



# MD290 Series

General-purpose AC Drive User Manual



V0.0

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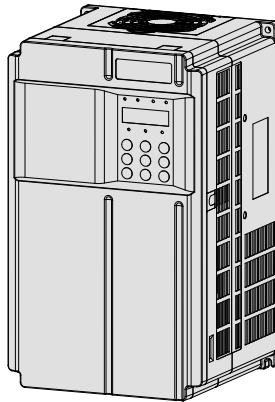
## Preface

Thank you for purchasing the MD290 series AC drive developed and manufactured by Inovance.

The MD290 is a general-purpose multi-functional AC drive and supports V/F control of AC asynchronous motor. It can drive various automation production equipment involving textile, paper-making, wiredrawing, machine tool, packing, food, fan and pump.

The MD290 features big start torque and simple commissioning, supports a maximum of 8 speeds for running, and achieves the close-loop process control system with the built-in PID function.

This manual is designed to ensure correct use of the drive, including selection, parameter setting, commissioning, maintenance & inspection. Before using the drive, read this manual carefully to have a thorough understanding of the product. Keep the manual well and forward it with the product to end users.



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### Note

- The drawings in the manual are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
  - The drawings in the manual are shown for description only and may not match the product you purchased.
  - The instructions are subject to change, without notice, due to product upgrade, specification modification as well as efforts to increase the accuracy and convenience of the manual.
  - Contact our agents or customer service center if you have any problem during the use.
-

## Introduction

### ■ Advantages

Besides all the functions of MD280N, the MD290 has improvements in the following aspects:

1. Small size

For the model of the same power, the size of the MD290 reduces over 40% compared with the MD280N.

2. Wide voltage range design

323 to 528 V

3. Built-in DC reactor

The MD290 AC drives of 30G/30P and above have built-in DC reactor, facilitating the installation.

4. Built-in braking unit and related protective function

The power class of the MD290 AC drive with built-in braking unit extends to 75G/90P (optional for 18.5G/22P to 75G/90P). The protective functions include braking resistor short-circuit, braking circuit overcurrent, brake pipe overload and brake pipe shoot-through.

5. Long serving life design

The bus capacitor has high disposition and long servicing life.

6. Cooling fan drive circuit protection

When short-circuit occurs on the cooling fan, the cooling fan drive circuit provides protection.

7. Complete protective functions

The whole series of MD290 AC drives have the protections on short-circuit to ground and pre-charge relay (contactor) close fault.

8. Complete EMC solution

Complete EMC solution (including optional EMI filter, common mode rejector / zero-phase reactor and simple filter) could be provided to satisfy the actual application and certification requirements.

### ■ Product Checking

Upon unpacking, check:

- Whether the nameplate model and AC drive ratings are consistent with your order. The box contains the AC drive, certificate of conformity, user manual and warranty card.
- Whether the AC drive is damaged during transportation. If you find any omission or damage, contact Inovance or your supplier immediately.

### ■ First-time Use

For the users who use this product for the first time, read the manual carefully. If you have any problem concerning the functions or performance, contact the technical support personnel of Inovance to ensure correct use.

### ■ Standard Compliant

The MD290 series AC drive complies with the international standards listed in the following table.

Directive	Directive Code	Standard
EMC directive	2004/108/EC	EN 61800-3 EN 55011 EN 61000-6-2
LVD directive	2006/95/EC 93/68/EEC	EN 61800-5-1

The MD290 series AC drive complies with the requirements of standard IEC/EN 61800-3 on the condition of correct installation and use by following the instructions in sections 7.3.2 and 7.3.6.



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## Safety Information and Precautions

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# Chapter 1 Safety Information and Precautions

This user manual includes some very important safety warnings and notices. There are two types of safety notice, and you must comply with both types of notice.

## DANGER





It indicates that failure to comply with the notice will result in severe personal injury or even death.







## WARNING




It indicates that failure to comply with the notice will result in personal injury or damage to property.

Read the following safety information and instructions carefully so that you understand how to install, commission, operate and maintain the MD290 AC drive system. Inovance accepts no liability or responsibility for any injury or loss caused by improper operation of the equipment described in the manual.

## 1.1 Safety Information

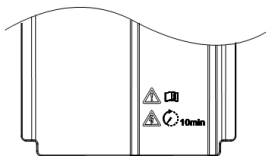
Use Stage	Safety Grade	Precautions
Before installation	 <b>DANGER</b>	<ul style="list-style-type: none"> <li>Do not install the equipment if you find water seepage, component missing or damage upon unpacking.</li> <li>Do not install the equipment if the packing list does not conform to the product you received.</li> </ul>
	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>Handle the equipment with care during transportation to prevent damage to the equipment.</li> <li>Do not use the equipment with any damaged or missing component. Failure to comply may result in personal injury.</li> <li>Do not touch the components with your hands. Failure to comply may result in static electricity damage.</li> </ul>
During installation	 <b>DANGER</b>	<ul style="list-style-type: none"> <li>Install the equipment on incombustible objects such as metal, and keep it away from combustible materials. Failure to comply may result in a fire.</li> <li>Do not loosen the fixed screws of the components, especially the screws with red mark.</li> </ul>
	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>Do not drop wire end or screw into the equipment. Failure to comply will result in equipment damage.</li> <li>Install the AC drive in places free of vibration and direct sunlight.</li> <li>When two AC drives are laid in the same cabinet, arrange the installation positions properly to ensure the cooling effect.</li> </ul>





Use Stage	Safety Grade	Precautions
At wiring	 <b>DANGER</b>	<ul style="list-style-type: none"> <li>Wiring must be performed only by qualified personnel under instructions described in this manual. Failure to comply may result in unexpected accidents.</li> <li>A circuit breaker must be used to isolate the power supply and the equipment. Failure to comply may result in a fire.</li> <li>Ensure that the power supply is cut off before wiring. Failure to comply may result in electric shock.</li> <li>Ground the equipment properly according to the requirements. Failure to comply may result in electric shock.</li> </ul>
	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>Never connect the power cables to the output terminals (U, V, W) of the AC drive. Pay attention to the marks of the wiring terminals and ensure correct wiring. Failure to comply will result in equipment damage.</li> <li>Never connect the braking resistor between the (+) and (-) terminals of the DC bus. Failure to comply may result in a fire.</li> <li>Use cables with dimensions recommended in the manual. Failure to comply may result in accidents.</li> <li>Use a shielded cable for the encoder, and ensure that the shield is reliably grounded.</li> </ul>
Before power-on	 <b>DANGER</b>	<ul style="list-style-type: none"> <li>Check that the following requirements are met: The voltage class of the power supply is consistent with the rated voltage class of the AC drive. 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 secured. Failure to comply may result in equipment damage.</li> <li>Do not perform the voltage resistance test on any part of the AC drive because such test has been done in the factory. Failure to comply may result in accidents.</li> </ul>
	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>Cover the AC drive properly before power-on to prevent electric shock.</li> <li>All peripheral devices must be connected properly under the instructions described in this manual. Failure to comply may result in accidents</li> </ul>
After power-on	 <b>DANGER</b>	<ul style="list-style-type: none"> <li>Do not open the cover after power-on. Failure to comply may result in electric shock.</li> <li>Do not touch any I/O terminal of the AC drive. Failure to comply may result in electric shock.</li> </ul>
	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>Prevent personal injury during motor rotation if motor auto-tuning is required. Failure to comply may result in accidents.</li> <li>Do not change the factory parameters of the AC drive to prevent equipment damage.</li> </ul>

Use Stage	Safety Grade	Precautions
During operation	 <b>DANGER</b>	<ul style="list-style-type: none"> <li>Signal detection during running must be performed only by qualified personnel. Failure to comply may result in personal injury or equipment damage.</li> <li>Do not touch the fan or the discharging resistor to check the temperature. Otherwise, you may get burnt</li> </ul>
	 <b>WARNING</b>	<ul style="list-style-type: none"> <li>Do not touch the top, both sides and the mounting side, which become hot during the drive running.</li> <li>Prevent dropping objects into the AC drive during drive running. Failure to comply may result in damage to the AC drive.</li> <li>Do not start or stop the AC drive by turning on or off the contactor. Failure to comply may result in equipment damage.</li> </ul>
During maintenance	 <b>DANGER</b>	<ul style="list-style-type: none"> <li>Repair or maintenance of the AC drive may be performed only by qualified personnel. Failure to comply may result in personal injury or equipment damage.</li> <li>Do not repair or maintain the AC drive at power-on. Failure to comply will result in electric shock.</li> <li>Repair or maintain the AC drive at least ten minutes after the AC drive 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.</li> <li>Ensure that the AC drive is disconnected from all power supplies before starting the repair or maintenance work.</li> <li>All the pluggable components must be plugged or removed only after power-off.</li> <li>Set and check the parameters again after the AC drive is replaced.</li> </ul>

## 1.2 General Precautions

1.



Label	Meaning
	<b>Danger !</b>
	<b>Never remove the protective covers while the power is on or within 10 minutes after the power is turned off. Ensure that the neutral point of the power supply has been grounded before using the AC drive.</b>
	<b>Read the user manual of the MD290 AC drive carefully before installation or operation.</b>
	<b>Wait for a period of 10 minutes after the AC drive is powered off before starting any repair, maintenance or wiring work .</b>

### 2. Requirements of a residual current device (RCD)

The AC drive generates high leakage current during running, which flows through the protective earthing (PE) conductor. Thus install a type-B RCD at primary side of the power supply. When selecting the RCD, consider the transient and steady-state leakage current to ground that may be generated at startup and during running of the AC drive. You can select a specialized RCD with the function of suppressing high harmonics or a general-purpose RCD with relatively large residual current.

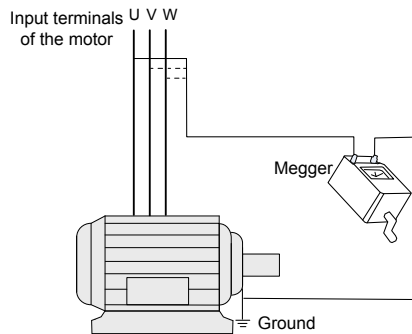
### 3. Motor insulation test

Arrange for a qualified technician to perform an insulation test on the motor under the following conditions:

- Before the motor is used for the first time
- When the motor is reused after being stored for a long time
- During regular maintenance checks.

This precaution detects poor insulation of the motor windings so that early actions can be taken to prevent damage to the AC drive. The motor must be disconnected from the AC drive during the insulation test. A 500 V volt insulation tester is recommended for this test, and the insulation resistance must not be less than 5 M $\Omega$ .

Figure 1-1 Connections required for a motor insulation test



### 4. Thermal protection of the motor.

If the rated capacity of the motor does not match that of the AC drive, adjust the motor protection parameters on the operation panel or install a thermal relay in the motor circuit for protection. It is especially important to take this precaution if the AC drive has a higher power rating than the motor.

### 5. Running at frequencies higher than 50 Hz.

The MD290 AC drive can output frequencies in the range 0 to 500 Hz. If it is necessary to operate the MD290 AC drive at frequencies higher than 50 Hz, consider the capacity of the machine.

### 6. Vibration of the mechanical device.

The AC drive might experience mechanical resonance at some output frequencies. It is possible to avoid this by selecting the jump frequency.

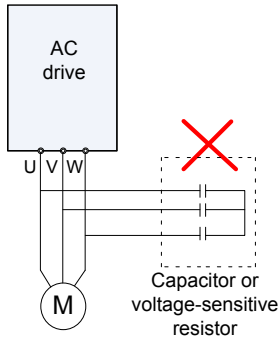
### 7. Motor heat and noise

The output of the AC drive is pulse width modulation (PWM) wave with certain harmonic frequencies, and therefore, the motor temperature, noise, and vibration are slightly greater than those when the AC drive runs at the mains frequency.

8. Voltage-sensitive device or capacitor on the output side of the AC drive.

Do not install a capacitor for improving power factor, or a voltage sensitive resistor for lightning protection, on the output side of the AC drive. This is because the output is a PWM waveform and the AC drive might suffer transient overcurrent or become damaged.

Figure 1-2 Disallowed connections to the AC drive output

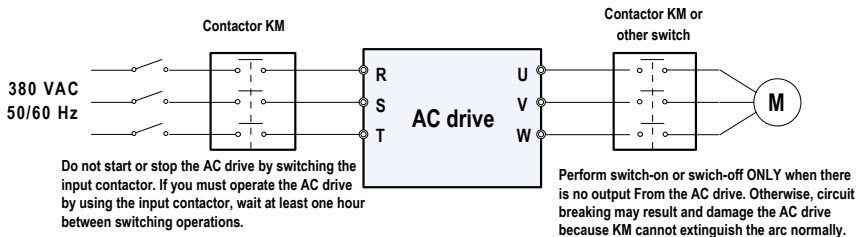


9. Contactor at the I/O terminal of the AC Drive.

If there is a contactor installed between the input side of the AC drive and the power supply, DO NOT use it to start or to stop the AC drive. However, if there is a real and urgent need to use the contactor to start or to stop the AC drive, make sure the time interval between switching is at least one hour. If the interval between switching is shorter than one hour, this will reduce the service life of the capacitor inside the AC drive.

If there is a contactor installed between the output side of the AC drive and the motor, do not switch off this contactor when the AC drive is operating. Damage might occur to components inside the AC drive if you switch off the output contactor when the AC drive is operating.

Figure 1-3 Input and output contactors



10. When the external voltage exceeds the rated voltage range

Do not operate the AC drive outside the rated voltage range specified in this User Manual. If you operate the AC drive outside its rated voltage range, components inside the AC drive might be damaged. If necessary, use an appropriate voltage step-up or step-down device to match the supply voltage to the rated voltage range for the AC drive.

### 11. De-rating when above default carrier frequency

When the carrier frequency of the MD290 is increased above the default setting, you need to de-rate the drive according to the following table:

Power	Carrier Frequency									
	3 kHz	4 kHz	5 kHz	6 kHz	7 kHz	8 kHz	9 kHz	10 kHz	11 kHz	12 kHz
18.5G/22P	100.0%	100.0%	100.0%	100.0%	95.7%	91.6%	87.9%	84.3%	81.0%	77.9%
22G/30P	100.0%	100.0%	100.0%	100.0%	95.5%	91.4%	87.6%	83.9%	80.5%	77.3%
30G/37P	100.0%	100.0%	100.0%	100.0%	93.5%	87.7%	82.4%	77.2%	72.5%	68.3%
37G/45P	100.0%	100.0%	100.0%	94.4%	89.0%	84.0%	79.4%	74.9%	70.8%	67.1%
45G/55P	100.0%	100.0%	100.0%	94.0%	88.6%	83.7%	79.2%	75.2%	71.5%	68.1%
55G/75P	100.0%	100.0%	94.1%	88.9%	84.0%	79.5%	75.5%	71.7%	68.3%	65.2%
75G/90P	100.0%	91.8%	84.2%	77.5%	70.9%	65.2%	60.1%	55.1%	50.6%	46.7%
90G/110P	100.0%	90.8%	82.3%	74.9%	67.7%	61.5%	56.0%	50.8%	46.2%	42.3%
110G/132P	100.0%	91.9%	84.4%	77.7%	71.3%	65.5%	60.4%	55.4%	51.1%	47.2%

### 12. Prohibition of three-phase input changed into two-phase input.

Do not change a three-phase input of the AC drive into a two-phase input.

### 13. Surge suppressor.

The AC drive has a built-in voltage-dependent resistor (VDR) for suppressing the surge voltage generated when the inductive loads around the AC drive (for example the electromagnetic contactor, electromagnetic relay, solenoid valve, electromagnetic coil and electromagnetic brake) are switched on or off.

If the inductive loads generate a very high surge voltage, use a surge suppressor for the inductive load and possibly also use a diode.

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#### Note

Do not connect the surge suppressor to the output side of the AC Drive.

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### 14. Ambient temperature and de-rating

The ambient temperature for normal use of the MD290 is -10°C to 40°C. De-rate the AC drive when the temperature exceeds 40°C. The drive must be de-rated 1.5% for every 1°C temperature rise. The allowable maximum temperature is 50°C.

### 15. Altitude and de-rating

In places where the altitude is above 1000 m, the cooling effect reduces due to thin air, and it is necessary to de-rate the AC drive. The drive must be de-rated 1% for every 100 m altitude rise. The allowable highest altitude is 3000 m.



### 1. Some special usages

If your installation requires special cabling that this user manual does not describe, for example to support a common DC bus, contact Inovance for technical support and advice.

### 2. Disposal

If it becomes necessary to dispose of any part of the AC drive system, DO NOT attempt to burn the parts on a fire. If you do, the electrolytic capacitors might explode, and the plastic components will create poisonous gases. Treat any parts for disposal as ordinary industrial waste.

### 3. Adaptable motor

- The standard adaptable motor is an adaptable four-pole squirrel cage asynchronous induction motor. For other types of motor, select the correct AC drive according to the rated motor current.
- The cooling fan and rotor shaft of non-variable-frequency motors are coaxial, which results in reduced cooling effect when the motor speed reduces. Therefore, add a more powerful fan or fit a variable-frequency motor in applications where the motor overheats easily.
- The standard parameters of the adaptable motor have already been configured inside the AC drive. However, it is still necessary to perform motor auto-tuning or to modify the default values based on actual conditions. Otherwise, the running result and protection performance will be adversely affected.
- The AC drive might cause an alarm or might be damaged when a 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, disconnect the drive from the tested parts.



Product Information

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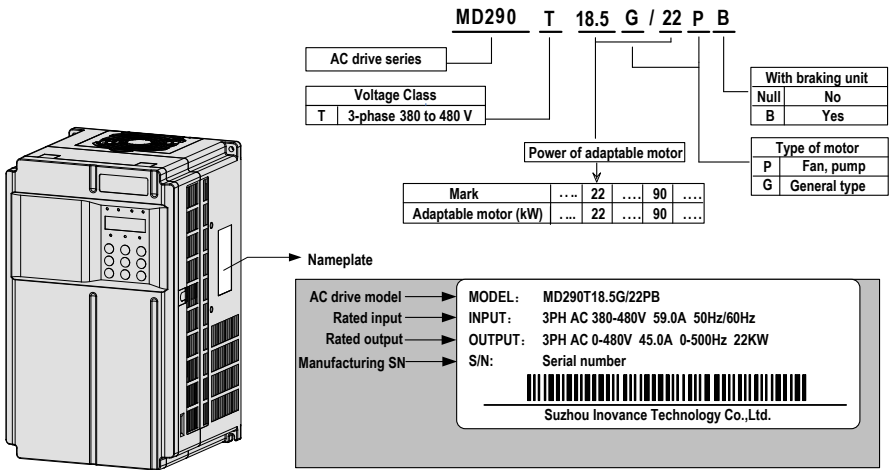
# Chapter 2 Product Information

## 2.1 Product Type Identification

Each model in the range of MD290 AC drive systems has a model number that identifies important characteristics and specifications for that particular unit.

The following figure shows an example of a model number and explains how it is derived from the system specification.

Figure 2-1 Nameplate and designation rules of the MD290



## 2.2 Components of the MD290

The MD290 series AC drives have two housing types, plastic housing and sheet metal housing, according to different voltage and powxxx classes.

Figure 2-2 Components of the MD290 of plastic housing (three-phase 380 to 480 V, 18.5G/22P to 37G/45P)

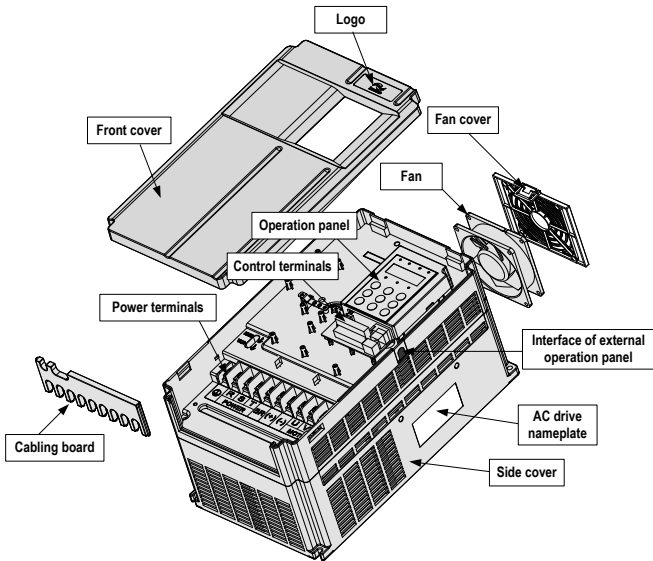
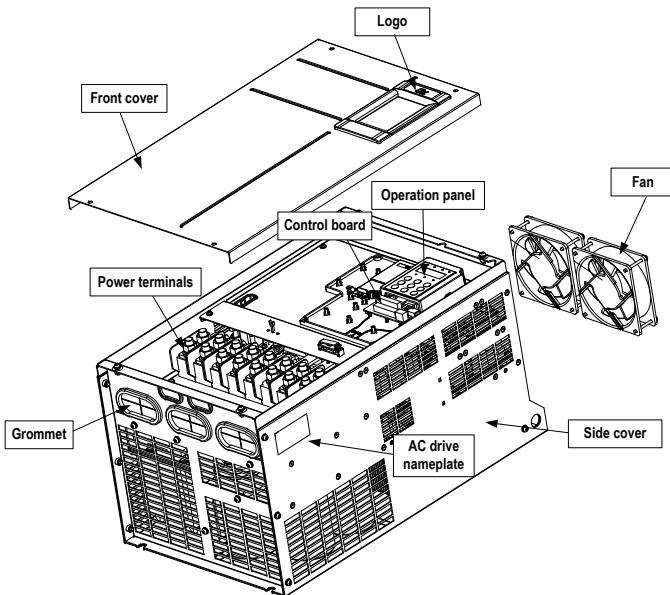


Figure 2-3 Components of the MD290 of sheet metal housing (three-phase 380 to 480 V, 45G/55P to 110G/132P)



## 2.3 Technical Specifications

Table 2-1 Technical specifications of the MD290

Item		Description
Standard functions	Max. frequency	V/F control: 0 to 500 Hz
	Carrier frequency	0.8 to 12 kHz The carrier frequency adjusts automatically depending on load characteristics.
	Input frequency resolution	Digital setting: 0.01 Hz Analog setting: Max. frequency x 0.025%
	Control mode	Voltage/Frequency (V/F) control
	Startup torque	G type: 0.5 Hz/150% P type: 0.5 Hz/100%
	Speed range	1: 50
	Speed stability accuracy	±1%
	Torque control accuracy	±5% (CLVC)
	Overload capacity	G type: 60 seconds for 150% of the rated current P type: 60 seconds for 130% of the rated current
	Torque boost	Customized boost 0.1 % to 30.0 %
	V/F curve	<ul style="list-style-type: none"> <li>• Straight-line V/F curve</li> <li>• Multi-point V/F curve</li> <li>• Square V/F curve</li> <li>• Complete V/F separation</li> <li>• Half V/F separation</li> </ul>
	V/F separation	<ul style="list-style-type: none"> <li>• Complete V/F separation</li> <li>• Half V/F separation</li> </ul>
	Ramp mode	<ul style="list-style-type: none"> <li>• Straight-line ramp</li> <li>• S-curve ramp</li> </ul> <p>Four separate acceleration/deceleration time settings in the range of 0s to 6500s.</p>
DC injection braking	<ul style="list-style-type: none"> <li>• DC injection braking frequency: 0.00 Hz to max. frequency</li> <li>• DC injection braking active time: 0.0s to 36.0s.</li> <li>• Current level of DC injection braking: 0.0% to 100.0%.</li> </ul>	

Standard functions	Jog control	Jog frequency range: 0.00–50.00 Hz Jog acceleration/deceleration time: 0.0–6500.0s
	Simple PLC and multi-speed operation	A maximum of 16 speeds are supported by means of the simple PLC function or control terminals.
	Onboard PID	It implements the process closed-loop control system.
	Auto voltage regulation (AVR)	It can keep constant output voltage automatically when the mains voltage changes.
	Fast current limit	It reduces the overcurrent faults to the minimum and guarantees normal running of the AC drive.
Individualized functions	Power dip ride-through	The load feedback energy compensates the voltage reduction at instantaneous power down, enabling the AC drive to continue running within the short time.
	Virtual I/Os	The AC drive provides five groups of virtual DI/DOs to implement simple logic control.
	Timing control	Time range: 0.0–6500.0 minutes
	Multi-motor switchover	Two motors can be switched over via two groups of motor parameters.
	Multiple field buses	Four field buses are supported, Modbus-RTU, PROFIBUS-DP, CANlink and CANopen.
	Motor overheat protection	The optional I/O extension card enables AI3 to receive the motor temperature sensor input (PT100, PT1000), implementing motor overheat protection.
	User programmable function	The optional programming card helps you to realize secondary development. Its programming environment is compatible with that of the PLC of Inovance.
	Advanced background software	It supports operations of AC drive parameters and the oscillograph function, via which the state inside the AC drive is monitored.

Item		Description
Operation	Command source	Allows different methods of switching between command sources: <ul style="list-style-type: none"> <li>• Operating panel control</li> <li>• Terminal control</li> <li>• Communication control</li> </ul>
	Frequency setting channel	Supports up to 10 frequency setting channels and allows different methods of switching between frequency setting channels: <ul style="list-style-type: none"> <li>• Digital setting</li> <li>• Analog voltage reference</li> <li>• Analog current reference</li> <li>• Pulse reference</li> <li>• Communication reference</li> </ul>
	Auxiliary frequency source	Supports up to 10 auxiliary frequency setting channels, and allows fine tuning of the auxiliary frequency and frequency superposition.
	Input terminals	Standard: <ul style="list-style-type: none"> <li>• Five digital input (DI) terminals, one of which supports up to 100 kHz high-speed pulse inputs.</li> <li>• Two analog input (AI) terminals, one of which supports only 0 to 10 V input, and the other supports 0 to 10 V and 0 to 20 mA current input.</li> </ul> Expanded capacity: <ul style="list-style-type: none"> <li>• Five digital input (DI) terminals.</li> <li>• One AI terminal that supports –10 to 10 V voltage input and PT100/PT1000 motor temperature sensor inputs.</li> </ul>
	Output terminals	Standard <ul style="list-style-type: none"> <li>• Single high-speed pulse output terminal (open-collector), supporting output of 0 to 100 kHz square signals</li> <li>• Single digital output (DO) terminal</li> <li>• Single relay output terminal</li> <li>• Single analog output (AO) terminal that supports either a current output in the range 0 to 20 mA or a voltage output in the range 0 to 10 V.</li> </ul> Expanded capacity: <ul style="list-style-type: none"> <li>• Single extra DO terminal</li> <li>• Single extra relay output terminal</li> <li>• Single extra AO terminal that supports either a current output in the range 0 to 20 mA or a voltage output in the range 0 to 10 V.</li> </ul>

Item		Description
Display and operating panel	LED display	The LED display shows parameters.
	LCD display	(Optional)
	Parameter clone	Parameters can be cloned quickly via the optional LCD operation panel.
	Key locking and function selection	Keys on the control panel can be locked or partially locked electronically to prevent mal-function.
	Protections	The MD290 supports the following protections: <ul style="list-style-type: none"> <li>• Motor short-circuit detection at power-on</li> <li>• Input/output phase loss protection</li> <li>• Overcurrent protection</li> <li>• Overvoltage protection</li> <li>• Undervoltage protection</li> <li>• Overheat protection</li> <li>• Overload protection</li> <li>• Regen resistor short-circuit protection</li> </ul>
	Optional parts	LCD operation panel, braking unit, I/O extension card 1, I/O extension card 2, User programmable card, RS485 communication card, PFOFIBUS-DP card, CANlink card, and CANopen card
Environment	Installation location	Install the MD290 AC drive where it is indoors and protected from direct sunlight, dust, corrosive or combustible gases, oil smoke, vapour, ingress from water or any other liquid, and salt.
	Altitude	Below 1000 m
	Ambient temperature	-10°C to 40°C (de-rated if the ambient temperature is between 40°C and 50°C)
	Humidity	Less than 95 % RH, non-condensing
	Vibration	Less than 5.9 m/s <sup>2</sup> (0.6 g)
	Storage temperature	-20°C to 60°C

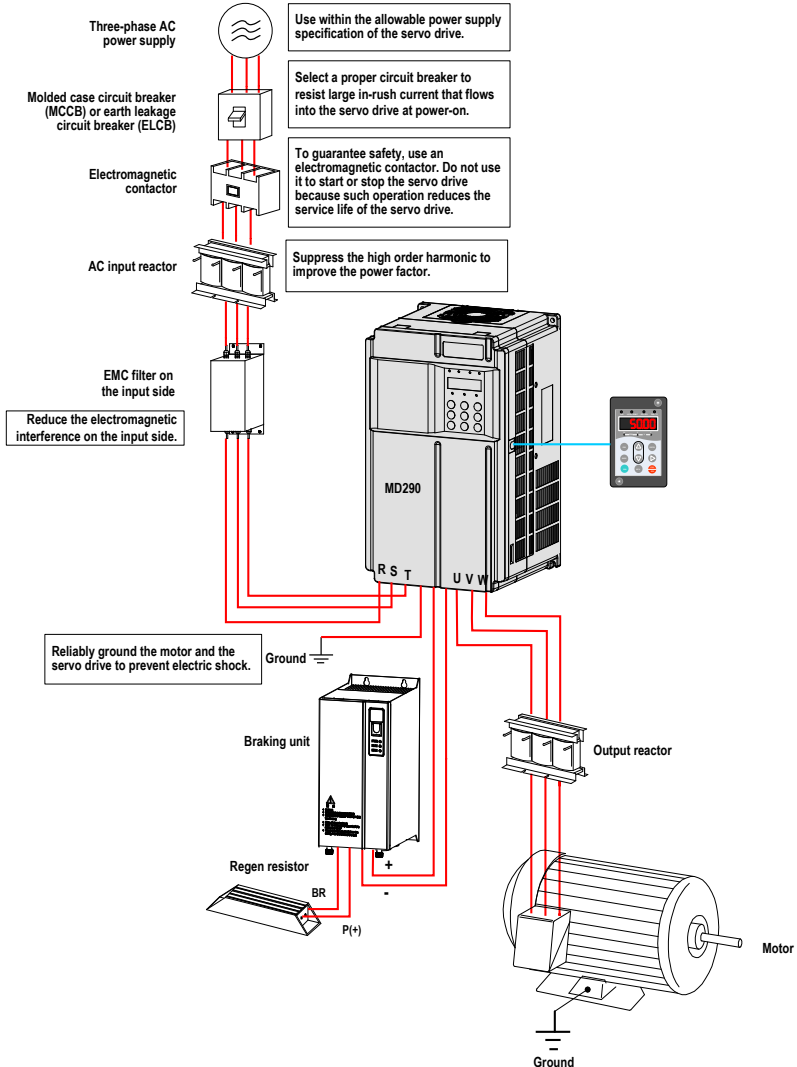


## 2.4 Connection to Peripheral Devices

When the MD290 is used to control the asynchronous motor to form a control system, it is necessary to install various electrical devices on the input and output sides of the AC drive to ensure system safety and stability.

In addition, several optional extension cards are available for the MD290 to implement various functions. The system configuration of three-phase 380 to 480 V 18.5G/22P drive is shown in the following figure.

Figure 2-4 System configuration of three-phase 380 to 480 V 18.5G/22P drive



Device Name	Mounting Position	Function Description
MCCB	Power receiving side	Cut off the power supply when overcurrent occurs on downstream devices.
Contactor	Between MCCB and AC drive input side	<ul style="list-style-type: none"> <li>Start and stop the AC drive.</li> <li>Do not start and stop the AC drive frequently by switching the contactor on and off (less than twice per minute) nor use it to directly start the AC drive.</li> </ul>
AC input reactor	AC drive input side	<ul style="list-style-type: none"> <li>Improve the power factor of the input side.</li> <li>Eliminate the higher harmonics of the input side effectively and prevent other devices from being damaged due to distortion of the voltage waveform.</li> <li>Eliminate the input current unbalance due to unbalance between the power phases.</li> </ul>
EMC input filter	AC drive input side	<ul style="list-style-type: none"> <li>Reduce the external conduction and radiation interference of the AC drive.</li> <li>Decrease the conduction interference flowing from the power end to the AC drive and improve the anti-interference capacity of the AC drive.</li> </ul>
AC output reactor	Between AC drive output side and the motor, close to the AC drive	<p>The output side of the AC drive generally has much higher harmonics. When the motor is far from the AC drive, there is much distributed capacitance in the circuit and certain harmonics may cause resonance in the circuit, bringing about the following two impacts:</p> <ul style="list-style-type: none"> <li>Degrade the motor insulation performance and damage the motor in the long run.</li> <li>Generate large leakage current and cause frequent AC drive protection trips.</li> </ul> <p>If the distance between the AC drive and the motor is greater than 100 m, install an AC output reactor.</p>

### Note

- Never install the capacitor or surge suppressor on the output side of the AC drive. Otherwise, it may cause faults to the AC drive or damage to the capacitor and surge suppressor.
- Inputs/Outputs (main circuit) of the AC drive contain harmonics, which may interfere with the communication device connected to the AC drive. Therefore, install an anti-interference filter to minimize the interference.
- For more details on peripheral devices, refer to related selection guideline.

## 2.4.2 Description of Peripheral Optional Devices

The peripheral optional devices include braking unit, extension cards of different functions and external operation panel, etc. If any optional device is required, specify it in your order.

Table 2-4 Peripheral optional devices of the MD290

Name	Model	Function	Remark
Internal braking unit	AC drive model ending with letter "B"	The models of 18.5G/22P to 75G/90P have the internal braking unit as an optional configuration.	-
External braking unit	MDBUN	The AC drives of 90G/110P and above must be configured with an external braking unit.	Multiple braking units are connected in parallel for the AC drive of 90G/110P and above.
I/O extension card 1	MD38IO1	It can extend five DIs and one AI (AI3 is used for separation analog input and can be connected to PT100, PT1000), one relay output, one DO and one AO with Modbus/CANlink communication terminal	It applies to the models of 3.7 kW and above.
I/O extension card 2	MD38IO2	It can extend three DIs.	It applies to all models.
RS485 communication card	MD38TX1	It is the Modbus communication adapter with isolation.	It applies to all models.
CANlink communication card	MD38CAN1	It is the CANlink communication adapter.	It applies to all models.
CANopen communication card	MD38CAN2	It is the CANopen communication adapter.	It applies to all models.
Profibus-DP communication card	MD38DP	It is the Profibus-DP communication card.	It applies to all models.
User programmable card	MD38PC1	It is completely compatible with Inovance's H1U series PLC.	It applies to all models.
External LED operation panel	MDKE	It supports LED display and operations.	It applies to the MD series AC drives with the RJ45 interface.
Hand-held LCD operator	MDKE7	It supports LCD display and operations.	It allows parameter clone.
Extension cable	MDCAB	It is a standard 8-core cable and can be connected to MDKE and MDKE7.	The standard length is 3 meters.
Bracket	MD500-AZJ-T*	It is used for embedded mounting of the AC drive.	*: For detailed model and power matching, refer to Table 3-1.



Mechanical Installation

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# Chapter 3 Mechanical Installation

## 3.1 Installation Environment

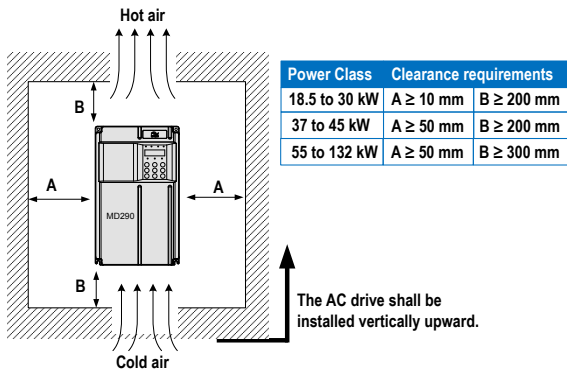
Item	Requirements
Ambient temperature	-10°C to 50°C
Heat dissipation	Install the AC Drive on an incombustible supporting surface and make sure there is sufficient space around the enclosure to allow for efficient heat dissipation. Use strong screws or bolts to secure the enclosure on the supporting surface.
Mounting location	Make sure the mounting location is: Away from direct sunlight Not in an area that has high humidity or condensation Protected against corrosive, combustible or explosive gases and vapours Free from oil, dirt, dust or metallic powders.
Vibration	Make sure the mounting location is not affected by levels of vibration that exceed 0.6 g. Avoid installing the enclosure near to punching machines or other mechanical machinery that generates high levels of vibration or mechanical shock.
Protective enclosure	The MD290 drives of plastic housing must be installed in a fireproof cabinet with doors that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations, and to relevant IEC requirements.

## 3.2 Mounting Orientation and Clearance

### ■ Mounting Clearance

The mechanical clearance requirements for the MD290 vary with power classes of the AC drive.

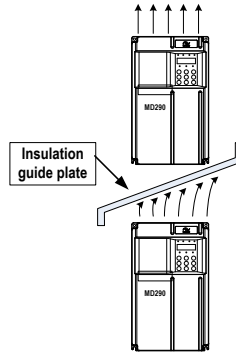
Figure 3-1 Mounting clearance of the MD290



The MD290 series AC drive dissipates heat from the bottom to the top. When multiple AC drives are required to work together, install them side by side.

For the application of installing multiple AC drives, if one row of AC drives need to be installed above another row, install an insulation guide plate to prevent AC drives in the lower row from heating those in the upper row and causing faults.

Figure 3-2 Installation of the insulation guide plate

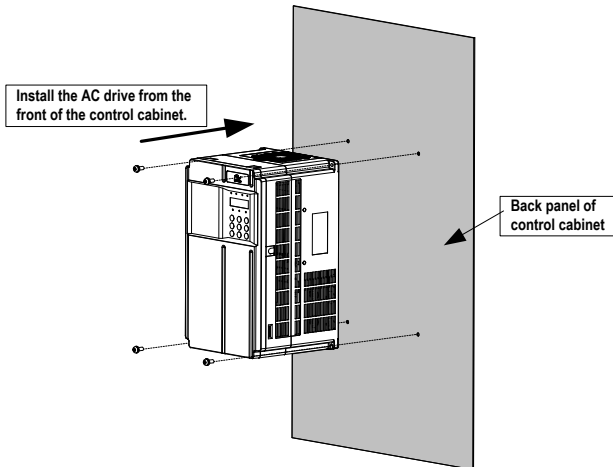


### 3.3 Installation Method and Process

The MD290 series has two housing types, plastic housing and sheet metal housing, according to different power classes. The MD290 supports both surface mounting and embedded mounting.

1. Surface mounting of the MD290 (plastic housing)

Figure 3-3 Surface mounting of the MD290 (plastic housing)



2. Embedded mounting the MD290 (plastic housing)

Figure 3-4 External hanging bracket for the MD290

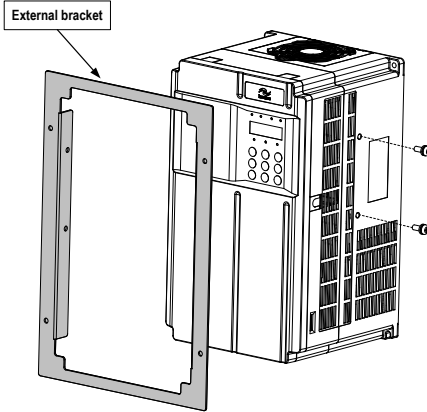
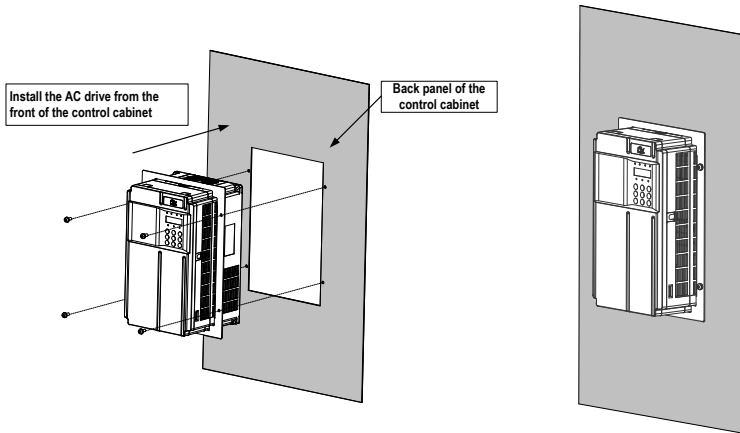


Figure 3-5 Embedded mounting of the MD290 (plastic housing)



3. Surface mounting of the MD290 (sheet metal housing)

Figure 3-6 Surface mounting of the MD290 (sheet metal housing)

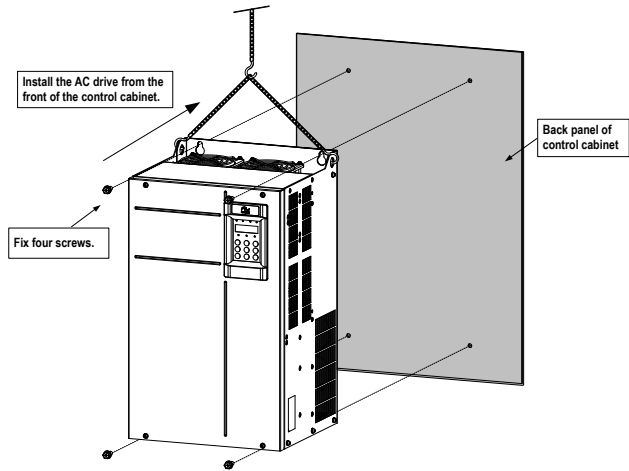
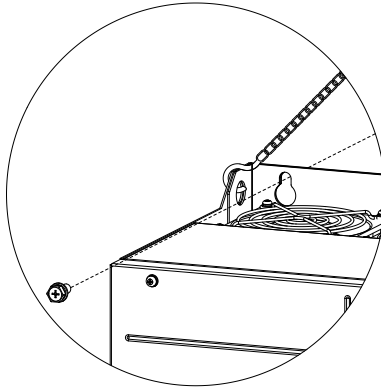


Figure 3-7 Hoisting the MD290 (sheet metal housing)





4. Embedded mounting of the MD290 (sheet metal housing)

Figure 3-8 External hanging bracket for the MD290 (sheet metal housing)

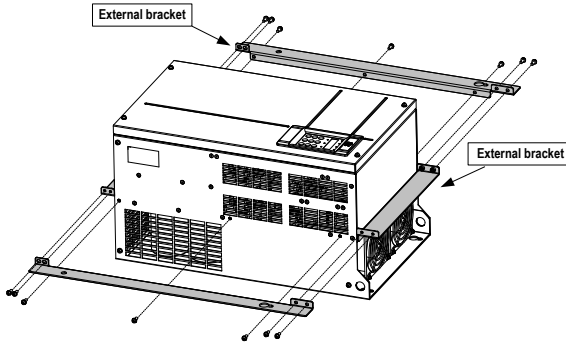


Figure 3-9 Embedded mounting of the MD290 (sheet metal housing)

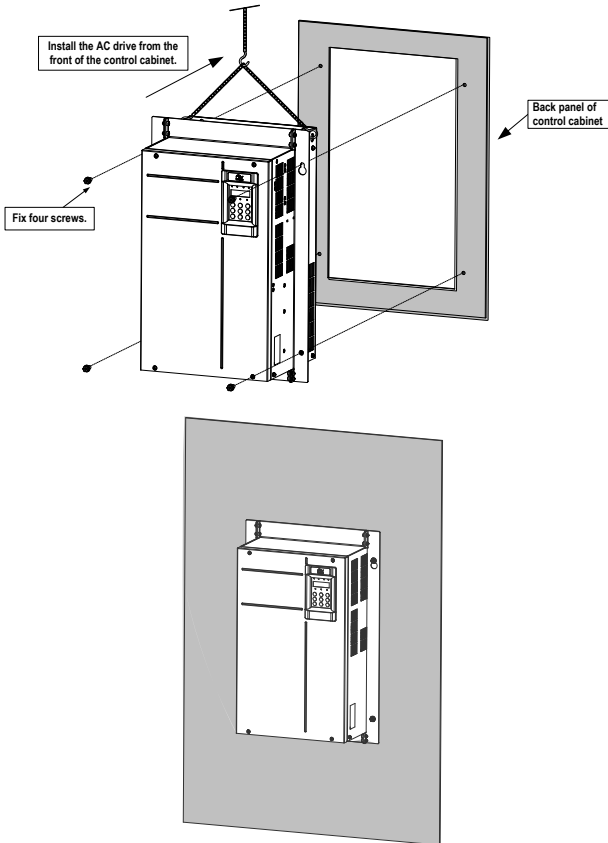


Table 3-1 Selection of external brackets for embedded mounting

Bracket Model	Applicable AC Drive Model
MD500-AZJ-T5	MD290T18.5G/22P
	MD290T22G/30P
MD500-AZJ-T6	MD290T30G/37P
	MD290T37G/45P
MD500-AZJ-T7	MD290T45G/55P
	MD290T55G/75P
MD500-AZJ-T8	MD290T75G/90P
	MD290T90G/110P
	MD290T110G/132P

The installation precautions are as follows:

- Reserve the installation clearances as specified in Figure 3-1 to ensure sufficient space for heat dissipation. Take heat dissipation of other components in the cabinet into consideration.
- Install the AC drives upright to facilitate heat dissipation. If multiple AC drives are installed in the cabinet, install them side by side. If one row of AC drives need to be installed above another row, install an insulation guide plate, as shown in Figure 3-2.
- Use the incombustible hanging bracket.
- In scenarios with heavy metal powder, install the heatsink outside the cabinet, and ensure that the room inside the fully-sealed cabinet is as large as possible.

### 3.4 Removal of the Front Cover

For the MD290 series AC drives, you need to remove the front cover before wiring the main circuit and control circuit. The following figures show how to remove the front cover of the MD290.

Figure 3-4 Removal of the front cover of the MD290 (plastic housing)

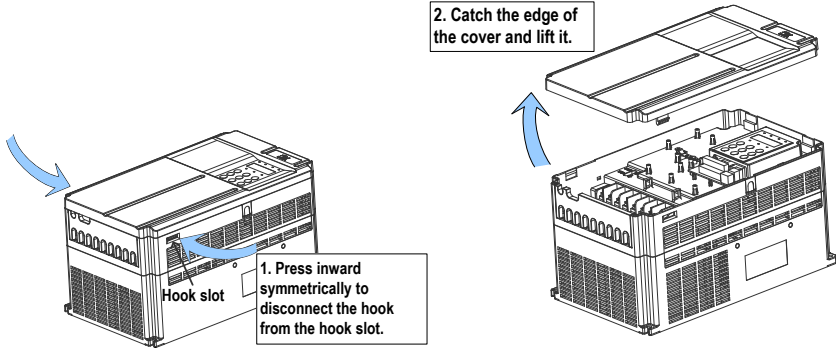
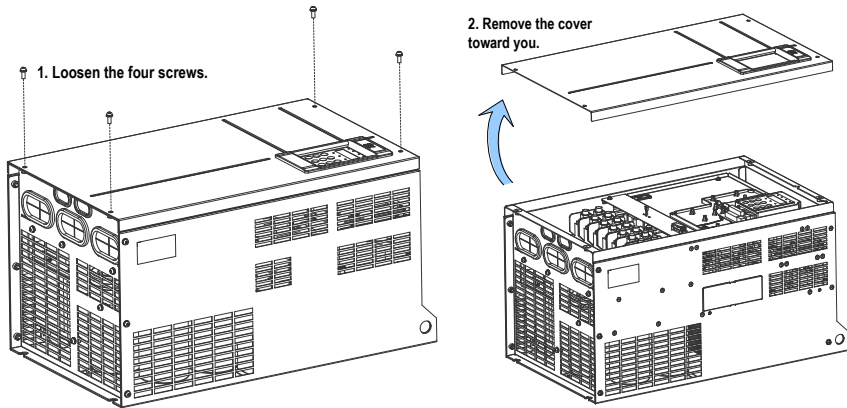


Figure 3-13 Removal of the front cover of the MD290 (sheet metal housing)



#### Note

Be careful when removing the front cover of the AC drive. Falling off of the cover may cause damage to the AC drive or personal injury.



Electrical Installation

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# Chapter 4 Electrical Installation

## 4.1 Main Circuit

### 4.1.1 Description of main circuit terminals

Figure 4-1 Terminal arrangement of the main circuit

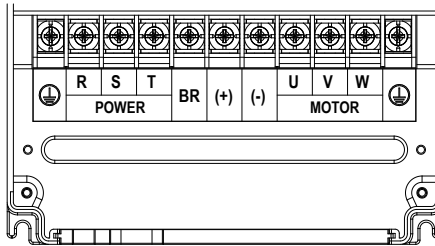


Table 4-1 Description of main circuit terminals of single-phase AC drive

Terminal	Name	Description
R, S, T	Three-phase power input terminals	Connect to the three-phase power supply.
(+), (-)	Positive and negative terminals of DC bus	Common DC bus input point. Connect to the external braking unit for the models of 90G/110P and above.
(+), BR	Terminals for connecting braking resistor	Connect to a braking resistor for the models of 75G/90P and below
U, V, W	AC drive output terminals	Connect to a three-phase motor.
⊕	Grounding terminal	Must be grounded.

### 4.1.2 Main Circuit Wiring

The MD290 of 75G/90P below has the built-in braking unit and you need to connect regen resistor to the main circuit. The MD290 of 90G/110P must connect the external braking unit.

