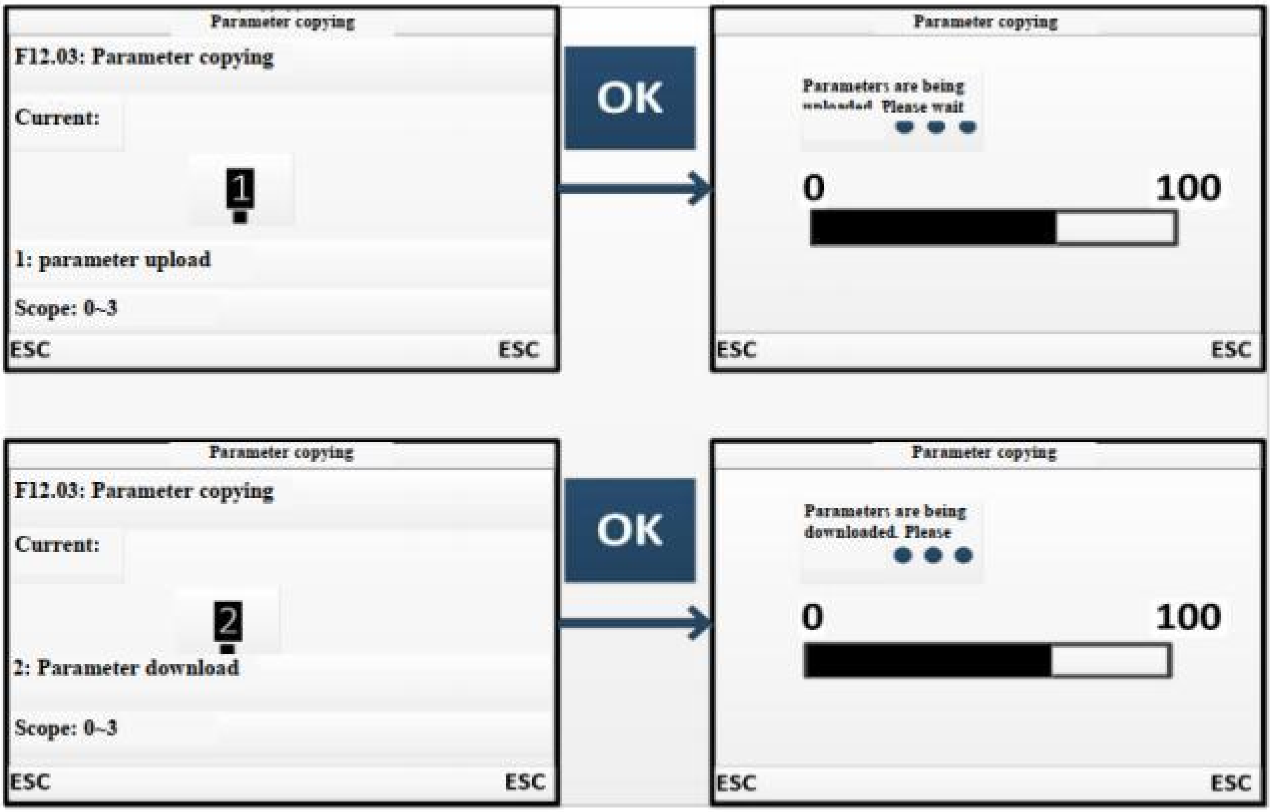
Quick positioning function: The full menu mode displays all groups of function codes and quick positioning can facilitate operations. To locate a function code, it is only required to set the function code to display and press the ENTER key OK to display the function code.

The process of changing the value of the function code F03.02 to 10 from the initial status upon power-on in the full menu mode is shown in the following figure. In level 2 menu, the number of function code groups can be known through the function code progress indication. As shown in the following figure, 02/36 means group F03 consists of 36 function codes, and the cursor is currently located at F03.02.



4.3 Parameter copying

For convenient parameter setting between inverters using the same function parameters, the keyboard is provided with parameter uploading and downloading functions. When function code F12.03 is set to 1 and ENTER is pressed  for confirmation, inverter-related parameters will be uploaded to the keyboard; upon uploading, the keyboard shows the progress; when uploading is completed, the value of the function code will automatically change to 0. The keyboard with uploading completed may be inserted into another inverter that needs to use the same parameters. Once the keyboard is inserted, you may change the value of the function code F12.03 to 2 and download the parameters to the inverter. If you set the value of the function code F12.03 to 3, motor parameters will be downloaded in addition to normal parameters. Upon downloading, the keyboard will show the progress. Similarly, upon completion of parameter downloading, the value of the function code will automatically change to 0.



It shall be particularly noted that:

1. No keyboard can be used for parameter downloading before it undergoes parameter uploading, as unknown parameters in the keyboard without parameter uploading may cause failure of an inverter by disturbing existing parameters in the inverter. If a keyboard is used for parameter downloading without parameter uploading, it will prompt presence of no parameter in the keyboard, suggesting parameter downloading is unsuccessful; press ECS to exit; perform uploading again before downloading.

2. For parameter downloading to an inverter with a different version of CPUS software, the keyboard will prompt whether to continue downloading regardless of the different version; at this time, it is required to make clear whether parameter downloading is permitted between the two different versions. If yes, press ENTER key to execute the downloading; if no, press ESC to cancel the current operation. **Be cautioned that parameter uploading and downloading between two inverters with incompatible parameters are likely to cause operation failure of the inverters.**

4.4 Run/Stop

After setting the parameters, press the RUN key to enable the normal operation of the inverter, and the STOP key to stop the inverter. The M.K an be defined to free parking or to stopping inverter operation by changing the function code F12.00 to 5.

When function code F01.34 is set to corresponding self-learning mode, it is required to press RUN so that the inverter can enter corresponding parameter identification status; upon parameter identification, it will show "TUNE"; when identification is done, it will return to the original display, and the function code F01.34 will automatically change to 0. Upon rotation parameter identification by the inverter, the motor may rotate; in emergent cases, the user may press STOP to cancel identification.

Chapter 5 **Trial run**

5.1 Inverter Commissioning Process

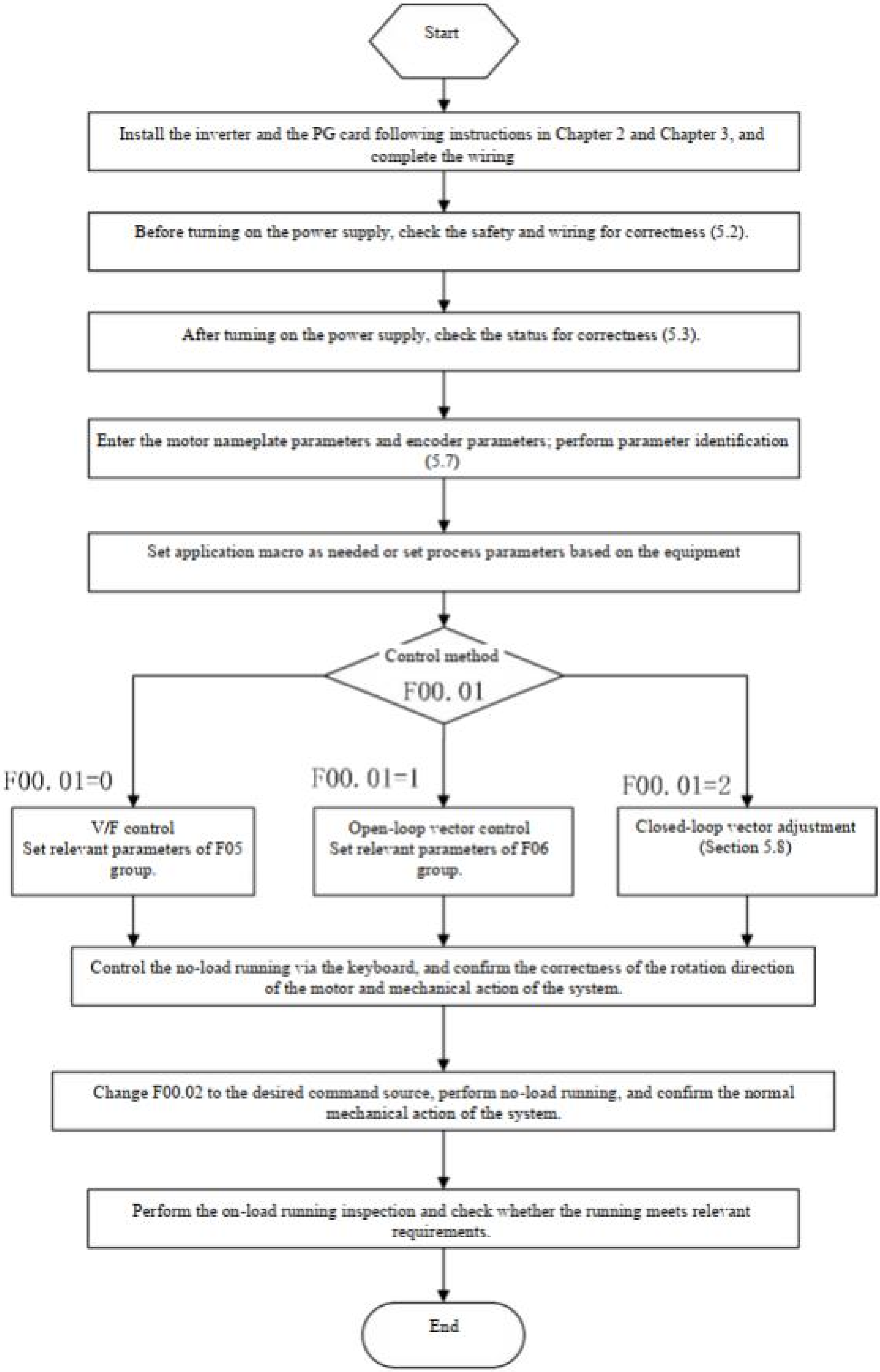


Fig. 5-1 Inverter Commissioning Process

5.2 Confirmation before Power-on

Please confirm the following items before turning on the power supply:

Item to be confirmed	Confirmation content
Power wiring confirmation	Check whether the input power voltage is consistent with the voltage of the inverter.
	Confirm that the circuit breaker has been connected to the power supply circuit, and the power cables are correctly connected to the input terminals (R, S, T) of the inverter.
	Make sure that the inverter and motor are properly grounded.
Motor wiring confirmation	Confirm that the motor is correctly connected to the output terminals (U, V, W) of the inverter, and the motor wiring is secured.
Confirmation of braking unit and braking resistor	Make sure that the braking resistor and braking unit are properly connected (use the dynamic braking resistor if necessary during operation).
Control terminal wiring confirmation	Check whether the control terminals of the inverter are correctly and reliably connected to other controls.
Control terminal status confirmation	Make sure that the control terminal circuit of the inverter is disconnected to prevent operation upon powering on.
Check wiring of the PG card and the encoder	When closed-loop control is required, it is required to check wiring of the PG card and the encoder for correctness and reliability
Mechanical load confirmation	Confirm that the machinery is in the no-load state and free of danger in operation.

5.3 Inverter Status Confirmation after Power-on

After the power supply is turned on, the control panel (keyboard) of the inverter displays the following information in the normal status.

State	Display	Description
During normal operation	The output frequency is 0 and the given frequency is 0	The digital setting 0Hz is displayed by default
Protection	Protection code in character or Exx format	The protection code is displayed in the protection status. See the protection measures in Chapter 6.

5.4 Precautions for Application Macro Setting

F16.00 is an industry application macro option. Select the application macro according to the specific application, and press the Enter key to automatically restore default settings.

Note: Select the application macro first, and then set the process parameters.

5.5 Start and Stop Control

F00.02=0: keyboard control

The start and stop of the inverter are controlled by the RUN key, STOP key on the keyboard. In the case of no trip protection, press the RUN key to enter the running status. If the strip LED indicator above the RUN key is solidly ON, it indicates that the inverter is in the running state. If it flickers, it means that the inverter is decelerating to stop.

F00.02=1: terminal control

The inverter start and stop are controlled by the start and stop control terminals defined by the function code F02.00 to F02.06. Terminal control is dependent on F00.03.

F00.02=2: communication control

The inverter start and stop are controlled by the host through the RS485 communication port.

F04.00=0: direct start

The inverter is started at the starting frequency, following the DC braking (not suitable when F04.04=0) and pre-excitation (not suitable when F04.07=0). The starting frequency will change to the set frequency after the holding time.

F04.00=1: start with speed tracking

The inverter is smoothly started at the current rotating frequency of the motor, following the speed tracking.

F04.19=0: deceleration to stop

The motor decelerates to stop according to the deceleration time set in the system.

F04.19=1: free stop

When there is a valid stop command, the inverter will stop output immediately, and the motor will freely coast to stop. The stop time depends on the inertia of the motor and load.

Function code	Function codename	Parameter description	Default setting	Attribute
F00.03	Options of terminal control mode	0: terminal RUN (running) and F/R (forward/reverse) 1: terminal RUN (forward) and F/R (reverse) 2: terminal RUN (forward), Xi (stop) and F/R (reverse) 3: terminal RUN (running), Xi (stop) and F/R (forward/reverse)	0	○

Terminal RUN: Xi terminal is set to “ 1: terminal RUN”

Terminal F/R: Xi terminal is set to “2: running direction F/R”

Terminal control can be divided into two types: two-line control and three-line control.

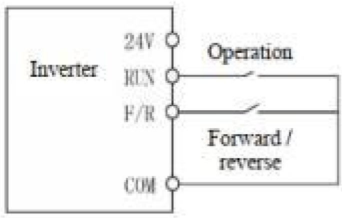
Two-line control:

F00.03=0: the terminal RUN is enabled and the terminal F/R controls forward/reverse running.

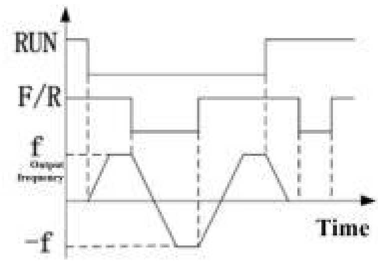
The terminal RUN is activated/deactivated to control the start and stop of the inverter; terminal F/R is activated/deactivated to control the forward/reverse running. The logic diagram is shown in the figure (b) below;

F00.03=1: the terminal RUN controls forward running, and the terminal F/R is in the reverse mode.

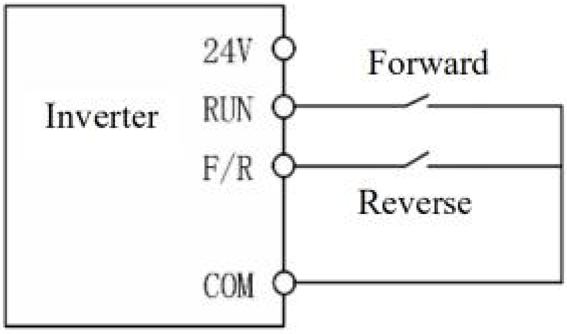
Enable/Disable the terminal RUN to control the forward running and stop of the inverter, and the terminal F/R to control the reverse running and stop. When the terminals RUN and F/Rare enabled simultaneously, the inverter will be stopped. When the mode of deceleration to stop is selected, the forward/reverse logic is as shown in the figure (d) below;



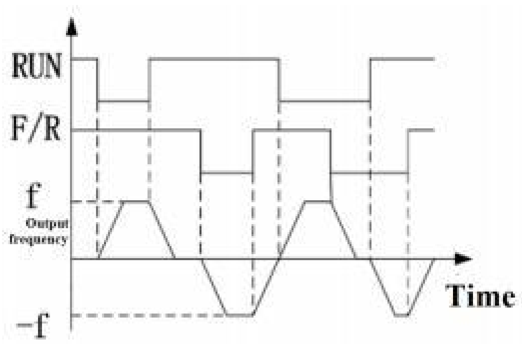
(a) Wiring diagram of two-line control (F00.03=0)



(b) F04.09=0, F00.03=0,run the forward/reverse logic



(c) Wiring diagram of two-line control (F00.03=1)



(d) F04.19=0, F00.03=1,run the forward/reverse logic

Fig. 5-2 Two-line control

Three-line control:

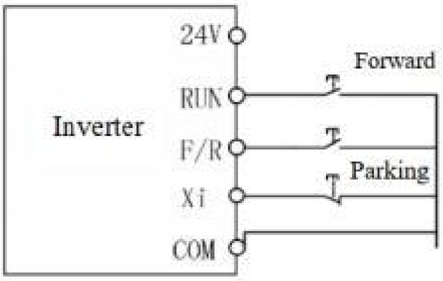
F00.03=2: terminal RUN (forward), Xi (stop) and F/R (reverse)

The terminal RUN is normally ON for forward running, and the terminal F/R is normally ON for reverse running, with valid pulse edges. The terminal Xi is normally closed for stop, with the valid level. When the inverter is in the running status, press Xi to stop it. When the mode of deceleration to stop (F04.19=0) is selected, the logic is as shown in figure (b) below. Xi is the terminal among X1~X7 that is defined by F02.00~F02.06 for "three-line running and stop control";

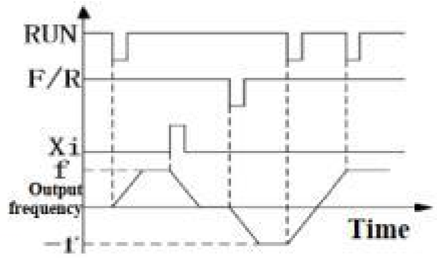
Note: X7 is high-speed pulse input; the supported frequency is 200kHz.

F00.03=3: the terminal RUN is for running, Xi for stop and F/R for forward/reverse control.

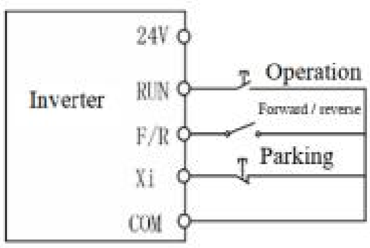
The terminal RUN is normally ON for running, with the valid pulse edge, F/R for forward/reverse switching (forward in the OFF status and reverse in the ON status), and Xi is normally OFF for stop, with the valid level. When the mode of deceleration to stop (F04.19=0) is selected, the logic diagram is as shown in figure (d) below.



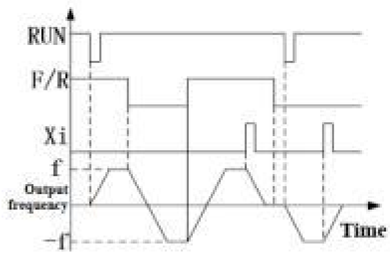
(a) Wiring diagram of three-line control (F00.03=2)



(b) F04.19=0, F00.03=2: forward/reverse running logic



(c) Wiring diagram of three-line control (F00.03=3)



(d) F04.19=0, F00.03=3: forward/reverse running logic

Fig. 5-3 Three-line control

5.6 Common Process Parameters of Inverter

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F00.01	Drive control mode of motor 1	0: V/F control (VVF) 1: Speed sensorless vector control (SVC) 2: Speed sensor vector control (FVC)		0	○
F00.04	Options of main frequency source A	0: digital frequency setting F00.07 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: Percentage setting of main frequency communication 7: Direct setting of main frequency communication		0	○

		8: digital potentiometer setting			
F00.07	Digital frequency setting	0.00 to maximum frequency F00.16	Hz	0.00	●
F00.14	Acceleration time 1	0.00~650.00 (F15.13=0)	s	15.00	●
F00.15	Deceleration time 1	0.00~650.00 (F15.13=0)	s	15.00	●
F00.16	Maximum frequency	1.00~600.00	Hz	50.00	○
F00.18	Upper frequency limit	Lower frequency limit F00.19 to maximum frequency F00.16	Hz	50.00	●
F00.19	Lower frequency limit	0.00 to upper frequency limit F00.18	Hz	0.00	●
F00.21	Reverse control	0: Allow forward/reverse running 1: Prohibit reversing		0	○

Note: Common process parameters may also include the input and output terminal function settings. Refer to the F02 and F03 groups in the function table.

5.7 Motor Parameter Identification

For the better control performance, motor parameters must be identified.

Identification Method	Application	Identification Effect
F01.34=1 Static self-learning of asynchronous motor	It is applied where the motor and load cannot be separated easily and rotary self-learning is not allowed.	General
F01.34=11 Static self-learning of synchronous motor		
F01.34=2 Rotary self-learning of asynchronous motor	Scenarios where the motor and load can be separated easily and open-loop control is adopted. Before operation, the motor shaft should be separated from the load. The motor under load must not be put into rotary self-learning.	Good
F01.34=12 Rotary self-learning of synchronous motor		
F01.34=3 Self-learning of asynchronous motor encoder	Closed-loop control; scenarios where the motor and load can be separated easily and closed-loop control is adopted. (For a synchronous motor with an encoder, encoder self-learning is required.)	Optimal
F01.34=13 encoder self-learning of synchronous motor		

- Prior to self-identification, make sure that the motor is stopped; otherwise, self-identification cannot be performed properly.

Parameter identification steps

- Where the motor and load can be separated, the mechanical load and motor should be completely separated in the power-off status.
- After the power-on, set the command source of the inverter to keyboard control (F00.02=0).

- Enter the nameplate parameters of the motor accurately.

Motor	Corresponding Parameter	
Motor 1 (Motor 2 corresponds to parameters of group F14)	F01.00 Motor type F01.02 Rated voltage of motor F01.04 Rated frequency of motor F01.06: Motor winding connection	F01.01 Rated power of electric motor F01.03 Rated current of motor F01.05 Rated speed

- For the asynchronous motor:

Set F01.34=1 for confirmation and press the RUN key. The inverter will start the static self-identification of the motor.

Set F01.34=2, make confirmation and press the RUN key. The inverter will start rotation self-identification of the motor.

Set F01.34=3, make confirmation and press the RUN key. The inverter will start encoder self-identification of the motor and encoder.

- For the synchronous motor:

Set F01.34=11, make confirmation and press the RUN key. The inverter will start stillness self-identification of the motor.

Set F01.34=12, make confirmation and press the RUN key. The inverter will start rotation self-identification of the motor.

Set F01.34=13, make confirmation and press the RUN key. The inverter will start encoder self-identification of the motor and encoder.

- It takes about two minutes to complete the self-identification of the motor. Then the system will return to the initial power-on status from the "tune" interface.
- If multiple motors are used in parallel, the rated power and rated current input of the motors should be the sum of power and current of these motors.

If two motors are used alternately, the parameters of the motor 2 in the F14 group need to be set separately, and identified based on F14.34.

5.8 Closed-loop vector adjustment procedures

- Set the command source of the inverter to keyboard control and the main frequency source to digital frequency F00.07 (5.00Hz); set F12.00 M.K multi-functional key to option: 3 (Forward/Reverse switching); drive control mode of motor F00.01: 0 (VVF).
- Press "RUN" on the keyboard to run the inverter; check F18.02 (PG feedback frequency) - it should fluctuate around 5.00Hz after stabilization; then press M.K to make the inverter run reversely, and after stabilization the feedback frequency should fluctuate around -5.00Hz. Afterwards, set F00.07 to 10.00Hz, 25.00Hz and 50.00Hz successively (make sure it is safe and technologically allowed!) Repeat the above operations. If all goes normal, it means the PG card and encoder are properly wired and set.
- If the motor rotation direction is opposite to the actual direction, please exchange connection of any motor line pair; if the feedback frequency direction of the encoder is opposite to the actual direction (F18.02 and F18.01 are opposite in direction), please exchange the wiring connection of phase A and B on the PG card; if the feedback frequency value is incorrect, please check F01.25 encoder line count.

5.9 Abnormality handling

Abnormal rotating direction of the motor

- Check whether the parameter value ofF00.03 is correctly set. The logic diagram is shown in Fig. 5-2 and Fig. 5.3.
- Check the motor wiring for correctness.
- Seek technical support.

Abnormal self-learning of encoder

- Check the motor wiring line count for correctness.
- Check all PG cards of the encoder for proper correspondence.
- Check the motor encoder wiring for correctness.
- Seek technical support.

Chapter 6 Application function description

6.1 Running command

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F00.02	Options of command source	0: keyboard control 1: Terminal control 2: Communication control		0	○

The command source is used to specify the input methods for start-up, stop, forwarding, reversing, jogging and other commands for inverter control. There are three ways for the command source, i.e. keyboard control, terminal control, and communication control.

The final command source also relates to the input functions “24: switching from the Run command to keyboard” and “25: switching from the Run command to communication”; If the input function “24: switching from the Run command to keyboard” is valid, the current command source is “keyboard control”. If the input function “25: switching from the Run command to communication” is valid, the current command source is “communication control”. Otherwise, the command source depends on the setting of the function code F00.02.

6.1.1 Start/stop via keyboard control

Set the parameter F00.02=0: keyboard control.

The start and stop of the inverter are controlled by the RUN key , STOP key on the keyboard. In the case of no trip protection, press the RUN key to enter the running status. If the green LED indicator between the RUN key and the M.K key is ON, it indicates that the inverter is in the running status. If this indicator is flickering, it means that the inverter is in the status of deceleration to stop.

Regardless of the speed or torque reference input control, the inverter will run in the input control mode at the jog speed once jogging is enabled.

6.1.2 Start/stop via terminal control

F00.02=1: terminal control

The start and stop of the inverter are controlled by the start and stop control terminals that are defined by the function codes F02.00 to F02.13. Detailed settings of terminal control are dependent on F00.03.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F00.03	Options of terminal control mode	0: terminal RUN (running) and F/R (forward/reverse) 1: terminal RUN (forward) and F/R (reverse) 2: terminal RUN (forward), Xi (stop) and F/R (reverse) 3: terminal RUN (running), Xi (stop) and F/R (forward/reverse)		0	○

Terminal RUN: Xi terminal is set to “1: terminal RUN”

Terminal F/R: Xi terminal is set to “2: running direction F/R”

Terminal control can be divided into two types: two-line control and three-line control.

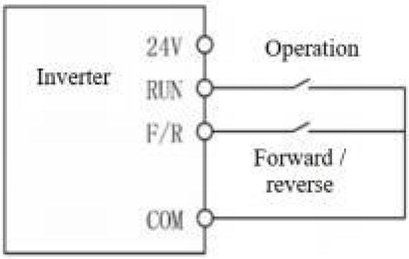
Two-line control:

F00.03=0: the terminal RUN is in the running status, and F/R in the forward/reverse status.

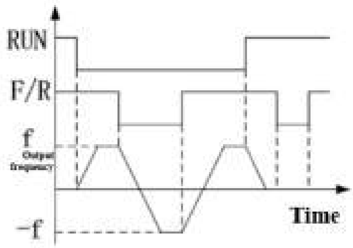
The terminal RUN is activated/deactivated to control the start and stop of the inverter; terminal F/R is activated/deactivated to control the forward/reverse running. When the mode of deceleration to stop is selected, the logic diagram is as shown in the figure (b) below;

F00.03=1: the terminal RUN controls forward running, and the terminal F/R is in the reverse mode.

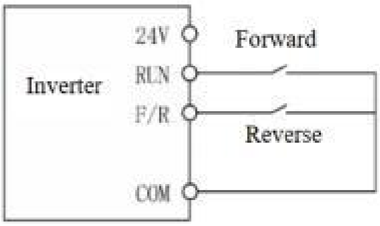
Enable/Disable the terminal RUN to control the forward running and stop of the inverter, and the terminal F/R to control the reverse running and stop. When the terminals RUN and F/Rare enabled simultaneously, the inverter will be stopped. When the mode of deceleration to stop is selected, the forward/reverse logic is as shown in the figure (d) below;



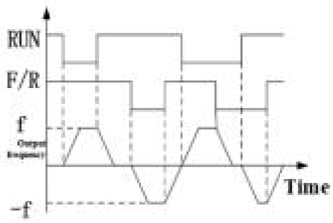
(a) Wiring diagram of two-line control (F00.03=0)



(b) F04.19=0, F00.03=0,run the forward/reverse logic



(c) Wiring diagram of two-line control (F00.03=1)



(d) F04.19=0, F00.03=1: forward/reverse running logic

Fig. 6-1 Two-line control

> When the start/stop value ofF00.03 is set to 0 or 1, even if the terminal RUN is available, the inverter can be stopped by pressing the STOP key STOP or sending an external stop command to the terminal. In this case, the inverter will not be in the running status until the terminal RUN is disabled and then enabled.

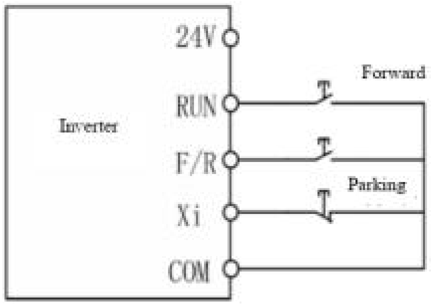
Three-line control:

F00.03=2: the terminal RUN controls forward running, the terminal Xi is for stop, and the terminal F/R is in the reverse status.

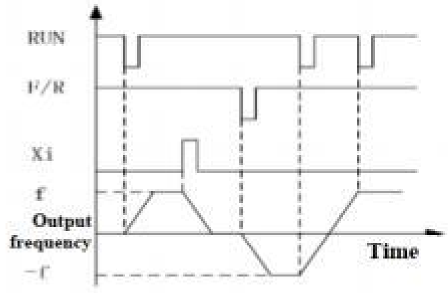
The terminal RUN is normally ON for forward running, and the terminal F/R is normally ON for reverse running, with valid pulse edges. The terminal Xi is normally closed for stop, with the valid level. When the inverter is in the running status, press Xi to stop it. When the mode of deceleration to stop (F04.19=0) is selected, the logic diagram is as shown in figure (b) below. The terminal Xi is for “three-line running and stop control” as defined by F02.00 to F02.04.

F00.03=3: the terminal RUN is for running, Xi for stop and F/R for forward/reverse control.

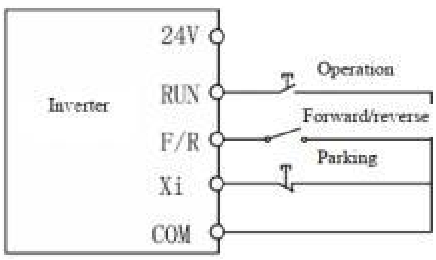
The terminal RUN is normally ON for running, with the valid pulse edge, F/R for forward/reverse switching (forward in the OFF status and reverse in the ON status), and Xi is normally OFF for stop, with the valid level. When the mode of deceleration to stop (F04.19=0) is selected, the logic diagram is as shown in figure (d) below.



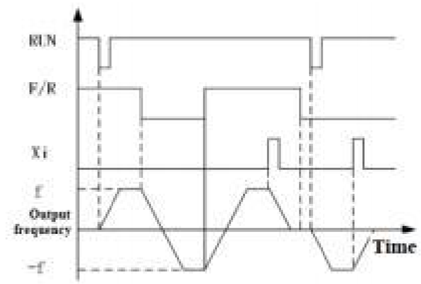
(a) Wiring diagram of three-line control (F00.03=2)



(b) F04.19=0, F00.03=2: forward/reverse running logic



(c) Wiring diagram of three-line control (F00.03=3)



(d) F04.19=0, F00.03=3: forward/reverse running logic

Fig. 6-2 Three-line control

The three-line control logic of the EM760 series inverter is consistent with the conventional electrical control. The keys and knob switches should be used correctly as shown in the schematic diagram. Otherwise, operation errors maybe caused.

6.1.3 Start/stop via communication control

F00.02=2: communication control

The inverter start and stop are controlled by the host through the RS485 communication port. See 10.3.4 Register address distribution 7000H control description for details.

6.2 Frequency command

6.2.1 Options of frequency source

The set mode of the inverter refers to the physical quantity that is taken as the controlled target when the inverter drives a motor.

Speed setting mode with the motor speed as controlled target

Digital setting, analog input setting, high-speed pulse input setting, communication setting, digital potentiometer setting, process PID setting, simple PLC setting or multi-segment speed setting can be performed separately or in a mixed manner. The figure below details the various input modes of the EM760 series inverter by speed setting:

As shown below, speed setting of EM760 series inverter is mainly divided into the setting of main frequency source A setting (referred to as "main A"), setting of auxiliary frequency source B (referred to as "auxiliary B"), and setting of main and auxiliary operations. The final settings are made by simply adjustment and limitation (e.g. upper frequency limit, maximum frequency limit, direction limit, frequency hopping limit).

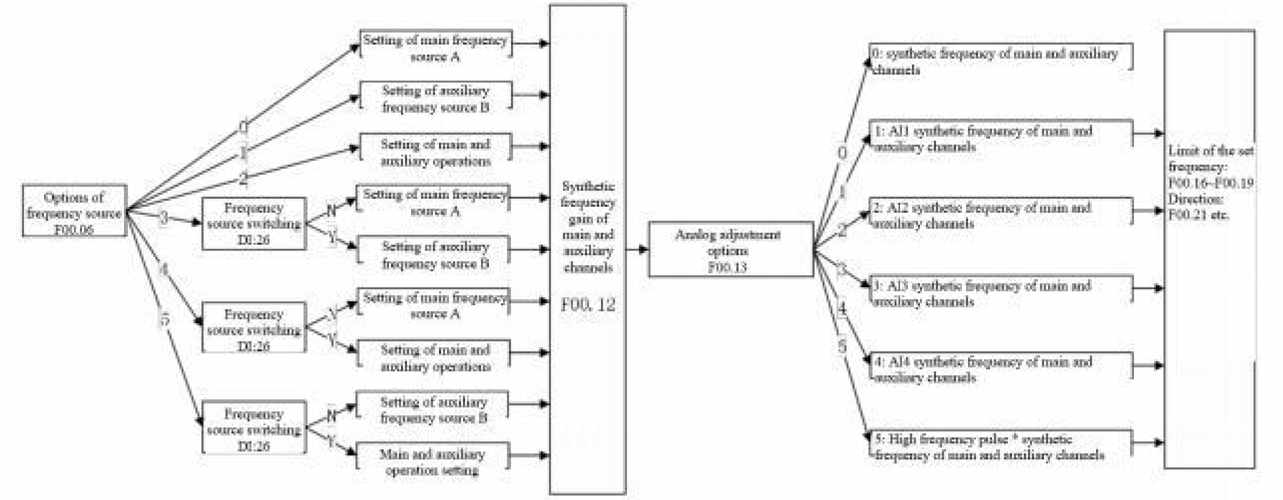


Fig. 6-3 Schematic Diagram of Setting of Main Frequency Source

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F00.06	Options of frequency source	0: main frequency source A 1: auxiliary frequency source B 2: main and auxiliary operation results 3: switching between main frequency source A and auxiliary frequency source B 4: switching between main frequency source A and main and auxiliary operation results 5: switching between auxiliary frequency source B and main and auxiliary operation results 6: Auxiliary frequency source B + feedforward calculation (winding / unwinding application)		0	○

Select the final valid frequency setting channel and operation mode.

F00.06=0: main frequency source A

The final set frequency only depends on the main frequency source A. See 6.2.2 for details.

F00.06=1: auxiliary frequency source B

The final set frequency only depends on the auxiliary frequency source B. See 6.2.3 for details.

F00.06=2: main and auxiliary operation results

The final set frequency depends on the main and auxiliary operation results. See 6.2.4 for details.

F00.06=3: switching between the main frequency source A and auxiliary frequency source B

The final set frequency is determined by the status of the input function "26: Frequency source switching": invalid, depending on the main frequency source A; valid, depending on the auxiliary frequency source B.

F00.06=4: switching between main frequency source A and main and auxiliary calculation results

The final set frequency is determined by the status of the input function “26: Frequency source switching”: invalid, depending on the main frequency source A; valid, depending on the main and auxiliary operation results. See 6.2.4 for details.

F00.06=5: switching between the auxiliary frequency source B and main and auxiliary operation results

The final set frequency is determined by the status of the input function “26: Frequency source switching”: invalid, depending on the auxiliary frequency source B; valid, depending on the main and auxiliary operation results. See 6.2.4 for details.

F00.06=6: Auxiliary frequency source B + feedforward calculation (winding/unwinding application)

See 6.10.1 Winding and unwinding application for details.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F00.10	Gain of main frequency source	0.0~300.0	%	100.0	●
F00.11	Gain of auxiliary frequency source	0.0~300.0	%	100.0	●
F00.12	Synthetic gain of main and auxiliary frequency sources	0.0~300.0	%	100.0	●
F00.13	Analog adjustment of synthetic frequency	0: synthetic frequency of main and auxiliary channels 1: AI1 * synthetic frequency of main and auxiliary channels 2: AI2 * synthetic frequency of main and auxiliary channels 3: AI3* synthetic frequency of main and auxiliary channels 4: AI4* synthetic frequency of main and auxiliary channels 5: High frequency pulse (PULSE) * synthetic frequency of main and auxiliary channels		0	○

Such parameters are mainly used to adjust the gain of each setting source, as shown below. Both the main frequency source A and the auxiliary frequency source B have a set gain. When synthesis is selected via the function code F00.06, a synthetic gain will be generated. The final setting is limited by the analog adjustment and upper and lower frequency limits.

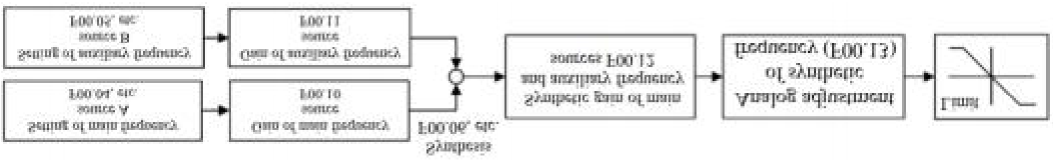


Fig. 6-4

Frequency Source Setting Control (Gain Description)

The gain type function codes (F00.10 to F00.12) are for “multiplication”, i.e. “set value = original set value * gain”. Below is only the description of the analog adjustment (F00.13).

F00.13=0: synthetic frequency of main and auxiliary channels

The synthetic frequency is directly set to the synthetic frequency of main and auxiliary channels.

F00.13=1: AI1 * synthetic frequency of main and auxiliary channels

F00.13=2: AI2 * synthetic frequency of main and auxiliary channels

F00.13=3: AI3 * synthetic frequency of main and auxiliary channels

F00.13=4: AI4 * synthetic frequency of main and auxiliary channels

The synthetic frequency is directly set to “AI (percentage) * synthetic frequency of main and auxiliary channels”.

The 100.00% of AI1~AI4 is the percentage relative to the synthetic frequency of main and auxiliary channels. AI4 requires an extension card. For detailed settings of analog input, see 6.5.7 for details.

F00.13=5: High frequency pulse (PULSE) * synthetic frequency of main and auxiliary channels

The synthetic frequency depends on “HDI (percentage) * synthetic frequency of main and auxiliary channels”. The high-speed pulse is input via the X7 terminal. When this channel is used, you need to set F02.06=40. The value 100.00% is the percentage relative to the synthetic frequency of main and auxiliary channels. For detailed settings of high-speed pulses, see 6.5.3 for details.

6.2.2 Selection of main frequency source

As shown below, it is necessary to comprehensively consider the digital terminal setting and its status during the setting of the main frequency source A. Depending on the terminal settings, multi-segment speed operation can be performed or digital, analog, pulse or communication settings can be applied directly.

If the terminals are unavailable, the current setting channel is determined by the function code F00.04, and final settings are obtained through UP/DOWN setting calculation.

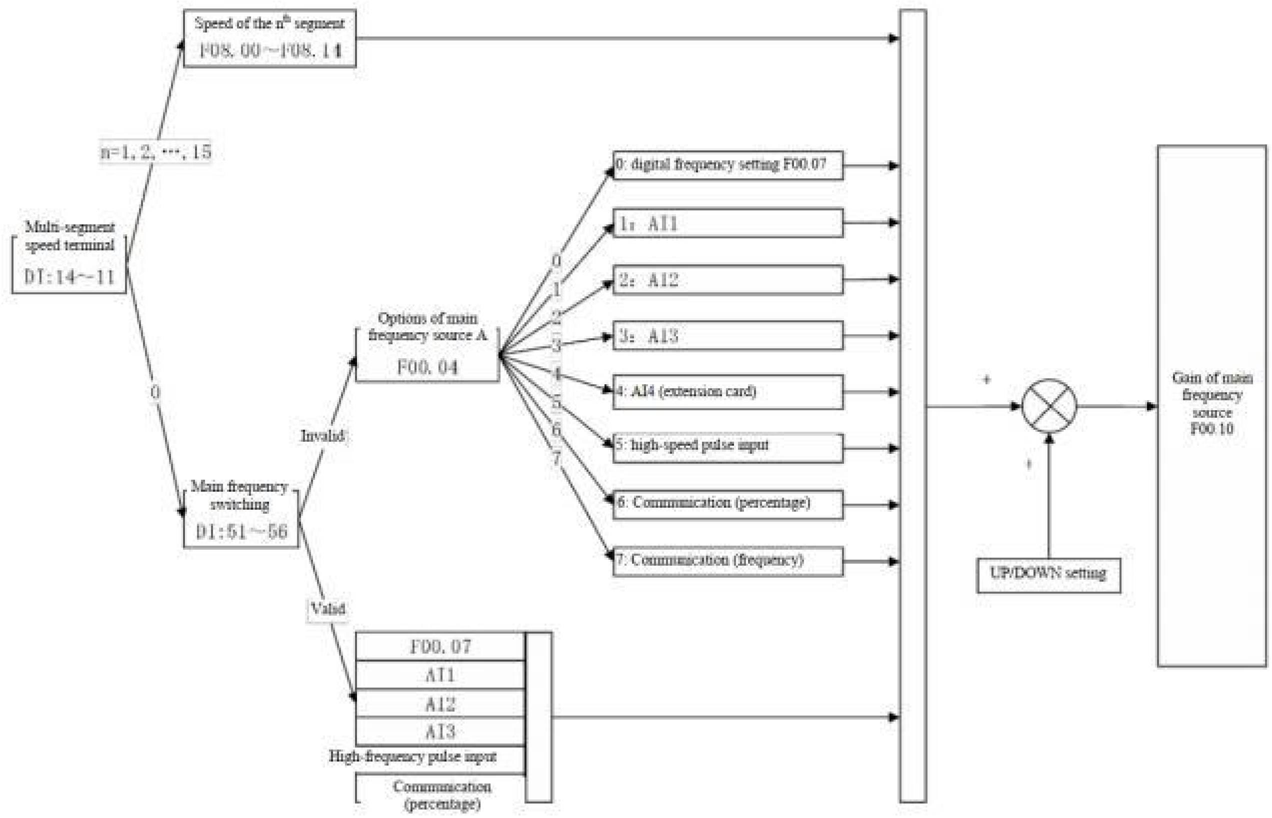


Fig. 6-5 Schematic Diagram of Setting of Main Frequency Source

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F00.04	Options of main frequency source A	0: digital frequency setting F00.07 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: Percentage setting of main frequency communication 7: Direct setting of main frequency communication		0	○

F00.04=0: digital frequency setting F00.07

The main frequency source A depends on the digital frequency setting F00.07.

F00.04=1: AI1

F00.04=2: AI2

F00.04=3: AI3

F00.04=4: AI4 (extension card)

The main frequency source A depends on the AI (percentage) * F00.16.

The percentage corresponding to the input physical quantity of the AI terminal is set by the function codes F02.32 to F02.56. 100.00% is the percentage to the set value ofF00.16 (maximum frequency).

F00.04=5: High-frequency pulse input (X7)

The main frequency source A depends on the HDI (percentage) * F00.16.

The terminal X7 can also be used for high-frequency pulse input (set the terminal function F02.06 to “40: pulse input”), with the frequency range of 0.00-100.00kHz. The corresponding percentage of terminal input pulse frequency is set by F02.26-F02.29. 100.0% is the percentage relative to the set value ofF00.16 (maximum frequency).

F00.04=6: Percentage setting of main frequency communication

- If the master-slave communication (F10.05=1) is enabled and the inverter works as the slave (F10.06=0), the main frequency source A is set to “700FH (master-slave communication setting) * F00.16 (maximum frequency) * F10.08 (slave receiving proportional coefficient)”, and the 700FH data range is -100.00% to 100.00%.
- For general communication (F10.05=0):

  The main frequency source A is set to “7001H (communication percentage setting of the main channel frequency A) * F00.16 (maximum frequency)”; data range of 7001H: -100.00%~100.00%.

F00.04=7: Direct setting of main frequency communication

The main frequency source A is set to “7015H (communication setting of the main channel frequency A)”; data range of 7015H: 0.00~F00.16 (maximum frequency).

See the table below for details. The final setting of the main frequency source A is also dependent on the DI terminal status:

Table 6-1 Detailed Setting of Main Frequency Source A

Terminal Function	Status Description	Priority
11-14: multi-segment speed terminals 1-4	If one is valid, the multi-segment speed mode will be enabled (F08.00-F08.14).	1
51: switching of main frequency source to digital frequency setting	Valid, depending on the digital frequency setting F00.07,the same as the function code F00.04=0	2
52: switching of main frequency source to AI1	Valid, depending on the AI1 input percentage setting, the same as the function code F00.04=1	3
53: Switching of main frequency source to AI2	Valid, depending on the AI2 input percentage setting, the same as the function code F00.04=2	4
54: switching of main frequency source to AI3	Valid, depending on the AI3 input percentage setting, the same as the function code F00.04=3	5
55: Switching of main frequency source to high-speed pulse input	Valid, depending on the HDI input percentage setting, the same as the function code F00.04=5	6
56: switching of main frequency source to communication setting	Valid, depending on the communication input, the same as the function code F00.04=6	7
--	All invalid, depending on the setting of function code F00.04	8

6.2.2.1 Setting main frequency via digital frequency

(1) Set F00.06=0 (main frequency setting)

(2) Set F00.04=0 (digital frequency setting)

(3) Set the desired running frequency in F00.07

6.2.2.2 Setting main frequency via analog (AI)

(1) Set F00.06=0 (main frequency setting)

(2) Set F00.04=1~4 (AI1~AI4 setting)

(3) Depending on the analog channel selected, select corresponding analog input type from F02.62~F02.65.

(4) Select the offset curve of the corresponding analog channel in F02.32. For setting method, see 6.5.7.

(5) For the final percentage of analog setting, the offset value prevails. The value 100% corresponds to F00.16 (maximum frequency).

(6) Set corresponding voltage or current for the selected analog channel from the external side. You can see current frequency setting via F18.01.

6.2.2.3 Setting main frequency via high-speed pulses (HDI)

(1) Set F00.06=0 (main frequency setting)

(2) Set F00.04=5 (high-speed pulse setting)

(3) Set F02.06=40 (the X7 function is for high-speed pulse input)

(4) Set the given corresponding offset curve in F02.26~F02.29. See 6.5.3 for details.

(5) High-speed pulse 100% corresponds to F00.16 (maximum frequency). Upon inputting pulses of certain frequency atX7, you can check current frequency setting via F18.01.

6.2.2.4 Setting main frequency via communication

(1) Set F00.06=0 (main frequency setting)

(2) For a slave of master-slave communication, set F00.04=6 (communication percentage setting of main frequency), F10.05=1 (master-slave communication enabled),and F10.06=0 (slave), and the main frequency source A is set to "700FH (master-slave communication setting) * F00.16 (maximum frequency) * F10.08 (slave receiving proportional coefficient)", and the 700FH data range is -100.00% to 100.00%.

(3) For a slave other than those of master-slave communication with the master setting in percentage, set F00.04=6 (percentage setting and F10.05=0 (master-slave communication disabled). The main frequency source A is set to "7001H (communication percentage setting of the main channel frequency A) * F00.16 (maximum frequency)"; data range of 7001H: -100.00%~100.00%.

(4) For a slave other than those of master-slave communication with direct setting frequency for master setting, set F00.04=7 (percentage setting). The main frequency source A is set to "7015H (communication setting of the main channel frequency A)"; data range of 7015H: 0.00~F00.16 (maximum frequency).

(5) Select communication address, baud rate and format in F10.00~F10.02.

(6) With the frequency set for the master, you can check ifthe set frequency is correct via F18.01.

6.2.2.5 Setting main frequency via multi-segment speed

Multi-segment speed has the top priority in main frequency setting. The final set frequency is determined by multi-segment speed terminals 1 - 4. If all of the multi-segment speed terminals 1 - 4 are not working, the main frequency is determined as per the main frequency source set by F00.04 and the state of DI terminals No. 51 - 56.

Table 6-2 Combination of Multi-segment Speed Command and Multi-segment Speed Terminal

Segment Speed	Multi-segment speed terminal 4	Multi-segment speed terminal 3	Multi-segment speed terminal 2	Multi-segment speed terminal 1	Selected frequency	Corresponding function code
1	Invalid	Invalid	Invalid	Invalid	Main frequency determined by F00.04 and DI terminals No. 51 - 56	F00.04

2	Invalid	Invalid	Invalid	Valid	Multi-segment speed 1	F08.00
3	Invalid	Invalid	Valid	Invalid	Multi-segment speed 2	F08.01
4	Invalid	Invalid	Valid	Valid	Multi-segment speed 3	F08.02
5	Invalid	Valid	Invalid	Invalid	Multi-segment speed 4	F08.03
6	Invalid	Valid	Invalid	Valid	Multi-segment speed 5	F08.04
7	Invalid	Valid	Valid	Invalid	Multi-segment speed 6	F08.05
8	Invalid	Valid	Valid	Valid	Multi-segment speed 7	F08.06
9	Valid	Invalid	Invalid	Invalid	Multi-segment speed 8	F08.07
10	Valid	Invalid	Invalid	Valid	Multi-segment speed 9	F08.08
11	Valid	Invalid	Valid	Invalid	Multi- speed 10	F08.09
12	Valid	Invalid	Valid	Valid	Multi-segment speed 11	F08.10
13	Valid	Valid	Invalid	Invalid	Multi-segment speed 12	F08.11
14	Valid	Valid	Invalid	Valid	Multi-segment speed 13	F08.12
15	Valid	Valid	Valid	Invalid	Multi-segment speed 14	F08.13
16	Valid	Valid	Valid	Valid	Multi-segment speed 15	F08.14

6.2.2.6 Addition to main frequency via UP/DOWN

Function code	Function codename	Parameter description								Unit	Default setting	Attribute
F12.10	UP/DOWN acceleration and deceleration rate	0.00: automatic rate 0.01 - 500.00								Hz/s	5.00	○
F12.11	Options of UP/DOWN offset clearing	0: do not clear 1: clear in non-running state 2: clear when UP/DOWN invalid 3: clear once in non-running state									0	○
F12.12	Options of UP/DOWN power-down saving of offset	0: do not save 1: save (valid after the offset is modified)									1	○
F12.41	Options of UP/DOWN zero crossing	0: prohibit zero crossing 1: allow zero crossing									0	○
F12.45	UP/DOWN function	D7	D6	D5	D4	D3	D2	D1	D0		001	

	selection	Channel sharing / Range limitation / Keyboard / Communication / High-speed pulse / Analog quantity / Digital frequency / Multi-segment speed 0: Invalid 1: valid		00010	○

(1) The UP/DOWN functions are mainly divided into the keyboard UP/DOWN and terminal UP/DOWN, which are handled separately and can be enabled at the same time. Keyboard UP/DOWN: Works only at Level 0 monitoring menu, under which press UP▲/DOWN▼ and the offset frequency will increase/decrease respectively, and so will the frequency setting on the keyboard.

Terminal UP/DOWN: Upon setting the digital input port as the corresponding function (the function code for UP and DOWN is 6 and 7 respectively), control is performed via terminals. When the UP/DOWN terminal is valid, the offset frequency will increase/decrease at the rate ofF12.10 and the final frequency is the set frequency plus offset frequency.

(2) When the keyboard UP and terminal DOWN are valid at the sametime, or the keyboard DOWN and terminal UP are valid at the same time, despite of the same acceleration and deceleration rates, the offset frequency will fluctuate because of different valid moments. This is a normal phenomenon.

(3) The UP/DOWN function is valid. When F12.41=0, the UP/DOWN function can reduce the output frequency ofthe inverter to 0 without reversing. When F12.41=1,the UP/DOWN function can reduce the output frequency of the inverter to 0, followed by reverse running of the motor.

(4) Select the UP/DOWN function in the corresponding frequency setting mode via F12.45.

D0: Set D0 as 1 if multi-segment speed is used to set frequency and UP/DOWN speed regulation is to be added.

D1: Set D1 as 1 if digital frequency F00.07 is used to set frequency and UP/DOWN speed regulation is to be added.

D2: Set D2 as 1 if analog is used to set frequency and UP/DOWN speed regulation is to be added.

D3: Set D3 as 1 if high-speed pulse is used to set frequency and UP/DOWN speed regulation is to be added.

D4: Set D4 as 1 if communication is used to set frequency and UP/DOWN speed regulation is to be added.

D5: Set D5 as 1 if keyboard UP/DOWN is desired for speed regulation. Set D5 as 0 if use of keyboard UP/DOWN is not required.

D6: If the main frequency setting has changed, all of the UP key, UP terminal, DOWN key and DOWN terminal don't work, and the offset frequency should be changed accordingly, set D6 as 1.

D7: Set D7 as 1 if all main frequency channels need to use the same UP/DOWN offset frequency.

6.2.3 Selection of auxiliary frequency source

As shown below, the current setting channel is determined directly by the function code F00.05 during the setting of the auxiliary frequency source B, and the process PID and simple PLC can be involved in the setting.

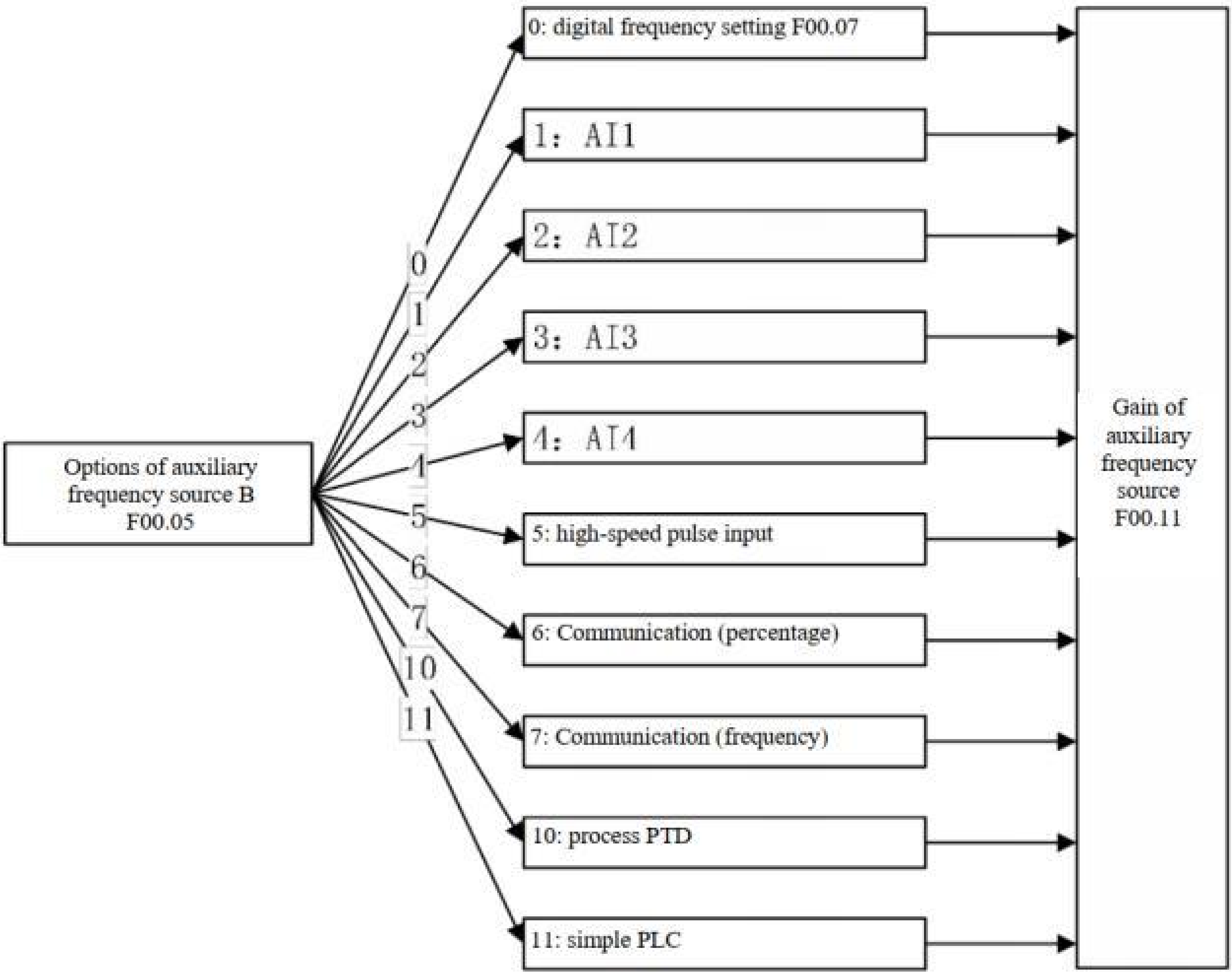


Fig. 6-6 Schematic Diagram of Setting of Auxiliary Frequency Source

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F00.05	Options of auxiliary frequency source B	0: digital frequency setting F00.07 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X5) 6: percent setting of auxiliary frequency communication 7: direct setting of auxiliary frequency communication 8: Reserved 9: Reserved 10: process PID 11: simple PLC		0	○

F00.05=0: digital frequency setting F00.07

The auxiliary frequency B depends on the digital frequency setting F00.07.

F00.05=1: AI1

F00.05=2: AI2

F00.05=3: AI3

F00.05=4: AI4

The auxiliary frequency B is determined by AI (percentage) * F00.16.

F00.05=5: High-frequency pulse input (X5)

The auxiliary frequency B is determined by HDI (percentage) * F00.16.

F00.05=6: percent setting of auxiliary frequency communication

- If the master-slave communication (F10.05=1) is enabled and the inverter works as the slave (F10.06=0), the auxiliary frequency B is set to "700FH (master-slave communication setting) * F00.16 (maximum frequency) * F10.08 (slave receiving proportional coefficient)", and the 700FH data range is -100.00% to 100.00%.
- For general communication (F10.05=0): the auxiliary frequency B is set to "7002H (communication setting of the auxiliary channel frequency B) * F00.16 (maximum frequency)";

F00.05=7: direct setting of auxiliary frequency communication

the auxiliary frequency B is set to "7016H (communication setting of the auxiliary channel frequency B)", and the data range of 70016H is 0.00 - F00.16 (maximum frequency).

F00.05=10: process PID

The auxiliary frequency B depends on the process PID function output, as detailed in 6.2.3.1. This is usually applied in on-site closed-loop process control, such as the constant-pressure closed-loop control and constant-tension closed-loop control.

F00.05=11: Simple PLC

The auxiliary frequency B depends on the simple PLC function output, as detailed in 6.2.3.2.

1. It's not recommended to select the same physical channel for both the main frequency source A and the auxiliary frequency source B;
2. The process PID and simple PLC modules will not be valid until they are selected.

6.2.3.1 Setting auxiliary frequency by Process PID

The EM760 series inverter has a process PID function, as described in this section. Process PID control is mainly for pressure control, flow control and temperature control.

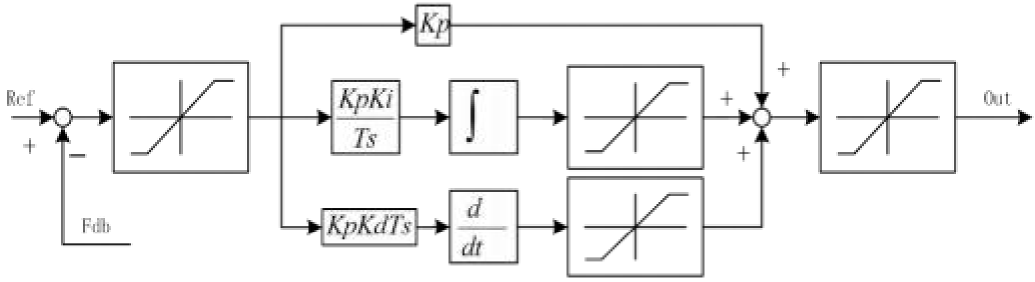


Fig. 6-7 Block Diagram of Process PID

PID control is a kind of closed-loop control. The output signal (Out) of the object controlled by the system is fed back to the PID controller, and the output of the controller is adjusted after PID operation, thus forming one or more closed loops. This function is to make the output value (Out) of the object controlled by the system consistent with the set target value (Ref). The specific block diagram is as shown above.

The PID controller is used for control by calculating the control quantity with three calculation factors, i.e. proportion (P), integral (I) and differential (D), according to the difference between the set target (Ref) and feedback signal (Fdb). The features of each calculation factor are as follows:

Proportion (P): Proportional control is one of the simplest control modes. The output of the controller is proportional to the input error signal. When only proportional control is enabled, there are steady-state errors in the system output.

Integral (I): In the integral control mode, the output of the controller is proportional to the integral of the input error signal. Steady-state errors can be eliminated, so that the system has no steady-state errors while operating in the steady state. However, drastic changes cannot be tracked.

Differential (D): In the differential control mode, the output of the controller is proportional to the differential (i.e. change rate of the error) of the input error signal. This can predict the trend of changes in errors,quickly respond to drastic changes, and improve the dynamic features of the system in the control process.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.00	PID setting source	0: digital PID setting 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: PULSE, high-frequency pulse (X7) 6: communication setting (percentage setting)		0	○
F09.01	Digital PID setting	0.0 to PID setting feedback range F09.03		0.0	●
F09.03	PID setting feedback range	0.1~6000.0		100.0	●

F09.00=0: digital PID setting F09.01

The PID setting depends on the digital PID setting (F09.01), and the specific percentage is F09.01/F09.03 * 100.00%.

F09.00=1: AI1

F09.00=2: AI2

F09.00=3: AI3

F09.00=4: AI4

See 6.5.7 for details of AI1 to AI4. When serving as PID setting, the percentage is directly given, and the maximum output is 100.00%.

F09.00=5: PULSE, high-frequency pulse (X7)

The set percentage of PID is directly dependent on the HDI (percentage).

See 6.5.3 for details of X7 serving as high-speed pulse input. When serving as PID setting, the percentage is directly given, and the maximum output is 100.00%.

F09.00=6: communication setting

The percentage of PID setting depends directly on the communication (percentage).

- If the master-slave communication (F10.05=1) is enabled and the inverter works as the slave (F10.06=0), the specific feedback percentage is "700FH (master-slave communication setting) * F10.08 (slave receiving proportional coefficient)", and the 700FH data range is -100.00% to 100.00%.
- For the general communication (F10.05=0), the specific setting percentage is "7004H (communication setting of process PID setting)", and the 7004H data range is -100.00% to 100.00%.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.02	PID feedback source	1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: PULSE, high-frequency pulse (X7) 6: Communication setting		1	○

F09.02=1: AI1

F09.02=2: AI2

F09.02=3: AI3

F09.02=4: AI4

The PID feedback percentage is directly dependent on the AI (percentage).

See 6.5.7 for details of AI1 to AI4. When serving as PID feedback, the percentage is directly given, and the maximum output is 100.00%.

F09.02=5: PULSE, high-frequency pulse (X7)

The set percentage of PID is directly dependent on the HDI (percentage).

See 6.5.3 for details of X7 serving as high-speed pulse input. When serving as PID setting, the percentage is directly given, and the maximum output is 100.00%.

F09.02=6: communication setting

The PID feedback percentage is directly dependent on the communication (percentage).

- If the master-slave communication (F10.05=1) is enabled and the inverter works as the slave (F10.06=0), the specific feedback percentage is “700FH (master-slave communication setting) * F10.08 (slave receiving proportional coefficient)”, and the 700FH data range is -100.00% to 100.00%.
- For the general communication (F10.05=0), the specific feedback percentage is “7005H (communication setting of process PID feedback)”, and the 7005H data range is -100.00% to 100.00%.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.04	PID positive and negative action selection	Ones place: Positive and negative action selection 0: positive 1: negative Tens place: Direction selection of positive and negative action follow-up command 0: Not follow 1: Follow		0	○

The process PID action mode depends jointly on the setting of the function code F09.04 and the status of the input function “44: PID positive/negative action switching”. The relation details when positive and negative actions don’t follow the command direction are as described below.

Table 6-3 PID Positive/Negative Action - Description 1

F09.04	44: PID positive/negative switching	Mode of action	Description
0	0	Positive action	Both the deviation and output are positive.
0	1	Negative action	The deviation is positive and the output is negative.
1	0	Negative action	The deviation is positive and the output is negative.
1	1	Positive action	Both the deviation and output are positive.

The relation details when the positive and negative actions follow the command direction areas shown below.

Table 6-4 PID Positive/Negative Action - Description 2

Command direction (0 for positive and 1 for negative)	F09.04	44: PID positive/negative switching	Mode of action	Description
0	0	0	Positive action	Both the deviation and output are positive.

0	0	1	Negative action	The deviation is positive and the output is negative.
0	1	0	Negative action	The deviation is positive and the output is negative.
0	1	1	Positive action	Both the deviation and output are positive.
1	0	0	Negative action	The deviation is positive and the output is negative.
1	0	1	Positive action	Both the deviation and output are positive.
1	1	0	Positive action	Both the deviation and output are positive.
1	1	1	Negative action	The deviation is positive and the output is negative.

Note: The deviation in PID control is usually “setting - feedback”.

- When the feedback signal is greater than the PID setting, the output frequency of the inverter should decrease for PID balance. Take the water supply control as an example. When the pressure increases, the pressure feedback will increase. The output frequency of the inverter must be decreased to reduce the pressure and keep the constant pressure. In this case, the PID should be set to the positive action.
- When the feedback signal is greater than the PID setting, the output frequency of the inverter needs to increase for PID balance. Take temperature control as an example. The PID regulator needs to be set to negative action to control the temperature.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.05	Proportional gain 1	0.00~100.00		0.40	●
F09.06	Integral time 1	0.000 to 30.000; 0.000: no integral	s	2.000	●
F09.07	Differential time 1	0.000~30.000	ms	0.000	●
F09.08	Proportional gain 2	0.00~100.00		0.40	●
F09.09	Integral time 2	0.000 to 30.000; 0.000: no integral	s	2.000	●
F09.10	Differential time 2	0.000~30.000	ms	0.000	●
F09.11	PID parameter switching conditions	0: no switching 1: switching via digital input terminal 2: automatic switching according to deviation 3: Automatic switching by frequency		0	●
F09.12	PID parameter switching deviation 1	0.00~F09.13	%	20.00	●
F09.13	PID parameter switching deviation 2	F09.12~100.00	%	80.00	●

For a variety of complex scenes, two sets of PID parameters have been introduced into the process PID module. Switching or linear interpolation of the two sets of parameters can be performed according to the function setting (F09.11) and input conditions [e.g. input function “43: PID parameter switching”, and deviation e(k)). See the instruction below for details.

Table 6-5 Description of PID Parameter Options

Method		Description
F09.11	**Other conditions**	
0	--	PID parameters are not switched. The first group of parameters is used.
1	43: PID parameter switching	PID parameters are switched via the digital input terminal (43: PID parameter switching).
	0	**Invalid switching, the first group of parameters**
	1	Valid switching, the second group of parameters
2	|e(k)|~F09.12/13	PID parameters are automatically switched according to the deviation.
	|e(k)|< F09.12	The first group of parameters
	|e(k)|> F09.13	The second group of parameters
	Middle	According to the deviation, linear interpolation is performed based on the two groups of parameters.
3	|P|~F09.12/13	PID parameters are automatically switched by frequency.
	|P|< F09.12	The first group of parameters
	|P|> F09.13	The second group of parameters
	Middle	According to the frequency, linear interpolation is performed based on the two groups of parameters.

As described in the table, when the function code F09.11 is set to 0, the PID parameters will not be switched, and the first group of parameters (F09.05 toF09.07) will prevail; when the function code is set to 1, the PID parameters will be selected according to the status of the input function "43: PID parameter switching"; when the function code 2 is used, the PID parameters will be selected according to the absolute value |e(k)| (=|setting-feedback|) of the current deviation and the relationship between the function codes F09.12 and F09.13, or the linear difference may be used; when the function code 3 is used, processing is similar to that of the option 2, the PID parameters will be selected according to the percentage of the current output frequency to maximum frequency |P| = (output frequency/maximum frequency * 100%) and the relationship between the function codes F09.12 and F09.13, or the linear difference maybe used.

In the case of "F09.12≤|e(k)|≤F09.13", the current PID parameters are obtained through linear interpolation of the first and second groups of parameters. The specific principle is shown by the intermediate segment in the figure below.

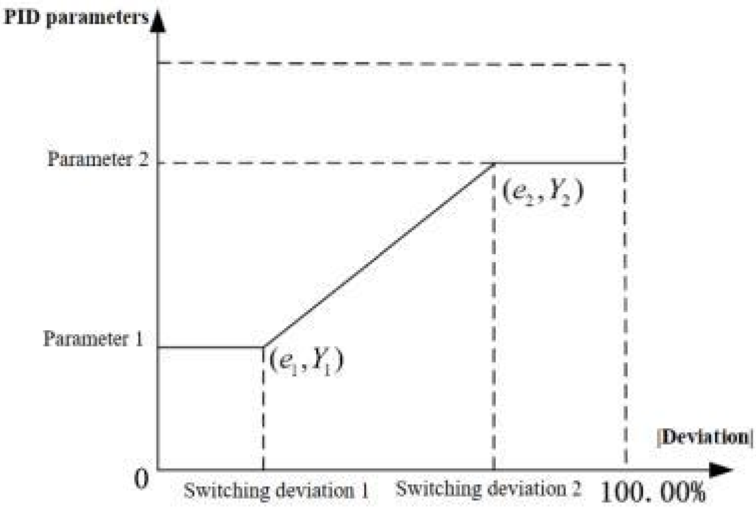


Fig. 6-8 Schematic Diagram of Automatic Switching of PID Parameters based on Deviation (F19.11=2)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.14	Initial PID value	0.00~100.00	%	0.00	●
F09.15	PID initial value holding time	0.00~650.00	s	0.00	●

The inverter starts running, and the process PID module constantly outputs the initial PID value (F09.14) for the initial PID holding time (F09.15). Then the output is adjusted by the PID based on the deviation. Specific effects are shown below.

When the initial PID holding time is set to 0.00s,i.e. F09.15=0.00, the initial PID output function will be invalid.

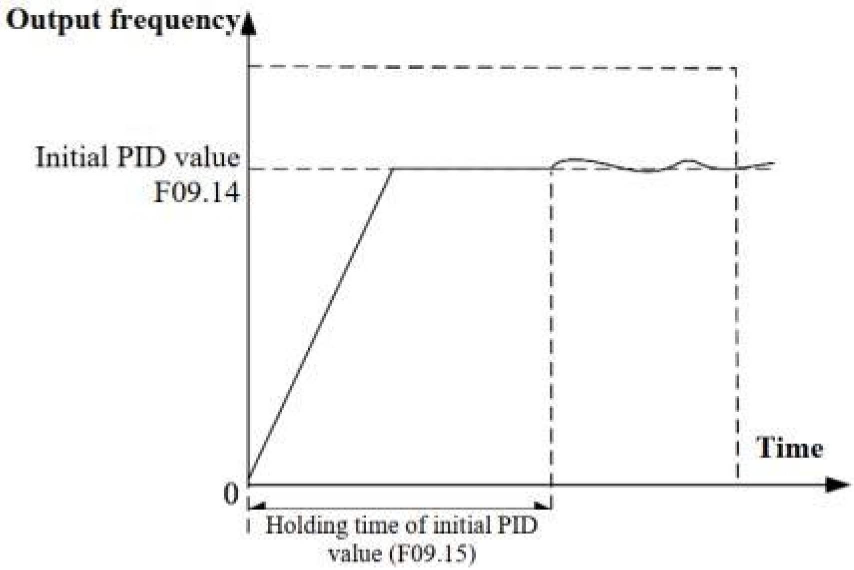


Fig. 6-9 Schematic Diagram of Initial PID Output

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.16	Upper limit of PID output	F09.17~+100.0	%	100.0	●
F09.17	Lower limit of PID output	–100.0~F09.16	%	0.0	●

The PID output is limited. The output range of the PID module in the whole process is (F09.17, F09.16). That is, if the actual adjustment result is beyond this range, the output will be based on the boundaries.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.18	PID deviation limit	0.00-100.00 (0.00: invalid)	%	0.00	●

When the deviation between the PID setting and feedback is less than or equal to the deviation limit (F09.18), the PID will stop the adjustment. When the deviation between the setting and feedback is smaller, the output frequency will remain stable. This is valid for some closed-loop control applications.

