

EMHEATER

User Manual

EM15 Series Frequency Inverter



China EM Technology Limited

Preface

Thank you for purchasing the EM15 series frequency inverter developed by China EM Technology Limited. EM15 series inverter is our company adopted the new concept to research and developed high-performance product. With unique control model, this inverter can realize high torque, high precision, wide variable speed and low noise drive; And PID regulation, simple PLC, flexible input and output terminals, Auto voltage regulation, rapid Current Limit, Torque limited and control, field bus control and a series of practical operation, control function, which provide a highly integrated solution for equipment manufacturers and terminal customers, in speed, energy saving, automatic control and other aspects, to meet the application needs of different customers.

Before unpacking, please check carefully:

- Whether the nameplate model of frequency inverter are consistent with your order ratings. The box contains the frequency inverter, user manual.
- Whether the frequency inverter is damaged during transportation. If you find any omission or damage, please contact us or your local supplier immediately.

First-time Use

For the users who use this product for the first time, read the manual carefully. If in doubt concerning some functions or performances, contact the technical support personnel to ensure correct use.

Due to the continuous improvement of frequency inverter, this document will be updated without prior notice.



EM15 series Frequency inverter complies with the following international standards. All products have passed the CE certification.

IEC/EN61800-5-1: 2003 Variable speed electric drive system safety requirements;

IEC/EN61800-3: 2004 Variable speed electric drive system, Part 3: The Electro Magnetic Compatibility (EMC) Standards of Product and its specific testing methods.

Note:

- **There are all parameters list integrated at appendix II.**



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1. Safety Information and Precautions







In this manual, the notices are graded based on the degree of danger:

 Danger	Indicates that failure to comply with the notice will result in severe personal injury or even death.
 Warning	Indicates that failure to comply with the notice will result in personal injury or property damage.

Read this manual carefully so that you have a thorough understanding. Installation, commissioning or maintenance may be performed in conjunction with this chapter. EMHEATER will assume no liability or responsibility for any injury or loss caused by improper operation.

1.1 Safety Information

Before installation	 Danger	<ul style="list-style-type: none"> Do not use damaged or missing components frequency inverter. Failure to comply will result in personal injury. Please use the electric motor with upper B insulation class. Failure to comply will result in personal injury.
During installation	 Danger	<ul style="list-style-type: none"> Install the frequency inverter on incombustible objects such as metal, and keep it away from combustible materials. Failure to comply may result in a fire.
	 Warning	<ul style="list-style-type: none"> When two frequency inverters are laid in the same cabinet, arrange the installation positions properly to ensure the enough cooling effect. Do not drop wire residue or screw into the frequency inverter. Failure to comply will result in damage to the frequency inverter.
Wiring	 Danger	<ul style="list-style-type: none"> Wiring must be performed only by qualified personnel under instructions described in this manual. Failure to comply may result in unexpected accidents. A circuit breaker must be used to isolate the power supply and the frequency inverter. Failure to comply may result in a fire. Ensure that the power supply is cut off before wiring. Failure to comply may result in electric shock. Connect the frequency inverter to ground properly by standard. Failure to comply may result in electric shock.
	 Warning	<ul style="list-style-type: none"> Never connect the power supply cables to the output terminals (U, V, W) of the Frequency inverter. Failure to comply will result in damage to the frequency inverter. Make sure that all the connecting wires comply with the requirement of EMC and the safety standard in the region. Use wire sizes recommended in the manual. Failure to comply may result in accidents. Never connect the braking resistor between the DC bus terminals (P+) and (P-). Failure to comply may result in a fire.
Before power-on	 Danger	<ul style="list-style-type: none"> Check that the following requirements comply with: The voltage class of the power supply is consistent with the rated voltage class of

	Danger	<p>the frequency inverter. The input terminals (R, S, T) and output terminals (U, V, W) are properly connected. No short-circuit exists in the peripheral circuit. The wiring is fastened. Failure to comply will result in damage to frequency inverter.</p> <ul style="list-style-type: none"> ● Cover the frequency inverter properly before power-on to prevent electric shock.
Before power-on	 Warning	<ul style="list-style-type: none"> ● Do not perform the voltage resistance test on any part of the frequency inverter because such test has been done in the factory. Failure to comply will result in accidents. ● All peripheral devices must be connected properly under the instructions described in this manual. Failure to comply will result in accidents.
After power-on	 Danger	<ul style="list-style-type: none"> ● Do not open the frequency inverter’s cover after power-on to prevent from electric shock. ● Do not touch the frequency inverter with wet hand and its peripheral circuit to prevent from electric shock. ● Do not touch the terminals of the frequency inverter (including the control terminals). Failure to comply may result in electric shock. ● Do not touch the U, V, W terminal or motor connecting terminals when frequency inverter automatically does safety testing for the external high-voltage electrical circuit. Failure to comply may result in electric shock.
	 Warning	<ul style="list-style-type: none"> ● Note the danger during the rotary running of motor when check the parameters. Failure to comply will result in accidents. ● Do not change the factory default settings of the frequency inverter. Failure to comply will result in damage to the frequency inverter.
During operation	 Danger	<ul style="list-style-type: none"> ● Do not go close to the equipment when selected the restart function. Failure to comply may result in personal injury. ● Do not touch the fan or the discharging resistor to check the temperature. Failure to comply will result in personal injury. ● Signal detection must be performed only by qualified personal during operation
	 Warning	<ul style="list-style-type: none"> ● Avoid objects falling into the frequency inverter when it is running. Failure to comply will result in damage to frequency inverter. ● Do not start/stop the frequency inverter by turning the contactor ON/OFF. Failure to comply will result in damage to the frequency inverter.
Maintenance	 Danger	<ul style="list-style-type: none"> ● Do not repair or maintain the frequency inverter at power-on. Failure to comply will result in electric shock. ● Repair or maintain the frequency inverter only after the charge light on frequency inverter is powered off. This allows for the residual voltage in the capacitor to discharge to a safe value. Failure to comply will result in personal injury. ● Repair or maintenance of the frequency inverter may be performed only by qualified personnel. Failure to comply will result in personal injury or damage to the frequency inverter.

1.2 General Precautions

1.2.1 Motor insulation test

Perform the insulation test when the motor is used for the first time, or when it is reused after being stored for a

long time, or in a regular check-up, in order to prevent the poor insulation of motor windings from damaging the frequency inverter. The motor must be disconnected from the frequency inverter during the insulation test. A 500-V mega-Ohm meter is recommended for the test. The insulation resistance must not be less than 5 MΩ.

1.2.2 Thermal protection of motor

If the rated capacity of the motor selected does not match that of the frequency inverter, especially when the frequency inverter's rated power is greater than the motor's, adjust the motor protection parameters on the operation panel of the frequency inverter or install a thermal relay in the motor circuit for protection.

1.2.3 Running at over 50 Hz

The frequency inverter provides frequency output of 0 to 3000 Hz (Up to 300 Hz is supported if the frequency inverter runs in FVC and SVC mode). If the frequency inverter is required to run at over 50 Hz, consider the bearable capacity of the machine.

1.2.4 Vibration of mechanical device

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

1.2.5 Motor heat and noise

The output of the frequency inverter is pulse width modulation (PWM) wave with certain harmonic frequencies, and therefore, the motor temperature, noise, and vibration are slightly greater than those motor runs at grid power frequency (50 Hz).

1.2.6 Voltage-sensitive device or capacitor at output side of the Frequency inverter

Do not install the capacitor for improving power factor or lightning protection voltage-sensitive resistor at the output side of the frequency inverter because the output of the frequency inverter is PWM wave. Otherwise, the frequency inverter may suffer transient over current and even to be damaged.

1.2.7 Contactor at the Input/Output side of the frequency inverter

When a contactor is installed between the input side of the frequency inverter and the power supply, the frequency inverter must not be started or stopped by switching the contactor on or off. If the frequency inverter has to be operated by the contactor, ensure that the time interval between switching is at least one hour. Since frequently charge and discharge will shorten the service life of the capacitor inside of frequency inverter.

When a contactor is installed between the output side of the frequency inverter and the motor, do not turn off the contactor when the frequency inverter is active. Otherwise, IGBT modules inside of frequency inverter may be damaged.

1.2.8 When input voltage is over rated voltage range

The frequency inverter must not be used over the allowable voltage range specified in this manual. Otherwise, the frequency inverter's components may be damaged. If required, use a corresponding voltage transformer device.

1.2.9 Prohibition of three-phase input changed into two-phase input

Do not change the three-phase input of the frequency inverter to two-phase input. Otherwise, a fault will be result or the frequency inverter will be damaged.

1.2.10 Surge suppressor

The frequency inverter has a built-in voltage dependent resistor (VDR) for suppressing the surge voltage. For frequently surge place, please add extra surge voltage protection device at input side of frequency inverter.

Note: Do not connect the surge suppressor at the output side of the AC.

1.2.11 Altitude and de-rating

In places where the altitude is above 1000 m and the cooling effect reduces due to thin air, it is necessary to de-rate the frequency inverter. Please contact our company for technical support.

1.2.12 Some special usages

If wiring that is not described in this manual such as common DC bus is applied, please contact the agent or our company for technical support.

1.2.13 Disposal

The electrolytic capacitors on the main circuits and PCB may explode when they are burnt. Poisonous gas is generated when the plastic parts are burnt. Please treat them as industrial waste.

1.2.14 Adaptable Motor

The standard adaptable motor is adaptable four-pole squirrel-cage asynchronous induction motor. For other types of motor, select a proper frequency inverter according to the rated motor current. If user uses inverter for permanent magnet synchronous motor, please contact my company for technical support.

The cooling fan and rotor shaft of non-variable-frequency motor are coaxial, which results in reduced cooling effect when the rotational speed decreasing. If variable speed is required, add a more powerful fan or replace it with variable-frequency motor in applications where the motor overheats easily.

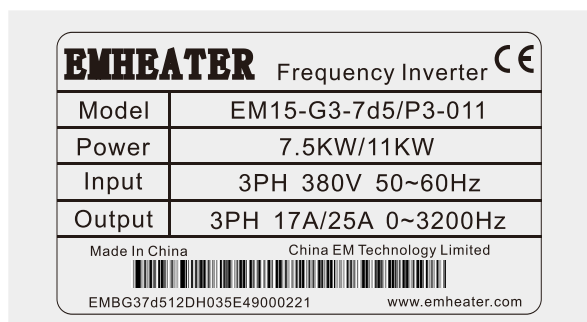
The standard parameters of the adaptable motor have been configured inside the frequency inverter. It is still necessary to perform motor auto-tuning or modify the default values based on actual conditions. Otherwise, the running result and protection performance will be affected.

The frequency inverter may alarm or even be damaged when short-circuit exists on cables or inside the motor. Therefore, perform insulation short-circuit test when the motor and cables are newly installed or during routine maintenance. During the test, make sure that the frequency inverter is disconnected from the tested parts.

2. Product Information

2.1 Products Label and Model Designation

EM15 - G 3 - 7d5 / P 3 - 011
 ① ② ③ ④ ⑤ ⑥ ⑦



①	EM15 Series Frequency Inverter
②, ⑤	Products Type: G: Gernal use P: Fan&Pump
③, ⑥	Voltage range: 1: Single phase 220V 13: Signle phase 220V to Three phase 380 2: Three phase 220V 3: Three phase 380V 4: Three phase 480V
④, ⑦	Adaptable motor: 7d5: 7.5KW ;011: 11KW

Diagram 2-1 Products Lable and Designation rules

2.1.1 Product appearance

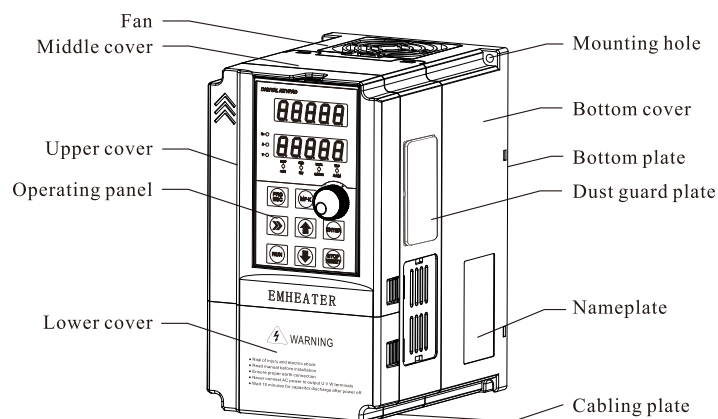


Diagram 2-2 Nameplate

The housing types of the EM15 models are listed in the following table:

	Plastic	Sheet metal
1PH 220V	0.4kW~2.2kW	--
3PH 220V	0.4kW~11kW	15kW~75kW
3PH 380V	0.75kW~22kW	30kW~500kW
3PH 480V	0.75kW~22kW	30kW~500kW

2.2 Technical Specifications

Input&Output	<ul style="list-style-type: none"> ● Input Voltage: 220V/380V/480V±15% ● Input Frequency: 47~63Hz ● Input Frequency Resolution: 0.01Hz (Digital setting); maximum frequency×0.025% (Analog setting) ● Output Voltage:0~Rated input voltage ● Output Frequency: 0~320Hz(SFC); 0~3200Hz (V/F)
Technical Performance	<ul style="list-style-type: none"> ● Control Mode: Sensor-less vector control(SVC); Closed-loop vector control (FVC); Voltage/Frequency (V/F) control ● Carrier Frequency: 0.5kHz~16kHz ● Startup Torque: G type: 0.5Hz/150% (FVC); 0Hz/180%(FVC); P type: 0.5Hz/100% ● Speed Range:1:100(SVC);1:1000(FVC) ● Speed Stability Accuracy: ±0.5%(SVC);±0.02%(FVC) ● Torque Control Accuracy: ±5%(FVC) ● Overload Capacity: G type:150% rated current 60s; 180% rated current 3s; P type: 120% rated current 60s;150% rated current 3s. ● Torque Boost: Auto boost; Manual boost 0.1%~30.0% ● DC braking: 0.00Hz~maximum frequency (DC braking frequency); 0.0s~36.0s(Braking time); 0.0%~100.0%(Braking trigger current value)
Individualized Functions	<ul style="list-style-type: none"> ● Built-in Simple PLC / Multiple Speeds: It realizes up to 16 speeds via the simple PLC function or combination of DI terminal states. ● Built-in PID: It realizes closed loop control system easily. ● Auto voltage regulation (AVR): It can keep constant output voltage automatically when the mains voltage fluctuation ● Overvoltage/ Overcurrent Stall Control: The current and voltage are limited automatically during the running process so as to avoid frequently tripping due to overvoltage / over current. ● Rapid Current Limit: To avoid frequently over current faults of the frequency inverter. ● Torque Limit and Control: It can limit the torque automatically and prevent frequently over current tripping during the running process. Torque control can be implemented in the VC mode. ● High Performance: Control of asynchronous motor and synchronous motor are implemented through the high-performance current vector control technology. ● Virtual I/O: Five groups of virtual DI/DO can realize simple logic control. ● Timing Control: Time range: 0.0~6500.0 minutes ● Motor Overheat Protection: The optional I/O extension card enables AI3 to receive the motor temperature sensor input (PT100, PT1000) so as to realize motor overheat protection. ● Multiple Encoder Types: It supports differential encoder, open-collector encoder ● Protection Mode: Motor short-circuit detection at power-on, input/output phase loss protection, over current and overvoltage protection, less voltage protection, overheat protection and overload protection,etc
External Interface	<ul style="list-style-type: none"> ● Running Command Giving: key panel; Control terminals; Serial communication port; You can switch between these giving in various ways. ● Frequency Giving: There are 10 kinds frequency giving: digital setting, analog voltage setting, analog current setting, pulse setting and serial communication port setting. ● Programmable Digital Input: 6 digital input (DI) terminals, one of which supports up to 100 kHz high-speed pulse input ● Programmable Analog Input: 3 analog input (AI) terminals, AI1,AI2 support 0V~10 V or 0mA~20mA input, AI3 support -10V~+10V ● Programmable Open Collector Output: 1 FMP output terminal, that supports 0~100 kHz square wave signal output (Can be used as DO output) ● Programmable Analog Output:2 analog output (AO) terminals, both of them supports 0mA~20mA current output and 0V~10V voltage output. ● Relay Output: 2 relay output terminal (2.2KW and below only have 1 relay output terminal)
Environment	<ul style="list-style-type: none"> ● Installation Location: Indoor, no direct sunlight, dust, corrosive gas, combustible gas, oil smoke, vapour, drip or salt. ● Altitude: Lower than 1000m ● Ambient Temperature: -10°C~ +40°C (de-rated if the ambient temperature is between 40°C and 50°C) ● Humidity: Less than 95%RH, without condensing ● Vibration: Less than 5.9 m/s² (0.6 g) ● Storage Temperature: -20°C ~ +60°C

2.3 Model and Technical data

Model	Power Capacity (KVA)	Input Current (A)	Output Current (A)	Adaptable Motor	
				KW	HP
Single phase 220V 50/60Hz					
EM15A-G1-d75	1.5	8.2	4	0.75	1
EM15A-G1-1d5	3	14	7	1.5	2
EM15-G1-2d2	4	23	9.6	2.2	3
Three phase 220V 50/60Hz					
EM15-G2-d75	3	5	3.8	0.75	1
EM15-G2-1d5	4	5.8	5.1	1.5	2
EM15-G2-2d2	5.9	10.5	9	2.2	3
EM15-G2-004	8.9	14.6	13	3.7	5
EM15-G2-5d5	17	26	25	5.5	7.5
EM15-G2-7d5	21	35	32	7.5	10
EM15-G2-011	30	46.5	45	11	15
EM15-G2-015	40	62	60	15	20
EM15-G2-018	57	76	75	18.5	25
EM15-G2-022	69	92	91	22	30
EM15-G2-030	85	113	112	30	40
EM15-G2-037	114	157	150	37	50
EM15-G2-045	134	180	176	45	60
EM15-G2-055	160	214	210	55	75
EM15-G2-075	231	307	304	75	100
Three phase 380V 50/60Hz					
EM15-G3-d75/P3-1d5	1.5/3	5/5.8	2.1/3.8	0.75/1.5	1/2
EM15-G3-1d5/P3-2d2	3/4	5.8/10.5	3.8/5.1	1.5/2.2	2/3
EM15-G3-2d2/P3-004	4/5.9	10.5/14.6	5.1/9	2.2/3.7	3/5
EM15-G3-004/P3-5d5	5.9/8.9	14.6/20.5	9/13	3.7/5.5	5/7.5
EM15-G3-5d5/P3-7d5	8.9/11	20.5/26	13/17	5.5/7.5	7.5/10
EM15-G3-7d5/P3-011	11/17	26/35	17/25	7.5/11	10/15
EM15-G3-011/P3-015	17/21	35/38.5	25/32	11/15	15/20
EM15-G3-015/P3-018	21/24	38.5/46.5	32/37	15/18.5	20/25
EM15-G3-018/P3-022	24/30	46.5/62	37/45	18.5/22	25/30
EM15-G3-022/P3-030	30/40	62/76	45/60	22/30	30/40
EM15-G3-030/P3-037	40/57	76/92	60/75	30/37	40/50
EM15-G3-037/P3-045	57/69	92/113	75/91	37/45	50/60
EM15-G3-045/P3-055	69/85	113/128	91/112	45/55	60/75
EM15-G3-055/P3-075	85/114	128/157	112/150	55/75	75/100
EM15-G3-075/P3-090	114/134	157/180	150/176	75/90	100/125
EM15-G3-090/P3-110	134/160	180/214	176/210	90/110	125/150
EM15-G3-110/P3-132	160/192	214/256	210/253	110/132	150/200
EM15-G3-132/P3-160	192/231	256/307	253/304	132/160	200/250
EM15-G3-160/P3-200	231/250	307/385	304/377	160/200	250/280
EM15-G3-200/P3-220	250/280	385/430	377/426	200/220	280/300

Model	Power Capacity (KVA)	Input Current (A)	Output Current (A)	Adaptable Motor	
				KW	HP
EM15-G3-220/P3-250	280/355	430/468	426/465	220/250	300/370
EM15-G3-250/P3-280	355/396	468/525	465/520	250/280	370/400
EM15-G3-280/P3-315	396/445	525/590	520/585	280/315	400/420
EM15-G3-315/P3-355	445/500	590/665	585/650	315/355	420/500
EM15-G3-355	500	665	650	355	500
EM15-G3-400	560	785	725	400	530
EM15-G3-450	630	883	820	450	600
EM15-G3-500	800	920	860	500	660
Three phase 480V 50/60Hz					
EM15-G4-d75/P4-1d5	1.5/3	5/5.8	2.1/3.8	0.75/1.5	1/2
EM15-G4-1d5/P4-2d2	3/4	5.8/10.5	3.8/5.1	1.5/2.2	2/3
EM15-G4-2d2/P4-004	4/5.9	10.5/14.6	5.1/9	2.2/3.7	3/5
EM15-G4-004/P4-5d5	5.9/8.9	14.6/20.5	9/13	3.7/5.5	5/7.5
EM15-G4-5d5/P4-7d5	8.9/11	20.5/26	13/17	5.5/7.5	7.5/10
EM15-G4-7d5/P4-011	11/17	26/35	17/25	7.5/11	10/15
EM15-G4-011/P4-015	17/21	35/38.5	25/32	11/15	15/20
EM15-G4-015/P4-018	21/24	38.5/46.5	32/37	15/18.5	20/25
EM15-G4-018/P4-022	24/30	46.5/62	37/45	18.5/22	25/30
EM15-G4-022/P4-030	30/40	62/76	45/60	22/30	30/40
EM15-G4-030/P4-037	40/57	76/92	60/75	30/37	40/50
EM15-G4-037/P4-045	57/69	92/113	75/91	37/45	50/60
EM15-G4-045/P4-055	69/85	113/128	91/112	45/55	60/75
EM15-G4-055/P4-075	85/114	128/157	112/150	55/75	75/100
EM15-G4-075/P4-090	114/134	157/180	150/176	75/90	100/125
EM15-G4-090/P4-110	134/160	180/214	176/210	90/110	125/150
EM15-G4-110/P4-132	160/192	214/256	210/253	110/132	150/200
EM15-G4-132/P4-160	192/231	256/307	253/304	132/160	200/250
EM15-G4-160/P4-200	231/250	307/385	304/377	160/200	250/280
EM15-G4-200/P4-220	250/280	385/430	377/426	200/220	280/300
EM15-G4-220/P4-250	280/355	430/468	426/465	220/250	300/370
EM15-G4-250/P4-280	355/396	468/525	465/520	250/280	370/400
EM15-G4-280/P4-315	396/445	525/590	520/585	280/315	400/420
EM15-G4-315/P4-355	445/500	590/665	585/650	315/355	420/500
EM15-G4-355	500	665	650	355	500
EM15-G4-400	560	785	725	400	530
EM15-G4-450	630	883	820	450	600
EM15-G4-500	800	920	860	500	660

2.4 Product appearance and installation dimension

2.4.1 Appearance and Installation Hole Dimension (mm)

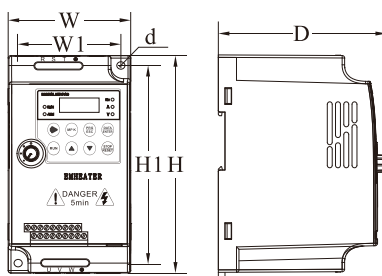


Diagram 2-3 Single phase 0.75~1.5kW Wall-mounted installation dimensions

Matching inverter		Appearance and installing dimension (Unit: mm)					
Voltege	Power Range	W	W1	H	H1	D	d
1PH 220V	0.75~1.5kW	85	73	142	130	116	Φ4

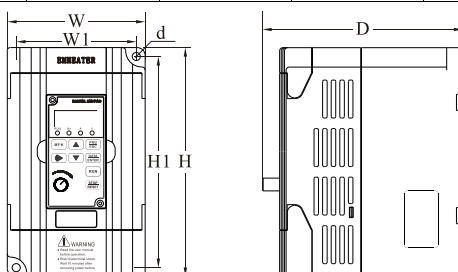


Diagram 2-4 Three phase 0.75~2.2kW Wall-mounted installation dimensions

Matching inverter		Appearance and installing dimension (Unit: mm)					
Voltege	Power Range	W	W1	H	H1	D	d
3PH 220V	0.75~1.5kW	100	89	151	140	116.5	Φ4
3PH 380V	0.75~2.2 kW						
3PH 480V	0.75~2.2 kW						

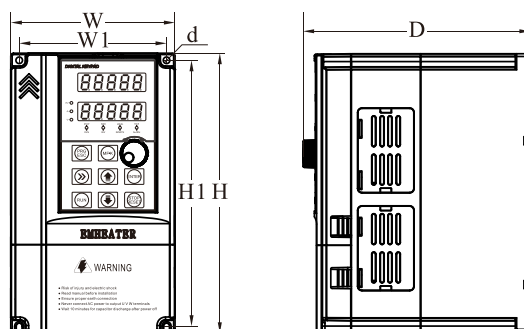


Diagram 2-5 Three phase 4~22kW Wall-mounted installation dimensions

Matching inverter		Appearance and installing dimension (Unit: mm)					
Voltege	Power Range	W	W1	H	H1	D	d
1 PH 220V	2.2kW	120	108	205	195	166	Φ4.5
3PH 220V	2.2kW						
3PH 380V	4~5.5kW						
3PH 480V	4~5.5kW	162	148	250	238	191	Φ5.5
3PH 220V	4~5.5kW						

Matching inverter		Appearance and installing dimension (Unit: mm)					
Voltege	Power Range	W	W1	H	H1	D	d
3PH 380V	7.5~11kW	223	207	323	307	207	Φ5.5
3PH 480V	7.5~11kW						
3PH 220V	7.5~11kW						
3PH 380V	15~22kW						
3PH 480V	15~22kW						

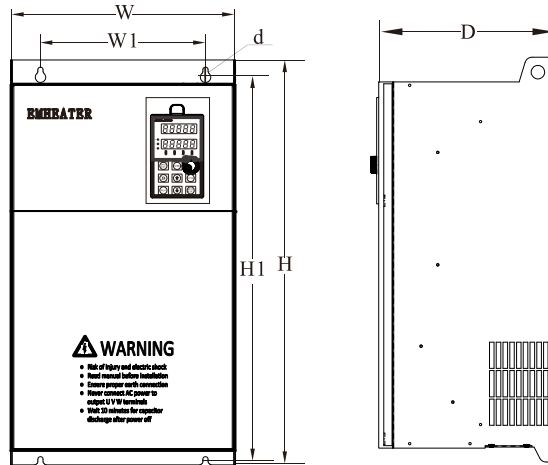


Diagram 2-6 Three phase 30~500kW Wall-mounted installation dimensions

Matching inverter		Appearance and installing dimension (Unit: mm)					
Voltege	Power Range	W	W1	H	H1	D	d
3PH 220V	15~18.5kW	300	220	540	500	240	Φ7
3PH 380V	30~37kW						
3PH 480V	30~37kW						
3PH 220V	22~30kW	340	260	580	540	270	Φ10
3PH 380V	45~55kW						
3PH 480V	45~55kW						
3PH 220V	37~45kW	410	260	610	575	280	Φ12
3PH 380V	75~90kW						
3PH 480V	75~90kW						
3PH 220V	55kW	460	320	710	690	335	Φ12
3PH 380V	110~132kW						
3PH 480V	110~132kW						
3PH 220V	75kW	535	360	885	830	370	Φ12
3PH 380V	160~220kW						
3PH 480V	160~220kW						
3PH 380V	250~315kW	650	360	1040	985	415	Φ12
3PH 480V	250~315kW						
3PH 380V	355~500kW	815	600	1350	1250	445	Φ12
3PH 480V	355~500kW						

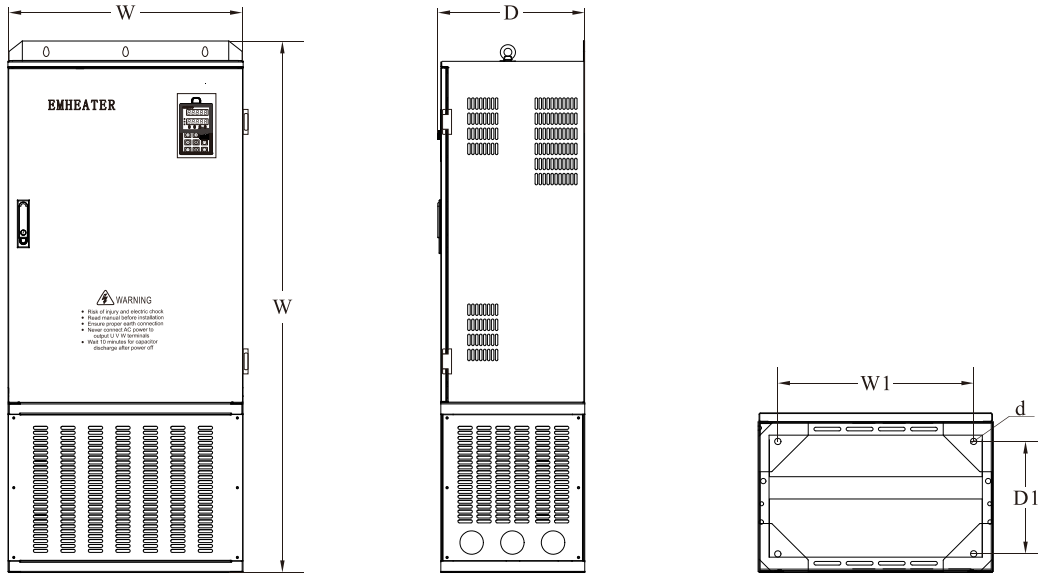


Diagram 2-7 Three phase 160~500kW Cabinet installation dimensions

Matching inverter		Appearance and installing dimension (Unit: mm)					
Voltege	Power Range	W	W1	H	D	D1	d
3PH 220V	75kW	535	438	1397	370	252	Φ14
3PH 380V	160~220kW						
3PH 480V	160~220kW						
3PH 380V	250~315kW	650	558	1552	415	297	Φ14
3PH 480V	250~315kW						
3PH 380V	355~500kW	815	722	1832	445	306	Φ14
3PH 480V	355~500kW						

2.4.2 Appearance and installation dimension of external keypad (keypad tray)

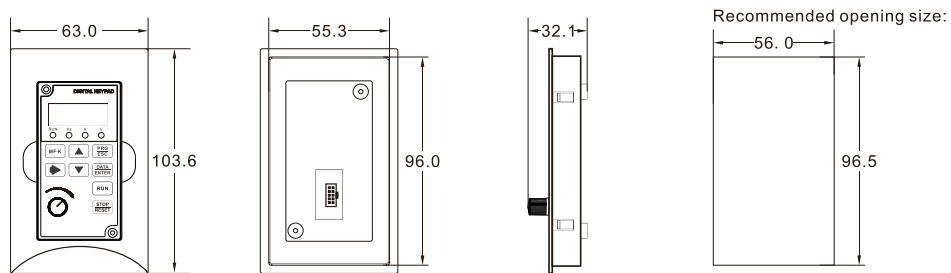


Diagram 2-8 Appearance and installation dimension of small size external keypad (keypad tray)

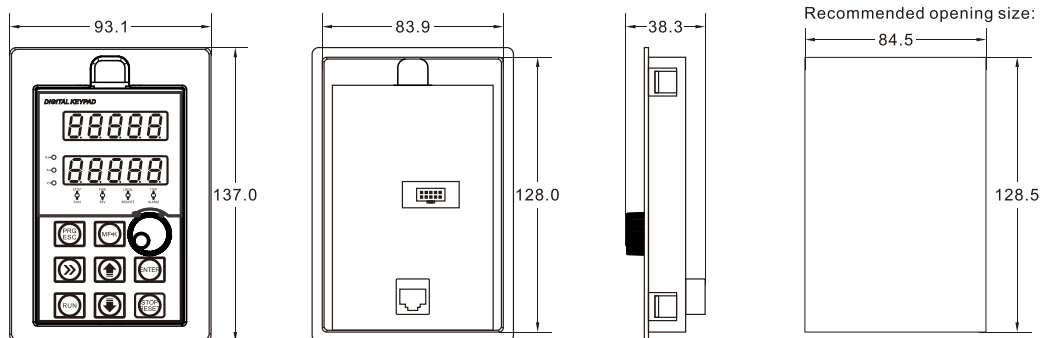


Diagram 2-9 Appearance and installation dimension of big size external keypad (keypad tray)

2.5 Daily maintenance of frequency inverters

2.5.1 Daily maintenance

Due to the influence of temperature, humidity, dust and vibration, it will lead to poor heat dissipation and component aging of frequency inverter, and results in potential failure or reducing the service life of frequency inverter. Therefore, it is necessary to do daily and regular maintenance of the frequency inverter.

Daily check items:

1. Check if the sound is normal during the running of the motor;
2. Check if there is a vibration during the running of the motor;
3. Check whether the installation environment of frequency inverter has changed;
4. Check if the cooling fan of frequency inverter is working correctly, the cooling air duct is clear;
5. Check if the frequency inverter is overheating;
6. Make sure that the frequency inverter should always be kept in a clean state;
7. Clear up effectively the dust on the surface of the frequency inverter, prevent the dust from entering into the inside of the frequency inverter, especially for the metal dust;
8. Clear up effectively the oil and dust on the cooling fan of frequency inverter.

2.5.2 Regular inspection

Please regularly check frequency inverter, especially for the difficult checking place of running.

Regular inspection items:

1. Check the air duct and clear up regularly;
2. Check if there are any loose screws;
3. Check if the inverter has been corroded;
4. Check whether the wiring terminals show signs of arcing.
5. Check if the terminals have arcing mark.

Note: When using the megger (please use the DC 500V meg ohm meter) to measure the insulation resistance, you shall disconnect the main circuit to the frequency inverter. Do not use the insulation resistance meter to test the control circuit. Do not to do the high voltage test (It has been done when the frequency inverter producing in factory.)

2.5.3 Wearing parts replacement

The vulnerable parts of frequency inverter include the cooling fan and filter electrolytic capacitor, its service life is closely related to the using environment and maintenance status. The general service life is:

Part Name	Service Life
Fan	3 to 4 Years
Electrolytic capacitor	5 to 6 Years

The user can confirm the replace time according to the running time.

1. Possible reasons for the damage of cooling fan: bearing wear and blade aging. Distinguish standard: Any cracks in the fan blade, any abnormal vibration sound during the starting of frequency inverter.
2. Possible reasons for the damage of filtering electrolytic capacitor: poor quality of the input power supply, the environment temperature is higher, the load change frequently and the electrolyte aging. Distinguish standard: Any leakage of its liquid, if the safety valve is protruding, electrostatic capacitance and insulation resistance measurement.

2.5.4 Storage of the frequency inverter

After buying the frequency inverter, users shall pay attention to the temporary and long-term storage as following:

1. Store the frequency inverter in the original packaging;
2. Long-term storage can lead to the degradation of electrolytic capacitors, and must ensure to power on for once within 2 years. And the power-on time is at least 5 hours. The input voltage must slowly rise to the rating by using the voltage regulator.

2.6 Selection Guide of braking component

Table 2-5 is the recommended value of braking resistor, users can select the different resistance value and power according to the actual situation, (but the resistance value must not be less than the recommended value in the table, and the power can be bigger.) The selection of braking resistance need to be confirmed according to the power that the motor generated in the practical application systems, and is relevant to the system inertia, deceleration time, the energy of the potential energy load, needs customers to choose according to actual situation. The greater the inertia the shorter deceleration time is needed and more frequently braking, so the braking resistor needs the one with bigger power but smaller resistance value.

2.6.1 Selection of braking resistance value

When braking, almost all the renewable energy of motor is consumed on the braking resistor.

According to the formula: $U \cdot U/R = P_b$

In the formula:

U --- The braking voltage when the system brake stably (different system is different, for the 380VAC system generally take 700V)

R - Braking resistor

P_b – Power of braking

2.6.2 Selection power of braking resistor

In theory the power of braking resistor is consistent with the braking power, but it need to be taken into consideration that the braking resistor power will derate to 70%.

According to the formula: $0.7 \cdot P_r = P_b \cdot D$

In this formula:

P_r ----Power of resistor

D---- Braking proportion (the proportion that the regeneration process accounts for the whole process)

Elevator---- 20%~30%

Uncoiling and coiling machine---- 20%~30%

Centrifugal machine---- 50%~60%

Occasionally braking load---- 5%

Other machine generally-----10%

Table 2-5 EM15 Inverter braking components selection table

Inverter Power	Recommend power of braking resistor	Recommend resistance value of braking resistor	Braking unit	Remarks
Single phase 220V				
EM15-G1-2d2	100W	$\geq 70\Omega$	Built-in as standard	No special instructions
Three phase 220V				
EM15-G2-d75	150W	$\geq 110\Omega$	Built-in as standard	No special instructions
EM15-G2-1d5	250W	$\geq 100\Omega$		

Inverter Power	Recommend power of braking resistor	Recommend resistance value of braking resistor	Braking unit	Remarks
EM15-G2-2d2	300W	$\geq 65\Omega$	External	No special instructions
EM15-G2-004	400W	$\geq 45\Omega$		
EM15-G2-5d5	800W	$\geq 22\Omega$		
EM15-G2-7d5	1000W	$\geq 16\Omega$		
EM15-G2-011	1500W	$\geq 11\Omega$		
EM15-G2-015	2500W	$\geq 8\Omega$		
EM15-G2-018	3.7 kW	$\geq 8.0\Omega$		
EM15-G2-022	4.5 kW	$\geq 8\Omega$		
EM15-G2-030	5.5 kW	$\geq 4\Omega$		
EM15-G2-037	7.5 kW	$\geq 4\Omega$		
EM15-G2-045	4.5 kW×2	$\geq 4\Omega\times 2$		
EM15-G2-055	5.5 kW×2	$\geq 4\Omega\times 2$		
EM15-G2-075	16kW	$\geq 1.2\Omega$		
Three phase 380V/480V				
EM15-G3[4]-d75/P3[4]-1d5	150W	$\geq 300\Omega$	Built-in as standard	No special instructions
EM15-G3[4]-1d5/P3[4]-2d2	150W	$\geq 220\Omega$		
EM15-G3[4]-2d2/P3[4]-004	250W	$\geq 200\Omega$		
EM15-G3[4]-004/P3[4]-5d5	300W	$\geq 130\Omega$		
EM15-G3[4]-5d5/P3[4]-7d5	400W	$\geq 90\Omega$		
EM15-G3[4]-7d5/P3[4]-011	500W	$\geq 65\Omega$		
EM15-G3[4]-011/P3[4]-015	800W	$\geq 43\Omega$		
EM15-G3[4]-015/P3[4]-018	1000W	$\geq 32\Omega$		
EM15-G3[4]-018/P3[4]-022	1300W	$\geq 25\Omega$		
EM15-G3[4]-022/P3[4]-030	1500W	$\geq 22\Omega$		
EM15-G3[4]-030/P3[4]-037	2500W	$\geq 16\Omega$	External	No special instructions
EM15-G3[4]-037/P3[4]-045	3.7 kW	$\geq 16.0\Omega$		
EM15-G3[4]-045/P3[4]-055	4.5 kW	$\geq 16\Omega$		
EM15-G3[4]-055/P3[4]-075	5.5 kW	$\geq 8\Omega$		
EM15-G3[4]-075/P3[4]-090	7.5 kW	$\geq 8\Omega$		
EM15-G3[4]-090/P3[4]-110	4.5 kW×2	$\geq 8\Omega\times 2$		
EM15-G3[4]-110/P3[4]-132	5.5 kW×2	$\geq 8\Omega\times 2$		
EM15-G3[4]-132/P3[4]-160	6.5 kW×2	$\geq 8\Omega\times 2$		
EM15-G3[4]-160/P3[4]-200	16kW	$\geq 2.5\Omega$		
EM15-G3[4]-200/P3[4]-220	20 kW	$\geq 2.5\Omega$		
EM15-G3[4]-220/P3[4]-250	22 kW	$\geq 2.5\Omega$		
EM15-G3[4]-250/P3[4]-280	12.5 kW×2	$\geq 2.5\Omega\times 2$		
EM15-G3[4]-280/P3[4]-315	14kW×2	$\geq 2.5\Omega\times 2$		
EM15-G3[4]-315/P3[4]-355	16kW×2	$\geq 2.5\Omega\times 2$		
EM15-G3[4]-355	17kW×2	$\geq 2.5\Omega\times 2$		
EM15-G3[4]-400	14 kW×3	$\geq 2.5\Omega\times 3$		
EM15-G3[4]-450	16 kW×3	$\geq 2.3\Omega\times 3$		

2.6.3 Braking resistor connection description

The braking resistor connection of EM15 series frequency inverter is showed as below:

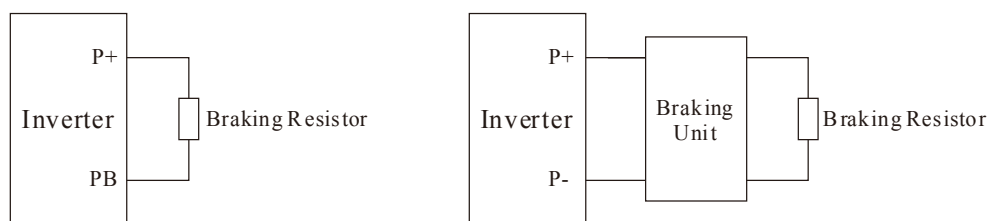


Diagram 2-10 Braking resistor connection scheme

3. Installation of Frequency Inverter

3.1 Installation environment

1. The place with indoor vents or ventilation devices.
2. The environment temperature shall be $-10^{\circ}\text{C}\sim 40^{\circ}\text{C}$. If the temperature is over 40°C but less than 50°C , better to take down the cover of frequency inverter or open the front door of cabinet to facilitate heat dissipation.
3. Try to avoid high temperature and wet place; the humidity shall be less than 90% without frost deposit.
4. Avoid direct sunlight.
5. Keep away from flammable, explosive and corrosive gas and liquid.
6. No dust, floating fiber and metal particles.
7. Install on the place without strongly vibration. And the vibration should be not over 0.6G, please pay attention to far away from the punching machine, etc.
8. Keep away from electromagnetic interference source.

3.2 Installation direction and space

In order to not affect the service life of frequency inverter and reduce its performance, note for its installation direction and space and correctly fasten it.

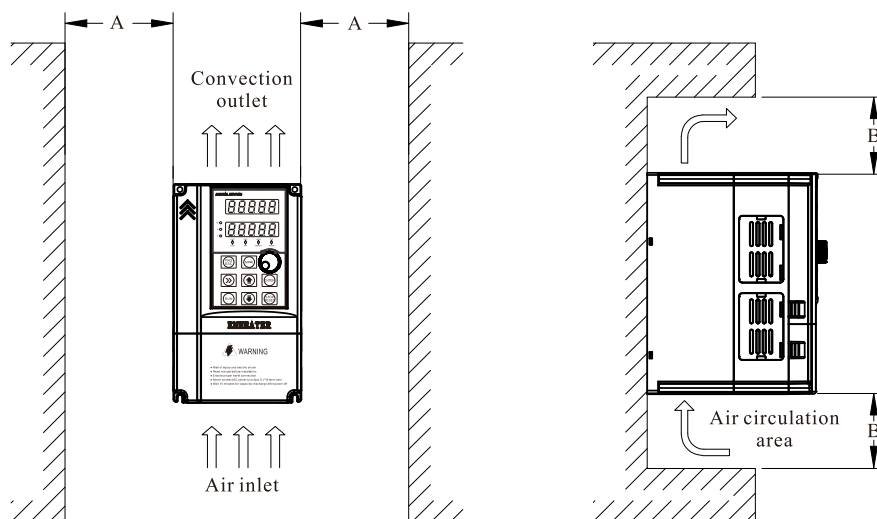


Diagram3-1 Ventilating duct installation dimension diagram of frequency inverter

Power class	Installation dimension	
	A	B
$\leq 7.5\text{kW}$	$\geq 20\text{mm}$	$\geq 100\text{mm}$
11kW - 30kW	$\geq 50\text{mm}$	$\geq 200\text{mm}$
$\geq 37\text{kW}$	$\geq 50\text{mm}$	$\geq 300\text{mm}$

Please install the frequency inverter vertically, to send out the heat upward, and pay attention to direction of frequency inverter to avoid inversion.

If there are several units of frequency inverter installed, please install them side by side, do not to install up and down.