Figure 4-2 Main circuit wiring of the MD290 (three-phase 380 to 480 V, 18.5G/22P to 75G/90P)

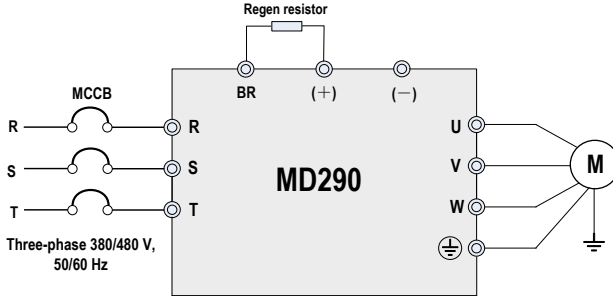
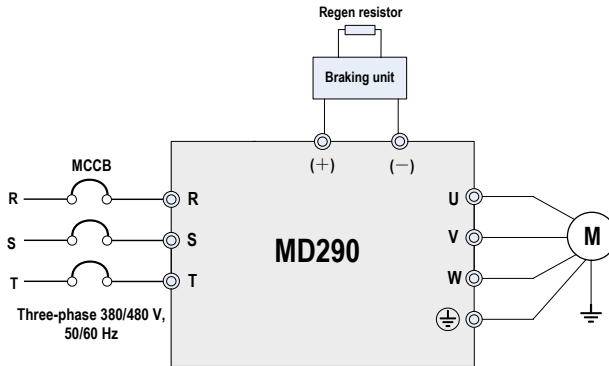


Figure 4-3 Main circuit wiring of the MD290 (three-phase 380 to 480 V, 90G/110P to 110G/132P)



### 4.1.3 Precautions on Main Circuit Wiring

#### 1. Power input terminals R, S, T

- The cable connection on the input side of the AC drive has no phase sequence requirement.
- The specification and installation method of external power cables must comply with the local safety regulations and related IEC standards.
- Use copper conductors of a proper size as power cables according to the recommended values in section 9.3.

#### 2) DC bus terminals (+), (-)

- Terminals (+) and (-) of DC bus have residual voltage after the AC drive is switched off. After indicator CHARGE goes off, wait at least 10 minutes before touching the equipment. Failure to comply may result in.
- connecting external braking components for the AC drive of 90G/110P and above, never reverse (+) and (-). Failure to comply may result in damage to the AC drive and even cause a fire.
- The cable length of the braking unit must not exceed 10 m. Use twisted pair wire or tight pair wires for parallel connection.
- Do not connect the braking resistor directly to the DC bus. Otherwise, it may damage the AC drive and even cause fire.

#### 3) Terminals (+), PB for connecting braking resistor

- For the AC drive of 75G/90P and below with the built-in braking unit, terminals (+), PB are effective.
- Connect a braking resistor of the recommended model, and ensure that the cable length of the braking resistor must be shorter 5 m. Otherwise, it may damage the AC drive.

#### 4) AC drive output terminals U, V, W

- The specification and installation method of external power cables must comply with the local safety regulations and related IEC standards.
- Use copper conductors of a proper size as power cables according to the recommended values in section 9.3.
- Do not connect a capacitor or surge absorber to the output side of the AC drive. Otherwise, it may cause frequent AC drive fault or even damage the AC drive.
- If the motor cable is too long, electrical resonance will be generated due to the impact of distributed capacitance. This will damage the motor insulation or generate higher leakage current, causing the AC drive to trip in overcurrent protection. If the motor cable is greater than 100 m long, an AC output reactor must be installed close to the AC drive.

#### 5) Terminal PE

- This terminal must be reliably connected to ground and the resistance of the grounding wire must be less than 0.1  $\Omega$ . Otherwise, it may cause abnormal running or even damage to the AC drive.
- Do not connect this terminal to the neutral conductor of the power supply.
- The impedance of the PE conductor must be able to withstand the large short-circuit current that may arise when a fault occurs.

- Select the size of the PE conductor according to the following table:

Cross-sectional Area of a Phase Conductor (S)	Min. Cross-sectional Area of Protective Conductor (Sp)
$S \leq 16 \text{ mm}^2$	S
$16 \text{ mm}^2 < S \leq 35 \text{ mm}^2$	16 mm <sup>2</sup>
$35 \text{ mm}^2 < S$	S/2

- You must use a yellow/green cable as the PE conductor.

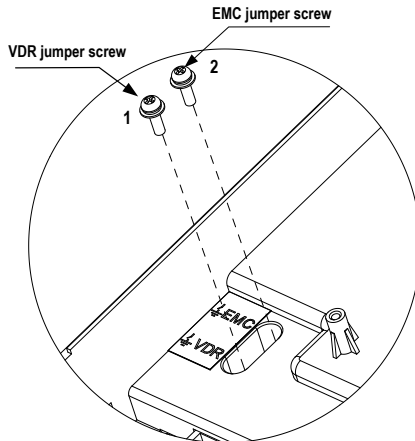
6) Requirements on upstream protection device

- Install a proper protection device on the power input side to provide protections on overcurrent, short-circuit and electrical isolation.
- When selecting the protection device, you should consider the current capacity of the power cable, system overload capacity and short-circuit capacity of the equipment upstream power distribution. Generally, make selection according to the recommended values in section 9.4.

7) Line voltage system

- The MD290 series AC drive is applicable to the line voltage system with neutral point grounded. If it is used in an IT system with no connection to earth at all, it is necessary to remove the VDR jumper screw as shown in the following figure and do not install a filter. Failure to comply may result in personal injury or damage to the drive.
- In the scenarios for use with a residual-current circuit breaker (RCCB), if the MCCB opens at startup, remove the EMC jumper screw as shown in the following figure.

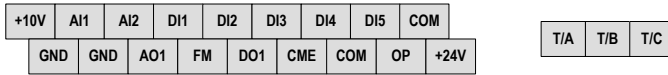
Figure 4-4 EMC jumper screw and VDR jumper screw





## 4.2 Control Circuit Wiring

### 4.2.1 Terminal Arrangement of Control Circuit



■ Terminal Function

Table 4-2 Description of the use of control circuit terminals

Type	Terminal		Name	Description
Power supply	+10V	GND	External +10 V power supply	Provides a +10 V power supply to an external unit. Generally used to supply an external potentiometer of 1 to 5 kΩ Max. output current: 10 mA
	+24V	COM	External +24 V power supply Applies to overvoltage Category II circuit	Provides a +24 V power supply to an external unit. Generally used to supply the DI/DO terminals and external sensors Max. output current: 200 mA
	OP		Input terminal of external power supply	Connect to +24 V by default. When DI1 to DI5 need to be driven by external signals, OP must be disconnected from + 24 V and connected to an external power supply.
Analog inputs	AI1	GND	Analog input 1	Voltage range for inputs: 0 to 10 VDC Input resistance: 22 kΩ
	AI2	GND	Analog input 2	Either a voltage or a current input, determined by the setting of jumper J9 Input voltage range: 0 to 10 VDC Input current range: 0 to 20 mA Input resistance: 22 kΩ (voltage input), 500 Ω or 250 Ω (current input) decided by J10
Digital inputs	DI1	OP	Digital input 1	Optically-coupled isolation compatible with dual-polarity inputs Input resistance: 1.39 kΩ Voltage range for inputs: 9 to 30 V
	DI2	OP	Digital input 2	
	DI3	OP	Digital input 3	
	DI4	OP	Digital input 4	
	DI5	OP	High-speed pulse input	In addition to having the same features as DI1 to DI4, DI5 can also be used for high-speed pulse inputs. Max. input frequency: 100 kHz Input resistance: 1.03 kΩ

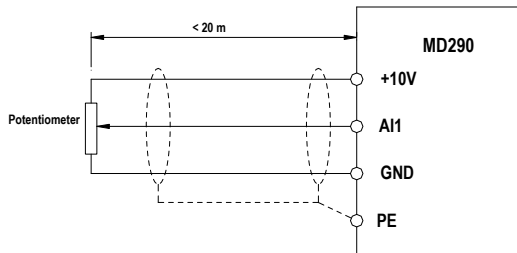
Type	Terminal		Name	Description
Analog output	AO1	GND	Analog output 1	Either a voltage or a current output, determined by the setting of jumper J7. Output voltage range: 0 to 10 V Output current range: 0 to 20 mA.
Digital outputs	DO1	CME	Digital output 1	Optically-coupled isolation, dual-polarity open collector output Output voltage range: 0 to 24 V Output current range: 0 to 50 mA. Note that CME and COM are internally insulated, but are shorted externally by a jumper. In this case, DO1 is driven by +24 V by default. Remove the jumper link if you need to apply external power to DO1.
	FM	COM	High-speed pulse output	Controlled by F5-00 (FM terminal output selection). Max. output frequency: 100 kHz. When used as an open-collector output, the specification is the same as for DO1.
Relay outputs	T/A	T/B	Normally-closed (NC) terminal	Contact driving capacity: 250 VAC, 3 A, Cos f = 0.4 30 VDC, 1 A
	T/A	T/C	Normally-open (NO) terminal	
Auxiliary interfaces	J13		Extension card interface	Interface for the 28-core terminal and optional cards (I/O extension card, PLC card and various bus cards)
	J11		External operating panel interface	Connect to an external operating panel.

### 4.3 Wiring Diagrams of Input/Output Terminals

#### 4.3.1 AI1 Wiring

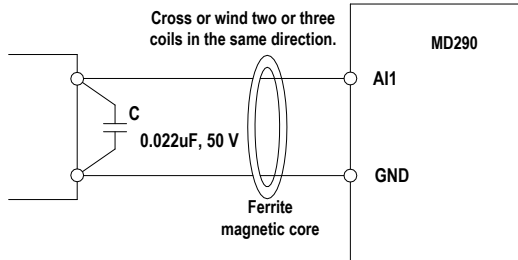
Analog signals at low levels can suffer from the effects of external interference. To reduce this effect, it is important to use shielded cables shorter than 20 m long to carry analog signals.

Figure 4-5 Wiring method for use with analog input 1



In applications where the analog signals suffer from the effects of severe external interference, install a filter capacitor or a ferrite magnetic core at the source of the analog signal.

Figure 4-6 Install filter capacitor or ferrite magnetic core

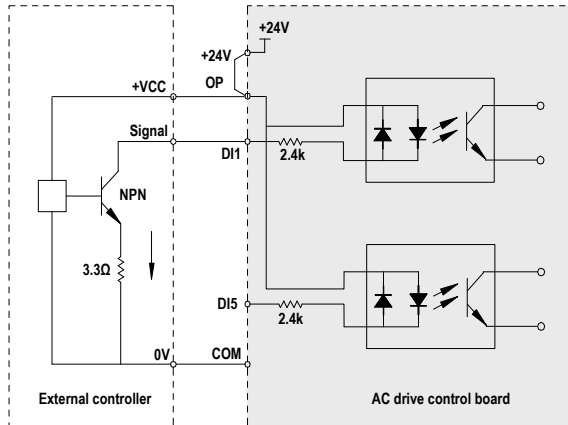


### 4.3.2 DI1-DI5 Wiring (Sink, Source)

Where possible, use shielded cables shorter than 20 m long to carry digital signals. If the installation uses active driving, it is necessary to use filters to prevent the digital signals causing interference on the power supply. In these circumstances, you are recommended to use the contact control mode.

■ SINK wiring

Figure 4-7 Wiring in SINK mode



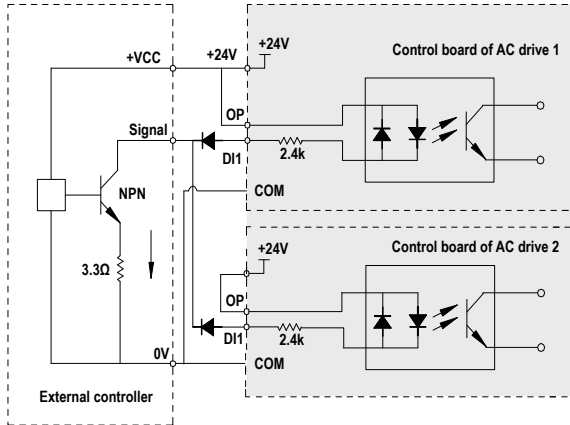
SINK mode is the most commonly used wiring mode.

To apply an external power supply, remove the jumper between the +24V and the OP terminals, and between the COM and the CME terminals. Connect the positive side of the external power 24V to the OP terminal, and the external power 0V to the corresponding DI terminal via the contact on the external controller.

In the SINK wiring mode, do not connect the DI terminals of different AC drives in parallel, otherwise, a digital input fault will occur. If it is necessary to connect different AC drives in parallel, connect a diode in series at the digital input. The diode characteristics must satisfy the following requirements:

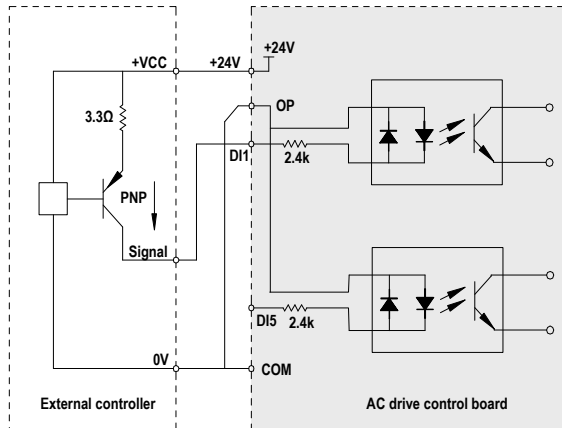
- Forward current rating  $I_F > 10 \text{ mA}$
- Forward voltage drop  $U_F < 1 \text{ V}$

Figure 4-8 Parallel connection of DI terminals in SINK mode



■ SOURCE wiring

Figure 4-9 SOURCE wiring mode



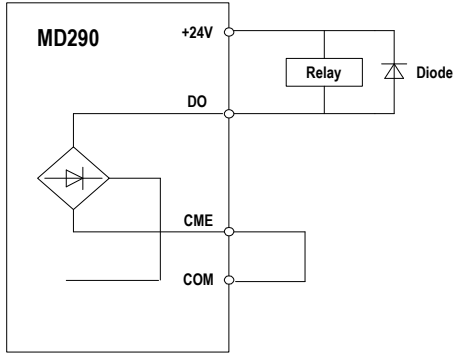
To use the SOURCE wiring mode, remove the jumper between the +24V and the OP terminals. Connect +24V to the common port of the external controller, and connect the OP terminal to the COM terminal.

If you intend to use an external power supply with the SOURCE wiring mode, remove the jumper between the +24V and the OP terminals. Connect the external power 0V to the OP terminal, and the positive side of the external power +24V to the corresponding DI terminal via the contact on the external controller.

### 4.3.3 DO Wiring

When the digital output terminal must drive the relay, it is necessary to install an absorption diode across the relay coil. This diode prevents inductive switching transients causing damage to the DC 24V power supply. The absorption diode must have a forward current rating of 50 mA.

Figure 4-10 DO wiring of the MD290



### 4.4 Electrical Wiring the MD290

Figure 4-11 Wiring of the MD290 of three-phase 380 to 480 V (18.5G/22P to 75G/90P)

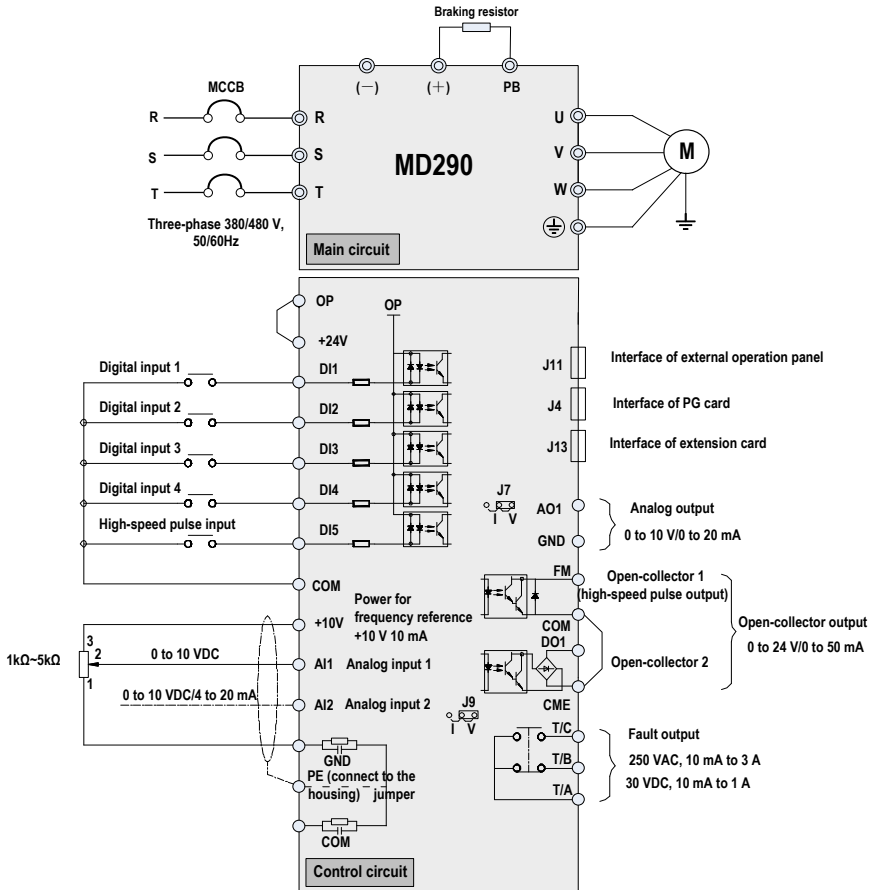


Figure 4-12 Wiring of the MD290 of three-phase 380 to 480 V (90G/110P to 110G/132P)

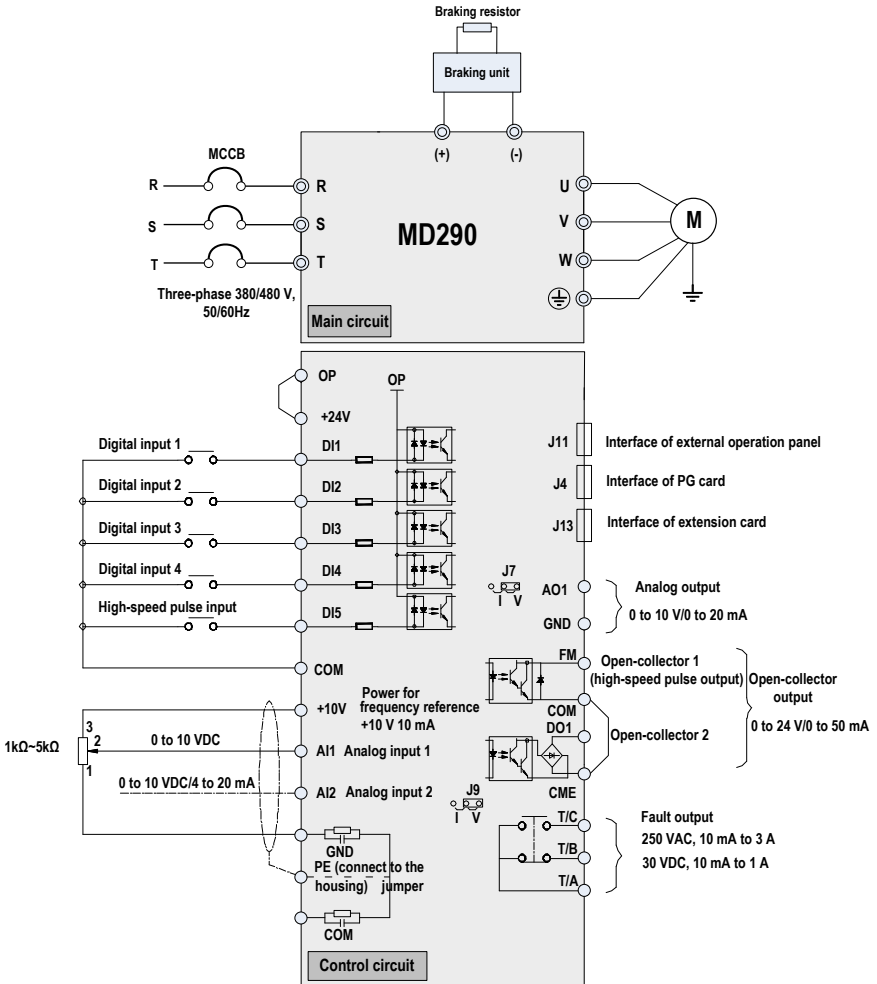
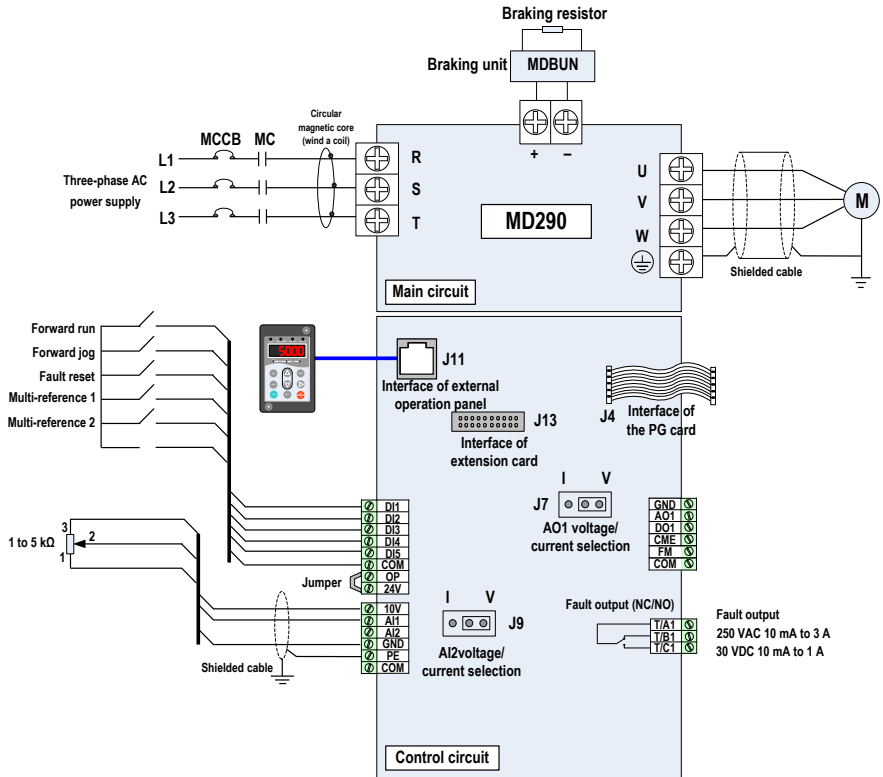


Figure 4-13 Typical wiring of the MD290









Operations

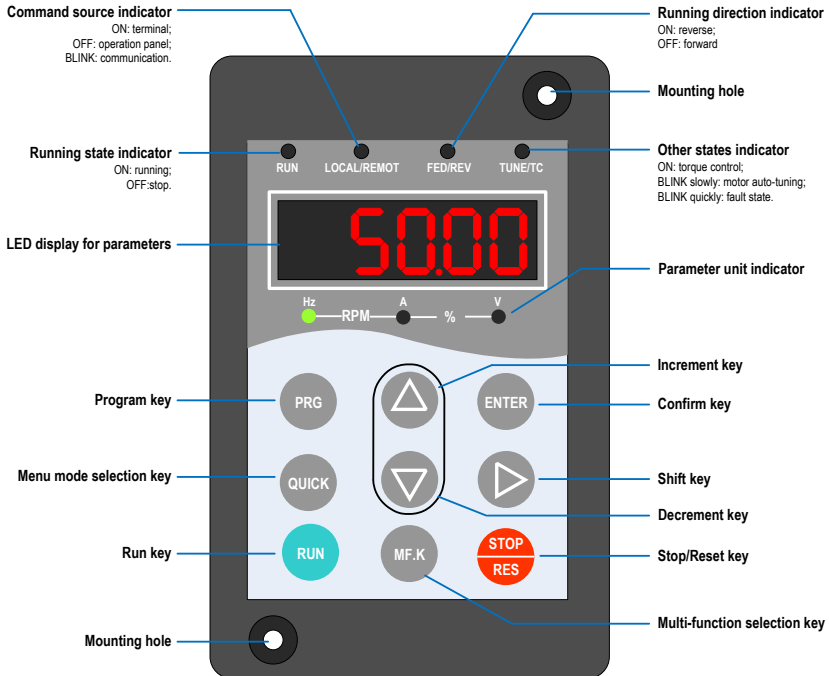
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# Chapter 5 Operations










## 5.1 Introduction to the Operating Panel

The operating panel, shown in Figure 5-1, allows you to monitor system operation, modify parameters and start or stop the MD290.

Figure 5-1 Details of the operating panel







■ Keys on operation panel

Key	Key Name	Function
	Programming	<ul style="list-style-type: none"> <li>Enter or exit the Level I menu.</li> <li>Return to the previous menu.</li> </ul>
	Confirm	<ul style="list-style-type: none"> <li>Enter each level of the menu interface.</li> <li>Confirm the displayed parameter setting.</li> </ul>
	Increment	<ul style="list-style-type: none"> <li>When navigating a menu, it moves the selection up through the screens available.</li> <li>When editing a parameter value, it increases the displayed value.</li> <li>When the AC drive is in RUN mode, it increases the speed.</li> </ul>
	Decrement	<ul style="list-style-type: none"> <li>When navigating a menu, it moves the selection down through the screens available.</li> <li>When editing a parameter value, it decreases the displayed value.</li> <li>When the AC drive is in RUN mode, it decreases the speed.</li> </ul>
	Shift	<ul style="list-style-type: none"> <li>Select the displayed parameter in the stop or running state.</li> <li>Select the digit to be modified when modifying a parameter value</li> </ul>
	RUN	<p>Start the AC drive when using the operating panel control mode.</p> <p>Note: It is inactive when using the terminal or communication control mode.</p>
	Stop/Reset	<ul style="list-style-type: none"> <li>Stop the AC drive when it is in the RUN state.</li> <li>Perform a reset operation when the AC drive is in the FAULT state.</li> </ul> <p>Note: The functions of this key can be restricted by using function F7-02.</p>
	Multifunction	Perform a function switchover as defined by the setting of F7-01, for example to quickly switch command source or direction.
	Menu mode selection	Press it to switch between menu modes as defined by the setting of FP-03.

■ Status Indicators

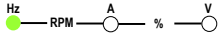

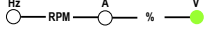
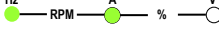
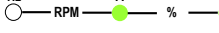
There are four red LED status indicators at the top of the operating panel.

Indicator	Indication
 <b>RUN</b>	OFF indicates the MD290 is in the stop state.
	ON indicates the MD290 is in the running state.
 <b>LOCAL/REMOT</b>	OFF indicates the MD290 is under the operating panel control.
	ON indicates the MD290 is under the terminal control.
	FLASHING indicates the MD290 is under the communication control.
 <b>FWD/REV</b>	OFF indicates reverse motor rotation.
	ON indicates forward motor rotation.
 <b>TUNE/TC</b>	ON indicates torque control mode.
	FLASHING SLOWLY (once a second) indicates auto-tuning state.
	FLASHING QUICKLY (four times a second) indicates a fault condition.

■ Unit Indicators

There are three red unit indicators below the data display. These indicators operate individually or in pairs to show the units used to display data, as shown in Figure 4-2.

Table 5-1 Unit indicator explanation

Indicator appearance	Meaning
	Hz for frequency
	A for current
	V for voltage
	RPM for rotational speed
	% for anything relevant

■ LED Display

The five-digit LED data display can show the following range of information:

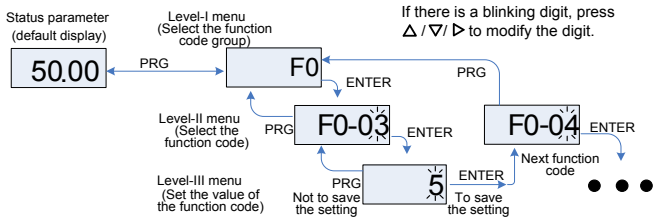
- The frequency reference
- The output frequency
- Monitoring information
- Fault code

## 5.2 Viewing and Modifying Function Codes

The operation panel of the MD290 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.

Figure 5-2 Operation procedure on the operation panel

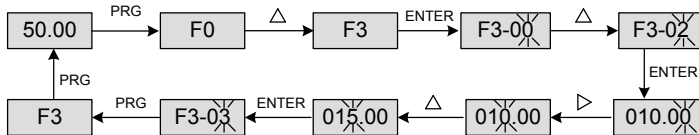


You can return to Level II menu from Level III menu by pressing or . The difference is as follows:

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

Here is an example of changing the value of F3-02 from 10.00 Hz to 15.00 Hz.

Figure 5-3 Example of changing the parameter value



In Level III menu, if the parameter has no blinking digit, it means that the parameter cannot be modified. This may be because:

- Such a function code is only readable, such as, AC drive model, actually detected parameter and running record parameter.
- Such a function code cannot be modified in the running state and can only be changed at stop.

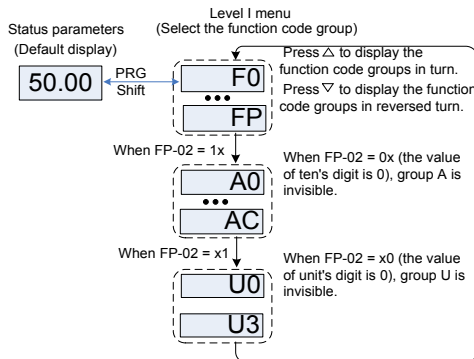
### 5.3 Structure of Function Codes

The MD290 has the function codes in groups A and U, and new function codes to group F.

Function Code Group	Function	Description
F0 to FP	Standard AC drive function code group	Compatible with MD320 series function codes and adding some function codes.
A0 to AC	Advanced function code group	Multi-motor parameters, AI/AO correction, optimization control, PLC card extension function setting.
U0 to U3	Running state function code group	Display of AC drive basic parameters

In the function code display state, select the required function code by pressing the key  $\Delta$  or  $\nabla$ , as shown in the following figure.

Figure 5-4 Selecting the required function code



FP-02 is used to determine whether group A and group U are displayed.

Function Code	Parameter Name	Setting Range	Default
FP-02	AC drive parameter display property	0: Not display	11
		1: Display	
		Unit's digit: group U	
		Ten's digit: group A	

### 5.4 Quick View of Function Codes

The MD290 provides two quick modes of viewing the required function codes.

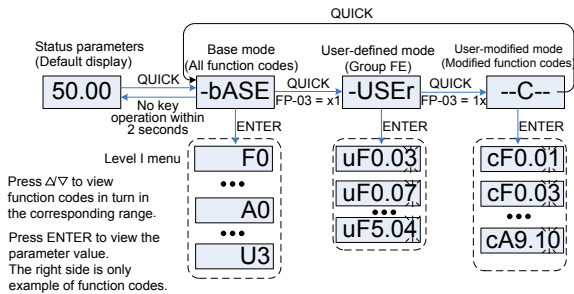
- You can define a maximum of 30 function codes into group FE.
- The MD290 automatically lists the modified function codes.

The operation panel provides three viewing modes: base mode, user-defined mode and user-modified mode, as listed in the following table.

Function Code Display Mode	Display
Base mode	- b A S E
User-defined mode	- U S E r
User-modified mode	-- C --

You can perform switchover amongst the three function code display modes by pressing **QUICK**. The method of viewing and modifying function codes in each mode is the same as the method of operating the operation panel described above.

Figure 5-5 Switchover amongst three function code display modes



FP-03 is used to determine whether the user-defined group and user-modified group are displayed.

Function Code	Parameter Name	Setting Range	Default
FP-03	Individualized parameter display property	0: Not display	11
		1: Display	
		Unit's digit: <b>-USER</b> group display selection	
		Ten's digit: <b>--C--</b> group display selection	



**-bASE**

It indicates all function codes of the MD290. After the mode is switched over to **-bASE**, level I menu is displayed.

**-USEr**

The user-defined menu is set to facilitate viewing and modifying of commonly used function codes. In this mode, the display parameter uF3.02 indicates function code F3-02. You can also modify parameters in this mode as in common editing state. After the mode is switched over to **-USEr**, level II menu is displayed.

The user-defined parameters are included in group FE. If FE is set to F0.00, it indicates that no function codes are available. A maximum of 30 parameters can be included in group FE. If "NULL" is displayed, it indicates that the user-defined menu is null.

A total of 16 parameters are pre-stored in the user-defined menu, as listed in the following table.

Function Code	Parameter Name	Function Code	Parameter Name
F0-01	Motor 1 control mode	F0-02	Command source selection
F0-03	Main frequency source X selection	F0-07	Frequency source superposition selection
F0-08	Preset frequency	F0-17	Acceleration time 1
F0-18	Deceleration time 1	F3-00	V/F curve setting
F3-01	Torque boost	F4-00	DI1 function selection
F4-01	DI2 function selection	F4-02	DI3 function selection
F5-04	DO1 function selection	F5-07	AO1 function selection
F6-00	Startup mode	F6-10	Stop mode

You can edit the user-defined menu based on actual requirements.


**--C--**

In you modified menu, only the parameters that are modified to a non-default value are displayed. The menu is generated by the AC drive automatically. After the mode is switched over to **--C--**, level II menu is displayed.

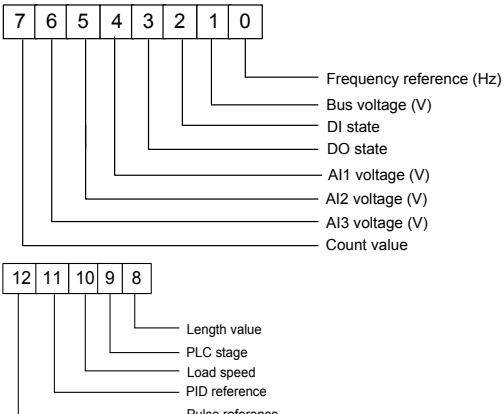
## 5.5 Definition and Operation of the Multifunction Key (MF.K)

You can define the function (command source switchover or rotation direction switchover) of the multifunction key in F7-01. For details, see the description of F7-01.

### 5.6 Viewing 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 F7-03, F7-04, and F7-05 in the hexadecimal format.


In stop state, a total of 13 status parameters can be displayed, as listed in the following table.

Function Code	Parameter Name	Setting Range	Default
F7-05	LED display stop parameters	0000–FFFF 	33

In running state, five running status parameters are displayed by default: running frequency, frequency reference, bus voltage, output voltage and output current. You can set whether other parameters are displayed by setting F7-03 and F7-04, as listed in the following table.

Function Code	Parameter Name	Setting Range	Default
F7-03	LED display running parameters 1		1F
F7-04	LED display running parameters 2		0

When the AC drive is powered on again after power failure, the parameters that are selected before power failure are displayed.

Select the required parameters by pressing . Set the values of the parameters by referring to the following example.

1. Determine the parameters to be displayed.

Running frequency, bus voltage, output voltage, output current, output power, output torque, PID feedback, encoder feedback speed

2. Set the binary data.

F7-03: 0000 0000 0111 1101B, F7-04: 0010 0000 0000 0001B

3. Convert the binary data to hexadecimal data:



F7-03: 007DH, F7-04: 2001H

Set the value on the operation panel: F7-03: H.1043 and F7-04: H.2001.


## 5.7 Starting or Stopping the AC Drive

### 5.7.1 Selecting the Start/Stop Command Source

There are three start/stop command sources, namely, operation panel control, terminal control, and communication control. You can select the command source in F0-02.

Function Code	Parameter Name	Setting Range	Description	Default
F0-02	Command source selection	0: Operation panel control (indicator OFF) 1: Terminal control (indicator ON) 2: Communication control (indicator blinking)	Press  or  to start or stop the AC drive. A DI terminal needs to be defined as the run/stop terminal. The Modbus-RTU communication protocol is used.	0

- 0: Operation panel control

Set F0-02 to 0. After you press , the AC drive starts running (the RUN indicator is ON). After you press

 when the AC drive is in running state, the AC drive stops running (the RUN indicator is OFF).

- 1: Terminal control

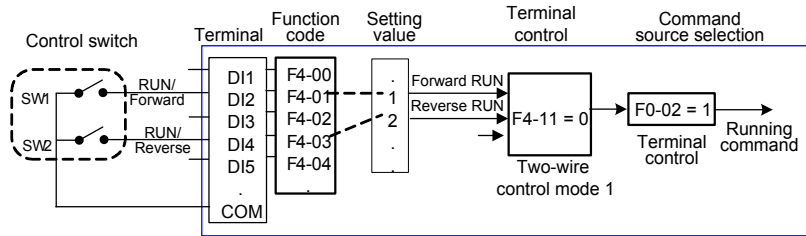
This control mode is applicable to scenarios where the DIP switch or electromagnetic button is used to start or stop the application system or scenarios where the dry contact signal is used to start or stop the AC drive.

The switch signal mode is set in F4-11. The input terminal of the start/stop signal is set in F4-00 to F4-09. For details, see the description of F4-11 and F4-00 to F4-09.

Example 1:

To use the DIP switch as the start/stop source, and allocate the forward rotation switch signal to DI2 and the reverse rotation switch signal to DI4, perform the setting as shown in the following figure.

Figure 5-6 Setting of using the DIP switch for start/stop

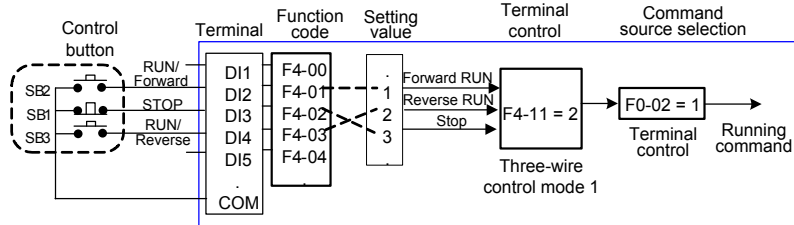


In the preceding figure, when SW1 is ON, the AC drive instructs forward rotation; when SW1 is OFF, the AC drive stops. When SW2 is ON, the AC drive instructs reverse running; when SW2 is OFF, the AC drive stops. If SW1 and SW2 are ON or OFF simultaneously, the AC drive stops.

Example 2:

To use the electromagnetic button as the start/stop source, and allocate the startup signal to DI2, stop signal to DI3 and reverse rotation signal to DI4, perform the setting as shown in the following figure.

Figure 5-7 Setting of using the electromagnetic button for start/stop



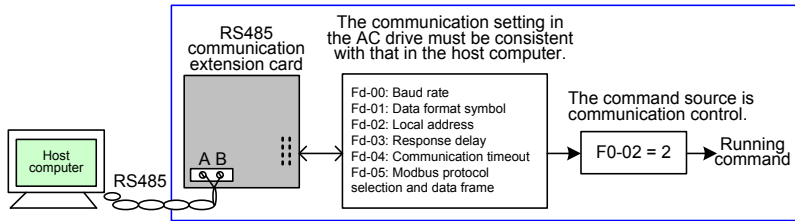
In the preceding figure, SB1 must stay ON during normal start and running. The AC drive stops immediately after SB1 becomes OFF. The signals from SB2 and SB3 become valid once they become ON. The running state of the AC drive is determined by the final actions on the three buttons.

- 2: Communication control

The host computer is used to control running of the AC drive by means of communication, such as the RS485, PROFIBUS-DP, CANlink, and CANopen. The MD290 interacts with the user programmable card also by means of communication.

Insert a proper communication card into the extension card interface of the AC drive, and set F0-02 to 2. Then, you can start or stop the AC drive in communication mode. The following figure shows the setting method.

Figure 5-8 Setting for start/stop using the communication control mode



When Fd-04 is set to a non-zero number, the function of automatic AC drive stop upon communication timeout is enabled. This prevents uncontrollable AC drive running due to faults of the communication cable or the host computer.

The communication port of the AC drive supports the Modbus-RTU protocol, and the communication is implemented only when the host computer supports the Modbus-RTU master station protocol.

### 5.7.2 Startup Mode

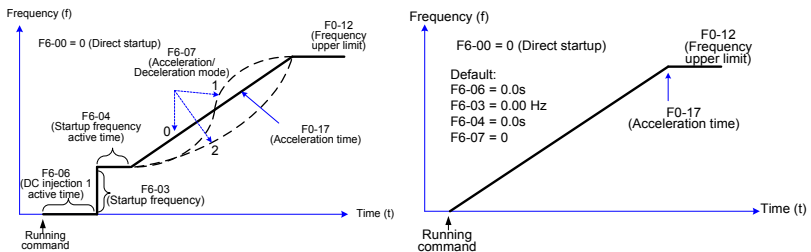
The MD290 supports the startup modes, namely, direct startup and catching a spinning motor, set in F6-00.

- F6-00 = 0 (direct startup)

It is applicable to small-inertia load. The frequency curve in this mode is shown in the following figure.

DC injection braking before startup is applicable to drive of load such as elevator and crane. Startup frequency is applicable to drive with burst start under start torque, such as cement mixer.

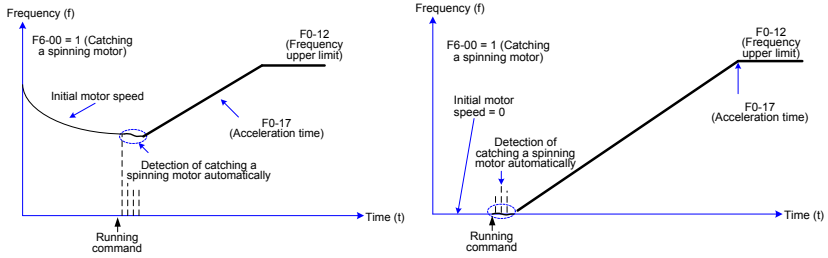
Figure 5-9 Frequency curve of direct startup



- F6-00 = 1 (Catching a spinning motor)

It is applicable to large-inertia mechanical load. The frequency curve in this mode is shown in the following figure. If the motor is still rotating due to the inertia when the AC drive starts up, this mode is used to prevent overcurrent at startup.

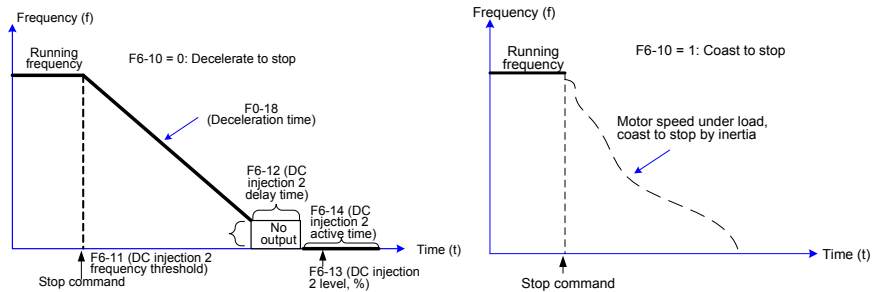
Figure 5-10 Frequency curve of catching a spinning motor



### 5.7.3 Stop Mode

The AC drive supports two stop modes, decelerate to stop and coast to stop, set in F6-10.

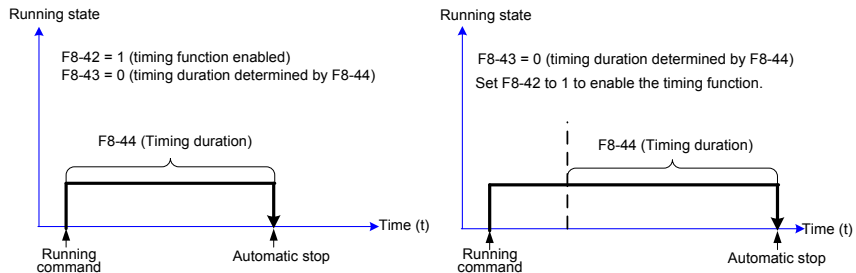
Figure 5-11 Diagram of two stop modes (decelerate to stop and coast to stop)



### 5.7.4 Timing Stop

The MD290 supports timing stop. This function is enabled by F8-42 and the timing duration is determined by F8-43 and F8-44.

Figure 5-12 Setting of the timing stop function

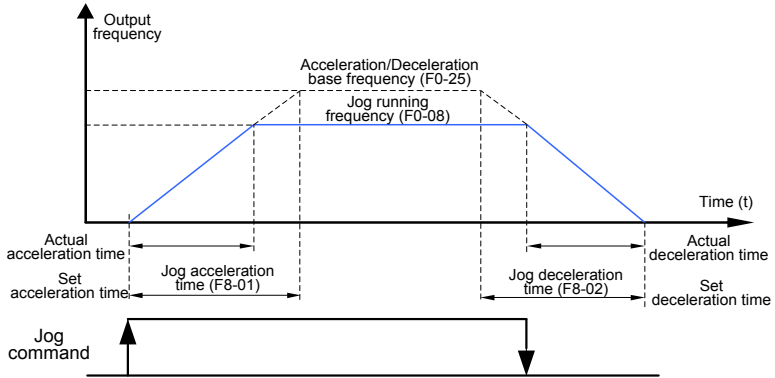


You can also set the timing duration by means of analog input (such as potentiometer signal). For details, see the description of F8-43.

### 5.7.5 Jog Running

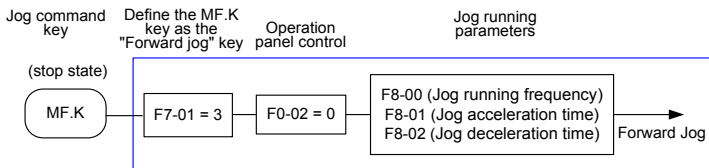
In certain applications, the AC drive needs to run in low speed temporarily to facilitate equipment test or other commissioning operations. In this case, you can enable the AC drive to perform jog running.

Figure 5-13 Jog running



■ Parameter Setting and Operation of Jog Running in Operation Panel Control

Figure 5-14 Jog running in operation panel control



Set the parameters according to the preceding figure. In stop state of the AC drive, hold down **MF.K**, and the AC drive starts jog running. After you release **MF.K**, the AC drive decelerates to stop.

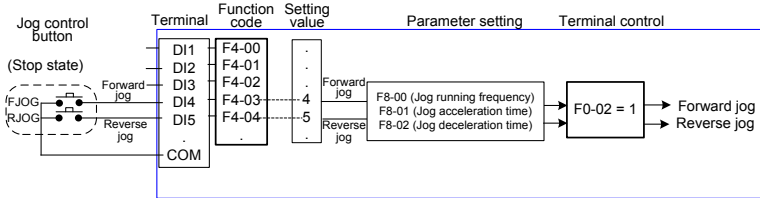
To perform reverse jog running, set F7-01 to 4 and F8-13 to 1. Hold down **MF.K** and the AC drive starts reverse jog running.



■ Parameter Setting and Operation of Jog Running in DI Terminal Control

For equipment that requires frequent jog running, such as textile machine, it is more convenient to control jog running by using keys or buttons. The setting is shown in the following figure.

Figure 5-15 Jog running in DI terminal control



Set the parameters according to the preceding figure. In stop state of the AC drive, hold down the FJOG button, and the AC drive starts forward jog running. After you release the FJOG button again, the AC drive decelerates to stop. The RJOG button is used for control of reverse jog running.

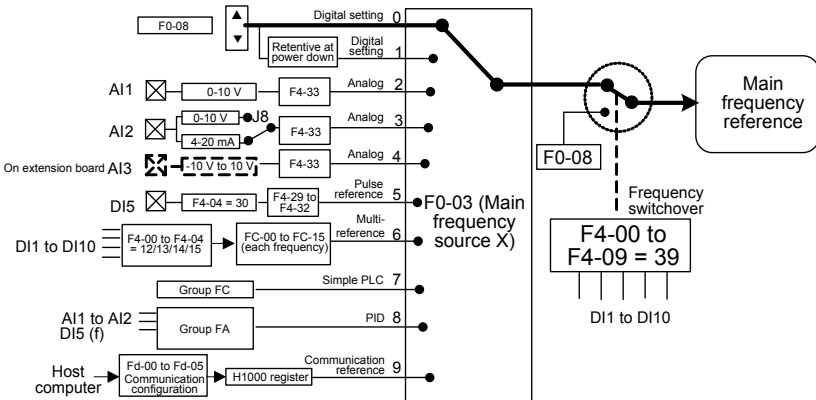
### 5.8 Setting the Frequency Reference

The AC drive provides two frequency sources, namely, main frequency source X and auxiliary frequency source Y. You can select one frequency source, switch over between the two sources, or even perform superposition on the two sources by setting the calculation formula to meet different control requirements of different scenarios.

#### 5.8.1 Setting the Main Frequency Reference

There are nine main frequency sources, digital setting (UP/DOWN modification, non-retentive at power down), digital setting (UP/DOWN modification, retentive at power down), AI1, AI2, AI3, pulse reference, multi-reference, simple PLC, and communication reference. You can select one in F0-03.

Figure 5-16 Setting the main frequency reference



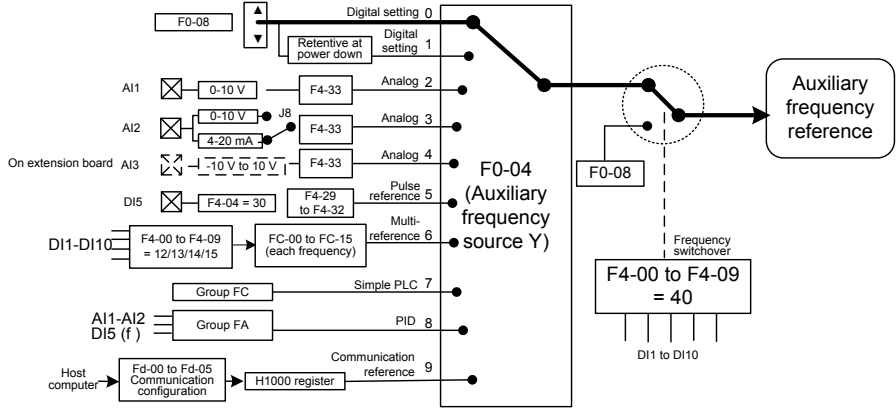
According to the preceding figure, the frequency reference of the AC drive can be set by means of function codes, manual adjustment, analog input, multi-speed terminal, external feedback signal, internal PID regulator, or the host computer.

Set the related function codes of each frequency setting mode, as shown in the preceding figure.

### 5.8.2 Setting the Auxiliary Frequency Reference

The auxiliary frequency sources are the same as the main frequency sources. You can set the auxiliary frequency source in F0-04.