If the input terminal function "41: process PID pause" is valid, the PID will also stop the adjustment. Users need to use these two modes together.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.19	PID differential limit	0.00~100.00	%	5.00	●

The differential (D) component of the PID regulator must not be greater than the PID differential limit (F09.19), in order to avoid the excessive deviation and output at a certain moment to cause system oscillations. If this value is set correctly, the impact of sudden interference on the system can be well suppressed.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.20	PID integral separation threshold	0.00-100.00 (100.00% = invalid integral separation)	%	100.00	●

For better PID regulation, only PD or P adjustment is needed sometimes, while integral adjustment is not needed. For this reason, the EM760 series inverter has a special integral separation function. When the deviation between the PID setting and feedback is greater than the PID integral separation threshold (F09.20), the integral separation will be valid. That is, the integral (I) adjustment of the PID regulator will be suspended. To facilitate remote control, the input terminal function "42: process PID integration pause" can be used. But if the function code setting is invalid (F09.20=100.00), the input terminal function will not work, as detailed below.

Table 6-6 Description of Integral Separation Function

Method		**Description**
F09.20	DI(42)	F09.20: PID integral separation threshold; DI (42): Process PID integral pause
100.00%	--	The integral (I) is always valid.
0.00% ~ 99.99%		Depending on the relationship between |e(k)| and F09.20 as well as the status of the DI function
	Invalid	If |e(k)|>F09.20, the integral separation is valid.
	Valid	The integral separation is valid.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.21	PID setting change time	0.000~30.000	s	0.000	●

The PID setting change time refers to the time required for the setting to change from 0.0% to 100.0%, similar to the acceleration and deceleration time function. When the PID setting changes, the actual PID setting will change linearly, thus reducing the impact ofsudden changes on the system. Smoothing is invalid during the initial setting. The setting will change from the current feedback value during the start.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.22	PID feedback filtering time	0.000~30.000	s	0.000	●
F09.23	PID output filtering time	0.000~30.000	s	0.000	●

F09.22 is used to filter the PID feedback. This is helpful to reduce the impact of interference on the feedback, but will cause the decline of the response performance of the process closed-loop system.

F09.23 is used to filter the PID output. This is helpful to reduce the sudden changes in the output frequency of the inverter, but will also cause the decline of the response performance of the process closed-loop system.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.24	Upper limit detection value of PID feedback disconnection	0.00-100.00; 100.00 = invalid feedback disconnection	%	100.00	●
F09.25	Lower limit detection value of PID feedback disconnection	0.00-100.00; 0.00 = invalid feedback disconnection	%	0.00	●
F09.26	Detection time of PID feedback disconnection	0.000~30.000	s	0.000	●

The function of PID feedback disconnection detection is to prevent galloping caused by feedback disconnection. Depending on the nature of the feedback sensor, the settings are different.

If the 0.0% type sensor is fed back at the time of disconnection, the lower limit of PID feedback disconnection detection (F09.25) needs to be set to an appropriate value. If the feedback amount is below the F09.25 setting and has been maintained for the PID feedback disconnection detection time (F09.26), the PID feedback will be regarded disconnected. When the 100.0% type sensor is fed back at the time of disconnection, the upper limit of PID feedback disconnection detection (F09.24) needs to be set to an appropriate value. If the feedback amount is greater than the feedback amount and has been maintained for the time corresponding to F09.26, the PID feedback will be regarded disconnected.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.27	PID sleep control options	0: Invalid 1: sleep at zero speed 2: sleep at lower frequency limit 3: sleep with tube sealed		0	●
F09.28	Sleep action point	0.00-100.00 (100.00 corresponds to the PID setting feedback range)	%	100.00	●

F09.29	Sleep delay time	0.0~6500.0	s	0.0	●
F09.30	Wake-up action point	0.00-100.00 (100.00 corresponds to the PID setting feedback range)	%	0.00	●
F09.31	Wake-up delay time	0.0~6500.0	s	0.0	●

When the output value and feedback value tend to be stable or the controlled quantity is within the allowable range on some occasions or at a certain moment, and the output is not allowed, the sleep status can be applied for a short time. If the controlled quantity is beyond the control range, the inverter will be awakened and generate the output. These steps will be repeated to make the controlled quantity within the allowable range and also save the energy. The detailed function description is shown below.

Table 6-7 Description of Sleep/Wake-up Function

Method		**Description**
Mode of action	**State**	
Positive action (e.g. constant pressure control)	Normal work	Judgment of the sleep conditions: If the |Feedback| is greater than the sleep action point (F09.28) (necessary condition: the feedback pressure must be greater than or equal to the set pressure during restart after the stop or sleep), or the output frequency of the inverter reaches the lower limit, causing the failure to continue to decelerate (due to the lower frequency limit or lower output limit of the inverter), and these conditions have been met and maintained to the sleep delay time (F09.29), the sleep status will be enabled. *: The PID continues the output during the delay period. The output depends on the function code after the delay period.
	Sleep status	Judgment of the wake-up conditions: If the |Feedback| is less than or equal to the value of the wake-up action point (F09.30), and this has been maintained for the wake-up delay time (F09.31), the sleep status will be disabled. *: The output depends on the function code during the delay period; and the PID can continue normal output after the delay period.
Negative action (e.g. constant temperature control)	Normal work	Judgment of the sleep conditions: If the |Feedback| is less than the sleep action point (F09.28) (necessary condition: the feedback pressure must be lower than or equal to the set pressure during restart after the stop or sleep), or the output frequency of the inverter reaches the lower limit, causing the failure to continue to decelerate (due to the lower frequency limit or lower output limit of the inverter), and these conditions have been met and maintained to the sleep delay time (F09.29), the sleep status will be enabled. *: The PID continues the output during the delay period. The output depends on the function code after the delay period.
	Sleep status	Judgment of the wake-up conditions: If the |Feedback| is greater than or equal to the value of the wake-up action point (F09.30), and this has been maintained for the wake-up delay time (F09.31), the sleep status will be disabled. *: The output depends on the function code during the delay period; and the PID can continue normal output after the delay period.

Suggestion: F09.28 (sleep action point) is greater than or equal to F09.30 (wake-up action point) during the positive action, and less than or equal to F09.30 (wake-up action point) during the negative action.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.32	Multi-segment PID setting 1	0.0 to PID setting feedback range F09.03		0.0	●
F09.33	Multi-segment PID setting 2	0.0 to PID setting feedback range F09.03		0.0	●
F09.34	Multi-segment PID setting 3	0.0 to PID setting feedback range F09.03		0.0	●

PID settings are determined in conjunction with the setting of the function code F09.00. The EM760 series inverter has a multi-segment PID setting function, and its switching conditions are mainly dependent on the input functions “15: multi-segment PID terminal 1” and “16: multi-segment PID terminal 2”, as detailed in the table below.

Table 6-8 Details of Multi-segment PID Setting Function

Method			**Setting**	**Scope**	**PID Setting**
16	15	F09.00			
Invalid	Invalid	0	F09.01	0.0~F09.03	0.00%~100.00%
		1	AI1	-100.00%~100.00%	-100.00%~100.00%
		2	AI2	-100.00%~100.00%	-100.00%~100.00%
		6	485	-100.00%~100.00%	-100.00%~100.00%
Invalid	Valid	--	F09.32	0.0~F09.03	0.00%~100.00%
Valid	Invalid	--	F09.33	0.0~F09.03	0.00%~100.00%
Valid	Valid	--	F09.34	0.0~F09.03	0.00%~100.00%

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.35	Upper limit of feedback voltage	Lower limit of feedback voltage to 10.00	V	10.00	●
F09.36	Lower limit of feedback voltage	0.00 to upper limit of feedback voltage	V	0.00	●

The upper and lower limits of the feedback voltage can be used for automatic material cutoff detection in winding applications. They represent the upper and lower limits of material cutoff, respectively. Due to the particularity of winding applications, F09.35 and F09.36 can be used to reflect the real sensor boundaries, which is more conducive to the system stability.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.37	Options of integral action within the set change time of PID	0: Always calculate the integral term 1: Calculate the integral term after the F09.21 set time is reached 2: Calculate the integral term when the error is less than F09.38		0	●
F09.38	Input deviation of integral action within the set change time of PID	0.00~100.00	%	30.00	●

F09.37=0: always calculate the integral term

This function code does not affect the integral action.

F09.37=1: Calculate the integral term after the F09.21 set time is reached

The integral is unavailable within the first change period (F09.21) after startup.

F09.37=2: calculate the integral term when the error is less than F09.38

The integral is unavailable within the first change period (F09.21) after startup. However, the integral will be enabled again if the error is less than F09.38 within this period.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.39	Wake-up option	0: target pressure F09.01* coefficient of wake-up action point 1: Wake-up action point (F09.30)		0	○
F09.40	Coefficient of wake-up action point	0.0-100.0 (100% corresponds to PID setting)	%	90.0	●

F09.39=0: target pressure F09.01* coefficient of wake-up action point

The PID will wake up if the PID feedback is less than F09.40 * pre-setting and such state lasts for the F09.31 wake-up delay time.

F09.39=1: wake-up action point (F09.30)

The PID will wake up if the PID feedback is less than F09.30 and such state lasts for the F09.31 wake-up delay time.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.41	Pipeline network alarm overpressure	0.0 to pressure sensor range F09.03	bar	6.0	●
F09.42	Overpressure protection time	0-3600 (0: invalid)	s	0	●

It is dedicated to the water pump application macro. When the overpressure of the pipeline network reaches the value of F09.41 and kept for the set time (F09.42), the E57 pipeline network overpressure protection will be reported.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F09.43	PID reverse limit	0: no limit 1: limit		0	○

It is dedicated to the straight wire drawing machine of the winding and unwinding application micro. When F27.00 is set to the option 3 (straight wire drawing machine) and the feedback signal is the maximum value for a long time after startup, the system will be adjusted by PID to the negative output.

F09.43=0: No limit

When the output is reduced to 0, it will not be limited and may continue to decrease.

F09.43=1: limit

When the output is reduced to 0, it will be limited and not continue to decrease.

6.2.3.2 Setting auxiliary frequency by Simple PID

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F08.15	Simple PLC running mode	0: stop after a single run 1: stop after a limited number of cycles 2: run at the last segment after a limited number of cycles 3: continuous cycles		0	●
F08.16	Limited number of cycles	1~10000		1	●

In addition to the multi-segment speed mode, it also has the simple PLC function. There are four running modes in total, as detailed in the table below.

Table 6-9 Details of PLC running mode

F08.15	Description
0	The inverter will be stopped after running in the last segment.
1	The inverter will run cyclically and be stopped after the set cycles. The number of cycles depends on the function code F08.16.
2	The inverter will run cyclically and keep the speed of the last segment after running in the last segment, until a stop command is received. The number of cycles depends on the function code F08.16.
3	The inverter will continue cyclic operation until a stop command is received.

* The last segment refers to the segment that is not set to 0, judged from the running time (F08.48) of the 15th segment toward the 1st segment.

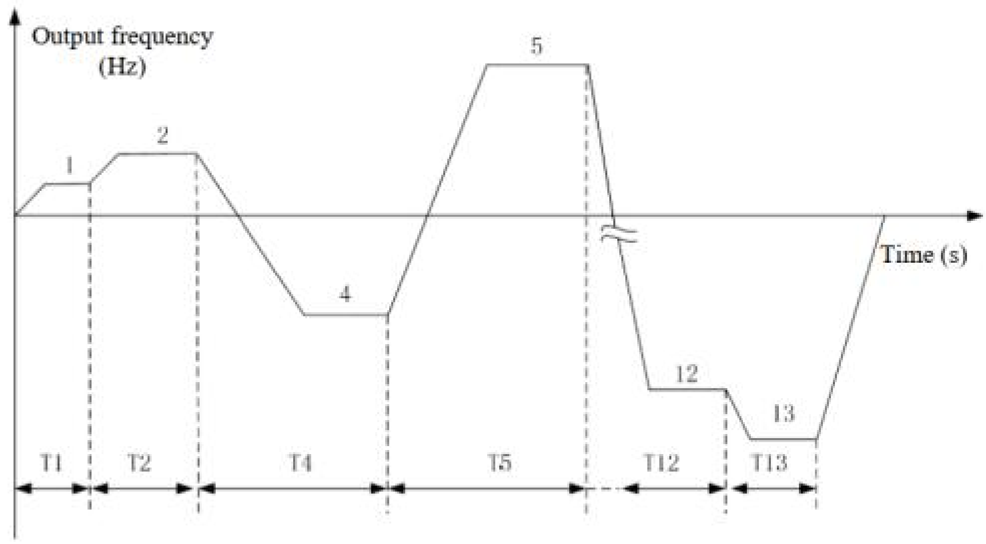


Fig. 6-10 Schematic Diagram of Simple PLC Operation

The figure above shows the operation diagram in the running mode “0: stop after a single run”. Since the running time of the 3rd segment is set to 0 (F08.24=0.0), the 3rd segment will not be put into actual operation. The running time of the 14th and 15th segments is set to 0 (F08.46=0.0, F08.48=0.0), so the last segment is the 13th segment, and the inverter will be stopped after running in the 13th segment.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F08.17	Simple PLC memory options	**Ones place:** Stop memory options 0: no memory (from the first segment) 1: memory (from the moment of stop) **Tens place:** Power-down memory options 0: no memory (from the first segment) 1: Memory (from the power-down moment)		00	●

The PLC stop memory is to record the current simple PLC running times (F18.10), running stage (F18.11), and running time at the current stage (F18.12). The inverter will continue to run from the memory stage during next operation. If you choose no memory, the PLC process will be performed everytime the inverter is started.

The PLC power-down memory is to record the current simple PLC running times (F18.10), running stage (F18.11), and running time at the current stage (F18.12) before the memory is powered off. The inverter will continue to run from the memory stage when the inverter is powered on again. If you choose no memory, the PLC process will be performed everytime the inverter is powered on.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F08.18	Simple PLC time unit	0: s (second) 1: min (minute)		0	●

In order to meet different working conditions, the running time involved in the PLC function is set to a numerical value. Its specific meaning needs to be set in conjunction with the simple PLC time unit (F08.18). At present, there are two types of unit: second and minute.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F08.19	Setting of the first segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.20	Running time of the first segment	0.0~6000.0	s/min	5.0	●
F08.21	Setting of the second segment	**Ones place:** Running direction options 0: forward 1: reverse		0	●

		Tens place: Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4			
F08.22	Running time of the second segment	0.0~6000.0	s/min	5.0	●
F08.23	Setting of the third segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.24	Running time of the third segment	0.0~6000.0	s/min	5.0	●
F08.25	Setting of the fourth segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.26	Running time of the fourth segment	0.0~6000.0	s/min	5.0	●
F08.27	Setting of the fifth segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●

F08.28	Running time of the fifth segment	0.0~6000.0	s/min	5.0	●
F08.29	Setting of the sixth segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.30	Running time of the sixth segment	0.0~6000.0	s/min	5.0	●
F08.31	Setting of the seventh segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.32	Running time of the seventh segment	0.0~6000.0	s/min	5.0	●
F08.33	Setting of the eighth segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.34	Running time of the eighth segment	0.0~6000.0	s/min	5.0	●
F08.35	Setting of the nineth segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options		0	●

		0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4			
F08.36	Running time of the ninth segment	0.0~6000.0	s/min	5.0	●
F08.37	Setting of the tenth segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.38	Running time of the tenth segment	0.0~6000.0	s/min	5.0	●
F08.39	Setting of the eleventh segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.40	Running time of the eleventh segment	0.0~6000.0	s/min	5.0	●
F08.41	Setting of the twelve segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.42	Running time of the twelfth segment	0.0~6000.0	s/min	5.0	●

F08.43	Setting of the thirteenth segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.44	Running time of the thirteenth segment	0.0~6000.0	s/min	5.0	●
F08.45	Setting of the fourteenth segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.46	Running time of the fourteenth segment	0.0~6000.0	s/min	5.0	●
F08.47	Setting of the fifteenth segment	**Ones place:** Running direction options 0: forward 1: reverse **Tens place:** Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4		0	●
F08.48	Running time of the fifteenth segment	0.0~6000.0	s/min	5.0	●

When the simple PLC is running, all of the segments 1 - 15 can have the operating frequency, operating direction, acceleration/deceleration time and operating time in the entire segment set separately. This is described below with the 13th segment (the last segment) as an example. The specific operation is shown in Fig. 6-10.

F08.12=50.00: the operating frequency of 13th segment is 50.00Hz.

F08.43=31: the operating direction in the 13th segment is reverse, and the acceleration and deceleration are controlled based on the acceleration and deceleration time 4 (F15.07/F15.08).

F08.44=5.0: the operating time in the 13th segment is 5.0s (F08.18=0 by default).

6.2.4 Main and auxiliary operation frequency

As shown below, there are 6 types of main and auxiliary operations, in which both the main and the auxiliary settings are valid.

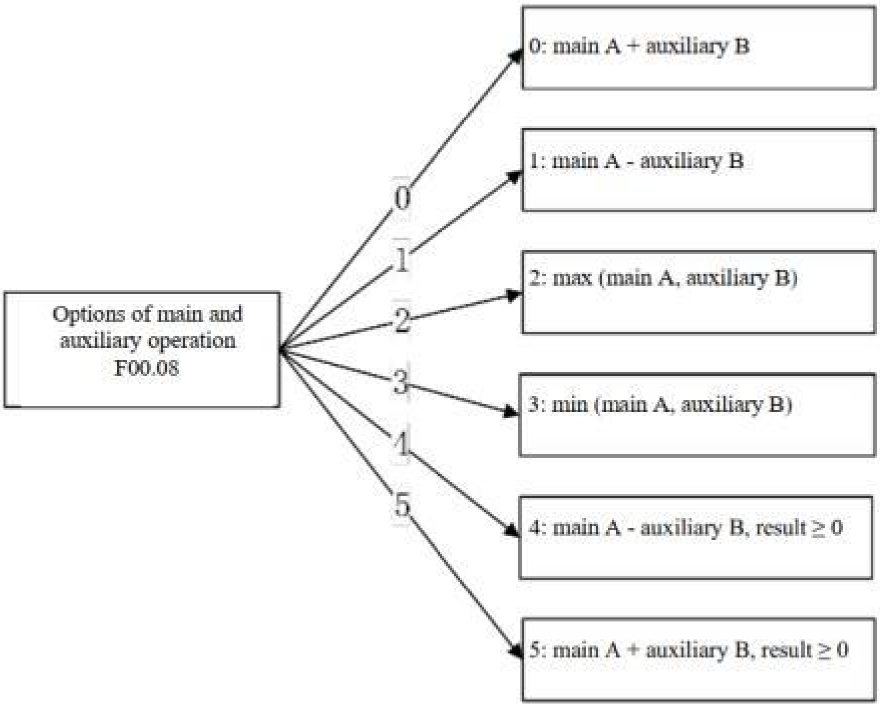


Fig. 6-11 Setting diagram of main and auxiliary operation frequency

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F00.08	Options of main and auxiliary operation	0: main frequency source A + auxiliary frequency source B 1: main frequency source A - auxiliary frequency source B 2: larger value of main and auxiliary frequency sources 3: smaller value of main and auxiliary frequency sources 4: main frequency source A - auxiliary frequency source B, and the result is greater than or equal to zero 5: main frequency source A + auxiliary frequency source B, and the result is greater than or equal to zero		0	○

Select the main and auxiliary operation mode. The final results are limited by the lower frequency limit (F00.19) and upper frequency limit (F00.18).

F00.08=0: main frequency source A + auxiliary frequency source B

The main and auxiliary operation result is the sum of the two items, and may be positive or negative. That is, the result of the forward 20.00Hz and reverse 40.00Hz is reverse 20.00Hz.

F00.08=1: main frequency source A - auxiliary frequency source B

The main and auxiliary operation result is the difference between the two items, and may be positive or negative. That is, the result of the forward 20.00Hz and reverse 40.00Hz is forward 50.00Hz (upper frequency limit F00.18=50.00).

F00.08=2: the larger of main and auxiliary operation results

The main and auxiliary operation result is the larger of the two items, and may be positive or negative. That is, the result of the forward 20.00Hz and reverse 40.00Hz is forward 20.00Hz.

F00.08=3: the smaller of main and auxiliary operation results

The main and auxiliary operation result is the smaller of the two items, and may be positive or negative. That is, the result of the forward 20.00Hz and reverse 40.00Hz is reverse 40.00Hz.

F00.08=4: main frequency source A - auxiliary frequency source B, and the result is greater than or equal to zero

The main and auxiliary operation result is the difference of the two items, and is greater than or equal to zero, that is, the result of the forward 20.00Hz and reverse 40.00Hz is running at 0Hz.

F00.08=5: main frequency source A + auxiliary frequency source B, and the result is greater than or equal to zero

The main and auxiliary operation result is the sum of the two items, and is greater than or equal to zero, that is, the result of the forward 20.00Hz and reverse 40.00Hz is running at 0Hz (the upper frequency limit is F00.18).

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F00.09	Reference options of auxiliary frequency source B in main and auxiliary operation	0: relative to the maximum frequency 1: Relative to main frequency source A		0	○

During the main and auxiliary operations, the range of the auxiliary frequency source B depends on the selected object, maximum frequency by default. If selected as relative to the main frequency source A (F00.09=1), the range of the auxiliary frequency source B will change along with that of the main frequency source A.

6.2.5 Frequency command limit

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F00.16	Maximum frequency	1.00~600.00	Hz	50.00	○

The allowable maximum frequency of the inverter is represented by Fmax. The Fmax range is from 20.00 to 600.00Hz. When the frequency resolution F00.31=1 (resolution is 0.1 Hz), the maximum frequency settable is 3,000.0 Hz.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F00.17	Options of upper frequency limit control	0: set by F00.18 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: percent setting of upper limit frequency communication 7: direct setting of upper limit frequency communication		0	○

F00.18	Upper frequency limit	Lower frequency limit F00.19 to maximum frequency F00.16	Hz	50.00	●
F00.19	Lower frequency limit	0.00 to upper frequency limit F00.18	Hz	0.00	●

F00.17=0: set by F00.18

The upper frequency limit is set by F00.18.

F00.17=1: AI1

F00.17=2: AI2

F00.17=3: AI3

F00.17=4: AI4

The upper frequency limit depends on AI (percentage) * F00.18.

For the details of AI1 to AI4, see 6.5.7. They have the same meaning. 100.00% is the percentage relative to the set value ofF00.18 (upper frequency limit).

F00.17=5: High-frequency pulse input (X7)

The upper frequency limit depends on HDI (percentage) * F00.18.

See 6.5.3 for the details when X7 serves as the high-speed pulse input. They have the same meaning. 100.00% is the percentage relative to the set value ofF00.18 (upper frequency limit).

F00.17=6: Communication percentage setting of upper frequency limit

- If the master-slave communication (F10.05=1) is enabled, and the inverter works as the slave (F10.06=0), the actual upper frequency limit is “700FH (master-slave communication setting) * F10.08 (slave receiving proportional coefficient) * F00.18 (upper frequency limit)”, and the 700FH data range is -100.00% to 100.00%.
- For general communication (F10.05=0):

  F00.17=6, the actual upper frequency limit is “700AH (communication setting percentage of the upper frequency limit)*F00.18 (upper frequency limit)”. The data range of 700AH is 0.00% - 200.00%.

F00.17=7: communication setting

The actual frequency limit is “7017H (communication setting of the upper frequency limit)”. The data range of 7017H is 0.00 - F00.16 (max. frequency).

F00.18 is the highest frequency allowed after the inverter is started. It is represented by Fup, ranging from Fdown to Fmax;

F00.19 is the lowest frequency allowed after the inverter is started. It is represented by Fdown, ranging from 0.00Hz to Fup.

1. The upper and lower frequency limits should be set carefully according to the nameplate parameters and operating conditions of the actually controlled motor, and the motor should be prevented from long-time operation at the low frequency; otherwise, the motor life maybe shortened due to overheat.
2. Relationship of the maximum frequency, upper frequency limit and lower frequency limit: 0.00Hz ≤ Fdown ≤ Fup ≤ Fmax ≤ 600.00Hz;
3. When the set frequency is lower than F00.19 (lower frequency limit), the running mode is dependent on F15.33.

6.3 Torque command

Torque setting mode with the motor torque as controlled target.

The digital setting, analog input setting, high-speed pulse input setting, communication setting, digital potentiometer setting or multi-segment torque setting can be applied. The figure below details the input modes of EM760 series inverters based on the torque setting.

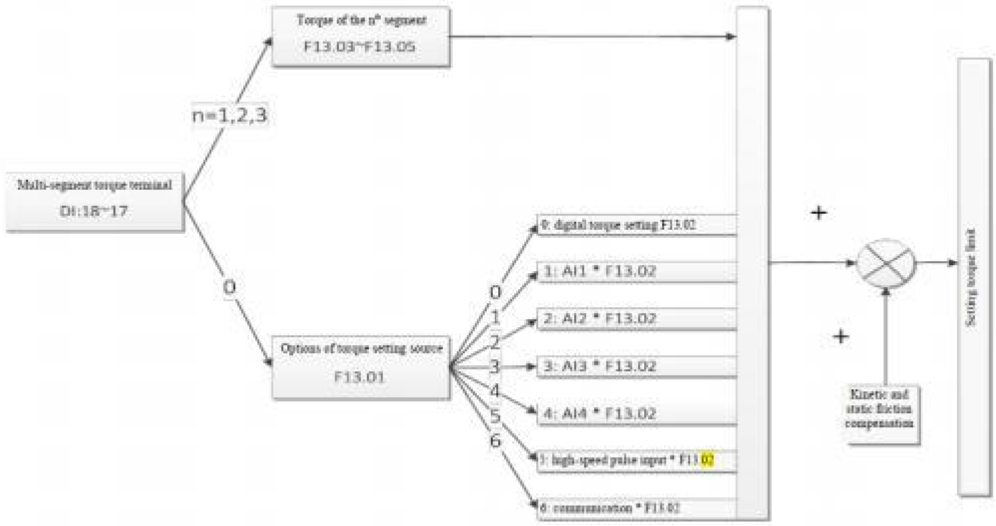


Fig. 6-12 Schematic Diagram of Torque Input Mode

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F13.00	Speed/torque control options	0: Speed control 1: Torque control		0	○

F13.00=0: speed control

The control mode is speed input, and the input is frequency.

F13.00=1: torque control

The input control mode is torque input, and the input is the percentage of the rated torque current of the motor. This is valid only in the driving mode of vector control (SVC or FVC),i.e. F00.01=1 or 2.

The final control mode is also related to the function terminals “29: torque control prohibition” and “28: speed control/torque control switching” as detailed in the table below.

Table 6-10 Details of Final Control Mode of Inverter

<table>
<tr><th>29: torque control prohibition</th><th>28: speed control/torque control switching</th><th>F13.00</th><th>Final control</th></tr>
<tr><td>Valid</td><td>*</td><td>*</td><td>Speed control</td></tr>
<tr><td rowspan="4">Invalid</td><td rowspan="2">Valid</td><td>0</td><td>Torque control</td></tr>
<tr><td>1</td><td>Speed control</td></tr>
<tr><td rowspan="2">Invalid</td><td>0</td><td>Speed control</td></tr>
<tr><td>1</td><td>Torque control</td></tr>
</table>

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F13.01	Options of torque setting source	0: digital torque setting F13.02 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: Communication setting (Full range of the items 1-6, corresponding to F13.02 digital torque setting)		0	○
F13.02	Digital torque setting	-200.0 to 200.0 (100.0 = the rated torque of motor)	%	100.0	●

F13.01=0: digital torque setting F13.02

The torque depends on F13.02.

F13.01=1: AI1

F13.01=2: AI2

F13.01=3: AI3

F13.01=4: AI4

The torque is dependent on AI (percentage) * F13.02.

F13.01=5: High-frequency pulse input (X7)

The torque depends on HDI (percentage)*F13.02.

See 6.5.7 for details of AI1 - AI4. See 6.5.3 for the details when X7 serves as the high-speed pulse input. They have the same meaning. 100.00% is the percentage relative to the set value of F13.02 (digital torque setting).

F13.01=6: communication setting

The torque depends on the communication and the like.

- If the master-slave communication (F10.05=1) is enabled and the inverter works as the slave (F10.06=0), the specific feedback percentage is "700FH (master-slave communication setting) * F10.08 (slave receiving proportional coefficient)", and the 700FH data range is -100.00% to 100.00%.
- For the general communication (F10.05=0), the specific setting percentage is "7003H (torque communication setting) * F13.02 (digital torque setting)", and the 7003H data range is -200.00% to 200.00%.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F13.03	Multi-segment torque 1	-200.0~200.0	%	0.0	●
F13.04	Multi-segment torque 2	-200.0~200.0	%	0.0	●
F13.05	Multi-segment torque 3	-200.0~200.0	%	0.0	●

For diversified torque applications, the EM760 series inverter supports the multi-segment torque function. Specifically, the input terminal functions "17: multi-segment torque terminal 1" and "18: multi-segment torque terminal 2" need to be set. See the instruction below for details.

Table 6-11 Combination of Multi-segment Torque Command and Multi-segment Torque Terminal

18: multi-segment torque terminal 2	17: multi-segment torque terminal 1	Number of Segments	Torque setting
Invalid	Invalid	Multi-segment torque 1	Depending on the F13.01 setting
Invalid	Valid	Multi-segment torque 2	F13.03
Valid	Invalid	Multi-segment torque 3	F13.04
Valid	Valid	Multi-segment torque 4	F13.05

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F13.06	Torque control acceleration and deceleration time	0.00~120.00	s	0.05	●

The motor speed can be changed gently by setting the acceleration and deceleration time of torque control.

F13.06 represents the time for the torque current to rise from 0 to the rated torque current or fall from the rated current to 0.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F13.08	Upper frequency limit options of torque control	0: set by F13.09 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: communication percentage setting 7: direct communication setting		0	○
F13.09	Upper frequency limit of torque control	0.50 to maximum frequency F00.16	Hz	50.00	●
F13.10	Upper frequency limit offset	0.00 to maximum frequency F00.16	Hz	0.00	●
F13.18	Reverse speed limit options	0~100	%	100	●
F13.19	Speed priority enabling of torque control	0: Disable 1: Enable		0	●

F13.08=0: depending on F13.09

The upper frequency limit depends on F13.09 during torque control.

F13.08=1: AI1

F13.08=2: AI2

F13.08=3: AI3

F13.08=4: AI4

The upper frequency limit in torque control is AI (percentage) * F13.09.

For the details of AI1 to AI4, see 6.5.7. They have the same meaning. 100.00% is the percentage relative to the set value of F13.09 (upper frequency limit for torque control).

F13.08=5: High-frequency pulse input (X7)

The upper frequency limit in torque control is HDI (percentage) * F13.09.

See 6.5.3 for the details when X7 serves as the high-speed pulse input. 100.00% is the percentage relative to the set value ofF13.09 (upper frequency limit for torque control).

F13.08=6: communication percentage setting

- If the master-slave communication (F10.05=1) is enabled and the inverter works as the slave (F10.06=0), the upper frequency limit is "700FH (master-slave communication setting) * F10.08 (slave receiving proportional coefficient) * F00.18 (upper frequency limit)", and the 700FH data range is -100.00% to 100.00%.
- For general communication (F10.05=0): the upper frequency limit is "700BH (communication percentage setting of the upper frequency limit of torque control) * F13.09 (upper frequency limit of torque control)". The data range of 700BH is 0.00% - 200.00%.

F13.08= 7: direct communication setting

F13.08=7: the upper frequency limit is "7018H (communication setting of the upper frequency limit of torque control)". The data range of 7018H is 0.00 - F00.16 (max. frequency).

The upper frequency limit of torque control is used to set the maximum forward or reverse running frequency of the inverter in the torque control mode.

In the torque control mode, if the load torque is less than the output torque of the motor, the motor speed will rise continuously, and the maximum speed of the motor must be limited during torque control to prevent the mechanical system from galloping and other accidents; if the load exceeds the output torque of the motor and even the motor is drive to run reversely, the maximum operating load frequency of the motor is still restricted in the case ofF13.19=1 and not restricted in the case ofF13.19=0.

The upper frequency limit of reverse running is dependent on F13.09 * F13.18.

Example: The torque is set to be positive and the upper frequency limit of torque control is the AI1 analog input: When the AI1 analog input is positive, the upper frequency limit corresponding to the forward speed limit is AI1 (percentage) * F13.09 and that corresponding to the reverse speed limit is AI1 (percentage) * F13.09 * F13.18; and when the AI1 analog input is negative, the upper frequency limit corresponding to the forward speed limit is AI1 (percentage) * F13.09 * F13.18 and that corresponding to the reverse speed limit is AI1 (percentage) * F13.09.

Maximum operating frequency in torque control = upper frequency limit of torque control + offset of upper frequency limit (valid only when F13.08=1 to 5), but the maximum operating frequency is limited by the maximum frequency ofF00.16.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F13.11	Static friction torque compensation	0.0~100.0	%	0.0	●
F13.12	Frequency range of static friction compensation	0.00~50.00	Hz	1.00	●
F13.13	Dynamic friction torque compensation	0.0~100.0	%	0.0	●

When the motor drives an object to move, it is necessary to overcome static/dynamic friction. You can set this group of parameters to enable the motor rotation at the specified torque while overcoming the inherent static/dynamic friction. The motor is mainly subject to static friction before rotation and dynamic friction after starting rotating. In short, the output performance of the motor is related to this group of parameters.

The specific description of this group of parameters is as follows: "when the actual frequency (estimate frequency in SVC and PG card feedback frequency in FVC) is less than or equal to the set value ofF13.12, the output torque is the 'set torque + F13.11 static friction torque compensation'; and when the actual frequency is greater than the set value ofF13.12, the output torque is 'set torque + F13.13 dynamic friction torque compensation'". The larger the compensation value, the stronger the compensation force will be. The compensation percentage is equal to the torque setting percentage.

6.4 Start/stop method

6.4.1 Start-up method

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.00	Start-up method	0: direct start 1: start of speed tracking		0	○

F04.00=0: direct start

The inverter is started at the starting frequency, following the DC braking (not suitable when F04.04=0) and pre-excitation (not suitable when F04.07=0). The starting frequency will change to the set frequency after the holding time.

F04.00=1: start with speed tracking

The inverter is smoothly started from the current rotation frequency of the motor, following the speed tracking (size and direction).

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.01	Start frequency	0.00~50.00	Hz	0.00	○
F04.02	Start frequency hold time	0.00-60.00, 0.00 is invalid	s	0.00	○

In order to ensure the motor torque during the start, please set the appropriate starting frequency. To fully establish the magnetic flux during the motor start, the starting frequency should be maintained for sometime. The starting frequency F04.01 is not limited by the lower frequency limit.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.03	Starting current of DC braking	0.0 to 100.0 (100.0 = rated current of motor)	%	50.0	○
F04.04	Starting time of DC braking	0.00~30.00	s	0.00	○

Before the inverter is started, the motor may be in the status of low-speed running or reverse rotation. If the inverter is started immediately, it maybe subject to overcurrent protection. In order to avoid such protections, it is necessary to perform DC braking to stop the motor and then make the motor run in the set direction to the set frequency before the inverter is started.

When F04.03 is set to different values, DC braking torques can be enabled.

F04.04 is used to set the time to enable DC braking. The inverter will start running once the set time is up. IfF04.04=0.00, DC braking is invalid during start.

* DC braking is started as shown in the figure below.

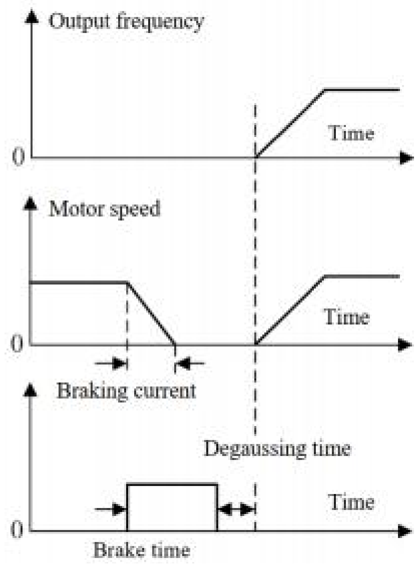


Fig. 6-13 Process of starting DC braking

When multiple motors are driven by a single inverter, this function can be applied.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.06	Pre-excitation current	50.0-500.0 (100.0 = no-load current)	%	100.0	○
F04.07	Pre-excitation time	0.00~10.00	s	0.10	○

The inverter will start running after the magnetic field is established according to the set pre-excitation current F04.06 and the set pre-excitation time F04.07 is up. If the pre-excitation time is set to 0, the inverter will be started directly without pre-excitation.

The pre-excitation current F04.06 is the percentage relative to the rated no-load current of the motor.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F04.08	Speed tracking mode	Ones place: Tracking start frequency 0: maximum frequency 1: stop frequency 2: power frequency Tens place: Selection of search direction 0: search only in command direction 1: Search in the opposite direction if the speed cannot be found in the command direction		01	○

When the speed tracking start mode (F04.00=1) is selected, the inverter will be subject to speed tracking according to the setting of F04.08 during the start. For quicker tracking to the current operating frequency of the motor, please select the appropriate mode based on the working conditions.

If the units place of F04.08 is 0, tracking will be performed from the maximum frequency. This can be applied when the operating conditions of the motor are completely uncertain (for example, the motor is already rotating when the inverter is powered on).

If the units place of F04.08 is 1, tracking will be performed from the stop frequency. This mode is usually applied.

If the units place of F04.08 is 2, tracking will be performed from the power frequency. This mode can be applied during switching from the power frequency.

If the tens place of F04.08 is 0, search will be performed only in the command direction after speed tracking is enabled. In case that the corresponding speed is not found, the inverter will start running from the zero speed.

If the tens place of F04.08 is 1, search will be performed first in the command direction after speed tracking is enabled and then in the opposite direction if no speed is found.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.10	Deceleration time of speed tracking	0.1~20.0	s	2.0	○
F04.11	Speed tracking current	30.0-150.0 (100.0 = rated current of inverter)	%	50.0	○
F04.12	Speed tracking compensation gain	0.00~10.00		1.00	○

F04.10: scanning speed for speed tracking from the predetermined frequency. The duration is the time for the rated frequency to decrease to 0.00Hz.

F04.11: current tracking, ratio to the rated current of the inverter. The lower the current, the less the impact on the motor is, and the higher the tracking accuracy is. If the set value is too small, the tracking result may be inaccurate, causing failure in start. The higher the current, the less the motor speed drops. This value should be increased during heavy-load tracking.

F04.12: tracking intensity, usually taking the default value. When the tracking speed is high and the overvoltage protection is enabled, you can try to increase this value.

6.4.2 Stop method

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.19	Stop mode	0: slow down to stop 1: Free stop		0	○

F04.19=0: deceleration to stop

The motor decelerates to stop according to the set deceleration time [default setting: based on F00.15 (deceleration time 1)].

F04.19=1: free stop

When the stop command is valid, the inverter will stop output immediately, and the motor will freely coast to stop. The stop time depends on the inertia of the motor and load.

If the free stop terminal has been set and enabled, the inverter will be immediately in the free stop status. Even if this terminal is disabled, the inverter will not restart running. Instead, the running command must be entered again to start the inverter.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.20	Starting frequency of DC braking in stop	0.00 to maximum frequency F00.16	Hz	0.00	○
F04.21	DC braking current in stop	0.0 - 150.0 (100.0 = rated current of motor)	%	50.0	○
F04.22	DC braking time in stop	0.00~30.00 0.00: invalid	s	0.00	○
F04.23	Demagnetization time for DC braking in stop	0.00~30.00	s	0.50	○

F04.20: Set the starting frequency of DC braking in deceleration to stop. Once the output frequency is less than the set frequency during deceleration stop, and the time of DC braking for stop is not 0, DC braking for stop will be enabled.

F04.21: Set different values to apply the torques of DC braking for stop.

F04.22: Set the duration of DC braking for stop. If F04.22=0.00, DC braking for stop will be invalid. When an external terminal sends a signal of DC braking for stop, the duration of DC braking for stop will be larger of the valid time of the signal of DC braking for stop from the external terminal and the set time of F04.22.

F04.23: When the output frequency reaches the set value of F04.20 during deceleration to stop, and the set time of F04.23 is up, DC braking will be enabled.

Process of DC braking for stop is as shown in the figure below.

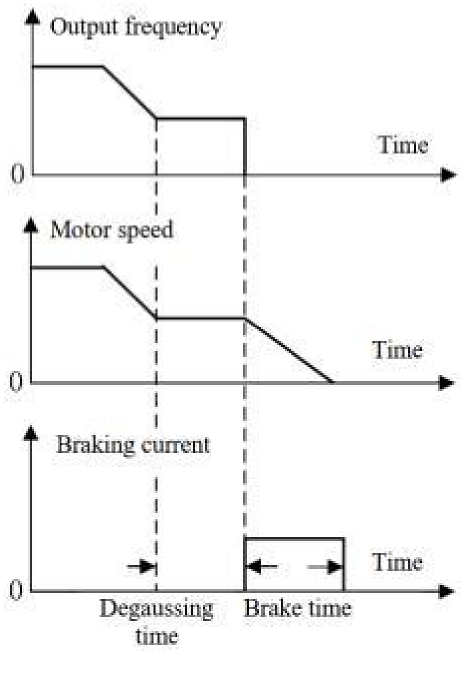


Fig. 6-14 Process of DC braking for stop

In the presence of heavy loads, the motor cannot be stopped completely through normal deceleration due to inertia. You can extend the duration of DC braking for stop or increase the current of DC braking for stop to stop the motor from rotating.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.24	Flux braking gain	100-150 (100: no flux braking)		100	○

When the magnetic flux braking is valid (F04.24>100), the motor can be quickly slowed down by increasing its magnetic flux, and the electric energy can be converted into thermal energy during motor braking.

Flux braking may lead to quick deceleration, but the output current may be high. The flux braking intensity (F04.24) can be set restriction and protection to avoid damage to the motor. If flux braking is not applied, the deceleration time will be extended but the output current will be low.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.26	Start mode after protection/free stop	0: start according to F04.00 setting mode 1: start of speed tracking		0	○

The start after the protection or free stop may be enabled by default according to the F04.00 setting (F04.26=0), or set to the speed tracking start (F04.26=1). For the stop mode, see the description of the function code F04.00.

6.4.3 Acceleration and deceleration time setting

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F04.14	Acceleration and deceleration mode	0: linear acceleration and deceleration 1: acceleration and deceleration of continuous S curve 2: acceleration and deceleration of intermittent S curve		0	○
F04.15	Starting time of S curve in acceleration	0.00 to system acceleration time/2 (F15.13=0) 0.0 to system acceleration time/2 (F15.13=1) 0 to system acceleration time/2 (F15.13=2)	s	1.00	●
F04.16	Ending time of S curve in acceleration	0.00 to system acceleration time/2 (F15.13=0) 0.0 to system acceleration time/2 (F15.13=1) 0 to system acceleration time/2 (F15.13=2)	s	1.00	●
F04.17	Starting time of S curve in deceleration	0.00 to system deceleration time/2 (F15.13=0) 0.0 to system deceleration time/2 (F15.13=1) 0 to system deceleration time/2 (F15.13=2)	s	1.00	●
F04.18	Ending time of S curve in deceleration	0.00 to system deceleration time/2 (F15.13=0) 0.0 to system deceleration time/2 (F15.13=1) 0 to system deceleration time/2 (F15.13=2)	s	1.00	●

F04.14=0: Linear acceleration and deceleration

The output frequency increases or decreases linearly. The acceleration and deceleration time is set by the function codes F00.14 and F00.15 by default.

F04.14=1: continuous S-curve acceleration and deceleration

The output frequency increases or decreases according to the curve. The S curve is usually where there are relatively low requirements for start and stop, such as elevators and conveyor belts. In the acceleration process shown in Fig. 7-16, t1 is the set value ofF04.15,and t2 is the set value ofF04.16. In the deceleration process, t3 is the set value ofF04.17, and t4 is the set value ofF04.18. The slope of the output frequency remains unchanged between t1 and t2 as well as between t3 and t4.

F04.14=2: intermittent S-curve acceleration and deceleration

Compared with the continuous S-curve, the intermittent S-curve will not be over-tuned. The current S-curve trend will be stopped immediately according to changes in the settings and acceleration/deceleration time, and the new planned S-curve trend will be applied.

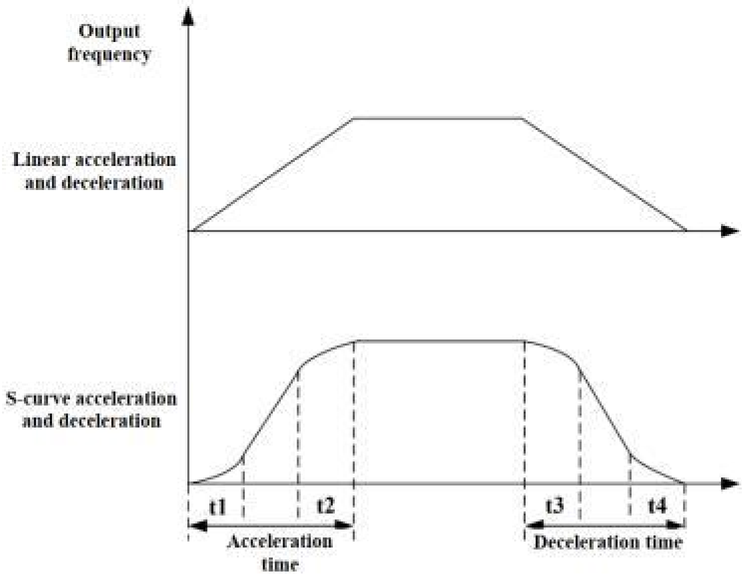


Fig. 6-15 Acceleration/Deceleration Time Control Diagram

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.03	Acceleration time 2	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	15.00	●

F15.04	Deceleration time 2	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	15.00	●
F15.05	Acceleration time 3	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	15.00	●
F15.06	Deceleration time 3	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	15.00	●
F15.07	Acceleration time 4	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	15.00	●
F15.08	Deceleration time 4	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	15.00	●
F15.09	Fundamental frequency of acceleration and deceleration time	0: maximum frequency F00.16 1: 50.00Hz 2: set frequency		0	○

The system has four groups (F00.14 and F00.15 in the first group) of acceleration and deceleration time options to meet different needs for normal operation. After completing the setting, the user can switch them via the combination of digital input functions “19: acceleration and deceleration time terminal 1” and “20: acceleration and deceleration time terminal 2”. See “Table 6-12 Function List of Multi-function Digital Input Terminals” for details.

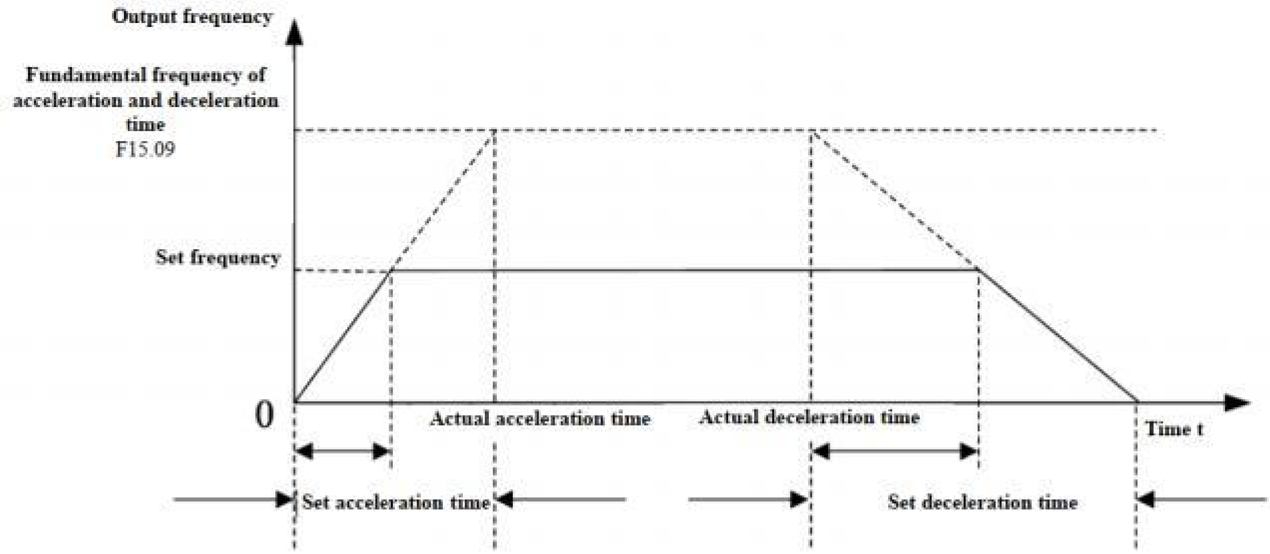


Fig. 6-16 Schematic Diagram of Acceleration and Deceleration Time

As shown in the figure above, the acceleration time is defined as the time of acceleration from 0.00 Hz to the reference frequency of acceleration/deceleration time; and the deceleration time is defined as the time of deceleration from the reference frequency of acceleration/deceleration time to 0.00 Hz. The actual acceleration/deceleration time varies according to the ratio between the set frequency and reference frequency.

The reference frequency of acceleration/deceleration time is set by function code F15.09 that represents the reference frequency of acceleration/deceleration time. If F15.09=0, the reference frequency depends on the function code F00.16 (maximum frequency). Assuming F00.16=100.00Hz, the acceleration (deceleration) time is expressed as the time for the output frequency to increase (decrease) from 0.00Hz (100.00Hz) to 100.00Hz (0.00Hz). If F15.09=2, the reference frequency depends on the function code F18.01 (set frequency). Assuming F18.01=100.00Hz, the acceleration (deceleration) time is expressed as the time for the output frequency to increase (decrease) from 0.00Hz (100.00Hz) to 100.00Hz (0.00Hz).

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.10	Automatic switching of acceleration and deceleration time	0: Invalid 1: valid		0	○
F15.11	Switching frequency of acceleration time 1 and 2	0.00 to maximum frequency F00.16	Hz	0.00	●
F15.12	Switching frequency of deceleration time 1 and 2	0.00 to maximum frequency F00.16	Hz	0.00	●

If the motor 1 is running at the normal (e.g. non-PLC/PID) speed (e.g. non-torque) and the acceleration/deceleration time terminals (19: acceleration and deceleration time terminal 1; 20: acceleration and deceleration time terminal 2) are invalid, the acceleration/deceleration time 1 and acceleration/deceleration time 2 can be switched by setting F15.10 to 1, as detailed in the figure below.

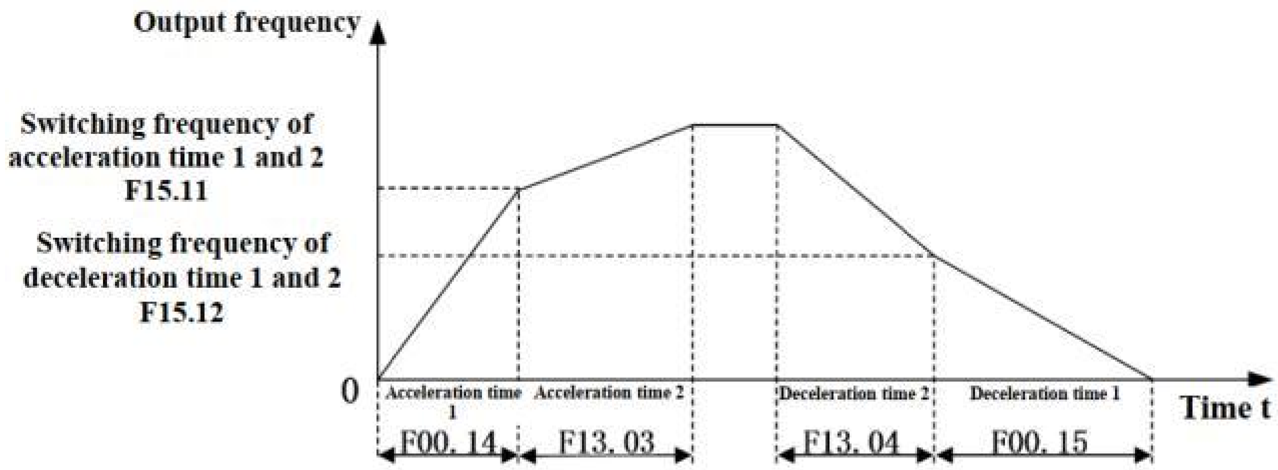


Fig. 6-17 Schematic Diagram of Automatic Switching of Acceleration and Deceleration Time

During acceleration, if the output frequency is less than the switching frequency of the acceleration time 1 and 2 (F15.11), the acceleration time 1 will be the current valid acceleration time; otherwise, the acceleration time 2 will be the current valid acceleration time.

During deceleration, if the output frequency is less than the switching frequency of the deceleration time 1 and 2 (F15.12), the deceleration time 1 will be the current valid deceleration time; otherwise, the deceleration time 2 will be the current valid deceleration time.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.13	Acceleration and deceleration time unit	0: 0.01s 1: 0.1s 2: 1s		0	○

Under different working conditions, the acceleration and deceleration time requirements may vary greatly. The system provides three acceleration and deceleration time units, depending on the function code F15.13. F15.13=1 means that the acceleration/deceleration time unit is “0.1s”. Except for that in torque control (F13.06), all the acceleration and deceleration time will change. For example, the value ofF00.14 will change from 15.00s to 150.0s by default.

6.5 Input/Output terminal

6.5.1 Digital input terminal (DI)

The standard configuration of EM760 series inverter includes 7 multi-function digital input terminals (X1 to X7) and 3 analog input terminals (AI1 to AI3), and the extension card supports 3 multi-function digital input terminals (X8 to X10) and 1 analog input terminal (AI4). Use of AI1 - AI4 requires setting corresponding functions as the digital input, as detailed in the F02.31 description of 6.5.7.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F02.00	Options of X1 digital input function	See Table 6-12 Function List of Multi-function Digital Input Terminals.		1	○
F02.01	Options of X2 digital input function			2	○
F02.02	Options of X3 digital input function			11	○

F02.03	Options of X4 digital input function			12	○
F02.04	Options of X5 digital input function			13	○
F02.05	Options of X6 digital input function			14	○
F02.06	Options of X7 digital input function			10	○
F02.07	Options of AI1 digital input function			0	○
F02.08	Options of AI2 digital input function			0	○
F02.09	Options of AI3 digital input function			0	○
F02.10	Options of AI4 digital input function			0	○
F02.11	Options of X8 digital input function				
F02.12	Options of X9 digital input function				
F02.13	Options of X10 digital input function				

The terminals X1 to X10, AI1 to AI4 are fourteen multi-function input terminals. The functions of the input terminals can be defined by setting the values of the function codes F02.00 to F02.13.

For example, if you define F02.00=1, the function of the X1 terminal is "RUN". If the command source is set to terminal control (F00.02=1) and the X1 terminal input is valid, the "RUN" function of the inverter will be enabled. Specific options are described in the table below.

If multiple terminals are set to the same function (except for #34 function terminal),the function status is dependent on the "OR logic" of the two terminals. In the case ofF02.00=1 and F02.04=1, once one of the terminals X1 or X5 is valid, the "RUN" function of the inverter will be enabled.

Table 6-12 Function List of Multi-function Digital Input Terminals

Settings	Function	Description
0	No function	Disable the protection terminal or set it to "0: Unavailable" to prevent malfunction.
1	Running terminal (RUN)	When the command source is set to terminal control (F00.02=1), and the function terminal is valid, the inverter will execute the corresponding RUN function according to the set value of the terminal control mode option (F00.03). (See 6.1.2 for details)
2	Running direction F/R	When the command source is set to terminal control (F00.02=1), and the function terminal is valid, the inverter will execute the corresponding F/R function according to the set value of the terminal control mode option (F00.03). (See 6.1.2 for details)
3	Stop control of three-line operation	When the command source is set to terminal control (F00.02=1), the terminal control mode is set to three-line control (F00.03=2/3) and the function terminal is valid, the inverter will execute the stop command. (See 6.1.2 for details)

<table>
<tr><td>4</td><td>Forward jog (FJOG)</td><td rowspan="2">When the command source is set to terminal control (F00.02=1), and the function terminal FJOG is valid, the inverter will run forward; if the function terminal RJOG is valid, the inverter will run reversely; and if the two function terminals are valid at the same time, the inverter will decelerate to stop.
*: When reverse running is prohibited, the speed of reverse jog will be limited to 0.</td></tr>
<tr><td>5</td><td>Reverse jog (RJOG)</td></tr>
<tr><td>6</td><td>Terminal UP</td><td rowspan="3">If the function terminal UP is valid, the frequency offset will be increase at the rate defined by F12.11; and if the function terminal DOWN is valid, the frequency offset will decrease at the rate defined by F12.11.
If the UP/DOWN offset clear terminal is valid, the frequency offset will be cleared to 0.
Final set frequency of the frequency source A = set frequency of the frequency source A + UP/DOWN offset.
*: The UP/DOWN function is valid only when the main frequency source A is involved in setting.
The offset frequency can be viewed via F18.15.
The function of the terminal UP/DOWN is the same as that of the UP/DOWN on the keyboard.</td></tr>
<tr><td>7</td><td>Terminal DOWN</td></tr>
<tr><td>8</td><td>Clear UP/DOWN offset</td></tr>
<tr><td>9</td><td>Free stop</td><td>If this function terminal is valid during inverter operation, the output will be blocked, the inverter will stop in the free status, and the motor will not be controlled by the inverter.</td></tr>
<tr><td>10</td><td>Reset protection</td><td>If the inverter is subject to protection and the faulty point is eliminated, you can use this terminal to reset the inverter. This has the same function as the Reset key on the keyboard.</td></tr>
<tr><td>11</td><td>Multi-segment speed terminal 1</td><td rowspan="3">When the speed control and main frequency source A are involved in setting, four function input terminals can be defined as multi-segment speed terminals. The current set frequency of the inverter depends on the code combination of these four terminals and the settings of related function codes. Details are given in the following table. (0/1: the current function terminal is invalid/valid).
*: When a function has no corresponding input terminal options, it is invalid (0) by default.
<table>
<tr><th>14</th><th>13</th><th>12</th><th>11</th><th>Set frequency of the inverter</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>Depending on the option (F00.04) of the main frequency source A</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>Multi-segment speed 1 (F08.00)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>Multi-segment speed 2 (F08.01)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>Multi-segment speed 3 (F08.02)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>Multi-segment speed 4 (F08.03)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>Multi-segment speed 5 (F08.04)</td></tr>
</table></td></tr>
<tr><td>12</td><td>Multi-segment speed terminal 2</td></tr>
<tr><td>13</td><td>Multi-segment speed terminal 3</td></tr>
</table>

<table>
<tr><td rowspan="10">14</td><td rowspan="10">Multi-segment speed terminal 4</td><td>0</td><td>1</td><td>1</td><td>0</td><td>Multi-segment speed 6 (F08.05)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>Multi-segment speed 7 (F08.06)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>Multi-segment speed 8 (F08.07)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>Multi-segment speed 9 (F08.08)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>Multi-segment speed 10 (F08.09)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>Multi-segment speed 11 (F08.10)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>Multi-segment speed 12 (F08.11)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>Multi-segment speed 13 (F08.12)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>Multi-segment speed 14 (F08.13)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>Multi-segment speed 15 (F08.14)</td></tr>
<tr><td>15</td><td>Multi-segment PID terminal 1</td><td colspan="5">The 4-segment PID setting can be performed via these two terminals, as detailed in the following table (0/1: the current function terminal is invalid/valid).</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Multi-segment PID terminal 2</td><td>16</td><td>15</td><td colspan="3">Multi-segment PID setting</td></tr>
<tr><td>0</td><td>0</td><td colspan="3">Depending on the PID setting source (F09.00)</td></tr>
<tr><td>0</td><td>1</td><td colspan="3">Multi-segment PID setting 1 (F09.32)</td></tr>
<tr><td>1</td><td>0</td><td colspan="3">Multi-segment PID setting 2 (F09.33)</td></tr>
<tr><td>1</td><td>1</td><td colspan="3">Multi-segment PID setting 3 (F09.34)</td></tr>
<tr><td>17</td><td>Multi-segment torque terminal 1</td><td colspan="5">The 4-segment torque setting can be performed via these two terminals, as detailed in the following table (0/1: the current function terminal is invalid/valid).</td></tr>
<tr><td rowspan="5">18</td><td rowspan="5">Multi-segment torque terminal 2</td><td>18</td><td>17</td><td colspan="3">Multi-segment torque setting</td></tr>
<tr><td>0</td><td>0</td><td colspan="3">Depending on the torque setting source option (F13.01)</td></tr>
<tr><td>0</td><td>1</td><td colspan="3">Multi-segment torque 1 (F13.03)</td></tr>
<tr><td>1</td><td>0</td><td colspan="3">Multi-segment torque 2 (F13.04)</td></tr>
<tr><td>1</td><td>1</td><td colspan="3">Multi-segment torque 3 (F13.05)</td></tr>
<tr><td>19</td><td>Acceleration and deceleration time terminal 1</td><td colspan="5">The inverters of this series have four groups of acceleration and deceleration time in total. You can define two function input terminals as acceleration and deceleration time terminals. The current acceleration/deceleration time of the inverter depends on the code combination of these four terminals and settings of related function codes. Details are given in the following table. (0/1: the current function terminal is invalid/valid), or see 6.4.3 for details.</td></tr>
<tr><td rowspan="5">20</td><td rowspan="5">Acceleration and deceleration time terminal 2</td><td>20</td><td>19</td><td colspan="3">Acceleration and deceleration time</td></tr>
<tr><td>0</td><td>0</td><td colspan="3">The first group (acceleration time: F00.14; deceleration time: F00.15)</td></tr>
<tr><td>0</td><td>1</td><td colspan="3">The second group (acceleration time: F15.03; deceleration time: F15.04)</td></tr>
<tr><td>1</td><td>0</td><td colspan="3">The third group (acceleration time: F15.05; Deceleration time: F15.06)</td></tr>
<tr><td>1</td><td>1</td><td colspan="3">The fourth group (acceleration time: F15.07; Deceleration time: F15.08)</td></tr>
</table>

21	Acceleration and deceleration prohibition	When the acceleration and deceleration prohibition terminal is valid, the execution of acceleration and deceleration commands will be prohibited, and the output frequency of the inverter will remain unchanged. The inverter in the overcurrent protection status will run based on the current limit.
22	Operation pause	The inverter decelerates to stop, but all running parameters will be kept in the memory, such as PLC and PID parameters. When this terminal is invalid, the inverter will restore the running status before stop.
23	External protection input	Using this terminal, you can input the protection signal of the external device, to facilitate protection monitoring and protection of the external device via the inverter. Upon receiving an external protection signal, the inverter will display “E4” and freely stop running.
24	Switching of RUN command to keyboard	The current command channel depends on the status of these two terminals and setting of F00.02. The priority is as follows: “24: switching of RUN command to keyboard” > “25: switching of RUN command to communication” > “F00.02: command source option”. Refer to 6.1 for details.
25	Switching of RUN command to communication	
26	Frequency source switching	This terminal is mainly used to switch the frequency sources in conjunction with the function code F00.06. This terminal will be valid only when F00.06=3~5. Refer to 6.2.1 for details.
27	Clearing of regular running time	The regular running function is defined by F16.05. This terminal can be used to clear the running time (reset the remaining time of regular running). Refer to 6.6.11 for details.
28	Speed control/torque control switching	These two terminals are used to change the current inverter control mode in conjunction with F13.00 When #28 terminal is valid, speed control and torque control can be switched; and when #29 terminal is valid, only speed control is enabled. See 6.3 for details.
29	Torque control prohibition	
30	Motor 1/Motor 2 switching	This terminal is used to determine the current valid motor in conjunction with F00.28. If #30 terminal is valid, the motors will be switched based on the F00.28 setting.
31	Resetting of simple PLC status (running from the first segment, with the running time cleared)	When this terminal is valid, the simple PLC module will restart running from the first segment. To further understand this function, you can check 6.2.3.2 for instructions.

32	simple PLC time pause (keep running at current segment)	When this terminal is valid, the simple PLC module will keep running at the current segment. When this terminal is invalid, the simple PLC module will continue to run after running at the current segment.
33	Reserved	
34	counter input (≤ 250Hz)	It is a pulse input terminal that has the counting function. The input pulse frequency is limited to 250Hz or below, and only one terminal can be set with this function. See 6.6.12 for details.
35	High speed counter input (≤ 100 kHz, only valid for X7)	It is a pulse input terminal that has the counting function. The input pulse frequency is limited to 100kHz or below. This is valid only for the terminal X7 (that is, only F02.06=35 can be set). See 6.6.12 for details.
36	Count clearing	This terminal is used to clear the counter that has a counting function.
37	Length counter input (≤ 250Hz)	It is a pulse input terminal that has the length counting function. The input pulse frequency is limited to 250Hz or below, and only one terminal can be set with this function. See 6.6.13 for details.
38	High-speed length counting input (≤ 100kHz, only valid for X7)	It is a pulse input terminal that has the length counting function. The input pulse frequency is limited to 100kHz or below. This is valid only for the terminal X7 (that is, only F02.06=38 can be set). See 6.6.13 for details.
39	Length clearing	This length clearing terminal has a length counting function.
40	Pulse input (≤ 100 kHz, only valid for X7)	This is a pulse signal input terminal, and the input pulse frequency is limited to 100kHz or below. It is valid only for the terminal X7. *: This is used only to set the equivalent AI percentage instead ofother special functions (e.g. counting). When F00.04=5, you need to set F02.06=40 and the set frequency pulse needs to be inputted from the terminal X7.
41	Process PID pause	When this terminal is valid, PID adjustment will be stopped, and the output of the process PID module will remain unchanged. For more information, refer to 6.2.3.1 function code F09.18.
42	Process PID integral pause	When this terminal is valid, the PID integral adjustment will be suspended, but the proportional and differential adjustment of the PID will be still valid. This function is known as integral separation. See the F09.20 description of 6.2.3.1.
43	PID parameter switching	If the digital input terminal (F09.11=1) for PID parameter switching is valid, PID parameters will be switched. See the description of the function codes F09.05 to F09.13 under 6.2.3.1.

44	PID positive/negative switching	When this terminal is valid, the PID positive/negative modes will be switched. See the description of the function code F09.04 under 6.2.3.1.
45	Stop and DC braking	When a stop command is triggered and the frequency reaches the starting frequency (F04.20) for direct braking during stop, braking will be enabled. The braking time is subject to the longer of the terminal closing time and stop/DC braking time (F04.22).
46	DC braking at stop	The stop command is not triggered. When there is a stop command, and the frequency reaches the starting frequency (F04.20) for direct braking during stop, braking will be enabled. The braking time is subject to the longer of the terminal closing time and stop/DC braking time (F04.22).
47	Immediate DC braking	The inverter will immediately stop running and be subject to DC braking at the current frequency. The braking current is dependent on the DC braking current (F04.21) in stop.
48	Fastest deceleration to stop	The inverter will stop running within the minimum allowable acceleration and deceleration time.
49	Reserved	
50	External stop	When this terminal is valid, the inverter will stop running according to the set stop mode (F04.19) and acceleration/deceleration time 4 (F15.07/F15.08).
51	Switching of main frequency source to digital frequency setting	When the main frequency source A is involved in setting, the multi-segment speed model is not enabled and this terminal is valid, the main frequency source will be switched to the corresponding setting. The functions 51 to 56 can work independently, but subject to the priority. See 6.2.2 for details.
52	Switching of main frequency source to AI1	
53	Switching of main frequency source to AI2	
55	Switching of main frequency source to high-frequency pulse input	
56	Switching of main frequency source to communication setting	
57	Inverter enabling	When the inverter meets the operating conditions and the current function terminal is valid, the inverter is able to run. Otherwise, it will not run even if other operating conditions are met. *: Inverter enabling function: If no terminal is selected, this function is valid by default; if one terminal is selected, the status of the selected terminal will prevail; and if more than one terminal is selected and any selected terminal is invalid, this function will not be valid.

58~67	Reserved	
68	Prohibition of reversing disabling	It is only applicable to the straight wire drawing machines in winding applications. 1: When the function of 69# input terminal is available and/or F00.21=1, 68# input terminal is available, and reversing disabling is prohibited, that is, reversing is allowed; otherwise, reversing disabling is not prohibited, that is, reversing is not allowed. 2: When the function of 69# input terminal is available and/or F00.21=1, 68# input terminal is available, and reversing is disabled, that is, reversion is not allowed; otherwise, reversing disabling is not disabled, that is, reversing is allowed.
69	Prohibition of reversing	When this terminal is valid, its function is the same as that in the case ofF00.21=1.
70~78	Reserved	
121	External material cutoff signal	This is a dedicated function for winding applications, which is used for external input of material cutoff detection. When material cutoff detection is an external signal and the terminal is closed (consistent with restrictions), E43 protection will be reported.
122	Wiring detection signal	This is a dedicated function for winding applications, which is used for wiring detection. When the valid or invalid time of the wiring detection signal expires, E44 protection will be reported.
123	Brake reset terminal	This is a dedicated function for winding applications. When the brake output is valid, this terminal can be closed to reset the brake output.

<table>
<tr><th>Function code</th><th>Function code name</th><th colspan="8">Parameter description</th><th>Unit</th><th>Default setting</th><th>Attribute</th></tr>
<tr><td rowspan="4">F02.15</td><td rowspan="4">Positive/negative logic 1 of digital input terminal</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td><td rowspan="4"></td><td rowspan="4">0000000</td><td rowspan="4">○</td></tr>
<tr><td>*</td><td>X7</td><td>X6</td><td>X5</td><td>X4</td><td>X3</td><td>X2</td><td>X1</td></tr>
<tr><td colspan="8">0: positive logic is valid in the closed state/invalid in the open state</td></tr>
<tr><td colspan="8">1: negative logic is valid in the closed state/invalid in the open state</td></tr>
<tr><td rowspan="4">F02.16</td><td rowspan="4">Positive/negative logic 2 of digital input terminal</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td><td rowspan="4"></td><td rowspan="4">0000000</td><td rowspan="4">○</td></tr>
<tr><td>*</td><td>X10</td><td>X9</td><td>X8</td><td>AI4</td><td>AI3</td><td>AI2</td><td>AI1</td></tr>
<tr><td colspan="8">0: positive logic is valid in the closed state/invalid in the open state</td></tr>
<tr><td colspan="8">1: negative logic is valid in the closed state/invalid in the open state</td></tr>
</table>

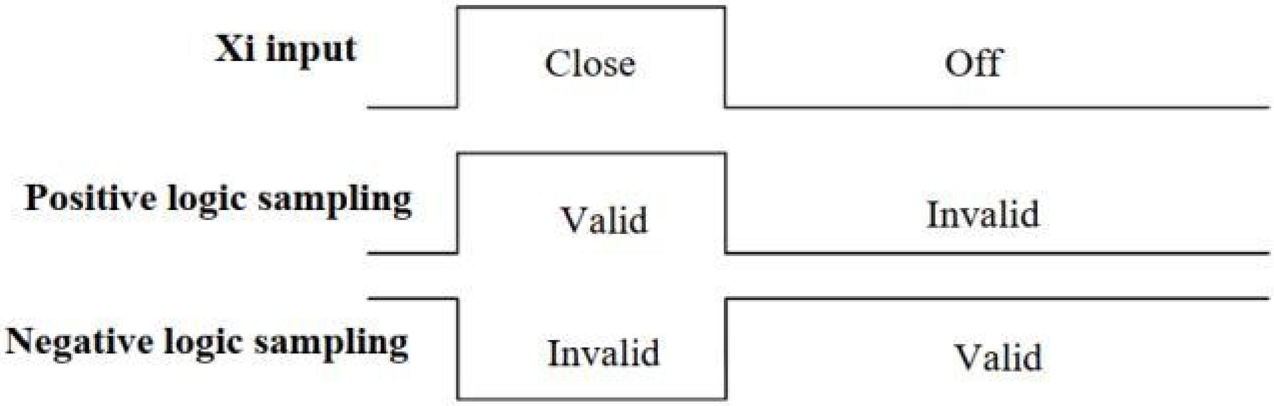


Fig. 6-18 Schematic Diagram of Positive/Negative Logic Sampling of Terminal

When the bit is set to 0, the multi-function input terminal is valid in the closed status and invalid in the open status;

When the bit is set to 1, the multi-function input terminal is valid in the open status and invalid in the closed status.