3.3 Peripheral Devices Connection Diagram

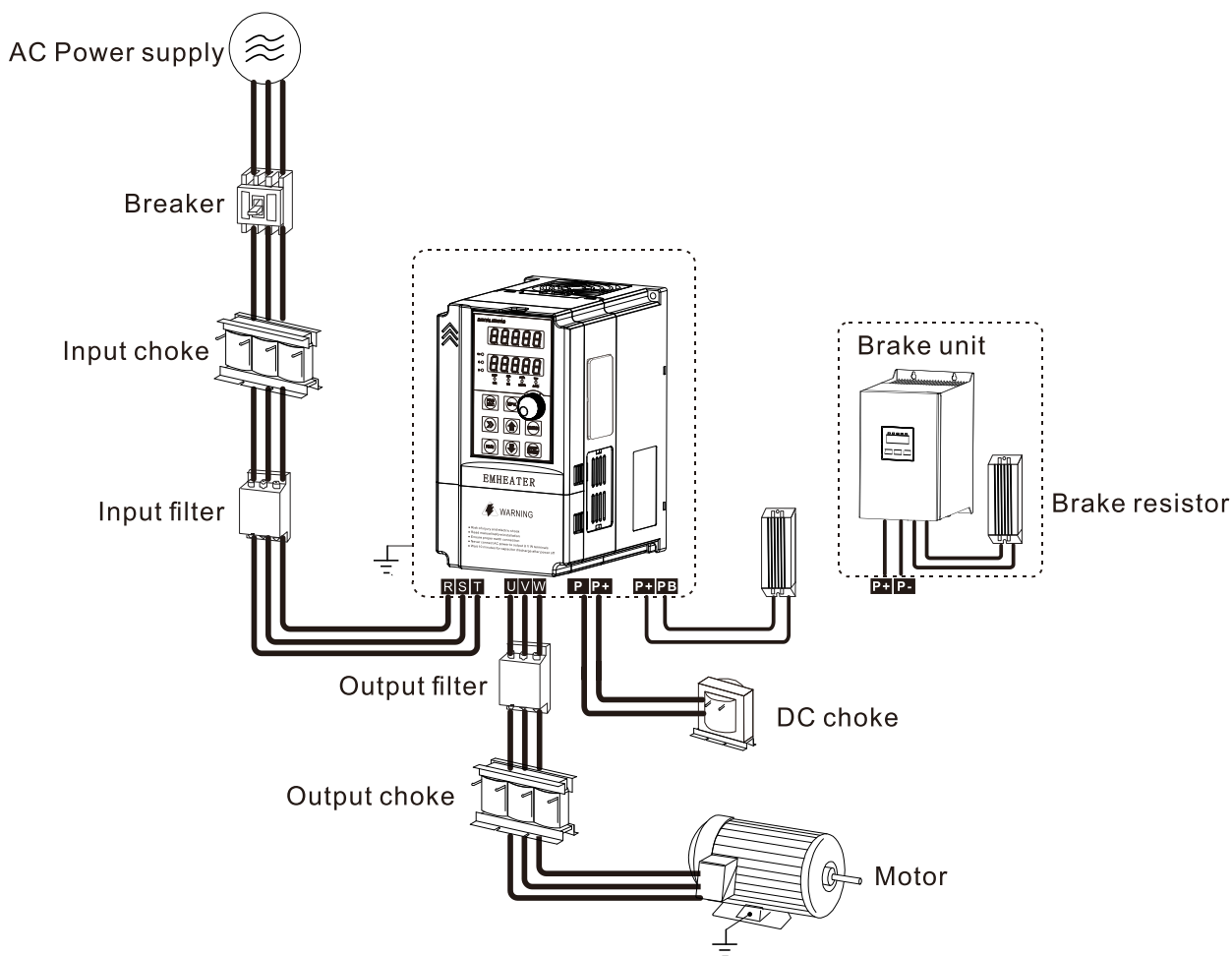


Diagram 3-2 Peripheral Devices Connection

3.4 Instructions of Main Circuit Peripheral Devices

Table 3-1 Main circuit peripheral devices use instructions

Parts Name	Function Description
MCCB	<p>Installation Location: Front of input circuit</p> <p>The capacity of the circuit breaker shall be 1.5 to 2 times of the rated current of the inverter. The protect time of the circuit breaker shall fully consider the time features of the inverter overload protection.</p>
Residual-current circuit breaker (RCCB)	<p>Installation Location: Front of input circuit</p> <p>As the inverter output is the high-frequency pulse output, there will be high-frequency leakage current. Special leakage circuit breaker shall be used when installing leakage circuit breaker at the input side of the inverter.</p> <p>It is suggested that B type leakage circuit breaker be used, and the leakage current value shall be set as 300mA.</p>

Input AC reactor or DC reactor	<p>Installation Location: Frequency inverter input side / near the frequency inverter</p> <p>The inverter power supply capacity is more than 600kVA or 10 times of the inverter capacity.</p> <p>If there is switch type reactive-load compensation capacitor or load with silicon control at the same power node, there will be high peak current flowing into input power circuit, causing the damage of the rectifier components.</p> <p>When the voltage unbalancedness of the three-phase power supply of the inverter exceeds 3%, the rectifier component will be damaged.</p> <p>It is required that the input power factor of the inverter shall be higher than 90%.</p> <p>When the above situations occurred, install the AC reactor at the input side of the inverter or DC reactor to the DC reactor terminal.</p>
Input noise filter	<p>Installation Location: The frequency inverter input side</p> <p>To reduce the noise input from the power to the inverter or output from the inverter to the power.</p>
Thermal protection relay	<p>Installation Location: The output side of frequency inverter</p> <p>Although the inverter has motor overload protection function, when one inverter drives two or more motors or multi-pole motors, to prevent the motor over-temperature failure, thermal protection relay shall be installed between the inverter and each motor.</p>
Output filter	<p>Installation Location: The output side of frequency inverter</p> <p>When the output side of the inverter is connected with output filter, the conduction and radiation interference can be reduced.</p>
Output AC reactor	<p>Installation Location: Between the output side of frequency inverter and motor, near the frequency inverter</p> <p>When the cable connecting the inverter and the motor is longer than 50 meters, it is suggested to install AC output reactor to suppress the high-frequency oscillation to avoid the damage to motor insulation, large leakage current and frequent inverter protective action.</p>

3.5 Model Selection of Main Circuit Peripheral Devices

Table 3-2 Model Selection Diagram of Main Circuit Peripheral Devices (Recommended)

Frequency inverter Model	MCCB (A)	Contactors (A)	Cable of Input Side Main Circuit (mm ²)	Cable of Output Side Main Circuit (mm ²)	Cable of Control Circuit (mm ²)
Single-phase 220V					
EM15A-G1-d75	16	10	2.5	2.5	1.0
EM15A-G1-1d5	20	16	4.0	2.5	1.0
EM15-G1-2d2	32	20	6.0	4.0	1.0
Three-phase 220V					
EM15-G2-d75	16	10	2.5	2.5	1.0
EM15- G2-1d5	16	10	2.5	2.5	1.0
EM15- G2-2d2	25	16	4.0	4.0	1.0
EM15- G2-004	32	25	4.0	4.0	1.0
EM15- G2-5d5	63	40	4.0	4.0	1.0
EM15- G2-7d5	63	40	6.0	6.0	1.0
EM15- G2-011	100	63	10	10	1.0
EM15- G2-015	125	100	16	10	1.0
EM15- G2-018	160	100	16	16	1.0

Frequency inverter Model	MCCB (A)	Contactora (A)	Cable of Input Side Main Circuit (mm ²)	Cable of Output Side Main Circuit (mm ²)	Cable of Control Circuit (mm ²)
EM15- G2-022	200	125	25	25	1.0
EM15- G2-030	200	125	35	25	1.0
EM15- G2-037	250	160	50	35	1.0
EM15- G2-045	250	160	70	35	1.0
EM15- G2-055	350	350	120	120	1.0
EM15- G2-075	500	400	185	185	1.0
Three-phase 380V					
EM15- G3-d75/P3-1d5	10	10	2.5	2.5	1.0
EM15- G3-1d5/P3-2d2	16	10	2.5	2.5	1.0
EM15- G3-2d2/P3-004	16	10	2.5	2.5	1.0
EM15- G3-004/P3-5d5	25	16	4.0	4.0	1.0
EM15- G3-5d5/P3-7d5	32	25	4.0	4.0	1.0
EM15- G3-7d5/P3-011	40	32	4.0	4.0	1.0
EM15- G3-011/P3-015	63	40	4.0	4.0	1.0
EM15- G3-015/P3-018	63	40	6.0	6.0	1.0
EM15- G3-018/P3-022	100	63	6	6	1.0
EM15- G3-022/P3-030	100	63	10	10	1.0
EM15- G3-030/P3-037	125	100	16	10	1.0
EM15- G3-037/P3-045	160	100	16	16	1.0
EM15- G3-045/P3-055	200	125	25	25	1.0
EM15- G3-055/P3-075	250	125	35	25	1.0
EM15- G3-075/P3-090	250	160	50	35	1.0
EM15- G3-090/P3-110	350	160	70	35	1.0
EM15- G3-110/P3-132	350	350	120	120	1.0
EM15- G3-132/P3-160	400	400	150	150	1.0
EM15- G3-160/P3-200	500	400	185	185	1.0
EM15- G3-200/P3-220	630	600	150*2	150*2	1.0
EM15- G3-220/P3-250	630	600	150*2	150*2	1.0
EM15- G3-250/P3-280	800	600	185*2	185*2	1.0
EM15- G3-280/P3-315	800	800	185*2	185*2	1.0
EM15- G3-315/P3-355	1000	800	150*3	150*3	1.0
EM15- G3-355/P3-400	1000	800	150*4	150*4	1.0
EM15- G3-400/P3-450	1200	1000	150*4	150*4	1.0
EM15-G3-450--	1200	1200	150*4	150*4	1.0

3.6 Removal and mounting of operating panel and cover

3.6.1 Removal and mounting of operating panel (keypad)

The operating panel of EM15 series Frequency inverter is a plug type, If you need to take it off when use or maintenance, please make sure the gentle actions, or it is easy to damage the plug type connection terminals on operating panel.

The removal and mounting of operating panel (keypad) is showed as Diagram3-3 and Diagram3-4:

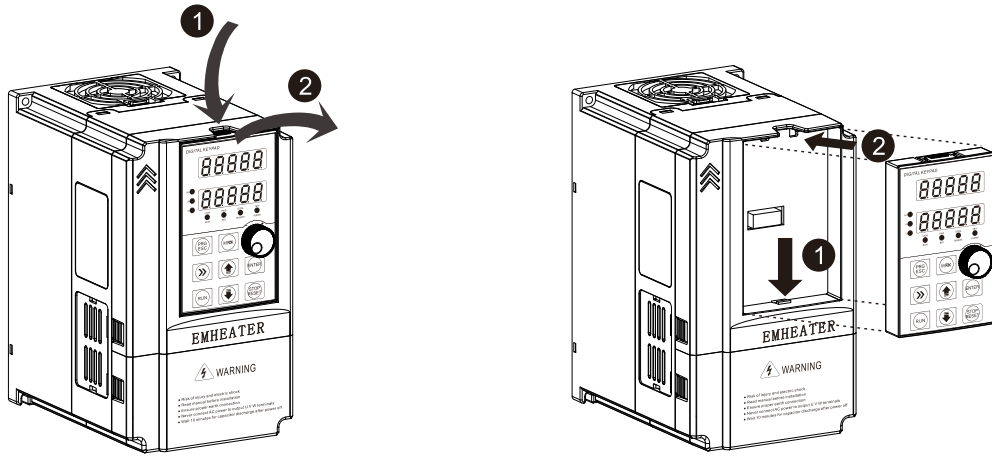


Diagram 3-3 Removal of operating panel (keypad) Diagram 3-4 Mounting of operating panel (keypad)

3.6.2 Removal and Mounting of Frequency Inverter

The EM15 series frequency inverter below 22kw (380V) uses plastic case. The removal and mounting of upper cover refers Diagram3-5. Please use tool to push the hooks on both side of lower cover.

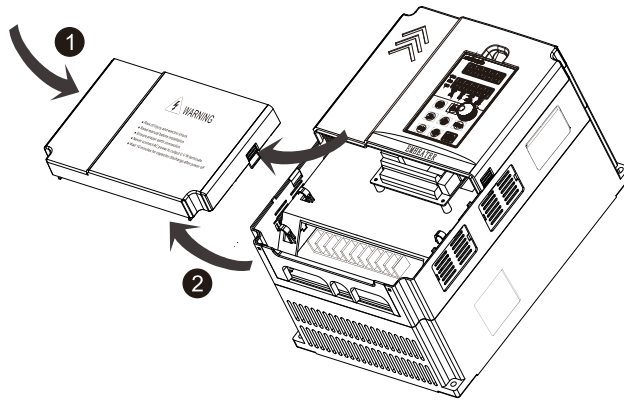


Diagram 3-5 The cover removal of plastic case

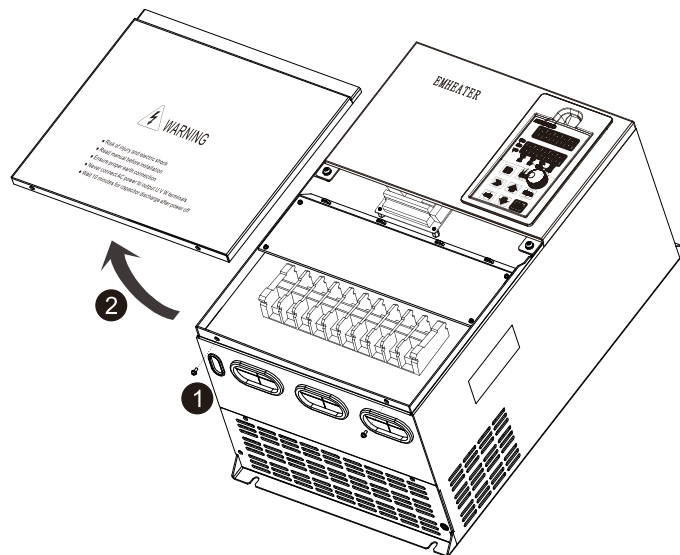


Diagram 3-6 The cover removal of sheet metal case

3.7 Connection Terminals Diagram Description

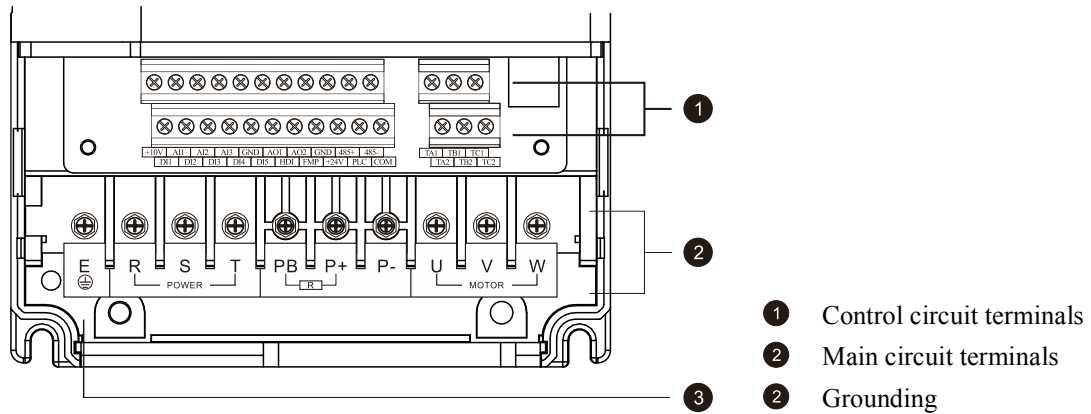
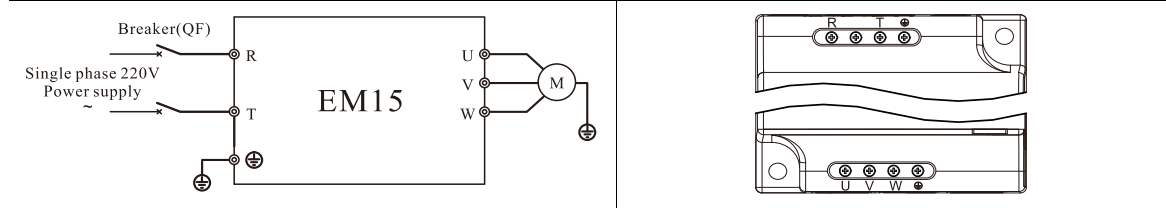


Diagram 3-7 EM15 Series terminal distribution diagram

3.8 Sketch and Description of Main Circuit Terminals

3.8.1 Function and description of Main Circuit Terminals

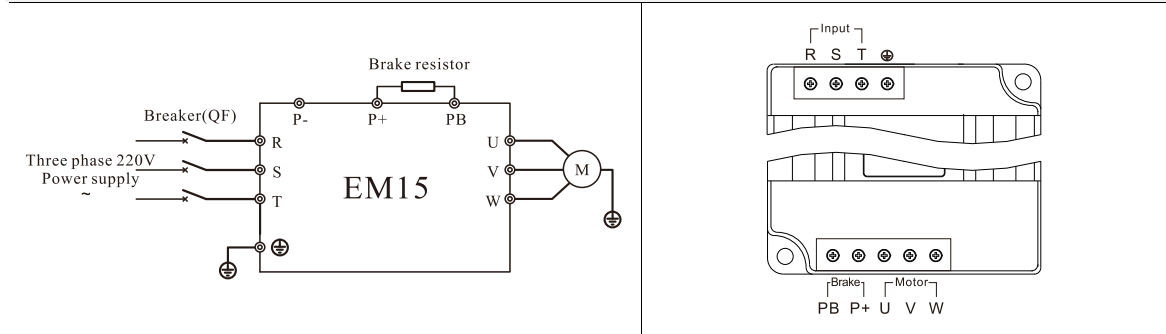
Single phase 220V: EM15-G1-d75 ~ EM15-G1-1d5



Three phase 220V: EM15-G2-d75 ~ EM15-G2-1d5

Three phase 380V: EM15-G3-d75/P3-1d5 ~ EM15-G3-2d2/P3-004

Three phase 480V: EM15-G4-D75/P4-1D5 ~ EM15-G4-2D2/P4-004

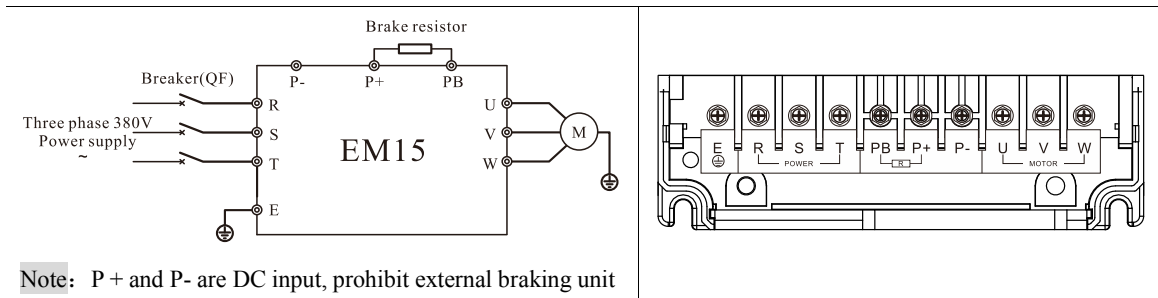


Single phase 220V: EM15-G1-2d2

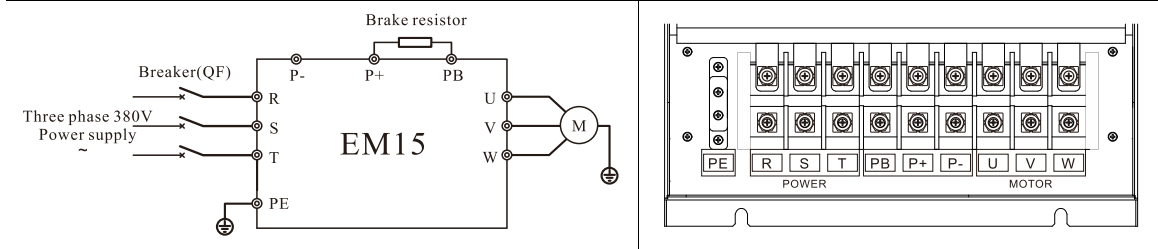
Three phase 220V: EM15-G2-2d2 ~ EM15-G2-011

Three phase 380V: EM15-G3-004/P3-5d5 ~ EM15-G3-022/P3-030

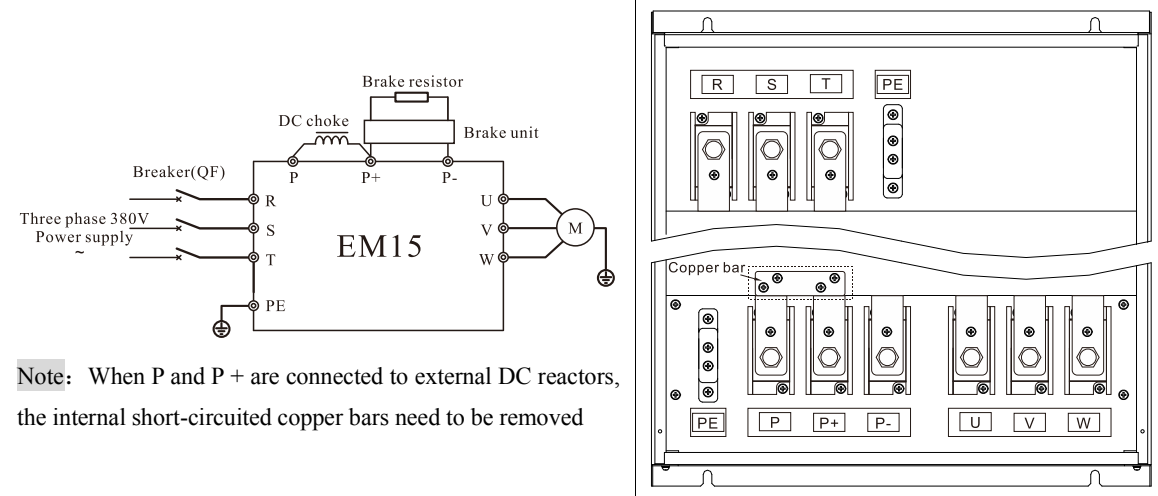
Three phase 480V: EM15-G4-004/P4-5d5 ~ EM15-G4-022/P4-030



Three phase 220V: EM15-G2-015 ~ EM15-G2-045
 Three phase 380V: EM15-G3-030/P3-037 ~ EM15-G3-090/P3-110
 Three phase 480V: EM15-G4-030/P4-037 ~ EM15-G4-090/P4-110



Three phase 220V: EM15-G2-055 ~ EM15-G2-075
 Three phase 380V: EM15-G3-110/P3-132~ EM15-G3-500
 Three phase 480V: EM15-G4-110/P4-132 ~ EM15-G4-500



Terminal symbol	Function description
L,N or R,T	Single-phase AC power input terminals
R,S,T	Three-phase AC power input terminals
P+,PB	Braking resistor connectin
P,P+	External DC reactor connecting terminals,shorted by bronze before delivery
P+,P-	DC power input terminals; External brake unit DC output terminal
⊕ or E/PE	Grounding terminal
U,V,W	Three-phase AC power output terminals

Note: Product with standard built-in unit can realize DC bus and braking function at the same time, if external DC reactor and braking function is needed, please contact the manufacturer.

3.9 Cautions for Main Circuit Wiring

3.9.1 Power Supply Wiring

- It is forbidden to connect the power cable to the inverter output terminal, otherwise, the internal components of the inverter will be damaged.
- To facilitate the input side over current protection and maintenance after power off, the inverter shall connect to the power supply through the circuit breaker or leakage circuit breaker and contactor.
- Please confirm that the power supply phases, rated voltage are consistent with that of the nameplate, otherwise, the inverter may be damaged.

3.9.2 Motor Wiring

If the cable between the inverter and the motor is too long, the higher harmonic leakage current of the output end will produce by adverse impact on the inverter and the peripheral devices. It is suggested that when the motor cable is longer than 100m, output AC reactor be installed. Refer to the following table for the carrier frequency setting.

Length of cable between the inverter and motor	Carrier frequency (d6-00)
Less than 50m	Less than 15kHz
Less than 100 m	Less than 10kHz
More than 100m	Less than 5kHz

3.9.3 Grounding Wiring

- The inverter will produce leakage current. The higher the carrier frequency is, the larger the leakage current will be. The leakage current of the inverter system is more than 3.5mA, and the specific value of the leakage current is determined by the use conditions. To ensure the safety, the inverter and the motor must be grounded.
- The grounding resistance shall be less than 10ohm. For the grounding wire diameter requirement, refer to 2.6 electrotpe of main circuit peripheral devices.
- Do not share grounding wire with the welding machine and other power equipment.
- In the applications with more than 2 inverters, keep the grounding wire from forming a loop.

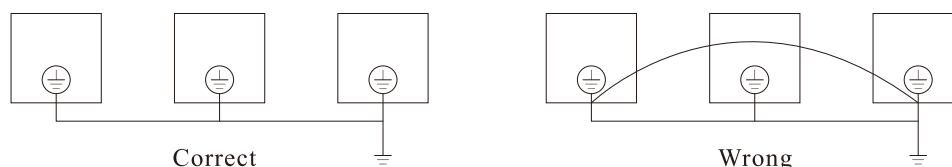


Diagram 3-8 Grounding Wire Connection Sketch Map

3.9.4 Countermeasures for Conduction and Radiation Interference

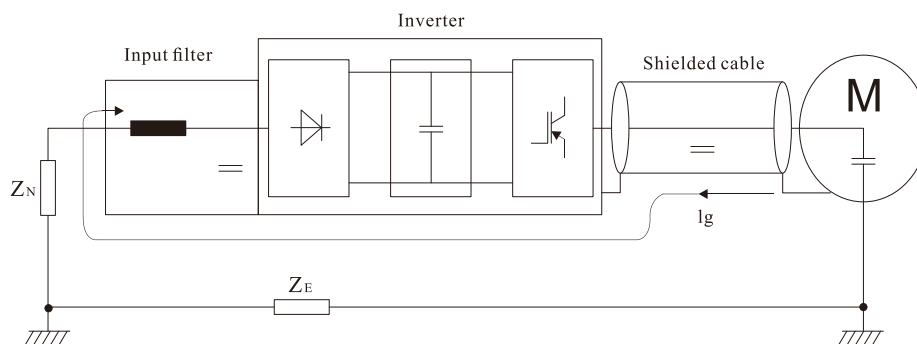


Diagram 3-9 Connection of conduction and radiation interference solutions

- When the input noise filter is installed, the wire connecting the filter to the inverter input power end shall be as short as possible.
- The filter enclosure and mounting cabinet shall be reliably grounded in large area to reduce the back flow impedance of the noise current I_g .
- The wire connecting the inverter and the motor shall be as short as possible. The motor cable adopts 4-core cable, with the grounding end grounded at the inverter side, the other end connected to the motor enclosure. The motor cable shall be sleeved into the metal tube.
- The input power wire and output motor wire shall be kept away from each other as far as possible.
- The equipment and signal cables vulnerable to influence shall be kept far away from the inverter.
- Key signal cables shall adopt shielding cable. It is suggested that the shielding layer shall be grounded with 360-degree grounding method and sleeved into the metal tube. The signal cable shall be kept far away from the inverter input wire and output motor wire. If the signal cable must cross the input wire and output motor wire, they shall be kept orthogonal.
- When analog voltage and current signals are adopted for remote frequency setting, twinning shielding cable shall be used. The shielding layer shall be connected to the grounding terminal PE of the inverter, and the signal cable shall be no longer than 50m.
- The wires of the control circuit terminals TA/TB/TC and other control circuit terminals shall be separately routed.
- It is forbidden to short circuit the shielding layer and other signal cables and the equipment.
- When the inverter is connected to the inductive load equipment (e.g. electromagnetic contactor, relay and solenoid valve), surge suppressor must be installed on the load equipment coil, as showed in Diagram 3-10

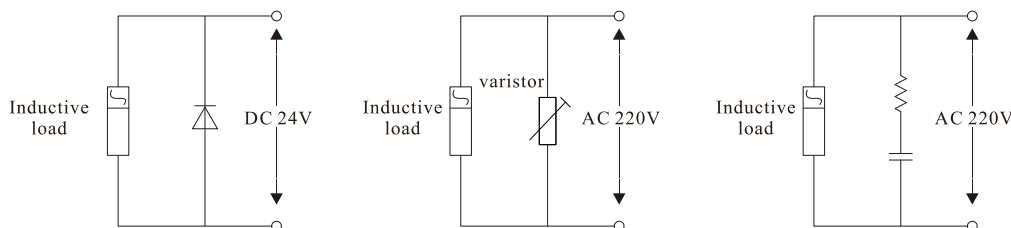


Diagram 3-10 Application example of inductive load surge suppressor

3.10 Control Circuit and Main Circuit Terminals Description

3.10.1 Control Circuit and Main Circuit Wiring

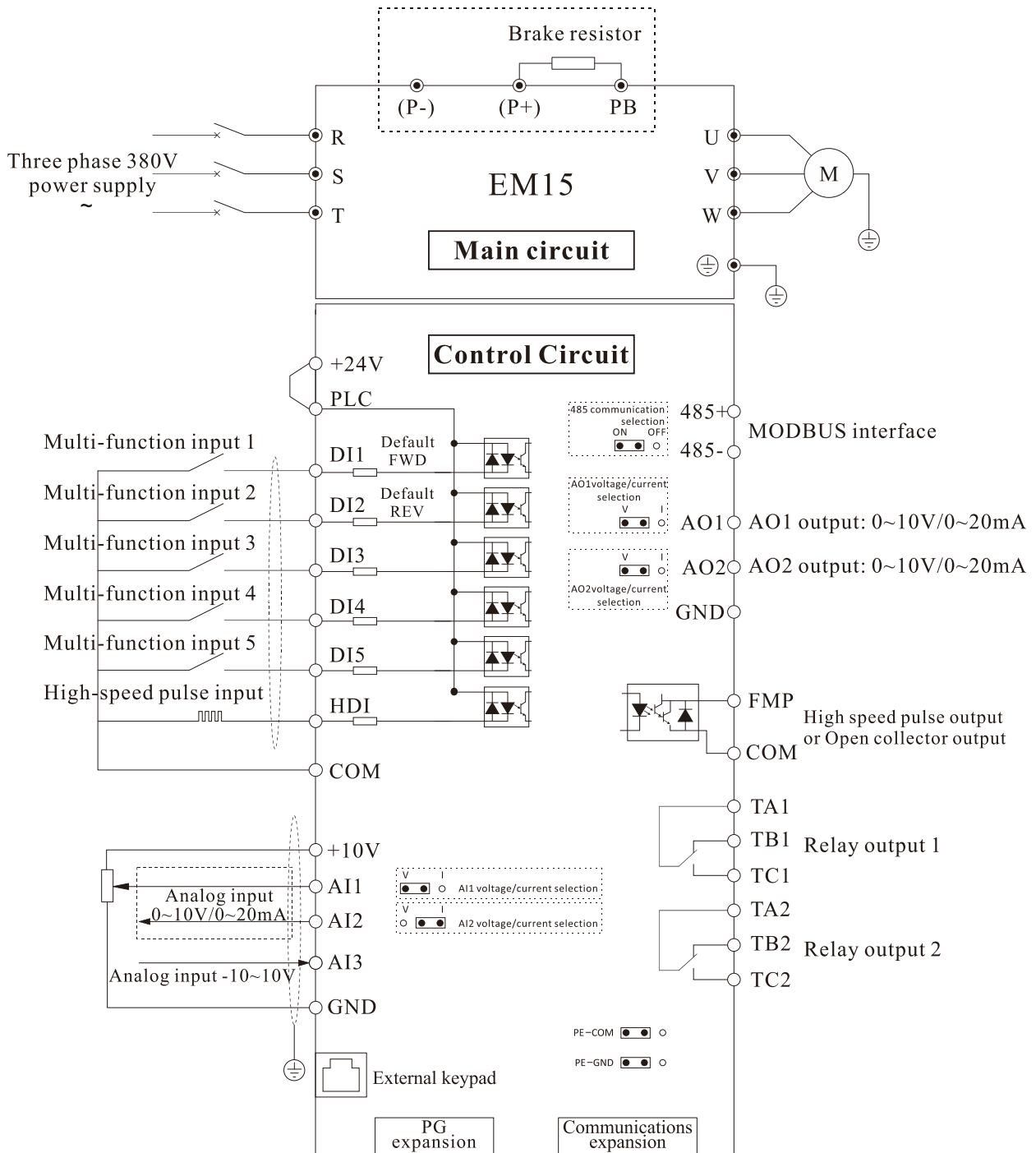


Diagram 3-11 Control Circuit and Main Circuit Wiring

3.10.2 Control Circuit Terminal Layout

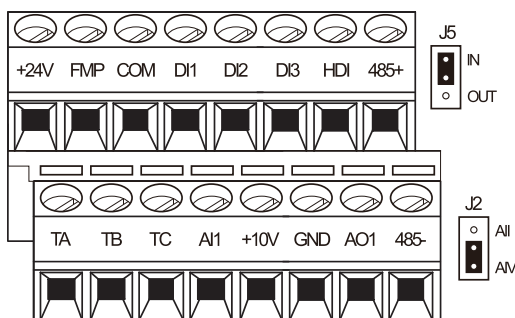


Diagram 3-12 Single phase 0.75~1.5kW Control Circuit Terminal Sketch Map

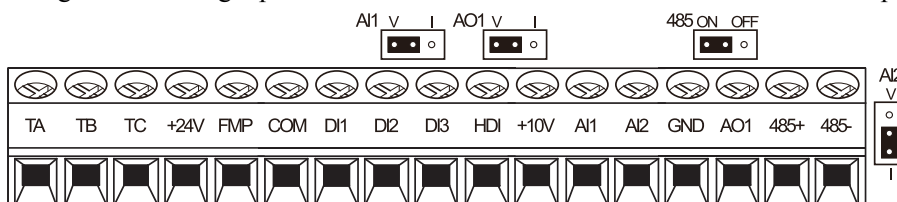


Diagram 3-13 Three phase 0.75~2.2kW Control Circuit Terminal Sketch Map

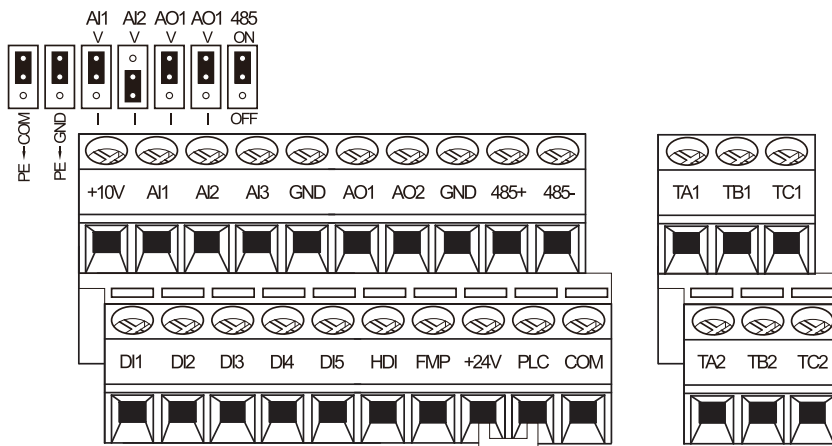


Diagram 3-14 Three phase 4Kw and above Control Circuit Terminal Sketch Map

3.10.3 Description of control circuit terminals

Table 3-3 Description of control circuit terminals

Type	Terminal Symbol	Terminal Name	Terminal function description
Power Supply	+10V-GND	External +10V power supply	Provide +10V power supply to external unit. Maximum output current:10Ma Generally, it provides power supply to external potentiometer with resistance range of 1 kΩ~5kΩ
	+24V-COM	External +24V power supply	Provide +24 V power supply to external unit. Generally, it provides power supply to DI/DO terminals and external sensors.Maximum output current: 200 mA
	PLC	External power supply input terminals	It connect with +24V default
Analog input	AI1-GND	Analog input 1	1. Input range: DC 0V~10V/ 0mA~20mA(decided by jumper AI1/AI2 on the control board); AI3: DC -10V~+10V 2. Impedance: 22 kΩ (voltage input), 500 Ω (current input)
	AI2-GND	Analog input 2	
	AI3-GND	Analog input 3	
Digital	DI1-COM	Digital input 1	1. Optical coupling isolation, compatible with dual polarity input

Type	Terminal Symbol	Terminal Name	Terminal function description
input	DI2-COM	Digital input 2	2.Input Impedance: 2.4 k Ω 3. Voltage range for level input: 9V~30 V
	DI3-COM	Digital input 3	
	DI4-COM	Digital input 4	
	DI5-COM	Digital input 5	
	HDI-COM	High Speed Pulse Input	Maximum input frequency: 100 kHz
Analog output	AO1-GND	Analog output 1	Voltage or current output is decided by jumper AO1/AO2. Output voltage range: 0V~10 V Output current range: 0mA~20 mA
	AO2-GND	Analog output 2	
	FMP- COM	High Speed Pulse Output	Constrained by function code b4-00 "FMP terminal output mode selection" as the high-speed pulse output, the highest frequency is 100kHz; when use as an open collector output, specifications is the same as DO.
Relay output	TA-TB	NC terminal	Contact driving capacity: 250 VAC, 3 A, COS ϕ = 0.4 DC 30 V, 1 A
	TA1/2-TB1/2		
	TA-TC	NO terminal	
	TA1/2-TC1/2		
Auxiliary interface	PG card interface		PG cards: Open-collector, differential are selectable options.
	Communications expansion		Reversed
	External keypad interface		Connected to an external keypad
Jumper	PE-COM		COM grounding PE selection ,default connection. In the case of interference, connecting PE to COM can improve anti-interference
	PE-GND		GND grounding PE selection ,default connection. In the case of interference, connecting PE to COM can improve anti-interference.
	AI1/J2		AI1 output selection. Voltage or Current output, voltage output by default.
	AI2		AI2 output selection. Voltage or Current output, current output by default.
	AO1		AO1 output selection. Voltage or Current output, voltage output by default.
	AO2		AO2 output selection. Voltage or Current output, voltage output by default.
	458		485 communication resistor selection, default connection ON. In the case of interference, anti-interference can be improved.
	J5		Internal and external keypad selection, default IN(Internal keypad) Note: This jumper only exists in the EM15A series

3.10.4 Wiring of Analog Input Terminals

When the voltage signal is used as analog input, it is vulnerable from outside interference. Please use shielding cable, and ensure that the shielding cable reliably connect to the grounding. The cable should be as short as possible, and keep away from power lines. In serious interference occasions, you might consider to add a filter capacitor or ferrite core in signal cable.

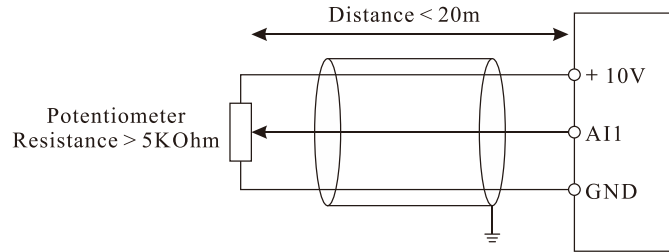


Diagram 3-15 Wiring of analog input terminals

3.10.5 Wiring of Multi-functional Input Terminals

DI wiring mode 1 (Factory default wiring mode): The external power supply is not used when DI is set as NPN mode.

DI wiring mode 2: The external power supply is used when DI is set as NPN mode.

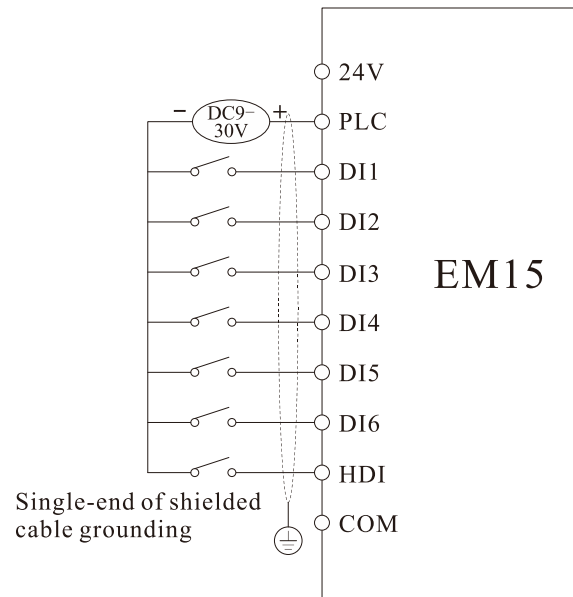
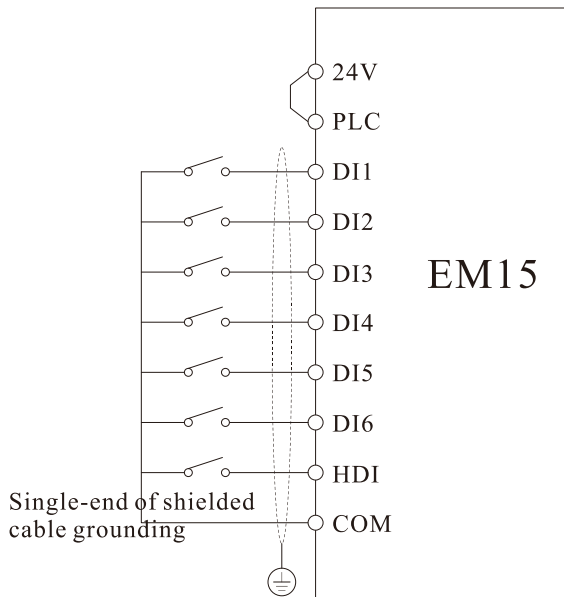


Diagram 3-16 Wiring of digital input terminals in four different modes

please install a fly-wheel diode to the two sides of relay. Please correctly install the polarity of fly-wheel diode, otherwise control card and DSP can be damaged.

4. Operation and display

4.1 Instruction of operation and display

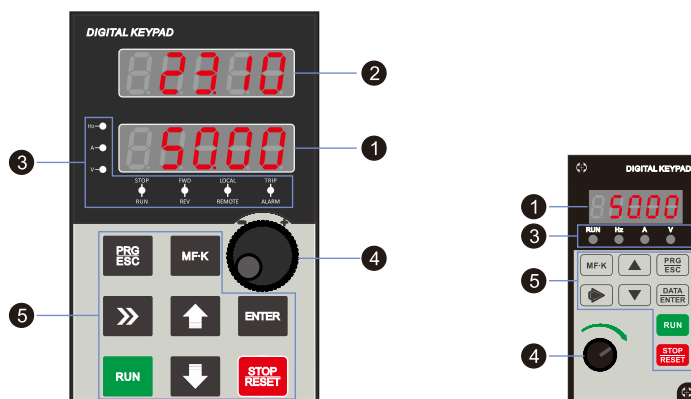


Diagram 4-1 Operating Keypad

No.	Name	Function	
①	Main LED display area	The 5-digit LED display is able to display the set frequency, output frequency, monitoring data and fault codes.	
②	Auxiliary LED display area	The 5-digit LED display is able to display various operating status information, such as the running frequency, the set frequency, output voltage and so on.	
③	Unit / Status Indicator area	Hz	Frequency unit
		A	Current unit
		V	Voltage unit
		STOP/ RUN	OFF indicates that the frequency inverter is in the stop state and ON indicates that the frequency inverter is in the running state.
		FWD/REV	It is Forward/Reversal indicator, ON indicates forward rotation.
		LOCAL /REMOTE	It indicates whether the frequency inverter is operated by operation keypad, terminals or remoter (communication). OFF indicates keypad operation control state; ON indicates terminals operation control state; Blinking indicates remote operation control state.
④	Encoder / Potentiometer knob	TRIP /ALARM	Tunning/ Torque Control/Fault indicator When the indicator is ON, it indicates torque control mode. When the indicator is blinking slowly, it indicates the auto-tuning state. When the indicator is blinking quickly, it indicates the fault state.
		Frequency, data or function code increase or decrease; the encoder knob has the confirmation key function	
⑤	Operation key area		Programming key: Enter or exit menu level I.
			Confirmation key: Enter the menu interfaces level by level, and confirm the parameter setting.
			Multi-function key: Perform function switchover according to the setting of b9-01
			Shift key: Select the displayed parameters in turn in the stop or running state, and select the digit to be modified when modifying parameters.
			Increment key: Increase data or function code.
			Decrement key: Decrease data or function code.
			Running key: Start the frequency inverter in the keypad control mode.
	Stop/Reset key: Stop the frequency inverter when it is in the running state and perform the reset operation when it is in the fault state. The functions of this key are restricted by b9-00.		

4.2 Viewing and Modifying Function Codes

The operation panel of the EM15 adopts three-level menu.

The three-level menu consists of function code group (Level I), function code (Level II), and function code setting value (level III), as shown in the following figure.

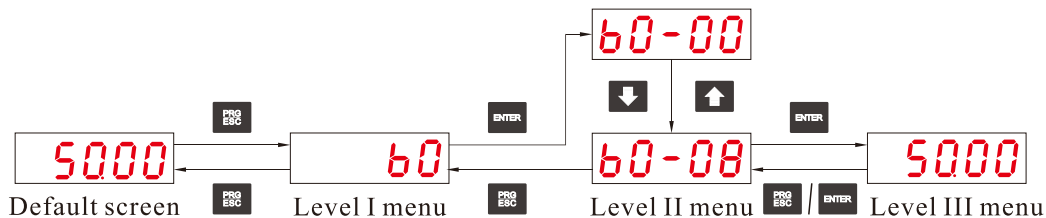


Diagram 4-2 Operation procedure on the operation panel

Instruction: We can return to level II menu from Level III menu by pressing "PRG" or "ENTER".

The difference between them is:


After you press "ENTER", the system saves the parameter setting first, and then goes back to Level II menu and shifts to the next function code.

After you press "PRG", the system does not save the parameter setting, but directly returns to Level II menu and remains at the present function code.

Under the Level III state, if there is no blinking digit of this parameter, then it indicates that the parameter can not to be modified. The possible reasons are:

1. This function code is a non-modifiable parameter, such as the actual testing parameters, operation records, etc.
2. This function code cannot be modified under the running state, but can modify after stopping.

4.3 Monitoring Status Parameters

In the stop or running state, you can press “” on the operation panel to display status parameters. Whether parameters are displayed is determined by the binary bits of values converted from the values of b9-02(running parameter 1), b9-03(running parameter 2), and b9-04(stopping parameter) in the hexadecimal format.

In stop state, there are 16 status parameters you can select to displayed or not, they are: setting frequency, bus voltage, DI input status, DO output status, analog input AI1 voltage, analog input AI2 voltage, analog input AI3 voltage, count value, length value, PLC running step, load speed, PID setting, PULSE input frequency and three reserved parameters.

In running state, there are five running state parameters: running frequency, setting frequency, bus voltage, output voltage and output current. This five parameters are default displaying. The other display parameter includes output power, output torque, DI input status, DO output status, analog input AI1 voltage, analog input AI2 voltage, analog input AI3 voltage, count value, length value, linear speed, PID setting, PID feedback, etc. You can set whether these parameters are displayed by setting b9-02 and b9-03.

When the frequency inverter is repowered on again after power failure, the parameters are recorded as before power failure and displaying.

4.4 Password Setting

The frequency inverter provides the user password protection function. When A0-00 is set to a non-zero value, the value is the user password. The password takes effect after you exit the function code editing state. When you press "PRG" key, "-----" will be displayed, and you must enter the correct user password to enter the menu.

To cancel the password protection function, enter with password and set A0-00 to 0.

4.5 Motor parameter auto-tuning

Select vector control running mode, before frequency inverter start to operate, you must accurately write in the nameplate parameter of motor by keypad. EM15 frequency inverter will match standard motor parameter according to the nameplate; the vector control mode strongly depended on motor's parameters, if you want to get good control performance, then you must let inverter to obtain the exact parameters of controlled motor.

The process of motor auto-tuning is as follows:

Firstly, select command source (b0-02) as keypad command channel. Then write in the actual motor parameters as the following parameters (according to the nameplate of present motor):

Parameter
d0-00: Motor Rated Power
d0-01: Motor Rated Voltage
d0-02: Motor Rated Current
d0-03: Motor Rated Frequency
d0-04: Motor Rated Speed

AC asynchronous motor tuning

If the motor can be disconnected from the load, then please set d0-30 to 2(asynchronous motor dynamic complete auto-tuning), If the motor cannot be fully disconnected with the load, then please select d0-30 to 3 (asynchronous motor static complete auto-tuning), then press the RUN key on the keypad. The frequency inverter will automatically calculate the following parameters of motor:

Parameter
d0-05: Stator resistance (asynchronous motor)
d0-06: Rotor resistance (asynchronous motor)
d0-07: Leakage inductive reactance(asynchronous motor)
d0-08: Mutual inductive reactance(asynchronous motor)
d0-09: No-load current(asynchronous motor)

Finish motor parameter auto-tuning.

5. Description of Function Codes

5.1 Group b0: Basic Function Parameters

b0-00	Motor type selection		Default	0
	Setting Range	0	AC asynchronous motor	

0- select Motor 1 as AC asynchronous motor

b0-01	Motor control mode		Default	2
	Setting Range	0	Sensor-less vector control (SVC)	
		1/2	V/F control	
		3	Closed-loop vector control (FVC)	

Unit's digit and Ten's digit is to select motor 1 and motor 2 control mode.

- **0: Sensor less vector control (SVC)**

It indicates open-loop vector control, and is applicable to high-performance control applications such as machine tool, centrifuge, wire drawing machine and injection molding machine. One frequency inverter can operate only one motor.

- **1/2: Voltage/Frequency control (V/F)**

It is applicable to applications with low load requirements or applications where one frequency inverter operates multiple motors, such as fan and pump.

- **3: Closed-loop vector control (FVC)**

It is applicable to high-accuracy speed control or torque control applications such as high-speed paper making machine, crane and elevator. One frequency inverter can operate only one motor. An encoder must be installed at the motor side, and a PG card matching the encoder must be installed at the frequency inverter side.

Note: If vector control is used, motor auto-tuning must be performed because the advantages of vector control can only be utilized after correct motor parameters are obtained. Better performance can be achieved by adjusting speed regulator parameters in group "d".

For the permanent magnetic synchronous motor (PMSM), the EM15 does not support SVC. FVC is used generally. In some low-power motor applications, you can also use V/F.

b0-02	Command source selection		Default	0
	Setting Range	0	Keypad control (LED off)	
		1	Terminal control (LED on)	
		2	Communication control (LED blinking)	

It is used to determine the input channel of the frequency inverter control commands, such as run, stop, forward rotation, reverse rotation and jog operation. You can input the commands in the following three channels:

- **0: Keypad control** ("LOCAL/REMOT" indicator off)

Commands are given by pressing keys "RUN" and "STOP/RESET" on the operation panel.

- **1: Terminal control** ("LOCAL/REMOT" indicator on)

Commands are given by means of multifunctional input terminals with functions such as FWD, REV, JOGF, and JOGR.



- **2: Communication control** ("LOCAL/REMOT" indicator blinking)

Commands are given from host computer. For more details please refer to the appendix of communication protocol.

b0-03	Main frequency source X selection		Default	1	
	Setting Range	0	Digital setting (UP/DOWN modifiable, no-record after power off)		
		1	Digital setting (UP/DOWN modifiable, record after power off)		
		2	AI1		
		3	AI2		
		4	AI3		
		5	Pulse setting		
		6	Multi-function		
		7	Built-in PLC		
		8	PID		
		9	Communication setting		
10	Keypad potentiometer(Only for EM15A)				



It is used to select the setting channel of the main frequency. You can set the main frequency in the following 10 channels:

0: Digital setting (Digital setting frequency b0-12, UP/DOWN modifiable, not record at power failure)

The initial value of the set frequency is the value of b0-12 (Digital setting frequency). You can change the set frequency by pressing  and  the operation panel (or using the UP/DOWN function of input terminals).

When the Frequency inverter is powered on again after power failure, the set frequency reverts to the value of b0-12.

1: Digital setting (Digital setting frequency b0-12, UP/DOWN modifiable, record at power failure)

The initial value of the set frequency is the value of b0-12 (Digital setting frequency). You can change the set frequency by pressing keys  and  on the operation panel (or using the UP/DOWN functions of input terminals).

When the frequency inverter is powered on again after power failure, the setting frequency is the value memorized at the moment of the last power failure.

Note that b0-10 (record digital setting frequency of power failure) determines whether the set frequency is memorized or cleared when the frequency inverter stops. It is related to stopping rather than power failure.

2: AI1

3: AI2

4: AI3

The frequency is set by analog input. The EM15 control board provides 3 analog input (AI) terminals (AI1, AI2, AI3). Including:

AI1: 0V~10V voltage input or 0mA~20 mA current input, determined by jumper AI1 on the control card;

AI2: 0V~10 V voltage input or 0mA~20 mA current input, determined by jumper AI2 on the control card;

AI3: -10V~10 V voltage input

The corresponding relationship curve between the input voltage of AI1, AI2 and AI3 and the target frequency can be user-defined.