Figure 5-17 Setting the auxiliary frequency reference

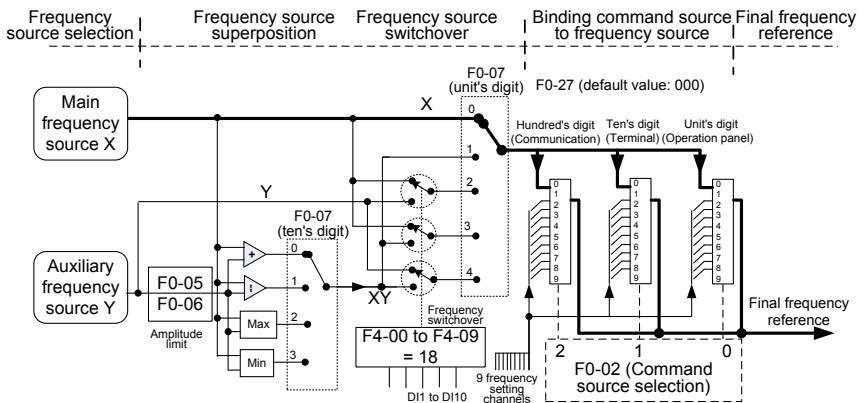


The relationship between the frequency reference and the main frequency source and auxiliary frequency source is set in F0-07, as follows:

1. Main frequency source X: The main frequency source is directly used to set the frequency reference.
2. Auxiliary frequency source Y: The auxiliary frequency source is directly used to set the frequency reference.
3. X and Y superposition:  $X+Y$ ,  $X-Y$ , maximum of X and Y, and minimum of X and Y.
4. Frequency switchover: A DI terminal is used to switch over amongst the preceding three frequency reference setting modes.

The following figure shows how to set the relationship in F0-07, in which the bold line indicates the default setting.

Figure 5-18 Relationship between the frequency reference and main and auxiliary frequency sources



Superposition between the main frequency source and the auxiliary frequency source can be used for closed-loop speed control. For example, using the main frequency source for setting the main frequency reference and the auxiliary frequency source for automatic adjustment, in conjunction with switchover performed by the external DI terminal signal, the required closed-loop control can be implemented.

### 5.8.3 Binding Command Source to Frequency Source

The three command sources can be separately bound to frequency sources in F0-27, as shown in Figure 4-19. When the specified command source (F0-02) is bound to a frequency source (corresponding digit in the value of F0-27), the frequency reference is determined by the frequency setting channel set in F0-27. In this case, both main and auxiliary frequency sources are ineffective.

### 5.8.4 AI Used as the Frequency Source

The AI terminal can be used as the frequency source. The MD290 provides two AI terminals (AI1 and AI2) on the control board, and the optional I/Oextension card provides another AI terminal (AI3).

The following figures show how to use the AI as the frequency source.

Figure 5-19 Voltage input of AI1 connected to the potentiometer as the frequency source (2–10 V corresponding to 10–40 Hz)

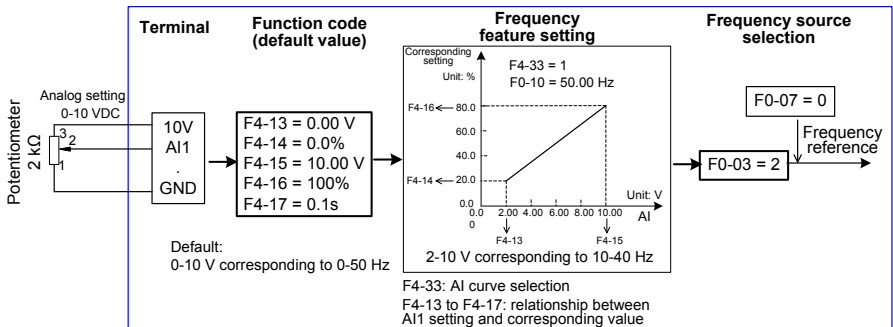
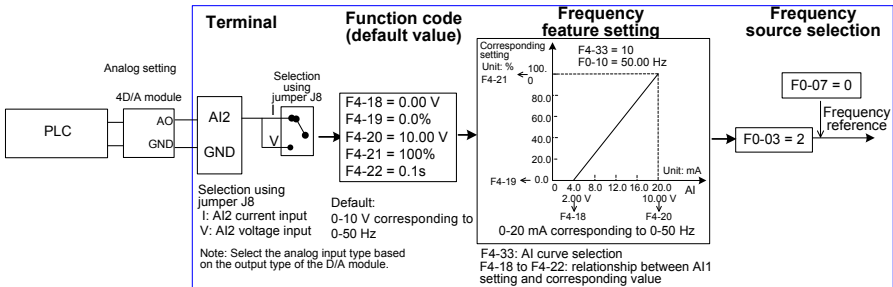


Figure 5-20 Current input of AI2 connected to 4DA module of the PLC as the frequency source (4–20 mA corresponding to 0–50 Hz)



Note

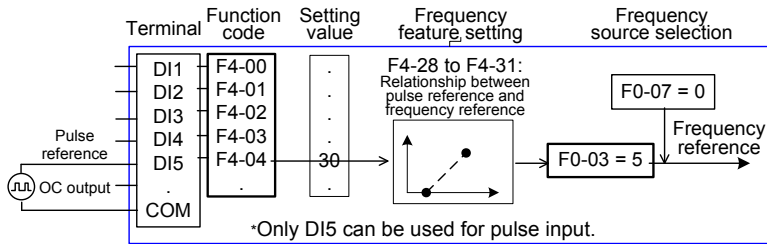
- MD290 provides two AI terminals (AI1 and AI2) on the control board, and the optional I/O extension card provides another AI terminal (AI3).
- AI1 provides 0–10 V voltage input. AI2 provides 0–10 V voltage input or 0–20 mA current input, determined by jumper J9 on the control board. AI3 provides -10 V to +10 V bipolar voltage input.
- When AI is used as the frequency source, 100% of the voltage or current input corresponding setting corresponds to the maximum frequency in F0-10.
- When the temperature transmitter is used for analog setting, it must be connected to AI3 on the I/O extension card.
- MD290 provides five corresponding relationship curves, which can be selected in F4-33. The input values and corresponding settings of each curve are set in F4-13 to F4-27 and group A6.

5.8.5 Pulse Reference Used as the Frequency Source

In many scenarios, pulse reference is used as the frequency source. The specifications of pulse signals are: voltage 9–30 V, frequency 0–100 kHz.

Only DI5 can be used for pulse input. The relationship between pulse input from DI5 and the corresponding setting is set in F4-28 to F4-31. The relationship is a two-point line, and 100% of pulse input corresponding setting corresponds to the maximum frequency of F0-10, as shown in Figure 4-22.

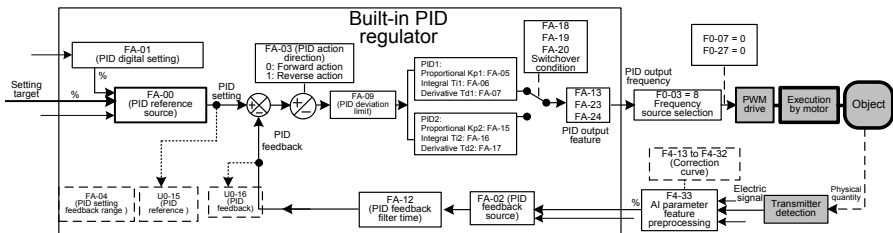
Figure 5-21 Pulse reference used as the frequency source



5.8.6 Frequency Closed-Loop Control

The MD290 has a built-in PID regulator. Together with the frequency sources, the PID regulator can implement automatic adjustment of progress control, such as constant temperature, constant pressure, and tension control.

Figure 5-22 Automatic adjustment by PID regulator



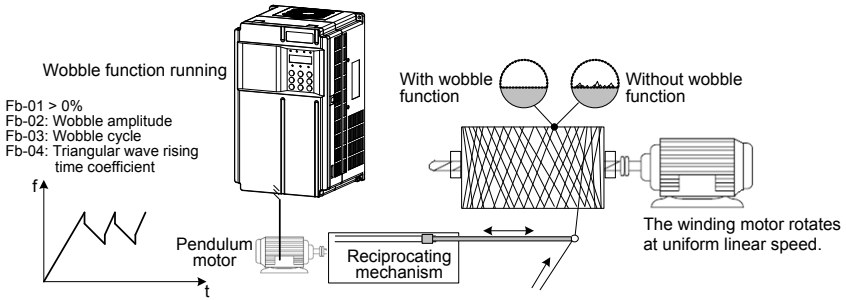
When PID frequency closed-loop control is implemented, F0-03 (Main frequency source X selection) must be set to 8 (PID). The PID-related parameters are set in group FA, as shown in Figure 4-23.

The MD290 has two built-in equivalent PID calculating units. You can set the features, such as adjustment speed and accuracy, for the two units separately based on the actual conditions. Switchover between the two units can be implemented automatically or by means of an external DI terminal.

### 5.8.7 Wobble Function Mode

For the textile and chemical fiber processing equipment, the wobble function improves the uniform density of traversing and winding, as shown in the following figure. The function is set in Fb-00 to Fb-04. For details, see the description of these function codes.

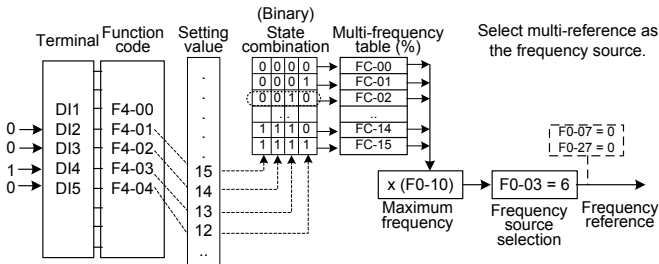
Figure 5-23 Wobble function



### 5.8.8 Multi-Speed Mode

In scenarios where the running frequency of the AC drive need not be adjusted continuously and only several frequencies are required, the multi-speed control can be used. The MD290 supports a maximum of 16 running frequencies, which are implemented by state combinations of four DI terminals. Set the function codes corresponding to DI terminals to a value among 12 to 15, and then the DI terminals are specified as the multi-frequency input terminals. The multiple frequencies are set based on the multi-frequency table in group FC. In addition, you need to set F0-03 (Main frequency source X selection) to 6 (Multi-reference). The following figure shows how to set the multi-speed function.

Figure 5-24 Setting the multi-speed function



In the preceding figure, DI7, DI4, DI8, and DI2 are used as the multi-frequency input terminals, each of which has a bit value. The state combinations of these terminals correspond to multiple frequencies. When (DI7, DI4, DI8, DI2) = (0, 0, 1, 0), the state combination value is 2, corresponding to the value set in FC-02. The frequency reference is automatically calculated by FC-02 x F0-10.

The MD290 supports a maximum of four DI terminals to be used as the multi-frequency input terminals. You can also use less than four DI terminals, and the empty bit is considered to be 0.

### 5.8.9 Setting the Motor Rotating Direction

After you restore the default setting of the AC drive and press **RUN**, the direction in which the AC drive drives the motor to run is regarded as the forward direction. If the rotating direction is reverse to the direction required by the equipment, power off the AC drive and exchange any two of the output UVW cables (wait until the main capacitor of the AC drive is completely discharged).

In applications where both forward rotation and reverse rotation are required, set F0-09 to 1. Then press **RUN** to make the motor rotate in the reverse direction, as shown in the following figure.

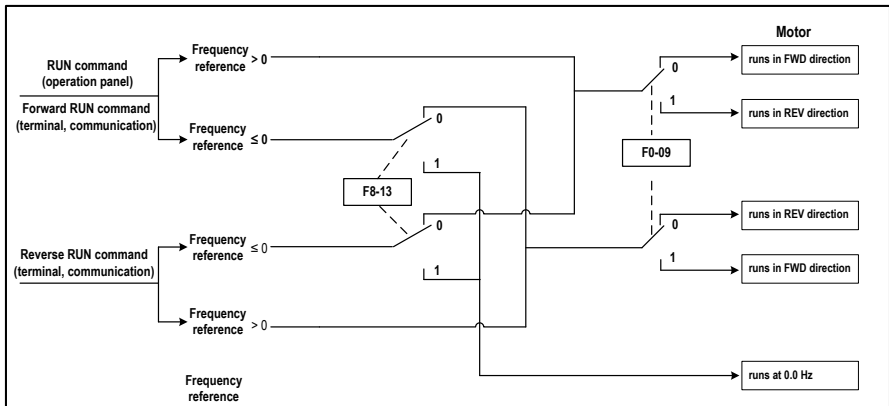
If the command source is terminal control and reverse rotation is required, use the default value 0 of F8-13 to enable reverse control.

According to the preceding figure, when the frequency reference of the AC drive is set by means of communication (F0-03 = 9) and reverse control is enabled (F8-13 = 0), the AC drive instructs the reverse direction if the frequency reference  $F_s$  is a negative value.

If the external command is reverse rotation or the frequency reference is a negative value, but reverse control is disabled (F8-13 = 1), the AC drive will run at 0 Hz and has no output.

In applications where reverse rotation is prohibited, do not change the rotating direction by modifying the function codes because the function codes will be restored once the AC drive restores the default settings.

Figure 5-25 Reverse the motor rotating direction

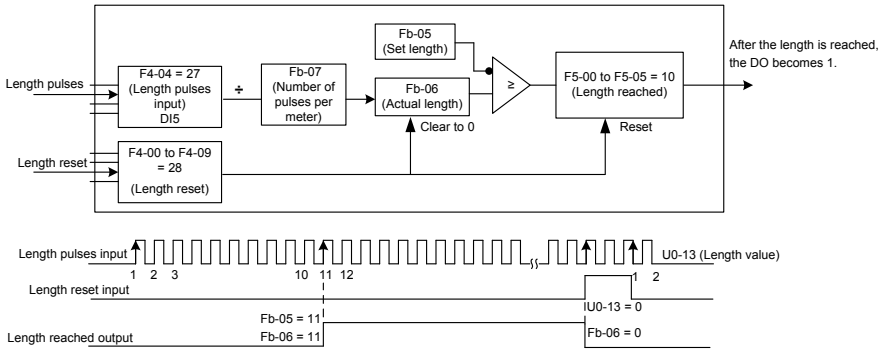


### 5.8.10 Setting the Fixed Length Control Mode

The MD290 has the fixed length control function. The length pulses are sampled by the DI allocated with function 27 (Length count input). The "Actual length" (Fb-06) is obtained by dividing the number of pulses sampled by the value of Fb-07 (Number of pulses per meter). When the actual length in Fb-06 exceeds the set length in Fb-05, the DO terminal allocated with function 10 (Length reached) becomes ON.

During the fixed length control, the length reset operation can be performed via the DI terminal allocated with function 28 (Length reset), as shown in the following figure.

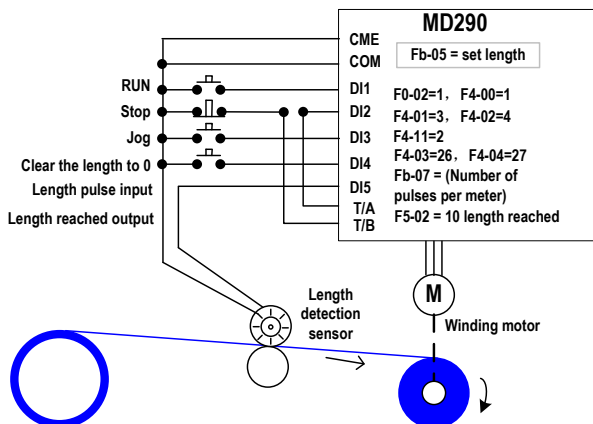
Figure 5-26 Function code setting for fixed length control



**Note**

- In the fixed length control mode, the direction cannot be identified and only the length shall be calculated based on the number of pulses.
- Only DI5 can be allocated with function "Length count input".
- An automatic stop system can be implemented if signal output by the DO terminal with function 10 (Length reached) is fed back to the AC drive input terminal with the stop function.

Figure 5-27 Common application example of the fixed length control function

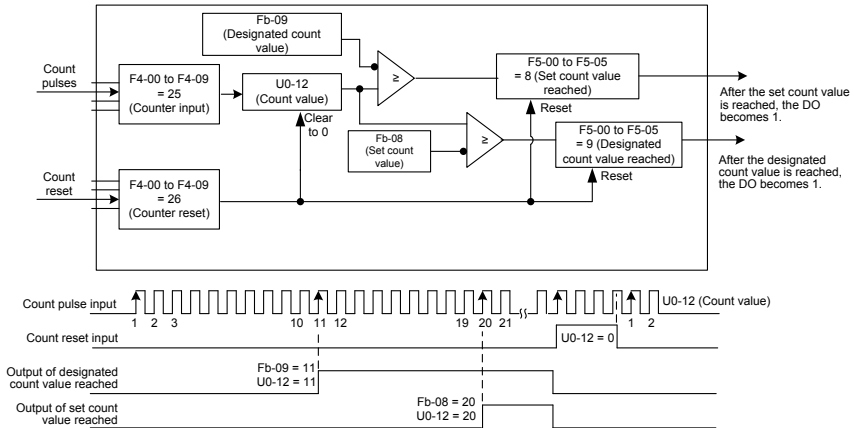


### 5.8.11 Use of the Counting Function

The count value needs to be collected by the DI terminal that is allocated with function 25 (Counter input). When the count value reaches Fb-08 (Set count value), the DO terminal allocated with function 8 (Set count value reached) becomes ON. Then the counter stops counting.

When the count value reaches Fb-09 (Designated count value), the DO terminal allocated with function 9 (Designated count value reached) becomes ON. The counter continues to count until the value of Fb-08 (Set count value) is reached.

Figure 5-28 Parameter setting in the counting mode



#### Note

- Fb-09 must not be greater than Fb-08.
- DI5 must be used when the pulse frequency is high.
- The DO terminal that is allocated with function 9 (Designated count value reached) and the DO terminal that is allocated with function 8 (Set count value reached) must not be the same.
- No matter whether the AC drive is in running or stop state, the counter will not stop until the set count value in Fb-08 is reached.
- The count value is retentive at power down.
- An automatic stop system can be implemented if the signal output by the DO terminal with function 8 or 9 (Set/Designated count value reached) is fed back to the AC drive input DI terminal with stop function.



## 5.9 Setting and Auto-tuning of Motor Parameters

### 5.9.1 Motor Parameter Setting

When the AC drive runs in the vector control mode (F0-01 = 0 or 1), accurate motor parameters are required to ensure satisfactory drive performance and running efficiency. This is extremely different from the V/F control (F0-01 = 2).

Motor parameters (motor 1 by default) that need to be set are listed in the following table.

Table 5-2 Motor parameters to be set

Parameter	Description	Remark
F1-00	Motor type	Asynchronous motor, variable-frequency asynchronous motor
F1-01 to F1-05	Rated motor power Rated motor voltage Rated motor current Rated motor frequency Rated motor speed	Model parameters, manual input
F1-06 to F1-20	Motor internal equivalent stator resistance, inductive reactance and rotor inductance	Auto-tuning parameters
F1-27/28/34	Encoder parameters They must be set in the vector control mode with sensor.	Encoder parameters

For complicated application system with multiple motors, the parameters of motor 2 are listed in the following table.

Table 5-3 Motors 2 parameter setting

Motor 2 Parameters	Description
A2-00	Asynchronous motor Variable-frequency asynchronous motor
A2-01 to A2-05	Model parameters, manual input
A2-06 to A2-20	Auto-tuning parameters
A2-27 to A2-34	Encoder parameters

### 5.9.2 Motor Auto-tuning

The methods for the AC drive to obtain the internal electrical parameters of the controlled motor are: dynamic auto-tuning, static auto-tuning 1, static auto-tuning 2 and manual input. All auto-tuning methods are applied to asynchronous motor only.


Auto-tuning	Application	Result
No-load dynamic auto-tuning	It is applied to applications where the motor can be disconnected from the load.	Best
With-load dynamic auto-tuning	It is applied to applications where the motor cannot be disconnected from the load.	OK
Static auto-tuning 1	It is applied to applications where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed. Auto-tuning of F1-09 and F1-10 is not required and use their default value.	Poor
Static auto-tuning 2	It is applied to applications where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed. All motor parameters require auto-tuning.	Better
Manual input	It is applied to applications where the motor cannot be disconnected from the load. Input the motor parameters of the same model with successful auto-tuning into function codes F1-00 to F1-10.	OK

The following part takes motor 1 as an example to describe motor auto-tuning. The auto-tuning of motor 2 is the same and only the function codes are changed correspondingly.

The motor auto-tuning procedure is as follows:

1. If the motor can be disconnected from the load, disconnect the motor from the load mechanically after power-off so that the motor can run without load.
2. After power-on, set F0-02 (Command source selection) to 0 (Operation panel control).
3. Input the motor nameplate parameters (such as F1-00 to F1-05) correctly and input the following parameters based on the actually selected motor.

Motor	Parameter
Motor 1	F1-00: Motor type selection
	F1-01: Rated motor power
	F1-02: Rated motor voltage
	F1-03: Rated motor current
	F1-04: Rated motor frequency
	F1-05: Rated motor speed
Motor 2	A2-00 to A2-05, defined the same as F1-00 to F1-05

4. Set F1-37 (Auto-tuning selection) to 2 (Dynamic auto-tuning). For motor 2, the corresponding function code is A2-37. Press  on the operation panel. The operation panel displays:



Then press **RUN** on the operation panel. The AC drive will drive the motor to accelerate/decelerate and run in the forward/reverse direction, and the RUN indicator is ON. The auto-tuning lasts approximately 2 minutes. When the preceding display disappears and the operation panel returns to the normal parameter display state, it indicates that the auto-tuning is completed.

The AC drive will automatically calculate the motor parameters listed in the following table.

Motor	Parameter
Motor 1	F1-06: Stator resistance
	F1-07: Rotor resistance
	F1-08: Leakage inductive reactance
	F1-09: Mutual inductive reactance
	F1-10: No-load current
Motor 2	A2-06 to A2-10, defined the same as F1-06 to F1-10

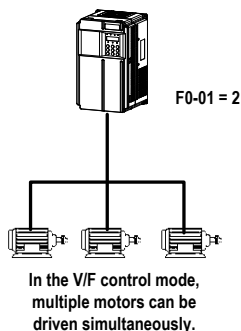
If the motor cannot be disconnected from the load, set F1-37 (Auto-tuning selection) to 3 (Static tuning 2) and then press **RUN** on the operation panel. The motor auto-tuning starts.

### 5.9.3 Setting and Switchover of Multiple Motor Parameter Groups

The AC drive supports switchover between two groups of motor parameters, namely, group F1 (motor 1 parameters), F2 (encoder parameters) and group A2 (motor 2 parameters).

You can select the current effective motor parameter group by means of function code F0-24 or DI terminals with functions 41 and 42. When the DI terminals with functions 41 and 42 become ON, they are privileged and the setting of F0-24 becomes invalid.

Figure 5-29 Driving multiple motors



## 5.10 Use of DI Terminals

The control board provides five DI terminals DI1 to DI5. You can obtain another five DI terminals DI6 to DI10 by installing an I/O extension card.

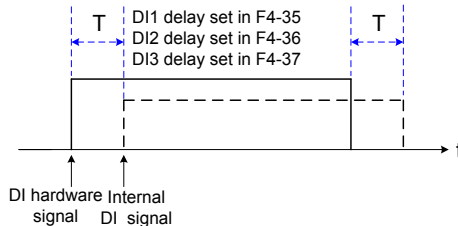
The internal hardware of DI terminals is configured with 24 VDC power supply for detection. You can input a signal to a DI terminal of the AC drive only by shorting the DI terminal and COM.

By default, F4-38 = 0000 and F4-39 = 0000. A DI terminal is active (logic 1) when being shorted to COM, and inactive (logic 0) when being shorted to COM.

You can change the DI terminal active mode. That is, a DI terminal is inactive (logic 0) when being shorted with COM, and active (logic 1) when being not shorted to COM. In this case, it is necessary to change the corresponding bit in F4-38 and F4-39 (these two parameters respectively specifying the active mode setting of DI1 to DI5 and DI16 to DI10) to 1.

The AC drive also provides F4-10 (DI filter time) for the DI signal to improve the anti-interference level. For DI1 to DI3, the AC drive provides the DI signal delay function, convenient for some applications requiring delay.

Figure 5-30 DI delay setting



The preceding 10 DI terminals can be defined in function codes F4-00 to F4-09. Each DI can be allocated with a function among the 50 functions. For details, see descriptions of F4-00 to F4-09.

The hardware design allows only DI5 to receive high-speed pulse signal. If high-speed pulse count is required, use DI5.

## 5.11 Use of DO Terminals

The control board provides three DO terminals, namely FM, DO1 and TA/TB/TC. FM and DO1 are transistor outputs and can drive 24 VDC low-voltage circuit; TA/TB/TC is relay output, and can drive 250 VAC control circuit.

You can obtain another two terminals DO2 and PA/PB/PC by installing an I/O extension card. DO2 is transistor output and PA/PB/PC is relay output.

You can define the function of the DO terminals by setting F5-01 and F5-05 to indicate the running state and alarm information of the AC drive. There are a total of 40 functions. For details, see the descriptions of group F5.

Terminal	Corresponding Function Code	Output Feature Description
FM-CME	F5-06 when F5-00 = 0	Transistor, able to output high-speed pulses 10 Hz to 100 KHz; drive capacity: 24 VDC, 50 mA
	F5-01 when F5-00 = 1	Transistor; drive capacity: 24 VDC, 50 mA
TA-TB-TC	F5-02	Relay; drive capacity: 250 VAC, 3 A
PA-PB-PC	F5-03	Extension card, relay; drive capacity: 250 VAC, 3 A
DO1-CME	F5-04	Transistor; drive capacity: 24 VDC, 50 mA
DO2-CME	F5-05	Extension card, transistor; drive capacity: 24 VDC, 50 mA

When F5-00 = 0, the FM terminal is high-speed pulse output. The frequency of output pulses indicates the value of the internal running parameter. The greater the value is, the higher the output pulse frequency is. 100% of the value corresponds to 100 kHz. The indicated internal parameter is defined by F5-06.

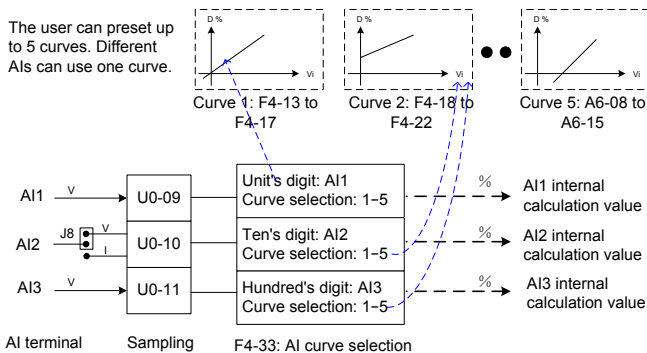
### 5.12 Use of AI Terminals

The AC drive supports a total of three AI terminals, among which AI1 and AI2 are provided on the control board and AI3 is provided on the extension card.

Terminal	Input Signal Characteristic
AI1-GND	It receives the signal of 0–10 VDC.
AI2-GND	If J9 is shorted with the pin marked with "V", the AI receives the voltage signal of 0–10 VDC. If J9 is shorted with the pin marked with "I", the AI receives the current signal of 0–20 mA.
AI3-GND	It is provided on the extension card and receives the signal of -10 to10 VDC.

As external voltage/current signal, AI is used for inputting the frequency reference, torque reference, voltage reference at V/F separation, and PID reference or feedback. The corresponding relationship between the voltage/current and the actual reference or feedback is defined by F4-13 to F4-27.

Figure 5-31 Corresponding relationship between the voltage/current and the actual reference or feedback



The sampling of AI terminals can be queried in U0-09 to U0-11. The calculation value is for internal subsequent calculation and cannot be directly read by the user.

### 5.13 Use of AO Terminals

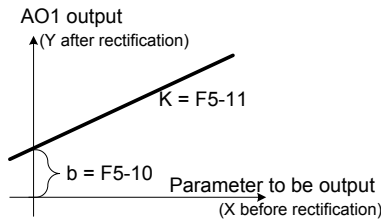
The AC drive provides two AO terminals. AO1 is provided on the control board and AO2 is extended.

Terminal	Output Signal Characteristic
AO1-GND	If J7 is shorted to the pin marked with "V", the AO outputs the signal of 0–10 VDC. If J7 is shorted to the pin marked with "I", the AO outputs the signal of 0–20 mA.
AO2-GND	It is provided on the extension card and outputs the signal of 0–10 VDC.

AO1 and AO2 can be used to indicate the internal running parameters. The indicated parameters can be defined by F5-07 and F5-08.

The designated running parameters can be rectified before output. The rectification feature is  $Y = kX + b$ , among which "X" indicates the running parameters to be output, and "k" and "b" of AO1 can be set by F5-10 and F5-11.

Figure 5-32 Setting of "k" and "b" of AO1



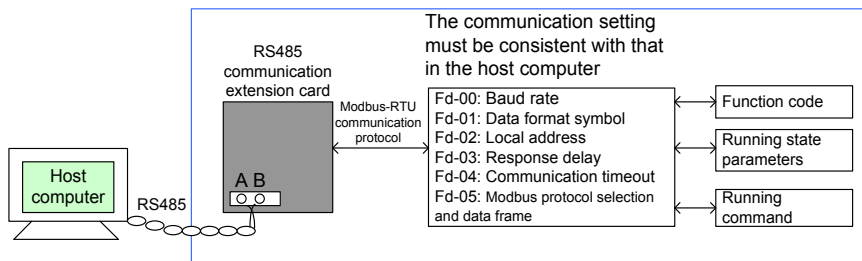
### 5.14 Use of Serial Communication

When RS485, PROFIBUS-DP or CANopen is adopted, install a corresponding extension card on the AC drive, and set F0-28 correctly according to the used communication protocol type. CAN-link is enabled by default and you need not select it.

For the configuration of hardware communication parameters for the communication port, see group Fd. Set the baud rate and data format symbol to keep consistent with those of the host computer, which is the precondition of normal communication.

The MD290 serial port itself supports the Modbus-RTU slave communication protocol. From the host computer, you can view or modify the AC drive function codes, view running state parameters, and send running command and frequency reference to the AC drive through the serial port.

Figure 5-33 Communication control mode of the AC drive



The MD290 arranges the function codes, running state parameters and running commands in the "register parameter address" mode. The host computer can define the protocol of communication data interaction.

## 5.15 Use of Extension Interfaces

The extension card and functions are described in the following table.

Table 4-4 Extension cards and functions

Name	Model	Function	Remark
I/O extension card 1	MD38IO1	It extends five DIs, an analog voltage input AI3 (isolation analog) connected to PT100, PT1000, a relay output, a DO, and an AO. It supports RS485 and CAN protocols.	Applied to the models of 3.7 kW and above.
I/O extension card 2-Size B	MD38IO2	It extends three DI terminals.	Applied to all models.
Modbus communication card	MD32-232	RS232 communication terminal without isolation, compatible with RJ45	Applied to all models.
	MD38TX1	RS485 communication card with isolation	Applied to all models.
CANlink communication extension card	MD38CAN1	CANlink communication adapter	Applied to all models.
CANopen communication extension card	MD38CAN2	CANopen communication adapter	Applied to all models.
Profibus-DP communication card	MD38DP2	Profibus-DP communication card	Applied to the models of 3.7 kW and above.
User programmable card	MD38PC1	User programmable extension card, completely compatible with Inovance's H1U series PLC	Applied to the models of 3.7 kW and above.

### 5.16 Password Setting

The AC drive provides the user password protection function. When FP-00 is set to a non-zero value, the password function is enabled. The password takes effect after you exit the function code editing state. When you press

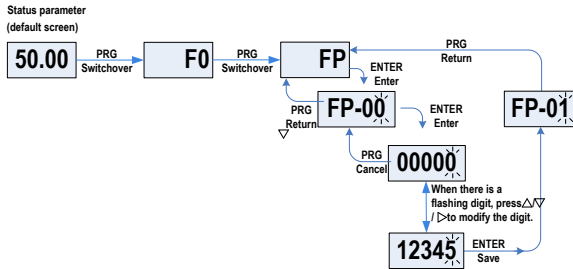


again, "-----" will be displayed, and you must enter the correct user password to enter the menu.

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

The following figure shows how to modify the password to 12345.

Figure 5-34 Modify the password to 12345.





### 5.17 Parameter Saving and Factory Parameter Restoring

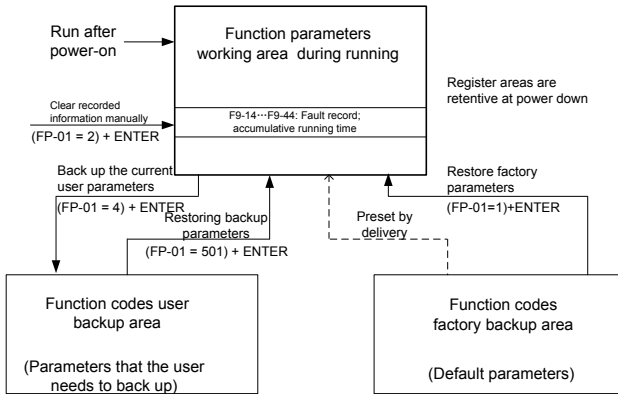
After a function code is modified on the operation panel, the modification will be saved in the register of the AC drive and remain effective at next power-on.

The AC drive supports backup and restoration of parameter setting, which is convenient for commissioning.

The AC drive also provides the retentive function on alarm information and accumulative running time.

You can restore the backup values or factory parameters of the AC drive or clear the running data through FP-01. For details, see the description of FP-01.

Figure 5-35 Parameter saving and default parameter restoring





Function Code Table

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# Chapter 6 Function Code Table

## 6.1 Introduction

### Note

Password protection is available for use with the MD290 AC Drive. If this protection has been enabled, you will need to know the user-defined password before you can edit the function codes described in this chapter. See section 5.16 "Password Setting" for instructions to set and remove password protection.

Groups F and A include standard function parameters. Group U includes the monitoring function parameters and extension card communication parameters.

The parameter description tables in this chapter use the following symbols:

The symbols in the function code table are described as follows:

Symbol	Meaning
☆	It is possible to modify the parameter with the MD290 in the stop or in the Run state.
★	It is not possible to modify the parameter with the MD290 in the Run state.
●	The parameter is the actual measured value and cannot be modified.
*	The parameter is a factory parameter and can be set only by the manufacturer.

## 6.2 Standard Parameters

Parameter No.	Parameter Name	Setting Range	Default	Property
Group F0: Standard Parameters				
F0-00	G/P type display	1 and 2	Model dependent	★
F0-01	Motor 1 control mode	2	2	★
F0-02	Command source selection	0 to 2	0	☆
F0-03	Main frequency reference setting channel selection	0 to 9	0	★
F0-04	Auxiliary frequency reference setting channel selection	0 to 9	0	★
F0-05	Base value of range of auxiliary frequency reference for Main and auxiliary superposition	0, 1	0	☆
F0-06	Range of auxiliary frequency Y for Main and auxiliary superposition	0% to 150%	100%	☆
F0-07	Frequency source superposition selection	00 to 34	00	☆
F0-08	Preset frequency	0.00 to max. frequency (F0-10)	50.00 Hz	☆
F0-09	Rotation direction	0 and 1	0	☆
F0-10	Max. frequency	50.00 to 500.00 Hz	50.00 Hz	★
F0-11	Source of frequency upper limit	0 to 5	0	★
F0-12	Frequency upper limit	Frequency lower limit (F0-14) to maximum frequency (F0-10)	50.00 Hz	☆
F0-13	Frequency upper limit offset	0.00 Hz to max. frequency (F0-10)	0.00 Hz	☆
F0-14	Frequency lower limit	0.00 Hz to frequency upper limit (F0-12)	0.00 Hz	☆
F0-15	Carrier frequency	0.8 to 12.0 kHz	Model dependent	☆
F0-16	Carrier frequency adjusted with temperature	0, 1	1	☆
F0-17	Acceleration time 1	0.00s to 650.00s (F0-19 = 2) 0.0s to 6500.0s (F0-19 = 1) 0s to 65000s (F0-19 = 0)	Model dependent	☆
F0-18	Deceleration time 1	0.00s to 650.00s (F0-19 = 2) 0.0s to 6500.0s (F0-19 = 1) 0s to 65000s (F0-19 = 0)	Model dependent	☆
F0-19	Acceleration/Deceleration time unit	0: 1s 1: 0.1s 2: 0.01s	1	★

Parameter No.	Parameter Name	Setting Range	Default	Property
F0-21	Frequency offset of Auxiliary frequency setting channel for Main and auxiliary superposition	0.00 Hz to max. frequency (F0-10)	0.00 Hz	☆
F0-22	Frequency reference resolution	2: 0.01 Hz	2	★
F0-23	Retentive of digital setting frequency upon stop	0, 1	0	☆
F0-24	Motor parameter group selection	0: Motor parameter group 1 1: Motor parameter group 2	0	★
F0-25	Acceleration/Deceleration time base frequency	0 to 2	0	★
F0-26	Base frequency for UP/DOWN modification during running	0, 1	0	★
F0-27	Binding command source to frequency source	000 to 999	000	☆
F0-28	Serial port communication protocol	0, 1	0	★
Group F1: Motor 1 Parameters				
F1-00	Motor type selection	0, 1	0	★
F1-01	Rated motor power	0.1 to 1000.0 kW	Model dependent	★
F1-02	Rated motor voltage	1 to 2000 V	Model dependent	★
F1-03	Rated motor current	0.01 to 655.35 A (AC drive power ≤ 55 kW) 0.1 to 6553.5 A (AC drive power > 55 kW)	Model dependent	★
F1-04	Rated motor frequency	0.01 Hz to max. frequency	Model dependent	★
F1-05	Rated motor speed	1 to 65535 rpm	Model dependent	★
F1-06	Stator resistance	0.001 to 65.535 Ω (AC drive power ≤ 55 kW) 0.0001 to 6.5535 Ω (AC drive power > 55 kW)	Auto-tuning dependent	★
F1-07	Rotor resistance	0.001 to 65.535 Ω (AC drive power ≤ 55 kW) 0.0001 to 6.5535 Ω (AC drive power > 55 kW)	Auto-tuning dependent	★
F1-08	Leakage inductive reactance	0.01 to 655.35 mH (AC drive power ≤ 55 kW) 0.001 to 65.535 mH (AC drive power > 55 kW)	Auto-tuning dependent	★
F1-09	Mutual inductive reactance	0.1 to 6553.5 mH (AC drive power ≤ 55 kW) 0.01 to 655.35 mH (AC drive power > 55 kW)	Auto-tuning dependent	★

Parameter No.	Parameter Name	Setting Range	Default	Property
F1-10	No-load current	0.01 A to F1-03 (AC drive power ≤ 55 kW) 0.1 A to F1-03 (AC drive power > 55 kW)	Auto-tuning dependent	★
F1-37	Auto-tuning selection	0: No auto-tuning 1: Static auto-tuning 1 2: Dynamic auto-tuning 3: Static auto-tuning 2	0	★
Group F3: V/F Control Parameters				
F3-00	V/F curve setting	0 to 11	0	★
F3-01	Torque boost	0.0% to 30%	Model dependent	☆
F3-02	Cut-off frequency of torque boost	0.00 Hz to max. frequency	50.00 Hz	★
F3-03	Multi-point V/F frequency 1 (F1)	0.00 Hz to F3-05	0.00 Hz	★
F3-04	Multi-point V/F voltage 1 (V1)	0.0% to 100.0%	0.0%	★
F3-05	Multi-point V/F frequency 2 (F2)	F3-03 to F3-07	0.00 Hz	★
F3-06	Multi-point V/F voltage 2 (V2)	0.0% to 100.0%	0.0%	★
F3-07	Multi-point V/F frequency 3 (F3)	F3-05 to rated motor frequency (F1-04)	0.00 Hz	★
F3-08	Multi-point V/F voltage 3 (V3)	0.0% to 100.0%	0.0%	★
F3-09	V/F slip compensation gain	0.0% to 200.0%	0.0%	★
F3-10	V/F over-excitation gain	0 to 200	64	☆
F3-11	V/F oscillation suppression gain	0 to 100	40	☆
F3-13	Voltage source for V/F separation	0 to 8	0	☆
F3-14	Digital setting of voltage for V/F separation	0 V to rated motor voltage	0 V	☆
F3-15	Voltage rise time of V/F separation	0.0s to 1000.0s	0.0s	☆
F3-16	Voltage decline time of V/F separation	0.0s to 1000.0s	0.0s	☆
F3-17	Stop mode selection for V/F separation	0: Frequency and voltage declining to 0 independently 1: Frequency declining after voltage declines to 0	0	☆
F3-18	Overcurrent stall prevention level	50% to 200%	150%	★
F3-19	Overcurrent stall prevention selection	0, 1	1	★
F3-20	Overcurrent stall prevention gain	0 to 100	20	☆
F3-21	Speed multiplying overcurrent stall prevention level compensation factor	50% to 200%	50%	★
F3-22	Overvoltage stall prevention level	650 to 800 V	760 V	★

Parameter No.	Parameter Name	Setting Range	Default	Property
F3-23	Overvoltage stall prevention selection	0, 1	1	★
F3-24	Overvoltage stall prevention frequency gain	0 to 100	30	☆
F3-25	Overvoltage stall prevention voltage gain	0 to 100	30	☆
F3-26	Overvoltage stall prevention max. frequency limit	0 to 50 Hz	5 Hz	★
F3-27	Slip compensation time constant	0.1s to 10.0s	0.5s	☆
Group F4: Input Terminals				
F4-00	DI1 function selection	0 to 59	1	★
F4-01	DI2 function selection	0 to 59	4	★
F4-02	DI3 function selection	0 to 59	9	★
F4-03	DI4 function selection	0 to 59	12	★
F4-04	DI5 function selection	0 to 59	13	★
F4-05	DI6 function selection	0 to 59	0	★
F4-06	DI7 function selection	0 to 59	0	★
F4-07	DI8 function selection	0 to 59	0	★
F4-08	DI9 function selection	0 to 59	0	★
F4-09	DI10 function selection	0 to 59	0	★
F4-10	DI filter time	0.000s to 1.000s	0.010s	☆
F4-11	Terminal command mode	0 to 3	0	★
F4-12	Terminal UP/DOWN rate	0.001 to 65.535 Hz/s	1.000 Hz/s	☆
F4-13	AI1 curve min. input	0.00 V to F4-15	0.00 V	☆
F4-14	Corresponding percentage of AI1 curve min. input	-100.00% to 100.0%	0.0%	☆
F4-15	AI1 curve max. input	F4-13 to 10.00 V	10.00 V	☆
F4-16	Corresponding percentage of AI1 curve max. input	-100.00% to 100.0%	100.0%	☆
F4-17	AI1 filter time	0.00s to 10.00s	0.10s	☆
F4-18	AI2 curve min. input	0.00 V to F4-20	0.00 V	☆
F4-19	Corresponding percentage of AI2 curve min. input	-100.00% to 100.0%	0.0%	☆
F4-20	AI2 curve max. input	F4-18 to 10.00 V	10.00 V	☆
F4-21	Corresponding percentage of AI2 curve max. input	-100.00% to 100.0%	100.0%	☆
F4-22	AI2 filter time	0.00s to 10.00s	0.10s	☆
F4-23	AI3 curve min. input	-10.00 V to F4-25	0.00 V	☆
F4-24	Corresponding percentage of AI3 curve min. input	-100.00% to 100.0%	0.0%	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F4-25	AI3 curve max. input	F4-23 to 10.00 V	10.00 V	☆
F4-26	Corresponding percentage of AI3 curve max. input	-100.00% to 100.0%	100.0%	☆
F4-27	AI3 filter time	0.00s to 10.00s	0.10s	☆
F4-28	Pulse min. input	0.00 kHz to F4-30	0.00 kHz	☆
F4-29	Corresponding percentage of pulse min. input	-100.00% to 100.0%	0.0%	☆
F4-30	Pulse max. input	F4-28 to 100.00 kHz	50.00 kHz	☆
F4-31	Corresponding percentage of pulse max. input	-100.00% to 100.0%	100.0%	
F4-32	Pulse filter time	0.00s to 10.00s	0.10s	☆
F4-33	AI curve selection	111 to 555	321	☆
F4-34	AI curve selection	000 to 111	000	☆
F4-35	DI1 delay	0.0s to 3600.0s	0.0s	☆
F4-36	DI2 delay	0.0s to 3600.0s	0.0s	★
F4-37	DI3 delay	0.0s to 3600.0s	0.0s	★
F4-38	DI active mode selection 1	00000 to 11111	00000	★
F4-39	DI active mode selection 2	00000 to 11111	00000	★
F4-40	AI2 input signal selection	0, 1	0	★
Group F5: Output Terminals				
F5-00	FM terminal output mode	0,1	0	☆
F5-01	FMR function selection	0 to 41	0	☆
F5-02	Relay (T/A-T/B-T/C) function selection	0 to 41	2	☆
F5-03	Extension card relay (P/A-P/B-P/C) function selection	0 to 41	0	☆
F5-04	DO1 function selection	0 to 41	1	☆
F5-05	Extension card DO2 function selection	0 to 41	4	☆
F5-06	FMP function selection	0 to 16	0	☆
F5-07	AO1 function selection	0 to 16	0	☆
F5-08	AO2 function selection	0 to 16	1	☆
F5-09	Max. FMP output frequency	0.01 to 100.00 kHz	50.00 kHz	☆
F5-10	AO1 zero offset coefficient	-100.0% to 100.0%	0.0%	☆
F5-11	AO1 gain	-10.00 to 10.00	1.00	☆
F5-12	AO2 zero offset coefficient	-100.0% to 100.0%	0.00%	☆
F5-13	AO2 gain	-10.00 to 10.00	1.00	☆
F5-17	FMR output delay	0.0s to 3600.0s	0.0s	☆



Parameter No.	Parameter Name	Setting Range	Default	Property
F5-18	Relay 1 output delay	0.0s to 3600.0s	0.0s	☆
F5-19	Relay 2 output delay	0.0s to 3600.0s	0.0s	☆
F5-20	DO1 output delay	0.0s to 3600.0s	0.0s	☆
F5-21	DO2 output delay	0.0s to 3600.0s	0.0s	☆
F5-22	DI active mode selection 1	00000 to 11111	00000	☆
F5-23	AO1 output signal selection	0, 1	0	★
<b>Group F6: Start/Stop Control</b>				
F6-00	Startup mode	0: Direct start 1: Catching a spinning motor	0	☆
F6-01	Mode of catching a spinning motor	0: From stop frequency 1: From zero speed 2: From max. frequency	0	★
F6-02	Speed of catching a spinning motor	1 to 100	20	☆
F6-03	Start frequency	0.00 to 10.00 Hz	0.00 Hz	☆
F6-04	Start frequency holding time	0.0s to 100.0s	0.0s	★
F6-05	DC injection braking 1 level/Pre-excitation level	0% to 100%	0%	★
F6-06	DC injection braking 1 active time / Pre-excitation active time	0.0s to 100.0s	0.0s	★
F6-07	Acceleration/Deceleration mode	0: Linear acceleration/ deceleration 1: Static S-curve acceleration/ deceleration	0	★
F6-08	Time proportion of S-curve start segment	0.0% to (100.0% – F6-09)	30.0%	★
F6-09	Time proportion of S-curve end segment	0.0% to (100.0% – F6-08)	30.0%	★
F6-10	Stop mode	0: Decelerate to stop 1: Coast to stop	0	☆
F6-11	DC injection braking 2 start frequency	0.00 Hz to maximum frequency	0.00 Hz	☆
F6-12	DC injection braking 2 delay time	0.0s to 100.0s	0.0s	☆
F6-13	DC injection braking 2 level	0% to 100%	0%	☆
F6-14	DC injection braking 2 active time	0.0s to 100.0s	0.0s	☆
F6-15	Braking use ratio	0% to 100%	100%	☆
F6-18	Catching a spinning motor current limit	30% to 200%	Model dependent	★
F6-21	Demagnetization time	0.00s to 5.00s	1.00s	★

Parameter No.	Parameter Name	Setting Range	Default	Property
Group F7: Keypad Operation and LED Display				
F7-01	MF.K Key function selection	0 to 4	0	★
F7-02	STOP/RESET key function	0, 1	1	☆
F7-03	LED display running parameters 1	0000 to FFFF	1F	☆
F7-04	LED display running parameters 2	0000 to FFFF	0	☆
F7-05	LED display stop parameters	0000 to FFFF	33	☆
F7-06	Load speed display coefficient	0.0001 to 6.5000	1.0000	☆
F7-07	Heatsink temperature of inverter module	0.0°C to 120.0°C	-	●
F7-08	Temporary software version	-	-	●
F7-09	Accumulative running time	0 to 65535 h	-	●
F7-10	Product SN	-	-	●
F7-11	Software version	-	-	●
F7-12	Number of decimal places for load speed display	10 to 23	21	☆
F7-13	Accumulative power-on time	0 to 65535 h	-	●
F7-14	Accumulative power consumption	0 to 65535 kWh	-	●
Group F8: Auxiliary Functions				
F8-00	Jog running frequency reference	0.00 Hz to maximum frequency	2.00 Hz	☆
F8-01	Jog acceleration time	0.0s to 6500.0s	20.0s	☆
F8-02	Jog deceleration time	0.0s to 6500.0s	20.0s	☆
F8-03	Acceleration time 2	0.0s to 6500.0s	Model dependent	☆
F8-04	Deceleration time 2	0.0s to 6500.0s	Model dependent	☆
F8-05	Acceleration time 3	0.0s to 6500.0s	Model dependent	☆
F8-06	Deceleration time 3	0.0s to 6500.0s	Model dependent	☆
F8-07	Acceleration time 4	0.0s to 6500.0s	0.0s	☆
F8-08	Deceleration time 4	0.0s to 6500.0s	0.0s	☆
F8-09	Frequency jump 1	0.00 Hz to max. frequency	0.00 Hz	☆
F8-10	Frequency jump 2	0.00 Hz to max. frequency	0.00 Hz	☆
F8-11	Frequency jump band	0.00 Hz to max. frequency	0.01 Hz	☆
F8-12	Forward/Reverse rotation dead-zone time	0.0s to 3000.0s	0.0s	☆
F8-13	Reverse RUN selection	0, 1	0	☆
F8-14	Running mode when frequency reference lower than frequency lower limit	0 to 2	0	☆
F8-15	Droop control	0.00 to 10.00 Hz	0.00 Hz	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
F8-16	Accumulative power-on time threshold	0 to 65000 h	0 h	☆
F8-17	Accumulative running time threshold	0 to 65000 h	0 h	☆
F8-18	Startup protection selection	0, 1	0	☆
F8-19	Frequency detection level 1	0.00 Hz to max. frequency	50.00 Hz	☆
F8-20	Frequency detection level 1 hysteresis	0.0% to 100.0%	5.0%	☆
F8-21	Detection width of frequency reference	0.00 to 100%	0.0%	☆
F8-22	Selection of frequency jump during acceleration/deceleration	0, 1	0	☆
F8-25	Frequency point of switchover of accel time 1 and accel time 2	0.00 Hz to max. frequency	0.00 Hz	☆
F8-26	Frequency point for switchover of decel time 1 and decel time 2	0.00 Hz to max. frequency	0.00 Hz	☆
F8-27	Selection of terminal jog preferred	0, 1	0	☆
F8-28	Frequency detection level 2	0.00 Hz to max. frequency	50.00 Hz	☆
F8-29	Frequency detection level 2 hysteresis	0.0% to 100.0%	5.0%	☆
F8-30	Detection of frequency 1	0.00 Hz to max. frequency	50.00 Hz	☆
F8-31	Detection width of frequency 1	0.0% to 100.0% (max. frequency)	0.0%	☆
F8-32	Detection of frequency 2	0.00 Hz to max. frequency	50.00 Hz	☆
F8-33	Detection width of frequency 2	0.0% to 100.0% (max. frequency)	0.0%	☆
F8-34	Zero current detection level	0.0% to 300.0% (rated motor current)	5.0%	☆
F8-35	Zero current detection delay	0.01s to 600.00s	0.10s	☆
F8-36	Output overcurrent threshold	0.0% (no detection) 0.1% to 300.0% (rated motor current)	200.0%	☆
F8-37	Output overcurrent detection delay	0.00s to 600.00s	0.00s	☆
F8-38	Detection of current 1	0.0% to 300.0% (rated motor current)	100.0%	☆
F8-39	Detection width of current 1	0.0% to 300.0% (rated motor current)	0.0%	☆
F8-40	Detection of current 2	0.0% to 300.0% (rated motor current)	100.0%	☆
F8-41	Detection width of current 2	0.0% to 300.0% (rated motor current)	0.0%	☆
F8-42	Timing function	0, 1	0	★
F8-43	Timing running time setting channel	0 to 3	0	★