These function code are subject tobit operation. You only need to set the corresponding bit to 0 or 1. Take F02.15 as an example, as shown in the following table:

Table 6-13 Function Code Details of Bit Operation

Setting item	*	X7	X6	X5	X4	X3	X2	X1
Corresponding bit	*	6	5	4	3	2	1	0
Settings	*	0/1	0/1	0/1	0/1	0/1	0/1	0/1

The seventh bit is reserved and cannot be set. The specific displayed value does not mean anything.

For example: To set the terminal X1 to reverse logic, you only need to set the 0^{th} bit corresponding to X1 to 1, i.e. F02.15=xxxxxxx1.

To set the terminals X1 and X5 to reverse logic, you only need to set the 0^{th} bit corresponding to X1 and 4^{th} bit corresponding to X5 to 1. That is, 02.15=xxx 1xxx1.

* This function is for logic matching with other external devices.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F02.17	Filtering times of digital input terminal	0 - 10,000; 0: no filtering; n: sampling once in nms		2	○

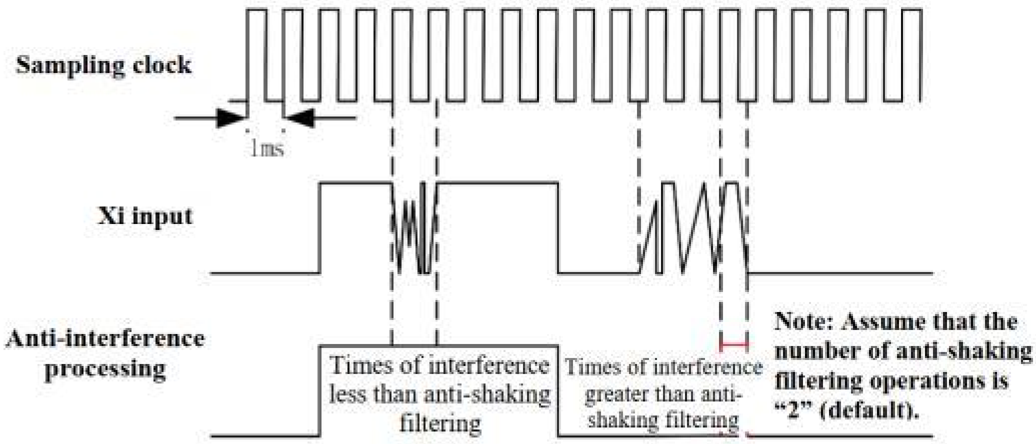


Fig. 6-19 Schematic Diagram of Terminal Filter Sampling

Since the multi-function input terminal is triggered by level or pulse, digital filtering is needed when the terminal status is read, in order to avoid interference.

* The parameters of this code do not need to be adjusted under normal circumstances. Where adjustment is required, pay attention to the relationship between the filtering time and terminal action duration, to avoid the susceptibility to interference due to insufficient filtering times or slow responses and command losses arising from excessive filtering times. The pre-requisite for X1 - X6 to reach the 250Hz input is to set F02.17 as 0.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F02.18	X1 valid delay time	0.00~650.00	s	0.00	●
F02.19	X1 invalid delay time	0.00~650.00	s	0.00	●
F02.20	X2 valid delay time	0.00~650.00	s	0.00	●
F02.21	X2 invalid delay time	0.00~650.00	s	0.00	●
F02.22	X3 valid delay time	0.00~650.00	s	0.00	●
F02.23	X3 invalid delay time	0.00~650.00	s	0.00	●
F02.24	X4 valid delay time	0.00~650.00	s	0.00	●
F02.25	X4 invalid delay time	0.00~650.00	s	0.00	●

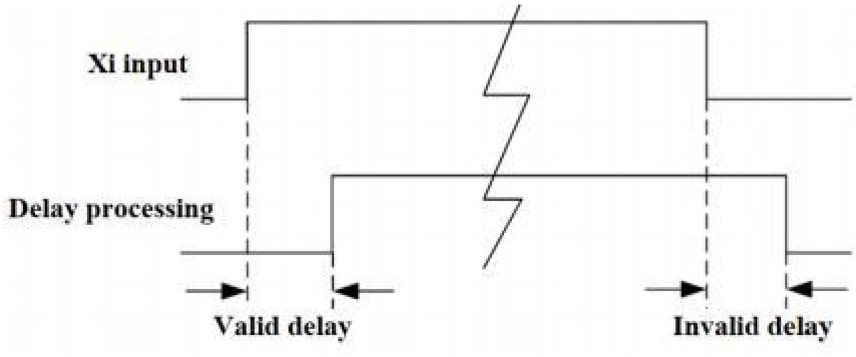


Fig. 6-20 Schematic Diagram of Terminal Delay Sampling

In the event of changes in the status of the function terminal,a response will be made with delay according to the function code settings. Currently only the terminals X1 to X4 support this function. Specifically, it is embodied in: This function will take effect when the function terminal changes from the invalid to valid status and is maintained with the valid delay, and not take effect when the function terminal changes from the valid to invalid status and is maintained with the invalid delay.

If the function code is set to 0.00s, the corresponding delay will be invalid.

6.5.2 Digital output terminal (DO)

The standard configuration of the EM760 series inverter includes 2 multi-function digital output terminals (Y1 and Y2) and 2 relay output terminals (R1 and R2). With the extension card inserted, support is available for another 2 relay output terminals (R3 and R4).

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F03.00	Options of Y1 output function	See Table 6-14 Function List of Multi-function Digital Output Terminals.		1	○
F03.01	Options of Y2 output function			3	○
F03.02	Options of R1 output function			7	○
F03.03	Options of R2 output function			8	○
F03.32	Options of R3 output function			0	○
F03.33	Options of R4 output function			0	○

Y1, Y2, R1 and R2 are 4 standard ways of multi-function digital output terminals. Their functions are defined by setting function codes F03.00 - F03.03. R3 and R4 are 2 extended multi-function output terminals. Their functions are defined by setting function codes F03.32 - F03.33.

For example, if you define F03.02=7, the function of the R1 terminal is “inverter protection”. When the inverter is in the protection status, the output of the function terminal R1 will be valid; and when the inverter is in the normal status, the output of the function terminal R1 will be invalid. Specific options are described in the table below.

Table 6-14 Function List of Multi-function Digital Output Terminals

Settings	Function	Description
0	No output	The protection terminal will be disabled or set to “0: Unavailable” to prevent incorrect output.
1	Inverter running (RUN)	The inverter is in the status of slave running, slave stop, jog running or jog stop. The current output is valid in the aforesaid statuses and invalid in other statuses.
2	Up to output frequency (FAR)	When the |output frequency-set frequency| is less than or equal to the frequency detection width (F15.20) in the running status, the current output will be valid. When the inverter is not in the running status, or the |output frequency-set frequency| is beyond the frequency detection width (F15.20), the current output will be invalid. See 6.6.3 for details.
3	Output frequency detection FDT1	When the |output frequency| is ≥ upper limit of output frequency detection FDT1 (F15.21) in the running status, the current output is valid. When the inverter is not in the running status, or the |output frequency| is ≤ lower limit of output frequency detection FDT1 (F15.22), the current output will be invalid. In other cases, the current output will remain unchanged. See 6.6.2 for details.
4	Output frequency detection FDT2	When the |output frequency| is ≥ upper limit of output frequency detection FDT2 (F15.23) in the running status, the current output is valid. When the inverter is not in the running status, or the |output frequency| is ≤ lower limit of output frequency detection FDT2 (F15.24), the current output will be invalid. In other cases, the current output will remain unchanged. See 6.6.2 for details.
5	Reverse running (REV)	When the running direction and acceleration/deceleration of the inverter is in the status of reverse acceleration, reverse deceleration or reverse constant speed, the current output will be valid. In other statuses, the current output will be invalid.
6	Jog	When the inverter is in the status of JOG running or JOG stop, the current output will be valid. In other statuses, the current output will be invalid.
7	Inverter protection	The current output will be valid when the inverter is in the protection status and invalid when the inverter is in other statuses.
8	Inverter ready to run (READY)	When the inverter has been powered on and completely initialized without any abnormality, the current output will be valid. When the inverter is not suitable for running, the current output will be invalid.
9	Reach the upper frequency limit	When the inverter is in the JOG or slave running status, the output frequency (F18.00) is greater than or equal to the upper frequency limit (F00.17||F00.18), and the set frequency (F18.01) is greater than or equal to the upper frequency limit (F00.17||F00.18), the current output will be valid. Otherwise, the current output will be invalid.
10	Reach the lower frequency limit	When the inverter is in the JOG or slave running status, the output frequency (F18.00) is less than or equal to the lower frequency limit (F00.19), and the set frequency (F18.01) is less than or equal to the lower frequency limit (F00.19), the current output will be valid. Otherwise, the current output will be invalid.

11	Valid current limit	When the output current (F18.06) is greater than or equal to the current limit (F07.12), the current output will be valid; when the output current (F18.06) is less than or equal to the current limit (F07.12) -5.0%, the current output will be invalid; and when the output current is an intermediate value, the current output will remain unchanged.
12	Valid overvoltage stall	When the output voltage (F18.07) is greater than or equal to the voltage of overvoltage stall control (F07.07), the current output will be valid; when the output voltage (F18.07) is less than or equal to the voltage of overvoltage stall control (F07.07) minus 10V, the current output will be invalid; and when the output voltage is an intermediate value, the current output will remain unchanged.
13	Complete simple PLC cycle	When the simple PLC is in the mode of stop after a single operation (F18.15=0), it will be stopped after one operation and the current output will be valid; when the simple PLC is in the mode of stop after a limited number of operations (F18.15=1), it will be stopped after the operations set by F08.16, and the current output will be valid; otherwise (e.g. further running, simple PLC status resetting), the current output will be invalid.
14	Reach the set count value	When the input pulse count value (F18.34) is greater than or equal to the set count value (F16.03), the current output will be valid; otherwise, the output will be invalid. See 6.6.12 for details.
15	Reach the specified count value	When the input pulse count value (F18.34) is greater than or equal to the specified count value (F16.04), the current output will be valid; otherwise, the output will be invalid. See 6.6.12 for details.
16	Reach the length (in meters)	When the input pulse conversion length (F18.34) is greater than or equal to the set length (F16.01), the current output will be valid; otherwise, the output will be invalid. See 6.6.13 for details.
17	Motor overload pre-alarm	When current estimated temperature rise of the motor ≥ the motor pre-alarm coefficient (F07.02) * motor overheat temperature rise, the current output will be valid; otherwise, the current output will be invalid.
18	Inverter overheat pre-alarm	When the inverter temperature is greater than or equal to the hot spot (-10℃), the pre-alarm output will be valid; and when the inverter temperature is less than the hotspot minus 15℃, the pre-alarm output will be invalid (5℃ hysteresis).
19	Reach the upper limit of PID feedback	If the PID feedback ≥ the upper limit (F09.35) of PID feedback voltage during operation, the current output will be valid; otherwise, the output will be invalid. The PID feedback is the percentage of the sensor processed with analog input * 10 V.
20	Reach the lower limit of PID feedback	If the PID feedback ≤ the lower limit (F09.36) of PID feedback voltage during operation, the current output will be valid; otherwise, the output will be invalid. The PID feedback is the percentage of the sensor processed with analog input * 10 V.

21	Analog level detection ADT1	When the selected analog channel input is greater than or equal to the result of analog level detection (F15.26/28), the corresponding output will be valid; when the selected analog channel input is less than or equal to the result of analog level detection (F15.26/28) minus hysteresis (F15.27/29), the corresponding output will be invalid; and in other statuses, the current output will remain unchanged. See 6.6.6 for details.
22	Analog level detection ADT2	
24	Undervoltage status	When the DC bus voltage (F18.08) is less than or equal to the voltage of undervoltage stall control (F07.08), the current output will be valid; when the DC bus voltage (F18.08) is greater than or equal to the voltage of power failure end judgment (F07.09), and the holding time is greater than or equal to the determined delay time of power failure end (F07.10), the current output will be invalid.
26	Up to the set time	When it reaches the regular running time, the current output will be valid; otherwise, the output will be invalid. See 6.6.11 for details.
27	Running at zero speed	When the inverter is in running status (excluding motor or encoder parameter self-learning) and the output frequency (F18.00) ≤ the zero speed judgement frequency (F04.29), the current output will be valid; otherwise, the current output will be invalid.
28~37	Reserved	
38	Off-load	The inverter is in the off-load status.
39	Zero-speed running 2	When the output frequency (F18.00) ≤ the zero speed judgement frequency (F04.29), the current output will be valid; otherwise, the current output will be invalid.
40	Current reached	When the actual output current of the motor reaches the set value, the output is valid.
41	The torque is reached	When the actual torque of the motor reaches the set value, the output is valid.
42	Up to the speed	When the actual speed of the motor reaches the set frequency, the output is valid.
43~46	Reserved	
47	PLC output	When this function is selected for the output terminal, the output of Y1, Y2, R1, R2, R3 and R4 will be controlled by the corresponding bit of F03.31. If the corresponding bit is 1, the output will be valid; and if the corresponding bit is 0, the output will be invalid.
48~66	Reserved	
67	Brake control	This is a dedicated function for winding applications. When the brake is enabled, the output of this function will be valid.
68	Material cutoff detection output	This is a dedicated function for winding applications. In case of material cutoff, the output of this function will be valid.
69	FDT1 lower limit (pulse)	This is similar to #3/4 function. The difference is that the output will be valid only when the frequency is lower than the lower FDT limit and automatically turn invalid after sometime. If the single pulse output is set, the time will be set by F03.17 to F03.20; and if the level output is enabled, the time is 0.1 s by default.
70	FDT2 lower limit (pulse)	
71	FDT1 lower limit (pulse, invalid in JOG)	This function is the same as #69/70 function, except for no output in the JOG status.

72	FDT2 lower limit (pulse, invalid in JOG)	
73	Output overcurrent	When this function of the output terminal is enabled, the current exceeds the F15.66 overcurrent detection level, and the duration reaches the value ofF15.67, the output will be valid.

The Y1 and Y2 multi-function output ports are of open collector output type, with YCM as the common output port. If the selected function is disabled, the electronic switch will be OFF, and the multi-function output ports will be in the invalid status. If the selected function is enabled, the electronic switch will be ON, and the multi-function output ports will be in the valid status. The open collector can be powered on internally or by an external power supply (12-30V).

The output of the relay, one of the standard supplies, is from the internal relay of the inverter. Each relay has one set of normally open contacts and one set of normally closed contacts. When the selected function is disabled, the EB-EC (RB-RC) is normally closed and EA-EC (RA-RC) is normally open. When the selected function is enabled, the internal relay coil will be powered on, the EB-EC (RB-RC) will be disconnected, and the EA-EC (RA-RC) will be engaged. As shown in the right figure.

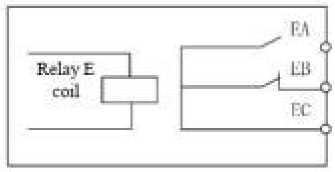


Fig. 6-21 Relay contact

Function code	Function codename	Parameter description								Unit	Default setting	Attribute
F03.05	Options of output signal type	D7	D6	D5	D4	D3	D2	D1	D0		0000	○
		*	*	*	*	R2	R1	Y2	Y1			
		0: level 1: single pulse										

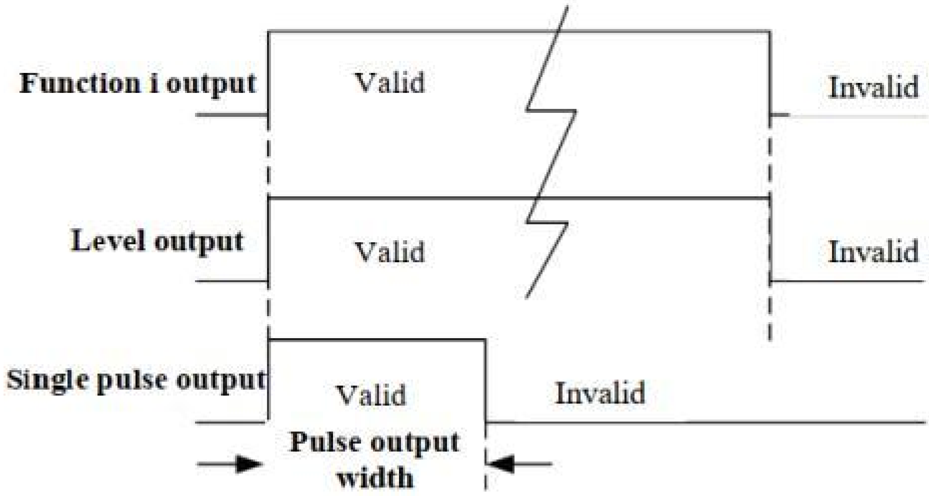


Fig. 6-22 Schematic Diagram of Level and Single Pulse Output of Digital Output Terminal

The digital output terminal has two output types: level and single pulse, as shown in the figure above. For the level output, the output status of the function terminal is consistent with the function status; and for the single pulse output, the active level of a certain pulse width will not be outputted until the function is enabled.

This function code is subject tobit operation. For specific settings, refer to the description of the function code F02.15 under 6.5.1.

<table>
<tr><th>Function code</th><th>Function codename</th><th colspan="8">Parameter description</th><th>Unit</th><th>Default setting</th><th>Attribute</th></tr>
<tr><td rowspan="4">F03.06</td><td rowspan="4">Positive/negative logic of digital output</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td><td rowspan="4"></td><td rowspan="4">00*0000</td><td rowspan="4">○</td></tr>
<tr><td>*</td><td>R4</td><td>R3</td><td>*</td><td>R2</td><td>R1</td><td>Y2</td><td>Y1</td></tr>
<tr><td colspan="8">0: positive logic is valid in the closed state/invalid in the open state</td></tr>
<tr><td colspan="8">1: negative logic is valid in the closed state/invalid in the open state</td></tr>
</table>

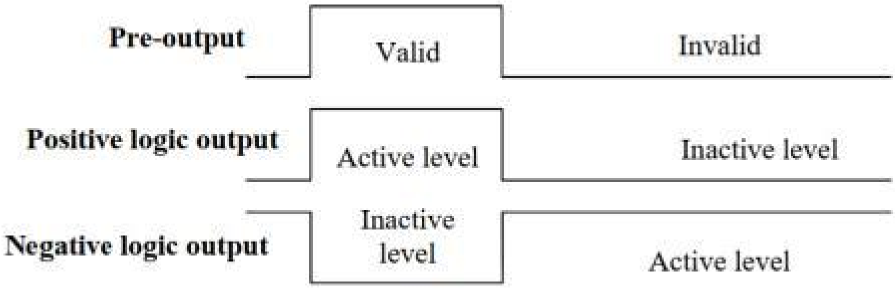


Fig. 6-23 Schematic Diagram of Positive and Negative Logic Output of Digital Output Terminal

The multi-function digital output terminal has two output logics according to the design:

0: Positive logic. When the function is enabled, the multi-function output terminal will output the active level; otherwise, the multi-function output terminal will output the inactive level.

1: Negative logic. When the function is enabled, the multi-function output terminal will output the inactive level; otherwise, the multi-function output terminal will output the active level.

This function code is subject tobit operation. For specific settings, refer to the description of the function code F02.15 under 6.5.1.

* This function is for logic matching with other external devices.

Active level: Y1, low level by default; R1, high level by default.

<table>
<tr><th>Function code</th><th>Function codename</th><th colspan="8">Parameter description</th><th>Unit</th><th>Default setting</th><th>Attribute</th></tr>
<tr><td rowspan="4">F03.08</td><td rowspan="4">Output status control in jog</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td><td rowspan="4"></td><td rowspan="4">00000</td><td rowspan="4">○</td></tr>
<tr><td>*</td><td>*</td><td>*</td><td>REV</td><td>FDT2</td><td>FDT1</td><td>FAR</td><td>RUN</td></tr>
<tr><td colspan="8">0: valid in jogging</td></tr>
<tr><td colspan="8">1: invalid in jogging</td></tr>
</table>

It is usually not necessary for DO to output certain statuses during jog running. The corresponding output can be shielded by setting the corresponding bit of this function code to 1. If F03.08=xxx1x is set and the FAR output is valid, the actually selected output terminal will not output the active level.

This function code is subject tobit operation. For specific settings, refer to the description of the function code F02.15 under 6.5.1.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F03.09	Y1 valid delay time	0.000~30.000	s	0.000	●
F03.10	Y1 invalid delay time	0.000~30.000	s	0.000	●
F03.13	R1 valid delay time	0.000~30.000	s	0.000	●
F03.14	R1 invalid delay time	0.000~30.000	s	0.000	●

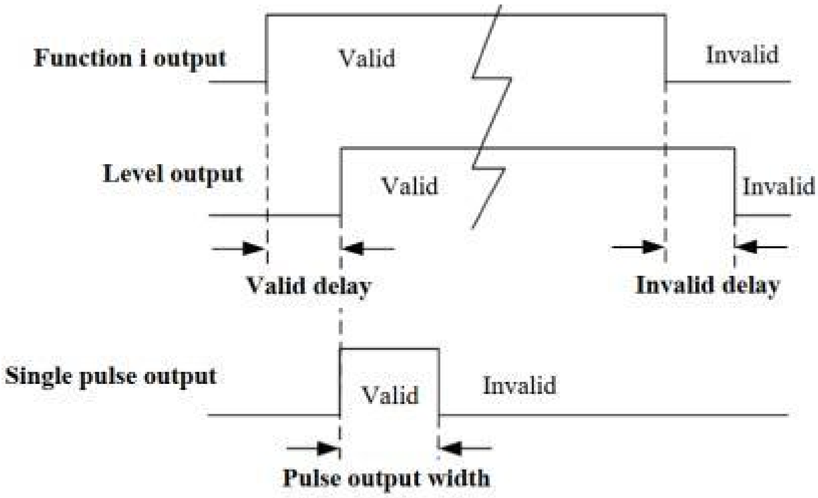


Fig. 6-24 Schematic Diagram of Level and Single Pulse Output of Digital Output Terminal

When the status of the selected function changes, the corresponding output terminal will make a response with delay based on the function code settings. At present, the terminals Y1 andR1 support this function. Details under default conditions: When the function changes from the invalid to valid status and is maintained with the valid delay, the corresponding output terminal will output the active level. When the function changes from the valid to invalid status and is maintained with the invalid delay, the corresponding output terminal will output the inactive level.

* If the function code is set to 0.000s, the delay will be invalid.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F03.17	Single pulse time of Y1 output	0.001~30.000	s	0.250	●
F03.18	Single pulse time of Y2 output	0.001~30.000	s	0.250	●
F03.19	Single pulse time of R1 output	0.001~30.000	s	0.250	●
F03.20	Single pulse time of R2 output	0.001~30.000	s	0.250	●

When one function output terminal is in the single pulse output mode (see F03.05 for details), the pulse width of the active level can be controlled by setting the single pulse output time, in order to meet different process or control requirements.

<table>
<tr><th>Function code</th><th>Function codename</th><th colspan="8">Parameter description</th><th>Unit</th><th>Default setting</th><th>Attribute</th></tr>
<tr><td rowspan="3">F03.31</td><td rowspan="3">Control logic options of PLC output terminal</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td><td rowspan="3"></td><td rowspan="3">00*0000</td><td rowspan="3">●</td></tr>
<tr><td>*</td><td>R4</td><td>R3</td><td>*</td><td>R2</td><td>R1</td><td>Y2</td><td>Y1</td></tr>
<tr><td colspan="8">0: no output
1: Output</td></tr>
</table>

The master can perform control with the help of the inverter output terminal. When this is desired, just write corresponding bits of F03.31 via communication. For applications where output terminal is enabled and disabled frequently, it's recommended to use the communication address 0x831F (0x031F+0x8000,not EEPROM) to avoid damage to EEPROM.

6.5.3 High-speed digital input terminal (HDI)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F02.26	Minimum input pulse frequency	0.00 to maximum input pulse frequency F02.28	kHz	0.00	●
F02.27	Minimum input setting	–100.0~+100.0	%	0.0	●
F02.28	Maximum input pulse frequency	0.01~100.00	kHz	50.00	●
F02.29	Maximum input setting	–100.0~+100.0	%	100.0	●
F02.30	Pulse input filtering time	0.00~10.00	s	0.10	●

The EM760 series inverter supports high-speed pulse input (HDI) feature and shares the X7 terminal. F02.26 - F02.30 are used to set pulse filter time and corresponding offset curve.

As shown below, the system performs line offset between (F02.26, F02.27) and (F02.28, F02.29) based on the input pulse frequency. Anything beyond the frequency range will be cut.

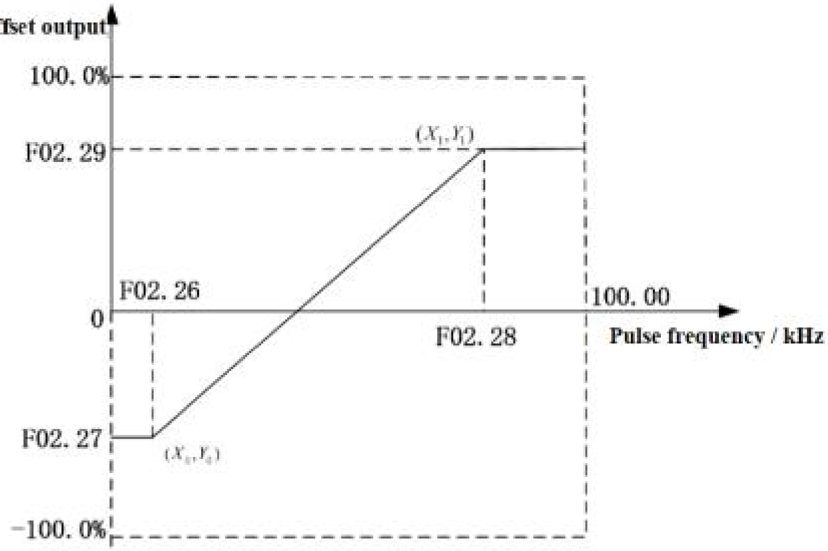


Fig. 6-25 Instructions on offset curve of high-speed pulse input

Where the input pulse frequency is subject to rapid change, or current system doesn't have to make rapid response to the input pulse, the filter time can be prolonged appropriately for system stability.

6.5.4 High-speed digital output terminal (HDO)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F03.07	Options of Y2 output type	0: ordinary digital output 1: high frequency pulse output		0	○

The EM760 series inverter supports high-speed pulse output (HDO) feature, which is similar to analog output. The only difference is that the output is in pulses of varying frequency instead of voltage. If high-speed pulse output is desired for Y2, set F03.07 as 1.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F03.23	Y2 high frequency pulse output function	See Table 6-15 Function List of Multi-function Analog Output Terminal		11	○

Select high-speed pulse output feature via F03.23.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F03.24	Frequency corresponding to 100% of Y2 high frequency pulse output	0.00~100.00	kHz	50.00	●
F03.25	Frequency corresponding to 0% of Y2 high frequency pulse output	0.00~100.00	kHz	0.00	●
F03.26	Filtering time of Y2 high frequency pulse output	0.00~10.00	s	0.10	●

Setting of high-frequency pulse output: 100.0% output corresponds to the setting of max. output frequency, and 0.0% the setting of min. output frequency. Anything therebetween is linear.

F03.26 performs first-order inertia filtering on the output.

6.5.5 Virtual digital input terminal (VDI)

The standard EM760 series inverter is equipped with eight virtual multi-function input terminals (VX1 to VX8), of which the functions and usages are basically the same as those of the actual input terminals. Differences are described below. For their similarities, refer to 6.5.1.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F17.00	VX1 virtual input function options	The same as the digital input terminal function options of the F02 group. See the function list of the multi-function digital input terminal in Table 6-12.		0	○
F17.01	VX2 virtual input function options			0	○
F17.02	VX3 virtual input function options			0	○
F17.03	VX4 virtual input function options			0	○
F17.04	VX5 virtual input function options			0	○
F17.05	VX6 virtual input function options			0	○

F17.06	VX7 virtual input function options			0	○
F17.07	VX8 virtual input function options			0	○
F17.08	Virtual input positive/negative logic	D7 D6 D5 D4 D3 D2 D1 D0 VX8 VX7 VX6 VX5 VX4 VX3 VX2 VX1 0: positive logic is valid in the closed state/invalid in the open state 1: negative logic is valid in the closed state/invalid in the open state		000 00000	○
F17.11	VX1 valid delay time	0.000~30.000	s	0.000	●
F17.12	VX1 invalid delay time	0.000~30.000	s	0.000	●
F17.13	VX2 valid delay time	0.000~30.000	s	0.000	●
F17.14	VX2 invalid delay time	0.000~30.000	s	0.000	●
F17.15	VX3 valid delay time	0.000~30.000	s	0.000	●
F17.16	VX3 invalid delay time	0.000~30.000	s	0.000	●
F17.17	VX4 valid delay time	0.000~30.000	s	0.000	●
F17.18	VX4 invalid delay time	0.000~30.000	s	0.000	●

The terminals VX1 to VX8 essentially have the same function, but there are no corresponding physical terminals actually. They all have the positive and negative logic functions. The terminals VX1 to VX4 have the delay function, and their statuses can be confirmed in the same way. They can be set separately. The terminal VX1 is taken as an example below.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F17.09	VX1-VX8 status setting options	D7 D6 D5 D4 D3 D2 D1 D0 VX8 VX7 VX6 VX5 VX4 VX3 VX2 VX1 0: the VXn status is the same as VYn output status 1: status set by F17.10		000 00000	○
F17.10	VX1-VX8 status setting	D7 D6 D5 D4 D3 D2 D1 D0 VX8 VX7 VX6 VX5 VX4 VX3 VX2 VX1 0: Invalid 1: valid		000 00000	●

- When F17.09=xxxxxxx0, the VX1 status is the same as the VY1 output status.

As stated literally, the status of the virtual input terminal is the same as that of the virtual output terminal, so this should be used in conjunction with the virtual output terminal.

If F17.19=16 (reach the length) and F17.28=xxxx xxx1 (the VY1 status depends on the output function status) under the default conditions, and " 16: reach the length" is valid, the VY1 output and VX1 synchronization will be valid. The corresponding operations (length count clearing and VY1 output status resetting) can be performed according to the VX1 setting (assuming "39: length clearing"). Then the fixed length count function can be enabled again to meet the requirements for repeated processing. If there are certain intervals between repeated processing procedures, you can also complete the aforesaid operations by setting the VX1 delay.

- When F17.09=xxxxxxx1, the VX1 status depends on the bit 0 of the function code F17.10.

The status of the virtual input terminal is directly dependent on the function code. This is mainly used for remote control by the host. The remote control terminal can be used to enable and disable the input terminal status directly with the function code 0x41 by changing the value ofF17.10 through communication.

<table>
<tr><th>Function code</th><th>Function codename</th><th colspan="8">Parameter description</th><th>Unit</th><th>Default setting</th><th>Attribute</th></tr>
<tr><td rowspan="2">F17.37</td><td rowspan="2">Virtual input terminal status</td><td>VX8</td><td>VX7</td><td>VX6</td><td>VX5</td><td>VX4</td><td>VX3</td><td>VX2</td><td>VX1</td><td rowspan="2"></td><td rowspan="2">000
00000</td><td rowspan="2">×</td></tr>
<tr><td colspan="8">0: Invalid
1: valid</td></tr>
</table>

The real-time status of current virtual input terminal is displayed.

6.5.6 Virtual digital output terminal (VDO)

The standard EM760 series inverter is equipped with eight virtual multi-function output terminals (VY1 to VY8), and their functions and usages are essentially the same as those of the actual output terminals. Differences are described below. For their similarities, refer to 6.5.2.

<table>
<tr><th>Function code</th><th>Function codename</th><th colspan="8">Parameter description</th><th>Unit</th><th>Default setting</th><th>Attribute</th></tr>
<tr><td>F17.19</td><td>VY1 virtual output function options</td><td colspan="8" rowspan="8">The same as the digital output terminal function options of the F03 group. See the function list of the multi-function digital output terminal in Table 6-14.</td><td></td><td>0</td><td>○</td></tr>
<tr><td>F17.20</td><td>VY2 virtual output function options</td><td></td><td>0</td><td>○</td></tr>
<tr><td>F17.21</td><td>VY3 virtual output function options</td><td></td><td>0</td><td>○</td></tr>
<tr><td>F17.22</td><td>VY4 virtual output function options</td><td></td><td>0</td><td>○</td></tr>
<tr><td>F17.23</td><td>VY5 virtual output function options</td><td></td><td>0</td><td>○</td></tr>
<tr><td>F17.24</td><td>VY6 virtual output function options</td><td></td><td>0</td><td>○</td></tr>
<tr><td>F17.25</td><td>VY7 virtual output function options</td><td></td><td>0</td><td>○</td></tr>
<tr><td>F17.26</td><td>VY8 virtual output function options</td><td></td><td>0</td><td>○</td></tr>
<tr><td rowspan="4">F17.27</td><td rowspan="4">Virtual output positive/negative logic</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td><td rowspan="4"></td><td rowspan="4">000
00000</td><td rowspan="4">○</td></tr>
<tr><td>VY8</td><td>VY7</td><td>VY6</td><td>VY5</td><td>VY4</td><td>VY3</td><td>VY2</td><td>VY1</td></tr>
<tr><td colspan="8">0: positive logic is valid in the closed state/invalid in the open state</td></tr>
<tr><td colspan="8">1: negative logic is valid in the closed state/invalid in the open state</td></tr>
<tr><td>F17.29</td><td>VY1 valid delay time</td><td colspan="8">0.000~30.000</td><td>s</td><td>0.000</td><td>●</td></tr>
<tr><td>F17.30</td><td>VY1 invalid delay time</td><td colspan="8">0.000~30.000</td><td>s</td><td>0.000</td><td>●</td></tr>
<tr><td>F17.31</td><td>VY2 valid delay time</td><td colspan="8">0.000~30.000</td><td>s</td><td>0.000</td><td>●</td></tr>
</table>

F17.32	VY2 invalid delay time	0.000~30.000	s	0.000	●
F17.33	VY3 valid delay time	0.000~30.000	s	0.000	●
F17.34	VY3 invalid delay time	0.000~30.000	s	0.000	●
F17.35	VY4 valid delay time	0.000~30.000	s	0.000	●
F17.36	VY4 invalid delay time	0.000~30.000	s	0.000	●

The terminals VY1 to VY8 essentially have the same function, but there are no corresponding physical terminals actually. They all have the positive and negative logic functions. The terminals VY1 to VY4 have the delay function, and their statuses can be confirmed in the same way. They can be set separately. The terminal VY1 is taken as an example below.

Function code	Function codename	Parameter description								Unit	Default setting	Attribute
F17.28	Control options of virtual output terminal	D7	D6	D5	D4	D3	D2	D1	D0		111 11111	○
		VY8	VY7	VY6	VY5	VY4	VY3	VY2	VY1			
		0: Depending on the status of terminal X1-X5 (without VY6-8) 1: depending on the output function status										

● F17.28=xxxxxxx0: the VY1 status is the same as the actual input status of X1.

The status of the virtual output terminal VY1 is synchronized with that of the actual input terminal X1. This can be applied in programming of multiple functions such as status confirmation or enabling of one switch.

● F17.28=xxxxxxx1: the VY1 status depends on the selected function status of the function code F17.19.

The status of the virtual output terminal depends on the set function status, and its main output is for software programming. The PID can be controlled via "reaching the upper limit of PID feedback" as follows: outputting the signal "19: reach the upper limit of PID feedback" through the virtual output terminal VY1 (F17.19=19), collecting it through the virtual input terminal VX1 and then setting the VX1 function to "41: process PID pause" (F17.00=41).

Note: The D7 bit of the VY8 option must be set to 1. That is, the VY8 function is always dependent on the output function status.

Function code	Function codename	Parameter description								Unit	Default setting	Attribute
F17.38	Virtual output terminal status	VY8	VY7	VY6	VY5	VY4	VY3	VY2	VY1		000 00000	×
		0: Invalid 1: valid										

The real-time status of current virtual output terminal is displayed.

6.5.7 Analog input terminal (AI)

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F02.31	Options of analog input function	**Ones place:** AI1		0000D	○

		0: analog input 1: digital input (0 below 1V, 1 above 3V, the same as last time under 1-3V) **Tens place:** AI2 0: analog input 1: digital input (the same as above) **Hundreds place:** AI3 0: analog input 1: digital input (the same as above) **Thousands place:** AI4 (expansion card) 0: analog input 1: digital input (the same as above)			

The analog input terminals AI1 to AI4 of the EM760 series inverter can be used as digital input terminals. You only need to set the corresponding bit to 1. To use the AI2 terminal as a digital terminal, you only need to set F02.31=xx1x. The analog input and digital logic conversion are as follows:

- When the input voltage of the terminal is less than 1V, its corresponding logic status will be invalid;
- When the input voltage of the terminal is greater than 3V, its corresponding logic status will be valid;
- When the input voltage of the terminal is within [1V, 3V], its corresponding logic status will remain unchanged.

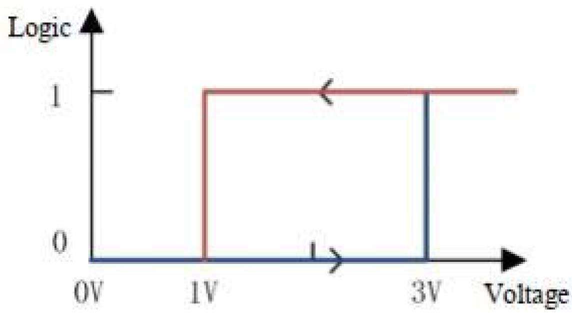


Fig. 6-26 Correspondence between Analog Input Terminal Voltage and Current Logic Status

If it is used as an analog input terminal, the filter time and corresponding offset curve can be set via F02.32 to F02.60. The terminals AI1 to AI4 can be set separately.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F02.32	Options of analog input curve	**Ones place:** Options of AI1 curve 0: curve 1		3210	○

		1: curve 2 2: curve 3 3: curve 4 **Tens place:** AI2 curve selection 0: curve 1 1: curve 2 2: curve 3 3: curve 4 Hundreds place: Options of AI3 curve 0: curve 1 1: curve 2 2: curve 3 3: curve 4 Thousands place: Options of AI4 curve 0: curve 1 1: curve 2 2: curve 3 3: curve 4			
F02.33	Minimum input of curve 1	-10~F02.35	V	0.10	●
F02.34	Minimum input setting of curve 1	–100.0~+100.0	%	0.0	●
F02.35	Maximum input of curve 1	-10~10.00	V	9.90	●
F02.36	Maximum input setting of curve 1	–100.0~+100.0	%	100.0	●
F02.37	Minimum input of curve 2	-10.00~F02.39	V	0.10	●
F02.38	Minimum input setting of curve 2	–100.0~+100.0	%	0.0	●
F02.39	Maximum input of curve 2	F02.37~10.00	V	9.90	●
F02.40	Maximum input setting of curve 2	–100.0~+100.0	%	100.0	●
F02.41	Minimum input of curve 3	-10.00V~F02.43	V	0.10	●
F02.42	Minimum input setting of curve 3	–100.0~+100.0	%	0.0	●
F02.43	Input of inflection point 1 of curve 3	F02.41~F02.45	V	2.50	●
F02.44	Input setting of inflection point 1 of curve 3	–100.0~+100.0	%	25.0	●
F02.45	Input of inflection point 2 of curve 3	F02.43~F02.47	V	7.50	●

F02.46	Input setting of inflection point 2 of curve 3	-100.0~+100.0	%	75.0	●
F02.47	Maximum input of curve 3	F02.45~ 10.00	V	9.90	●
F02.48	Maximum input setting of curve 3	-100.0~+100.0	%	100.0	●
F02.49	Minimum input of curve 4	-10.00~F02.51	V	-9.90	●
F02.50	Minimum input setting of curve 4	-100.0~+100.0	%	-100.0	●
F02.51	Input of inflection point 1 of curve 4	F02.49~F02.53	V	-5.00	●
F02.52	Input setting of inflection point 1 of curve 4	-100.0~+100.0	%	-50.0	●
F02.53	Input of inflection point 2 of curve 4	F02.51~F02.55	V	5.00	●
F02.54	Input setting of inflection point 2 of curve 4	-100.0~+100.0	%	50.0	●
F02.55	Maximum input of curve 4	F02.53~ 10.00	V	9.90	●
F02.56	Maximum input setting of curve 4	-100.0~+100.0	%	100.0	●
F02.57	AI1 filtering time	0.00~10.00	s	0.10	●
F02.58	AI2 filtering time	0.00~10.00	s	0.10	●
F02.59	AI3 filtering time	0.00~10.00	s	0.10	●
F02.60	AI4 filtering time (expansion card)	0.00~10.00	s	0.10	●

F02.32 is used to select the corresponding offset curve for each analog input terminal. In total, four groups of offset curves are available. Among them, the curves 1 and 2 indicate two-point offsets, while the curves 3 and 4 indicate four-point offsets. After selecting an offset curve, you can set the corresponding function code to meet the input requirements.

The filtering time can be adjusted according to the analog input and actual working conditions. The actual effect will prevail.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F02.61	AD sampling hysteresis	0~50		2	○

This function code can be increased properly in the case of analog input hysteresis, long input lines or excessive on-site interference resulting in significant input fluctuations. In principle, this function code should be minimized.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F02.62	Selection of analog input AI1 type	0: 0~10V 1: Reserved 2: Reserved 3: -10~10V 4: 0~5V		0	○
F02.63	Selection of analog input AI2 type	0: 0~10V 1: 4~20mA		1	○

		2: 0~20mA 3: Reserved 4: 0~5V			
F02.64	Analog input AI3 type selection	0: 0~10V 1: 4~20mA 2: 0~20mA 3: Reserved 4: 0~5V		0	○
F02.65	Analog input AI4 type selection	0: 0~10V 1: Reserved 2: Reserved 3: -10~10V 4: 0~5V		3	○

Select the input type of AI1 to AI4: current or voltage type. Determine the upper and lower limits corresponding to the range.

F02.62 =0: 0~10V

AI1 is the voltage type, with a range of 0-10V. The input voltage (0-10V) corresponds to the setting 0%-100%. 0V corresponds to 0%, and +10V corresponds to 100%.

F02.62 =3: -10~10V

AI1 is the voltage type, with a range of -10-10V. The input voltage (-10 to 10V) corresponds to the setting -100% to 100%. -10V corresponds to -100%, and +10V corresponds to 100%.

F02.62 =4: 0~5V

AI1 is the voltage type, with a range of 0-5V. The input voltage (0-5V) corresponds to the setting 0%-100%. 0V corresponds to 0%, and +5V corresponds to 100%.

F02.63 =0: 0~10V

AI2 is the voltage type, with a range of 0-10V. The input voltage (0-10V) corresponds to the setting 0%-100%. 0V corresponds to 0%, and +10V corresponds to 100%.

F02.63 =1: 4~20mA

AI2 is the current type, with a range of 4-20mA. The input current (4-20mA) corresponds to the setting 0%-100%. The current of 4mA or less corresponds to 0%, and 20mA corresponds to 100%.

F02.63 =2: 0~20mA

AI2 is the current type, with a range of 0-20mA. The input current (0-20mA) corresponds to the setting 0%-100%. 0mA corresponds to 0%, and 20mA corresponds to 100%.

F02.63 =4: 0~5V

AI2 is the voltage type, with a range of 0-5V. The input voltage (0-5V) corresponds to the setting 0%-100%. 0V corresponds to 0%, and +5V corresponds to 100%.

F02.64 and F02.63 share the same instructions, and so do F02.65 and F02.62.

6.5.8 Analog output terminal (AO)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F03.21	Options of analog output M1	See Table 6-15 Function List of Multi-function Analog Output Terminal		0	○
F03.22	Options of analog output M2			2	○

M1 and M2 are multi-function analog output terminals. Their functions can be defined separately by setting the value of the function code F03.21 and F03.22.

For example, ifF03.21=0 is defined, the function of the M1 terminal is to output the “operating frequency (absolute value)”. The current |operating frequency| is reflected by the output voltage. If the operating frequency increases from 0.00Hz to 50.00Hz (assuming F00.16=50.00), the voltage of the M1 output port will increase from 0.00V to 10.00V under the default conditions, showing the same change trend. Specific options are described in the table below.

Table 6-15 Function List of Multi-function Analog Output Terminal

Settings	Function	Description
0	Operating frequency (absolute value)	0.00Hz to Fmax, corresponding to the output 0.0% to 100.0%
1	Set frequency (absolute value)	0.00Hz to Fmax, corresponding to the output 0.0% to 100.0%
2	Output torque (absolute value)	0.0% to 200.0%, corresponding to the output 0.0% to 100.0%
3	Set torque (absolute value)	0.0% to 200.0%, corresponding to the output 0.0% to 100.0%
4	Output current	0.0A to 2*Ie, corresponding to the output 0.0% to 100.0%
5	Output voltage	0.0V to 1.5*Ue, corresponding to the output 0.0% to 100.0%
6	Bus voltage	0V to about 2.63*Ue, corresponding to the output 0.0% to 100.0% (That is, for the 220V driver, 579V corresponds to the output 100.0%; for the 380V driver, 1000V corresponds to the output 100.0%, and for the 660V driver, 1736V corresponds to the output 100.0% Drivers at different voltage levels have the same output voltage at their rated voltages.)
7	Output power	0.00kW to 2*Pe, corresponding to the output 0.0% to 100.0%
8	AI1	Output the actual input voltage, instead of the offset result. 0.0% to 100.0%, corresponding to the output 0.0% to 100.0%
9	AI2	

10	AI3	
11	AI4 (expansion card)	
12	High-frequency pulse input (with 100% corresponding to 100.00kHz)	The function codes F02.26-F02.28 correspond to the output 0.0%-100.0%.
13	Communication setting 1	Communication setting by M1 terminal, communication address option 701AH
14	Count value	0 to F16.03, corresponding to the output F16.10 to F16.11
15	Length value	0 to F16.01, corresponding to the output F16.10 to F16.11
16	PID output percentage	-100.0% to 100.0%, corresponding to the output 0.0% to 100.0%
18	PID feedback	-100.0% to 100.0%, corresponding to the output 0.0% to 100.0%
19	PID setting	-100.0% to 100.0%, corresponding to the output 0.0% to 100.0%

* Fmax, maximum frequency (F00.16, and F14.78 when using motor 2)

Ie, rated current of the inverter (F12.21)

Ue, rated voltage of the inverter (F12.20)

Pe, rated power of the inverter (F12.19)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F03.27	M1 output bias	-100.0~100.0	%	0.0	●
F03.28	M1 output gain	-9.999~9.999		1.000	●
F03.29	M2 output bias	-100.0~100.0	%	0.0	●
F03.30	M2 output gain	-9.999~9.999		1.000	●

The above function codes are usually used to correct the zero drift of analog output and the deviation of output amplitude. They can also be used to customize the required AO output curve to meet the requirements of different instruments or others. If the offset is represented by “b”, the gain by “k”, actual output by “Y” and standard output by “X”, the actual output is: Y=kX＋b.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F03.34	Output type options of analog output M1	0: 0~10V 1: 4~20mA 2: 0~20mA		0	O
F03.35	Output type options of analog output M2	0: 0~10V 1: 4~20mA 2: 0~20mA		1	O

The M1 output type is controlled by F03.34:

F03.34=0: output voltage 0-10V

F03.34=1: output current 4-20mA

F03.34=2: output current 0-20mA

The M2 output type is controlled by F03.35, for which the instructions are the same as F03.34.

6.6 Auxiliary function

6.6.1 Jog function

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.00	Jog frequency	0.00 to maximum frequency F00.16	Hz	5.00	●
F15.01	Jog acceleration time	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	5.00	●
F15.02	Jog deceleration time	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	5.00	●

As shown below, when the jog running command (FJOG/RJOG) is valid, the inverter will start running at the set frequency ofF15.00; and when the jog running command is invalid, the inverter will be stopped according to the stop mode.

F15.01 and F15.02 are set as the acceleration and deceleration time during operation. Their values (e.g. 500) depend on the acceleration and deceleration time unit (F15.13), and have different meanings and ranges. For example, F15.13=0 means that the acceleration and deceleration time is 5.00s, and F15.13=1 means that the acceleration and deceleration time is 50.0s.

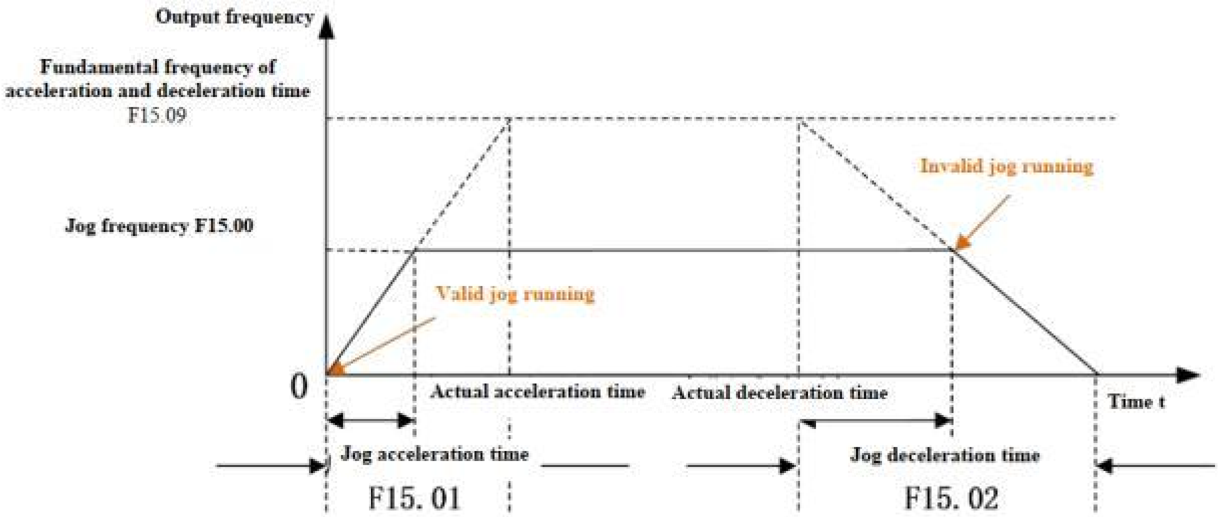


Fig. 6-27 Schematic Diagram of Jog Running

*: The separate set frequency and acceleration/deceleration time are applied in jog running, and not shared in normal running, but with the same physical meanings.

The triggering conditions of the jog running command vary depending on the control mode and valid conditions, as detailed in the table below.

Table 6-16 Interpretation of jog running command

Command Source Option (F00.02)	Jog running command
0: keyboard control	Set the M.K multi-function key option (F12.00) to "1: forward jog" or "2: reverse jog". Press the M.K key M.K to enable the jog running command and release this key M.K to disable the jog running command. *: Unplug the keyboard during JOG running to stop the inverter.
1: Terminal control	Select the digital input terminal function "4: forward jog (FJOG)" or "5: reverse jog (RJOG)". By default, if the function terminal is valid, the jog running command will be valid; and if the function terminal is invalid, the jog running command will be invalid.
2: Communication control	If the host writes "0003H: JOG forward" or "0004: JOG reverse" to the register 7000H through the MODBUS protocol, the jog running command will be valid; if it writes "000BH: jog stop", the jog running command will be invalid.

6.6.2 Output frequency detection (FDT)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.21	Upper limit of output frequency detection FDT1	0.00 to maximum frequency F00.16	Hz	30.00	O
F15.22	Lower limit of output frequency detection FDT1	0.00 to maximum frequency F00.16	Hz	28.00	O
F15.23	Upper limit of output frequency detection FDT2	0.00 to maximum frequency F00.16	Hz	20.00	O
F15.24	Lower limit of output frequency detection FDT2	0.00 to maximum frequency F00.16	Hz	18.00	O

If the multi-function or relay output is set as 3 (output frequency detection range FDT1), when the output frequency of the inverter has increased to the upper limit of output frequency detection FDT1 (F15.21), the corresponding output terminal will start to act; and when the output frequency of the inverter has dropped to the lower limit of output frequency detection FDT1 (F15.22), the corresponding output terminal will stop acting, as shown below.

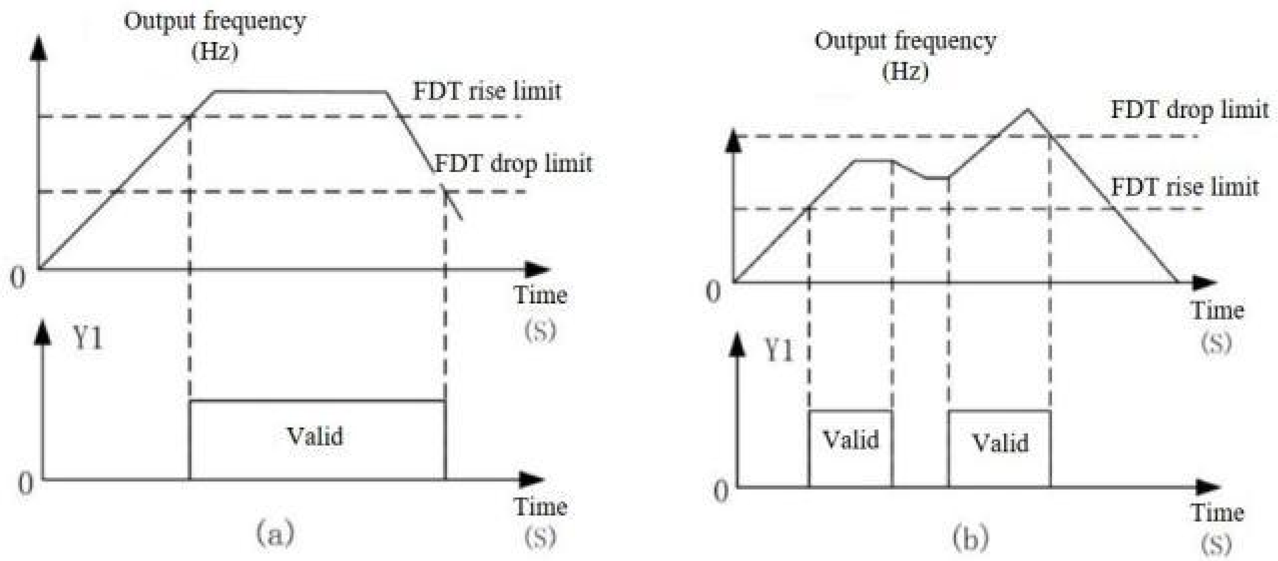


Fig. 6-28　　Output frequency detection range FDT

6.6.3　Detection of output frequency reaching setting (FAR)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.20	Detection width of output frequency arrival (FAR)	0.00~50.00	Hz	2.50	O

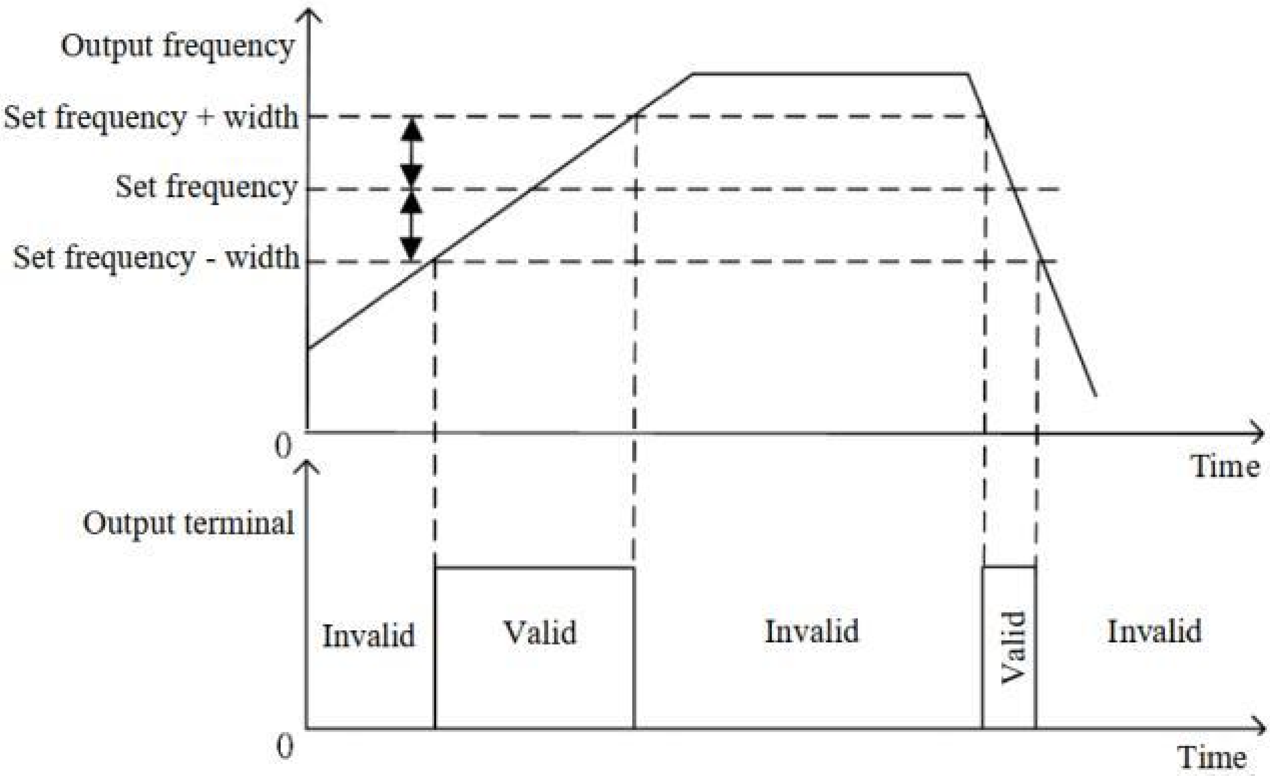


Fig. 6-29　　Schematic Diagram of FAR Detection

As shown in the figure above, when the multi-function output terminal or relay output is set to "2: up to output frequency (FAR)", and the absolute value of the difference between the |output frequency| and |given frequency| is less than or equal to the set value of FAR detection width (F15.20) during inverter operation, the corresponding function terminal will output the active level. Otherwise, this terminal will output the inactive level.

6.6.4 Speed detection (SDT)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.63	Speed reaches the rising limit	0.00~Fmax	Hz	30.00	●
F15.64	Speed reaches the filtering time	0~60000	ms	500	●
F15.65	Speed reaches the falling limit	0.00~Fmax	Hz	0.00	●

Speed reached: During acceleration, if the output frequency gets higher than "Speed reaches the rising limit" (F15.63), current output is valid; and during deceleration, if the output frequency becomes less than "Speed reaches the falling limit" (F15.65), current output is invalid. Increasing F15.64 improves resistance to interference and prevents mis-operation, but it also extends the delay of output terminal actions.

Function number of "Speed reached output terminal": 42.

6.6.5 Frequency hopping

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.14	Frequency hopping point 1	0.00~600.00	Hz	600.00	●
F15.15	Hopping range 1	0.00-20.00, 0.00 is invalid	Hz	0.00	●
F15.16	Frequency hopping point 2	0.00~600.00	Hz	600.00	●
F15.17	Hopping range 2	0.00-20.00, 0.00 is invalid	Hz	0.00	●
F15.18	Frequency hopping point 3	0.00~600.00	Hz	600.00	●
F15.19	Hopping range 3	0.00-20.00, 0.00 is invalid	Hz	0.00	●

The frequency hopping function (FH function for short) can prevent the output frequency of the inverter from the mechanical resonance frequency point of the mechanical load. If the inverter is prohibited from running at a constant speed within the frequency hopping range, hopping will not occur during acceleration. Instead, the inverter will run smoothly.

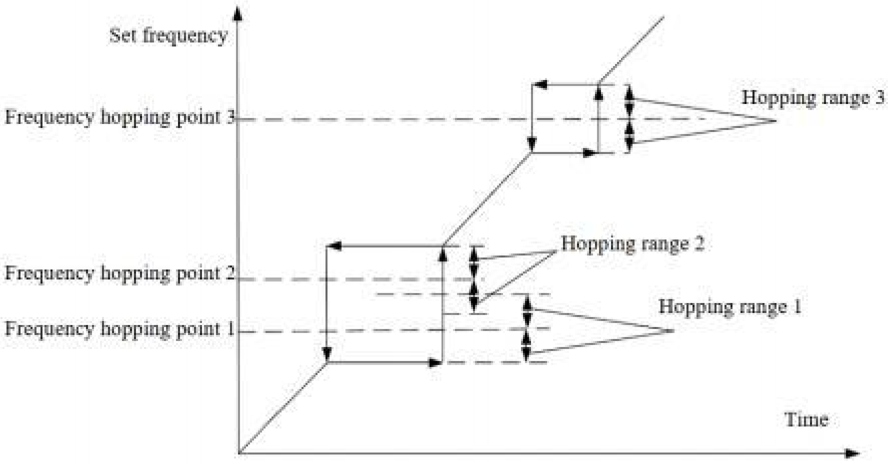


Fig. 6-30 Schematic Diagram of Frequency Hopping

As shown in the figure above, the frequency hopping function is set in the form of "frequency hopping point + hopping range". The specific frequency hopping range is (frequency hopping point - hopping range, frequency hopping point + hopping range). At most three frequency hopping areas can be set. When the respective hopping range is 0, the corresponding frequency hopping function will be invalid.

When the frequency hopping function is valid and the set frequency rises within the regulation range, the final set frequency is "frequency hopping point - hopping range"; and when the frequency hopping function drops, the final set frequency is "frequency hopping point + hopping range".

Multiple frequency hopping areas can be superimposed, as shown in the frequency hopping areas 1 and 2 in the figure above. The final frequency hopping range is (frequency hopping point 1 - hopping range 1, frequency hopping point 2 + hopping range 2).

6.6.6 Analog level detection (ADT)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.25	Options of analog level detection ADT	0: AI1 1: AI2 2: AI3 3: AI4 (expansion card)		0	○
F15.26	Analog level detection ADT1	0.00~100.00	%	20.00	●
F15.27	ADT1 hysteresis	0.00 to F15.26 (valid down in one direction)	%	5.00	●
F15.28	Analog level detection ADT2	0.00~100.00	%	50.00	●
F15.29	ADT2 hysteresis	0.00 to F15.28 (valid down in one direction)	%	5.00	●

The analog level detection function is used to detect and monitor the analog input of the current selected F15.25 channel, and also perform internal operation and external alarm monitoring. Two detection conditions can be set, but only one analog input channel can be detected.

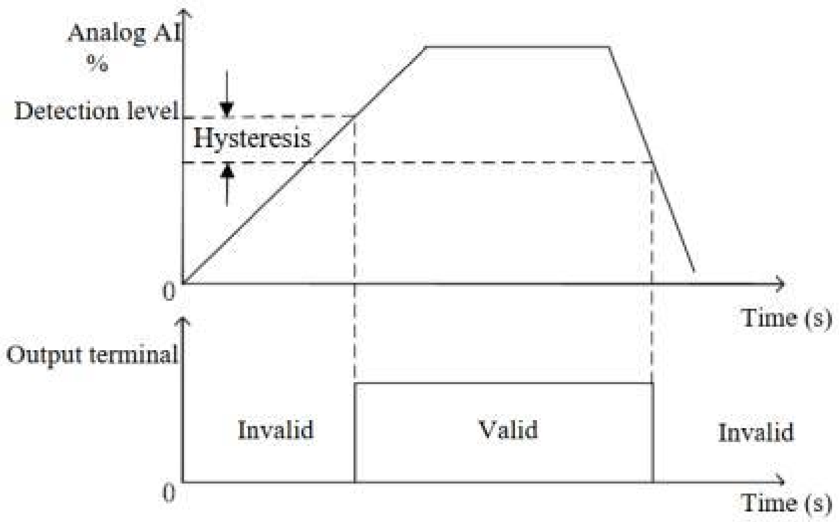


Fig. 6-31 Schematic Diagram of ADT Detection

As shown in the figure above, a valid starting point has been set for the detection level. When the percentage of analog input is above the detection level after offset processing, the ADT function will be valid. The conditions for invalid ADT function are dependent on the one-way downward hysteresis. When the conversion result of analog input decreases to less than the result of “detection level - hysteresis”, the ADT function will be invalid.

Function number of ADT1 output terminal: 21.

Function number of ADT2 output terminal: 22.

6.6.7 Current reach detection

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.44	Current reaches the detection value	0.0~300.0 (100.0% corresponds to the rated current of motor)	%	100.0	●
F15.45	Current reaches the hysteresis	0.0~F15.44	%	5.0	●

Current reached: In running status, and when the output current is greater than the current reach detection value (F15.44), the current output is valid. In non-running status, or when the output current is less than or equal to the current reach detection value (F15.44) - CDT hysteresis (F15.45), the current output is invalid. In other cases, current output status remains unchanged. Between current reach detection value (F15.44) - CDT hysteresis (F15.45) and current reach detection value (F15.44), the terminal remains in the previous status.

Function number of current reach output terminal: 40.

6.6.8 Torque reach detection

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.46	Torque reaches the detection value	0.0~300.0 (100.0% corresponds to the rated torque of motor)	%	100.0	●
F15.47	Torque reaches the hysteresis	0.0~F15.46	%	5.0	●

Torque reach: In running status, and when |output torque| is greater than |torque reach detection value (F15.46)|, the current output is valid. In non-running status, or when |output torque| is less than or equal to |torque reach detection value (F15.46)| - TDT hysteresis (F15.47), the current output is invalid. In other cases, current output status remains unchanged. Between torque reach detection value (F15.46) - TDT hysteresis (F15.47) and torque reach detection value (F15.46), the terminal remains in the previous status.

Function number of torque reach output terminal: 41.

6.6.9 Overcurrent detection

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.66	Overcurrent detection level	0.1-300.0 (0.0: no detection; 100.0%: corresponding to the rated current of motor)	%	200.0	●
F15.67	Overcurrent detection delay time	0.00~600.00	s	0.00	●

When the current exceeds the overcurrent detection level (F15.66) and the duration reaches F15.67,the function “73: output overcurrent” of the output terminal will be valid.

6.6.10 Cooling fan control

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.34	Fan control	Ones place: Fan control mode 0: running after power-on 1: running at startup 2: intelligent operation, subject to temperature control Tens place: Electrification fan control 0: Run 1 minute first and then enter the fan control mode for running 1: Directly run in the fan control mode Hundreds place: Low-speed fan running mode enabled (200G/220P~400G/450P) 0: Low-speed running invalid 1: Low-speed running valid		101	O

In order to use the fan reasonably, the fan system has three running modes, depending on the fan control function code (F15.34). The specific running mode of the fan is shown below.

Table 6-17 Details of Fan Operation

Fan control	Fan operation
0: running after power-on	When the inverter is powered on, the fan will start running.
1: running at startup	When the inverter starts running, the fan will start running. When this parameter is set to 1 min, the fan will stop running.
2: intelligent operation, subject to temperature control	When the temperature of the inverter is greater than 45°C, the fan will start running; when the temperature of the inverter is less than 40°C, the fan will stop running; and when the temperature of the inverter is in between the two values, the fan will remain unchanged.

When “2: intelligent operation, subject to temperature control” is selected, make sure that the temperature detection module of the inverter works properly.

If low-speed fan running mode is enabled, the fan of a high-power model will run at low speed to reduce noise; and if low-speed fan running mode is disabled, the fan will of a high-power model will run at full speed.

6.6.11 Timing function

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F16.05	Set time of regular running	0.0-6500.0, 0.0 is invalid	min	0.0	●

Regular running function: The regular running function can be enabled by setting this function code other than 0. When the running time reaches the set time, the inverter will be shutdown, and the terminal output of the option “26: reach the set time” will be valid, and there will be a prompt indicating that the inverter has been run for the set time.

Users can view the remaining time of regular running by F18.35, or clear the current running time by the input function “27: clear regular running time” (i.e. resetting F18.35). This represents the set time in the non-running status and remaining time in the running status. That is, one regular running process lasts from start to stop, and the accumulated time in the non-running status will be cleared.

6.6.12 Counting function

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F16.03	Set count value	F16.04~65535		1000	●
F16.04	Specified count value	1~F16.03		1000	●

EM760 series inverters support counting, as shown in the figure below. Pulse information is input from the digital input terminal. When the count reaches the specific value, there will be the corresponding valid signal output. The user can use this signal for programming (e.g. DI/VX input as the stop command) or view the real-time count by F18.33.

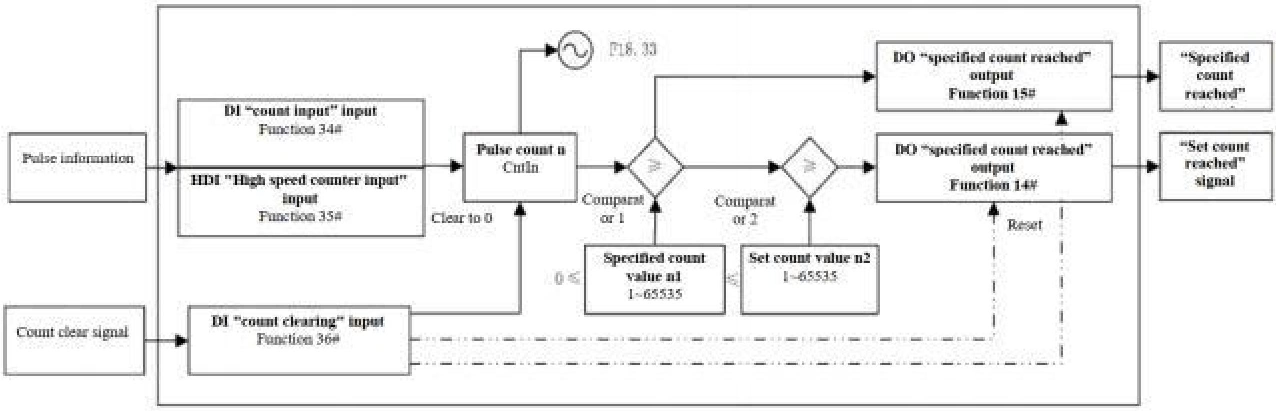


Fig. 6-32 Block Diagram of Counting Function

Counting principle: Specific information is entered in the pulse form. The number of pulses is collected by the DI terminal and then is compared with the “specified count” n_1. If $n < n_1$, it means that the value does not reach the “specified count”. Otherwise, it means that the value reaches the “specified count”, the result is outputted by the DO terminal, counting is continued, and the value is compared with the “set count”. If $n<n_2$, it means that the value does not reach the “set count”. Otherwise, it means that the value reaches the “set count”, the result will be outputted by the DO terminal and counting will be stopped. The “36: clear counter” input can be used to clear the count and reset the output signal.

When the pulse frequency exceeds 250Hz (=1/(2 (default filtering times)*2*$1ms^{-1}$)), make sure of the input through the high-speed pulse input terminal (X7), and set F02.06 to “35: high-speed count input”. 250Hz is only a theoretical value. The actual effect will prevail. In order to avoid errors, use the high-speed pulse input terminal wherever possible.

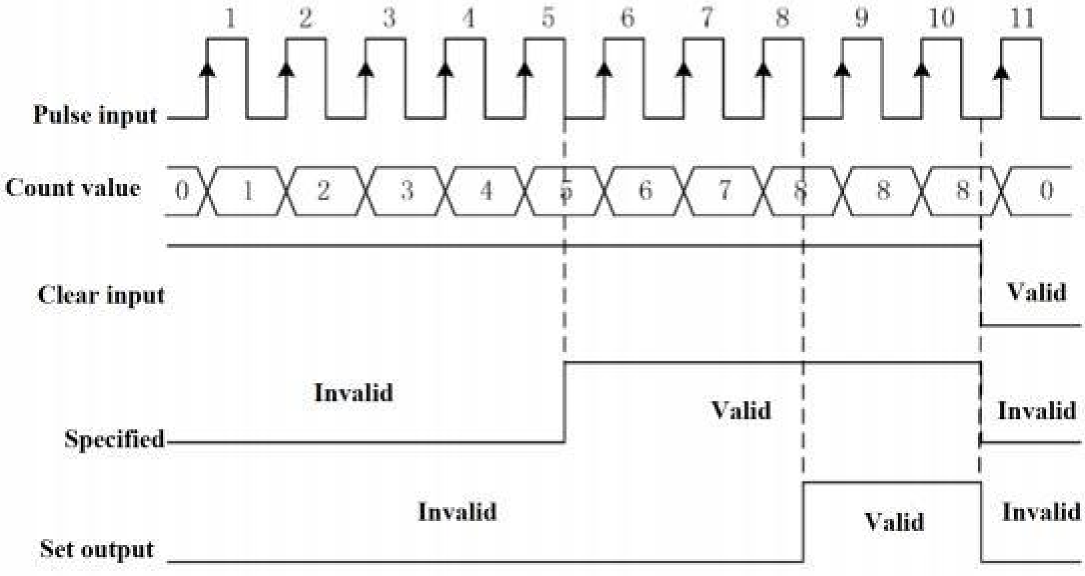


Fig. 6-33 Example of Counting

The figure above shows an example, where F16.03=8 and F16.04=5. When the count reaches the specified value 5, the output of “15: reach the specified value” will be valid. When the count reaches the set value 8, the output of “14: reach the set value” will be valid. When the input of “36: clear length” is valid, the count will be cleared to 0, and the outputs of “15: reach the specified value” and “14: reach the set value” will be invalid.