When AI is used as the frequency setting source, the corresponding value 100% of the voltage/current input corresponds to the value of b0-13 (Maximum frequency).

5: Pulse setting (HDI)

The frequency is set by HDI (high-speed pulse). The signal specification of pulse setting is 9V~30V (voltage range) and 0 kHz~100 kHz (frequency range). Pulse can be only input by HDI.

The relation between HDI terminal input pulse frequency and corresponding setting is set by b5-00~ b5-03. The corresponding relation is the linear relation of these two points. The corresponding value 100% of pulse setting corresponds to the value of b0-13 (Maximum frequency).

6: Multi-function

In Multi-segment speed mode, combinations of different DI terminal states correspond to different set frequencies. The EM15 supports a maximum of 16 speeds implemented by 16 state combinations of four DI terminals (set with

functions 12 to 15) in Group C1. The multiple segments speed indicates percentages of the value of b0-13 (Maximum frequency).

If a DI terminal is used for the Multi-function function, you need to perform related setting in group b3. For details, refer to the descriptions of Group b3.

7: Simple PLC (built-in)

When the simple programmable logic controller (PLC) mode is used as the frequency source, the running frequency of the frequency inverter can be switched over among the 16 frequency references. You can set the holding time and acceleration/deceleration time of the 16 frequency references. For details, refer to the descriptions of Group C2.

8: PID

The output of PID control is used as the running frequency. PID control is generally used in on-site closed-loop control, such as constant pressure closed-loop control and constant tension closed-loop control.

When applying PID as the frequency source, and the keypad is at the zero class menu, then operate UP/DOWN, the inverter will automatically enter into the PID digital setting(C0-01) parameter to change the state. When the power is off, it will save the setting value.

9: Communication setting

The frequency is set by means of communication.



10: Keypad potentiometer(Only for EM15A)

The frequency command is given by potentiometer in the keypad. It is only valid for the keypad with potentiometer.

b0-04	Auxiliary frequency source Y selection		Default	1
	Setting Range	0	Digital setting (UP/DOWN modifiable, no-record after power off)	
	1	Digital setting (UP/DOWN modifiable, record after power off)		
	2	AI1		
	3	AI2		
	4	AI3		
	5	Pulse setting		
	6	Multi-function		
	7	Built-in PLC		
	8	PID		
	9	Communication setting		
	10	Keypad potentiometer(Only for EM15A)		

When used as an independent frequency input channel (frequency source switched over from X to Y), the auxiliary frequency source Y is used in the same way as the main frequency source X (refer to b0-03).

When the auxiliary frequency source is used for operation (frequency source is "X and Y operation"), pay attention to the following aspects:

1. If the auxiliary frequency source Y is digital setting, the digital setting frequency (b0-12) does not take effect. You can directly adjust the set main frequency by pressing keys  and  on the operation panel (or using the UP/DOWN function of input terminals).
2. If the auxiliary frequency source is analog input (AI1, AI2 and AI3) or pulse setting, 100% of the input corresponds to the range of the auxiliary frequency Y (set in b0-05 and b0-06).
3. If the auxiliary frequency source is pulse setting, it is similar to analog input.

Note: The main frequency source X and auxiliary frequency source Y must not use the same channel. That is, b0-03 and b0-04 cannot be set to the same value in case of confusion.

b0-05	Selection of auxiliary frequency Y range		Default	0
	Setting Range	0	Relative to maximum frequency	
		1	Relative to main frequency X	
b0-06	Range of auxiliary frequency Y		Default	100%
	Setting Range	0%~150%		

If X and Y operation is used, b0-05 and b0-06 are used to set the adjustment range of the auxiliary frequency source. You can set the auxiliary frequency to be relative to either maximum frequency or main frequency X. If relative to main frequency X, the setting range of the auxiliary frequency Y varies according to the main frequency X.

b0-07	Auxiliary frequency source Y selection		Default	0
	Setting Range	Unit's digit: Frequency source selection.		
		0	Main frequency source X	
		1	X and Y calculation (calculation result determined by ten's digit)	
		2	Switchover between X and Y	
		3	Switchover between X and "X and Y calculation"	
		4	Switchover between Y and "X and Y calculation"	
		Ten's digit: X and Y calculation relationship		
		0	X+Y	
		1	X-Y	
		2	Maximum of them	
3	Minimum of them			

It is used to select the frequency setting channel. Frequency setting can be realized by the main frequency source X and auxiliary frequency source Y operation.

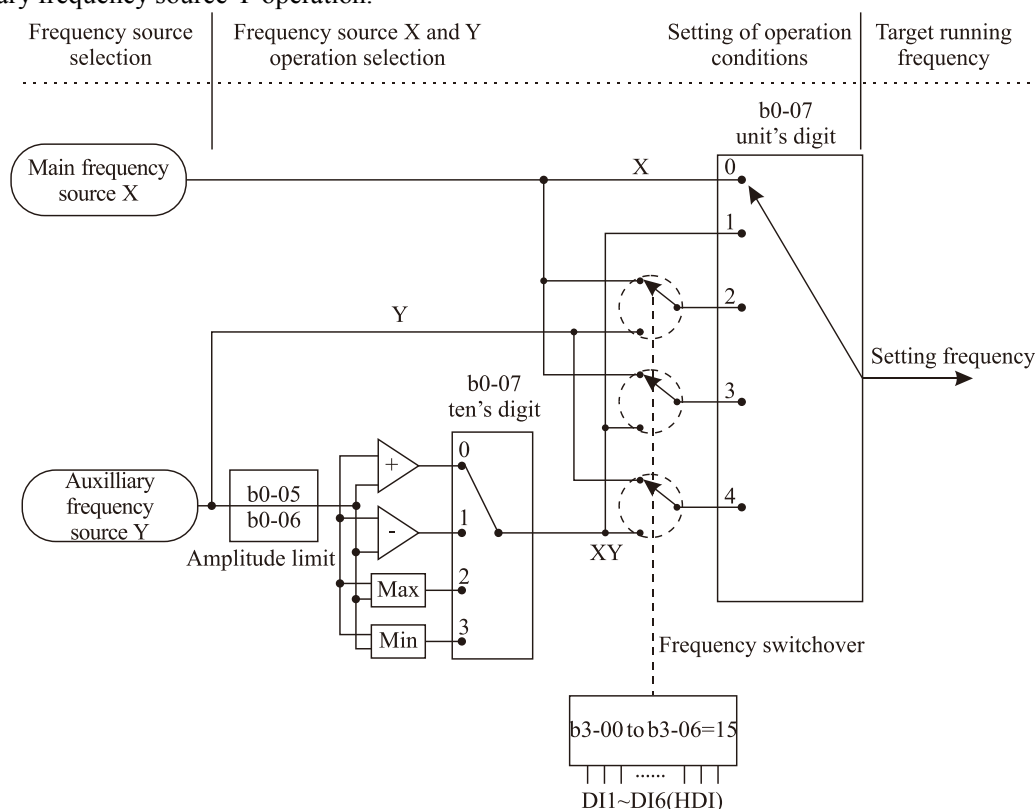


Diagram 5-1 Target frequency setting

If the frequency source involves X and Y operation, you can set the frequency offset in b0-08 for superposition to the X and Y operation result, flexibly satisfying various requirements.

b0-08	Frequency offset of auxiliary frequency source of X and Y		Default	0.00 Hz
	Setting Range	0.00 Hz ~ maximum frequency(b0-13)		

This parameter is valid only when the frequency source is set to "X and Y operation". The final frequency is obtained by adding the frequency offset set in this parameter to the X and Y operation result.

b0-09	Binding command source to frequency source			Default	0	
	Setting Range	Unit's digit: Binding keypad command to following frequency source.				
		0	No binding			
		1	Digital setting frequency			
		2	AI1			
		3	AI2			
		4	AI3			
		5	Pulse setting (HDI)			
		6	Multi-function			
		7	Simple PLC			
		8	PID			
		9	Communication setting			
		Ten's digit: Binding terminal command to frequency source ;0~9, same as unit's digit				
		Hundred's digit: Binding communication command to frequency source; 0~9, same as unit's digit				
Thousand's digit: Automatically running binding to frequency source; 0~9, same as unit's digit						

It is used to bind the three running command sources with the nine frequency sources, facilitating to implement synchronous switchover.



For details on the frequency sources, see the description of b0-03 (Main frequency source X selection).



Different running command sources can be bound to the same frequency source.

If a command source has bound to a frequency source, this frequency source set in b0-03~ b0-07 no longer takes effect when this command source is effective.

b0-10	Record of digital setting frequency of power failure			Default	1
	Setting Range	0	not record		
		1	record		

This parameter is valid only when the frequency source is digital setting.

If b0-10 is set to 0, the digital setting frequency value restore to the value of b0-12 (Digital setting frequency) after the frequency inverter stops. The modification by using keys  and  or the terminal UP/DOWN function is cleared to zero.

If b0-10 is set to 1, the digital setting frequency value is the set frequency at the moment when the frequency inverter stops. The modification by using keys  and  or the terminal UP/ DOWN function remains is record and valid.

b0-11	Frequency unit			Default	2
	Setting Range	1	0.1 Hz		
		2	0.01 Hz		

It is used to set the resolution of all frequency-related parameters.

If the resolution is 0.1 Hz, the EM15 can output up to 3000.0Hz. If the resolution is 0.01 Hz, the EM15 can output up to 300.00 Hz.

Note:

- Modifying this parameter will make the decimal places of all frequency-related parameters change and corresponding frequency values change display.
- This parameter is not restored when factory fault setting is done.

b0-12	Digital setting frequency			Default	50.00 Hz
	Setting Range	0.00 ~ maximum frequency (b0-13)			

If the frequency source is digital setting or terminal UP/DOWN, the value of this parameter is the initial frequency of the frequency inverter (digital setting).

b0-13	Maximum frequency		Default	50.00 Hz
	Setting Range	50.00~3000.00 Hz		

When the frequency source is AI, pulse setting (HDI), or Multi-segment speed, the 100% of input corresponds to the value of this parameter.

The output frequency of the EM15 can reach up to 3000 Hz. To take both frequency reference resolution and frequency input range into consideration, you can set the number of decimal places for frequency reference in b0-11.

- If b0-11 is set to 1, the frequency reference resolution is 0.1 Hz. In this case, the setting range of b0-13 is 50.0 to 3000.0 Hz.
- If b0-11 is set to 2, the frequency reference resolution is 0.01 Hz. In this case, the setting range of b0-13 is 50.00 to 300.00 Hz.

Note: After the value of b0-11 is modified, the frequency resolution of all frequency related function codes change accordingly.

b0-14	Record of digital setting frequency of power failure		Default	0
	Setting Range	0	Set by (b0-15)	
		1	AI1	
		2	AI2	
		3	AI3	
		4	Pulse setting (HDI)	
5	Communication setting			

It is used to set the source of the frequency upper limit, including digital setting (b0-15), AI, pulse setting or communication setting. If the frequency upper limit is set by means of AI1, AI2, AI3, HDI or communication, the setting is similar to that of the main frequency source X. For details, see the description of b0-03.

For example, to avoid runaway in torque control mode in winding machine application, you can set the frequency upper limit by means of analog input. When the frequency inverter reaches the upper limit, it will run at this limited speed.

b0-15	Frequency upper limit		Default	50.00 Hz
	Setting Range	Frequency lower limit (b0-17)~maximum frequency (b0-13)		

This parameter is used to set the frequency upper limit.

b0-16	Frequency upper limit offset		Default	0.00 Hz
	Setting Range	0.00 Hz~ maximum frequency(b0-13)		

If the source of the frequency upper limit is analog input or pulse setting, the final frequency upper limit is obtained by adding the offset in this parameter to the frequency upper limit set in b0-14.

b0-17	Frequency lower limit		Default	0.00 Hz
	Setting Range	0.00 Hz ~frequency upper limit(b0-15)		

If the frequency command is lower than the value of b0-17, the frequency inverter can stop, or run at the frequency lower limit, or run at zero speed. The result can be determined by b2-17(setting frequency lower than frequency lower limit running mode).

b0-18	Rotation direction		Default	0
	Setting Range	0	Forward direction	
		1	Reverse direction	



You can change the rotation direction of the motor just by modifying this parameter without changing the motor wiring. Modifying this parameter is equivalent to exchanging any two phase of the motor's U, V, W wires.

Note:

The motor will restore original running direction after parameter initialization (A0-09). Do not use this function in applications where changing the rotating direction of the motor is prohibited after system commissioning is complete.

b0-19	Base frequency for UP/ DOWN modification during running		Default	0
	Setting Range	0	Running frequency	
		1	Setting frequency	

This parameter is valid only when the frequency source is digital setting.

It is used to set the base frequency to be modified by using keys  and  or the terminal UP/DOWN function. If the running frequency and setting frequency are different, there will be a large difference between the frequency inverter's performance during the acceleration/ deceleration process.

b0-20	Acceleration/Deceleration mode		Default	0
	Setting Range	0	Linear acceleration/ deceleration	
		1	S-curve acceleration/deceleration A	
		2	S-curve acceleration/deceleration B	

It is used to set the frequency changing mode during the frequency inverter start and stop process.

0: Linear acceleration/deceleration

The output frequency increases or decreases in linear mode. The EM15 provides four groups of acceleration/deceleration time, which can be selected by using multi-function DI terminals (b3-00 to b3-11).

1: S-curve acceleration/deceleration A

The output frequency increases or decreases along the S curve. This mode is generally used in the applications where start and stop processes are required relatively smooth, such as elevator and conveyor belt. The b0-23 and b0-24 respectively define the time proportions of the start segment and the end segment.

2: S-curve acceleration/deceleration B

In this curve, the rated motor frequency f_b is always the inflexion point of S curve. This mode is usually used in applications where acceleration/deceleration is required at the speed higher than the rated frequency.

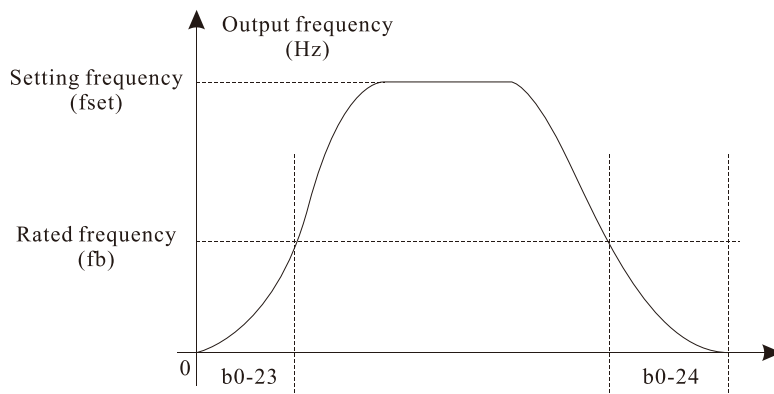


Diagram 5-2 S-curve acceleration/deceleration B diagram

b0-21	Acceleration time 1		Default	Model dependent
	Setting Range	0.00s~650.00s (b0-25 = 2)		
		0.0s~6500.0s (b0-25 = 1)		
0s~65000s (b0-25 = 0)				
b0-22	Deceleration time 1		Default	Model dependent
	Setting Range	0.00s~650.00s (b0-25 = 2)		
		0.0s~6500.0s (b0-25 = 1)		
0s~65000s (b0-25 = 0)				

Acceleration time indicates the time required by the frequency inverter to accelerate from 0 Hz to "Acceleration / Deceleration base frequency" (b0-26), that is, t_1 in Diagram 6-3. Including, f is setting frequency, f_b is motor rated frequency, T is the acceleration time from 0 Hz to rated frequency f_b .

Deceleration time indicates the time required by the frequency inverter to decelerate from "Acceleration / Deceleration base frequency" (b0-26) to 0 Hz, that is, t_2 in Diagram 6-3.

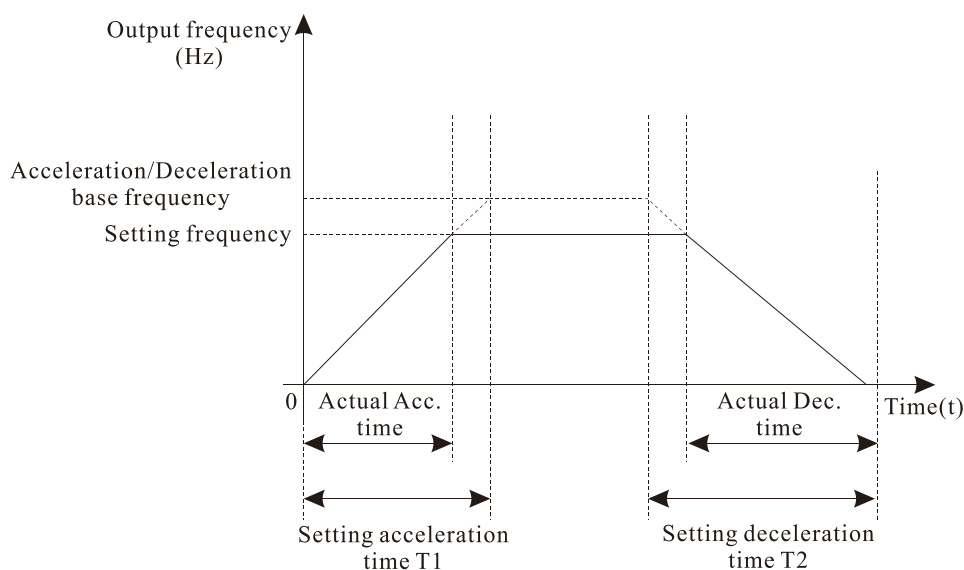


Diagram 5-3 Acceleration/Deceleration time

The EM15 provides totally four groups of acceleration/deceleration time for selection. You can perform switchover by using a DI terminal. And you can set the four groups of acceleration/deceleration time through the following function codes: Group 1: b0-21, b0-22; Group 2: b2-03, b2-04; Group 3: b2-05, b2-06; Group 4: b2-07, b2-08

b0-23	Time proportion of S-curve start segment	Default	30.0%
	Setting Range	0.0% ~ (100.0% minus b0-24)	
b0-24	Time proportion of S-curve end segment	Default	30.0%
	Setting Range	0.0% ~ (100.0% minus b0-23)	

These two parameters respectively define the time proportions of the start segment and the end segment of S-curve acceleration/deceleration A.

In Diagram 6-4, t_1 is the time defined in b0-23, within which the slope of the output frequency change increases gradually. t_2 is the time defined in b0-24, within which the slope of the output frequency change gradually decreases to 0. Within the time between t_1 and t_2 , the slope of the output frequency change remains unchanged, that is, linear acceleration/ deceleration.

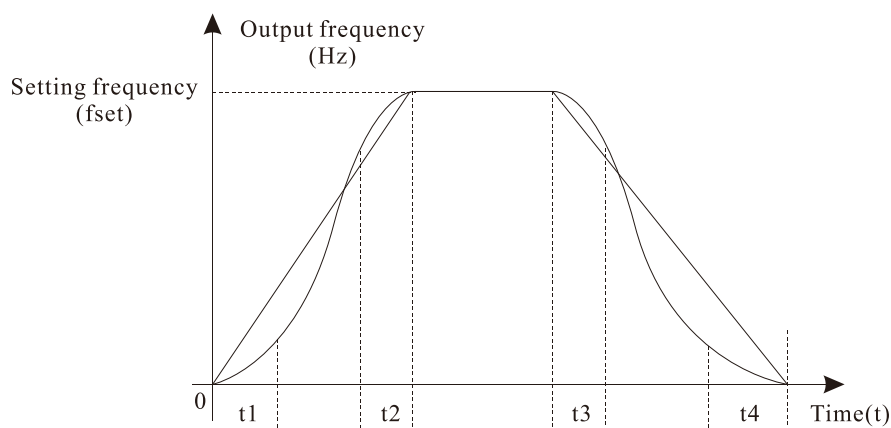


Diagram 5-4 S-curve acceleration/deceleration A

b0-25	Acceleration/Deceleration mode	Default	1
	Setting Range	0	1s
		1	0.1s
	2	0.01s	

To satisfy requirements of different applications, the EM15 provides three acceleration/ deceleration time units, 1s, 0.1s and 0.01s.

Note: Modifying this parameter will make the decimal places of all frequency-related parameters change and corresponding frequency values change. Pay attention for this in on-site application.

b0-26	Acceleration/Deceleration time base frequency		Default	0
	Setting Range	0	Maximum frequency (b0-13)	
		1	Set frequency	
		2	100 Hz	

The acceleration/deceleration time indicates the time for the frequency inverter to increase from 0 Hz to the frequency set in b0-26, figure 6-3 is the acceleration/deceleration time diagram. If this parameter is set to 1, the acceleration/deceleration time is related to the set frequency. If the set frequency changes frequently, the motor's acceleration/deceleration also changes.

5.2 Group b1: Start/Stop Control Parameters

b1-00	Start mode		Default	0
	Setting Range	0	Direct start	
		1	Rotational speed tracking restart	
		2	Pre-excited start (AC asynchronous motor)	

0: Direct start

If the DC braking time is set to 0, the frequency inverter starts to run from the startup frequency.

If the DC braking time is not 0, the frequency inverter performs DC braking first and then starts to run from the startup frequency. It is applicable to small-inertia load application and to where the motor is likely to rotate at startup.

1: Rotational speed tracking restart

The frequency inverter judges the rotational speed and direction of the motor firstly, and then starts at the tracked frequency. Such smooth start has no impact on the rotating motor. It is applicable to the restart of instantaneous power failure of large-inertia loads. To ensure the perfect performance of rotational speed tracking restart, please set the motor parameters correctly.

2: Pre-excited start (asynchronous motor)

It is valid only for asynchronous motor and used for building the magnetic field before the motor runs.

For pre-excited current and pre-excited time, see parameters of b1-05 and b1-06.

If the pre-excited time is 0, the frequency inverter cancels pre-excitation and starts to run from startup frequency.

If the pre-excited time is not 0, the frequency inverter pre-excites firstly before startup, improving the dynamic response of the motor.

b1-01	Rotational speed tracking mode		Default	0
	Setting Range	0	From frequency at stop	
		1	From zero speed	
		2	From maximum frequency	

To complete the rotational speed tracking process within the shortest time, select the proper mode in which the frequency inverter tracks the motor rotational speed.

0: From frequency at stop

It is the commonly selected mode.

1: From zero frequency

It is applicable to restart after a long time of power failure.

2: From the maximum frequency

It is applicable to the power-generating load.

b1-02	Rotational speed tracking ratio		Default	20
	Setting Range	1~100		

In the rotational speed tracking restart mode, select the rotational speed tracking speed. The larger the value is, the faster the tracking is. However, too large value may cause unreliable tracking.

b1-03	Startup frequency		Default	0.00 Hz
	Setting Range	0.00~10.00 Hz		
b1-04	Startup frequency holding time		Default	0.0s
	Setting Range	0.0s~100.0s		

To ensure the motor torque at frequency inverter startup, set a proper startup frequency. In addition, to build excitation when the motor starts up, the startup frequency must be held for a certain period.

The startup frequency (b1-03) is not restricted by the frequency lower limit. If the setting target frequency is lower than the startup frequency, the frequency inverter will not start and stays in the holding state.

During switchover between forward rotation and reverse rotation, the startup frequency holding time is disabled. The holding time is not included in the acceleration time but in the running time of simple PLC.

Example 1:

b0-03 = 0	The frequency source is digital setting.
b0-12 = 2.00 Hz	The digital setting frequency is 2.00 Hz.
b1-03 = 5.00 Hz	The startup frequency is 5.00 Hz.
b1-04 = 2.0s	The startup frequency holding time is 2.0s.

In this example, the frequency inverter stays in the holding state and the output frequency is 0.00 Hz.

Example 2:

b0-03 = 0	The frequency source is digital setting.
b0-12 = 10.00 Hz	The digital setting frequency is 10.00 Hz.
b1-03 = 5.00 Hz	The startup frequency is 5.00 Hz.
b1-04 = 2.0s	The startup frequency holding time is 2.0s.

In this example, the frequency inverter accelerates to 5.00 Hz at 2s, and then accelerates to the set frequency 10.00 Hz.

b1-05	Startup DC braking current/ Pre-excited current		Default	0%
	Setting Range	0%~100%		
b1-06	Startup DC braking time/ Pre-excited time		Default	0.0s
	Setting Range	0.0s~100.0s		

Startup DC braking is generally used during restart of the frequency inverter after the rotating motor stops. Pre-excitation is used to make the frequency inverter build magnetic field for the asynchronous motor before startup to improve the responsiveness.

Startup DC braking is valid only for direct start (b1-00 = 0). In this case, the frequency inverter performs DC braking at the setting startup DC braking current. After the startup DC braking time, the frequency inverter starts to run. If the startup DC braking time is 0, the frequency inverter starts directly without DC braking. The larger the startup DC braking current is, the larger the braking force is.

If the startup mode is pre-excited start (b1-00 = 3), the frequency inverter firstly builds magnetic field based on the set pre-excited current. After the pre-excited time, the frequency inverter starts to run. If the pre-excited time is 0, the frequency inverter starts directly without pre-excitation.

The startup DC braking current or pre-excited current is a percentage of motor rated current.

b1-07	Stop mode		Default	0
	Setting Range	0	Decelerate to stop	
		1	Free stop	

0: Decelerate to stop

After the stop command is enabled, the frequency inverter decreases the output frequency according to the deceleration time and stops when the frequency decreases to zero.

1: Free stop

After the stop command is enabled, the frequency inverter immediately stops the output. The motor will free stop based on the mechanical inertia.

b1-08	DC braking initial frequency of stopping	Default	0.00 Hz
	Setting Range	0.00 Hz ~ maximum frequency	
b1-09	DC braking waiting time of stopping	Default	0.0s
	Setting Range	0.0s~100.0s	
b1-10	DC braking current of stopping	Default	0%
	Setting Range	0%~100%	
b1-11	DC braking time of stopping	Default	0.0s
	Setting Range	0.0s~100.0s	

● b1-08 (Initial frequency of stop DC braking)

During the process of decelerating to stop, the frequency inverter starts DC braking when the running frequency is lower than the value set in b1-08.

● b1-09 (Waiting time of stop DC braking)

When the running frequency decreases to the initial frequency of stop DC braking, the frequency inverter stops output for a certain period and then starts DC braking. This prevents faults such as over current caused due to DC braking at high speed.

● b1-10 (Stop DC braking current)

This parameter specifies the output current at DC braking and is a percentage relative to the motor rated current. The larger the value is, the stronger the DC braking effects, but the more heat the motor and frequency inverter emit.

● b1-11 (Stop DC braking time)

This parameter specifies the holding time of DC braking. If it is set to 0, DC braking is cancelled. The stop DC braking process is shown in the following figure.

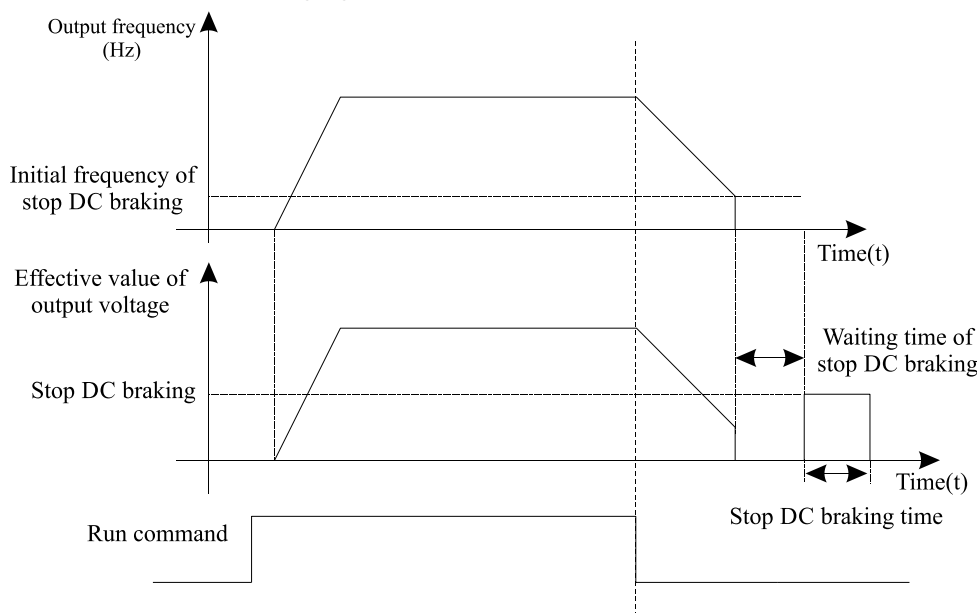


Diagram 5-5 Stop DC braking process

5.3 Group b2: Auxiliary Functions

b2-00	JOG running frequency	Default	2.00 Hz
	Setting Range	0.00 Hz ~ maximum frequency	
b2-01	JOG acceleration time	Default	Model dependent
	Setting Range	0.0s~6500.0s	
b2-02	JOG deceleration time	Default	Model dependent
	Setting Range	0.0s~6500.0s	

These parameters are used to define the set frequency and acceleration/deceleration time of the frequency inverter when jogging. The startup mode is fixed as "Direct start" (b1-00 = 0) and the stop mode is fixed as "Decelerate to

stop" (b1-07 = 0) during jogging.

b2-03	Acceleration time 2	Default	Model dependent
	Setting Range	0.0s~6500.0s	
b2-04	Deceleration time 2	Default	Model dependent
	Setting Range	0.0s~6500.0s	
b2-05	Acceleration time 3	Default	Model dependent
	Setting Range	0.0s~6500.0s	
b2-06	Deceleration time 3	Default	Model dependent
	Setting Range	0.0s~6500.0s	
b2-07	Acceleration time 4	Default	Model dependent
	Setting Range	0.0s~6500.0s	
b2-08	Deceleration time 4	Default	Model dependent
	Setting Range	0.0s~6500.0s	

The EM15 provides a total of four groups of acceleration/deceleration time, that is, the above three groups and the group b0-21 and b0-22. Definitions of four groups are completely the same, for more details, see the description of b0-21 and b0-22. You can switch over between the four groups of acceleration/deceleration time through different state combinations of DI terminals. For more details, see the descriptions of b3-01 to b3-011.

b2-09	Jump frequency 1	Default	0.00Hz
	Setting Range	0.00 Hz ~maximum frequency	
b2-10	Jump frequency 2	Default	0.00Hz
	Setting Range	0.00 Hz ~maximum frequency	
b2-11	Frequency jump amplitude	Default	0.00Hz
	Setting Range	0.00 Hz ~maximum frequency	

If the setting frequency is within the jump frequency range, the actual running frequency is the jump frequency close to the set frequency. Setting the jump frequency helps to avoid the mechanical resonance point of the load.

The EM15 supports two jump frequencies. If both are set to 0, the frequency jump function is disabled. The principle of the jump frequencies and jump amplitude is shown in the following figure 5-6.

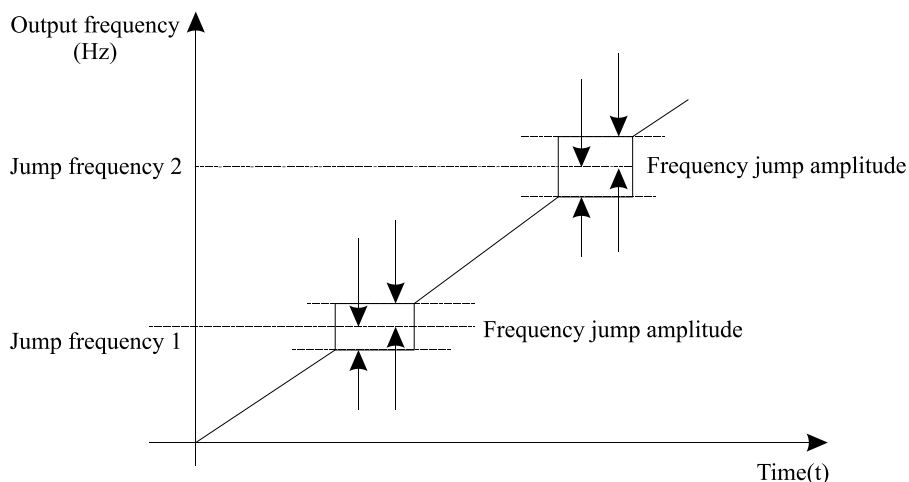


Diagram 5-6 Principle of the jump frequencies and jump amplitude

b2-12	Jump frequency during acceleration/ deceleration	Default	0
	Setting	0	Disabled
	Range	1	Enabled

It is used to set whether the jump frequencies are valid during acceleration/deceleration.

When the jump frequencies are valid during acceleration/deceleration, and the running frequency is within the frequency jump range, the actual running frequency will jump over the set frequency jump amplitude (rise directly from the lowest jump frequency to the highest jump frequency). The following figure shows the diagram when the

jump frequencies are valid during acceleration/deceleration.

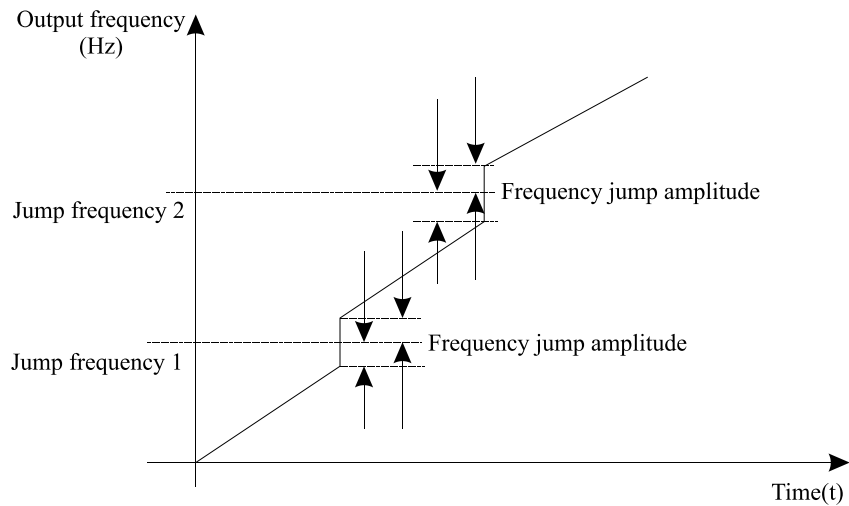


Diagram 5-7 Diagrams when the jump frequencies are valid during acceleration/deceleration

b2-13	Frequency switchover point between acceleration time 1 and acceleration time 2		Default	0.00Hz
	Setting Range	0.00 Hz ~maximum frequency		
b2-14	Frequency switchover point between deceleration time 1 and deceleration time 2		Default	0.00Hz
	Setting Range	0.00 Hz ~maximum frequency		

This function is valid when motor 1 is selected and acceleration/deceleration time switchover is not performed by means of DI terminal. It is used to select different groups of acceleration/ deceleration time based on the running frequency range rather than DI terminal during the running process of the frequency inverter.

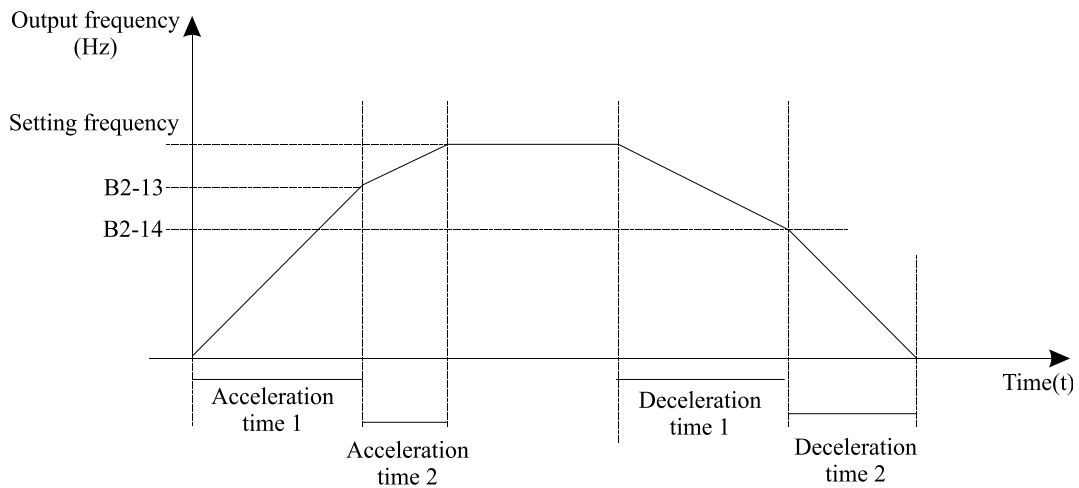


Diagram 5-8 Acceleration/deceleration time switchover

During acceleration, if the running frequency is smaller than the value of b2-13, acceleration time 1 is selected. If the running frequency is larger than the value of b2-13, acceleration time 2 is selected.

During deceleration, if the running frequency is larger than the value of b2-14, deceleration time 1 is selected. If the running frequency is smaller than the value of b2-14, deceleration time 2 is selected.

b2-15	Reverse running		Default	0
	Setting Range	0	Enabled	
		1	Disabled	

It is used to set whether the frequency inverter allows reverse rotation. In the applications where reverse rotation is

prohibited, set this parameter to 1.

b2-16	Forward/Reverse rotation dead-zone time		Default	0.0s
	Setting Range	0.0~3000.0s		

It is used to set the time when the output is 0 Hz at transition of the frequency inverter forward rotation and reverse rotation, as shown in the following figure.

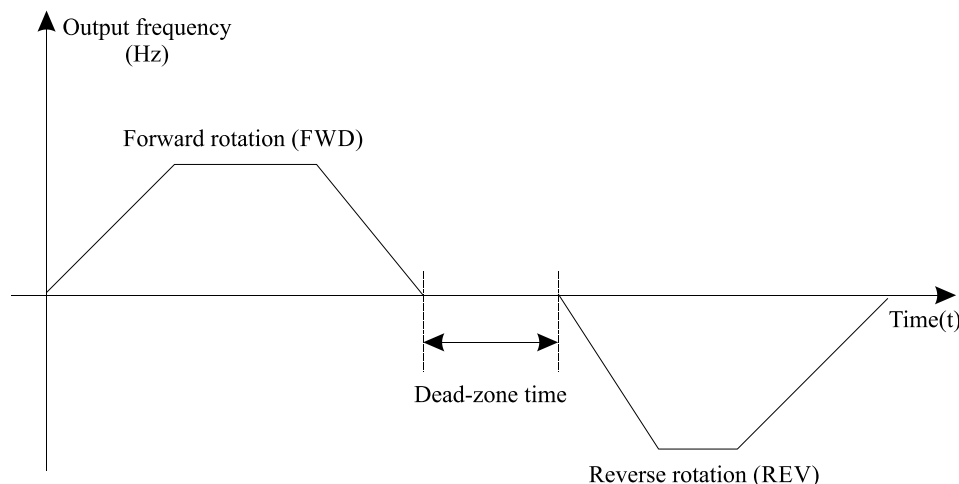


Diagram 5-9 Forward/Reverse rotation dead-zone time

b2-17	Running mode when set frequency less than limited lower frequency		Default	0
	Setting Range	0	Run at frequency lower limit	
		1	Stop	
2	Run at zero speed			

It is used to set the frequency inverter running mode when the set frequency is lower than the frequency lower limit. The EM15 provides three running modes to satisfy requirements of various applications.

b2-18	Droop control		Default	0.00Hz
	Setting Range	0.00Hz~10.00 Hz		

This function is used for balancing the workload allocation when multiple motors are used to drive the same load. The output frequency of the frequency inverters decreases as the load increases. You can reduce the workload of the motor under load by decreasing the output frequency for this motor, implementing workload balancing among multiple motors.

b2-19	Terminal JOG priority		Default	0
	Setting Range	0	Disabled	
1		Enabled		

It is used to set whether terminal JOG is priority. (Only external terminal control mode is valid)

If terminal JOG is priority, the frequency inverter switches to terminal JOG running state when there is a terminal JOG command during the running process of the frequency inverter.

b2-21	Setting running time reach threshold		Default	0h
	Setting Range	0~65000 h		

It is used to set the accumulative running time threshold of the Frequency inverter. If the accumulative running time (b9-09) reaches the value set in this parameter, the corresponding DO terminal becomes ON.

b2-22	Action after running time reached		Default	0
	Setting Range	0	Continue to run	
1		Stop		

This function is used to define the action after b2-21 preset time reached. Setting 0 inverter will continue work after present running time reached; and set 1, the inverter will stop.

b2-23	Cooling fan control			Default	0
	Setting Range	0	Fan working during running		
		1	Fan working during power on		

It is used to set the working mode of the cooling fan. If this parameter is set to 0, the fan works when the frequency inverter is in running state. When the frequency inverter stops, the cooling fan works if the heatsink temperature is higher than 40°C, and stops working if the heatsink temperature is lower than 40°C.

If this parameter is set to 1, the cooling fan keeps working after power-on.

b2-24	Dormant frequency			Default	0.00Hz
	Setting Range	0.00Hz ~wakeup frequency (b2-26)			
b2-25	Dormant delay time			Default	0.0s
	Setting Range	0.0s~6000.0s			
b2-26	Wakeup frequency			Default	0.00Hz
	Setting Range	Dormant frequency (b2-24)~ maximum frequency (b0-13)			
b2-27	Wakeup delay time			Default	0.0s
	Setting Range	0.0s~6000.0s			

These parameters are used to implement the dormant and wakeup functions in the water supply application.

When the frequency inverter is in running state, the frequency inverter enters the dormant state and stops automatically after the dormant delay time (b2-25) if the set frequency is lower than or equal to the dormant frequency (b2-24).

When the frequency inverter is in dormant state and the present running command is effective, the frequency inverter starts up after the wakeup delay time (b2-27) if the set frequency is higher than or equal to the wakeup frequency (b2-26).

Generally, set the wakeup frequency should be equal to or higher than the dormant frequency. If the wakeup frequency and dormant frequency are set to 0, the dormant and wakeup functions are disabled.

When the dormant function is enabled, if the frequency source is PID, whether PID operation is performed in the dormant state is determined by C0-27. In this case, select PID operation enabled in the stop state (C0-27 = 1).

b2-28	Timing function			Default	0
	Setting Range	0	Disabled		
		1	Enabled		
b2-29	Timing duration source			Default	0
	Setting Range	0	b2-30		
		1	AI1		
		2	AI2		
		3	AI3		
	(100% of analog input corresponds to the value of b2-30)				
b2-30	Set timing duration			Default	0.0min
	Setting Range	0.0min~6500.0 min			

These parameters are used to implement the frequency inverter timing function.

If b2-28 is set to 1, the frequency inverter starts to time at startup. When the set timing duration reached, the frequency inverter stops automatically, and meanwhile the corresponding DO outputs ON signal.

The frequency inverter starts timing from 0.0min each time it starts up and the remaining timing duration can be checked by U0-20.

The timing duration is set in b2-29 and b2-30, in unit of minute.

b2-31	This time running time reached threshold			Default	0.0min
	Setting Range	0.0min~6500.0 min			

If the present running time reaches the value set in this parameter, the corresponding DO outputs ON signal, indicating that present running time is reached.

b2-32	DI terminal status after power on			Default	0
	Setting	0	Valid		
	Range	1	Invalid		

This parameter is used to enable the frequency inverter safety protection. If it is set to 0, the frequency inverter does not respond to the run command after power-on (for example, an input terminal is ON before power-on). The frequency inverter responds only after the run command is cancelled and becomes valid again.

In addition, the frequency inverter does not respond to the run command valid from fault reset of the frequency inverter. The run protection can be disabled only after the run command is cancelled one time.

In this way, the motor will not automatically startup to avoid unexpected dangerous conditions for these startup commands from power-on and fault reset.

5.4 Group b3: Input Terminals

The EM15 provides 6 digital input (DI) terminals (HDI can be used for high-speed pulse input) and 3 analog input (AI) terminals.

b3-00	DI1 function selection	Default	1(FWD)
b3-01	DI2 function selection	Default	2(REV)
b3-02	DI3 function selection	Default	6
b3-03	DI4 function selection	Default	7
b3-04	DI5 function selection	Default	8
b3-05	Reserved control terminal for expansion	Default	0
b3-06	HDI function selection	Default	32
	Setting Range	b3-00~b3-06: 0~49	

The following table lists the functions available for the DI terminals.

Table 5-1 Functions of DI terminals

Value	Function	Description
0	No function	Set 0 for reserved terminals to avoid malfunction.
1	Forward RUN (FWD) or running command	The terminal is used to control forward or reverse running of the frequency inverter.
2	Reverse RUN (REV) or the direction of FWD/REV	
3	Three-line control	The terminal determines three-line control of the frequency inverter. For details, see the description of b3-13.
4	Forward JOG (FJOG)	FJOG indicates forward JOG running, while RJOG indicates reverse JOG running. The JOG frequency, acceleration time and deceleration time are described respectively in b2-00, b2-01 and b2-02.
5	Reverse JOG (RJOG)	
6	Multi-function terminal 1	The setting of 16 speeds or 16 other references can be implemented through combinations of 16 states of these four terminals.
7	Multi-function terminal 2	
8	Multi-function terminal 3	
9	Multi-function terminal 4	
10	Terminal UP	If the frequency is determined by external terminals, the terminals with the two functions are used as increment and decrement commands for frequency modification. When the frequency source is digital setting, they are used to adjust the frequency.
11	Terminal DOWN	
12	UP and DOWN setting clear (terminal, operation panel)	If the frequency source is digital setting, the terminal is used to clear the modification by using the UP/ DOWN function or the increment/decrement key on the operation panel, returning the set frequency to the value of b0-12.
13	Terminal 1 for acceleration/ deceleration time selection	Totally four groups of acceleration/deceleration time can be selected through combinations of two states of these two terminals.

Value	Function	Description
14	Terminal 2 for acceleration/ deceleration time selection	
15	Frequency source switchover	The terminal is used to perform switchover between two frequency sources according to the setting in b0-07.
16	Switchover between main frequency source X and digital setting frequency	After this terminal becomes ON, the frequency source X is replaced by the digital setting frequency (b0-12).
17	Switchover between auxiliary frequency source Y and digital setting frequency	After this terminal is enabled, the frequency source Y is replaced by the digital setting frequency (b0-12).
18	Terminal 1 for Command source switchover	If the command source is set to terminal control (b0-02 = 1), this terminal is used to perform switchover between terminal control and operation panel control. If the command source is set to communication control (b0-02 = 2), this terminal is used to perform switchover between communication control and operation panel control.
19	Terminal 2 for Command source switchover	It is used to perform switchover between terminal control and communication control. If the command source is terminal control, the system will switch over to communication control after this terminal becomes ON.
20	Speed control/Torque control switchover	This terminal enables the frequency inverter to switch over between speed control and torque control. When this terminal becomes OFF, the frequency inverter runs in the mode set in d1-00. When this terminal becomes ON, the frequency inverter switches over to the other control mode.
21	Torque control prohibited	The Frequency inverter is prohibited from torque control and enters the speed control mode.
22	PID pause	PID is invalid temporarily. The frequency inverter maintains the present frequency output without supporting PID adjustment of frequency source.
23	PID integral pause	After this terminal becomes ON, the integral adjustment function pauses. However, the proportional and differentiation adjustment functions are still valid.
24	Reverse PID action direction	After this terminal becomes ON, the PID action direction is reversed to the direction set in C0-04.
25	PID parameter switchover	If the PID parameters switchover performed by means of DI terminal (C0-12 = 1). When the terminal becomes OFF; the PID parameters are C0-06~C0-08; when this terminal becomes ON, the PID parameters switch to C0-09 ~ C0-11.
26	PLC status reset	The terminal is used to restore the original status of PLC control for the frequency inverter when PLC control is started again after a pause.
32	Pulse input (enabled only for HDI/HDI)	HDI is used for pulse input.
33	Frequency modification forbidden	After this terminal becomes ON, the frequency inverter does not respond to any frequency modification.
34	Acceleration/Deceleration prohibited	It enables the frequency inverter to maintain the present frequency output without being affected by external signals (except the STOP command).
36	Motor selection terminal 2 (Reserved)	Reserved.
37	Fault reset (RESET)	The terminal is used for fault reset function, the same as the function of RESET key on the operation panel. Remote fault reset is implemented by this function.
38	Normally open (NO) input of external fault	If this terminal becomes ON, the frequency inverter reports Err15 and performs the fault protection action. For more details, see the

Value	Function	Description
		description of bb-32.
39	Normally closed (NC) input of external fault	After this terminal becomes ON, the frequency inverter reports Err15 and performs the fault protection action. For more details, see the description of bb-32.
40	User-defined fault 1	If these two terminals become ON, the frequency inverter reports Err27 and Err28 respectively, and performs fault protection actions based on the setting in bb-34.
41	User-defined fault 2	
42	RUN pause	The frequency inverter decelerates to stop, but the running parameters are all memorized, such as PLC, swing frequency and PID parameters. After this function is disabled, the frequency inverter restore to its status before stop.
43	Free stop	The frequency inverter blocks its output, the motor free stop and is not controlled by the frequency inverter. It is the same as free stop described in b1-07.
44	Emergency stop	When this terminal becomes ON, the frequency inverter stops within the shortest time. During the stop process, the current remains at the set current upper limit. This function is used to satisfy the requirement of stopping the frequency inverter in emergency state.
45	External STOP terminal 1	In operation keypad mode, this terminal can be used to stop the frequency inverter, equivalent to the function of the STOP key on the operation keypad.
46	External STOP terminal 2	In any control mode (operation panel, terminal or communication), it can be used to make the frequency inverter decelerate to stop. In this case, the deceleration time is deceleration time 4.
47	Deceleration DC braking	When this terminal becomes ON, the frequency inverter decelerates to the initial frequency of DC braking and then switches over to DC braking state.
48	Immediate DC braking	After this terminal becomes ON, the frequency inverter directly switches over to the DC braking state.
49	Clear this time running time	When this terminal becomes ON, the frequency inverter's this time running time is cleared. This function must be supported by b2-28 and b2-31.