Parameter No.	Parameter Name	Setting Range	Default	Property
F8-44	Timing running time	0.0 to 6500.0 min	0.0 min	★
F8-45	AI1 input voltage lower limit	0.00 V to F8-46	3.10 V	☆
F8-46	AI1 input voltage upper limit	F8-45 to 10.00 V	6.80 V	☆
F8-47	Module temperature threshold	0°C to 100°C	75°C	☆
F8-48	Cooling fan working mode	0, 1	0	☆
F8-49	Wakeup frequency	Hibernating frequency (F8-51) to max. frequency (F0-10)	0.00 Hz	☆
F8-50	Wakeup delay time	0.0s to 6500.0s	0.0s	☆
F8-51	Hibernating frequency	0.00 Hz to wakeup frequency (F8-49)	0.00 Hz	☆
F8-52	Hibernating delay time	0.0s to 6500.0s	0.0s	☆
F8-53	Current running time	0.0 to 6500.0 min	0.0 min	☆
F8-54	Output power correction coefficient	0.00% to 200.0%	100.0%	☆
Group F9: Fault and Protection				
F9-00	Motor overload protection selection	0, 1	1	☆
F9-01	Motor overload protection gain	0.20 to 10.00	1.00	☆
F9-02	Motor overload pending coefficient	50% to 100%	80%	☆
F9-07	Detection of short-circuit to ground upon power-on	0, 1	1	☆
F9-08	Braking unit action voltage	700 to 800 V	780 V	★
F9-09	Auto reset times	0 to 20	0	☆
F9-10	Selection of DO action during auto reset	0, 1	0	☆
F9-11	Delay of auto reset	0.1s to 100.0s	1.0s	☆
F9-12	Selection of power input phase loss/ contactor close protection	00 to 11	11	☆
F9-13	Power output phase loss protection	0, 1	1	☆
F9-14	1st fault type	0 to 55	-	●
F9-15	2nd fault type	0 to 55	-	●
F9-16	3rd (latest) fault type	0 to 55	-	●
F9-17	Frequency upon 3rd fault	-	-	●
F9-18	Current upon 3rd fault	-	-	●
F9-19	Bus voltage upon 3rd fault	-	-	●
F9-20	DI state upon 3rd fault	-	-	●
F9-21	Digital output terminal state upon 3rd fault	-	-	●
F9-22	AC drive state upon 3rd fault	-	-	●
F9-23	Current power-on time upon 3rd fault	-	-	●

Parameter No.	Parameter Name	Setting Range	Default	Property
F9-24	Current running time upon 3rd fault	-	-	●
F9-27	Frequency upon 2nd fault	-	-	●
F9-28	Current upon 2nd fault	-	-	●
F9-29	Bus voltage upon 2nd fault	-	-	●
F9-30	DI state upon 2nd fault	-	-	●
F9-31	Digital output terminal state upon 2nd fault	-	-	●
F9-32	AC drive state upon 2nd fault	-	-	●
F9-33	Current power-on time upon 2nd fault	-	-	●
F9-34	Current running time upon 2nd fault	-	-	●
F9-37	Frequency upon 1st fault	-	-	●
F9-38	Current upon 1st fault	-	-	●
F9-39	Bus voltage upon 1st fault	-	-	●
F9-40	DI state upon 1st fault	-	-	●
F9-41	Digital output terminal state upon 1st fault	-	-	●
F9-42	AC drive state upon 1st fault	-	-	●
F9-43	Current power-on time upon 1st fault	-	-	●
F9-44	Current running time upon 1st fault	-	-	●
F9-47	Fault protection action selection 1	00000 to 22222	00000	☆
F9-48	Fault protection action selection 2	00000 to 11111	00000	☆
F9-49	Fault protection action selection 3	00000 to 22222	00000	☆
F9-50	Fault protection action selection 4	00000 to 22222	00000	☆
F9-54	Frequency selection for continuing to run upon fault	0 to 4	0	☆
F9-55	Backup frequency upon abnormality	0.0% to 100.0% (max. frequency)	100.0%	☆
F9-56	Type of motor temperature sensor	0: No temperature sensor 1: PT100 2: PT1000	0	☆
F9-57	Motor overheat protection threshold	0°C to 200°C	110°C	☆
F9-58	Motor overheat pending threshold	0°C to 200°C	90°C	☆
F9-59	Power dip ride-through function selection	0 to 2	0	★
F9-60	Voltage level of power dip ride-through function disabled	80% to 100%	85%	★
F9-61	Judging time of bus voltage recovering from power dip	0.0s to 100.0s	0.5s	★

Parameter No.	Parameter Name	Setting Range	Default	Property
F9-62	Judging time of power dip action	60s to 100s	80s	★
F9-63	Selection of load lost protection	0: Disabled 1: Enabled	0	☆
F9-64	Load lost detection level	0.0% to 100.0% (rated motor current)	10.0%	☆
F9-65	Load lost detection time	0.0s to 60.0s	1.0s	☆
F9-67	Reserved	-	-	-
F9-68	Reserved	-	-	-
F9-69	Reserved	-	-	-
F9-70	Reserved	-	-	-
F9-71	Power dip ride-through gain Kp	0 to 100	40	☆
F9-72	Power dip ride-through integral coefficient	0 to 100	30	☆
F9-73	Power dip ride-through gain Kp	0.0s to 300.0s	20.0s	★
Group FA: PID Function				
FA-00	PID reference source	0 to 6	0	☆
FA-01	PID digital setting	0.0% to 100.0%	50.0%	☆
FA-02	PID feedback source	0 to 8	0	☆
FA-03	PID operation direction	0, 1	0	☆
FA-04	PID reference and feedback range	0 to 65535	1000	☆
FA-05	Proportional gain Kp1	0.0 to 100.0	20.0	☆
FA-06	Integral time Ti1	0.01s to 10.00s	2.00s	☆
FA-07	Differential time Td1	0.000s to 10.000s	0.000s	☆
FA-08	Negative PID output limit	0.00 Hz to max. frequency	2.00 Hz	☆
FA-09	PID error limit	0.0% to 100.0%	0.0%	☆
FA-10	PID Derivative limit	0.00% to 100.00%	0.10%	☆
FA-11	PID reference change time	0.00s to 650.00s	0.00s	☆
FA-12	PID feedback filter time	0.00s to 60.00s	0.00s	☆
FA-13	PID output filter time	0.00s to 60.00s	0.00s	☆
FA-14	Reserved	-	-	-
FA-15	Proportional gain Kp2	0.0 to 100.0	20.0	☆
FA-16	Integral time Ti2	0.01s to 10.00s	2.00s	☆
FA-17	Differential time Td2	0.000s to 10.000s	0.000s	☆
FA-18	PID parameter switchover condition	0 to 3	0	☆
FA-19	PID error 1 for auto switchover	0.0% to FA-20	20.0%	☆
FA-20	PID error 2 for auto switchover	FA-19 to 100.0%	80.0%	☆
FA-21	PID initial value	0.0% to 100.0%	0.0%	☆
FA-22	PID initial value active time	0.00s to 650.00s	0.00s	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
FA-23	Max. deviation between two PID outputs in forward direction	0.00% to 100.00%	1.00%	☆
FA-24	Max. deviation between two PID outputs in reverse direction	0.00% to 100.00%	1.00%	☆
FA-25	PID integral property	00 to 11	00	☆
FA-26	Detection level of PID feedback loss	0.0%: No detection 0.1% to 100.0%	0.0%	☆
FA-27	Detection time of PID feedback loss	0.0s to 20.0s	0.0s	☆
FA-28	Selection of PID operation at stop	0, 1	0	☆
<b>Group Fb: Wobble Function, Fixed Length and Count</b>				
Fb-00	Wobble setting mode	0, 1	0	☆
Fb-01	Wobble amplitude	0.0% to 100.0%	0.0%	☆
Fb-02	Wobble step	0.0% to 50.0%	0.0%	☆
Fb-03	Wobble cycle	0.0s to 3000.0s	10.0s	☆
Fb-04	Triangular wave rising time coefficient	0.0% to 100.0%	50.0%	☆
Fb-05	Set length	0 to 65535 m	1000 m	☆
Fb-06	Actual length	0 to 65535 m	0 m	☆
Fb-07	Number of pulses per meter	0.1 to 6553.5	100.0	☆
Fb-08	Set count value	1 to 65535	1000	☆
Fb-09	Designated count value	1 to 65535	1000	☆
<b>Group FC: Multi-Reference and Simple PLC Function</b>				
FC-00	Reference 0	-100.0% to 100.0%	0.0%	☆
FC-01	Reference 1	-100.0% to 100.0%	0.0%	☆
FC-02	Reference 2	-100.0% to 100.0%	0.0%	☆
FC-03	Reference 3	-100.0% to 100.0%	0.0%	☆
FC-04	Reference 4	-100.0% to 100.0%	0.0%	☆
FC-05	Reference 5	-100.0% to 100.0%	0.0%	☆
FC-06	Reference 6	-100.0% to 100.0%	0.0%	☆
FC-07	Reference 7	-100.0% to 100.0%	0.0%	☆
FC-08	Reference 8	-100.0% to 100.0%	0.0%	☆
FC-09	Reference 9	-100.0% to 100.0%	0.0%	☆
FC-10	Reference 10	-100.0% to 100.0%	0.0%	☆
FC-11	Reference 11	-100.0% to 100.0%	0.0%	☆
FC-12	Reference 12	-100.0% to 100.0%	0.0%	☆
FC-13	Reference 13	-100.0% to 100.0%	0.0%	☆
FC-14	Reference 14	-100.0% to 100.0%	0.0%	☆
FC-15	Reference 15	-100.0% to 100.0%	0.0%	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
FC-16	Simple PLC running mode	0 to 2	0	☆
FC-17	Simple PLC retentive selection	00 to 11	00	☆
FC-18	Running time of simple PLC reference 0	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-19	Acceleration/deceleration time of simple PLC reference 0	0 to 3	0	☆
FC-20	Running time of simple PLC reference 1	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-21	Acceleration/deceleration time of simple PLC reference 1	0 to 3	0	☆
FC-22	Running time of simple PLC reference 2	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-23	Acceleration/deceleration time of simple PLC reference 2	0 to 3	0	☆
FC-24	Running time of simple PLC reference 3	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-25	Acceleration/deceleration time of simple PLC reference 3	0 to 3	0	☆
FC-26	Running time of simple PLC reference 4	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-27	Acceleration/deceleration time of simple PLC reference 4	0 to 3	0	☆
FC-28	Running time of simple PLC reference 5	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-29	Acceleration/deceleration time of simple PLC reference 5	0 to 3	0	☆
FC-30	Running time of simple PLC reference 6	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-31	Acceleration/deceleration time of simple PLC reference 6	0 to 3	0	☆
FC-32	Running time of simple PLC reference 7	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-33	Acceleration/deceleration time of simple PLC reference 7	0 to 3	0	☆
FC-34	Running time of simple PLC reference 8	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-35	Acceleration/deceleration time of simple PLC reference 8	0 to 3	0	☆
FC-36	Running time of simple PLC reference 9	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-37	Acceleration/deceleration time of simple PLC reference 9	0 to 3	0	☆



Parameter No.	Parameter Name	Setting Range	Default	Property
FC-38	Running time of simple PLC reference 10	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-39	Acceleration/deceleration time of simple PLC reference 10	0 to 3	0	☆
FC-40	Running time of simple PLC reference 11	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-41	Acceleration/deceleration time of simple PLC reference 11	0 to 3	0	☆
FC-42	Running time of simple PLC reference 12	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-43	Acceleration/deceleration time of simple PLC reference 12	0 to 3	0	☆
FC-44	Running time of simple PLC reference 13	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-45	Acceleration/deceleration time of simple PLC reference 13	0 to 3	0	☆
FC-46	Running time of simple PLC reference 14	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-47	Acceleration/deceleration time of simple PLC reference 14	0 to 3	0	☆
FC-48	Running time of simple PLC reference 15	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-49	Acceleration/deceleration time of simple PLC reference 15	0 to 3	0	☆
FC-50	Time unit of simple PLC running	0, 1	0	☆
FC-51	Reference 0 source	0 to 6	0	☆
<b>Group Fd: Communication</b>				
Fd-00	Baud rate	0000 to 9999	5005	☆
Fd-01	Data format symbol	0 to 3	0	☆
Fd-02	Local address	0: Broadcast address; 1 to 247	1	☆
Fd-03	Response delay	0 to 20	2	☆
Fd-04	Communication timeout	0.0 (invalid); 0.1 to 60.0	0.0	☆
Fd-05	Communication protocol	00 to 31	30	☆
Fd-06	Current resolution read by communication	0: 0.01 1: 0.1	0	☆
Fd-08	CANlink communication timeout time	0.0 (Invalid) 0.1 to 60.0	0	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
Group FE: User-Defined Parameters				
FE-00	User-defined parameter 0	F0-00 to FP-xx, A0-00 to Ax-xx, U0-00 to U0-xx	F0-10	☆
FE-01	User-defined parameter 1	Same as FE-00	F0-02	☆
FE-02	User-defined parameter 2	Same as FE-00	F0-03	☆
FE-03	User-defined parameter 3	Same as FE-00	F0-07	☆
FE-04	User-defined parameter 4	Same as FE-00	F0-08	☆
FE-05	User-defined parameter 5	Same as FE-00	F0-17	☆
FE-06	User-defined parameter 6	Same as FE-00	F0-18	☆
FE-07	User-defined parameter 7	Same as FE-00	F3-00	☆
FE-08	User-defined parameter 8	Same as FE-00	F3-01	☆
FE-09	User-defined parameter 9	Same as FE-00	F4-00	☆
FE-10	User-defined parameter 10	Same as FE-00	F4-01	☆
FE-11	User-defined parameter 11	Same as FE-00	F4-02	☆
FE-12	User-defined parameter 12	Same as FE-00	F5-04	☆
FE-13	User-defined parameter 13	Same as FE-00	F5-07	☆
FE-14	User-defined parameter 14	Same as FE-00	F6-00	☆
FE-15	User-defined parameter 15	Same as FE-00	F6-10	☆
FE-16	User-defined parameter 16	Same as FE-00	F0-00	☆
FE-17	User-defined parameter 17	Same as FE-00	F0-00	☆
FE-18	User-defined parameter 18	Same as FE-00	F0-00	☆
FE-19	User-defined parameter 19	Same as FE-00	F0-00	☆
FE-20	User-defined parameter 20	Same as FE-00	F0-00	☆
FE-21	User-defined parameter 21	Same as FE-00	F0-00	☆
FE-22	User-defined parameter 22	Same as FE-00	F0-00	☆
FE-23	User-defined parameter 23	Same as FE-00	F0-00	☆
FE-24	User-defined parameter 24	Same as FE-00	F0-00	☆
FE-25	User-defined parameter 25	Same as FE-00	F0-00	☆
FE-26	User-defined parameter 26	Same as FE-00	F0-00	☆
FE-27	User-defined parameter 27	Same as FE-00	F0-00	☆
FE-28	User-defined parameter 28	Same as FE-00	F0-00	☆
FE-29	User-defined parameter 29	Same as FE-00	F0-00	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
Group FP: Function Parameter Management				
FP-00	User password	0 to 65535	0	☆
FP-01	Parameter initialization	0: No operation 01: Restore factory parameters except motor parameters 02: Clear records 04: Back up current user parameters 501: Restore user backup parameters	0	★
FP-02	Selection of general function parameter display	00 to 11	11	☆
FP-03	Selection of individualized parameter display	00 to 11	00	☆
FP-04	Selection of parameter modification	0, 1	0	☆
Group A1: Virtual DI/DO				
A1-00	VDI1 function selection	0 to 59	0	★
A1-01	VDI2 function selection	0 to 59	0	★
A1-02	VDI3 function selection	0 to 59	0	★
A1-03	VDI4 function selection	0 to 59	0	★
A1-04	VDI5 function selection	0 to 59	0	★
A1-05	VDI active state setting mode	00000 to 11111	00000	★
A1-06	Selection of VDI active state	00000 to 11111	00000	★
A1-07	Function selection for AI1 used as DI	0 to 59	0	★
A1-08	Function selection for AI2 used as DI	0 to 59	0	★
A1-09	Function selection for AI3 used as DI	0 to 59	0	★
A1-10	Active state selection for AI used as DI	000 to 111	000	☆
A1-11	VDO1 function selection	0 to 41	0	☆
A1-12	VDO2 function selection	0 to 41	0	☆
A1-13	VDO3 function selection	0 to 41	0	☆
A1-14	VDO4 function selection	0 to 41	0	☆
A1-15	VDO5 function selection	0 to 41	0	☆
A1-16	VDO1 output delay	0.0s to 3600.0s	0.0s	☆
A1-17	VDO2 output delay	0.0s to 3600.0s	0.0s	☆
A1-18	VDO3 output delay	0.0s to 3600.0s	0.0s	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
A1-19	VDO4 output delay	0.0s to 3600.0s	0.0s	☆
A1-20	VDO5 output delay	0.0s to 3600.0s	0.0s	☆
A1-21	VDO active mode selection	00000 to 11111	00000	☆
Group A2: Motor 2 Parameters				
A2-00	Motor type selection	0 to 1	0	★
A2-01	Rated motor power	0.1 to 1000.0 kW	Model dependent	★
A2-02	Rated motor voltage	1 to 2000 V	Model dependent	★
A2-03	Rated motor current	0.01 to 655.35 A (AC drive power ≤ 55 kW) 0.1 to 6553.5 A (AC drive power > 55 kW)	Model dependent	★
A2-04	Rated motor frequency	0.01 Hz to max. frequency	Model dependent	★
A2-05	Rated motor speed	1 to 65535 rpm	Model dependent	★
A2-06	Stator resistance	0.001 to 65.535 Ω (AC drive power ≤ 55 kW) 0.0001 to 6.5535 Ω (AC drive power > 55 kW)	Auto-tuning dependent	★
A2-07	Rotor resistance	0.001 to 65.535 Ω (AC drive power ≤ 55 kW) 0.0001 to 6.5535 Ω (AC drive power > 55 kW)	Auto-tuning dependent	★
A2-08	Leakage inductive reactance	0.01 to 655.35 mH (AC drive power ≤ 55 kW) 0.001 to 65.535 mH (AC drive power > 55 kW)	Auto-tuning dependent	★
A2-09	Mutual inductive reactance	0.1 to 6553.5 mH (AC drive power ≤ 55 kW) 0.01 to 655.35 mH (AC drive power > 55 kW)	Auto-tuning dependent	★
A2-10	No-load current	0.01 A to F1-03 (AC drive power ≤ 55 kW) 0.1 A to F1-03 (AC drive power > 55 kW)	Auto-tuning dependent	★
A2-62	Motor 2 acceleration/deceleration time selection	0 to 4	0	☆
A2-63	Motor 2 torque boost	0.0% (fixed torque boost) 0.1% to 30.0%	Model dependent	☆
A2-65	Motor 2 oscillation suppression gain	0 to 100	Model dependent	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
Group A5: Control Optimization				
A5-00	DPWM switchover frequency upper limit	5.00 Hz to max. frequency	8.00 Hz	☆
A5-01	PWM modulation pattern	0, 1	0	☆
A5-02	Dead zone compensation mode selection	0, 1	1	☆
A5-03	Random PWM depth	0 to 10	0	☆
A5-04	Selection of fast current limit	0, 1	1	☆
A5-05	Current detection compensation	0 to 100	5	☆
A5-06	Undervoltage threshold	210 to 420 V	350 V	☆
A5-08	Dead-zone time adjustment	100% to 200%	150%	★
A5-09	Overvoltage threshold	650 to 820 V	820 V	★
Group A6: AI Curve Setting				
A6-00	AI curve 4 min. input	-10.00 V to A6-02	0.00 V	☆
A6-01	Corresponding percentage of AI curve 4 min. input	-100.0% to 100.0%	0.0%	☆
A6-02	AI curve 4 inflexion 1 input	A6-00 to A6-04	3.00 V	☆
A6-03	Corresponding percentage of AI curve 4 inflexion 1 input	-100.0% to 100.0%	30.0%	☆
A6-04	AI curve 4 inflexion 1 input	A6-02 to A6-06	6.00 V	☆
A6-05	Corresponding percentage of AI curve 4 inflexion 1 input	-100.0% to 100.0%	60.0%	☆
A6-06	AI curve 4 max. input	A6-04 to 10.00 V	10.00 V	☆
A6-07	Corresponding percentage of AI curve 4 max. input	-100.0% to 100.0%	100.0%	☆
A6-08	AI curve 5 min. input	-10.00 V to A6-10	-10.00 V	☆
A6-09	Corresponding percentage of AI curve 5 min. input	-100.0% to 100.0%	-100.0%	☆
A6-10	AI curve 5 inflexion 1 input	A6-08 to A6-12	-3.00 V	☆
A6-11	Corresponding percentage of AI curve 5 inflexion 1 input	-100.0% to 100.0%	-30.0%	☆
A6-12	AI curve 5 inflexion 1 input	A6-10 to A6-14	3.00 V	☆
A6-13	Corresponding percentage of AI curve 5 inflexion 1 input	-100.0% to 100.0%	30.0%	☆
A6-14	AI curve 5 max. input	A6-12 to 10.00 V	10.00 V	☆
A6-15	Corresponding percentage of AI curve 5 max. input	-100.0% to 100.0%	100.0%	☆
A6-24	Jump point of AI1 input corresponding setting	-100.0% to 100.0%	0.0%	☆
A6-25	Jump amplitude of AI1 input corresponding setting	0.0% to 100.0%	0.5%	☆

Parameter No.	Parameter Name	Setting Range	Default	Property
A6-26	Jump point of AI2 input corresponding setting	-100.0% to 100.0%	0.0%	☆
A6-27	Jump amplitude of AI2 input corresponding setting	0.0% to 100.0%	0.5%	☆
A6-28	Jump point of AI3 input corresponding setting	-100.0% to 100.0%	0.0%	☆
A6-29	Jump amplitude of AI3 input corresponding setting	0.0% to 100.0%	0.5%	☆
<b>Group A7: User Programmable Card</b>				
A7-00	User programmable function selection	0: Disabled 1: Enabled	0	★
A7-01	AC drive output terminal control source selection	00000 to 11111	00000	★
A7-02	User programmable card AI3 and AO2 function selection	0 to 7	0	★
A7-03	PLC program controls the FMP output	0.0% to 100.0%	0.0%	☆
A7-04	PLC program controls the AO1 output	0.0% to 100.0%	0.0%	☆
A7-05	Selection of PLC program controlling digital output	000 to 111	000	☆
A7-06	Setting frequency reference via the user programmable card	-100.00% to 100.00%	0.0%	☆
A7-07	Setting torque reference via the user programmable card	-200.0% to 200.0%	0.0%	☆
A7-08	Setting running command via the user programmable card	0 to 7	0	☆
A7-09	Setting torque reference via the user programmable card	0: No fault  80 to 89: User defined fault code	0	☆
<b>Group A8: Point-point Communication</b>				
A8-00	Selection of point-point communication	0: Disabled 1: Enabled	0	☆
A8-01	Master and slave selection	0: Master 1: Slave	0	☆
A8-02	Selection of action of the slave in point-point communication	000 to 111	000	★
A8-03	Selection of purpose of the slave received data	0: Torque reference 1: Speed reference	0	☆
A8-04	Zero offset of received data	-100.00% to 100.00%	0.00%	★
A8-05	Gain of received data	-10.00 to 10.00	1.00	★

Parameter No.	Parameter Name	Setting Range	Default	Property
A8-06	Point-point communication interruption detection time	0.0s to 10.0s	1.0s	☆
A8-07	Master data sending cycle in point-point communication	0.001s to 10.000s	0.001s	☆
A8-08	Zero offset of received data (frequency)	-100.00% to 100.00%	0.00%	★
A8-09	Gain of received data (frequency)	-10.00 to 10.00	1.00	★
A8-10	Runaway prevention coefficient	0.00% to 100.00%	10.00%	★
Group AC: AI/AO Correction				
AC-00	AI1 measured voltage 1	0.500 to 4.000 V	Factory-corrected	☆
AC-01	AI1 displayed voltage 1	0.500 to 4.000 V	Factory-corrected	☆
AC-02	AI1 measured voltage 2	6.000 to 9.999 V	Factory-corrected	☆
AC-03	AI1 displayed voltage 2	6.000 to 9.999 V	Factory-corrected	☆
AC-04	AI2 measured voltage 1	0.500 to 4.000 V	Factory-corrected	☆
AC-05	AI2 displayed voltage 1	0.500 to 4.000 V	Factory-corrected	☆
AC-06	AI2 measured voltage 2	6.000 to 9.999 V	Factory-corrected	☆
AC-07	AI2 displayed voltage 2	9.999 to 10.000 V	Factory-corrected	☆
AC-08	AI3 measured voltage 1	9.999 to 10.000 V	Factory-corrected	☆
AC-09	AI3 displayed voltage 1	9.999 to 10.000 V	Factory-corrected	☆
AC-10	AI3 measured voltage 2	9.999 to 10.000 V	Factory-corrected	☆
AC-11	AI3 displayed voltage 2	9.999 to 10.000 V	Factory-corrected	☆
AC-12	AO1 target voltage 1	0.500 to 4.000 V	Factory-corrected	☆
AC-13	AO1 measured voltage 1	0.500 to 4.000 V	Factory-corrected	☆
AC-14	AO1 target voltage 2	6.000 to .999 V	Factory-corrected	☆
AC-15	AO1 measured voltage 2	6.000 to 9.999 V	Factory-corrected	☆
AC-16	AO2 target voltage 1	0.500 to 4.000 V	Factory-corrected	☆
AC-17	AO2 measured voltage 1	0.500 to 4.000 V	Factory-corrected	☆
AC-18	AO2 target voltage 2	6.000 to 9.999 V	Factory-corrected	☆
AC-19	AO2 measured voltage 2	6.000 to 9.999 V	Factory-corrected	☆
AC-20	AI2 measured current 1	0.000–20.000 mA	Factory corrected	☆
AC-21	AI2 sampling current 1	0.000–20.000 mA	Factory corrected	☆
AC-22	AI2 measured current 2	0.000–20.000 mA	Factory corrected	☆
AC-23	AI2 sampling current 2	0.000–20.000 mA	Factory corrected	☆
AC-24	AO1 ideal current 1	0.000–20.000 mA	Factory corrected	☆
AC-25	AO1 sampling current 1	0.000–20.000 mA	Factory corrected	☆
AC-26	AO1 ideal current 2	0.000–20.000 mA	Factory corrected	☆
AC-27	AO1 sampling current 2	0.000–20.000 mA	Factory corrected	☆

### 6.3 Monitoring Function Codes

Function Code	Parameter Name	Display Range
Group U0: Monitoring Parameters		
U0-00	Running frequency	0.00 to 500.00 Hz
U0-01	Frequency reference	0.00 to 500.0 Hz
U0-02	Bus voltage	0.0 to 3000.0 V
U0-03	Output voltage	0 to 1140 V
U0-04	Output current	0.00 to 655.35 A
U0-05	Output power	0 to 32767
U0-06	Output torque	-200.0% to 200.0%
U0-07	DI state	0 to 32767
U0-08	DO state	0 to 1023
U0-09	AI1 voltage	-
U0-10	AI2 voltage	-
U0-11	AI3 voltage	-
U0-12	Count value	-
U0-13	length value	-
U0-14	Load speed display	0 to 65535
U0-15	PID reference	0 to 65535
U0-16	PID feedback	0 to 65535
U0-17	PLC stage	-
U0-18	Pulse reference	0.00 to 20.00 kHz
U0-19	Feedback speed	-500.0 to 500.0 Hz
U0-20	Remaining running time	0.0 to 6500.0 min
U0-21	AI1 voltage before correction	0.00 to 10.57 V
U0-22	AI2 voltage (V)/ current (mA) before correction	0.00 to 10.57 V
U0-23	AI3 voltage before correction	-10.57 to 10.57 V
U0-24	Linear speed	0 to 65535 m/min
U0-25	Accumulative power-on time	-
U0-26	Accumulative running time	-
U0-27	Pulse reference	0 to 65535 Hz
U0-28	Communication reference	-100.00% to 100.00%
U0-28	Reserved	-
U0-30	Main frequency reference	0.00 to 500.00 Hz
U0-31	Auxiliary frequency reference	0.00 to 500.00 Hz
U0-32	Viewing any register address value	-
U0-34	Motor temperature	-
U0-37	Power factor angle	-180° to 180°



Function Code	Parameter Name	Display Range
U0-39	Target voltage upon V/F separation	0 V to rated motor voltage
U0-40	Output voltage upon V/F separation	0 V to rated motor voltage
U0-41	DI state display	-
U0-42	DO state display	-
U0-43	DI set for function state display 1	-
U0-44	DI set for function state display 2	-
U0-45	Fault information	-
U0-59	Frequency Reference	-100.00% to 100.00%
U0-60	Running frequency	-100.00% to 100.00%
U0-61	AC drive running state	0 to 65535
U0-62	Current fault code	0 to 99
U0-63	Sending value of point-point communication	-100.00% to 100.00%
U0-64	Number of slaves	0 to 63
U0-66	Communication extension card type	100: CANopen 200: PROFIBUS-DP 300: CANlink
U0-67	Communication extension card version	-
U0-68	DP card AC drive stat	bit0: running state bit1: running direction bit2: whether AC drive is faulty bit3: target frequency reached bit4 to bit7: reserved bit8 to bit15: fault code
U0-69	Speed of transmitting DP	0.00 Hz to max. frequency
U0-70	Motor speed of transmitting DP	0 to rated motor
U0-71	Communication card current display	-
U0-72	Communication card faulty state	-
U0-73	Motor SN	0: Motor 1 1: Motor 2



Function Parameter Descriptions

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## Chapter 7 Description of Function Codes

### Group F0: Basic Parameters

Function Code	Parameter Name	Setting Range	Default
F0-00	G/P type display	1: G type (constant torque load) 2: P type (variable torque load e.g. fan and pump)	2

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

- 1: Applicable to constant torque load with rated parameters specified
- 2: Applicable to variable torque load (fan and pump) with rated parameters specified)

Function Code	Parameter Name	Setting Range	Default
F0-01	Motor 1 control mode	2: V/F control	2

- 2: V/F control

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

Function Code	Parameter Name	Setting Range	Default
F0-02	Command source selection	0: Operation panel control (indicator OFF) 1: Terminal control (indicator ON) 2: Communication control (indicator blinking)	0

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

- 0: Operation panel control ("LOCAL/REMOT" indicator OFF)

Commands are given by pressing keys  and  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. If this parameter is set to 2, a communication card (Modbus RTU, PROFIBUS-DP card, CANlink card, user programmable card or CANopen card) must be installed.

- If a PROFIBUS-DP card is selected and PZD1 data is valid, commands are given by means of PZD1 data.
- If a user programmable card is selected, commands are written to A7-08 by means of the programmable card.
- If any other card is selected, commands are written by means of the communication address 0x2000.
-

Function Code	Parameter Name	Setting Range	Default
F0-03	Main frequency source X selection	0: Digital setting (non-retentive at power down) 1: Digital setting (retentive at power down) 2: AI1 3: AI2 4: AI3 5: Pulse reference (DI5) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication reference	0



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 (non-retentive at power down)

The initial value of the frequency reference is the value of F0-08 (Preset frequency). You can change the frequency reference by pressing  and  on the operation panel (or using the UP/DOWN function of input terminals).

When the AC drive is powered on again after power down, the frequency reference restores to the value of F0-08.

- 1: Digital setting (retentive at power down)

The initial value of the frequency reference is the value of F0-08 (Preset frequency). You can change the frequency reference by pressing keys  and  on the operation panel (or using the UP/DOWN function of input terminals).

When the AC drive is powered on again after power down, the frequency reference is the value memorized at the moment of the last power down.

Note that F0-23 (Retentive of digital setting frequency upon stop) determines whether the frequency reference is memorized or cleared when the AC drive stops. It is related to stop rather than power down.

- 2: AI1
- 3: AI2
- 4: AI3

The frequency reference is set by analog input. The MD290 control board provides two AI terminals (AI1, AI2). Another AI terminal (AI3) is provided by the I/O extension card.

AI1 is 0–10 V voltage input, AI2 is 0–10 V voltage input or 0–20 mA current input, determined by jumper J9, and AI3 is 0–10 V voltage input.

The MD290 provides five curves indicating the mapping relationship between the input voltage of AI1, AI2 and AI3 and the frequency reference, three of which are linear (point-point) correspondence and two of which are four-point correspondence curves. You can set the curves by using function codes F4-13 to F4-27 and function codes in group A6, and select curves for AI1, AI2 and AI3 in F4-33.

When AI is used as the frequency setting source, the corresponding value 100% of the voltage/current input corresponds to the value of F0-10 (Maximum frequency).

- 5: Pulse reference (DI5)

The frequency reference is input by means of DI5 (high-speed pulse). The signal specification of pulse reference is 9–30 V (voltage range) and 0–100 kHz (frequency range).

You can set the mapping relationship between DI5 pulse reference and the corresponding setting in F4-28 to F4-31, and the relationship is a linear curve. 100% of the corresponding setting of pulse reference corresponds to the value of F0-10 (Maximum frequency).

- 6: Multi-reference

In multi-reference mode, state combinations of different DI terminal correspond to different frequency references. The MD290 supports a maximum of 16 references implemented by 16 state combinations of four DI terminals (allocated with functions 12 to 15) in Group FC. The multiple references indicate percentages of the value of F0-10 (Maximum frequency).

If a DI terminal is used for the multi-reference function, you need to perform related setting in group F4.

- 7: Simple PLC

When the simple PLC mode is used as the frequency source, the running frequency of the AC drive 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 FC.

- 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, you need to set parameters of PID function in group FA.

- 9: Communication reference

The frequency reference is input by means of communication.

If the AC drive is a slave in point-point communication and receives data as the frequency source, data transmitted by the master is used as the frequency reference. For details, see the description of group A8.

If PROFIBUS-DP communication or CANopen is valid and PZD1 is used for frequency setting, data transmitted by PDZ1 is directly used as the frequency source. The data format is -F0-10 to F0-10.

In other conditions, data is given by the host computer through the communication address 0x1000. The data format is -100.00% to 100.00%. 100.00% corresponds to the value of F0-10 (Maximum frequency). For example, PZD1 (0x1000) is 5000, that is, 50.00 Hz; PZD1 (0x1000) is -5000, that is, -50.00 Hz;

The MD290 supports four communication protocols: Modbus, PROFIBUS-DP, CANopen and CANlink. They cannot be used simultaneously.



If the communication mode is used, a communication card must be installed. The MD290 provides four optional communication cards and you can select one based on actual requirements. If the communication protocol is Modbus, PROFIBUS-DP or CANopen, the corresponding serial communication protocol needs to be selected based on the setting of F0-28.

The CANlink protocol is always valid.

Function Code	Parameter Name	Setting Range	Default
F0-04	Auxiliary frequency source Y selection	0: Digital setting (non-retentive at power down) 1: Digital setting (retentive at power down) 2: AI1 3: AI2 4: AI3 5: Pulse reference (DI5) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication reference	0

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 F0-03).

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

1. If the auxiliary frequency source Y is digital setting, the preset frequency (F0-08) does not take effect. You can directly adjust the main frequency reference 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 reference, 100% of the input corresponds to the range of the auxiliary frequency Y (set in F0-05 and F0-06).
3. If the auxiliary frequency source is pulse reference, it is similar to analog input.

#### Note

X and Y cannot use the same channel. That is, F0-03 and F0-04 cannot be set to the same value

Function Code	Parameter Name	Setting Range	Default
F0-05	Range base of auxiliary frequency Y for X and Y superposition	0: Relative to maximum frequency 1: Relative to main frequency X	0
F0-06	Range of auxiliary frequency Y for X and Y superposition	0%–150%	0

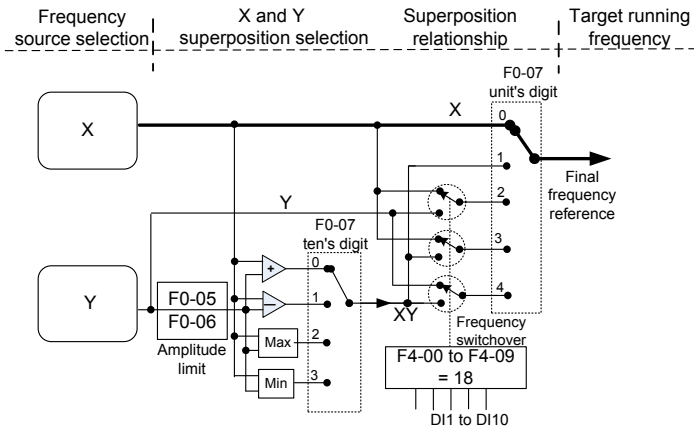
If X and Y superposition is used, F0-05 and F0-06 are used to set the adjustment range of the auxiliary frequency source.

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.

Function Code	Parameter Name	Setting Range	Default
F0-07	Frequency source superposition selection	Unit's digit (Frequency source selection)	0
		0: Main frequency source X 1: X and Y superposition (superposition relationship determined by ten's digit) 2: Switchover between X and Y 3: Switchover between X and "X and Y superposition" 4: Switchover between Y and "X and Y superposition"	
		Ten's digit (X and Y superposition relationship)	
		0: X+Y 1: X-Y 2: MAX (X, Y) 3: MIN (X, Y)	

It is used to select the frequency setting channel. The frequency reference is implemented based on main frequency source X and auxiliary frequency source Y superposition.

Figure 7-1 Frequency setting based on main frequency source X and auxiliary frequency source Y



If the frequency source involves X and Y superposition, you can set the frequency offset in F0-21, which is added to the X and Y superposition result to flexibly satisfy various requirements.

Function Code	Parameter Name	Setting Range	Default
F0-08	Preset frequency	0.00 to maximum frequency	50 Hz

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

Function Code	Parameter Name	Setting Range	Default
F0-09	Rotation direction	0: Same direction 1: Reverse direction	0

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 of U, V, W cables of the motor.

#### Note

The motor will resume running in the original direction after parameter initialization. Do not use this function in applications where changing the rotating direction of the motor is prohibited after system commissioning is completed.

Function Code	Parameter Name	Setting Range	Default
F0-10	Maximum frequency	50.00–500.00 Hz	50.00 Hz

When the frequency source is AI, pulse reference (DI5), or multi-reference, 100% of the input corresponds to the value of this parameter.

Function Code	Parameter Name	Setting Range	Default
F0-11	Source of frequency upper limit	0: Set by F0-12 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference	0

It is used to set the source of the frequency upper limit, including digital setting (F0-12), AI, pulse reference or communication reference. If the frequency upper limit is set by means of AI1, AI2, AI3, DI5 or communication, the setting is similar to that of the main frequency source X. For details, see the description of F0-03.

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

Function Code	Parameter Name	Setting Range	Default
F0-12	Frequency upper limit	Frequency lower limit (F0-14) to maximum frequency (F0-10)	50.00 Hz

This parameter is used to set the frequency upper limit.



Function Code	Parameter Name	Setting Range	Default
F0-13	Frequency upper limit offset	0.00 Hz to maximum frequency (F0-10)	0.00 Hz

When the source of the frequency upper limit is analog input or pulse reference, the final frequency upper limit is obtained by adding the offset in this parameter to the frequency upper limit set in F0-11.

Function Code	Parameter Name	Setting Range	Default
F0-14	Frequency lower limit	0.00 Hz to frequency upper limit (F0-12)	0.00 Hz

If the frequency reference is lower than the value of this parameter, the AC drive can stop, run at the frequency lower limit, or run at zero speed, determined by F8-14.

Function Code	Parameter Name	Setting Range	Default
F0-15	Carrier frequency	0.5–16.0 kHz	Model dependent

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

When the carrier frequency becomes lower, high harmonics of the output current, the power loss and temperature rise of the motor increase.

When the carrier frequency becomes higher, power loss and temperature rise of the motor decline. However, the AC drive has an increase in power loss, temperature rise and interference.

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

Table 7-1 Influences of carrier frequency adjustment

Carrier frequency	Low	High
Motor noise	Large	Small
Output current waveform	Bad	Good
Motor temperature rise	High	Low
AC drive temperature rise	Low	High
Leakage current	Small	Large
External radiation interference	Small	Large

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

Function Code	Parameter Name	Setting Range	Default
F0-16	Carrier frequency adjusted with temperature	0: No 1: Yes	1

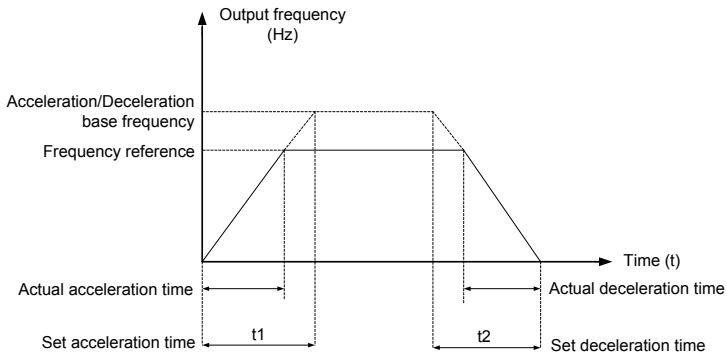
It is used to set whether the carrier frequency is adjusted based on the temperature. The AC drive automatically reduces the carrier frequency when detecting that the heatsink temperature is high. The AC drive resumes the carrier frequency to the set value when the heatsink temperature becomes normal.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

Function Code	Parameter Name	Setting Range	Default
F0-17	Acceleration time 1	0.00–650.00s (F0-19 = 2) 0.0–6500.0s (F0-19 = 1) 0–65000s (F0-19 = 0)	Model dependent
F0-18	Deceleration time 1	0.00–650.00s (F0-19 = 2) 0.0–6500.0s (F0-19 = 1) 0–65000s (F0-19 = 0)	Model dependent

Acceleration time indicates the time required by the AC drive to accelerate from 0 Hz to "Acceleration/Deceleration base frequency" (F0-25), that is,  $t_1$  in Figure 6-2.

Deceleration time indicates the time required by the AC drive to decelerate from "Acceleration/Deceleration base frequency" (F0-25) to 0 Hz, that is,  $t_2$  in Figure 6-2.

Figure 7-2 Acceleration/Deceleration time



The MD290 provides totally four groups of acceleration/deceleration time for selection. You can perform switchover by using a DI terminal.

- Group 1: F0-17, F0-18
- Group 2: F8-03, F8-04
- Group 3: F8-05, F8-06
- Group 4: F8-07, F8-08

Function Code	Parameter Name	Setting Range	Default
F0-19	Acceleration/Deceleration time unit	0: 1s 1: 0.1s 2: 0.01s	1

To satisfy requirements of different applications, the MD290 provides three acceleration/deceleration time units, 1s, 0.1s and 0.01s.

#### Note

Modifying this parameter will make the displayed decimal places change and corresponding acceleration/deceleration time also change

Function Code	Parameter Name	Setting Range	Default
F0-21	Frequency offset of auxiliary frequency source Y for X and Y superposition	0.00 Hz to maximum frequency (F0-10)	0.00 Hz





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

Function Code	Parameter Name	Setting Range	Default
F0-22	Frequency reference resolution	2: 0.01 Hz	2

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

Function Code	Parameter Name	Setting Range	Default
F0-23	Retentive of digital setting frequency upon stop	0: Not retentive 1: Retentive	0

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

- If F0-23 is set to 0, the digital setting frequency value resumes to the value of F0-08 (Preset frequency) after the AC drive stops. The modification by using keys  and  or the terminal UP/DOWN function is cleared.
- If F0-23 is set to 1, the digital setting frequency value is the frequency reference at the moment when the AC drive stops. The modification by using keys  and  or the terminal UP/DOWN function remains effective.

Function Code	Parameter Name	Setting Range	Default
F0-24	Motor parameter group selection	0: Motor parameter group 1 1: Motor parameter group 2	0

The MD290 can drive two motors at different time. You can set the motor nameplate parameters respectively, independent motor auto-tuning, different control modes, and parameters related to running performance respectively for the two motors.

Motor parameter group 1 corresponds to groups F1 and F2. Motor parameter group 2 corresponds to group A2.



You can select the current motor parameter group by using F0-24 or perform switchover between the motor parameter groups by means of a DI terminal. If motor parameters selected by means of F0-24 conflict with those selected by means of DI terminal, the selection by DI is preferred.

Function Code	Parameter Name	Setting Range	Default
F0-25	Acceleration/Deceleration time base frequency	0: Maximum frequency (F0-10) 1: Frequency reference 2: 100 Hz	0

The acceleration/deceleration time indicates the time for the AC drive to increase from 0 Hz to the frequency set in F0-25. If this parameter is set to 1, the acceleration/deceleration time is related to the frequency reference. If the frequency reference changes frequently, the motor's acceleration/deceleration also changes.

Function Code	Parameter Name	Setting Range	Default
F0-26	Base frequency for UP/DOWN modification during running	0: Running frequency 1: Frequency reference	0

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 frequency reference are different, there will be a large difference between the AC drive's performance during the acceleration/deceleration process.

Function Code	Parameter Name	Setting Range	Default
F0-27	Binding command source to frequency source	Unit's digit (Binding operation panel command to frequency source)	000
		0: No binding 1: Digital setting frequency 2: AI1 3: AI2 4: AI3 5: Pulse reference (DI5) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication reference	
		Ten's digit (Binding terminal command to frequency source)	
		Same as unit's digit	
		Hundred's digit (Binding communication command to frequency source)	
		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 F0-03 (Main frequency source X selection). Different running command sources can be bound to the same frequency source.

If a command source has a bound frequency source, the frequency source set in F0-03 to F0-07 no longer takes effect when the command source is effective.

Function Code	Parameter Name	Setting Range	Default
F0-28	Serial port communication protocol	0: Modbus protocol 1: Profibus-DP network bridge	0

### Group F1: Motor 1 Parameters

Function Code	Parameter Name	Setting Range	Default
F1-00	Motor type selection	0: Common asynchronous motor 1: Variable frequency asynchronous motor	1
F1-01	Rated motor power	0.1–1000.0 kW	Model dependent
F1-02	Rated motor voltage	1–2000 V	Model dependent
F1-03	Rated motor current	0.01–655.35 A (AC drive power ≤ 55 kW) 0.1–6553.5 A (AC drive power > 55 kW)	Model dependent
F1-04	Rated motor frequency	0.01 Hz to maximum frequency	Model dependent
F1-05	Rated motor speed	1–65535 RPM	Model dependent

Set the parameters according to the motor nameplate.

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

Function Code	Parameter Name	Setting Range	Default
F1-06	Stator resistance	0.001–65.535 Ω (AC drive power ≤ 55 kW) 0.0001–6.5535 Ω (AC drive power > 55 kW)	Model dependent
F1-07	Rotor resistance	0.001–65.535 Ω (AC drive power ≤ 55 kW) 0.0001–6.5535 Ω (AC drive power > 55 kW)	Model dependent
F1-08	Leakage inductive reactance	0.01–655.35 mH (AC drive power ≤ 55 kW) 0.001–65.535 mH (AC drive power > 55 kW)	Model dependent
F1-09	Mutual inductive reactance	0.1–6553.5 mH (AC drive power ≤ 55 kW) 0.01–655.35 mH (AC drive power > 55 kW)	Model dependent
F1-10	No-load current	0.01 to F1-03 (AC drive power ≤ 55 kW) 0.1 to F1-03 (AC drive power > 55 kW)	Model dependent

The parameters in F1-06 to F1-10 are asynchronous motor parameters. These parameters are unavailable on the motor nameplate and are obtained by means of motor auto-tuning. Only F1-06 to F1-08 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 F1-06 to F1-10.

Each time "Rated motor power" (F1-01) or "Rated motor voltage" (F1-02) is changed, the AC drive automatically restores values of F1-06 to F1-10 to the parameter setting for the common standard Y series asynchronous motor.