Limit 65535 ≥ set count ≥ specified count ≥ 0. If the set count and specified count are 0, the counter function will be invalid. This function is allowed for one terminal only at a time.

6.6.13 Fixed length function

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F16.01	Set length	1~65535(F16.13=0) 0.1~6553.5(F16.13=1) 0.01~655.35(F16.13=2) 0.001~65.535(F16.13=3)	m	1000	●
F16.02	Pulses per meter	0.1~6553.5		100.0	●
F16.13	Set length resolution	0: 1m 1: 0.1m 2: 0.01m 3: 0.001m		0	O

EM760 series inverters have a fixed-length counting function, as shown in the figure below. The length counting function is performed by entering the length information from the digital input terminal in the pulse form and then setting the related function code. The final length count information can be outputted by the digital output terminal for other purposes (e.g. DI/VX input as the stop command). Users can also view the real-time length count via F18.34. The length resolution can be set by F16.13. In case of any change in the length resolution, F16.01 will change accordingly. For example, ifF16.13 is set to 0:1m, the setting range ofF16.01 is 1-65535m.

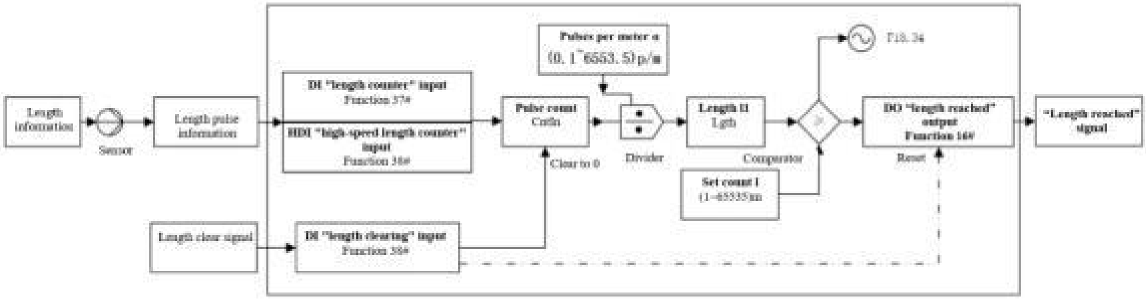


Fig. 6-34 Block Diagram of Fixed-length Counting

Principle of fixed-length counting: The length detection sensor converts the length information into pulse information. The DI terminal collects the number N of input pulses. The length is calculated based on the set function code "Pulses per meter" α: $l_1 = \frac{N}{\alpha}$, and then compared with the "Set length" l. If $l_1 < l$, it means that the length does not reach the set value; otherwise, the fixed-length count is completed. The "39: Clear length" input can be applied to clear the count and reset the output signal.

When the pulse frequency is greater than 250Hz (=1/(2 (default filtering times)*2*1ms^{-1})), make sure of the input from the high-speed pulse input terminal (X5) and set F02.06 to "38: high-speed length count input". 250Hz is only a theoretical value. The actual effect will prevail. In order to avoid errors, use the high-speed pulse input terminal wherever possible.

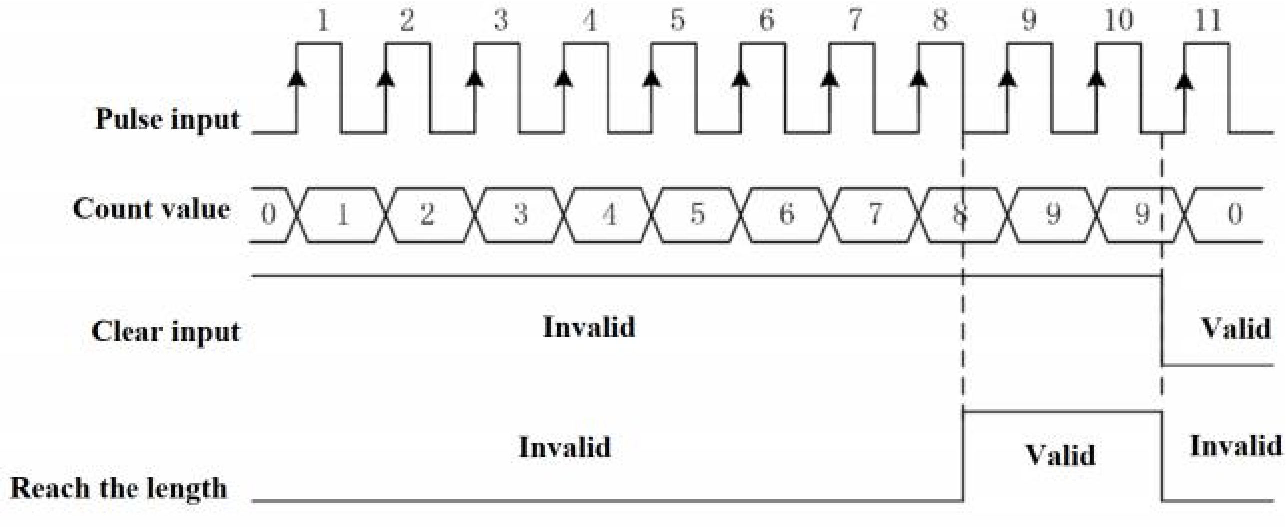


Fig. 6-35 Example of Fixed-length Counting

The figure above shows an example, where F16.01=2 and F16.02=4.0. When the length count is 8 (=2×4), the "16: length reached" output will be valid. When the "39: clear length" input is valid, the count will be cleared, and the "16: length reached" output will be invalid.

6.6.14 Energy consumption braking

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.30	Options of energy consumption braking function	0: Invalid 1: valid		0	O
F15.31	Energy consumption braking voltage	110.0~140.0 (380V,100.0=537V)	%	128.5	O
F15.32	Braking rate	20~100 (100 means that duty ratio is 1)	%	100	●

Energy consumption braking is a braking method for quick deceleration by converting the energy generated in deceleration into the thermal energy of the braking resistor. It is suitable for braking under large-inertia loads or stop by rapid braking. In this case, it is necessary to select the appropriate braking resistor and braking unit, as detailed in 10.1 Braking resistor and 10.2 Braking unit.

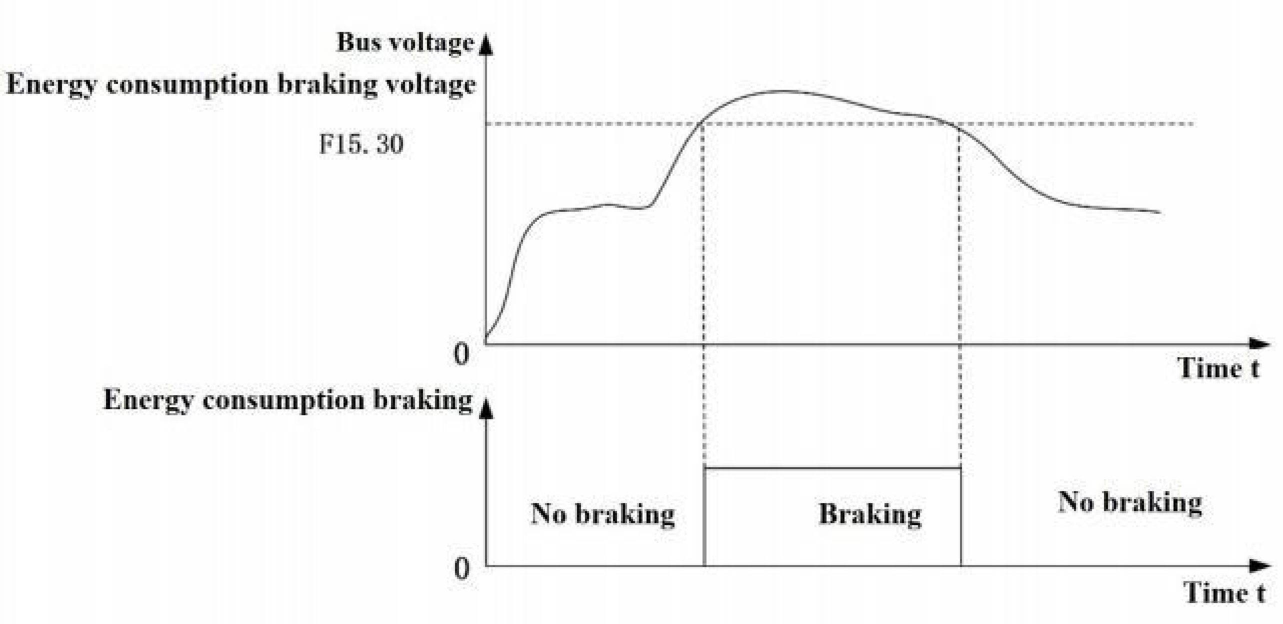


Fig. 6-36 Schematic Diagram of Energy Consumption Braking

In the case of valid energy consumption braking (F15.30=1), as shown in the figure above, when the bus voltage is greater than the energy consumption braking voltage (F15.31),energy consumption braking will be started; and when the bus voltage decreases to less than the aforesaid value, energy consumption braking will be disabled.

The IGBT in the braking unit is engaged during energy consumption braking. Energy can be quickly released by the braking resistor. The braking utilization rate (F15.32) is the duty cycle of IGBT running. The greater the duty cycle, the larger the degree of braking is.

6.6.15 Parameter locking

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F12.02	Parameter locking	0: do not lock 1: reference input not locked 2: all locked, except for this function code		0	●

In order to avoid unnecessary danger caused by keyboard operation or misoperation of non-workers, the keyboard has a parameter locking function. The current function code is unlocked by default, and all function codes can be set. After the function code is debugged according to the working conditions, the parameters can be locked.

- 1: reference input not locked

In the lock mode, all function codes cannot be modified, expect this function code and those with reference input properties. Specific function codes with parameter input properties are shown in the table below:

Table 6-18 List of Function Codes with Reference Input Properties

Function code	Function codename	Function code	Function codename
F00.07	Digital frequency setting	F08.11	Multi-segment speed 12
F08.00	Multi-segment speed 1	F08.12	Multi-segment speed 13
F08.01	Multi-segment speed 2	F08.13	Multi-segment speed 14
F08.02	Multi-segment speed 3	F08.14	Multi-segment speed 15
F08.03	Multi-segment speed 4	F13.02	Digital torque setting
F08.04	Multi-segment speed 5	F09.01	Digital PID setting
F08.05	Multi-segment speed 6	F09.32	Multi-segment PID setting 1
F08.06	Multi-segment speed 7	F09.33	Multi-segment PID setting 2
F08.07	Multi-segment speed 8	F09.34	Multi-segment PID setting 3
F08.08	Multi-segment speed 9	F13.03	Multi-segment torque 1
F08.09	Multi- speed 10	F13.04	Multi-segment torque 2
F08.10	Multi-segment speed 11	F13.05	Multi-segment torque 3

- 2: all locked, except for this function code

In the lock mode, all function codes cannot be set except this function code. This mode is mostly used when it is not necessary to set parameters after debugging. We can only perform running, stop and parameter monitoring in this mode.

We can press the ESC key to enable the monitoring mode and right shift key to switch the parameters in cycles. The function codes F12.04 to F12.08 are used to select the parameters to be displayed in the cycle display queue. The selected items basically correspond to the monitoring parameter group of the F18 group, so you can directly view the current values of all parameters in the F18 group. This function is mainly conducive to parameter display, especially during operation.

By default, several common items are included in the cycle display queue, including the output frequency (F18.00), set frequency (F18.01), output current (F18.06), output voltage (F18.08) and DC bus voltage (F18.09). Please set the corresponding bit to 1 to select other display parameters and 0 to hide the selected parameters.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F00.29	User password	0~65535		0	O

F00.29 is used to set a password to enable the password protection and prevent the function code parameters of the inverter from modification by unauthorized personnel. If the password is set to 0, the password function will be invalid. When anon-zero user password is set, all parameters (except this function code) can only be viewed and are not modifiable.

6.6.16 Upload and download

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F12.03	Parameter copying	0: No operation 1: parameter upload to keyboard 2: Download parameters to inverter (No download for F01 and F14) 3: Download parameters to inverter		0	O

Where several inverters need to run with the same parameter settings, we can debug one inverter first, set it to F12.03=1 to upload the set parameters to the keyboard for temporary storage and finally set the other inverters to F12.03=2 (no download for motor parameters) or F12.03 = 3 (download motor parameters) to download the parameters to these inverters. This function can be applied to quickly set the parameters of several inverters. Even if some parameter settings are different, this function can be applied to set multiple function codes before setting by other means.

6.7 Monitoring

This group of parameters is used only to view the current status of the inverter and cannot be changed.

Function code	Function codename	Parameter description	Unit
F18.00	Output frequency	Display the current output frequency of the inverter. Scope: 0.00 to upper frequency limit. *: This parameter will be updated promptly in the speed control mode.	Hz
F18.01	Set frequency	Display the current set frequency of the inverter. Scope: 0.00 to maximum frequency F00.16. *: This parameter will be updated promptly in the speed control mode.	Hz
F18.02	PG feedback frequency	In case of FVC control or other control methods that involve a feedback encoder, PG card feedback frequency is displayed. Scope: 0.00 to upper frequency limit. *: This parameter will be updated in real time only when the PG card is configured.	Hz

F18.03	Estimate feedback frequency	Display the estimated feedback frequency in the SVC control mode. Scope: 0.00 to upper frequency limit. *: This parameter will be updated promptly in the SVC control mode.	Hz
F18.04	Output torque	Display the current output torque of the inverter. Scope: -200.0 - 200.0.	%
F18.05	Torque setting	Display the current set torque of the inverter. Scope: -200.0 - 200.0. *: This parameter will be updated promptly in the torque control mode.	%
F18.06	Output current	Display the current output current of the inverter. Depending on the rated power level of the motor, the range is as follows: 0.00 to 650.00 (rated power of motor: ≤ 75 kW) 0.0 to 6500.0 (rated power of motor: > 75 kW)	A
F18.07	Output current percentage	Display the current output current as a percentage (relative to the rated current of the inverter). Range: 0.0 to 300.0.	%
F18.08	Output voltage	Display the current output voltage of the inverter. Scope: 0.0 - 690.0.	V
F18.09	DC bus voltage	Display the current bus voltage. Scope: 0 - 1200.	V
F18.10	Simple PLC running times	When the auxiliary frequency source B is involved in setting (F00.06 ≠ 0), the setting mode is "11: simple PLC" (F00.05=11) and the simple PLC runs in the mode of limited cycles (F08.15=1/2), the real-time number of cycles will be displayed. "0" indicates that the first operation is being performed, and "1" indicates that the first operation has been completed and the second operation is being carried out. Range 0 - F08.16.	:
F18.11	Simple PLC operation stage	When the auxiliary frequency source B is involved in setting (F00.06 ≠ 0), and the setting mode is "11: simple PLC" (F00.05=11), the real-time PLC running status will be displayed. Scope: 1-15, corresponding to the multi-segment speed 1 (F08.00) to multi-segment speed 15 (F08.14).	
F18.12	PLC running time at the current stage	When the auxiliary frequency source B is involved in setting (F00.06 ≠ 0) and the setting mode is "11: simple PLC" (F00.05=11), the PLC running time at the current stage will be displayed in a real-time manner. Scope: 0.0 to the set time of the corresponding segment (example: the time of the first segment is dependent on F08.20).	S / min
F18.13	Reserved		
F18.14	Load rate	Display the current load speed. For the correct display, please set the load speed display factor (F12.09). Scope: 0 - 65535.	rpm
F18.15	UP/DOWN offset frequency	Display the UP/DOWN offset frequency. See 6.2.2.6 for interpretation.	Hz

F18.16	PID setting	Display the current PID setting, except for the current setting percentage (F09.03).	
F18.17	PID feedback	Display the current PID feedback, except for the current feedback percentage (F09.03).	
F18.18	Power meter: MWh	Display the cumulative input (output + fan) power consumption in MWh (thousand KWh). The current power consumption can be obtained in conjunction with F18.19.	MWh
F18.19	Watt-hour meter: kWh	Display the cumulative input (output + fan) power consumption in kWh (kilowatt-hour). The current power consumption can be obtained in conjunction with F18.18.	kWh
F18.20	Output power	Display the current output power of the inverter. Scope: -650.00~650.00.	kW
F18.21	Output power factor	Display the current output power factor of the inverter. Scope: -1.00 - 1.00.	
F18.22	Digital input terminal status 1	Display the current valid status of the input terminals X1 to X5. The five-bit digit tubes from left to right are: X5 X4 X3 X2 X1 0/1 0/1 0/1 0/1 0/1 *: "0" means that the current terminal function is invalid; and "1" means that the current terminal function is valid.	
F18.23	Digital input terminal status 2	Display the current valid status of the input terminals X6/X7/AI1 to AI3. The five-bit digit tubes from left to right are: AI3 AI2 AI1 X7 X6 0/1 0/1 0/1 0/1 0/1 Analog input terminals AI1 - AI3 are monitored under this function code when they serve as digital input; "0" means that the current terminal function is invalid; and "1" means that the current terminal function is valid.	
F18.24	Digital input terminal status 3	Display the current valid status of the input terminals X8 - X11/AI4. The five-bit digit tubes from left to right are: AI4 * X10 X9 X8 0/1 0/1 0/1 0/1 0/1 *: The display terminals of this function code are all extension card (EC-IO-A1) terminals. Please configure if you wish to use it; "0" means that the current terminal function is invalid; and "1" means that the current terminal function is valid.	
F18.25	Output terminal state	Display the current valid status of the output terminals R1/R2/Y1/Y2. The five-bit digital tubes from left to right are: * R2 R1 Y2 Y1 0/1 0/1 0/1 0/1 0/1	

		"0" means that the current function terminal is invalid; and "1" means that the current function terminal is valid.	
F18.26	AI1	Display the per-unit value of the current analog input channel 1 (AI1) relative to 100.0%. Scope: -100.0 - 100.0	%
F18.27	AI2	Display the per-unit value of the current analog input channel 2 (AI2) relative to 100.0%. Scope: 0.0 - 100.0.	%
F18.28	AI3	Display the per-unit value of the current analog input channel 3 (AI3) relative to 100.0%. Scope: 0.0 - 100.0.	
F18.29	AI4	Display the per-unit value of the current analog input channel 4 (AI4) relative to 100.0%. Scope: -100.0 - 100.0 *: AI4 analog input terminal is an extension card (EC-IO-A1) terminal. Please configure if you wish to use it;	
F18.30	Output terminal state	Display the current valid status of the output terminals R4/R3. The five-bit digital tubes from left to right are: * * * R4 R3 0/1 0/1 0/1 0/1 0/1 *: The display terminals of this function code are all extension card (EC-IO-A1) terminals. Please configure if you wish to use it; "0" means that the current function terminal is invalid; and "1" means that the current function terminal is valid.	
F18.31	High-frequency pulse input frequency: kHz	0.00~100.00	kHz
F18.32	High-frequency pulse input frequency: Hz	0~65535	Hz
F18.33	Count value	0~65535	
F18.34	Actual length	0~65535	m
F18.35	Remaining time of regular running	Display the remaining time of regular running. For specific function. see the description of the F16.05 regular running function. Scope: 0.0 - F16.05.	min
F18.36	Rotor position of synchronous motor	0.0~359.9°	
F18.37	Rotary transformation location	Shows position of rotary transformation location. Scope: 0~4095.	
F18.38	Motor temperature	Shows motor temperature acquired by the extension card. Range: 0 - 200.	℃
F18.39	VF separation target voltage	Display the VF separation target voltage in a real-time manner. Scope: 0.0 to rated voltage of the motor	V

F18.40	VF separation output voltage	Display the actual output voltage of VF separation in a real-time manner. Scope: 0.0 to rated voltage of the motor	V
F18.41 ~ F18.45	Reserved		
F18.46	Output frequency symbol	0~65535	
F18.47 ~ F18.50	Reserved		
F18.51	PID output	-100.0~100.0	%
F18.52 ~ F18.57			
F18.58	Feedback pulse high	Higher bit of encoder feedback pulse (hexadecimal)	
F18.59	Feedback pulse low	Lower bit of encoder feedback pulse (hexadecimal)	
F18.60	Inverter temperature	-40~200	℃
F18.67	Cumulative energy saving MWH	0~65535	MWh
F18.68	Cumulative energy saving kWH	0.0~999.9	kWh
F18.69	High cumulative cost saving (*1000)	0~65535	
F18.70	Low cumulative cost saving	0.0~999.9	
F18.71	Power-frequency power consumption MWH	0~65535	MWh
F18.72	Power-frequency power consumption kWH	0.0~999.9	kWh

6.8 Communication setting

The EM760 series inverter supports the RTU format Modbus protocol, and the “single-master multi-slave” communication network with RS-485 bus.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F10.00	Local Modbus communication address	1-247; 0: broadcast address		1	O

For the entire communication network, the inverter as a slave must have its own unique address. Its setting range is 1 to 247. That is, a network supports 247 slave stations at most.

* 0 is the broadcast address, which does not need to be set. All slave inverters can be recognized.

The slaves and hosts attached to the same network must follow the same sending and receiving principles (e.g. baud rate, data format, and protocol format) to ensure normal communication. Hence, the network devices must have the same settings for function codes ofF10.01 (baud rate) and F10.02 (data format).

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F10.01	Baud rate of Modbus communication	0: 4800 1: 9600 2: 19200 3: 38400 4: 57600 5: 115200	bps	1	O

During the communication based on the Modbus-RTU protocol, the EM760 series inverter supports six different baud rates in bps (bit/s). Take F10.01=9600bps as an example. It means that data is transmitted at a rate of 9600bits per second. By default, each byte consists of valid 8-bit data (such as 0x01). When 10-bit data needs to be transmitted in the actual situation, the transmission time is about 1.04ms (approximately 1.04167ms=10bit/9600bps).

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F10.02	Modbus data format	0: 1-8-N-1 (1 start bit + 8 data bits + 1 stop bit) 1: 1-8-E-1 (1 start bit + 8 data bits + 1 even parity check bit + 1 stop bit) 2: 1-8-O-1 (1 start bit + 8 data bits + 1 odd parity check bit + 1 stop bit) 3: 1-8-N-2 (1 start bit + 8 data bits + 2 stop bits) 4: 1-8-E-2 (1 start bit + 8 data bits + 1 even parity check bit + 2 stop bits) 5: 1-8-O-2 (1 start bit + 8 data bits + 1 odd parity check bit + 2 stop bits)		0	O

In the UART transmission, the data usually consists of a start bit, valid data (8 bits by default), check bit (optional), and a stop bit. The EM760 series inverter supports six data formats according to the Modbus-RTU combinations in communication.

Start Bit	Valid Data								Check Bit	Stop Bit
1	7	6	5	4	3	2	1	0	N/O/E	1

IfF10.02=0, it means that the current data consists of one start bit + eight data bits + no check bit + one stop bit.

* N (NONE): no parity; E (EVEN): even parity; O (ODD), odd parity.

In order to meet different needs, the inverter also supports communication timeout and response delay during the communication based on the Modbus protocol.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F10.03	Modbus communication timeout	0.0 to 60.0; 0.0: invalid (also valid for master-slave mode)	s	0.0	●

As shown in the figure below, the communication time interval △tis defined as the period from the previous reception of valid data frames by the slave station (inverter) to next reception of valid data frames. If △tis greater than the set time (depending on the function code F10.03; this function is invalid if set to 0), it will be regarded communication timeout.

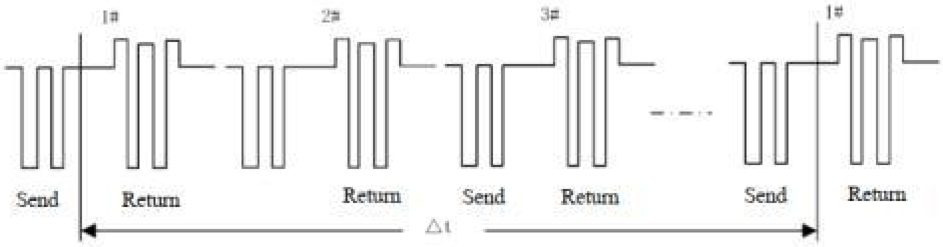


Fig. 6-37 Schematic Diagram of Communication Timeout

Example of this function: If the master station must send data to a slave station (e.g. #1) within a certain period, you can use the communication timeout function of#1 slave station and set F10.03>T. The communication timeout protection will not be triggered during normal communication. However, if the master station does not send data to #1 slave station within the specified time T, and this lasts for more than the set value of F10.03, a communication protection (Ei6) will be reported. Once informed of the "communication protection of#1 slave station", the staff can conduct troubleshooting.

* The set value ofF10.03 must be greater than the set time T, but must not be too large, in order to avoid adverse effects arising from too long operation in the protection status.

* F10.03 should be set to be invalid under normal circumstances. This parameter will be set only in the continuous communication system to monitor the communication.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F10.04	Modbus response delay	1~20	ms	2	●

The response delay (t_{wait2}) is defined as the time interval from the reception of the valid data frame[1] by the inverter to data parsing and return. To ensure the stable operation of the protocol chip, the response delay should be set within 1-20ms (it must not be set to 0). **If the communication data involves EEPROM operation, the actual response delay time will be extended, i.e. "EEPROM operation time + F10.04".**

1: valid dataframe: sent by the external master station to inverter, in which thefunction code, data length and CRC are correct.

The figure shows the data sending segment (t_{send}), sending end segment (t_{wait1}), 75176-to-sending wait segment (t_{wait2}), data return segment (t_{return}), and 75176-to-receiving wait segment (t_{wait3}).

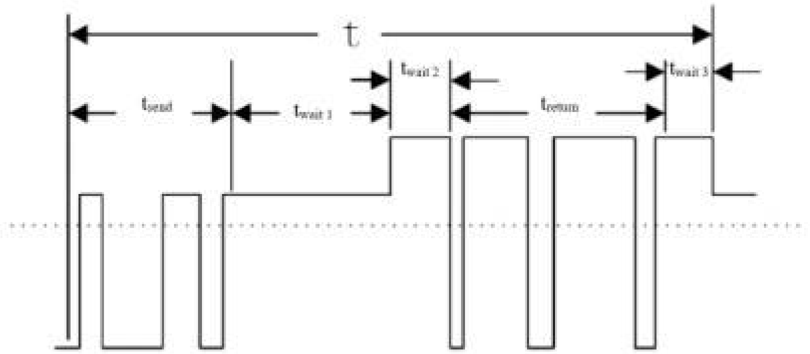


Fig. 6-38 Timing Parse Diagram of Complete Data Frame

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F10.05	Options of master-slave communication function	0: Invalid 1: valid		0	O
F10.06	Master-slave options	0: slave 1: host (Modbus protocol broadcast transmission)		0	O
F10.07	Data sent by host	0: output frequency 1: set frequency 2: output torque 3: set torque 4: PID setting 5: output current		1	O
F10.08	Proportional factor of slave reception	0.00-10.00 (multiple)		1.00	●
F10.09	Host sending interval	0.000~30.000	s	0.200	●

The EM760 series inverter supports the master-slave communication function. That is, one inverter works as the host and others as slaves. The slaves work according to the command sent by the host, so that these inverters can work synchronously.

- The inverter used as the host is set as follows:

F10.05=1: enable the master-slave communication function;

F10.06=1: select current inverter as the host (only one inverter can be set as the host in a network); and select F10.07 as the variable to be synchronized. If it's output current, set F10.07 = 5.

- The inverter is used as the slave is set as follows:

F10.05=1: enable the master-slave communication function;

F10.06=0: select the current inverter as the slave;

Select one setting as the communication setting. IfF09.00=6 is set and the process PID is set separately (F00.05=10, F00.06=1), the slave inverter will be set to the host output current for PID adjustment.

You can set the receiving proportional coefficient (F10.08) to determine how the slave inverter receives data. If F10.08=0.80 is set, the final application data is "Recv (received data) * 0.80 (F10.08)".

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F10.56	Options of 485 EEPROM writing	0-10: default operation (for commissioning) 11: writing not triggered (available after commissioning)		0	O

For the application "PLC controller/HMI + inverter", you can set F10.56=11 after debugging. Then all write data ofPLC communication will not be stored, which can avoid damage to the memory.

If you need parameter settings and power-down storage, set F10.56=0 first.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F10.61	SCI response option	0: Reply to both read and write commands 1: Reply to write commands only 2: No reply to both read and write commands		0	O

F10.61=0: During the Modbus communication with the upper computer, both read and write parameters will be returned to the upper computer.

F10.61=1: During the Modbus communication with the upper computer, the read parameters will be returned to the upper computer, while the write parameters will not.

F10.61=2: During the Modbus communication with the upper computer, both read and write parameters will not be returned to the upper computer. This can improve the communication efficiency.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F45.00	Enable Modbus communication free mapping	0: Invalid 1: valid		0	●
F45.01	Source address 1	0~65535		0	●
F45.02	Target address 1	0~65535		0	●
F45.03	Mapping coefficient	0.00~100.00		1.00	●

(1) Function of Modbus communication free mapping

This function maps any function codes to internal function codes of the inverter, so as to ensure normal use of Modbus communication without having to alter the original PLC program.

F45.00: enable communication mapping. You'll have to set F45.00 = 1 to use the communication mapping feature, otherwise it won't work. To disable mapping, just set F45.00=0.

You can map up to 30 sets of function codes, each of which requires 3 function codes:

1. Source address: source address to be mapped
2. Target address: internal function code address to be mapped to with the source address
3. Mapping coefficient: when the decimal places are different between the source address and the target address data, you can adjust it via the mapping coefficient. If the decimal places are the same, no change is required for this.

(2) Conversion rules of mapping address

All mapping addresses are set as decimal. Conversion rules: To map F15.38 to F18.22, first convert the index 15 of the source address F15.38 into hexadecimal 0FH, and sub-index 38 into hexadecimal 26H. Synthesize them into 0F26H, and convert it into corresponding decimal 3878. Convert the index 18 of the target address F18.22 into hexadecimal 12H, and sub-index 22 into hexadecimal 16H. Synthesize them into 1216H, and convert it into corresponding decimal 4630. Set the function codes as follows:

F45.00=1 (mapping effective)

F45.01=3878 (source address F15.38)

F45.02=4630 (target address F18.22)

(3) Mapping coefficient

When the decimal separator is different between the source address and the target address, you can adjust it via the mapping coefficient. All parameters are readable. Therefore, mapping coefficient is set as per parameter reading by default, and will be converted automatically for parameter writing. No extra effort is required on setting a writing coefficient.

In reading inverter parameters, data will be sent to the PLC after being multiplied by mapping coefficient. In writing parameters, the inverter will divide the data by mapping coefficient after receiving it.

In case of reading output frequency of the inverter, with the source address F10.00=50.0Hz and the target address F00.07=50.00Hz, you need to set the mapping coefficient as 0.10. Data returned by the inverter to the PLC: target address data * mapping coefficient = 5000 * 1 = 500, which is consistent with the source address F10.00 in respect of decimal separator. When writing inverter output frequency, the PLC sends the data 500, and the inverter receives: 500 / 0.1 = 5000, which is consistent with the target address F00.07 in respect of decimal separator.

Principles on setting mapping coefficient: always set the mapping coefficient for parameter reading, whether you are actually reading or writing the parameter.

(4) Mapping example:

a. Mapping external address to internal address of the same function

When replacing the communication function of the EM303B inverter, acceleration and deceleration time should be written. The function codes of acceleration and deceleration time are F00.09 and F00.10 for EM303Band F00.14 and F00.15 for EM760. The original PLC program writes acceleration and deceleration time into F00.09 and F00.10 during communication. Normal communication between EM760 and PLC can be secured through mapping without having to altering the PLC program. Just map the first 2 pieces of data of F00.09: F00.09 and F00.10 to F00.14 and F00.15 respectively.

Source address 1	F00.09 (0009H/9D)	Target address 1	F00.14 (000EH/14D)	Acceleration time
Source address 2	F00.10 (000AH/10D)	Target address 2	F00.15 (000FH/15D)	Deceleration time

Settings of mapping parameters are as follows:

F45.00=1 (mapping effective)

F45.01=9 (source address 1)

F45.02=14 (target address 1)

F45.04=10 (source address 2)

F45.05=15 (target address 2)

Upon setting of the parameters above, EM760 will convert the received address F00.09 of PLC write into F00.14 and the received address F00.10 of PLC write into F00.15, to realize normal modification of acceleration/deceleration time. In case of wrong setting for address mapping, not only the acceleration/deceleration time of EM760 can't be modified, but also the function codes F00.09 and F00.10 of EM760 will be wrongly changed.

b. Sending inconsecutive addresses by one frame using address mapping

The PLC needs to read the output frequency, output current, PID setting, and status of digital input terminal of EM760 inverter. Since all the four addresses are inconsecutive, the PLC will have to send 4 frames for reading. With address mapping, only one frame will be required to read the 4 pieces of data that are not consecutive. Just map the first 4 pieces of data ofF18.00: F18.00, F18.01, F18.02, and F18.03 to F18.00, F18.06, F18.16, and F18.22.

Source address 1	F18.00(1200H/4608D)	Target address 1	F18.00 (1200H/4608D)	Output frequency
Source address 2	F18.01 (1201H/4609D)	Target address 2	F18.06 (1206H/4614D)	Output current
Source address 3	F18.02 (1202H/4610D)	Target address 3	F18.16 (1210H/4624D)	PID setting
Source address 4	F18.03 (1203H/4611D)	Target address 4	F18.22 (1216H/4630D)	Digital input terminal status

Settings of mapping parameters are as follows:

F45.00=1 (mapping effective)

F45.01=4608 (source address 1)

F45.02=4608 (target address 1)

F45.04=4609 (source address 2)

F45.05=4614 (target address 2)

F45.07=4610 (source address 3)

F45.08=4624 (target address 3)

F45.10=4611 (source address 4)

F45.11=4630 (target address 4)

6.9 Technology

6.9.1 Industry application macro

Function code of industry application macro	Function codename	Parameter description	Unit	Default setting	Attribute
F16.00	Industry application	0: Universal model 1: Water supply application 2: Reserved 3: Winding application (see 6.9.2) 4: fan application 5: Spindle application of machine tool 6: Polisher application 7: High-speed motor application 8: Reserved 9: EM100 communication macro 10: EM303B communication macro		0	O

F16.00=0: general model

Since the inverter is a general-purpose product, relevant functions for each application should not be enabled.

6.9.1.1 Water supply application

F16.00=1: water supply application

The inverter serves as a PID-regulated control product for constant-pressure water supply.

Function code	Function codename	Parameter description	Unit	Current value of application macro	Attribute
F00.02	Options of command source	0: keyboard control (LOC/REM indicator ON)		0	O
F00.05	Options of auxiliary frequency source B	10: process PID		10	O
F00.06	Options of frequency source	1: auxiliary frequency source B		1	O
F00.14	Acceleration time 1	0.00~650.00(F15.13=0)	s	10.00	●
F00.15	Deceleration time 1	0.00~650.00(F15.13=0)	s	15.00	●
F00.19	Lower frequency limit	0.00 to upper frequency limit F00.18	Hz	0.00	●
F00.21	Reverse control	0: Allow forward/reverse running 1: Prohibit reversing		1	O
F00.30	Model selection	0: G type 1: P type		1	O
F02.00	Options of X1 digital input function	See the input terminal function table.		1	O
F02.01	Options of X2 digital input function	See the input terminal function table.		23	O
F02.63	Selection of analog input AI2 type	0: 0~10V		0	O
F03.00	Options of Y1 output function	See function list of digital output terminals		59	○
F03.02	Options of R1 output function	See function list of digital output terminals		7	○
F05.00	V/F curve setting	4: square V/F		4	O
F07.06	Bus voltage control options	Ones place: Instantaneous stop/no-stop function options 0: Invalid 1: deceleration 2: deceleration to stop Tens place: Overvoltage stall function options 0: Invalid 1: valid		11	O
F07.14	Number of retries after failure	0-20; 0: disable retry after failure		5	O
F07.16	Interval of retries after failure	0.01~30.00	s	30	●
F09.01	Digital PID setting	0.0 to PID setting feedback range F09.03	bar	3.00	●
F09.02	PID feedback source	2: AI2		2	O

F09.03	PID setting feedback range	0.01~600.00	bar	10.00	●
F09.05	Proportional gain 1	0.00~ 100.00		3.00	●
F09.06	Integral time 1	0.000 - 30.000, 0.000: no integral	s	1.000	●
F09.27	PID sleep control options	0: Invalid 1: sleep at zero speed 2: sleep at lower frequency limit 3: sleep with tube sealed		0	●
F09.28	Sleep action point	0.00-100.00 (100.00 corresponds to the PID setting feedback range)	%	100.00	●
F09.29	Sleep delay time	0.0~6500.0	s	60.0	●
F09.30	Wake-up action point	0.00-100.00 (100.00 corresponds to the PID setting feedback range)	bar	2.00	●
F09.31	Wake-up delay time	0.0~6500.0	s	0.5	●
F09.39	Wake-up option	0: target pressure F09.01* coefficient of wake-up action point 1: Wake-up action point (F09.30)		1	O
F09.40	Coefficient of wake-up action point	0.0-100.0 (100% corresponds to PID setting)	%	80.0	●
F09.41	Pipeline network alarm overpressure	0.0 to pressure sensor range F09.03	%	8.0	●
F09.42	Overpressure protection time	0-3600 (0: invalid)	s	0	●
F09.44	Sleep mode options	0: Sleep at sleep frequency (F09.45) 1: Sleep at sleep action points (F09.28)		0	O
F09.45	Sleep frequency	0.00 to upper frequency limit F00.18	Hz	30	●
F12.33	Running status display parameter 1 of mode 1 (display parameter 5 of LED stop status)	0.00~99.99		18.00	●
F12.34	Running status display parameter 2 of mode 1 (display parameter 1 of LED stop status)	0.00~99.99		18.01	●
F12.35	Running status display parameter 3 of mode 1 (display parameter 2 of LED stop status)	0.00~99.99		18.06	●

F12.36	Running status display parameter 4 of mode 1 (display parameter 3 of LED stop status)	0.00~99.99		18.08	●
F12.37	Running status display parameter 5 of mode 1 (display parameter 4 of LED stop status)	0.00~99.99		18.09	●
F11.01	User-selected parameter 1	The displayed content is Uxx.xx, which means that the Fxx.xx function code is selected. If the F11.00 function code is enabled, the keyboard will display U16.00, indicating the first optional parameter F16.00.		U00.02	●
F11.02	User-selected parameter 2			U09.01	●
F11.03	User-selected parameter 3			U09.03	●
F11.04	User-selected parameter 4			U09.27	●
F11.05	User-selected parameter 5			U09.45	●
F11.06	User-selected parameter 6			U09.30	●
F11.07	User-selected parameter 7			U12.38	●
F11.08	User-selected parameter 8			U12.39	●

6.9.1.2 Fan application

F16.00=4: Fan application

The inverter can be used to configure the parameters of the corresponding function code for the fan application macro.

Function code	Function codename	Parameter description	Unit	Current value of application macro	Attribute
F00.02	Options of command source	1: terminal control (LOC/REM indicator: OFF)		1	O
F00.04	Options of main frequency source A	1: AI1		1	O
F00.14	Acceleration time 1	0.00~650.00(F15.13=0)	s	25.00	●
F00.15	Deceleration time 1	0.00~650.00(F15.13=0)	s	30.00	●
F00.21	Reverse control	0: Allow forward/reverse running 1: Prohibit reversing		1	O
F00.30	Model selection	0: G type 1: P type		1	O
F02.01	Options of X2 digital input function	See the input terminal function table.		24	O
F02.02	Options of X3 digital input function	See the input terminal function table.		9	O

F04.00	Start-up method	0: direct start 1: start of speed tracking		1	O
F04.08	Speed tracking mode	Ones place: Tracking start frequency 1: stop frequency Tens place: Selection of search direction 1: Search in the opposite direction if the speed cannot be found in the command direction		11D	O
F04.19	Stop mode	0: slow down to stop 1: free stop		1	O
F05.00	V/F curve setting	4: square V/F		4	O
F07.06	Bus voltage control options	Ones place: Instantaneous stop/no-stop function options 1: deceleration Tens place: Overvoltage stall function options 1: valid		11	O
F07.14	Number of retries after failure	0-20; 0: disable retry after failure		5	O
F07.16	Interval of retries after failure	0.01~30.00	s	30.00	●
F17.01	VX2 virtual input function options	The same as the function options of digital input terminal ofF02 group		51	O
F17.28	Control options of virtual output terminal	D7 D6 D5 D4 D3 D2 D1 D0 VY8 VY7 VY6 VY5 VY4 VY3 VY2 VY1 0: depending on the status of X1-X7 terminals 1: depending on the output function status		11111101 B	O

6.9.1.3 Spindle application of machine tool

F16.00=5: Machine tool spindle application

The inverter can be used to configure the parameters of the corresponding function code for the application micro of machine tool spindle.

Function code	Function codename	Parameter description	Unit	Current value of application macro	Attribute
F00.01	Drive control mode of motor 1	0: V/F control (VVF)		0	O

F00.02	Options of command source	1: terminal control (LOC/REM indicator: OFF)		1	O
F00.03	Options of terminal control mode	1: terminal RUN (forward) and F/R (reverse)		1	O
F00.04	Options of main frequency source A	1: AI1		1	O
F00.14	Acceleration time 1	0.00~650.00(F15.13=0)	s	2.00	●
F00.15	Deceleration time 1	0.00~650.00(F15.13=0)	s	2.00	●
F00.16	Maximum frequency	1.00Hz~600.00	Hz	100.00	O
F00.18	Upper frequency limit	Lower frequency limit F00.19 to maximum frequency F00.16	Hz	100.00	●
F07.06	Bus voltage control options	Ones place: Instantaneous stop/no-stop function options 0: Invalid Tens place: Overvoltage stall function options 0: Invalid		0	O
F07.27	AVR function	2: automatic		2	O
F15.30	Options of energy consumption braking function	0: Invalid 1: valid		1	O
F15.31	Energy consumption braking voltage	110.0~140.0(380V,100.0=537V)	%	132.0	O

6.9.1.4 Polisher application

F16.00=6: polisher application

The inverter can be used to configure the parameters of the corresponding function code for the polisher application macro.

Function code	Function codename	Parameter description	Unit	Current value of application macro	Attribute
F00.02	Options of command source	1: terminal control (LOC/REM indicator: OFF)		1	O
F00.04	Options of main frequency source A	7: main frequency communication setting (direct frequency)		7	O
F00.14	Acceleration time 1	0.00~650.00(F15.13=0)	s	5.00	●
F00.15	Deceleration time 1	0.00~650.00(F15.13=0)	s	5.00	●
F00.16	Maximum frequency	1.00Hz~600.00	Hz	50.00	O
F00.18	Upper frequency limit	Lower frequency limit F00.19 to maximum frequency F00.16	Hz	50.00	●
F10.01	Baud rate of Modbus communication	2: 19200		2	O
F10.02	Modbus data format	1: 1-8-E-1 (1 start bit + 8 data bits + 1 even parity check bit + 1 stop bit)		1	O

6.9.1.5 High-speed motor application

F16.00=7: High-speed motor application

The inverter can be used to configure the parameters of the corresponding function code for the high-speed motor application macro.

Function code	Function codename	Parameter description	Unit	Current value of application macro	Attribute
F00.01	Drive control mode of motor 1	0: V/F control (VVF)		0	O
F00.31	Frequency resolution	1: 0.1Hz (speed unit: 10rpm)		1	O
F00.23	Carrier frequency	1.0-16.0 (rated power of the inverter: 0.75-4.00kW)	kHz	8	●
F00.24	Automatic adjustment of carrier frequency	0: Invalid		0	O
F05.10	Compensation gain of V/F stator voltage drop	0.00~200.00	%	0.00	●
F05.11	V/F slip compensation gain	0.00~200.00	%	0.00	●
F07.00	Protection shield	E20 E22 E13 E06 E05 E04 E07 E08 0: valid protection 1: shielded protection		00000001	O

6.9.1.6 Communication macro of EM100 and EM303

F16.00=9: EM100 communication macro

The inverter can be used to configure the parameters of the corresponding function code for the EM100 communication macro. If you were using the EM100 model combined with Modbus communication, set F16.00=9, and you can replace EM100 directly without altering customer's PLC program while securing common communication functions, including writing frequency and reading output current/frequency and inverter running state.

F16.00=10: EM303B communication macro

The inverter can be used to configure the parameters of the corresponding function code for the EM303B communication macro. If you were using the EM303B model combined with Modbus communication, set F16.00=10, and you can replace EM303B directly without altering customer's PLC program while securing common communication functions, including writing frequency and reading output current/frequency and inverter running state;

Function code	Function code name	Current value ofEM100 communication macro	Corresponding function code of EM100 communication macro address	Current value of EM303B communication macro	Corresponding function code of EM303B communication macro address	Attribute
F00.04	Options of main frequency source A	0		0		O
F45.00	Enable Modbus communication free mapping	1		1		●

F45.01	Source address 1	7	F00.07(0007H)	7	F00.07(0007H)	●
F45.02	Target address 1	32775	F00.07(8007H)	32775	F00.07(8007H)	●
F45.04	Source address 2	8199	F00.07(2007H)	8199	F00.07(2007H)	●
F45.05	Target address 2	32775	F00.07(8007H)	32775	F00.07(8007H)	●
F45.07	Source address 3	16384	4000H	16384	4000H	●
F45.08	Target address 3	28672	7000H	28672	7000H	●
F45.10	Source address 4	9	F00.09(0009H)	9	F00.09(0009H)	●
F45.11	Target address 4	32782	F00.14(800EH)	32782	F00.14(800EH)	●
F45.13	Source address 5	10	F00.10(000AH)	10	F00.10(000AH)	●
F45.14	Target address 5	32783	F00.15(800FH)	32783	F00.15(800FH)	●
F45.16	Source address 6	8201	F00.09(2009H)	8201	F00.09(2009H)	●
F45.17	Target address 6	32782	F00.14(800EH)	32782	F00.14(800EH)	●
F45.19	Source address 7	8202	F00.10(200AH)	8202	F00.10(200AH)	●
F45.20	Target address 7	32783	F00.15(800FH)	32783	F00.15(800FH)	●
F45.22	Source address 8	2305	F09.01(0901H)	1025	F04.01(0401H)	●
F45.23	Target address 8	35073	F09.01(8901H)	35073	F09.01(8901H)	●
F45.25	Source address 9	10497	F09.01(2901H)	1292	F05.12(050CH)	●
F45.26	Target address 9	35073	F09.01(8901H)	36098	F13.02(8D02H)	●
F45.28	Source address 10	4096	C00.00(1000H)	9217	F04.01(2401H)	●
F45.29	Target address 10	4608	F18.00(1200H)	35073	F09.01(8901H)	●
F45.31	Source address 11	16640	4100H	9484	F05.12(250CH)	●
F45.32	Target address 11	29184	7200H	36098	F13.02(8D02H)	●
F45.34	Source address 12	4098	C00.02(1002H)	28673	7001H (main digital frequency)	●
F45.35	Target address 12	4614	F18.06(1206H)	32775	F00.07(8007H)	●
F45.37	Source address 13	4100	C00.04(1004H)	28675	7003H (torque setting)	●
F45.38	Target address 13	4622	F18.14(120EH)	36098	F13.02(8D02H)	
F45.40	Source address 14	4097	C00.01(1001H)	28676	7004H (PID setting)	

F45.41	Target address 14	4616	F18.08(1208H)	35073	F09.01(8901H)	●
F45.43	Source address 15	4352	E00.00(1100H)	28680	7008H (acceleration time)	●
F45.44	Target address 15	4864	F19.00(1300H)	32782	F00.14(800EH)	●
F45.46	Source address 16	4353	E00.01(1101H)	28681	7009H (deceleration time)	●
F45.47	Target address 16	4870	F19.06(1306H)	32783	F00.15(800FH)	●
F45.49	Source address 17	4354	E00.02(1102H)	4096	C00.00(1000H)	●
F45.50	Target address 17	4876	F19.12(130CH)	4608	F18.00(1200H)	●
F45.52	Source address 18	7	F00.07(0007H)	16640	4100H	●
F45.53	Target address 18	32775	F00.07(8007H)	29184	7200H	●
F45.55	Source address 19	8199	F00.07(2007H)	4109	C00.13(100DH)	●
F45.56	Target address 19	32775	F00.07(8007H)	4614	F18.06(1206H)	●
F45.58	Source address 20	16384	4000H	4111	C00.15(100FH)	●
F45.59	Target address 20	28672	7000H	4616	F18.08(1208H)	●
F45.61	Source address 21	9	F00.09(0009H)	4097	C00.01(1001H)	●
F45.62	Target address 21	32782	F00.14(800EH)	4654	F18.46(122EH)	●
F45.64	Source address 22	10	F00.10(000AH)	4352	E00.00(1100H)	●
F45.65	Target address 22	32783	F00.15(800FH)	4864	F19.00(1300H)	●
F45.67	Source address 23	8201	F00.09(2009H)	4360	E00.08(1108H)	●
F45.68	Target address 23	32782	F00.14(800EH)	4870	F19.06(1306H)	●
F45.70	Source address 24	8201	F00.09(2009H)	4368	E00.16(1110H)	●
F45.71	Target address 24	32782	F00.14(800EH)	4876	F19.12(130CH)	●

After the corresponding application macro is selected by changing the function code, F12.14 will be executed automatically to restore the default settings, and the parameters will be restored the macro-specific parameters.

6.9.2 Winding and unwinding application with swing lever

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.00	Application macro	0: Winding mode 1: Unwinding mode 2: Wire drawing mode 3: Straight wire drawing machine mode		0	O

F27.00=0 Winding mode:

This mode can be used for winding. After the default settings are restored, the parameters will be restored for winding applications.

F27.00=1 Unwinding mode:

This mode can be used for unwinding. After the default settings are restored, the parameters will be restored for unwinding applications.

F27.00=2 Wire drawing mode:

This mode can be used for wire drawing. After the default settings are restored, the parameters will be restored for wire drawing applications.

F27.00=3 Straight wire drawing machine mode:

This mode can be used for the straight wire drawing machine. After the default settings are restored, the parameters will be restored for the straight wire drawing machine.

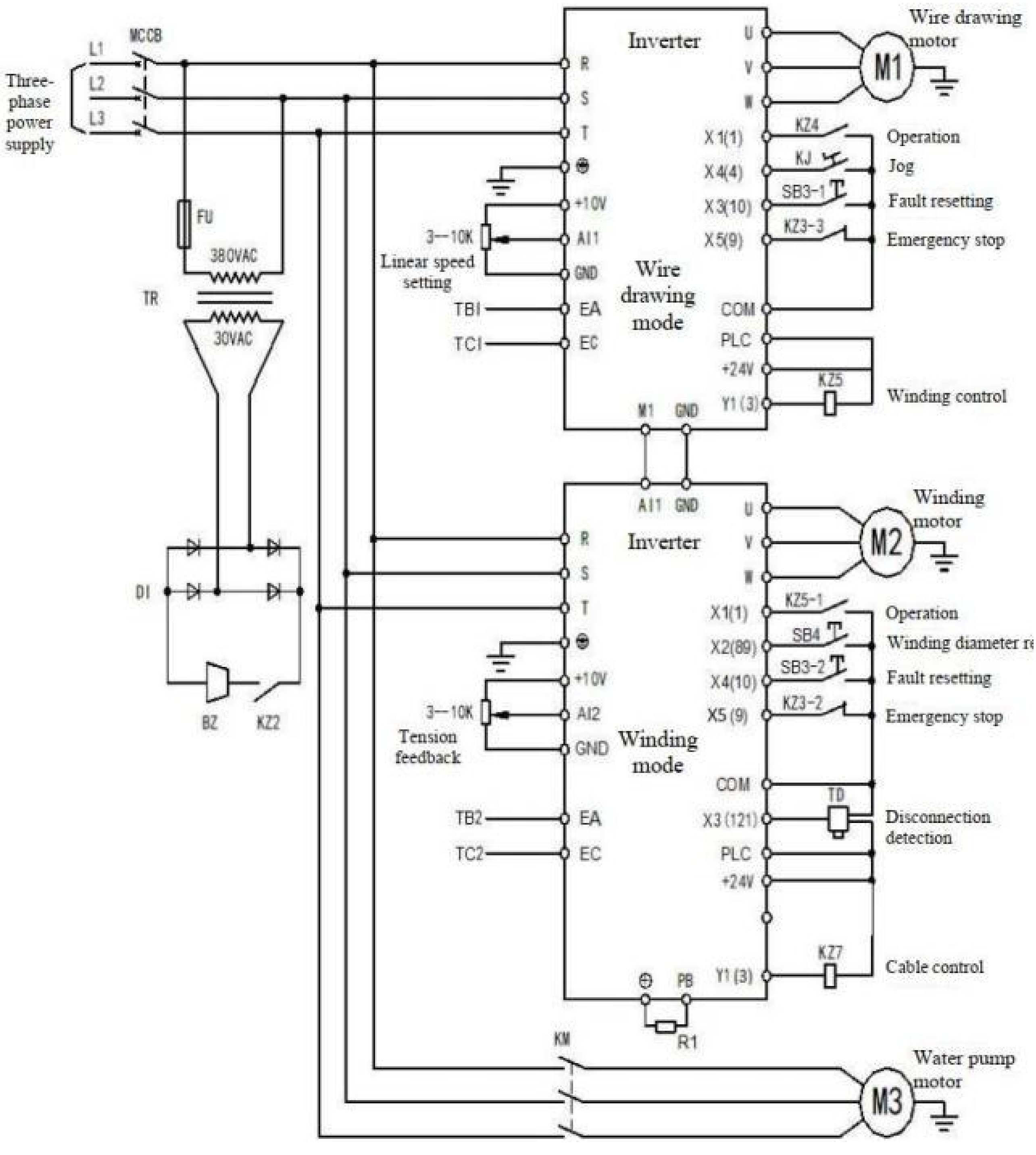
Function code	Description	0: Winding mode	1: Unwinding mode	2: Wire drawing mode	3: Straight wire drawing machine mode
Set F16.00=3, select the operation mode and restore the default settings. The application parameters are automatically set to the following default values.					
Basic parameters (the motor parameters need to be set manually and subject to static self-learning)					
F00.02	Command source	1: Terminal control	1: Terminal control	1: Terminal control	1: Terminal control
F00.03	Terminal control mode	0: terminal RUN	0: terminal RUN	0: terminal RUN	0: terminal RUN
F00.04	Main frequency A	1: AI1 setting	0: Digital setting	1: AI1	1: AI1 setting
F00.05	Auxiliary frequency B	10: process PID	10: process PID		10: process PID
F00.06	Frequency source	6: auxiliary frequency B + feedforward calculation	6: auxiliary frequency B + feedforward calculation		6: auxiliary frequency B + feedforward calculation
F00.07	Main frequency A setting		75.00Hz		
F00.14	Acceleration time	1.00s	1.00s	70.00s	1.00s
F00.15	Deceleration time	1.00s	1.00s	70.00s	1.00s
F00.16	Maximum frequency	75.00Hz	75.00Hz	75.00Hz	50.00Hz
F00.18	Upper frequency limit	75.00Hz	75.00Hz	75.00Hz	50.00Hz

F00.20	Reverse control	1: Prohibit reversing	0: Allow forward/reverse running	1: Prohibit reversing	0: Allow forward/reverse running
F02.00	X1 terminal	1: RUN	1: RUN	1: RUN	1: RUN
F02.01	X2 terminal	89: Reset feedforward	89: Reset feedforward	19: acceleration and deceleration time terminal 1	2: FR reverse
F02.02	X3 terminal	121: External material cutoff signal	121: External material cutoff signal	10: Reset protection	10: Reset protection
F02.03	X4 terminal	10: Reset protection	10: Reset protection	4: FJOG	26: Frequency source switching
F02.04	X5 terminal	9: free stop	9: free stop	9: free stop	121: External material cutoff signal
F02.57	AI1 filtering	0.05s	0.05s	0.05s	0.05s
F02.58	AI2 filtering	0.00s	0.00s	0.00s	0.00s
F03.00	Y1 Output	3: FDT1	3: FDT1	3: FDT1	68: Material cutoff detection
F03.02	R1 output	7: Inverter protection	7: Inverter protection	7: Inverter protection	7: Inverter protection
F03.08	Jog output control			0b01100: FDT jog without output	
F04.19	Stop mode	1: free stop	1: free stop	0: slow down to stop	1: free stop
F04.20	Starting frequency of DC braking in stop			2.50Hz	
F04.22	DC braking time in stop	3.00s	3.00s	3.00s	
F04.23	Demagnetization time for DC braking in stop	0.00s	0.00s	0.00s	
F05.11	Slip compensation gain	0.00%	0.00%	0.00%	
F05.00	VF curve selection				1
F05.02	VF voltage point V1				3.0%

F05.04	VF voltage point V2				6.0%
F05.06	VF voltage point V3				15.0%
F07.11	Current limit				0: Invalid
F15.01	Jog acceleration time			8.00s	
F15.02	Jog deceleration time			8.00s	
F15.03	Acceleration time 2			70.00s	
F15.04	Deceleration time 2			5.00s	
F15.21	FDT1 setting	1.00Hz	1.00Hz	2.00Hz	1.00Hz
F15.22	FDT1 hysteresis	-1.50Hz	-1.50Hz	-1.00Hz	-1.50Hz
F15.23	FDT2 setting	1.00Hz	1.00Hz	2.00Hz	1.00Hz
F15.24	FDT2 hysteresis	-1.50Hz	-1.50Hz	-1.00Hz	-1.50Hz
F15.30	Energy consumption braking	1: valid	1: valid	1: valid	1: valid
PID parameters					
F09.01	PID setting	5.0	5.0		5.0
F09.02	Feedback channel	2: AI2	2: AI2		2: AI2
F09.03	PID range	10.0	10.0		10.0
F09.05	Proportion 1	0.06	0.30		0.03
F09.06	Integral 1	0.000s	0.000s		4.000s
F09.07	Differential 1	30.000ms	30.000ms		30.000ms
F09.08	Proportion 2	0.10	0.40		0.07
F09.09	Integral 2	0.000s	0.000s		4.000s
F09.10	Differential 2	30.000ms	30.000ms		50.000ms
F09.11	Parameter switching mode	2: automatic switching according to deviation	3: Automatic switching by frequency		2: automatic switching according to deviation
F09.12	Deviation 1	5.00%	0.00%		5.00%
F09.13	Deviation 2	45.00%	100.00%		45.00%

F09.16	Upper limit of PID output				40.0%
F09.17	Lower limit of PID output	-50.0%	-50.0%		-40.0%
F09.19	Differential limit	1.00%	1.00%		0.50%
F09.21	PID setting change time	2.000s	2.000s		0.500s
F09.35	Upper limit of feedback voltage	9.50V	9.50V		9.50V
F09.36	Lower limit of feedback voltage	0.50V	0.50V		0.50V
F09.37	Options of integral action of PID change setting				2: Start when the error is less than F09.38
Feedforward parameters and other settings					
F27.01	Feedforward channel	1: Feedforward * main A	2: Feedforward *10V		1: Feedforward * main A
F27.02	Feedforward range	1:0.00 to upper limit	2: -upper limit to upper limit		0: No change in feedforward gain
F27.04	Upper limit of feedforward	500.00%	100.00%		500.00%
F27.05	Initial feedforward	50.00%	0.00%		100.00%
F27.13	Soft start increment	0.60%/s	0.70%/s		
F27.14	Feedforward increment 1	0.11%/s	0.18%/s		
F27.15	Feedforward increment 2	0.30%/s	0.50%/s		
F27.16	Feedforward increment 3	0.75%/s	1.30%/s		
F27.17	Feedforward increment 4	1.55%/s	2.75%/s		
F27.18	Feedforward increment 5	4.00%/s	7.40%/s		
F27.19	Feedforward increment 6	11.00%/s	20.50%/s		
F27.20	Material cutoff control	1201	101	1201	201

Wiring diagram of double-frequency wire drawing machine:

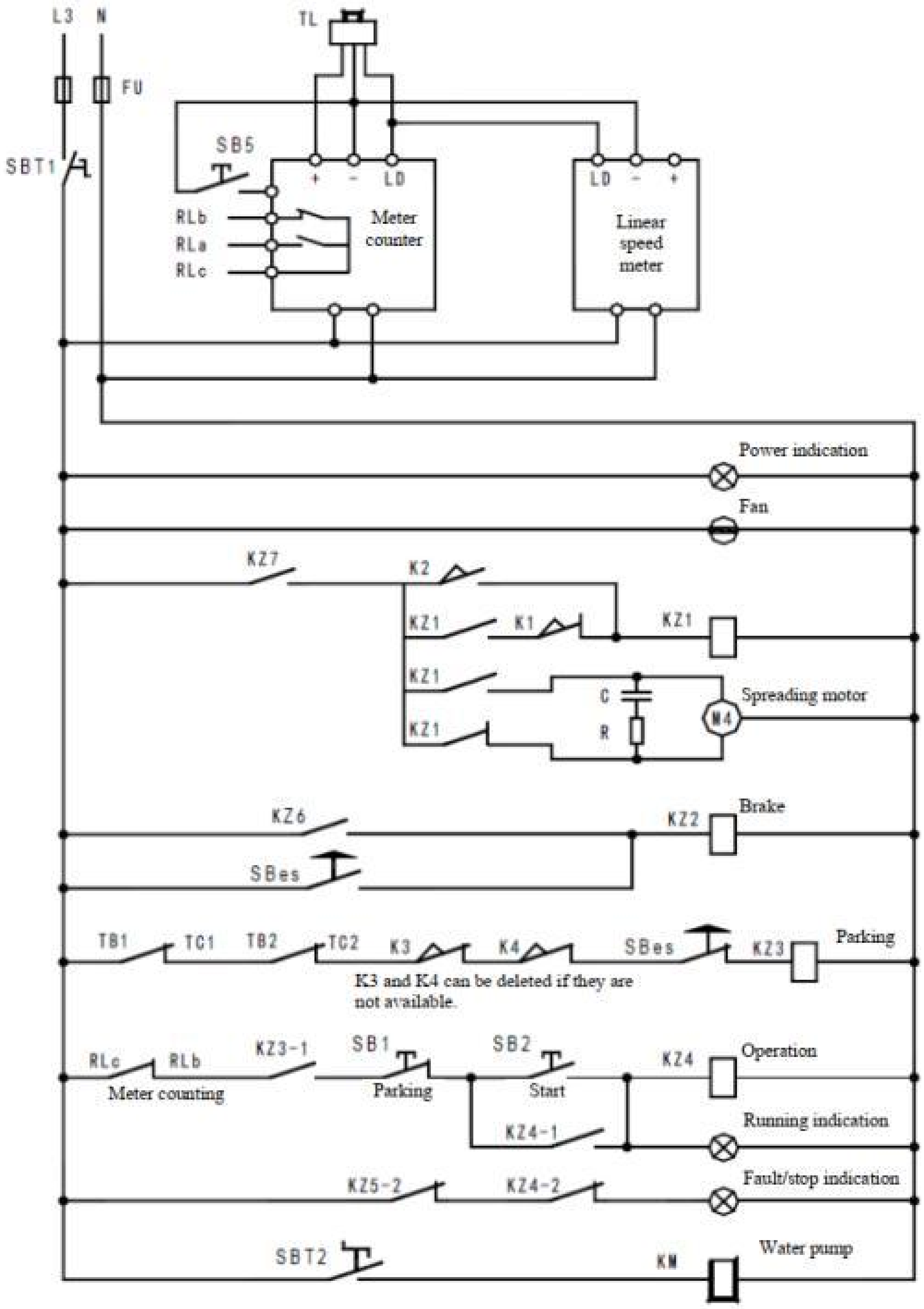


Note:

1. The output terminal function is not set to 67 by default (brake control function). For brake control of the inverter, set the related terminal function, and check whether F27.25 to F27.26 are appropriate.

2. The unwinding function is similar to the straight wire drawing machine. Refer to the wiring diagram of winding and list of parameter macros for wiring.

Electrical connection diagram:



Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.01	Feedforward gain action channel	0: feedforward gain * set source B 1: Feedforward gain * set source A 2: Feedforward gain * 10V		1	O

F27.01=0 Feedforward gain * set source B:

The feedforward gain acts on the set source B.

F27.01=1 Feedforward gain * set source A A:

The feedforward gain acts on the set source A.

F27.01=2 Feedforward gain *10V:

The feedforward gain is directly multiplied by Fmax and then superimposed on the output.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.02	Feedforward gain input mode	0: No change in feedforward gain 1: 0.00 to upper limit of feedforward gain 2: - upper limit of feedforward gain to + upper limit of feedforward gain		1	O

F27.02=0 Unchanged feedforward gain:

The feedforward gain is always the set value ofF27.05.

F27.02=1 0.00 to upper limit of feedforward gain:

The feedforward gain will be automatically adjusted between 0.00 and F27.04 settings.

F27.02=2 - Upper limit of feedforward gain to + upper limit of feedforward gain:

The feedforward gain will be automatically adjusted between -F27.04 and + F27.04 settings.

The unmarked settings are the same as those ofF27.00=0 by default.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.03	Feedforward control	Ones place: Feedforward reset option 0: automatic resetting 1: terminal resetting Tens place: Feedforward power-off stop option 0: save after power-off 1: do not save after power-off Hundreds place: Continuous feedforward calculation 0: Not calculate 1: Continuous calculation		10	O

Set the ones place ofF27.03 to 0: automatic reset

Automatic reset: The feedforward gain is reset automatically after shutdown.

Set the ones place ofF27.03 to 1: terminal reset

Terminal reset: The feedforward gain is reset by the terminal.

Set the tens place ofF27.03 to 0: save after power failure

Save after power failure: When the feedforward gain is powered off and then powered on, the value before power failure will be restored.

Set the tens place ofF27.03 to 1: not save after power failure

Not save after power failure: When the feedforward gain is powered off and then powered on, the initial feedforward gain will be restored.

Set the hundreds place of F27.03 to 0: not calculate (only for the straight wire drawing machine)

No calculation: When the DI input function "26: frequency source switching" of the external terminal is enabled, the feedforward calculation will not be continued.

Set the hundreds place ofF27.03 to 1: calculate (only for the straight wire drawing machine)

No calculation: When the DI input function "26: frequency source switching" of the external terminal is enabled, the feedforward calculation will be continued.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.04	Upper limit of feedforward gain	0.00~500.00	%	500.00	O

Upper limit of feedforward gain setting or change

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.05	Initial feedforward gain	0.00~500.00	%	50.00	●

Initial value of feedforward gain

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F27.06	Feedforward gain filter Time	0~1000	ms	0	●

Under normal circumstances, it is not necessary to set the filtering of feedforward gain.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F27.07	Feedforward range 0	0.00 to feedforward range 1	%	4.00	●
F27.08	Feedforward range 1	Feedforward range 0 to feedforward range 2	%	12.00	●
F27.09	Feedforward range 2	Feedforward range 1 to feedforward range 3	%	23.00	●
F27.10	Feedforward range 3	Feedforward range 2 to feedforward range 4	%	37.00	●
F27.11	Feedforward range 4	Feedforward range 3 to feedforward range 5	%	52.00	●
F27.12	Feedforward range 5	Feedforward range 4 to 100.00	%	72.00	●
F27.13	Soft start increment	0.00~50.00	%/s	0.60	●
F27.14	Feedforward increment 1	0.00~50.00	%/s	0.11	●

F27.15	Feedforward increment 2	0.00~50.00	%/s	0.30	●
F27.16	Feedforward increment 3	0.00~50.00	%/s	0.75	●
F27.17	Feedforward increment 4	0.00~50.00	%/s	1.55	●
F27.18	Feedforward increment 5	0.00~50.00	%/s	4.00	●
F27.19	Feedforward increment 6	0.00~50.00	%/s	11.00	●

F27.13 Soft start increment:

Feedforward change rate within the first period ofF09.21.

F27.07 Feedforward increment 1:

Feedforward change rate corresponding to the deviation ofF27.07-F27.08.

F27.12 Feedforward increment 6:

Feedforward change rate corresponding to the deviation ofF27.12-100.00%..

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.20	Material cutoff control mode	**Ones place:** Disconnection detection mode 0: Automatic detection 1: External signal **Tens place:** Material cutoff detection control 0: Detect when the output is greater than the lower limit of material cutoff detection 1: no detection **Hundreds place:** Material cutoff handling mode 0: Protection of terminal action only 1: Delayed stop and protection report 2: Material cutoff protection 3: Automatic reset of material cutoff protection 4: Material cutoff detection terminal output only 5: Automatic reset of material cutoff detection terminal **Thousands place:** Brake mode 0: mode 0 1: mode 1 **Myriabit:** Reverse unwinding mode 0: No speed limit 1: Reverse speed limit by F27.24		11211	O

Ones place ofF27.20 = 0: automatic detection

Wire disconnection is detected automatically by the inverter. In this mode, F09.35 and F09.36 must be set accurately.

Ones place ofF27.20 = 1: external signal

Wire disconnection is detected by the external proximity switch.

Tens place ofF27.20 = 0: Detection with the output greater than the lower limit of material cutoff detection

When the stop command is received, and the output frequency is less than the set value ofF27.22, wire disconnection will not be detected.

Tens place ofF27.20 = 1: no detection

Wire disconnection will not be detected.

Hundreds place ofF27.20 = 0: Protection terminal action only

In case of wire disconnection, the inverter will continue to run at the set frequency ofF27.24, and only the 68# function terminal and protection output terminal will act.

Hundreds place ofF27.20 = 1: Delayed stop and trip protection

In case of wire disconnection, the 68# function terminal and protection output terminal will act, the inverter will stop after running at the frequency of F27.24 for the time of F27.23 and then the protection will be enabled.

Hundreds place ofF27.20 = 2: Material cutoff protection

In case of wire disconnection, the inverter will be in the protection status.

Hundreds place ofF27.20 = 3: Automatic reset of material cutoff protection

In case of wire disconnection, the inverter will be in the protection status and reset automatically after the set delay time ofF27.26.

Hundreds place ofF27.20 = 4: Only output of material cutoff detection terminal

In case of wire disconnection, the inverter will not be subject to trip protection, and only the output terminal for material cutoff detection output will be valid.

Hundreds place ofF27.20 =5: Automatic resetting of material cutoff detection terminal

This is the same as the option 4. The terminal of material cutoff detection output is invalid only when the swing rod returns to the normal range.

Thousands place ofF27.20 = 0: Mode 0

Mode 0: When the output frequency is within the brake signal output frequency (F27.25) from top to bottom, the brake will not work.

Thousands place ofF27.20 = 1: Mode 1

Mode 1: When the output frequency is within the brake signal output frequency (F27.25) from top to bottom, the brake will work.

Ten hundreds places ofF27.20 = 0: no speed limit

There is no reverse speed limit.

Ten hundreds places ofF27.20 = 1: reverse speed limit by F27.24

There is no reverse speed limit by F27.24.

Function	Function code	Parameter description	Unit	Default	Attribute

code	name			setting	
F27.21	Material cutoff detection delay	0.0~10.0	s	6.0	●

When the inverter receives the running command, wire disconnection detection will be performed after the set time.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.22	Lower limit of material cutoff detection after parking	0.00~60.00	Hz	5.00	●

If the tens place of F27.20 is set to 0 and the inverter decelerates to this frequency, wire disconnection will not be detected.

(This function will not be enabled until the output frequency of the inverter must exceed this frequency after the soft start time and be lower than this frequency after deceleration.)

