Preface

Thank you for purchasing the MD500 series AC drive developed and manufactured by Inovance.

The MD500 is a general-purpose high-performance current vector AC drive for the purpose of control of three-phase AC asynchronous motor on speed and torque. With advanced vector control technology, it has high torque output at low speed, good dynamic feature and strong overload capacity. It increases the user programmable function, background monitoring software and communication bus function, and supports multi-kind PG cards. It is used to drive various automation production equipment involving textile, paper-making, wiredrawing, machine tool, packing, food, fan and pump.

Introduction

Advantages

1. Small size and high power density
2. Wide voltage range design

   Rated voltage input: 380 to 480 V, wide voltage range: 323 to 528 V
3. Built-in DC reactor

   The MD500 AC drives of 30 kW and above have built-in DC reactor.
4. Built-in braking unit and related protective function

   The power class of the MD500 AC drives with built-in braking unit extends to 75 kW. The protective functions including braking resistor short-circuit, braking circuit overcurrent, brake pipe shoot-througn.
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 due to motor rotor-lock or damage, the cooling fan drive circuit provides protection.
7. Complete protective functions

   The whole series of MD500 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.

CE Mark

The CE mark on the MD500 declares that the AC drive complies with the European low voltage directive (LVD) and EMC directive.

The MD500 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 MD500 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 chapter 7.

Contents

Safety Information and Precautions

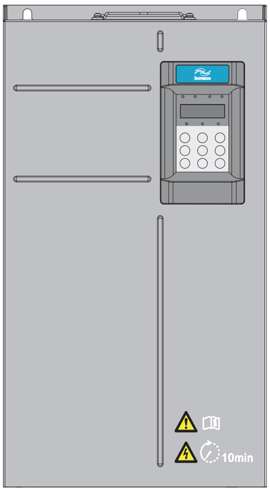
Safety Information and Precautions

Before the Use

Thank you for purchasing the MD500 series AC drive. This manual introduces how to use the drive correctly. Before using the drive (installation, wiring, operation, maintenance and inspection), read this manual carefully. In addition, use the drive only after you get to understand the safety information and precautions in this chapter.

About This Manual

The manual related to the MD500 series AC drive is listed in the following table.

MD500 AC Drive	Manual Description
	MD500 Series High-performance Vector Control AC Drive User Manual The manual is packed together with the drive in the carton. **Documentation code: 19010xxx**
	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.
	● 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.

This manual includes some very important safety warnings and notices. There are three types of safety notice, and you must comply with the three 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 may result in severe personal injury or even death.

⚠ CAUTION

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

Read the following safety information and instructions carefully so that you understand how to install, commission, operate and **maintain the MD500 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.

Safety Information

General

⚠ DANGER

To Prevent Electric Shock

- Never wire the AC drive while the power is on. Cut off all power supplies and wait for at least ten minutes before any checking work so that the residual voltage on capacitors can discharge safely.
- Always ensure that the AC drive is tied to ground well because the contact current of the drive is larger than 3.5 mA.

⚠ WARNING

To Prevent Sudden Movement

- **The system may start accidentally once the power is applied, resulting in severe personal injury or even death. Confirm** that the cover of the AC drive is secure and the motor is allowed to restart before applying power to the drive.

To Prevent Electric Shock

- **Never modify or refit the AC drive. Inovance will accept no liability or responsibility for any modification or refitting.**
- **Never allow unqualified personnel to perform any maintenance, inspection or part replacement work.**
- Never remove the cover or touch the PCB of the drive.

To Prevent Fire

- **Always confirm the rated voltage of the AC drive matches the power voltage before applying the power. Incorrect power voltage of the main circuit may result in a fire.**

⚠ CAUTION

To Prevent Crush

- Never transporting the drive by carrying the front cover. Failure to comply may **result in personal injury from main body of the drive falling off.**
- Always handle the drive with care.
- Do not use the drive if there are damaged or missing parts.

To Prevent Damage to the Equipment

- Follow the proper electrostatic discharge (ESD) procedures when operating the AC drive. Failure to comply will damage the interna circuit of the drive.
- Do not perform a voltage resistance test on any part of the AC drive. The factory performs tests of this type during manufacture and damage might occur if you repeat these tests.
- Do not power on or operate the drive that has been damaged or has any missing part. Failure to comply may cause further damage.
- Perform branch circuit and short circuit protection according to local code. Failure to comply may damage the drive. The drive is applicable to the circuit capable of 100 kA below short-circuit current and and 480 VAC maximum voltage (400 V class).

To Reduce Interference

- Never install equipments such as transformer that generate electromagnetic wave or interference surrounding the drive. Failure to comply may result in unexpected action of the drive. If it is necessay to install such equipment, install a shield plate between it and the drive.

To Prevent Malfunction

- Never share grounding cable with welding machines or electrical equipments that require large current. Failure to comply may result in the drive or equipment malfunction.
- When using multiple drives, ground them properly according to the instructions in this manual. Improper grounding may result in the drive or equipment malfunction.

Before Installation

⚠ DANGER

- Never install the equipment if the equipment shows signs of water damage or damage during transit, or if parts are missing.
- Never install the the equipment if the packing list does not conform to the product you receive.

During Installation

⚠ DANGER

- **Do not loosen the fixed screws on components. It is especially important not to remove screws that have a red mark.**

⚠ WARNING

- Never connect power cables to the output terminals (U, V, W) of the AC drive. Identify the marks of the cable terminals carefully, and make sure you complete all connections correctly.
- Never connect the regen resistor between the DC bus terminals (+) and (–).
- Use a shielded cable for connections to the encoder, and make sure you connect the shielding layer to an effective ground.

Making Electrical Connections

⚠ DANGER

- Connect the output terminals (U, V, W) of the AC drive to the input terminals (U, V, W) of the motor. Make sure to keep their phase sequence consistent. Inconsistent phase sequence will result in reverse rotation of the motor.
- Never connect power cables to the output terminals of the AC drive. Failure to **comply will result in damage to the AC drive or even a fire.**

After Power-on

⚠ DANGER

- Never open or remove the protective cover of the AC drive when the equipment is powered on.
- **Never touch any of the input/output terminals of the AC drive.**

⚠ WARNING

- Never touch the rotating part of the motor during motor auto-tuning or while the motor is running.
- Never change the factory settings of the MD500 AC drive.

During Operation

DANGER

- Do not touch the fan or the discharging resistor, which becomes hot.
- **Signal measurements must be made only by a qualified technician.**

WARNING

- **Prevent objects falling into the MD500 AC drive.**
- Follow the correct procedures described in this user manual to start and to stop the MD500 AC drive. Do not start or stop the AC drive by using the power contactor or circuit breaker.

During Maintenance

DANGER

- **Repair and maintenance operations on the MD500 AC drive must be performed only by qualified technicians.**
- Never repair or main the drive while the power is on. Follow the repair and maintenance instructions in this user manual.
- Wait for a period of 10 minutes after the AC drive is powered off before allowing any repairs or maintenance work to start, so that hot parts can cool down and to allow the residual voltage on capacitors to discharge safely.
- Disconnect the AC drive from the power supply before starting any repair or maintenance operations.
- Perform parameter setting and check after the drive is replaced.

WARNING

- The rotating motor feeds power back to the AC drive system. Because of this, the AC drive will still be charged even if the motor stops and the power is disconnected. Therefore, disconnect the motor from the AC drive before starting any maintenance on the AC drive.

General Precautions

1. 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, you should 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 of 300 mA ($I_{\Delta n}$ is two to four times of protective conductor current).

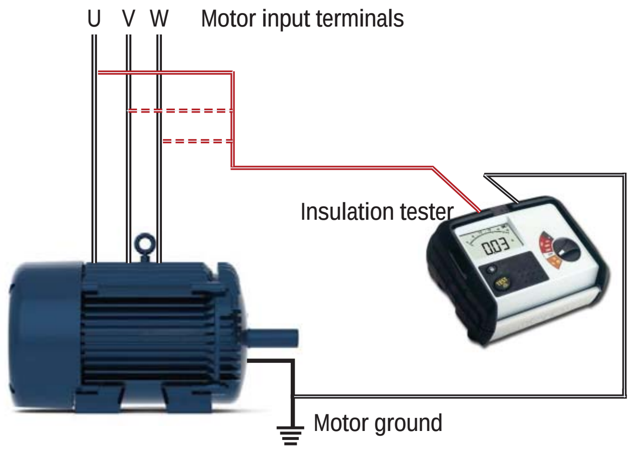
2. Motor insulation test

   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 volt insulation tester is recommended for this test, and the insulation resistance must not be less than 5 M.

   Figure 1 Connections required for a motor insulation test



3. Thermal protection of the motor

   If the rated capacity of the motor selected does not match that of the AC drive, adjust the motor protection parameters on the operation panel of the AC drive 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.

4. Running at frequency higher than 50 Hz

   The MD500 AC drive can output frequency in the range 0 to 500 Hz. If it is necessary to operate the MD500 AC drive at frequency higher than 50 Hz, consider the capacity of the machine.

5. 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.**

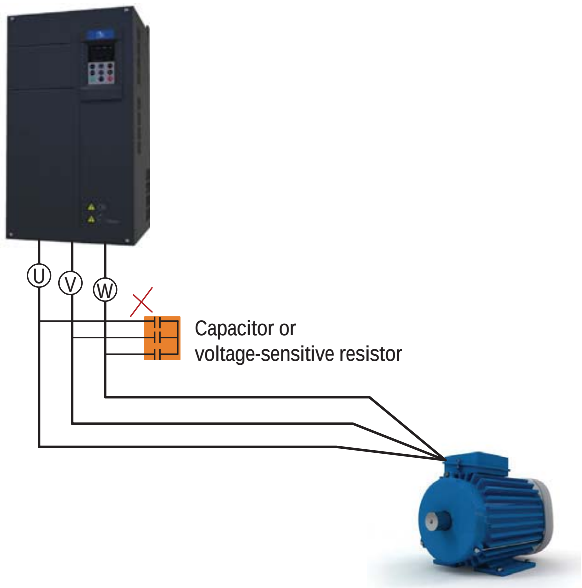
6. Motor heat and noise

   The output from the MD380 AC Drive is a pulse width modulation (PWM) waveform, which contains harmonic frequencies. Because of this, the motor temperature, noise and vibration increase slightly when the AC drive operates at the line frequency (50 Hz).

7. 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 2 Disallowed connections to the AC Drive output

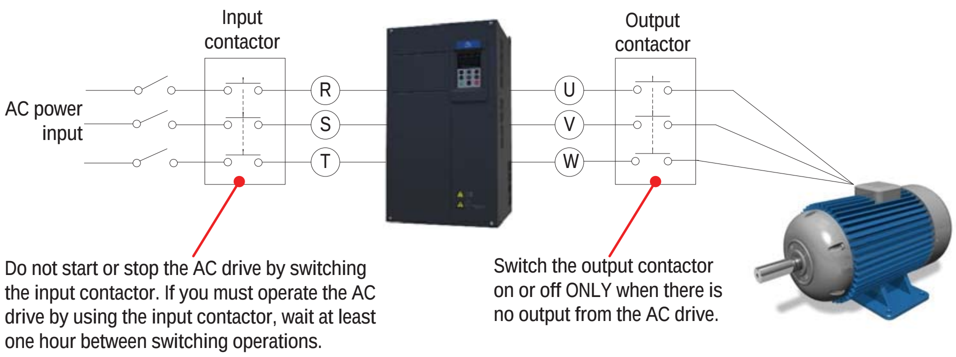


8. **Contactor at the I/O terminal of the AC Drive**

   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 3 Input and output contactors



9. 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.

10. 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.

11. 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.

    Note

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

12. 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.

13. 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.

14. Adaptable motor

    - The standard adaptable motor is an adaptable four-pole squirrelcage 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. If variable speed is required, 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.

Drive Label Warnings

The AC drive labels the warning information in the following position.

Please obey the warning information during the use.

Directive Code	Standard
	Read the user manual of the MD500 AC drive carefully before installation or operation. Failure to comply will result in electric shock.
	Never remove the protective covers while the power is on or within10 minutes after the power is turned off. Wait for a period of 10 minutes after the AC drive is powered off before starting any repair, maintenance or wiring work .

Restrictions

- The MD500 AC drive is not designed or manufactured for use in devices or systems that may directly affect or threaten human livesor health.
- Customers who intend to arrange the AC drive for special use such as device or system relating to manned transportation vehicles, health care, space aviation, nuclear energy, electric power, or in underwater applications must contact the agent or sales representatives of Inovance..
- The AC drive has been manufactured under strict quality control. However, if this product is to be installed in any location where the fault of this product may result in a severe accident or loss, install safety devices.

1

Product Information

1. Product Information

Safety Information

Thank you for purchasing the MD500 series AC drive. This manual introduces how to use the drive correctly. Before using the drive (installation, wiring, operation, maintenance and inspection), read this manual carefully. In addition, use the drive only after you get to understand the safety information and precautions in this chapter.

⚠ DANGER

To Prevent Crush

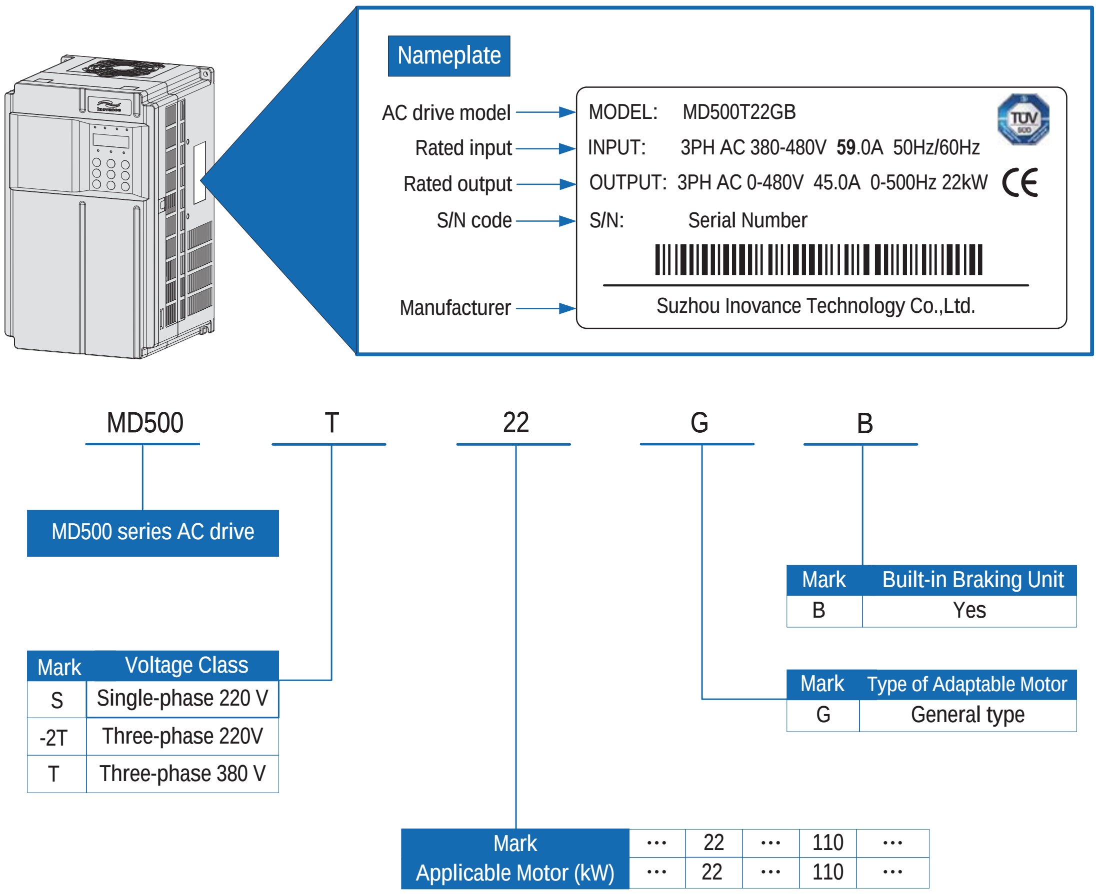
- **Never transporting the drive by carrying the front cover. Failure to comply may result in personal injury from main boby of** the drive falling off.
- Follow the proper electrostatic discharge (ESD) procedures when operating the AC drive. Failure to comply will damage the interna circuit of the drive.

1.1 Product Type Identification

Each model in the range of MD500 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.

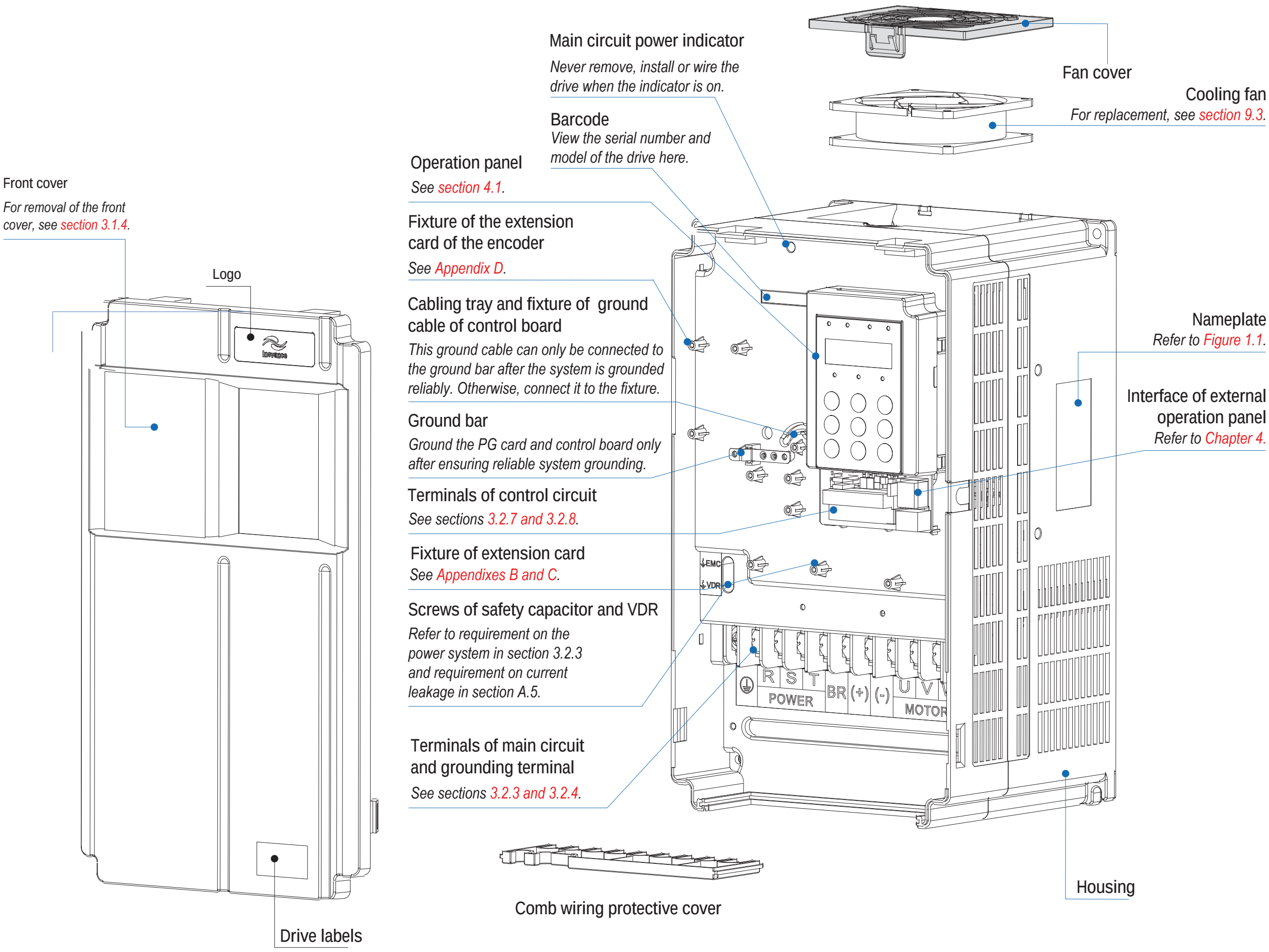
Figure 1-1 How a MD500 model number derived from the system specification