If motor auto-tuning cannot be performed onsite, manually input the values of these parameters according to data provided by the motor manufacturer.

Function Code	Parameter Name	Setting Range	Default
F1-37	Auto-tuning selection	0: No auto-tuning 1: Static auto-tuning 1 2: Dynamic auto-tuning 3: Static auto-tuning 2	0

- 0: No auto-tuning

Auto-tuning is prohibited.

- 1: Static auto-tuning 1

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

- 2: Dynamic auto-tuning

During the process of complete auto-tuning, the AC drive performs static auto-tuning first and then accelerates to 80% of the rated motor frequency within the acceleration time set in F0-17. The AC drive keeps running for a certain period and then decelerates to stop within deceleration time set in F0-18.

- 3: Static auto-tuning 2

It is applicable to scenarios without the encoder and is performed in the motor standstill state. Be careful during the auto-tuning process because the motor may joggle slightly.

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#### Note

Motor auto-tuning can be performed in operation panel control, terminal control and communication control.

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## Group F3: V/F Control Parameters

Group F3 is valid only for V/F control.

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

Function Code	Parameter Name	Setting Range	Default
F3-00	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 9: Reserved 10: V/F complete separation 11: V/F half separation	0

- 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 such V/F curve can be obtained by setting parameters of F3-03 to F3-08.

- 2: Square V/F

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

- 3 to 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 AC drive are independent. The output frequency is determined by the frequency source, and the output voltage is determined by "Voltage source for V/F separation" (F3-13).

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 F3-13. The relationship between V and F are also related to the rated motor voltage and rated motor frequency in Group F1.

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

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

Function Code	Parameter Name	Setting Range	Default
F3-01	Torque boost	0.0%–30%	Model dependent
F3-02	Cut-off frequency of torque boost	0.00 Hz to maximum frequency	50.00 Hz

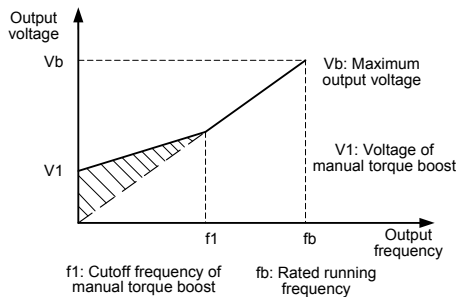
To compensate the low frequency torque characteristics of V/F control, you can boost the output voltage of the AC drive at low frequency by modifying F3-01.

If the torque boost is set to too large, the motor may overheat, and the AC drive may suffer overcurrent.

If the load is large and the motor startup torque is insufficient, increase the value of F3-01. If the load is small, decrease the value of F3-01. If it is set to 0.0, the AC drive performs automatic torque boost. In this case, the AC drive automatically calculates the torque boost value based on motor parameters including the stator resistance.

F3-02 specifies the frequency under which torque boost is valid. Torque boost becomes invalid when this frequency is exceeded, as shown in the following figure.

Figure 7-3 Manual torque boost



Function Code	Parameter Name	Setting Range	Default
F3-03	Multi-point V/F frequency 1 (F1)	0.00 Hz to F3-05	0.00 Hz
F3-04	Multi-point V/F voltage 1 (V1)	0.0%–100.0%	0.0%
F3-05	Multi-point V/F frequency 2 (F2)	F3-03 to F3-07	0.00 Hz
F3-06	Multi-point V/F voltage 2 (V2)	0.0%–100.0%	0.0%
F3-07	Multi-point V/F frequency 3 (F3)	F3-05 to rated motor frequency (F1-04) Note: The rated frequency of motor 2 is set in A2-04.	0.00 Hz
F3-08	Multi-point V/F voltage 3 (V3)	0.0%–100.0%	0.0%

These six parameters are used to define the multi-point V/F curve.

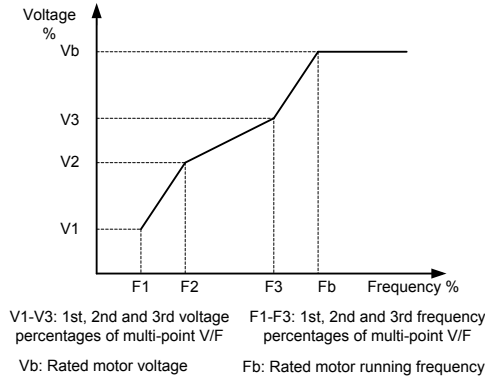
The multi-point V/F curve is set based on the motor's load characteristic. The relationship between voltages and frequencies is:

$$V1 < V2 < V3, F1 < F2 < F3$$

At low frequency, higher voltage may cause overheat or even burnt out of the motor and overcurrent stall or overcurrent protection of the AC drive.



Figure 7-4 Setting of multi-point V/F curve



Function Code	Parameter Name	Setting Range	Default
F3-09	V/F slip compensation gain	0.0%–200.0%	0.0%

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 AC drive through calculation based on the rated motor frequency and rated motor rotational speed in group F1.

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

Function Code	Parameter Name	Setting Range	Default
F3-10	V/F over-excitation gain	0–200	64

During deceleration of the AC drive, over-excitation can restrain rise of the bus voltage, preventing the overvoltage fault. The larger the over-excitation is, the better the restraining result is.

Increase the over-excitation gain if the AC drive is liable to overvoltage error during deceleration. However, too large over-excitation gain may lead to an increase in the output current. Set F3-09 to a proper value in actual applications.

Set the over-excitation gain to 0 in the applications where the inertia is small and the bus voltage will not rise during motor deceleration or where there is a braking resistor.

Function Code	Parameter Name	Setting Range	Default
F3-11	V/F oscillation suppression gain	0–100	40

Set this parameter to a value as small as possible in the prerequisite of efficient oscillation suppression to avoid influence on V/F control.

Set this parameter to 0 if the motor has no oscillation. Increase the value properly only when the motor has obvious oscillation. The larger the value is, the better the oscillation suppression result will be.

When the oscillation suppression function is enabled, the rated motor current and no-load current must be correct. Otherwise, the V/F oscillation suppression effect will not be satisfactory.

Function Code	Parameter Name	Setting Range	Default
F3-13	Voltage source for V/F separation	0: Digital setting (F3-14) 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Multi-reference 6: Simple PLC 7: PID 8: Communication reference 100.0% corresponds to the rated motor voltage (F1-02, A2-02).	0
F3-14	Voltage digital setting for V/F separation	0 V to rated motor voltage	0 V

V/F separation is generally applicable to scenarios 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 F3-14 or by means of analog, multi-reference, 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 (F3-14)  
The output voltage is set directly in F3-14.
- 1: AI1; 2: AI2; 3: AI3  
The output voltage is set by AI terminals.
- 4: Pulse reference (DI5)  
The output voltage is set by pulses of the terminal DI5.  
Pulse input specification: voltage range 9–30 V, frequency range 0–100 kHz
- 5: Multi-reference  
If the voltage source is multi-reference, parameters in group F4 and FC must be set to determine the corresponding relationship between setting signal and setting voltage. 100.0% of the multi-reference setting in group FC corresponds to the rated motor voltage.
- 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 FA.

- 8: Communication reference

The output voltage is set by means of communication.

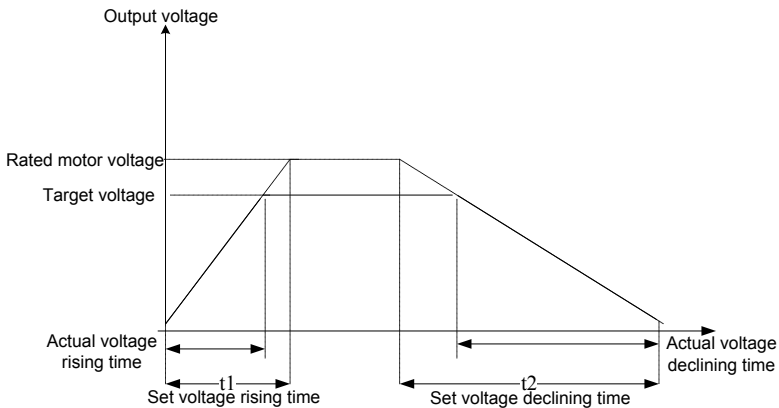
The voltage source for V/F separation is set in the same way as the frequency source. For details, see F0-03. 100.0% of the setting in each mode corresponds to the rated motor voltage. If the corresponding value is negative, its absolute value is used.

Function Code	Parameter Name	Setting Range	Default
F3-15	Voltage rise time of V/F separation	0.0–1000.0s	0.0s
F3-16	Voltage decline time of V/F separation	0.0–1000.0s	0.0s

F3-15 indicates the time required for the output voltage to rise from 0 V to the rated motor voltage shown as  $t_1$  in the following figure.

F3-16 indicates the time required for the output voltage to decline from the rated motor voltage to 0 V, shown as  $t_2$  in the following figure.

Figure 7-5 Voltage of V/F separation

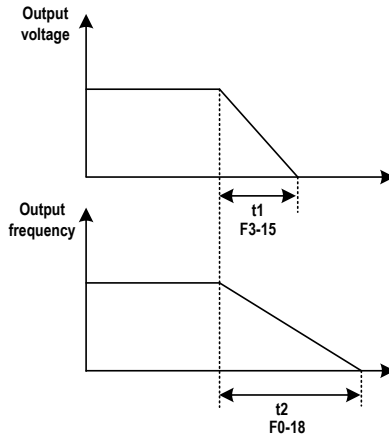


Function Code	Parameter Name	Setting Range	Default
F3-17	Stop mode at V/F separation	0: Frequency/Voltage declining to 0 independently 1: Voltage declining to 0 first and then frequency declining to 0	0.0s

0: Frequency/Voltage declining to 0 independently

The V/F separation output voltage decreases to 0 V according to the value set in F3-15. Simultaneously, the V/F separation output frequency decreases to 0 Hz according to the value set in F3-18.

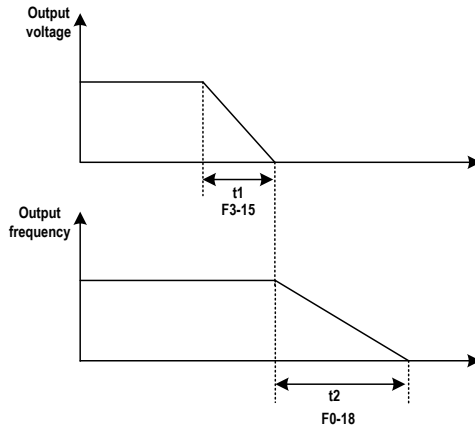
Figure 7-6 Frequency/Voltage declining to 0 independently



1: Voltage declining to 0 first and then frequency declining to 0

The V/F separation output voltage decreases to 0 V according to the value set in F3-15 first. Then the V/F separation output frequency decreases to 0 Hz according to the value set in F3-18.

Figure 7-7 Voltage declining to 0 first and then frequency declining to 0

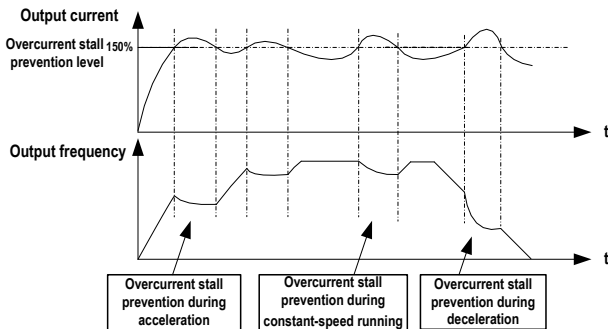


Function Code	Parameter Name	Setting Range	Default
F3-18	Overcurrent stall prevention level	50% to 200%	G: 150% P: 140%
F3-19	Overcurrent stall prevention selection	0: Disabled 1: Enabled	1
F3-20	Overcurrent stall prevention gain	0 to 100	20
F3-21	Speed multiplying overcurrent stall prevention level compensation factor	0% to 200%	0

When the output current exceeds the value set in F3-18 during acceleration, running at constant speed or deceleration, the overcurrent stall prevention function is enabled and the output frequency starts to drop. Until the output current recovers below the stall prevention level, the output frequency starts to accelerate to the target frequency again.

Using this function will increase the acceleration time. If the actual acceleration time cannot satisfy the requirement, increase the value of F3-18 adequately.

Figure 7-8 Overcurrent stall prevention function



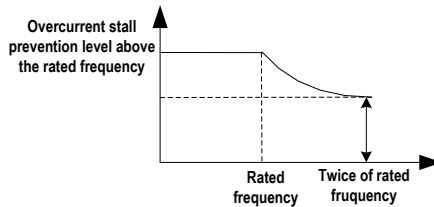
In the high frequency area, the motor drive current is small and bigger motor speed drop is caused by stall current compared with below the rated frequency. To improve the motor running characteristic, you can lower the overcurrent stall prevention level above the rated frequency.

The overcurrent stall prevention function above the rated frequency helps to improve the acceleration performance in the applications, such as centrifuge, where high running frequency and several times of field weakening are required, and the load inertia is large.

The overcurrent stall prevention level above the rated frequency =  $(f_s/f_n) \times k \times \text{LimitCur}$ .

- $f_s$ : running frequency
- $f_n$ : rated motor frequency
- $k$ : speed multiplying overcurrent stall prevention level compensation factor (F3-21)
- $\text{LimitCur}$ : Overcurrent stall prevention level (F3-18)

Figure 7-9 Overcurrent stall prevention level above the rated frequency



### Note

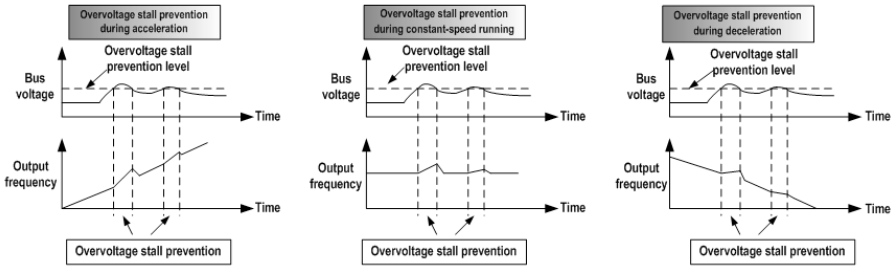
- The overcurrent stall prevention level 150% indicates 1.5 times of the rated current of the AC drive.
- For high-power motor with carrier frequency below 4 kHz, Reduce the overcurrent stall prevention level. This is because the fast current limit function is enabled in advance of the overcurrent stall prevention function due to increase of pulsating current, which will result in insufficient torque output.

Function Code	Parameter Name	Setting Range	Default
F3-22	Overvoltage stall prevention level	650 to 800 V	760 V
F3-23	Overvoltage stall prevention selection	0: Disabled 1: Enabled	1
F3-24	Overvoltage stall prevention frequency gain	0 to 100	30
F3-25	Overvoltage stall prevention voltage gain	0 to 100	30
F3-26	Overvoltage stall prevention max. frequency limit	0 to 50 Hz	5 Hz

When the bus voltage exceeds the value set F3-22, it indicates that the motor becomes an electric generator (motor speed larger than the drive output frequency). In this case, the overvoltage stall prevention function is enabled and adjusts the output frequency (dissipates the regenerative energy).

Using this function will increase the deceleration time and avoid overvoltage trip. If the actual deceleration time cannot satisfy the requirement, increase the value of F3-10 (V/F over-excitation gain) adequately.

Figure 7-10 Overvoltage stall prevention function



**Note**

When using regen resistor, braking unit or energy feedback unit, pay attention to the following aspects:

- Set F3-10 (V/F over-excitation gain) to 0. Otherwise, overcurrent may result during the drive running.
- Set F3-23 (overvoltage stall prevention selection) to 0 (disabled). Otherwise, the deceleration time may be increased.

Function Code	Parameter Name	Setting Range	Default
F3-27	Slip compensation time constant	0.1s to 10.0s	0.5s

The smaller the value of F3-27 is set, the faster response will be obtained. But too small setting may cause overvoltage fault Err07 to large-inertia load.

## Group F4: Input Terminals

The MD290 provides five DI terminals (DI5 can be used for high-speed pulse input) and two analog input (AI terminals). The optional extension card provides another five DI terminals and an AI terminal (AI3).

Function Code	Parameter Name	Setting Range	Default
F4-00	DI1 function selection	0 to 50	1
F4-01	DI2 function selection	0 to 50	4
F4-02	DI3 function selection	0 to 50	9
F4-03	DI4 function selection	0 to 50	12
F4-04	DI5 function selection	0 to 50	13
F4-05	DI6 function selection	0 to 50	0
F4-06	DI7 function selection	0 to 50	0
F4-07	DI8 function selection	0 to 50	0
F4-08	DI9 function selection	0 to 50	0
F4-09	DI10 function selection	0 to 50	0

The functions of the digital input terminals are described in the following figure.

Value	Function	Description
0	No function	Set reserved terminals to 0 to avoid malfunction.
1	Forward run (FWD)	The DI terminals selecting these two functions control forward and reverse running of the AC drive.
2	Reverser run (REV)	
3	Three-wire control mode	The DI terminal set for this function determines three-wire control mode of the AC drive.
4	Forward jog (FJOG)	FJOG indicates forward jog running, and RJOG indicates reverse jog running. The jog frequency, jog acceleration time and jog deceleration time are described respectively in F8-00, F8-01 and F8-02.
5	Reverse jog (RJOG)	
6	Terminal UP	The terminals selecting these two functions are used for increment and decrement when frequency reference is input via external DI terminal, or when the frequency source is digital setting.
7	Terminal DOWN	
8	Coast to stop	When the terminal set for this function becomes on, the AC drive shuts off output and the stop process of the motor is not controlled by the AC drive. It means the same as coast to stop described in F6-10.
9	Fault reset (RESET)	You can perform fault reset via DI terminal set for this function. It is the same as the function of RESET key on the operation panel. Remote fault reset is implemented by this function.
10	RUN disabled	When the terminal set for this function becomes on, the AC drive decelerates to stop and retains all running parameters, such as PLC, wobble and PID parameters. Once the terminal becomes off, the AC drive resumes the running state before stop.



Value	Function	Description
11	External fault NO input	When the terminal set for this function becomes on, the AC drive reports ERR15 and performs the fault protection action. For details, see F9-47.
12	Multi-reference terminal 1	The 16 speeds or 16 other references can be implemented through combinations of 16 states of these four terminals.
13	Multi-reference terminal 2	
14	Multi-reference terminal 3	
15	Multi-reference terminal 4	
16	Terminal 1 for acceleration/ deceleration time selection	Totally four groups of acceleration/deceleration time can be selected through combinations of four states of these two terminals.
17	Terminal 2 for acceleration/ deceleration time selection	
18	Frequency source switchover	The terminal set for this function is used to perform switchover between two frequency sources according to the setting in F0-07.
19	UP and DOWN setting clear (terminal, operation panel)	If the frequency source is digital setting, the terminal set for this function is used to clear the modification by using the UP/DOWN function or the increment/decrement key on the operation panel, restoring the frequency reference to the value of F0-08.
20	Command source switchover 1	If the command source is terminal control (F0-02 = 1), this terminal is used to perform switchover between terminal control and operation panel control.  If the command source is communication control (F0-02 = 2), this terminal is used to perform switchover between communication control and operation panel control.
21	Acceleration/Deceleration prohibited	This function ensures the AC drive to maintain the current frequency output without being affected by external signals (except the STOP command).
22	PID disabled	This function disables the PID function. The AC drive maintains the current frequency output without supporting PID adjustment of frequency source.
23	PLC state reset	When the simple PLC function is enabled again after it was disabled in the execution process, this function restores the original state of simple PLC for the AC drive
24	Wobble disabled	When the terminal set for this function becomes on, the wobble function becomes disabled and the AC drive outputs center frequency.
25	Counter input	The terminal set for this function is used to count pulses.
26	Counter reset	The terminal set for this function is used to clear the counter.
27	Length signal pulses count	The terminal set for this function is used to count pulses of the length signal.
28	Length reset	The terminal set for this function is used to clear the length.
29	Reserved	-
30	Pulse input as frequency reference (valid only for DI5)	DI5 is used for pulse input as frequency reference.

Value	Function	Description
31	Reserved	-
32	Immediate DC injection braking	Once the terminal set for this function becomes on, the AC drive directly switches over to the DC injection braking state.
33	External fault NC input	Once the terminal set for this function becomes on, the AC drive reports ERR15 and stops.
34	Frequency modification enabled	When the terminal set for this function becomes on, the AC drive responds to frequency modification.
35	PID operation direction reverse	When the terminal set for this function becomes on, the PID operation direction is reversed to the direction set in FA-03.
36	External stop 1	In the operation panel mode, the terminal set for this function can be used to stop the AC drive, equivalent to the function of the STOP key on the operation panel.
37	Command source switchover 2	The terminal set for this function is used to perform switchover between terminal control and communication control. If the command source is terminal control, the AC drive switches over to communication control after the terminal becomes ON.
38	PID integral disabled	When the terminal set for this function becomes on, the integral function becomes disabled. However, the proportional and differentiation functions are still effective.
39	Switchover between main frequency reference and preset frequency	When the terminal set for this function becomes on, the frequency reference is replaced by the preset frequency set in F0-08.
40	Switchover between auxiliary frequency reference and preset frequency	When the terminal set for this function becomes on, the frequency reference is replaced by the preset frequency set in F0-08.
41	Motor selection	Switchover between the two groups of motor parameters can be implemented through the two state combinations of the terminal set for this function.
42	Reserved	-
43	PID parameter switchover	If PID parameters switchover is done via DI terminal (FA-18 = 1), the PID parameters are FA-05 to FA-07 when the terminal set for this function becomes off; the PID parameters are FA-15 to FA-17 when the terminal set for this function becomes on.
44	User-defined fault 1	If the terminals selecting these two functions become on, the AC drive reports Err27 and Err28 respectively, and performs fault protection actions based on the setting in F9-49.
45	User-defined fault 2	
46	Reserved	-
47	Emergency stop	When the terminal set for this function becomes on, the AC drive immediately stops as fast as possible. During the stop process, the current remains at the set upper limit. This function aims at satisfying the applications where emergency stop is required.

Value	Function	Description
48	External stop 2	This function enables the AC drive to decelerate to stop in any control mode (operation panel, terminal or communication). In this case, the deceleration time is deceleration time 4.
49	Deceleration DC injection braking	When the terminal set for this function becomes on, the AC drive decelerates to the DC injection braking 2 frequency threshold and then switches over to DC injection braking state.
50	Clear the current running time	When the terminal set for this function becomes on, the current running time of the AC drive is cleared. This function must be supported by F8-42 and F8-53.
51	Two-wire control mode/Three-wire control mode	This function enables the AC drive to switch over between two-wire control mode and three-wire control mode. If F4-11 is set to two-wire control mode 1, the AC drive switches over to three-wire control mode 1 when the terminal set for this function becomes on.
52	Reverse running prohibited	When the terminal set for this function becomes on, reverse running of the AC drive is prohibited. It is the same as the function of F8-13.

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

Table 7-2 State combinations of the four multi-reference terminals

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

If the frequency source is multi-reference, the value 100% of FC-00 to FC-15 corresponds to the value of F0-10 (Maximum frequency).

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

Two terminals for acceleration/deceleration time selection have four state combinations, as listed in the following table.

Table 7-3 State combinations of two terminals for acceleration/deceleration time selection

Terminal 2	Terminal 1	Acceleration/Deceleration Time Selection	Corresponding Parameters
OFF	OFF	Acceleration/Deceleration time 1	F0-17, F0-18
OFF	ON	Acceleration/Deceleration time 2	F8-03, F8-04
ON	OFF	Acceleration/Deceleration time 3	F8-05, F8-06
ON	ON	Acceleration/Deceleration time 4	F8-07, F8-08

Two motor selection terminals have four state combinations, corresponding to four motors, as listed in the following table.

Table 6-4 State combinations of the motor selection terminal

Terminal 2	Terminal 1	Selected Motor	Corresponding Parameters
OFF	OFF	Motor 1	Group F1, Group F2
OFF	ON	Motor 2	Group A2

Function Code	Parameter Name	Setting Range	Default
F4-10	DI filter time	0.000–1.000s	0.010s

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 reduce the response of DI terminals.

Function Code	Parameter Name	Setting Range	Default
F4-11	Terminal command mode	0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2	0

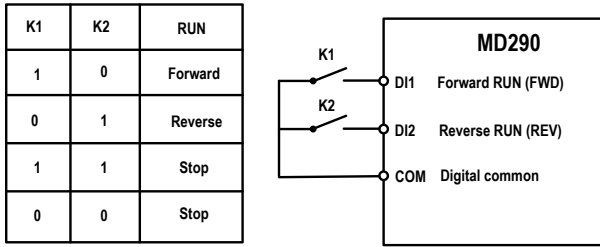
This parameter is used to set the control mode in which the AC drive is controlled by external terminals. The following uses DI1, DI2 and DI3 among DI1 to DI10 as an example, with allocating functions of DI1, DI2 and DI3 by setting F4-00 to F4-02.

- 0: Two-wire control mode 1

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

Function Code	Parameter Name	Value	Function Description
F4-11	Terminal command mode	0	Two-wire control mode 1
F4-00	DI1 function selection	1	Forward RUN (FWD)
F4-01	DI2 function selection	2	Reverse RUN (REV)

Figure 7-11 Setting of two-wire control mode 1



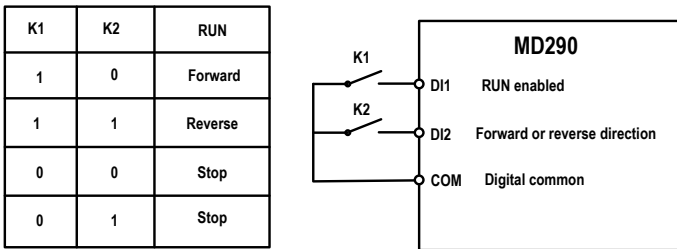
As shown in the preceding figure, when only K1 is ON, the AC drive instructs forward rotation. When only K2 is ON, the AC drive instructs reverse rotation. When K1 and K2 are ON or OFF simultaneously, the AC drive stops.

- 1: Two-wire control mode 2

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

Function Code	Parameter Name	Value	Function Description
F4-11	Terminal command mode	1	Two-wire control mode 2
F4-00	DI1 function selection	1	RUN enabled
F4-01	DI2 function selection	2	Forward or reverse direction

Figure 7-12 Setting of two-wire control mode 2



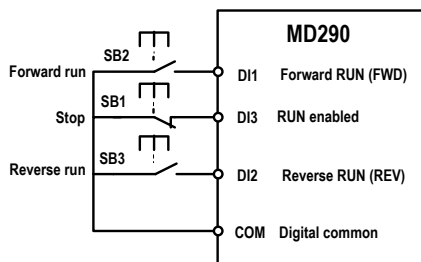
As shown in the preceding figure, if K1 is ON, the AC drive instructs forward rotation when K2 is OFF, and instructs reverse rotation when K2 is ON. If K1 is OFF, the AC drive stops.

- 2: Three-wire control 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:

Function Code	Parameter Name	Value	Function Description
F4-11	Terminal command mode	2	Three-wire control mode 1
F4-00	DI1 function selection	1	Forward RUN (FWD)
F4-01	DI2 function selection	2	Reverse RUN (REV)
F4-02	DI3 function selection	3	Three-wire control

Figure 7-13 Setting of three-wire control mode 1



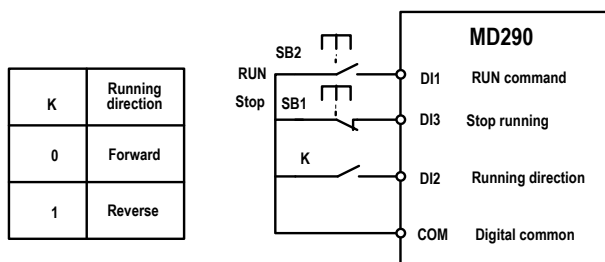
As shown in the preceding figure, if SB1 is ON, the AC drive instructs forward rotation when SB2 is pressed to be ON and instructs reverse rotation when SB3 is pressed to be ON. The AC drive stops immediately after SB1 becomes OFF. During normal startup and running, SB1 must remain ON. The AC drive's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

- 3: Three-wire control 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:

Function Code	Parameter Name	Value	Function Description
F4-11	Terminal command mode	3	Three-wire control mode 2
F4-00	DI1 function selection	1	RUN enabled
F4-01	DI2 function selection	2	Forward or reverse direction
F4-02	DI3 function selection	3	Three-wire control

Figure 7-14 Setting of three-wire control mode 2



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

Function Code	Parameter Name	Setting Range	Default
F4-12	Terminal UP/DOWN rate	0.001–65.535 Hz/s	1.00 Hz/s

It is used to adjust the rate of change of frequency when the frequency is adjusted by means of terminal UP/DOWN.

Function Code	Parameter Name	Setting Range	Default
F4-13	AI curve 1 minimum input	0.00 V to F4-15	0.00 V
F4-14	Corresponding setting of AI curve 1 minimum input	-100.00% to 100.0%	0.0%
F4-15	AI curve 1 maximum input	F4-13 to 10.00 V	10.00 V
F4-16	Corresponding setting of AI curve 1 maximum input	-100.00% to 100.0%	100.0%
F4-17	AI1 filter time	0.00–10.00s	0.10s

These parameters are used to define the relationship between the analog input voltage and the corresponding setting. When the analog input voltage exceeds the maximum value (F4-15), the maximum value is used. When the analog input voltage is less than the minimum value (F4-13), the value set in F4-34 (Setting for AI less than minimum input) is used.

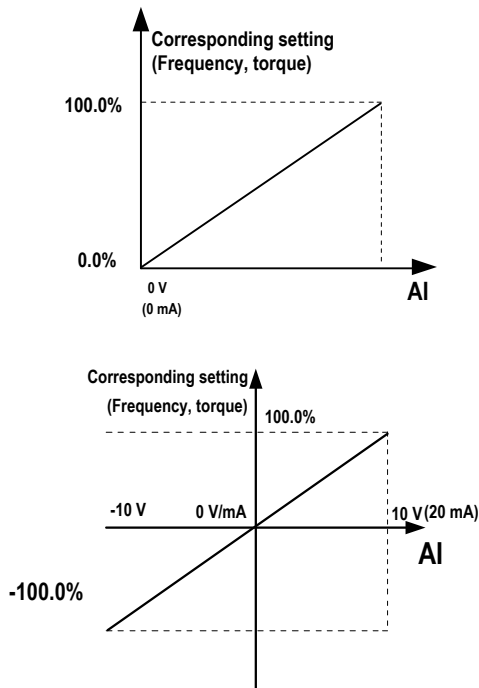
When the analog input is current input, 1 mA current corresponds to 0.5 V voltage.

F4-17 (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 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.

Two typical setting examples are shown in the following figure.

Figure 7-15 Corresponding relationship between analog input and set values



Function Code	Parameter Name	Setting Range	Default
F4-18	AI curve 2 minimum input	0.00 V to F4-20	0.00 V
F4-19	Corresponding setting of AI curve 2 minimum input	-100.00% to 100.0%	0.0%
F4-20	AI curve 2 maximum input	F4-18 to 10.00 V	10.00 V
F4-21	Corresponding setting of AI curve 2 maximum input	-100.00% to 100.0%	100.0%
F4-22	AI2 filter time	0.00–10.00s	0.10s

Function Code	Parameter Name	Setting Range	Default
F4-23	AI curve 3 minimum input	0.00 V to F4-25	0.00 V
F4-24	Corresponding setting of AI curve 3 minimum input	-100.00% to 100.0%	0.0%
F4-25	AI curve 3 maximum input	F4-23 to 10.00 V	10.00 V
F4-26	Corresponding setting of AI curve 3 maximum input	-100.00% to 100.0%	100.0%
F4-27	AI3 filter time	0.00–10.00s	0.10s

The method of setting AI2 and AI3 functions is similar to that of setting AI1 function.

Function Code	Parameter Name	Setting Range	Default
F4-28	Pulse minimum input	0.00 kHz to F4-30	0.00 kHz
F4-29	Corresponding setting of pulse minimum input	-100.00% to 100.0%	0.0%
F4-30	Pulse maximum input	F4-28 to 50.00 kHz	50.00 kHz
F4-31	Corresponding setting of pulse maximum input	-100.00% to 100.0%	100.0%
F4-32	Pulse filter time	0.00–10.00s	0.10s

These parameters are used to set the relationship between DI5 pulse input and corresponding settings. The pulses can only be input by DI5. The method of setting this function is similar to that of setting AI1 function.

Function Code	Parameter Name	Setting Range	Default
F4-33	AI curve selection	Unit's digit (AI1 curve selection)	321
		Curve 1 (2 points, see F4-13 to F4-16)	
		Curve 2 (2 points, see F4-18 to F4-21)	
		Curve 3 (2 points, see F4-23 to F4-26)	
		Curve 4 (4 points, see A6-00 to A6-07)	
		Curve 5 (4 points, see A6-08 to A6-15)	
		Ten's digit (AI2 curve selection)	
Same as AI1			
Hundred's digit (AI3 curve selection)			
Same as AI1			



The unit's digit, ten's digit and hundred's digit of this parameter are respectively used to select the corresponding curve of AI1, AI2 and AI3. Any of the five curves can be selected for AI1, AI2 and AI3.

Curve 1, curve 2 and curve 3 are all 2-point curves, set in group F4. Curve 4 and curve 5 are both 4-point curves, set in group A6.

The MD290 provides two AI terminals as standard. AI3 is provided by an optional extension card.

Function Code	Parameter Name	Setting Range	Default
F4-34	Setting for AI less than minimum input	Unit's digit (Setting for AI1 less than minimum input)	000
		0: Minimum value 1: 0.0%	
		Ten's digit (Setting for AI2 less than minimum input)	
		Same as AI1	
		Hundred's digit (Setting for AI3 less than minimum input)	
		Same as AI1	

This parameter is used to determine the corresponding setting when the analog input voltage is less than the minimum value. The unit's digit, ten's digit and hundred's digit of this parameter respectively correspond to the setting for AI1, AI2 and AI3.

If the value of a certain digit is 0, when analog input voltage is less than the minimum input, the corresponding setting of the minimum input (F4-14, F4-19, F4-24) is used.

If the value of a certain digit is 1, when analog input voltage is less than the minimum input, the corresponding value of this analog input is 0.0%.

Function Code	Parameter Name	Setting Range	Default
F4-35	DI1 delay	0.0–3600.0s	0.0s
F4-36	DI2 delay	0.0–3600.0s	0.0s
F4-37	DI3 delay	0.0–3600.0s	0.0s

These parameters are used to set the delay time of the AC drive when the status of DI terminals changes.

Currently, only DI1, DI2 and DI3 support the delay time function.

Function Code	Parameter Name	Setting Range	Default
F4-38	DI valid mode selection 1	Unit's digit (DI1 valid mode)	00000
		0: High level valid 1: Low level valid	
		Ten's digit (DI2 valid mode)	
		Same as DI1	
		Hundred's digit (DI3 valid mode)	
		Same as DI1	
		Thousand's digit (DI4 valid mode)	
		Same as DI1	
		Ten thousand's digit (DI5 valid mode)	
		Same as DI1	
F4-39	DI valid mode selection 2	Unit's digit (DI6 valid mode)	00000
		Same as DI1	
		Ten's digit (DI7 valid mode)	
		Same as DI1	
		Hundred's digit (DI8 state)	
		Same as DI1	
		Thousand's digit (DI9 valid mode)	
		Same as DI1	
		Ten thousand's digit (DI10 valid mode)	
		0, 1 (same as DI1)	

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

- 0: High level valid

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

- 1: Low level valid

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

Function Code	Parameter Name	Setting Range	Default
F4-40	AI2 input signal selection	0: Voltage signal 1: Current signal	0

AI2 supports voltage/current output, which is determined by jumper. After setting the jumper, perform corresponding setting in F4-40.

## Group F5: Output Terminals

The MD290 provides an analog output (AO) terminal, a digital output (DO) terminal, a relay terminal and a FM terminal (used for high-speed pulse output or open-collector switch signal output) as standard. If these output terminals cannot satisfy requirements, use an optional I/O extension card that provides an AO terminal (AO2), a relay terminal (relay 2) and a DO terminal (DO2).

Function Code	Parameter Name	Setting Range	Default
F5-00	FM terminal output mode	0: Pulse output (FMP) 1: Switch output (FMR)	0

The FM terminal is programmable multiplexing terminal. It can be used for high-speed pulse output (FMP), with maximum frequency of 100 kHz. Refer to F5-06 for relevant functions of FMP. It can also be used as open collector switch signal output (FMR).

Function Code	Parameter Name	Default
F5-01	FMR function selection	0
F5-02	Relay (T/A-T/B-T/C) function selection	2
F5-03	Extension card relay (P/A-P/B-P/C) function selection	0
F5-04	DO1 function selection	1
F5-05	Extension card DO2 function selection	4

These five parameters are used to select the functions of the five digital output terminals. T/A-T/B-T/C and P/A-P/B-P/C are respectively the relays on the control board and the extension card.

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

Table 7-4 Functions of output terminals

Value	Function	Description
0	No output	The terminal has no function.
1	AC drive running	When the AC drive is running and has output frequency (can be zero), the terminal becomes ON.
2	Fault output	When the AC drive stops due to a fault, the terminal becomes ON.
3	Frequency-level detection FDT1 output	Refer to the descriptions of F8-19 and F8-20.
4	Frequency reached	Refer to the descriptions of F8-21.
5	Zero-speed running (no output at stop)	If the AC drive runs with the output frequency of 0, the terminal becomes ON. If the AC drive is in the stop state, the terminal becomes OFF.
6	Motor overload pending	The AC drive judges whether the motor load exceeds the overload pending threshold before performing the protection action. If the pending threshold is exceeded, the terminal becomes ON. For motor overload parameters, see the descriptions of F9-00 to F9-02.
7	AC drive overload pending	The terminal becomes ON 10s before the AC drive overload protection action is performed.
8	Set count value reached	The terminal becomes ON when the count value reaches the value set in FB-08.

Value	Function	Description
9	Designated count value reached	The terminal becomes ON when the count value reaches the value set in FB-09.
10	Length reached	The terminal becomes ON when the detected actual length exceeds the value set in FB-05.
11	PLC cycle completed	When simple PLC completes one cycle, the terminal outputs a pulse signal with width of 250 ms.
12	Accumulative running time reached	If the accumulative running time of the AC drive exceeds the time set in F8-17, the terminal becomes ON.
13	Frequency limited	If the set frequency exceeds the frequency upper limit or lower limit and the output frequency of the AC drive reaches the upper limit or lower limit, the terminal becomes ON.
14	Reserved	-
15	Ready for RUN	If the AC drive main circuit and control circuit become stable, and the AC drive detects no fault and is ready for RUN, the terminal becomes ON.
16	AI1 larger than AI2	When the input of AI1 is larger than the input of AI2, the terminal becomes ON.
17	Frequency upper limit reached	If the running frequency reaches the upper limit, the terminal becomes ON.
18	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.
19	Undervoltage state output	If the AC drive is in undervoltage state, the terminal becomes ON.
20	Communication setting	Refer to the communication protocol.
21	Reserved	Reserved.
22	Reserved	Reserved.
23	Zero-speed running 2 (having output at stop)	If the output frequency of the AC drive is 0, the terminal becomes ON. In the state of stop, the signal is still ON.
24	Accumulative power-on time reached	If the AC drive accumulative power-on time (F7-13) exceeds the value set in F8-16, the terminal becomes ON.
25	Frequency level detection FDT2 output	Refer to the descriptions of F8-28 and F8-29.
26	Frequency 1 reached	Refer to the descriptions of F8-30 and F8-31.
27	Frequency 2 reached	Refer to the descriptions of F8-32 and F8-33.
28	Current 1 reached	Refer to the descriptions of F8-38 and F8-39.
29	Current 2 reached	Refer to the descriptions of F8-40 and F8-41.
30	Timing reached	If the timing function (F8-42) is valid, the terminal becomes ON after the current running time of the AC drive reaches the set time.
31	AI1 input limit exceeded	If AI1 input is larger than the value of F8-46 (AI1 input voltage upper limit) or lower than the value of F8-45 (AI1 input voltage lower limit), the terminal becomes ON.
32	Load lost	If the load becomes 0, the terminal becomes ON.
33	Reverse running	If the AC drive is in the reverse running state, the terminal becomes ON.

Value	Function	Description
34	Zero current state	Refer to the descriptions of F8-28 and F8-29.
35	Module temperature reached	If the heatsink temperature of the inverter module (F7-07) reaches the set module temperature threshold (F8-47), the terminal becomes ON.
36	Output current limit exceeded	Refer to the descriptions of F8-36 and F8-37.
37	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.
38	Alarm output	If a fault occurs on the AC drive and the AC drive continues to run, the terminal outputs the alarm signal.
39	Motor overheat pending	If the motor temperature reaches the temperature set in F9-58 (Motor overheat pending threshold), the terminal becomes ON. You can view the motor temperature by using U0-34.
40	Current running time reached	If the current running time of AC drive exceeds the value of F8-53, the terminal becomes ON.

Function Code	Parameter Name	Default
F5-06	FMP function selection	0
F5-07	AO1 function selection	0
F5-08	AO2 function selection	1

The output pulse frequency of the FMP terminal ranges from 0.01 kHz to "Maximum FMP output frequency" (F5-09). The value of F5-09 is between 0.01 kHz and 100.00 kHz.

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

Table 6-6 Relationship between pulse and analog output ranges and corresponding functions

Value	Function	Range (Corresponding to Pulse or Analog Output Range 0.0%–100.0%)
0	Running frequency	0 to maximum frequency
1	Frequency reference	0 to maximum frequency
2	Output current	0 to 2 times of rated motor current
3	Output torque (absolute value)	0 to 2 times of rated motor torque
4	Output power	0 to 2 times of rated power
5	Output voltage	0 to 1.2 times of rated AC drive voltage
6	Pulse input	0.01–100.00 kHz
7	AI1	0–10 V
8	AI2	0–10 V (or 0–20 mA)
9	AI3	0–0 V
10	Length	0 to maximum set length
11	Count value	0 to maximum count value

Value	Function	Range (Corresponding to Pulse or Analog Output Range 0.0%–100.0%)
12	Communication reference	0.0%–100.0%
13	Motor speed	0 to rotational speed corresponding to maximum output frequency
14	Output current	0.0–1000.0 A
15	Output voltage	0.0–000.0 V
16	Output torque (actual value)	-2 times of rated motor torque to 2 times of rated motor torque

Function Code	Parameter Name	Setting Range	Default
F5-09	Maximum FMP output frequency	0.01–100.00 kHz	50.00 kHz

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

Function Code	Parameter Name	Setting Range	Default
F5-10	AO1 zero offset coefficient	-100.0% to 100.0%	0.0%
F5-11	AO1 gain	-10.00 to 10.00	1.00
F5-12	AO2 zero offset coefficient	-100.0% to 100.0%	0.00%
F5-13	AO2 gain	-10.00 to 10.00	1.00

These parameters are used to correct the zero offset 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 (or 16 mA) when the frequency is 0 V. As shown in the following figure, you need to set the offset to 80%. If it is expected that the output is 3 V (or 6 mA) at the maximum frequency, set the gain to -0.50.

Figure 7-16 The output without any offset or gain

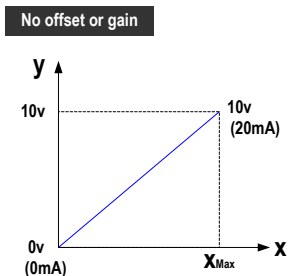


Figure 7-17 The output with offset or gain (voltage type)

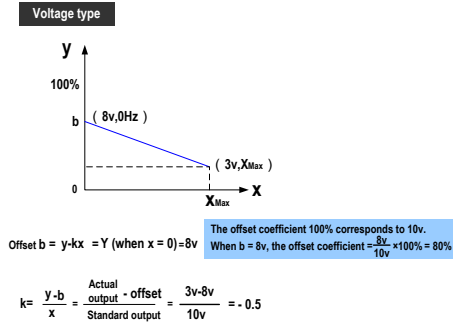
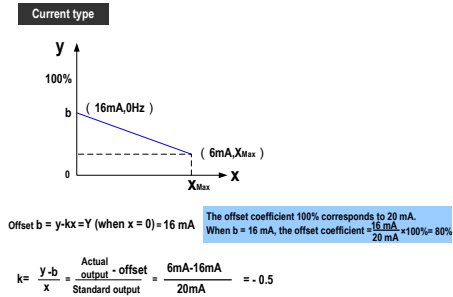


Figure 7-18 The output with offset or gain (current type)



Function Code	Parameter Name	Setting Range	Default
F5-17	FMR output delay	0.0–3600.0s	0.0s
F5-18	Relay 1 output delay	0.0–3600.0s	0.0s
F5-19	Relay 2 output delay	0.0–3600.0s	0.0s
F5-20	DO1 output delay	0.0–3600.0s	0.0s
F5-21	DO2 output delay	0.0–3600.0s	0.0s

These parameters are used to set the delay time of output terminals FMR, relay 1, relay 2, DO1 and DO2 from status change to actual output.

Function Code	Parameter Name	Setting Range	Default
F5-22	DO valid mode selection	Unit's digit (FMR valid mode)	00000
		0: Positive logic 1: Negative logic	
		Ten's digit (Relay 1 valid mode)	
		Same as FMR	
		Hundred's digit (Relay 2 valid mode)	
		Same as FMR	
		Thousand's digit (DO1 valid mode)	
		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 1, relay 2, DO1 and DO2.

- 0: Positive logic

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

- 1: Positive logic

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

Function Code	Parameter Name	Setting Range	Default
F5-23	AO1 output signal selection	0: Voltage signal 1: Current signal	0

The AO1 supports output of voltage and current. You need to select the output signal via the jumper and perform the same setting in this parameter.



## Group F6: Start/Stop Control

Function Code	Parameter Name	Setting Range	Default
F6-00	Startup mode	0: Direct startup 1: Catching a spinning motor	0

### 0. Direct startup

If the DC injection braking active time is set to 0, the AC drive starts to run from the startup frequency.

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

### 1. Catching a spinning motor

To catch a spinning motor, the AC drive detects the speed and direction of the spinning motor, and then starts to run from the spinning motor frequency, minimizing impact of power supply to the motor.

It is applicable to the restart upon instantaneous power down of large-inertia load. In this startup mode, ensure that the motor parameters in group F1 are set correctly.

Function Code	Parameter Name	Setting Range	Default
F6-01	Mode of catching a spinning motor	0: From stop frequency 1: From line frequency 2: From maximum frequency	0

F6-01: This function parameter selects a proper catching mode to catch a spinning motor within the shortest time.

### 0. From stop frequency

It is the commonly used mode.

### 1. From line frequency

It is applicable to restart after long-time power down.

### 2. From maximum frequency

It is applicable to power generating load.

Function Code	Parameter Name	Setting Range	Default
F6-02	Speed of catching a spinning motor	1 to 100	20

F6-02: This function parameter sets the speed of catching a spinning motor. The larger the value is, the faster the catching is. However, too large value may cause unreliable catching.

Function Code	Parameter Name	Setting Range	Default
F6-03	Startup frequency	0.00–10.00 Hz	0.00 Hz
F6-04	Startup frequency holding time	0.0s–100.0s	0.0s

F6-03: Set this function parameter properly to ensure the motor torque at startup. It is not restricted by the frequency lower limit. But if the frequency reference is lower than the startup frequency, the AC drive will not start and stay standby.

F6-04: This function parameter is required to fully build magnetic flux at startup of the motor. It is not included in the acceleration time but included in the simple PLC running time. It does not take effect during FWD/REV switchover.

Example 1:

Setting	Description
F0-03 = 0	The frequency setting channel is digital setting.
F0-08 = 2.00 Hz	The frequency reference via digital setting is 2.00 Hz.
F6-03 = 5.00 Hz	The startup frequency is 5.00 Hz.
F6-04 = 2.0s	The startup frequency holding time is 2.0s.

In this example, the AC drive stays standby and the output frequency is 0.0 Hz.

Example 2:

Setting	Description
F0-03 = 0	The frequency setting channel is digital setting.
F0-08 = 10.00 Hz	The frequency reference via digital setting is 10.00 Hz.
F6-03 = 5.00 Hz	The startup frequency is 5.00 Hz.
F6-04 = 2.0s	The startup frequency holding time is 2.0s.

In this example, the AC drive accelerates to 5.00 Hz first, and then accelerates to the frequency reference 10.00 Hz after 2s.

Function Code	Parameter Name	Setting Range	Default
F6-05	DC injection braking 1 level	0% to 100%	0%
F6-06	DC injection braking 1 active time	0.0s to 100.0s	0.0s

F6-05 and F6-06: The DC injection braking function is effective for direct startup (F6-00 = 0). It is generally applied to restart of the spinning motor after stop.

The AC drive performs DC injection braking based on the value set in F6-05 and starts to run after the time set in F6-06. The larger the DC injection braking 1 level is, the larger the braking force will be achieved. If F6-06 is set to 0, the AC drive directly starts without DC injection braking.

The DC injection braking 1 level or pre-excitation level is a percentage relative to the following two base values.

- If the rated motor current is less than or equal to 80% of the rated AC drive current, the base value is the rated motor current.
- If the rated motor current is greater than 80% of the rated AC drive current, the base value is 80% of the rated AC drive current.

Function Code	Parameter Name	Setting Range	Default
F6-07	Acceleration/Deceleration mode	0: Linear acceleration/deceleration 1: Static S-curve acceleration/deceleration A	0

F6-07: This function parameter sets the acceleration/deceleration mode in the start and stop process of the AC drive.

0. Linear acceleration/deceleration

The output frequency increases or decreases linearly.

3. Static S-curve acceleration/deceleration A

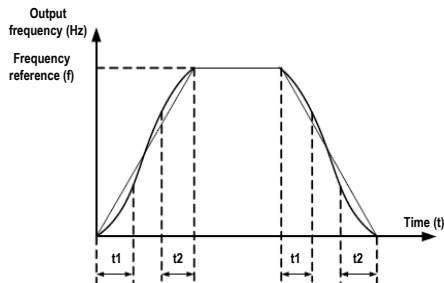
The output frequency increases or decreases along with the S curve on the condition that the target frequency is fixed. This mode is applied to the applications where soft start or stop is required, such as elevator and conveyor belt.