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.23	Time of continuous running after material cutoff	0.0~60.0	s	10.0	●
F27.24	Frequency of continuous running after material cutoff	0.00~Fmax	Hz	5.00	●

The set time ofF27.23 is calculated when the wire disconnection is identified. According to the setting of F27.24, the operating frequency in this period is reverse during unwinding and positive during winding.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.25	Brake signal output frequency	0.00~Fup	Hz	2.50	●
F27.26	Braking signal duration	0.0~ 100.0	s	5.0	●

F27.25 and F27.26 are not valid until one output terminal is defined as “brake control” (67# function). When the output frequency ofthe inverter drops to the set value ofF27.25, the brake control terminal will be valid and maintained (the brake mode 1 is enabled).

It will be invalid after the set time of F27.26. When the brake control terminal is valid, the inverter will stop freely. There is no response to the running command when the brake control terminal is valid.

IfF27.26 is set to 0.0, the brake control terminal will remain valid and can be reset by the brake reset terminal or protection reset terminal.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.27	Minimum frequency of wiring detection	0.00~20.00	Hz	10.00	●
F27.28	Judgment time for invalid cable signal	0.1~20.0	s	10.0	●
F27.29	Judgment time for valid cable signal	0.1~20.0	s	2.0	●

When the input terminal is set to "122: wiring detection signal", F27.27-F27.29 will be valid.

When the output frequency of the inverter reaches the set value ofF27.27, wiring detection will be started.

If the wiring detection terminal is valid within the set time ofF27.28, the wiring switch will be considered invalid.

If the wiring detection terminal is always valid within the set time ofF27.29, the wiring pole will stop moving.

If the wiring pole protection is detected, the inverter will report E44 protection and stop freely.

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F27.30	Filtering time for material cutoff detection	1~100	ms	5	●

The set time of this function is the filtering time of material cutoff detection. It is valid simultaneously for automatic material cutoff detection and external material cutoff detection.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F27.36	Current value of feedforward gain	-500.0~500.0	%	0	×

This function code is used to view the current feedforward gain.

Winding and unwinding application with swing lever

6.10Protection function setting group

6.10.1 Protection shield

<table>
<tr><th>Function code</th><th>Function code name</th><th colspan="8">Parameter description</th><th>Unit</th><th>Default setting</th><th>Attribute</th></tr>
<tr><td rowspan="2">F07.00</td><td rowspan="2">Protection shield</td><td>E20</td><td>E22</td><td>E13</td><td>E06</td><td>E05</td><td>E04</td><td>E07</td><td>E08</td><td rowspan="2"></td><td rowspan="2">00000000</td><td rowspan="2">O</td></tr>
<tr><td colspan="8">0: valid protection
1: shielded protection</td></tr>
<tr><td rowspan="2">F07.31</td><td rowspan="2">Mask bit of encoder fault</td><td>*</td><td>*</td><td>*</td><td>Sine and cosine speed detection</td><td>CD signal</td><td>UVW Software</td><td>UVW Hardware</td><td>ABZ Hardware</td><td rowspan="2"></td><td rowspan="2">00000</td><td rowspan="2">O</td></tr>
<tr><td colspan="8">0: valid protection
1: shielded protection</td></tr>
<tr><td>F07.35</td><td>Protection</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>E15</td><td>E18</td><td>E81</td><td></td><td>000</td><td>O</td></tr>
</table>

	Mask 2	0: valid protection 1: shielded protection			
F07.43	Warning shield	* * * * * C32 C31 C30 0: valid protection 1: shielded protection		000	O

Bit setting = 0: when the inverter detects the protection corresponding to this bit, it will stop the output and enter the protection status.

Bit setting = 1: when the inverter detects the protection corresponding to this bit, it will keep the original status without protection.

This code is subject to bit operation. You only need to set the corresponding bit to 0 or 1. As shown in the table below:

Table 6-19 Detailed Definition of Protection Shield Bits

Protection code	E20	E22	E13	E06	E05	E04	E07	E08
Corresponding bit	7	6	5	4	3	2	1	0
Settings	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

For example: To shield the E07 protection, you only need to set the first bit corresponding to E07 to 1, i.e. F07.00=xxx xxx1x.

To shield the E08 and E13 protection, you only need to set the 0^{th} bit corresponding to E08 and the 5^{th} bit corresponding to E13 to 1. That is, F07.00=xx1 xxxx1.

Unless there are special needs, please do not shield any protection function, so as to prevent the inverter from damage as a result of protection failure.

6.10.2 Motor protection

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.01	Motor overload protection gain	0.20~10.00		1.00	●
F07.02	Motor overload pre-alarm coefficient	50~100	%	80	●

The inverse time curve of motor overload protection is: 200% ×(F07.01) ×rated current of the motor, sending an alarm of motor overload protection (E13) if the duration reaches one minute; 150% ×(F07.01) ×rated current of the motor, sending an alarm of motor overload (E13) if the duration reaches 15 minutes.

The user needs to set F07.01 correctly according to the actual overload capacity of the motor. If the set value is too large, the motor maybe damaged as a result of overheat but the inverter may not send an alarm!

The F07.02 warning coefficient is used to determine the extent of motor overload for a protection warning. The larger this value, the less the warning is advanced.

When the cumulative output current of the inverter is greater than the product of the inverse time curve of load by F07.02, the multi-function digital DO terminal of the inverter will output the valid signal "17: Motor overload pre-alarm".

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.03	Motor temperature sensor type	0: No temperature sensor 1: PT100 2: PT1000 3: KTY84-130/150 4: PTC-130/150		0	●
F07.04	Motor overheat protection threshold	0~200	℃	110	●
F07.05	Motor overheat pre-alarm threshold	0~200	℃	90	●

Motor temperature protection is not in place by default. If you wish to enable it, please make sure current motor comes with a temperature sensor and temperature signals are input from 4 ways of analog voltage signals (requiring our IO card EM760-IO-A1), and then specify the type of the temperature sensor (F07.03) to provide overheat protection for the motor.

The user can check current motor temperature via function code F18.38. If the temperature is higher than the alarm threshold of motor overheating (F07.05), the function of the digital output terminal “25: motor overheating alarm” becomes effective, and the signals can be used for indication. If the temperature is higher than the threshold of motor overheating protection (F07.04), the inverter will report the overheating fault (E2) and take corresponding protective actions.

*: The motor overheat fault (E2) cannot be reset immediately. You must wait until the motor temperature drops to be far below the protection threshold.

Voltage and current control

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.25	Motor overspeed detection level	0.0-50.0 (reference: maximum frequency F00.16)	%	20.0	●
F07.26	Motor overspeed detection time	0.0-60.0, 0.0: disable motor overspeed protection	s	1.0	●

IfF07.26 is set as 0, overspeed protection is invalid.

IfF07.26 is set as any values other than 0, the inverter will report the motor overspeed protection fault (E25) when the load speed exceeds motor overspeed detection level (F07.25) and remains that way for the time of motor overspeed detection (F07.26).

Motor overspeed detection will be performed only when the driving control mode is FVC (F00.01=2) and current state is running or JOG running.

6.10.3 Voltage and current settings

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.06	Bus voltage control options	Ones place: Instantaneous stop/no-stop function options 0: Invalid 1: deceleration 2: deceleration to stop Tens place: Overvoltage stall function options		10	O

		0: Invalid 1: valid			
F07.07	Voltage of overvoltage stall control	110.0~150.0 (380V,100.0=537V)	%	134.1(720V)	O

F07.06=0X: Invalid

The overvoltage stall is invalid. It is recommended not to set it to 0 in the case of no external braking unit.

The undervoltage stall is also invalid.

When the value in the ones place is 1 or 2, F07.30 is the reference deceleration time.

F07.06=1X: Valid overvoltage stall

When the overvoltage stall is valid, the stall control voltage is dependent on F07.07.

The DC bus overvoltage is usually caused by deceleration. Due to the energy feedback during deceleration, the DC bus voltage will rise.

When the DC bus voltage is greater than the overvoltage threshold and the overvoltage stall is valid (F07.06=1X), the deceleration of the inverter will be suspended, the output frequency will remain unchanged, and the energy feedback will be stopped until the DC bus voltage is normal. Then the inverter will restart deceleration. The process of overvoltage stall protection in deceleration is shown in Fig. 6-39.

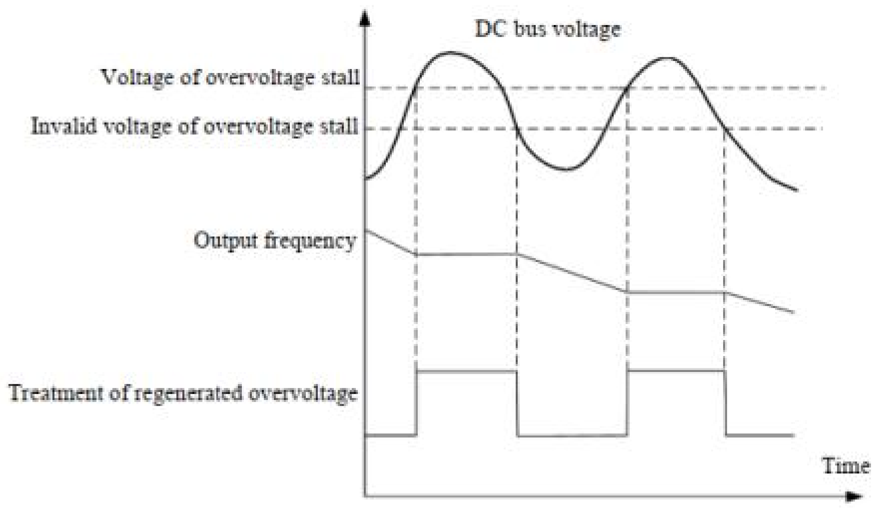


Fig. 6-39 Schematic Diagram of Overvoltage Stall Protection

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.08	Instantaneous stop/no-stop operating voltage	60.0 ~ Instantaneous stop/no-stop recovery voltage (100.0= standard bus voltage)		76.0	O
F07.09	Instantaneous stop/no-stop recovery voltage	Instantaneous stop/no-stop operating voltage to 100.0	%	86.0	●
F07.10	Check time for instantaneous stop/no-stop recovery voltage	0.00~100.00	s	0.5	●
F07.30	Instantaneous stop/no-stop deceleration time	0.00~300.00	s	20.00	O

When the bus voltage is lower than the instantaneous stop/non-stop action voltage (F07.08), the inverter will be in the power-down status. When the bus voltage is higher than the instantaneous stop/non-stop recovery voltage (F07.09), and the judgment time (F07.10) for the instantaneous stop/non-stop recovery voltage is up, the inverter will recover normal operation.

When the ones place of the instantaneous stop/non-stop option ofF07.06 bus voltage control is set to " 1: Slow down", as shown in Fig. 6-40: When the bus voltage is lower than the instantaneous stop/non-stop action voltage (F07.08), the inverter will slow down at the speed set based on the declaration time for the instantaneous stop/non-stop action (F07.30). When the bus voltage is higher than the instantaneous stop/non-stop recovery voltage (F07.09), the inverter will not slow down. When the cumulative time reaches the judgement time for instantaneous stop/non-stop recovery voltage (F07.10), the inverter will start to acceleration, and the frequency will gradually return to the set value.

When the ones place of the instantaneous stop/non-stop option ofF07.06 bus voltage control is set to "2: Slow down to stop", the action is similar to that of the option 1. When the bus voltage reaches the instantaneous stop/non-stop action voltage, the speed set based on the instantaneous stop/non-stop slowdown time (F07.30) will constantly decrease to 0, regardless of voltage recovery.

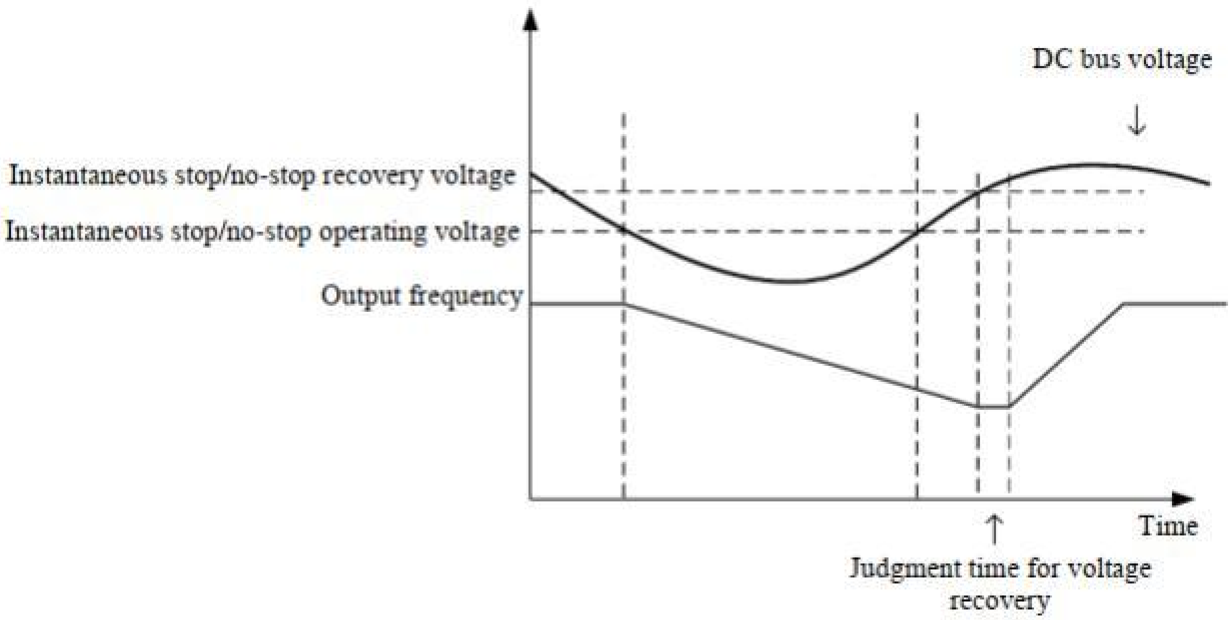


Fig. 6-40 Schematic Diagram of Instantaneous Stop/Non-stop Deceleration Function

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F07.11	Current limit control	0: Invalid 1: limit mode 1 2: limit mode 2		2	O
F07.12	Current limit level	20.0-180.0 (100% = rated current of inverter)	%	150.0	●

F07.11=0: invalid

The current limit does not work.

F07.11=1: limit mode 1

F07.11=2: limit mode 2

When the output current reaches the current limit level (F07.12) and the current limit control is valid (F07.11=1) during operation, the current limit function of the inverter will be enabled. The output frequency will be reduced to limit the increase in output current, thus disabling the overcurrent stall of the inverter. When the output current decreases to below the current limit level, the original running status will be restored. The current limit process is shown in 6-41.

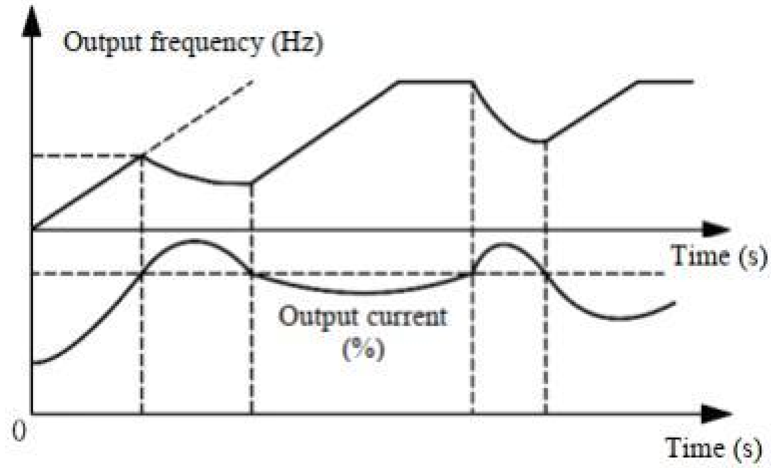


Fig. 6-41 Current Limit Process

F07.12 is used to set the operating conditions of current limit. If the current of the inverter is greater than the set value of this code, the current limit function will be enabled, thus controlling the output current not to exceed the current limit level.

The current limit is valid only for the V/F drive mode. It is recommended to use this function in the case of large inertia or fan type loads or driving of multiple motors by a single inverter.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.13	Quick current limit options	0: Invalid 1: valid		0	O

F07.13=0: invalid

The quick current limit does not work.

F07.13=1: valid

The quick current limit can reduce overcurrent protections.

6.10.4 Protection retry settings

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.14	Protection retries	0-20; 0: Disable protection retry		0	O
F07.15	Digital output action in protection retries	0: no action		0	O

<table>
<tr><td></td><td>Output terminal action options</td><td colspan="8">1: action</td><td></td><td></td><td></td></tr>
<tr><td>F07.16</td><td>Interval of protection retries</td><td colspan="8">0.01~30.00</td><td>s</td><td>0.50</td><td>●</td></tr>
<tr><td>F07.17</td><td>Restoration time of protection retries</td><td colspan="8">0.01~30.00</td><td>s</td><td>10.00</td><td>●</td></tr>
<tr><td rowspan="2">F07.18</td><td rowspan="2">Action option of protection</td><td>E08</td><td>*</td><td>E07</td><td>*</td><td>E02</td><td>E06</td><td>E05</td><td>E04</td><td></td><td>00000000</td><td>O</td></tr>
<tr><td colspan="8">0: allow protection retry
1: disable protection retry</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">F07.32</td><td rowspan="2">Action option 2 of protection</td><td>E10</td><td>E13</td><td>E15</td><td>E16</td><td>*</td><td>E19</td><td>E20</td><td>*</td><td></td><td>111111</td><td>O</td></tr>
<tr><td colspan="8">0: allow protection retry
1: disable protection retry</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">F07.36</td><td rowspan="2">Action option 3 of protection</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>E09</td><td>E17</td><td></td><td>11</td><td>O</td></tr>
<tr><td colspan="8">0: allow protection retry
1: disable protection retry</td><td></td><td></td><td></td></tr>
</table>

The function of protection retry is to prevent the impact of occasional protection on the normal operation of the system. This is valid only for protections of F07.18, F07.32 and F07.36.

If protection retry is enabled, this will be performed after a corresponding protection. That is, the protection will be reset. The protection status depends on F07.15 and the output of the digital output terminal. If a fault is still detected after the protection retry interval, the protection retry will be continued to the set number of protection retries (F07.14) and then the corresponding protection will be reported. If the fault is not detected after several protection retries, the protection retries will be deemed successful and the inverter will continue to run normally.

When protection retries succeed and no trip protection is enabled within the recovery time (F07.17), the number of protection retries will be cleared. When a protection is enabled again, protection retries will be performed from zero. In case of any trip protection within this period, protection retries will be carried out based on the last count.

6.10.5 Protective action setting

<table>
<tr><th>Function code</th><th>Function code name</th><th colspan="8">Parameter description</th><th>Unit</th><th>Default setting</th><th>Attribute</th></tr>
<tr><td rowspan="2">F07.19</td><td rowspan="2">Action option 1 of protection</td><td>E21</td><td>E16</td><td>E15</td><td>E14</td><td>E13</td><td>E12</td><td>E08</td><td>E07</td><td rowspan="2"></td><td rowspan="2">000
00000</td><td rowspan="2">O</td></tr>
<tr><td colspan="8">0: free stop
1: stop according to stop mode</td></tr>
<tr><td rowspan="2">F07.20</td><td rowspan="2">Action option 2 of protection</td><td colspan="2">E06</td><td colspan="2">E28</td><td colspan="2">E27</td><td>E25</td><td>E23</td><td rowspan="2"></td><td rowspan="2">00000</td><td rowspan="2">O</td></tr>
<tr><td colspan="8">0: free stop
1: stop according to stop mode</td></tr>
</table>

With regard to some protections, the action mode of the inverter can be selected via this function code. The inverter will stop running freely when the corresponding bit is set to 0 and according to the stop mode (F04.19) when the corresponding bit is set to 1.

These two function codes are subject to bit operation. You only need to set the corresponding bit to 0 or 1. As shown in the table below:

Table 6-20 Detailed Definition of Protection Action Bits

F07.19	E21	E16	E15	E14	E13	E12	E08	E07
F07.20	*	*	*	*	E28	E27	*	E23
Corresponding bit	7	6	5	4	3	2	1	0
Settings	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

For example, to stop the inverter according to the stop mode (F04.19) after the Ea3 and E3 protection are enabled, you only need to set the 1st bit corresponding to E08 and the 3rd bit corresponding to E3 to 1. That is, F07.19=xxx x1x1x.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.21	Options of load loss protection	0: Invalid 1: valid		0	●
F07.22	Load loss detection level	0.0~100.0	%	20.0	●
F07.23	Load loss detection time	0.0~60.0	s	1.0	●
F07.24	Options of load loss protection action	0: trip protection, free stop 1: trip protection, stop according to stop mode 2: Continue to run, with DO status output		1	O

When the off-load protection is valid (F07.21=1), the inverter will be in the running status without DC braking, and the output current is below the off-load detection level (F07.22) and maintained for the off-load detection time (F07.23), the inverter will be in the off-load status. Specific processing depends on F07.24.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.27	AVR function	0: Invalid 1: valid 2: automatic		1	O

F07.27=0: invalid

The automatic voltage regulation (AVR) function is invalid.

F07.27=1: valid

The AVR function is continuously valid. If the input voltage is lower than the rated input voltage, and the output frequency is greater than the corresponding frequency on the VF curve, the inverter will output the output the maximum voltage to maximize the power output of the motor. If the input voltage is higher than the rated input voltage, the output voltage of the inverter will decrease, and the VF ratio will remain unchanged.

F07.27=2: automatic

The AVR function is valid automatically (invalid during deceleration): the inverter will automatically adjust the output voltage according to changes in the actual grid voltage, to keep it at the rated output voltage.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.28	Stall protection detection time	0.0-6000.0 (0.0: no stall protection detection)	s	0.0	O
F07.29	Stall control intensity	0~100	%	20	O

When the continuous stall time exceeds the set value of F07.28, the driver will report a stall protection.

In the stall status, the driver will perform automatic control according to the set value ofF07.29. The intensity setting depends on the on-site application, instead of maximization.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F07.34	Encoder disconnection detection percentage	0~150.0	%	100.0	O
F07.37	Initial voltage for saving upon power disconnection	60.0~100.0	%	76.0	O
F07.38	Electrification voltage reading and determination	60.0~100.0	%	86.0	O
F07.39	Delay time of electrification reading and determination	0~100.00	S	5.00	O
F07.40	Delay time of steady undervoltage determination	5~6000	ms	20	O
F07.41	Selection of input phase loss detection method	0: Software detection 1: Hardware detection 2: Simultaneous software and hardware detection		0	O
F07.42	Setting value of current for determining short to ground	0.0~100.0	%	50.0	O
F07.44	Upper limit of current for output phase loss detection	10.0~100.0	%	30.0	O
F07.45	Times of output phase loss detection	1~60000		10	O
F07.47	Soft start disconnection delay time	20~1000	ms	400	O
F07.50	STO fault resetting	0: manual resetting 1: automatic resetting (automatically resets if conditions of triggering by fault are not met)		0	O

Chapter 7 **Instructions on control performance**

7.1 Asynchronous motor control

7.1.1 Asynchronous motor VF control

VF control is suitable for general-purpose loads such as fans and pumps, or when multiple motors are driven by one inverter or the power of the inverter is quite different from that of the motor.

Debugging methods for common issues on VF control:

(1) It'shard to balance the speed during simple synchronous control
Set F05.11=0.00

(2) Same frequency setting results in too large current for fan and water pump control
Set F05.11=0.00

(3) Motor jittering

Regulate F05.13, to higher values first.

(4) Imbalanced loads on multiple motors driving the same load
Set F05.15 as rated slip frequency of the motor.

(5) Insufficient power under low frequency

A. Set F05.10 and F05.11 as 0 first when adjusting multi-segment VF curve

B. Set F05.00 as 1 and F00.01 as 0

C. Set inverter frequency as 0.5 Hz in no-load condition. Run the inverter, and check the output current F18.06. If the output current is less than the rated value of the motor, increase F05.02 until the former approaches the latter.

D. Set inverter frequency as 2 Hz in no-load condition. Run the inverter, and check the output current F18.06. If the output current is less than the rated value of the motor, increase F05.04 until the former approaches the latter.

E. Set inverter frequency as 5 Hz in no-load condition. Run the inverter, and check the output current F18.06. If the output current is less than the rated value of the motor, increase F05.06 until the former approaches 80% of the latter.

F. Run the inverter in with loads. If running with loads is normal but the output current is a bit excessive, decrease F05.06 slowly as long as the running is not affected. If load driving is still a problem, go on to increase F05.02, F05.04 and F05.06 and follow C, D, and E for commissioning. The current shouldn't get greater than 1.5 times of rated motor current.

Instructions on parameters related to VF control

Function code	Function code name	Parameter description	Unit	Default setting	Attribute
F05.00	V/F curve setting	0: straight line V/F 1: multi-point broken line V/F 2: 1.3-power V/F 3: 1.7-power V/F 4: square V/F 5: VF complete separation mode (Ud = 0, Uq = K * t = voltage of separation voltage source) 6: VF semi-separation mode (Ud = 0, Uq = K * t = F/Fe * 2 * voltage of separation voltage source)		0	O

F05.00=0: linear V/F

It is suitable for ordinary constant-torque loads.

F05.00=1: multi-point V/F

It is suitable for special loads such as dehydrators, centrifuges and cranes. Any V/F relationship curve can be obtained by setting the parameters F05.01 to F05.06.

F05.00=2/3: 1.3th power/1.7th power of V/F

It is a VF curve between the linear VF and square VF.

F05.00=4: square V/F

It is suitable for centrifugal loads such as fans and pumps.

F05.00=5: VF complete separation mode

In this case, the output frequency and output voltage of the inverter are independent of each other. The output frequency depends on the frequency source, and the output voltage is determined by F05.07 (VF separation voltage source).

The VF complete separation mode is usually applied in induction heating, inverter power supply, torque motor control, etc.

F05.00=6: VF semi-separation mode

In this case, Vand Fare proportional, but their proportional relationship can be set by the voltage source F05.07. In addition, the relationship between V and F is also related to the rated voltage and rated frequency of the motor in the F1 group.

Assuming that the voltage source input is X (X is 0 to 100%), the relationship between the output voltage V and frequency F of the inverter is:

V/F=2 * X * (rated voltage of the motor)/(rated frequency of the motor)

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F05.01	Frequency point F1 of multi-point VF	0.00~F05.03	Hz	0.50	●
F05.02	Voltage point V1 of multi-point VF	0.0~100.0 (100.0 = Rated voltage)	%	1.0	●
F05.03	Frequency point F2 of multi-point VF	F05.01~F05.05	Hz	2.00	●
F05.04	Voltage point V2 of multi-point VF	0.0~100.0	%	4.0	●
F05.05	Frequency point F3 of multi-point VF	F05.03 to rated frequency of motor (reference frequency)	Hz	5.00	●
F05.06	Voltage point V3 of multi-point VF	0.0~100.0	%	10.0	●

The code parameters F05.01 to F05.06 are valid when the multi-point polyline VF is selected (F05.00=1).

All V/F curves are dependent on the curve set by the percentage of input frequency and the percentage of output voltage, linearized in sections within different input ranges.

The rated frequency of the motor is the final frequency of the V/F curve, and also the frequency corresponding to the highest output voltage. Percentage of the input frequency: rated frequency of the motor = 100.0%; percentage of the output voltage: rated voltage U_e of the motor = 100.0%.

> The relationships of the three voltage points and frequency points must meet the following requirements: V1<V2<V3, F1<F2<F3;
>
> If the slope of the V/F curve is too large, the "overcurrent" protection maybe enabled. Particularly, if the low-frequency voltage is too high, the motor maybe overheated and even burnt, and the inverter maybe subject to overcurrent stall or overcurrent protection.

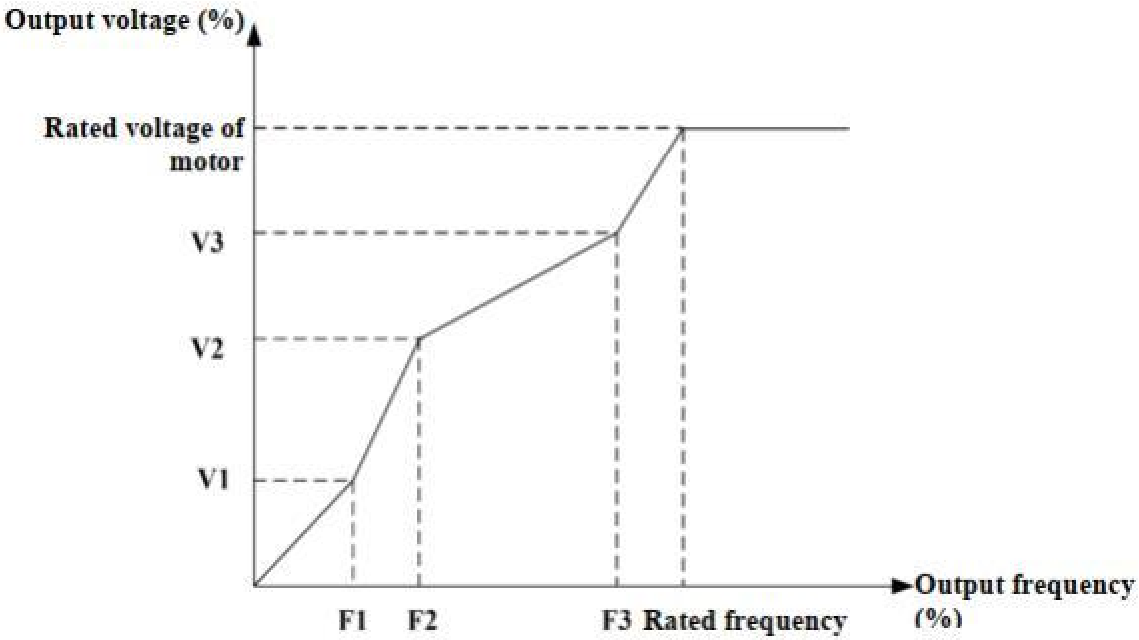


Fig. 7-1 Schematic Diagram of Multi-point Polyline V/F Curve

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F05.07	Voltage source of VF separation mode	0: digital setting of VF separation voltage 1: AI1 2: AI2 3: AI3 4: high frequency pulse (X7) 5: PID 6: Communication setting Note: 100% is the rated voltage of the motor.		0	O
F05.08	Digital setting of VF separation voltage	0.0~100.0 (100.0=Rated voltage of motor)	%	0.0	●

VF separation is usually applied in induction heating, inverter power supply, torque motor control, etc.

When VF separation control is selected, the output voltage can be set by the function code F05.08 or according to the analog, high-speed pulse, PID or communication settings. For non-digital settings, 100% of each setting corresponds to the rated voltage of the motor. When the percentage set by the analog output is negative, the set absolute value will betaken as the valid set value.

F05.07=0: digital setting of VF separation voltage (F05.08)

The VF separation output voltage depends on the digital setting of VF separation voltage (F05.08).

F05.07=1: AI1

F05.07=2: AI2

F05.07=3: AI3

F05.07=4: high-frequency pulse (X7)

The VF separation output voltage depends on AI/high-speed pulse (percentage) * rated motor voltage.

F05.07=5: process PID

The VF separation output voltage depends on the process PID function output, as described in 6.2.3.1.

F05.07=6: communication setting

The VF separation output voltage depends on the communication.

- If the master-slave communication (F10.05=1) is enabled and the inverter works as the slave (F10.06=0), the VF separation output voltage is “700FH (master-slave communication setting) * F01.02 or others (rated voltage of the motor) * F10.08 (slave receiving proportional coefficient) * rated motor voltage”. The 700FH data range is 0.00% to 100.00%.
- For general communication (F10.05=0), the VF separation output voltage is “7006H (voltage setting of the VF separation mode) * rated motor voltage”, and the 7006H data range is 0.00% to 100.00%.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F05.09	Rise time of VF separation voltage	0.00~60.00	s	2.00	●

The rise time of VF separation voltage refers to the time for the output voltage to increase from 0 to the rated voltage of the motor.

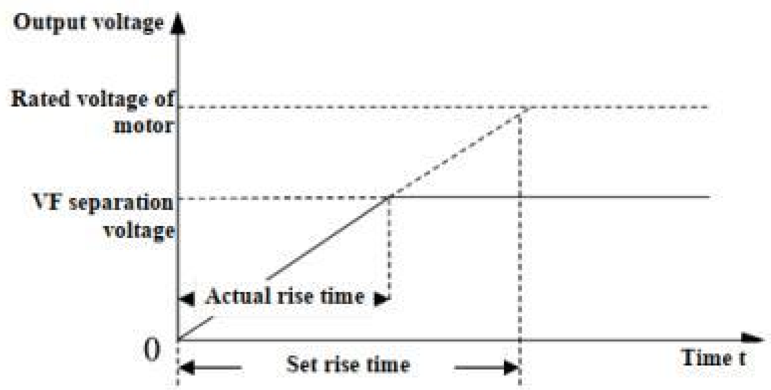


Fig. 7-2 Rise Time Description of VF Separation Voltage

It is used to compensate for the voltage drop caused by the stator resistor and wire, and improve the low-frequency load capacity.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F05.11	V/F slip compensation gain	0.00~200.00	%	100.00	●
F05.12	V/F slip filtering time	0.00~10.00	s	1.00	●

As the load increases,the rotor speed of the motor will decrease. To make the rotor speed of the motor close to the synchronous speed underrated load, slip compensation can be enabled. When the motor speed is less than the target value, the set value ofF05.11 can be increased.

*: In the case of F05.11=0, slip compensation is invalid. This parameter is valid only for the asynchronous motor.

The slip is 100% during the quick start with large inertia and 0 when the frequency reaches the set value. Quick increase or decrease of the output frequency will cause overvoltage or overcurrent. F05.12 filtering can slow down the rise of voltage and current.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F05.13	Oscillation suppression gain	0~20000		300	●
F05.14	Oscillation suppression cutoff frequency	0.00~600.00	Hz	55.00	●

This parameter can be adjusted to suppress motor oscillations during the open loop control (VF). When the motor does not oscillate, this parameter should not be adjusted as little as possible or properly reduced. If the motor oscillates obviously, this parameter can be increased properly.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F05.15	Droop control frequency	0.00~10.00	Hz	0.00	●

This function is usually applied for load distribution when one load is driven by multiple motors.

Droop control is to reduce the output frequency of the inverter with the load increasing, so that the output frequency of the motor drops more if it carries greater portion of the load driven by multiple motors, thus reducing the load on this motor and leading to evener distribution of the load on multiple motors.

This parameter refers to the output frequency drop of the inverter under the rated load.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F05.16	Energy saving rate	0.00~50.00	%	0.00	●
F05.17	Energy saving action time	1.00~60.00	s	5.00	●

The energy saving rate (F05.16) reflects the energy saving capacity. The larger the set value, the more energy will be saved. If the set value is 0.00, energy saving will be invalid.

When energy-saving operation is valid, energy saving control will be enabled once the energy saving conditions are met and have been maintained for the energy saving time (F05.17).

7.1.2 Asynchronous motor SVC control

The most important part in asynchronous motor SVC control is to input rated motor parameters as per the nameplate, and disconnect the motor from the load for rotary self-learning of the asynchronous motor as far as possible. If such disconnection can't be secured, static self-learning can be performed instead. However, the result will be less good than rotary self-learning.

(1) In case of low interference resistance, adjust F06.00~F06.05, boost proportional gain, and reduce integral time.

(2) In case of motor vibration, adjust F06.00~F06.05, reduce proportional gain, and increase integral time.

(3) In case of reversing upon start-up, reduce appropriately pre-excitation time F04.07 and pre-excitation current F04.06.

(4) If some braking force is required for zero speed, one of the solutions is to set the SVC zero frequency processing method F06.17 as 0: braking, and adjust torque by regulating F06.18 in the meantime.

Instructions on vector control parameters:

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.00	Speed proportional gain ASR_P1	0.00~100.00		12.00	●
F06.01	Speed integral time constant ASR_T1	0.000~30.000 0.000: no integral	s	0.250	●
F06.02	Speed proportional gain ASR_P2	0.00~100.00		10.00	●
F06.03	Speed integral time constant ASR_T2	0.000~30.000 0.000: no integral	s	0.300	●
F06.04	Switching frequency 1	0.00 to switching frequency 2	Hz	5.00	●
F06.05	Switching frequency 2	Switching frequency 1 to maximum frequency F00.16	Hz	10.00	●

In the vector control mode, the dynamic speed response of the inverter is adjusted by changing the speed proportional gain (ASR_P) and speed integral time (ASR_T) of the speed PI regulator. The increase in ASR_P or decrease in ASR_T may accelerate the dynamic response of the speed loop. If ASR_P is too large or ASR_T is too small, however, the system may be over-tuned to cause oscillation.

Users should adjust the above speed PI parameters according to the actual load characteristics. Generally, as long as the system does not oscillate, ASR_P should be increased as much as possible, and then ASR_T should be adjusted, so that the system makes response fast, without excessive over-tuning.

To enable fast dynamic responses of the system at low and high speeds, PI regulation should be performed separately at low and high speeds. During the actual operation, the speed regulator will automatically calculate the current PI parameters based on the current frequency. The speed PI parameters are P1 and T1 at the switching frequency 1, and P2 and T2 at the switching frequency 2. If the frequency is greater than the F06.04 switching frequency 1 and less than F06.05 switching frequency 2, the switching frequency 1 and switching frequency 2 will be subject to linear transition. As shown below.

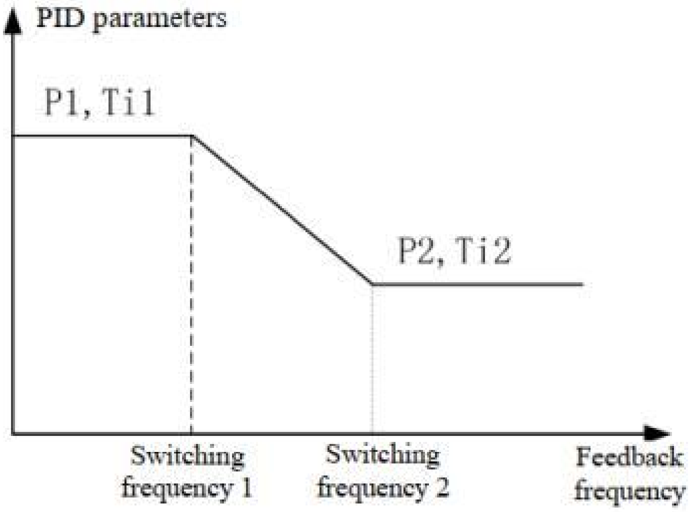


Fig. 7-3 Schematic Diagram of PI Parameters

> 1. The parameters F06.00 to F06.05 need to be adjusted carefully. They should not be adjusted under normal circumstances.
> 2. While setting the switching frequency, note that the F06.04 switching frequency 1 must be less than or equal to the F06.05 switching frequency 2.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.07	Filtering time constant of speed loop output	0.000~0.100	s	0.001	●

Speed loop output filtering can reduce the impact on the current loop, but the value ofF06.07 should not be too large. Otherwise, slow responses may be caused. Use the default settings under normal circumstances.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.08	Vector control slip gain	50.00~200.00	%	100.00	●

As the load increases, the rotor speed of the motor will increase. To make the rotor speed close to the synchronous speed under the rated load, slip compensation can be enabled. When the motor speed is less than the target value, the set value of F06.08 can be increased.

For the speed sensorless vector control, this parameter can be used to adjust the speed accuracy of the motor. Increase this parameter if the motor speed is low under load, and viceversa.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.09	Upper limit source selection of speed control torque	0: set by F06.10 and F06.11 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: Communication setting (percentage) 6: Take the maximum values of AI2 and AI3 7: Take the minimum values of AI2 and AI3		0	O
F06.10	Upper limit of speed control motor torque	0.0~250.0	%	165.0	●
F06.11	Upper limit of speed control brake torque	0.0~250.0	%	165.0	●

Vector control is used to set the operating conditions of the torque limit. If the output torque of the inverter is greater than the set upper limit, the torque limit function will be enabled, thus controlling the output torque not to exceed the upper limit of speed control torque.

F06.09=0: depending on F06.10 and F06.11

The upper limit of electric torque is F06.10, and that of braking torque is F06.11.

F06.09=1: AI1

F06.09=2: AI2

F06.09=3: AI3

F06.09=4: AI4

The upper torque limit is dependent on AI (percentage) * F06.10/F06.11.

For the detailed interpretation of AI1 to AI4,refer to 6.5.7. 100.00% is the percentage to the set value of F06.10/F06.11.

F06.09=5: communication setting

The upper torque limit depends on the communication.

- If the master-slave communication (F10.05=1) is enabled and the inverter works as the slave (F10.06=0), the upper torque limit is “700FH (master-slave communication setting) * 250.0% * F10.08 (slave receiving proportional coefficient)”, and the 700FH data range is -100.00% to 100.00%.

- For the general communication (F10.05=0), the upper torque limit is “7019H (communication setting of the upper torque limit for speed control) * F06.10/F06.11”, and the 7019H data range is 0.0 to 250.0%.

F06.09=6: Take the maximum values of AI2 and AI3

The formula for torque upper limit calculation is the same as described above, except that the percentage of AI is the larger of AI2 and AI3.

F06.09=7: Take the minimum values of AI2 and AI3

The formula for torque upper limit calculation is the same as described above, except that the percentage of AI is the smaller of AI2 and AI3.

1. This code parameter represents the ratio of the output torque in the torque limit action to the rated output torque of the inverter.
2. The user can set the upper torque limit according to the actual needs, to protect the motor or meet the working conditions.
3. The electric mode and braking mode are set separately.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.12	Excitation current proportional gain ACR-P1	0.00~100.00		0.50	●
F06.13	Excitation current integral time constant ACR-T1	0.0.00~600.00 0.00: no integral	ms	10.00	●
F06.14	Torque current proportional gain ACR-P2	0.00~100.00		0.50	●
F06.15	Torque current integral time constant ACR-T2	0.0.00~600.00 0.00: no integral	ms	10.00	●

The parameters of the current loop PID regulator directly affect the performance and stability of the system. The user does not need to change the default settings under normal circumstances.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.17	SVC zero-frequency processing	0: braking 1: not processed 2: seal the tube		2	O
F06.18	SVC zero-frequency braking current	50.0-400.0 (100.0 is the no-load current of the motor)	%	100.0	O

In the case of SVC control (e.g. F00.01=1) and zero-frequency operation, the inverter will work according to the F06.17 setting.

F06.17=0: braking by the set current ofF06.18 to secure a function close to zero servo;

F06.17=1: no processing;

F06.17=2: the inverter freely stop running with its output blocked.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.20	Voltage feedforward gain	0~100	%	0	●

In the vector control mode, voltage feedforward adjustment is added to automatically increase the torque, i.e. the compensation for stator voltage drop.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.21	Flux weakening control options	0: Invalid 1: direct calculation 2: automatic adjustment		1	O
F06.22	Flux weakening voltage	70.00~100.00	%	100.00	●
F06.24	Proportional gain of flux weakening regulator	0.00~10.00		0.50	●
F06.25	Integral time of flux weakening regulator	0.01~60.00	s	2.00	●

Flux weakening control options:

F06.21=0: invalid

Flux weakening control is not performed. The maximum speed of the motor is related to the bus voltage of the inverter. When the maximum speed of the motor does not meet user requirements, the flux weakening function of the synchronous motor should be enabled to increase the speed.

EM760 has two flux weakening modes: direct calculation and automatic adjustment.

F06.21=1: direct calculation

In the direct calculation mode, the flux weakening current is calculated according to the target speed and can be adjusted manually via the option 06.22. The lower the flux weakening current, the lower the total output current will be, but the desired effect of flux weakening may not be achieved.

F06.21=2: automatic adjustment

In the automatic adjustment, the optimal flux weakening current will be selected automatically, but it may affect the dynamic performance of the system or become unstable.

The speed of flux weakening current adjustment can be changed by setting the proportional gain (F06.24) and integral time (F06.25). However, fast adjustment of the flux weakening current adjustment may cause instability. This does not need to be changed manually under normal circumstances.

7.1.3 Asynchronous motor FVC control

The difference of FVC control compared to SVC control is the addition of encoder speed detection. Steps of commissioning:

(1) Select corresponding PG card according to the encoder.

(2) Connect the encoder to the PG card.

(3) Set rated motor parameters F01.00 - F01.06 as per motor nameplate. Specify encoder type F01.24 and number of encoder wires F01.25 as per encoder nameplate. If rotary transformation is used, you need to set the pole pairs F01.30 of rotary transformer as well.

(4) Disconnect the load, and perform self-learning of asynchronous motor encoder. See 7.3.1 for detailed steps.

(5) If the load can't be disconnected, perform static self-learning of asynchronous motor, in case of which VF is required to determine encoder direction. To do this, set F00.01=0 and give 10 Hz, and check if F18.02 and F18.01 have the same direction. If not, invert F01.27 (set it as 0/1 if it's 1/0).

(6) In case of excessive current in running with load, increase F06.06 appropriately.

(7) In case of reversing upon start-up, reduce F04.06 and F04.07 appropriately.

(8) In case of low rigidity, adjust F06.00~F06.05, increase speed loop gain, and reduce integral time; and if the rigidity is great and has caused motor vibration, reduce speed loop gain accordingly, and increase integral time.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F01.24	Encoder type	0: ABZ gain encoder 1: UVW gain encoder 2: Reserved 3: SinCos encoder (with CD signal) 4: Rotary transformer		0	O

The EM760 series inverter supports a number of types of encoders, which, however, require varying PG cards. Please purchase the proper PG card as well (See Appendix III). Upon installing the PG card, set F01.24 properly based on the actual conditions, otherwise the inverter will not work during closed-loop control.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F01.25	Encoder line count	1~65535		1024	O

Where speed sensor vector control (FVC) is available, the number of lines of the encoder must be correctly set, otherwise the motor will not work properly.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F01.27	AB pulse phase sequence	0: forward 1: reverse		0	O

For encoders with AB signals (F01.24 = 0/1), when the feedback frequency direction of the PG card is found opposite to the set frequency, set F01.27 as 1 if it's 0, and 0 if it's 1.

This parameter can be correctly set through motor parameter self-learning.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F01.30	Pole pairs of rotary transformer	1~65535		1	O

The rotary transformer involves pole pairs, parameter of which should hence be properly set if this kind of encoders is used.

7.2 Synchronous motor control

7.2.1 Synchronous motor SVC control (non-standard)

Please contact your distributor to customize anon-standard inverter if synchronous motor SVC functions are to be used.

Commissioning steps of synchronous motor SVC:

(1) Check motor nameplate, and set the type and rated power/voltage/current/frequency/speed of the motor as noted on the nameplate. If the nameplate has indicated the counter-electromotive force, you need to input it into F01.22. If it's not indicated, no input is required.

(2) Carryout static self-learning of parameters for the motor, and then check if stator resistance (F01.19), d-axis inductance (F01.20) and q-axis inductance (F01.21) have been learned.

(3) Rotary self-learning. If the motor nameplate has indicated accurately the counter-electromotive force, this is skipped. Otherwise, you can either perform rotary self-learning or skip it. However, self-learning allows you to get the counter-electromotive force more accurately.

(4) Perform no-load running. If the motor is started smoothly without any reversing when Run is pressed, and stops smoothly when Stop is pressed, no-load start-up and stop works properly.

(5) Perform running with loads. Upon setting function-related parameters, do joint commissioning with loads.

(6) If a large and short "Ding" sound occurs at the instant of start-up, reduce F06.61 appropriately, and then decrease F06.58 and F06.61 proportionally.

(7) If low-frequency current is excessive during no-load commissioning, reduce F06.29.

(8) If no-load currents of no-load high frequency of 30 Hz and above are excessive, reduce F06.33. However, over-reduction is not recommended, for it might lead to an increase in no-load noise.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.21	Flux weakening control options	**Asynchronous motor** Ones place: Asynchronous flux weakening mode 0: Invalid Non-zero: PI adjustment output Tens place: Output voltage limiting method of asynchronous motor in the flux weakening mode 0: F06.22 output voltage limiting according to bus voltage 1: F06.22 output voltage limiting according to rated voltage		12	O

		Synchronous motor Ones place: Synchronous motor flux weakening mode 0: Invalid 1: direct calculation 2: automatic adjustment Tens place: Output voltage limiting method of synchronous motor in the flux weakening mode 0: F06.22 output voltage limiting according to bus voltage 1: F06.22 output voltage limiting according to rated voltage			
F06.22	Flux weakening voltage	70.00~100.00	%	100.00	●
F06.23	Maximum field weakening current of synchronous motor	0.0-150.0 (100.0 is the rated current of the motor)	%	100.0	●

If the ten'splace ofF06.21 is 0, it means flux weakening regulation is performed only when the output voltage reaches the maximum suppliable by the busbar. In this case, F06.22 refers to the percentage of the max. AC voltage corresponding to the busbar voltage. If the ten's place is 1, it means output voltage is controlled based on the rated voltage of the motor. F06.22 refers to the percentage of the rated voltage of the motor.

In case of an asynchronous motor and non-zero units place ofF06.21, flux weakening is secured by reducing excitation current, which is acquired via closed-loop automatic regulation of flux weakening voltage. When the units place ofF06.21 is 0, the flux weakening function is invalid while the excitation current remains unchanged.

In case of a synchronous motor and 1 at the units place of F06.21, the backward excitation current is acquired via closed-loop automatic regulation of flux weakening voltage. In case of 2 at the units place of F06.21, the backward excitation current is the sum of the closed-loop automatic regulation of flux weakening voltage plus the excitation current calculated from flux weakening. When the units place ofF06.21 is 0, the flux weakening function is invalid.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.24	Proportional gain of flux weakening regulator	0.00~10.00		0.50	●
F06.25	Integral time of flux weakening regulator	0.000~6.000	s	0.200	●

F06.24 and F06.25 are the proportional gain and integral time constant of the regulator during closed-loop automatic regulation of flux weakening voltage.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.29	Injection current of low frequency band	0.0-60.0 (100.0 is the rated current of the motor)	%	40.0	●
F06.33	Injection current f high frequency band	0.0-30.0 (100.0 is the rated current of the motor)	%	8.0	●

The magnitude of injection component of excitement current can be set for F06.29 and F06.33.

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F06.51	Synchronous motor open-loop until SVC switching frequency	0.0~50.0	%	2.5	O

F06.51 is the switching parameter with hysteresis used by the synchronous motor SVC during start-up.

7.2.2 Synchronous motor FVC control

In case of synchronous motor FVC control, it's recommended to select UVW encoder as far as possible and rotary transformer. If a regular incremental encoder is selected, the initial position will be identified automatically during the first run upon power-on.

All steps are the same as the asynchronous motor FVC control except that synchronous motor encoder self-learning is selected for self-learning.

7.3 Motor Parameter Self-identification

7.3.1 Parameter Self-identification of Asynchronous Motor

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F01.34	Motor parameter self-learning	0: No operation 1: static self-learning of asynchronous motor 2: rotation self-learning of asynchronous motor 3: Self-learning of asynchronous motor encoder		0	O

F01.34=0: not identified

F01.34=1: the asynchronous motor remains stationary during parameter self-identification.

Prior to the static self-learning of the asynchronous motor, please set the motor type (F01.00) and motor nameplate parameters (F01.01 toF01.08) correctly. Relevant parameters (F01.09 toF01.13) of the asynchronous motor can be obtained during static self-learning.

This mode is mainly used when the motor cannot rotate. Static self-learning has poorer effects than rotary self-learning.

F01.34=2: the asynchronous motor rotates during parameter self-identification. Please disengage the load.

Prior to the rotary self-learning of the asynchronous motor, please set the motor type (F01.00) and motor nameplate parameters (F01.01 toF01.08) correctly. Relevant parameters (F01.09 toF01.18) of the asynchronous motor can be obtained during rotary self-learning.

This mode is mainly used when the motor can rotate. However, loads should be avoided or minimized; otherwise, self-learning will have poor effects.

F01.34=3: the asynchronous motor rotates during encoder parameter self-identification. Please disengage the load. Please connect the encoder first.

Prior to the encoder self-learning of the asynchronous motor, please set the motor type (F01.00), motor nameplate parameters (F01.01 toF01.06), and encoder parameters - F01.24, F01.25 and F01.30 - correctly. Encoder self-learning allows you to acquire parameters related to the asynchronous motor such as F01.09 to F01.18 while judging current conditions of the encoder.

This mode is mainly used when the motor can rotate. However, loads should be avoided or minimized; otherwise, self-learning will have poor effects.

1. Motor parameter self-learning is valid only in the keyboard-controlled start/stop mode (F00.02=0): Set F01.34 to the corresponding value, and press the OK key for confirmation and then the RUN key to start motor parameter self-learning. After the parameter self-learning, F01.34 of the inverter will be automatically set to 0;
2. Please do perform parameter self-learning once before running with FVC drive control, so as to reach better results of control;
3. If there is an overcurrent or overvoltage fault during self-learning, extend the acceleration and deceleration time and try again.
4. Before self-learning with the encoder, you must set correctly the encoder type (F01.24), encoder line count (F01.25) and the number of rotary transformer pole pairs (F01.30, set only when F01.24=4). Parameters related to phase sequence (F01.27 - F01.28) can be either set manually or acquired via self-learning.
5. The first group of motor parameters is taken as an example above. For the second group of motor parameters, refer to the above description.

7.3.2 Parameter Self-identification of Synchronous Motor

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F01.34	Motor parameter self-learning	10: No operation 11: static self-learning of synchronous motor 12: rotary self-learning of synchronous motor 13: encoder self-learning of synchronous motor		0	O

F01.34=10: not identified

There are 3 self-learning methods for the synchronous motor. You can make your option based on the working conditions. However, you must perform once the self-learning of motor parameters upon new installation or replacement of the motor.

In case of SVC drive mode, you can perform " 12 rotary self-learning" or " 11 static self-learning", and manually input the counter electromotive force (F01.22); and in case of FVC drive mode, you can perform " 13 encoder self-learning" alone. However, " 12 rotary self-learning" should be carried out additionally if you wish to further enhance control performance.

F01.34=11: the synchronous motor remains stationary during parameter self-identification.

Prior to the static self-learning of the synchronous motor, please set the motor type (F01.00) and motor nameplate parameters (F01.01 to F01.05) correctly. Relevant parameters (F01.19 to F01.21) of the synchronous motor and current loop parameters (F06.12 to F06.15) can be obtained during static self-learning.

This mode is mainly used when the motor cannot rotate. It is necessary to manually enter the counter electromotive force (F01.22).

F01.34=12: the synchronous motor rotates during parameter self-identification.

Prior to the rotary self-learning of the synchronous motor, please set the motor type (F01.00) and motor nameplate parameters (F01.01 toF01.05) correctly. Relevant parameters (F01.19 toF01.21) of the synchronous motor, current loop parameters (F06.12 to F06.15) and counter electromotive force (F01.22) can be obtained during rotary self-learning.

This mode is mainly used when the motor can rotate. However, loads should be avoided or minimized; otherwise, self-learning will have poor effects.

F01.34=13: the motor revolves slowly during encoder self-learning of the synchronous motor.

Prior to the encoder self-learning of the synchronous motor, you must set the motor type (F01.00), motor nameplate parameters (F01.01 to F01.05), encoder type (F01.24) and line count (F01.25) correctly. For rotary transformers, you must set number of pole pairs (F01.30) additionally. Encoder self-learning allows you to acquire the synchronous parameters F01.19 - F01.21, the encoder parameters F01.26 - F01.29, and the current loop parameters F06.12 - F06.15.

Chapter 8 **Protection/Warning Solutions**

8.1 Protection content

When any abnormality occurs to the inverter, the digital keyboard display will show the corresponding protection code and parameters, the protection relay and protection output terminal will work, and the inverter will stop the output. In case of protection, the motor will stop rotating normally or slow down until it is stopped. Protection content and solutions of the EM760 series inverter are shown in the table below.

Table 8-1 Protection Contents and Solutions of EM760 Series Inverter

Protection code	Protection Type	Protection Cause	Protection Solution
E01	Short circuit protection	1. Inter-phase short circuit 2. Short circuit of the external braking resistor. 3. The inverter module is damaged. 4. Short circuit to the ground	1. Check the wiring for short circuits. 2. Investigate the cause and reset the controller after implementing the corresponding solutions. 3. Seek technical support. 4. Check whether the output cable is broken or whether the motor shell is broken down.
E02	Instantaneous overcurrent	1. The acceleration and deceleration time is too short. 2. In the V/F drive mode, the V/F curve setting is unreasonable. 3. The motor is running during startup. 4. The motor used is beyond the capacity of the inverter or the load is too heavy. 5. Motor parameters are not suitable and need to be identified. 6. The phases on the output side of the inverter are short-circuited. 7. The inverter is damaged. 8. Short circuit to the ground	1. Increase the acceleration and deceleration time. 2. Reasonably set the V/F curve. 3. Enable speed tracking or start DC braking. 4. Use the appropriate motor or inverter. 5. Identify the motor parameters. 6. Check the wiring for short circuits. 7. Seek technical support. 8. Check whether the output cable is broken or whether the motor shell is broken down.
E04	Steady-state overcurrent	The same as E02	The same as E02
E05	Overvoltage	1. The deceleration time is too short, and the motor has too much regenerated energy. 2. The braking unit or braking resistor forms an open circuit. 3. The braking unit or braking resistor does not match. 4. The power voltage is too high. 5. The energy consumption braking function is not enabled 6. Short circuit to the ground	1. Increase the deceleration time. 2. Check the wiring of the braking unit and braking resistor. 3. Use a suitable braking unit/braking resistor. 4. Reduce the power voltage to the specified range. 5. For the model of the built-in braking unit, set F15.30 to 1, and enable the energy consumption braking. 6. Check whether the output cable is broken or whether the motor shell is broken down.

E06	Undervoltage	1. The input power supply is subject to phase loss. 2. The terminals of the input power supply are loose. 3. The voltage of the input power supply drops too much. 4. The switch contacts of the input power supply are aging.	1. Check the input power supply and wiring. 2. Tighten the screws of input terminals. 3. Check the air circuit breaker and contactor.
E07	Input phase loss	1. The input power supply is subject to phase loss. 2. The input power supply fluctuates greatly.	1. Check the input power supply. 2. Check the wiring of the input power supply. 3. Check whether the terminal is loose. 4. Use a voltage regulator on the input side.
E08	Output phase loss	1. The output terminals U, V and W have phase losses.	1. Check the connection between the inverter and motor. 2. Check whether the output terminal is loose. 3. Check whether the motor winding is disconnected.
E09	Inverter overload	1. The acceleration and deceleration time is too short. 2. In the V/F drive mode, the V/F curve setting is unreasonable. 3. The load is too heavy. 4. The braking time is too long, the braking intensity is too high, or DC braking is enabled repeatedly.	1. Increase the acceleration and deceleration time. 2. Reasonably set the V/F curve. 3. Use the inverter that matches the load. 4. Reduce the braking time and braking intensity. Do not enable DC braking repeatedly.
E10	Inverter overheat	1. The ambient temperature is too high. 2. The inverter is subject to poor ventilation. 3. The cooling fan fails.	1. The operating environment of the inverter should meet the specifications. 2. Improve the ventilation environment and check whether the air duct is blocked. 3. Replace the cooling fan.
E11	Parameter setting conflict	1. There is a logic conflict in parameter settings.	1. Check whether parameters set is illogical before the protection.
E12	Motor overheat	1. The temperature measured by the motor temperature sensor is greater than the set threshold. 2. The motor temperature sensor is disconnected. 3. Excess environment temperature. 4. The load is too heavy.	1. Check whether the thermal protection threshold of the motor is appropriate. 2. Check whether the sensor is disconnected. 3. Strengthen the heat dissipation of the motor. 4. The motor model is not suitable.
E13	Motor overload	1. The acceleration and deceleration time is too short. 2. In the V/F drive mode, the V/F curve setting is unreasonable. 3. The load is too heavy.	1. Increase the acceleration and deceleration time. 2. Reasonably set the V/F curve. 3. Use a motor matching the load.
E14	External protection	1. The protection terminal of the external device acts.	1. Check the external device.
E15	Inverter memory protection	1. Interference results in memory reading and writing errors. 2. The internal memory of the controller is read and written repeatedly, causing damage to the	1. Press the STOP key for resetting and retry. 2. For the parameters (e.g. frequency setting) to be modified frequently, set F10.56 to 11 after debugging.

		memory.	
E16	Communication error	1. Communication timeout is enabled in the discontinuous communication system. 2. Communication is disconnected.	1. F10.03 is set to 0.0 in the discontinuous communication system. 2. Adjust the F10.03 communication timeout. 3. Check whether the communication cable is disconnected.

E17	Abnormality of inverter temperature sensor	The inverter temperature sensor is disconnected or short-circuited.	1. Seek technical support.
E18	The soft start relay is not engaged.	1. The wiring gets loose. 2. The soft start relay fails.	1. Check the inverter wiring. 2. Seek technical support.
E19	Error of current detection circuit	The detection circuit of the drive board or control board is damaged.	1. Seek technical support.
E20	Stall protection	1. The deceleration time is too short. 2. Error of dynamic brake for deceleration. 3. The load is too heavy.	1. Increase the deceleration time. 2. Check the dynamic brake. 3. Check whether the motor cannot be stopped as it is driven by another load.
E21	PID feedback disconnection	1. The PID feedback is greater than the upper limit (F09.24) or less than the lower limit (F09.25), depending on the type of the feedback sensor.	1. Check whether the feedback line falls off. 2. Check whether the sensor is working abnormally. 3. Adjust the detection value of feedback disconnection to a reasonable level.
E22	Encoder fault	1. The encoder is not properly wired. 2. The PG card is not installed properly. 3. The PG card selected is not of the right type. 4. The encoder is damaged. 5. There is on-site interference.	1. Check the wiring of the PG card and encoder. 2. Check whether the PG card is inserted properly. 3. Check the PG card type selected. 4. Replace the encoder. 5. Take electromagnetic compatibility measures (e.g. use of magnetic ring) for the inverter output cable.
E23	Keyboard memory fails	1. Interference results in memory reading and writing errors. 2. The memory is damaged.	1. Press the STOP key for resetting and retry. 2. Seek technical support.
E24	Self-identification error	1. Press the STOP key during parameter identification. 2. The external terminal stops working (FRS = ON) properly during parameter identification. 3. The motor is not connected. 4. The rotary self-learning motor is not disconnected from the load. 5. The motor fails.	1. Press the STOP key for resetting. 2. The external terminal should not be operated during parameter identification. 3. Check the connection between the inverter and motor. 4. Disconnect the rotary self-learning motor from the load. 5. Check the motor.
E25	Moter overspeed protection	1. PG card is not connected 2. Encoder line count F01.25 is not properly set 3. AB phase sequence F01.27 is incorrect 4. Excessive load results in greater motor speed than the given inverter speed or reverse rotation of the motor	1. Connect the PG card or switch to V/F control 2. Set the encoder line count according to the encoder instructions 3. Exchange the A and B phase wiring of the encoder. 4. Reduce the load or replace with an inverter and motor of the immediately greater power.
E26	Load loss protection	1. The motor is not connected or does not match the load. 2. Load loss occurs. 3. The parameters of load loss protection are not set reasonably.	1. Check the wiring and use the appropriate motor 2. Check the equipment. 3. Change the off-load detection level F07.22 and detection time F07.23.

E27	Up to cumulative power-on time	1. The inverter maintenance time is up.	1. Contact the dealer for technical support.

E28	Up to cumulative running time	1. The inverter maintenance time is up.	1. Contact the dealer for technical support.
E43	Material cutoff protection	1. When the external signal is detected, the external signal terminal is closed. 2. During automatic detection, the feedback is greater than the upper voltage limit or less than the lower voltage limit.	1. When disconnection occurs upon startup, reduce the initial feedforward and the soft start feedforward gain. 2. When oscillation disconnection occurs during operation, change the proportion P. 3. Check whether it is caused by loose connection of the sensor.
E44	Wiring protection	1. The valid time of the wiring detection terminal is too long. 2. The invalid time of the wiring detection terminal is too long.	1. Check whether the sensor can work normally. 2. Check whether the terminal is capable of properly judging the closing and opening.
E57	Overpressure in pipeline network	1. The feedback pressure in the water supply application is too high.	1. Check whether the sensor is in the abnormal status. 2. Check whether the analog input terminal can be normal. 3. Check the external device.
E76	The output is short-circuited to ground.	1. The output is short-circuited to ground. 2. The inverter module is damaged.	1. Check whether the output cable is broken or whether the motor shell is broken down. 2. Investigate the cause and reset the controller after implementing the corresponding solutions. 3. Seek technical support.
E81	Encoder line count fault	1. An incorrect encoder line count is set. 2. The motor encoder is improperly wired	1. Check the motor wiring line count for correctness. 2. Check the motor encoder wiring for correctness.
C30	No PG card is detected	1. F00.01 is set to 2, but no PG card is inserted	1. When closed-loop control is used, please insert corresponding encoder PG card
C31	Two absolutely identical cards	1. Two absolutely identical cards are inserted in the card slots	1. Please check whether a wrong card is inserted
C32	Two cards of the same type	1. Two cards of the same type are inserted in the card slots; for example, both are PG cards or communication cards	1. Please check whether a wrong card is inserted

When the inverter is subject to the aforesaid protection, press the STOP key STOP to reset/clear protection or use the protection resetting terminal to exit the protection status. If the protection has been eliminated, the inverter will return to the function setting status; otherwise, the digital tube will continue to display the current protection information.

The protection number corresponds to the digit behind the letter “E”. For example, the digit corresponding to “EXX” is “XX”.

For example, E01 corresponds to 1, and E10 corresponds to 10.

8.2 Protection analysis

If the motor does not work as expected due to errors in function setting and external control terminal connection after the inverter is powered on, refer to the analysis in this section for the corresponding solutions. If a protection code is displayed, see the solution in 9.1.

8.2.1 Failure in parameter setting of function codes

- The displayed parameters remain unchanged during the forward or reverse spinning of the digital potentiometer.

  When the inverter is in the running status, some code parameters cannot be modified without stopping the inverter.

- The displayed parameters can be modified but cannot be stored during the forward or reverse spinning of the digital potentiometer.

  Some function codes are locked and cannot be modified.

When F12.02 is set to 1 or 2, parameter changes are restricted. Please set F12.02 to 0. Or, this occurs after the user password is set.

8.2.2 Abnormality of motor rotation

- When the RUN key 

 on the keyboard is pressed, the motor does not rotate.
  - Terminal control of the start and stop: Check the setting of the function code F00.02.
  - The free stop terminal FRS and COM are closed: Disconnect the free stop terminal FRS from COM.
  - Switching of the running command to terminal is valid. In this case, the running command is only subject to terminal control. This will be invalid if modified.
  - The status combination of the running command channel is terminal control: Change it to keyboard control.
  - The reference input frequency is set to 0: Increase the reference input frequency.
  - The input power supply is abnormal or the control circuit fails.
- The control terminals RUN and F/R are ON, and the motor does not rotate.
  - Enabling of the stop function by the external terminal is invalid: Check the setting of function code F00.02.
  - Free stop terminal FRS=ON: Change the free stop terminal to FRS=OFF.
  - Control switch failure: Check the control switch.
  - The reference input frequency is set to 0: Increase the reference input frequency.
- The motor can only rotate in one direction.

Reverse running is prohibited: When the reverse running prohibition code F00.21 is set to 1, the inverter is not allowed for reverse running.

- The motor rotates in the opposite direction.

The output phase sequence of the inverter is inconsistent with the input phase sequence of the motor: Exchange any two of the motor wires in the power-off status to change the rotation direction of the motor.

8.2.3 Too long acceleration time of motor

- The current limit level is too low.

When the overcurrent limit setting is valid, and the output current of the inverter reaches the set current limit, the output frequency will remain unchanged during acceleration, until the output current is less than the limit. Then the output frequency will continue to rise. This makes the acceleration time of the motor longer than the set time. Check whether the set current limit of the inverter is too low.

- The set acceleration time is too long. Please check the acceleration time code.

8.2.4 Too long deceleration time of motor

- When energy consumption braking is valid:
  - ■ The resistance of the braking resistor is too high, and the energy consumption braking power is too low, which extends the deceleration time.
  - ■ The set value of braking rate (F15.32) is too small, which extends the deceleration time. Increase the set value of braking rate.
  - ■ The set deceleration time is too long. Check the deceleration time code.
- When the stall protection is valid:
  - ■ When the overvoltagestall protection is enabled, and the DC bus voltage exceeds the voltage of overvoltage stall (F07.07), the output frequency will remains unchanged; and when the DC bus voltage is lower than F07.07, the output frequency will continue to drop, which extends the deceleration time.
  - ■ The set deceleration time is too long. Check the deceleration time code.

8.2.5 Electromagnetic interference and RF interference

- Since the inverter works in the high-frequency switching status, electromagnetic interference and RF interference will be generate to the control device. The following measures can betaken.
  - ■ Reduce the carrier frequency (F00.23) of the inverter.
  - ■ Install a noise filter on the input side of the inverter.
  - ■ Install a noise filter on the output side of the inverter.
  - ■ Install a metal tube outside the cables. Install the inverter in a metal casing.
  - ■ Make the inverter and motor grounded reliably.
  - ■ Connect the main circuit and control circuit separately. Use the shielded cables in the control circuit, and connect them according to the wiring method in Chapter 3.

8.2.6 Action of leakage circuit breaker

- When the inverter is running, the leakage circuit breaker works.

Since the inverter outputs high-frequency PWM signals, a high-frequency leakage current will be generated. Please use the dedicated leakage circuit breaker with the current sensitivity above 30 mA. If an ordinary leakage circuit breaker is used, use a leakage circuit breaker with the current sensitivity above 200 mA and action time of more than 0.1 s.

8.2.7 mechanical vibration

- The inherent frequency of the mechanical system resonates with the carrier frequency of the inverter.

The motor is not faulty, but the mechanical system produces sharp resonant sounds. This is caused by the resonation between the inherent frequency of the mechanical system and carrier frequency of the inverter. Please adjust the carrier frequency (F00.23) to avoid resonation.

- The inherent frequency of the mechanical system resonates with the output frequency of the inverter.

Resonation between the inherent frequency of the mechanical system and output frequency of the inverter will lead to mechanical noise. Please use the vibration suppression function (F05. 13), or install the anti-vibration rubber or take other anti-vibration measures on the motor base.

- PID control oscillation

The adjustment parameters P, Ti and Td of the PID controller are not set correctly. Please set the PID parameters again.

8.2.8 Motor rotation in the absence of inverter output

- Insufficient DC braking for stop
  - ■ The DC braking torque for stop is too small. Please increase the set value of the DC braking current for stop (F04.21).
  - ■ The DC braking time for stop is short. Please increase the set value of the DC braking time for stop (F04.22). Under normal circumstances, please give priority to increase in the DC braking current for stop.

8.2.9 Inconsistency between output frequency and set frequency

- The set frequency exceeds the upper frequency limit.

When the set frequency exceeds the set value of the upper frequency limit, the output frequency will be the upper frequency limit. Set the frequency again within the upper frequency limit range; or check whether F00.16, F00.17 and F00.18 are appropriate.

Maintenance

8.3 Daily Maintenance of Inverter

The inverter maybe subject to various faults due to changes in its operating environment, such as the impact of temperature, humidity, smoke, dust and the like, and ageing of internal components. Thus, daily inspection and regular maintenance should be carried out to the inverter during storage and operation.

- Check whether the components of the inverter are intact and whether the screws are tightened after transportation and before operation.
- During the normal operation of the inverter, clean dust on a regular basis and check whether the screws are tightened.
- If the inverter is not in use for a long time, it is recommended to power it on (preferably 30 min) once every six months during storage, to prevent the failure of electronic components.
- The inverter should not be used in the humid place or place with metal dust. If necessary, use the inverter in an electrical cabinet with protective measures or an on-site protective cabin.

Please check the following items during the normal operation of the inverter:

- Check the motor for abnormal sound and vibration.
- Check the inverter and motor for abnormal heating.
- Check whether the ambient temperature is too high.
- Check whether the output current is normal.
- Check whether the cooling fan of the inverter works properly.

Depending on the usage, the user needs to check the inverter on a regular basis to eliminate faults and safety hazards. Prior to the inspection, turnoff the power supply and wait until the LED indicator of the keyboard is OFF, and then wait for 10min. The check content is shown in the table below.