1.2 Components of the MD500

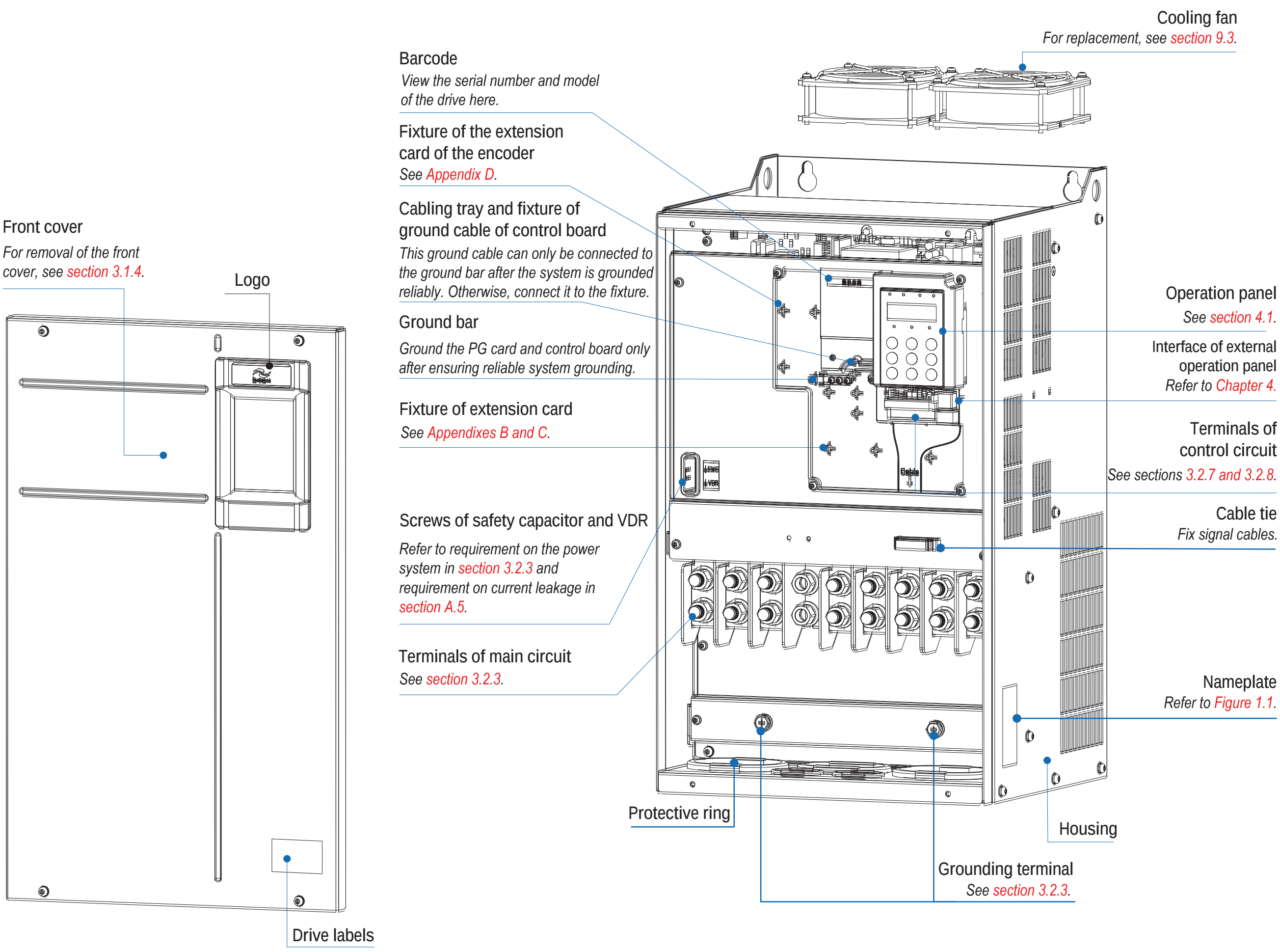
The MD500 can have either a plastic housing or a sheet metal housing, depending on the voltage and power class of the specific MD500 unit.

Figure 1-2 Components of the MD500 AC drive with a plastic housing (three-phase 380 to 480 V, 18.5 to 37 kW)



Label	Meaning
	Read the user manual of the MD500 AC drive carefully before installation or operation. Failure to comply will result in electric shock.
 	Never remove the protective covers while the power is on or within10 minutes after the power is turned off. Wait for a period of 10 minutes after the AC drive is powered off before starting any repair, maintenance or wiring work .

Figure 1-3 Components of the MD500 AC drive with a sheet metal housing (three-phase 380 to 480 V, 45 to 110 kW)



Label	Meaning
	Read the user manual of the MD500 AC drive carefully before installation or operation. Failure to comply will result in electric shock.
	Never remove the protective covers while the power is on or within10 minutes after the power is turned off. Wait for a period of 10 minutes after the AC drive is powered off before starting any repair, maintenance or wiring work .

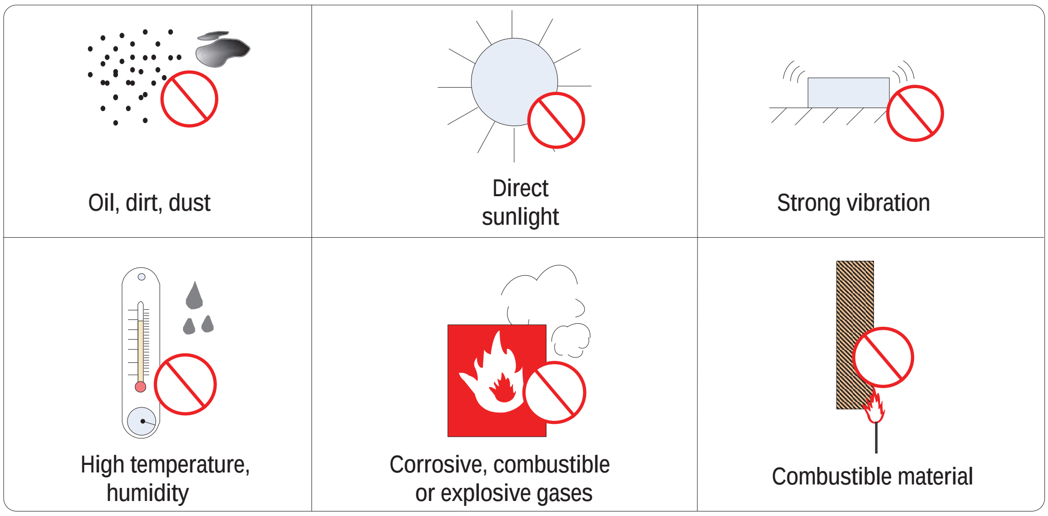
2

Mechanical Installation

2. Mechanical Installation

2.1 Installation Environment

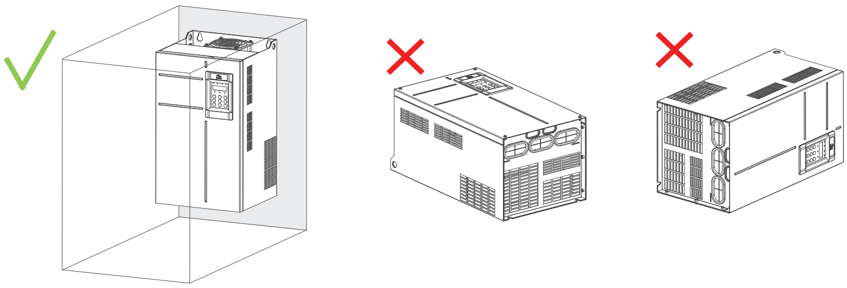
Item	Requirements
Ambient temperature	-10°C to 50°C
Heat dissipation	**Install the AC Drive on an incombustible supporting surface and make sure there is sufficient space around the enclosure to allow for efficient heat dissipation. See 2.2 “Mounting Orientation and** Clearance” below. Use strong screws 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 MD500 units that have plastic drives 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.



2.2 Mounting Orientation and Clearance

■ Mounting Orientation

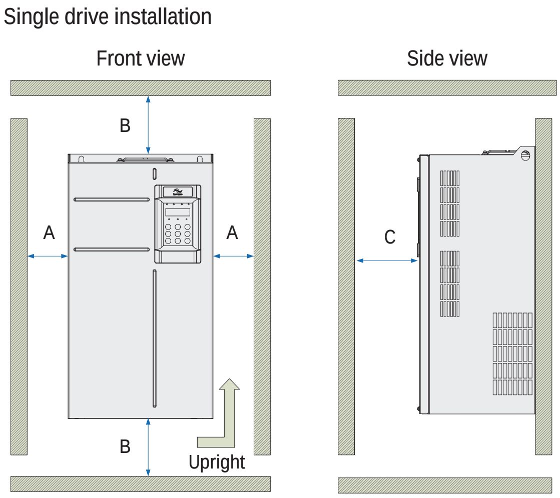
Always mount the AC drive in an upright position.



■ Mounting Clearance

The mechanical clearance requirements for the MD500 vary with power classes of the AC drive.

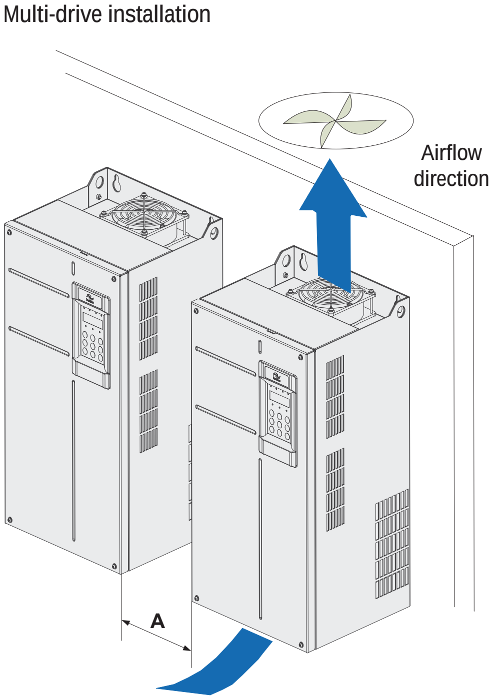
Figure 2-1 Correct mounting clearance of the MD500



Power Class	Clearance Requirements		
18.5 to 22 kW	A ≥ 10 mm	B ≥ 200 mm	C ≥ 40 mm
30 to 37 kW	A ≥ 50 mm	B ≥ 200 mm	C ≥ 40 mm
45 to 110 kW	A ≥ 50 mm	B ≥ 300 mm	C ≥ 40 mm

The MD500 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.

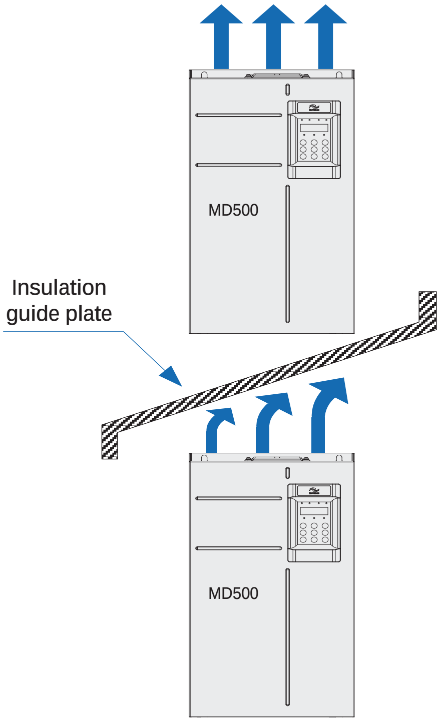
Figure 2-2 Clearance for multi-drive installation



Power Class	Clearance Requirements
18.5 to 22 kW	A ≥ 10 mm
30 to 37 kW	A ≥ 50 mm
45 to 110 kW	A ≥ 50 mm

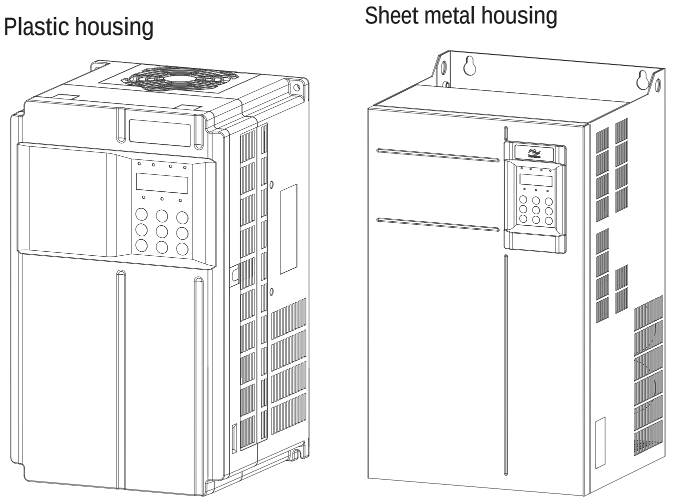
For the application of installing multiple AC drives, if one row of AC drives need to be installed above another row, install an insulation guide plate to prevent AC drives in the lower row from heating those in the upper row and causing faults.

Figure 2-3 Installation of the insulation guide plate



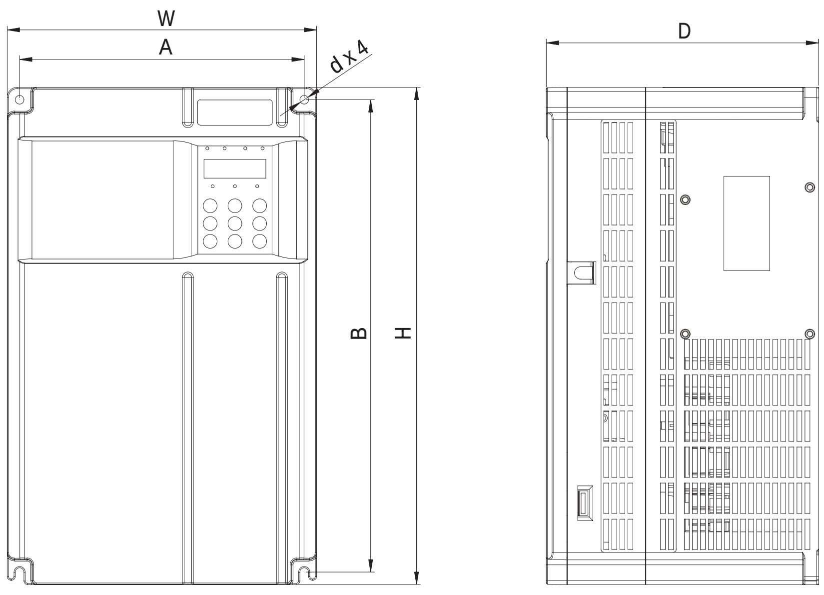
2.3 Physical Appearance and Mounting Dimensions

2.3.1 Physical Appearance



2.3.2 Mounting Dimensions

■ Plastic Housing



■ Sheet Metal Housing

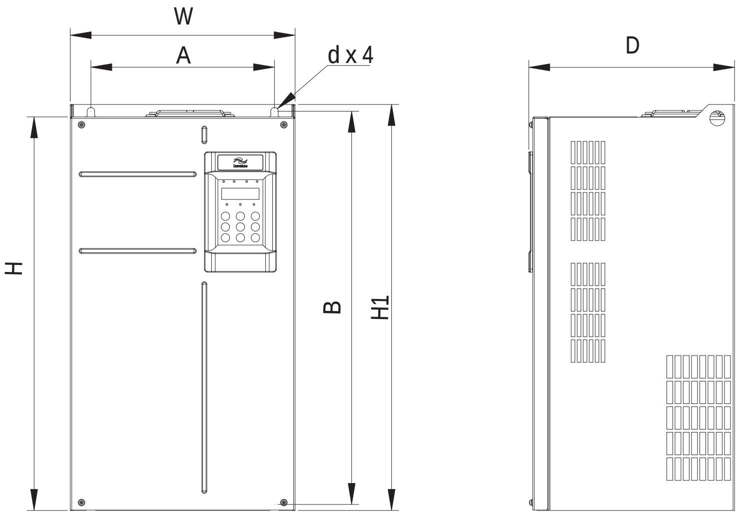


Table 2-1 Mounting dimensions of the MD500

MD500 Model	Dimensions (mm)							Weight
	A	B	H	H1	W	D	d	kg
Three-phase 380 to 480 V								
MD500T18.5G	**195**	335	350	-	210	**192**	Ø6	**9.1**
MD500T22G								
MD500T30G	230	380	400	-	250	220	Ø7	17
MD500T37G								
MD500T45G	245	523	523	540	300	275	Ø10	35
MD500T55G								
MD500T75G	270	560	550	576	315	338	Ø10	51.5
MD500T90G								
MD500T110G								

2.4 Installation Method and Proces

■ Installation Method

⚠WARNING

MD500 units enclosed in a sheet-metal housing have weights of 35 kg or more. These units have eye bolts that **allow a mechanical hoist to support the weight of the unit during installation. To prevent personal injury or damage to the equipment, you must fit and use these eye bolts to support the MD500 during installation.**

Mounting Method	Applicable Housing	Remark
Surface mounting	● Plastic housing ● Sheet metal housing	The AC drive is mounted directly on a vertical supporting surface without requiring a rectangular cutout in the surface. It is secured using four screws or bolts at the corners of the rear panel.
Embedded mounting	● Plastic housing ● Sheet metal housing	It requires a rectangular cutout in the supporting surface. You can embed the housing from the front or the rear of the vertical mounting surface, and secure it in place by using the supplied hanging brackets.

2.4.1 Surface Mounting

Note

It is very important that you identify the correct mounting hole locations and diameters for the model of MD500 AC drive that **you are installing. And check that you have identified the correct dimensions before you start to drill the mounting holes.**

The surface mounting process is as follows:

1. Select a suitable location to install the MD500 AC drive. See the recommendations under the section 2.1 "Installation Environment" on page ###.

   ⚠WARNING

   Check that there are no items of equipment, cables or pipes behind the mounting surface that might be damaged when you drill the mounting holes.

2. Measure and mark the drill centers for the four mounting holes according to the dimensions shown in Table 2-1 for your model of MD500.

3. Carefully drill the four mounting holes at the correct diameter as shown in Table 2-1 for your model of MD500.

4. **If necessary, use help to lift the MD500 to the installation location. Hold it in the correct position until there are fixings in place** to secure it safely.

5. **Add locking washers and flat washers to the securing bolts or screws, insert them through the four mounting holes in the** housing, and tighten them to secure the housing to the supporting surface.

See the following two examples.

Figure 2-4 Surface-mounted installation of the MD500 plastic housing

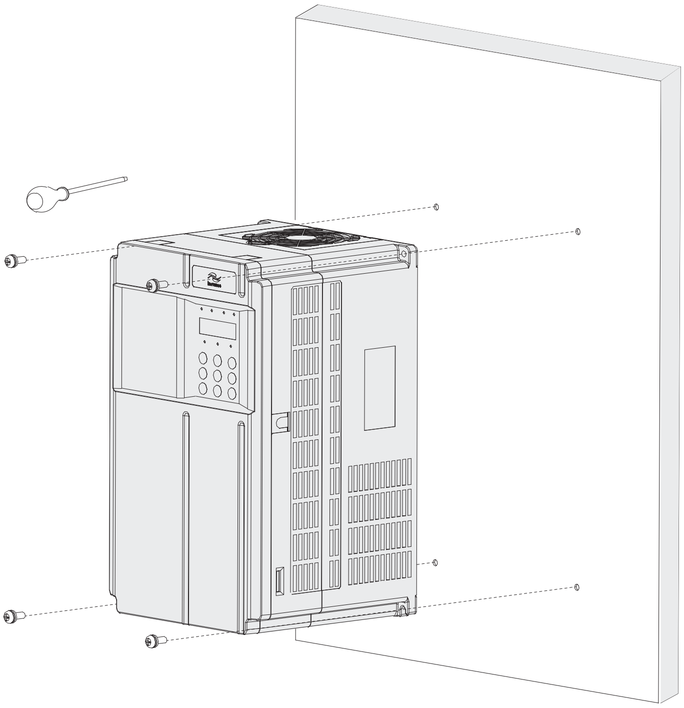
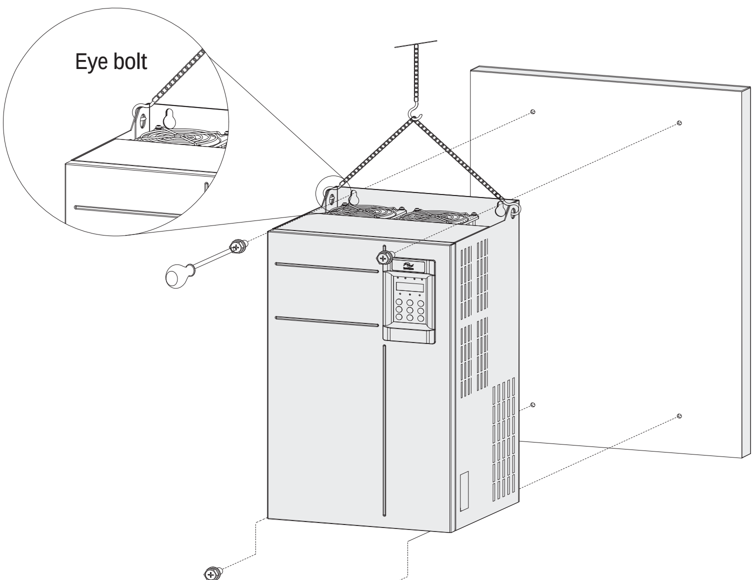


Figure 2-5 Surface-mounted installation of the MD500 sheet metal housing



This completes the mechanical installation of a surface-mounted MD500 housing. You can now follow the instructions in ## to complete removal of the front cover of the MD500 before performing electrical installation.