Function Code	Parameter Name	Setting Range	Default
F6-08	Time proportion of S-curve start segment	0.0% to (100.0% – F6-09)	30.0%
F6-09	Time proportion of S-curve end segment	0.0% to (100.0% – F6-08)	30.0%

F6-08 and F6-09: These two function parameters define the time proportion of the start segment and end segment of the S-curve acceleration/deceleration, respectively. They must satisfy  $F6-08 + F6-09 \leq 100.0\%$ .

In the following figure,  $t_1$  is set by F6-08, and  $t_2$  is set by F6-09. The output frequency slope increases gradually in  $t_1$  and decreases gradually to 0 in  $t_2$ . The slope remains unchanged between  $t_1$  and  $t_2$ , that is, linear acceleration/deceleration.

Figure 7-19 Static S-curve acceleration/deceleration



Function Code	Parameter Name	Setting Range	Default
F6-10	Stop mode	0: Decelerate to stop 1: Coast to stop	0

F6-10: This function parameter defines the stop mode of the AC drive.

0. Decelerate to stop

Once the stop command is input, the AC drive decreases the output frequency based on the deceleration time to 0.

1. Coast to stop

Once the stop command is input, the AC drive immediately stops output. The motor then coasts to stop based on the mechanical inertia.

Function Code	Parameter Name	Setting Range	Default
F6-11	DC injection braking 2 frequency threshold	0.00 Hz to maximum frequency	0.00 Hz
F6-12	DC injection braking 2 delay time	0.0 to 100.0s	0.0s
F6-13	DC injection braking 2 level	0% to 100%	0%
F6-14	DC injection braking 2 active time	0.0s to 100.0s	0.0s

F6-11 to and F6-14: These function parameters define the DC injection braking function at stop.

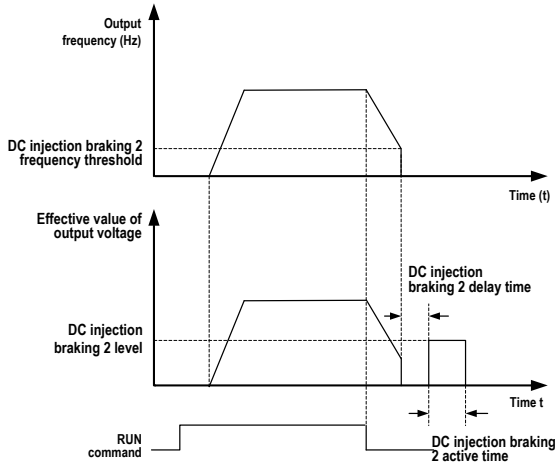
F6-11: The AC drive starts DC injection braking when the running frequency decreases to the value set in this parameter in the process of deceleration to stop.

F6-12: When the running frequency decreases to the value set in F6-11, the AC drive stops output for a time and then starts DC injection braking. This prevents the occurrence of fault such as overcurrent caused by direct DC injection braking at high speed.

F6-13: It indicates the output current at DC injection braking and is percentage of the rated motor current. The larger this setting value is, the better DC injection braking result is obtained, but the motor and AC drive overheat more.

F6-14: If it is set to 0, DC injection braking is disabled.

Figure 7-20 DC injection braking function diagram at stop



Function Code	Parameter Name	Setting Range	Default
F6-15	Braking use ratio	0% to 100%	100%

F6-15: It is effective for the AC drive with internal braking unit only. It adjusts the duty ratio of the braking unit. The larger the value is, the better the braking result will be achieved. But too large setting will cause big fluctuation of bus voltage.

Function Code	Parameter Name	Setting Range	Default
F6-18	Catching a spinning motor current limit	30% to 200%	100%


F6-18: It limits the current during the catching a spinning motor process.

Function Code	Parameter Name	Setting Range	Default
F6-21	Demagnetization time	0.0s to 5.0s	1.0s

There is still residual magnetism on the rotor windings in a short period every time the motor coasts to stop or stops due to occurrence of a fault. If the motor is restarted within short time after stop, overcurrent may occur.

## Group F7: Keypad Operation and LED Display

Function Code	Parameter Name	Setting Range	Default
F7-01	MF.K Key function selection	0: MF.K key disabled 1: Keypad control and remote control switchover (terminal or communication) 2: Forward RUN and reverse RUN switchover 3: Forward jog 4: Reverse jog	0

F7-01: This function parameter sets the function of the  key.

0. MF.K key disabled

The MF.K key has no function.

1. Keypad control and remote control switchover (terminal or communication)

You can perform switchover from the command source to keypad control. If the command source is keypad, this key is inactive.

2. Forward RUN and reverse RUN switchover

You can change the direction of the frequency reference via the MF.K key. It is active only when the command source is keypad.

3. Forward jog

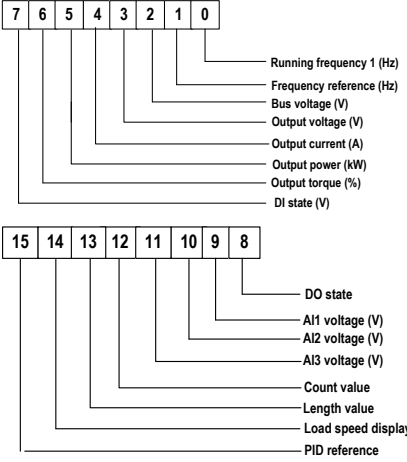
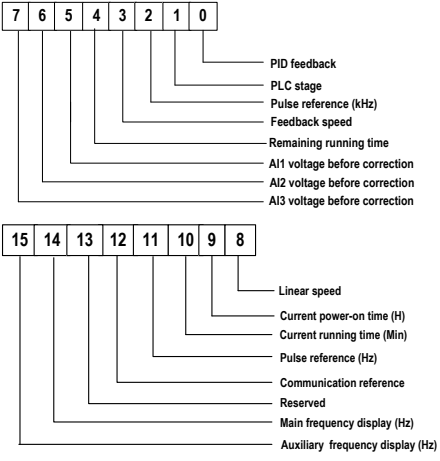
You can implement forward jog (FJOG) via the MF.K key.

4. Reverse jog

You can implement reverse jog (RJOG) via the MF.K key.

Function Code	Parameter Name	Setting Range	Default
F7-02	STOP/RESET key function	0: Stop function enabled only in keypad control 1: Stop function enabled in any operation mode	1

F7-02: This function parameter sets the function of the STOP/RESET key.

Function Code	Parameter Name	Setting Range	Default
F7-03	LED display running parameters 1	0000 to FFFF  <p>If a parameter needs to be displayed during the running, set the corresponding bit to 1, and set F7-03 to the hexadecimal equivalent.</p>	1F
F7-04	LED display running parameters 2	0000 to FFFF  <p>If a parameter needs to be displayed during the running, set the corresponding bit to 1, and set F7-04 to the hexadecimal equivalent.</p>	0

F7-03 to and F7-04: You can set a maximum of 32 parameters that can be viewed during drive running according to the binary bits of these two parameters. The display starts from the lowest bit of F7-03.

Function Code	Parameter Name	Setting Range	Default
F7-05	LED display stop parameters	0000 to 1FFF 	33

If a parameter needs to be displayed during the running, set the corresponding bit to 1, and set F7-05 to the hexadecimal equivalent.

Function Code	Parameter Name	Setting Range	Default
F7-06	Load speed display coefficient	0.0001 to 6.5000	1.0000

F7-06: This function parameter adjusts the correspondence relationship between the output frequency of the AC drive and the load speed. For details, see the description of F7-12.

Function Code	Parameter Name	Setting Range	Default
F7-07	Heatsink temperature of inverter module	0.0°C to 120.0°C	-

F7-07: This function parameter displays the IGBT temperature of the inverter module. The IGBT overheat protection value of the inverter module varies with the drive model.

Function Code	Parameter Name	Setting Range	Default
F7-09	Accumulative running time	0 to 65535 h	0 h

F7-09: This function parameter displays the accumulative running time of the AC drive. After the accumulative running time reaches the value set in F8-17, the digital output terminal set for function 12 becomes on.



Function Code	Parameter Name	Setting Range	Default
F7-10	Performance software version	-	-
F7-11	Function software version	-	-
F7-12	Number of decimal places for load speed display	Unit's digit: Number of decimal places of U0-14	1
		0: 0 decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	
		Ten's digit: Number of decimal places of U0-19/U0-29	
		1: 1 decimal place 2: 2 decimal places	

F7-12: This function parameter sets the number of decimal places for load speed display. The following gives an example to explain how to calculate the load speed.

Assume that F7-06 (Load speed display coefficient) is 2.000 and F7-12 is 2 (2 decimal places). When the running frequency of the AC drive is 40.00 GHz, the load speed is  $40.00 \times 2.000 = 80.00$  (display of 2 decimal places).

If the AC drive is in the stop state, the load speed display is the speed corresponding to the frequency reference. If the frequency reference is 50.00 Hz, the load speed in the stop state is  $50.00 \times 2.000 = 100.00$  (display of 2 decimal places).

Function Code	Parameter Name	Setting Range	Default
F7-13	Accumulative power-on time	0 to 65535 h	0 h

F7-13: This function parameter displays the accumulative power-on time of the AC drive since delivery. If the time reaches the value set in F8-17, the digital output terminal set for function 24 becomes on.

Function Code	Parameter Name	Setting Range	Default
F7-14	Accumulative power consumption	0 to 65535 kWh	-

F7-14: This function parameter displays the accumulative power consumption of the AC drive until now.

Function Code	Parameter Name	Setting Range	Default
F7-15	Temporary performance software version	-	-
F7-16	Temporary function software version	-	-

## Group F8: Auxiliary Functions

Function Code	Parameter Name	Setting Range	Default
F8-00	Jog running frequency reference	0.00 Hz to maximum frequency	2.00 Hz
F8-01	Jog acceleration time	0.0s to 6500.0s	20.0s
F8-02	Jog deceleration time	0.0s to 6500.0s	20.0s

F8-00 to and F8-02: These three function parameters define the frequency reference, acceleration time and deceleration time for drive jog running.

In jog running mode, F6-00 must be set to 0 (direct startup) and F6-10 must be set to 0 (Decelerate to stop).

Function Code	Parameter Name	Setting Range	Default
F8-03	Acceleration time 2	0.0s to 6500.0s	Model dependent
F8-04	Deceleration time 2	0.0s to 6500.0s	Model dependent
F8-05	Acceleration time 3	0.0s to 6500.0s	Model dependent
F8-06	Deceleration time 3	0.0s to 6500.0s	Model dependent
F8-07	Acceleration time 4	0.0s to 6500.0s	Model dependent
F8-08	Deceleration time 4	0.0s to 6500.0s	Model dependent

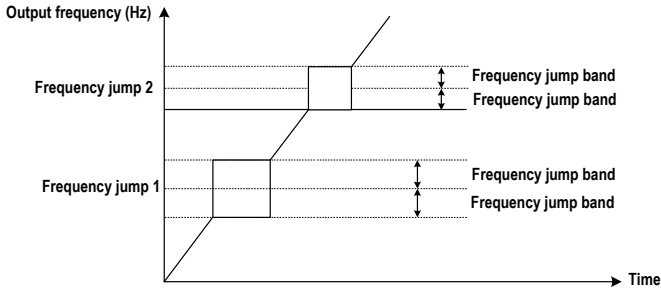
F8-03 to F8-08: These function parameters define the other three groups of acceleration/deceleration time. They are the same as F0-17 and F0-18, which define the first group of acceleration/deceleration time.

You can perform switchover amongst the four groups of acceleration/deceleration time through state combinations of DI terminals. For details, see the description of F4-01 to F4-05.

Function Code	Parameter Name	Setting Range	Default
F8-09	Frequency jump 1	0.00 Hz to max. frequency	0.00 Hz
F8-10	Frequency jump 2	0.00 Hz to max. frequency	0.00 Hz
F8-11	Frequency jump band	0.00 Hz to max. frequency	0.00 Hz

F8-09 to F8-11: The frequency jump function enables the AC drive to avoid the mechanical resonance point of the load. The MD290 can be set with two separate frequencies. If both are set to 0, the frequency jump function is disabled.

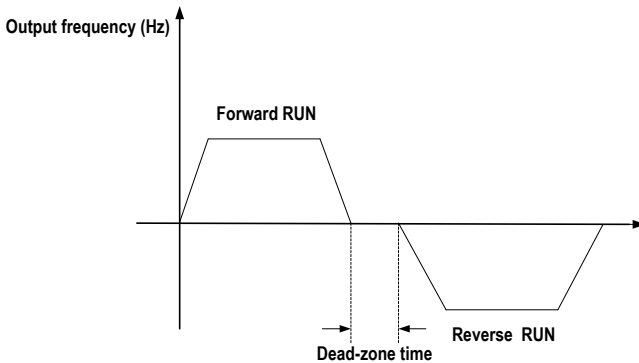
Figure 7-21 Jump frequency function



Function Code	Parameter Name	Setting Range	Default
F8-12	Forward/Reverse rotation dead-zone time	0.0s to 3000.0s	0.0s

F8-12: This function parameter sets the time of 0 Hz output at transition of forward RUN and reverse RUN of the AC drive.

Figure 7-22 Forward run and reverse run switchover dead-zone time



Function Code	Parameter Name	Setting Range	Default
F8-13	Reverse RUN selection	0: Enabled 1: Disabled	0

F8-13: This function parameter determines whether reverse RUN is allowed. In the applications where reverse RUN is prohibited, set this parameter to 1.

Function Code	Parameter Name	Setting Range	Default
F8-14	Running mode when frequency reference lower than frequency lower limit	0: Run at frequency lower limit 1: Stop 2: Run at zero speed	0

F8-14: This function parameter set the drive running mode when the frequency reference is lower than the frequency lower limit.

Function Code	Parameter Name	Setting Range	Default
F8-15	Droop control	0.00 to 10.00 Hz	0.00 Hz

F8-15: The droop control function aims at balancing the load level of multiple motors that drive the same load.

The output frequency of the AC drive decreases as the load increases. In this way, the load level of the motor is reduced by decreasing the output frequency for this motor, implementing load level balancing.

Function Code	Parameter Name	Setting Range	Default
F8-16	Accumulative power-on time threshold	0 to 65000 h	0 h

F8-16: If the accumulative power-on time (F7-13) reaches the value set in this parameter, the digital output terminal set for function 24 becomes ON.

For example, to enable the AC drive to output Err29 when the accumulative power-on time reaches 100 hours, perform the following settings:

Setting	Description
A1-00 = 44	Allocate VDI with the user-defined fault 1 function.
A1-05 = 0000	The active state of VDI1 is from VDO1.
A1-11 = 24	Allocate VDO1 with the power-on time reached function.
F8-16 = 100	Set the accumulative power-on time threshold to 100 hours.

Function Code	Parameter Name	Setting Range	Default
F8-17	Accumulative running time threshold	0 to 65000 h	0 h

F8-17: If the accumulative running time (F7-09) reaches the value set in this parameter, the digital output terminal set for function 12 becomes on.

Function Code	Parameter Name	Setting Range	Default
F8-18	Startup protection selection	0: Enabled 1: Disabled	0

F8-18: This function parameter determines whether to enable safety protection at drive startup. If such protection is enabled (F8-18 = 1), the AC drive will not respond to the RUN command that is input at power-on or fault reset. This helps to avoid unexpected motor running at power-on or fault reset.

The AC drive will get out of startup protection after you cancel the RUN command.

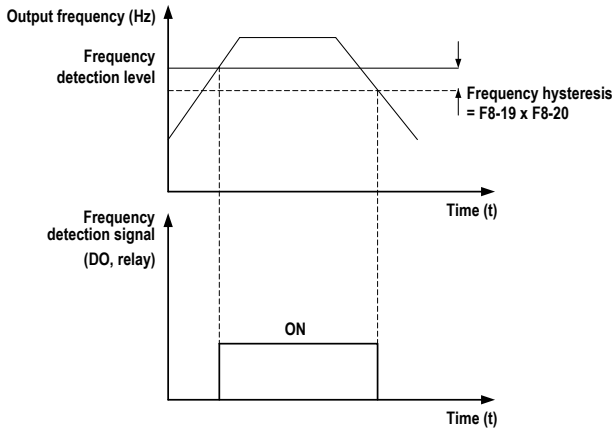
Function Code	Parameter Name	Setting Range	Default
F8-19	Frequency detection level 1	0.00 Hz to max. frequency	50.00 Hz
F8-20	Frequency detection level 1 hysteresis	0.0% to 100.0%	5.0%

F8-19 and F8-20: These two function parameters set the frequency detection function that can be allocated to digital output terminals.

F8-19: It sets the detection level for the digital output function 3. When the drive running frequency exceeds the detection level, the digital output terminal set for function 3 becomes on.

F8-20: It sets the hysteresis level for the frequency detection function. It is the percentage of frequency hysteresis relative to the frequency detection level (F8-19).

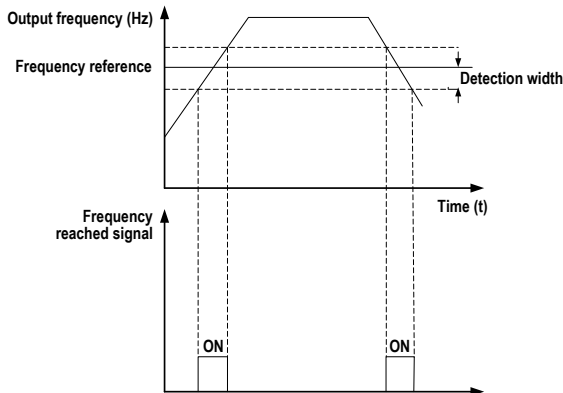
Figure 7-23 Frequency detection function



Function Code	Parameter Name	Setting Range	Default
F8-21	Detection width of frequency reference	0.00 to 100%	0.0%

F8-21: This function parameter sets the detection width of frequency reference. It is a percentage relative to the maximum frequency. When the drive's output frequency reaches the width, the digital output terminal set for function 4 becomes on.

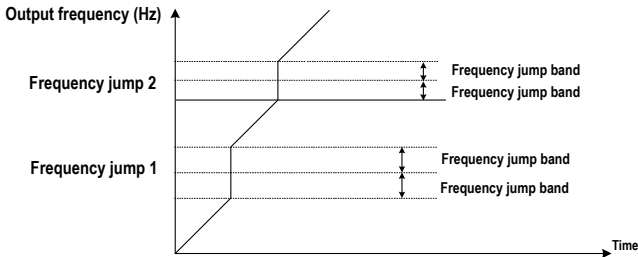
Figure 7-24 Frequency reached detection width



Function Code	Parameter Name	Setting Range	Default
F8-22	Selection of frequency jump during acceleration/ deceleration	0: Disabled 1: Enabled	1

F8-22: This function parameter determines whether frequency jump is enabled during acceleration/ deceleration. If it is enabled, when the running frequency is within the jump band, the AC drive will jump over the jump band.

Figure 7-25 Frequency jump during acceleration/deceleration



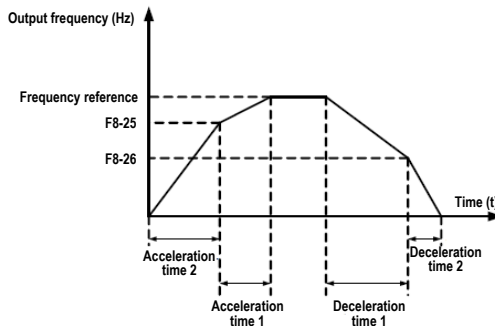
Function Code	Parameter Name	Setting Range	Default
F8-25	Frequency point of switchover of accel time 1 and accel time 2	0.00 Hz to max. frequency	0.00 Hz
F8-26	Frequency point for switchover of decel time 1 and decel time 2	0.00 Hz to max. frequency	0.00 Hz

F8-25 and F8-26: These two function parameters determine selection of acceleration /deceleration time. This function is active only when motor 1 is selected and acceleration/deceleration time is not switched over via external DI terminal.

During acceleration, if the running frequency is below F8-25, acceleration time 2 is selected. If it is above F8-25, acceleration time 1 is selected.

During deceleration, if the running frequency is above F8-26, deceleration time 1 is selected. If it is below F8-26, deceleration time 2 is selected.

Figure 7-26 Acceleration time and deceleration time switchover



Function Code	Parameter Name	Setting Range	Default
F8-27	Selection of terminal jog preferred	0: Disabled 1: Enabled	0

F8-27: This function parameter determines whether terminal jog is preferred. If this function is enabled, the AC drive will switch over to terminal jog running state when a terminal jog command is input during drive running.

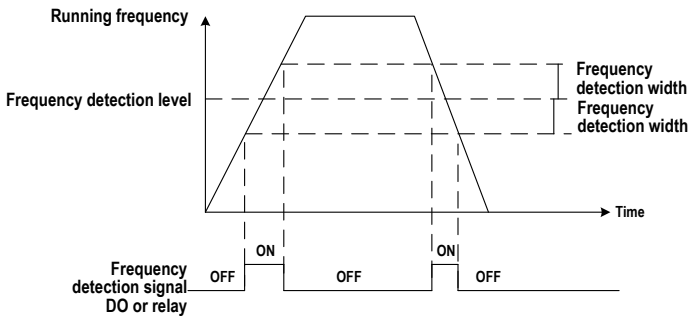
Function Code	Parameter Name	Setting Range	Default
F8-28	Frequency detection level 2	0.00 Hz to max. frequency	50.00 Hz
F8-29	Frequency detection level 2 hysteresis	0.0% to 100.0%	5.0%

F8-28 and F8-29: They are the same as F8-19 and F8-20. Refer to the description of the two parameters.

Function Code	Parameter Name	Setting Range	Default
F8-30	Detection of frequency 1	0.00 Hz to max. frequency	50.00 Hz
F8-31	Detection width of frequency 1	0.0% to 100.0% (max. frequency)	0.0%
F8-32	Detection of frequency 2	0.00 Hz to max. frequency	50.00 Hz
F8-33	Detection width of frequency 2	0.0% to 100.0% (max. frequency)	0.0%

F8-30 to F8-32: These function parameters set the detection level and width of two frequencies. The MD290 provides two groups of frequency detection parameters for the digital output functions 26 and 27.

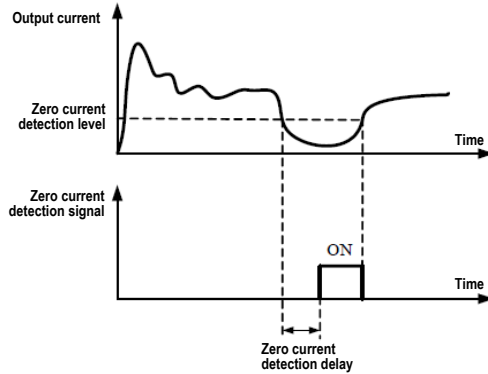
Figure 7-27 Any frequency reached detection



Function Code	Parameter Name	Setting Range	Default
F8-34	Zero current detection level	0.0% to 300.0% (rated motor current)	5.0%
F8-35	Zero current detection delay	0.01s to 600.00s	0.10s

F8-34 and F8-35: These two function parameters set the detection level and delay of zero current for the digital output function 34. If the drive's output current is equal to or smaller than the value set in F8-34 and the duration exceeds the value set in F8-35, the digital output terminal set for function 34 becomes on.

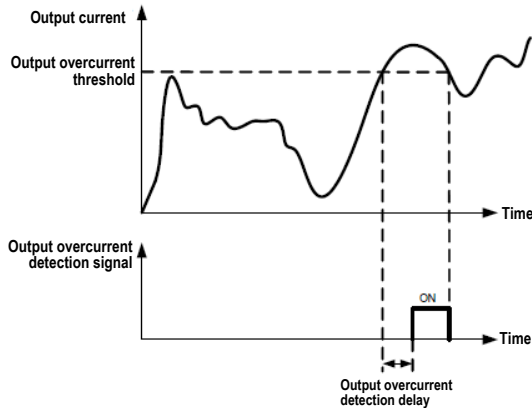
Figure 7-28 Zero current detection delay



Function Code	Parameter Name	Setting Range	Default
F8-36	Output overcurrent threshold	0.0% (no detection) 0.1% to 300.0% (rated motor current)	200.0%
F8-37	Output overcurrent detection delay	0.00s to 600.00s	0.00s

F8-36 and F8-37: These two function parameters set overcurrent protection for the digital output function 36. If the drive's output current is equal to or smaller than the value set in F8-36 and the duration exceeds the value set in F8-37, the digital output terminal set for function 34 becomes on.

Figure 7-29 Detection of output current exceeding the limit

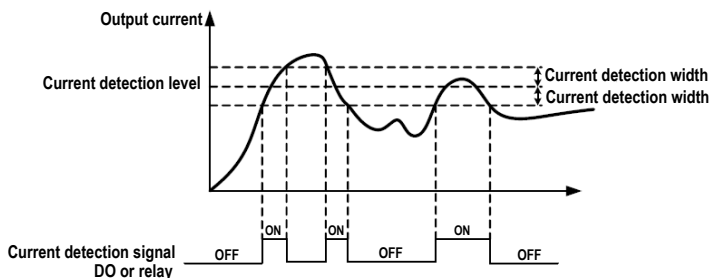




Function Code	Parameter Name	Setting Range	Default
F8-38	Detection of current 1	0.0% to 300.0% (rated motor current)	100.0%
F8-39	Detection width of current 1	0.0% to 300.0% (rated motor current)	0.0%
F8-40	Detection of current 2	0.0% to 300.0% (rated motor current)	100.0%
F8-41	Detection width of current 2	0.0% to 300.0% (rated motor current)	0.0%

F8-38 and F8-41: These function parameters set the detection level and width of current 1 and current 2 for the digital output functions 28 and 29. If the drive's output current reaches the width, the digital output terminals set for functions 28 and 29 become on.

Figure 7-30 Any frequency reached detection



Function Code	Parameter Name	Setting Range	Default
F8-42	Timing function	0: Disabled 1: Enabled	0
F8-43	Timing running time setting channel	0: Set by F8-44 1: AI1 2: AI2 3: AI3 (100% of analog input corresponds to the value of F8-44)	0
F8-44	Timing running time	0.0 to 6500.0 min	0.0

F8-42 and F8-44: These function parameters define the timing function of the AC drive. Once it is enabled, the AC drive starts timing from startup. When the set timing running time is reached, the AC drive stops automatically and the digital output terminal set for the function 30 becomes on.

The AC drive starts timing from 0 again for each startup. You can view the remaining timing running time in U0-20.

Function Code	Parameter Name	Setting Range	Default
F8-45	AI1 input voltage lower limit	0.00 V to F8-46	3.10 V
F8-46	AI1 input voltage upper limit	F8-45 to 11.00 V	6.80 V

F8-45 and F8-46: These two function parameters indicate whether the AI1 input voltage is in the setting range. If the AI1 input is larger than F8-46 or smaller than F8-45, the digital output terminal set for the function 31 becomes on.

Function Code	Parameter Name	Setting Range	Default
F8-47	Module temperature threshold	0°C to 100°C	75°C

F8-47: This function parameter sets the module temperature threshold. When the heatsink temperature reaches the value set in F8-47, the digital output terminal set for the function 35 becomes on.

Function Code	Parameter Name	Setting Range	Default
F8-48	Cooling fan working mode	0: Working during drive running 1: Working continuously	0

F8-48: This function parameter sets the working mode of the cooling fan.

0. Working during running

The fan works during drive running. When the drive stops, the fan works if the heatsink temperature is above 40°C and stops if the heatsink temperature is below 40°C.

1. Working continuously

The fan keeps working after power-on.

Function Code	Parameter Name	Setting Range	Default
F8-49	Wakeup frequency	Hibernating frequency (F8-51) to max. frequency (F0-10)	0.00 Hz
F8-50	Wakeup delay time	0.0s to 6500.0s	0.0s
F8-51	Hibernating frequency	0.00 Hz to wakeup frequency (F8-49)	0.00 Hz
F8-52	Hibernating delay time	0.0s to 6500.0s	0.0s

F8-49 to F8-52: These function parameters define the hibernating and wakeup function in the water supply application. Generally, set the wakeup frequency equal to or higher than the hibernating frequency. If they are set to 0, the function is disabled.

During drive running, when the frequency reference is equal to or smaller than F8-51, the AC drive enters the hibernating state after the delay set in F8-52.

In the hibernating state, when the frequency reference is equal to or larger than F8-49, the AC drive wakes up after the delay set in F8-50.

When the frequency source is PID, whether to perform PID operation in the hibernating state is determined by FA-28 (Selection of PID operation at stop).

Function Code	Parameter Name	Setting Range	Default
F8-53	Current running time reached	0.0–6500.0 min	0.0 min

F8-53: This function parameter sets the current running time. If the current running time reaches the value set in this parameter, the digital output terminal set for the function 40 becomes on, indicating that the current running time is reached.

Function Code	Parameter Name	Setting Range	Default
F8-54	Output power correction coefficient	0.0% to 200.0%	100.0%

When the output power (U0-05) is not equal to the required value, you can perform linear correction on output power by using this parameter.

### Group F9: Fault and Protection

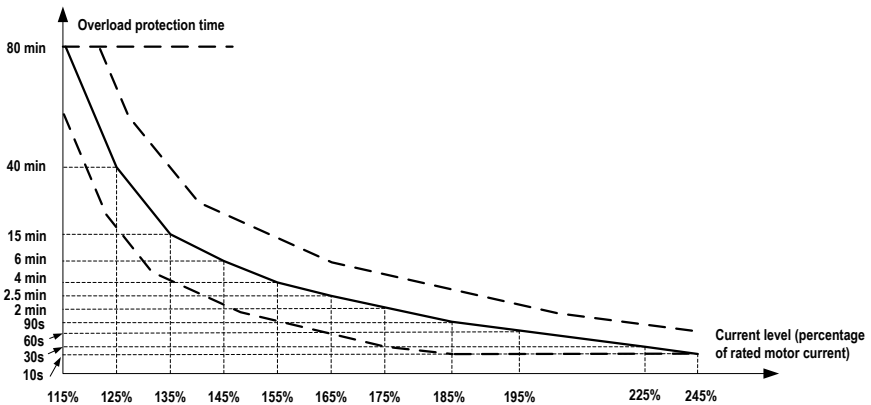
Function Code	Parameter Name	Setting Range	Default
F9-00	Motor overload protection selection	0: Disabled 1: Enabled	1
F9-01	Motor overload protection gain	0.20 to 10.00	1.00

- F9-00 = 0: The motor overload protection is disabled. In this case, install a thermal relay on the input side of the motor.
- F9-00 = 1: The AC drive judges whether the motor is inverse time-lag curve.

If the motor overload current level and the overload protection time need be adjusted, modify the setting of F9-01.

The inverse time-lag curve is shown in the following figure.

Figure 7-31 Inverse time-lag curve



When the motor running current reaches 175% of the rated motor current and the motor runs at this level for 2 minutes, Err11 (motor overload) is reported. When the motor running current reaches 115% of the rated motor current and the motor runs at this level for 80 minutes, Err11 is reported.

Suppose that the rated motor current is 100 A.

- F9-01 = 1.00: According to Figure 7-47, when the motor running current reaches 125 A (125% of 100 A) and the motor runs at 125 A for 40 minutes, Err11 is reported.
- F9-01 = 1.20: According to Figure 7-47, when the motor running current reaches 125 A (125% of 100 A) and the motor runs at 125 A for  $40 \times 1.2 = 48$  minutes, Err11 is reported.

**Note**

The motor overload protection supports the longest 80 minutes and the shortest 10 seconds.

For example, the application requires report of Err11 when the motor runs at 150% of rated motor current for two minutes.

According to Figure 7-47, 150% (I) is in the range of 145% (I1) and 155% (I2). 145% corresponds to the overload protection time 6 minutes (T1) and 145% corresponds to the overload protection time 4 minutes (T2). You can calculate the overload protection time T corresponding to 150% from the following formula:

$$T = T1 + (T2 - T1) \times (I - I1) / (I2 - I1) = 4 + (6 - 4) \times (150\% - 145\%) / (155\% - 145\%) = 5 \text{ minutes}$$

Then you can calculate the motor overload protection gain from the following formula:  $F9-01 = \text{Desired overload protection time} / \text{Corresponding overload protection time} = 2 / 5 = 0.4$ .

#### Note

Set F9-01 properly according to the actual overload capacity of the motor. If the setting is too large, the AC drive may not report Err11 timely when the motor is damaged due to overheating.

Function Code	Parameter Name	Setting Range	Default
F9-02	Motor overload pending coefficient	50% to 100%	80%

F9-02: The AC drive has the motor overload pending function that reminds of motor overload in advance through the digital output function 6.

When the accumulative output current of the AC drive reaches above the inverse time-lag curve x F9-02, the DO terminal set for the function outputs the ON signal.

Function Code	Parameter Name	Setting Range	Default
F9-07	Detection of short-circuit to ground upon power-on	0: Disabled 1: Enabled	0

F9-07: This function parameter determines whether to detect motor short circuit to ground at power-on. If this function is enabled, the AC drive's UVW will have voltage output for a while after power-on.

Function Code	Parameter Name	Setting Range	Default
F9-08	Braking unit action voltage	700 to 800 V	780 V

F9-08: The braking unit action voltage  $V_{break}$  must satisfy  $800 \geq V_{break} \geq (1.414 \times V_s + 30)$ .  $V_s$  represents the AC power voltage input to the AC drive.

Note that improper setting of this parameter may result in abnormal running of the built-in braking unit.

Function Code	Parameter Name	Setting Range	Default
F9-09	Auto reset times	0 to 20	0

F9-09: This function parameter sets the allowable times of auto fault reset. If the reset times exceed the value set in this parameter, the AC drive will keep the fault state.

Function Code	Parameter Name	Setting Range	Default
F9-10	Selection of DO action during auto reset	0: Not act 1: Act	0

F9-10: This function parameter decides whether the digital output terminal set for the fault output acts during the fault reset.

Function Code	Parameter Name	Setting Range	Default
F9-11	Delay of auto reset	0.1s to 100.0s	1.0s

F9-11: This function parameter sets the delay of auto reset after the AC drive reports a fault.

Function Code	Parameter Name	Setting Range	Default
F9-12	Selection of power input phase loss protection	0: Disabled 1: Enabled	1

F9-12: This function parameter determines whether to perform power input phase loss protection.

Function Code	Parameter Name	Setting Range	Default
F9-13	Power output phase loss protection	0: Disabled 1: Enabled	1

F9-13: This function parameter determines whether to perform power output phase loss protection.

Function Code	Parameter Name	Setting Range
F9-14	1st fault type	0 to 51
F9-15	2nd fault type	
F9-16	3rd (latest) fault type	

F9-14 to F9-16: These function parameters record the types of the most recent three faults. 0 indicates no fault.

Function Code	Parameter Name	Setting Range
F9-17	Frequency upon 3rd fault	It displays the frequency when the latest fault occurs.
F9-18	Current upon 3rd fault	It displays the current when the latest fault occurs.
F9-19	Bus voltage upon 3rd fault	It displays the bus voltage when the latest fault occurs.

Function Code	Parameter Name	Descriptions																				
F9-20	DI state upon 3rd fault	<p>It displays the state of all DI terminals when the latest fault occurs.</p> <table border="1"> <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>DI10</td><td>DI9</td><td>DI8</td><td>DI7</td><td>DI6</td><td>DI5</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td> </tr> </table> <p>If a DI is on, the setting is 1. If the DI is off, the setting is 0. The display is the equivalent decimal number converted from the binary settings.</p>	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	DI10	DI9	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1
Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0													
DI10	DI9	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1													
F9-21	Digital output terminal state upon 3rd fault	<p>It displays the state of all digital output terminals when the latest fault occurs.</p> <table border="1"> <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> <p>If an output terminal is on, the setting is 1. If the output terminal is off, the setting is 0. The display is the equivalent decimal number converted from the binary settings.</p>	Bit4	Bit3	Bit2	Bit1	Bit0	DO2	DO1	REL2	REL1	FMP										
Bit4	Bit3	Bit2	Bit1	Bit0																		
DO2	DO1	REL2	REL1	FMP																		
F9-22	AC drive state upon 3rd fault	Reserved																				
F9-23	Current power-on time upon 3rd fault	It displays the current power-on time when the latest fault occurs.																				
F9-24	Current running time upon 3rd fault	It displays the current running time when the latest fault occurs.																				
F9-27	Frequency upon 2nd fault	Same as F9-17 to F9-24.																				
F9-28	Current upon 2nd fault																					
F9-29	Bus voltage upon 2nd fault																					
F9-30	DI state upon 2nd fault																					
F9-31	Digital output terminal state upon 2nd fault																					
F9-32	AC drive state upon 2nd fault																					
F9-33	Current power-on time upon 2nd fault																					
F9-34	Current running time upon 2nd fault																					
F9-37	Frequency upon 1st fault	Same as F9-17 to F9-24.																				
F9-38	Current upon 1st fault																					
F9-39	Bus voltage upon 1st fault																					
F9-40	DI state upon 1st fault																					
F9-41	Digital output terminal state upon 1st fault																					
F9-42	AC drive state upon 1st fault																					
F9-43	Current power-on time upon 1st fault																					
F9-44	Current running time upon 1st fault																					

F9-17 to F9-44: These function parameters record the frequency, current, bus voltage, DI state, digital output terminal state, AC drive state, power-on time and running time at occurrence of the three faults.

Function Code	Parameter Name	Setting Range	Default
F9-47	Fault protection action selection 1	0: Coast to stop 1: Stop according to the stop mode 2: Continue to run	00000
		Unit's digit: Motor overload (Err11)	
		Ten's digit: Power input phase loss (Err12)	
		Hundred's digit: Power output phase loss (Err13)	
		Thousand's digit: External fault (Err15)	
		Ten thousand's digit: Communication fault (Err16)	
		F9-48	
Ten's digit: EEPROM read-write fault (Err21)			
0: Coast to stop 1: Stop according to the stop mode			
Hundred's digit: Reserved			
Thousand's digit: Reserved			
Ten thousand's digit: Accumulative running time reached (Err26) 0: Coast to stop 1: Stop according to the stop mode 2: Continue to run			
F9-49	Fault protection action selection 3	Unit's digit: User-defined fault 1 (Err27) 0: Coast to stop 1: Stop according to the stop mode 2: Continue to run	00000
		Ten's digit: User-defined fault 2 (Err28) Same as unit's digit	
		Hundred's digit: Power-on time reached (Err29) Same as unit's digit	
		Thousand's digit: Load lost (Err30) 0: Coast to stop 1: Stop according to the stop mode 2: Continue to run at 7% of rated motor frequency and restore to the frequency reference if the load does not get lost	
		Ten thousand's digit: PID feedback lost during drive running (Err31) Same as unit's digit	

Function Code	Parameter Name	Setting Range	Default
F9-50	Fault protection action selection 4	0: Coast to stop	00000
		1: Stop according to the stop mode	
		2: Continue to run	
		Unit's digit: Too large speed feedback error (Err42)	
		Ten's digit: Reserved	
		Hundred's digit: Reserved	
		Thousand's digit: Reserved	
		Ten thousand's digit: Reserved	

F9-47 to F9-50: These function parameters set the action mode of the AC drive at occurrence of fault.

0. Coast to stop

The AC drive displays Err\*\* and directly stops.

1. Stop according to the stop mode

The AC drive displays A\*\* and stops according to the stop mode. After stop, the AC drive displays Err\*\*.

2. Continue to run

The AC drive continues to run and displays A\*\*. The running frequency is set in F9-54.

Function Code	Parameter Name	Setting Range	Default
F9-54	Frequency selection for continuing to run upon fault	0: Current running frequency 1: Frequency reference 2: Frequency upper limit 3: Frequency lower limit 4: Backup frequency upon abnormality	0
F9-55	Backup frequency upon abnormality	0.0% to 100.0% (max. frequency)	100.0%

F9-54 to F9-55: These function parameters define the running frequency of the AC drive when "Continue to run" is selected at occurrence of fault. The setting value of F9-55 is a percentage of maximum frequency.

Function Code	Parameter Name	Setting Range	Default
F9-56	Type of motor temperature sensor	0: No temperature sensor 1: PT100 2: PT1000	0
F9-57	Motor overheat protection threshold	0°C to 200°C	110°C
F9-58	Motor overheat pending threshold	0°C to 200°C	90°C

A motor temperature sensor can be connected to the AI3 and PGND on the extension I/O card. This input is used by the drive for motor overheat protection.



When the input signal reaches the value set in F9-57, the AC drive reports Err25 and acts as selected in the thousand's digit in F9-48. When the input signal reaches the value set in F9-58, the digital output terminal set for the function 39 becomes on.

The MD290 supports both PT100 and PT1000. Make sure to set the sensor type correctly. You can view the motor temperature in U0-34.

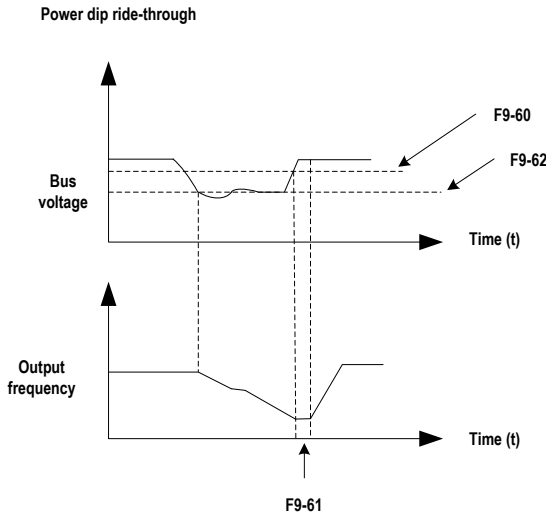
■ Power Dip Ride-through

F9-59 to F9-62: These function parameters define the power dip ride-through function. When an instantaneous power loss or a sudden power dip occurs, the AC drive compensates the DC bus voltage reduction with the real-time energy feedback by reducing the output frequency.

F9-59 = 1: When power dip occurs, the AC drive decelerates. When the bus voltage recovery ramp time is longer than the value set in F9-61, the AC drive accelerates to the frequency reference.

F9-59 = 2: When power dip occurs, the AC drive decelerates to stop.

Figure 7-32 The power dip ride-through function



Function Code	Parameter Name	Setting Range	Default
F9-59	Power dip ride-through function selection	0: Disabled 1: Bus voltage constant control 2: Decelerate to stop	0
F9-60	Voltage level of power dip ride-through function disabled	85% to 100%	85%
F9-61	Judging time of bus voltage recovering from power dip	0.0s to 10.0s	0.5s
F9-62	Judging time of power dip action	60s to 100s	80s
F9-71	Power dip ride-through gain Kp	0 to 100	30

Function Code	Parameter Name	Setting Range	Default
F9-72	Power dip ride-through integral coefficient Ki	0 to 100	40
F9-73	Power dip ride-through action deceleration time	0.0s to 300.0s	20.0s

### Note

- In the bus voltage constant control mode, when the line voltage recovers, the AC drive continues to accelerate to the target frequency. In the deceleration to stop mode, when the line voltage recovers, the AC drive continues to decelerates to 0 Hz and stops.
- The power dip ride-through function is purposed to ensure the motor to decelerate to stop normally when the line voltage is abnormal, and to start immediately once the line voltage recovers to normal. This is to prevent the motor from coasting to stop suddenly due to the undervoltage fault when the line voltage is abnormal. It takes the motor very long time to coast to stop for large-inertia system. After the line voltage recovers to normal, restart of the motor spinning at high speed will result in the overload or overcurrent fault to the AC drive.

Function Code	Parameter Name	Setting Range	Default
F9-63	Selection of load lost protection	0: Disabled 1: Enabled	0
F9-64	Load lost detection level	0.0% to 100.0% (rated motor current)	10.0%
F9-65	Load lost detection time	0.0s to 60.0s	1.0s

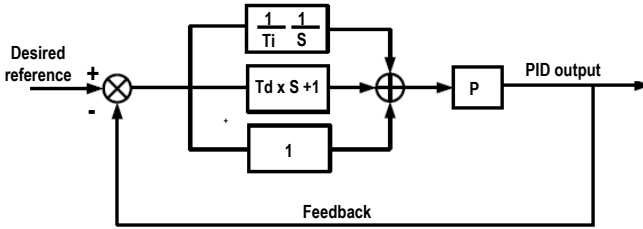
These function parameters define the load lost protection function.

When the output current of the AC drive falls below the detection level (F9-64) for longer than the time set in F9-65, the AC drive automatically declines the output frequency to 7% of the rated frequency. Once the load recovers during protection, the AC drive accelerates to the frequency reference.

### Group FA: PID Function

The PID (Proportional + Integral + Derivative) function uses system feedback for closed-loop control of variables such as flow, pressure, temperature, and so on. The purpose of the PID control is to keep the drive output frequency as close as possible to a desired reference via the PID adjustment.

Figure 7-33 PID function



Function Code	Parameter Name	Setting Range	Default
FA-00	PID reference source	0: Set by FA-01 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference 6: Multi-reference	0
FA-01	PID digital setting	0.0% to 100.0%	50.0%

FA-00 and FA-01: These function parameters set the input channel of the PID reference. The PID reference is a relative value and ranges from 0.0% to 100.0%. The PID feedback is also a relative value. The PID function is aimed at making the PID reference and the PID feedback as close as possible.

Function Code	Parameter Name	Setting Range	Default
FA-02	PID feedback source	0: AI1 1: AI2 2: AI3 3: AI1 - AI2 4: Pulse reference (DI5) 5: Communication reference 6: AI1 + AI2 7: Max. ( AI1 ,  AI2 ) 8: Min. ( AI1 ,  AI2 )	0

FA-02: This function parameter sets the PID feedback channel. The PID feedback is a relative value and ranges from 0.0% to 100.0%.

Function Code	Parameter Name	Setting Range	Default
FA-03	PID operation direction	0: Forward operation 1: Reverse operation	0

FA-03: This function parameter sets the direction of the PID operation. It is influenced by the DI function 35 "PID operation direction reverse".

- Forward operation

When the PID feedback is smaller than the reference, the AC drive increases the output frequency. The winding tension control requires forward PID operation.

- Reverse operation

When the PID feedback is smaller than the reference, the AC drive decreases the output frequency. The unwinding tension control requires reverse PID operation.

Function Code	Parameter Name	Setting Range	Default
FA-04	PID reference and feedback range	0 to 65535	80%

FA-04: It is a non-dimensional parameter and is used for calculate the display of PID reference (U0-15) and PID feedback (U0-16).

- $U0-15 = \text{PID reference (percentage)} \times \text{FA-04}$
- $U0-16 = \text{PID feedback (percentage)} \times \text{FA-04}$

For example, if FA-04 is set to 2000 and PID reference is 100.0%, the display of PID reference (U0-15) is 2000.

Function Code	Parameter Name	Setting Range	Default
FA-05	Proportional gain Kp1	0.0 to 100.0	20.0
FA-06	Integral time Ti1	0.01s to 10.00s	2.00s
FA-07	Differential time Td1	0.00s to 10.000s	0.000s

FA-05 to FA-07: These function parameters are the proportional gain (Kp1), integral time (Ti1) and derivative time (Td1) of PID control.

- Proportional gain (Kp1)

A large value tends to reduce the present error, but too large setting will cause system oscillation.

- Integral time (Ti1)

The shorter the integral time is, the faster the error will be predicted. But too short setting will cause overshoot or system oscillation.

- Derivative time (Td1)

The longer the derivative time is, the faster the system will respond to the error. But too longer setting will cause vibration.

Function Code	Parameter Name	Setting Range	Default
FA-08	Negative PID output limit	0.00 Hz to max. frequency	2.00 Hz

FA-08: This function parameter sets the limit of the negative PID output (the AC drive runs in the reverse direction) because too high negative PID output is not allowed in some applications.

Function Code	Parameter Name	Setting Range	Default
FA-09	PID error limit	0.0% to 100.0%	0.0%

FA-09: This function parameter sets the error limit of the PID reference and PID feedback. When the PID error reaches this level, the PID function becomes disabled. This function helps to stabilize the output frequency of the AC drive, effective for some closed-loop control applications.

Function Code	Parameter Name	Setting Range	Default
FA-10	PID Derivative limit	0.00% to 100.00%	0.10%

FA-10: This function parameter applies a limit to the derivative output, which is sensitive in PID function and may cause system oscillation.

Function Code	Parameter Name	Setting Range	Default
FA-11	PID reference change time	0.00s to 650.00s	0.00s

FA-11: This function parameter sets the time it takes the PID reference to change from 0.0% to 100.0%. The PID reference changes linearly based on the time set in this parameter, reducing negative impact of sudden PID reference change.

Function Code	Parameter Name	Setting Range	Default
FA-12	PID feedback filter time	0.00s to 60.00s	0.00s
FA-13	PID output filter time	0.00s to 60.00s	0.00s

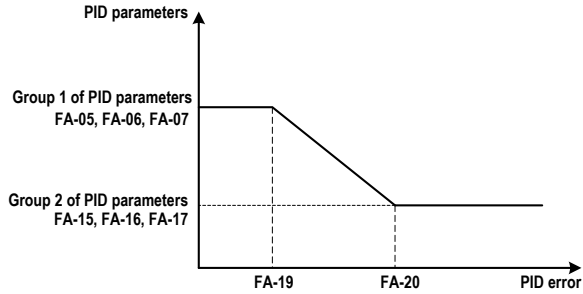
FA-12 and FA-13: These two function parameters provide filter function to the PID feedback and PID output, lowering interference on the PID feedback and weakening sudden change of the PID change but slowing the response of the process closed-loop system.

Function Code	Parameter Name	Setting Range	Default
FA-15	Proportional gain Kp2	0.0 to 100.0	20.0
FA-16	Integral time Ti2	0.01s to 10.00s	2.00s
FA-17	Differential time Td2	0.000s to 10.000s	0.000s
FA-18	PID parameter switchover condition	0: No switchover 1: Switchover via DI 2: Auto switchover based on PID error	0
FA-19	PID error 1 for auto switchover	0.0% to FA-20	20.0%
FA-20	PID error 2 for auto switchover	FA-19 to 100.0%	80.0%

FA-15 to FA-20: On some applications, switchover of PID parameters is required because one group of PID parameters cannot satisfy the requirement.