Table 8-2 Content of regular inspection

Check Item	Check Content	Solution
Screws of main circuit terminals and control circuit terminals	Check whether the screws are loose.	Tighten the screws with a screwdriver.
Cooling fins	Check whether there is dust or foreign objects.	Purge them with dry compressed air (pressure: 4-6 kg/cm^2).
PCB (printed circuit board)		
Cooling fan	Check it for abnormal noise and vibration. Check whether the cumulative running time is up to 20,000 hours.	Replace the cooling fan
Power components	Check whether there is dust.	Purge them with dry compressed air (pressure: 4-6 kg/cm^2).
Electrolytic capacitor	Check it for color changes, odor and bubbles.	Replace the electrolytic capacitor.

In order to make the inverter work properly in along time, regular maintenance and replacement must be performed regularly based on the service life of its internal components. The service life of the components of the inverter varies depending on the operating environment and conditions. The replacement period of the inverter in the table below is for reference only.

Table 8-3 Replacement Intervals of Inverter Components

Name of Part	Standard Replacement Interval (Year)
Cooling fan	2-3 years
Electrolytic capacitor	4-5 years
Printed circuit board	5-8 years

The operating conditions for replacement of the inverter components listed in the above table are as follows:

Ambient temperature: Annual average 30℃.

Load factor: Less than 80%.

Operating time: less than 12 hours per day.

8.4 Instructions for Inverter Warranty

Our company will provide warranty services for the inverter in the following cases.

The warranty applies to the inverter body only. Our company is responsible for the warranty of the inverter that fails or is damaged within 12 months during normal operation, and will charge reasonable maintenance fees after 12 months.

Certain maintenance fees will also be charged within one year in the following cases:

- The inverter is damaged due to noncompliance with the instructions in this manual during operation;
- The inverter is damaged due to flood, fire, abnormal voltage, etc.;
- The inverter is damaged as a result of incorrect wiring;
- The inverter is damaged due to unauthorized modification;

Relevant service fees will be calculated based on the actual costs.
If any, the additional agreement shall prevail.

Chapter 9 **Select accessories**

9.1 Braking Resistor

If the speed of the controlled motor drops too fast or the motor load shakes too fast during the inverter operation, its electromotive force will charge the internal capacitor reversely via the inverter, resulting in the voltage boost at two ends of the power module. This is likely to cause damage to the inverter. The internal control of the inverter will suppress this based on the load. If the braking performance does not meet the customer requirements, an external braking resistor is needed to release energy in a timely manner. Due to the external braking resistor of energy consumption braking type, the energy will be completely dissipated to the power braking resistor. Hence, the power and resistance of the braking resistor must be selected reasonably and effectively.

The power of the braking resistor can be calculated by the following formula:

Resistor power Pb = inverter power P ×braking frequency D

D - Braking frequency. This is an estimated value, depending on the load conditions. Under normal circumstances, D is as follows:

D=10% under ordinary loads

D=5% for occasional braking loads

D = 10% to 15% for elevators

D = 5% to 20% for centrifuges

D = 10% to 20% for oilfield kowtow machines

D = 50% to 60% for unwinding and winding. It should be calculated based on the system design indicators.

D = 50% to 60% for lifting equipment with a lowering height over 100m

The recommended power and resistance for the braking resistor of the EM760 series inverter are given in the table below. The recommended resistor power is calculated based on the braking rate (10% to 20%). It is for reference only. If the inverter is used in the case of frequent acceleration/deceleration or continuous braking, the power of the braking resistor needs to be increased. The user can change the value according to the load conditions, but within the specified range.

Table 9-1 Selection of braking resistors

Inverter Model	Motor (kW)	Resistance (Ω)	Resistor Power (W)	Wire connected to resistor (mm^2)
EM760-0R7-3B	0.75	≥360	≥200	1
EM760-1R5-3B	1.5	≥180	≥400	1.5
EM760-2R2-3B	2.2	≥180	≥400	1.5
EM760-4R0-3B	4	≥90	≥800	2.5

EM760-5R5-3B	5.5	≥60	≥1000	4
EM760-7R5-3B	7.5	≥60	≥1000	4
EM760-011-3B	11	≥30	≥2000	6
EM760-015-3B	15	≥30	≥2000	6
EM760-018-3B	18.5	≥30	≥2000	6
EM760-022-3B	22	≥15	≥4000	6
EM760-030-3B	30	≥10	≥4000	6
EM760-037-3B	37	≥10	≥6000	6
EM760-018-6B	18.5	≥30	≥4000	6
EM760-022-6B	22	≥30	≥4000	6
EM760-030-6B	30	≥30	≥4000	6
EM760-037-6B	37	≥30	≥6000	6
EM760-045-6B	45	≥30	≥6000	6
EM760-055-6B	55	≥30	≥8000	6
EM760-075-6B	75	≥30	≥8000	6

* The wires listed above refer to the outgoing wires of a single resistor. If resistors are connected in parallel, the bus should be enlarged accordingly. For models of single/three-phase 220 V conductors, cable withstand voltage should be higher than AC300V; for models of three-phase 380 V, AC450V; and for models of three-phase 660 V, AC1000V, with temperature resistance of over 105°C.

9.2 Braking unit

EM760 series inverters (EM760-045-3, EM760-090-6 and above) should be used in combination with our BR100 series braking units (power range: 18.5 - 500kW). The models of our braking units are as follows.

Table 9-2 Description of braking unit

Model and specification	Application	Minimum Resistance (Ω)	Average Braking Current I_{av}(A)	Peak Current I_{max}(A)	Applicable Inverter Power **(kW)**
BR100-045	Energy consumption braking	10	45	75	18.5~45
BR100-160	Energy consumption braking	6	75	150	55~160
BR100-200	Energy consumption braking	5	100	200	185~200
BR100-315	Energy consumption braking	3	120	300	220~315
BR100-400	Energy consumption braking	3	200	400	355~400
BR100-400	Energy consumption braking	3	200	400	355~400
BR100-500	Energy consumption braking	3	250	450	450~500
BR100-450-6	Energy	3	250	450	110~450

	consumption braking				

When BR100-160~500 and BR100-450-6 work with the minimum resistance, the braking unit can work continuously at the braking frequency D=33%.

* In the case of D>33%, the braking unit will work intermittently. Otherwise, an over-temperature protection fault will occur.

9.2.1 Selection of Connecting Wires

Since all braking units and braking resistors work at high voltage (>400VDC) and in the discontinuous status, please select appropriate wires. See Table 9-3 for the wiring specifications of the main circuit. Use the cables with the conforming insulation levels and cross-sections.

Table 9-3 Wire Specifications of Braking Units and Braking Resistors

Specification and model	Average Braking Current I_{av}(A)	Peak Braking Current I_{max}(A)	Cross-section (mm^2) of Copper-core Cable
BR100-045	45	75	10
BR100-160	75	150	16
BR100-200	100	200	25
BR100-315	120	300	25
BR100-400	200	400	35
BR100-500	250	450	35
BR100-450-6	250	450	35

Flexible cables have higher flexibility. Because cables maybe in contact with high-temperature devices, it is recommended to use copper-core and heat-resistant flexible cables or flame-retardant cables. The braking unit should be close to the inverter as much as possible and no more than 2m far away from the inverter. Otherwise, the DC-side cables should be twisted and used with magnetic rings to reduce radiation and inductance.

The lengths of connecting wires of the braking unit, braking resistor and inverter are shown in Fig. 9-1.

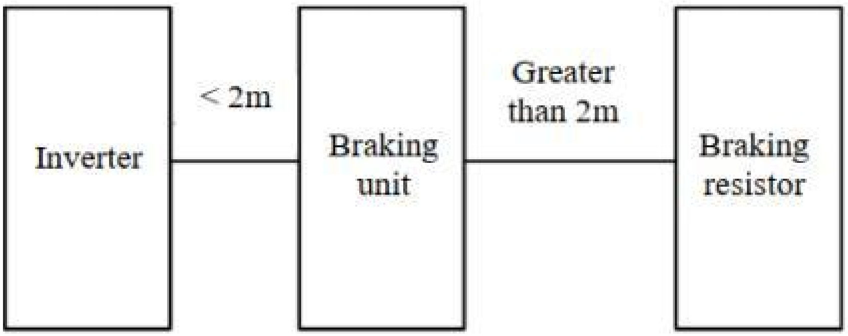


Fig. 9-1 Wire Length

9.3 Multi-functional IO expansion card

9.3.1 EM760-IO-A1

Item	Specifications	Description
Input	3-channel multi-functional digital inputs	X8, X9, X10
	4-channel analog voltage signal input	Voltage input of -10V~+10V and PT100/PT1000/KTY84/PTC temperature sensors are supported. Upon connection to corresponding control terminal based on the type of the motor temperature sensor, select corresponding type of sensors through F07.03. PT100/PT1000 sensors require short-circuit cap for PT model selection.

Output	2-channel relay output	R3: RA3-RC3 are normally open R4: RA4-RC4 are normally open

Instructions on mechanical installation

- Please install/remove the IO card only when the inverter is safely powered off.
- Please remove the screw of the IO card bracket of the inverter, and install either screw 1 or 2 as shown in the installation diagram.
- Please install the copper pillar supplied with the IO card to the position of the screw, and install the fixing screw for the IO card.

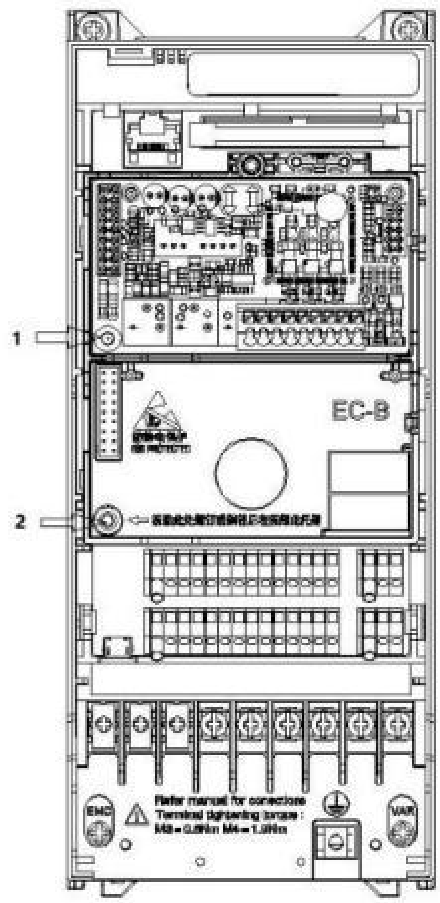
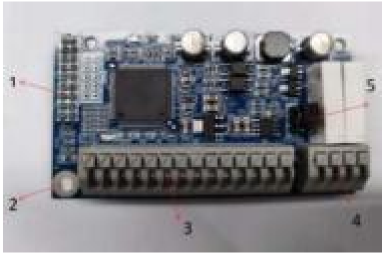
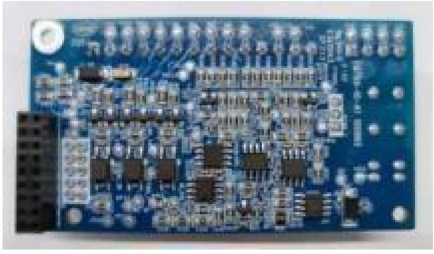


Fig. 9-2 Installation diagram of IO expansion card

- **The picture of the real product is shown below**



Front



Back

Fig. 9-3 Picture of areal IO expansion card

1. Inverter interface
2. Screw positioning holes
3. Input terminal
4. Relay terminal
5. Select short-circuit cap for PT temperature sensor

Description of extension terminal functions

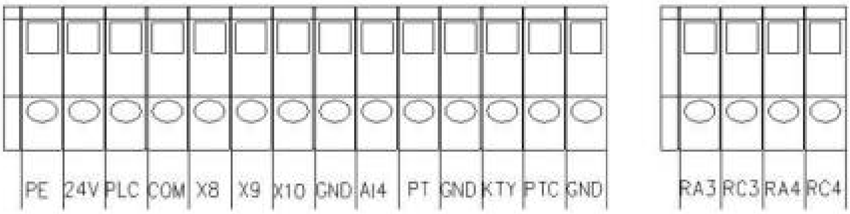


Fig. 9-4 Terminal of IO expansion card

Table 9-4 Terminal functions of IO expansion card

Category	Terminal label	Terminal name	Terminal function description
Auxiliary power supply	24V-COM	+24V power supply	To supply working power to digital I/O terminal
	PLC	Multi-functional common input terminal	Delivery with default connection to 24V When an external power source drives the digital input terminal, it is required to disconnect the 24V terminal and connect the external power source
Digital input port	X8-COM	Multi-function input terminal 8	Optocoupler isolation, compatible with NPN and PNP bipolar input Input impedance: 4kΩ Input voltage range: 9-30V The installation method is the same as Fig. 3-7 (Wiring of Multi-function Output Terminals) in the User's Guide for EM760 series high-performance vector inverters.
	X9-COM	Multi-function input terminal 9	
	X10-COM	Multi-function input terminal 10	
Relay output	R3: RA3-RC3	Relay output terminal	RA3-RC3: normally open
	R4: RA4-RC4		RA4-RC4: normally open

Analog input	AI4-GND	Analog input terminal 4	Input voltage range: DC -10~10V/0~10V, optional for selection by using function code F02.65
	PT-GND	Temperature sensor input	PT100/PT1000 temperature sensor input. First, select PT model via the short-circuit cap, and then make selection through the function code F07.03.
	PTC-GND	Temperature sensor input	PTC-130/150 temperature sensor input, selected through the function code F07.03.
	KTY-GND	Temperature sensor input	KTY84-130/150 temperature sensor input, selected through the function code F07.03.
Shield	PE	Shield earthing	Used for earthing of the terminal wiring shielding layer

9.4 Encoder expansion card (PG card)

9.4.1 PG card (EM760-PG-OD1) of open-collector (differential) encoder

Specification and model	Description	Encoder interface
EM760-PG-OD1	It can be used with differential (line drive) output encoder, open collector output encoder and push-pull complementary output encoder. Encoders with a rated voltage of 5 V and 12 V (5 V by default) are supported.	9PIN wiring terminal

Instructions on mechanical installation:

- Please install/remove the PG card only when the inverter is safely powered off.
- Please remove the screw of the PG card bracket of the inverter, and install either screw 1 or 2 as shown in the installation diagram.
- Please install the copper pillar supplied with the PG card to the position of the screw, and install the fixing screw for the PG card.
- Please set the direction of the DIP switch as per the rated voltage of the encoder.

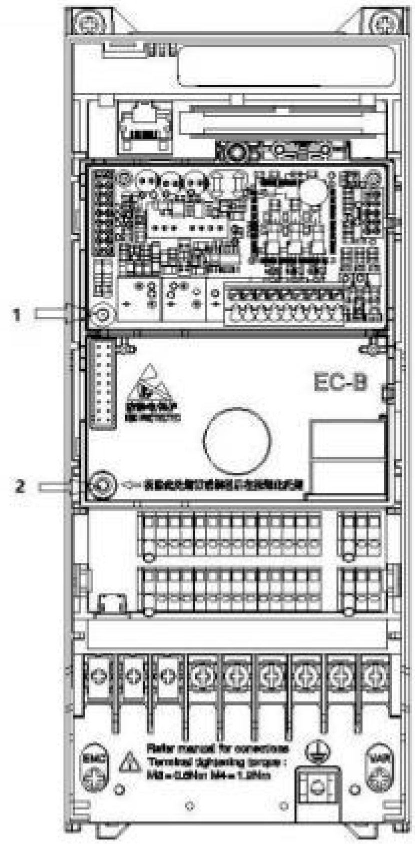


Fig. 9-5 Installation diagram of PG card

Fig. 9-6 Open collector (differential) PG card - real product

Specifications and definitions of wiring terminal signals

Table 9-5 PG card (EM760-PG-OD1) terminal signals

S.N.	Terminal signals	Description
1	PE	Grounding signal
2	VP	Power output voltage: 5V±5% or 12V±5% (selected via the DIP switch) Maximum output current: 200mA
3	0V	Common port of power supply and signals
4	A+	Encoder signal input, max. response frequency 100 kHz
5	A-	
6	B+	
7	B-	
8	Z+	
9	Z-	

Instructions on terminal wiring:

- Please set the direction of the DIP switch as per the rated voltage of the encoder so that the VCC port of the PG card outputs corresponding voltage.
- When the NPN type OC-gate output encoder is employed, the encoder signal is connected to the press-fit terminal (A-, B-, and Z-).
- When the PNP type OC-gate output encoder is employed, the encoder signal is connected to the press-fit terminal (A+, B+, and Z+).
- When the differential or push-pull complementary output encoder is employed, connect corresponding signal line to the PG card terminal directly.

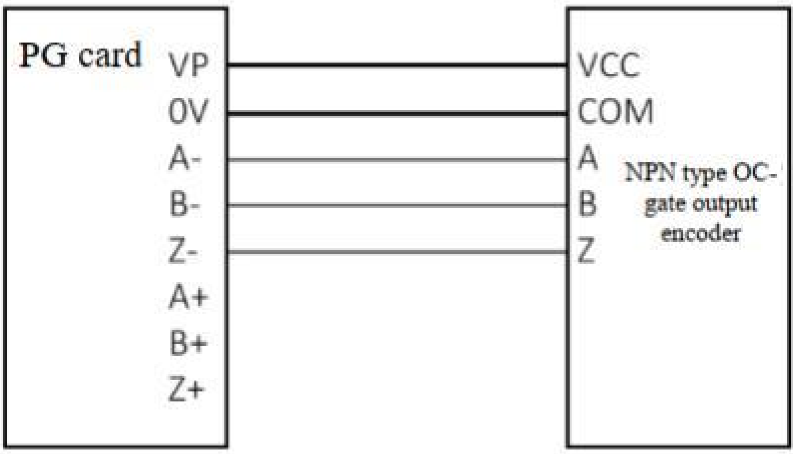


Fig. 9-7 Use of NPN type OC-gate output encoder

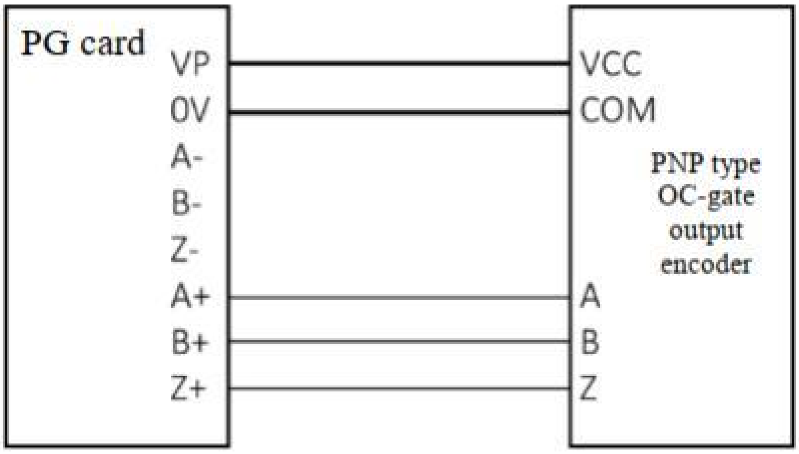


Fig. 9-8 Use of PNP type OC-gate output encoder

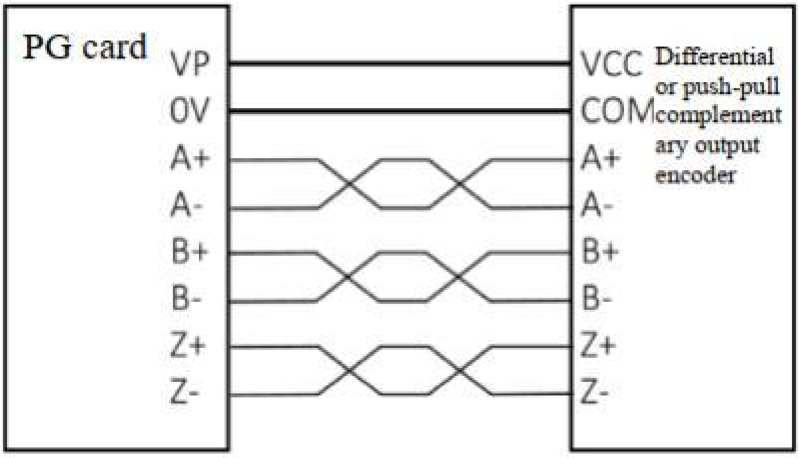


Fig. 9-9 Use of Differential or push-pull complementary output encoder

9.4.2 PG card with divided frequency (EM760-PG-OD2) of open-collector (differential) encoder

Specification and model	Description	Encoder interface
EM760-PG-OD2	It can be used with differential (line drive) output encoder, open collector output encoder, push-pull complementary output encoder, and has the function of frequency dividing output. Its output is the NPN open collector output. Encoders with a rated voltage of 5 V and 12 V (5 V by default) are supported.	Input: 9-pin press-fit wiring terminal Output: 4-pin press-fit wiring terminal

Instructions on mechanical installation:

- Please install/remove the PG card only when the inverter is safely powered off.
- Please remove the screw of the PG card bracket of the inverter, and install either screw 1 or 2 as shown in the installation diagram.
- Please install the copper pillar supplied with the PG card to the position of the screw, and install the fixing screw for the PG card.
- Please set the direction of the DIP switch as per the rated voltage of the encoder.

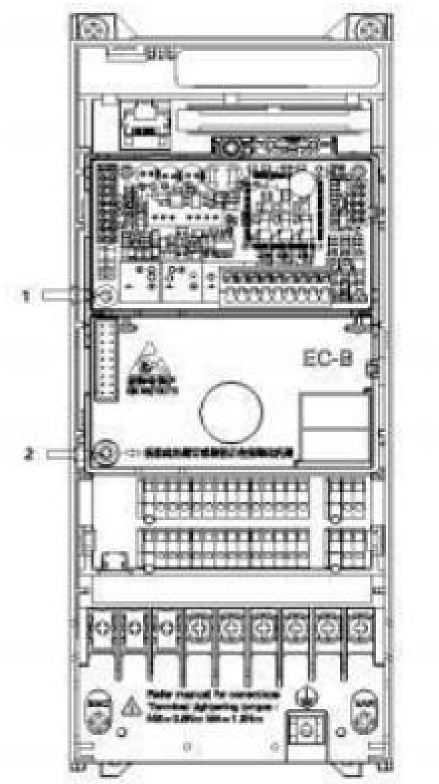


Fig. 9-10 Installation diagram of PG card

Fig. 9-11 Open collector (differential) PG card with frequency dividing - real product

Specifications and definitions of wiring terminal signals

Table 9-6 Frequency-dividing PG card (EM760-PG-OD2) - terminal signal instructions

S.N.	Terminal signals	Description
1	PE	Grounding signal
2	VP	Power output voltage: 5V±5% or 12V±5% (selected via the DIP switch) Maximum output current: 200mA
3	0V	Common port of power supply and signals
4	A-	Encoder signal input, max. response frequency 300 kHz
5	B-	
6	Z-	
7	A+	
8	B+	
9	Z+	

10	AO	Frequency-dividing output signals, OC (NPN type open collector) output
11	BO	
12	ZO	
13	COM	Common port of signals

Instructions on terminal wiring:

- Please set the direction of the DIP switch as per the rated voltage of the encoder so that the VCC port of the PG card outputs corresponding voltage.
- When the NPN type OC-gate output encoder is employed, the encoder signal is connected to the press-fit terminal (A-, B-, and Z-).
- When the PNP type OC-gate output encoder is employed, the encoder signal is connected to the press-fit terminal (A+, B+, and Z+).
- When the differential or push-pull complementary output encoder is employed, connect corresponding signal line to the PG card terminal directly.

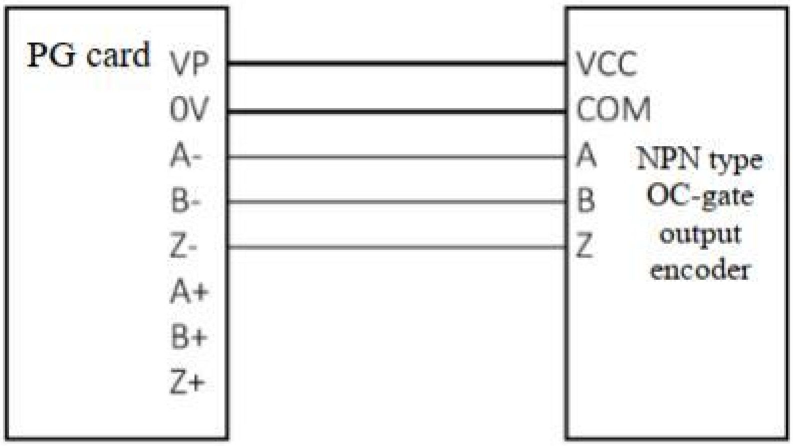


Fig. 9-12 Use of NPN type OC-gate output encoder

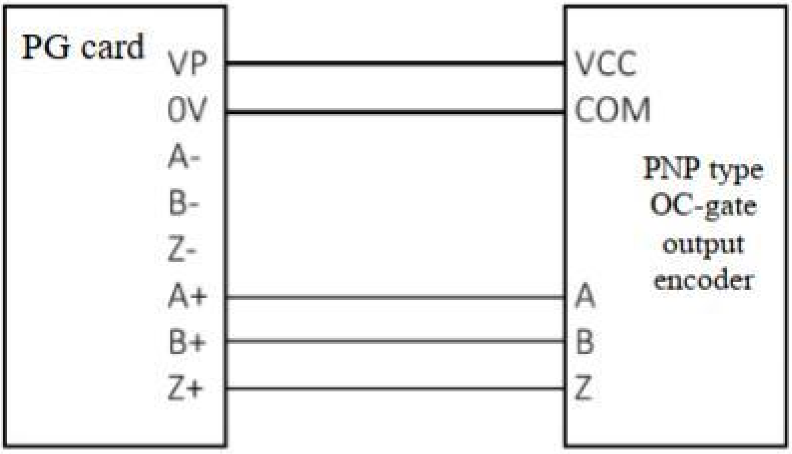


Fig. 9-13 Use of PNP type OC-gate output encoder

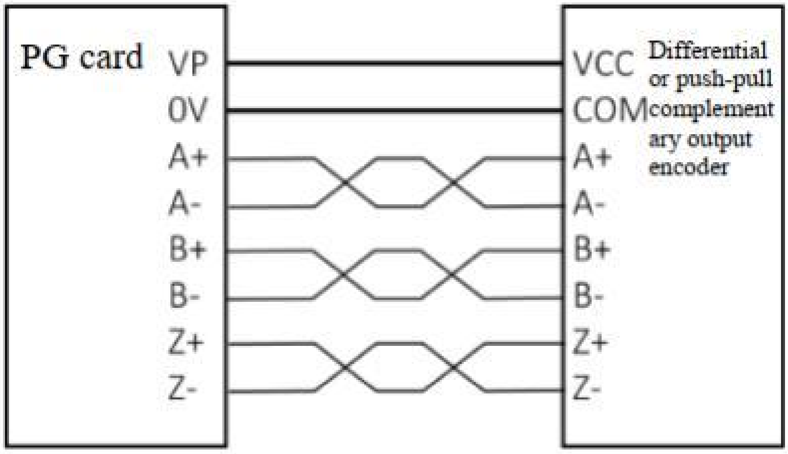


Fig. 9-14 Use of Differential or push-pull complementary output encoder

Instructions of frequency-dividing PG card:

Upon proper installation of the PG card and power-on of the machine, the user can access the parameter sets F15.48 and F15.49 via the function code from the keyboard to specify the desired frequency divide-by-value. Frequency division of up to 256 and down to none can be secured.

Table 9-7 Setting codes of Frequency-dividing PG card functions:

Function code	Function codename	Parameter description	Unit	Default setting	Attribute
F15.48	Divided frequencies of encoder	1~256		1	●
F15.49	High-frequency filtering coefficient of PG card	0~255		0	●

9.4.3 UVW differential encoder PG card (EM760-PG-U1)

Specification and model	Description	Encoder interface
EM760-PG-U1	UVW differential input PG card	15PIN wiring terminal

Instructions on mechanical installation:

- Please install/remove the PG card only when the inverter is safely powered off.
- Please remove the screw of the PG card bracket of the inverter, and install either screw 1 or 2 as shown in the installation diagram.
- Please install the copper pillar supplied with the PG card to the position of the screw, and install the fixing screw for the PG card.

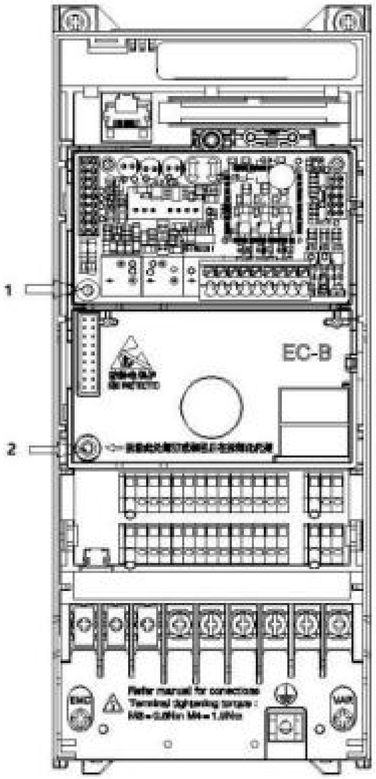


Fig. 9-15 Installation diagram of PG card

Fig. 9-16 UVW differential PG card - real product

Specifications and definitions of wiring terminal signals

Table 9-8 PG card (EM760-PG-U1) terminal signals

S.N.	Terminal signals	Description
1	PE	Grounding signal
2	5V	Power output voltage: 5V±5%; Maximum output current: 200mA
3	0V	Power grounding terminal
4	A+	Encoder signal input, differential input Amplitude of differential signals ≤ 7 V, maximum response frequency 300 kHz
5	A-	
6	B+	
7	B-	
8	Z+	
9	Z-	
10	U+	
11	U-	
12	V+	
13	V-	
14	Z+	
15	Z-	

Instructions on terminal wiring:

When the differential output encoder is employed, connect corresponding signal line to the PG card terminal directly.

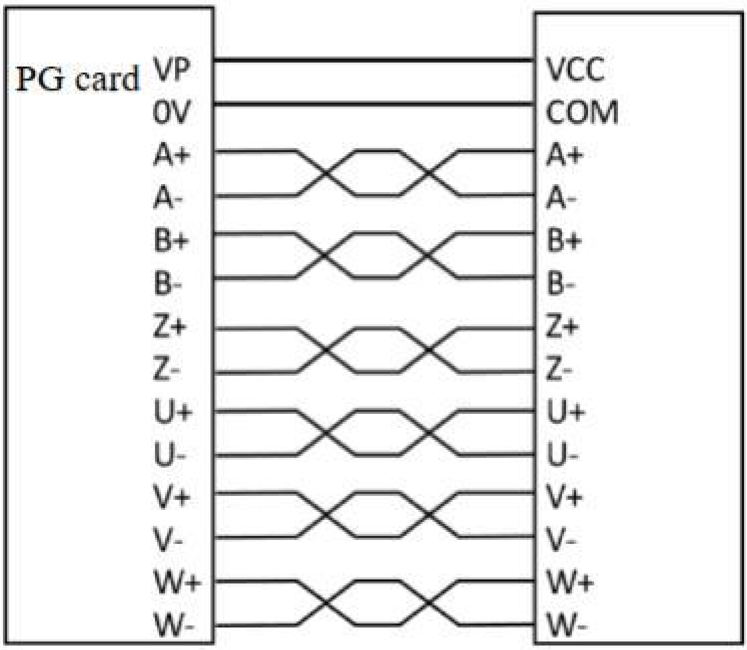


Fig. 9-17 Use of differential output encoder

9.4.4 Rotary transformer PG card (EM760-PG-R1)

Specification and model	Description	Encoder interface
EM760-PG-R1	Rotary transformer PG card	Input: 8-pin press-fit wiring terminal Output: 4-pin press-fit wiring terminal

Instructions on mechanical installation:

- Please install/remove the PG card only when the inverter is safely powered off.
- Please remove the screw of the PG card bracket of the inverter, and install either screw 1 or 2 as shown in the installation diagram.
- Please install the copper pillar supplied with the PG card to the position of the screw, and install the fixing screw for the PG card.

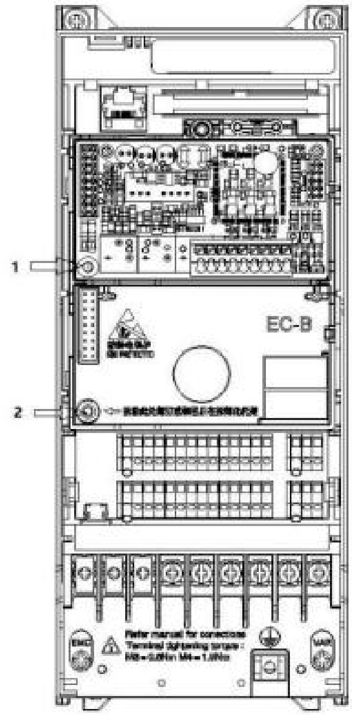


Fig. 9-19 Installation diagram of PG card Fig. 9-20 Rotary transformer PG card - real product

Specifications and definitions of wiring terminal signals

Table 9-9 PG card (EM760-PG-R1) terminal signals

S.N.	Terminal signals	Description
1	PE	Grounding signal
2	N/A	N/A
3	SIN+	Feedback signals of rotary transformer 3.5±0.175 Vrms, 10 kHz
4	SIN-	
5	COS-	
6	COS+	
7	EXC+	Excitation signals of rotary transformer 7Vrms, 10kHz
8	EXC-	
10	A0	OC (NPN type open collector) output
11	B0	
12	Z0	
13	GND	Common port of signals

9.4.5 Sincos encoder PG card (EM760-PG-S1)

Specification and model	Description	Encoder interface
EM760-PG-S1	It can be used with SinCos encoders.	16PIN wiring terminal

Instructions on mechanical installation:

- Please install/remove the PG card only when the inverter is safely powered off.
- Please remove the screw of the PG card bracket of the inverter, and install either screw 1 or 2 as shown in the installation diagram.
- Please install the copper pillar supplied with the PG card to the position of the screw, and install the fixing screw for the PG card.

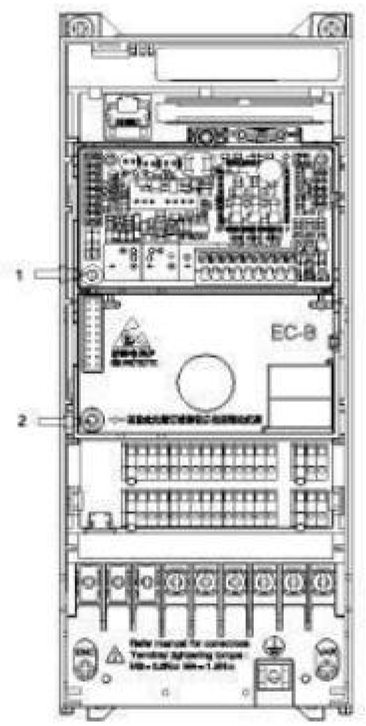


Fig. 9-21 Installation diagram of PG card

Fig. 9-22 SinCos PG card - real product

Specifications and definitions of wiring terminal signals

Table 9-10 SinCos PG card (EM760-PG-S1) terminal signals

S.N.	Terminal signals	Description
1	PE	Ground terminal
2	VP	Power output voltage: 5V±5% Maximum output current: 300mA

3	GND	Common port of power supply and signals
4	A+	Analog differential signal input of SinCos encoder
5	A-	
6	B+	
7	B-	
8	C+	
9	C-	
10	D+	
11	D-	
12	R+	
13	R-	
14	AO	Outputs pulse signals, open collector output
15	BO	
16	GND	Common port of signals

9.5 Expansion card for communication

9.5.1 CANopen communication card (EM760-CM-C1)

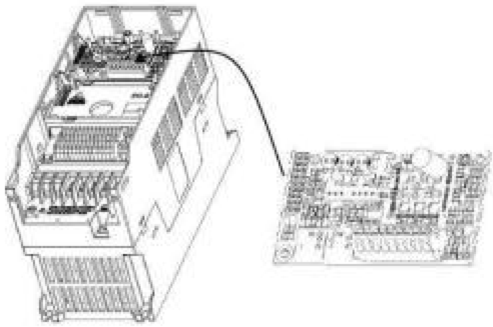
Instructions on mechanical installation:

Connection between EM760-CM-C1 communication card and inverter:

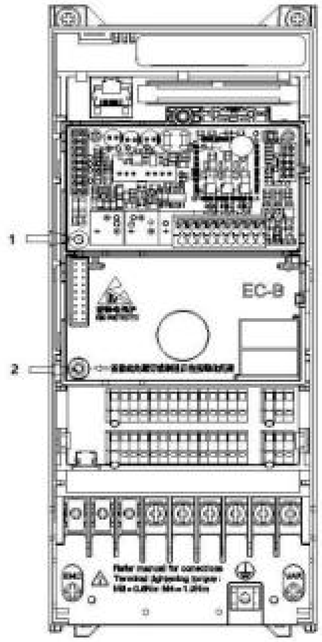
(1) Cut off the power supply to the EM760 high-performance vector inverter.

(2) Open the top cover of the EM760 inverter.

(3) First, remove the bracket screw (either 1 or 2 as shown below) of the expansion card. Fix the copper pillar supplied with the card into the screw hole with a slotted screwdriver. Align the expansion card with the positioning pillar and press it down. Lock the card with the copper pillar with the screw to finish the installation.



a



b

Fig. 9-23 Installation diagram of CANopen communication card

Removal of EM760-CM-C1 communication card and inverter:

Remove the fixing screw, pull the clip open,prise the PCB off the clip, and remove the PCB.

Picture of real product:

a Front

b Back

Fig. 9-24 CANopen communication card - real product

Note: 1. POWER lamp 2. RUN lamp 3. ERR lamp 4. READY lamp 5. CANopen interface 6. Screw positioning hole 7. Inverter interface

CANopen interface:

This interface is for CANopen network connection. Interface definitions are shown in the table below:

Pin	Signal	Definition
1	CAN_H	Positive signal line
2	CAN_L	Negative signal line
3	PGND	Signal ground
4	CAN_H	Positive signal line
5	CAN_L	Negative signal line
6	PGND	Signal ground

Note: Function settings of pins 1, 2 and 3 are completely the same as those of 5, 6 and 7 for the convenience of wiring by the user. For example, connect pins 1, 2 and 3 to the master station, and pins 5, 6 and 7 to the pins 1, 2 and 3 of the next node.

9.5.2 PROFINET communication card (EM760-CM-PN1)

Installation position and real product picture of PN card

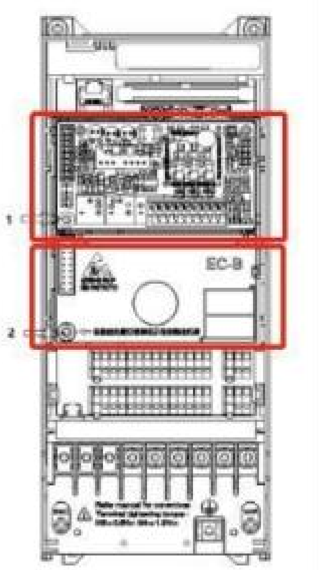


Fig. 9-25 PROFINET communication card - installation diagram

Fig. 9-26 PROFINET communication card - real product

Note: The PROFINET communication card can only be inserted in Slot 2.

Please refer to the *User Guide of EM760-CM-PN1-Profinet* for detailed instructions on its use.

9.6 Wi-Fi module

Product appearance and size

Fig. 9-27 Product appearance

Function:

The EM760 Wi-Fi module independently developed by Sine Electric is an optional part to the EM760 inverter. With this optional part and the app, the user can have Wi-Fi-based access to the inverter through a typical PC with WLAN card or a smart phone to perform fast commissioning, parameter setting, jogging start-up/stop, etc.

Technical specification

Wireless technology and work frequency: Wi-Fi 2400~2483.5MHz

Wireless modulation technology: 802.11b/g/n

Scope of extreme work temperature: -20°C~70°C

Product characteristics

Supports AP operation mode.

Operation mode:

AP: Enables the hotspot feature for the WiFi module, and connect the master to such hotspot. AP mode is the default upon shipment.

AP mode (Point-to-point connection)	

Status LED:

LED	Off	Flash	On
Power/PWR	Module not powered on	——	Module powered on
Serial port/UART	Communication error between module and inverter	——	Communication normal between module and inverter
MODE	Software anomaly	AP mode	——
Network/NET(AP)	No master connection	Exchanging data	Master connected

If you wish to connect the WiFi module externally to the electric control cabinet door, you need to purchase the optional EM760 keyboard installation bracket, and connect the WiFi module and the inverter with network cables.

9.7 EM760 LED two-row keyboard

9.7.1 Structure of LED keyboard

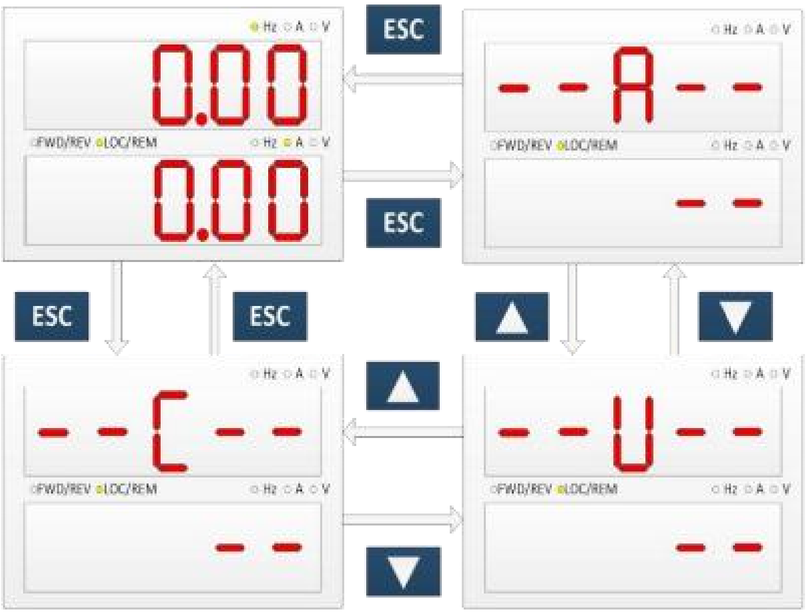
The LED keyboard consists of two rows of five-digit digital tubes, nine operation keys, and two status indicators. Users can perform parameter setting, status monitoring and start/stop of the inverter via the keyboard.

9.7.2 LED Keyboard Operation

The LED keyboard menu is divided into monitoring (Level 0), menu mode selection (Level 1), the function code selection (Level 2) and the detailed function code (Level 3) from low to high. The menu levels are represented by numbers in subsequent text of this manual.

Menu mode selection has 3 options: **full menu mode (--A--)** displays all function codes; **user-defined mode (--U--)** displays only function codes of user group F11; **non-default mode (--C--)** displays only the function codes that differ from the default settings

When the keyboard is powered on, it shows the level 1 menu, i.e. the monitoring interface, by default. On the monitoring interface press the LEFT key to switch the function code displayed in the first line and press the RIGHT key to switch the function code displayed in the second line; the function codes for switching is set by using F12.33-F12.37; in the level 1 menu, press the ESC key to enter level 0 menu; in the level 0 menu, use the UP key and the DOWN key to select a different menu mode. Press the ESC key in the Level 0 menu togo back to the monitoring screen of Level 1 menu. The procedure for menu mode selection is shown in the figure below.



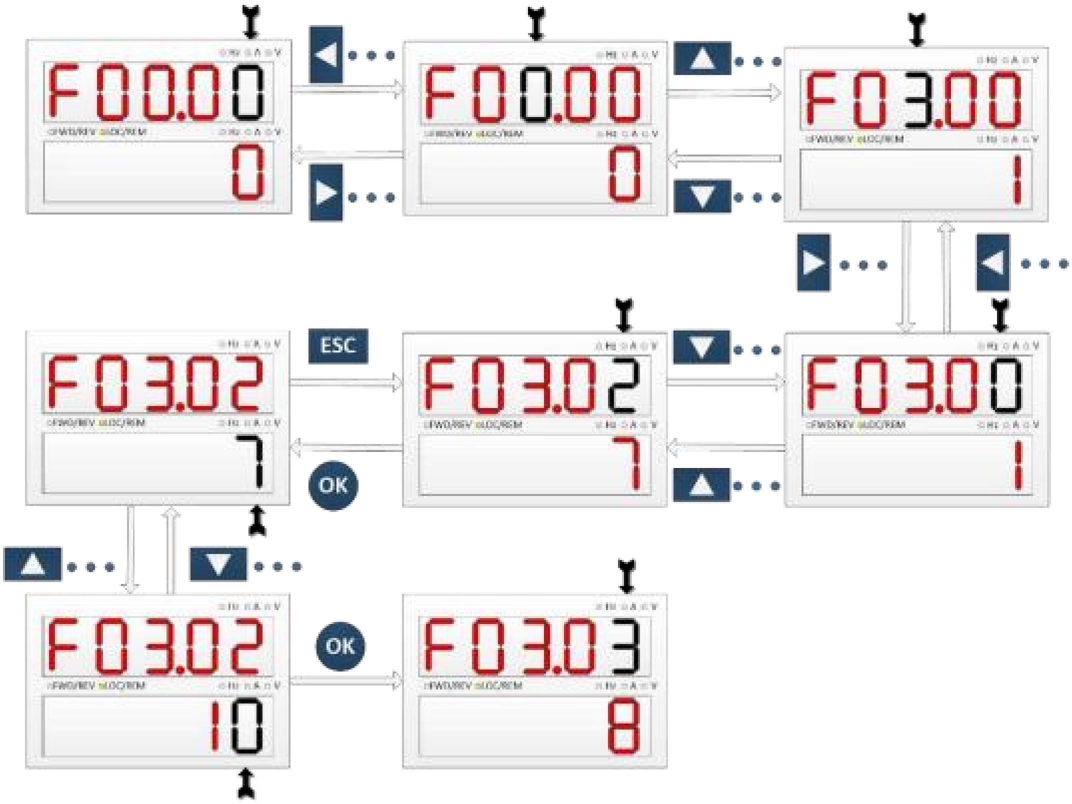
9.7.3 Full menu mode of LED keyboard

In the full menu mode **(--A--)**, press the ENTER key to enter the Level 2 menu and select any function code. Then press the ENTER key to enter the Level 3 menu, where you can modify the function code. Except for a few special ones, the function codes needed by general users can be modified.

In all menu modes, the user needs to press the ENTER key to save parameter modifications, upon which the screen will return to Level 2 menu and display the next function code.

In the Level 3 menu, press the ESC key to abandon parameter modifications: if the function code is equal to the unmodified value, directly exit the Level 3 menu and go back to the Level 2 menu; otherwise, the unmodified value will be restored and displayed, and the user can press the ESC key to exit the Level 3 menu and go back to the Level 2 menu.

The process of changing the value of the function code F03.02 to 10 from the initial status upon power-on in the full menu mode (__A__) is shown in the following figure (The black arrow is current position of the cursor. During operation, the digital tube where the cursor stays will keep flashing).



9.7.4 Parameter copying

For convenient parameter setting between inverters using the same function parameters, the LED keyboard is provided with parameter uploading and downloading functions. When function code F12.03 is set to 1 and ENTER is pressed OK for confirmation, inverter-related parameters will be uploaded to the keyboard; upon uploading, the keyboard shows the progress; when uploading is completed, the value of the function code will automatically change to 0. The keyboard with uploading completed may be inserted into another inverter that needs to use the same parameters. Once the keyboard is inserted, you may change the value of the function code F12.03 to 2 and download the parameters to the inverter. If you set the value of the function code F12.03 to 3, motor parameters will be downloaded in addition to normal parameters. Upon downloading, the keyboard will show the progress. Similarly, upon completion of parameter downloading, the value of the function code will automatically change to 0. The operation steps are shown in the figure below.

When using the upload/download functions, it shall be noted that:

1. No keyboard can be used for parameter downloading before it undergoes parameter uploading, as unknown parameters in the keyboard without parameter uploading may cause failure of an inverter by disturbing existing parameters in the inverter. If a keyboard is used for parameter downloading without parameter uploading, it will prompt presence of no parameter in the keyboard, suggesting parameter downloading is unsuccessful; press ECS to exit; perform uploading again before downloading.

2. For parameter downloading to an inverter with a different version of CPUS software, the keyboard will prompt whether to continue downloading regardless of the different version; at this time, it is required to make clear whether parameter downloading is permitted between the two different versions. If yes, press ENTER key OK to execute the downloading; if no, press ESC to cancel the current operation. **Be cautioned that parameter uploading and downloading between two inverters with incompatible parameters are likely to cause operation failure of the inverters.**

9.7.5 Run/Stop

After setting the parameters, press the RUN key RUN to enable the normal operation of the inverter, and the STOP key STOP to stop the inverter. The M.K M.K can be defined to free parking or to stopping inverter operation by changing the function code F12.00 to 5.

When function code F01.34 is set to corresponding self-learning mode, it is required to press RUN RUN so that the inverter can enter corresponding parameter identification status; upon parameter identification, it will show “TUNE”; when identification is done, it will return to the original display, and the function code F01.34 will automatically change to 0. Upon rotation parameter identification by the inverter, the motor may rotate; in emergent cases, the user may press STOP STOP to cancel identification.

Chapter 10 MODBUS Communication Protocol

10.1 Applicable scope

1. Applicable series: EM760 series
2. Applicable network: Support the “single-master multi-slave” communication network with MODBUS-RTU protocol and RS-485 bus.

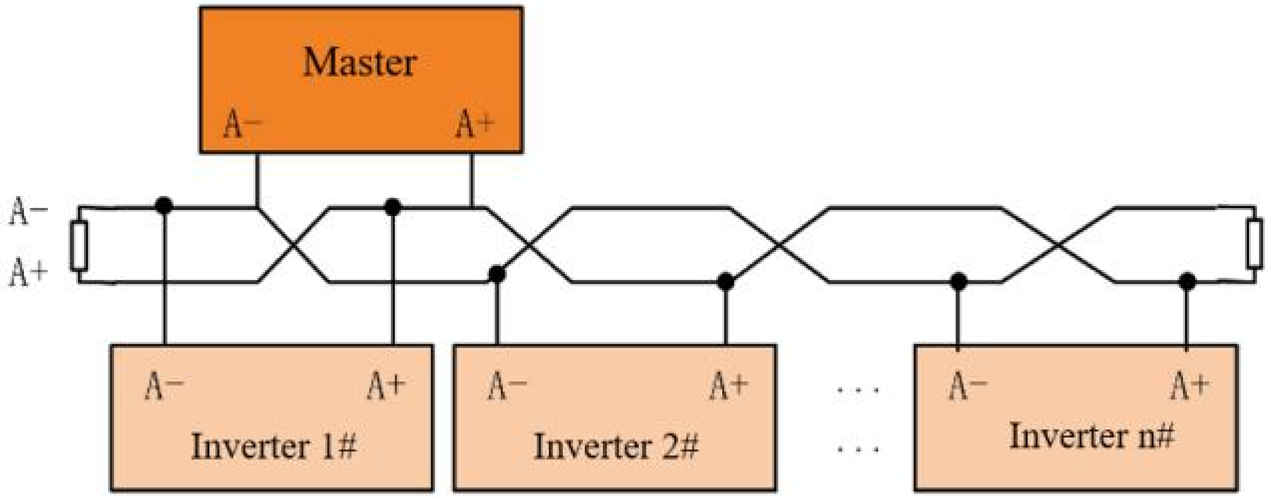


Fig. 10-1 Schematic Diagram of Communication Network

10.2 Interface mode

RS-485 asynchronous half-duplex communication mode, with the least significant bit sent first;

RS-485 network address: 1-247; 0 is the broadcast address;

Default data format of RS-485 terminal: 1-8-N-1[2] (1-8-E-1, 1-8-O-1, 1-8-N-2, 1-8-E-2 and 1-8-O-2 are optional);

Default baud rate of RS-485 terminal: 9600bps (options: 4800bps, 19200bps, 38400bps, 57600bps and 115200bps);

It is recommended to use twisted-pair shielded cable as the communication cable to reduce the impact of external interference on communication.

[2]*: 1-8-N-1, meaning 1 start bit - 8 characters per byte of data - no parity - 1 stop bit. E: even parity. O: odd parity.*

10.3 Protocol Format

10.3.1 Message format

As shown in the figure below,a standard MODBUS message includes a start tag, RTU (Remote Terminal Unit) message, and end tag.

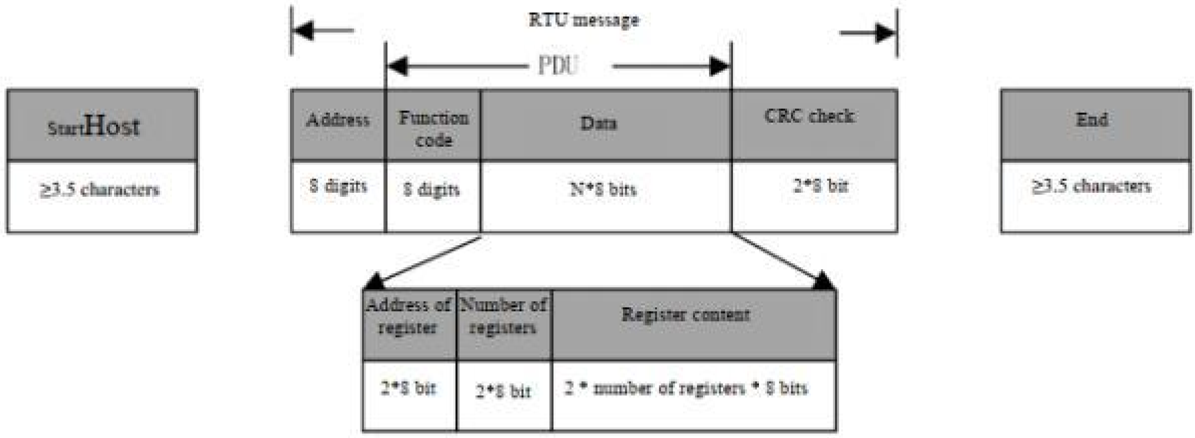


Fig. 10-2　　Schematic Diagram of Message Frame in RTU Mode

The RTU message includes the address code, PDU (Protocol Data Unit) and CRC[3] check. The PDU includes the function code and data part (mainly including the register address, number of registers, register content and the like; the detailed definitions of function codes are different, as shown in 11.3.3).

[3]: *The low byte of CRC check is infront of the high byte*

10.3.2 Address code

Address Range	Purpose
1~247	Slave
0	Broadcast

10.3.3 Function code

The classification of MODBUS function codes is shown in the figure below.

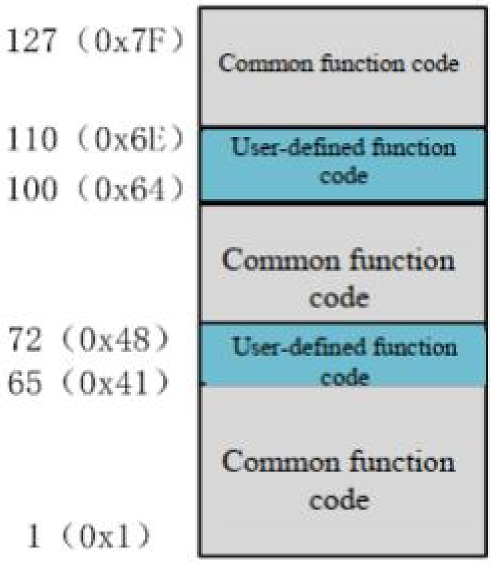


Fig. 10-3　　Classification of MODBUS function codes

As shown in the table below, EM760 series products mainly involve **common function codes**. For example, 0x03 is to read multiple registers or status words,**0x06** is to write a single register or command, 0x10 is to write multiple registers or commands, and 0x08 is for diagnosis.

In addition, for some specific functions, such as register writing (RAM) without EEPROM storage, the **user-defined function codes** include 0x41 for writing of a single register or command (without saving), and 0x42 for writing of multiple registers or commands (without saving).

When the abnormal valid data is received from a device, a related abnormality message will be returned (see 11.3.7 Exception response). The abnormality function code is defined to distinguish the abnormal data from normal communication data. Corresponding to the normal request function code, the **abnormality function code = request function code + 0x80**.

Table 10-1 Function Code Definitions of EM760 Series Product

Function code	Abnormality function code	Function
03	83	This function code is used to read multiple registers or status words.
41	C1	This function code is used to write a single register or command without saving.
42	C2	This function code is used to write multiple registers or commands without saving.
08	88	This function code is used for diagnosis.
06	86	This function code is used to write a single register or command.
10	90	This function code is used to write multiple registers or commands.

PDU parts are detailed in the following sections, depending on various functions.

10.3.3.1 0x03: function code used to read multiple registers or status words

In the remote terminal unit, this function code is used to read the content in the continuous block of the holding register. The request PDU describes the starting register address and the number of registers.

The register data in the response message is divided into two bytes in each register. The first byte of each register includes high-order bits and the second byte includes low-order bits.

- Request PDU

Function code	1 byte	**0x03**
Starting Address	2 bytes	0x0000~0xFFFF
Number of registers	2 bytes	1~16

- Response PDU

Function code	1 byte	**0x03**
Number of bytes	1 byte	2×N*
Register value	N*×2 bytes	

N* = number of registers

- Error PDU

Error code	1 byte	**0x83**
Exception code	1 byte	01, 02, 03 or 04

Below is an example of a request to read the registers F19.00 to F19.05 (relevant information about the last protection):

Request		Respond			
Domain name	(0X)	Domain name (normal)	(0X)	Domain name (abnormal)	(0X)
Function code	03	Function code	03	Function	83
Starting address Hi	13	Number of bytes	0C	Exception code	03 (example, the same below)
Starting address Lo	00	Register value Hi (F19.00)	00		
Number (Hi) of registers	00	Register value Lo (F19.00)	11		
Number (Lo) of registers	06	Register value Hi (F19.01)	00		
		Register value Lo (F19.01)	00		
		Register value Hi (F19.02)	00		
		Register value Lo (F19.02)	00		
		Register value Hi (F19.03)	01		
		Register value Lo (F19.03)	2C		
		Register value Hi (F19.04)	00		
		Register value Lo (F19.04)	00		
		Register value Hi (F19.05)	00		
		Register value Lo (F19.05)	00		

According to the returned data, the "17 (0011H): temperature sensor abnormality protection" of the inverter is enabled, in which the output frequency is 0.00Hz, the output current is 0.00A,the bus voltage is 300V (012CH), the acceleration and deceleration status is "standby", and the working time is 0 hour.

*: **At present, the function code 0x03 of MODBUS protocol supports the reading of multiple function codes across groups. However, it is recommended not to read them across groups in the case of no special requirements, so the customer's software does not need to be upgraded after our products are upgraded.**

10.3.3.2 0x41: function code used to write a single register or command (without saving)

In the remote terminal unit, this function code is used to write a single non-holding register.

The request PDU describes the address to be written to the register.

The normal response is the response made to the request, which is returned after the register content is written.

- Request PDU

Function code	1 byte	**0x41**
Address of register	2 bytes	0x0000~0xFFFF
Register value	2 bytes	0x0000~0xFFFF

- Response PDU

Function code	1 byte	**0x41**
Address of register	2 bytes	0x0000~0xFFFF
Register value	2 bytes	0x0000~0xFFFF

- Error PDU

Error code	1 byte	**0xC1**
Exception code	1 byte	See Table 6-26

Below is an example of a request to change the main frequency source A (7001H) to "-50.00%":

<table>
<tr><th colspan="2">Request</th><th colspan="4">Respond</th></tr>
<tr><th>Domain name</th><th>(0x)</th><th>Domain name (normal)</th><th>(0x)</th><th>Domain name (abnormal)</th><th>(0x)</th></tr>
<tr><td>Function</td><td>41</td><td>Function</td><td>41</td><td>Function</td><td>C1</td></tr>
<tr><td>Register address Hi</td><td>70</td><td>Register address Hi</td><td>70</td><td rowspan="2">Exception code</td><td rowspan="2">03</td></tr>
<tr><td>Register address Lo</td><td>01</td><td>Register address Lo</td><td>01</td></tr>
<tr><td>Register value Hi</td><td>EC</td><td>Register value Hi</td><td>EC</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Register value Lo</td><td>78</td><td>Register value Lo</td><td>78</td></tr>
</table>

* This function code cannot be used to change the parameters of the attribute "○" (it cannot be changed during operation). That is, only the parameters of the attribute "●" (it can be changed during operation) can be changed. Otherwise, the error code 1 will be returned.

10.3.3.3 0x42: function code used to write multiple registers or commands (without saving)

In the remote terminal unit, this function code is used to write consecutive non-holding register blocks (1 to 16 registers).

The value requested to be written is described in the request data field. The data of each register is divided into two bytes.

In the normal response, the function code, starting address and number of registers written will be returned.

- Request PDU

Function code	1 byte	**0x42**
Starting Address	2 bytes	0x0000~0xFFFF
Number of registers	2 bytes	1~16
Number of bytes	1 byte	2×N*
Register value	N*×2 bytes	

N* = number of registers

- Response PDU

Function code	1 byte	**0x42**
Starting Address	2 bytes	0x0000~0xFFFF
Number of registers	2 bytes	1~16

- Error PDU

Error code	1 byte	**0xC2**
Exception code	1 byte	See Table 6-26

Below is an example of a request to set the acceleration time 1 (F00.14) to 5.00 and deceleration time 1 (F00.15) to 6.00:

<table>
<tr><th colspan="2">Request</th><th colspan="4">Respond</th></tr>
<tr><th>Domain name</th><th>(0x)</th><th>Domain name (normal)</th><th>(0x)</th><th>Domain name (abnormal)</th><th>(0x)</th></tr>
<tr><td>Function</td><td>42</td><td>Function</td><td>42</td><td>Function</td><td>C2</td></tr>
<tr><td>Starting address Hi</td><td>00</td><td>Starting address Hi</td><td>00</td><td rowspan="2">Exception code</td><td rowspan="2">03</td></tr>
<tr><td>Starting address Lo</td><td>0E</td><td>Starting address Lo</td><td>0E</td></tr>
<tr><td>Number (Hi) of registers</td><td>00</td><td>Number (Hi) of registers</td><td>00</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Number (Lo) of registers</td><td>02</td><td>Number (Lo) of registers</td><td>02</td></tr>
<tr><td>Number of bytes</td><td>04</td><td colspan="4" rowspan="5"></td></tr>
<tr><td>Register value Hi (F00.14)</td><td>01</td></tr>
<tr><td>Register value Lo (F00.14)</td><td>F4</td></tr>
<tr><td>Register value Hi (F00.15)</td><td>02</td></tr>
<tr><td>Register value Lo (F00.15)</td><td>58</td></tr>
</table>

* This function code cannot be used to change the parameters of the attribute "○" (it cannot be changed during operation). That is, only the parameters of the attribute "●" (it can be changed during operation) can be changed. Otherwise, the error code 1 will be returned.

10.3.3.4 0x08: function code for diagnosis

The Modbus function code 08 involves a series of tests to check the communication system between the client (master station) and server (slave station), or internal error statuses of the server.

The test to be executed is defined by the sub-function code fields of two bytes in the request. The server makes responses properly.

Copy the function codes and sub-function codes. Some diagnoses will enable the remote terminal unit to return the corresponding data through the data field in normal response.

Under normal circumstances, when the diagnosis function is sent to the remote terminal unit, the user program in this remote terminal unit will not be affected. Diagnosis can't access user logic such as discrete magnitude and the register. The error counter in the remote terminal unit can be remotely reset by applying some functions.

The main diagnosis function used by our company is line diagnosis (0000), which is used to test the normal communication between the host and slave. The normal response to a request to return query data is to return the same data. At the sametime, the function codes and sub-function codes are also copied.

- Request PDU

Function code	1 byte	**0x08**
Sub-function code	2 bytes	0x0000~0xFFFF
Data	2 bytes	0x0000~0xFFFF

- Response PDU

Function code	1 byte	**0x08**
Sub-function code	2 bytes	0x0000~0xFFFF
Data	2 bytes	0x0000~0xFFFF

- Error PDU

Error code	1 byte	**0x88**
Exception code	1 byte	See Table 10-4

- Sub-function code

Sub-function	Meaning	Data field (request)	Data field (response)
0000	Return query data	Any	Copy request data
…			

0000: return the data transferred in the request data field in the response. All messages should be consistent with the request message.

The following table is an example of requesting the remote terminal unit to return query data. The sub-function code 0000 is used.

The returned data is sent in the two-byte data field (0xA537).

Request		Respond			
Domain name	(0x)	Domain name (normal)	(0x)	Domain name (abnormal)	(0x)
Function	08	Function	08	Function	88
Sub-function code Hi	00	Sub-function code Hi	00	Exception code	03
Sub-function code Lo	00	Sub-function code Lo	00		
Data Hi	A5	Data Hi	A5		
Data Lo	37	Data Lo	37		

10.3.3.5 0x06: function code used to write a single register or command

In the remote terminal unit, this function code is used to write a single holding register.

The request PDU describes the address to be written to the register.

The normal response is the response made to the request, which is returned after the register content is written.

- Request PDU

Function code	1 byte	**0x06**
Address of register	2 bytes	0x0000~0xFFFF
Register value	2 bytes	0x0000~0xFFFF

- Response PDU

Function code	1 byte	**0x06**
Address of register	2 bytes	0x0000~0xFFFF
Register value	2 bytes	0x0000~0xFFFF

- Error PDU

Error code	1 byte	**0x86**
Exception code	1 byte	See Table 10-4

Below is an example of a request to change the drive control mode of the motor 1 (F00.01) to "1: SVC".

Request		Respond			
Domain name	(0x)	Domain name (normal)	(0x)	Domain name (abnormal)	(0x)
Function	06	Function	06	Function	86
Register address Hi	00	Register address Hi	00	Exception code	03
Register address Lo	01	Register address Lo	01		
Register value Hi	00	Register value Hi	00		
Register value Lo	01	Register value Lo	01		

* The function code 0x06 cannot be used if modified frequently, in order to avoid damage to the inverter.

The user-defined function code 0x41 "change without saving" corresponds to the standard common function code 0x06. Its definition is the same as that of the corresponding standard function code (the same request, response and error PDU). The difference is that when the slave responds to this user-defined function code, the corresponding value of RAM is changed only and not stored in EEPROM (holding register).

For the function codes (e.g. F00.07) that are often modified, it is recommended to use the function code 0x41 (you can change the main frequency source A by directly setting 7001H, as detailed in 10.3.4), to avoid damage to the inverter. The specific operation is as follows.

Request		Respond	
Domain name	(0x)	Domain name (normal)	(0x)
Function	41	Function	41
Register address Hi	00	Register address Hi	00
Register address Lo	07	Register address Lo	07
Register value Hi	13	Register value Hi	13
Register value Lo	88	Register value Lo	88

Once the set frequency (F00.07) is set to 50.00Hz, the above data will be valid but not be stored in EEPROM. That is, the inverter will run at 50.00Hz after change but at the frequency before change if powered on again.

10.3.3.6 0x10: function code used to write multiple registers or commands

In the remote terminal unit, this function code is used to write consecutive register blocks (1 to 16 registers).

The value requested to be written is described in the request data field. The data of each register is divided into two bytes.

In the normal response, the function code, starting address and number of registers written will be returned.

- Request PDU

Function code	1 byte	**0x10**
Starting Address	2 bytes	0x0000~0xFFFF
Number of registers	2 bytes	1~16
Number of bytes	1 byte	2×N*
Register value	N*×2 bytes	

N* = number of registers

- Response PDU

Function code	1 byte	**0x10**
Starting Address	2 bytes	0x0000~0xFFFF
Number of registers	2 bytes	1~16

- Error PDU

Error code	1 byte	**0x90**
Exception code	1 byte	See Table 10-4

Below is an example of a request to write 00 01 and 00 03 into two registers starting from F03.00 (i.e. setting the Y1 and Y2 output terminal function):

Request		Respond			
Domain name	(0x)	Domain name (normal)	(0x)	Domain name (abnormal)	(0x)
Function	10	Function	10	Function	90
Starting address Hi	03	Starting address Hi	03	Exception code	03
Starting address Lo	00	Starting address Lo	00		
Number (Hi) of registers	00	Number (Hi) of registers	00		
Number (Lo) of registers	02	Number (Lo) of registers	02		
Number of bytes	04				
Register value Hi (F03.00)	00				
Register value Lo (F03.00)	01				
Register value Hi (F03.01)	00				
Register value Lo (F03.01)	03				

* The function code 0x10 cannot be used if modified frequently, in order to avoid damage to the inverter.