The four multi-function terminals have 16 state combinations, corresponding to 16 reference values, as listed in the following table.

K4	K3	K2	K1	Reference Setting	Corresponding Parameter
OFF	OFF	OFF	OFF	Reference 0	C1-00
OFF	OFF	OFF	ON	Reference 1	C1-01
OFF	OFF	ON	OFF	Reference 2	C1-02
OFF	OFF	ON	ON	Reference 3	C1-03
OFF	ON	OFF	OFF	Reference 4	C1-04
OFF	ON	OFF	ON	Reference 5	C1-05
OFF	ON	ON	OFF	Reference 6	C1-06
OFF	ON	ON	ON	Reference 7	C1-07
ON	OFF	OFF	OFF	Reference 8	C1-08
ON	OFF	OFF	ON	Reference 9	C1-09
ON	OFF	ON	OFF	Reference 10	C1-10
ON	OFF	ON	ON	Reference 11	C1-11
ON	ON	OFF	OFF	Reference 12	C1-12
ON	ON	OFF	ON	Reference 13	C1-13
ON	ON	ON	OFF	Reference 14	C1-14
ON	ON	ON	ON	Reference 15	C1-15

If the frequency source is multi-function, the value 100% of C1-00~ C1-15 corresponds to the value of b0-13 (Maximum frequency).

Besides as the multi-speed function, the multi-function can be also used as the PID setting source or the voltage source for V/F separation, satisfying the requirement on switchover of different setting values.

Table 5-2 Function description of Acceleration/Deceleration time selection terminals

Terminal 2	Terminal 1	Acceleration/Deceleration Time	Corresponding
OFF	OFF	Acceleration/Deceleration time 1	b0-21, b0-22
OFF	ON	Acceleration/Deceleration time 2	b2-03, b2-04
ON	OFF	Acceleration/Deceleration time 3	b2-05, b2-06
ON	ON	Acceleration/Deceleration time 4	b2-07, b2-08

b3-12	DI filter time		Default	0.010s
	Setting Range	0.000s~1.000s		

It is used to set the software filter time of DI terminal status. If DI terminals are liable to interference and may cause malfunction, increase the value of this parameter to enhance the anti-interference capability. However, increase of DI filter time will slow down the response of DI terminals.

b3-13	Terminal command mode			Default	0
	Setting Range	0	Two-line mode 1		
		1	Two-line mode 2		
		2	Three-line mode 1		
		3	Three-line mode 2		

This parameter is used to set the mode in which the frequency inverter is controlled by external terminals. The following uses DI1, DI2 and DI3 among DI1 to DI12 as an example, with allocating functions of DI1, DI2 and DI3 by setting b3-00 to b3-02.

0: Two-line mode 1

It is the most commonly used two-line mode, in which the forward/reverse rotation of the motor is decided by DI1 and DI2. The parameters are set as below:

Code	Name	Value	Function Description
b3-13	Terminal command mode	0	Two-line 1
b3-00	DI1 function selection	1	Forward RUN (FWD)
b3-01	DI2 function selection	2	Reverse RUN (REV)

K1	K2	Running direction
1	0	FWD
0	1	REV
1	1	STOP
0	0	STOP

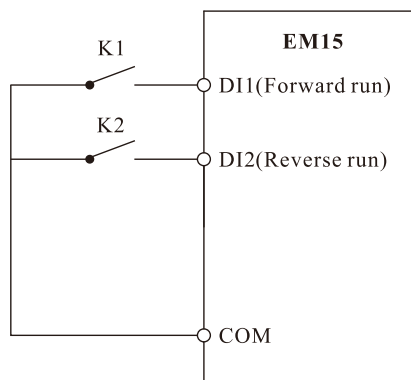


Diagram 5-10 Setting of two-line mode 1

As shown in the preceding figure, when only K1 is ON, the frequency inverter instructs forward rotation. When only K2 is ON, the frequency inverter instructs reverse rotation. When K1 and K2 are ON or OFF simultaneous, the frequency inverter stops.

1: Two-line mode 2

In this mode, DI1 is RUN enabled terminal, and DI2 determines the running direction. The parameters are set as below:

Code	Name	Value	Function Description
b3-13	Terminal command mode	1	Two-line 2
b3-00	DI1 function selection	1	RUN enabled
b3-01	DI2 function selection	2	Forward or reverse

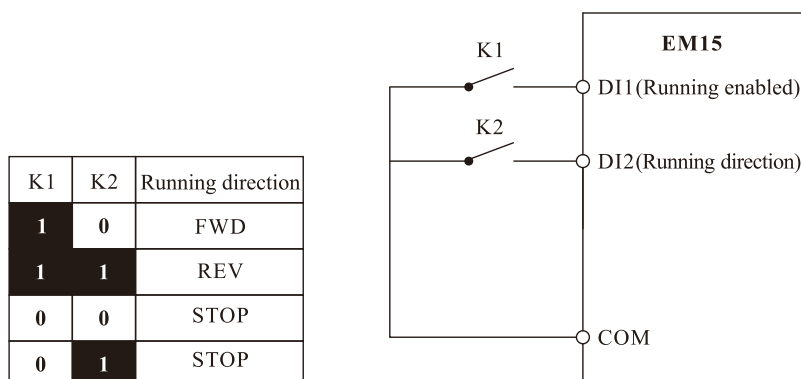


Diagram 5-11 Setting of two-line mode 2

As shown in the preceding figure, if K1 is ON, the frequency inverter instructs forward rotation when K2 is OFF, and instructs reverse rotation when K2 is ON. If K1 is OFF, the Frequency inverter stops.

2: Three-line mode 1

In this mode, DI3 is RUN enabled terminal, and the direction is decided by DI1 and DI2. The parameters are set as below:

Code	Name	Value	Function Description
b3-13	Terminal command mode	2	Three-line 1
b3-00	DI1 function selection	1	Forward RUN (FWD)
b3-01	DI2 function selection	2	Reverse RUN (REV)
b3-02	DI3 function selection	3	Three-line control

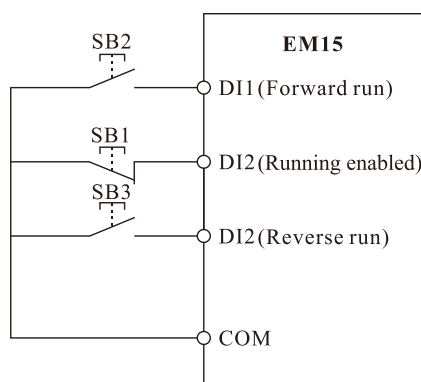


Diagram 5-12 Setting of three-line mode 1

As shown in the preceding figure, if SB1 is ON, the frequency inverter instructs forward rotation when SB2 is pressed to be ON, and instructs reverse rotation when SB3 is pressed to be ON. The frequency inverter stops immediately after SB1 becomes OFF. During normal startup and running, SB1 must remain ON. The frequency inverter's running state is determined by the final actions on SB1, SB2 and SB3.

3: Three-line mode 2

In this mode, DI3 is RUN enabled terminal. The RUN command is given by DI1 and the direction is decided by DI2. The parameters are set as below:

Code	Name	Value	Function Description
b3-13	Terminal command mode	3	Three-line 2
b3-00	DI1 function selection	1	RUN enabled

b3-01	DI2 function selection	2	Forward or reverse
b3-02	DI3 function selection	3	Three-line control

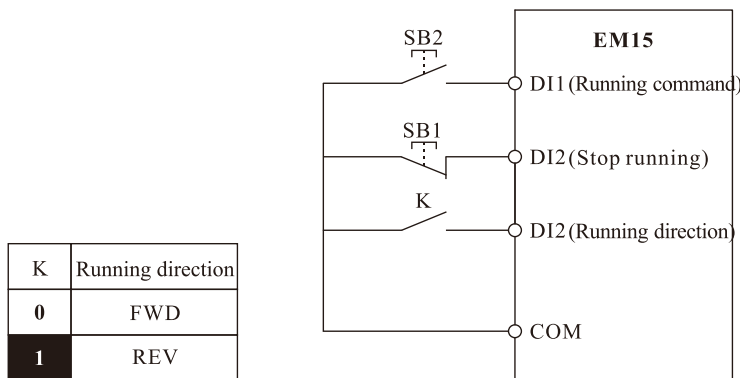


Diagram 5-13 Setting of three-line mode 2

As shown in the preceding figure, if SB1 is ON, the frequency inverter starts running when SB2 is pressed to be ON; the frequency inverter instructs forward rotation when K is OFF and instructs reverse rotation when K is ON. The Frequency inverter stops immediately after SB1 becomes OFF. During normal startup and running, SB1 must remain ON, SB2 is effective immediately after ON action.

b3-14	Rate of UP/DOWN terminal	Default	1.000 Hz/s
	Setting Range	0.001Hz/s~65.535 Hz/s	

It is used to adjust the ratio of changing of frequency for per second when the frequency is adjusted by means of terminal UP/DOWN.

1. If b0-11 (Frequency reference resolution) is 2, the setting range is 0.001Hz/s~65.535 Hz/s.
2. If b0-11 (Frequency reference resolution) is 1, the setting range is 0.01Hz/s~655.35 Hz/s.

b3-15	DI1 ON delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b3-16	DI1 OFF delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b3-17	DI2 ON delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b3-18	DI2 OFF delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b3-19	DI3 ON delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b3-20	DI3 OFF delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b3-21	DI4 ON delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b3-22	DI4 OFF delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b3-23	DI5 ON delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b3-24	DI5 OFF delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	

These parameters are used to set the delay time of the frequency inverter when the status of DI terminals changes. The DI1 to DI5 support the delay time function.

b3-25	DI valid selection 1		Default	00000
	Setting Range	Unit's digit: DI1 valid mode.		
		0	High level valid	
		1	Low level valid	
		Ten's digit: DI2 valid mode.0, 1 (same as DI1)		
		Hundred's digit: DI3 valid mode.0, 1 (same as DI1)		
		Thousand's digit: DI4 valid mode.0, 1 (same as DI1)		
Ten thousand's digit: DI5 valid mode.0, 1 (same as DI1)				

These parameters are used to set the valid mode of DI terminals.

0: Low level valid

The DI terminal is invalid when being connected with COM, and valid when being disconnected from COM.

1: High level valid

The DI terminal is valid when being connected with COM, and invalid when being disconnected from COM.

5.5 Group b4: Output Terminals

The EM15 provides an analog output (AO) terminal, two relay terminal and a FM terminal (used for high-speed pulse output or open-collector output signal output) as standard. If these output terminals cannot satisfy requirements, use an optional I/O extension card.

b4-00	FM terminal output mode		Default	0
	Setting	0	Pulse output	
	Range	1	Open- collector output terminal	

The FM terminal is programmable multiplexing terminal. It can be used for high-speed pulse output (FMP), with maximum frequency of 50.00 kHz. Refer to b6-00 for relevant functions of FMP. It can also be used as open collector switch signal output (FMR).

b4-01	FMR function (open- collector output terminal)	Default	0
b4-02	Relay 1 function (TA1-TB1-TC1)	Default	3
b4-03	Relay 2 function (TA-TB-TC;TA2-TB2-TC2)	Default	2

These 3 parameters are used to select the functions of the digital output terminals.

The functions of the output terminals are described in the following table.

Value	Function	Description
0	No output	The terminal has no function.
1	Ready for RUN	If the frequency inverter main circuit and control circuit become stable, and the frequency inverter detects no fault and is ready for RUN, the terminal becomes ON.
2	Frequency inverter running	When the frequency inverter is running and has output frequency (can be zero), the terminal becomes ON.
3	Fault output (free stop)	When the frequency inverter stops due to a fault, the terminal becomes ON.
4	Fault output(free stop fault, no output at under-voltage)	
5	Swing frequency limited	If the set frequency exceeds the frequency upper limit or lower limit and the output frequency of the frequency inverter reaches the upper limit or lower limit, the terminal becomes ON.
6	Torque limited	In speed control mode, if the output torque reaches the torque limit, the frequency inverter enters the stall protection state and meanwhile the terminal becomes ON.

Value	Function	Description
7	Frequency upper limit reached	If the running frequency reaches the upper limit, the terminal becomes ON.
8	Frequency lower limit reached (no output at stop)	If the running frequency reaches the lower limit, the terminal becomes ON. In the stop state, the terminal becomes OFF.
9	Frequency lower limit reached (having output at stop)	If the running frequency reaches the lower limit, the terminal becomes ON. In the stop state, the signal is still ON.
10	Reverse running	If the frequency inverter is in the reverse running state, the terminal becomes ON.
11	Zero-speed running (no output at stop)	If the frequency inverter runs with the output frequency of 0, the terminal becomes ON. If the frequency inverter is in the stop state, the terminal becomes OFF.
12	Zero-speed running 2 (having output at stop)	If the output frequency of the frequency inverter is 0, the terminal becomes ON. In the state of stop, the signal is still ON.
16	PLC cycle complete	When simple PLC completes one cycle, the terminal outputs a pulse signal with width of 250ms.
17	Frequency-level detection FDT1 output	Refer to the descriptions of b4-22 and b4-23.
18	Frequency level detection FDT2 output	Refer to the descriptions of b4-25 and b4-26.
19	Frequency reached	Refer to the descriptions of b4-24.
20	Frequency 1 reached	Refer to the descriptions of b4-27 and b4-28.
21	Frequency 2 reached	Refer to the descriptions of b4-29 and b4-30.
22	Current 1 reached	Refer to the descriptions of b4-35 and b4-36.
23	Current 2 reached	Refer to the descriptions of b4-37 and b4-38.
24	Module temperature reached	If the heatsink temperature of the inverter module (b9-07) reaches the set module temperature threshold (b4-39), the terminal becomes ON.
25	Timing reached	If the timing function (b2-28) is valid, the terminal becomes ON after the present running time of the frequency inverter reaches the set time.
26	Zero current state	Refer to the descriptions of b4-31 and b4-32.
27	Output current limit exceeded	Refer to the descriptions of b4-33 and b4-34.
28	Lower voltage state output	If the frequency inverter is in lower voltage state, the terminal becomes ON.
29	Frequency inverter overload pre-warning	The frequency inverter judges whether the motor load exceeds the overload pre-warning threshold before performing the protection action. If the pre-warning threshold is exceeded, the terminal becomes ON. For motor overload parameters, see the descriptions of bb-01 to bb-03.
30	Motor overheat warning	If the motor temperature reaches the temperature set in bb-27 (Motor overheat warning threshold), the terminal becomes ON. You can view the motor temperature by using U0-33.
31	Motor overload pre-warning	The frequency inverter judges motor overload according to preset motor overload threshold, and terminal becomes ON. The overload threshold setting refer to bb-01~bb-03.
32	Off load	If the load becomes 0, the terminal becomes ON.
33	AI1 larger than AI2	When the input of AI1 is larger than the input of AI2, the terminal becomes ON.

Value	Function	Description
34	AI1 input limit exceeded	If AI1 input is larger than the value of b5-06 (AI1 input voltage upper limit) or lower than the value of b5-05 (AI1 input voltage lower limit), the terminal becomes ON.
35	Alarm output (all faults)	If a fault occurs on the frequency inverter and the frequency inverter continues to run, the terminal outputs the alarm signal.
36	This time running time reached	If the current running time of frequency inverter exceeds the value of b2-31, the terminal becomes ON.
38	Accumulative running time reached	If the accumulative running time of the frequency inverter exceeds the time set in b2-21, the terminal becomes ON.

b4-10	FMR ON delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b4-11	FMR OFF delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b4-12	Relay 1 ON delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b4-13	Relay 1 OFF delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b4-14	Relay 2 ON delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	
b4-15	Relay 2 OFF delay time	Default	0.0s
	Setting Range	0.0s~3000.0s	

These parameters are used to set the delay time of output terminals FMR, relay, DO1, DO2 and DO3 from status change to actual output.

b4-20	DO logic selection 1	Default	00000	
	Setting Range	Unit's digit: FMR valid mode.		
		0	Positive logic	
		1	Negative logic	
		Ten's digit: Relay 1 valid mode 0, 1 (same as FMR)		
		Hundred's digit: Relay 2 valid mode. 0, 1 (same as FMR)		
		Thousand's digit: DO1 valid mode. 0, 1 (same as FMR)		
Ten thousand's digit: DO2 valid mode. 0, 1 (same as FMR)				

It is used to set the logic of output terminals FMR, relay, DO1 and DO2.

0: Positive logic

The output terminal is valid when being connected with COM, and invalid when being disconnected from COM.

1: Negative logic

The output terminal is invalid when being connected with COM, and valid when being disconnected from COM.

b4-22	Frequency detection value 1 (FDT1)	Default	50.00 Hz
	Setting Range	0.00 Hz~ maximum frequency	
b4-23	Frequency detection hysteresis 1 (FDT hysteresis 1)	Default	5.0%
	Setting Range	0.0%~100.0% (FDT1 level)	

If the running frequency is higher than the value of b4-22, the corresponding DO terminal becomes ON. If the running frequency is lower than value of b4-22, the DO terminal goes OFF.

These two parameters are respectively used to set the detection value of output frequency and hysteresis value of cancellation of the output. The value of b4-23 is a percentage of the hysteresis frequency to the frequency detection value (b4-22). The FDT function is shown in the following Diagram 5-14.

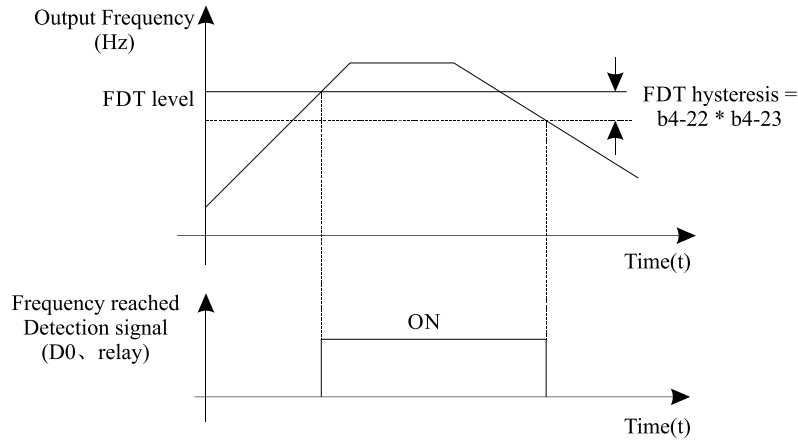


Diagram 5-14 FDT level

b4-24	Detection width of frequency	Default	0.0%
	Setting Range	0.0%~100.0%(maximum frequency)	

If the frequency inverter running frequency is within the certain range of the set frequency, the corresponding DO terminal becomes ON.

This parameter is used to set the range within which the output frequency is detected to reach the set frequency. The value of this parameter is a percentage relative to the maximum frequency. The detection range of frequency reached is shown in the following diagram 5-15.

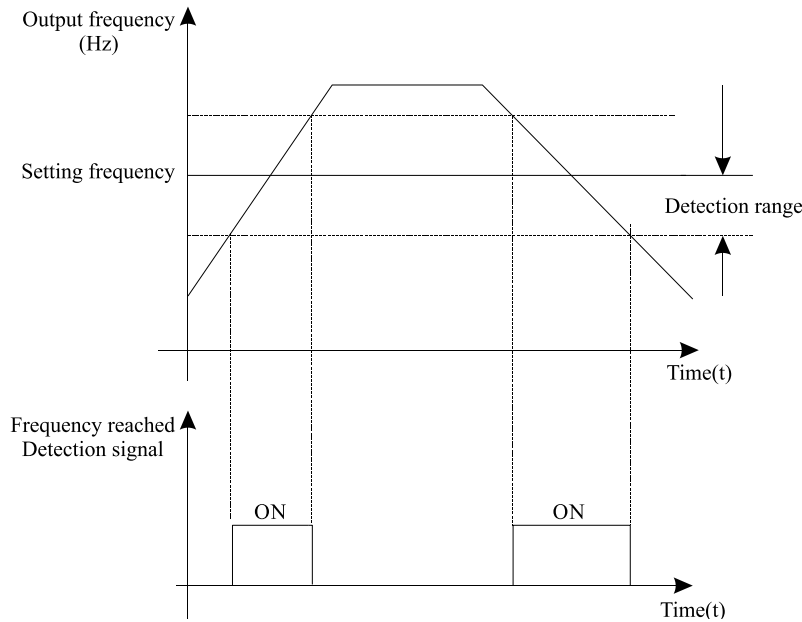


Diagram 5-15 Detection range of frequency reached

b4-25	Frequency detection value 2 (FDT2)	Default	50.00Hz
	Setting Range	0.00 Hz~ maximum frequency	
b4-26	Frequency detection hysteresis 2 (FDT hysteresis 2)	Default	5.0%
	Setting Range	0.00~100% ((FDT2))	

The frequency detection function is the same as FDT1 function. For details, refer to the descriptions of b4-22 and b4-23.

b4-27	Any frequency reaching detection value 1	Default	50.00 Hz
	Setting Range	0.00 Hz ~ maximum frequency	
b4-28	Any frequency reaching detection amplitude 1	Default	0.0%
	Setting Range	0.0%~100.0% (maximum frequency)	

b4-29	Any frequency reaching detection value 2		Default	50.00 Hz
	Setting Range	0.00 Hz ~ maximum frequency		
b4-30	Any frequency reaching detection amplitude 2		Default	0.0%
	Setting Range	0.0%~100.0% (maximum frequency)		

If the output frequency of the frequency inverter is within the positive and negative amplitudes of the any frequency reaching detection value, the corresponding DO becomes ON.

The EM15 provides two groups of any frequency reaching detection parameters, including frequency detection value and detection amplitude, as shown in the following figure.

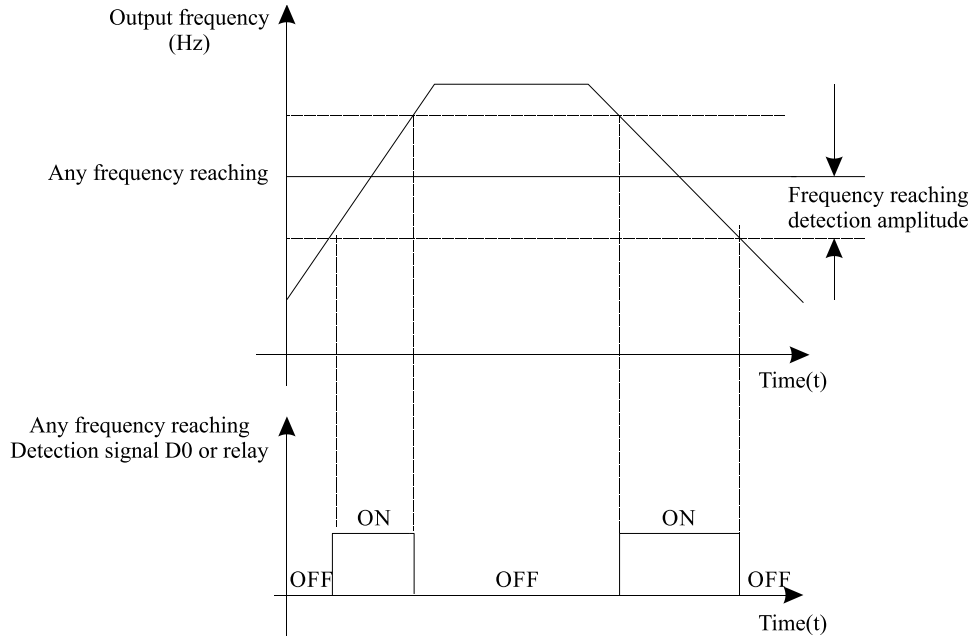


Diagram 5-16 Any frequency reaching detection

b4-31	Zero current detection level		Default	5.0%
	Setting Range	0.0%~100.0% (rated motor current)		
b4-32	Zero current detection delay time		Default	0.10s
	Setting Range	0.00s~600.00s		

If the output current of the frequency inverter is equal to or less than the zero current detection level and the duration exceeds the zero current detection delay time, the corresponding DO becomes ON. The zero current detection is shown in the following figure.

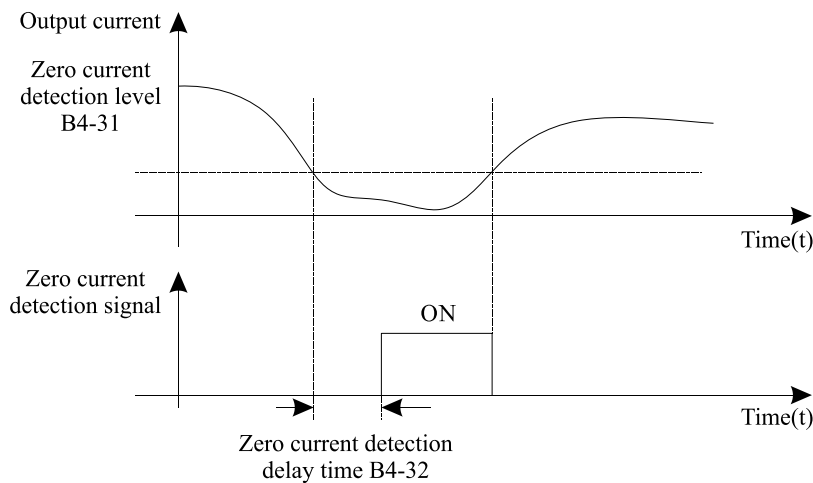


Diagram 5-17 Zero current detection

b4-33	Over current output threshold	Default	200.0%
	Setting Range	0.0%~300.0% (rated motor current)	
b4-34	Over current output detection delay time	Default	0.00s
	Setting Range	0.00s~600.00s	

If the output current of the frequency inverter is equal to or higher than the over current threshold and the duration exceeds the detection delay time, the corresponding DO becomes ON. The output over currentdetection function is shown in the following figure.

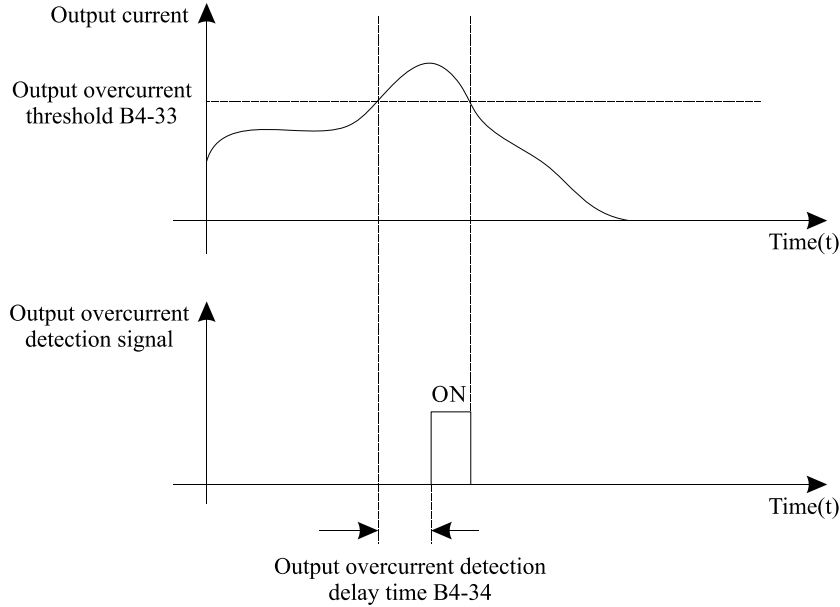


Diagram 5-18 Output over current detection

b4-35	Any current reaching 1	Default	100.0%
	Setting Range	0.0%~100.0% (rated motor current)	
b4-36	amplitude of any current reaching 1	Default	0.0%
	Setting Range	0.0%~100.0% (rated motor current)	
b4-37	Any current reaching 2	Default	100.0%
	Setting Range	0.0%~100.0% (rated motor current)	
b4-38	amplitude of any current reaching 2	Default	0.0%
	Setting Range	0.0%~100.0% (rated motor current)	

If the output current of the frequency inverter is within the positive and negative amplitudes of any current reaching detection value, the corresponding DO becomes ON.

The EM15 provides two groups of any current reaching detection parameters, including current detection value and detection amplitudes, as shown in the following figure.

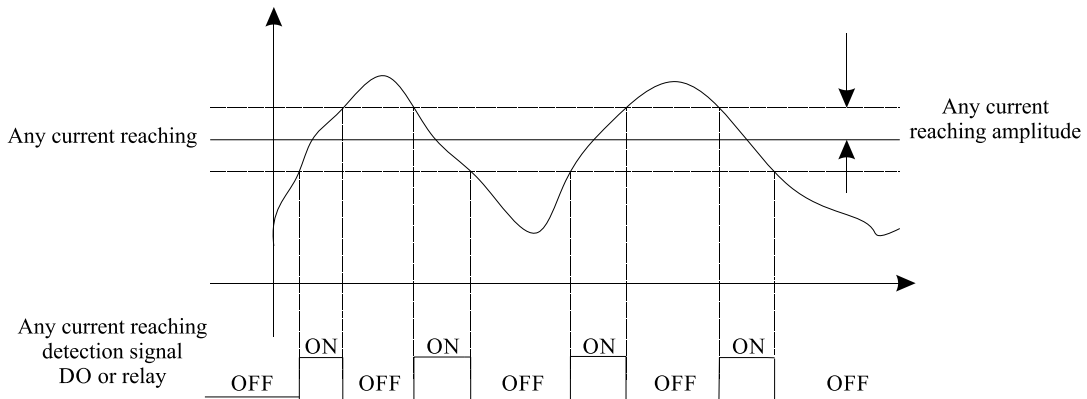


Diagram 5-19 Any current reaching detection

b4-39	IGBT module temperature threshold		Default	75°C
	Setting Range	25~100°C		

When the heatsink temperature of the frequency inverter reaches the value of this parameter, the corresponding DO becomes ON, indicating that the IGBT module temperature reaches the threshold.

5.6 Group b5: Pulse/Analog input terminals

b5-00	Pulse minimum input(HDI)		Default	0.00 kHz
	Setting Range	0.00 kHz ~b5-02		
b5-01	Corresponding setting of pulse minimum input		Default	0.00%
	Setting Range	-100.00% ~100.0%		
b5-02	Pulse maximum input		Default	50.00 kHz
	Setting Range	b5-00 ~ 100.00 kHz		
b5-03	Corresponding setting of pulse maximum input		Default	100.0%
	Setting Range	-100.00% ~100.0%		
b5-04	Pulse filter time		Default	0.10s
	Setting Range	0.00s~10.00s		

Can only be input by HDI. The method of setting this function is similar to that of setting A11 function..

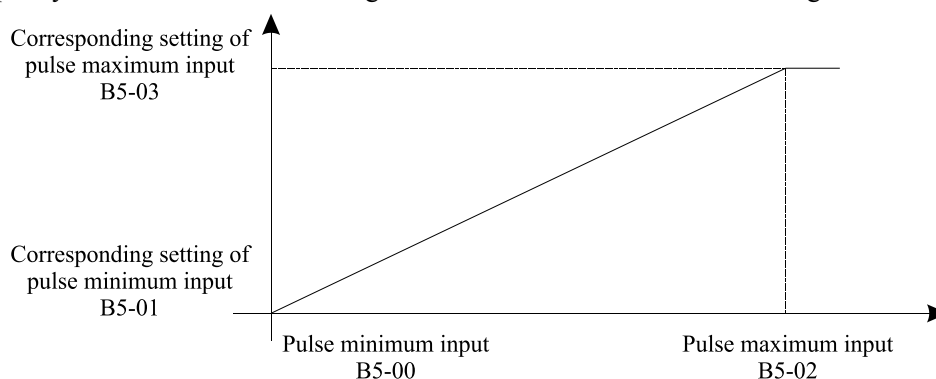


Diagram 5-20 The relationship between pulse input and setting value

b5-05	A11 input voltage lower limit of protection		Default	3.10 V
	Setting Range	0.00 V~ b5-06		
b5-06	A11 input voltage upper limit of protection		Default	6.80 V
	Setting Range	b5-05~10.00 V		

These two parameters are used to set the limits of the input voltage to provide protection on the frequency inverter. When the A11 input is larger than the value of b5-06 or smaller than the value of b5-05, the corresponding DO becomes ON, indicating that A11 input exceeds the limit. Every analog input has five setting points to facilitate the setting of the AI curve.

b5-07	A11 input minimum value		Default	0.00 V
	Setting Range	0.00 V ~ b5-15		
b5-08	Corresponding setting of A11 minimum input		Default	0.0%
	Setting Range	-100.00% ~100.0%		
b5-09	Second point input value of A11		Default	10.00V
	Setting Range	0.00 V~10.00 V		

b5-10	Corresponding setting of second point input value of AI1		Default	100.0%
	Setting Range	-100.0% ~100.0%		
b5-11	AI1 input filter time		Default	0.01s
	Setting Range	0.00s~10.00s		
b5-12	AI2 input minimum value		Default	2.00V
	Setting Range	0.00 V~10.00 V		
b5-13	Corresponding setting of AI2 minimum input		Default	0.0%
	Setting Range	-100.0% ~100.0%		
b5-14	AI2 Maximum input value		Default	10.00V
	Setting Range	0.00 V~10.00 V		
b5-15	Corresponding setting of AI2 Maximum input value		Default	100%
	Setting Range	-100.0% ~100.0%		
b5-16	AI2 input filter time		Default	0.10s
	Setting Range	0.00s~10.00s		
b5-17	AI3 input minimum value		Default	-10.00V
	Setting Range	-10.00V~10.00V		
b5-18	Corresponding setting of AI3 minimum input		Default	0.0%
	Setting Range	-100.0%~100.0%		
b5-19	AI3 Maximum input value		Default	10.00V
	Setting Range	0.00 V~10.00 V		
b5-20	Corresponding setting of AI3 Maximum input value		Default	100.0%
	Setting Range	-100.0%~100.0%		
b5-21	AI3 input filter time		Default	0.10s
	Setting Range	0.00s~10.00s		

These parameters are used to define the relationship between the analog input voltage and the corresponding setting value.

When the analog input is current input, 1 mA current corresponds to 0.5 Volts.

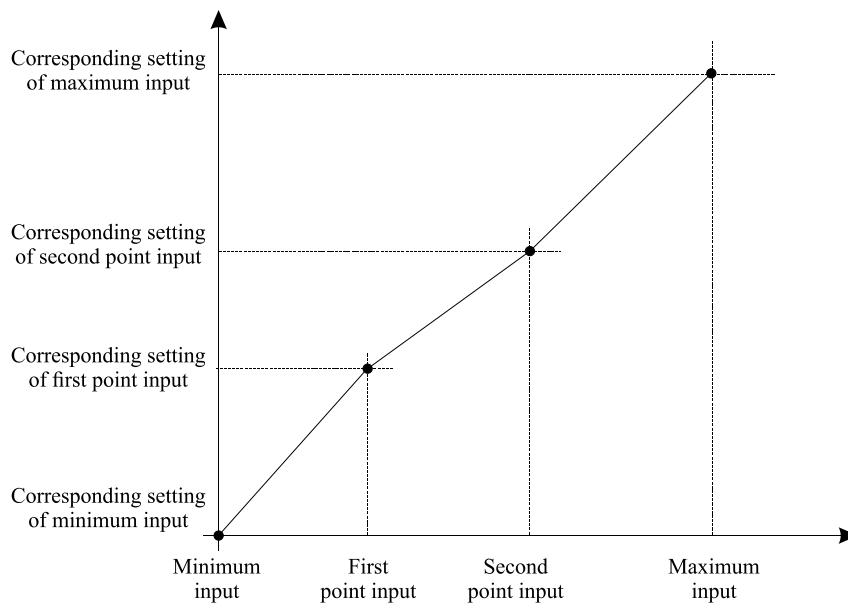


Diagram 5-21 Corresponding relationship between analog input and setting values

b5-17 (AI1 filter time) is used to set the software filter time of AI1. If the analog input is liable to interference, increase the value of this parameter to stabilize the detected analog input. However, increase of the AI filter time will slow down the response of analog detection. Set this parameter properly based on actual conditions.

In different applications, 100% of analog input corresponds to different nominal values. For details, refer to the description of different applications.

For the setting method of AI curve 2 and AI curve 3, please refer to AI curve 1.

b5-22	AI curve 4 minimum input		Default	0.00V
	Setting Range	-10.00V~b5-24		
b5-23	Corresponding setting of AI curve 4 minimum input		Default	0.0%
	Setting Range	-100.0%~+100.0%		
b5-24	AI curve 4 inflection point 1 input		Default	3.00V
	Setting Range	b5-21~b5-26		
b5-25	Corresponding setting of AI curve 4 inflection point 1 input		Default	30.0%
	Setting Range	-100.0%~+100.0%		
b5-26	Corresponding setting of AI curve 4 inflection point 2 input		Default	6.00V
	Setting Range	b5-23~b5-27		
b5-27	AI curve 4 inflection point 2 input		Default	60.0%
	Setting Range	-100.0%~+100.0%		
b5-28	AI curve 4 Maximum input		Default	10.00V
	Setting Range	b5-27~+10.00V		
b5-29	Corresponding setting of AI curve 4 Maximum input		Default	100.0%
	Setting Range	-100.0%~+100.0%		
b5-30	AI curve 5 minimum input		Default	-10.00V
	Setting Range	-10.00V~b5-31		
b5-31	Corresponding setting of AI curve 5 minimum input		Default	-100.0%
	Setting Range	-100.0%~+100.0%		
b5-32	AI curve 5 inflection point 1 input		Default	-3.00V
	Setting Range	b5-28~b5-33		
b5-33	Corresponding setting of AI curve 5 inflection point 1 input		Default	-30.0%
	Setting Range	-100.0%~+100.0%		
b5-34	AI curve 5 inflection point 2 input		Default	3.00V
	Setting Range	b5-31~b5-35		
b5-35	Corresponding setting of AI curve 5 inflection point 2 input		Default	30.0%
	Setting Range	-100.0%~+100.0%		
b5-36	AI curve 5 Maximum input		Default	10.00V
	Setting Range	b5-33~+10.00V		
b5-37	Corresponding setting of AI curve 5 Maximum input		Default	100.0%
	Setting Range	-100.0%~+100.0%		
b5-38	AI1 jump point		Default	0.0%
	Setting Range	-100.0%~100.0%		
b5-39	AI1 jump amplitude		Default	0.5%
	Setting Range	0%~100.0%		
b5-40	AI2 jump point		Default	0.0%
	Setting Range	-100.0%~100.0%		
b5-41	AI2 jump amplitude		Default	0.5%
	Setting Range	0%~100.0%		
b5-42	AI3 jump point		Default	0.0%
	Setting Range	-100.0%~100.0%		
b5-43	AI3 jump amplitude		Default	0.5%
	Setting Range	0%~100.0%		

b5-44	AI curve selection		Default	H321
	Setting Range	Unit's digit:AI1 curve selection		
		1	curve 1(2 point, refer b5-07~b5-10)	
		2	curve 2(2 point, refer b5-12~b5-15)	
		3	curve 3(2 point, refer b5-17~b5-20)	
		4	curve 4(4 point, refer b5-22~b5-29)	
		5	curve 5(4 point, refer b5-30~b5-37)	
		Ten's digit:AI2curve selection,same as above		
Hundred's digit:AI3 curve selection,same as above				
b5-45	AI lower than minimum input setting selection		Default	H.000
	Setting Range	Unit's digit:AI1 lower than minimum input setting		
		0	corresponding minimum input setting	
		1	0.0%	
		Ten's digit:AI2 lower than minimum input setting selection, same as above		
		Hundred's digit:AI3 lower than minimum input setting selection, same as above		

The AI terminals (AI1 to AI3) of EM15 all support the corresponding setting jump function, which fixes the AI input corresponding setting at the jump point when AI input corresponding setting jumps around the jump range.

For example:

AI1 input voltage fluctuation around 5.00V and the amplitude range is 4.90V~5.10V. AI1 minimum input 0.00V corresponds to 0.00% and maximum input 10.00V corresponds to 100.0%. The detected AI1 input corresponding setting varies between 49.0% and 51.0%.

If you set jump point b5-38 to 50.0% and jump amplitude b5-39 to 1.0%, then frequency inverter obtained AI1 input corresponding setting is fixed to 50.0%, eliminating the fluctuation effect.

5.7 Group b6: Pulse/analog output terminals

b6-00	FMP function selection	Default	0
b6-01	AO1 output function selection	Default	0
b6-02	AO2 output function selection	Default	1

The output pulse frequency of the FMP terminal ranges from 0.01 kHz to "Maximum FMP output frequency" (b6-03). The value of b6-03 is between 0.01 kHz and 50.00 kHz.

The output range of AO1 is 0V~10 V or 0mA~20mA. The output range of AO2 is 0~10V, The relationship between pulse and analog output ranges and corresponding functions is listed in the following table.

Value	Function	Range (Corresponding to Pulse or Analog Output Range 0.0%~100.0%)
0	Running frequency	0Hz~ maximum output frequency
1	Setting frequency	0Hz~ maximum output frequency
2	Output current	0 ~2 times of rated motor current
3	Output torque (absolute value)	0~ 2 times of rated motor torque(absolute value of torque)
4	Output power	0 ~2 times of rated power
5	Output voltage	0 ~1.2 times of rated frequency inverter DC bus voltage
6	Motor rotational speed	0~rotational speed corresponding to maximum output frequency
7	Output current	0.0A~1000.0 A
8	Output voltage	0.0V~1000.0 V
9	Output torque (actual value)	-200% of rated motor torque~ 200% of rated motor torque
10	Pulse input	0.01 kHz ~100.00 kHz
11	AI1	0V~10 V
12	AI2	0V~10 V
13	AI3	0V~10 V
16	Communication setting	0~32767

b6-03	Maximum FMP output frequency		Default	50.00 kHz
	Setting Range	0.01 kHz ~100.00 kHz		

If the FM terminal is used for pulse output, this parameter is used to set the maximum frequency of pulse output.

b6-04	AO1 offset coefficient		Default	0.0%
	Setting Range	-100.0% ~100.0%		
b6-05	AO1 gain		Default	1.00
	Setting Range	-10.00~10.00		
b6-06	AO2 offset coefficient		Default	0.0%
	Setting Range	-100.0% ~100.0%		
b6-07	AO2 gain		Default	1.00
	Setting Range	-10.00~10.00		

These parameters are used to correct the zero drift of analog output and the output amplitude deviation. They can also be used to define the desired AO curve. If "b" represents zero offset, "k" represents gain, "Y" represents actual output, and "X" represents standard output, the actual output is: $Y = kX + b$.

The zero offset coefficient 100% of AO1 and AO2 corresponds to 10 V (or 20 mA). The standard output refers to the value corresponding to the analog output of 0 to 10 V (or 0 to 20 mA) with no zero offset or gain adjustment.

For example, if the analog output is used as the running frequency, and it is expected that the output is 8 V when the frequency is 0 and 3 V at the maximum frequency, the gain shall be set to -0.50, and the zero offset shall be set to 80%.

5.8 Group b7: Virtual digital input (VDI)/digital output (VDO) terminals

b7-00	VDI1 function selection	Default	0
b7-01	VDI2 function selection	Default	0
b7-02	VDI3 function selection	Default	0
b7-03	VDI4 function selection	Default	0
b7-04	VDI5 function selection	Default	0

VDI1~VDI5 have the same functions as DI terminals on the control board and can be used for digital input. For more details, see description of b3-00 ~ b3-11.

b7-05	VDI state setting mode		Default	00000
	Setting Range	Unit's digit: VDI1.		
		0	Valid decided by state of VDOx	
		1	Valid decided by b7-06	
		Ten's digit: VDI2 0, 1 (same as VDI1)		
		Hundred's digit: VDI3. 0, 1 (same as VDI1)		
		Thousand's digit: VDI4. 0, 1 (same as VDI1)		
Ten thousand's digit: VDI5. 0, 1 (same as VDI1)				
b7-06	VDI state setting		Default	00000
	Setting Range	Unit's digit: VDI1.		
		0	Invalid	
		1	Valid	
Ten's digit: VDI2 0, 1 (same as VDI1)				

	Hundred's digit: VDI3. 0, 1 (same as VDI1)
	Thousand's digit: VDI4. 0, 1 (same as VDI1)
	Ten thousand's digit: VDI5. 0, 1 (same as VDI1)

Different from DI terminals, VDI state can be set in two modes, selected in b7-05:

- For example 1:Decided by state of VDOx

Whether the state of VDI is valid or not, that is determined by the state of the corresponding VDO. VDI x is uniquely bound to VDO x (x is one of 1~5). For example, to implement the function that the frequency inverter reports an alarm and stops when the AI1 input exceeds the limit, perform the following setting:

1. Set VDI1 with function 44 "User-defined fault 1" (b7-00 = 44).
2. VDI1 terminal valid is decided by state of VDO1 (b7-05= xxx0).
3. Set VDO1 with function "AI1 input limit exceeded" (b7-11 = 31).

When the AI1 input exceeds the limit, VDO1 becomes ON. At this moment, VDI1 becomes ON and the frequency inverter receives you-defined fault 1. Then the frequency inverter reports Err27 and stops.

- Example 2: Decided by b7-06

The VDI state is determined by b7-06. For example, to implement the function that the frequency inverter automatically enters the running state after power-on, perform the following setting:

1. Set VDI1 with function 1 "Forward RUN (FWD)" (b7-00 = 1).
2. Set b7-05 to xxx1: The state of VDI1 is decided by b7-06.
3. Set b7-06 to xxx1: VDI1 is valid.
4. Set b0-02 to 1: The command source to terminal control.
5. Set b2-32 to 0: Startup protection is not enabled.

When the frequency inverter completes initialization after power-on, it detects that VDI1 is valid and VDI1 is set with the function of forward RUN. That is, the frequency inverter receives the forward RUN command from the terminal. Therefore, the frequency inverter starts to run in forward direction.

b7-07	Function selection for AI1 used as DI		Default	0
	Setting Range	0~49		
b7-08	Function selection for AI2 used as DI		Default	0
	Setting Range	0~49		
b7-09	Function selection for AI3 used as DI		Default	0
	Setting Range	0~49		
b7-10	Valid state selection for AI used as DI		Default	0
	Setting Range	Unit's digit: AI1..		
		0	High level valid	
		1	Low level valid	
		Ten's digit: AI2. 0, 1 (same as unit's digit)		
Hundred's digit: AI3.0, 1 (same as unit's digit)				

The functions of these parameters are to use AI as DI. When AI is used as DI, the AI state is high level if the AI input voltage is 7 V or higher and is low level if the AI input voltage is 3 V or lower.

If the AI input voltage is between 3 V and 7 V, the AI state is hysteresis. And then b7-10 is used to determine whether high level valid or low level valid when AI is used as DI.

The setting of AI (used as DI) function is the same as that of DI. For details, see the descriptions of DI setting.

The following figure takes AI input voltage as an example to describe the relationship between AI input voltage and corresponding DI state.