The switchover can be implemented either via a DI terminal or automatically implemented according to the PID error level.

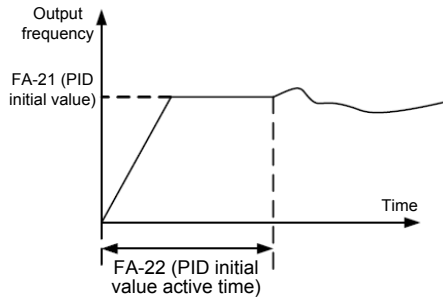
Figure 7-34 PID parameters switchover



Function Code	Parameter Name	Setting Range	Default
FA-21	PID initial value	0.0% to 100.0%	0.0%
FA-22	PID initial value active time	0.00s to 650.00s	0.00s

FA-21 and FA-22: When the AC drive starts up, the PID function acts only after the PID output is fixed at the PID initial value (FA-21) for the time set in FA-22.

Figure 7-35 The PID initial value



Function Code	Parameter Name	Setting Range	Default
FA-23	Max. deviation between two PID outputs in forward direction	0.00% to 100.00%	1.00%
FA-24	Max. deviation between two PID outputs in reverse direction	0.00% to 100.00%	1.00%

FA-23 and FA-24: These function parameters limit the deviation between two PID outputs (2 ms per PID output) to suppress rapid change of PID output and stabilize the drive running.

They correspond to the absolute maximum value of the output deviation in forward direction and in reverse direction.

Function Code	Parameter Name	Setting Range	Default
FA-25	Max. deviation between two PID outputs in reverse direction	Unit's digit: Integral separation 0: Disabled 1: Enabled	00
		Ten's digit: Whether to stop integral operation when the PID output reaches the limit 0: Continue integral operation 1: Stop integral operation	

FA-25: This function parameter determines whether to enable integral separation and whether to stop integral operation when the PID output reaches the limit.

If integral separation is enabled, when the DI set for the function 38 "PID integral disabled" is on, the integral operation becomes disabled. This moment, only the P gain and derivative time take effect.

If integral separation is disabled, no matter whether the DI set for the function 38 "PID integral disabled" is on, integral separation is inactive.

Function Code	Parameter Name	Setting Range	Default
FA-26	Detection level of PID feedback loss	0.0%: No detection 0.1% to 100.0%	0.0%
FA-27	Detection time of PID feedback loss	0.0s to 20.0s	0.0s

FA-26 and FA-27: These function parameters define the PID feedback loss detection function. When the PID feedback is smaller than the value set in FA-26 for the time set in FA-27, the AC drive reports Err31 and acts as selected in ten's thousand's digit in F9-49.

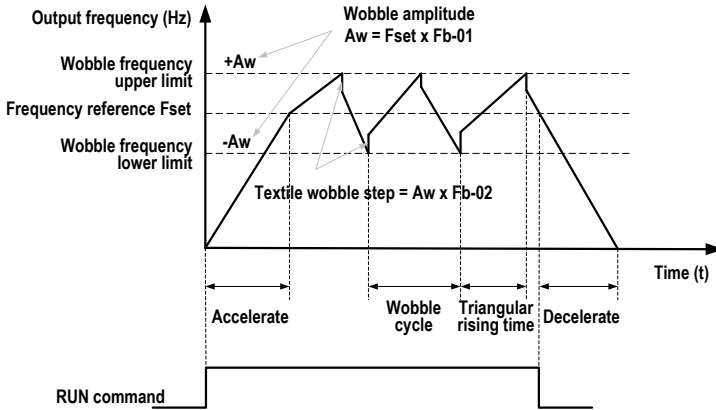
Function Code	Parameter Name	Setting Range	Default
FA-28	Selection of PID operation at stop	0: Disabled 1: Enabled	0

FA-28: This function parameter determines whether to continue PID operation when the AC drive stops. Generally, the PID operation is disabled in the stop state.

### Group Fb: Wobble Function, Fixed Length and Count

The wobble function is applicable to the industries such as textile and chemical fiber and the winding and unwinding applications. It indicates the output frequency wobbles up and down with the frequency reference as the center. The trace of the running frequency at the time axis is shown in the following figure.

Figure 7-36 Wobble function



Function Code	Parameter Name	Setting Range	Default
Fb-00	Wobble setting mode	0: Relative to the frequency reference 1: Relative to the max. frequency	0

Fb-00: This function parameter selects the base value of the wobble amplitude.

Fb-00 = 0: It is a variable wobble amplitude system. The wobble amplitude varies with the central frequency (frequency reference).

Fb-00 = 1: It is a fixed wobble amplitude system. The wobble amplitude is fixed.

Function Code	Parameter Name	Setting Range	Default
Fb-01	Wobble amplitude	0.0% to 100.0%	0.0%
Fb-02	Wobble step	0.0% to 50.0%	0.0%

Fb-01 and Fb-02: These function parameters set the wobble amplitude and wobble step.

- When Fb-00 = 0,  $A_w$  (wobble amplitude) = F0-07 (Frequency source superposition selection) x Fb-01.
- When Fb-00 = 1,  $A_w$  (wobble amplitude) = F0-10 (Max. frequency) x Fb-01.

Wobble step frequency =  $A_w$  (wobble amplitude) x Fb-02 (Wobble step). The wobble running frequency must be within the frequency upper limit and frequency lower limit.



Function Code	Parameter Name	Setting Range	Default
Fb-03	Wobble cycle	0.1s to 3000.0s	10.0s
Fb-04	Triangular wave rising time coefficient	0.1% to 100.0%	50.0%

Fb-03: It specifies the time of a complete wobble cycle.

Fb-04: It is the percentage of triangular wave rising time to Fb-03 (Wobble cycle).

- Triangular wave rising time = Fb-03 (Wobble cycle) x FB-04 (Triangular wave rising time coefficient, unit: s)
- Triangular wave falling time = Fb-03 (Wobble cycle) x (1 - Fb-04 Triangular wave rising time coefficient, unit: s)

Function Code	Parameter Name	Setting Range	Default
Fb-05	Set length	0 to 65535 m	1000 m
Fb-06	Actual length	0 to 65535 m	0 m
Fb-07	Number of pulses per meter	0.1 to 6553.5	100.0

Fb-05 to Fb-07: These function parameters are used for fixed length control.

You can obtain the actual length (Fb-06) by dividing the number of pulses sampled by DI by Fb-07 (Number of pulses each meter). The sampling DI terminal must be set for the function 27 "Length signal pulses count". For high pulse frequency, use terminal DI5.

When the actual length reaches the value set in Fb-05, the digital output terminal set for the function 10 "Length reached" becomes on.

Length reset can be implemented via the DI terminal set for the function 28 "Length reset".

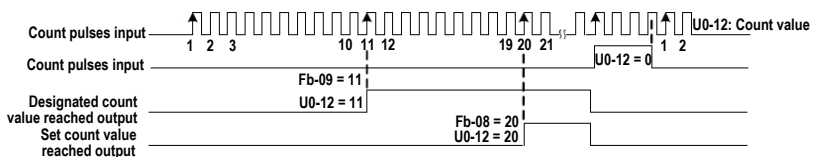
Function Code	Parameter Name	Setting Range	Default
Fb-08	Set count value	1 to 65535	1000
Fb-09	Designated count value	1 to 65535	1000

Fb-08 and Fb-09: These function parameters are the set count value and designated count value. The counting value is sampled by the DI terminal set for the function 25 "Counter input". For high pulse frequency, use terminal DI5.

When the counting value reaches the level set in Fb-08, the digital output terminal set for the function 8 "Set count value reached" becomes on.

When the counting value reaches the level set in Fb-09, the digital output terminal set for the function 9 "Designated count value reached" becomes on.

Fb-09 should be equal to or smaller than Fb-08.



## Group FC: Multi-Reference and Simple PLC Function

The multi-reference of the MD290 can be used as multi-speed, V/F separated voltage source and PID reference source.

The simple PLC function is completely different from the user programmable function. It can only complete simple combination of multiple references.

Function Code	Parameter Name	Setting Range	Default
FC-00	Reference 0	-100.0% to 100.0%	0.0%
FC-01	Reference 1	-100.0% to 100.0%	0.0%
FC-02	Reference 2	-100.0% to 100.0%	0.0%
FC-03	Reference 3	-100.0% to 100.0%	0.0%
FC-04	Reference 4	-100.0% to 100.0%	0.0%
FC-05	Reference 5	-100.0% to 100.0%	0.0%
FC-06	Reference 6	-100.0% to 100.0%	0.0%
FC-07	Reference 7	-100.0% to 100.0%	0.0%
FC-08	Reference 8	-100.0% to 100.0%	0.0%
FC-09	Reference 9	-100.0% to 100.0%	0.0%
FC-10	Reference 10	-100.0% to 100.0%	0.0%
FC-11	Reference 11	-100.0% to 100.0%	0.0%
FC-12	Reference 12	-100.0% to 100.0%	0.0%
FC-13	Reference 13	-100.0% to 100.0%	0.0%
FC-14	Reference 14	-100.0% to 100.0%	0.0%
FC-15	Reference 15	-100.0% to 100.0%	0.0%

FC-00 and FC-15: The multi-reference 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. Multi-reference can be switched over based on different states of DI terminals. For details, see the descriptions of group F4.

Function Code	Parameter Name	Setting Range	Default
FC-16	Simple PLC running mode	0: Stop after running one cycle 1: Keep final values after running one cycle 2: Repeat after running one cycle	0

FC-16: It determines the simple PLC running mode.

### 0. Stop after running one cycle

The AC drive stops after running one cycle, and will not start up until receiving new RUN command.

### 1. Keep final values after running one cycle

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

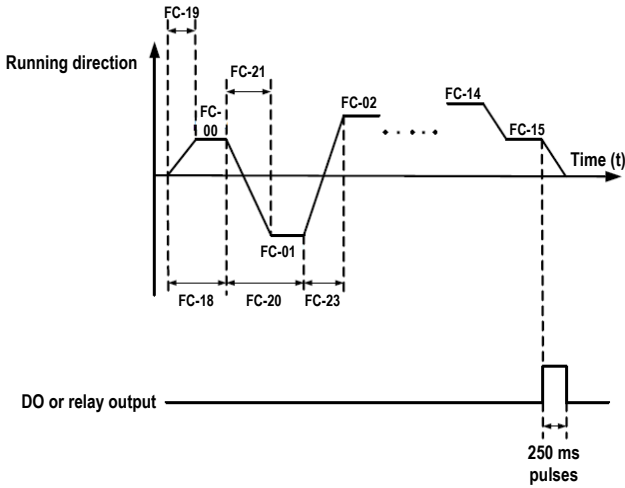
2. Repeat after running one cycle

The AC drive 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 used as the frequency source, the value of FC-00 to FC-15 (positive or negative) determines the drive running direction. If the value is negative, it indicates that the AC drive runs in the reverse direction.

Figure 7-37 The simple PLC function



Function Code	Parameter Name	Setting Range	Default
FC-17	Simple PLC retentive selection	Unit's digit: Retentive at power loss 0: No 1: Yes	00
		Ten's digit: Retentive at stop 0: No 1: Yes	

FC-17: It decides whether simple PLC is retentive at power loss or stop.

If yes, the AC drive memorizes the PLC running stage and running frequency before power loss or stop and will continue to run from the memorized stage at next power-on. If not, the AC drive restarts the PLC process at next power-on.

Function Code	Parameter Name	Setting Range	Default
FC-18	Running time of simple PLC reference 0	0.0s (h) to 6500s (h)	0.0s (h)
FC-19	Acceleration/deceleration time of simple PLC reference 0	0 to 3	0
FC-20	Running time of simple PLC reference 1	0.0s (h) to 6500s (h)	0.0s (h)
FC-21	Acceleration/deceleration time of simple PLC reference 1	0 to 3	0
FC-22	Running time of simple PLC reference 2	0.0s (h) to 6500s (h)	0.0s (h)
FC-23	Acceleration/deceleration time of simple PLC reference 2	0 to 3	0
FC-24	Running time of simple PLC reference 3	0.0s (h) to 6500s (h)	0.0s (h)
FC-25	Acceleration/deceleration time of simple PLC reference 3	0 to 3	0
FC-26	Running time of simple PLC reference 4	0.0s (h) to 6500s (h)	0.0s (h)
FC-27	Acceleration/deceleration time of simple PLC reference 4	0 to 3	0
FC-28	Running time of simple PLC reference 5	0.0s (h) to 6500s (h)	0.0s (h)
FC-29	Acceleration/deceleration time of simple PLC reference 5	0 to 3	0
FC-30	Running time of simple PLC reference 6	0.0s (h) to 6500s (h)	0.0s (h)
FC-31	Acceleration/deceleration time of simple PLC reference 6	0 to 3	0
FC-32	Running time of simple PLC reference 7	0.0s (h) to 6500s (h)	0.0s (h)
FC-33	Acceleration/deceleration time of simple PLC reference 7	0 to 3	0
FC-34	Running time of simple PLC reference 8	0.0s (h) to 6500s (h)	0.0s (h)
FC-35	Acceleration/deceleration time of simple PLC reference 8	0 to 3	0
FC-36	Running time of simple PLC reference 9	0.0s (h) to 6500s (h)	0.0s (h)
FC-37	Acceleration/deceleration time of simple PLC reference 9	0 to 3	0
FC-38	Running time of simple PLC reference 10	0.0s (h) to 6500s (h)	0.0s (h)
FC-39	Acceleration/deceleration time of simple PLC reference 10	0 to 3	0

Function Code	Parameter Name	Setting Range	Default
FC-40	Running time of simple PLC reference 11	0.0s (h) to 6500s (h)	0.0s (h)
FC-41	Acceleration/deceleration time of simple PLC reference 11	0 to 3	0
FC-42	Running time of simple PLC reference 12	0.0s (h) to 6500s (h)	0.0s (h)
FC-43	Acceleration/deceleration time of simple PLC reference 12	0 to 3	0
FC-44	Running time of simple PLC reference 13	0.0s (h) to 6500s (h)	0.0s (h)
FC-45	Acceleration/deceleration time of simple PLC reference 13	0 to 3	0
FC-46	Running time of simple PLC reference 14	0.0s (h) to 6500s (h)	0.0s (h)
FC-47	Acceleration/deceleration time of simple PLC reference 14	0 to 3	0
FC-48	Running time of simple PLC reference 15	0.0s (h) to 6500s (h)	0.0s (h)
FC-49	Acceleration/deceleration time of simple PLC reference 15	0 to 3	0
FC-50	Time unit of simple PLC running	0: s (second) 1: h (hour)	0

FC-18 to FC-50: These function parameters set the running time and acceleration/deceleration time of 16 references of simple PLC.

Function Code	Parameter Name	Setting Range	Default
FC-51	Reference 0 source	0: Set by FC-00 1: AI1 2: AI2 3: AI3 4: Pulse reference 5: PID 6: Set by preset frequency (F0-08), modified via terminal UP/DOWN	0

FC-51: This function parameter determines the setting channel of reference 0.

## Group Fd: Communication Parameters

For the details, refer to the MD290 Modbus Communication Protocol.

## Group FE: User-Defined Parameters

The AC drive allows you to add a maximum of 30 MD290 function parameters to group FE, facilitating you to view and modify. If F0.00 is displayed on group FE, it indicates that group FE is null and ignore it.

Function Code	Parameter Name	Setting Range	Default
FE-00	User-defined parameter 0	F0-00 to FP-xx, A0-00 to Ax-xx, U0-xx	F0-00
FE-01	User-defined parameter 1	Same as FE-00	F0-02
FE-02	User-defined parameter 2	Same as FE-00	F0-03
FE-03	User-defined parameter 3	Same as FE-00	F0-07
FE-04	User-defined parameter 4	Same as FE-00	F0-08
FE-05	User-defined parameter 5	Same as FE-00	F0-17
FE-06	User-defined parameter 6	Same as FE-00	F0-18
FE-07	User-defined parameter 7	Same as FE-00	F3-00
FE-08	User-defined parameter 8	Same as FE-00	F3-01
FE-09	User-defined parameter 9	Same as FE-00	F4-00
FE-10	User-defined parameter 10	Same as FE-00	F4-01
FE-11	User-defined parameter 11	Same as FE-00	F4-02
FE-12	User-defined parameter 12	Same as FE-00	F5-04
FE-13	User-defined parameter 13	Same as FE-00	F5-07
FE-14	User-defined parameter 14	Same as FE-00	F6-00
FE-15	User-defined parameter 15	Same as FE-00	F6-10
FE-16	User-defined parameter 16	Same as FE-00	F0-00
FE-17	User-defined parameter 17	Same as FE-00	F0-00
FE-18	User-defined parameter 18	Same as FE-00	F0-00
FE-19	User-defined parameter 19	Same as FE-00	F0-00
FE-20	User-defined parameter 20	Same as FE-00	F0-00
FE-21	User-defined parameter 21	Same as FE-00	F0-00
FE-22	User-defined parameter 22	Same as FE-00	F0-00
FE-23	User-defined parameter 23	Same as FE-00	F0-00
FE-24	User-defined parameter 24	Same as FE-00	F0-00
FE-25	User-defined parameter 25	Same as FE-00	F0-00
FE-26	User-defined parameter 26	Same as FE-00	F0-00
FE-27	User-defined parameter 27	Same as FE-00	F0-00
FE-28	User-defined parameter 28	Same as FE-00	F0-00
FE-29	User-defined parameter 29	Same as FE-00	F0-00

## Group FP: Function Parameter Management

Function Code	Parameter Name	Setting Range	Default
FP-00	User password	0 to 65535	0

FP-00: This function parameter controls the security protection function that requires a user-defined password.

To enable password protection, set a non-zero value in this parameter. This value is the user-defined password. Then you can use the password to enter the function code editing mode. Make sure to remember the password you set.

To remove password protection, enter the function code editing mode using the current password and set FP-00 to 00000.

Function Code	Parameter Name	Setting Range	Default
FP-01	Parameter initialization	0: No operation 1: Restore factory parameters except motor parameters 2: Clear records 4: Back up current user parameters 501: Restore user backup parameters	0

FP-01: The MD290 has the parameter initialization function.

### 0. No operation

Parameter initialization is disabled.

### 1. Restore factory parameters except motor parameters

Most MD290 function parameters are restored to factory parameters. The parameters will not be restored include motor parameters, F0-22 (Frequency reference resolution), F7-09 (Accumulative running time), F7-13 (Accumulative power-on time), F7-14 (Accumulative power consumption) and recorded fault information.

### 2. Clear records

F7-09 (Accumulative running time), F7-13 (Accumulative power-on time), F7-14 (Accumulative power consumption) and recorded fault information are cleared.

### 3. Back up current user parameters

You can make a separate external backup of parameter settings. This feature allows you to load a set of parameter settings during commissioning, or to restore a set of settings after completing a maintenance or repair operation on the MD290.

### 501. Restore user backup parameters




You are allowed to restore previous backup user parameters.

Function Code	Parameter Name	Setting Range	Default
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FP-02	Selection of general function parameter display	Unit's digit: Group U 0: Not display 1: Display	11
		Ten's digit: Group A 0: Not display 1: Display	
FP-03	Selection of individualized parameter display	Unit's digit: User-defined group 0: Not display 1: Display	00
		Ten's digit: User-modified group 0: Not display 1: Display	

FP-02 to FP-03: These function parameters determine whether to display the general function parameters and the individualized parameters

The MD290 classifies the parameters into three groups, general group, user-defined group and user-modified group. They are defined and displayed as follows:

Parameter Group	Description	Display
General group	Display function codes of the AC drive in sequence of F0 to FF, A0 to AF and U0 to UF.	
User-defined group	Display a maximum of 32 user-defined parameters in group FE.	
User-modified group	Display the parameters that are modified.	

For example, function parameter F0-00 is displayed as F0-00 in general group, as uF0-00 in user-defined group and cF0-00 in user-modified group.

Function Code	Parameter Name	Setting Range	Default
FP-04	Selection of parameter modification	0: Disabled 1: Enabled	0

FP-04: This function parameter controls modification of function parameters to avoid danger caused by unexpected parameter modification.



## Group A1: Virtual DI/DO

Function Code	Parameter Name	Setting Range	Default
A1-00	VDI1 function selection	0 to 59	0
A1-01	VDI2 function selection	0 to 59	0
A1-02	VDI3 function selection	0 to 59	0
A1-03	VDI4 function selection	0 to 59	0
A1-04	VDI5 function selection	0 to 59	0

A1-00 and A1-04: These function parameters set function to the five virtual DI terminals VDI1 to VDI5, which have the same digital input functions (0 to 50) as the ten DI terminals do. For more details, see the description of F4-00 to F4-09.

Function Code	Parameter Name	Setting Range	Default
A1-05	VDI active state setting mode	0: Decided by state of VDOx	00000
		1: Decided by A1-06	
		Unit's digit: VDI1	
		Ten's digit: VDI2	
		Hundred's digit: VDI3	
		Thousand's digit: VDI4	
A1-06	Selection of VDI active state	0: Inactive	00000
		1: Active	
		Unit's digit: VDI1	
		Ten's digit: VDI2	
		Hundred's digit: VDI3	
		Thousand's digit: VDI4	
	Ten thousand's digit: VDI5		

A1-05 and A1-06: These function parameters determine the active mode of the VDI1 to VDI5.

#### 0. Decided by state of VDOx

To enable the AC drive to report fault and stop when the input from AI1 reaches the limit, perform the following settings:

1. Set A1-00 to 44 to allocate VDI1 to the function 44 "User-defined fault 1".
2. Set A1-05 to xxx0 to decide the VDI1 active state by state of VDOx.
3. Set A1-11 to 31 to allocate VDO1 with the function 31 "AI1 input exceeding limit".

Then when the input from AI1 reaches the limit, VDO1 becomes on. Then, VDI1 becomes on and the AC drive receives the user-defined fault.

1. Decided by A1-06

To enable the AC drive to automatically enter the running state after power-on, perform the following settings:

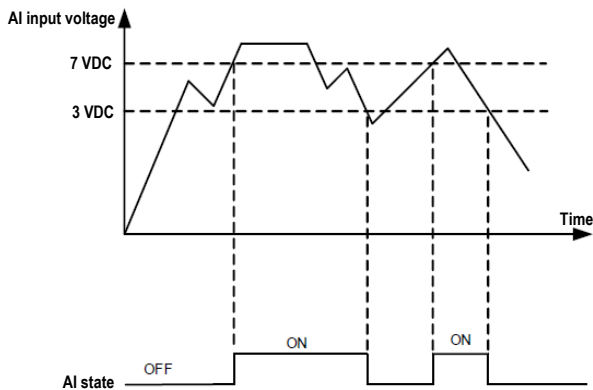
1. Set A1-00 to 1 to allocate VDI1 to the function 1 "Forward RUN (FWD)".
2. Set A1-05 to xxx1 to decide the VDI1 active state by state of A1-06.
3. Set F0-02 to 1 to use terminal control as the command source.
4. Set F8-18 to 0 to disable the startup protection.

After completing initialization at power-on, the AC drive detects that VDI1 is set for the function FWD is active. This means the AC drive receives the FWD command from VDI1 and starts forward running.

Function Code	Parameter Name	Setting Range	Default
A1-07	Function selection for AI1 used as DI	0 to 50	0
A1-08	Function selection for AI2 used as DI	0 to 50	0
A1-09	Function selection for AI3 used as DI	0 to 50	0
A1-10	Active state selection for AI used as DI	0: High level active 1: Low level active Unit's digit: AI1 Ten's digit: AI2 Hundred's digit: AI3	000

A1-07 and A1-10: These function parameters enable AI to be used as DI. When the AI input voltage is higher than 7 V, the AI is in the high level state. When the AI input voltage is lower than 3 V, the AI is in the low level state. The AI is in the hysteresis state between 3 V and 7 V.

Figure 7-38 AI terminal active state judgement



Function Code	Parameter Name	Setting Range	Default
A1-11	VDO1 function selection	0: Short with physical DIx internally 1 to 41	0
A1-12	VDO2 function selection	0: Short with physical DIx internally 1 to 41	0
A1-13	VDO3 function selection	0: Short with physical DIx internally 1 to 41	0
A1-14	VDO4 function selection	0: Short with physical DIx internally 1 to 41	0
A1-15	VDO5 function selection	0: Short with physical DIx internally 1 to 41	0
A1-16	VDO1 output delay	0.0s to 3600.0s	0.0s
A1-17	VDO2 output delay	0.0s to 3600.0s	0.0s
A1-18	VDO3 output delay	0.0s to 3600.0s	0.0s
A1-19	VDO4 output delay	0.0s to 3600.0s	0.0s
A1-20	VDO5 output delay	0.0s to 3600.0s	0.0s
A1-21	VDO active mode selection	0: High level active 1: Low level active Unit's digit: VDO1 Ten's digit: VDO2 Hundred's digit: VDO3 Thousand's digit: VDO4 Ten's thousand's digit: VDO5	00000

A1-11 and A1-21: These function parameters set functions to VDO terminals, which have the same digital output functions (1 to 40) as the DO terminals do. For more details, see the description in group F5. The VDO can be used together with VDIX to implement some simple logic control.

## Group A2: Motor 2 Parameters

The MD290 can switch over running between two motors. For the two motors, you can:

- Set motor nameplate parameters respectively
- Perform motor auto-tuning respectively
- Select V/F control respectively
- Set parameters related to V/F control independently

Motor 2 parameters are defined the same as motor 1 parameters. For details, see the descriptions of groups F1 and F2.

Function Code	Parameter Name	Setting Range	Default
A2-00	Motor type selection	0 to 1	0
A2-01	Rated motor power	0.1 to 30.0 kW	Model dependent
A2-02	Rated motor voltage	1 to 1000 V	Model dependent
A2-03	Rated motor current	0.01 to 655.35 A	Model dependent
A2-04	Rated motor frequency	0.01 to max. frequency	Model dependent
A2-05	Rated motor speed	1 to 65535 rpm	Model dependent
A2-06	Stator resistance	0.001 to 65.535 Ω	Auto-tuning parameter
A2-07	Rotor resistance	0.001 to 65.535Ω	Auto-tuning parameter
A2-08	Leakage inductive reactance	0.01 to 655.35 mH	Auto-tuning parameter
A2-09	Mutual inductive reactance	0.1 to 6553.5 mH	Auto-tuning parameter
A2-10	No-load current	0.01 A to A2-03	Auto-tuning parameter
A2-61	Motor 2 control mode	0 and 2	2
A2-62	Motor 2 acceleration/ deceleration time selection	0 to 4	0
A2-63	Motor 2 torque boost	0.0% (fixed torque boost) 0.1% to 30.0%	Model dependent
A2-65	Motor 2 oscillation suppression gain	0 to 100	Model dependent

## Group A5: Control Optimization

Function Code	Parameter Name	Setting Range	Default
A5-00	DPWM switchover frequency upper limit	0.00 to 15.00 Hz	12.00 Hz

A5-00: This function parameter is effective only for V/F control and determines the digital pulse width modulation (DPWM) pattern in V/F control. This parameter rarely needs to be modified.

- If the output frequency is lower than the setting, the 7-segment continuous modulation pattern will be used, which may result in larger switching loss but smaller current ripple.
- If the output frequency is higher than the setting, the 5-segment intermittent modulation pattern will be used, which may result in smaller switching loss but larger current ripple.

Function Code	Parameter Name	Setting Range	Default
A5-01	PWM modulation pattern	0: Asynchronous modulation 1: Synchronous modulation	0

A5-01: This function parameter is effective only for V/F control.

Synchronous modulation is applied when the drive's output frequency reaches 85 Hz or above, improving the quality of output voltage. Asynchronous modulation is applied when the drive's output frequency is below 85 Hz.

Function Code	Parameter Name	Setting Range	Default
A5-02	Dead zone compensation mode selection	0: No compensation 1: Compensation mode 1	1

A5-02: This function parameter rarely needs to be modified. It can be modified only when there is special requirement on output voltage waveform quality or motor oscillation occurs.

Function Code	Parameter Name	Setting Range	Default
A5-03	Random PWM depth	0: Random PWM invalid 1 to 10	0

A5-03: This function parameter aims at lower the unpleasant motor noise and reducing the electromagnetic interference.

Function Code	Parameter Name	Setting Range	Default
A5-04	Selection of fast current limit	0: Disabled 1: Enabled	1

A5-04: The fast current limit function helps to minimize occurrence of AC drive overcurrent, ensuring continuous running of the drive. But the drive is not to stay in long-timing fast current limit because this may result in drive overheating. In this case, the drive reports Err40, indicating that the AC drive is overloaded and must stop.

Function Code	Parameter Name	Setting Range	Default
A5-05	Current detection compensation	0 to 100	5

A5-05: This function parameter sets the drive's current detection compensation and rarely needs to be modified. Too large setting may deteriorate the control performance.

Function Code	Parameter Name	Setting Range	Default
A5-06	Undervoltage threshold	60.0% to 140.0%	100.0%

A5-06: This function parameter sets the voltage threshold for Err09 (undervoltage).

100.0% of the AC drive of different voltage classes correspond to different undervoltage point, as shown below.

Parameter Name	Setting Range
Single-phase 220 V	200 V
Three-phase 220 V	200 V
Three-phase 380 V	350 V

Function Code	Parameter Name	Setting Range	Default
A5-08	Dead-zone time adjustment	100%–200%	150%

It is only valid for 1140 V voltage class.

You can modify the value of this parameter to improve the voltage utilization rate. Too small value may system instability. Do not modify it generally.

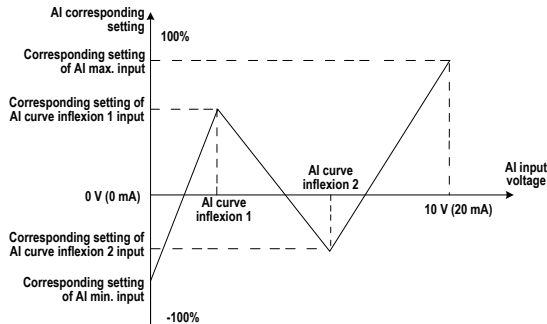
Function Code	Parameter Name	Setting Range	Default
A5-09	Narrow pulse control selection	0: Disabled 1: Enabled	0

### Group A6: AI Curve Setting

Function Code	Parameter Name	Setting Range	Default
A6-00	AI curve 4 min. input	-10.00 V to A6-02	0.00 V
A6-01	Corresponding percentage of AI curve 4 min. input	-100.0% to 100.0%	0.0%
A6-02	AI curve 4 inflexion 1 input	A6-00 to A6-04	3.00 V
A6-03	Corresponding percentage of AI curve 4 inflexion 1 input	-100.0% to 100.0%	30.0%
A6-04	AI curve 4 inflexion 1 input	A6-02 to A6-06	6.00 V
A6-05	Corresponding percentage of AI curve 4 inflexion 1 input	-100.0% to 100.0%	60.0%
A6-06	AI curve 4 max. input	A6-06 to 10.00 V	10.00 V
A6-07	Corresponding percentage of AI curve 4 max. input	-100.0% to 100.0%	100.0%
A6-08	AI curve 5 min. input	-10.00 V to A6-10	-10.00 V
A6-09	Corresponding percentage of AI curve 5 min. input	-100.0% to 100.0%	-100.0%
A6-10	AI curve 5 inflexion 1 input	A6-08 to A6-12	-3.00 V
A6-11	Corresponding percentage of AI curve 5 inflexion 1 input	-100.0% to 100.0%	-30.0%
A6-12	AI curve 5 inflexion 1 input	A6-10 to A6-14	3.00 V
A6-13	Corresponding percentage of AI curve 5 inflexion 1 input	-100.0% to 100.0%	30.0%
A6-14	AI curve 5 max. input	A6-14 to 10.00 V	10.00 V
A6-15	Corresponding percentage of AI curve 5 max. input	-100.0% to 100.0%	100.0%

A6-00 to A6-15: These function parameters define the AI curve 4 and AI curve 5, which have the similar function of AI curve 1 to AI curve 3. AI curve 1 to AI curve 3 are linear correspondence and AI curve 4 and AI curve 5 are four-point correspondence.

Figure 7-39 AI curve 4 and AI curve 5



Function Code	Parameter Name	Setting Range	Default
A6-16	Jump point of AI1 input corresponding setting	-100.0% to 100.0%	0.0%
A6-17	Jump amplitude of AI1 input corresponding setting	0.0% to 100.0%	0.5%
A6-18	Jump point of AI2 input corresponding setting	-100.0% to 100.0%	0.0%
A6-19	Jump amplitude of AI2 input corresponding setting	0.0% to 100.0%	0.5%
A6-20	Jump point of AI3 input corresponding setting	-100.0% to 100.0%	0.0%
A6-21	Jump amplitude of AI3 input corresponding setting	0.0% to 100.0%	0.5%

A6-16 to A6-21: The MD290 has the jump function on the corresponding percentage of AI1 to AI3 input, stabilizing the input entered from AI.

The AI1 input jumps around 5.00 V and the jump range is 4.90 to 5.10 V. The AI1 min. input 0.00 V corresponds to 0.0% and the max. input 10.00 V corresponds to 100.0%. The corresponding percentage of the detected AI1 input fluctuates between 49.0% and 51.0%.

You can set A6-16 to 50.0% and A6-17 to 1.0% to fix the corresponding percentage of AI1 input at 50.0%.

## Group A7: User Programmable Function

### Group A8: Point-point Communication

Function Code	Parameter Name	Setting Range	Default
A8-00	Point-point communication	0: Disabled 1: Enabled	0

It is used to decide whether to enable the point-point communication.

The point-point communication indicates direct communication between two or more MD290 AC drives by using CANlink. The master sends frequency or torque reference to one or multiple slaves according to its own frequency or torque signal.

If multiple AC drives are connected by using CANlink cards, the terminal resistor of the CANlink card connected to the end AC drive shall be switched on.

If this function is enabled, the CANlink communication addresses of the AC drives are automatically matched without special setting.

The baud rate is set in Fd-00.

Function Code	Name	Setting Range	Default
A8-01	Master and slave selection	0: Master 1: Slave	0

This parameter is used to determine whether the AC drive is master or slave.



At point-point communication, you only need to set the CANlink communication baud rate. The communication addresses are allocated automatically based on whether the AC drive is master or slave.

Function Code	Parameter Name	Setting Range	Default
A8-02	Master and slave interaction	0: No 1: Yes	0
		Unit's digit: Whether the slave follows the master command	
		Ten's digit: Whether sending fault information	
		Hundred's digit: Whether alarming if the slave gets offline	

When A8-01 (Master and slave selection) is set to 1 (Slave) and F0-02 (Command source selection) is set to 2 (Communication control), if A8-02 is set to 1, the slave follows the master to start or stop.

If the ten's digit of the slave is set to 1, the slave sends the fault information to the master if a fault occurs on the slave.

If the hundred's digit of the master is set to 1, the master alarms when the slave gets offline.

Function Code	Name	Setting Range	Default
A8-03	Message frame selection	0: Master and slave control frame 1: Droop control frame	0

Function Code	Parameter Name	Setting Range	Default
A8-04	Zero offset of received data (torque)	-100.00%~100.00%	0.00%
A8-05	Gain of received data (torque)	-10.00~10.00	1.00

These two parameters are used to adjust data received from the master and define the torque reference relationship between the master and the slave.

If "b" expresses the zero offset of received data, "k" expresses the gain, and "y" expresses the actually used data. The actually used data can be obtained based on the formula:

$$y = kx + b$$

The value y ranges from -100.00% to 100.00%.

Function Code	Parameter Name	Setting Range	Default
A8-06	Point-point communication interruption detection time	0.0~10.0s	1.0s

It is used to set the point-point communication interruption time at which this fault is detected. If it is set to 0, it indicates no detection.

Function Code	Parameter Name	Setting Range	Default
A8-07	Master data sending cycle at point-point communication	0.001~10.000s	0.001s

It is used to set the data sending cycle of the master in point-point communication.

Function Code	Parameter Name	Setting Range	Default
A8-08	Zero offset of received data (frequency)	-100.00%~100.00%	0.00%
A8-09	Gain of received data (frequency)	-10.00~10.00	1.00

These two parameters are used to adjust data received from the master and define the frequency reference relationship between the master and the slave.

If "b" expresses the zero offset of received data, "k" expresses the gain, and "y" expresses the actually used data. The actually used data can be obtained based on the formula:

$$y = kx + b$$

The value y ranges from -100.00% to 100.00%.

Function Code	Name	Setting Range	Default
A8-10	Runaway prevention coefficient	0.00% to 100.00%	10.00%

This parameter is valid only when the slave is in torque control and follows the master output torque to perform load allocation. This function enables detection of slave runaway. If it is set to 0.00%, the runaway prevention function is disabled. The recommended setting is 5.00% to 20.00%.

### Group AC: AI/AO Correction

Function Code	Parameter Name	Setting Range	Default
AC-00	AI1 measured voltage 1	0.500 to 4.000 V	Factory-corrected
AC-01	AI1 displayed voltage 1	0.500 to 4.000 V	Factory-corrected
AC-02	AI1 measured voltage 2	6.000 to 9.999 V	Factory-corrected
AC-03	AI1 displayed voltage 2	6.000 to 9.999 V	Factory-corrected
AC-04	AI2 measured voltage 1	0.500 to 4.000 V	Factory-corrected
AC-05	AI2 displayed voltage 1	0.500 to 4.000 V	Factory-corrected
AC-06	AI2 measured voltage 2	6.000 to 9.999 V	Factory-corrected
AC-07	AI2 displayed voltage 2	6.000 to 9.999 V	Factory-corrected
AC-08	AI3 measured voltage 1	-9.999 to 10.000 V	Factory-corrected
AC-09	AI3 displayed voltage 1	-9.999 to 10.000 V	Factory-corrected
AC-10	AI3 measured voltage 2	-9.999 to 10.000 V	Factory-corrected
AC-11	AI3 displayed voltage 2	-9.999 to 10.000 V	Factory-corrected

AC-00 to AC-11: The function of correcting the input entered from the AI terminal is to make the sampling voltage value the same as the voltage reference. These function parameters have been corrected by delivery and are restored to the factory-corrected value during parameter initialization, thus rarely requiring on-site correction.

Measured voltage indicates the actual output voltage measured by multimeter. Displayed voltage indicates the voltage sampled and displayed by the drive. For details, refer to U0-21, U0-22 and U0-23.

During Correction, send two voltage values to each AI terminal and save the measured values and displayed values to AC-00 to AC-11. Then the AC drive will automatically perform AI zero offset and gain correction.

Function Code	Parameter Name	Setting Range	Default
AC-12	AO1 target voltage 1	0.500 to 4.000 V	Factory-corrected
AC-13	AO1 measured voltage 1	0.500 to 4.000 V	Factory-corrected
AC-14	AO1 target voltage 2	6.000 to .999 V	Factory-corrected
AC-15	AO1 measured voltage 2	6.000 to 9.999 V	Factory-corrected
AC-16	AO2 target voltage 1	0.500 to 4.000 V	Factory-corrected
AC-17	AO2 measured voltage 1	0.500 to 4.000 V	Factory-corrected
AC-18	AO2 target voltage 2	6.000 to 9.999 V	Factory-corrected
AC-19	AO2 measured voltage 2	6.000 to 9.999 V	Factory-corrected
AC-20	AI2 measured current 1	0.000 to 20.000 mA	Factory corrected
AC-21	AI2 sampling current 1	0.000 to 20.000 mA	Factory corrected
AC-22	AI2 measured current 2	0.000 to 20.000 mA	Factory corrected
AC-23	AI2 sampling current 2	0.000 to 20.000 mA	Factory corrected
AC-24	AO1 ideal current 1	0.000 to 20.000 mA	Factory corrected
AC-25	AO1 sampling current 1	0.000 to 20.000 mA	Factory corrected
AC-26	AO1 ideal current 2	0.000 to 20.000 mA	Factory corrected
AC-27	AO1 sampling current 2	0.000 to 20.000 mA	Factory corrected

AC-12 to AC-27: The function of correcting the AO output is to make the actual output voltage/current of AO the same as the target output voltage/current.

These function parameters have been corrected by delivery and are restored to the factory-corrected value during parameter initialization, thus rarely requiring on-site correction.

Target voltage indicates the theoretical output voltage of the drive. Measured voltage indicates the actual output voltage value measured by the multimeter.

## Group U0: Monitoring Parameters

Group U0 is used to monitor the AC drive'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 to U0-31 are the monitoring parameters in the running and stop state defined by F7-03 and F7-04.

Function Code	Parameter Name	Display Range
U0-00	Running frequency	0.00 to 500.00 Hz
U0-01	Frequency reference	0.00 to 500.0 Hz

U0-00 and U0-01: These two parameters display the absolute value of theoretical running frequency and frequency reference. The output frequency of the drive is displayed in U0-19.

Function Code	Parameter Name	Display Range
U0-02	Bus voltage	0.0 to 3000.0 V
U0-03	Output voltage	0 to 1140 V
U0-04	Output current	0.00 to 655.35 A
U0-05	Output power	0 to 32767
U0-06	Output torque	-200.0% to 200.0%

U0-02 and U0-06: They display the bus voltage and output voltage, output current, output power and output torque of the drive.

Function Code	Parameter Name	Display Range
U0-07	DI state	0 to 32767

U0-07: It displays the current 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 DIs is described in the following table:

Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Bit8	Bit9
DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	DI9	DI10
Bit10	Bit11	Bit12	Bit13	Bit14	Bit15	-	-	-	-
VDI1	VDI2	VDI3	VDI4	VDI5	-	-	-	-	-

Function Code	Parameter Name	Display Range
U0-08	DO state	0 to 1023

U0-08: It displays the current state of DO terminals. After the value is converted into a binary number, each bit corresponds to a DO. "1" indicates high level signal, and "0" indicates low level signal. The corresponding relationship between bits and DOs is described in the following table.

Bit0	Bit1	Bit2	Bit3	Bit4	Bit5
DO3	Relay 1	Relay 2	DO1	DO2	VDO1
Bit6	Bit7	Bit8	Bit9	Bit10	Bit11
VDO2	VDO3	DO4	VDO5	-	-

Function Code	Parameter Name	Display Range
U0-14	Load speed display	0 to 65535
U0-15	PID reference	0 to 65535
U0-16	PID feedback	0 to 65535
U0-18	Pulse reference	0.00 to 20.00 kHz

Function Code	Parameter Name	Display Range
U0-19	Feedback speed	-500.0 to 500.0 Hz

U0-19: It displays the actual output frequency of the AC drive.

When the value is between -99.99 to 300.00 Hz, two decimal places are displayed. If the value is out of this range, one decimal place is displayed.

Function Code	Parameter Name	Display Range
U0-20	Remaining running time	0.0 to 6500.0 min

U0-20: It displays the remaining running time during the drive timing running.

Function Code	Parameter Name	Display Range
U0-21	AI1 voltage before correction	0.00 to 10.57 V
U0-22	AI2 voltage (V)/ current (mA) before correction	0.00 to 10.57 V 0.000 to 20.000 mA
U0-23	AI3 voltage before correction	-10.57 to 10.57 V

U0-21 to U0-23: They display the sampled AI input voltage (before correction). They actually used AI input voltage after correction are displayed in U0-09, U0-10 and U0-11.

A total of three decimal places are displayed. But when a negative number is displayed, only two decimal places are displayed together with negative sign "-".

Function Code	Parameter Name	Display Range
U0-24	Linear speed	0 to 65535 m/min

U0-24: It displays the linear speed of the DI5 used for high-speed pulse sampling. The unit is meter/minute. The linear speed is obtained according to the actual number of pulses sampled per minute and Fb-07 (Number of pulses per meter).

Function Code	Parameter Name	Display Range
U0-27	Pulse reference	0 to 65535 Hz

U0-27: It displays the DI5 high-speed pulse sampling frequency, in minimum unit of 1 Hz. It is the same as U0-18, except for the difference in units.

Function Code	Parameter Name	Display Range
U0-28	Communication reference	-100.00% to 100.00%

U0-28: It displays the data written by means of the communication address 0x1000.

Function Code	Parameter Name	Display Range
U0-30	Main frequency reference	0.00 to 500.00 Hz
U0-31	Auxiliary frequency reference	0.00 to 500.00 Hz

U0-30 and U0-31: They display the main frequency reference and auxiliary frequency reference. When the value is between 0.00 to 300.00 Hz, two decimal places are displayed. If the value is out of this range, one decimal place is displayed.

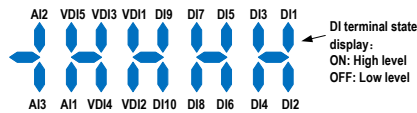
Function Code	Parameter Name	Display Range
U0-35	Target torque	-200.0% to 200.0%
U0-37	Power factor angle	-180° to 180°

Function Code	Parameter Name	Display Range
U0-39	Target voltage upon V/F separation	0 V to rated motor voltage
U0-40	Output voltage upon V/F separation	0 V to rated motor voltage

U0-39 and U0-40: They display the target output voltage and current actual output voltage in the V/F separation state. For details, see the description of parameters in group F3.

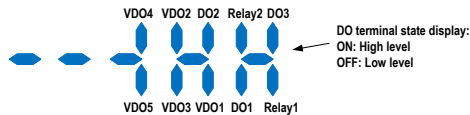
Function Code	Parameter Name	Display Range
U0-41	DI state display	-

U0-41: It displays the DI state and the display format is shown as below:



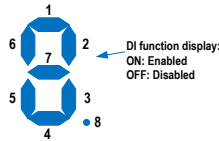
Function Code	Parameter Name	Display Range
U0-42	DO state display	-

U0-42: It displays the DO state and the display format is shown as below:



Function Code	Parameter Name	Display Range
U0-43	DI set for function state display 1	-

U0-43: It displays whether the DI terminals set for the functions 1 to 40 are active. 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 as below:



Function Code	Parameter Name	Display Range
U0-44	DI set for function state display 2	-

U0-44: It displays whether the DI terminals set for the functions 41 to 59 are active. The display format is similar to U0-43. The 7-segment LEDs display functions 41–48, 49–56 and 57–59, respectively from right to left.

Function Code	Parameter Name	Display Range
U0-59	Frequency Reference	-100.00% to 100.00%
U0-60	Running frequency	-100.00% to 100.00%

U0-59 and U0-60: 100.00% corresponds to the maximum frequency (F0-10).

Function Code	Parameter Name	Display Range
U0-61	AC drive running state	0 to 65535

U0-61: It displays the running state of the AC drive. The data format is listed in the following table:

Bit0	0: Stop 1: Run
Bit1	0: Constant 1: Accelerate
Bit2	2: Decelerate
Bit3	0: Bus voltage normal 1: Undervoltage

Function Code	Name	Display Range
U0-62	Current fault code	0–99

It displays the current fault code.

Function Code	Name	Display Range
U0-63	Sent value of point-point communication	-100.00% to 100.00%
U0-64	Number of slaves	0-63

It displays the data at point-point communication. U0-63 is the data sent by the master, and U0-64 is the number of online slaves.

Function Code	Name	Display Range
U0-66	Communication extension card model	100: CANopen 200: PROFIBUS-DP 300: CANlink
U0-67	Communication extension card version	-
U0-68	DP card AC drive state	bit0: Running state bit1: Running direction bit2: Whether AC drive is faulty Bit3: Target frequency reached Bit4 to Bit7: Reserved Bit8 to Bit15: Fault code
U0-69	Transmitting DP communication speed 0.01 Hz	0.00 to max. frequency
U0-70	Transmitting DP communication motor speed 1 rpm	0 to 65535
U0-71	Communication card dedicated current display	-
U0-72	Communication card fault state	-
U0-73	Motor SN	0: Motor 1 1: Motor 2

U0-68	Bit0	0: Stop 1: Run
	Bit1	0: Forward run 1: Reserve run
	Bit2	0: No fault 1: Faulty
	Bit4 to Bit7	-
	Bit8 to Bit15	Fault code







EMC

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# Chapter 8 EMC

## 8.1 Definition of Terms

### ■ EMC

Electromagnetic compatibility (EMC) describes the ability of electronic and electrical devices or systems to work properly in the electromagnetic environment and not to generate electromagnetic interference that influences other local devices or systems.

In other words, EMC includes two aspects: The electromagnetic interference generated by a device or system must be restricted within a certain limit; the device or system must have sufficient immunity to the electromagnetic interference in the environment.

### ■ First environment

Environment that includes domestic premises, it also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes

### ■ Second environment

Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes

### ■ Category C1 AC drive

Power Drive System (PDS) of rated voltage less than 1000 V, intended for use in the first environment

### ■ Category C2 AC drive

PDS of rated voltage less than 1000 V, which is neither a plug in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by a professional

### ■ Category C3 AC drive

PDS of rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment

### ■ Category C4 AC drive

PDS of rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment

## 8.2 Introduction to EMC Standard

### 8.2.1 EMC Standard

The MD290 series AC drive satisfies the requirements of standard EN 61800-3. 2004 Category C2. The AC drives are applied to both the first environment and the second environment.

### 8.2.2 Installation Environment

The system manufacturer using the AC drive is responsible for compliance of the system with the European EMC directive. Based on the application of the system, the integrator must ensure that the system complies with standard EN 61800-3. 2004 Category C2, C3 or C4.

The system (machinery or appliance) installed with the AC drive must also have the CE mark. The system integrator is responsible for compliance of the system with the EMC directive and standard EN 61800-3. 2004 Category C2.

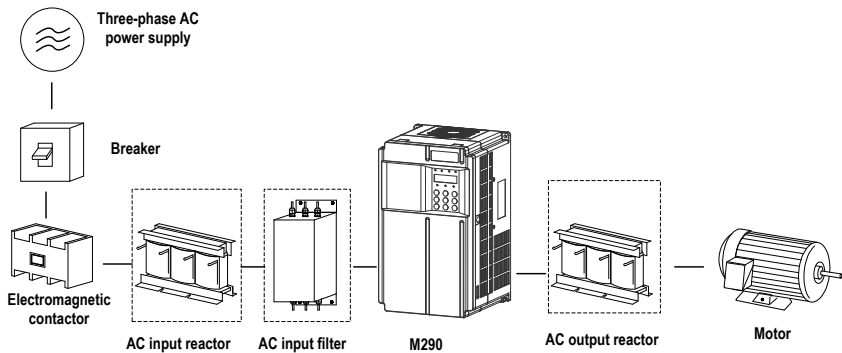


**WARNING**

If applied in the first environment, the AC drive may generate radio interference. Besides the CE compliance described in this chapter, users must take measures to avoid such interference, if necessary.