10.3.4 Register address distribution

Table 10-2 Detailed Definition of Register Address of MODBUS Protocol

Address Space		Description	
Function code 0000H - 6F63H		For the function code FXX.YY, the high order is hexadecimal of XX and the low order is hexadecimal of YY. For example, the address of F00.14 is 000EH (00D=00H, 14D=0EH).	
Function code (not saved after power-down) 8000H-EF63H		When the parameters are set with the function code 0x06 or 0x10, the function that "the settings are valid immediately and not saved after power-down" can be realized in the form of "original address +8000H". For example, the corresponding address of F00.14 is 800EH (=000EH+8000H).	
Control command (**write only**) 7000H ~ 71FFH	7000H control word	0000H	Invalid command
		0001H	Forward running
		0002H	Reverse running
		0003H	JOG forward
		0004H	JOG reverse
		0005H	Deceleration to stop
		0006H	Stop the controller quickly
		0007H	Free stop
		0008H	Reset protection
		0009H	+/- input switching
		000BH	JOG stop

		Others to 00FFH	Reserved
	7001H	Communication percentage setting of main channel frequency A	-100.00% to 100.00% (100% = maximum frequency)
	7002H	Communication percentage setting of auxiliary channel frequency B	-100.00% to 100.00% (100% = maximum frequency)
	7003H	Torque communication setting	-200.00% to 200.00% (100% = digital torque setting)
	7004H	Communication setting of process PID setting	-100.00%~100.00%
	7005H	Communication setting of process PID feedback	-100.00%~100.00%
	7006H	Voltage setting of VF separation mode	0.00% to 100.00% (digital setting reference)
	7007H~7009H	Reserved	
	700AH	Communication percentage setting of upper frequency limit	0.00% to 200.00% (digital setting reference)
	700BH	Communication percentage setting of upper frequency limit of torque control	0.00% to 200.00% (digital setting reference)
	700CH	Linear speed input for inertia compensation	0.00% to 100.00% (digital setting reference)
	700DH~700EH	Reserved	
	700FH	Master-slave communication setting	-100.00% to 100.00% (maximum reference)
	7010H~7013H	Reserved	
	7014H	External protection	Protection input of external device (including option card)
	7015H	Communication setting of main channel frequency A	0.00 to maximum frequency
	7016H	Communication setting of auxiliary channel frequency B	0.00 to maximum frequency
	7017H	Communication setting of upper frequency limit	0.00 to maximum frequency
	7018H	Communication setting of upper frequency limit of torque control	0.00 to maximum frequency

	7019H	Communication setting of upper torque limit of speed control	0.0 to 250.0% (based on 100.0% or direct sending)	
	701AH	Communication setting 1	Communication setting by M1 terminal, communication address option 701AH	
	701CH~71FFH	Reserved		
Working status 7200H - 73FFH	7200H status word 1	Bit7 to 0 running status	00H	Parameter setting
			01H	Slave running
			02H	JOG running
			03H	Self-learning running
			04H	Slave stop
			05H	JOG stop
			06H	Protection status
			07H	Factory self-inspection
			08H~0FFH	Reserved
		Bit15-8 protection information	00H	Normal running of inverter
			xxH	Inverter protection status, where “xx” is the protection code
	7201H status word 2	Bit0 setting direction	1	- setting is valid
			0	+ setting is valid
		Bit1 running direction	1	Reverse frequency output
			0	Forward frequency output
		Bit3 to 2 running mode	00	Speed control mode
			01	Torque control mode
			10	Reserved
			11	Reserved
		Bit4 parameter protection	1	Valid parameter protection
			0	Invalid parameter protection
		Bit6~5	Reserved	
		Bit8 to 7 setting mode	00	Keyboard control
			01	Terminal control
			10	Communication control

<table>
<tr><td rowspan="29"></td><td rowspan="6"></td><td colspan="2"></td><td colspan="2">11</td><td colspan="5">Reserved</td></tr>
<tr><td colspan="2">Bit9</td><td colspan="2">Reserved</td><td colspan="5"></td></tr>
<tr><td colspan="2" rowspan="2">Bit10 warning</td><td colspan="2">0</td><td colspan="5">No warning</td></tr>
<tr><td colspan="2">1</td><td colspan="5">Warning status (see 7230H for details)</td></tr>
<tr><td colspan="2">Bit15~10</td><td colspan="7">Reserved</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td rowspan="8">7202H monitoring frequency +/- status word 1 (1: -; 0: +)</td><td colspan="2">Bit0</td><td colspan="7">Output frequency</td></tr>
<tr><td colspan="2">Bit1</td><td colspan="7">Input frequency</td></tr>
<tr><td colspan="2">Bit2</td><td colspan="7">Synchronization frequency</td></tr>
<tr><td colspan="2">Bit3</td><td colspan="7">Reserved</td></tr>
<tr><td colspan="2">Bit4</td><td colspan="7">Estimate feedback frequency</td></tr>
<tr><td colspan="2">Bit5</td><td colspan="7">Estimated slip frequency</td></tr>
<tr><td colspan="2">Bit6</td><td colspan="7">Load rate</td></tr>
<tr><td colspan="2">Bit15~7</td><td colspan="7">Reserved</td></tr>
<tr><td>7203H</td><td colspan="9">Output frequency</td></tr>
<tr><td>7204H</td><td colspan="9">Output voltage</td></tr>
<tr><td>7205H</td><td colspan="9">Output power</td></tr>
<tr><td>7206H</td><td colspan="9">Running speed</td></tr>
<tr><td>7207H</td><td colspan="9">Bus voltage</td></tr>
<tr><td>7208H</td><td colspan="9">Output torque</td></tr>
<tr><td rowspan="4">7209H</td><td rowspan="4">Digital input 1</td><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>
<tr><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td></tr>
<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>
<tr><td>*</td><td>*</td><td>*</td><td>X5</td><td>X4</td><td>X3</td><td>X2</td><td>X1</td></tr>
<tr><td rowspan="4">720AH</td><td rowspan="4">Digital input 2</td><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>
<tr><td>VX8</td><td>VX7</td><td>VX6</td><td>VX5</td><td>VX4</td><td>VX3</td><td>VX2</td><td>VX1</td></tr>
<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>
<tr><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>AI2</td><td>AI1</td></tr>
<tr><td rowspan="4">720BH</td><td rowspan="4">Digital output 1</td><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>
<tr><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td></tr>
<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>
<tr><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>Y1</td><td>*</td><td>R1</td></tr>
</table>

<table>
<tr><td rowspan="4"></td><td rowspan="4">720CH</td><td rowspan="4">Digital output 2</td><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>
<tr><td>VY8</td><td>VY7</td><td>VY6</td><td>VY5</td><td>VY4</td><td>VY3</td><td>VY2</td><td>VY1</td></tr>
<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>
<tr><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td rowspan="19"></td><td>720DH</td><td colspan="9">Previous two protections</td></tr>
<tr><td>720EH</td><td colspan="9">Previous three protections</td></tr>
<tr><td>720FH</td><td colspan="9">Last protection</td></tr>
<tr><td>7210H</td><td colspan="9">Output frequency of the last protection</td></tr>
<tr><td>7211H</td><td colspan="9">Output current of the last protection</td></tr>
<tr><td>7212H</td><td colspan="9">Bus voltage of the last protection</td></tr>
<tr><td>7213H</td><td colspan="9">Running status of the last protection</td></tr>
<tr><td>7214H</td><td colspan="9">Working time of the last protection</td></tr>
<tr><td>7215H</td><td colspan="9">Set acceleration time</td></tr>
<tr><td>7216H</td><td colspan="9">Set deceleration time</td></tr>
<tr><td>7217H</td><td colspan="9">Cumulative length</td></tr>
<tr><td>7218H</td><td colspan="9">Reserved</td></tr>
<tr><td>7219H</td><td colspan="9">UP/DOWN offset frequency symbol (0/1: +/-)</td></tr>
<tr><td>7224H</td><td colspan="9">Output current</td></tr>
<tr><td>7225H</td><td colspan="9">Set frequency</td></tr>
<tr><td>7228H</td><td colspan="9">Cumulative power-on time</td></tr>
<tr><td>722FH</td><td colspan="9">Fault No.</td></tr>
<tr><td>7230H</td><td>Warning number</td><td colspan="8">0: no warning; others: current warning sign</td></tr>
<tr><td>Other - 73FFH</td><td colspan="9">Reserved</td></tr>
<tr><td rowspan="8">Product information 7500H - 75FFH</td><td>7500H</td><td colspan="2">Performance software S/N 1</td><td colspan="7">Corresponding to the function code F12.22</td></tr>
<tr><td>7501H</td><td colspan="2">Performance software S/N2</td><td colspan="7">Corresponding to the function code F12.23</td></tr>
<tr><td>7502H</td><td colspan="2">Functional software S/N 1</td><td colspan="7">Corresponding to the function code F12.24</td></tr>
<tr><td>7503H</td><td colspan="2">Functional software S/N 2</td><td colspan="7">Corresponding to the function code F12.25</td></tr>
<tr><td>7504H</td><td colspan="2">Keyboard software serial number 1</td><td colspan="7">Corresponding to the function code F12.26</td></tr>
<tr><td>7505H</td><td colspan="2">Keyboard software serial number 2</td><td colspan="7">Corresponding to the function code F12.27</td></tr>
<tr><td>7506H</td><td colspan="2">Serial No. 1</td><td colspan="7">Corresponding to the function code F12.28</td></tr>
<tr><td>7507H</td><td colspan="2">Serial No. 2</td><td colspan="7">Corresponding to the function code F12.29</td></tr>
</table>

	7508H	Serial No. 3	Corresponding to the function code F12.30
	7509H~75FFH	Reserved	
Others	Reserved		

10.3.5 Definition of frame data length

The PDU part of the RTU frame of the MODBUS message is able to read/write 1-16 registers. For different function codes, the actual length of the RTU frame varies, as detailed in the table below.

Table 10-3 Correspondence between RTU Frame Length and Function Code

Function code (0x)	RTU frame length (bytes)			Maximum length (Byte)
	Request	Normal response	Exception response	
03	8	$5+2N_r$[4]	5	37
41(06)	8	8	5	8
08	8	8	5	8
42(10)	$9+2N_w$[5]	8	5	41

[4]: $N_r \leq 16$, indicating the number of requests to read registers;

[5]: $N_w \leq 16$, indicating the number of requests to write registers.

[6]: $N_w + N_r \leq 16$;

10.3.6 CRC check

The low byte of CRC check is in front of the high byte.

The transmitter first calculates the CRC value, which is included in the sent message. Upon receiving the message, the receiver will recalculate the CRC value and compare the calculated value with the received CRC value. If the two values are not equal, it means that there is an error in the sending process.

Calculation process of CRC check:

(1) Define a CRC register and assign an initial value, FFFFH.

(2) Perform the XOR calculation with the first byte of the transmitted message and the value of the CRC register, and store the result in the CRC register. Starting from the address code, the start bit and stop bit are not involved in calculation.

(3) Extract and check the LSB (the least significant bit of the CRC register).

(4) If the LSB is 1, each bit of the CRC register is shifted to the right by one bit, and the most significant bit is supplemented by 0. Perform the XOR calculation of the value of the CRC register and A001H, and store the result in the CRC register.

(5) If the LSB is 0, each bit of the CRC register is shifted to the right by one bit, and the most significant bit is supplemented by 0.

(6) Repeat the steps 3, 4, and 5 until 8 shifts are completed.

(7) Repeat the steps 2, 3, 4, 5 and 6 to process next byte of the transmitted message, until all bytes of the transmitted message are processed.

(8) After the calculation, the content of the CRC register is the value of CRC check.

(9) In a system with limited time resources, it is recommended to perform CRC check by the table lookup method.

The simple function of CRC is as follows (programmed in C language):

```
unsigned int CRC_Cal_Value(unsigned char *Data, unsigned char Length)
{
    unsigned int crc_value = 0xFFFF;
    int i = 0;
    while(Length--)
    {
crc_value ^= *Data++;
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);
}
```

This only describes the theory of CRC check and requires a long execution time. Especially when the check data is long, the calculation time will be too long. Thus, the following two table lookup methods are applied for 16-bit and 8-bit controllers, respectively.

- CRC16 lookup table for the 8-bit processor: (The high byte in the final result of this program is in front. Please reverse it during sending.)

```
const Uint8 crc_l_tab[256] = {
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
```

```
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40
};
constUint8 crc_h_tab[256] = {
0x00,0xC0,0xC1,0x01,0xC3,0x03,0x02,0xC2,0xC6,0x06,0x07,0xC7,0x05,0xC5,0xC4,0x04,
0xCC,0x0C,0x0D,0xCD,0x0F,0xCF,0xCE,0x0E,0x0A,0xCA,0xCB,0x0B,0xC9,0x09,0x08,0xC8,
0xD8,0x18,0x19,0xD9,0x1B,0xDB,0xDA,0x1A,0x1E,0xDE,0xDF,0x1F,0xDD,0x1D,0x1C,0xDC,
0x14,0xD4,0xD5,0x15,0xD7,0x17,0x16,0xD6,0xD2,0x12,0x13,0xD3,0x11,0xD1,0xD0,0x10,
0xF0,0x30,0x31,0xF1,0x33,0xF3,0xF2,0x32,0x36,0xF6,0xF7,0x37,0xF5,0x35,0x34,0xF4,
0x3C,0xFC,0xFD,0x3D,0xFF,0x3F,0x3E,0xFE,0xFA,0x3A,0x3B,0xFB,0x39,0xF9,0xF8,0x38,
0x28,0xE8,0xE9,0x29,0xEB,0x2B,0x2A,0xEA,0xEE,0x2E,0x2F,0xEF,0x2D,0xED,0xEC,0x2C,
0xE4,0x24,0x25,0xE5,0x27,0xE7,0xE6,0x26,0x22,0xE2,0xE3,0x23,0xE1,0x21,0x20,0xE0,
0xA0,0x60,0x61,0xA1,0x63,0xA3,0xA2,0x62,0x66,0xA6,0xA7,0x67,0xA5,0x65,0x64,0xA4,
0x6C,0xAC,0xAD,0x6D,0xAF,0x6F,0x6E,0xAE,0xAA,0x6A,0x6B,0xAB,0x69,0xA9,0xA8,0x68,
0x78,0xB8,0xB9,0x79,0xBB,0x7B,0x7A,0xBA,0xBE,0x7E,0x7F,0xBF,0x7D,0xBD,0xBC,0x7C,
0xB4,0x74,0x75,0xB5,0x77,0xB7,0xB6,0x76,0x72,0xB2,0xB3,0x73,0xB1,0x71,0x70,0xB0,
0x50,0x90,0x91,0x51,0x93,0x53,0x52,0x92,0x96,0x56,0x57,0x97,0x55,0x95,0x94,0x54,
0x9C,0x5C,0x5D,0x9D,0x5F,0x9F,0x9E,0x5E,0x5A,0x9A,0x9B,0x5B,0x99,0x59,0x58,0x98,
0x88,0x48,0x49,0x89,0x4B,0x8B,0x8A,0x4A,0x4E,0x8E,0x8F,0x4F,0x8D,0x4D,0x4C,0x8C,
0x44,0x84,0x85,0x45,0x87,0x47,0x46,0x86,0x82,0x42,0x43,0x83,0x41,0x81,0x80,0x40
};
```

```
Uint16CRC(Uint8 * buffer, Uint8 crc_len)
{
Uint8 crc_i,crc_lsb,crc_msb;
Uint16 crc;
crc_msb = 0xFF;
crc_lsb = 0xFF;
while(crc_len--)
{
crc_i = crc_lsb ^ *buffer;
buffer ++;
crc_lsb = crc_msb ^ crc_l_tab[crc_i];
crc_msb = crc_h_tab[crc_i];
}
crc = crc_msb;
crc = (crc << 8) + crc_lsb;
return crc;
}
```

- CRC16 lookup table for the 16-bit processor: (The high byte in the final result of this program is in front. Please reverse it during sending.)

```
const Uint16 crc_table[256] = {
0x0000,0xC1C0,0x81C1,0x4001,0x01C3,0xC003,0x8002,0x41C2,0x01C6,0xC006
,0x8007,0x41C7,0x0005,0xC1C5,0x81C4,0x4004,0x01CC,0xC00C,0x800D,0x41CD
,0x000F,0xC1CF,0x81CE,0x400E,0x000A,0xC1CA,0x81CB,0x400B,0x01C9,0xC009
,0x8008,0x41C8,0x01D8,0xC018,0x8019,0x41D9,0x001B,0xC1DB,0x81DA,0x401A
,0x001E,0xC1DE,0x81DF,0x401F,0x01DD,0xC01D,0x801C,0x41DC,0x0014,0xC1D4
,0x81D5,0x4015,0x01D7,0xC017,0x8016,0x41D6,0x01D2,0xC012,0x8013,0x41D3
,0x0011,0xC1D1,0x81D0,0x4010,0x01F0,0xC030,0x8031,0x41F1,0x0033,0xC1F3
,0x81F2,0x4032,0x0036,0xC1F6,0x81F7,0x4037,0x01F5,0xC035,0x8034,0x41F4
,0x003C,0xC1FC,0x81FD,0x403D,0x01FF,0xC03F,0x803E,0x41FE,0x01FA,0xC03A
,0x803B,0x41FB,0x0039,0xC1F9,0x81F8,0x4038,0x0028,0xC1E8,0x81E9,0x4029
,0x01EB,0xC02B,0x802A,0x41EA,0x01EE,0xC02E,0x802F,0x41EF,0x002D,0xC1ED
,0x81EC,0x402C,0x01E4,0xC024,0x8025,0x41E5,0x0027,0xC1E7,0x81E6,0x4026
,0x0022,0xC1E2,0x81E3,0x4023,0x01E1,0xC021,0x8020,0x41E0,0x01A0,0xC060
```

```
,0x8061,0x41A1,0x0063,0xC1A3,0x81A2,0x4062,0x0066,0xC1A6,0x81A7,0x4067
,0x01A5,0xC065,0x8064,0x41A4,0x006C,0xC1AC,0x81AD,0x406D,0x01AF,0xC06F
,0x806E,0x41AE,0x01AA,0xC06A,0x806B,0x41AB,0x0069,0xC1A9,0x81A8,0x4068
,0x0078,0xC1B8,0x81B9,0x4079,0x01BB,0xC07B,0x807A,0x41BA,0x01BE,0xC07E
,0x807F,0x41BF,0x007D,0xC1BD,0x81BC,0x407C,0x01B4,0xC074,0x8075,0x41B5
,0x0077,0xC1B7,0x81B6,0x4076,0x0072,0xC1B2,0x81B3,0x4073,0x01B1,0xC071
,0x8070,0x41B0,0x0050,0xC190,0x8191,0x4051,0x0193,0xC053,0x8052,0x4192
,0x0196,0xC056,0x8057,0x4197,0x0055,0xC195,0x8194,0x4054,0x019C,0xC05C
,0x805D,0x419D,0x005F,0xC19F,0x819E,0x405E,0x005A,0xC19A,0x819B,0x405B
,0x0199,0xC059,0x8058,0x4198,0x0188,0xC048,0x8049,0x4189,0x004B,0xC18B
,0x818A,0x404A,0x004E,0xC18E,0x818F,0x404F,0x018D,0xC04D,0x804C,0x418C
,0x0044,0xC184,0x8185,0x4045,0x0187,0xC047,0x8046,0x4186,0x0182,0xC042
,0x8043,0x4183,0x0041,0xC181,0x8180,0x4040};
Uint16 CRC16(Uint16  *msg , Uint16 len){
Uint16 crcL = 0xFF , crcH = 0xFF;
Uint16 index;
while(len--){
index = crcL ^ *msg++;
crcL = ((crc_table[index] & 0xFF00) >> 8) ^ (crcH);
crcH = crc_table[index] & 0xFF;
}
return (crcH<<8) | (crcL);
}
```

10.3.7 Exception response

When the master station sends a request to the slave station, the master station expects a normal response. Query of the master station may result in one of the following four events:

- If a request without communication error is received from the slave station and can be processed properly, a normal response will be returned by the slave station.
- If the slave station does not receive a request due to communication errors, no message will be returned. This will be regarded as a timeout by the slave station.
- If the slave station receives a request but detects a communication error (parity, address, frame error, etc.), no response will be returned. This will be regarded as a timeout by the slave station.

- If the slave station receives a request without communication error but cannot process the request (e.g. a request to read the non-existent register), the slave station will return an exception response and the master station will be informed of the actual error.

The exception response message has two fields different from those of the normal response:

- Function code field: In the normal response, the slave station copies the function code of the original request in the corresponding function code field. The MSB values of all function codes are 0. In the exception response, the MSB of the function code is set to 1 by the slave station. That is, **the exception response function code = normal response function code + 0x80**.
- Data field: The slave station can return the data from the data field in the normal response and exception code in the exception response. The defined exception codes are detailed in the table below.

Table 10-4 Definitions of Exception Codes

Exception code	Item	Meaning
01H	Illegal function	The function code received by the slave station (inverter) is beyond the configured range (see11.3.3 Function codes).
02H	Illegal data address	The data address received by the slave station (inverter) is not allowed. In particular, the combination of the start address of the register and the transmission length is invalid (see11.3.4 Register address distribution).
03H	Illegal data frame	The slave station (inverter) has detected the incorrect query data frame length or CRC check.
04H	Slave protection	When the slave station (inverter) tries to execute a requested operation, an unrecoverable error occurs. This maybe caused by the logic error, failure to write to the EEPROM, etc.
05H	Data over-range	The data received by the slave station (inverter) is not between the minimum and maximum values of the corresponding register.
06H	Parameter read-only	The current register is read-only and cannot be written.
07H	Unchangeable parameter in running	When the inverter is in the running status, the current register cannot be written. If necessary, please shut down the inverter.
08H	Parameter protection by password	The current register is protected by a password.

10.4Protocol Description

10.4.1 Definition of inter-frame and intra-frame time interval

A complete MODBUS message contains not only the necessary data units, but also the starting and ending tags. Thus, as shown in Fig. 10-2 or Fig. 10-4, the idle level with a transmission time of 3.5 characters or more is defined as the starting and ending tag. If there is an idle level with a transmission time of more than 1.5 characters during message transmission, the transmission will be deemed exceptional.

Specific starting/ending and exception intervals are related to the baud rate, as detailed in Table 6-27. If the baud rate is 9600bps and the sampling period is 1ms, the starting and ending time interval is the idle level of 4ms or more (3.5×10/9600=3.64≈4), and the exceptional data interval is the idle level in which the interval of data bits of one frame is greater than or equal to 2ms (1.5×10/9600=1.56≈2) and less than 4m (the idle level of normal data bits is less than or equal to 1ms).

Table 10-5 Correspondence between Time Interval and Baud Rate (t_{adjust}=1ms)

Baud rate (bps)	Starting and ending time interval $T_{interval}$ (t_{adjust})	Exception interval $T_{exception}$ (t_{adjust})	Remarks
4800	8	4	The idle level of 3ms or less is allowed for a normal frame. When the idle level is 8ms or greater, it indicates the end of a frame of data.
9600	4	2	The idle level of 1ms or less is allowed for a normal frame. When the idle level is 4ms or greater, it indicates the end of a frame of data.
19200	2	1	The idle level of less than 1ms is allowed for a normal frame. When the idle level is 2ms or greater, it indicates the end of a frame of data.
Higher	**1**	**1**	**When an idle level of 1ms appears, it indicates the end of a frame.**

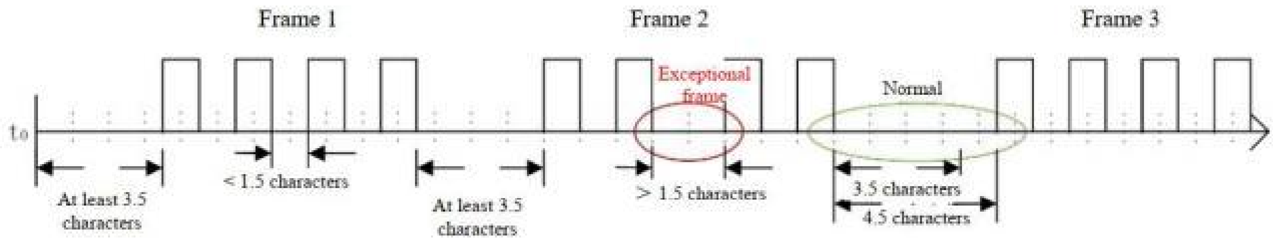


Fig. 10-4 Schematic Diagram of Normal and Exceptional Data Frames

10.4.2 Data frame processing

Upon receiving a frame data, the system will first perform preprocessing to determine whether it is a legal frame sent to this machine and check whether the data is correct, followed by final processing. If the received frame is not legal, the data will not be sent back. If the received frame is legal but incorrect, the corresponding exceptional message frame will be sent back.

Legal frame: Meet the address (local or broadcast) and length (not less than 3) requirements.

Correct frame: It is a legal frame with a correct memory address. The memory content is within the defined range and can be processed at present.

10.4.3 Response delay

The response delay (depending on the function code F10.04) is defined as the time interval from the reception of valid data frame[7] (data in the RS-485 network, different from the command sent by the keyboard) to data parsing and return. Since the starting and ending characters are defined in the standard protocol, it is impossible to avoid response delay, at least "3.5-character time interval + 1 ms (chip stabilization time of 485 protocol, t_{wait2})". The specific minimum time interval is related to the baud rate. If the baud rate is 9600bps, the minimum response delay is 5ms ($3.5\times10/9600+1=4.64\approx5$).

If the communication data involves EEPROM operation, the time interval will be longer.

[7]: Valid data frame: Sent by the external master station (not keyboard) to this machine. The function code, length and CRC of the data are correct.

Table 6-36 shows the data sending segment (t_{send}), sending end segment (t_{wait1}), 75176-to-sending wait segment (t_{wait2}), data return segment (t_{return}), and 75176-to-receiving wait segment (t_{wait3}).

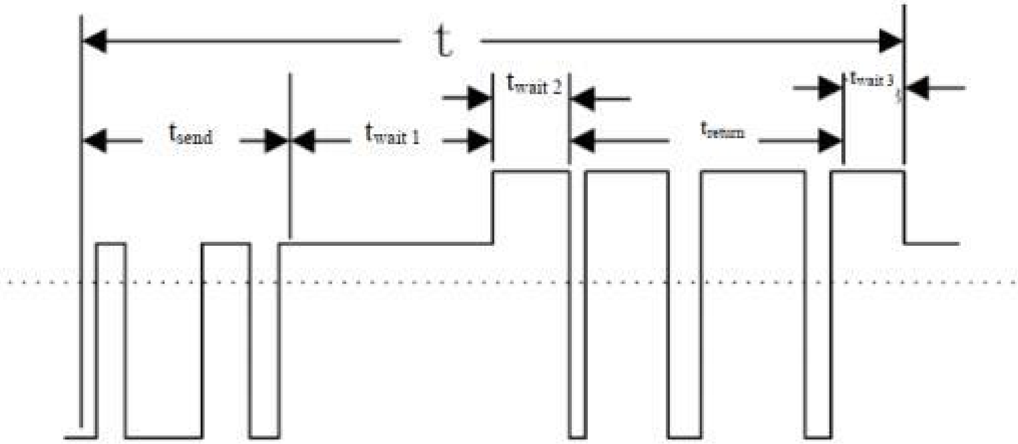


Fig. 10-5 Timing Parse Diagram of Complete Data Frame

10.4.4 Communication timeout

The communication time interval △t is defined as the period from the previous reception of valid data frames by the slave station (inverter) to next reception of valid data frames. If △tis greater than the set time (depending on the function code F10.03; this function is invalid if set to 0), it will be regarded communication timeout.

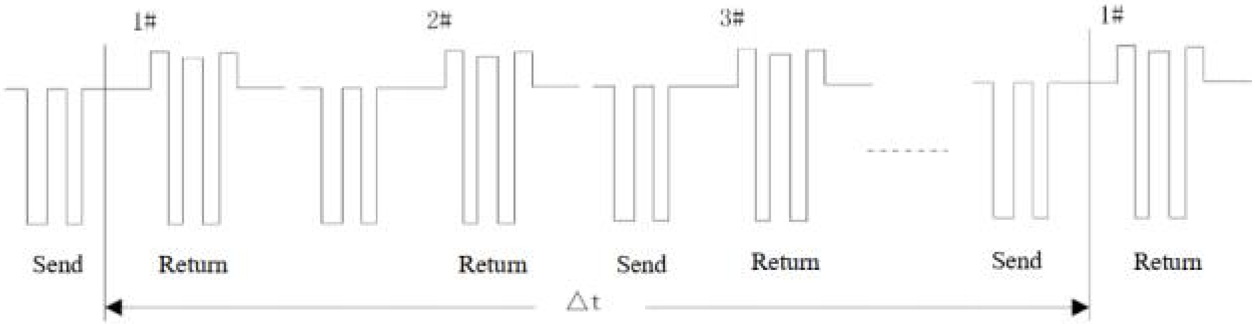


Fig. 10-6 Schematic Diagram of 485 Network Link Data

10.5Examples

1) Forward running of inverter

Send: 01 41 70 0000 01 E6 C5

Return: 01 41 70 0000 01 E6 C5 (normal)

Return: 01 C1 04 70 53 (exception, assuming a slave protection)

	Send		Normal Return		Exception Return	
*	Frame header	≥3.5 characters (idle)				
1	Address	01	Address	01	Address	01
2	Function code	41	Function code	41	Function code	C1

3	Register address Hi	70	Register address Hi	70	Exception code	04 (assumption)
4	Register address Lo	00	Register address Lo	00	CRC check Lo	70
5	Register value Hi	00	Register value Hi	00	CRC check Hi	53
6	Register value Lo	01	Register value Lo	01		
7	CRC check Lo	E6	CRC check Lo	E6		
8	CRC check Hi	C5	CRC check Hi	C5		
*	Tail	≥3.5 characters (idle)				

2) Free stop of inverter

Send: 01 41 70 0000 07 66 C7

Return: 01 41 70 0000 07 66 C7 (normal)

Return: 01 C1 04 70 53 (exception, assuming a slave protection)

	Send		Normal Return		Exception Return	
*	Frame header	≥3.5 characters (idle)				
1	Address	01	Address	01	Address	01
2	Function code	41	Function code	41	Function code	C1
3	Register address Hi	70	Register address Hi	70	Exception code	04 (assumption)
4	Register address Lo	00	Register address Lo	00	CRC check Lo	70
5	Register value Hi	00	Register value Hi	00	CRC check Hi	53
6	Register value Lo	07	Register value Lo	07		
7	CRC check Lo	66	CRC check Lo	66		
8	CRC check Hi	C7	CRC check Hi	C7		
*	Tail	≥3.5 characters (idle)				

3) Command word for change of set frequency (e.g. 50.00Hz/1388H) (F00.04=7)

Send: 01 41 70 15 13 88 3B 97

Return: 01 41 70 15 13 88 3B 97 (normal)

Return: 01 C1 04 70 53 (exception, assuming a slave protection)

	Send		Normal Return		Exception Return	
*	Frame header	≥3.5 characters (idle)				
1	Address	01	Address	01	Address	01

2	Function code	41	Function code	41	Function code	C1
3	Register address Hi	70	Register address Hi	70	Exception code	04 (assumption)
4	Register address Lo	15	Register address Lo	15	CRC check Lo	70
5	Register value Hi	13	Register value Hi	13	CRC check Hi	53
6	Register value Lo	88	Register value Lo	88		
7	CRC check Lo	3B	CRC check Lo	3B		
8	CRC check Hi	97	CRC check Hi	97		
*	Tail	≥3.5 characters (idle)				

1) Read the information of last protection (read the function codes F19.00-F19.05)

Send: 01 03 13 00 00 06 C1 4C

Return: 01 03 0C 00 11 00 00 00 00 01 2C 00 00 00 00 53 5B (normal)

Return: 01 83 04 40 F3 (exception, assuming a slave protection)

	Send		Normal Return		Exception Return	
*	Frame header	≥3.5 characters (idle)				
1	Address	01	Address	01	Address	01
2	Function code	03	Function code	03	Function code	83
3	Starting address Hi	13	Number of bytes	0C	Exception code	04 (assumption)
4	Starting address Lo	00	Register value Hi (F19.00)	00	CRC check Lo	40
5	Number (Hi) of registers	00	Register value Lo (F19.00)	11	CRC check Hi	F3
6	Number (Lo) of registers	06	Register value Hi (F19.01)	00		
7	CRC check Lo	C1	Register value Lo (F19.01)	00		
8	CRC check Hi	4C	Register value Hi (F19.02)	00		
9			Register value Lo (F19.02)	00		
10			Register value Hi (F19.03)	01		
11			Register value Lo (F19.03)	2C		
12			Register value Hi (F19.04)	00		
13			Register value Lo (F19.04)	00		
14			Register value Hi (F19.05)	00		
15			Register value Lo (F19.05)	00		
16			CRC check Lo	53		
17			CRC check Hi	5B		
*	Tail		≥3.5 characters (idle)			

2) Check whether the line is connected.

Send: 01 08 00 00 AA 55 5E 94

Return: 01 08 00 00 AA 55 5E 94 (normal)

Return: 01 88 04 47 C3 (exception, assuming a slave protection)

	Send		Normal Return		Exception Return	
*	Frame header	≥3.5 characters (idle)				
1	Address	01	Address	01	Address	01
2	Function	08	Function	08	Function code	88
3	Sub-function code Hi	00	Sub-function code Hi	00	Exception code	04 (assumption)
4	Sub-function code Lo	00	Sub-function code Lo	00	CRC check Lo	47
5	Data Hi	AA	Data Hi	AA	CRC check Hi	C3
6	Data Lo	55	Data Lo	55		
7	CRC check Lo	5E	CRC check Lo	5E		
8	CRC check Hi	94	CRC check Hi	94		
*	Tail	≥3.5 characters (idle)				

3) Change the carrier frequency (F00.23) to 4.0kHz. (use the function code 0x06 as such function codes are expected to be stored in EEPROM after change)

Send: 01 06 00 17 00 28 39 D0

Return: 01 06 00 17 00 28 39 D0 (normal)

Return: 01 86 04 43 A3 (exception, assuming a slave protection)

	Send		Normal Return		Exception Return	
*	Frame header	≥3.5 characters (idle)				
1	Address	01	Address	01	Address	01
2	Function code	06	Function code	06	Function code	86
3	Register address Hi	00	Register address Hi	00	Exception code	04 (assumption)
4	Register address Lo	17	Register address Lo	17	CRC check Lo	43
5	Register value Hi	00	Register value Hi	00	CRC check Hi	A3
6	Register value Lo	28	Register value Lo	28		
7	CRC check Lo	39	CRC check Lo	39		
8	CRC check Hi	D0	CRC check Hi	D0		
*	Tail	≥3.5 characters (idle)				

Chapter 11 **Function Code Table**

Function code	Function codename	Parameter description	Unit	Default setting	Attribute	Communication address
F00	Basic function parameter group					
F00.01	Drive control mode of motor 1	0: V/F control (VVF) 1: Speed sensorless vector control (SVC) 2: Speed sensor vector control (FVC)		0	O	0x0001
F00.02	Options of command source	0: keyboard control (LOC/REM indicator ON) 1: terminal control (LOC/REM indicator: OFF) 2: communication control (LOC/REM indicator: flicker)		0	O	0x0002
F00.03	Options of terminal control mode	0: terminal RUN (running) and F/R (forward/reverse) 1: terminal RUN (forward) and F/R (reverse) 2: terminal RUN (forward), Xi (stop) and F/R (reverse) 3: terminal RUN (running), Xi (stop) and F/R (forward/reverse)		0	O	0x0003
F00.04	Options of main frequency source A	0: digital frequency setting F00.07 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: main frequency communication setting (percentage) 7: main frequency communication setting (direct frequency)		0	O	0x0004
F00.05	Options of auxiliary frequency source B	0: digital frequency setting F00.07 1: AI1 2: AI2 3: AI3		0	O	0x0005

		4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: auxiliary frequency communication setting (percentage) 7: auxiliary frequency communication setting (direct frequency) 10: process PID 11: simple PLC				
F00.06	Options of frequency source	0: main frequency source A 1: auxiliary frequency source B 2: main and auxiliary operation results 3: switching between main frequency source A and auxiliary frequency source B 4: switching between main frequency source A and main and auxiliary operation results 5: switching between auxiliary frequency source B and main and auxiliary operation results 6: Auxiliary frequency source B + feedforward calculation (winding application)		0	O	0x0006
F00.07	Digital frequency setting	0.00 to maximum frequency F00.16	Hz	50.00	●	0x0007
F00.08	Options of main and auxiliary operation	0: main frequency source A + auxiliary frequency source B 1: main frequency source A - auxiliary frequency source B 2: larger value of main and auxiliary frequency sources 3: smaller value of main and auxiliary frequency sources 4: main frequency source A - auxiliary frequency source B 5: main frequency source A + auxiliary frequency source B		0	O	0x0008
F00.09	Reference options of auxiliary frequency source B in main and auxiliary operation	0: relative to the maximum frequency 1: Relative to main frequency source A		0	O	0x0009
F00.10	Gain of main frequency source	0.0~300.0	%	100.0	●	0x000A
F00.11	Gain of auxiliary frequency source	0.0~300.0	%	100.0	●	0x000B
F00.12	Synthetic gain of main and auxiliary frequency sources	0.0~300.0	%	100.0	●	0x000C

F00.13	Analog adjustment of synthetic frequency	0: synthetic frequency of main and auxiliary channels 1: AI1 * synthetic frequency of main and auxiliary channels 2: AI2 * synthetic frequency of main and auxiliary channels 3: AI3* synthetic frequency of main and auxiliary channels 4: AI4* synthetic frequency of main and auxiliary channels 5: High frequency pulse (PULSE) * synthetic frequency of main and auxiliary channels		0	O	0x000D
F00.14	Acceleration time 1	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	15.00	●	0x000E
F00.15	Deceleration time 1		s	15.00	●	0x000F
F00.16	Maximum frequency	1.00~600.00	Hz	50.00	O	0x0010
F00.17	Options of upper frequency limit control	0: set by F00.18 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: Communication setting (percentage) 7: Communication setting (direct frequency)		0	O	0x0011
F00.18	Upper frequency limit	Lower frequency limit F00.19 to maximum frequency F00.16	Hz	50.00	●	0x0012
F00.19	Lower frequency limit	0.00 to upper frequency limit F00.18	Hz	0.00	●	0x0013
F00.20	Running direction	0: consistent direction 1: opposite direction		0	●	0x0014
F00.21	Reverse control	0: Allow forward/reverse running 1: Prohibit reversing		0	O	0x0015
F00.22	Duration of forward and reverse dead zone	0.00~650.00	s	0.00	●	0x0016

F00.23	Carrier frequency	1.0-16.0 (rated power of the inverter: less than 4kW) 1.0-10.0 (rated power of the inverter: 5.5-7.5kW) 1.0 - 8.0 (rated power of inverter 11 - 45kW) 1.0 - 4.0 (rated power of inverter 55 - 90kW) 1.0 - 3.0 (rated power of inverter 110 - 560kW)	kHz	2.0	●	0x0017
F00.24	Automatic adjustment of carrier frequency	0: Invalid 1: valid 1 2: valid 2		1	O	0x0018
F00.25	Noise suppression of carrier frequency	0: Invalid 1: Noise suppression mode 1 of carrier frequency 2: Noise suppression mode 2 of carrier frequency		0	O	0x0019
F00.26	Noise suppression width	1~20		1	●	0x001A
F00.27	Noise suppression intensity	0-10: Noise suppression mode 1 of carrier frequency 0-4: Noise suppression mode 2 of carrier frequency		0	●	0x001B
F00.28	Options of motor parameter group	0: parameter group of motor 1 1: parameter group of motor 2		0	O	0x001C
F00.29	User password	0~65535		0	O	0x001D
F00.30	Model selection	0: G type 1: P type		0	O	0x001E
F00.31	Frequency resolution	0: 0.01Hz; 1: 0.1Hz (speed unit: 10rpm)		0	O	0x001F
F00.32	Frequency point corresponding to the lower limit of carrier frequency	0.00~F0.33	Hz	20.00	O	0x0020
F00.33	Frequency point corresponding to the upper limit of carrier frequency	10.00~150.00	HZ	50.00	O	0x0021
F00.34	Lower limit of carrier frequency	1.0~F00.23	kHz	2.0	O	0x0022

F00.35	Inverter supply voltage selection	0: 380V 1: 440V 2: 480V 3: 600V 4: 690V		0	O	0x0023
F00.36	Start/stop channel selection for communication control	0: Modbus 1: Profinet		0	O	0x0024
F00.37	Communication-specific channel selection	2: EtherCAT 3: CANopen 10: All protocols are valid		0	O	0x0025
F00.38	Parameter locking function selection	0: Locked for all command channels 1: Only the keyboard locked		0	O	0x0026
F00.39	Single-brush and double-brush PWM switch control	0: Single-brush 1: Double-brush 2: Automatic switch		0	O	0x0027
F01	Parameter group of motor 1					
F01.00	Motor type	0: ordinary asynchronous motor 1: variable-frequency asynchronous motor 2: permanent magnet synchronous motor		0	O	0x0100
F01.01	Rated power of electric motor	0.10~650.00	kW	Depending on the motor type	O	0x0101
F01.02	Rated voltage of motor	50~2000	V	Depending on the motor type	O	0x0102
F01.03	Rated current of motor	0.01 to 600.00 (rated power of motor: ≤ 75 kW) 0.1 to 6000.0 (rated power of motor: > 75 kW)	A	Depending on the motor type	O	0x0103
F01.04	Rated frequency of motor	0.01~600.00	Hz	Depending on the motor type	O	0x0104
F01.05	Rated speed	1~60000	rpm	Depending on the motor type	O	0x0105
F01.06	Motor winding connection	0: Y 1: Δ		Depending on the motor type	O	0x0106

F01.07	Rated power factor of motor	0.600~1.000		Depending on the motor type	O	0x0107
F01.08	Motor efficiency	30.0~100.0	%	Depending on the motor type	O	0x0108
F01.09	Stator resistance of asynchronous motor	1 to 60,000 (rated power of motor: ≤ 75 kW) 0.1 to 6,000.0 (rated power of motor: > 75 kW)	mΩ	Depending on the motor type	O	0x0109
F01.10	Rotor resistance of asynchronous motor	1 to 60,000 (rated power of motor: ≤ 75 kW) 0.1 to 6,000.0 (rated power of motor: > 75 kW)	mΩ	Depending on the motor type	O	0x010A
F01.11	Leakage inductance of asynchronous motor	0.01 to 600.00 rated power of motor: ≤ 75 kW) 0.001 to 60.000 (rated power of motor: > 75 kW)	mH	Depending on the motor type	O	0x010B
F01.12	Mutual inductance of asynchronous motor	0.1 to 6,000.0 (rated power of motor: ≤ 75 kW) 0.01 to 600.00 (rated power of motor: > 75 kW)	mH	Depending on the motor type	O	0x010C
F01.13	No-load excitation current of asynchronous motor	0.01 to 600.00 rated power of motor: ≤ 75 kW) 0.1 to 6,000.0 (rated power of motor: > 75 kW)	A	Depending on the motor type	O	0x010D
F01.14	Magnetic saturation coefficient 1 of asynchronous motor	10.00~100.00	%	87.00	O	0x010E
F01.15	Magnetic saturation coefficient 2 of asynchronous motor	10.00~100.00	%	80.00	O	0x010F
F01.16	Magnetic saturation coefficient 3 of asynchronous motor	10.00~100.00	%	75.00	O	0x0110
F01.17	Magnetic saturation coefficient 4 of asynchronous motor	10.00~100.00	%	72.00	O	0x0111
F01.18	Magnetic saturation coefficient 5 of asynchronous motor	10.00~100.00	%	70.00	O	0x0112
F01.19	Stator resistance of synchronous motor	1 to 60,000 (rated power of motor: ≤ 75 kW) 0.1 to 6,000.0 (rated power of motor: > 75 kW)	mΩ	Depending on the motor type	O	0x0113
F01.20	d-axis inductance of synchronous motor	0.01 to 600.00 rated power of motor: ≤ 75 kW) 0.001 to 60.000 (rated power of motor: > 75 kW)	mH	Depending on the motor type	O	0x0114
F01.21	q-axis inductance of synchronous motor	0.01 to 600.00 rated power of motor: ≤ 75 kW) 0.001 to 60.000 (rated power of motor: > 75 kW)	mH	Depending on the motor type	O	0x0115

F01.22	Counter electromotive force of synchronous motor	10.0-2000.0 (counter electromotive force of rated speed)	V	Depending on the motor type	O	0x0116
F01.24	Encoder type	0: ABZ gain encoder 1: UVW gain encoder 3: SinCos encoder 4: Rotary transformer		0	O	0x0118
F01.25	Encoder line count	1~65535		1024	O	0x0119
F01.26	Zero-pulse phase angle of encoder	0.0~359.9°		0.0	O	0x011A
F01.27	AB pulse phase sequence	0: forward 1: reverse		0	O	0x011B
F01.28	UVW encoder phase sequence	0: forward 1: reverse		0	O	0x011C
F01.29	UVW initial offset phase angle	0.0~359.9°		0.0	O	0x011D
F01.30	Pole pairs of rotary transformer	1~65535		1	O	0x011E
F01.31	High-frequency filter coefficient of encoder	0-15		10	O	0x011F
F01.32	Detection time of speed feedback disconnection	0.0~10.0 (0.0: inactive detection of speed feedback disconnection)		1.0	O	0x0120
F01.33	Speed feedback filtering time	0.000~0.100	s	0.002	O	0x0121
F01.34	Motor parameter self-learning	0: No operation 1: static self-learning of asynchronous motor 2: rotation self-learning of asynchronous motor 3: Self-learning ofasynchronous motor encoder 10: No operation (when permanent magnet synchronous motor is selected) 11: static self-learning of synchronous motor 12: rotary self-learning of synchronous motor 13: encoder self-learning of synchronous motor		0	O	0x0122

F02	Input terminal function group					
F02.00	Options of X1 digital input function	0: no function 1: terminal running (RUN) 2: running direction (F/R) 3: stop control in three-line operation 4: forward jog (FJOG) 5: reverse jog (RJOG) 6: terminal UP 7: terminal DOWN 8: clear UP/DOWN offset 9: free stop 10: reset fault 11: multi-segment speed terminal 1 12: multi-segment speed terminal 2 13: multi-segment speed terminal 3 14: multi-segment speed terminal 4 15: multi-segment PID terminal 1 16: multi-segment PID terminal 2 17: multi-segment torque terminal 1 18: multi-segment torque terminal 2 19: acceleration and deceleration time terminal 1 20: acceleration and deceleration time terminal 2		1	O	0x0200
F02.01	Options of X2 digital input function			2	O	0x0201
F02.02	Options of X3 digital input function			11	O	0x0202
F02.03	Options of X4 digital input function			12	O	0x0203
F02.04	Options of X5 digital input function			13	O	0x0204
F02.05	Options of X6 digital input function			14	O	0x0205
F02.06	Options of X7 digital input function			10	O	0x0206
F02.07	Options of AI1 digital input function			0	O	0x0207
F02.08	Options of AI2 digital input function			0	O	0x0208
F02.09	Options of AI3 digital input function			0	O	0x0209
F02.10	Options of AI4 digital input function (expansion card)			0	O	0x020A
F02.11	Options of X8 digital input function (expansion card)			0	O	0x020B
F02.12	Options of X9 digital input function (expansion card)			0	O	0x020C
F02.13	Options of X10 digital input function (expansion card)			0	O	0x020D

F02.14	Reserved			0	×	0x020E
21: Acceleration and deceleration prohibition 22: operation pause 23: external fault input 24: Switching of RUN command to keyboard 25: switching of RUN command to communication 26: Frequency source switching 27: clearing of regular running time 28: speed control/torque control switching 29: torque control prohibition 30: motor 1/motor 2 switching 31: resetting of simple PLC status (running from the first segment, with the running time cleared) 32: simple PLC time pause (keep running at current segment) 33: Zero-servo command		34: counter input (≤250Hz) 35: high-speed count input (≤100kHz, only valid for X7) 36: count clearing 37: length counter input (≤250Hz) 38: High-speed length counting input (≤100kHz, only valid for X7) 39: length clearing 40: pulse input (≤ 100 kHz,only valid for X7) 41: process PID pause 42: process PID integral pause 43: PID parameter switching 44: PID positive/negative switching 45: stop and DC braking 46: DC braking at stop 47: immediate DC braking 48: fastest deceleration to stop 50: external stop	51: switching of main frequency source to digital frequency setting 52: switching of main frequency source to AI1 53: Switching of main frequency source to AI2 54: switching of main frequency source to AI3 55: Switching of main frequency source to high-frequency pulse input 56: switching of main frequency source to communication setting 57: inverter enabling 69: Reserving prohibited xor 89: Reset feedforward 121: External material cutoff signal 122: Wiring detection signal 123: Brake reset terminal			
F02.15	Positive/negative logic 1 of digital input terminal	D7 D6 D5 D4 D3 D2 D1 D0 * X7 X6 X5 X4 X3 X2 X1 0: positive logic is valid in the closed state/invalid in the open state 1: negative logic is valid in the closed state/invalid in the open state		*0000000	O	0x020F
F02.16	Positive/negative logic 2 of digital input terminal	D7 D6 D5 D4 D3 D2 D1 D0 X11 X10 X9 X8 AI4 AI3 AI2 AI1 0: positive logic is valid in the closed state/invalid in the open state 1: negative logic is valid in the closed state/invalid in the open state		00000000	O	0x0210

F02.17	Filtering times of digital input terminal	0-100; 0: no filtering; n: sampling every nms		2	O	0x0211
F02.18	X1 valid delay time	0.000~650.00	s	0.000	●	0x0212
F02.19	X1 invalid delay time	0.000~650.00	s	0.000	●	0x0213
F02.20	X2 valid delay time	0.000~650.00	s	0.000	●	0x0214
F02.21	X2 invalid delay time	0.000~650.00	s	0.000	●	0x0215
F02.22	X3 valid delay time	0.000~650.00	s	0.000	●	0x0216
F02.23	X3 invalid delay time	0.000~650.00	s	0.000	●	0x0217
F02.24	X4 valid delay time	0.000~650.00	s	0.000	●	0x0218
F02.25	X4 invalid delay time	0.000~650.00	s	0.000	●	0x0219
F02.26	Minimum input pulse frequency	0.00 to maximum input pulse frequency F02.28	kHz	0.00	●	0x021A
F02.27	Minimum input setting	–100.0~+100.0	%	0.0	●	0x021B
F02.28	Maximum input pulse frequency	0.01~100.00	kHz	50.00	●	0x021C
F02.29	Maximum input setting	–100.0~+100.0	%	100.0	●	0x021D
F02.30	Pulse input filtering time	0.00~10.00	s	0.10	●	0x021E
F02.31	Options of analog input function	Ones place: AI1 0: analog input 1: digital input (0 below 1V, 1 above 3V, the same as last time under 1-3V)		0000D	O	0x021F

		Tens place: AI2; as above Hundreds place: AI3; as above Thousands place: AI4 (expansion card); as above				
F02.32	Options of analog input curve	Ones place: Options of AI1 curve 0: curve 1 1: curve 2 2: curve 3 3: curve 4 Tens place: AI2 curve selection; as above Hundreds place: AI3 curve selection; as above Thousands place: AI4 curveselection; as above		3210D	O	0x0220
F02.33	Minimum input of curve 1	0.00~F02.35	V	0.10	●	0x0221
F02.34	Minimum input setting of curve 1	–100.0~+100.0	%	0.0	●	0x0222
F02.35	Maximum input of curve 1	F02.33~10.00	V	9.90	●	0x0223
F02.36	Maximum input setting of curve 1	–100.0~+100.0	%	100.0	●	0x0224
F02.37	Minimum input of curve 2	-10.00~F02.39	V	0.10	●	0x0225
F02.38	Minimum input setting of curve 2	–100.0~+100.0	%	0.0	●	0x0226
F02.39	Maximum input of curve 2	F02.37~10.00	V	9.90	●	0x0227
F02.40	Maximum input setting of curve 2	–100.0~+100.0	%	100.0	●	0x0228
F02.41	Minimum input of curve 3	0.00V~F02.43	V	0.10	●	0x0229

F02.42	Minimum input setting of curve 3	-100.0~+100.0	%	0.0	●	0x022A
F02.43	Input of inflection point 1 of curve 3	F02.41~F02.45	V	2.50	●	0x022B
F02.44	Input setting of inflection point 1 of curve 3	-100.0~+100.0	%	25.0	●	0x022C
F02.45	Input of inflection point 2 of curve 3	F02.43~F02.47	V	7.50	●	0x022D
F02.46	Input setting of inflection point 2 of curve 3	-100.0~+100.0	%	75.0	●	0x022E
F02.47	Maximum input of curve 3	F02.45~10.00	V	9.90	●	0x022F
F02.48	Maximum input setting of curve 3	-100.0~+100.0	%	100.0	●	0x0230
F02.49	Minimum input of curve 4	-10.00~F02.51	V	-9.90	●	0x0231
F02.50	Minimum input setting of curve 4	-100.0~+100.0	%	-100.0	●	0x0232
F02.51	Input of inflection point 1 of curve 4	F02.49~F02.53	V	-5.00	●	0x0233
F02.52	Input setting of inflection point 1 of curve 4	-100.0~+100.0	%	-50.0	●	0x0234
F02.53	Input of inflection point 2 of curve 4	F02.51~F02.55	V	5.00	●	0x0235
F02.54	Input setting of inflection point 2 of curve 4	-100.0~+100.0	%	50.0	●	0x0236
F02.55	Maximum input of curve 4	F02.53~10.00	V	9.90	●	0x0237
F02.56	Maximum input setting of curve 4	-100.0~+100.0	%	100.0	●	0x0238
F02.57	AI1 filtering time	0.000~10.000	s	0.100	●	0x0239
F02.58	AI2 filtering time	0.000~10.000	s	0.100	●	0x023A

F02.59	AI3 filtering time	0.000~10.000	s	0.100	●	0x023B
F02.60	AI4 filtering time (Expansion card)	0.000~10.000	s	0.100	●	0x023C
F02.61	AD sampling hysteresis	0~50		2	O	0x023D
F02.62	Selection of analog input AI1 type	0: 0~10V 3: -10~10V 4: 0~5V		0	O	0x023E
F02.63	Selection of analog input AI2 type	0: 0~10V 1: 4~20mA 2: 0~20mA 4: 0~5V		1	O	0x023F
F02.64	Analog input AI3 type selection	0: 0~10V 1: 4~20mA 2: 0~20mA 4: 0~5V		0	O	0x0240
F02.65	Analog input AI4 type selection (expansion card)	0: 0~10V 2: Reserved 3: -10~10V 4: 0~5V		2	O	0x0241
F03	Output terminal function group					
F03.00	Options of Y1 output function	0: no output 1: inverter running (RUN) 2: up to output frequency (FAR) 3: output frequency detection FDT1 4: output frequency detection FDT2 5: reverse running (REV)		1	O	0x0300
F03.01	Options of Y2 output function			3	O	0x0301
F03.02	Options of R1 output function (EA-EB-EC)			7	O	0x0302

F03.03	Options of R2 output function (RA-RB-RC)	6: jog 7: inverter fault		8	O	0x0303
F03.04	Reserved			0	O	0x0304
8: inverter ready to run 9: reach the upper frequency limit 10: reach the lower frequency limit 11: valid current limit 12: valid overvoltage stall 13: complete simple PLC cycle 14: reach the set count value 15: reach the specified count value 16: reach the length 17: motor overload pre-alarm 18: inverter overheat pre-alarm		19: reach the upper limit of PID feedback 20: reach the lower limit of PID feedback 21: analog level detection ADT1 22: analog level detection ADT2 24: undervoltage state 25: motor overheat pre-alarm 26: up to the set time 27: zero-speed running 38: off-load 39: Zero-speed running 2 40: Current reached 41: Torque reached	42: up to the speed 47: PLC output 59: Sleep indicator 67: Brake control 68: Material cutoff detection output 69: FDT1 lower limit (pulse) 70: FDT2 lower limit (pulse) 71: FDT1 lower limit (pulse, invalid in JOG) 72: FDT2 lower limit (pulse, invalid in JOG) 73: Overcurrent status 86: STO failure indication			
F03.05	Options of output signal type	D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 * | * | * | * | R2 | R1 | Y2 | Y1 0: level 1: single pulse		0000	O	0x0305
F03.06	Positive/negative logic of digital output	D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 * | R4 | R3 | * | R2 | R1 | Y2 | Y1 0: positive logic is valid in the closed state/invalid in the open state 1: negative logic is valid in the closed state/invalid in the open state		000000	O	0x0306
F03.07	Options of Y2 output type	0: ordinary digital output 1: high frequency pulse output		0	O	0x0307
F03.08	Output status control in jog	D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 * | * | * | REV | FDT2 | FDT1 | FAR | RUN 0: valid in jogging 1: invalid in jogging		00000	O	0x0308

F03.09	Y1 valid delay time	0.00~650.00	s	0.00	●	0x0309
F03.10	Y1 invalid delay time	0.00~650.00	s	0.00	●	0x030A
F03.11	Y2 valid delay time	0.00~650.00	s	0.00	●	0x030B
F03.12	Y2 invalid delay time	0.00~650.00	s	0.00	●	0x030C
F03.13	R1 valid delay time	0.00~650.00	s	0.00	●	0x030D
F03.14	R1 invalid delay time	0.00~650.00	s	0.00	●	0x030E
F03.15	R2 valid delay time	0.00~650.00	s	0.00	●	0x030F
F03.16	R2 invalid delay time	0.00~650.00	s	0.00	●	0x0310
F03.17	Single pulse time of Y1 output	0.001~30.000	s	0.250	●	0x0311
F03.18	Single pulse time of Y2 output	0.001~30.000	s	0.250	●	0x0312
F03.19	Single pulse time of R1 output	0.001~30.000	s	0.250	●	0x0313
F03.20	Single pulse time of R2 output	0.001~30.000	s	0.250	●	0x0314
F03.21	Options of analog output M1	0: running frequency (absolute value) 1: set frequency (absolute value) 2: output torque (absolute value) 3: set torque (absolute value)		0	O	0x0315
F03.22	Options of analog output M2			2	O	0x0316
F03.23	Y2 high frequency pulse output function			11	O	0x0317
4: output current			15: length value			

5: Output voltage 6: bus voltage 7: output power 8: AI1 9: AI2		10: AI3 11: AI4 (expansion card) 12: High frequency pulse input (100.00% corresponds to the maximum frequency, and 0.00% corresponds to the minimum frequency) 13: Communication setting 1 14: count value	16: PID output 18: PID feedback 19: PID setting 30: Communication setting 2 31: Communication setting 3 32: Speed loop output			
F03.24	Frequency corresponding to 100% of Y2 high frequency pulse output	0.00~100.00	kHz	50.00	●	0x0318
F03.25	Frequency corresponding to 0% of Y2 high frequency pulse output	0.00~100.00	kHz	0.00	●	0x0319
F03.26	Filtering time of Y2 high frequency pulse output	0.00~10.00	s	0.10	●	0x031A
F03.27	M1 output bias	-100.0~100.0	%	0.0	●	0x0311
F03.28	M1 output gain	-9.999~9.999		1.000	●	0x0312
F03.29	M2 output bias	-100.0~100.0	%	0.0	●	0x0313
F03.30	M2 output gain	-9.999~9.999		1.000	●	0x0314
F03.31	Control logic options of PLC output terminal	D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 * | R4 | R3 | * | R2 | R1 | Y2 | Y1 0: No output 1: Output		000000	●	0x0315
F03.32	Options of R3 output function (expansion card)	For details, refer to introduction to F03.02		0	O	0x0316
F03.33	Options of R4 output function (expansion card)	For details, refer to introduction to F03.02		0	O	0x0317
F03.34	Output type selection of analog quantity M1	0: 0~10V 1: 4~20mA 2: 0~20mA		0	O	0x0318
F03.35	Output type selection of analog quantity M2			1	O	0x0319
F04	Start/stop control parameter group					

F04.00	Start-up method	0: direct start 1: start of speed tracking		0	O	0x0400
F04.01	Start frequency	0.00~50.00	Hz	0.00	O	0x0401
F04.02	Start frequency hold time	0.00-60.00, 0.00 is invalid	s	0.00	O	0x0402
F04.03	Starting current of DC braking	0.0 to 100.0 (100.0 = rated current of motor)	%	50.0	O	0x0403
F04.04	Starting time of DC braking	0.00~30.00, 0.00 invalid	s	0.00	O	0x0404
F04.06	Pre-excitation current	10.0~500.0 (100.0 = no-load current)	%	100.0	O	0x0406
F04.07	Pre-excitation time	0.00~10.00	s	0.10	O	0x0407
F04.08	Speed tracking mode	Ones place: Tracking start frequency 0: maximum frequency 1: stop frequency 2: power frequency Tens place: Selection of search direction 0: search only in command direction 1: Search in the opposite direction if the speed cannot be found in the command direction		01	O	0x0408
F04.10	Deceleration time of speed tracking	0.1~20.0	s	2.0	O	0x040A
F04.11	Speed tracking current	30.0-150.0 (100.0 = rated current of inverter)	%	50.0	O	0x040B
F04.12	Speed tracking compensation gain	1.00~10.00		1.00	O	0x040C
F04.14	Acceleration and deceleration mode	0: linear acceleration and deceleration 1: acceleration and deceleration of continuous S curve 2: acceleration and deceleration of intermittent S curve		0	O	0x040E
F04.15	Starting time of S curve in acceleration	0.00 to system acceleration time/2 (F15.13=0) 0.0 to system acceleration time/2 (F15.13=1) 0 to system acceleration time/2 (F15.13=2)	s	1.00	●	0x040F
F04.16	Ending time of S curve in acceleration		s	1.00	●	0x0410

F04.17	Starting time of S curve in deceleration		s	1.00	●	0x0411
F04.18	Ending time of S curve in deceleration		s	1.00	●	0x0412
F04.19	Stop mode	0: slow down to stop 1: free stop		0	O	0x0413
F04.20	Starting frequency of DC braking in stop	0.00 to maximum frequency F00.16	Hz	0.00	O	0x0414
F04.21	DC braking current in stop	0.0 to 100.0 (100.0 = rated current of motor)	%	50.0	O	0x0415
F04.22	DC braking time in stop	0.00~30.00 0.00: invalid	s	0.00	O	0x0416
F04.23	Demagnetization time for DC braking in stop	0.00~30.00	s	0.50	O	0x0417
F04.24	Flux braking gain	100-200 (100: no flux braking)		100	O	0x0418
F04.26	Start mode after failure/free stop	0: start according to F04.00 setting mode 1: start of speed tracking		0	O	0x041A
F04.27	Second confirmation of terminal start command	0: Not required for confirmation 1: to be confirmed 2: Way 2 for no confirmation (no confirmation is made even upon fault resetting)		0	O	0x041B
F04.28	Minimum valid output frequency	0.00~50.00 (0.00: function invalid)	Hz	0	O	0x041C
F04.29	Zero speed check frequency	0.00~5.00	Hz	0.25	●	0x041D
F04.30	Initial magnetic pole search mode of synchronous motor	0: Invalid 1: Mode 1		1	●	0x041E
F04.32	Gain of low-frequency excitation current regulation	0.0~300.0	%	100		0x0420
F04.33	Switching time of low-frequency excitation current regulation	0.00~10.00	s	0		0x0421
F05	V/F control parameter group					
F05.00	V/F curve setting	0: straight line V/F		0	O	0x0500

		1: multi-point broken line V/F 2: 1.3-power V/F 3: 1.7-power V/F 4: square V/F 5: VF complete separation mode (Ud = 0,Uq = K * t = voltage of separation voltage source) 6: VF semi-separation mode (Ud = 0, Uq = K * t = F/Fe * 2 * voltage of separation voltage source)				
F05.01	Frequency point F1 of multi-point VF	0.00~F05.03	Hz	0.50	●	0x0501
F05.02	Voltage point V1 of multi-point VF	0.0~100.0 (100.0 = Rated voltage)	%	1.0	●	0x0502
F05.03	Frequency point F2 of multi-point VF	F05.01~F05.05	Hz	2.00	●	0x0503
F05.04	Voltage point V2 of multi-point VF	0.0~100.0	%	4.0	●	0x0504
F05.05	Frequency point F3 of multi-point VF	F05.03 to rated frequency of motor (reference frequency)	Hz	5.00	●	0x0505
F05.06	Voltage point V3 of multi-point VF	0.0~100.0	%	10.0	●	0x0506
F05.07	Voltage source of VF separation mode	0: digital setting of VF separation voltage 1: AI1 2: AI2 3: AI3 4: high frequency pulse (X7) 5: PID 6: Communication setting Note: 100% is the rated voltage of the motor.		0	O	0x0507
F05.08	Digital setting of VF separation voltage	0.0 to 100.0 (100.0=Rated voltage of motor)	%	0.0	●	0x0508

F05.09	Rise time of VF separation voltage	0.00~60.00	s	2.00	●	0x0509
F05.10	Compensation gain of V/F stator voltage drop	0.00~200.00	%	100.00	●	0x050A
F05.11	V/F slip compensation gain	0.00~200.00	%	100.00	●	0x050B
F05.12	V/F slip filtering time	0.00~10.00	s	1.00	●	0x050C
F05.13	Oscillation suppression gain	0~20000		300	●	0x050D
F05.14	Oscillation suppression cutoff frequency	0.00~600.00	Hz	55.00	●	0x050E
F05.15	Droop control frequency	0.00~10.00	Hz	0.00	●	0x050F
F05.16	Energy saving rate	0.00~50.00	%	0.00	●	0x0510
F05.17	Energy saving action time	1.00~60.00	s	5.00	●	0x0511
F05.18	Flux compensation gain of synchronous motor	0.00~500.00	%	100.00	●	0x0512
F05.19	Filtering time constant of flux compensation of synchronous motor	0.00~10.00	s	0.50	●	0x0513
F05.20	Change rate of VF separate power supply setting	–50.00~50.00	%	0.00	●	0x0514
F06	Vector control parameter group					
F06.00	Speed proportional gain ASR_P1	0.00~100.00		12.00	●	0x0600
F06.01	Speed integral time constant ASR_T1	0.000~30.000 0.000: no integral	s	0.250	●	0x0601
F06.02	Speed proportional gain ASR_P2	0.00~100.00		10.00	●	0x0602
F06.03	Speed integral time constant	0.000~30.000	s	0.300	●	0x0603

	ASR_T2	0.000: no integral				
F06.04	Switching frequency 1	0.00 to switching frequency 2	Hz	5.00	●	0x0604
F06.05	Switching frequency 2	Switching frequency 1 to maximum frequency F00.16	Hz	10.00	●	0x0605
F06.07	Filtering time constant of speed loop output	0.000~0.100	s	0.001	●	0x0607
F06.08	Vector control slip gain	10.00~200.00	%	100.00	●	0x0608
F06.09	Upper limit source selection of speed control torque	0: set by F06.10 and F06.11 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: Communication setting (percentage) 6: Take the maximum values of AI2 and AI3 7: Take the minimum values of AI2 and AI3		0	O	0x0609
F06.10	Upper limit of speed control motor torque	0.0~250.0	%	165.0	●	0x060A
F06.11	Upper limit of speed control brake torque	0.0~250.0	%	165.0	●	0x060B
F06.12	Excitation current proportional gain ACR-P1	0.00~ 100.00		0.50	●	0x060C
F06.13	Excitation current integral time constant ACR-T1	0.00~600.00 0.00: no integral	ms	10.00	●	0x060D
F06.14	Torque current proportional gain ACR-P2	0.00~ 100.00		0.50	●	0x060E
F06.15	Torque current integral time constant ACR-T2	0.00~600.00 0.00: no integral	ms	10.00	●	0x060F
F06.17	SVC zero-frequency processing	0: braking		2	O	0x0611

		1: not processed 2: seal the tube				
F06.18	SVC zero-frequency braking current	50.0-400.0 (100.0 is the no-load current of the motor)	%	100.0	O	0x0612
F06.20	Voltage feedforward gain	0~100	%	0	●	0x0614
F06.21	Flux weakening control options	Asynchronous motor Ones place: Asynchronous flux weakening mode 0: No PI adjustment output Non-zero: PI adjustment output Tens place: Output voltage limiting method of asynchronous motor in the flux weakening mode 0: F06.22 output voltage limiting according to bus voltage 1: F06.22 output voltage limiting according to rated voltage Synchronous motor Ones place: Synchronous motor flux weakening mode 0: Invalid 1: direct calculation 2: automatic adjustment Tens place: Output voltage limiting method of synchronous motor in the flux weakening mode 0: F06.22 output voltage limiting according to bus voltage 1: F06.22 output voltage limiting according to rated voltage		12	O	0x0615
F06.22	Flux weakening voltage	70.00~100.00	%	100.00	●	0x0616
F06.23	Maximum flux weakening current of synchronous motor	0.0-150.0 (100.0 is the rated current of the motor)	%	100.0	●	0x0617
F06.24	Proportional gain of flux weakening regulator	0.00~60.00		0.50	●	0x0618
F06.25	Integral time of flux weakening regulator	0.001~6.000	s	0.200	●	0x0619
F06.26	MTPA control options of synchronous motor	0: Invalid 1: valid		1	O	0x061A
F06.27	Self-learning gain at initial position	0~200	%	100	●	0x061B

F06.28	Frequency of low frequency band of injection current	0.00-100.00 (100.00 is the rated frequency of the motor)	%	10.00	●	0x061C
F06.29	Injection current of low frequency band	0.0-200.0 (100.0 is the rated current of the motor)	%	40.0	●	0x061D
F06.30	Regulator gain of low frequency band of injection current	0.00~10.00		0.50	●	0x061E
F06.31	Regulator integral time of low frequency band of injection current	0.00~300.00	ms	10.00	●	0x061F
F06.32	Frequency of high frequency band of injection current	0.00-100.00 (100.00 is the rated frequency of the motor)	%	20.00	●	0x0620
F06.33	Injection current f high frequency band	0.0-30.0 (100.0 is the rated current of the motor)	%	8.0	●	0x0621
F06.34	Regulator gain of high frequency band of injection current	0.00~10.00		0.50	●	0x0622
F06.35	Regulator integral time of high frequency band of injection current	0.00~300.00	ms	10.00	●	0x0623
F06.36	Magnetic saturation coefficient of synchronous motor	0.00~1.00		0.60	O	0x0624
F06.37	Stiffness coefficient of speed loop	0~20		11	●	0x0625
F06.40	Amplitude of injected reactive current of synchronous motor	-50.0~+50.0	%	10.0	O	0x0628
F06.41	Open-loop low-frequency processing of synchronous motor	0: VF 1: IF 2: IF in start and VF in stop 3: Throughout SVC		0	O	0x0629
F06.42	Open-loop low-frequency processing range of synchronous motor	0.0~50.0	%	8.0	O	0x062A
F06.43	IF injection current	0.0~600.0	%	80.0	O	0x062B

F06.44	Time constant of pull-in current of magnetic pole	0.0~6000.0	ms	1.0	O	0x062C
F06.45	Initial lead angle of magnetic pole	0.0~359.9	°	0.0	O	0x062D
F06.46	Speed tracking proportional gain of synchronous motor	0.00~10.00		1.00	O	0x062E
F06.47	Speed tracking integral gain of synchronous motor	0.00~10.00		1.00	O	0x062F
F06.48	Filtering time constant of speed tracking of synchronous motor	0.00~10.00	ms	0.40	O	0x0630
F06.49	Speed tracking control intensity of synchronous motor	1.0~100.0		5.0	O	0x0631
F06.50	Speed tracking control threshold of synchronous motor	0.00~10.00		0.20	O	0x0632
F06.51	Rise time of injected active current of synchronous motor	0.1~50.0	s	5.0	O	0x0633
F06.52	Linear transition code value of compensation in dead zone	1~1000		15	O	0x0634
F06.53	Excitation current setting for frequency switching from F3 to F4	0.0~100.0	%	50.0	●	0x0635
F06.54	Switching frequency 3	0.00~50.00	HZ	6.00	O	0x0636
F06.55	Switching frequency 4	0.00~60.00	HZ	10.00	O	0x0637
F06.56	Steady load torque and current setting	0.0~150.0	%	30.0	O	0x0638
F06.57	Filtering time constant of current	0.001~5.000	ms	0.350	O	0x0639
F06.58	Start injection pulse width	0.020~5.000	ms	0.050	O	0x063A
F06.59	Switching frequency 1	0.00~F06.60	HZ	0.00	O	0x063B
F06.60	Switching frequency 2	0.00~(F06.54/2)	HZ	1.00	O	0x063C

F06.61	Current setting for self-learning at the initial position	0.10~1.25		0.90	O	0x063D
F06.62	Speed ring proportion for rotation self-learning	0.00~100.00		2.00	O	0x063E
F06.63	Speed ring integral time for rotation self-learning	0.000~30.000	s	0.150	O	0x063F
F06.64	Acceleration time for rotation self-learning	5.00~100.00	s	20.00	O	0x0640
F06.65	Deceleration time for rotation self-learning	5.00~100.00	s	20.00	O	0x0641
F06.66	Asynchronous motor type selection	0: Built-in permanent magnet synchronous motor 1: Surface-mounted permanent magnet synchronous motor 2: Permanent magnet direct drive motor		0	O	0x0642
F06.67	Excitation current MTPA calculation gain	0.0~300.0	%	20.0	●	0x0643
F06.68	Excitation current flux weakening calculation gain	0.0~300.0	%	20.0	●	0x0644
F06.69	Start compensation angle	0~360	°	0	O	0x0645
F06.70	Expanded counter electrodynamic potential filtering factor 1	0.000~1.732		0.279	●	0x0646
F06.71	Expanded counter electrodynamic potential filtering factor 2	0.000~1.732		0.578	●	0x0647
F06.72	Minimum estimated frequency of synchronous motor SVC	0.01~100.00	HZ	0.50	O	0x0648
F06.73	Low frequency band ID-specific gain	0~500.0	%	100.0	●	0x0649
F06.74	Smooth switching times	1~1000		20	●	0x064A
F06.75	Speed toggle-hold times	1~2000		100	●	0x064B
F06.76	Low-speed correction factor of stator resistor of asynchronous motor	10.0~500.0	%	100.0	●	0x064C

F06.77	Low speed correction factor of rotor resistor of asynchronous motor	10.0~500.0	%	100.0	●	0x064D
F06.78	Slip gain switching frequency of asynchronous motor	0.10~Fmax	Hz	5.00	O	0x064E
F06.79	Speed ring differential time constant ASR_Td1	0.000~10.000	S	0	●	0x064F
F06.80	Speed ring differential time constant ASR_Td	0.000~10.000	S	0	●	0x0650
F06.81	Speed ring differential limit	0.0~150.0	%	0	●	0x0651
F06.82	Filtering time constant of bus voltage	0.0~1500.0	ms	8.0	●	0x0652
F07	Protection function setting group					
F07.00	Protection shield	E20 | E22 | E13 | E06 | E05 | E04 | E07 | E08 0: valid protection 1: shielded protection		00000000	O	0x0700
F07.01	Motor overload protection gain	0.20~10.00		1.00	●	0x0701
F07.02	Motor overload pre-alarm coefficient	50~100	%	80	●	0x0702
F07.03	Motor temperature sensor type	0: No temperature sensor 1: PT100 2: PT1000 3: KTY84-130/150 4: PTC-130/150		0	●	0x0703
F07.04	Motor overheat protection threshold	0~200	℃	110	●	0x0704
F07.05	Motor overheat pre-alarm threshold	0~200	℃	90	●	0x0705