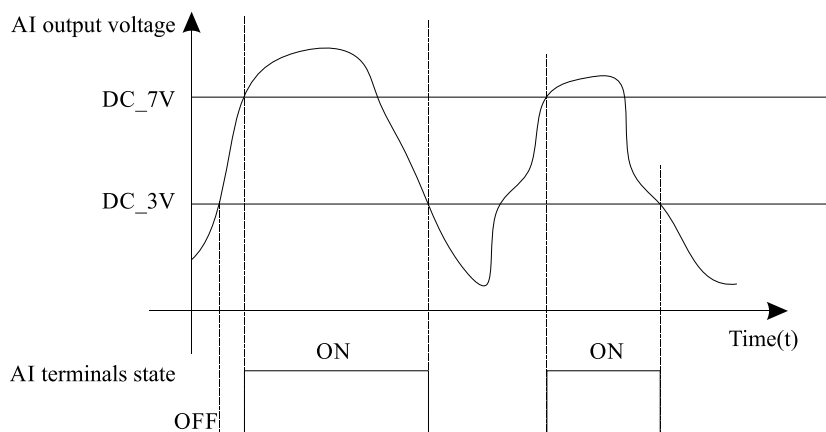


Diagram 5-22 Relationship of AI input voltage and corresponding DI status

b7-11	VDO1 function selection		Default	0
	Setting Range	0: connect with physical DIx internally 1~38: Check b4 group physical DO output selection		
b7-12	VDO2 function selection		Default	0
	Setting Range	0: connect with physical DIx internally 1~38: Check b4 group physical DO output selection		
b7-13	VDO3 function selection		Default	0
	Setting Range	0: connect with physical DIx internally 1~38: Check b4 group physical DO output selection		
b7-14	VDO4 function selection		Default	0
	Setting Range	0: connect with physical DIx internally 1~38: Check b4 group physical DO output selection		
b7-15	VDO5 function selection		Default	0
	Setting Range	0: connect with physical DIx internally 1~38: Check b4 group physical DO output selection		
b7-16	VDO1 output delay		Default	0.0s
	Setting Range	0.0s~3000.0s		
b7-17	VDO2 output delay		Default	0.0s
	Setting Range	0.0s~3000.0s		
b7-18	VDO3 output delay		Default	0.0s
	Setting Range	0.0s~3000.0s		
b7-19	VDO4 output delay		Default	0.0s
	Setting Range	0.0s~3000.0s		
b7-20	VDO5 output delay		Default	0.0s
	Setting Range	0.0s~3000.0s		
b7-21	VDO valid state selection		Default	00000
	Setting Range	Unit's digit: VDO1.		
		0	Positive logic valid	
		1	Reverse logic valid	
		Ten's digit: VDO2 0, 1 (same as unit's digit)		
		Hundred's digit: VDO3. 0, 1 (same as unit's digit)		
		Thousand's digit: VDO4. 0, 1 (same as unit's digit)		
Ten thousand's digit: VDO5. 0, 1 (same as unit's digit)				

VDO functions are similar to the DO functions on the control board. The VDO can be used together with VDIx to implement some simple logic control.

- If VDO function is set to 0, the state of VDO1 to VDO5 is determined by the state of DI1 to DI5 on the control board. In this case, VDOx and DIx are one-to-one mapping relationship.

● If VDO function is set to non-0, the function setting and use of VDOx are the same as DO in group b4. The VDOx state valid can be set in b7-21. The application examples of VDIx involved the usage of VDOx, and please see these examples for your reference.

5.9 Group b9: Keypad and Display

b9-00	STOP/RESET key function		Default	1
	Setting Range	0	STOP/RESET key enabled only in operation panel control	
		1	STOP/RESET key enabled in any operation mode	
b9-01	STOP/RESET key function		Default	3
	Setting Range	0	MF.K key disabled	
		1	Switchover between operation panel control and remote command control (terminal or communication)	
		2	Switchover between forward rotation and reverse rotation	
		3	Forward JOG	
		4	Reverse JOG	
5		Function parameters		

MF.K key refers to multifunctional key. You can set the function of the MF.K key by using this parameter. You can perform switchover by using this key both in stop or running state.

0: MF.K key disabled

This key is disabled.

1: Switchover between operation panel control and remote command control (terminal or communication)

You can perform switchover from the present command source to the operation panel control (local operation). If the present command source is operation panel control, this key is invalid.

2: Switchover between forward rotation and reverse rotation

You can change the direction of the frequency inverter running by using the MF.K key. It is invalid only when the present command source is operation panel control.

3: Forward JOG

You can perform forward JOG (FJOG) by using the MF.K key.

4: Reverse JOG

You can perform reverse JOG (RJOG) by using the MF.K key.

5: Function parameters

You can view function parameters by using the MF.K key.

BASE	Show all function parameters in sequence
USER	View or modify common user parameters
C	The function parameters that have been modified by a user are shown here.

b9-02	LED display running parameters 1	Default	H.001F
	Setting Range	<p>0000~FFFF:</p> <p>If a parameter needs to be displayed during the running, set the corresponding bit to 1, and set b9-02 to the hexadecimal equivalent of this binary number.</p>	
b9-03	LED display running parameters 2	Default	H.0000
	Setting Range	<p>0000~FFFF:</p> <p>If a parameter needs to be displayed during the running, set the corresponding bit to 1, and set b9-03 to the hexadecimal equivalent of this binary number.</p>	

These two parameters are used to set the monitoring parameters that can be viewed when the frequency inverter is in the running state. You can view a maximum of 32 running state. The displaying sequence is displayed from the lowest bit of b9-02.

b9-04	LED display parameter of stopping		Default	H.0033
	Setting Range	<p>0000~FFFF:</p> <p>If a parameter needs to be displayed during the running, set the corresponding bit to 1, and set b9-04 to the hexadecimal equivalent of this binary number.</p>		

b9-05	Load speed display coefficient	Default	0.2920
	Setting Range	0.0001~ 6.5000	

This parameter is used to adjust the relationship between the output frequency of frequency inverter and the load speed. For details, see the description of b9-06.

b9-06	Number of decimal places for load speed display		Default	0
	Setting Range	0	0 decimal display	
		1	1 decimal display	
		2	2 decimal display	
		3	3 decimal display	

b9-06 is used to set the number of decimal places for load speed display. The following gives an example to explain how to calculate the load speed:

Assume that b9-05 (Load speed display coefficient) is 0.2920 and b9-06 is 0 (0 decimal places). When the running frequency of the frequency inverter is 40.00 Hz, the load speed is

$$40.00(\text{Running frequency}) \times 0.2920 \times 100 = 1168$$

If the frequency inverter is in the stop state, the load speed is the speed corresponding to the set frequency, namely, "setting load speed". If the set frequency is 50.00 Hz, the load speed in the stop state is

$$50.00(\text{Setting frequency}) \times 0.292 \times 100 = 1460$$

b9-07	Heatsink temperature	Default	--
	Setting Range	0.0°C ~100.0°C	

It is used to display the temperature of heatsink.

Different inverter model has different temperature value for over-temperature protection.

b9-09	Accumulative running time		Default	--
	Setting Range	0~65535 h		

It is used to display the accumulative running time of the frequency inverter. After the accumulative running time reaches the value set in b2-21, the terminal with the digital output function 12 becomes ON.

b9-11	Auxiliary LED display parameters		Default	00004
	Setting Range	Corresponding U0 group parameters		

It is used to setting auxiliary LED display parameters.

For Example:

If b9-11 setting to 00001, the auxiliary LED display setting frequency (U0-01)

If b9-11 setting to 00004, the auxiliary LED display output frequency (U0-04)

U0 monitoring parameters:

U0-00	Running frequency	U0-18	Input pulse frequency	U0-37	Power factor angle
U0-01	Setting frequency	U0-19	Feedback speed, unit:0.01Hz	U0-38	ABZ position
U0-02	DC Bus voltage	U0-20	Remaining running time	U0-39	Target voltage of V/F separation
U0-03	Output voltage	U0-21	AI1 voltage before correction	U0-40	Output voltage of V/F separation
U0-04	Output current	U0-22	AI2 voltage before correction	U0-41	DI input state visual display
U0-05	Output power	U0-23	AI3 voltage before correction	U0-42	DO output state visual display
U0-06	Output torque	U0-24	Linear speed	U0-43	DI function state visual display 1
U0-07	DI state	U0-26	Present power-on time	U0-44	DO function state visual display 2
U0-08	DO state	U0-27	Present running time	U0-45	Fault information
U0-09	AI1 voltage	U0-28	Actual feedback speed	U0-46	Phase Z signal counting
U0-10	AI2 voltage	U0-29	Encoder feedback speed	U0-47	Present setting frequency (%)
U0-11	AI3 voltage	U0-30	Main frequency X	U0-48	Present running frequency (%)
U0-14	Load speed display	U0-31	Auxiliary frequency Y	U0-49	Frequency inverter running state
U0-15	PID setting	U0-32	Viewing any register address value	U0-50	Sent value of point-point communication
U0-16	PID feedback	U0-34	Motor temperature	U0-51	Received value of point-point communication
U0-17	PLC stage	U0-35	Target torque		

5.10 Group bA: Communication parameters

bA-00	Communication type selection		Default	0
	Setting Range	0: Modbus protocol		

The EM15 now supports Modbus, later will add the communication protocol such as PROFIBUS-DP and CANopen. For details, see the description of "EM15 communication protocol".

bA-01	Baud ratio setting		Default	5
	Setting Range	0:300BPS 1:600BPS 2:1200BPS 3:2400BPS 4:4800BPS 5:9600BPS 6:19200BPS 7:38400BPS		

This parameter is used to set the data transfer baud rate from host computer to frequency inverter. Please note that baud rate of the host computer and the inverter should be consistent. Otherwise, the communication is impossible.

The higher the baud rate is, the faster the communication is.

bA-02	Modbus Data format		Default	0
	Setting Range	0	No check, data format <8,N,2>	
		1	Even parity check, data format<8,E,1>	
		2	Odd Parity check, data format<8,O,1>	
		3	No check, data format <8,N,1>	

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

bA-03	Broadcast address		Default	1
	Setting Range	1~249 (0: Broadcast address) Valid for Modbus		

When the local address is set to 0, that is, broadcast address, it can realize the broadcast function of host computer. The address is unique; it is base of point to point communication between host computer and frequency inverter.

bA-04	Modbus response delay		Default	2 ms
	Setting Range	0~20 ms (Only valid for Modbus)		

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

bA-05	Communication timeout		Default	0.0s
	Setting Range	0.0s:invalid 0.1s~60.0s Valid for Modbus		

When this parameter is set to 0.0s, the communication interface timeout function is invalid.

When the function code is set to a value, if the interval time between this communication and the next communication is beyond the communication timeout, the system will report communication failure error (Err16). At normal application, it will be set as invalid. If in the continuous communication system, setting this parameter, you can monitor the communication status.

bA-06	Modbus protocol data transmission format selection		Default	31
	Setting Range	Unit's digit: Modbus protocol.		
		0	Non-standard Modbus protocol	
		1	Standard Modbus protocol	
		Ten's digit: Profibus-DP		
		0	PP01	
		1	PP02	
		2	PP03	
3		PP05		

bA-06=1: Select standard Modbus protocol.

bA-06=0: When reading the command, the slave machine return is one byte more than the standard Modbus protocol's, for details, refer to communication data structure of appendix .

bA-07	Communication reading current resolution			Default	0
	Setting	0	0.01A		
	Range	1	0.1A		

It is used to confirm the unit of current value when the communication reads the output current.

5.11 Group bb: Fault and Protection

bb-00	G/P type selection			Default	1
	Setting	0	P type		
	Range	1	G type		

This parameter is used to display the delivered model and cannot be modified.

0: Applicable to variable torque load (fan and pump) with rated parameters specified.

1: Applicable to constant torque general load with rated parameters specified.

bb-01	Motor overload protection selection			Default	1
	Setting	0	Disabled		
	Range	1	Enabled		
bb-02	Motor overload protection gain			Default	1.00
	Setting Range	0.20~10.00			

- bb-01 = 0

The motor overload protective function is disabled. The motor is exposed to potential damage due to overheating. A thermal relay is suggested to be installed between the frequency inverter and the motor.

- bb-01 = 1

The frequency inverter judges whether the motor is overloaded according to the inverse time-lag curve of the motoroverload protection.

The inverse time-lag curve of the motor overload protection is:

$$220\% \times (\text{bb-02}) \times \text{rated motor current}$$

(if the load remains at this value for one minute, the frequency inverter reports motor overload fault), or

$$150\% \times (\text{bb-02}) \times \text{rated motor current}$$

(if the load remains at this value for 60 minutes, the frequency inverter reports motor overload fault).

Set bb-02 properly based on the actual overload capacity. If the value of bb-02 is set too large, may result in damaging to the motor because the motor overheats but the frequency inverter does not report the alarm.

bb-03	Motor overload pre-warning coefficient			Default	80%
	Setting Range	50%~100%			

This function is used to give a warning signal to the control system via DO before motor overload protection. This parameter is used to determine the percentage, at which pre- warning is performed before motor overload. The larger the value is, the less advance the pre-warning will be.

When the output current of the frequency inverter is greater than the value of the overload inverse time-lag curve multiplied by bb-03, the DO terminal of the frequency inverter set with motor overload pre-warning becomes ON.

bb-09	Fault auto reset times			Default	0
	Setting Range	0~20(Unlimited number of times)			

It is used to set the times of fault auto resets if this function is used. After the value is exceeded, the frequency

inverter will remain in the fault state.

bb-10	Relay action selection during fault auto reset			Default	0
	Setting	0	Not act		
	Range	1	Act		

It is used to decide whether DO acts during the fault auto reset if the fault auto reset function is used.

bb-11	Time interval of fault auto reset			Default	1.0s
	Setting Range	0.1s~100.0s			

It is used to set the waiting time from the frequency inverter alarm to fault auto reset.

bb-12	Input phase loss protection/contactor energizing protection selection			Default	11
	Setting Range	Unit's digit: Input phase loss protection			
		0	Disabled		
		1	Enabled		
Ten's digit: Contactor energizing protection 0,1(same as Unit's digit)					

It is used to determine whether to perform input phase loss or contactor energizing protection.

The EM15 models that provide this function are listed in the following table.

Voltage Class	Models
Single-phase 220 V	None
Three-phase 220 V	From 11 kW G model
Three-phase 380 V	From 18.5 kW G model
Three-phase 690 V	From 18.5 kW G model

For every voltage class, the EM15 frequency inverters provide function of input phase loss or contactor energizing protection for above model. The EM15 Frequency inverters do not have this function below the power listed in the table no matter whether bb-12 is set to 0 or 1.

bb-13	Output phase loss protection			Default	1
	Setting	0	Disabled		
	Range	1	Enabled		

It is used to determine whether to perform output phase loss protection.

bb-14	Off load protection			Default	0
	Setting Range	0	Disabled		
		1	Enabled		
bb-15	Off load detection level			Default	10.0%
	Setting Range	0.0%~100.0% (rated motor current)			
bb-16	Off load detection time			Default	1.0s
	Setting Range	0.0s~60.0s			

If off load protection is enabled, when the output current of the frequency inverter is lower than the detection level (bb-15) and the duration time exceeds the detection time (bb-16), the output frequency of frequency inverter automatically declines to 7% of the rated frequency. During the protection, the frequency inverter automatically accelerates to the set frequency if the load restore to normal.

bb-17	Over-speed detection value		Default	20.0%
	Setting Range	0.0%~50.0% (maximum frequency)		
bb-18	Over-speed detection time		Default	1.0s
	Setting Range	0.0s~60.0s		

This function is valid only when the frequency inverter runs in the VC+PG mode.

If the actual motor rotational speed detected by the frequency inverter exceeded the maximum frequency and the excessive value is greater than the value of bb-17 and the lasting time exceeded the value of bb-18, the frequency inverter reports Err43 and acts according to the selected fault protection action.

If the bb-18(over-speed detection time) is 0.0s, the over-speed detection function is disabled.

bb-19	Detection value of too large speed deviation		Default	20.0%
	Setting Range	0.0%~50.0% (maximum frequency)		
bb-20	Detection time of too large speed deviation		Default	5.0s
	Setting Range	0.0s~60.0s		

This function is valid only when the frequency inverter runs in the VC+PG mode.

If the frequency inverter detects the deviation over than bb-19 between the actual motor rotational and the setting motor frequency, and the duration time exceeds the value of bb-20, the frequency inverter reports Err42 and act according to the selected fault protection action.

If bb-20 (Detection time of too large speed deviation) is 0.0s, this function is disabled.

bb-21	Action selection at instantaneous power failure		Default	0
	Setting Range	0	Invalid	
		1	Decelerate	
		2	Decelerate to stop	
bb-22	Judging voltage of instantaneous power failure restoring		Default	85.0%
	Setting Range	60.0%~100.0%(standard bus voltage)		
bb-23	judging time of Instantaneous power rise		Default	0.50s
	Setting Range	0.00s~100.00s		
bb-24	Judging voltage of instantaneous power failure		Default	80.0%
	Setting Range	60.0%~100.0% (standard bus voltage)		

Of instantaneous power failure or sudden voltage dip, the DC bus voltage of the Frequency inverter reduces. This function enables the Frequency inverter to compensate the DC bus voltage reduction with the load feedback energy by reducing the output frequency so as to keep the Frequency inverter running continuously.

- If bb-21 = 1, when instantaneous power failure or sudden voltage dip, the frequency inverter decelerates until DC bus voltage restore to normal, the frequency inverter accelerates to the set frequency. If the DC bus voltage remains normal for the time exceeding the value set in bb-22, it is considered that the DC bus voltage restores to normal.
- If bb-21 = 2, when instantaneous power failure or sudden voltage dip, the frequency inverter decelerates to stop.

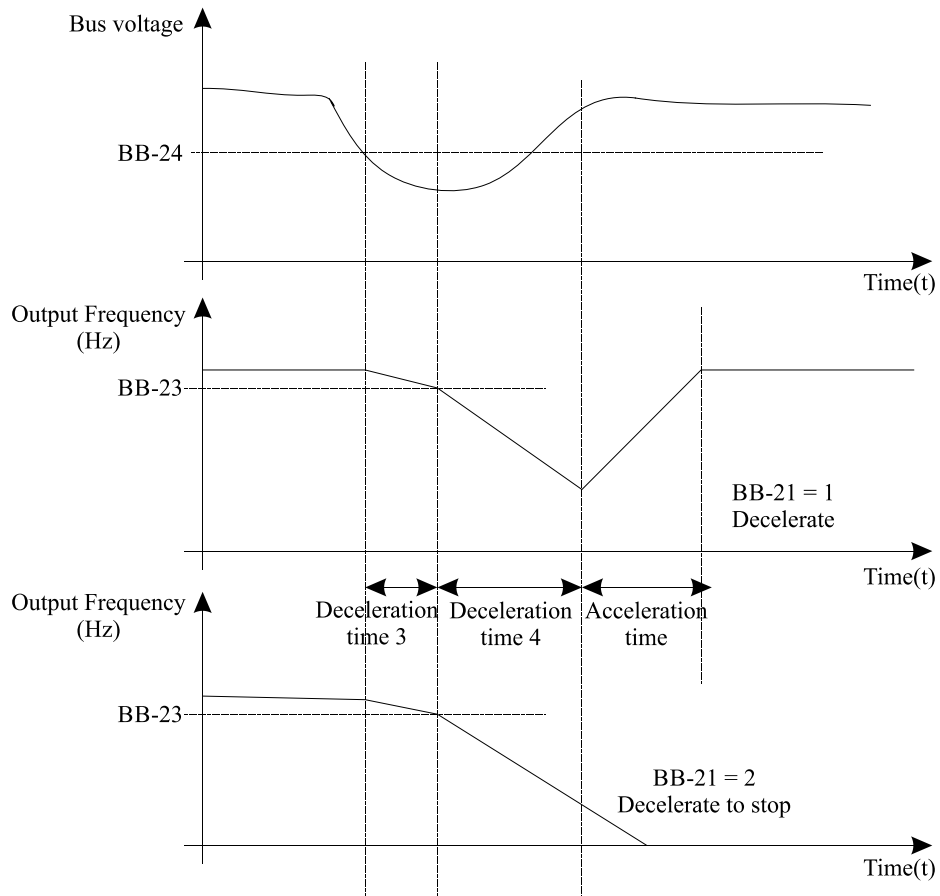


Diagram 5-24 Frequency inverter action diagram of instantaneous power failure

bb-25	Type of motor temperature sensor		Default	0
	Setting Range	0	No temperature sensor	
		1	PT100	
		2	PT1000	
bb-26	Motor overheat protection threshold		Default	110.0%
	Setting Range	0°C~200°C		
bb-27	Motor overheat pre-warning threshold		Default	90.0%
	Setting Range	0°C~200°C		

The signal of the motor temperature sensor needs to be connected to the optional I/O extension card. This card is an optional component. PG card also can be used for the temperature signal input with motor over-temperature protection function. Please contact with manufacturer or distributors.

The PG card interface of the EM15 supports both PT100 and PT1000. Set the sensor type correctly during the use. You can view the motor temperature via parameter U0-34.

If the motor temperature exceeds the value set in bb-26, the frequency inverter reports an alarm and acts according to the selected fault protection action.

If the motor temperature exceeds the value set in bb-27, the DO terminal of frequency inverter set with motor overheat warning becomes ON.

bb-28	Overvoltage threshold		Default	Model dependent
	Setting Range	200.0~2500.0 V		

It is used to set the overvoltage threshold of the frequency inverter. The default values of different voltage classes are

listed in the following table.

Voltage Class	Default Overvoltage Threshold
Single-phase 220 V	400.0 V
Three-phase 220 V	400.0 V
Three-phase 380 V	830.0 V
Three-phase 480 V	890.0 V

Note: The default value is also the upper limit of the frequency inverter's internal overvoltage protection voltage. The parameter becomes effective only when the setting of bb-28 is lower than the default value. If the setting is higher than the default value, use the default value.

bb-29	Under voltage threshold		Default	Model dependent
	Setting Range	200~2000V		

It is used to set the under voltage threshold of Err09. The default values of different voltage classes are listed in the following table.

Voltage Class	Nominal Value of under voltage threshold
Single-phase 220 V	200 V
Three-phase 220 V	200 V
Three-phase 380 V	350 V
Three-phase 480 V	450 V

bb-30	Brake unit use ratio		Default	100.0%
	Setting Range	0%~100%		

It is valid only for the frequency inverter with internal braking unit and used to adjust the duty ratio of the braking unit. The larger the value of this parameter is, the better the braking result will be. However, too larger value causes great fluctuation of DC bus voltage during the braking process.

bb-32	Fault protection action selection 1		Default	00000
	Setting Range	Unit's digit: Motor overload, Err11.		
		0	Free stop	
		1	Stop according to the stop mode	
		2	Continue to run	
		Ten's digit: Power input phase loss, Err12. Same as unit's digit		
		Hundred's digit: Power output phase loss, Err13. Same as unit's digit		
		Thousand's digit: External equipment fault, Err15. Same as unit's digit		
Ten thousand's digit: Communication fault, Err16. Same as unit's digit				
bb-33	Fault protection action selection 2		Default	00000
	Setting Range	Unit's digit: Encoder/PG card fault, Err20.		
		0	Free stop	
		Ten's digit: EEPROM read-write fault, Err21.		
		0	Free stop	
		1	Stop according to the stop mode	
		Hundred's digit : Reserved		
		Thousand's digit: Motor Overheat, Err25. Same as unit's digit in bb-32		
Ten thousand's digit: Running time reached, Err26. Same as unit's digit in bb-32				

bb-34	Fault protection action selection 3		Default	00000
	Setting Range	Unit's digit: User-defined fault 1,Err27. Same as unit's digit in bb-32		
		Ten's digit: User-defined fault 2,Err28. Same as unit's digit in bb-32		
		Hundred's digit: Accumulative power-on time reached,Err29. Same as unit's digit in bb-32		
		Thousand's digit: Off load, Err30.		
		0	Free stop	
		1	Stop according to the stop mode	
		2	Reduce to 7% of rated motor frequency and continue running. If the load recovers and it will auto regain to setting frequency.	
	Ten thousand's digit: PID feedback lost during running, Err31. Same as unit's digit in bb-32			
bb-35	Fault protection action selection 4		Default	000
	Setting Range	Unit's digit: Speed deviation too large, Err42 Same as unit's digit in bb-32		
		Ten's digit: Motor over-speed, Err43. Same as unit's digit in bb-32		
		Hundred's digit: Initial position fault, Err51. Same as unit's digit in bb-32		

- If "free stop" is selected, the frequency inverter displays Err** and directly stops.
- If "Stop according to the stop mode" is selected, the frequency inverter displays A** and stops according to the stop mode. After stop, the frequency inverter displays Err**.
- If "Continue to run" is selected, the frequency inverter continues to run and displays A**. The running frequency is set in bb-37.

bb-37	Frequency selection for continuing to run of fault		Default	0
	Setting Range	0	Current running frequency	
		1	Set frequency	
		2	Frequency upper limit	
		3	Frequency lower limit	
	4	Backup frequency of abnormality (bb-37)		
bb-38	Backup frequency of abnormality		Default	100.0%
	Setting Range	0.0%~100.0% (maximum frequency)		
bb-39	overload protection gain		Default	100%
	Setting Range	85%~115%		

If a fault occurs during the running of the frequency inverter and the handling of fault is set to "continue to run", the frequency inverter displays A** and continues to run at the frequency set in bb-37.

The setting of bb-38 is a percentage relative to the maximum frequency.

5.12 Group bC: Fault detection Parameters

bC-00	First fault type	0~99
bC-01	Second fault type	
bC-02	Third fault type (latest)	

It is used to record the types of the most recent three faults of the frequency inverter. 0 indicates no fault. For possible causes and solution of each fault, refer to Chapter 7.

bC-03	Frequency of latest fault		Default	0
	Description	It displays the frequency when the latest fault occurs.		
bC-04	Current of latest fault		Default	0
	Description	It displays the current when the latest fault occurs.		
bC-05	DC Bus voltage of latest fault		Default	0
	Description	It displays the DC bus voltage when the latest fault occurs.		

bC-06	Input terminals status of latest fault		Default	0																			
	Description	It displays the status of all DI terminals when the latest fault occurs. The sequence is as follows: <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>BIT9</td><td>BIT8</td><td>BIT7</td><td>BIT6</td><td>BIT5</td><td>BIT4</td><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td> </tr> <tr> <td>DI0</td><td>DI9</td><td>DI8</td><td>DI7</td><td>HDI</td><td>DI5</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td> </tr> </table> If a DI is ON, the setting is 1. If the DI is OFF, the setting is 0. The value is the equivalent decimal number converted from the DI status.			BIT9	BIT8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0	DI0	DI9	DI8	DI7	HDI	DI5	DI4	DI3	DI2
BIT9	BIT8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0														
DI0	DI9	DI8	DI7	HDI	DI5	DI4	DI3	DI2	DI1														
bC-07	Output terminal status of latest fault		Default	0																			
	Description	It displays the status of all output terminals when the latest fault occurs. The sequence is as follows: <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>BIT4</td><td>BIT3</td><td>BIT2</td><td>BIT1</td><td>BIT0</td> </tr> <tr> <td>DO2</td><td>DO1</td><td>REL2</td><td>REL1</td><td>FMP</td> </tr> </table> If an output terminal is ON, the setting is 1. If the output terminal is OFF, the setting is 0. The value is the equivalent decimal number converted from the DI statuses.			BIT4	BIT3	BIT2	BIT1	BIT0	DO2	DO1	REL2	REL1	FMP									
BIT4	BIT3	BIT2	BIT1	BIT0																			
DO2	DO1	REL2	REL1	FMP																			
bC-08	Frequency inverter status of latest fault		Default	0																			
bC-09	Description	Reserved																					
	Power-on time of latest fault		Default	0																			
bC-10	Description	It displays the present power-on time when the latest fault occurs.																					
	Running time of latest fault		Default	0																			
bC-11	Description	It displays the present running time when the latest fault occurs.																					
	Frequency of 2nd fault		Default	0																			
bC-12	Current of 2nd fault		Default	0																			
bC-13	DC Bus voltage of 2nd fault		Default	0																			
bC-14	Input terminal status of 2nd fault		Default	0																			
bC-15	Output terminal status of 2nd fault		Default	0																			
bC-16	Frequency inverter status of 2nd fault		Default	0																			
bC-17	Power-on time of 2nd fault		Default	0																			
bC-18	Running time of 2nd fault		Default	0																			
bC-19	Frequency of 1st fault		Default	0																			
bC-20	Current of 1st fault		Default	0																			
bC-21	DC Bus voltage of 1st fault		Default	0																			
bC-22	Input terminal status of 1st fault		Default	0																			
bC-23	Output terminal status of 1st fault		Default	0																			
bC-24	Frequency inverter status of 1st fault		Default	0																			
bC-25	Power-on time of 1st fault		Default	0																			
bC-26	Running time of 1st fault		Default	0																			
	Description	bC-11~bC-26 same as bC-03~bC-10.																					

5.13 Group bd Motor protection

bd-00	Overset alarm current value		Default	0.00
	Setting Range	0.0~600A		
bd-01	Overcurrent alarm delay time		Default	0.00
	Setting Range	0.0~600s		

For example: 4KW inverter rated current is 9A, customer site needs to protect motor when load current is at 6A more than 5s, corresponding setting parameters: bd-00=6.00A and bd-01=5.0S exceeds current and time panel display Err24 protection error and stop.

5.14 Group C0: Process Control PID Function

PID control is a general process control method. By performing proportional, integral and differential operations

on the difference between the feedback signal and the target signal, it adjusts the output frequency and constitutes a feedback system to stabilize the controlled counter around the target value.

It is applied to process control such as flow control, pressure control and temperature control. The following figure shows the principle block diagram of PID control.

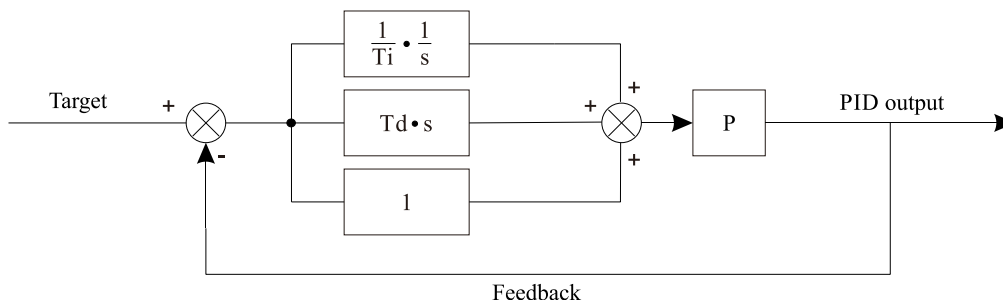


Diagram 5-25 Principle block diagram of PID control.

C0-00	PID setting source		Default	7
	Setting Range	0	C0-01	
		1	AI1	
		2	AI2	
		3	AI3	
		4	Pulse setting (HDI)	
		5	Communication setting	
		6	Multi-function	
C0-01	PID digital setting		Default	50.0%
	Setting Range	0.0%~100.0%		

C0-00 is used to select the channel of target process PID setting. The PID setting is a relative value and ranges from 0.0% to 100.0%. The PID feedback is also a relative value. The purpose of PID control is to make the PID setting and PID feedback equal.

C0-02	PID setting change time		Default	0.00s
	Setting Range	0.00s~650.00s		

The PID setting change time indicates the time required for PID setting changing from 0.0% to 100.0%. The PID setting changes linearly according to the change time, reducing the impact caused by sudden setting change on the system.

C0-03	PID setting source		Default	0
	Setting Range	0	AI1	
		1	AI2	
		2	AI3	
		3	Pulse setting (HDI)	
		4	AI1 – AI2	
		5	AI1 + AI2	
		6	MAX (AI1 , AI2)	
		7	MIN (AI1 , AI2)	
8	Communication setting			

This parameter is used to select the feedback signal channel of process PID. The PID feedback is a relative value

and ranges from 0.0% to 100.0%. Similarly, the feedback of PID is also a relative value. The function of PID is to make the two values the equal.

C0-04	PID action direction		Default	0
	Setting	0	Forward action	
	Range	1	Reverse action	

0: Forward action

When the feedback value is smaller than the PID setting, the frequency inverter's output frequency rises. For example, the winding tension control requires forward PID action.

1: Reverse action

When the feedback value is smaller than the PID setting, the frequency inverter's output frequency reduces. For example, the unwinding tension control requires reverse PID action.

Note this function is influenced by the DI function 35 "Reverse PID action direction".

C0-05	PID setting feedback range		Default	1000
	Setting Range	0~65535		

This parameter is a non-dimensional unit. It is used for PID setting display (U0-15) and PID feedback display (U0-16).

Relative value 100% of PID setting feedback corresponds to the value of C0-05. If C0-05 is set to 2000 and PID setting is 100.0%, the PID setting display (U0-15) is 2000.

C0-06	Proportional gain KP1		Default	20.0
	Setting Range	0.00~100.0		
C0-07	Integral time TI1		Default	0.80s
	Setting Range	0.01s~10.00s		
C0-08	Differential time TD1		Default	0.000s
	Setting Range	0.000s~10.000s		

- C0-06 (Proportional gain Kp1)

It decides the regulating intensity of the PID regulator. The higher the Kp1 is, the larger the regulating intensity is. The value 10.00 indicates when the deviation between PID feedback and PID setting is 100.0%, the adjustment amplitude of the PID regulator on the output frequency reference is the maximum frequency.

- C0-07 (Integral time Ti1)

It decides the integral regulating intensity. The shorter the integral time is, the larger the regulating intensity is. When the deviation between PID feedback and PID setting is 100.0%, the integral regulator performs continuous adjustment for the time. Then the adjustment amplitude reaches the maximum frequency.

- C0-08 (Differential time Td1)

It decides the regulating intensity of the PID regulator on the deviation change. The longer the differential time is, the larger the regulating intensity is. Differential time is the time within which the feedback value change reaches 100.0%, and then the adjustment amplitude reaches the maximum frequency.

C0-09	Proportional gain KP2		Default	20.0
	Setting Range	0.00~100.0		

C0-10	Integral time TI2		Default	2.00s
	Setting Range	0.01s~10.00s		
C0-11	Differential time TD2		Default	0.000s
	Setting Range	0.000s~10.000s		
C0-12	PID parameter switchover condition		Default	0
	Setting Range	0	No switchover	
		1	Switchover via DI	
2		Automatic switchover based on deviation		
C0-13	PID parameter switchover deviation 1		Default	20.0%
	Setting Range	0.0% ~ C0-14		
C0-14	PID parameter switchover deviation 2		Default	80.0%
	Setting Range	C0-13 ~ 100.0%		

In some applications, PID parameters switchover is required when one group of PID parameters cannot satisfy the requirement of the whole running process.

These parameters are used for switchover between two groups of PID parameters. Regulator parameters C0-09 ~ C0-11 are set in the same way as C0-06 ~ C0-08.

The switchover can be implemented either via a DI terminal or automatically implemented based on the deviation. If you select switchover via a DI terminal, the DI must be set with function 43 "PID parameter switchover". If the DI is OFF, group 1 (C0-06 ~ C0-08) is selected. If the DI is ON, group 2 (C0-09 to C0-11) is selected.

If you select automatic switchover, when the absolute value of the deviation between PID feedback and PID setting is smaller than the value of C0-13, group 1 is selected. When the absolute value of the deviation between PID feedback and PID setting is higher than the value of C0-14, group 2 is selected. When the deviation is between C0-13 and C0-14, the PID parameters are the linear interpolated value of the two groups of parameter values.

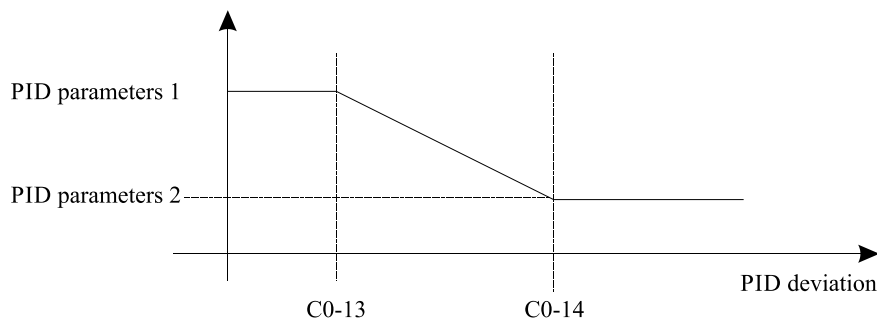


Diagram 5-26 PID parameters switchover

C0-15	PID integral property		Default	00
	Setting Range	Unit's digit: Integral separated.		
		0	Invalid	
		1	Valid	
		Ten's digit: Whether to stop integral operation when the output reaches the limit.		
		0	Continue integral operation	
1	Stop integral operation			

● Integral separation

If integral separation is set to valid, and the DI is defined as function 22"PID integral pause". In this case, only

proportional and differential operations take effect.

If integral separation is set to invalid, no matter whether the DI set with function 22 "PID integral pause" is ON or not, integral separation remains invalid.

- Stop integral

After the output has reached to maximum or minimum limit in PID operation, we can select to stop the integral operation or not. If we select to stop, it may help to reduce the PID overshoot.

C0-16	PID initial value		Default	0.0%
	Setting Range	0.0%~100.0%		
C0-17	PID initial value holding time		Default	0.00s
	Setting Range	0.00s~650.00s		

When the frequency inverter starts up, the PID output initial value (C0-16), and sustain the holding time (C0-17), the PID start close-loop calculation.

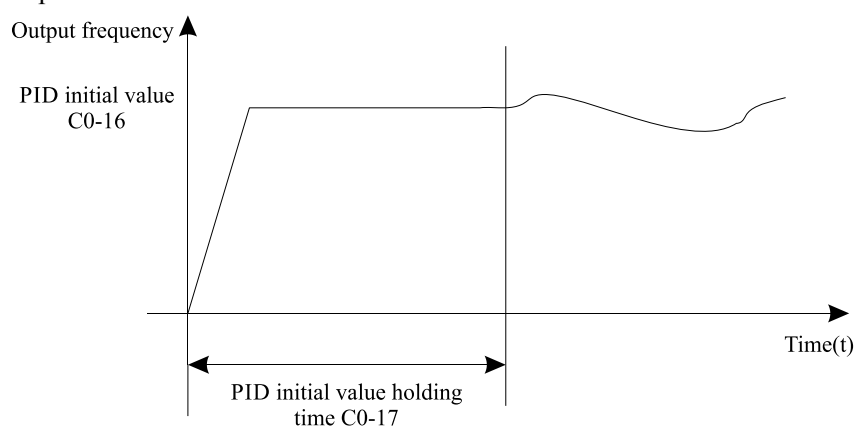


Diagram 5-27 PID initial value function

C0-18	Frequency upper limit of PID reverse rotation		Default	0.00 Hz
	Setting Range	0.00 ~ maximum frequency		

In some situations, only when the PID output frequency is a negative value (frequency inverter reverse rotation), PID setting and PID feedback can be equal. However, too high reverse rotation frequency is prohibited in some applications, and C0-18 is used to determine the reverse rotation frequency upper limit.

C0-19	PID deviation limit		Default	0.0%
	Setting Range	0.0%~100.0%		

If the deviation between PID feedback and PID setting is smaller than the value of C0-19, PID control stops. The small deviation between PID feedback and PID setting will make the output frequency stabilize, which is effective for some closed-loop control applications.

C0-20	PID differential limit		Default	0.10%
	Setting Range	0.00%~100.00%		

It is used to set the PID differential output range. In PID control, the differential operation may easily cause system oscillation. Thus, the PID differential regulation is restricted to a small range.

C0-21	Maximum positive deviation between two PID outputs		Default	1.00%
	Setting Range	0.00%~100.00%		

C0-22	Maximum negative deviation between two PID outputs		Default	1.00%
	Setting Range	0.00%~100.00%		

This function is used to limit the deviation between two PID outputs (2 ms per PID output) to suppress the rapid change of PID output and stabilize the running of the frequency inverter.

C0-21 and C0-22 respectively are corresponding to the maximum absolute value of the output deviation in forward direction and in reverse direction.

C0-23	PID feedback filter time		Default	0.00s
	Setting Range	0.00s~60.00s		
C0-24	PID output filter time		Default	0.00s
	Setting Range	0.00s~60.00s		

C0-23 is used to filter the PID feedback, helping to reduce interference on the feedback but slowing the response of the process closed-loop system.

C0-24 is used to filter the PID output frequency, helping to weaken sudden change of the frequency inverter output frequency but slowing the response of the process closed-loop system.

C0-25	Detection value of PID feedback loss		Default	0.0%
	Setting Range	0.0%: Not judging feedback loss 0.1%~100.0%		
C0-26	Detection time of PID feedback loss		Default	0.0s
	Setting Range	0.0s~20.0s		

These parameters are used to judge whether PID feedback is lost.

If the PID feedback is smaller than the value of C0-25 and the lasting time exceeds the value of C0-26, the frequency inverter reports Err31 and acts according to the selected fault protection action.

C0-27	PID operation at stop		Default	1
	Setting Range	0	No PID operation at stop	
		1	PID operation at stop	

It is used to select whether to continue PID operation in the state of stopping. Generally, to set the PID operation stops when the frequency inverter stops.

5.15 Group C1:Multi-function

The Multi-function of EM15has many functions. Besides multi-speed, it can be used as the setting source of the V/F separated voltage source and setting source of process PID. In addition, the Multi-function is relative value.

The simple PLC function is different from the EM15 user programmable function. Simple PLC can only complete simple combination of Multi-function.

C1-00	Multi-function 0		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-01	Multi-function 1		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-02	Multi-function 2		Default	0.0%
	Setting Range	-100.0%~100.0%		

C1-03	Multi-function 3		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-04	Multi-function 4		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-05	Multi-function 5		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-06	Multi-function 6		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-07	Multi-function 7		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-08	Multi-function 8		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-09	Multi-function 9		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-10	Multi-function 10		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-11	Multi-function 11		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-12	Multi-function 12		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-13	Multi-function 13		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-14	Multi-function 14		Default	0.0%
	Setting Range	-100.0%~100.0%		
C1-15	Multi-function 15		Default	0.0%
	Setting Range	-100.0%~100.0%		

Multi-function can be the setting source of frequency, V/F separated voltage and process PID. The Multi-function is relative value and ranges from -100.0% to 100.0%.

As frequency source, it is a percentage relative to the maximum frequency. As V/F separated voltage source, it is a percentage relative to the rated motor voltage. As process PID setting source, it does not require conversion.

Multi-function can be switched over based on different states of DI terminals. For details, see the descriptions of group b3.

C1-16	Multi-function 0 source		Default	0
	Setting Range	0	Set by C1-00	
		1	AI1	
		2	AI2	
		3	AI3	
		4	Pulse setting(HDI)	
		5	PID	
6	Set by digital setting frequency frequency (b0-12), modified via terminal UP/DOWN			

It determines the setting channel of multi-function 0. You can perform convenient switchover between the setting

channels. When multi-function or simple PLC is used as frequency source, the switchover between two frequency sources can be realized easily.

5.16 Group C2: Simple PLC

C2-00	Simple PLC running mode		Default	0
	Setting Range	0	Stop after the Frequency inverter runs one cycle	
		1	Keep final values after the frequency inverter runs one cycle	
		2	Repeat after the frequency inverter runs one cycle	

0: Stop after the frequency inverter runs one cycle

The frequency inverter stops after running one cycle, and will not start up until receiving another command.

1: Keep final values after the frequency inverter runs one cycle

The frequency inverter keeps the final running frequency and direction after running one cycle.

2: Repeat after the frequency inverter runs one cycle

The frequency inverter automatically starts another cycle after running one cycle, and will not stop until receiving the stop command.

Simple PLC can be either the frequency source or V/F separated voltage source.

When simple PLC is used as the frequency source, whether parameter values of C1-00 ~ C1-15 are positive or negative determines the frequency inverter running direction. If the parameter values are negative, it indicates that the frequency inverter runs in reverse direction.

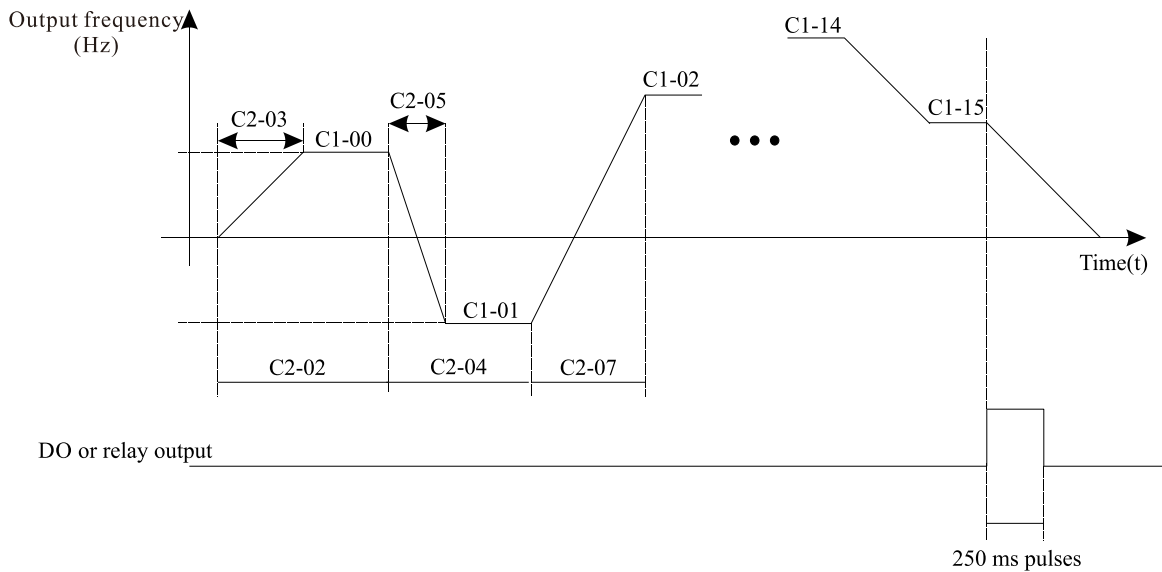


Diagram 5-28 Simple PLC when used as frequency source

C2-01	Simple PLC record selection		Default	00
	Setting Range	Unit's digit: Record of power failure.		
		0	no record after power off	
		1	record after power off	
		Ten's digit: Record of stopping		
		0	no record after stopping	
1		record after stopping		

PLC record of power failure indicates that the frequency inverter memorizes the PLC running stage and running frequency before power failure, and frequency inverter will continue to run from the memorized stage after it is

powered on again. If the unit's digit is set to 0, the frequency inverter restarts the PLC process after it is powered on again.

PLC record of stopping indicates that the frequency inverter records the PLC running stage and running frequency of stop, and frequency inverter will continue to run from the recorded stage after power on again. If the ten's digit is set to 0, the frequency inverter will restarts the PLC process after it power on again.