## 8.3 Selection of Peripheral EMC Devices

Figure 8-1 Peripheral EMC devices of the MD290



### 8.3.1 Installation of EMC Input Filter on Power Input Side

An EMC filter installed between the AC drive and the power supply can not only restrict the interference of electromagnetic noise in the surrounding environment on the AC drive, but also prevents the interference from the AC drive on the surrounding equipment.

The MD290 series AC drive satisfies the requirements of category C2 only with an EMC filter installed on the power input side. The installation precautions are as follows:

- Strictly comply with the ratings when using the EMC filter. The EMC filter is category I electric apparatus, and therefore, the metal housing ground of the filter should be in good contact with the metal ground of the installation cabinet on a large area, and requires good conductive continuity. Otherwise, it will result in electric shock or poor EMC effect.
- The ground of the EMC filter and the PE conductor of the AC drive must be tied to the same common ground. Otherwise, the EMC effect will be affected seriously.
- The EMC filter should be installed as closely as possible to the power input side of the AC drive.

#### ■ Standard EMC Filter

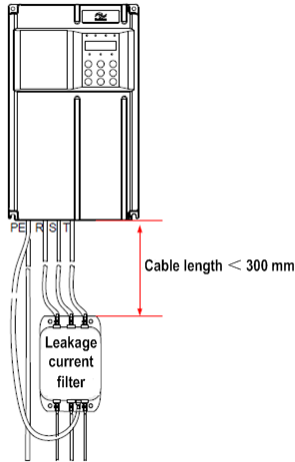
The following table lists the recommended manufacturers and models of EMC filters for the MD290 series AC drive. Select a proper one based on actual requirements.

Table 8-1 Recommended manufacturers and models of EMC filters

AC Drive Model	AC Input Filter Model (Changzhou Jianli)	AC Input Filter Model (Schaffner)
MD290T18.5G/22P	DL-50EBK5	FN 3258-55-34
MD290T22G/30P	DL-65EBK5	FN 3258-75-34
MD290T30G/37P	DL-65EBK5	FN 3258-75-34
MD290T37G/45P	DL-80EBK5	FN 3258-100-35
MD290T45G/55P	DL-100EBK5	FN 3258-100-35
MD290T55G/75P	DL-130EBK5	FN 3258-130-35
MD290T75G/90P	DL-160EBK5	FN 3258-180-40
MD290T90G/110P	DL-200EBK5	FN 3258-180-40
MD290T110G/132P	DL-250EBK5	FN 3270H-250-99

■ Simple EMC Filter

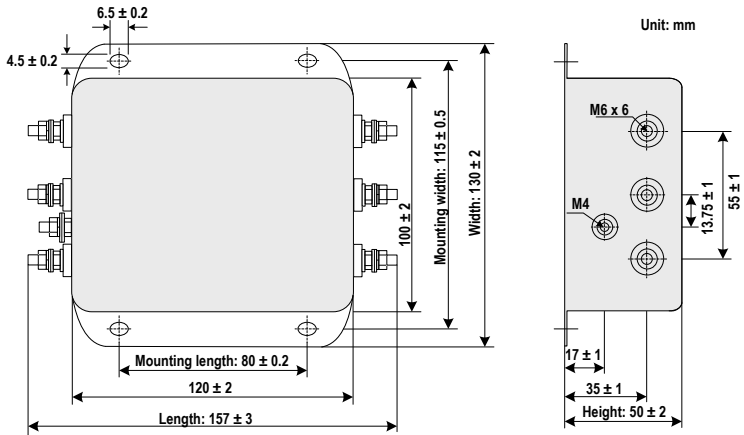
Figure 8-2 Installation of the simple EMC filter



● Selection of the simple EMC filter

MD290 Model	Simple EMC filter	Filter Rated Current	Overall Dimensions (Length x Width x Height)	Mounting Dimensions (Mounting Length x Mounting Width)
MD290T18.5G/22P	DL65EB1/10	65	218 x 140 x 80	184 x 112
MD290T22G/30P				
MD290T30G/37P				
MD290T37G/45P	DL-120EB1/10	120	334 x 185 x 90	304 x 155
MD290T45G/55P				
MD290T55G/75P	DL-180EB1/10	180	388 x 220 x 100	354 x 190
MD290T75G/90P				
MD290T90G/110P				
MD290T110G/132P	Unavailable			

● Mounting Dimensions



■ Magnetic Ring

Add the magnetic ring to the R, S, T input cables or the U, V, W output cables to improve the EMC performance.



● Selection of the magnetic ring

Magnetic Ring Model	Dimensions (Outer Diameter x Inner Diameter x Thickness: mm)
DY644020H	64 x 40 x 20
DY805020H	80 x 50 x 20
DY1207030H	120 x 70 x 30

### 8.3.2 Installation of AC Reactor on Power Input Side

An AC input reactor is installed to eliminate the harmonics of the input current. As an optional device, the reactor can be installed externally to meet strict requirements of an application environment for harmonics. The following table lists the recommended manufacturers and models of input reactors.

Table 9-2 Recommended manufacturers and models of AC input reactors

AC Drive Model	AC Input Reactor Model (Inovance)	Reactor Rated Current (A)
MD290T18.5G/22P	MD-ACL-50-4T-183-2%	50
MD290T22G/30P	MD-ACL-80-4T-303-2%	80
MD290T30G/37P	MD-ACL-80-4T-303-2%	80
MD290T37G/45P	MD-ACL-80-4T-303-2%	80
MD290T45G/55P	MD-ACL-120-4T-453-2%	120
MD290T55G/75P	MD-ACL-120-4T-453-2%	120
MD290T75G/90P	MD-ACL-200-4T-753-2%	200
MD290T90G/110P	MD-ACL-200-4T-753-2%	200
MD290T110G/132P	MD-ACL-250-4T-114-2%	250

### 8.3.3 Installation of AC Reactor on Power Output Side

Whether to install an AC output reactor on the power output side is dependent on the actual situation. The cable connecting the AC drive and the motor should not be too long; capacitance enlarges when an over-long cable is used and thus high-harmonics current may be easily generated.

If the length of the output cable is equal to or greater than the value in the following table, install an AC output reactor on the power output side of the AC drive.

Table 8-3 Cable length threshold when an AC output reactor is installed

AC Drive Power (kW)	Rated Voltage (V)	Min. Cable Length When Selecting Output Reactor (m)
4	200 to 500	50
5.5	200 to 500	70
7.5	200 to 500	100
11	200 to 500	110
15	200 to 500	125
18.5	200 to 500	135
22	200 to 500	150
≥ 30	200 to 500	150



The following table lists the recommended manufacturer and models of AC output reactors.

Table 8-4 Recommended manufacturer and models of AC output reactors

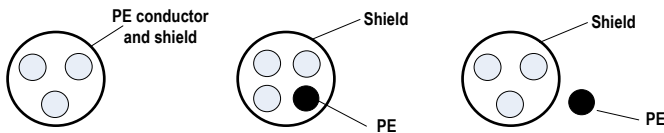
AC Drive Model	AC Output Reactor Model (Inovance)	Reactor Rated Current (A)
MD290T18.5G/22P	MD-OCL-50-4T-183-1%	50
MD290T22G/30P	MD-OCL-60-4T-223-1%	60
MD290T30G/37P	MD-OCL-80-4T-303-1%	80
MD290T37G/45P	MD-OCL-90-4T-373-1%	90
MD290T45G/55P	MD-OCL-120-4T-453-1%	120
MD290T55G/75P	MD-OCL-150-4T-553-1%	150
MD290T75G/90P	MD-OCL-200-4T-753-1%	200
MD290T90G/110P	MD-OCL-250-4T-114-1%	250
MD290T110G/132P	MD-OCL-250-4T-114-1%	250

## 8.4 Shielded Cable

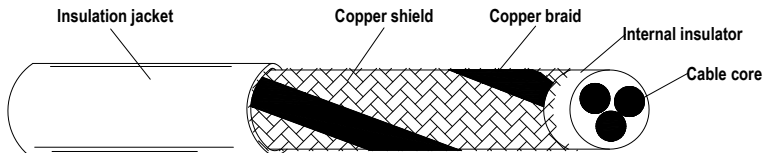
### 8.4.1 Requirements for Shielded Cable

The shielded cable must be used to satisfy the EMC requirements of CE marking. Shielded cables are classified into three-conductor cable and four-conductor cable. If conductivity of the cable shield is not sufficient, add an independent PE cable, or use a four-conductor cable, of which one phase conductor is PE cable.

The three-conductor cable and four-conductor cable are shown in the following figure.

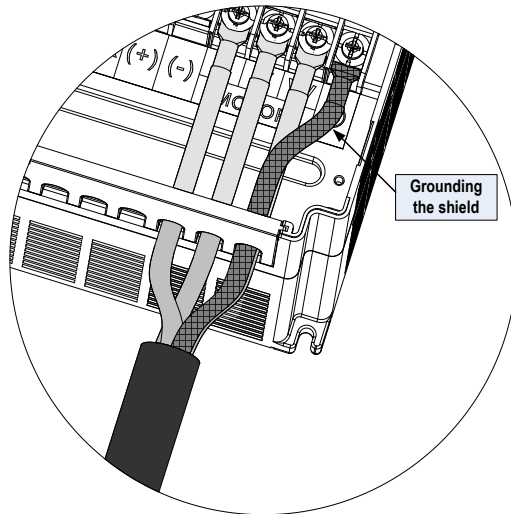


To suppress emission and conduction of the radio frequency interference effectively, the shield of the shielded cable is copper braid. The braided density of the copper braid should be greater than 90% to enhance the shielding efficiency and conductivity, as shown in the following figure.



The following figure shows the grounding method of the shielded cable.

Figure 8-3 Grounding of the shielded cable



The installation precautions are as follows:

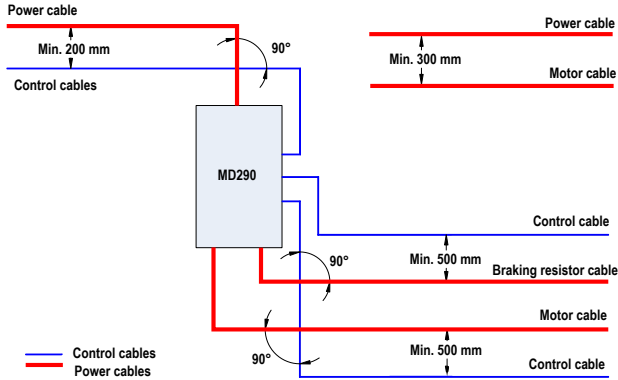
1. Symmetrical shielded cable is recommended. The four-conductor shielded cable can also be used as an input cable.
2. The motor cable and PE shielded conducting wire (twisted shielded) should be as short as possible to reduce electromagnetic radiation and external stray current and capacitive current of the cable. If the motor cable is over 100 meters long, an output filter or reactor is required.
3. It is recommended that all control cables be shielded.
4. It is recommended that shielded cables or shielded steel tube armored cables be used for the drive power output, and the shield must be well grounded. For devices suffering from interference, shielded twisted pair (STP) cable is recommended and the cable shield must be well grounded.

#### 8.4.2 Cabling Requirements

1. The motor cables must be laid far away from other cables. The motor cables of several AC drives can be laid side by side.
2. It is recommended that the motor cables, power input cables and control cables be laid in different ducts. To avoid electromagnetic interference caused by rapid change of the output voltage of the AC drive, the motor cables and other cables must not be laid side by side for a long distance.
3. If the control cable must run across the power cable, make sure they are arranged at an angle of close to 90°. Other cables must not run across the AC drive.
4. The power input and output cables of the AC drive and weak-current signal cables (such as control cable) should be laid vertically (if possible) rather than in parallel.

5. The cable ducts must be in good connection and well grounded. Aluminium ducts can be used to improve electric potential.
6. The filter, AC drive and motor should be connected to the system (machinery or appliance) properly, with spraying protection at the installation part and conductive metal in full contact.

Figure 8-4 Cabling diagram

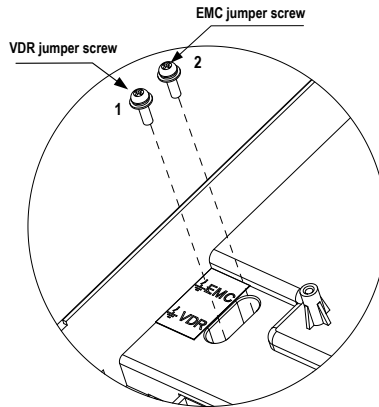


## 8.5 Solutions to Current Leakage

1. The AC drive outputs high-speed pulse voltage, producing high-frequency leakage current during running of the AC drive. To prevent electric shock and even a fire caused by current leakage, it is necessary to install a residual current circuit-breaker to the AC drive.
2. Each AC drive produces more than 100 mA leakage current. Therefore, the sensitivity current of the residual current circuit-breaker must be above 100 mA.
3. High-frequency pulse interference may cause the circuit-breaker to malfunction, and thus the residual current circuit-breaker must have the high-frequency filtering function.
4. If multiple AC drives are required, each AC drive must be installed with a circuit-breaker.
5. The factors that influence the leakage current are as follows:
  - AC drive capacity
  - Carrier frequency
  - Type and length of motor cable
  - EMI filter
6. When the leakage current causes the circuit-breaker to act, you should:
  - Increase the sensitivity current of the circuit-breaker.
  - Replace the circuit-breaker with a new one with high-frequency suppression function.
  - Reduce the carrier frequency.
  - Shorten the length of the output cable.
  - Install a current leakage suppression device.

## 7. EMC jumper screw

The AC drive has the built-in safety capacitor groups and VDR group and they are connected by default. If the leakage current protection switch acts at power-on of the whole machine, remove the EMC jumper screw as shown in the following figure.



## 8.6 Solutions to Common EMC Interference Problems

The AC drive generates very strong interference. Although EMC measures are taken, the interference may still exist due to improper cabling or grounding during use. When the AC drive interferes with other devices, adopt the following solutions.

Interference Type	Solution
Leakage protection switch tripping	<ul style="list-style-type: none"> <li>• Connect the motor housing to the PE of the AC drive.</li> <li>• Connect the PE of the AC drive to the PE of the line voltage.</li> <li>• Add a safety capacitor to the power input cable.</li> <li>• Add magnetic rings to the input drive cable.</li> </ul>
AC drive interference during running	<ul style="list-style-type: none"> <li>• Connect the motor housing to the PE of the AC drive.</li> <li>• Connect the PE of the AC drive to the PE of the line voltage.</li> <li>• Add a safety capacitor to the power input cable and wind the cable with magnetic rings.</li> <li>• Add a safety capacitor to the interfered signal port or wind the signal cable with magnetic rings.</li> <li>• Connect the equipment to the common ground.</li> </ul>
Communication interference	<ul style="list-style-type: none"> <li>• Connect the motor housing to the PE of the AC drive.</li> <li>• Connect the PE of the AC drive to the PE of the mains voltage.</li> <li>• Add a safety capacitor to the power input cable and wind the cable with magnetic rings.</li> <li>• Add a matching resistor between the communication cable source and the load side.</li> <li>• Add a common grounding cable besides the communication cable.</li> <li>• Use a shielded cable as the communication cable and connect the cable shield to the common grounding point.</li> </ul>
I/O interference	<ul style="list-style-type: none"> <li>• Enlarge the capacitance at the low-speed DI. A maximum of 0.11 <math>\mu\text{F}</math> capacitance is suggested.</li> <li>• Enlarge the capacitance at the AI. A maximum of 0.22 <math>\mu\text{F}</math> is suggested.</li> </ul>



Selection and Dimensions

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## Chapter 9 Selection and Dimensions

### 9.1 Electrical Specifications of the MD290

Table 9-1 Models and technical data of the MD290

Model	Power Capacity (kVA)	Input Current (A)	Output Current (A)	Adaptable Motor (kW, HP)		Thermal Power Consumption (kW)
MD290T18.5G/22P	54	49.5/59	37/45	18.5/22	25/30	0.651/0.807
MD290T22G/30P	60	59/65.8	45/58	22/30	30/40	0.807/1.01
MD290T30G/37P	65	57/71	60/75	30/37	40/50	1.01/1.20
MD290T37G/45P	79	69/86	75/91	37/45	50/60	1.20/1.51
MD290T45G/55P	102	89/111	91/112	45/55	60/75	1.51/1.80
MD290T55G/75P	131	106/143	112/150	55/75	75/100	1.80/1.84
MD290T75G/90P	153	139/167	150/176	75/90	100/125	1.84/2.08
MD290T90G/110P	181	164/198	176/210	90/110	125/150	2.08/2.55
MD290T110G/132P	219	196/239	210/253	110/132	150/200	2.55/3.06

**Note**

The models of 15G/18.5P and below and 132G/160P and above are under development.

Figure 9-1 Physical appearance and mounting dimensions of the MD290 (plastic housing)

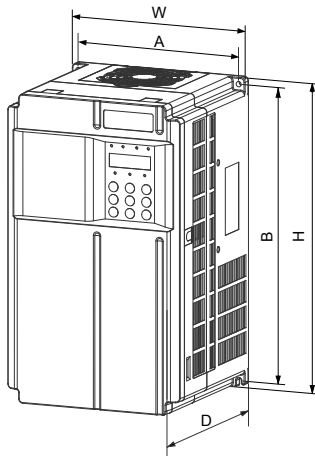


Figure 9-2 Physical appearance and mounting dimensions of the MD290 (sheet metal housing)

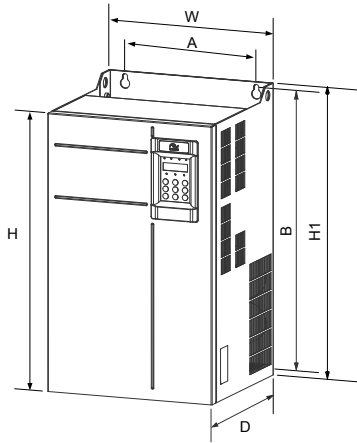


Table 9-2 Mounting dimensions of the MD290

AC Drive Model	Mounting Hole (mm)		Overall Dimensions (mm)				Mounting Hole Diameter (mm)	Weight (kg)
	A	B	H	H1	W	D		
MD290T18.5G/22P	195	335	350	/	210	192	Ø6	9.1
MD290T22G/30P								
MD290T30G/37P	230	380	400	/	250	220	Ø7	17
MD290T37G/45P								
MD290T45G/55P	245	523	523	540	300	275	Ø10	35
MD290T55G/75P								
MD290T75G/90P	270	560	550	576	338	315	Ø10	51.5
MD290T90G/110P								
MD290T110G/132P								



## 9.2 Power Terminals and Cable Diameter

### Note

- The data and models recommended in the table are for reference only. The diameter of the cable the use selects must not exceed the terminal dimensions in the figure.
- The prerequisite of cable selection is the recommended value of PVC insulated cooper wire or cable diameter at the ambient temperature of 40°C in the steady state.

Figure 9-3 Terminal dimensions of MD290T 18.5G/22P/22G/30P

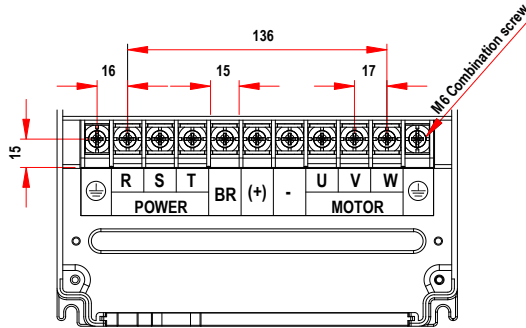


Table 9-3 Cable dimensions and tightening torque of MD290T 18.5G/22P/22G/30P

AC Drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm <sup>2</sup> )	Tightening Torque (N·m)	Recommended Cable Lug Model
MD290T18.5G/22P	49.5/59	16	4.0	GTNR16-6
MD290T22G/30P	59/65.8	16	4.0	GTNR16-6

Figure 9-4 Terminal dimensions of MD290T 30G/37P/37G/45P

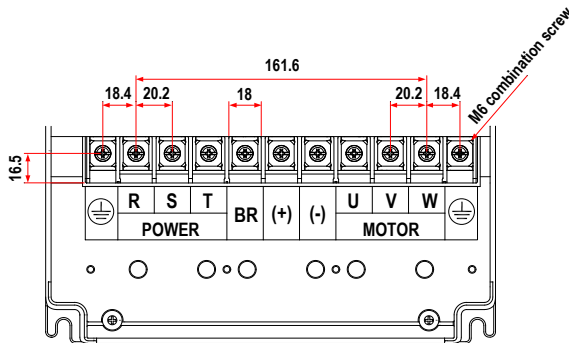


Table 9-4 Cable dimensions and tightening torque of MD290T 30G/37P/37G/45P

AC Drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm2)	Tightening Torque (N·m)	Recommended Cable Lug Model
MD290T30G/37P	57/71	25	4.0	GTNR25-6
MD290T37G/45P	69/86	25	4.0	GTNR25-6

Figure 9-5 Terminal dimensions of MD290T 45G/55P/55G/75P

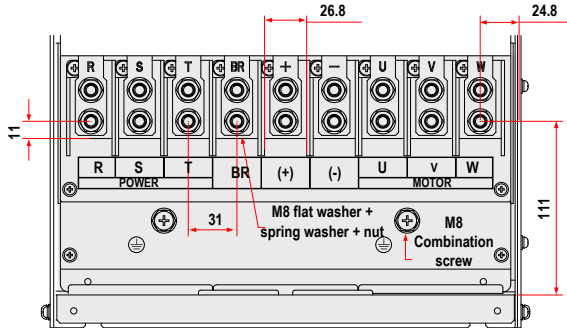


Table 9-5 Cable dimensions and tightening torque of MD290T 45G/55P/55G/75P

AC Drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm2)	Tightening Torque (N·m)	Recommended Cable Lug Model
MD290T45G/55P	89/111	35	10.5	GTNR35-8
MD290T55G/75P	106/143	50	10.5	GTNR50-8

Figure 9-6 Terminal dimensions of MD290T 90P/110P/132P

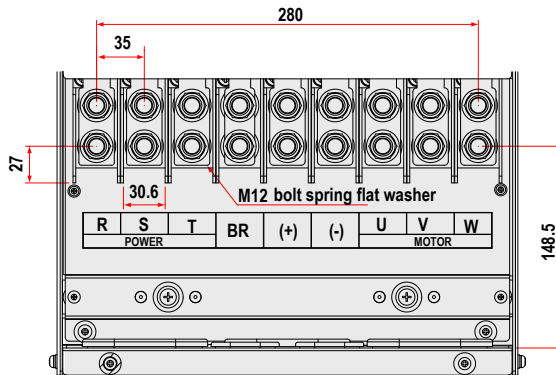


Table 9-6 Cable dimensions and tightening torque of MD290T 90P/110P/132P

AC Drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm <sup>2</sup> )	Tightening Torque (N·m)	Recommended Cable Lug Model
MD290T75G/90P	139/167	70	35.0	GTNR70-12
MD290T90G/110P	164/198	95	35.0	GTNR95-12
MD290T110G/132P	196/239	120	35.0	GTNR120-12

■ Cable Lug Specification

The recommended cable lug is manufactured by Suzhou Yuanli Metal Enterprise.

Figure 9-7 Appearance of recommended cable lugs



Figure 9-8 Dimensions of recommended TNR series cable lugs

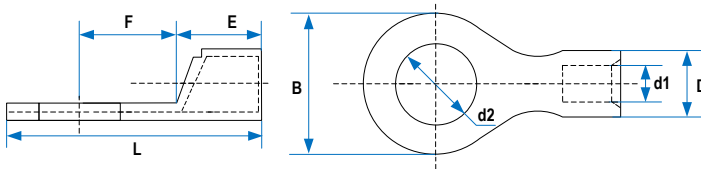


Table 9-7 Models and dimensions of the TNR series cable lugs

Cable Lug Model	Cable Range		D	d1	E	F	B	d2	L	Current (A)	Crimping Tool
	AWG/MCM	mm <sup>2</sup>									
TNR0.75-4	22-16	0.25-1.0	2.8	1.3	4.5	6.6	8.0	4.3	15.0	10	RYO-8 AK-1M
TNR1.25-4	22-16	0.25-1.65	3.4	1.7	4.5	7.3	8	5.3	15.8	19	

Figure 9-9 Dimensions of recommended GTNR series cable lugs

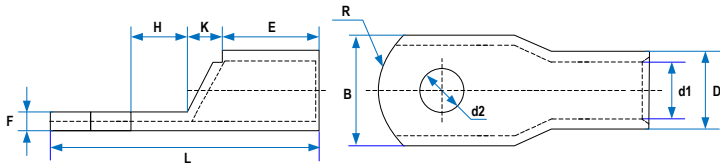


Table 9-8 Models and dimensions of the GTNR series cable lugs

Cable Lug Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool	
GTNR1.5-5	4.0	2.2	5.0	5.0	2.0	8.0	5.3	1.0	16.0	5	RYO-8 YYT-8 RYO-14	
GTNR2.5-4	4.5	2.9	7.0	5.0	2.0	8.0	4.3	1.0	18.0	7		
GTNR2.5-5				6.0			5.3		20.0			
GTNR2.5-6							10.2		6.4			0.8
GTNR4-5	5.2	3.6	7.0	6.0	2.0	10.0	5.3	1.0	20.0			
GTNR4-6				7.5			6.4					
GTNR6-5	6.0	4.2	9.0	6.0	3.0	10.0	5.3	1.2	23.0			
GTNR6-6				7.5			6.4		26.0			
GTNR6-8							12.0		8.4			1.0
GTNR10-6	7.0	5.0	9.0	8.0	3.5	12.4	6.4	1.3	26.5			
GTNR10-8							8.4		27.5			
GTNR16-6	7.8	5.8	12.0	8.0	4.0	12.4	6.4	1.3	31.0		CT-38 CT-100	
GTNR16-8							8.4					
GTNR25-6	9.5	7.5	12.0	8.0	4.5	14.0	6.4	2.0	32.0	10		
GTNR25-8				9.0			15.5		8.4		1.6	34.0
GTNR25-10				10.5			17.5		10.5		1.4	37.0
GTNR35-6	11.4	8.6	15.0	9.0	5.0	15.5	6.4	2.8	38.0			
GTNR35-8							8.4					
GTNR35-10				10.5			17.5				10.5	2.5
GTNR50-8	12.6	9.6	16.0	11.0	6.0	18.0	8.4	2.8	43.5		CT-100	
GTNR50-10							10.5					
GTNR70-8	15.0	12.0	18.0	13.0	7.0	21.0	8.4	2.8	50.0	14		
GTNR70-10							10.5					
GTNR70-12							13.0					
GTNR95-10	17.4	13.5	20.0	13.0	9.0	25.0	10.5	3.9	55.0			
GTNR95-12							13.0					

Cable Lug Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR120-12	19.8	15.0	22.0	14.0	10.0	28.0	13.0	4.7	60.0	16	RYC-150
GTNR120-16				16.0			17.0		64.0		
GTNR150-12	21.2	16.5	26.0	16.0	11.0	30.0	13.0	4.7	60.0	24	
GTNR150-16							17.0				
GTNR185-16	23.5	18.5	32.0	17.0	12.0	34.0	17.0	5.0	78.0		
GTNR240-16	26.5	21.5	38.0	20.0	14.0	38.0	17.0	5.5	92.0		
GTNR240-20							21.0				

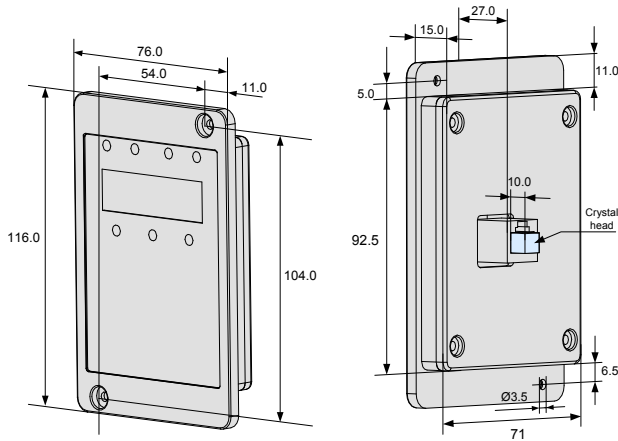
### 9.3 Selection of Peripheral Electrical Devices

Table 9-9 Selection of peripheral electrical devices of the MD290

AC Drive Model	AC Drive Rated Input Current	MCCB (A)	Contactors (A)	Cable of Input Side Main Circuit (mm <sup>2</sup> )	Cable of Output Side Main Circuit (mm <sup>2</sup> )	Cable of Control Circuit (mm <sup>2</sup> )	Main Circuit Grounding Cable (mm <sup>2</sup> )
Three-phase 440 V, 50/60 Hz							
MD290T18.5G/22P	49.50/59.00	80	65	16	16	0.75	16
MD290T22G/30P	59.00/65.80	100	80	16	16	0.75	16
MD290T30G/37P	57.00/71.00	100	80	25	25	0.75	16
MD290T37G/45P	69.00/86.00	160	95	25	25	0.75	16
MD290T45G/55P	89.00/111.00	160	115	35	35	0.75	16
MD290T55G/75P	106.00/143.00	250	150	50	50	0.75	25
MD290T75G/90P	139.00/167.00	250	170	70	70	0.75	35
MD290T90G/110P	164.00/198.00	400	205	95	95	0.75	50

### 9.4 Physical Dimensions of External Operation Panel

Figure 9-10 Physical dimensions of external operation panel



### 9.5 Selection of Braking Unit and Braking Resistor

#### 9.5.1 Physical Dimensions of External DC Reactor

The motor and load's regenerative energy is almost completely consumed on the braking resistor when braking.

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

- U refers to the braking voltage at system stable braking.

Different systems select different braking voltages. The 290 AC drive usually selects 780 V braking voltage, which can be adjusted in F9-08.

- $P_b$  refers to the braking power.

#### 9.5.2 Selection of Power of Braking Resistor

In theory, the power of the regen resistor is the same as the braking power. But in consideration of de-rating, the power of the regen resistor is calculated from the following formula:

$$K \times P_r = P_b \times D$$

- K ranges from 15% to 30%.
- $P_r$  refers to the power of the regen resistor.
- D refers to the braking frequency (percentage of the regenerative process to the whole deceleration).

Application	Elevator	Winding and unwinding	Centrifuge	Occasional braking load	General application
Braking Frequency	20%–30%	20%–30%	50%–60%	5%	10%

Table 9-10 Recommended values of braking resistor

AC Drive Model	Resistance for Long Running (ohm)	Power for Long Running (W)	Min. Resistance (ohm)	Min. Power (W)	Braking Unit		Remark
MD290T18.5G/22PB	82.2	27000	24	9000	Built-in, optional		AC drive model ending with letter "B"
MD290T22G/30PB	69.1	30000	24	9000			
MD290T30G/37PB	50.7	45000	19.2	11000			
MD290T37G/45PB	41.1	50000	12.8	16000			
MD290T45G/55PB	33.8	61000	12.8	16000			
MD290T55G/75PB	27.7	75000	9.6	24000			
MD290T75G/90PB	20.3	100000	6.8	30000			
MD290T90G/110P	11.2 × 2	135000 × 2	9.3 × 2	16000 × 2	External	Input voltage ≤ 440 VAC	MDBUN-60-T × 2
	12.7 × 2	152000 × 2	10.6 × 2	18000 × 2		Input voltage > 440 VAC	MDBUN-60-5T × 2
MD290T110G/132P	11.2 × 2	135000 × 2	9.3 × 2	16000 × 2	External	Input voltage ≤ 440 VAC	MDBUN-60-T × 2
	12.7 × 2	152000 × 2	10.6 × 2	18000 × 2		Input voltage > 440 VAC	MDBUN-60-5T × 2



Maintenance and Trouble-shooting

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# 10 Maintenance and Trouble-shooting

## 10.1 Maintenance

### 10.1.1 Routine Maintenance

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

Routine maintenance involves checking:

- Whether the motor sounds abnormally during running
- Whether the motor vibrates excessively during running
- Whether the installation environment of the AC drive changes.
- Whether the AC drive's cooling fan works normally
- Whether the AC drive overheats

Routine cleaning involves:

- Keep the AC drive clean all the time.
- Remove the dust, especially metal powder on the surface of the AC drive, to prevent the dust from entering the AC drive.
- Clear the oil stain on the cooling fan of the AC drive.

### 10.1.2 Periodic Inspection

Perform periodic inspection in places where inspection is difficult.

Periodic inspection involves:

- Check and clean the air duct periodically.
- Check whether the screws become loose.
- Check whether the AC drive is corroded.
- Check whether the wiring terminals show signs of arcing.
- Carry out the main circuit insulation test.

---

#### Note

- Before measuring insulating resistance with megameter (500 VDC megameter recommended), disconnect the main circuit from the AC drive.
  - Do not use the insulating resistance meter to test the insulation of the control circuit. The high voltage test need not be performed again because it has been completed before delivery.
-

### 10.1.3 Replacement of Vulnerable Components

The vulnerable components of the AC drive are cooling fan and filter electrolytic capacitor. Their service life is related to the operating environment and maintenance status. Generally, the service life is shown as follows:

Component	Service Life	Possible Damage Reason	Judging Criteria
Fan	2 to 3 years	Bearing worn Blade aging	Whether there is crack on the blade Whether there is abnormal vibration noise upon startup
Electrolytic capacitor	4 to 5 years	Input power supply in poor quality High ambient temperature Frequent load jumping Electrolytic aging	Whether there is liquid leakage. Whether the safe valve has projected. Measure the static capacitance. Measure the insulating resistance.

### 10.1.4 Storage of the AC Drive

For storage of the AC drive, pay attention to the following two aspects:

1. Pack the AC drive with the original packing box provided by Inovance.
2. Long-term storage degrades the electrolytic capacitor. Thus, the AC drive must be energized once every 2 years, each time lasting at least 5 hours. The input voltage must be increased slowly to the rated value with the regulator.

## 10.2 Warranty Agreement

1. Free warranty only applies to the AC drive itself.
2. Inovance will provide 18-month warranty from date of manufacturing for the failure or damage under normal use conditions. If the equipment has been used for over 18 months, reasonable repair expenses will be charged.
3. Reasonable repair expenses will be charged for the damages due to the following causes:
  - Improper operation without following the instructions
  - Fire, flood or abnormal voltage.
  - Using the AC drive for non-recommended function
4. The maintenance fee is charged according to Inovance's uniform standard. If there is an agreement, the agreement prevails.

### 10.3 Faults and Solutions

When a fault occurs during running, the AC drive stops output immediately, the contact of the fault relay acts, and the operation panel displays the fault code.

Troubleshoot the fault according to the following table. If the fault cannot be eliminated, contact the agent or Inovance.

Fault Name	Display	Possible Causes	Solutions
Inverter unit protection	Err01	<ol style="list-style-type: none"> <li>1. The output circuit is short circuited.</li> <li>2. The cable between the motor and the AC drive is too long.</li> <li>3. The module overheats.</li> <li>4. The internal connections become loose.</li> <li>5. The main control board is faulty.</li> <li>6. The drive board is faulty.</li> <li>7. The inverter module is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Eliminate external faults.</li> <li>2. Install a reactor or an output filter.</li> <li>3. Check that the air filter and the cooling fan work properly.</li> <li>4. Connect all cables properly.</li> <li>5. Contact the agent or Inovance for technical support.</li> </ol>
Overcurrent during acceleration	Err02	<ol style="list-style-type: none"> <li>1. The output circuit is grounded or short circuited.</li> <li>2. Reserved</li> <li>3. The acceleration time is too short.</li> <li>4. Customized torque boost or V/F curve is not appropriate.</li> <li>5. The voltage is too low.</li> <li>6. The spinning motor is started.</li> <li>7. A sudden load is added during acceleration.</li> <li>8. The AC drive size is small.</li> </ol>	<ol style="list-style-type: none"> <li>1. Eliminate external faults.</li> <li>2. Perform the motor auto-tuning.</li> <li>3. Increase the acceleration time.</li> <li>4. Adjust the manual torque boost or V/F curve.</li> <li>5. Adjust the voltage to normal range.</li> <li>6. Enable the catching a spinning motor function or start the motor after it stops.</li> <li>7. Remove the added load.</li> <li>8. Replace a large drive.</li> </ol>
Overcurrent during deceleration	Err03	<ol style="list-style-type: none"> <li>1. The output circuit is grounded or short circuited.</li> <li>2. Reserved</li> <li>3. The deceleration time is too short.</li> <li>4. The voltage is too low.</li> <li>5. A sudden load is added during deceleration.</li> <li>6. The braking unit and regenerative braking resistor are not installed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Eliminate external faults.</li> <li>2. Perform the motor auto-tuning.</li> <li>3. Increase the deceleration time.</li> <li>4. Adjust the voltage to normal range.</li> <li>5. Remove the added load.</li> <li>6. Install the braking unit and regen resistor.</li> </ol>
Overcurrent at constant speed	Err04	<ol style="list-style-type: none"> <li>1. The output circuit is grounded or short circuited.</li> <li>2. Motor auto-tuning is not performed.</li> <li>3. The voltage is too low.</li> <li>4. A sudden load is added during operation.</li> <li>5. The AC drive size is small.</li> </ol>	<ol style="list-style-type: none"> <li>1. Eliminate external faults.</li> <li>2. Perform the motor auto-tuning.</li> <li>3. Adjust the voltage to normal range.</li> <li>4. Remove the added load.</li> <li>5. Replace a large drive.</li> </ol>

Fault Name	Display	Possible Causes	Solutions
Overvoltage during acceleration	Err05	<ol style="list-style-type: none"> <li>1. The input voltage is too high.</li> <li>2. An external force drives the motor during acceleration.</li> <li>3. The acceleration time is too short.</li> <li>4. The braking unit and regenerative braking resistor are not installed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the voltage to normal range.</li> <li>2. Cancel the external force or install a regenerative braking resistor.</li> <li>3. Increase the acceleration time.</li> <li>4. Install the braking unit and regenerative braking resistor.</li> </ol>
Overvoltage during deceleration	Err06	<ol style="list-style-type: none"> <li>1. The input voltage is too high.</li> <li>2. An external force drives the motor during deceleration.</li> <li>3. The deceleration time is too short.</li> <li>4. The braking unit and regenerative braking resistor are not installed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the voltage to normal range.</li> <li>2. Cancel the external force or install the regenerative braking resistor.</li> <li>3. Increase the deceleration time.</li> <li>4. Install the braking unit and regenerative braking resistor.</li> </ol>
Overvoltage at constant speed	Err07	<ol style="list-style-type: none"> <li>1. The input voltage is too high.</li> <li>2. An external force drives the motor during deceleration.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the voltage to normal range.</li> <li>2. Cancel the external force or install the regenerative braking resistor.</li> </ol>
Control power supply fault	Err08	The input voltage is not within the allowable range.	Adjust the input voltage to the allowable range.
Undervoltage	Err09	<ol style="list-style-type: none"> <li>1. Instantaneous power failure occurs.</li> <li>2. The AC drive's input voltage is not within the allowable range.</li> <li>3. The bus voltage is abnormal.</li> <li>4. The rectifier bridge and buffer resistor are faulty.</li> <li>5. The drive board is faulty</li> <li>6. The main control board is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reset the fault.</li> <li>2. Adjust the voltage to normal range.</li> <li>3. Contact the agent or Inovance.</li> </ol>
AC drive overload	Err10	<ol style="list-style-type: none"> <li>1. The load is too heavy or locked-rotor occurs on the motor.</li> <li>2. The AC drive size is small.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce the load and check the motor and mechanical conditions.</li> <li>2. Replace a large drive.</li> </ol>


Fault Name	Display	Possible Causes	Solutions
Motor overload	Err11	<ol style="list-style-type: none"> <li>1. F9-01 is set improperly.</li> <li>2. The load is too heavy or motor standstill occurs.</li> <li>3. The AC drive size is small.</li> </ol>	<ol style="list-style-type: none"> <li>1. Set F9-01 correctly.</li> <li>2. Reduce the load and check the motor and mechanical conditions.</li> <li>3. Replace a large drive.</li> </ol>
Power input phase loss	Err12	<ol style="list-style-type: none"> <li>1. The three-phase power input is abnormal.</li> <li>2. The drive board is faulty.</li> <li>3. The lightening protection board is faulty.</li> <li>4. The main control board is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Eliminate external faults.</li> <li>2. Contact the agent or Inovance for technical support.</li> </ol>
Power output phase loss	Err13	<ol style="list-style-type: none"> <li>1. The cable connecting the AC drive and the motor is faulty.</li> <li>2. The AC drive's three-phase outputs are unbalanced when the motor is running.</li> <li>3. The drive board is faulty</li> <li>4. The module is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Eliminate external faults.</li> <li>2. Check whether the motor three-phase winding is normal.</li> <li>3. Contact the agent or Inovance.</li> </ol>
Module overheat	Err14	<ol style="list-style-type: none"> <li>1. The ambient temperature is too high.</li> <li>2. The air filter is blocked.</li> <li>3. The fan is damaged.</li> <li>4. The thermally sensitive resistor of the module is damaged.</li> <li>5. The inverter module is damaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Lower the ambient temperature.</li> <li>2. Clean the air filter.</li> <li>3. Replace the damaged fan.</li> <li>4. Replace the damaged thermally sensitive resistor.</li> <li>5. Replace the inverter module.</li> </ol>
External equipment fault	Err15	<ol style="list-style-type: none"> <li>1. External fault signal is input via DI.</li> <li>2. External fault signal is input via virtual I/O.</li> </ol>	Reset the operation.
Communication fault	Err16	<ol style="list-style-type: none"> <li>1. The host computer is in abnormal state.</li> <li>2. The communication cable is faulty.</li> <li>3. F0-28 is set improperly.</li> <li>4. The communication parameters in group FD are set improperly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the cabling of host computer.</li> <li>2. Check the communication cabling.</li> <li>3. Set F0-28 correctly.</li> <li>4. Set the communication parameters properly.</li> </ol>
Contacting fault	Err17	<ol style="list-style-type: none"> <li>1. The drive board and power supply are faulty.</li> <li>2. The contactor is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the faulty drive board or power supply board.</li> <li>2. Replace the faulty contactor.</li> </ol>
Current detection fault	Err18	The drive board is faulty.	Replace the faulty drive board.
Motor auto-tuning fault	Err19	<ol style="list-style-type: none"> <li>1: The motor parameters are not set according to the nameplate.</li> <li>2: The motor auto-tuning times out.</li> </ol>	<ol style="list-style-type: none"> <li>1: Set the motor parameters according to the nameplate properly.</li> <li>2: Check the cable connecting the AC drive and the motor.</li> </ol>
EEPROM read-write fault	Err21	The EEPROM chip is damaged.	Replace the main control board.

Fault Name	Display	Possible Causes	Solutions
AC drive hardware fault	Err22	1. Overvoltage exists. 2. Overcurrent exists.	1. Handle based on overvoltage. 2. Handle based on overcurrent. Err22 is caused by hardware overvoltage fault on most conditions.
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 the parameter initialization function.
User-defined fault 1	Err27	1. The user-defined fault 1 signal is input via DI. 2. User-defined fault 1 signal is input via virtual I/O.	Reset the operation.
User-defined fault 2	Err28	1. The user-defined fault 2 signal is input via DI. 2. The user-defined fault 2 signal is input via virtual I/O.	Reset the operation.
Accumulative power-on time reached	Err29	The accumulative power-on time reaches the setting value.	Clear the record through the parameter initialization function.
Load lost	Err30	The load gets disconnected during the drive running.	Check that the load is disconnected.
PID feedback lost during running	Err31	The PID feedback is lower than the setting of FA-26.	Check the PID feedback signal or set FA-26 to a proper value.
Pulse-by-pulse current limit fault	Err40	1. The load is too heavy or motor standstill occurs. 2. The AC drive size is small.	1. Reduce the load and check the motor and the machine. 2. Replace a large drive.
Motor switchover fault during running	Err41	Change the selection of the motor via terminal during running of the AC drive.	Perform motor switchover after the AC drive stops.
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.
Slave fault in the master/slave control mode	Err55	1. The slave is faulty	1. View the slave fault code and the solution.
Braking unit overload	Err61	1. The braking resistor is small.	1. Replace with a large braking resistor.
Braking unit abnormal	Err62	1. The braking module is abnormal.	1. Contact Inovance for technical support.

## 10.4 Symptoms and Diagnostics

The following symptoms may occur during use of the AC drive. When these symptoms occur, perform simple analysis based on the following table.

No.	Symptom	Possible Causes	Solutions
1	There is no display at power-on. There is no display at power-on.	<ol style="list-style-type: none"> <li>1. There is no power supply to the AC drive or the power input to the AC drive is too low.</li> <li>2. The switching mode power supply on the drive board of the AC drive is faulty.</li> <li>3. The rectifier bridge is damaged.</li> <li>4. The control board or the operation panel is faulty.</li> <li>5. The cable connecting the control board and the drive board and the operation panel breaks.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the power supply.</li> <li>2. Check the bus voltage.</li> <li>3. Re-connect the 4-core and 28-core cables.</li> <li>4. Contact the agent or Inovance for technical support.</li> </ol>
2	"HC" is displayed at power-on.	<ol style="list-style-type: none"> <li>1. The cable between the drive board and the control board is in poor contact.</li> <li>2. Related components on the control board are damaged.</li> <li>3. The motor or the motor cable is short circuited to the ground.</li> <li>4. The power input to the AC drive is too low.</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-connect the 4-core and 28-core cables.</li> <li>2. Contact the agent or Inovance for technical support.</li> </ol>
3	"Err23" is displayed at power-on.	<ol style="list-style-type: none"> <li>1. The motor or the motor output cable is short-circuited to the ground.</li> <li>2. The AC drive is damaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check insulation of the motor and the output cable with a megger.</li> <li>2. Contact the agent or Inovance for technical support.</li> </ol>
4	The AC drive display is normal upon power-on. But after running the AC drive displays "HC" and stops immediately.	<ol style="list-style-type: none"> <li>1. The cooling fan is damaged or locked-rotor occurs.</li> <li>2. The external control terminal cable is short circuited.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the damaged fan.</li> <li>2. Eliminate external fault.</li> </ol>
5	Err14 (module overheat) is reported frequently.	<ol style="list-style-type: none"> <li>1. The setting of carrier frequency is too high.</li> <li>2. The cooling fan is damaged, or the air filter is blocked.</li> <li>3. Components inside the AC drive are damaged (thermal coupler or others).</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce the carrier frequency (F0-15).</li> <li>2. Replace the fan and clean the air filter.</li> <li>3. Contact the agent or Inovance for technical support.</li> </ol>
6	The motor does not rotate after the AC drive runs.	<ol style="list-style-type: none"> <li>1. Check the motor and the motor cables.</li> <li>2. The motor parameters are set improperly.</li> <li>3. The cable between the drive board and the control board is in poor contact.</li> <li>4. The drive board is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check that cabling between the AC drive and the motor is normal.</li> <li>2. Replace the motor or rectify mechanical faults.</li> <li>3. Check and set the motor parameters again.</li> </ol>

No.	Symptom	Possible Causes	Solutions
7	The DI terminals are disabled.	<ol style="list-style-type: none"> <li>1. The related parameters are set incorrectly.</li> <li>2. The external signal is incorrect.</li> <li>3 The jumper across OP and +24 V becomes loose.</li> <li>4. The control board is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and set the parameters in group F4 again.</li> <li>2. Re-connect the external signal cables.</li> <li>3. Re-confirm the jumper bar across OP and +24 V.</li> <li>4. Contact the agent or Inovance for technical support.</li> </ol>
9	The AC drive reports overcurrent and overvoltage frequently.	<ol style="list-style-type: none"> <li>1. The motor parameters are set improperly.</li> <li>2. The acceleration/deceleration time is improper.</li> <li>3. The load fluctuates.</li> </ol>	<ol style="list-style-type: none"> <li>1. Set the motor parameters or perform motor auto-tuning again.</li> <li>2. Set proper acceleration/ deceleration time.</li> <li>3. Contact the agent or Inovance for technical support.</li> </ol>
10	Err17 is reported upon power-on or running.	The soft startup contactor is not closed.	<ol style="list-style-type: none"> <li>1. Check whether the contactor cable is loose.</li> <li>2. Check whether the contactor is faulty.</li> <li>3. Check whether 24 V power supply of the contactor is faulty.</li> <li>4. Contact the agent or Inovance for technical support.</li> </ol>
11	 is displayed upon power-on.	Related component on the control board is damaged.	Replace the control board.





# Warranty Agreement

1. The warranty period of the product is 18 months from date of manufacturing. During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Inova will be responsible for free maintenance.
2. Within the warranty period, maintenance will be charged for the damages caused by the following reasons:
  - a. Improper use or repair/modification without prior permission
  - b. Fire, flood, abnormal voltage, other disasters and secondary disaster
  - c. Hardware damage caused by dropping or transportation after procurement
  - d. Improper operation
  - e. Trouble out of the equipment (for example, external device)
3. If there is any failure or damage to the product, please correctly fill out the Product Warranty Card in detail.
4. The maintenance fee is charged according to the latest Maintenance Price List of Inova.
5. The Product Warranty Card is not re-issued. Please keep the card and present it to the maintenance personnel when asking for maintenance.
6. If there is any problem during the service, contact Inova's agent or Inova directly.
7. This agreement shall be interpreted by Inova Automation Co., Limited.

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# Product Warranty Card

Customer information	Address:	
	Company name: Postcode:	Contact person:
		Tel or Email:
Product information	Product model:	
	Serial No (Attach here):	
	Name Supplier who supplied you the unit	
Failure Description (eg. Fault code)		
	Maintenance personnel:	

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