2.4.2 Embedded Mounting

There are three stages in the process of preparing an embedded mounting for the MD500 housing:

Stage	Applicable Housing	Remark
Stage 1	Fit hanging brackets to the MD500 housing.	**See "Installing the Hanging Bracket" on page ##.**
Stage 2	Prepare the mounting surface by making a cutout and drilling holes as required for the voltage and power rating for your model of MD500.	**See "Preparing the Mounting Surface" on page ##.**
Stage 3	Install the housing and secure it in position.	**See "Install the Housing" on page ##.**

■ Stage 1: Installing the Hanging Bracket

The shipment includes two hanging brackets and their fixings. These are for use when you use the embedded mounting method to install plastic or sheet metal housing.

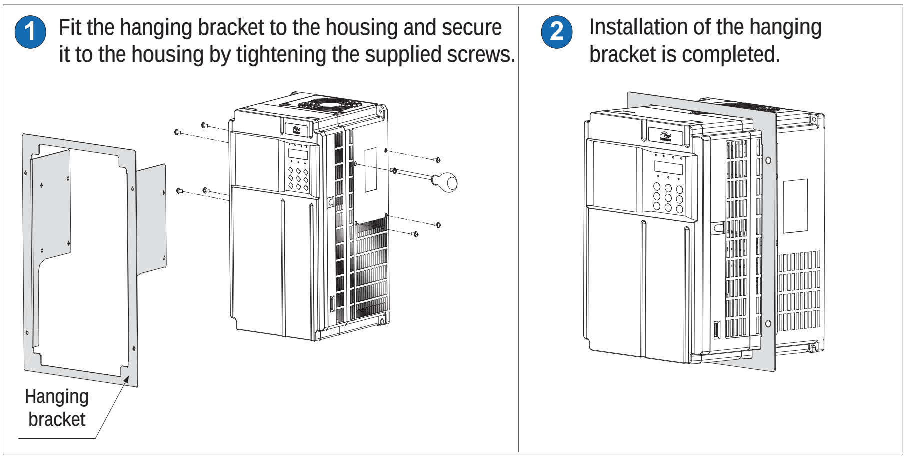
⚠WARNING

- MD500 units enclosed in a sheet-metal housing have weights of 35 kg or more. These units have eye bolts that **allow a mechanical hoist to support the weight of the unit during installation. To prevent personal injury or damage to the equipment, you MUST fit and use these eye bolts to support the MD500 during installation.**
- Always use suitable help to carry, move or support heavy MD500 housings. The sheet-metal housings are all heavy, and **you risk personal injury or damage to the equipment if you attempt to carry, move or support them without help.**

1. **Lay the MD500 housing on a strong, flat surface with the control panel facing upwards.**
2. Fit the supplied hanging brackets to the housing:
   - Fit the brackets in the correct orientation, depending on whether you are embedding the housing from the front or from the rear of the supporting surface.
   - For sheet metal housing, use the two supplied eye bolts to secure the hanging bracket to the top of the housing.

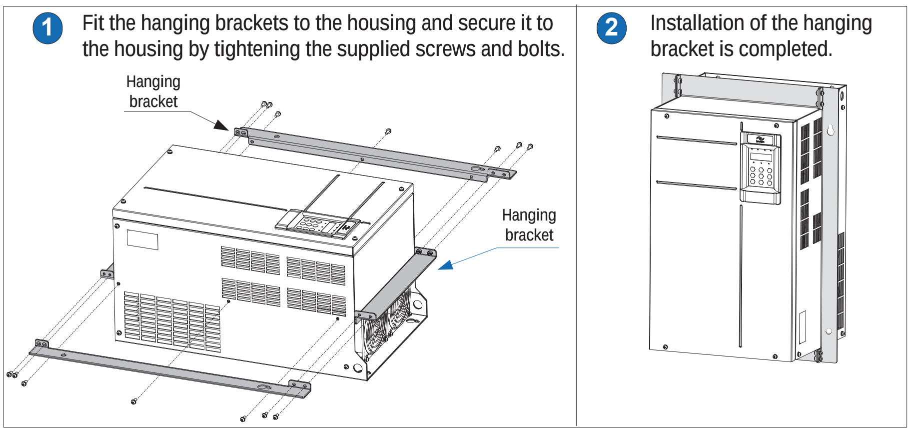
See Figure 2-6 and Figure 2-7 for examples that show how to fit the hanging brackets to the housing.

Figure 2-6 Hanging bracket installation for a plastic housing



Continue to see Figure 2-8

Figure 2-7 Hanging bracket installation for a sheet metal housing



Continue to see Figure 2-**9**

3. Make sure all the screws and bolts that secure the hanging brackets to the housing are tight.

■ Stage 2: Preparing the Mounting Surface

4. Refer to Table 2-1 to identify your model of MD500 housing, and make a careful note of the following dimensions:
   - The mounting hole distances A and B
   - The mounting hole diameter d
   - The overall dimensions of the housing H and W
5. Mark the mounting surface to identify the centres of the four mounting holes.
6. Mark an outline for the cutout by using the dimensions H and W. Make sure the cutout is centred with respect to the mounting holes.
7. Carefully drill the four mounting holes.
8. Carefully cut a rectangular cutout hole in the supporting surface according to the markings you made in step 6.
9. Prepare the edges of the cutout to remove sharp edges and burrs.

■ Stage 3: Installing the Housing

10. Lift the housing into the cutout you have prepared.

    Insert the housing from the correct side of the mounting surface, depending on whether you are using a front-mounting or a rear-mounting arrangement.

> ⚠WARNING
>
> Always use a hoist to lift a sheet metal housing, and use help to support the **housing in its mounting location until you have fixed it in place.**

11. Insert the securing screws through the holds in the hanging brackets, and use them to secure the housing to the mounting surface.

    See Figure 2-8 and Figure 2-9 for examples that show how to install the MD500 housing.

Figure 2-8 Embedded installation of a plastic housing

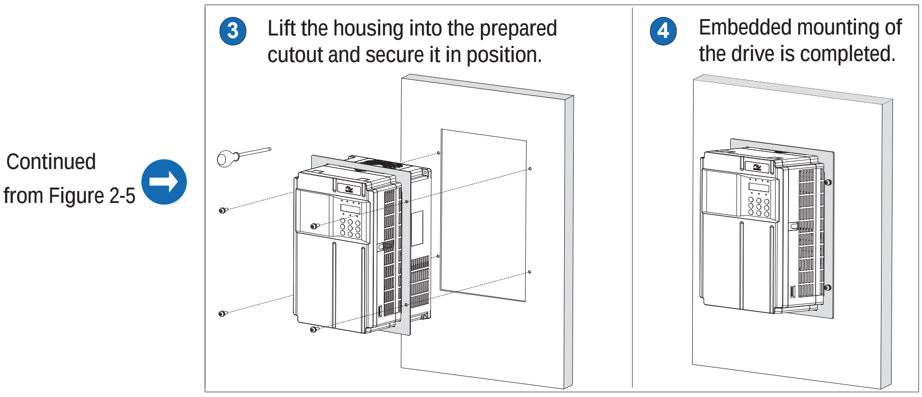
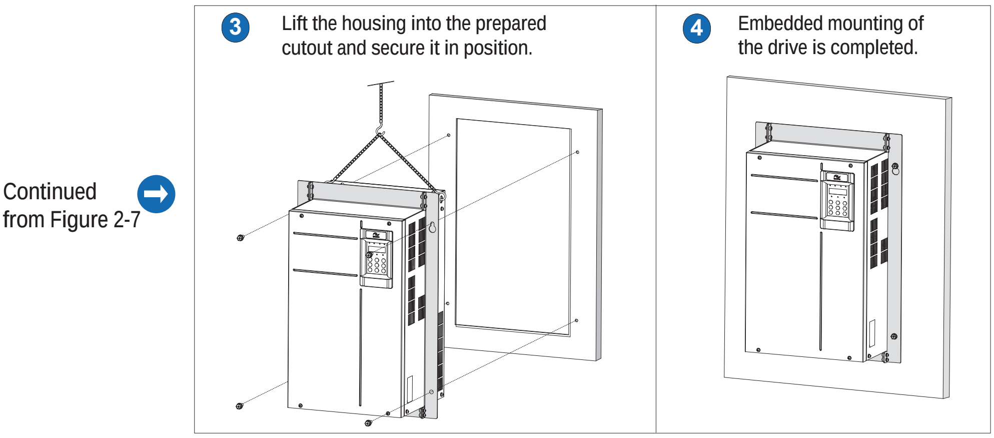


Figure 2-9 Embedded installation of a sheet metal housing



This completes the mechanical installation of an embedded MD500 housing. You can now follow the instructions in ## to complete removal of the front cover of the MD500 before performing electrical installation.

Hanging Bracket Models

Hanging Bracket Model	Adaptable AC Drive Model
MD500-AZJ-T5	MD500T18.5G
	MD500T22G
MD500-AZJ-T6	MD500T30G
	MD500T37G
MD500-AZJ-T7	MD500T45G
	MD500T55G
MD500-AZJ-T8	MD500T75G
	MD500T90G
	MD500T110G

2.5 Removing and Installing the Front Cover

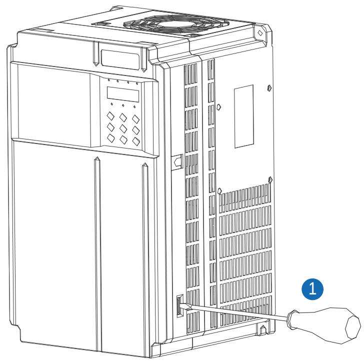
You must remove the front cover before performing electrical installation

DANGER

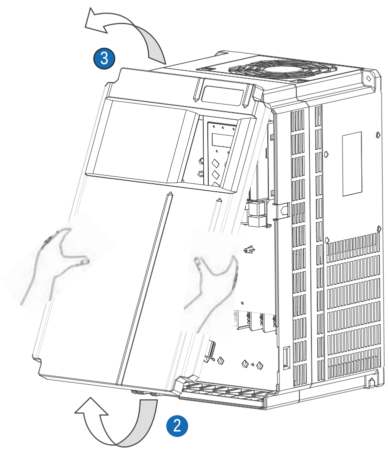
- Ensure that the drive power-off time exceeds 10 minutes before removing the cover.
- Be careful when removing the front cover of the AC drive. Falling off of the **cover may cause damage to the AC drive or personal injury.**

2.5.1 Removing and Reattaching the Front Cover of a Plastic Housing

Removal

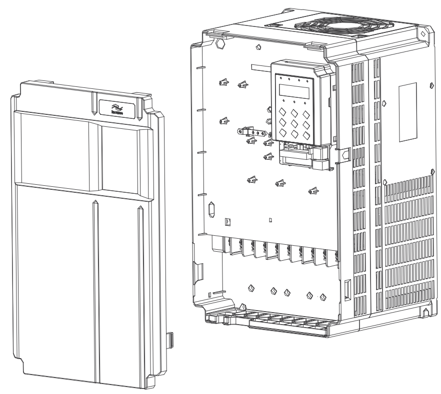


1 Pinch inwards on the hook found at either side of the front cover .



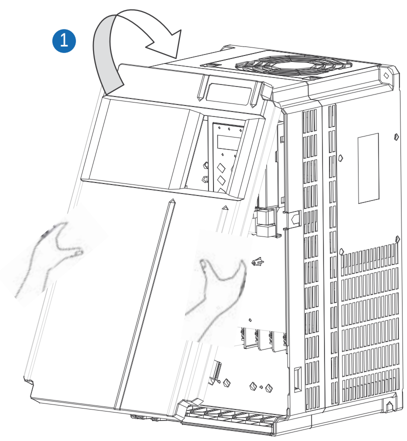
2 Hold the lower part of the front cover.

3 Lift the front cover.

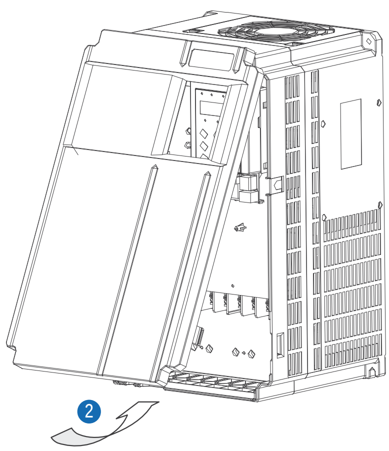


Removal is completed.

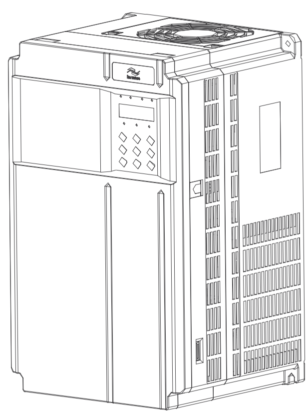
Reattaching



1 Hook the front cover to the drive.



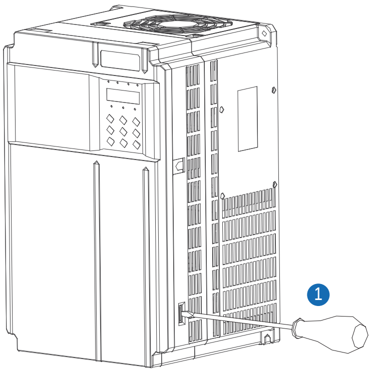
2 Align the front cover to the drive and push it down in the arrow direction

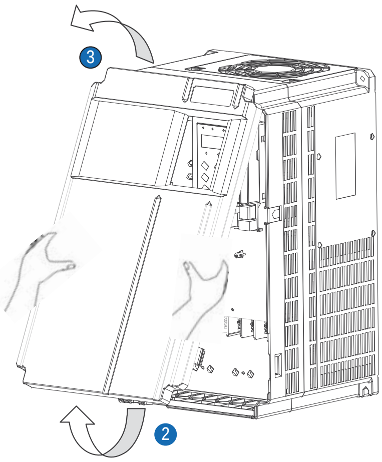


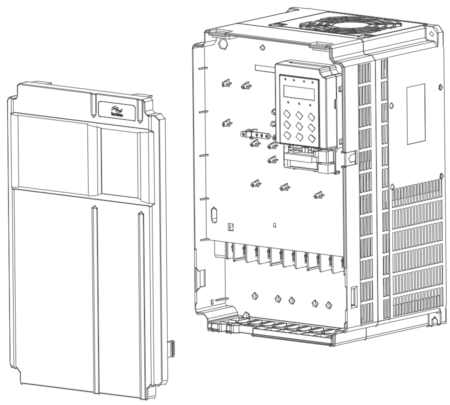
Reattaching is completed.

2.5.2 Removing and Reattaching the Front Cover of a Sheet Metal Housing

Removal







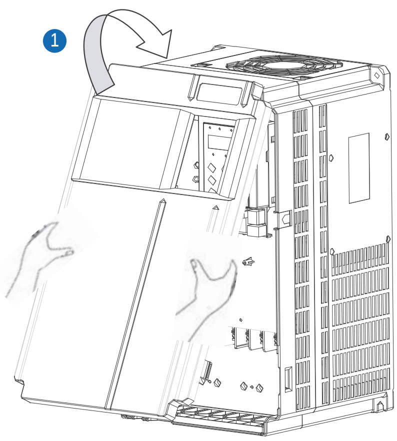
1 Pinch inwards on the hook found at either side of the front cover .

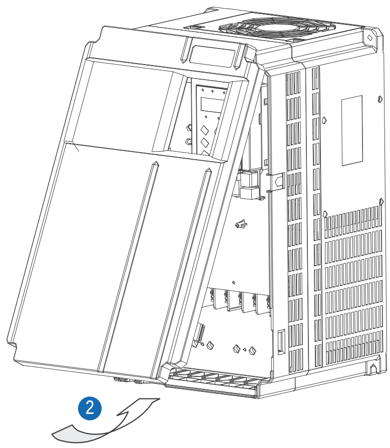
2 Hold the lower part of the front cover.

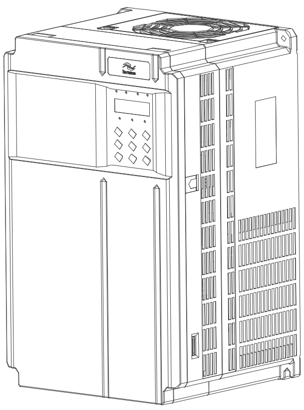
3 Lift the front cover.

Removal is completed.

Reattaching







1 Hook the front cover to the drive.

2 Align the front cover to the drive and push it down in the arrow direction

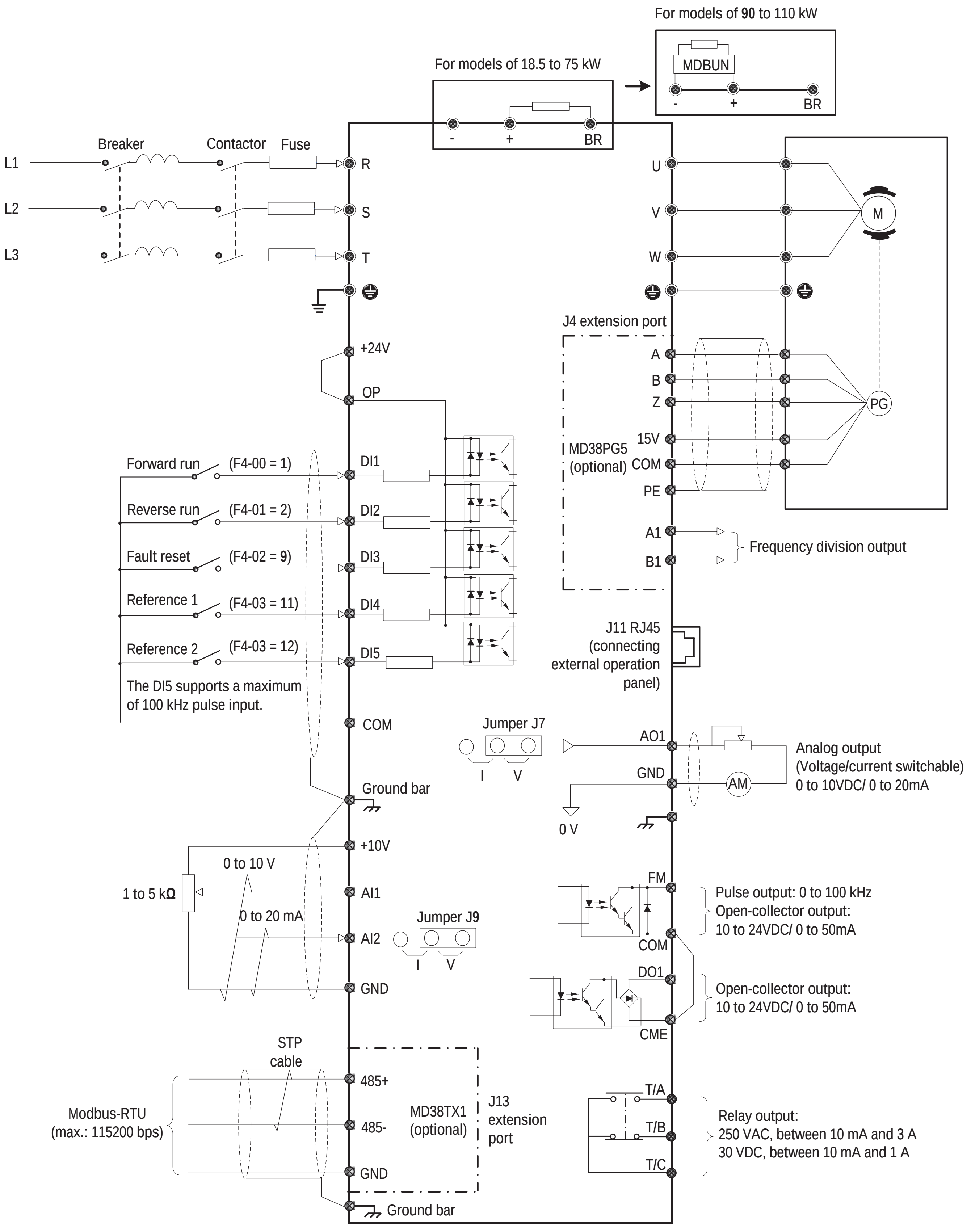
Reattaching is completed.