F07.06	Bus voltage control options	Ones place: Instantaneous stop/no-stop function options 0: Invalid 1: deceleration 2: deceleration to stop Tens place: Overvoltage stall function options 0: invalid 1: valid		10	O	0x0706
F07.07	Voltage of overvoltage stall control	110.0~150.0(380V,100.0=537V)	%	134.1	O	0x0707
F07.08	Instantaneous stop/no-stop operating voltage	60.0 to instantaneous stop/no-stop recovery voltage (100.0 = standard bus voltage)	%	76.0	O	0x0708
F07.09	Instantaneous stop/no-stop recovery voltage	Instantaneous stop/no-stop recovery voltage~100.0	%	86.0	O	0x0709
F07.10	Check time for instantaneous stop/no-stop recovery voltage	0.00~100.0	s	0.50	O	0x070A
F07.11	Current limit control	0: Invalid 1: limit mode 1 2: limit mode 2		2	O	0x070B
F07.12	Current limit level	20.0-180.0(100.0 = the rated current of inverter)	%	150.0	●	0x070C
F07.13	Quick current limit options	0: Invalid 1: valid		0	O	0x070D
F07.14	Number of retries after failure	0~20, 0: disable retry after failure		0	O	0x070E
F07.15	Options of digital output action in retries after failure	0: no action 1: action		0	O	0x070F
F07.16	Interval of retries after failure	0.01~30.00	s	0.50	●	0x0710
F07.17	Restoration time in retries after failure	0.01~30.00	s	10.00	●	0x0711
F07.18	Options of retries after failure	E08 | * | E07 | * | E02 | E06 | E05 | E04 0: allow retry after failure 1: disable retry after failure		000000	O	0x0712
F07.19	Action option 1 after failure	E21 | E16 | E15 | E14 | E13 | E12 | E08 | E07 0: free stop 1: stop according to stop mode		00000000	O	0x0713

F07.20	Action option 2 after failure	E28 | E27 | E25 | E23 0: free stop 1: stop according to stop mode		0000	O	0x0714
F07.21	Options of load loss protection	0: Invalid 1: valid		0	●	0x0715
F07.22	Load loss detection level	0.0~100.0	%	20.0	●	0x0716
F07.23	Load loss detection time	0.0~60.0	s	1.0	●	0x0717
F07.24	Options of load loss protection action	0: free stop 1: stop according to stop mode		1	O	0x0718
F07.25	Motor overspeed detection level	0.0-50.0 (reference: maximum frequency F00.16)	%	20.0	●	0x0719
F07.26	Motor overspeed detection time	0.0-60.0, 0.0: disable motor overspeed protection	s	1.0	●	0x071A
F07.27	AVR function	0: Invalid 1: valid	%	1	O	0x071B
F07.28	Stall fault detection time	0.0-6000.0 (0.0: no stall fault detection)	s	0.0	O	0x071C
F07.29	Stall control intensity	0~100	%	20	O	0x071D
F07.30	Instantaneous stop/no-stop deceleration time	0.00~300.00	S	20.00	O	0x071E
F07.32	Options of retries after failure 2	E10 | E13 | E15 | E16 | * | E19 | E20 | * 0: allow retry after failure 1: disable retry after failure		11111111	O	0x0720
F07.34	Encoder disconnection detection percentage	0~150.0	%	100.0	O	0x0722
F07.35	Protection shield 2	* | * | * | * | * | E15 | E18 | E81 0: valid protection 1: shielded protection		000	O	0x0723
F07.36	Options of retries after failure 3	* | * | * | * | * | * | E09 | E17 0: allow retry after failure 1: disable retry after failure		11	O	0x0724
F07.37	Initial voltage for saving upon power disconnection	60.0~F07.38	%	76.0	O	0x0725
F07.38	Electrification voltage reading and determination	F07.37~100.0	%	86.0	O	0x0726

F07.39	Delay time of electrification reading and determination	0~100.0	S	5.00	O	0x0727
F07.40	Delay time of steady undervoltage determination	50~6000	ms	20	O	0x0728
F07.41	Selection of input phase loss detection method	0: Software detection 1: Hardware detection 2: Simultaneous software and hardware detection		0	O	0x0729
F07.42	Setting value of current for determining short to ground	0.00~100.0	%	20.0	O	0x072A
F07.43	Warning shield	* * * * * C32 C31 C30 0: Warning valid 1: Warning shielded		00000000	O	0x072B
F07.44	Upper limit of current for output phase loss detection	10.0~100.0	%	30.0	O	0x072C
F07.45	Times of output phase loss detection	1~60000		10	O	0x072D
F07.46	Times of determining ILP hardware detection	5~10000		100	●	0x072E
F07.47	Soft start disconnection delay time	20~1000	mS	400	O	0x072F
F07.50	STO fault resetting	0: manual resetting 1: automatic resetting		0	O	0x0732
F08	Multi-segment speed and simple PLC					
F08.00	Multi-segment speed 1	0.00 to maximum frequency F00.16	Hz	0.00	●	0x0800
F08.01	Multi-segment speed 2	0.00 to maximum frequency F00.16	Hz	5.00	●	0x0801
F08.02	Multi-segment speed 3	0.00 to maximum frequency F00.16	Hz	10.00	●	0x0802

F08.03	Multi-segment speed 4	0.00 to maximum frequency F00.16	Hz	15.00	●	0x0803
F08.04	Multi-segment speed 5	0.00 to maximum frequency F00.16	Hz	20.00	●	0x0804
F08.05	Multi-segment speed 6	0.00 to maximum frequency F00.16	Hz	25.00	●	0x0805
F08.06	Multi-segment speed 7	0.00 to maximum frequency F00.16	Hz	30.00	●	0x0806
F08.07	Multi-segment speed 8	0.00 to maximum frequency F00.16	Hz	35.00	●	0x0807
F08.08	Multi-segment speed 9	0.00 to maximum frequency F00.16	Hz	40.00	●	0x0808
F08.09	Multi- speed 10	0.00 to maximum frequency F00.16	Hz	45.00	●	0x0809
F08.10	Multi-segment speed 11	0.00 to maximum frequency F00.16	Hz	50.00	●	0x080A
F08.11	Multi-segment speed 12	0.00 to maximum frequency F00.16	Hz	50.00	●	0x080B
F08.12	Multi-segment speed 13	0.00 to maximum frequency F00.16	Hz	50.00	●	0x080C
F08.13	Multi-segment speed 14	0.00 to maximum frequency F00.16	Hz	50.00	●	0x080D
F08.14	Multi-segment speed 15	0.00 to maximum frequency F00.16	Hz	50.00	●	0x080E
F08.15	Simple PLC running mode	0: stop after a single run 1: stop after a limited number of cycles 2: run at the last segment after a limited number of cycles 3: continuous cycles		0	●	0x080F
F08.16	Limited number of cycles	1~10000		1	●	0x0810
F08.17	Simple PLC memory options	Ones place: Stop memory options 0: no memory (from the first segment) 1: memory (from the moment of stop) Tens place: Power-down memory options 0: no memory (from the first segment) 1: Memory (from the power-down moment)		0	●	0x0811
F08.18	Simple PLC time unit	0: s (second) 1: min (minute)		0	●	0x0812
F08.19	Setting of the first segment	Ones place: Running direction options		0	●	0x0813

		0: forward 1: reverse Tens place: Acceleration and deceleration time options 0: acceleration and deceleration time 1 1: acceleration and deceleration time 2 2: acceleration and deceleration time 3 3: acceleration and deceleration time 4				
F08.20	Running time of the first segment	0.0~6000.0	s/min	5.0	●	0x0814
F08.21	Setting of the second segment	Same as F08.19		0	●	0x0815
F08.22	Running time of the second segment	0.0~6000.0	s/min	5.0	●	0x0816
F08.23	Setting of the third segment	Same as F08.19		0	●	0x0817
F08.24	Running time of the third segment	0.0~6000.0	s/min	5.0	●	0x0818
F08.25	Setting of the fourth segment	Same as F08.19		0	●	0x0819
F08.26	Running time of the fourth segment	0.0~6000.0	s/min	5.0	●	0x081A
F08.27	Setting of the fifth segment	Same as F08.19		0	●	0x081B
F08.28	Running time of the fifth segment	0.0~6000.0	s/min	5.0	●	0x081C
F08.29	Setting of the sixth segment	Same as F08.19		0	●	0x081D
F08.30	Running time of the sixth segment	0.0~6000.0	s/min	5.0	●	0x081E
F08.31	Setting of the seventh segment	Same as F08.19		0	●	0x081F
F08.32	Running time of the seventh segment	0.0~6000.0	s/min	5.0	●	0x0820
F08.33	Setting of the eighth segment	Same as F08.19		0	●	0x0821
F08.34	Running time of the eighth segment	0.0~6000.0	s/min	5.0	●	0x0822

F08.35	Setting of the nineth segment	Same as F08.19		0	●	0x0823
F08.36	Running time of the ninth segment	0.0~6000.0	s/min	5.0	●	0x0824
F08.37	Setting of the tenth segment	Same as F08.19		0	●	0x0825
F08.38	Running time of the tenth segment	0.0~6000.0	s/min	5.0	●	0x0826
F08.39	Setting of the eleventh segment	Same as F08.19		0	●	0x0827
F08.40	Running time of the eleventh segment	0.0~6000.0	s/min	5.0	●	0x0828
F08.41	Setting of the twelve segment	Same as F08.19		0	●	0x0829
F08.42	Running time of the twelfth segment	0.0~6000.0	s/min	5.0	●	0x082A
F08.43	Setting of the thirteenth segment	Same as F08.19		0	●	0x082B
F08.44	Running time of the thirteenth segment	0.0~6000.0	s/min	5.0	●	0x082C
F08.45	Setting of the fourteenth segment	Same as F08.19		0	●	0x082D
F08.46	Running time of the fourteenth segment	0.0~6000.0	s/min	5.0	●	0x082E
F08.47	Setting of the fifteenth segment	Same as F08.19		0	●	0x082F
F08.48	Running time of the fifteenth segment	0.0~6000.0	s/min	5.0	●	0x0830
F09	PID function group					
F09.00	PID setting source	0: digital PID setting 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: PULSE, high-frequency pulse (X7) 6: Communication setting		0	O	0x0900

F09.01	Digital PID setting	0.0 to PID setting feedback range F09.03		0.0	●	0x0901
F09.02	PID feedback source	1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: PULSE, high-frequency pulse (X7) 6: Communication setting 7: Reserved 8: output torque		1	O	0x0902
F09.03	PID setting feedback range	0.1~6000.0		100.0	●	0x0903
F09.04	PID positive and negative action selection	Ones place: 0: positive 1: negative Tens place: Direction selection of positive and negative action follow-up command 0: Not follow 1: Follow		0	O	0x0904
F09.05	Proportional gain 1	0.00~100.00		0.40	●	0x0905
F09.06	Integral time 1	0.000 - 30.000, 0.000: no integral	s	2.000	●	0x0906
F09.07	Differential time 1	0.000~30.000	ms	0.000	●	0x0907
F09.08	Proportional gain 2	0.00~100.00		0.40	●	0x0908
F09.09	Integral time 2	0.000 - 30.000, 0.000: no integral	s	2.000	●	0x0909
F09.10	Differential time 2	0.000~30.000	ms	0.000	●	0x090A
F09.11	PID parameter switching conditions	0: no switching 1: switching via digital input terminal 2: automatic switching according to deviation		0	●	0x090B

		3: Automatic switching by frequency				
F09.12	PID parameter switching deviation 1	0.00~F09.13	%	20.00	●	0x090C
F09.13	PID parameter switching deviation 2	F09.12~100.00	%	80.00	●	0x090D
F09.14	Initial PID value	0.00~100.00	%	0.00	●	0x090E
F09.15	PID initial value holding time	0.00~650.00	s	0.00	●	0x090F
F09.16	Upper limit of PID output	F09.17~+100.0	%	100.0	●	0x0910
F09.17	Lower limit of PID output	–100.0~F09.16	%	0.0	●	0x0911
F09.18	PID deviation limit	0.00-100.00 (0.00: invalid)	%	0.00	●	0x0912
F09.19	PID differential limit	0.00~100.00	%	5.00	●	0x0913
F09.20	PID integral separation threshold	0.00-100.00 (100.00% = invalid integral separation)	%	100.00	●	0x0914
F09.21	PID setting change time	0.000~30.000	s	0.000	●	0x0915
F09.22	PID feedback filtering time	0.000~30.000	s	0.000	●	0x0916
F09.23	PID output filtering time	0.000~30.000	s	0.000	●	0x0917
F09.24	Upper limit detection value of PID feedback disconnection	0.00-100.00; 100.00 = invalid feedback disconnection	%	100.00	●	0x0918
F09.25	Lower limit detection value of PID feedback disconnection	0.00-100.00; 0.00 = invalid feedback disconnection	%	0.00	●	0x0919
F09.26	Detection time of PID feedback disconnection	0.000~30.000	s	0.000	●	0x091A
F09.27	PID sleep control options	0: Invalid 1: sleep at zero speed 2: sleep at lower frequency limit 3: sleep with tube sealed		0	●	0x091B

F09.28	Sleep action point	0.00-100.00 (100.00 corresponds to the PID setting feedback range)	%	100.00	●	0x091C
F09.29	Sleep delay time	0.0~6500.0	s	0.0	●	0x091D
F09.30	Wake-up action point	0.00-100.00 (100.00 corresponds to the PID setting feedback range)	%	0.00	●	0x091E
F09.31	Wake-up delay time	0.0~6500.0	S	0.0	●	0x091F
F09.32	Multi-segment PID setting 1	0.0 to PID setting feedback range F09.03		0.0	●	0x0920
F09.33	Multi-segment PID setting 2	0.0 to PID setting feedback range F09.03		0.0	●	0x0921
F09.34	Multi-segment PID setting 3	0.0 to PID setting feedback range F09.03		0.0	●	0x0922
F09.35	Lower limit of feedback voltage	Lower limit of feedback voltage to 10.00	V	10.00	●	0x0923
F09.36	Upper limit of feedback voltage	0.00 to upper limit of feedback voltage	V	0.00	●	0x0924
F09.37	Options of integral action within the set change time of PID	0: Always calculate the integral term 1: Calculate the integral term after the F09.21 set time is reached 2: Calculate the integral term when the error is less than F09.38		0	●	0x0925
F09.38	Input deviation of integral action within the set change time of PID	0.00~100.00	%	30	●	0x0926
F09.39	Wake-up option	0: target pressure F09.01* coefficient of wake-up action point 1: Wake-up action point (F09.30)		0	O	0x0927
F09.40	Coefficient of wake-up action point	0.0-100.0 (100% corresponds to PID setting)	%	90.0	●	0x0928
F09.41	Pipeline network alarm overpressure	0.0 to pressure sensor range F09.03	bar	6.0	●	0x0929
F09.42	Overpressure protection time	0-3600 (0: invalid)	s	0	●	0x092A
F09.43	PID reverse limit	0: Invalid 1: valid		0	O	0x092B
F09.44	Sleep mode options	0: Sleep at sleep frequency (F09.45) 1: Sleep at sleep action points (F09.28)		0	O	0x092C

F09.45	Sleep frequency	0.00 to upper frequency limit F00.18	Hz	30.00	●	0x092D
F09.46	PID feedback increment	0~100		5	●	0x092E
F09.47	PID non-responsive feedback interval	0.00~600.00	bar	0.02	●	0x092F
F10	Communication function group					
F10.00	Local Modbus communication address	1-247; 0: broadcast address		1	O	0x0A00
F10.01	Baud rate of Modbus communication	0: 4800 1: 9600 2: 19200 3: 38400 4: 57600 5: 115200		1	O	0x0A01
F10.02	Modbus data format	0: 1-8-N-1 (1 start bit + 8 data bits + 1 stop bit) 1: 1-8-E-1 (1 start bit + 8 data bits + 1 even parity check bit + 1 stop bit) 2: 1-8-O-1 (1 start bit + 8 data bits + 1 odd parity check bit + 1 stop bit) 3: 1-8-N-2 (1 start bit + 8 data bits + 2 stop bits) 4: 1-8-E-2 (1 start bit + 8 data bits + 1 even parity check bit + 2 stop bits) 5: 1-8-O-2 (1 start bit + 8 data bits + 1 odd parity check bit + 2 stop bits)		0	O	0x0A02
F10.03	Communication timeout	0.0s-60.0s; 0.0: invalid (valid for the master-slave mode)	s	0.0	●	0x0A03
F10.04	Modbus response delay	1~20	ms	2	●	0x0A04
F10.05	Options of master-slave communication function	0: Invalid 1: valid		0	O	0x0A05

F10.06	Master-slave options	0: slave 1: Host (broadcast transmission)		0	O	0x0A06
F10.07	Data sent by host	0: output frequency 1: set frequency 2: output torque 3: set torque 4: PID setting 5: output current		1	O	0x0A07
F10.08	Proportional factor of slave reception	0.00-10.00 (multiple)		1.00	●	0x0A08
F10.09	Host sending interval	0.000~30.000	s	0.200	●	0x0A09
F10.12	Communication address of CANopen expansion card	1~127		1	O	0x0A0C
F10.14	Delay time of communication card process data response	0.0~200.0	ms	0.0	O	0x0A0E
F10.15	Baud rate of communication between the expansion card and the bus	Ones place: CANopen 0: 125K 1: 250K 2: 500K 3: 1M Tens place: Reserved		23	O	0x0A0F
F10.17 ~ F10.31	Selection of data type received by PZD2~PZD16	When data 65535 is displayed, it means the current PZD remains unused; when other data, say 4609, is displayed, it means the currently selected function code is F18.01 (18D=12H, 01D=01H, 1201H=4609D).		65535	O	0x0A11
F10.32 ~ F10.46	Selection of data type sent by PZD2~PZD16			65535	O	
F10.47	Communication card status	Ones place: Reserved Tens place: CANopen		000	×	0x0A2F

		0: Initialization 1: Pre-operation 2: Operation 3: Stop 4: CANopen communication abnormality 5: Modbus communication abnormality 6: Factory testing Hundreds place: Reserved				
F10.48	Communication card software version				×	0x0A30
F10.49	Quantity of process data received	1~16		2	×	0x0A31
F10.50	Quantity of process data sent	1~16		2	×	0x0A32
F10.51	Selection of address setting mode for process data	0: Keyboard setting 1: Master station configuration		0	×	0x0A33
F10.52	Selection of communication card manual resetting	0: Invalid 1: valid		0	×	0x0A34
F10.56	Options of 485 EEPROM writing	0-10: default operation (for commissioning) 11: writing not triggered (available after commissioning)		0	O	0x0A38
F10.57	Enabling of SCI sending timeout resetting	0: invalid resetting 1: valid resetting		1	●	0x0A39
F10.58	Delay time of SCI sending timeout resetting	110~10000		150	●	0x0A3A
F10.61	SCI response option	0: Reply to both read and write commands 1: Reply to write commands only 2: No reply to both read and write commands		0	O	0x0A3D
F10.62	CANopen self-check identification code	0~65535		0	×	0x0A3E

F11	User-selected array (for details, refer to the user's manual or the complete function table)					
F11.00	User-selected parameter 1	The displayed content is Uxx.xx, which means that the Fxx.xx function code is selected. When the function code F11.00 is enabled, the keyboard displays U00.00, indicating that the first selected parameter is F00.00.		U16.00	●	0x0B00
F11.01	User-selected parameter 2			U00.01	●	0x0B01
F11.02	User-selected parameter 3			U00.02	●	0x0B02
F11.03	User-selected parameter 4			U00.03	●	0x0B03
F11.04	User-selected parameter 5			U00.04	●	0x0B04
F11.05	User-selected parameter 6			U00.07	●	0x0B05
F11.06	User-selected parameter 7			U00.14	●	0x0B06
F11.07	User-selected parameter 8			U00.15	●	0x0B07
F11.08	User-selected parameter 9			U00.16	●	0x0B08
F11.09	User-selected parameter 10			U00.18	●	0x0B09
F11.10	User-selected parameter 11			U00.19	●	0x0B0A
F11.11	User-selected parameter 12			U00.29	●	0x0B0B
F11.12	User-selected parameter 13			U02.00	●	0x0B0C
F11.13	User-selected parameter 14			U02.01	●	0x0B0D
F11.14	User-selected parameter 15			U02.02	●	0x0B0E
F11.15	User-selected parameter 16			U03.00	●	0x0B0F
F11.16	User-selected parameter 17			U03.02	●	0x0B10
F11.17	User-selected parameter 18			U03.21	●	0x0B11
F11.18	User-selected parameter 19			U04.00	●	0x0B12

F11.19	User-selected parameter 20			U04.20	●	0x0B13
F11.20	User-selected parameter 21			U05.00	●	0x0B14
F11.21	User-selected parameter 22			U05.03	●	0x0B15
F11.22	User-selected parameter 23			U05.04	●	0x0B16
F11.23	User-selected parameter 24			U08.00	●	0x0B17
F11.24	User-selected parameter 25			U19.00	●	0x0B18
F11.25	User-selected parameter 26			U19.01	●	0x0B19
F11.26	User-selected parameter 27			U19.02	●	0x0B1A
F11.27	User-selected parameter 28			U19.03	●	0x0B1B
F11.28	User-selected parameter 29			U19.04	●	0x0B1C
F11.29	User-selected parameter 30			U19.05	●	0x0B1D
F11.30	User-selected parameter 31			U19.06	●	0x0B1E
F11.31	User-selected parameter 32			U19.12	●	0x0B1F
F12	Keyboard and display function group					
F12.00	M.K multi-function key options	0: ESC 1: forward jog 2: reverse jog 3: forward/reverse switching		0	O	0x0C00

		4: quick stop 5: free stop				
F12.01	Options of stop function of STOP key	0: valid only in keyboard control 1: with all command channels valid		1	O	0x0C01
F12.02	Parameter locking	0: do not lock 1: reference input not locked 2: all locked, except for this function code		0	●	0x0C02
F12.03	Parameter copying	0: No operation 1: parameter upload to keyboard 2: Download parameters to inverter (excluding F01 and F14) 3: Download parameters to inverter		0	O	0x0C03
F12.09	Load speed display coefficient	0.01~600.00		30.00	●	0x0C09
F12.10	UP/DOWN acceleration and deceleration rate	0.00: automatic rate 0.01~500.00	Hz/s	5.00	O	0x0C0A
F12.11	Options of UP/DOWN offset clearing	0: do not clear 1: clear in non-running state 2: clear when UP/DOWN invalid		0	O	0x0C0B
F12.12	Options of UP/DOWN power-down saving of offset	0: do not save 1: save (valid after the offset is modified)		1	O	0x0C0C
F12.13	Power meter resetting	0: do not clear 1: clear		0	●	0x0C0D
F12.14	Restoration of default setting	0: No operation 1: restoration of factory defaults (excluding the motor parameters, inverter parameters, manufacturer parameters, running and power-on time record) 2: restoration of factory defaults (including motor and application macro parameter)		0	O	0x0C0E
F12.15	Cumulative power-on time (h)	0~65535	h	XXX	×	0x0C0F

F12.16	Cumulative power-on time (min)	0~59	min	XXX	×	0x0C10
F12.17	Cumulative running time (h)	0~65535	h	XXX	×	0x0C11
F12.18	Cumulative running time (min)	0~59	min	XXX	×	0x0C12
F12.19	Rated power of inverter	0.40~650.00	kW	Depending on the motor type	×	0x0C13
F12.20	Rated voltage of inverter	60~690	V	Depending on the motor type	×	0x0C14
F12.21	Rated current of inverter	0.1~1500.0	A	Depending on the motor type	×	0x0C15
F12.22	Performance software S/N 1	XXX.XX		XXX.XX	×	0x0C16
F12.23	Performance software S/N2	XX.XXX		XX.XXX	×	0x0C17
F12.24	Functional software S/N 1	XXX.XX		XXX.XX	×	0x0C18
F12.25	Functional software S/N 2	XX.XXX		XX.XXX	×	0x0C19
F12.26	Keyboard software serial number 1	XXX.XX		XXX.XX	×	0x0C1A
F12.27	Keyboard software serial number 2	XX.XXX		XX.XXX	×	0x0C1B
F12.28	Serial No. 1	XX.XXX		XX.XXX	×	0x0C1C
F12.29	Serial No. 2	XXXX.X		XXXX.X	×	0x0C1D
F12.30	Serial No. 3	XXXXX		XXXXX	×	0x0C1E
F12.31	LCD language options	0: Chinese 1: English		0	●	0x0C1F
F12.33	Running status display parameter 1 of Mode 1 (LED stop status display parameter 5)	0.00~99.99		18.00	●	0x0C21
F12.34	Running status display parameter 2 of Mode 1 (LED stop status display parameter 1)	0.00~99.99		18.01	●	0x0C22

F12.35	Running status display parameter 3 of Mode 1 (LED stop status display parameter 2)	0.00~99.99		18.06	●	0x0C23
F12.36	Running status display parameter 4 of Mode 1 (LED stop status display parameter 3)	0.00~99.99		18.08	●	0x0C24
F12.37	Running status display parameter 5 of Mode 1 (LED stop status display parameter 4)	0.00~99.99		18.09	●	0x0C25
F12.38	LCD large-line display parameter 1	0.00~99.99		18.00	●	0x0C26
F12.39	LCD large-line display parameter 2	0.00~99.99		18.06	●	0x0C27
F12.40	LCD large-line display parameter 3	0.00~99.99		18.01	●	0x0C28
F12.41	Options of UP/DOWN zero crossing	0: prohibit zero crossing 1: allow zero crossing		0	O	0x0C29
F12.42	Frequency setting of digital potentiometer	0.00 to maximum frequency 00.16	HZ	0.00	×	0x0C2A
F12.43	Digital potentiometer torque setting	0.00-|Digital torque setting F13.02	%	0.0	×	0x0C2B
F12.46	ACLib version number			XXX.XX	×	0x0C2E
F12.45	UP/DOWN function selection	D7: Channel sharing D6: Range limitation D5: Keyboard D4: Communication D3: High-speed pulse D2: Analog quantity D1: Digital frequency D0: Multi-segment speed 0: Invalid 1: valid		00100010	O	0x0C2D

F12.47	Any address	0~65535		28673	●	0x0C2F
F13	Torque control parameter group					
F13.00	Speed/torque control options	0: Speed control 1: Torque control		0	O	0x0D00
F13.01	Options of torque setting source	0: digital torque setting F13.02 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: Communication setting (Full range of the items 1-6, corresponding to F13.02 digital torque setting)		0	O	0x0D01
F13.02	Digital torque setting	-200.0 to 200.0 (100.0 = the rated torque of motor)	%	100.0	●	0x0D02
F13.03	Multi-segment torque 1	-200.0~200.0	%	0.0	●	0x0D03
F13.04	Multi-segment torque 2	-200.0~200.0	%	0.0	●	0x0D04
F13.05	Multi-segment torque 3	-200.0~200.0	%	0.0	●	0x0D05
F13.06	Torque control acceleration and deceleration time	0.00~120.00	s	0.05	●	0x0D06
F13.08	Upper frequency limit options of torque control	0: set by F13.09 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: high frequency pulse input (X7) 6: Communication setting (percentage) 7: Communication setting (direct frequency setting)		0	O	0x0D08

F13.09	Upper frequency limit of torque control	0.00 to maximum frequency F00.16	Hz	50.00	●	0x0D09
F13.10	Upper frequency limit offset	0.00 to maximum frequency F00.16	Hz	0.00	●	0x0D0A
F13.11	Static friction torque compensation	0.0~100.0	%	0.0	●	0x0D0B
F13.12	Frequency range of static friction compensation	0.00~50.00	Hz	1.00	●	0x0D0C
F13.13	Dynamic friction torque compensation	0.0~100.0	%	0.0	●	0x0D0D
F13.18	Reverse speed limit options	0~100	%	100	●	0x0D12
F13.19	Speed priority enabling of torque control	0: Disable 1: Enable		0	●	0x0D13
F14	Parameter group of motor 2					
F14.00	Motor type	0: ordinary asynchronous motor 1: variable-frequency asynchronous motor 2: permanent magnet synchronous motor		0	O	0x0E00
F14.01	Rated power of electric motor	0.10~650.00	kW	Depending on the motor type	O	0x0E01
F14.02	Rated voltage of motor	50~2000	V	Depending on the motor type	O	0x0E02
F14.03	Rated current of motor	0.01 to 600.00 (rated power of motor: ≤ 75 kW) 0.1 to 6000.0 (rated power of motor: > 75 kW)	A	Depending on the motor type	O	0x0E03
F14.04	Rated frequency of motor	0.01~600.00	Hz	Depending on the motor type	O	0x0E04
F14.05	Rated speed	1~60000	rpm	Depending on the motor type	O	0x0E05
F14.06	Motor winding connection	0: Y 1: Δ		Depending on the motor type	O	0x0E06
F14.07	Rated power factor of motor	0.600~1.000		Depending on the motor type	O	0x0E07
F14.08	Motor efficiency	30.0~100.0	%	Depending on the motor type	O	0x0E08
F14.09	Stator resistance of asynchronous motor	1-60000 (rated power of motor: ≤ 75kW) 0.1 to 6000.0 (rated power of motor: > 75 kW)	mΩ	Depending on the motor type	O	0x0E09

F14.10	Rotor resistance of asynchronous motor	1-60000 (rated power of motor: ≤ 75 kW) 0.1 to 6000.0 (rated power of motor: > 75 kW)	mΩ	Depending on the motor type	O	0x0E0A
F14.11	Leakage inductance of asynchronous motor	0.01 to 600.00 (rated power of motor: ≤ 75 kW) 0.001 to 60.000 (rated power of motor: > 75 kW)	mH	Depending on the motor type	O	0x0E0B
F14.12	Mutual inductance of asynchronous motor	0.1 to 6000.0 (rated power of motor: > 75 kW 0.01 to 600.00 (rated power of motor: > 75 kW)	mH	Depending on the motor type	O	0x0E0C
F14.13	No-load excitation current of asynchronous motor	0.01 to 600.00 (rated power of motor: ≤ 75 kW) 0.1 to 6000.0 (rated power of motor: > 75 kW)	A	Depending on the motor type	O	0x0E0D
F14.14	Flux weakening coefficient 1 of asynchronous motor	10.00~100.00	%	100.00	O	0x0E0E
F14.15	Flux weakening coefficient 2 of asynchronous motor	10.00~100.00	%	100.00	O	0x0E0F
F14.16	Flux weakening coefficient 3 f asynchronous motor	10.00~100.00	%	100.00	O	0x0E10
F14.17	Flux weakening coefficient 4 f asynchronous motor	10.00~100.00	%	100.00	O	0x0E11
F14.18	Flux weakening coefficient 5 f asynchronous motor	10.00~100.00	%	100.00	O	0x0E12
F14.19	Stator resistance of synchronous motor	1-60000 (rated power of motor: ≤ 75kW) 0.1 to 6000.0 (rated power of motor: > 75 kW)	mΩ	Depending on the motor type	O	0x0E13
F14.20	d-axis inductance of synchronous motor	0.01 to 600.00 (rated power of motor: ≤ 75 kW) 0.001 to 60.000 (rated power of motor: > 75 kW)	mH	Depending on the motor type	O	0x0E14
F14.21	q-axis inductance of synchronous motor	0.01 to 600.00 (rated power of motor: ≤ 75 kW) 0.001 to 60.000 (rated power of motor: > 75 kW)	mH	Depending on the motor type	O	0x0E15
F14.22	Counter electromotive force of synchronous motor	10.0-2000.0 (counter electromotive force of rated speed)	V	Depending on the motor type	O	0x0E16
F14.23	Initial electrical angle of synchronous motor	0.0-359.9 (valid for synchronous motor)			O	0x0E17
F14.24	Encoder type	0: ABZ gain encoder 1: UVW gain encoder		0	O	0x0E18

		2: Reserved (cable-economical UVW encoder) 3: Reserved (SinCos PG card) 4: Rotary transformer				
F14.25	Encoder line count	1~65535		1024	O	0x0E19
F14.26	Zero-pulse phase angle of encoder	0.0~359.9°		0.0	O	0x0E1A
F14.27	AB pulse phase sequence	0: forward 1: reverse		0	O	0x0E1B
F14.28	UVW encoder phase sequence	0: forward 1: reverse		0	O	0x0E1C
F14.29	UVW initial offset phase angle	0.0~359.9°		0.0	O	0x0E1D
F14.30	Pole pairs of rotary transformer	1~65535		1	O	0x0E1E
F14.31	Reserved					0x0E1F
F14.32	Detection time of speed feedback disconnection	0.0~10.0		1.0	O	0x0E20
F14.33	Speed feedback filtering time	0.000~0.100	s	0.002	O	0x0E21
F14.34	Motor parameter self-learning	0: No operation 1: static self-learning of asynchronous motor 2: rotation self-learning of asynchronous motor 3: Self-learning ofasynchronous motor encoder 11: static self-learning of synchronous motor 12: rotary self-learning of synchronous motor 13: encoder self-learning of synchronous motor		0	O	0x0E22
F14.35	Drive control mode of motor 2	0: V/F control (VVF) 1: Speed sensorless vector control (SVC) 2: Speed sensor vector control (FVC)		0	O	0x0E23
F14.36	Speed proportional gain ASR_P1	0.00~100.00		12.00	●	0x0E24
F14.37	Speed integral time constant ASR_T1	0.000~30.000 0.000: no integral	s	0.250	●	0x0E25
F14.38	Speed proportional gain ASR_P2	0.00~100.00		10.00	●	0x0E26

F14.39	Speed integral time constant ASR_T2	0.000~30.000 0.000: no integral	s	0.300	●	0x0E27
F14.40	Switching frequency 1	0.00 to switching frequency 2	Hz	5.00	●	0x0E28
F14.41	Switching frequency 2	Switching frequency 1 to maximum frequency F00.16	Hz	10.00	●	0x0E29
F14.42	No-load current gain of motor 2	10.0~300.0	%	100.0	●	0x0E2A
F14.43	Filtering time constant of speed loop output	0.000~0.100	s	0.001	●	0x0E2B
F14.44	Vector control slip gain	50.00~200.00	%	100.00	●	0x0E2C
F14.45	Upper limit source selection of speed control torque	0: Set by F14.46 and F14.47 1: AI1 2: AI2 3: AI3 4: AI4 (expansion card) 5: Communication setting (percentage) 6: Take the maximum values of AI2 and AI3 7: Take the minimum values of AI2 and AI3		0	O	0x0E2D
F14.46	Upper limit of speed control motor torque	0.0~250.0	%	165.0	●	0x0E2E
F14.47	Upper limit of speed control brake torque	0.0~250.0	%	165.0	●	0x0E2F
F14.48	Excitation current proportional gain ACR-P1	0.00~100.00		0.50	●	0x0E30
F14.49	Excitation current integral time constant ACR-T1	0.00~600.00 0.00: no integral	ms	10.00	●	0x0E31
F14.50	Torque current proportional gain ACR-P2	0.00~100.00		0.50	●	0x0E32
F14.51	Torque current integral time constant ACR-T2	0.00~600.00 0.00: no integral	ms	10.00	●	0x0E33

F14.52	Stiffness coefficient of speed loop of motor 2	0~20		11	●	0x0E34
F14.53	SVC zero-frequency processing	0: braking 1: not processed 2: seal the tube		2	O	0x0E35
F14.54	SVC zero-frequency braking current	50.0-400.0 (100.0 is the no-load current of the motor)	%	100.0	O	0x0E36
F14.56	Voltage feedforward gain	0~100	%	0	●	0x0E38
F14.57	Flux weakening control options	0: Invalid 1: direct calculation 2: automatic adjustment		1	O	0x0E39
F14.58	Flux weakening voltage	70.00~100.00	%	100.00	●	0x0E3A
F14.59	Maximum field weakening current of synchronous motor	0.0-150.0 (100.0 is the rated current of the motor)	%	100.0	●	0x0E3B
F14.60	Proportional gain of flux weakening regulator	0.00~60.00		0.50	●	0x0E3C
F14.61	Integral time of flux weakening regulator	0.000~6.000	s	0.200	●	0x0E3D
F14.62	MTPA control option of synchronous motor	0: Invalid 1: valid		0	O	0x0E3E
F14.63	Self-learning gain at initial position	0~200	%	100	O	0x0E3F
F14.64	Frequency of low frequency band of injection current	0.00-100.00 (100.00 is the rated frequency of the motor)	%	10.00	●	0x0E40
F14.65	Injection current of low frequency band	0-200.0 (100.0 is the rated current of the motor)	%	40.0	●	0x0E41
F14.66	Regulator gain of low frequency band of injection current	0.00~10.00		0.50	●	0x0E42
F14.67	Regulator integral time of low frequency band of injection current	0.00~300.00	ms	10.00	●	0x0E43
F14.68	Frequency of high frequency band of injection current	0.00-100.00 (100.00 is the rated frequency of the motor)	%	20.00	●	0x0E44

F14.69	Injection current f high frequency band	0.0-30.0 (100.0 is the rated current of the motor)	%	8.0	●	0x0E45
F14.70	Regulator gain of high frequency band of injection current	0.00~10.00		0.50	●	0x0E46
F14.71	Regulator integral time of high frequency band of injection current	0.00~300.00	ms	10.00	●	0x0E47
F14.72	Open-loop low-frequency of processing synchronous motor	0: VF 1: IF 2: IF in start and VF in stop 3: Throughout SVC		0	O	0x0E48
F14.73	Excitation current setting for frequency switching from F3 to F4	0.0~100.0	%	50.0	●	0x0E49
F14.74	Switching frequency 3	0.0~50.00	Hz	6.00	O	0x0E4A
F14.75	Switching frequency 4	0.0~60.00	Hz	10.00	O	0x0E5B
F14.76	Steady load torque and current setting	0.0~150.0	%	30.0	●	0x0E5C
F14.77	Acceleration/deceleration time options of motor 2	0: the same as motor 1 1: acceleration and deceleration time 1 2: acceleration and deceleration time 2 3: acceleration and deceleration time 3 4: acceleration and deceleration time 4		0	O	0x0E4D
F14.78	Maximum frequency of motor 2	1.00~600.00	Hz	50.00	O	0x0E4E
F14.79	Upper frequency limit of motor 2	Lower limit frequency F00.19 to maximum frequency F14.78	Hz	50.00	●	0x0E4F
F14.80	V/F curve setting of motor 2	0: straight line V/F 1: multi-point broken line V/F 2: 1.3-power V/F 3: 1.7-power V/F 4: square V/F 5: VF complete separation mode (Ud = 0,Uq = K * t = voltage of separation voltage source) 6: VF semi-separation mode (Ud = 0, Uq = K * t = F/Fe * 2 * voltage of separation voltage source)		0	O	0x0E50
F14.81	Multi-point VF frequency F1 of motor 2	0.00~F14.83	Hz	0.50	●	0x0E51

F14.82	Multi-point VF voltage V1 of motor 2	0.0~100.0 (100.0 = Rated voltage)	%	1.0	●	0x0E52
F14.83	Multi-point VF frequency F2 of motor 2	F14.81~F14.85	Hz	2.00	●	0x0E53
F14.84	Multi-point VF voltage V2 of motor 2	0.0~100.0	%	4.0	●	0x0E54
F14.85	Multi-point VF frequency F3 of motor 2	F14.83 to rated frequency of motor (reference frequency)	Hz	5.00	●	0x0E55
F14.86	Multi-point VF voltage V3 of motor 2	0.0~100.0	%	10.0	●	0x0E56
F14.87	Stop mode of motor 2	0: Slow down to stop 1: free stop		0	O	0x0E57
F14.88	Start injection pulse width	0.020~5.000	ms	0.050	O	0x0E58
F14.89	Asynchronous motor type selection	0: Built-in permanent magnet synchronous motor 1: Surface-mounted permanent magnet synchronous motor 2: Permanent magnet direct drive motor	s	0	O	0x0E59
F14.90	Excitation current MTPA calculation gain	0.0~300.0	%	20.0	●	0x0E5A
F14.91	Excitation current flux weakening calculation gain	0.0~300.0	%	20.0	●	0x0E5B
F14.92	Start compensation angle	0~360	°	0	O	0x0E5C
F14.93	Expanded counter electrodynamic potential filtering factor 1	0.000~1.732		0.279	●	0x0E5D
F14.94	Expanded counter electrodynamic potential filtering factor 2	0.000~1.732		0.578	●	0x0E5E
F14.95	Minimum estimated frequency of synchronous motor SVC	0.01~100.00	Hz	0.50	O	0x0E5F
F14.96	Low-speed correction factor of stator resistor of asynchronous motor	10.0~500.0	%	100.0	●	0x0E60
F14.97	Low speed correction factor of rotor resistor of asynchronous motor	10.0~500.0	%	100.0	●	0x0E61

F14.98	Slip gain switching frequency of asynchronous motor	0.10~Fmax	Hz	5.00	O	0x0E62
F15	Auxiliary function group					
F15.00	Jog frequency	0.00 to maximum frequency F00.16	Hz	5.00	●	0x0F00
F15.01	Jog acceleration time	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	5.00	●	0x0F01
F15.02	Jog deceleration time		s	5.00	●	0x0F02
F15.03	Acceleration time 2		s	15.00	●	0x0F03
F15.04	Deceleration time 2		s	15.00	●	0x0F04
F15.05	Acceleration time 3		s	15.00	●	0x0F05
F15.06	Deceleration time 3		s	15.00	●	0x0F06
F15.07	Acceleration time 4		s	15.00	●	0x0F07
F15.08	Deceleration time 4		s	15.00	●	0x0F08
F15.09	Fundamental frequency of acceleration and deceleration time	0: maximum frequency F00.16 1: 50.00Hz 2: set frequency		0	O	0x0F09
F15.10	Automatic switching of acceleration and deceleration time	0: Invalid 1: valid		0	O	0x0F0A
F15.11	Switching frequency of acceleration time 1 and 2	0.00 to maximum frequency F00.16	Hz	0.00	●	0x0F0B
F15.12	Switching frequency of deceleration time 1 and 2	0.00 to maximum frequency F00.16	Hz	0.00	●	0x0F0C
F15.13	Acceleration and deceleration time unit	0:0.01s 1:0.1s 2:1s		0	O	0x0F0D
F15.14	Frequency hopping point 1	0.00~600.00	Hz	600.00	●	0x0F0E

F15.15	Hopping range 1	0.00~20.00, 0.00: Invalid	Hz	0.00	●	0x0F0F
F15.16	Frequency hopping point 2	0.00~600.00	Hz	600.00	●	0x0F10
F15.17	Hopping range 2	0.00~20.00, 0.00: Invalid	Hz	0.00	●	0x0F11
F15.18	Frequency hopping point 3	0.00~600.00	Hz	600.00	●	0x0F12
F15.19	Hopping range 3	0.00~20.00, 0.00: Invalid	Hz	0.00	●	0x0F13
F15.20	Detection width of output frequency arrival (FAR)	0.00~50.00	Hz	2.50	O	0x0F14
F15.21	Upper limit of output frequency detection FDT1	0.00 to maximum frequency F00.16	Hz	30.00	O	0x0F15
F15.22	Lower limit of output frequency detection FDT1	0.00 to maximum frequency F00.16	Hz	28.00	O	0x0F16
F15.23	Upper limit of output frequency detection FDT2	0.00 to maximum frequency F00.16	Hz	20.00	O	0x0F17
F15.24	Lower limit of output frequency detection FDT2	0.00 to maximum frequency F00.16	Hz	18.00	O	0x0F18
F15.25	Options of analog level detection ADT	0: AI1 2: AI3 1: AI2 3: AI4 (expansion card)		0	○	0x0F19
F15.26	Analog level detection ADT1	0.00~100.00	%	20.00	●	0x0F1A
F15.27	ADT1 hysteresis	0.00 to F15.26 (valid down in one direction)	%	5.00	●	0x0F1B
F15.28	Analog level detection ADT2	0.00~100.00	%	50.00	●	0x0F1C
F15.29	ADT2 hysteresis	0.00 to F15.28 (valid down in one direction)	%	5.00	●	0x0F1D
F15.30	Options of energy consumption braking function	0: Invalid 1: valid		0	O	0x0F1E
F15.31	Energy consumption braking voltage	110.0~140.0(380V,100.0=537V)	%	128.5	O	0x0F1F
F15.32	Braking rate	20-100 (100 means that duty ratio is 1)	%	100	●	0x0F20

F15.33	Operating mode with set frequency less than lower frequency limit	0: running at the lower frequency limit 1: Shutdown 2: zero-speed running		0	O	0x0F21
F15.34	Fan control	Ones place: Fan control mode 0: running after power-on 1: running at startup 2: intelligent operation, subject to temperature control Tens place: Electrification fan control 0: Run 1 minute first and then enter the fan control mode for running 1: Directly run in the fan control mode Hundreds place: Low-speed fan running mode enabled (above 200kW) 0: Low-speed running invalid 1: Low-speed running valid		101	O	0x0F22
F15.35	Overmodulation intensity	1.00~1.10		1.05	●	0x0F23
F15.36	Switching options of PWM modulation mode	0: invalid (7-segment PWM modulation) 1: valid (5-segment PWM modulation)		0	O	0x0F24
F15.37	Switching frequency of PWM modulation mode	0.00 to maximum frequency F00.16	Hz	15.00	●	0x0F25
F15.38	Options of dead zone compensation mode	0: no compensation 1: compensation mode 1 2: compensation mode 2		1	O	0x0F26
F15.39	Terminal jog priority	0: Invalid 1: valid		0	O	0x0F27
F15.40	Deceleration time for quick stop	0.00~650.00(F15.13=0) 0.0~6500.0(F15.13=1) 0~65000(F15.13=2)	s	1.00	●	0x0F28
F15.41	Output power display coefficient	50.00~150.00	%	100.0	●	0x0F29

F15.42	Output current display coefficient	50.00~150.00	%	100.0	●	0x0F2A
F15.43	Output voltage display coefficient	50.00~150.00	%	100.0	●	0x0F2B
F15.44	Current reaches the detection value	0.0~300.0 (100.0% corresponds to the rated current of motor)	%	100.0	●	0x0F2C
F15.45	Current reaches the hysteresis	0.0~F15.44	%	5.0	●	0x0F2D
F15.46	Torque reaches the detection value	0.0~300.0 (100.0% corresponds to the rated torque of motor)	%	100.0	●	0x0F2E
F15.47	Torque reaches the hysteresis	0.0~F15.46	%	5.0	●	0x0F2F
F15.48	Divided frequencies of encoder	1~256		1	●	0x0F30
F15.49	High-frequency filtering coefficient of PG card	0~255		0	●	0x0F31
F15.62	PG card feedback frequency filtering time	0.000~30.000	S	0.010	●	0x0F3E
F15.63	Speed reaches the rising limit	0.00~Fmax	HZ	30.00	●	0x0F3F
F15.64	Speed reaches the filtering time	0~60000	Ms	500	●	0x0F40
F15.65	Speed reaches the falling limit	0.00~Fmax	HZ	0.00	●	0x0F41
F15.66	Overcurrent detection level	0.1-300.0 (0.0: no detection; 100.0%: corresponding to the rated current of motor)	%	200.0	●	0x0F42
F15.67	Overcurrent detection delay time	0.00~600.00	s	0.00	●	0x0F43
F15.68	Market price	0.00~100.00		1.00	O	0x0F44
F15.69	Power-frequency load factor	30.0~200.0	%	90.0	O	0x0F45
F16	Customization function group					
F16.00	Industry application	0: Universal model 1: Water supply application macro 3: Winding and unwinding application		0	O	0x1000

		9: EM100 communication macro 10: EM303B communication macro				
F16.01	Set length	1~65535(F16.13=0) 0.1~6553.5(F16.13=1) 0.01~655.35(F16.13=2) 0.001~65.535(F16.13=3)	m	1000	●	0x1001
F16.02	Pulses per meter	0.1~6553.5		100.0	●	0x1002
F16.03	Set count value	F16.04~65535		1000	●	0x1003
F16.04	Specified count value	1~F16.03		1000	●	0x1004
F16.05	Set time of regular running	0.0-6500.0, 0.0 is invalid	min	0.0	●	0x1005
F16.06	Agent password	0~65535		0	O	0x1006
F16.07	Setting of cumulative power-on arrival time	0-65535; 0: disable the protection when the power-on time is up	H	0	O	0x1007
F16.08	Setting of cumulative running arrival time	0-65535; 0: disable the protection when the running time is up	H	0	O	0x1008
F16.09	Factory password	0~65535		XXXXX	●	0x1009
F16.10	Analog output percentage when the set length/design count is 0	0.00~100.00	%	0.00	O	0x100A
F16.11	Analog output percentage when the set length/design count is the set value	0.00~100.00	%	100.00	O	0x100B
F16.13	Set length resolution	0:1m 1:0.1m 2:0.01m 3:0.001m		0	O	0x100D
F16.14	Slot 1 type	0: No card		XXXX	×	0x100E

		1: PROFINET card 2: EtherCAT card 3: CANopen card 4~9: Reserved 10: Gain encoder PG card 11: Gain encoder PG card with UVW 12: Rotary transformer PG card 13: SinCos PG card 14: Gain encoder PG card with divided frequency 15~ 19: retention 20: IO expansion card 1 21~29: retention 30: PLC card				
F16.15	Slot 2 type	Same with slot 1		XXXX	×	0x100F
F16.16	Slot 1 software S/N 1	0.00~65.335		XXXX	×	0x1010
F16.17	Slot 1 software S/N 2	0.00~65.335		XXXX	×	0x1011
F16.18	Slot 2 software S/N 1	0.00~65.335		XXXX	×	0x1012
F16.19	Slot 2 software S/N 2	0.00~65.335		XXXX	×	0x1013
F17	Virtual I/O function group					
F17.00	VX1 virtual input function options	The same as the function options of digital input terminal of F02 group		0	O	0x1100
F17.01	VX2 virtual input function options			0	O	0x1101
F17.02	VX3 virtual input function options			0	O	0x1102

F17.03	VX4 virtual input function options			0	O	0x1103
F17.04	VX5 virtual input function options			0	O	0x1104
F17.05	VX6 virtual input function options			0	O	0x1105
F17.06	VX7 virtual input function options			0	O	0x1106
F17.07	VX8 virtual input function options			0	O	0x1107
F17.08	Virtual input positive/negative logic	D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 VX8 | VX7 | VX6 | VX5 | VX4 | VX3 | VX2 | VX1 0: positive logic is valid in the closed state/invalid in the open state 1: negative logic is valid in the closed state/invalid in the open state		00000000	O	0x1108
F17.09	VX1-VX8 status setting options	D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 VX8 | VX7 | VX6 | VX5 | VX4 | VX3 | VX2 | VX1 0: the VXn status is the same as VYn output status 1: status set by F17.10		00000000	O	0x1109
F17.10	VX1-VX8 status setting	D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 VX8 | VX7 | VX6 | VX5 | VX4 | VX3 | VX2 | VX1 0: Invalid 1: valid		00000000	●	0x110A
F17.11	VX1 valid delay time	0.00~650.00	s	0.00	●	0x110B
F17.12	VX1 invalid delay time	0.00~650.00	s	0.00	●	0x110C
F17.13	VX2 valid delay time	0.00~650.00	s	0.00	●	0x110D
F17.14	VX2 invalid delay time	0.00~650.00	s	0.00	●	0x110E

<table>
<tr><td>F17.15</td><td>VX3 valid delay time</td><td colspan="8">0.00~650.00</td><td>s</td><td>0.00</td><td>●</td><td>0x110F</td></tr>
<tr><td>F17.16</td><td>VX3 invalid delay time</td><td colspan="8">0.00~650.00</td><td>s</td><td>0.00</td><td>●</td><td>0x1110</td></tr>
<tr><td>F17.17</td><td>VX4 valid delay time</td><td colspan="8">0.00~650.00</td><td>s</td><td>0.00</td><td>●</td><td>0x1111</td></tr>
<tr><td>F17.18</td><td>VX4 invalid delay time</td><td colspan="8">0.00~650.00</td><td>s</td><td>0.00</td><td>●</td><td>0x1112</td></tr>
<tr><td>F17.19</td><td>VY1 virtual output function options</td><td colspan="8" rowspan="8">The same as the function options of Y1 digital output terminal ofF03 group</td><td></td><td>0</td><td>O</td><td>0x1113</td></tr>
<tr><td>F17.20</td><td>VY2 virtual output function options</td><td></td><td>0</td><td>O</td><td>0x1114</td></tr>
<tr><td>F17.21</td><td>VY3 virtual output function options</td><td></td><td>0</td><td>O</td><td>0x1115</td></tr>
<tr><td>F17.22</td><td>VY4 virtual output function options</td><td></td><td>0</td><td>O</td><td>0x1116</td></tr>
<tr><td>F17.23</td><td>VY5 virtual output function options</td><td></td><td>0</td><td>O</td><td>0x1117</td></tr>
<tr><td>F17.24</td><td>VY6 virtual output function options</td><td></td><td>0</td><td>O</td><td>0x1118</td></tr>
<tr><td>F17.25</td><td>VY7 virtual output function options</td><td></td><td>0</td><td>O</td><td>0x1119</td></tr>
<tr><td>F17.26</td><td>VY8 virtual output function options</td><td></td><td>0</td><td>O</td><td>0x111A</td></tr>
<tr><td rowspan="3">F17.27</td><td rowspan="3">Virtual output positive/negative logic</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td><td rowspan="3"></td><td rowspan="3">00000000</td><td rowspan="3">O</td><td rowspan="3">0x111B</td></tr>
<tr><td>VX8</td><td>VX7</td><td>VX6</td><td>VX5</td><td>VX4</td><td>VX3</td><td>VX2</td><td>VX1</td></tr>
<tr><td colspan="8">0: positive logic is valid in the closed state/invalid in the open state
1: negative logic is valid in the closed state/invalid in the open state</td></tr>
<tr><td rowspan="3">F17.28</td><td rowspan="3">Control options of virtual output terminal</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td><td rowspan="3"></td><td rowspan="3">11111111</td><td rowspan="3">O</td><td rowspan="3">0x111C</td></tr>
<tr><td>VX8</td><td>VX7</td><td>VX6</td><td>VX5</td><td>VX4</td><td>VX3</td><td>VX2</td><td>VX1</td></tr>
<tr><td colspan="8">0: Depending on the status of terminal X1-X5
1: depending on the output function status</td></tr>
</table>

F17.29	VY1 valid delay time	0.00~650.00	s	0.00	●	0x111D
F17.30	VY1 invalid delay time	0.00~650.00	s	0.00	●	0x111E
F17.31	VY2 valid delay time	0.00~650.00	s	0.00	●	0x111F
F17.32	VY2 invalid delay time	0.00~650.00	s	0.00	●	0x1120
F17.33	VY3 valid delay time	0.00~650.00	s	0.00	●	0x1121
F17.34	VY3 invalid delay time	0.00~650.00	s	0.00	●	0x1122
F17.35	VY4 valid delay time	0.00~650.00	s	0.00	●	0x1123
F17.36	VY4 invalid delay time	0.00~650.00	s	0.00	●	0x1124
F17.37	Virtual input terminal status	VX8 | VX7 | VX6 | VX5 | VX4 | VX3 | VX2 | VX1 0: Invalid 1: valid		00000000	×	0x1125
F17.38	Virtual output terminal status	VX8 | VX7 | VX6 | VX5 | VX4 | VX3 | VX2 | VX1 0: Invalid 1: valid		00000000	×	0x1126
F18	Monitoring parameter group					
F18.00	Output frequency	0.00 to upper frequency limit	Hz	0.00	×	0x1200
F18.01	Set frequency	0.00 to maximum frequency F00.16	Hz	0.00	×	0x1201
F18.02	PG feedback frequency	0.00 to upper frequency limit	Hz	0.00	×	0x1202

F18.03	Estimate feedback frequency	0.00 to upper frequency limit	Hz	0.00	×	0x1203
F18.04	Output torque	-200.0~200.0	%	0.0	×	0x1204
F18.05	Torque setting	-200.0~200.0	%	0.0	×	0x1205
F18.06	Output current	0.00 to 650.00 (rated power of motor: ≤ 75 kW) 0.0 to 6500.0 (rated power of motor: > 75 kW)	A	0.00	×	0x1206
F18.07	Output current percentage	0.0-300.0 (100.0 = the rated current of inverter)	%	0.0	×	0x1207
F18.08	Output voltage	0.0~690.0	V	0.0	×	0x1208
F18.09	DC bus voltage	0~1200	V	0	×	0x1209
F18.10	Simple PLC running times	0~10000		0	×	0x120A
F18.11	Simple PLC operation stage	1~15		1	×	0x120B
F18.12	PLC running time at the current stage	0.0~6000.0		0.0	×	0x120C
F18.14	Load rate	0~65535	rpm	0	×	0x120E
F18.15	UP/DOWN offset frequency	0.00 to 2 * Maximum frequency F00.16	Hz	0.00	×	0x120F
F18.16	PID setting	0.0 to PID maximum range		0.0	×	0x1210
F18.17	PID feedback	0.0 to PID maximum range		0.0	×	0x1211
F18.18	Power meter: MWh	0~65535	MWh	0	×	0x1212
F18.19	Watt-hour meter: kWh	0.0~999.9	kWh	0.0	×	0x1213
F18.20	Output power	0.00~650.00	kW	0.00	×	0x1214
F18.21	Output power factor	-1.000~1.000		0.000	×	0x1215
F18.22	Digital input terminal status 1	X5 X4 X3 X2 X1 0/1 0/1 0/1 0/1 0/1		XXX	×	0x1216
F18.23	Digital input terminal status 2	AI3 AI2 AI1 X5 X4 0/1 0/1 0/1 0/1 0/1		XXX	×	0x1217

F18.24	Digital input terminal status 3	AI4	*	X10	X9	X8		XXX	×	0x1218
		*	0/1	0/1	0/1	0/1				
F18.25	Output terminal state 1	*	R2	R1	Y2	Y1		XXX	×	0x1219
		0/1	0/1	0/1	0/1	0/1				
F18.26	AI1	-100.0~100.0					%	0.0	×	0x121A
F18.27	AI2	0.0~100.0					%	0.0	×	0x121B
F18.28	AI3	0.0~100.0					%	0.0	×	0x121C
F18.29	AI4	-100.0~100.0					%	0.0	×	0x121D
F18.30	Output terminal state 2	*	*	*	R3	R4		XXX	×	0x121E
		0/1	0/1	0/1	0/1	0/1				
F18.31	High-frequency pulse input frequency: kHz	0.00~100.00					kHz	0.00	×	0x121F
F18.32	High-frequency pulse input frequency: Hz	0~65535					Hz	0	×	0x1220
F18.33	Count value	0~65535						0	×	0x1221
F18.34	Actual length	0~65535					m	0	×	0x1222
F18.35	Remaining time of regular running	0.0~6500.0					min	0.0	×	0x1223
F18.36	Rotor position of synchronous motor	0.0~359.9°						0.0	×	0x1224
F18.37	Rotary transformation location	0~4095						0	×	0x1225
F18.38	Motor temperature	0~200					℃	0	×	0x1226
F18.39	VF separation target voltage	0~690					V	0	×	0x1227
F18.40	VF separation output voltage	0~690					V	0	×	0x1228

F18.41	View any address			0	×	0x1229
F18.42	Random carrier frequency display	1000~16000	HZ	0	×	0x122A
F18.51	PID output	-100.0~100.0	%		×	0x1233
F18.58	Feedback pulse high	0~65535		0	×	0x123A
F18.59	Feedback pulse low	0~65535		0	×	0x123B
F18.60	Inverter temperature	-40~200	℃	0	×	0x123C
F18.67	Saved electric energy (MWH)	Cumulative energy saving MWH	MWh	0~65535	×	0x1243
F18.68	Saved electric energy (KWH)	Cumulative energy saving KWH	kWh	0.0~999.9	×	0x1244
F18.69	Saved electric charge (1,000 yuan)	High cumulative cost saving (*1000)		0~65535	×	0x1245
F18.70	Saved electric charge (yuan)	Low cumulative cost saving		0.0~ 999.9	×	0x1246
F18.71	Power-frequency power consumption MWh	Power-frequency power consumption MWH	MWh	0~65535	×	0x1247
F18.72	Power-frequency power consumption KWh	Power-frequency power consumption KWH	kWh	0.0~999.9	×	0x1248
F19	Fault record group					
F19.00	Last fault category	0: No failure Refer to Chapter 6 "Faults and Solutions" for fault codes.		0	×	0x1300
F19.01	Output frequency in failure	0.00 to upper frequency limit	Hz	0.00	×	0x1301
F19.02	Output current in failure	0.00 to 650.00 (rated power ofmotor: ≤ 75 kW) 0.0 to 6500.0 (rated power of motor: > 75 kW)	A	0.00	×	0x1302
F19.03	Bus voltage in failure	0~1200	V	0	×	0x1303

F19.04	Running status in failure	0: not running 1: forward acceleration 2: reverse acceleration 3: forward deceleration 4: reverse deceleration 5: constant speed in forward running 6: reverse constant speed in reverse running		0	×	0x1304
F19.05	Working time in failure	0.00~6553	h	0	×	0x1305
F19.06	Previous fault category	Same as F19.00 parameter description		0	×	0x1306
F19.07	Output frequency in failure		Hz	0.00	×	0x1307
F19.08	Output current in failure		A	0.00	×	0x1308
F19.09	Bus voltage in failure		V	0	×	0x1309
F19.10	Running status in failure	Same as F19.04 parameter description		0	×	0x130A
F19.11	Working time in failure		h	0	×	0x130B
F19.12	Last two fault categories	Same as F19.00 parameter description		0	×	0x130C
F19.13	Output frequency in failure		Hz	0.00	×	0x130D
F19.14	Output current in failure		A	0.00	×	0x130E
F19.15	Bus voltage in failure		V	0	×	0x130F
F19.16	Running status in failure	Same as F19.04 parameter description		0	×	0x1310

F19.17	Working time in failure		h	0	×	0x1311
F27	Winding/unwinding application macro parameter group					
F27.00	Application macro	0: Winding mode 1: Unwinding mode 2: Wire drawing mode 3: Straight wire drawing machine mode		0	O	0x1B00
F27.01	Feedforward gain action channel	0: feedforward gain * set source B 1: Feedforward gain * set source A 2: Feedforward gain * 10V		1	O	0x1B01
F27.02	Feedforward gain input mode	0: No change in feedforward gain 1: 0.00 to upper limit of feedforward gain 2: - upper limit of feedforward gain to + upper limit of feedforward gain		1	O	0x1B02
F27.03	Feedforward control	Ones place: Feedforward reset option 0: Automatic reset 1: Terminal reset Tens place: Feedforward power-off stop option 0: Save after power failure 1: Not save after power failure Hundreds place: Options of continuous feedforward calculation 0: Not calculate 1: Calculate		10	O	0x1B03
F27.04	Upper limit of feedforward gain	0.00~500.00	%	500.00	O	0x1B04
F27.05	Initial feedforward gain	0.00~500.00	%	50.00	●	0x1B05
F27.06	Feedforward gain filter time	0~1000	ms	0	●	0x1B06
F27.07	Feedforward range 0	0.00 to feedforward range 1	%	4.00	●	0x1B07
F27.08	Feedforward range 1	Feedforward range 0 to feedforward range 2	%	12.00	●	0x1B08
F27.09	Feedforward range 2	Feedforward range 1 to feedforward range 3	%	23.00	●	0x1B09

F27.10	Feedforward range 3	Feedforward range 2 to feedforward range 4	%	37.00	●	0x1B0A
F27.11	Feedforward range 4	Feedforward range 3 to feedforward range 5	%	52.00	●	0x1B0B
F27.12	Feedforward range 5	Feedforward range 4 to 100.00	%	72.00	●	0x1B0C
F27.13	Soft start increment	0.00~50.00	%/S	0.60	●	0x1B0D
F27.14	Feedforward increment 1	0.00~50.00	%/S	0.11	●	0x1B0E
F27.15	Feedforward increment 2	0.00~50.00	%/S	0.30	●	0x1B0F
F27.16	Feedforward increment 3	0.00~50.00	%/S	0.75	●	0x1B10
F27.17	Feedforward increment 4	0.00~50.00	%/S	1.55	●	0x1B11
F27.18	Feedforward increment 5	0.00~50.00	%/S	4.00	●	0x1B12
F27.19	Feedforward increment 6	0.00~50.00	%/S	11.00	●	0x1B13
F27.20	Material cutoff control mode	Ones place: Disconnection detection mode 0: Automatic detection 1: External signal Tens place: Material cutoff detection control 0: Detect when the output is greater than the lower limit of material cutoff detection 1: no detection Hundreds place: Material cutoff handling mode 0: Protection of terminal action only 1: Delayed stop and trip protection 2: Material cutoff protection 3: Automatic reset after protection shutdown 4: Material cutoff detection terminal output only 5: Automatic reset of material cutoff detection terminal Thousands place: Brake mode 0: mode 0 1: mode 1 Myriabit: Reverse unwinding mode 0: No speed limit 1: Reverse speed limit by F27.24		01201	O	0x1B14

F27.21	Material cutoff detection delay	0.0~10.0	S	6.0	●	0x1B15
F27.22	Lower limit of material cutoff detection after parking	0.00~60.00	Hz	5.00	●	0x1B16
F27.23	Time of continuous running after material cutoff	0.0~60.0	S	10.0	●	0x1B17
F27.24	Frequency of continuous running after material cutoff	0.00~Fmax	Hz	5.00	●	0x1B18
F27.25	Brake signal output frequency	0.00~FUP	Hz	2.50	●	0x1B19
F27.26	Braking signal duration	0.0~100.0	S	5.0	●	0x1B1A
F27.27	Minimum frequency of wiring detection	0.00~20.00	Hz	10.00	●	0x1B1B
F27.28	Judgment time for invalid cable signal	0.1~20.0	S	10.0	●	0x1B1C
F27.29	Judgment time for valid cable signal	0.1~20.0	S	2.0	●	0x1B1D
F27.30	Filtering time for material cutoff detection	1~100	ms	5	●	0x1B1E
F27.31	Mask bit of fault	* * * * * * E43 E44 0: valid protection 1: shielded protection		00	O	0x1B1F
F27.36	Current value of feedforward gain	-500.0~500.0	%	0.00	×	0x1B24
F45	Modbus free mapping parameter group					
F45.00	Enable Modbus communication free mapping	0: Invalid 1: valid		0	●	0x2D00
F45.01	Source address 1	0~65535	-	0	●	0x2D01
F45.02	Mapping address 1	0~65535	-	0	●	0x2D02

F45.03	Read gain 1	0.00~100.00	-	1.00	●	0x2D03
F45.04	Source address 2	0~65535	-	0	●	0x2D04
F45.05	Mapping address 2	0~65535	-	0	●	0x2D05
F45.06	Read gain 2	0.00~100.00	-	1.00	●	0x2D06
F45.07	Source address 3	0~65535	-	0	●	0x2D07
F45.08	Mapping address 3	0~65535	-	0	●	0x2D08
F45.09	Read gain 3	0.00~100.00	-	1.00	●	0x2D09
F45.10	Source address 4	0~65535	-	0	●	0x2D0A
F45.11	Mapping address 4	0~65535	-	0	●	0x2D0B
F45.12	Read gain 4	0.00~100.00	-	1.00	●	0x2D0C
F45.13	Source address 5	0~65535	-	0	●	0x2D0D
F45.14	Mapping address 5	0~65535	-	0	●	0x2D0E
F45.15	Read gain 5	0.00~100.00	-	1.00	●	0x2D0F
F45.16	Source address 6	0~65535	-	0	●	0x2D10
F45.17	Mapping address 6	0~65535	-	0	●	0x2D11
F45.18	Read gain 6	0.00~100.00	-	1.00	●	0x2D12
F45.19	Source address 7	0~65535	-	0	●	0x2D13
F45.20	Mapping address 7	0~65535	-	0	●	0x2D14
F45.21	Read gain 7	0.00~100.00	-	1.00	●	0x2D15
F45.22	Source address 8	0~65535	-	0	●	0x2D16
F45.23	Mapping address 8	0~65535	-	0	●	0x2D17

F45.24	Read gain 8	0.00~100.00	-	1.00	●	0x2D18
F45.25	Source address 9	0~65535	-	0	●	0x2D19
F45.26	Mapping address 9	0~65535	-	0	●	0x2D1A
F45.27	Read gain 9	0.00~100.00	-	1.00	●	0x2D1B
F45.28	Source address 10	0~65535	-	0	●	0x2D1C
F45.29	Mapping address 10	0~65535	-	0	●	0x2D1D
F45.30	Read gain 10	0.00~100.00	-	1.00	●	0x2D1E
F45.31	Source address 11	0~65535	-	0	●	0x2D1F
F45.32	Mapping address 11	0~65535	-	0	●	0x2D20
F45.33	Read gain 11	0.00~100.00	-	1.00	●	0x2D21
F45.34	Source address 12	0~65535	-	0	●	0x2D22
F45.35	Mapping address 12	0~65535	-	0	●	0x2D23
F45.36	Read gain 12	0.00~100.00	-	1.00	●	0x2D24
F45.37	Source address 13	0~65535	-	0	●	0x2D25
F45.38	Mapping address 13	0~65535	-	0	●	0x2D26
F45.39	Read gain 13	0.00~100.00	-	1.00	●	0x2D27
F45.40	Source address 14	0~65535	-	0	●	0x2D28
F45.41	Mapping address 14	0~65535	-	0	●	0x2D29
F45.42	Read gain 14	0.00~100.00	-	1.00	●	0x2D2A
F45.43	Source address 15	0~65535	-	0	●	0x2D2B
F45.44	Mapping address 15	0~65535	-	0	●	0x2D2C

F45.45	Read gain 15	0.00~100.00	-	1.00	●	0x2D2D
F45.46	Source address 16	0~65535	-	0	●	0x2D2E
F45.47	Mapping address 16	0~65535	-	0	●	0x2D2F
F45.48	Read gain 16	0.00~100.00	-	1.00	●	0x2D30
F45.49	Source address 17	0~65535	-	0	●	0x2D31
F45.50	Mapping address 17	0~65535	-	0	●	0x2D32
F45.51	Read gain 17	0.00~100.00	-	1.00	●	0x2D33
F45.52	Source address 18	0~65535	-	0	●	0x2D34
F45.53	Mapping address 18	0~65535	-	0	●	0x2D35
F45.54	Read gain 18	0.00~100.00	-	1.00	●	0x2D36
F45.55	Source address 19	0~65535	-	0	●	0x2D37
F45.56	Mapping address 19	0~65535	-	0	●	0x2D38
F45.57	Read gain 19	0.00~100.00	-	1.00	●	0x2D39
F45.58	Source address 20	0~65535	-	0	●	0x2D3A
F45.59	Mapping address 20	0~65535	-	0	●	0x2D3B
F45.60	Read gain 20	0.00~100.00	-	1.00	●	0x2D3C
F45.61	Source address 21	0~65535	-	0	●	0x2D3D
F45.62	Mapping address 21	0~65535	-	0	●	0x2D3E
F45.63	Read gain 21	0.00~100.00	-	1.00	●	0x2D3F
F45.64	Source address 22	0~65535	-	0	●	0x2D40
F45.65	Mapping address 22	0~65535	-	0	●	0x2D41

F45.66	Read gain 22	0.00~100.00	-	1.00	●	0x2D42
F45.67	Source address 23	0~65535	-	0	●	0x2D43
F45.68	Mapping address 23	0~65535	-	0	●	0x2D44
F45.69	Read gain 23	0.00~100.00	-	1.00	●	0x2D45
F45.70	Source address 24	0~65535	-	0	●	0x2D46
F45.71	Mapping address 24	0~65535	-	0	●	0x2D47
F45.72	Read gain 24	0.00~100.00	-	1.00	●	0x2D48
F45.73	Source address 25	0~65535	-	0	●	0x2D49
F45.74	Mapping address 25	0~65535	-	0	●	0x2D4A
F45.75	Read gain 25	0.00~100.00	-	1.00	●	0x2D4B
F45.76	Source address 26	0~65535	-	0	●	0x2D4C
F45.77	Mapping address 26	0~65535	-	0	●	0x2D4D
F45.78	Read gain 26	0.00~100.00	-	1.00	●	0x2D4E
F45.79	Source address 27	0~65535	-	0	●	0x2D4F
F45.80	Mapping address 27	0~65535	-	0	●	0x2D50
F45.81	Read gain 27	0.00~100.00	-	1.00	●	0x2D51
F45.82	Source address 28	0~65535	-	0	●	0x2D52
F45.83	Mapping address 28	0~65535	-	0	●	0x2D53
F45.84	Read gain 28	0.00~100.00	-	1.00	●	0x2D54
F45.85	Source address 29	0~65535	-	0	●	0x2D55
F45.86	Mapping address 29	0~65535	-	0	●	0x2D56

F45.87	Read gain 29	0.00~100.00	-	1.00	●	0x2D57
F45.88	Source address 30	0~65535	-	0	●	0x2D58
F45.89	Mapping address 30	0~65535	-	0	●	0x2D59
F45.90	Read gain 30	0.00~100.00	-	1.00	●	0x2D5A