C2-02	Running time of simple PLC Segment 0		Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)		
C2-03	Acceleration/deceleration time of simple PLC Segment 0		Default	0
	Setting Range	0~3		
C2-04	Running time of simple PLC Segment 1		Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)		
C2-05	Acceleration/deceleration time of simple PLC Segment 1		Default	0
	Setting Range	0~3		
C2-06	Running time of simple PLC Segment 2		Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)		
C2-07	Acceleration/deceleration time of simple PLC Segment 2		Default	0
	Setting Range	0~3		
C2-08	Running time of simple PLC Segment 3		Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)		
C2-09	Acceleration/deceleration time of simple PLC Segment 3		Default	0
	Setting Range	0~3		
C2-10	Running time of simple PLC Segment 4		Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)		
C2-11	Acceleration/deceleration time of simple PLC Segment 4		Default	0
	Setting Range	0~3		
C2-12	Running time of simple PLC Segment 5		Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)		
C2-13	Acceleration/deceleration time of simple PLC Segment 5		Default	0
	Setting Range	0~3		
C2-14	Running time of simple PLC Segment 6		Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)		
C2-15	Acceleration/deceleration time of simple PLC Segment 6		Default	0
	Setting Range	0~3		
C2-16	Running time of simple PLC Segment 7		Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)		
C2-17	Acceleration/deceleration time of simple PLC Segment 7		Default	0
	Setting Range	0~3		
C2-18	Running time of simple PLC Segment 8		Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)		
C2-19	Acceleration/deceleration time of simple PLC Segment 8		Default	0
	Setting Range	0~3		
C2-20	Running time of simple PLC Segment 9		Default	0.0s (h)

	Setting Range	0.0s(h)~6553.5s(h)			
C2-21	Acceleration/deceleration time of simple PLC Segment 9			Default	0
	Setting Range	0~3			
C2-22	Running time of simple PLC Segment 10			Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)			
C2-23	Acceleration/deceleration time of simple PLC Segment 10			Default	0
	Setting Range	0~3			
C2-24	Running time of simple PLC Segment 11			Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)			
C2-25	Acceleration/deceleration time of simple PLC Segment 11			Default	0
	Setting Range	0~3			
C2-26	Running time of simple PLC Segment 12			Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)			
C2-27	Acceleration/deceleration time of simple PLC Segment 12			Default	0
	Setting Range	0~3			
C2-28	Running time of simple PLC Segment 13			Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)			
C2-29	Acceleration/deceleration time of simple PLC Segment 13			Default	0
	Setting Range	0~3			
C2-30	Running time of simple PLC Segment 14			Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)			
C2-31	Acceleration/deceleration time of simple PLC Segment 14			Default	0
	Setting Range	0~3			
C2-32	Running time of simple PLC Segment 15			Default	0.0s (h)
	Setting Range	0.0s(h)~6553.5s(h)			
C2-33	Acceleration/deceleration time of simple PLC Segment 15			Default	0
	Setting Range	0~3			
C2-34	Time unit of simple PLC running			Default	0
	Setting Range	0	s (second)		
		1	h (hour)		
C2-35	PLC function selection			Default	0
	Setting Range	0	C2-02~C2-34 is valid		
		1	C2-35~C2-68 is valid		
C2-36	Acceleration time of Segment 0			Default	10.0s
	Setting Range	0.0S-3000.0S			
C2-37	Deceleration time of Segment 0			Default	10.0s
	Setting Range	0.0S-3000.0S			
C2-38	Acceleration time of Segment 1			Default	10.0s
	Setting Range	0.0S-3000.0S			
C2-39	Deceleration time of Segment 1			Default	10.0s
	Setting Range	0.0S-3000.0S			
C2-40	Acceleration time of Segment 2			Default	10.0s

C2-41	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 2		Default	10.0s
C2-42	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 3		Default	10.0s
C2-43	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 3		Default	10.0s
C2-44	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 4		Default	10.0s
C2-45	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 4		Default	10.0s
C2-46	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 5		Default	10.0s
C2-47	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 5		Default	10.0s
C2-48	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 6		Default	10.0s
C2-49	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 6		Default	10.0s
C2-50	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 7		Default	10.0s
C2-51	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 7		Default	10.0s
C2-52	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 8		Default	10.0s
C2-53	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 8		Default	10.0s
C2-54	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 9		Default	10.0s
C2-55	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 9		Default	10.0s
C2-56	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 10		Default	10.0s
C2-57	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 10		Default	10.0s
C2-58	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 11		Default	10.0s
C2-59	Setting Range	0.0S-3000.0S		
	Deceleration time of Segment 11		Default	10.0s
C2-60	Setting Range	0.0S-3000.0S		
	Acceleration time of Segment 12		Default	10.0s

C2-61	Deceleration time of Segment 12		Default	10.0s
	Setting Range	0.0S-3000.0S		
C2-62	Acceleration time of Segment 13		Default	10.0s
	Setting Range	0.0S-3000.0S		
C2-63	Deceleration time of Segment 13		Default	10.0s
	Setting Range	0.0S-3000.0S		
C2-64	Acceleration time of Segment 14		Default	10.0s
	Setting Range	0.0S-3000.0S		
C2-65	Deceleration time of Segment 14		Default	10.0s
	Setting Range	0.0S-3000.0S		
C2-66	Acceleration time of Segment 15		Default	10.0s
	Setting Range	0.0S-3000.0S		
C2-67	Deceleration time of Segment 15		Default	10.0s
	Setting Range	0.0S-3000.0S		

5.17 Group C3: Swing Frequency, Fixed Length and Count

When C0-00 = 7, this group of parameters is valid.

C3-00	Pressure setting(MPa)		Default	0.200Mpa
	Setting Range	0.000~60.000Mpa		
C3-01	Full scale maximum pressure (Mpa)		Default	1.000Mpa
	Setting Range	0.000~60.000Mpa		
C3-03	Explosion-proof tube protection pressure (Mpa)		Default	1.500Mpa
	Setting Range	0.001~60.000Mpa		
C3-04	Sleep wakeup pressure (Mpa)		Default	0.001Mpa
	Setting Range	0.000~60.000Mpa		
C3-07	Sleep frequency		Default	80%
	Setting Range	0.0~100%(Corresponding to the set pressure percentage)		
C3-08	The lasting time of frequency is less than sleep pressure		Default	10s
	Setting Range	0~250s		
C3-09	Sleep selection		Default	1
	Setting Range	0	Frequency sleep available	
		1	Pressure selection available	

5.18 Group d0: Motor 1 Parameters

d0-00	Rated motor power		Default	Model dependent
	Setting Range	0.1kw~1000.0 kW		
d0-01	Rated motor voltage		Default	Model dependent
	Setting Range	1V~2000 V		
d0-02	Rated motor current		Default	Model dependent
	Setting Range	0.01A~655.35 A (Frequency inverter power \leq 55 kW) 0.1A~6553.5 A (Frequency inverter power \geq 75 kW)		

d0-03	Rated motor frequency		Default	50.00Hz
	Setting Range	0.01 Hz~ maximum frequency		
d0-04	Rated motor rotational speed		Default	Model dependent
	Setting Range	1rpm~65535rpm		

Set the parameters according to the motor nameplate no matter whether V/F control or vector control is adopted.

To achieve better V/F or vector control performance, motor auto-tuning is required. The motor auto-tuning accuracy depends on the correct setting of motor nameplate parameters.

d0-05	Stator resistance (asynchronous motor)		Default	Model dependent
	Setting Range	0.001 Ω ~65.535 Ω (frequency inverter power ≤ 55 kW) 0.0001 Ω ~6.5535 Ω (frequency inverter power ≥ 75 kW)		
d0-06	Rotor resistance (asynchronous motor)		Default	Model dependent
	Setting Range	0.001 Ω ~65.535 Ω (Frequency inverter power ≤ 55 kW) 0.0001 Ω ~6.5535 Ω (frequency inverter power ≥ 75 kW)		
d0-07	Leakage inductive reactance (asynchronous motor)		Default	Model dependent
	Setting Range	0.01mH~655.35 mH (frequency inverter power ≤ 55 kW) 0.001mH~65.535 mH (frequency inverter power ≥ 75 kW)		
d0-08	Mutual inductive reactance (asynchronous motor)		Default	Model dependent
	Setting Range	0.1mH~6553.5 mH (Frequency inverter power ≤ 55 kW) 0.01mH~655.35 mH (Frequency inverter power ≥ 75 kW)		
d0-09	No-load current (asynchronous motor)		Default	Model dependent
	Setting Range	0.01A ~ d0-02 (Frequency inverter power ≤ 55 kW) 0.1A to d0-02 (Frequency inverter power ≥ 75 kW)		

The parameters in d0-05 ~ d0-09 are asynchronous motor parameters. These parameters are unavailable on the motor nameplate and are obtained by means of motor auto-tuning. Only d0-05 ~ d0-07 can be obtained through static motor auto-tuning. Through complete motor auto-tuning, encoder phase sequence and current loop PI can be obtained besides the parameters in d0-05 ~ d0-09.

When the "Rated motor power" (d0-00) or "Rated motor voltage" (d0-01) is changed; the frequency inverter automatically restores values of d0-05 ~ d0-09, to restore setting of these 5 parameters according to common standard Y series asynchronous motor.

If it is impossible to perform motor auto-tuning onsite, manually set the values of these parameters according to data provided by the motor manufacturer.

d0-21	Encoder wires		Default	1024
	Setting Range	1~32767		
d0-22	Encoder type selection		Default	0
	Setting Range	0	ABZ incremental encoder	
d0-23	Encoder type selection		Default	0
	Setting Range	0	Forward	
	Setting Range	1	Reverse	

parameter d0-23 is valid only for ABZ incremental encoder (d0-20 = 0) and is used to set the A/B phase sequence of the ABZ incremental encoder.

It is valid for both asynchronous motor and synchronous motor. The A/B phase sequence can be obtained through "Asynchronous motor complete auto-tuning" or "Synchronous motor no-load auto-tuning".

d0-28	Encoder fault detection time		Default	0.0s
	Setting Range	0.0s: No action 0.1s~10.0s		

This parameter is used to set the detecting time that a wire-break faults. If it is set to 0.0s, the frequency inverter does not detect the encoder wire-break fault. If the duration time of the encoder wire-break fault detected by the frequency inverter exceeds the time set in this parameter, the frequency inverter reports Err20.

d0-30	Motor auto-tuning selection			Default	0
	Setting Range	0	No auto-tuning		
		1	Asynchronous motor static auto-tuning		
		2	Asynchronous motor dynamic complete auto-tuning		
		3	Asynchronous motor static complete auto-tuning		

0: No auto-tuning

Auto-tuning is prohibited.

1: Asynchronous motor static auto-tuning

It is applicable to scenarios where complete auto-tuning cannot be performed because the asynchronous motor cannot be disconnected from the load.

Before performing static auto-tuning, properly set the motor type and motor nameplate parameters of d0-00 ~ d0-04 firstly. The frequency inverter will obtain parameters of d0-05 ~ d0-07 by static auto-tuning.

Action guide: Set this parameter to 1, and press **RUN** key. Then, the frequency inverter starts static auto-tuning.

2: Asynchronous motor dynamic complete auto-tuning

To perform this type of auto-tuning, ensure that the motor is disconnected from the load. During the process of complete auto-tuning, the frequency inverter performs static auto-tuning first and then accelerates to 80% of the rated motor frequency within the acceleration time set in b0-21. The frequency inverter keeps running for a certain period and then decelerates to stop with deceleration time set in b0-22.

Before performing complete auto-tuning, properly set the motor type, motor nameplate parameters of b0-00 and d0-00~ d0-04, "Encoder type" (d0-20) and "Encoder pulses per revolution" (d0-19) first.

The frequency inverter will obtain motor parameters of d0-05 ~ d0-09, "A/B phase sequence of ABZ incremental encoder" (d0-21) and vector control current loop PI parameters of d1-10 ~ d1-13 by complete auto-tuning.

Action guide: Set this parameter to 2, and press **RUN** key. Then, the frequency inverter starts complete auto-tuning.

3: Asynchronous motor static complete auto-tuning

It is applicable to site where the synchronous motor cannot be disconnected from the load.

Note: Motor auto-tuning can be performed only in operation panel mode.

5.19 Group d1: Motor vector control parameters

The Group d1 function codes are only valid for motor 1 vector control. It is invalid for motor 2 parameters or motor 1 V/F control.

d1-00	Speed/Torque control selection			Default	0
	Setting Range	0	Speed control		
		1	Torque control		

It is used to select the frequency inverter's control mode: speed control or torque control.

The EM15 provides DI terminals with two torque related functions, function 21 (Torque control prohibited) and function 20 (Speed control/Torque control switchover). The two DI terminals need to be used together with d1-00

to implement speed control/torque control switchover.

If the DI terminal set with function 20 (Speed control/Torque control switchover) is OFF, the control mode is determined by d1-00. If the DI terminal set with function 20 is ON, the control mode is reverse to the value of d1-00.

However, if the DI terminal with function 21 (Torque control prohibited) is ON, the frequency inverter is fixed to run in the speed control mode.

d1-01	Speed loop proportional gain 1(Kp1)	Default	30
	Setting Range	1~100	
d1-02	Speed loop integral time 1(Ti1)	Default	0.50s
	Setting Range	0.01s~10.00s	
d1-03	Switchover frequency	Default	5.00 Hz
	Setting Range	0.00 HZ~ d1-06	
d1-04	Speed loop proportional gain 2(KP2)	Default	20
	Setting Range	1~100	
d1-05	Speed loop integral time 2(Ti2)	Default	1.00s
	Setting Range	0.01s~10.00s	
d1-06	Switchover frequency 2	Default	10.00 Hz
	Setting Range	d1-03~ maximum output frequency	

Speed loop PI parameters vary with running frequencies of the frequency inverter.

- If the running frequency is less than or equal to "Switchover frequency 1" (d1-03), the speed loop PI parameters are d1-01 and d1-02.
- If the running frequency is equal to or greater than "Switchover frequency 2" (d1-06), the speed loop PI parameters are d1-04 and d1-05.
- If the running frequency is between d1-03 and d1-06, the speed loop PI parameters are obtained from the linear switchover between the two groups of PI parameters, as shown in Diagram 5-29.

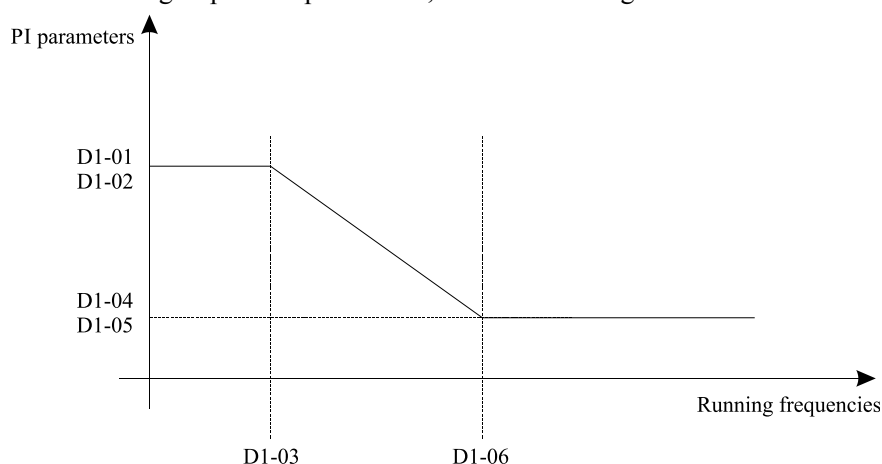


Diagram 5-29 Relationship between running frequencies and PI parameters

The speed dynamic response characteristics in vector control can be adjusted by setting the proportional gain and integral time of the speed regulator.

To achieve a faster system response, increase the proportional gain and reduce the integral time. Be aware that this may lead to system oscillation. The recommended adjustment method is as follows:

If the factory setting cannot meet the requirements, make proper adjustment. Increase the proportional gain first to ensure that the system does not oscillate, and then reduce the integral time to ensure that the system has quick

response and small overshoot.

Note: Improper PI parameter setting may cause too large speed overshoot, and overvoltage fault may even occur when the overshoot drops.

d1-07	Motor running slip gain		Default	100%
	Setting Range	50%~200%		
d1-09	Vector control over excitation gain		Default	64
	Setting Range	0~200		
d1-10	Motor running torque upper limit source in speed control mod		Default	0
	Setting Range	0	d1-16	
		1	AI1	
		2	AI2	
		3	AI3	
		4	Pulse setting (HDI)	
5	Communication setting			
d1-11	Electric torque limit		Default	150.0%
	Setting Range	0.0%~200.0%		

In the speed control mode, the maximum output torque of the frequency inverter is restricted by d1-10. If the torque upper limit is analog, pulse or communication setting, 100% of the setting corresponds to the value of d1-11, and 100% of the value of d1-11 corresponds to the frequency inverter rated torque.

For details on the AI1, AI2 and AI3 setting, see the description of the AI curves. For details on the pulse setting, see the description of b5-00 ~ b5-04.

d1-14	Excitation current loop proportional gain		Default	2000
	Setting Range	0~30000		
d1-15	Excitation current loop integral gain		Default	1300
	Setting Range	0~30000		
d1-16	Torque current loop proportional gain		Default	2000
	Setting Range	0~30000		
d1-17	Torque current loop integral gain		Default	1300
	Setting Range	0~30000		
d1-18	Speed loop integral property		Default	0
	Setting Range	0	Integral separation disabled	
		1	Integral separation enabled	

These are current loop PI parameters for vector control. These parameters are automatically obtained through "Asynchronous motor complete auto-tuning" or "Synchronous motor no-load auto-tuning", and need not be modified.

The dimension of the current loop integral regulator is integral gain rather than integral time. Note that too large current loop PI gain may lead to oscillation of the entire control loop.

Therefore, when current oscillation or torque fluctuation is great, manually decrease the proportional gain or integral gain here.

d1-21	Maximum output voltage coefficient		Default	105%
	Setting Range	100%~110%		

This parameter indicates boost capacity of maximum voltage of the AC drive. Increasing d1-21 will improve max. loading capacity in motor field weakening area. Be aware that this may lead to an increase in motor current ripple and an increase in motor heating.

Decreasing it will reduce motor current ripple and motor heating. Be aware that this will lower max. loading capacity in motor field weakening area. Adjustment of this parameter is not required normally.

d1-22	Max. torque coefficient of field weakening area		Default	100%
	Setting Range	50%~200%		

This parameter takes effect only when the motor runs above the rated motor frequency.

When the motor need rapidly accelerate to twice of rated motor frequency but actual acceleration time is very long, decrease the setting of d1-22 adequately.

When the motor runs above twice of rated motor frequency and speed dip is very large after a load is added, increase the setting of d1-22 adequately. Adjustment of this parameter is not required normally.

d1-24	Torque setting source in torque control			Default	0
	Setting Range	0	Digital setting (d1-27)		
		1	AI1		
		2	AI2		
		3	AI3		
		4	Pulse setting (HDI)		
		5	Communication setting		
		6	MIN (AI1, AI2)		
7	MAX (AI1, AI2)				
d1-26	Torque digital setting in torque control			Default	150.0%
	Setting Range	-200.0%~200.0%			

The d1-24 is used to set the torque setting source. There are a total of eight torque setting sources.

The torque setting is a relative value. 100.0% corresponds to the frequency inverter's rated torque. The setting range is -200.0% ~ 200.0%, indicating the frequency inverter's maximum torque is twice of the frequency inverter's rated torque.

If the torque setting is positive, the frequency inverter rotates in forward direction. If the torque setting is negative, the frequency inverter rotates in reverse direction.

0: Digital setting (d1-26)

The target torque directly uses the value set in d1-26.

1:AI1

2:AI2

3:AI3

The target torque is decided by analog input. The EM15 control board provides three AI terminals (AI1, AI2,AI3). AI1 and AI2 is 0V~10 V voltage input or 0mA~20mA current input decided by jumper on the control board, and AI3 is -10 V ~ +10 V voltage input.

For the details of AI Curve setting, please refer to the description of analog input parameters.

When AI is used as frequency setting source, the corresponding value 100% of voltage/ current input corresponds to the value of d1-26.

4: Pulse setting (HDI)

The target torque is set by HDI (high-speed pulse). The pulse setting signal specification is 9V~30 V (voltage range) and 0 kHz~100 kHz (frequency range). The pulse can only be input via HDI. The relationship (which is a two-point line) between HDI input pulse frequency and the corresponding value is set in b5-00 ~ b5-03. The corresponding value 100.0% of pulse input corresponds to the percentage of d1-26.

5: Communication setting

The target torque is set by means of communication.

d1-28	Forward maximum frequency in torque control		Default	50.00 Hz
	Setting Range	0.00 Hz ~ maximum frequency(b0-13)		
d1-29	Reverse maximum frequency in torque control		Default	50.00 Hz
	Setting Range	0.00 Hz ~ maximum frequency(b0-13)		

The two parameters are used to set the maximum frequency in forward or reverse rotation in torque control mode. In torque control, if the load torque is smaller than the motor output torque, the motor's rotational speed will rise continuously. To avoid runaway of the mechanical system, the motor maximum rotating speed must be limited in torque control.

You can implement continuous change of the maximum frequency in torque control dynamically by controlling the frequency upper limit.

d1-30	Acceleration time in torque control		Default	0.00s
	Setting Range	0.00s~650.00s		

In torque control, the difference between the motor output torque and the load torque determines the speed change rate of the motor and load. The motor rotational speed may change quickly and this will result in noise or too large mechanical stress. The setting of acceleration/deceleration time in torque control makes the motor rotational speed change softly.

However, in applications requiring rapid torque response, set the acceleration/deceleration time in torque control to 0.00s. For example, two frequency inverters are connected to drive the same load. To balance the load allocation, set one frequency inverter as master in speed control and the other as slave in torque control. The slave receives the master's output torque as the torque command and must follow the master rapidly. In this case, the acceleration/deceleration time of the slave in torque control is set to 0.0s.

5.20 Group d2: Motor V/F Control Parameters

Group d2 is valid only for V/F control.

The V/F control mode is applicable to low requirement load applications (fan or pump) or applications where one frequency inverter operates multiple motors or there is a large difference between the frequency inverter power and the motor power.

d2-00	V/F curve setting		Default	0
	Setting Range	0	Linear V/F	
		1	Multi-point V/F	
		2	Square V/F	
		3	1.2-power V/F	
		4	1.4-power V/F	
		6	1.6-power V/F	
		8	1.8-power V/F	
		10	V/F complete separation	
		11	V/F half separation	

0: Linear V/F

It is applicable to common constant torque load.

1: Multi-point V/F

It is applicable to special load such as dehydrator and centrifuge. Any relationship V/F curve can be obtained by setting parameters of d2-03 ~ d2-08.

2: Square V/F

It is applicable to centrifugal loads such as fan and pump.

3 ~ 8: V/F curve between linear V/F and square V/F

10: V/F complete separation

In this mode, the output frequency and output voltage of the frequency inverter are independent. The output frequency is determined by the frequency source, and the output voltage is determined by "Voltage source for V/F separation" (d2-12).

It is applicable to induction heating, inverse power supply and torque motor control.

11: V/F half separation

In this mode, V and F are proportional and the proportional relationship can be set in d2-12. The relationship between V and F are also related to the "rated motor voltage" and "rated motor frequency".

Assume that the voltage source input is X (0% ~100%), the relationship between V and F is:

$$V/F = 2 \times X \times (\text{Rated motor voltage}) / (\text{Rated motor frequency})$$

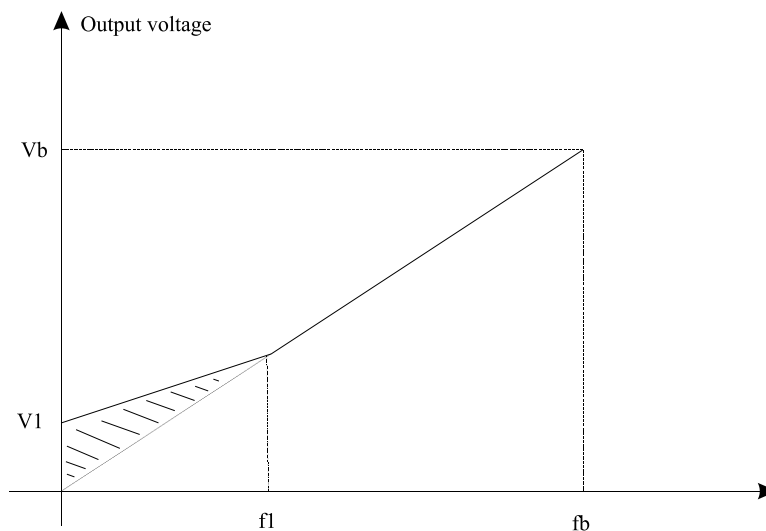
d2-01	Torque boost		Default	Model dependent
	Setting Range	0.0% (torque auto-boost) 0.1%~30.0%		
d2-02	Cut-off frequency of torque boost		Default	50.0%
	Setting Range	0.0%~80.0% Actual cut-off frequency= Motor rated frequency*d2-02		

To compensate the low frequency torque characteristics of V/F control, you can boost the output voltage of the frequency inverter at low frequency by modifying d2-01.

If the torque boost is set to too large, the motor is easily overheated, and the frequency inverter easily suffers over current.

If the load is large and the motor startup torque is insufficient, increase the value of d2-01. If the load is small, decrease the value of d2-01. If it is set to 0.0, the frequency inverter performs automatic torque boost. In this case, the frequency inverter automatically calculates the torque boost value based on motor parameters including the stator resistance.

d2-02 specifies the frequency under which torque boost is valid. Torque boost becomes invalid when this frequency is exceeded, as shown in the following figure.



V1: Voltage of manual torque boost
 Vb: Maximum output voltage
 fl: Cutoff frequency of manual torque boost
 fb: Rated running frequency

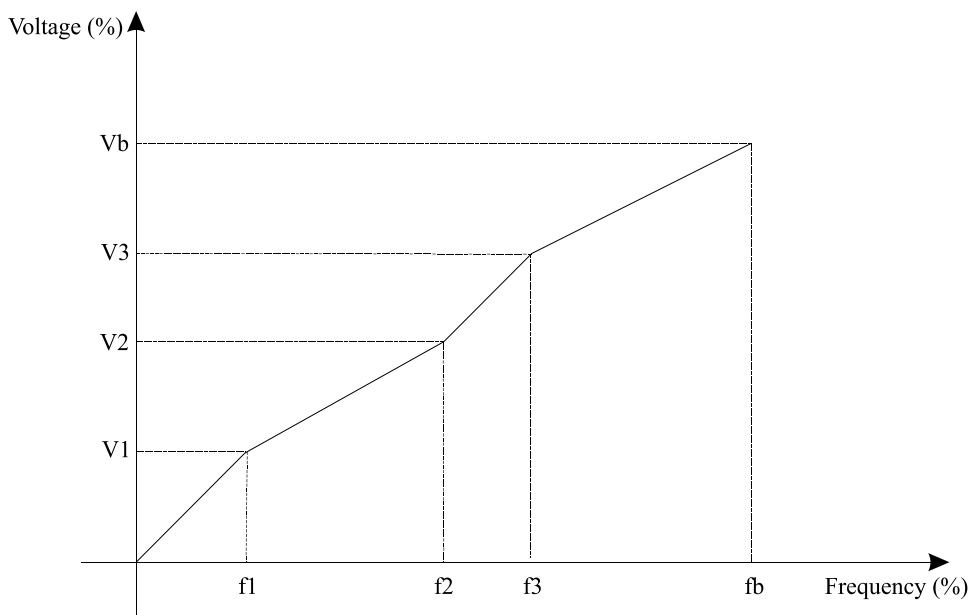
Diagram 5-30 Manual torque boost

d2-03	Multi-point V/F frequency 1 (F1)		Default	0.00 Hz
	Setting Range	0.00 Hz ~ d2-05		
d2-04	Multi-point V/F voltage 1 (V1)		Default	0.0%
	Setting Range	0.0%~100.0%		
d2-05	Multi-point V/F frequency 2 (F2)		Default	0.00 Hz
	Setting Range	d2-03 to d2-07		
d2-06	Multi-point V/F voltage 2 (V2)		Default	0.0%
	Setting Range	0.0%~100.0%		
d2-07	Multi-point V/F frequency 3 (F3)		Default	0.00 Hz
	Setting Range	d2-05 ~ maximum frequency		
d2-08	Multi-point V/F voltage 3 (V3)		Default	0.0%
	Setting Range	0.0%~100.0%		

When d2-00 set to 1, these six parameters are used to define the multi-point V/F curve.

The multi-point V/F curve is set based on the motor's load characteristic. The relationship between voltages and frequencies is: $V1 < V2 < V3$, $f1 < f2 < f3$. Diagram 6-32 shows the setting of multi-point V/F curve.

At low frequency, higher voltage may cause motor overheat or even burnt and cause frequency inverter over current stall or over current protection.



V1-V3: 1st, 2nd and 3rd voltage percentages of multi-point V/F
 Vb : Rated motor voltage
 f1-f3: 1st, 2nd and 3rd voltage percentages of multi-point V/F
 fb: Rated motor running frequency

Diagram 5-32 Setting of multi-point V/F curve

d2-09	V/F slip compensation coefficient		Default	0.0%
	Setting Range	0.0%~200.0%		

This parameter is valid only for the asynchronous motor.

It can compensate the rotational speed slip of the asynchronous motor when the load of the motor increases, stabilizing the motor speed in case of load change.

If this parameter is set to 100%, it indicates that the compensation when the motor bears rated load is the rated motor slip. The rated motor slip is automatically obtained by the frequency inverter through calculation based on

the rated motor frequency and rated motor rotational speed in group d0.

Generally, if the motor rotational speed is different from the target speed, slightly adjust this parameter.

d2-11	V/F oscillation suppression gain	Default	40
	Setting Range	0~100	

The setting method for this parameter is to set as small as possible on the premise of effective oscillation suppression, to avoid the badly effect for V/F running. When there is no oscillation of the motor, please set the gain to 0. Only when there is obvious oscillation of the motor, you can increase the gain properly. The larger the gain is, more obviously the effect of oscillation suppression is.

When the oscillation suppression function is used, the parameters of motor rated current and no-load current must be set correctly, or the effect of oscillation suppression is poor.

d2-13	V/F curve setting		Default	0
	Setting Range	0	Digital setting (d2-13)	
		1	AI1	
		2	AI2	
		3	AI3	
		4	Pulse setting (HDI)	
		5	Multi-function	
		6	Simple PLC	
		7	PID	
		8	Communication setting	
Note: 100.0% corresponds to the rated motor voltage				
d2-14	Voltage digital setting for V/F separation		Default	0 V
	Setting Range	0 V ~ rated motor voltage		

V/F separation is generally applicable to these sites, such as induction heating, inverse power supply and motor torque control.

If V/F separated control is enabled, the output voltage can be set in d2-14 or by analog, Multi-function, simple PLC, PID or communication. If you set the output voltage by means of non-digital setting, 100% of the setting corresponds to the rated motor voltage. If a negative percentage is set, its absolute value is used as the effective value.

0: Digital setting (d2-14)

The output voltage is set directly in d2-13.

1: AI1;

2: AI2;

3: AI3

The output voltage is set by analog input terminals.

4: Pulse setting (HDI)

The output voltage is set by pulses of the terminal HDI.

Pulse setting specification: voltage range 9V~30 V, frequency range 0kHz~100 kHz

5: Multi-function

6: Simple PLC

If the voltage source is simple PLC mode, parameters in group FC must be set to determine the setting output voltage.

7: PID

The output voltage is generated based on PID closed loop. For details, see the description of PID in group C0.

8: Communication setting

The output voltage is set by the host computer by means of communication.

The voltage source for V/F separation is selected in the similar way to the frequency source selection. For details, see b0-03 (main frequency source X specification). 100.0% of the setting in each mode corresponds to the rated motor voltage. If the corresponding value is negative, its absolute value is used.

d2-15	Voltage rise time of V/F separation		Default	0.0s
	Setting Range	0.0s~1000.0s Note: It indicates the time for the voltage rising from 0 V ~ rated motor voltage.		

d2-15 indicates the time required for the output voltage to rise from 0 V to the rated motor voltage shown as t1 in the following figure.

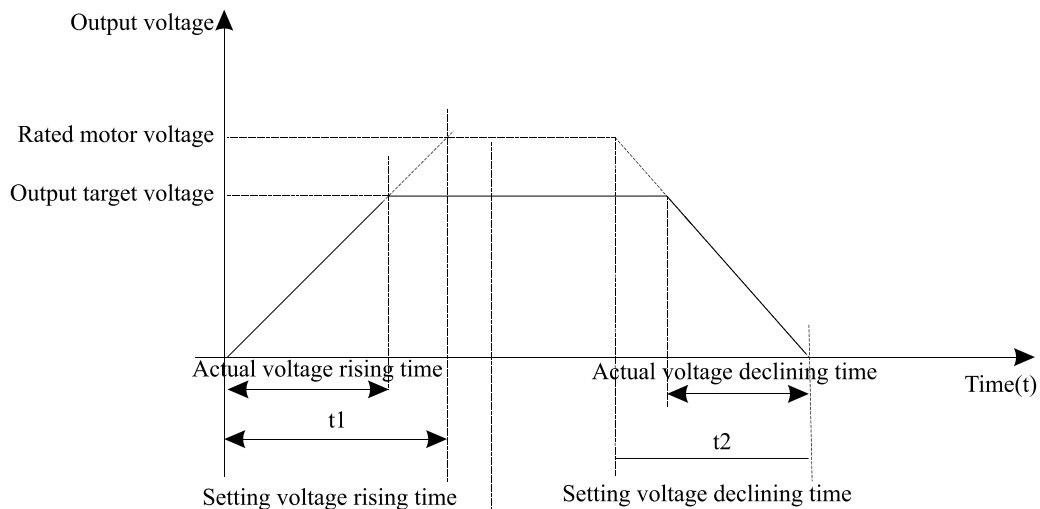


Diagram 5-33 Voltage of V/F separation

5.21 Group d6: Control Optimization Parameters 1

d6-00	Carrier frequency		Default	Model dependent
	Setting Range	0.5kHz~16.0 kHz		

It is used to adjust the carrier frequency of the frequency inverter, helping to reduce the motor noise, avoiding the resonance of the mechanical system, and reducing the leakage current to earth and interference generated by the frequency inverter.

If the carrier frequency is low, output current has high harmonic wave, and then the motor will increase power loss and temperature rising.

If the carrier frequency is higher, the power loss and temperature rising of the motor will decline. However, the frequency inverter will have an increasing in power loss, temperature rising and interference.

Adjusting the carrier frequency will exert influences on the aspects listed in the following table.

Table 6-1 Influences of carrier frequency adjustment

Carrier frequency	Low→High
Motor noise	Large→Small
Output current waveform	Bad→Good
Motor temperature rising	High→Low
Frequency inverter Leakage current	Low→High
	Small→Large
External radiation interference	Small→Large

The factory setting of carrier frequency varies with the frequency inverter power. If you need to modify the carrier frequency, note that if the set carrier frequency is higher than factory setting, it will lead to an increase in temperature rise of the frequency inverter's heatsink. In this case, you need to de-rate the frequency inverter. Otherwise, the frequency inverter may overheat and alarm.

d6-01	DPWM switchover frequency upper limit			Default	8.00 Hz
	Setting Range	5.00Hz~15.00 Hz			
d6-02	PWM modulation mode			Default	0
	Setting	0	Asynchronous modulation		
	Range	1	Synchronous modulation		

This parameter is valid only for V/F control.

Synchronous modulation indicates that the carrier frequency varies linearly with the change of the output frequency, ensuring that the ratio of carrier frequency to output frequency remains unchanged. Synchronous modulation is generally used at high output frequency, which helps improve the output voltage quality.

At low output frequency (100 Hz or lower), synchronous modulation is not required. This is because ratio of carrier frequency to output frequency is still high, and asynchronous modulation is more superior at such low running frequency.

Synchronous modulation takes effect only when the running frequency is higher than 85 Hz. If the frequency is lower than 85 Hz, asynchronous modulation is always valid.

d6-03	Carrier frequency adjustment with temperature			Default	1
	Setting	0	No		
	Range	1	Yes		

It is used to set whether the carrier frequency is adjusted based on the temperature. The frequency inverter automatically reduces the carrier frequency when detecting that the heatsink temperature is high. The frequency inverter restores the carrier frequency to the set value when the heatsink temperature becomes normal. This function is used to reduce the overheat alarms.

d6-04	Dead zone compensation mode selection			Default	1
	Setting Range	0	No compensation		
		1	Compensation mode 1		
		2	Compensation mode 2		

Generally, you need not modify this parameter. Try to use a different compensation mode only when there is special requirement on the output voltage waveform quality or oscillation occurs on the motor.

For high power frequency inverter, compensation mode 2 is recommended.

d6-05	Random PWM depth			Default	0
	Setting Range	0: Random PWM invalid 1~10: Random PWM carrier frequency depth			

The setting of random PWM depth can make the motor shrill noise to soft and reduce the electromagnetic interference to other equipments. If this parameter is set to 0, random PWM is invalid.

d6-06	Current detected compensation			Default	0
	Setting Range	0~100			

d6-07	SVC mode selection			Default	2
	Setting	1	SVC mode 1		
	Range	2	SVC mode 2		

SVC mode 1: Used in the application that high speed stability required.

SVC mode 2: Used in the application that high torque control linearity required.

5.22 Group U0: Monitoring Parameters

Group U0 is used to monitor the frequency inverter's running state. You can view the parameter values by using operation panel, convenient for on-site commissioning, or from the host computer by means of communication (address: 0x7000 ~ 0x7044).

U0-00 ~ U0-31 are the monitoring parameters in the running and stop state defined by b9-02 and b9-03.

U0-00	Running frequency	Display Range	0.00~300.00 Hz (b0-11 = 2)
U0-01	Setting frequency	Display Range	0.00~3000.0 Hz (b0-11 = 1)

These two parameters display the absolute value of theoretical running frequency and set frequency. For the actual output frequency of the frequency inverter, see U0-19.

U0-02	DC Bus voltage	Display Range	0.0~3000.0 V
--------------	----------------	----------------------	--------------

It displays the frequency inverter's DC bus voltage.

U0-03	Output voltage	Display Range	0V~1140 V
--------------	----------------	----------------------	-----------

It displays the frequency inverter's output voltage in the running state.

U0-04	Output current	Display Range	0.00A~655.35 A (Power ≤ 55 kW) 0.0A~6553.5 A (Power > 55 kW)
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It displays the frequency inverter's output current in the running state.

U0-05	Output power	Display Range	0~32767
--------------	--------------	----------------------	---------

It displays the frequency inverter's output power in the running state.

U0-06	Output torque	Display Range	-200.0%~200.0%
--------------	---------------	----------------------	----------------

It displays the frequency inverter's output torque in the running state.

U0-07	DI state	Display Range	-0~32767
--------------	----------	----------------------	----------

It displays the present state of DI terminals. After the value is converted into a binary number, each bit corresponds to a DI. "1" indicates high level signal, and "0" indicates low level signal. The corresponding relationship between bits and DIx is described in the following table.

Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7
DI1	DI2	DI3	DI4	DI5	HDI	DI7	DI8
Bit8	Bit9	Bit10	Bit11	Bit12	Bit13	Bit14	Bit15
DI9	DI10	VDI1	VDI2	VDI3	VDI4	VDI5	

U0-08	DO state	Display Range	0~1023
--------------	----------	----------------------	--------

It indicates the present state of DO terminals. After the value is converted into a binary number, each bit

corresponds to a DO terminal. "1" indicates high level signal, and "0" indicates low level signal. The corresponding relationship between bits and DOx is described in the following table.

Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7
DO3	Relay 1	Relay 2	DO1	DO2	VDO1	VDO2	VDO3
Bit8	Bit9	Bit10	Bit11	Bit12	Bit13	Bit14	Bit15
VDO4	VDO4						

U0-14	Load speed display	Display Range	0~1023
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For more details, see the description of b9-06.

U0-15	PID setting	Display Range	0~65535
U0-16	PID feedback	Display Range	0~65535

They display the PID setting value and PID feedback value.

- PID setting = PID setting (percentage) × C0-05
- PID feedback = PID feedback (percentage) × C0-05

U0-18	Input pulse frequency	Display Range	0.00kHz ~100.00 kHz
--------------	-----------------------	----------------------	---------------------

It displays the high-speed pulse sampled frequency of HDI, in minimum unit of 0.01 kHz.

U0-19	Feedback speed, unit:0.01Hz	Display Range	-3000.0Hz~3000.0 Hz -300.00Hz~300.00 Hz
--------------	-----------------------------	----------------------	--

It displays the actual output frequency of the frequency inverter.

- If b0-11 (frequency command resolution) is set to 1, the display range is -3000.00~3000.00 Hz.
- If b0-11 (frequency command resolution) is set to 2, the display range is -300.00Hz~300.00 Hz.

U0-20	Remaining running time	Display Range	0.0min~6500.0 min
--------------	------------------------	----------------------	-------------------

It displays the remaining running time when the timing operation is enabled. For details on timing operation, refer to b2-28 ~ b2-30.

U0-21	AI1 voltage before correction	Display Range	0.00V~10.57 V
U0-22	AI2 voltage before correction	Display Range	0.00V~10.57 V
U0-23	AI3 voltage before correction	Display Range	0.00V~10.57 V

They display the AI sampling voltage actual value. The actually used voltage is obtained after linear correction, which will reduce the deviation between the sampled voltage and the actual input voltage.

For actual corrected voltage, see U0-09, U0-10 and U0-11. Refer to group b8 for the correction mode.

U0-24	Linear speed	Display Range	0.0min~65535m/min
--------------	--------------	----------------------	-------------------

It displays the linear speed of the HDI high-speed pulse sampling. The unit is meter per minute (meter/min). The linear speed is calculated according to the actual number of pulses sampled per minute and C3-07 (Number of pulses per meter).

U0-27	Communication setting value	Display Range	-100.00%~100.00%
--------------	-----------------------------	----------------------	------------------

It displays the data written in by means of the communication address 0x1000.

U0-28	Actual feedback speed	Display Range	-300.00Hz~300.00Hz -3000.0Hz~3000.0Hz
--------------	-----------------------	----------------------	--

It displays the motor running frequency measured by the encoder.

- If b0-11 (frequency command resolution) is 1, the display range is -3000.0Hz~3000.0 Hz.
- If b0-11 (frequency command resolution) is 2, the display range is -300.00Hz~300.00 Hz.

U0-29	Encoder feedback speed	Display Range	-300.00Hz~300.00Hz -3000.0Hz~3000.0Hz
--------------	------------------------	----------------------	--

It displays the motor running frequency measured by the encoder.

If b0-11 (frequency command resolution) is 1, the display range is -3200.0Hz ~ 3200.0Hz

If b0-11 (frequency command resolution) is 2, the display range is -320.00Hz ~ 320.00Hz.

U0-30	Main frequency X	Display Range	-300.00Hz~300.00Hz -3000.0Hz~3000.0Hz
--------------	------------------	----------------------	--

It displays the setting of auxiliary frequency X.

- If b0-11 (frequency command resolution) is 1, the display range is -3000.0Hz~3000.0 Hz.
- If b0-11 (frequency command resolution) is 2, the display range is -300.00Hz~300.00 Hz.

U0-31	Auxiliary frequency Y	Display Range	-300.00Hz~300.00Hz -3000.0Hz~3000.0Hz
--------------	-----------------------	----------------------	--

It displays the setting of auxiliary frequency Y.

- If b0-11 (frequency command resolution) is 1, the display range is -3000.0Hz~3000.0 Hz.
- If b0-11 (frequency command resolution) is 2, the display range is -300.00Hz~300.00 Hz.

U0-34	Motor temperature	Display Range	0°C~200°C
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It displays the motor temperature obtained by means of AI3 sampling. For the motor temperature detection details, see bb-25.

U0-35	Target torque	Display Range	-200.0%~200.0%
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It displays the present torque upper limit value.

U0-37	Power factor angle	Display Range	0~4095
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It displays the present power factor angle.

U0-38	ABZ position	Display Range	0~65535
--------------	--------------	----------------------	---------

It displays the phase A and B pulse counting of the present ABZ or UVW encoder. This value is four times the number of pulses that the encoder runs. For example, if the display is 4000, the actual number of pulses that the encoder runs is $4000/4 = 1000$.

The value increase when the encoder rotates in forward direction and decreases when the encoder rotates in reverse direction. After increasing to 65535, the value starts to increase from 0 again. After decreasing to 0, the value starts to decrease from 65535 again.

You can check whether the installation of the encoder is normal by viewing U0-37.

U0-39	Target voltage of V/F separation	Display Range	0 V ~ rated motor voltage
--------------	----------------------------------	----------------------	---------------------------

U0-40	Output voltage of V/F separation	Display Range	0 V ~ rated motor voltage
--------------	----------------------------------	----------------------	---------------------------

They display the target output voltage and present actual output voltage in the V/F separation state. For V/F separation more details, see the descriptions of group d2.

U0-41	DI input state visual display	Display Range	--
--------------	-------------------------------	----------------------	----

It displays the DI state visually and the display format is shown in the following figure.

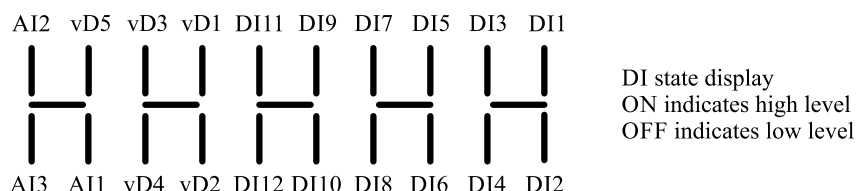


Diagram 5-34 Display format of the DI state

U0-42	DO output state visual display	Display Range	--
--------------	--------------------------------	----------------------	----

It displays the DO state visually and the display format is shown in the following figure.

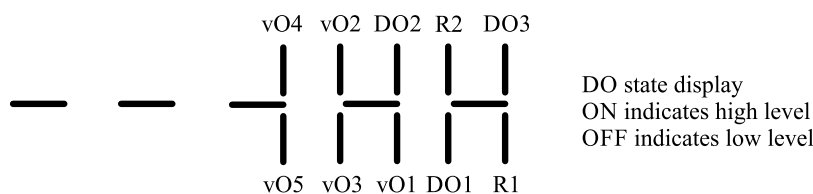


Diagram 5-35 Display format of the DO state

U0-43	DI function state visual display 1	Display Range	--
--------------	------------------------------------	----------------------	----

It displays whether the DI functions 1-40 are valid. The operation panel has five 7-segment LEDs and each 7-segment LED displays the selection of eight functions. The 7-segment LED is defined in the following figure.

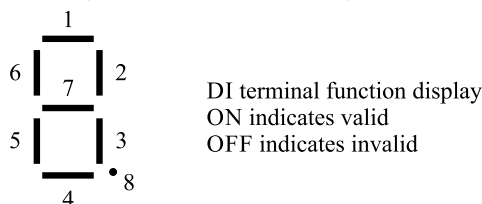


Diagram 5-36 Definition of 7-segment LED

The 7-segment LED display functions 1-8, 9-16, 17-24, 25-32 and 33-40 respectively from right to left.

U0-44	DI function state visual display 2	Display Range	--
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It displays whether the DI functions 41~59 are valid. The display format is similar to U0-42.

The 7-segment LEDs display functions 41~48, 49~56 and 57~59, respectively from right to left.

U0-46	Phase Z signal counting	Display Range	--
--------------	-------------------------	----------------------	----

It displays the phase Z counting of the present ABZ or UVW encoder. The value increases or decreases by 1 every time the encoder rotates a round forwardly or reversely. You can check whether the installation of the encoder is normal by viewing U0-45.

U0-47	Present setting frequency (%)	Display Range	-100.00%~100.00%
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U0-48	Present running frequency (%)	Display Range	-100.00%~100.00%
--------------	-------------------------------	----------------------	------------------

It displays the present setting frequency and running frequency. 100.00% corresponds to the frequency inverter's maximum frequency (b0-13).

U0-49	Frequency inverter running state	Display Range	0~65535
--------------	----------------------------------	----------------------	---------

It displays the running state of the frequency inverter. The data format is listed in the following table:

U0-49	Bit0 Bit1	0: stop 1: forwarder running 2: reverse running
	Bit 2 Bit3	0: constant speed 1:acceleration 2:deceleration
	Bit 4	0:Normal DC bus voltage 1:Low DC bus voltage

U0-50	Sent value of point-point communication	Display Range	-100.00%~100.00%
U0-51	Received value of point-point communication	Display Range	-100.00%~100.00%

It displays the data at point-point communication. U0-50 is the data sent by the master, and U0-51 is the data received by the slave.

5.23 Group A0: System parameters

A0-00	User password		Default	--
	Display Range	0~65535		

If it is set to any non-zero number, the password protection function is enabled. After a password has been set and taken effect, you must enter the correct password in order to enter the menu. If the entered password is incorrect you cannot view or modify parameters.

If A0-00 is set to 00000, the previously set user password is cleared, and the password protection function is disabled.

A0-01	Product number		Default	Model dependent
	Display Range	Frequency inverter product number		
A0-02	Software version		Default	Model dependent
	Display Range	Software version of control board		
A0-06	Function parameters selection		Default	01
	Setting Range	00	Not display	
		01	Display	

A0-07	Parameter modification property		Default	0
	Setting Range	0	Modifiable	
		1	Not modifiable	

It is used to set whether the parameters are modifiable to avoid mal-function. If it is set to 0, all parameters are modifiable. If it is set to 1, all parameters can only be viewed.

A0-09	Restore default settings		Default	0
	Setting Range	0	No operation	
		1	Restore default settings except motor parameters and accumulation record.	
		4	Clear records	
	Other	Reserved		

0: No operation**1: Restore default settings except motor parameters**

If A0-09 is set to 1, most function codes are restored to the default settings **except** motor parameters, frequency command resolution (b0-11), fault records, accumulative running time (b9-09), accumulative power-on time (b9-08) and accumulative power consumption (b9-10).

4: Clear records

If A0-09 is set to 4, the fault records, accumulative power-on time (b9-08), accumulative running time (b9-09), and accumulative power consumption (b9-10) are cleared.

Option:

A0-11	Parameter copy		Default	--
	Setting Range	1	The machine parameter upload to the keypad	
		2	Keyword function download to the machine	

1: The machine parameter upload to the keypad**2: Keyword function download to the machine**

Noted: After completed the operation of 1~2, parameter is automatically restored to aero.

5.24 Group A2: Control Optimization Parameters 2

A2-00	Current limit level		Default	150%
	Setting Range	50%~200%		
A2-01	Current limit selection		Default	1
	Setting Range	0~1		
A2-02	Current limit gain		Default	20
	Setting Range	0~100		
A2-03	Compensation factor of speed multiplying current limit		Default	50%
	Setting Range	50%~200%		

In high frequency area, motor drive current is small. Bigger motor speed dip is caused by current limit level compared with below rated frequency. To improve motor running characteristic, you can lower current limit level above rated frequency.

The current limit function above rated frequency helps to improve acceleration performance in the applications, such as centrifuge, where high running frequency and several times of field weakening are required, and load inertia is large.

A2-04	Voltage limit		Default	760V
	Setting Range	200.0V~2000.0V		
A2-05	Voltage limit selection		Default	1
	Setting Range	0~1		
A2-06	Frequency gain for voltage limit		Default	30
	Setting Range	0~100		
A2-07	Voltage gain for voltage limit		Default	30
	Setting Range	0~100		
A2-08	Frequency rise threshold during voltage limit		Default	5Hz
	Setting Range	0~50Hz		

The increase of A2-06 improves the control effect of the bus voltage, but the output frequency can fluctuate, and if the

fluctuate is large, can reduce A2-06 appropriately.