3

Electrical Installation

3. Electrical Installation

3.1 Typical System Connection

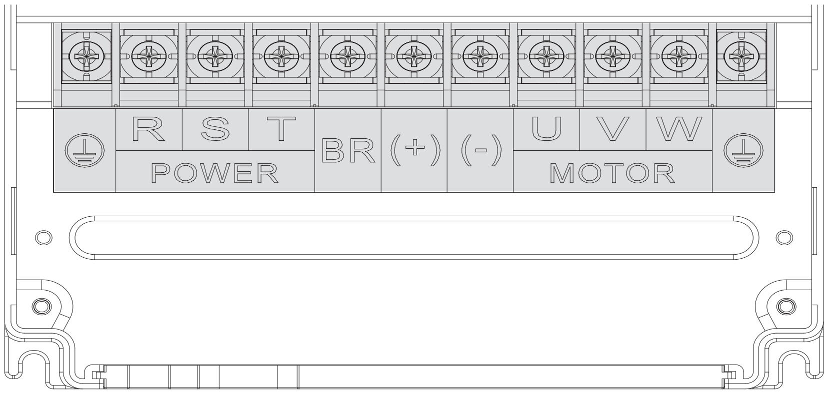


3.2 Main Circuit Wiring

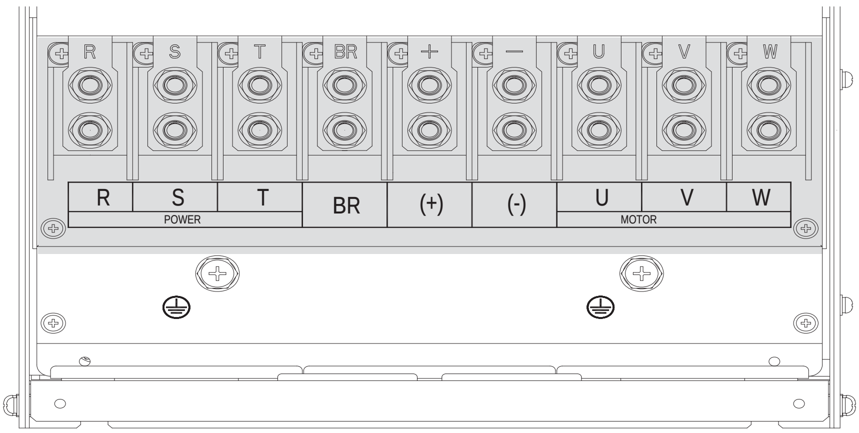
3.2.1 Main Circuit Terminals

■ Terminal Arrangement

Plastic housing



Sheet metal housing



■ Terminal Function

Table 3-1 Description of input and output connections of MD500

Terminal	Name	Description
R, S, T	Three-phase supply input	Connections to the three-phase power supply.
(+), (-)	DC bus terminals	Common DC bus input. Connection for the external braking unit (MDBUN) **with AC drive units of 90 kW and above.**
(+), BR	Regen resistor connection	Connection for the external regen resistor for AC drive units of 75 kW and below.
U, V, W	AC drive outputs	Connections to a three-phase motor.
	Ground (PE)	Ground connection.

Cable Dimensions and Tightening Torque

Figure 3-1 Terminal dimensions of MD500T18.5G/22G

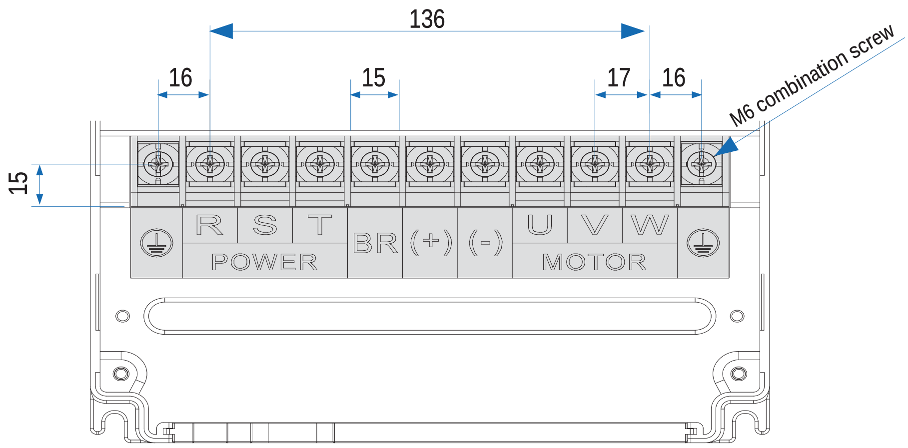


Table 3-2 Cable dimensions and tightening torque of MD500T18.5G/22P/22G/30P

AC Drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm^2)	Tightening Torque (N·m)	Recommended Cable Lug Model
MD500T18.5G	**49.5**	10	4.0	GTNR10-6
MD500T22G	**59**	16	4.0	GTNR16-6

Figure 3-2 Terminal dimensions of MD500T30G/37G

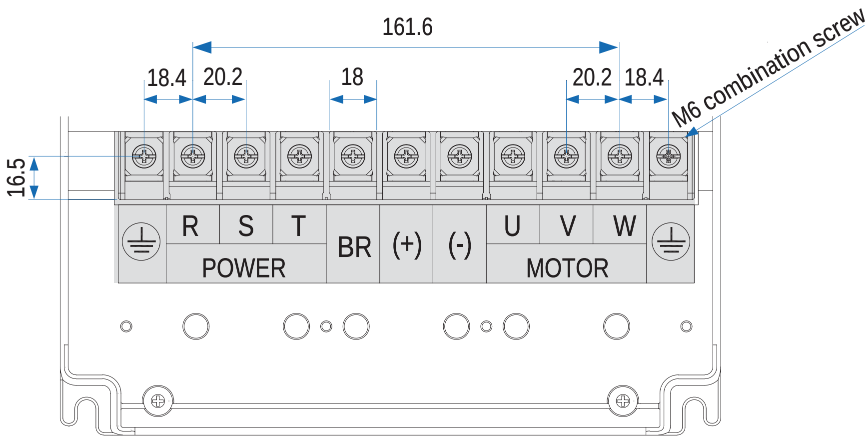


Table 3-3 Cable dimensions and tightening torque of MD500T30G/37G

AC Drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm^2)	Tightening Torque (N·m)	Recommended Cable Lug Model
MD500T30G	57	16	4.0	GTNR16-6
MD500T37G	**69**	25	4.0	GTNR25-6

Figure 3-3 Terminal dimensions of MD500T45G/55G

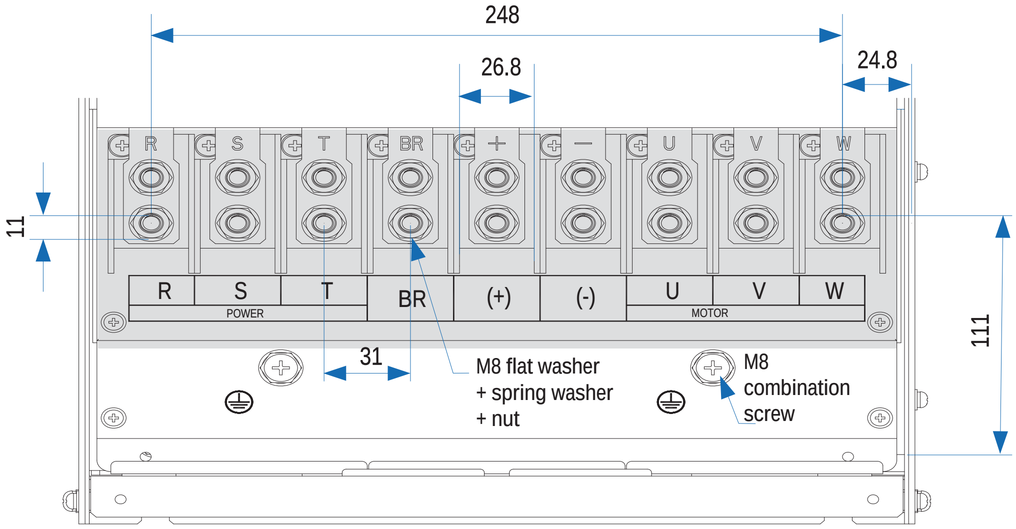


Table 3-4 Cable dimensions and tightening torque of MD500T45G/55G/

AC Drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm^2)	Tightening Torque (N·m)	Recommended Cable Lug Model
MD500T45G	**89**	25	10.5	GTNR25-8
MD500T55G	106	35	10.5	GTNR35-8

Figure 3-4 Terminal dimensions of MD500T75G/90G/110G

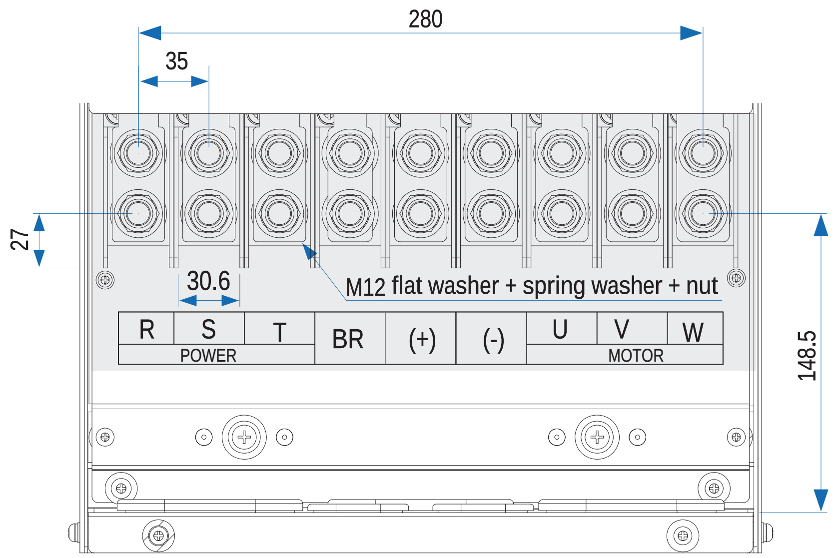


Table 3-5 Cable dimensions and tightening torque of MD500T75G/90G/110G

AC Drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm^2)	Tightening Torque (N·m)	Recommended Cable Lug Model
MD500T75G	**139**	50	35.0	GTNR70-12
MD500T90G	164	70	35.0	GTNR70-12
MD500T110G	**196**	**95**	35.0	**GTNR95-12**

Cable Lug Specification

The recommended cable lug is manufactured by Suzhou Yuanli Metal Enterprise.

Figure 3-5 Appearance of recommended cable lugs

CTNR series TNR series

Figure 3-6 Dimensions of recommended TNR series cable lugs

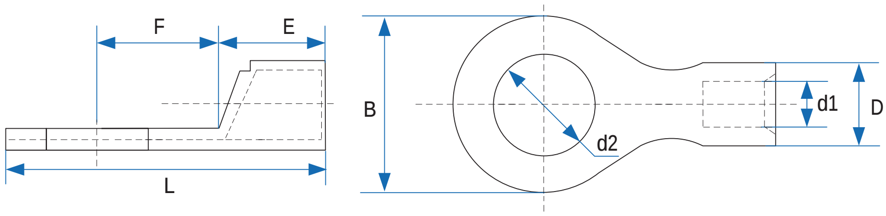


Table 3-6 Models and dimensions of the TNR series cable lugs

Cable Lug Model	Cable Range AWG/MCM	mm²	D	d1	E	F	B	d2	L	Current (A)	Crimping Tool
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
TNR1.25-4	22-16	0.25-1.65	3.4	1.7	4.5	7.3	8	5.3	15.8	**19**	AK-1M

Figure 3-7 Dimensions of recommended GTNR series cable lugs

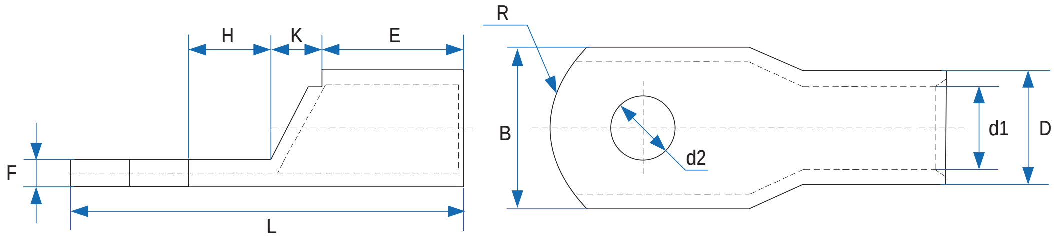


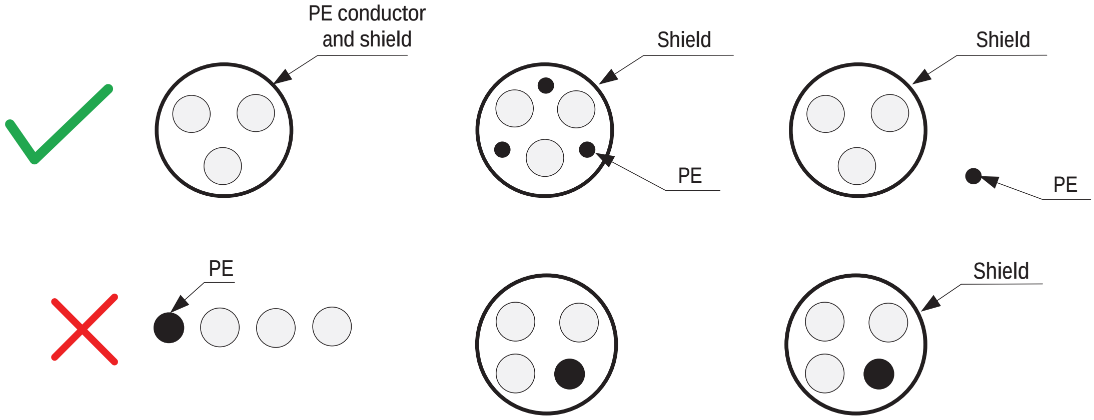
Table 3-7 Models and dimensions of the GTNR series cable lugs

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
GTNR2.5-4	4.5	**2.9**	7.0	5.0	2.0	8.0	4.3	1.0	18.0		YYT-8
GTNR2.5-5				6.0			5.3		20.0	7	RYO-14
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							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
GTNR16-8							8.4				CT-100
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	40.5		
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				
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				

3.2.2 Wiring Precautions

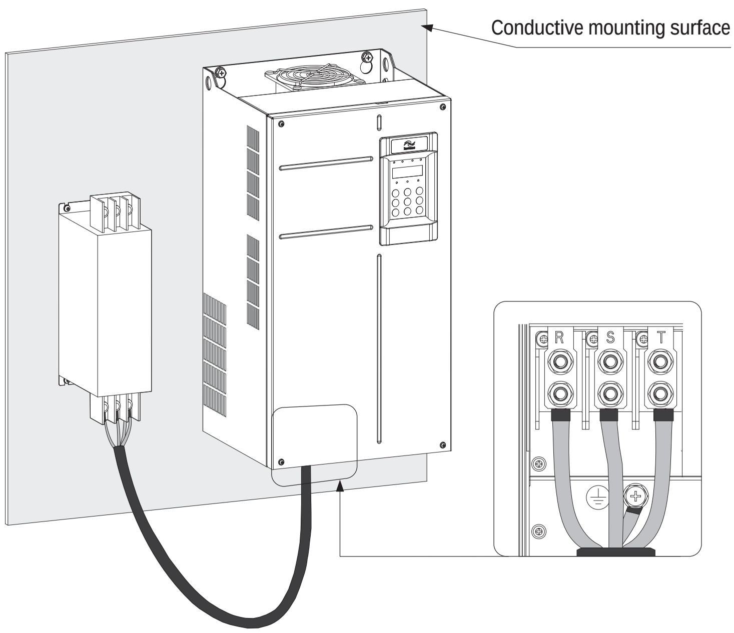
■ Cable Selection

Inovance recommends symmetrical shielded cable as main circuit cable, which can reduce electromagnetic radiation of the entire conductive system compared with the four-conductor cable.



■ Power Input

- There are no phase sequence requirements for three-phase cable connections. It does not matter which phase connects to each of the R, S and T terminals.
- **The cable specification and installation of all external power cables must comply with local safety regulations and relevant** IEC standards.
- Use power cables that have copper conductors of the proper size.
- **Install the filter close to the power input side of the AC drive with the connecting cable shorter than 30 cm. Connect the ground terminal of the filter and the ground terminal of the drive together. Make sure to install the filter and the drive on** the same conductive surface and connect this surface to the main ground terminal of the cabinet.



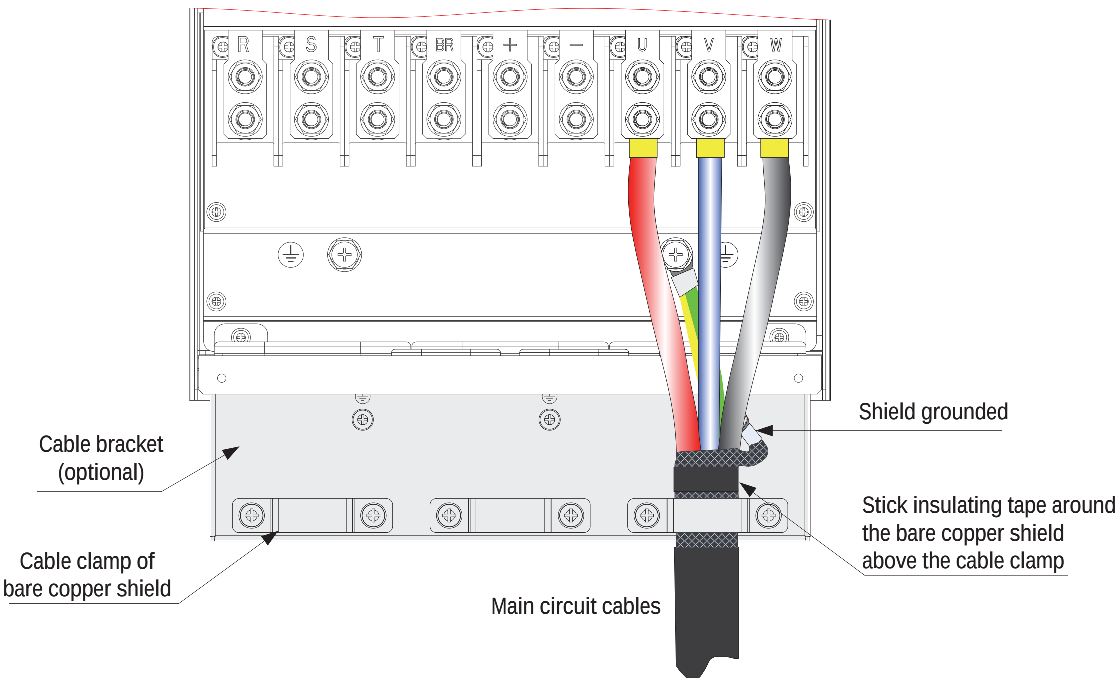
DC Bus Terminals

- The DC bus terminals, labeled (+) and (–), are signal terminals that carry a residual voltage for a period after the AC drive has been switched off.
- To avoid the risk of electric shock, wait for at least 10 minutes after the CHARGE indicator goes off before you touch the equipment.
- **To avoid the risk of equipment damage or fire, when you select an external braking unit for use with an AC drive of 90 kW** and above, DO NOT reverse the poles (+) and (–).
- Do not use a cable length of more than 10 m to connect the DC bus terminals to the external MDBUN braking unit. Use twisted pair wires or close pair wires for this connection.
- **To avoid the risk of equipment damage or fire, do not connect the regen resistor directly to the DC bus. The DC bus is a** signal connection only.

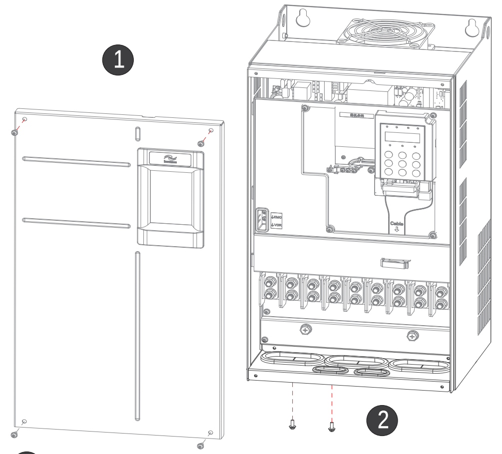
Regen Resistor

- **The regen resistor terminals (+) and PB are for use only with MD500 AC drive units up to 75 kW that are fitted with an** internal braking unit.
- To avoid the risk of equipment damage, do not use a cable length of more than 5 m to connect an external regen resistor.
- To avoid the risk of ignition due to overheating of the regen resistor, do not place anything combustible around the regen resistor.
- **Set F6-15 (Braking use ratio) and F9-08 (Braking unit action initial voltage) properly according to the actual load after connecting regen resistor to MD500 AC drive units up to 75 kW that are fitted with an internal braking unit.**

AC Drive Output

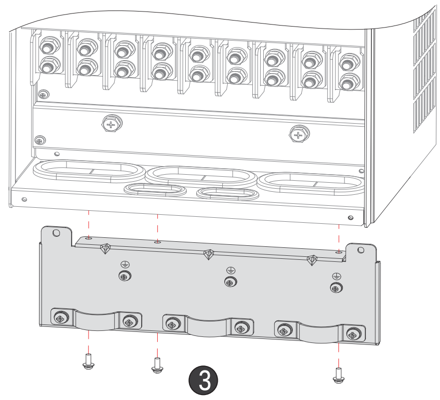


Installation of the cable bracket is as follows:

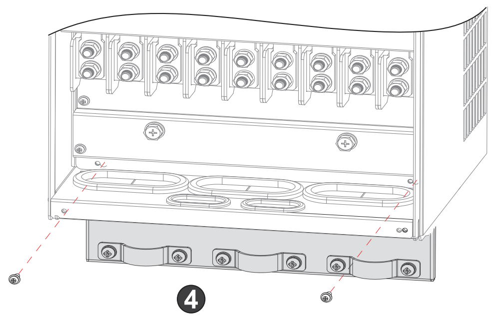


1 Remove the front cover.

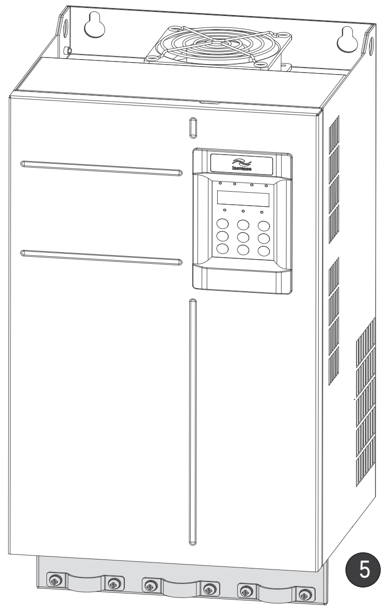
2 Remove the two M4*12 screws from the air inlet plate.



3 Mount the cable bracket to the drive and take three M4*12 screws to fix the bracket at the positions here.

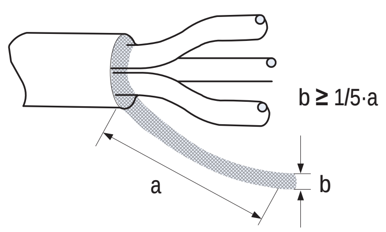


4 Take two M4*12 screws to fix the bracket at the positions here.



5 Reattach the front cover to complete the installation.

- **The cable specification and installation of all cables connected to the AC drive output U, V, W must comply with local** safety regulations and relevant IEC standards.
- Use power cables that have copper conductors of the proper size.
- To avoid the risk of equipment damage or operating faults, do not connect a capacitor or surge absorber to the output of the AC drive.
- Long motor cables can contribute to electrical resonance caused by distributed capacitance and inductance. In some cases this might cause equipment damage in the AC drive, in the motor or in the cables. To avoid these problems, install an AC output reactor near to the AC drive if the cable run to the motor is longer than about 100 m.
- Make the lead-out wire at the stripped end of the motor cable as short as possible. The diameter of the lead-out wire must **be equal to or great than one fifth of its length.**



Ground (PE) Connection

- For safety of personnel and reliability of the equipment, it is important to connect the ground (PE) terminal to an effective electrical ground. The resistance value of the ground cable must be less than 10 Ω.
- Do not connect the ground terminal to the neutral conductor of the power supply cable.
- The protective grounding conductor must be able to carry large short-term current that might arise if a fault occurs. The table below shows the recommended cross-sectional area for the protective grounding conductor for different sizes of phase conductor.

Cross-sectional area of the phase conductor (S)	Recommended cross-sectional area of the protective grounding conductor
$S \leq 16\ mm^2$	S
$16\ mm^2 < S \leq 35\ mm^2$	$16\ mm^2$
$35\ mm^2 < S$	S/2

- **Use proper grounding cable with yellow/green insulation for the protective grounding conductor.**
- Ground the shield.
- Install the AC drive on a metal mounting surface and ensure the entire conductive base of the drive in good connection with the mounting surface.
- **Install the filter and the AC drive on the same mounting surface and ensure the filtering effect.**

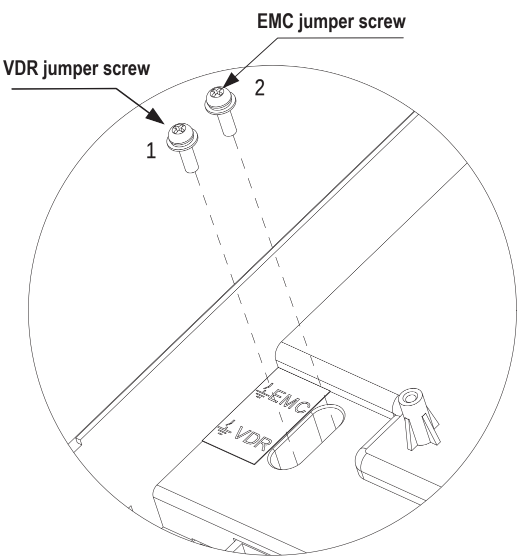
Power Input Protection

- Install protection devices (a fuse and a MCCB) on the electrical power input to the MD500. The protection devices must provide protection on overcurrent and on short-circuit.
- The protection devices must be able to completely isolate the MD500 from the electrical power input.
- The cables and the protection device on the electrical power input must be suitably rated for the power and voltage class of the MD500 under normal conditions, and under possible fault conditions such as system overload and short-circuit on the power input.

Line Voltage System

- The MD500 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.

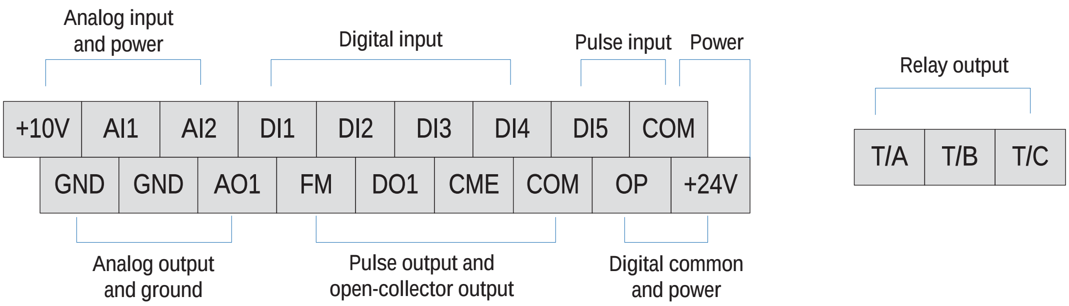
Figure 3-8 EMC jumper screw and VDR jumper screw



3.3 Control Circuit Wiring

3.3.1 Control Circuit Terminals

■ Terminal Arrangement



■ Terminal Function

Table 3-8 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**
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.

Type	Terminal		Name	Description
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)
	J4		PG card interface	Open-collector, UVW and Resolver are selectable options.
	J11		External operating panel interface	Connect to an external operating panel.

Cable Dimensions and Tightening Torque

Please use the ferrule-type terminal with insulated sleeves. In the scenarios where single wire or twisted wire is applied, keep the strip length of 6 mm, as shown in the following figure.

Figure 3-9 Requirement of ferrule terminal

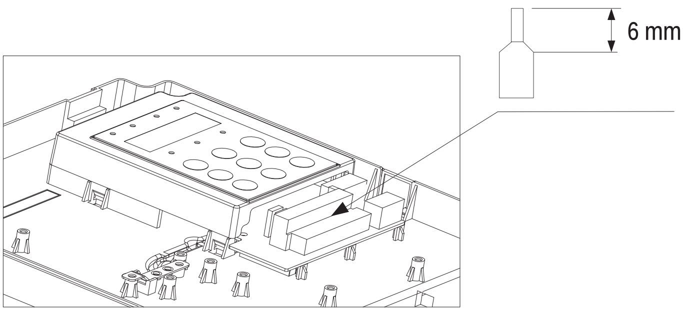
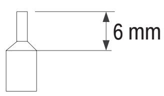


Table 3-9 Cable dimensions and tightening torque

Terminal Block	Single Wire mm^2 (AWG)	Twisted Wire mm^2 (AWG)	Tightening Torque
Control circuit	0.2 to 0.75 (AWG24 to 18)		0.8 to 1.0

Table 3-10 Cable specification and ferrule terminal model

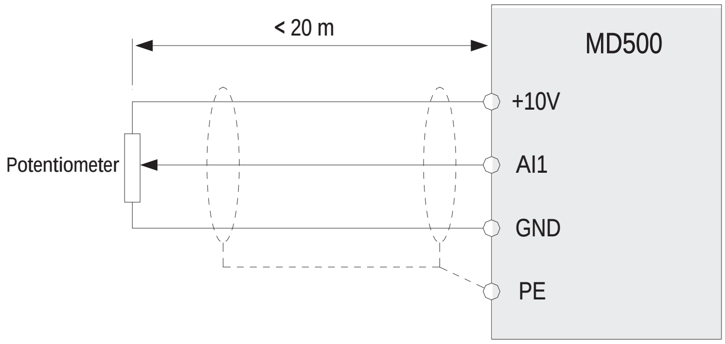
Cable Specification mm^2 (AWG)	Ferrule Terminal Model	Strip Length
0.75 (18)	0.75-8GY	

3.3.2 Wiring Diagram

■ 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.

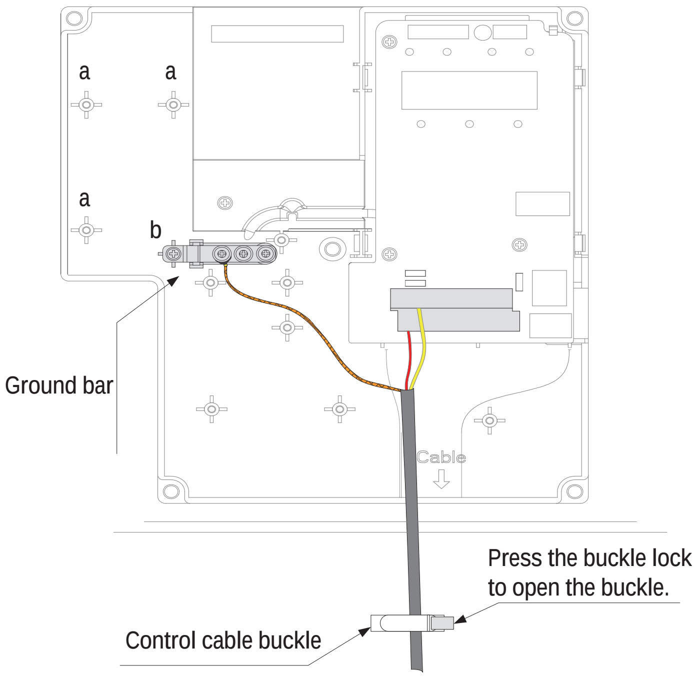
Figure 3-10 Wiring method for use with analog input 1



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.

The lead of the AI terminal cable shield must be connected to the PE terminal on the AC drive side.

Figure 3-11 Connect AI terminal cable shield to the PE terminal of the drive

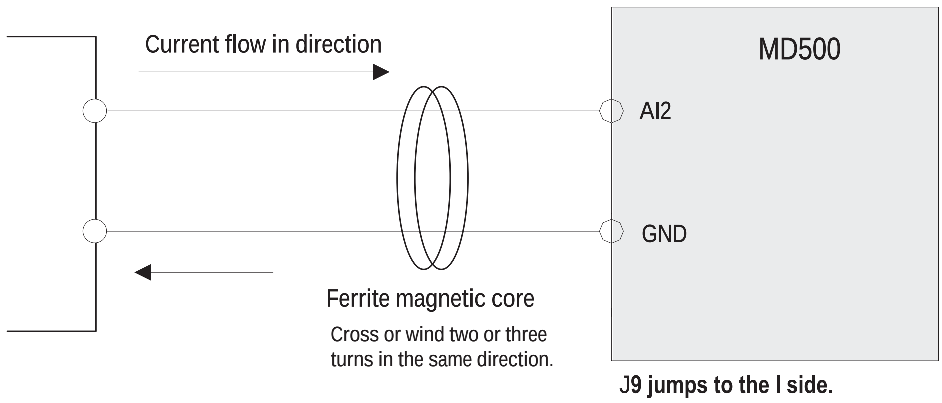


AI2 Wiring

When voltage signal is selected to flow into the AI2, it has the same wiring method as the AI1 does.

When current signal is selected to flow into the AI2, AI2 is the direction of current flow in and GND is the direction of current flow out. The jumper J9 jumps to the I side.

Figure 3-12 Wiring method for use with analog input 2



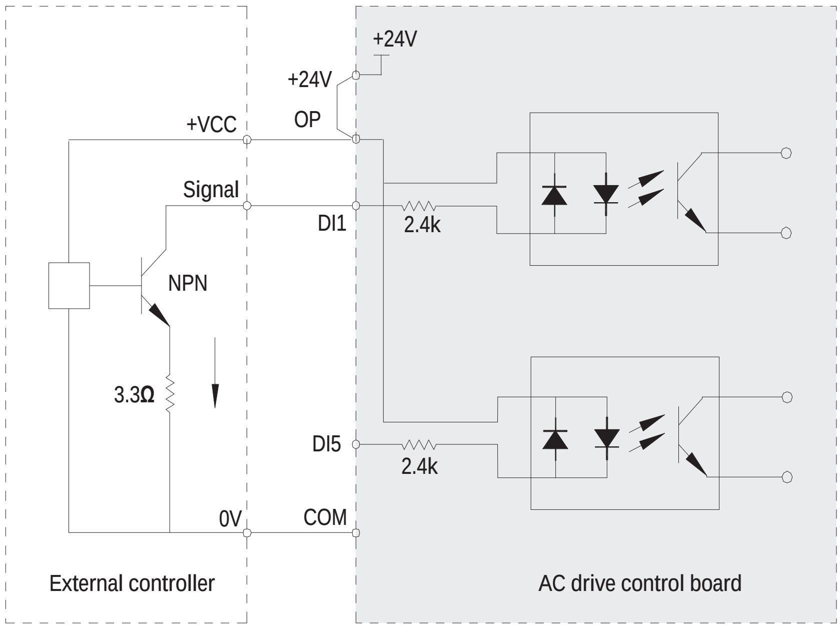
DI1-DI5 Wiring (Sink, Source)

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.

1. SINK wiring

Figure 3-13 Wiring in SINK mode



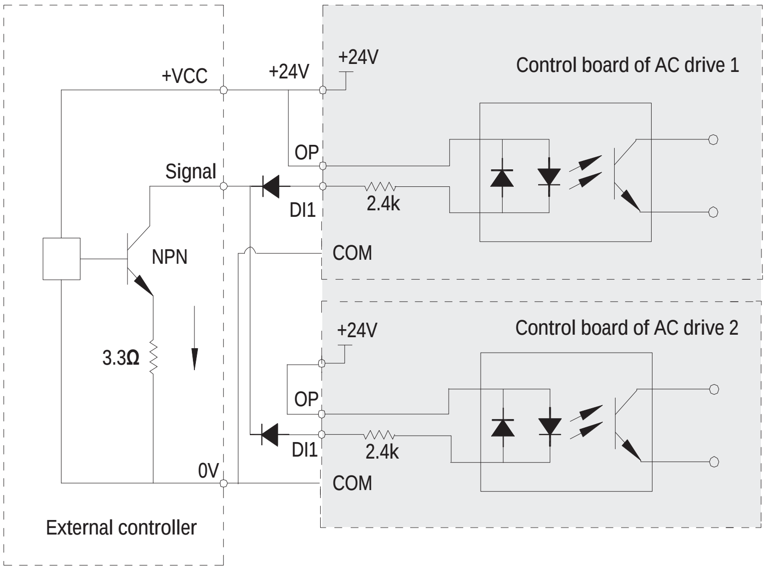
SINK mode is the most commonly used wiring mode.

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.

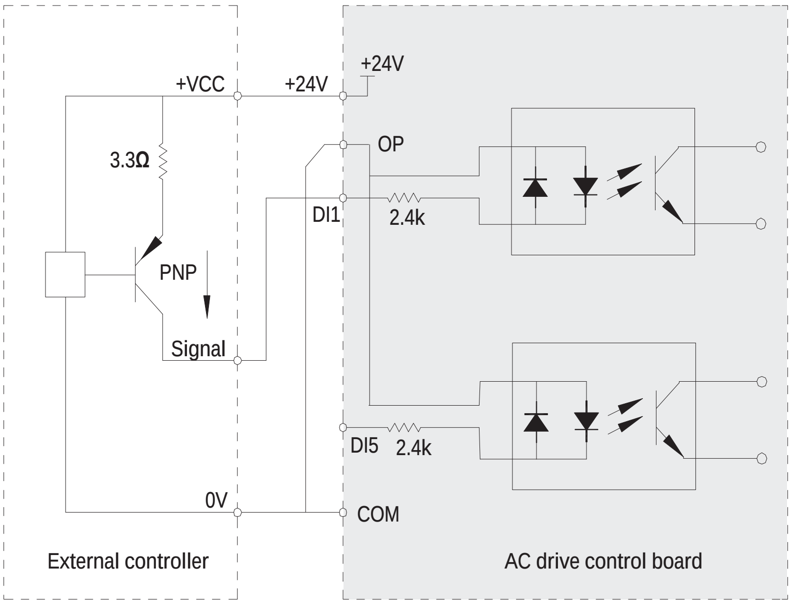
In the SINK wiring mode, do not connect the DI terminals of different AC drives in parallel, otherwise a digital input fault will occur. If it is necessary to connect different AC drives in parallel, connect a diode in series at the digital input. The diode characteristics must satisfy the following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

- Forward current rating If: >10 mA
- **Forward voltage drop Vf: <1 V**

Figure 3-14 Parallel connection of DI terminals in SINK mode



2. SOURCE wiring

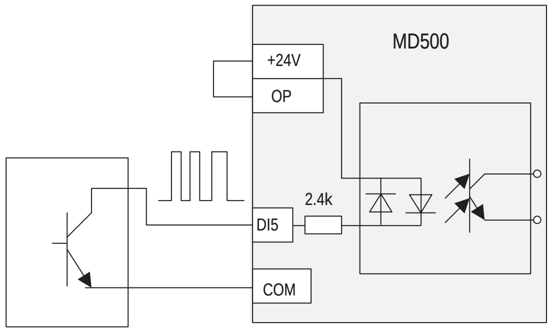


To use the SOURCE wiring mode, remove the jumper between the +24V and the OP terminals. Connect +24V to the common port of the external controller, and connect the OP terminal to the COM terminal.

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.

Wiring of DI5 (High-speed Pulse Input)

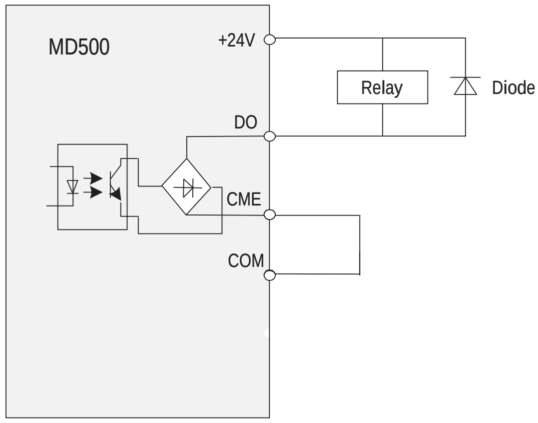
As high speed pulse input terminal, the DI5 allows maximum frequency input of 100 kHz.



Pulse output device

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.



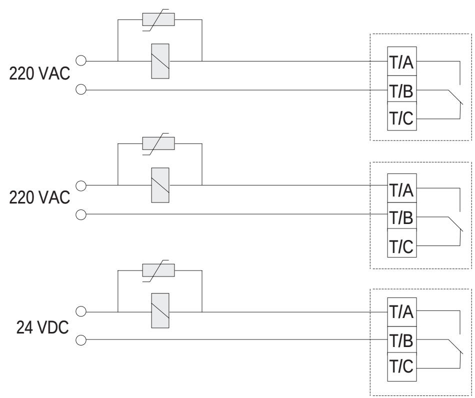
When the FM terminal is used for FMP continuous pulse output, it allows the maximum frequency output of 100 kHz.