Note: when using a braking resistor or when installing a brake unit or energy feedback unit:

Please setting A2-05 to 0, if it is not "0", it may cause deceleration time extension problem.

A2-09	Slip compensation time constant		Default	0.5s
	Setting Range	0.1s~10.0s		

If A2-09 sets the smaller the value, and fast response time. But when the setting value is too small, 07 overvoltage failure is easy to occur in large inertia load.

A2-10	Automatic frequency boost enable		Default	0
	Setting Range	0~1		
A2-11	Min motoring torque current		Default	50%
	Setting Range	10%~100%		
A2-12	Max regenerative torque current		Default	20%
	Setting Range	10%~100%		
A2-13	Auto-rise frequency KP		Default	50
	Setting Range	0~100		
A2-14	Auto-rise frequency KI		Default	50
	Setting Range	0~100		
A2-15	Torque compensation gain		Default	100
	Setting Range	80~150		
A2-16	Rotational speed tracking closed loop current KP		Default	500
	Setting Range	0~1000		
A2-17	Rotational speed tracking closed loop current KI		Default	800
	Setting Range	0~1000		
A2-18	Rotational speed tracking closed loop current limit		Default	Model dependent
	Setting Range	30%~200%		

The max current in rotational speed tracking process is limited to the range of the set value of the A2-18. The effect of rotational speed tracking will get worse if setting value is too small.

A2-19	Rotational speed tracking closed loop current lower limit		Default	30%
	Setting Range	10%~100%		
A2-20	Time of rotational speed tracking voltage rise		Default	1.1s
	Setting Range	0.5~3.0s		

A2-21	Demagnetization time		Default	1.0s
	Setting Range	0.00s~5.00s		

The demagnetization time is the minimum interval between stop and start.,this function code valid only when the rotational speed tracking function is enabled. Easy to cause overvoltage fault if the value setting is too small.

A2-22	Braking applied voltage		Default	760V
	Setting Range	650V~800V		

The starting voltage of the action of the built-in braking unit

6. EMC (Electromagnetic compatibility)

6.1 Definition

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

6.2 EMC Standard Description

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

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

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

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

6.3 EMC Guide

6.3.1 Harmonic Effect

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

6.3.2 Electromagnetic Interference and Installation Precautions

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

Installation precautions:

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

6.3.3 Handling method for the interferences of the surrounding equipment on the inverter

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

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

6.3.4 Handling method for the interferences of frequency inverter on the surrounding equipment

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

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

6.3.5 Leakage current and handling

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

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

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

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

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

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

generate error action.

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

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

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

7. Fault Diagnosis and Solution

7.1 Fault Alarm and Countermeasures

EM15 inverter has 35 types of warning information and protection function. In case of abnormal fault, the protection function will be invoked, the inverter will stop output, and the faulty relay contact of the inverter will start, and the fault code will be displayed on the display panel of the inverter. Before consulting the service department, the user can perform self-check according to the prompts of this chapter, analyze the fault cause and find out the solution. If the fault is caused by the reasons as described in the dotted frame, please consult the agents of inverter or our company directly. Among the 35 types of warning information, Err22 is hardware over current or over voltage signal. In most cases, the hardware over voltage fault will cause Err22 alarm.

Table 7-1 Common faults and solution of the frequency inverter

Fault Type	Display	Possible Causes	Solutions
Inverter unit protection	Err01	1: The output circuit is grounded or short circuited. 2: The connecting cable of the motor is too long. 3: The IGBT overheat. 4: The internal connections become loose. 5: The main control board is faulty. 6: The drive board is faulty. 7: The inverter IGBT is faulty.	1: Eliminate external faults. 2: Install a reactor or an output filter. 3: Check the air filter and the cooling fan. 4: Connect all cables properly. 5: Ask for technical support 6: Ask for technical support 7: Ask for technical support
Over current during acceleration	Err02	1: The output circuit is grounded or short circuited. 2: Motor auto-tuning is not performed. 3: The acceleration time is too short. 4: Manual torque boost or V/F curve is not appropriate. 5: The voltage is too low. 6: The startup operation is performed on the rotating motor. 7: A sudden load is added during acceleration. 8: The frequency inverter model is of too small power class.	1: Eliminate external faults. 2: Perform the motor auto-tuning. 3: Increase the acceleration time. 4: Adjust the manual torque boost or V/F curve. 5: Adjust the voltage to normal range. 6: Select rotational speed tracking restart or start the motor after it stops. 7: Remove the added load. 8: Select a frequency inverter of higher power class.
Over current during deceleration	Err03	1: The output circuit is grounded or short circuited. 2: Motor auto-tuning is not performed. 3: The deceleration time is too short. 4: The voltage is too low. 5: A sudden load is added during deceleration. 6: The braking unit and braking resistor are not installed.	1: Eliminate external faults. 2: Perform the motor auto-tuning. 3: Increase the deceleration time. 4: Adjust the voltage to normal range. 5: Remove the added load. 6: Install the braking unit and braking resistor.

Fault Type	Display	Possible Causes	Solutions
Over current at constant speed	Err04	1: The output circuit is grounded or short circuited. 2: Motor auto-tuning is not performed. 3: The voltage is too low. 4: A sudden load is added during operation. 5: The frequency inverter model is of too small power class.	1: Eliminate external faults. 2: Perform the motor auto-tuning. 3: Adjust the voltage to normal range. 4: Remove the added load. 5: Select an Frequency inverter of higher power class.
Overvoltage during acceleration	Err05	1: The input voltage is too high. 2: An external force drives the motor during acceleration. 3: The acceleration time is too short. 4: The braking unit and braking resistor are not installed.	1: Adjust the voltage to normal range. 2: Cancel the external force or install a braking resistor. 3: Increase the acceleration time. 4: Install the braking unit and braking resistor.
Overvoltage during deceleration	Err06	1: The input voltage is too high. 2: An external force drives the motor during deceleration. 3: The deceleration time is too short. 4: The braking unit and braking resistor are not installed.	1: Adjust the voltage to normal range. 2: Cancel the external force or install the braking resistor. 3: Increase the deceleration time. 4: Install the braking unit and braking resistor.
Overvoltage at constant speed	Err07	1: The input voltage is too high. 2: An external force drives the motor during deceleration.	1: Adjust the voltage to normal range. 2: Cancel the external force or install the braking resistor.
Control power supply fault	Err08	The input voltage is not within the allowable range.	Adjust the input voltage to the allowable range.
Low voltage	Err09	1: Instantaneous power failure occurs on the input power supply. 2: The frequency inverter's input voltage is not within the allowable range. 3: The DC bus voltage is abnormal. 4: The rectifier bridge and buffer resistor are faulty. 5: The drive board is faulty. 6: The main control board is faulty.	1: Reset the fault. 2: Adjust the voltage to normal range. 3: Ask for technical support 4: Ask for technical support 5: Ask for technical support 6: Ask for technical support
Frequency inverter overload	Err10	1: The load is too heavy or locked- rotor occurs on the motor. 2: The frequency inverter model is of too small power class.	1: Reduce the load and check the motor and mechanical condition. 2: Select a frequency inverter of higher power class.
Motor overload	Err11	1: bb-02 is set improperly. 2: The load is too heavy or locked- rotor occurs on the motor. 3: The frequency inverter model is of too small power class.	1: Set bb-02 correctly. 2: Reduce the load and check the motor and the mechanical condition. 3: Select a frequency inverter of higher power class.
Power input phase loss	Err12	1: The three-phase power input is abnormal. 2: The drive board is faulty. 3: The lightningproof board is faulty. 4: The main control board is faulty.	1: Eliminate external faults. 2: Ask for technical support. 3: Ask for technical support. 4: Ask for technical support.

Fault Type	Display	Possible Causes	Solutions
Power output phase loss	Err13	1: The cable connecting the frequency inverter and the motor is faulty. 2: The frequency inverter's three-phase outputs are unbalanced when the motor is running. 3: The drive board is faulty. 4: The IGBT module is faulty.	1: Eliminate external faults. 2: Check whether the motor three phase winding is normal. 3: Ask for technical support. 4: Ask for technical support.
IGBT Module overheat	Err14	1: The ambient temperature is too high. 2: The air filter is blocked. 3: The fan is damaged. 4: The thermally sensitive resistor of the IGBT module is damaged. 5: The inverter IGBT module is damaged.	1: Lower the ambient temperature. 2: Clean the air filter. 3: Replace the damaged fan. 4: Replace the damaged thermally sensitive resistor. 5: Replace the inverter module.
External equipment fault	Err15	1: External fault signal is input via DI. 2: External fault signal is input via virtual I/O.	1: Reset the operation. 2: Reset the operation.
Communication fault	Err16	1: The host computer is in abnormal state. 2: The communication cable is faulty. 3: The communication extension card is set improperly. 4: The communication parameters in group bA are set improperly.	1: Check the cabling of host computer. 2: Check the communication cabling. 3: Set the communication extension card correctly. 4: Set the communication parameters properly.
Contact fault	Err17	1: The drive board and power supply are faulty. 2: The contactor is faulty.	1: Replace the faulty drive board or power supply board. 2: Replace the faulty contactor.
Current detection fault	Err18	1: The HALL device is faulty. 2: The drive board is faulty.	1: Replace the faulty HALL device. 2: Replace the faulty drive board.
Motor auto-tuning fault	Err19	1: The motor parameters are not set according to the nameplate. 2: The motor auto-tuning times out.	1: Set the motor parameters according to the nameplate properly. 2: Check the cable connecting the Frequency inverter and the motor.
Encoder fault	Err20	1: The encoder type is incorrect. 2: The cable connection of the encoder is incorrect. 3: The encoder is damaged. 4: The PG card is faulty.	1: Set the encoder type correctly based on the actual situation. 2: Eliminate external faults. 3: Replace the damaged encoder. 4: Replace the faulty PG card.
EEPROM read-write fault	Err21	The EEPROM chip is damaged.	Replace the main control board.
Frequency inverter hardware fault	Err22	1: Overvoltage exists. 2: Over current exists.	1: Handle based on over voltage. 2: Handle based on over current.
Short circuit to ground	Err23	The motor is short circuited to the ground.	Replace the cable or motor.
Accumulative running time reached	Err26	The accumulative running time reaches the setting value.	Clear the record through parameter A0-09

Fault Type	Display	Possible Causes	Solutions
User-defined fault 1	Err27	1: The signal of user-defined fault 1 is input via DI. 2:The signal of user-defined fault 1 is input via virtual I/O.	1: Reset the operation. 2: Reset the operation.
User-defined fault 2	Err28	1: The signal of user-defined fault 2 is input via DI. 2:The signal of user-defined fault 2 is input via virtual I/O.	1: Reset the operation. 2: Reset the operation.
Accumulative power-on time reached	Err29	The accumulative power-on time reaches the setting value.	Clear the record through parameter A0-09
Off load	Err30	The frequency inverter running current is lower than the setting value.	Check that the load is disconnected or the parameter setting is correct.
PID feedback lost during running	Err31	The PID feedback is lower than the setting of C0-26.	Check the PID feedback signal or set C0-26 to a proper value.
By wave current limiting fault	Err40	1: The load is too heavy or locked- rotor occurs on the motor. 2: The frequency inverter model is of too small power class.	1: Reduce the load and check the motor and mechanical condition. 2: Select a frequency inverter of higher power class.
Motor switchover fault during running	Err41	Change the selection of the motor via terminal during running of the frequency inverter.	Perform motor switchover after the frequency inverter stops.
Too large speed deviation	Err42	1: The encoder parameters are set incorrectly. 2: The motor auto-tuning is not performed. 3: The detection parameters of too large speed deviation are set incorrectly.	1: Set the encoder parameters properly. 2: Perform the motor auto-tuning. 3: Set the detection parameters correctly based on the actual situation.
Motor over-speed	Err43	1: The encoder parameters are set incorrectly. 2: The motor auto-tuning is not performed. 3: The over-speed detection parameters are set incorrectly.	1: Set the encoder parameters properly. 2: Perform the motor auto-tuning. 3: Set the over-speed detection parameters correctly based on the actual situation.
Motor overheat	Err45	1: The cabling of the temperature sensor becomes loose. 2: The motor temperature is too high.	1: Check the temperature sensor cabling and eliminate the cabling fault. 2: Lower the carrier frequency or adopt other heat radiation measures.
Initial position fault	Err51	1: The motor parameters are not too deviation based on the actual situation.	1: Check that the motor parameters are set correctly and whether the setting of rated current is too small.

7.2 Common Faults and Solutions

You may come across the following faults during the use of the frequency inverter. Refer to the following table for simple fault analysis.

Table 8-2 Troubleshooting to common faults of the frequency inverter

SN	Fault	Possible Causes	Solutions
1	There is no display at power-on.	1: There is no power supply to the frequency inverter or the power input to the frequency inverter is too low. 2: The power supply of the switch on the drive board of the frequency inverter is faulty. 3: The rectifier bridge is damaged. 4: The control board or the operation panel is faulty. 5: The cable connecting the control board and the drive board and the operation panel loose or breaks.	1: Check the power supply. 2: Check the DC bus voltage. 3: Check the internal wiring plug 4: Change a keypad 5: Ask for technical support.
2	"-coc-" is displayed at power-on.	1: The cable between the drive board and the control board is in poor contact. 2: Related components on the control board are damaged. 3: The motor or the motor cable is short circuited to the ground. 4: The HALL device is faulty. 5: The power input to the frequency inverter is too low.	1: Checking wiring 2: Ask for technical support.
3	"Err23" is displayed at power-on.	1: The motor or the motor output cable is short-circuited to the ground. 2: The frequency inverter is damaged.	1: Measure the insulation of the motor and the output cable with a megger. 2: Ask for technical support.
4	The frequency inverter display is normal after power-on. But "-coc-" is displayed after running and stops immediately.	1: The cooling fan is damaged or locked-rotor occurs. 2: The external control terminal cable is short circuited.	1: Replace the damaged fan. 2: Eliminate external fault.
5	Err14 (IGBT module overheat) fault is reported frequently.	1: The setting of carrier frequency is too high. 2: The cooling fan is damaged, or the air filter is blocked. 3: Components inside the frequency inverter are damaged (thermal coupler or others).	1: Reduce the carrier frequency (d6-00). 2: Replace the fan and clean the air filter. 3: Ask for technical support.
6	The motor does not rotate after the frequency inverter runs.	1: Check the motor and the motor cables. 2: The frequency inverter parameters are set improperly (motor parameters). 3: The cable between the drive board and the control board is in poor contact. 4: The drive board is faulty.	1: Ensure the cable between the Frequency inverter and the motor is normal. 2: Replace the motor or clear mechanical faults. 3: Check and re-set motor parameters.
7	The DI terminals are disabled.	1: The parameters are set incorrectly. 2: The external signal is incorrect. 3: The jumper bar across OP and +24 V becomes loose. 4: The control board is faulty.	1: Check and reset the parameters in group F4. 2: Re-connect the external signal cables. 3: Re-confirm the jumper bar across OP and +24 V. 4: Ask for technical support.
8	The motor speed is always low in VC mode.	1: The encoder is faulty. 2: The encoder cable is connected incorrectly or in poor contact.	1: Replace the encoder and ensure the cabling is proper. 2: Replace the PG card.

SN	Fault	Possible Causes	Solutions
		3: The PG card is faulty. 4: The drive board is faulty.	3: Ask for technical support.
9	The frequency inverter reports overcurrent and overvoltage frequently.	1: The motor parameters are set improperly. 2: The acceleration/deceleration time is improper. 3: The load fluctuates.	1: Re-set motor parameters or re-perform the motor auto-tuning. 2: Set proper acceleration/deceleration time. 3: Ask for technical support.
10	Err17 is reported of power-on or running.	The soft startup contactor is not sucked up.	1: Check whether the contactor cable is loose. 2: Check whether the contactor is faulty. 3: Check whether 24 V power supply of the contactor is faulty. 4: Ask for technical support.
11	■■■■■ is displayed of power-on.	Related component on the control board is damaged.	Replace the control board.

Appendix I. Modbus communication protocol

EM15 series of inverter provides RS485 communication interface, and adopts MODBUS communication protocol. User can carry out centralized monitoring through PC/PLC to get operating requirements. And user can set the running command, modify or read the function codes, the working state or fault information of frequency inverter by Modbus communication protocol.

I. About Protocol

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

II. Application Methods

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

III. Bus structure

1) Hardware interface.

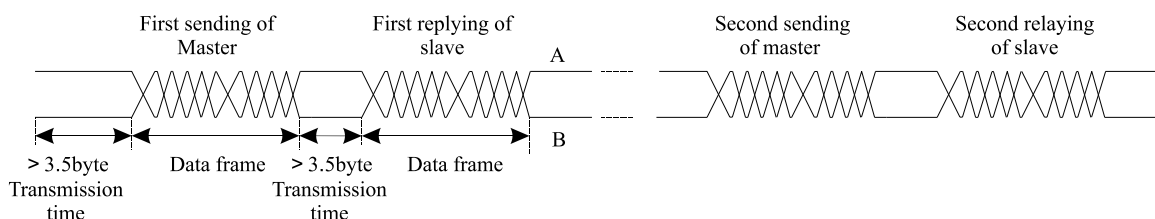
The "485+" and "485-" terminals on frequency inverter are the communication interfaces of Modbus

2) Topological mode

It is a "Single-master Multi-slave" system. In this network, every communication machine has a unique slave address. One of them is as "master" (usually PC host machine, PLC and HMI, etc.), actively sends out the communication, to read or write the parameters of slave. Other machines will be used as slave and response to the inquiry/command from master. At one time only one machine can send the data and other machines are in the receiving status. The setup range of slave address is 0 to 247. Zero refers to broadcast communication address. The address of slave must be exclusive in the network.

3) Transmission mode

There provide asynchronous series and half-duplex transmission mode. In the series asynchronous communication, the data is sent out frame by frame in the form of message. According to the Modbus-RTU protocol, when the free time of no transmission in communication data lines is more than the transmission time of 3.5byte, it indicates that a new start of communication frame.



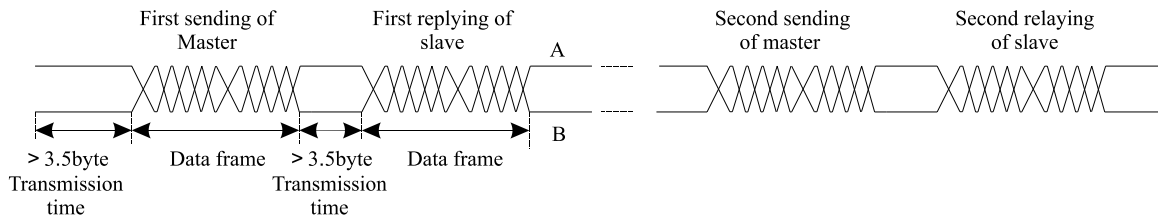
EM15 series inverter has built-in the Modbus-RTU communication protocol, and is applicable to response the slave "Inquiry/command" or doing the action according to the master's "Inquiry / Command" and response to the

data.

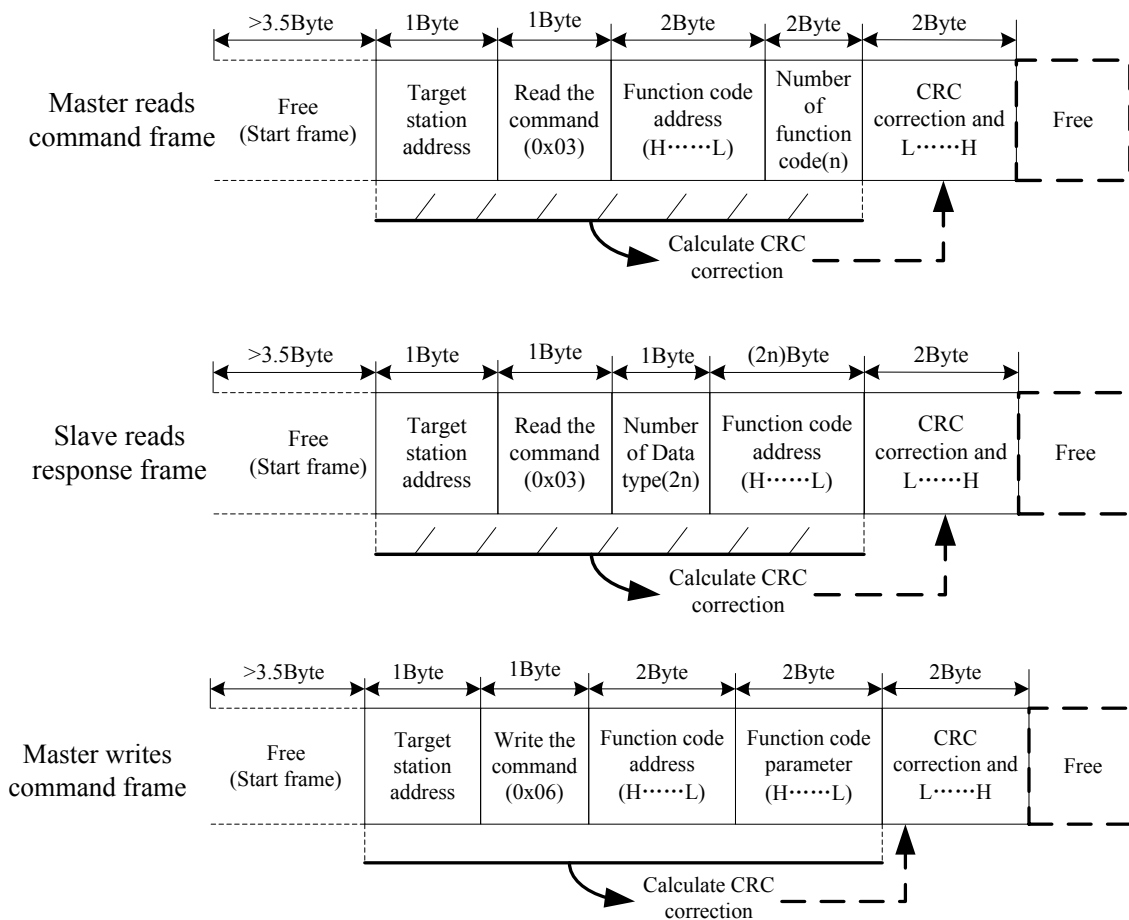
Here, master is personnel computer (PC), industrial machine or programmable logical controller (PLC), and the slave is inverter. Master not only visits some slave, but also sends the broadcast information to all the slaves. For the single master "Inquiry/Command", all of slaves will return a signal that is a response; for the broadcast information provided by master, slave needs not feedback a response to master machine.

Communication data structure

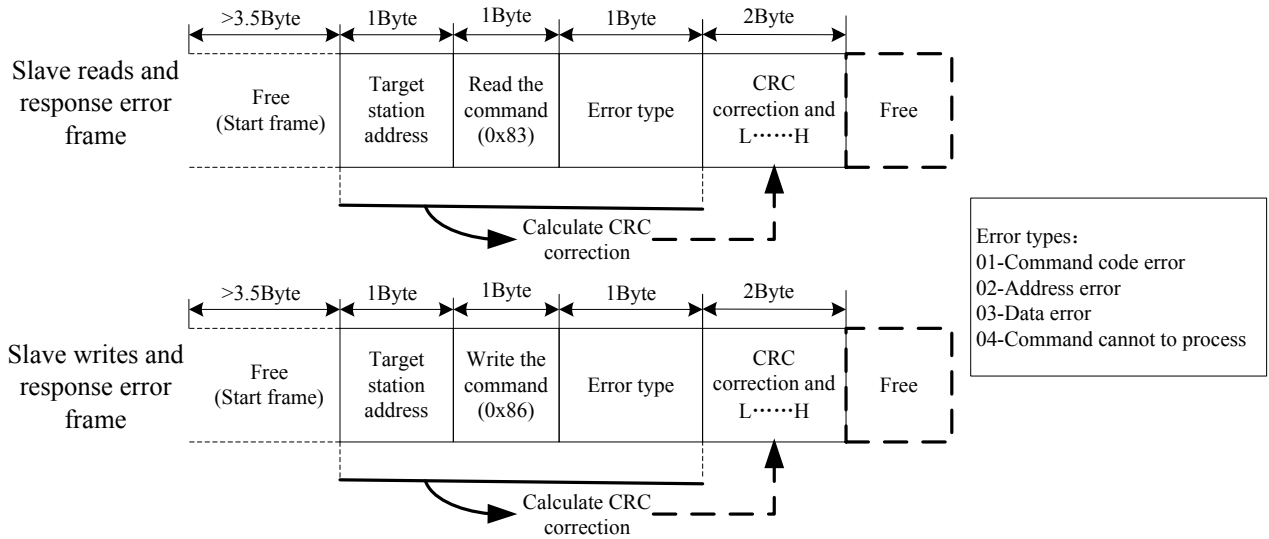
Modbus protocol communication data format of EM15 series inverter is shown as following. The inverter only support the reading and writing of Word type parameters, the corresponding reading operation command is "0x03", the writing operation command is "0x06". The writing and reading operation of byte or bit is not supported.



In theory, the host computer can continuously read several function codes once (that is, the maximum value of "n" is 12), but note that not to jump across the last function code in this function group to avoid the wrong reply.



If the wrong communication frame was detected by the slave or other reasons caused the failure of reading and writing, the wrong frame will be replied.



RTU frame format

Frame start (START)	More than the 3.5- character time
Slave address(ADR)	Communication address:1 to 247(0: broadcast address)
Command code(CMD)	03: Read slave parameters 06: Write slave parameters
Function code address(H)	It indicates the external parameter address of frequency inverter in hexadecimal format; There are functional code or non-functional code (such as running state parameter/ running command parameters) type parameters, for details see the address definition.
Function code address(L)	
Number of function code(H)	It indicates the number of function code ready by the frame. If it is "1", then it indicates that it reads one function code. During the transmission, high bit is put in the front, and low bit is at the back.
Number of function code(L)	
Data(H)	It indicates the replying data or the data waiting to write-in. During the transmission, high bit is put in the front, and low bit is at the back.
Data(L)	
END	3.5- character time

Command codes and communication data

Command Code 03H (0000 0011), read N words (can read a maximum of consecutive 12 words).

For example: for an inverter with the slave address of 01H, the start address of memory is 1001H, read 5 words consecutively (Running frequency, DC bus voltage, output voltage, output current, output power), the structure of the frame is as follows:

RTU mode: Command Message of the Master

START	T1-T2-T3-T4
ADDR	01H
CMD	03H

Higher bits of start address	00H
Lower bits of start address	04H
Higher bits of data number	00H
Lower bits of data number	02H
CRC CHK lower bit	85H
CRC CHK higher bit	CAH
END	T1-T2-T3-T4

RTU mode: Response Message of the Slave

START	T1-T2-T3-T4
ADDR	01H
CMD	03H
Higher bits of data number	00H
Lower bits of data number	0AH
Higher bits of running frequency	xxH
Lower bits of running frequency	xxH
Higher bits of DC bus voltage	xxH
Lower bits of DC bus voltage	xxH
Higher bits of output voltage	xxH
Lower bits of output voltage	xxH
Higher bits of output current	xxH
Lower bits of output current	xxH
Higher bits of output power	xxH
Lower bits of output power	xxH
CRC CHK lower bit	xxH
CRC CHK higher bit	xxH
END	T1-T2-T3-T4

Command code 06H (0000 0110), write one word.

For example, write 1000(2710H)(Setting frequency b0-12) into the address 1000H of the inverter with the slave address of 01H, the structure of the frame is as follows:

RTU mode: Command Message of the Master

START	T1-T2-T3-T4
ADDR	01H
CMD	06H
High bits of data address	10H
Low bits of data address	01H
High bits of data content	27H
Low bits of data content	10H
CRC CHK lower bit	97H
CRC CHK higher bit	36H
END	T1-T2-T3-T4

RTU mode: Response Message of the Slave

START	T1-T2-T3-T4
ADDR	01H
CMD	06H
High bits of data address	10H
Low bits of data address	01H
High bits of data content	27H
Low bits of data content	10H
CRC CHK lower bit	97H
CRC CHK higher bit	36H
END	T1-T2-T3-T4

CRC Checking

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

If the two values are not equal, that means transmission is error

The CRC is started by 0xFFFF. Then a process begins of applying successive eight-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit, do not apply to the CRC. During generation of the CRC, each eight-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next eight-bit byte is exclusive ORed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

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

```
unsigned int crc_chk_value(unsigned char *data_value, unsigned char length
```