Note

- Be careful to install the absorption diode with the correct polarity, to prevent damage to the 24 VDC power supply when there is a digital output.
- **CME and COM are internally insulated, but are shorted externally by a jumper. In this case, DO1 is driven to +24 V by default. Remove the jumper link if you need to drive DO1 from an external power supply.**

Relay Terminal Wiring

To smooth peak voltage that results from cutting off power to inductive load (relay, contactor and motor), use a voltage dependent resistor (VDR) at the relay contact and add absorbing circuit to the inductive load, such as VDR, RC absorbing circuit or diode.



3.4 Wiring Checklist

□ √	No.	Item
□	1	Check the received drive to ensure that you receive a correct model .
□	2	Make sure the correct peripheral devices (regen resistor, braking **unit, AC reactor, filter and breaker) are used.**
□	3	Check the optional cards to ensure that the receiving is correct.
□	4	Check that the mounting method and location meet the requirements.
□	5	Check that the input voltage of the drive is between 323 and 528 V.
□	6	**Check that the rated motor voltage matches the drive output specification.**
□	7	Connect the power supply to the R, S, T terminals of the drive properly.
□	8	Connect the motor input cables to the U, V, W terminals of the drive properly.
□	**9**	**Check that the cable diameter of main circuit complies with the specification.**
□	10	Decrease F0-15 (carrier frequenency) if the motor output cables exceed 50 m.
□	11	Ground the AC drive properly.
□	12	Check that the output terminals and control signal terminals are connected securely and reliably.
□	13	Check whether two motors are driven. If yes, consider whether to add a thermal relay.
□	14	When using regen resistor and braking unit, check whether they are wired properly and whether the resistance value is proper.
□	15	Check whether inter-phase capacitance is connected and whether the power supply to the AC drive can be cut off via the overload protection function of the resistor.
□	16	Use STP wires as signal lines.
□	17	Connect the optional cards correctly.
□	18	Ensure to run control cables and power cables separately.

4

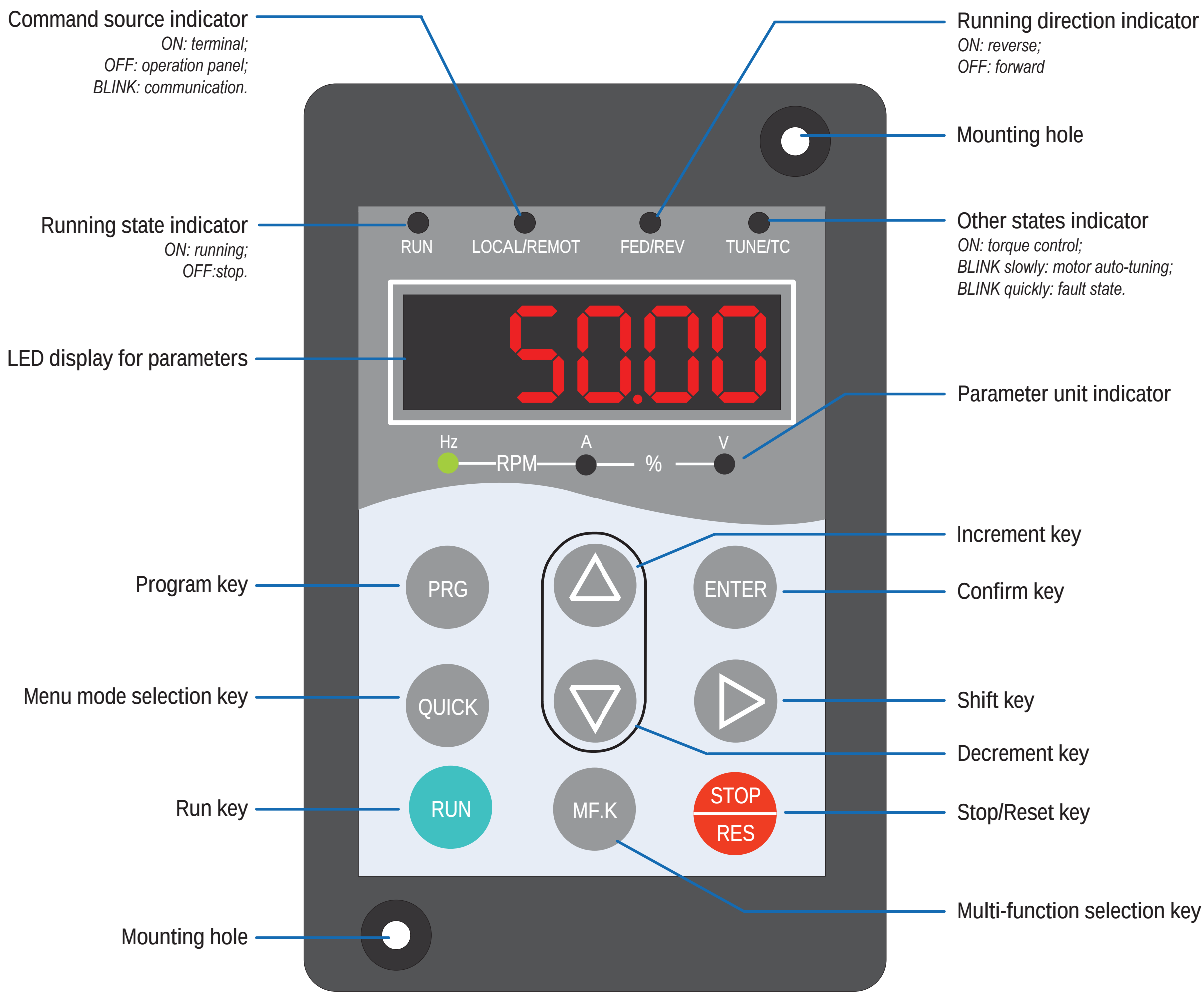
Operations

4. Operations

4.1 Introduction to the Operating Panel

The operating panel, shown in Figure 4-1, allows you to monitor system operation, modify parameters and start or stop the MD500.

Figure 4-1 Details of the operating panel



Keys on operation panel

Key	Key Name	Function
PRG	Programming	● Enter or exit the Level I menu. ● Return to the previous menu.
ENTER	**Confirm**	● Enter each level of the menu interface. ● **Confirm the displayed parameter setting.**
△	Increment	● When navigating a menu, it moves the selection up through the screens available. ● When editing a parameter value, it increases the displayed value. ● When the AC drive is in RUN mode, it increases the speed.
▽	Decrement	● When navigating a menu, it moves the selection down through the screens available. ● When editing a parameter value, it decreases the displayed value. ● When the AC drive is in RUN mode, it decreases the speed.
▷	Shift	● Select the displayed parameter in the stop or running state. ● **Select the digit to be modified when modifying a parameter value**
RUN	RUN	Start the AC drive when using the operating panel control mode. Note: It is inactive when using the terminal or communication control mode.
STOP RES	**Stop/Reset**	● Stop the AC drive when it is in the RUN state. ● Perform a reset operation when the AC drive is in the FAULT state. Note: The functions of this key can be restricted by using function F7-02.
MF.K	Multifunction	**Perform a function switchover as defined by the setting of F7-01, for** example to quickly switch command source or direction.
QUICK	Menu mode selection	**Press it to switch between menu modes as defined by the setting of FP-03.**

Relevant parameters for operation panel setting

Function Code	Parameter Name	Setting Range	Default
F7-01	MF.K key function selection	0: MF.K key disabled 1: Switchover from remote control (terminal or communication) to keypad control 2: Switchover between forward rotation and reverse rotation **3: Forward jog** **4: Reverse jog** 5: Individualized parameter display	0
F7-02	**STOP/RESET key function**	**0: STOP/RESET key enabled only in keypad control** **1: STOP/RESET key enabled in any operation mode**	1
FP-03	Parameter display property	**For user defined and user modified parameters** 00: non of them will display **01: user defined parameters will display** **10: user modified parameters will display** 11: both of them will display	00

Status Indicators

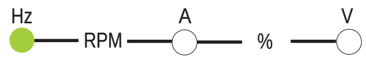
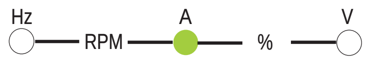
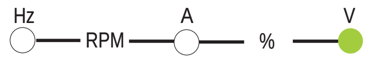
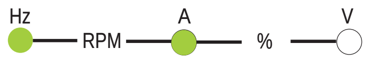
There are four red LED status indicators at the top of the operating panel.

Indicator	Indication
◯ RUN	OFF indicates the MD500 is in the stop state.
	ON indicates the MD500 is in the running state.
◯ LOCAL/REMOT	OFF indicates the MD500 is under the operating panel control.
	ON indicates the MD500 is under the terminal control.
	FLASHING indicates the MD500 is under the communication control.
◯ FWD/REV	OFF indicates reverse motor rotation.
	ON indicates forward motor rotation.
◯ TUNE/TC	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.

Figure 4-2 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

The following table lists the indication of the LED display.

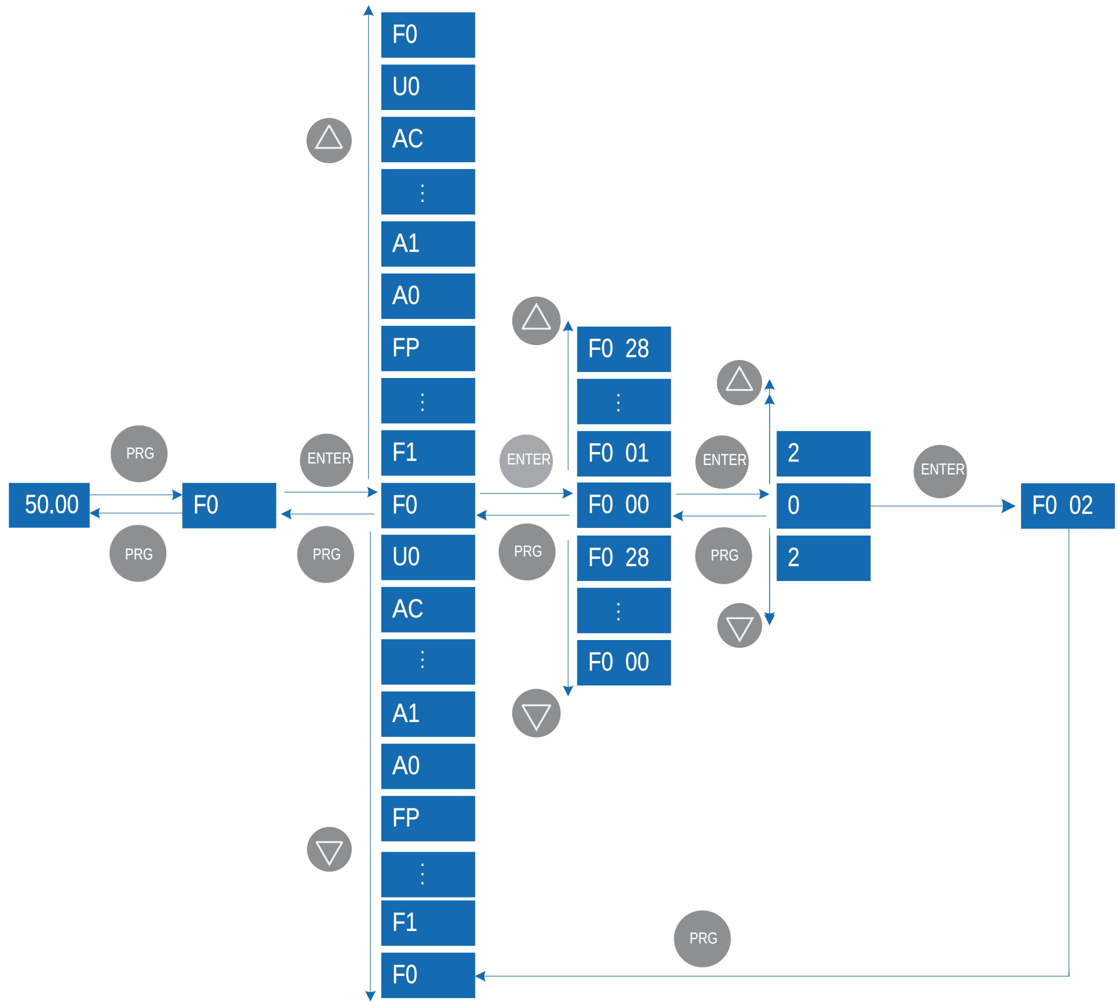
LED Display	Indication	LED Display	Indication	LED Display	Indication	LED Display	Indication
0	0	6	6	C	C	n	N
1	1	7	7	c	c	P	P
2	2	8	8	d	D	r	R
3	3	9	**9**	E	E	T	T
4	4	A	A	F	F	U	U
5	5, S	b	B	L	L	u	u

4.2 Operating Panel Menu Structure

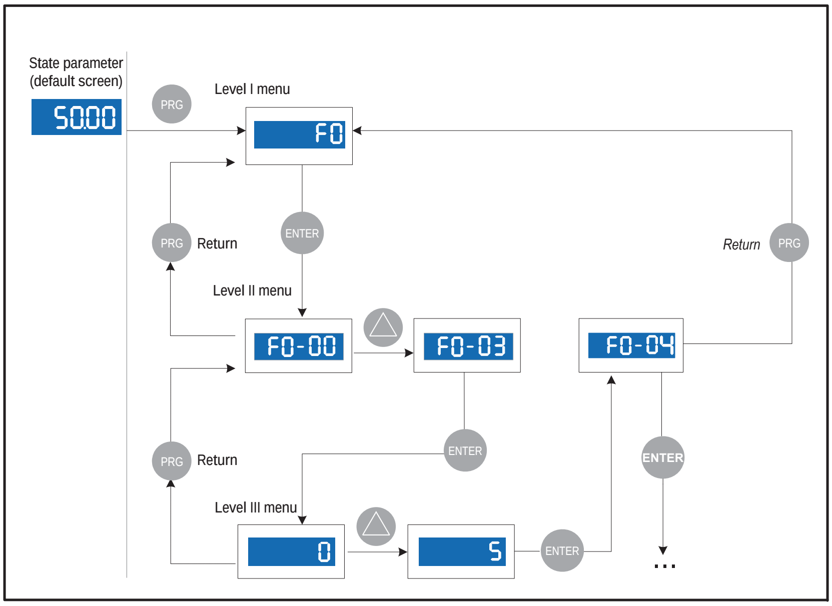
The MD500 operating panel has three levels of menu:

1. Level I - the function parameter group
2. Level II - the function parameter
3. Level III - the function parameter value

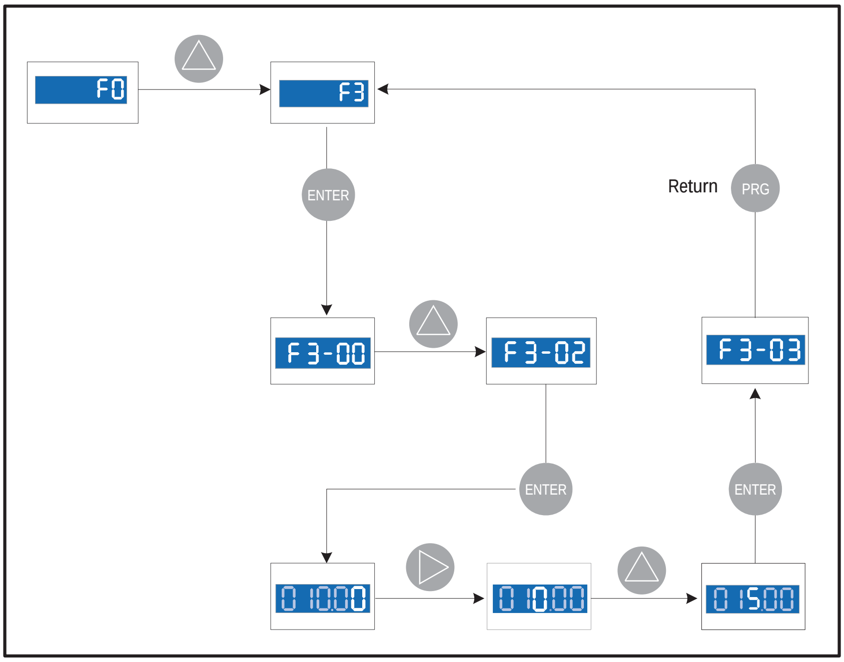
Figure 4-3 Structure of the three levels of menu



The operation procedure of the three levels of menu is as follows:



The following shows how to modify F3-02 from 10.00 Hz to 15.00 Hz.



Press ENTER from a Level III menu to:

1. Save the parameter value you have set
2. Return to the Level II menu, and then
3. Select the next function parameter.

Press PRG from a Level III menu to:

1. Return to the Level II menu without saving the parameter value, and remain at the current function code.

■ Unchangeable Parameters

When operating in Level III menus, if the parameter does not include a flashing digit, then it is not possible to change that parameter. There are two possible reasons for this:

1. The function parameter you have selected is read-only. This is because:
    - The display is showing the AC drive model.
    - The display is showing an actual parameter detected by the system.
    - The display is showing a running record parameter.
2. The displayed function parameter cannot be changed while the AC drive is in the RUN state. You can change these types of parameter only when the AC drive is in the stop state.

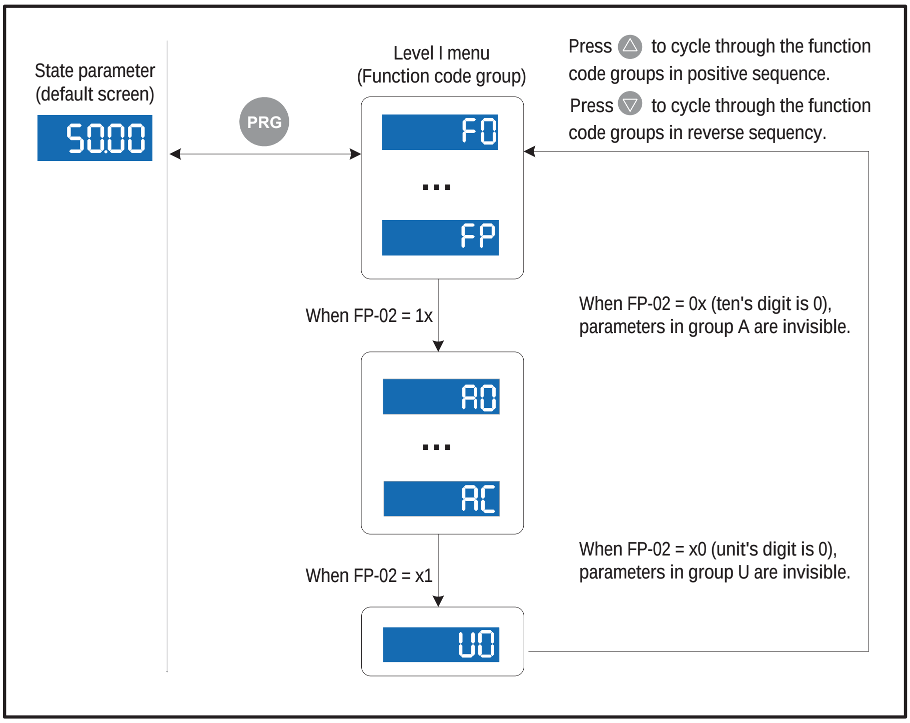
4.3 Overall Arrangement of Function Parameters

The MD500 includes functions in group F, and new function groups A and U.

Function Code Group	Description	Standard Function Parameters
F0 to FP	Standard function code group	Standard function parameters
A0 to AC	Advanced function code group	**AI/AO correction**
U0 to U3	Running state function code group	Display of basic parameters

■ Selection of Function Parameter Group

Figure 4-4 Selection of function parameter group



■ Selection of Displaying A and U Groups

The value you set for function parameter FP-02 determines whether the operating panel displays groups U and A.

Value of FP-02	Group A	Group U
00	Not displayed	Not displayed
01	Not displayed	Displayed
10	Displayed	Not displayed
11 (default)	Displayed	Displayed

4.4 Function Parameter Operations

4.4.1 Viewing and Editing Function Parameters

■ Viewing Function Parameters

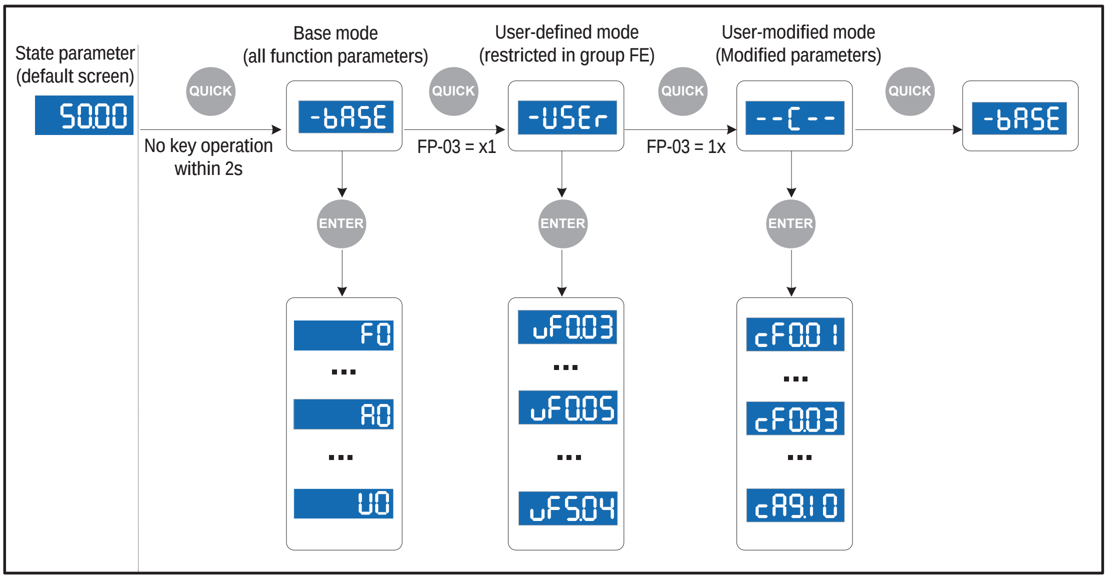
The MD500 provides three display modes for viewing function parameters, described in Table 4-1.

Table 4-1 Function parameter display modes

Function Code Display Mode	Parameter Name	Setting Range
Base mode	-bASE	Show all the function parameters in sequence
User-defined quick-view mode	-USEr	**The user can define up to 30 function parameters** to include into function group FE.
User-modified quick-view mode	--C--	The function parameters that have been **modified by a user are showed here.**

Press QUICK to cycle through the three function parameter display modes. In each mode, the method you use to view and modify parameter value is the same as shown in Figure 4-3.

Figure 4-5 Switching between the three function parameter display modes



The value you set for function parameter FP-03 determines whether the operating panel displays the quick-view user-defined and the quick-view user-modified function groups. The base mode is always available.

Table 14 Setting FP-03 to select the quick-view display modes

Value of FP-03	User-modified Group	User-defined Group
00	Not displayed	Not displayed
01	Not displayed	Displayed
10	Displayed	Not displayed
11 (default)	Displayed	Displayed

■ Editing Function Parameters

This editing method is mostly used in on-site commissioning.

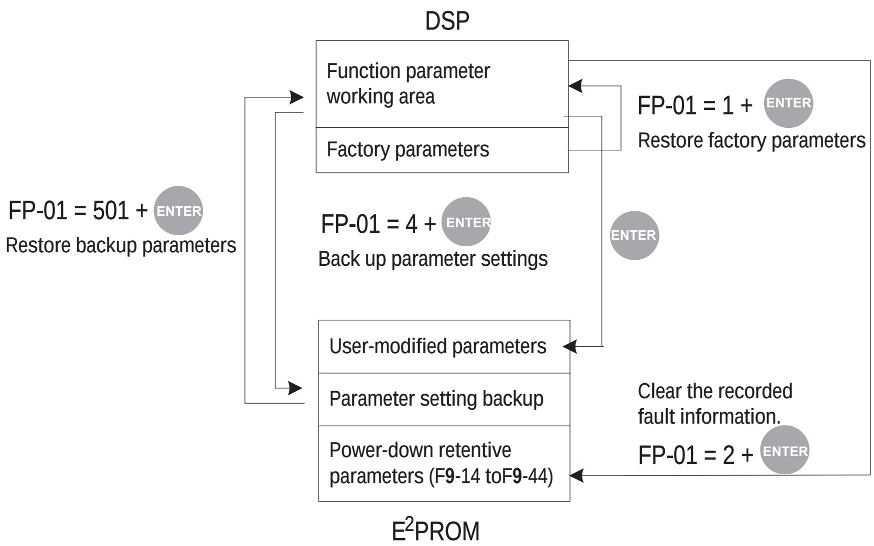
- Pressing △ and ▽ in Level I menu is to quickly change the function parameter group.
- Pressing △ and ▽ in Level II menu is to quickly increase or decrease the function parameter number.
- Pressing △ and ▽ in Level III menu is to quickly increase or decrease the function parameter value. To save the setting, press ENTER. To cancel the setting, press PRG.

4.4.2 Saving and Restoring Settings

After you change the value of any function parameter, the MD500 saves the new value locally so that it remains effective when you next power on the AC drive. The MD500 also retains alarm information and cumulative running time statistics.

The MD500 allows you to 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 parameter settings after completing a maintenance or repair operation on the MD500.

You can also restore the default parameter settings, or clear the running data by using the function parameter FP-01. See ## for a description of function code FP-01.



4.4.3 Password Security

The MD500 AC drive provides a security protection function that requires a user-defined password. Function parameter FP-00 controls this function.

When FP-00 has the default value zero, it is not necessary to enter a password to program the MD500.

To enable the password protection, do as follows:

1. **Set a non-zero value for FP-00. This value is the user-defined password.**
2. Make a written note of the value you have set for FP-00 and keep the note in a safe location.
3. Press ENTER to exit the function parameter editing mode.

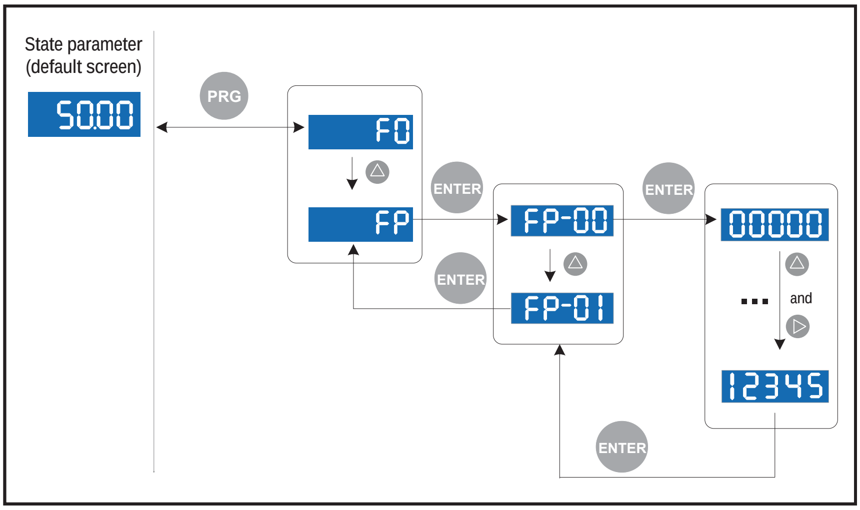
The password protection is successfully enabled. Then when you press PRG , the display shows "------". You must enter the correct password to enter the programming menu.

To remove password protection, do as follows:

1. Use the current password to enter the function parameter editing mode.
2. Set FP-00 to zero.
3. Press ENTER to exit the function parameter editing mode.

The password protection is successfully removed.

The following figure gives an example, showing how to set the password to 12345.



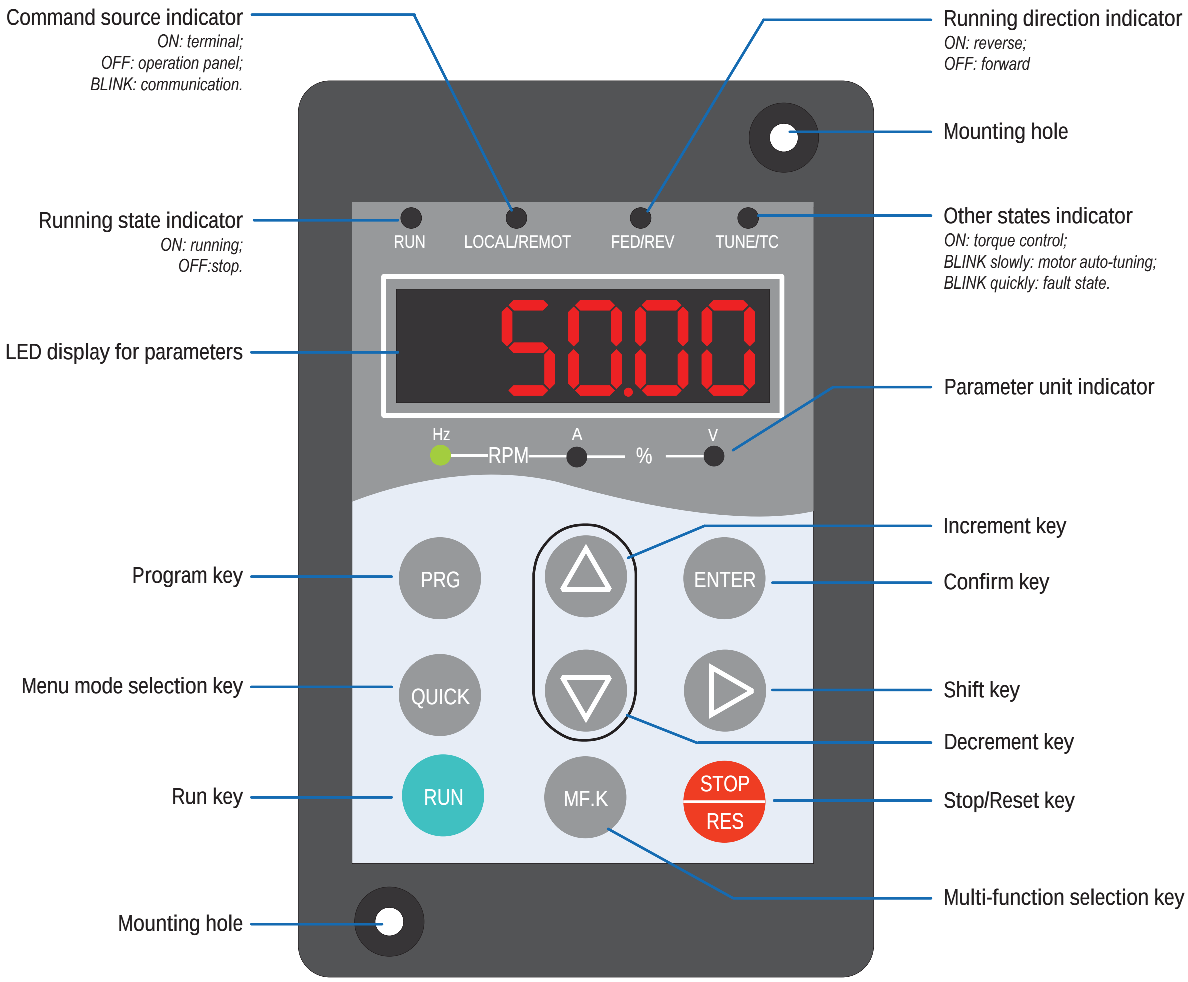
5

Quick Setup

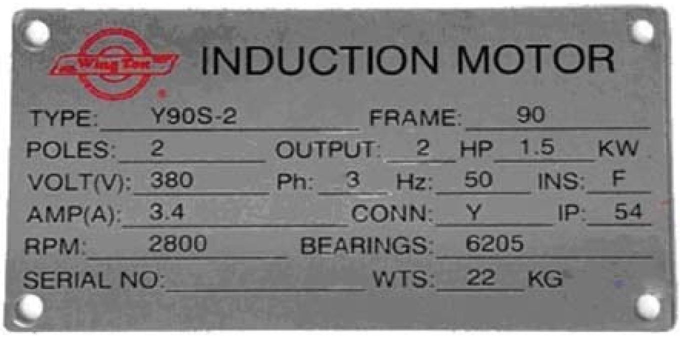
5. Quick Setup

5.1 Get Familiar With Operation Panel

Before any commissioning work, you must go back to chapter 4 to get acquainted with the operation panel first. The operation panel allows you to monitor system operation, modify parameters and start or stop the MD500.



5.2 Setup Flowchart

START	Para.	Parameter name	Default	Commission
Before power on				
Check voltage of power supply		Bear in mind that if a higher voltage power supply than necessary is connected to inverter, then inverter will probably get damaged instantly, for example 380V **power supplies to a 220V class inverter, then rectifier bridge will get burnt.** So please check it before power on with a reliable instrument.		
Check wirings of power supply and inverter outputs		If we wrongly connect power supply to inverter, then inverter will probably get damaged instantly. If any one of inverter outputs keeps short-circuited to ground all the way, then inverter may get damaged sooner or later, though protective algorithm is planted inside. Motor windings being short-circuited between phases or to ground may also be damaging.		
Restore parameters	FP-01	Parameter operation	0	
		0: No operation 1: Restore default settings except motor parameters 2: Clear records including errors 4: Restore user's backup parameters 501: Backup parameters NOTE: usually people have no idea what parameters have been changed, so it's seriously recommended to restore parameters to default at the beginning of commissioning.		
Set motor parameters		Motor Nameplate		
				
	F1-01	Rated motor power	model dependent	
		Unit: kW		
	F1-02	Rated motor voltage	model dependent	
		Unit: V		
	F1-03	Rated motor current	model dependent	
		Unit: A		
	F1-04	Rated motor frequency	model dependent	
		Unit: Hz		
	F1-05	Rated motor speed	model dependent	
		Unit: rpm.		

CONTINUE	Para.	Parameter name	Default	Commission

Step	Para.	Parameter name	Default	Commission
CONTINUE If an encoder is used				
Set encoder parameters	F1-27	Encoder pulses per revolution	1024	
		1 to 65535ppr		
	F1-28	Encoder type	0	
		0: ABZ incremental encoder 1: UVW incremental encoder 2: Resolver **3: SIN/COS encoder** 4: Wire-saving UVW encoder		
	F1-30	**A/B phase sequence of ABZ encoder**	0	
		0: Forward 1: Reserve		
	F1-31	Encoder installation angle	0.0	
		0.0°to 359.9°		
	F1-34	Number of pole pairs of resolver	1	
		1 to 65535 pairs of poles		
Perform motor auto tuning	F1-37	Auto-tuning selection	0	
		0: No auto-tuning 1: Asynchronous motor static auto-tuning 1 2: Asynchronous motor dynamic auto-tuning 3: Asynchronous motor static auto-tuning 2 NOTE: Motor won’t rotate at this stage if choose 1 or 3, for they are both static, while if choose 2 then motor will rotate, so better disconnect load from motor shaft for safety. Steps of auto-tuning: 1. Make sure the UVW connection between inverter and motor is not disconnected by output contactor; if it is, then manually handle with the output contactor; 2. Set F0-02=0 (Operation panel control), so that the key RUN can start the tuning procedure. 3. Set F1-37=1 or 2 or 3, press ENTER , then LED on panel will display letters "TUNE". 4. Press the key RUN on panel, then motor starts auto-**tuning, it usually takes about 30 seconds to finish this auto-**tuning, wait until LED stops displaying "TUNE".		
Select command source	F0-02	Command source selection	1	
		0: Operation panel control (indicator ‘LOCAL/REMOT’ turns OFF) **1: Terminal control (indicator ‘LOCAL/REMOT’ turns ON)** **2: Communication control (indicator ‘LOCAL/REMOT’ turns blinking)**		
Select control mode	F0-01	Control mode selection	0	
		0: SVC control 1: FVC control 2: VF control		
CONTINUE	Para.	Parameter name	Default	Commission

CONTINUE	Para.	Parameter name	Default	Commission
Select frequency reference source	F0-03	Main frequency source X selection	0	
		0:Digital setting F0-08 (pressing or can revise F0-08 easily, and the revised value won't be cleared even after power off) 1:Digital setting F0-08 (pressing or can change F0-08 easily, but the revised value would be cleared after power off) 2: AI1 3: AI2 4: AI3 5: Pulse setting (DI5) 6: Multi-reference setting 7: Simple PLC 8: PID **9: Communication setting**		
If F0-08 is frequency reference Set F0-08	F0-08	Preset frequency	50.00	
		Hz to F0-10		
If AI1 is frequency reference Set AI1	F4-13	AI curve 1 minimum input	0.00	
		0 V to F4-15;		
	F4-14	Corresponding setting of AI1 minimum input	0.0	
		-100.0% to 100.0%		
	F4-15	AI1 maximum input	10.00	
		F4-13 to 10.00 V		
	F4-16	Corresponding setting of AI1 maximum input	100.0	
		-100.0% to 100.0%		
If AI2 is frequency reference Set AI2	F4-18	AI curve 2 minimum input	0.00	
		0 V to F4-20;		
	F4-19	Corresponding setting of AI2 minimum input	0.0	
		-100.0% to 100.0%		
	F4-20	AI2 maximum input	10.00	
		F4-18 to 10.00 V		
	F4-21	Corresponding setting of AI2 maximum input	100.0	
		-100.0% to 100.0%		

CONTINUE	Para.	Parameter name	Default	Commission

CONTINUE	Para.	Parameter name	Default	Commission
If AI3 is frequency reference				
Set AI3	F4-23	AI curve 3 minimum input	0.00	
		0 V to F4-25;		
	F4-24	Corresponding setting of AI3 minimum input	0.0	
		-100.0% to 100.0%		
	F4-25	AI3 maximum input	10.00	
		F4-23 to 10.00 V		
If multi-reference is frequency reference	F4-26	Corresponding setting of AI3 maximum input	100.0	
		-100.0% to 100.0%		
Set multi-reference	FC-00	Reference 0	0.0	
		0.0 to 100.0%.		
	FC-01 to FC-15	Reference 1-15	0.0	
		0.0 to 100.0%.		

CONTINUE	Para.	Parameter name	Default	Commission

CONTINUE
If any digital input is used
Set DI function

Para.	Parameter name	Default	Commissioning
F4-00	DI1 function selection	1	
	0: No function 1: Forward RUN (FWD) 2: Reverse RUN (REV) 3: Three-wire control 4: Forward JOG (FJOG) 5: Reverse JOG (RJOG) 6: Terminal UP 7: Terminal DOWN 8: Coast to stop **9: Fault reset (RESET)** 10: RUN pause 11: External fault normally open (NO) input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 **16: Terminal 1 for acceleration/deceleration time selection** **17: Terminal 2 for acceleration/deceleration time selection** 18: Frequency source switchover **19: UP and DOWN setting clear (terminal, keypad)** 20: Command source switchover terminal 1 **21: Acceleration/Deceleration prohibited** 22: PID pause 23: PLC status reset 24: Swing pause 25: Counter input 26: Counter reset 27: Length count input 28: Length reset **29: Torque control prohibited** 30: Pulse input (enabled only for DI5) 31: Reserved **32: Immediate DC injection braking**		

CONTINUE

Para.	Parameter name	Default	Commission

CONTINUE	Para.	Parameter name	Default	Commission
	F4-00	DI1 function selection	1	
		33: External fault normally closed (NC) input **34: Frequency modification forbidden** 35: PID action direction reverse 36: External STOP terminal 1 37: Command source switchover terminal 2 38: PID integral disabled **39: Switchover between main frequency source X and preset frequency** 40: Switchover between auxiliary frequency source Y and preset frequency 41: Motor selection terminal 1 42: Motor selection terminal 2 43: PID parameter switchover **44: User-defined fault 1** **45: User-defined fault 2** **46: Speed control/Torque control switchover** 47: Emergency stop 48: External STOP terminal 2 **49: Deceleration DC injection braking** 50: Clear the current running time **51–59: Reserved** **Setting range:0 to 59;**		
	F4-01	DI2 function selection	4	
		Setting range same as DI1.		
	F4-02	DI3 function selection	**9**	
		Setting range same as DI1.		
	F4-03	DI4 function selection	12	
		Setting range same as DI1.		
	F4-04	DI5 function selection	13	
		setting range same as DI1;		
	F4-05	DI6 function selection	0	
		setting range same as DI1;		
	F4-06	DI7 function selection	0	
		Setting range same as DI1;		
	F4-07	DI8 function selection	0	
		Setting range same as DI1		
	F4-08	**DI9 function selection**	0	
		Setting range same as DI1.		
	F4-09	DI10 function selection	0	
		setting range same as DI1;		

CONTINUE	Para.	Parameter name	Default	Commissioning

CONTINUE	Para.	Parameter name	Default	Commissioning
If any digital output is used				
Set DO function	F5-00	FM output mode selection	0	
		0: FM terminal outputs pulses, the frequency of which represents the value of variable which is assigned by F5-06. 1: FM terminal outputs switch signal, the value of which represents the status of variable which is assigned by F5-01		
	F5-01	FM (switch signal) function selection	0	
		0: No output 1: AC Drive running 2: Fault output 3: Frequency-level detection FDT1 output 4: Frequency reached 5: Zero-speed running (no output at stop) 6: Motor overload pre-warning 7: AC drive overload pre-warning 8: Set count value reached **9: Designated count value reached** 10: Length reached 11: PLC cycle completed 12: Accumulative running time reached 13: Frequency limited 14: Torque limited 15: Ready for RUN 16: Reserved 17: Frequency upper limit reached 18: Frequency lower limit reached (no output at stop) **19: Undervoltage status output** 20: Communication setting 21,22: Reserved 23: Zero-speed running 2 (having output at stop) 24: Accumulative power-on time reached 25: Frequency level detection FDT2 output		