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

```

```

    {
        crc_value=crc_value>>1;
    }
}
}
return(crc_value);
}

```

Definition of communication parameter address

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

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

High level bytes: Group A0~AF(GroupA0-A2/ Groupb0-bC), Groupb0-bF(Group C0-C6/Groupd0-d6), 70-7F(Group U)

Low level bytes: 00 to FF

For example: b0-03, address indicates to 0xA303.

Note: Group U: Only for reading parameter, cannot be changed parameters, some parameters cannot be changed during operation, some parameters regardless of what kind of state the inverter in, the parameters cannot be changed. Change the function code parameters, pay attention to the scope of the parameters, units, and relative instructions.

Function code group	Communication inquiry address	Inquiry address When Communication modifies RAM
A0~ A2	0xA000~ 0xA2FF	0x4000~ 0x42FF
b0~bC	0xA300~ 0xAFFF	0x4300~ 0x4FFF
C0~C6	0xb000~ 0xB7FF	0x5000~ 0x57FF
d0~d6	0xB800~ 0xBEFF	0x5800~ 0x5EFF
U0	0x7000~ 0x70FF	

Besides, due to EEPROM be frequently stored, it will reduce the lifetime of EEPROM. In the communication mode, and some function codes don't have to be stored as long as change the RAM value.

Stop/start parameter

Parameter address	Parameter description	Parameter address	Parameter description
1000	Communication set value (-10000 ~ 10000)(Decimal)	1010	PID setting
1001	Running frequency	1011	PID feedback
1002	DC Bus voltage	1012	PLC process
1003	Output voltage	1013	Pulse input frequency, unit: 0.01KHz
1004	Output current	1014	Feedback speed, unit:0.1Hz
1005	Output power	1015	Remaining running time
1006	Output torque	1016	Voltage before AI1correction
1007	Running speed	1017	Voltage before AI2correction
1008	DI input terminal	1018	Voltage before AI3correction
1009	DO output terminal	1019	Linear speed
100A	AI1 voltage	101A	Present power-on time
100B	AI2 voltage	101B	Present running time
100C	AI3 voltage	101C	Pulse input frequency, unit:1Hz
100D	Counting value input	101D	Communication setting value
100E	Length value input	101E	Actual feedback speed

100F	Load speed	101F	Main frequency X display
		1020	Auxiliary frequency Y display

Note: Communication setting value is the percentage of relative value, 10000 corresponds to 100%, -10000 correspond to -100.00%.

Control command input frequency inverter: (write in only)

Command word address	Command function
2000	0001: Forward running
	0002: Reverse running
	0003: Forward jog
	0004: Reverse jog
	0005: Free stop
	0006:Decelarating stop
	0007: Fault reset

Read inverter status: (read only)

Command word address	Command function
3000	0001: Forward running
	0002: Reverse running
	0003: Stop

Parameter locking password collation: (If the feedback is the 8888H, it indicates the password collation passed)

Password address	Contents of input password
1F00	*****

Digital output terminal control: (write in only)

Address Of locking password command	Contents of locking password command
2001	BIT0: DO1 output control BIT1: DO2 output control BIT2: Relay 1 output control BIT3: Relay 2 output control BIT4: FMR output control BIT5: VDO1 BIT6: VDO2 BIT7: VDO3 BIT8: VDO4 BIT9: VDO5

Analog output AO1 control: (write in only)

Command word address	Command function
2002	0~7FFF indicates 0%~100%

Analog output AO2 control: (write in only)

Command word address	Command function
2003	0~7FFF indicates 0%~100%

Pulse output control: (write in only)

Command word address	Command function
2004	0~7FFF indicates 0%~100%

Inverter fault description:

Inverter fault description	Inverter fault information	
8000	0000: No fault 0001: Reserved 0002: acceleration over current 0003: deceleration over current 0004: Constant speed over current 0005: acceleration over voltage 0006: deceleration over voltage 0007: Constant speed over voltage 0008: Buffer resistor fault 0009: less voltage fault 000A: Frequency inverter overload 000B: Motor overload 000C: Input phase failure 000D: Output phase failure 000E: IGBT overheat 000F: External equipment fault 0010: Communication fault 0011: Contactor fault 0012: Current detection fault 0013: Motor auto-tuning fault 0014: Encoder/PG fault	0015: EEPROM read-write in fault 0016: Frequency inverter hardware fault 0017: Short circuit to ground fault 0018: Reversed 0019: Reversed 001A: Accumulative running time reached 001B: User-defined fault 1 001C: User-defined fault 2 001D: Accumulative power-on time reached 001E: Off load 001F: PID lost during running 0028: fast current limit fault 0029: Motor switchover fault during running 002A: Too large speed deviation 002B: Motor over-speed 002D: Motor overheat 005A: Encode lines setting fault 005B: Not connect to the encoder 005C: Initial location fault 005E: Speed feedback fault

ModBus communication fault address

Address Definition	Fault information	
8001	0000: Not fault 0001: Password error 0002: Command code error 0003: CRC error 0004: Illegal address	0005: Illegal data 0006: Parameter change invalid 0007: System locked 0008: Inverter busy (EEPROM is storing)

Group bA Communication parameters

bA-00	Communication type selection		Default	0
	Setting Range	0: Modbus protocol		

The EM15 now supports Modbus, later will add the communication protocol such as PROFIBUS-DP and CANopen protocol. For details, see the description of "EM15 communication protocol".

bA-01	Baud ratio setting		Default	5
	Setting Range	0: 300BPS 1: 600BPS 2: 1200BPS 3: 2400BPS	4: 4800BPS 5: 9600BPS 6: 19200BPS 7: 38400BPS	

This parameter is used to set the data transfer rate from host computer and the frequency inverter. Please note that baud ratio of the host computer and the inverter should be consistent. Otherwise, the communication is impossible.

The higher the baud ratio is, the faster the communication is.

bA-02	Modbus Data format		Default	0
	Setting Range	0	No check, data format <8,N,2>	
		1	Even parity check, data format<8,E,1>	
		2	Odd Parity check, data format<8,O,1>	
	3	No check, data format <8,N,1>		

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

bA-03	Broadcast address		Default	0
	Setting Range	1~249 (0: Broadcast address) Valid for Modbus		

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

bA-04	Modbus response delay		Default	2 ms
	Setting Range	0~20 ms (Only valid for Modbus)		

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

bA-05	Communication timeout		Default	0.0s
	Setting Range	0.0s:invalid 0.1s~60.0s Valid for Modbus		

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

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

bA-06	Modbus protocol data transmission format selection		Default	1
	Setting Range	Unit's digit: Modbus protocol.		
		0	Non-standard Modbus protocol	
	1	Standard Modbus protocol		

bA-06=1: Select standard Modbus protocol.

bA-06=0: When reading the command, the slave machine return is one byte more than the standard Modbus protocol's, for details, refer to communication data structure of this protocol.

bA-07	Communication reading current resolution		Default	0
	Setting Range	0	0.01A	
		1	0.1A	

It is used to confirm the unit of current value when the communication reads the output current.

Appendix II. Function Code Table

If A0-00 is set to a non-zero number, parameter protection is enabled. You must write in correct user password to enter the menu.

To cancel the password protection function, enter with password and set A0-00 to 0.

The parameter menu under the user-defined parameter mode can directly enter without password.

Group "A" is frequency inverter system parameter. Group "b" is basic function parameters. Group "C" is application parameter, Group "d" is control parameter, and Group "U" is monitoring function parameters.

The symbols in the function code table are described as follows:

"☆": The parameter can be modified when the frequency inverter is in stop or running state.

"★": The parameter cannot be modified when the frequency inverter is in running state.

"●": The parameter is the actually measured value and cannot be modified.

"*": The parameter is factory parameter and can be modified only by the manufacturer.

Standard Function Parameters

Code	Parameter Name	Functional description	Default	Property
Group b0: Basic Function Parameters				
b0-00	Motor type selection	0: AC asynchronous motor	0	★
b0-01	Motor control mode	0: Sensor-less vector control (SVC) 1/2:V/F control 3: Closed-loop vector control (FVC)	2	★
b0-02	Command source selection	0: Keypad control (LED off) 1: Terminal control (LED on) 2: Communication control (LED blinking)	0	★
b0-03	Main frequency source X selection	0: Digital setting (Digital setting frequency b0-12, UP/DOWN modifiable, no-record after power off) 1: Digital setting (Digital setting frequency b0-12, UP/DOWN modifiable, record after power off) 2: AI1 3: AI2 4: AI3 5: Pulse setting (HDI) 6: Multi-function 7: Built-in PLC 8: PID 9: Communication setting 10. Keypad Potentiometer(Only for EM15A)	1	★
b0-04	Auxiliary frequency source Y selection	The same as b0-03 (Main frequency source X selection)	0	★
b0-05	Selection of auxiliary frequency Y range	0: Relative to maximum frequency 1: Relative to main frequency X	0	☆
b0-06	Range of auxiliary frequency Y	0%~150%	100%	☆

Code	Parameter Name	Functional description	Default	Property
b0-07	Frequency source selection	Unit's digit: Frequency source selection. 0: Main frequency source X 1: X and Y calculation (calculation result determined by ten's digit) 2: Switchover between X and Y 3: Switchover between X and "X and Y calculation" 4: Switchover between Y and "X and Y calculation" Ten's digit: X and Y calculation relationship 0: X+Y 1: X-Y 2: Maximum of them 3: Minimum of them	0	☆
b0-08	Frequency offset of auxiliary frequency source of X and Y	0.00 Hz ~ maximum frequency(b0-13)	0.00 Hz	☆
b0-09	Binding command source to frequency source	Unit's digit: Binding keypad command to following frequency source. 0: No binding 1: Digital setting frequency 2: AI1 3: AI2 4: AI3 5: Pulse setting (HDI) 6: Multi-function 7: Simple PLC 8: PID 9: Communication setting Ten's digit: Binding terminal command to frequency source. 0~9, same as unit's digit Hundred's digit: Binding communication command to frequency source. 0~9, same as unit's digit Thousand's digit: Automatically running binding to frequency source. 0~9, same as unit's digit	0	☆
b0-10	Record of digital setting frequency of power failure	0: not record 1:record	1	☆
b0-11	Frequency unit	1: 0.1 Hz 2: 0.01 Hz	2	☆
b0-12	Digital setting frequency	0.00 ~ maximum frequency (b0-13)	50.00 Hz	☆
b0-13	Maximum frequency	50.00~3000.00 Hz	50.00 Hz	☆
b0-14	Source of frequency upper limit	0: Set by (b0-15) 1: AI1 2: AI2 3: AI3 4: Pulse setting (HDI) 5: Communication setting	0	☆

Code	Parameter Name	Functional description	Default	Property
b0-15	Frequency upper limit	Frequency lower limit (b0-17) ~ maximum frequency (b0-13)	50.00 Hz	☆
b0-16	Frequency upper limit offset	0.00 Hz~ maximum frequency(b0-13)	0.00 Hz	☆
b0-17	Frequency lower limit	0.00 Hz ~frequency upper limit(b0-15)	0.00 Hz	☆
b0-18	Rotation direction	0: Forward direction 1: Reverse direction	0	☆
b0-19	Base frequency for UP/ DOWN modification during running	0: Running frequency 1: Setting frequency	0	★
b0-20	Acceleration/Deceleration mode	0: Linear acceleration/ deceleration 1: S-curve acceleration/deceleration A 2: S-curve acceleration/deceleration B	0	☆
b0-21	Acceleration time 1	0.00s~650.00s (b0-25 = 2) 0.0s~6500.0s (b0-25 = 1) 0s~65000s (b0-25 = 0)	Model dependent	☆
b0-22	Deceleration time 1	0.00s~650.00s (b0-25 = 2) 0.0s~6500.0s (b0-25 = 1) 0s~65000s (b0-25 = 0)	Model dependent	☆
b0-23	Time proportion of S-curve start segment	0.0% ~ (100.0% minus b0-24)	30.0%	☆
b0-24	Time proportion of S-curve end segment	0.0% ~ (100.0% minus b0-23)	30.0%	☆
b0-25	Acceleration/Deceleration time unit	0:1s 1: 0.1s 2: 0.01s	1	☆
b0-26	Acceleration/Deceleration time base frequency	0: Maximum frequency (b0-13) 1: Set frequency 2: 100 Hz	0	★
Group b1: Start and Stop Control Parameters				
b1-00	Start mode	0: Direct start 1: Rotational speed tracking restart 2: Pre-excited start (AC asynchronous motor)	0	★
b1-01	Rotational speed tracking mode	0: From frequency at stop 1: From zero speed 2: From maximum frequency	0	★
b1-02	Rotational speed tracking ratio	1~100	20	★
b1-03	Startup frequency	0.00~10.00 Hz	0.00 Hz	☆
b1-04	Startup frequency holding time	0.0s~100.0s	0.0s	★
b1-05	Startup DC braking current/ Pre-excited current	0%~100%	0%	★
b1-06	Startup DC braking time/ Pre-excited time	0.0s~100.0s	0.0s	★
b1-07	Stop mode	0: Decelerate to stop 1: free stop	0	☆

Code	Parameter Name	Functional description	Default	Property
b1-08	DC braking initial frequency of stopping	0.00 Hz ~ maximum frequency	0.00 Hz	☆
b1-09	DC braking waiting time of stopping	0.0s~100.0s	0.0s	★
b1-10	DC braking current of stopping	0%~100%	0%	★
b1-11	DC braking time of stopping	0.0s~100.0s	0.0s	★
Group b2: Auxiliary Function				
b2-00	JOG running frequency	0.00 Hz ~ maximum frequency	2.00 Hz	☆
b2-01	JOG acceleration time	0.0s~6500.0s	Model dependent	☆
b2-02	JOG deceleration time	0.0s~6500.0s	Model dependent	☆
b2-03	Acceleration time 2	0.0s~6500.0s	Model dependent	☆
b2-04	Deceleration time 2	0.0s~6500.0s	Model dependent	☆
b2-05	Acceleration time 3	0.0s~6500.0s	Model dependent	☆
b2-06	Deceleration time 3	0.0s~6500.0s	Model dependent	☆
b2-07	Acceleration time 4	0.0s~6500.0s	Model dependent	☆
b2-08	Deceleration time 4	0.0s~6500.0s	Model dependent	☆
b2-09	Jump frequency 1	0.00 Hz ~ maximum frequency	0.00 Hz	☆
b2-10	Jump frequency 2	0.00 Hz ~ maximum frequency	0.00 Hz	☆
b2-11	Frequency jump amplitude	0.00 Hz ~ maximum frequency	0.00Hz	☆
b2-12	Jump frequency during acceleration/ deceleration	0: Disabled 1: Enabled	0	☆
b2-13	Frequency switchover point between acceleration time 1 and acceleration time 2	0.00 Hz ~ maximum frequency	0.00Hz	☆
b2-14	Frequency switchover point between deceleration time 1 and deceleration time 2	0.00 ~ maximum frequency	0.00Hz	☆
b2-15	Reverse running	0: Enabled 1: Disabled	0	☆
b2-16	Forward/Reverse rotation dead-zone time	0.0~3000.0s	0.0s	☆
b2-17	Running mode when set frequency less than limited lower frequency	0: Run at frequency lower limit 1: Stop 2: Run at zero speed	0	☆
b2-18	Droop control	0.00Hz~10.00 Hz	0.00Hz	☆

Code	Parameter Name	Functional description	Default	Property
b2-19	Terminal JOG priority	0: Disabled 1: Enabled	0	☆
b2-21	Setting running time reach threshold	0~65000 h	0h	☆
b2-22	Action after running time reached	0: Continue to run 1: Stop	0	☆
b2-23	Cooling fan control	0: Fan working during running 1: Fan working during power on	0	☆
b2-24	Dormant frequency	0.00Hz ~wakeup frequency (b2-26)	0.00Hz	☆
b2-25	Dormant delay time	0.0s~6000.0s	0.0s	☆
b2-26	Wakeup frequency	Dormant frequency (b2-24)~ maximum frequency (b0-13)	0.00Hz	☆
b2-27	Wakeup delay time	0.0s~6000.0s	0.0s	☆
b2-28	Timing function	0: Disabled 1: Enabled	0	☆
b2-29	Timing duration source	0: b2-30 1: AI1 2: AI2 3: AI3 (100% of analog input corresponds to the value of b2-30)	0	☆
b2-30	Set timing duration	0.0min~6500.0 min	0.0min	☆
b2-31	This time running time reached threshold	0.0min~6500.0 min	0.0min	☆
b2-32	DI terminal status after power on	0: Valid 1: Invalid	0	☆
Group b3: Switch Input Terminal Parameters				
b3-00	DI1 function selection	0: No function 1: Forward RUN (FWD) or running command 2: Reverse RUN (REV) or FWD/REV running direction	01	★
b3-01	DI2 function selection	3: Three-line control	02	★
b3-02	DI3 function selection	4: Forward JOG (FJOG)	06	★
b3-03	DI4 function selection	5: Reverse JOG (RJOG)	07	★
b3-04	DI5 function selection	6: Multi-function terminal 1	08	★
b3-05	reserved control terminal for expansion	7: Multi-function terminal 2 8: Multi-function terminal 3 9: Multi-function terminal 4 10: Terminal UP 11: Terminal DOWN 12: clear to zero of UP and DOWN setting (terminal, keypad) 13: Terminal 1 for acceleration/ deceleration time selection 14: Terminal 2 for acceleration/ deceleration time selection	00	★

Code	Parameter Name	Functional description	Default	Property
b3-06	HDI function selection	15: Frequency source switchover 16: Switchover between main frequency source X and digital setting frequency 17: Switchover between auxiliary frequency source Y and digital setting frequency 18: Terminal 1 for Command source switchover 19: Terminal 2 for Command source switchover 20: Speed control/Torque control switchover 21: Torque control prohibited 22: PID pause 23: PID integral pause 24: Reverse PID action direction 25: PID parameter switchover 26: PLC status reset 32: Pulse input (enabled only for HDI) 33: Frequency modification enable 34: Acceleration/Deceleration prohibited 36: Motor selection terminal 2(reserve) 37: Fault reset 38: Normally open (NO) input of external fault 39: Normally closed (NC) input of external fault 40: User-defined fault 1 41: User-defined fault 2 42: Running pause 43: Free stop 44: Emergency stop 45: External STOP terminal 1 46: External STOP terminal 2 47: Deceleration DC braking 48: Immediate DC braking 49: Clear the current running time	32	★
b3-12	DI filter time	0.000s~1.000s	0.010s	☆
b3-13	Terminal command mode	0: Two-line mode 1 1: Two-line mode 2 2: Three-line mode 1 3: Three-line mode 2	0	★
b3-14	Rate of UP/DOWN terminal	0.001Hz/s~65.535 Hz/s	1.000 Hz/s	☆
b3-15	DI1 ON delay time	0.0s~3000.0s	0.0s	☆
b3-16	DI1 OFF delay time	0.0s~3000.0s	0.0s	☆
b3-17	DI2 ON delay time	0.0s~3000.0s	0.0s	☆
b3-18	DI2 OFF delay time	0.0s~3000.0s	0.0s	☆
b3-19	DI3 ON delay time	0.0s~3000.0s	0.0s	☆
b3-20	DI3 OFF delay time	0.0s~3000.0s	0.0s	☆
b3-21	DI4 ON delay time	0.0s~3000.0s	0.0s	☆
b3-22	DI4 OFF delay time	0.0s~3000.0s	0.0s	☆

Code	Parameter Name	Functional description	Default	Property
b3-23	DI5 ON delay time	0.0s~3000.0s	0.0s	☆
b3-24	DI5 OFF delay time	0.0s~3000.0s	0.0s	☆
b3-25	DI valid selection 1	Unit's digit: DI1 valid mode. 0: High level valid 1: Low level valid Ten's digit: DI2 valid mode. 0, 1 (same as DI1) Hundred's digit: DI3 valid mode. 0, 1 (same as DI1) Thousand's digit: DI4 valid mode. 0, 1 (same as DI1) Ten thousand's digit: DI5 valid mode. 0, 1 (same as DI1)	00000	★
Group b4: Switch Signal output Terminals				
b4-00	FM terminal output mode	0: Pulse output 1: Open- collector output terminal	0	☆
b4-01	FMR function (open-collector output terminal)	0: No output 1: Ready signal 2: Frequency inverter running 3: Fault output (free stop fault) 4: Fault output (free stop fault, but do not output when lower voltage)	0	☆
b4-02	Relay 1 function (TA1-TB1-TC1)	5: Swing frequency limit 6: Torque limit 7: Frequency upper limit reached 8: Frequency lower limit reached (relevant to running) 9: Frequency lower limit reached (having output at stop)	3	☆
b4-03	Relay 2 function (TA2-TB2-TC2)	10: Reverse running 11: Zero-speed running (no output at stop) 12: Zero-speed running 2 (having output at stop) 16: PLC cycle complete 17: Frequency-level detection FDT1 output 18: Frequency level detection FDT2 output 19: Frequency reached 20: Frequency 1 reached 21: Frequency 2 reached 22: Current 1 reached 23: Current 2 reached 24: Module temperature reached 25: Timing reached 26: Zero current state 27: Output current exceeded limitation 28: Lower voltage state output 29: Frequency inverter overload pre-warning 30: Motor overheat pre-warning 31: Motor overload pre-warning 32: off load	2	☆

Code	Parameter Name	Functional description	Default	Property
		33: AI1 larger than AI2 34: AI1 input exceeded limitation 35: Alarm output (all faults) 36: Present running time reached 37: Accumulative power-on time reached 38: Accumulative running time reached		
b4-10	FMR ON delay time	0.0s~3000.0s	0.0s	☆
b4-11	FMR OFF delay time	0.0s~3000.0s	0.0s	☆
b4-12	Relay 1 ON delay time	0.0s~3000.0s	0.0s	☆
b4-13	Relay 1 OFF delay time	0.0s~3000.0s	0.0s	☆
b4-14	Relay 2 ON delay time	0.0s~3000.0s	0.0s	☆
b4-15	Relay 2 OFF delay time	0.0s~3000.0s	0.0s	☆
b4-20	DO logic selection 1	Unit's digit: FMR valid mode. 0: Positive logic 1: Negative logic Ten's digit: Relay 1 valid mode. 0, 1 (same as FMR) Hundred's digit: Relay 2 valid mode. 0, 1 (same as FMR) Thousand's digit: DO1 valid mode. 0, 1 (same as FMR) Ten thousand's digit: DO2 valid mode. 0, 1 (same as FMR)	00000	☆
b4-22	Frequency detection value 1 (FDT1)	0.00 Hz~ maximum frequency	50.00 Hz	☆
b4-23	Frequency detection hysteresis 1 (FDT hysteresis 1)	0.0%~100.0% (FDT1 level)	5.0%	☆
b4-24	Detection width of frequency	0.00% ~ 100%(maximum frequency)	0.0%	☆
b4-25	Frequency detection value 2 (FDT2)	0.00 Hz ~ maximum frequency	50.00HZ	☆
b4-26	Frequency detection hysteresis 2 (FDT hysteresis 2)	0.00~100% (maximum frequency)	5.0%	☆
b4-27	Any frequency reaching detection value 1	0.00 Hz ~ maximum frequency	50.00 Hz	☆
b4-28	Any frequency reaching detection amplitude 1	0.0%~100.0% (maximum frequency)	0.0%	☆
b4-29	Any frequency reaching detection value 2	0.00 Hz ~ maximum frequency	50.00 Hz	☆
b4-30	Any frequency reaching detection amplitude 2	0.0%~100.0% (maximum frequency)	0.0%	☆
b4-31	Zero current detection level	0.0%~100.0% (rated motor current)	5.0%	☆
b4-32	Zero current detection delay time	0.00s~600.00s	0.10s	☆
b4-33	Over current output	0.0%~300.0% (rated motor current)	200.0%	☆

Code	Parameter Name	Functional description	Default	Property
	threshold			
b4-34	Over current output detection delay time	0.00s~600.00s	0.00s	☆
b4-35	Any current reaching 1	0.0%~100.0% (rated motor current)	100.0%	☆
b4-36	amplitude of any current reaching 1	0.0%~100.0% (rated motor current)	0.0%	☆
b4-37	Any current reaching 2	0.0%~100.0% (rated motor current)	100.0%	☆
b4-38	Amplitude of any current reaching 2	0.0%~100.0% (rated motor current)	0.0%	☆
b4-39	IGBT module temperature threshold	25~100°C	75°C	☆
Group b5: Pulse/Analog input terminals				
b5-00	Pulse minimum input(HDI)	0.00 kHz ~b5-02	0.00 kHz	☆
b5-01	Corresponding setting of pulse minimum input	-100.00% ~100.0%	0.00%	☆
b5-02	Pulse maximum input	b5-00 ~ 100.00 kHz	50.00 kHz	☆
b5-03	Corresponding setting of pulse maximum input	-100.00% ~100.0%	100.0%	☆
b5-04	Pulse filter time	0.00s~10.00s	0.10s	☆
b5-05	AI1 input voltage lower limit of protection	0.00 V~ b5-06	3.10 V	☆
b5-06	AI1 input voltage upper limit of protection	b5-05~10.00 V	6.80 V	☆
b5-07	AI1 input minimum value	0.00 V ~ b5-15	0.00V	☆
b5-08	Corresponding setting of AI1 minimum input	-100.00% ~100.0%	0.0%	☆
b5-09	AI1 Maximum input value	0.00V~10.00V	10.00V	☆
b5-10	Corresponding setting of AI1 Maximum input value	-100.0%~100.0%	100.0%	☆
b5-11	AI1 input filter time	0.00s~10.00s	0.10s	☆
b5-12	AI2 input minimum value	0.00V~10.00V	2.00V	☆
b5-13	Corresponding setting of AI2 minimum input	-100.0%~100.0%	0.0%	☆
b5-14	AI2 Maximum input value	0.00V~10.00V	10.00V	☆
b5-15	Corresponding setting of AI2 Maximum input value	-100.0%~100.0%	100.0%	☆
b5-16	AI2 input filter time	0.00s~10.00s	0.10s	☆
b5-17	AI3 input minimum value	-10.00V~10.00V	-10.00V	☆
b5-18	Corresponding setting of AI3 minimum input	-100.0%~100.0%	-100.0%	☆
b5-19	AI3 Maximum input value	-10.00V~10.00V	10.00V	☆
b5-20	Corresponding setting of AI3 Maximum input value	-100.0%~100.0%	100.0%	☆
b5-21	AI3 input filter time	0.00s~10.00s	0.10s	☆
b5-22	AI curve 4 minimum input	-10.00V~b5-24	0.00V	☆

Code	Parameter Name	Functional description	Default	Property
b5-23	Corresponding setting of AI curve 4 minimum input	-100.0%~+100.0%	0.0%	☆
b5-24	AI curve 4 inflection point 1 input	B5-21~b5-26	3.00V	☆
b5-25	Corresponding setting of AI curve 4 inflection point 1 input	-100.0%~+100.0%	30.0%	☆
b5-26	Corresponding setting of AI curve 4 inflection point 2 input	b5-23~b5-27	6.00V	☆
b5-27	AI curve 4 inflection point 2 input	-100.0%~+100.0%	60.0%	☆
b5-28	AI curve 4 Maximum input	b5-27~+10.00V	10.00V	☆
b5-29	Corresponding setting of AI curve 4 Maximum input	-100.0%~+100.0%	100.0%	☆
b5-30	AI curve 5 minimum input	-10.00V~b5-31	-10.00V	☆
b5-31	Corresponding setting of AI curve 5 minimum input	-100.0%~+100.0%	-100.0%	☆
b5-32	AI curve 5 inflection point 1 input	b5-28~b5-33	-3.00V	☆
b5-33	Corresponding setting of AI curve 5 inflection point 1 input	-100.0%~+100.0%	-30.0%	☆
b5-34	AI curve 5 inflection point 2 input	b5-31~b5-35	3.00V	☆
b5-35	Corresponding setting of AI curve 5 inflection point 2 input	-100.0%~+100.0%	30.0%	☆
b5-36	AI curve 5 Maximum input	b5-33~+10.00V	10.00V	☆
b5-37	Corresponding setting of AI curve 5 Maximum input	-100.0%~+100.0%	100.0%	☆
b5-38	AI1 jump point	-100.0%~100.0%	0.0%	☆
b5-39	AI1 jump amplitude	0%~100.0%	0.5%	☆
b5-40	AI2 jump point	-100.0%~100.0%	0.0%	☆
b5-41	AI2 jump amplitude	0%~100.0%	0.5%	☆
b5-42	AI3 jump point	-100.0%~100.0%	0.0%	☆
b5-43	AI3 jump amplitude	0%~100.0%	0.5%	☆
b5-44	AI curve selection	Unit's digit: AI1 curve selection 1: curve 1(2 point, refer b5-07~b5-10) 2: curve 2(2 point, refer b5-12~b5-15) 3: curve 3(2 point, refer b5-17~b5-20) 4: curve 4(4 point, refer b5-22~b5-29) 5: curve 5(4 point, refer b5-30~b5-37) Ten's digit: AI2 curve selection, same as above Hundred's digit: AI3 curve selection, same as above	H321	☆

Code	Parameter Name	Functional description	Default	Property
b5-45	AI lower than minimum input setting selection	Unit's digit:AI1 lower than minimum input setting 0:corresponding minimum input setting 1:0.0% Ten's digit:AI2 lower than minimum input setting selection, same as above Hundred's digit:AI3 lower than minimum input setting selection, same as above	H.000	☆
Group b6: Pulse/Analog Output Terminals				
b6-00	FMP function selection	0: Running frequency corresponding to 0~Max. operation frequency 1: Set frequency corresponding to 0~Max. operation frequency 2: Output current corresponding to 0~Doubled motor rated current 3: Output torque (absolute value) corresponding to 0~double rated torque	0	☆
b6-01	AO1 output function selection	4: Output power corresponding to 0~Doubled motor rated power 5: Output voltage corresponding to 0~1.2 times DC bus voltage 6: Motor rotational speed corresponding to 0~Max. operation frequency 7: Output current corresponding to 0~1000A 8: Output voltage corresponding to 0~1000V 9: Output torque corresponding to (-200%~200%) motor rated torque	0	☆
b6-02	AO2 output function selection	10: Pulse input corresponding to 0Hz~100kHz 11: AI1 corresponding to 0~10V 12: AI2 corresponding to 0~10V 13: AI3 corresponding to 0~10V 16: Communication setting corresponding to 0~32767	1	☆
b6-03	Maximum FMP output frequency	0.01 kHz ~100.00 kHz	50.00 kHz	☆
b6-04	AO1 offset coefficient	-100.0% ~100.0%	0.0%	☆
b6-05	AO1 gain	-10.00~10.00	1.00	☆
b6-06	AO2 offset coefficient	-100.0% ~100.0%	0.00%	☆
b6-07	AO2 gain	-10.00 ~10.00	1.00	☆
Group b7 : Virtual DI (VDI)/Virtual DO (VDO)				
b7-00	VDI1 function selection	0~49	0	★
b7-01	VDI2 function selection	0~49	0	★
b7-02	VDI3 function selection	0~49	0	★
b7-03	VDI4 function selection	0~49	0	★
b7-04	VDI5 function selection	0~49	0	★

Code	Parameter Name	Functional description	Default	Property
b7-05	VDI state setting mode	Unit's digit: VDI1. 0: Valid decided by state of VDOx 1: Valid decided by b7-06 Ten's digit: VDI2. 0, 1 (same as VDI1) Hundred's digit: VDI3. 0, 1 (same as VDI1) Thousand's digit: VDI4. 0, 1 (same as VDI1) Ten thousand's digit: VDI5. 0, 1 (same as VDI1)	00000	☆
b7-06	VDI state setting	Unit's digit: VDI1. 0: Invalid 1: Valid Ten's digit: VDI2 0, 1 (same as VDI1) Hundred's digit: VDI3 0, 1 (same as VDI1) Thousand's digit: VDI4 0, 1 (same as VDI1) Ten thousand's digit: VDI5. 0, 1 (same as VDI1)	00000	☆
b7-07	Function selection for AI1 used as DI	0~49	0	★
b7-08	Function selection for AI2 used as DI	0~49	0	★
b7-09	Function selection for AI3 used as DI	0~49	0	★
b7-10	Valid state selection for AI used as DI	Unit's digit: AI1. 0: High level valid 1: Low level valid Ten's digit: AI2. 0, 1 (same as unit's digit) Hundred's digit: AI3. 0, 1 (same as unit's digit)	0	☆
b7-11	VDO1 function selection	0: connect with physical DIx internally 1~40	0	☆
b7-12	VDO2 function selection	0: connect with physical DIx internally 1~40	0	☆
b7-13	VDO3 function selection	0: connect with physical DIx internally 1~40	0	☆
b7-14	VDO4 function selection	0:connect with physical DIx internally 1~40	0	☆
b7-15	VDO5 function selection	0: connect with physical DIx internally 1~40	0	☆
b7-16	VDO1 output delay	0.0s~3000.0s	0.0s	☆
b7-17	VDO2 output delay	0.0s~3000.0s	0.0s	☆

Code	Parameter Name	Functional description	Default	Property
b7-18	VDO3 output delay	0.0s~3000.0s	0.0s	☆
b7-19	VDO4 output delay	0.0s~3000.0s	0.0s	☆
b7-20	VDO5 output delay	0.0s~3000.0s	0.0s	☆
b7-21	VDO valid state selection	Unit's digit: VDO1. 0: Positive logic valid 1: Reverse logic valid Ten's digit: VDO2 0, 1 (same as unit's digit) Hundred's digit: VDO3. 0, 1 (same as unit's digit) Thousand's digit: VDO4. 0, 1 (same as unit's digit) Ten thousand's digit: VDO5. 0, 1 (same as unit's digit)	00000	☆
Group b9: Keypad and Display				
b9-00	STOP/RESET key function	0: STOP/RESET key enabled only in operation panel control 1: STOP/RESET key enabled in any operation mode	1	☆
b9-01	MF.K Key function selection	0: MF.K key disabled 1: Switchover between operation panel control and remote command control (terminal or communication) 2: Switchover between forward rotation and reverse rotation 3: Forward JOG 4: Reverse JOG 5. Function parameters	3	☆
b9-02	LED display running parameters 1	0000~FFFF Bit00: Running frequency 1 (Hz) Bit01: Setting frequency (Hz) Bit02: DC bus voltage (V) Bit03: Output voltage (V) Bit04: Output current (A) Bit05: Output power (kW) Bit06: Output torque (%) Bit07: DI input status Bit08: DO output status Bit09: AI1 voltage (V) Bit10: AI2 voltage (V) Bit11: AI3 voltage (V) Bit12: Count value Bit13: Length value Bit14: Load speed display Bit15: PID setting	H.001F	☆

Code	Parameter Name	Functional description	Default	Property
b9-03	LED display running parameters 2	0000~FFFF Bit00: PID feedback Bit01: PLC stage Bit02: Pulse setting frequency (kHz) Bit03: Running frequency 2 (Hz) Bit04: Remaining running time Bit05: AI1 voltage before calibration (V) Bit06: AI2 voltage before calibration (V) Bit07: AI3 voltage before calibration (V) Bit08: Linear speed Bit09: Received Bit10: Present running time (Min) Bit11: Heat sink temperature display (°C) Bit12: Communication setting value Bit13: Encoder feedback frequency (Hz) Bit14: Main frequency X display (Hz) Bit15: Auxiliary frequency Y display (Hz)	H.0000	☆
b9-04	LED display parameter of stopping	0000~FFFF Bit00: Setting frequency (Hz) Bit01: DC bus voltage (V) Bit02: DI input status Bit03: DO output status Bit04: AI1 voltage (V) Bit05: AI2 voltage (V) Bit06: AI3 voltage (V) Bit07: Count value Bit08: Length value Bit09: PLC stage Bit10: Load speed Bit11: PID setting Bit12: Pulse setting frequency(kHz) Bit13:Heatsink temperature display(°C)	H.0033	☆
b9-05	Load speed display coefficient	0.0001~ 6.5000	0.2920	☆
b9-06	Number of decimal places for load speed display	0: 0 decimal display 1: 1 decimal display 2: 2 decimal display 3: 3 decimal display	0	☆
b9-07	Heatsink temperature	0.0°C ~100.0°C	--	●
b9-09	Accumulative running time	0~65535 h	--	●
b9-11	Auxiliary LED display parameters	Corresponding U0 group parameters	00004	●
Group bA: Communication Parameters				
bA-00	Communication type selection	0: Modbus protocol	0	☆

Code	Parameter Name	Functional description	Default	Property
bA-01	Baud ratio setting	Unit's digit: Modbus baud ratio. 0: 300 BPS 1: 600 BPS 2: 1200 BPS 3: 2400 BPS 4: 4800 BPS 5: 9600 BPS 6: 19200 BPS 7: 38400 BPS	5	☆
bA-02	Modbus Data format	0: No check, data format <8,N,2> 1: Even parity check, data format<8,E,1> 2: Odd Parity check, data format<8,O,1> 3: No check, data format <8,N,1> Valid for Modbus	0	☆
bA-03	Broadcast address	0~247 (0: Broadcast address) Valid for Modbus	1	☆
bA-04	Modbus response delay	0~20 ms Only valid for Modbus	2 ms	☆
bA-05	Communication timeout	0.0s:invalid 0.1s~60.0s Valid for Modbus	0.0s	☆
bA-06	Modbus protocol data transmission format selection	Unit's digit: Modbus protocol. 0: Non-standard Modbus protocol 1: Standard Modbus protocol Ten's digit: Profibus-DP 0:PP01 1:PP02 2:PP03 3:PP05	31	☆
bA-07	Communication reading current resolution	0: 0.01A 1: 0.1A	0	☆
Group bb: Fault and Protection Setting				
bb-00	G/P type selection	0: P type 1: G type	1	☆
bb-01	Motor overload protection selection	0: Disabled 1: Enabled	1	☆
bb-02	Motor overload protection gain	0.20~10.00	1.00	☆
bb-03	Motor overload pre-warning coefficient	50%~100%	80%	☆
bb-09	Fault auto reset times	0~20(Unlimited number of times)	0	☆
bb-10	Relay action selection during fault auto reset	0: Not act 1: Act	0	☆
bb-11	Time interval of fault auto reset	0.1s~100.0s	1.0s	☆
bb-12	Input phase loss protection/contactor energizing protection	Unit's digit: Input phase loss protection 0: Disabled 1: Enabled	11	☆

Code	Parameter Name	Functional description	Default	Property
	selection	Ten's digit: Contactor energizing protection 0,1(same as Unit's digit)		
bb-13	Output phase loss protection	0: Disabled 1: Enabled	1	☆
bb-14	Off load protection	0: Disabled 1: Enabled	0	☆
bb-15	Off load detection level	0.0%~100.0% (rated motor current)	10.0%	☆
bb-16	Off load detection time	0.0s~60.0s	1.0s	☆
bb-17	Over-speed detection value	0.0%~50.0% (maximum frequency)	20.0%	☆
bb-18	Over-speed detection time	0.0s~60.0s	1.0s	☆
bb-19	Detection value of too large speed deviation	0.0%~50.0% (maximum frequency)	20.0%	☆
bb-20	Detection time of too large speed deviation	0.0s~60.0s	5.0s	☆
bb-21	Action selection at instantaneous power failure	0: Invalid 1: Decelerate 2: Decelerate to stop	0	☆
bb-22	Judging voltage of instantaneous power failure restoring	60.0%~100.0%(standard bus voltage)	85.0%	☆
bb-23	judging time of Instantaneous power rise	0.00s~100.00s	0.50s	☆
bb-24	Judging voltage of instantaneous power failure	60.0%~100.0% (standard bus voltage)	80.0%	☆
bb-25	Type of motor temperature sensor	0: No temperature sensor 1: PT100 2: PT1000	0	☆
bb-26	Motor overheat protection threshold	0°C~200°C	110°C	☆
bb-27	Motor overheat pre-warning threshold	0°C~200°C	90°C	☆
bb-28	Overvoltage threshold	200.0~2500.0 V	Model dependent	☆
bb-29	Under voltage threshold	200.0V~2000.0V	Model dependent	☆
bb-30	Brake unit use ratio	0%~100%	100%	☆

Code	Parameter Name	Functional description	Default	Property
bb-32	Fault protection action selection 1	Unit's digit: Motor overload, Err11. 0: Free stop 1: Stop according to the stop mode 2: Continue to run Ten's digit: Power input phase loss, Err12. Same as unit's digit Hundred's digit: Power output phase loss, Err13. Same as unit's digit Thousand's digit: External equipment fault, Err15. Same as unit's digit Ten thousand's digit: Communication fault, Err16. Same as unit's digit	00000	☆
bb-33	Fault protection action selection 2	Unit's digit: Encoder/PG card fault, Err20. 0: Free stop Ten's digit: EEPROM read-write fault, Err21. 0: Free stop 1: Stop according to the stop mode Hundred's digit : Reserved Thousand's digit: Motor Overheat, Err25. Same as unit's digit in bb-32 Ten thousand's digit: Running time reached, Err26. Same as unit's digit in bb-32	00000	☆
bb-34	Fault protection action selection 3	Unit's digit: User-defined fault 1,Err27. Same as unit's digit in bb-32 Ten's digit: User-defined fault 2,Err28. Same as unit's digit in bb-32 Hundred's digit: Accumulative power-on time reached,Err29. Same as unit's digit in bb-32 Thousand's digit: Off load, Err30. 0: Free stop 1: Stop according to the stop mode 2: reduce to 7% of rated motor frequency and continue running. If the load recovers and it will auto regain to setting frequency. Ten thousand's digit: PID feedback lost during running, Err31. Same as unit's digit in bb-32	00000	☆
bb-35	Fault protection action selection 4	Unit's digit: Speed deviation too large, Err42 Same as unit's digit in bb-32 Ten's digit: Motor over-speed, Err43. Same as unit's digit in bb-32 Hundred's digit: Initial position fault, Err51. Same as unit's digit in bb-32	00000	☆
bb-37	Frequency selection for continuing to run of fault	0: Current running frequency 1: Set frequency 2: Frequency upper limit	0	☆

Code	Parameter Name	Functional description	Default	Property
		3: Frequency lower limit 4: Backup frequency of abnormality (bb-37)		
bb-38	Backup frequency of abnormality	0.0%~100.0% (maximum frequency)	100.0%	☆
bb-39	Inverter overload protection gain	85%-115%	100%	
Group bC: Fault diagnosis				
bC-00	First fault type	—	—	●
bC-01	Second fault type	—	—	●
bC-02	Third fault type (latest)	—	—	●
bC-03	Frequency of latest fault	—	—	●
bC-04	Current of latest fault	—	—	●
bC-05	DC Bus voltage of latest fault	—	—	●
bC-06	Input terminals status of latest fault	—	—	●
bC-07	Output terminal status of latest fault	—	—	●
bC-08	Frequency inverter status of latest fault	—	—	●
bC-09	Power-on time of latest fault	—	—	●
bC-10	Running time of latest fault	—	—	●
bC-11	Frequency of 2nd fault	—	—	●
bC-12	Current of 2nd fault	—	—	●
bC-13	DC Bus voltage of 2nd fault	—	—	●
bC-14	Input terminal status of 2nd fault	—	—	●
bC-15	Output terminal status of 2nd fault	—	—	●
bC-16	Frequency inverter status of 2nd fault	—	—	●
bC-17	Power-on time of 2nd fault	—	—	●
bC-18	Running time of 2nd fault	—	—	●
bC-19	Frequency of 1st fault	—	—	●
bC-20	Current of 1st fault	—	—	●
bC-21	DC Bus voltage of 1st fault	—	—	●
bC-22	Input terminal status of 1st fault	—	—	●
bC-23	Output terminal status of 1st fault	—	—	●
bC-24	Frequency inverter status of 1st fault	—	—	●
bC-25	Power-on time of 1st fault	—	—	●
bC-26	Running time of 1st fault	—	—	●

Code	Parameter Name	Functional description	Default	Property
Group bd: Motor protection				
bd-00	Overset alarm current value	0.0~600A	0.00	☆
bd-01	Overcurrent alarm delay time	0.0~600s	0.00	☆
Group C0: PID Control Function				
C0-00	PID setting source	0: C0-01 1: AI1 2: AI2 3: AI3 4: Pulse setting (HDI) 5: Communication setting 6: Multi-function 7: New Mode(Pressure value)	7	☆
C0-01	PID digital setting	0.0%~100.0%	50.0%	☆
C0-02	PID setting change time	0.00s~650.00s	0.00s	☆
C0-03	PID feedback source	0: AI1 1: AI2 2: AI3 3: Pulse setting (HDI) 4: AI1 – AI2 5: AI1 + AI2 6: MAX (AI1 , AI2) 7: MIN (AI1 , AI2) 8: Communication setting	0	☆
C0-04	PID action direction	0: Forward action 1: Reverse action	0	☆
C0-05	PID setting feedback range	0~65535	1000	☆
C0-06	Proportional gain KP1	0.00~100.0	20.0	☆
C0-07	Integral time TI1	0.01s~10.00s	0.80s	☆
C0-08	Differential time TD1	0.000s~10.000s	0.000s	☆
C0-09	Proportional gain KP2	0.00~100.00	20.0	☆
C0-10	Integral time TI2	0.01s~10.00s	2.00s	☆
C0-11	Differential time TD2	0.00s~10.00s	0.000s	☆
C0-12	PID parameter switchover condition	0: No switchover 1: Switchover via DI 2: Automatic switchover based on deviation	0	☆
C0-13	PID parameter switchover deviation 1	0.0% ~ C0-14	20.0%	☆
C0-14	PID parameter switchover deviation 2	C0-13 ~ 100.0%	80.0%	☆
C0-15	PID integral property	Unit's digit: Integral separated. 0: Invalid 1: Valid Ten's digit: Whether to stop integral operation when the output reaches the limit. 0: Continue integral operation 1: Stop integral operation	00	☆

Code	Parameter Name	Functional description	Default	Property
C0-16	PID initial value	0.0%~100.0%	0.0%	☆
C0-17	PID initial value holding time	0.00s~650.00s	0.00s	☆
C0-18	Frequency upper limit of PID reverse rotation	0.00 ~ maximum frequency	0.00 Hz	☆
C0-19	PID deviation limit	0.0%~100.0%	0.0%	☆
C0-20	PID differential limit	0.00%~100.00%	0.10%	☆
C0-21	Maximum positive deviation between two PID outputs	0.00%~100.00%	1.00%	☆
C0-22	Maximum negative deviation between two PID outputs	0.00%~100.00%	1.00%	☆
C0-23	PID feedback filter time	0.00s~60.00s	0.00s	☆
C0-24	PID output filter time	0.00s~60.00s	0.00s	☆
C0-25	Detection value of PID feedback loss	0.0%: Not judging feedback loss 0.1%~100.0%	0.0%	☆
C0-26	Detection time of PID feedback loss	0.0s~20.0s	0.0s	☆
C0-27	PID operation at stop	0: No PID operation at stop 1: PID operation at stop	1	☆
Group C1: Multi-function				
C1-00	Multi-function 0	-100.0%~100.0%	0.0%	☆
C1-01	Multi-function 1	-100.0%~100.0%	0.0%	☆
C1-02	Multi-function 2	-100.0%~100.0%	0.0%	☆
C1-03	Multi-function 3	-100.0%~100.0%	0.0%	☆
C1-04	Multi-function 4	-100.0%~100.0%	0.0%	☆
C1-05	Multi-function 5	-100.0%~100.0%	0.0%	☆
C1-06	Multi-function 6	-100.0%~100.0%	0.0%	☆
C1-07	Multi-function 7	-100.0%~100.0%	0.0%	☆
C1-08	Multi-function 8	-100.0%~100.0%	0.0%	☆
C1-09	Multi-function 9	-100.0%~100.0%	0.0%	☆
C1-10	Multi-function 10	-100.0%~100.0%	0.0%	☆
C1-11	Multi-function 11	-100.0%~100.0%	0.0%	☆
C1-12	Multi-function 12	-100.0%~100.0%	0.0%	☆
C1-13	Multi-function 13	-100.0%~100.0%	0.0%	☆
C1-14	Multi-function 14	-100.0%~100.0%	0.0%	☆
C1-15	Multi-function 15	-100.0%~100.0%	0.0%	☆
C1-16	Multi-function 0 source	0: Set by C1-00 1: AI1 2: AI2 3: AI3 4: Pulse setting(HDI) 5: PID 6: Set by digital setting frequency (b0-12), modified via terminal UP/ DOWN	0	☆
Group C2: Simple PLC				

Code	Parameter Name	Functional description	Default	Property
C2-00	Simple PLC running mode	0: Stop after the Frequency inverter runs one cycle 1: Keep final values after the frequency inverter runs one cycle 2: Repeat after the frequency inverter runs one cycle	0	☆
C2-01	Simple PLC record selection	Unit's digit: Record of power failure. 0: no record after power off 1: record after power off Ten's digit: Record of stopping. 0: no record after stopping 1: record after stopping	00	☆
C2-02	Running time of simple PLC Segment 0	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-03	Acceleration/deceleration time of simple PLC Segment 0	0~3	0	☆
C2-04	Running time of simple PLC Segment 1	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-05	Acceleration/deceleration time of simple PLC Segment 1	0~3	0	☆
C2-06	Running time of simple PLC Segment 2	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-07	Acceleration/deceleration time of simple PLC Segment 2	0~3	0	☆
C2-08	Running time of simple PLC Segment 3	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-09	Acceleration/deceleration time of simple PLC Segment 3	0~3	0	☆
C2-10	Running time of simple PLC Segment 4	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-11	Acceleration/deceleration time of simple PLC Segment 4	0~3	0	☆
C2-12	Running time of simple PLC Segment 5	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-13	Acceleration/deceleration time of simple PLC Segment 5	0~3	0	☆
C2-14	Running time of simple PLC Segment 6	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-15	Acceleration/deceleration time of simple PLC Segment 6	0~3	0	☆
C2-16	Running time of simple PLC Segment 7	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-17	Acceleration/deceleration	0~3	0	☆

Code	Parameter Name	Functional description	Default	Property
	time of simple PLC Segment 7			
C2-18	Running time of simple PLC Segment 8	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-19	Acceleration/deceleration time of simple PLC Segment 8	0~3	0	☆
C2-20	Running time of simple PLC Segment 9	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-21	Acceleration/deceleration time of simple PLC Segment 9	0~3	0	☆
C2-22	Running time of simple PLC Segment 10	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-23	Acceleration/deceleration time of simple PLC Segment 10	0~3	0	☆
C2-24	Running time of simple PLC Segment 11	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-25	Acceleration/deceleration time of simple PLC Segment 11	0~3	0	☆
C2-26	Running time of simple PLC Segment 12	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-27	Acceleration/deceleration time of simple PLC Segment 12	0~3	0	☆
C2-28	Running time of simple PLC Segment 13	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-29	Acceleration/deceleration time of simple PLC Segment 13	0~3	0	☆
C2-30	Running time of simple PLC Segment 14	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-31	Acceleration/deceleration time of simple PLC Segment 14	0~3	0	☆
C2-32	Running time of simple PLC Segment 15	0.0s(h)~6553.5s(h)	0.0s (h)	☆
C2-33	Acceleration/deceleration time of simple PLC Segment 15	0~3	0	☆
C2-34	Time unit of simple PLC running	0: s (second) 1: h (hour)	0	☆
C2-35	PLC function selection	0:C2-02~C2-34 is valid 1:C2-35~C2-68 is valid	0	☆
C2-36	Acceleration time of Segment 0	0.0S-3000.0S	10.0s	☆

Code	Parameter Name	Functional description	Default	Property
C2-37	deceleration time of Segment 0	0.0S-3000.0S	10.0s	☆
C2-38	Acceleration time of Segment 1	0.0S-3000.0S	10.0s	☆
C2-39	deceleration time of Segment 1	0.0S-3000.0S	10.0s	☆
C2-40	Acceleration time of Segment 2	0.0S-3000.0S	10.0s	☆
C2-41	deceleration time of Segment 2	0.0S-3000.0S	10.0s	☆
C2-42	Acceleration time of Segment 3	0.0S-3000.0S	10.0s	☆
C2-43	deceleration time of Segment 3	0.0S-3000.0S	10.0s	☆
C2-44	Acceleration time of Segment 4	0.0S-3000.0S	10.0s	☆
C2-45	deceleration time of Segment 4	0.0S-3000.0S	10.0s	☆
C2-46	Acceleration time of Segment 5	0.0S-3000.0S	10.0s	☆
C2-47	deceleration time of Segment 5	0.0S-3000.0S	10.0s	☆
C2-48	Acceleration time of Segment 6	0.0S-3000.0S	10.0s	☆
C2-49	deceleration time of Segment 6	0.0S-3000.0S	10.0s	☆
C2-50	Acceleration time of Segment 7	0.0S-3000.0S	10.0s	☆
C2-51	deceleration time of Segment 7	0.0S-3000.0S	10.0s	☆
C2-52	Acceleration time of Segment 8	0.0S-3000.0S	10.0s	☆
C2-53	deceleration time of Segment 8	0.0S-3000.0S	10.0s	☆
C2-54	Acceleration time of Segment 9	0.0S-3000.0S	10.0s	☆
C2-55	deceleration time of Segment 9	0.0S-3000.0S	10.0s	☆
C2-56	Acceleration time of Segment 10	0.0S-3000.0S	10.0s	☆
C2-57	deceleration time of Segment 10	0.0S-3000.0S	10.0s	☆
C2-58	Acceleration time of Segment 11	0.0S-3000.0S	10.0s	☆
C2-59	deceleration time of Segment 11	0.0S-3000.0S	10.0s	☆

Code	Parameter Name	Functional description	Default	Property
C2-60	Acceleration time of Segment 12	0.0S-3000.0S	10.0s	☆
C2-61	Acceleration time of Segment 12	0.0S-3000.0S	10.0s	☆
C2-62	deceleration time of Segment 13	0.0S-3000.0S	10.0s	☆
C2-63	Acceleration time of Segment 13	0.0S-3000.0S	10.0s	☆
C2-64	deceleration time of Segment 14	0.0S-3000.0S	10.0s	☆
C2-65	Acceleration time of Segment 14	0.0S-3000.0S	10.0s	☆
C2-66	deceleration time of Segment 15	0.0S-3000.0S	10.0s	☆
C2-67	Acceleration time of Segment 15	0.0S-3000.0S	10.0s	☆
Group C3: Swing Frequency, Fixed Length and Count				
C3-00	Pressure setted(MPa)	0.000~60.000Mpa	0.000Mpa	☆
C3-01	full scale maximum pressure (Mpa)	0.000~60.000Mpa	1.000Mpa	☆
C3-03	Explosion-proof tube protection pressure (Mpa)	0.001~60.000Mpa	1.500Mpa	☆
C3-04	Sleep wakeup pressure (Mpa)	0.0~100%(Corresponding to the set pressure percentage)	80%	☆
C3-07	Sleep frequency	0.00~maximum frequency	20.00HZ	☆
C3-08	The lasting time of frequency is less than sleep pressure	0~250s	10s	☆
C3-09	Sleep selection	0:frequency sleep available 1:pressure selection available	1	☆
Group d0: Motor 1 Parameters				
d0-00	Rated motor power	0.1kw~1000.0 kW	Model dependent	★
d0-01	Rated motor voltage	1V~2000 V	Model dependent	★
d0-02	Rated motor current	0.01A~655.35 A (Frequency inverter power ≤55 kW) 0.1A~6553.5 A (Frequency inverter power ≥75 kW)	Model dependent	★
d0-03	Rated motor frequency	0.01 Hz~ maximum frequency	50.00Hz	★
d0-04	Rated motor rotational speed	1rpm~65535rpm	Model dependent	★
d0-05	Stator resistance (asynchronous motor)	0.001 Ω ~65.535 Ω (frequency inverter power≤ 55 kW) 0.0001 Ω ~6.5535 Ω (frequency inverter power ≥75 kW)	Model dependent	★
d0-06	Rotor resistance (asynchronous motor)	0.001 Ω ~65.535 Ω (Frequency inverter power≤ 55 kW) 0.0001 Ω ~6.5535 Ω (Frequency inverter power ≥75	Model dependent	★

Code	Parameter Name	Functional description	Default	Property
		kW)		
d0-07	Leakage inductive reactance (asynchronous motor)	0.01mH~655.35 mH (Frequency inverter power≤ 55 kW) 0.001mH~65.535 mH (Frequency inverter power ≥75 kW)	Model dependent	★
d0-08	Mutual inductive reactance (asynchronous motor)	0.1mH~6553.5 mH (Frequency inverter power≤ 55 kW) 0.01mH~655.35 mH (Frequency inverter power ≥75 kW)	Model dependent	★
d0-09	No-load current (asynchronous motor)	0.01A ~ d0-02 (Frequency inverter power ≤55 kW) 0.1A to d0-02 (Frequency inverter power ≥75 kW)	Model dependent	★
d0-21	Encoder pulses per revolution	1~32767	1024	★
d0-22	Encoder type selection	0: ABZ incremental encoder	0	★
d0-23	Encoder input direction	0: Forward 1: Reverse	0	★
d0-29	Encoder fault detection time	0.0s: No action 0.1s~10.0s	0.0s	★
d0-30	Motor auto-tuning selection	0: No auto-tuning 1: Asynchronous motor static auto-tuning 2: Asynchronous motor dynamic complete auto-tuning 3: Asynchronous motor static complete auto-tuning	0	★
Group d1: Vector Control Parameters				
d1-00	Speed/Torque control selection	0: Speed control 1: Torque control	0	★
d1-01	Speed loop proportional gain 1(Kp1)	1~100	30	☆
d1-02	Speed loop integral time 1(Ti1)	0.01s~10.00s	0.50s	☆
d1-03	Switchover frequency 1	0.00HZ ~ d1-06	5.00 Hz	☆
d1-04	Speed loop proportional gain 2(KP2)	1~100	20	☆
d1-05	Speed loop integral time 2(Ti2)	0.01s~10.00s	1.00s	☆
d1-06	Switchover frequency 2	d1-03~ maximum output frequency	10.00 Hz	☆
d1-07	Motor running slip gain	50%~200%	100%	☆
d1-09	Vector control over excitation gain	0~200	64	☆
d1-10	Motor running torque upper limit source in speed control mode	0: d1-16 1: AI1 2: AI2 3: AI3 4: Pulse setting (HDI) 5: Communication setting	0	☆
d1-11	Electric torque limit	0.0%~200.0%	150.0%	☆
d1-14	Excitation current loop proportional gain	1~30000	2000	☆

Code	Parameter Name	Functional description	Default	Property
d1-15	Excitation current loop integral gain	0~30000	1300	☆
d1-16	Torque current loop proportional gain	1~30000	2000	☆
d1-17	Torque current loop integral gain	0~30000	1300	☆
d1-18	Speed loop integral property	0: Integral separation disabled 1: Integral separation enabled	0	☆
d1-21	Maximum output voltage coefficient	100%~110%	105%	☆
d1-22	Max. torque coefficient of field weakening area	50%~200%	100%	☆
d1-24	Torque setting source in torque control	0: Digital setting (d1-27) 1: AI1 2: AI2 3: AI3 4: Pulse setting (HDI) 5: Communication setting 6: MIN (AI1, AI2) 7: MAX (AI1, AI2) Full range of values 1~7 corresponds to the digital setting of d1-27.	0	☆
d1-26	Torque digital setting in torque control	-200.0%~200.0%	150.0%	☆
d1-28	Forward maximum frequency in torque control	0.00 Hz ~ maximum frequency(b0-13)	50.00 Hz	☆
d1-29	Reverse maximum frequency in torque control	0.00 Hz ~ maximum frequency(b0-13)	50.00 Hz	☆
d1-30	Acceleration time in torque control	0.00s~650.00s	0.00s	☆
Group d2: V/F Control Parameters				
d2-00	V/F curve setting	0: Linear V/F 1: Multi-point V/F 2: Square V/F 3: 1.2-power V/F 4: 1.4-power V/F 6: 1.6-power V/F 8: 1.8-power V/F 10: V/F complete separation 11: V/F half separation	0	★
d2-01	Torque boost	0.0% (torque auto-boost) 0.1%~30.0%	Model dependent	★
d2-02	Cut-off frequency of torque boost	0.0%~80.0% Actual cut-off frequency= Motor rated frequency*(d2-02)	50.0%	★
d2-03	Multi-point V/F frequency	0.00 Hz ~ d2-05	0.00 Hz	☆

Code	Parameter Name	Functional description	Default	Property
	1 (F1)			
d2-04	Multi-point V/F voltage 1 (V1)	0.0%~100.0%	0.0%	☆
d2-05	Multi-point V/F frequency 2 (F2)	d2-03 to d2-07	0.00 Hz	☆
d2-06	Multi-point V/F voltage 2 (V2)	0.0%~100.0%	0.0%	☆
d2-07	Multi-point V/F frequency 3 (F3)	d2-05 ~ maximum frequency	0.00 Hz	☆
d2-08	Multi-point V/F voltage 3 (V3)	0.0%~100.0%	0.0%	☆
d2-09	V/F slip compensation coefficient	0.0%~200.0%	0.0%	☆
d2-11	V/F oscillation suppression gain	0~100	40	☆
d2-13	V/F curve setting	0: Digital setting (d2-13) 1: AI1 2: AI2 3: AI3 4: Pulse setting (HDI) 5: Multi-function 6: Simple PLC 7: PID 8: Communication setting (Note: 100.0% corresponds to the rated motor voltage)	0	☆
d2-14	Voltage digital setting for V/F separation	0 V ~ rated motor voltage	0 V	☆
d2-15	Voltage rise time of V/F separation	0.0s~1000.0s Note: It indicates the time for the voltage rising from 0 V ~ rated motor voltage.	0.0s	☆
Group d6: Control Optimization Parameters 1				
d6-00	Carrier frequency	0.5kHz~16.0 kHz	Model dependent	☆
d6-01	DPWM switchover frequency upper limit	5.00Hz~15.00 Hz	8.00 Hz	★
d6-02	PWM modulation mode	0: Asynchronous modulation 1: Synchronous modulation	0	★
d6-03	Carrier frequency adjustment with temperature	0: No 1: Yes	1	☆
d6-04	Dead zone compensation mode selection	0: No compensation 1: Compensation mode 1 2: Compensation mode 2	1	☆
d6-05	Random PWM depth	0: Random PWM invalid 1~10: Random PWM carrier frequency depth	0	☆
d6-06	Current detected compensation	0~100	0	★

Code	Parameter Name	Functional description	Default	Property
d6-07	SVC mode selection	1: SVC mode 1 2: SVC mode 2	2	☆
Group U0: Standard Monitoring Parameters				
U0-00	Running frequency	0.00~300.00 Hz (b0-11 = 2)	-	●
U0-01	Setting frequency	0.00~3000.0 Hz (b0-11 = 1)	-	●
U0-02	DC Bus voltage	0.0~3000.0 V	-	●
U0-03	Output voltage	0V~1140 V	-	●
U0-04	Output current	0.00A~655.35 A (Frequency inverter power ≤ 55 kW) 0.0A~6553.5 A (Frequency inverter power > 55 kW)	-	●
U0-05	Output power	0~32767	-	●
U0-06	Output torque	-200.0%~200.0%	-	●
U0-07	DI state	-0~32767	-	●
U0-08	DO state	0~1023	-	●
U0-09	AI1 voltage	-	-	●
U0-10	AI2 voltage	-	-	●
U0-11	AI3 voltage	-	-	●
U0-14	Load speed display	0~65535	-	●
U0-15	PID setting	0~65535	-	●
U0-16	PID feedback	0~65535	-	●
U0-17	PLC stage	-	-	●
U0-18	Input pulse frequency	0.00kHz ~100.00 kHz	-	●
U0-19	Feedback speed, unit:0.01Hz	-3000.0Hz~3000.0 Hz -300.00Hz~300.00 Hz	-	●
U0-20	Remaining running time	0.0min~6500.0 min	-	●
U0-21	AI1 voltage before correction	0.00V~10.57 V	-	●
U0-22	AI2 voltage before correction	0.00V~10.57 V	-	●
U0-23	AI3 voltage before correction	-10.57V~10.57 V	-	●
U0-24	Linear speed	0.0min~65535m/min	-	●
U0-26	Present running time	-	-	●
U0-27	Communication setting value	-100.00%~100.00%	-	●
U0-28	Actual feedback speed	-3000.0Hz~3000.0 Hz -300.00Hz~300.00 Hz	-	●
U0-29	Encoder feedback speed	-3000.0Hz~3000.0 Hz -300.00Hz~300.00 Hz	-	●
U0-30	Main frequency X	0.00Hz~300.00 Hz 0.0Hz~3000.0 Hz	-	●
U0-31	Auxiliary frequency Y	0.00Hz~300.00 Hz 0.0Hz~3000.0 Hz	-	●
U0-32	Viewing any register address value	0°C~200°C	-	●
U0-34	Motor temperature	0°C~200°C	-	●
U0-35	Target torque	-200.0%~200.0%	-	●
U0-37	Power factor angle	-	-	●
U0-38	ABZ position	0~65535	-	●

Code	Parameter Name	Functional description	Default	Property
U0-39	Target voltage of V/F separation	0 V ~ rated motor voltage	-	●
U0-40	Output voltage of V/F separation	0 V ~ rated motor voltage	-	●
U0-41	DI input state visual display	-	-	●
U0-42	DO output state visual display	-	-	●
U0-43	DI function state visual display 1	-	-	●
U0-44	DO function state visual display 2	-	-	●
U0-45	Fault information	-	-	●
U0-46	Phase Z signal counting	-	-	●
U0-47	Present setting frequency (%)	-100.00%~100.00%	-	●
U0-48	Present running frequency (%)	-100.00%~100.00%	-	●
U0-49	Frequency inverter running state	0~65535	-	●
U0-50	Sent value of point-point communication	-100.00%~100.00%	-	●
U0-51	Received value of point-point communication	-100.00%~100.00%	-	●
Group A0: System Parameters				
A0-00	User password	0~65535	0	☆
A0-01	Product number	Frequency inverter product number	Model dependent	●
A0-02	Software version	Software version of control board	Model dependent	●
A0-06	Function parameters selection	00: Not display 01: Display	01	☆
A0-07	Parameter modification property	0: Modifiable 1: Not modifiable	0	☆
A0-09	Restore default settings	0: No operation 1: Restore default settings except motor parameters and accumulation record. 4: Clear records	0	★
A0-11	Parameter copy	1: The machine parameter upload to the keyboard. 2: Keyboard function download to the machine.	--	★
Group A2: Control Optimization Parameters 2				
A2-00	Current limit level	50%~200%	150%	☆
A2-01	Current limit selection	0~1	1	☆
A2-02	Current limit gain	0~100	20	☆
A2-03	Compensation factor of speed multiplying current limit	50%~200%	50%	☆

Code	Parameter Name	Functional description	Default	Property
A2-04	Voltage limit	200.0V~2000.0V	760V	☆
A2-05	Voltage limit selection	0~1	1	☆
A2-06	Frequency gain for voltage limit	0~100	30	☆
A2-07	Voltage gain for voltage limit	0~100	30	☆
A2-08	Frequency rise threshold during voltage limit	0~50Hz	5Hz	☆
A2-09	Slip compensation time constant	0.1s~10.0s	0.5s	☆
A2-10	Automatic frequency boost enable	0~1	0	☆
A2-11	Min motoring torque current	10%~100%	50%	☆
A2-12	Max regenerative torque current	10%~100%	20%	☆
A2-13	Auto-rise frequency KP	0~100	50	☆
A2-14	Auto-rise frequency KI	0~100	50	☆
A2-15	Torque compensation gain	80~150	100	☆
A2-16	Rotational speed tracking closed loop current KP	0~1000	500	☆
A2-17	Rotational speed tracking closed loop current KI	0~1000	800	☆
A2-18	Rotational speed tracking closed loop current limit	30%~200%	Model dependent	☆
A2-19	Rotational speed tracking closed loop current lower limit	10%~100%	30%	☆
A2-20	Time of rotational speed tracking voltage rise	0.5s~3.0s	1.1s	☆
A2-21	Demagnetization time	0.00s~5.00s	1.0s	☆
A2-22	Braking applied voltage	650V~800V	690V	☆

Appendix III

Model	Output Current (A)	Adaptable Motor		Appearance and installing dimension(mm)					
		KW	HP	W	W1	H	H1	D	Φd
1 phase 220V input & 3 phase 380V output									
EM15-G13-d75	2.1	0.75	1	118	106.5	185	175.5	157	Φ4.5
EM15-G13-1d5	3.8	1.5	2						
EM15-G13-2d2	5.1	2.2	3						
EM15-G13-004	9	3.7	5						
EM15-G13-5d5	13	5.5	7.5	160	148	247	235	177	Φ5.5
EM15-G13-7d5	17	7.5	10						
EM15-G13-011	25	11	15	220	205	320	305	198	Φ5.5
EM15-G13-015	32	15	20						
EM15-G13-018	37	18.5	25						

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