CONTINUE	Para.	Parameter name	Default	Commissioning

CONTINUE	Para.	Parameter name	Default	Commissioning
If any digital output is used				
Set DO function	F5-01	FM (switch signal) function selection	0	
		26: Frequency 1 reached 27: Frequency 2 reached 28: Current 1 reached **29: Current 2 reached** 30: Timing duration reached 31: AI1 input limit exceeded 32: Load lost 33: Reverse running 34: Zero current state 35: Module temperature reached 36:Software current limit exceeded 37: Frequency lower limit reached (having output at stop) 38: Alarm output **39: Motor overheat warning** 40: Current running time reached 41: Fault output (no output at undervoltage)		
	F5-02	**Relay function selection(T/A-T/B-T/C)**	2	
		Setting range same as FM;		
	F5-03	**Relay function selection (P/A-P/B-P/C)**	0	
		Setting range same as FM; the relay P/A-P/B-P/C is on extension I/O card.		
CONTINUE	Para.	Parameter name	Default	Commissioning

CONTINUE	Para.	Parameter name	Default	Commissioning
↓	F5-04	DO1 function selection	1	
		Setting range same as FM		
	F5-05	Extension card DO2 function selection	4	
		Setting range same as FM		
	F5-06	FM (pulse signal) function selection	0	
		0: Running frequency 1: Set frequency 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: Pulse input 7: AI1 8: AI2 **9: AI3** 10: Length 11: Count value 12: Communication setting 13: Motor rotational speed 14: Output current 15: Output voltage 16: Output torque (actual value)		
If any analogue output is used Set AO function	F5-07	AO1 function selection	0	
		Setting range same as F5-06		
↓	F5-08	AO2 function selection	1	
		Setting range same as F5-06; AO2 is on extension card.		
Set accel/decel time	F0-17	Acceleration time 1	model dependent	
		0.00 to 650.00s (if F0-19=2) **0.0 to 6500.0s (if F0-19=1)** **0 to 65000s (if F0-19=0)**		
↓	F0-18	Deceleration time 1	model dependent	
		0.00 to 650.00s (if F0-19=2) **0.0 to 6500.0s (if F0-19=1)** **0 to 65000s (if F0-19=0)**		
If smooth accel/decel is requested Set S-curve	F6-07	**Acceleration/Deceleration mode**	3	
		0 : Linear acceleration/deceleration **1: S-curve acceleration/deceleration A**		
↓	F6-08	Time proportion of S-curve at Accel start	30.0	
		0.0% to (100.0% - F6-09)		
	F6-09	Time proportion of S-curve at Accel end	30.0	
		0.0% to (100.0% - F6-08)		
CONTINUE	Para.	Parameter name	Default	Commissioning

CONTINUE	Para.	Parameter name	Default	Commissioning
if it is VF control				
Set VF parameters	F3-00	**V/F curve selection**	0	
		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** SETTING RANGE: 0 to 11;		
	F3-01	Torque boost	0.0	
		0.0 to 30.0 %; NOTE: if it is 0, then auto torque boost is activated, and it is recommended to use auto torque boost.		
	F3-02	Frequency limit of torque boost	50.00	
		0.00 Hz to maximum output frequency		
	F3-03	**Multi-point V/F frequency 1 (F1)**	0.00	
		0.00 Hz to F3-05		
	F3-04	**Multi-point V/F voltage 1 (V1)**	0.0	
		0.0 to 100.0 V		
	F3-05	**Multi-point V/F frequency 2 (F2)**	0.00	
		F3-03 to F3-07, Hz		
	F3-06	**Multi-point V/F voltage 2 (V2)**	0.0	
		0.0 to 100.0 V		
	F3-07	**Multi-point V/F frequency 3 (F3)**	0.00	
		F3-05 to rated motor frequency F1-04, Hz		
	F3-08	**Multi-point V/F voltage 3 (V3)**	0.0	
		0.0 to 100.0 V		
Trial RUN		Use operational panel, or digital input terminal, or communication control, to **start inverter, and see if the running performance satisfies your application.** If yes, then go forward to next step, if NO, then wrap back to check.		
CONTINUE	Para.	Parameter name	Default	Commissioning

CONTINUE	Para.	Parameter name	Default	Commissioning
if it is SVC or FVC control				
Adjust speed loop parameters	F2-00	Speed loop proportional gain 1	30	
To achieve better performance		0 to 100.		
	F2-01	Speed loop integral time 1	0.5	
		0.01 to 10.00 Sec.		
	F2-02	Switchover frequency 1	5.00	
		0.00Hz to F2-05		
	F2-03	Speed loop proportional gain 2	20	
		0 to 100.		
	F2-04	Speed loop integral time 2	1.0	
		0.01 to 10.00 Sec.		
	F2-05	Switchover frequency 2	10.00	
		F2-02 to maximum output frequency		
OVER				

6

Parameter Table

6. Parameter Table

6.1 Introduction

Note

Password protection is available for use with the MD310 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 4.4.3 "Password Security" 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 parameter table are described as follows:

Symbol	Meaning
☆	It is possible to modify the parameter with the MD310 in the stop or in the Run state.
★	It is not possible to modify the parameter with the MD310 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	0 to 2	0	*
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	0.5 to 16.0 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	★
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	☆

Function Code	Parameter Name	Setting Range	Default	Property
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	★
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	★
F1-27	Encoder pulses per revolution	1 to 65535	1024	★
F1-28	Encoder type	0: ABZ incremental encoder 2: Resolver	0	★
F1-30	**A/B phase sequence of ABZ** incremental encoder	0: Forward 1: Reserve	0	★
F1-34	Number of pole pairs of resolver	1 to 65535		★
F1-36	Encoder wire-break fault detection time	0.0s: No detection 0.1s to 10.0s	0.0s	★
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 F2: Vector Control Parameters				
F2-00	Speed loop proportional gain 1	1 to 100	30	☆
F2-01	Speed loop integral time 1	0.01s to 10.00s	0.50s	☆

Function Code	Parameter Name	Setting Range	Default	Property
F2-02	Switchover frequency 1	0.00 to F2-05	5.00 Hz	☆
F2-03	Speed loop proportional gain 2	1 to 100	20	☆
F2-04	Speed loop integral time 2	0.01s to 10.00s	1.00s	☆
F2-05	Switchover frequency 2	F2-02 to max. frequency	10.00 Hz	☆
F2-06	Vector control slip gain	50% to 200%	100%	☆
F2-07	**Speed loop filter time constant**	0.000s to 0.100s	0.000s	☆
F2-09	Torque upper limit source in speed control mode	0 to 7	0	☆
F2-10	Digital setting of torque upper limit in speed control mode	0.0% to 200.0%	150.0%	☆
F2-11	Torque limit source in speed control (regenerative)	0 to 7	0	☆
F2-12	Digital setting of torque limit in speed control regenerative)	0.0% to 200.0%	150.0%	☆
F2-13	**Excitation adjustment** proportional gain	0 to 60000	2000	☆
F2-14	**Excitation adjustment** integral gain	0 to 60000	1300	☆
F2-15	**Torque adjustment** proportional gain	0 to 60000	2000	☆
F2-16	**Torque adjustment integral gain**	0 to 60000	1300	☆
F2-17	Speed loop integral separation selection	0: Disabled 1: Enabled		☆
F2-20	**Max. output voltage coefficient**	100% to 110%	105%	★
F2-21	**Max. torque coefficient of field weakening area**	50% to 200%	100%	☆
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	☆

Function Code	Parameter Name	Setting Range	Default	Property
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	★
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	★
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	☆

Function Code	Parameter Name	Setting Range	Default	Property
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%	☆
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	☆
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	★

Function Code	Parameter Name	Setting Range	Default	Property
Group F6: Start/Stop Control				
F6-00	Startup mode	0: Direct start 1: Catching a spinning motor 2: Pre-excited start	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** **2: Dynamic 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**	0.0 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	☆
F6-15	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	★
Group F7: Keypad Operation and LED Display				
F7-01	MF.K Key function selection	0 to 5	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 100.0°C	-	●
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	-	●

Function Code	Parameter Name	Setting Range	Default	Property
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	0.00 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 rate	0.00% to 100.00%	0.00%	☆
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%	☆

Function Code	Parameter Name	Setting Range	Default	Property
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	★
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	☆
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%	☆
F9-03	Overvoltage stall gain	0 (no overvoltage stall) to 100	0	☆
F9-04	Overvoltage stall protective voltage	**650 V to F9-08**	**689 V**	☆
F9-05	Overcurrent stall gain	0 to 100	20	☆
F9-06	Overcurrent stall protective level	100% to 200%	150%	★
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	-	-	●

Function Code	Parameter Name	Setting Range	Default	Property
F9-22	AC drive state upon 3rd fault	-	-	●
F9-23	Current power-on time upon 3rd fault	-	-	●
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	★
F9-62	Voltage level of power dip ride-through function enabled	60% to 100%	80%	★
F9-63	Selection of load lost protection	0: Disabled 1: Enabled	0	☆

Function Code	Parameter Name	Setting Range	Default	Property
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	Overspeed detection level	0.0% to 50.0% (max. frequency)	20.0%	☆
F9-68	Overspeed detection time	0.0s to 60.0s	1.0s	☆
F9-69	Detection level of too large speed feedback error	0.0% to 50.0% (max. frequency)	20.0%	☆
F9-70	Detection time of too large speed feedback error	0.0s to 60.0s	5.0s	☆
F9-71	Power dip ride-through gain Kp	0 to 100	30	☆
F9-72	Power dip ride-through **integral coefficient**	0 to 100	40	☆
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	☆
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	☆
Group Fb: Wobble Function, Fixed Length and Count				
Fb-00	Wobble setting mode	0, 1	0	☆
Fb-01	Wobble amplitude	0.0% to 100.0%	0.0%	☆

Function Code	Parameter Name	Setting Range	Default	Property
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	☆
Group Fb: Multi-Reference and Simple PLC Function				
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-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)	☆

Function Code	Parameter Name	Setting Range	Default	Property
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	☆
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	☆
Group Fd: Communication				
Fd-00	Baud rate	**0000 to 9999**	6005	☆
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	☆

Function Code	Parameter Name	Setting Range	Default	Property
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	☆
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, U3-00 to U3-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				
FP-00	User password	0 to 65535	0	☆
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-02	Selection of general function parameter display	00 to 11	11	☆
FP-03	Selection of individualized parameter display	00 to 11	00	☆

Function Code	Parameter Name	Setting Range	Default	Property
FP-04	Selection of parameter **modification**	0, 1	0	☆
Group A0: Torque Control and Limit				
A0-00	**Speed/Torque control selection**	0, 1	0	★
A0-01	Torque reference source in torque control	0 to 7	0	★
A0-03	Torque digital setting in torque control	-200.0% to 200.0%	150.0%	☆
A0-05	Forward max. frequency in torque control	0.00 Hz to max. frequency (F0-10)	50.00 Hz	☆
A0-06	Reverse max. frequency in torque control	0.00 Hz to max. frequency (F0-10)	50.00 Hz	☆
A0-07	Acceleration time in torque control	0.00s to 650.00s	0.00s	☆
A0-08	Deceleration time in torque control	0.00s to 650.00s	0.00s	☆
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	☆
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 30.0 kW	Model dependent	★
A2-02	Rated motor voltage	1 to 1000 V	Model dependent	★
A1-03	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	★

Function Code	Parameter Name	Setting Range	Default	Property
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	★
A2-27	Encoder pulses per revolution	1 to 65535	1024	★
A2-28	Encoder type	0: ABZ incremental encoder 2: Resolver	0	★
A2-30	**A/B phase sequence of ABZ** incremental encoder	0: Forward 1: Reserve	0	★
A2-31	Encoder installation angle	**0.0 to 359.9**	0.0	★
A2-34	Number of pole pairs of resolver	1 to 65535		★
A2-36	Encoder wire-break fault detection time	0.0s: No detection 0.1s to 10.0s	0.0s	★
A2-37	Auto-tuning selection	0 to 3	0	★
A2-38	Speed loop proportional gain 1	1 to 100	30	☆
A2-39	Speed loop integral time 1	0.01s to 10.00s	0.50	☆
A2-40	Switchover frequency 1	0.00 to A2-43	5.00	☆
A2-41	Speed loop proportional gain 2	1 to 100	20	☆
A2-42	Speed loop integral time 2	0.01 to 10.00	1.00	☆
A2-43	Switchover frequency 2	A2-40 to max. frequency	10.00	☆
A2-44	Vector control slip gain	50% to 200%	100%	☆
A2-45	**Speed loop filter time constant**	0.000s to 0.100s	0.000s	☆
A2-47	Torque upper limit source in speed control mode	0 to 7	0	☆
A2-48	Digital setting of torque upper limit in speed control mode	0.0% to 200.0%	150.0%	☆
A2-51	**Excitation adjustment** proportional gain	0 to 60000	2000	☆
A2-52	**Excitation adjustment** integral gain	0 to 60000	1300	☆
A2-53	**Torque adjustment** proportional gain	0 to 60000	2000	☆
A2-54	**Torque adjustment integral gain**	0 to 60000	1300	☆
A2-55	Speed loop integral separation selection	0: Disabled 1: Enabled		☆
A2-61	Motor 2 control mode	0 to 2	0	★
A2-62	**Motor 2 acceleration/** deceleration time selection	0 to 4	0	☆

Function Code	Parameter Name	Setting Range	Default	Property
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				
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	150%	☆
A5-08	**Dead-zone time adjustment**	100% to 200%	0	★
A5-09	Overvoltage threshold	200.0 to 2500.0 V	Model dependent	★
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%	☆
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%	☆

Function Code	Parameter Name	Setting Range	Default	Property
A6-29	Jump amplitude of AI3 input corresponding setting	0.0% to 100.0%	0.5%	☆
Group A7: User Programmable Card				
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%	0.00%	☆
A7-07	Setting torque reference via the user programmable card	-200.00% to 200.00%	0.00%	☆
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	☆
Group A8: Point-point Communication				
A8-00	Selection of point-point communication	0: Disabled 1: Enabled	1	☆
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	011	★
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	★
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%	★
A8-11	Window width	0.20 to 10.00 Hz	0.5 Hz	
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	☆

Function Code	Parameter Name	Setting Range	Default	Property
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	☆

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	-
U0-35	Target torque	-200.0% to 200.0%
U0-37	Power factor angle	-180° to 180°
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	-
U0-58	Phase Z counting	0 to 65535
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

Function Code	Parameter Name	Display Range
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
U0-65	Torque upper limit	-200.00% to 200.00%
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
U0-74	Actual motor output torque	-100% to 100%

7

Description of Parameters

7 Description of Parameters

7.1 Start/Stop Command Source

The MD500 AC drive has the following three control methods to start and to stop the MD500 AC drive.

- Operating panel keys
- Terminal control
- Communication control

You can select the proper control mode in function parameter F0-02.

Function Code	Parameter Name	Setting Range	Default
F0-02	Command source selection	0: Operation panel control (LED off) 1: Terminal control (LED on) **2: Communication control (LED flashing)**	0

- **F0-02 = 0: Operation panel control (The LOCAL/REMOT indicator is off.)**

  The run commands are given by pressing keys RUN and STOP/RES on the operation panel.

  – Press RUN to start the AC Drive.

  – Press STOP/RES to stop the AC Drive.

  For details of the operation panel, refer to chapter 4.

- **F0-02 = 1: Terminal control (The LOCAL/REMOT indicator is on.)**

  The terminal control mode applies to installations where the Start and Stop signals come from:

  – A DIP switch or electromagnetic button, or
  – A dry contact signal source

  Commands are given by using multi-functional input terminals with functions such as FWD, REV, JOGF and JOGR.

  For details on the terminal control, see section 7.1.1 Terminal Control.

- **F0-02 = 2:Communication control (The LOCAL/REMOT indicator is flashing.)**

  The most common configuration for the MD500 uses a host computer to control the AC drive through a communication link such as Modbus, PROFIBUS-DP, CANlink, or CANopen.

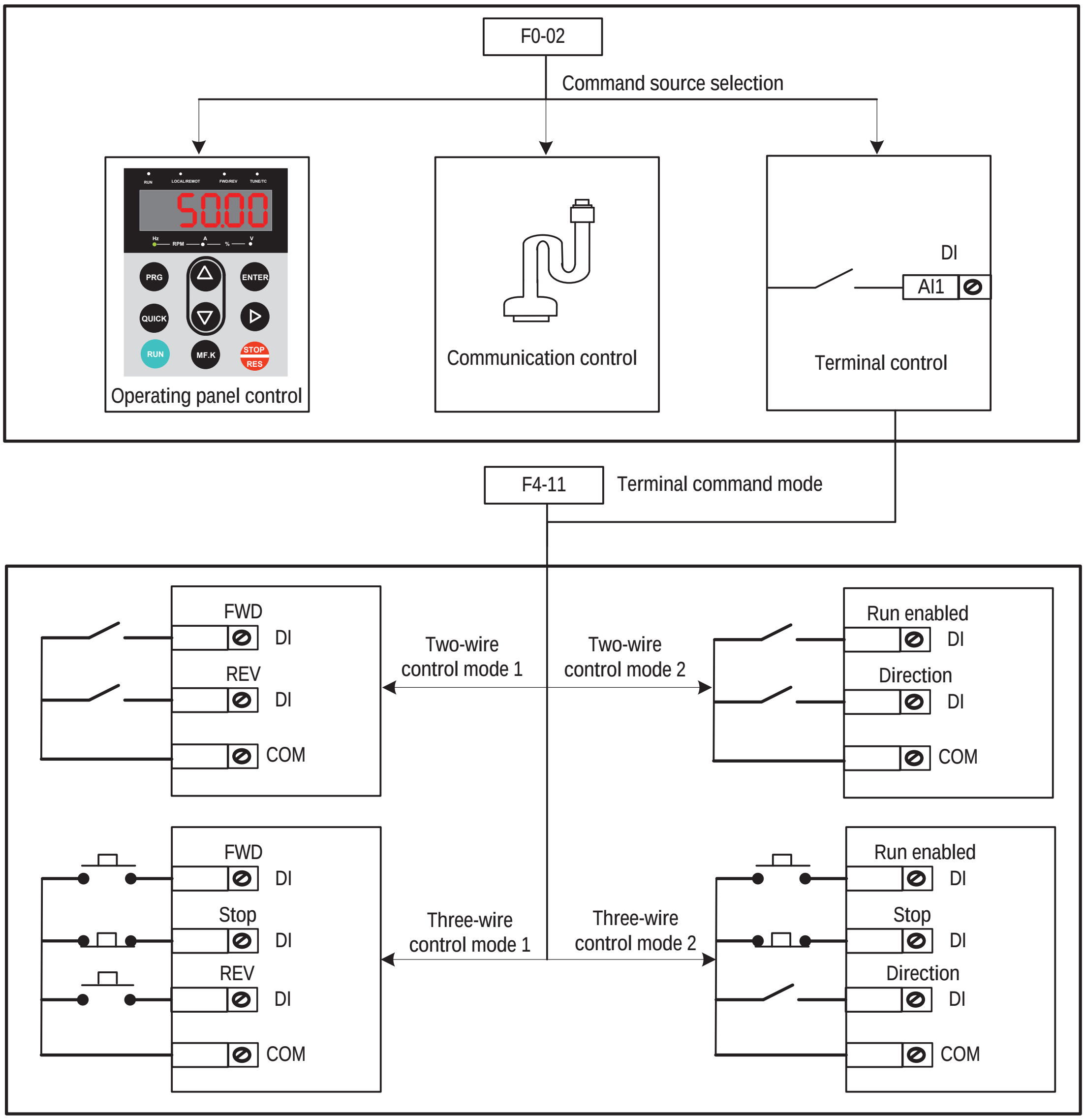
  For details on the communication control, see section 7.1.2 Communication Control.

7.1.1 Terminal Control

Function parameter F4-11 defines the four terminal control modes, in which the AC drive running is controlled by 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

Figure 7-1 Four terminal control modes



The following example takes DI1, DI2 and DI3 to describe how to control the AC drive via DI terminals.

■ F4-11 = 0: Two-wire Control Mode 1

It is the most commonly used two-wire control mode. Allocate the DI1 with the forward run function and the DI2 with the reverse run function.

You need to connect the forward run switch to the DI1 terminal and the reverse run switch to the DI2 terminal.

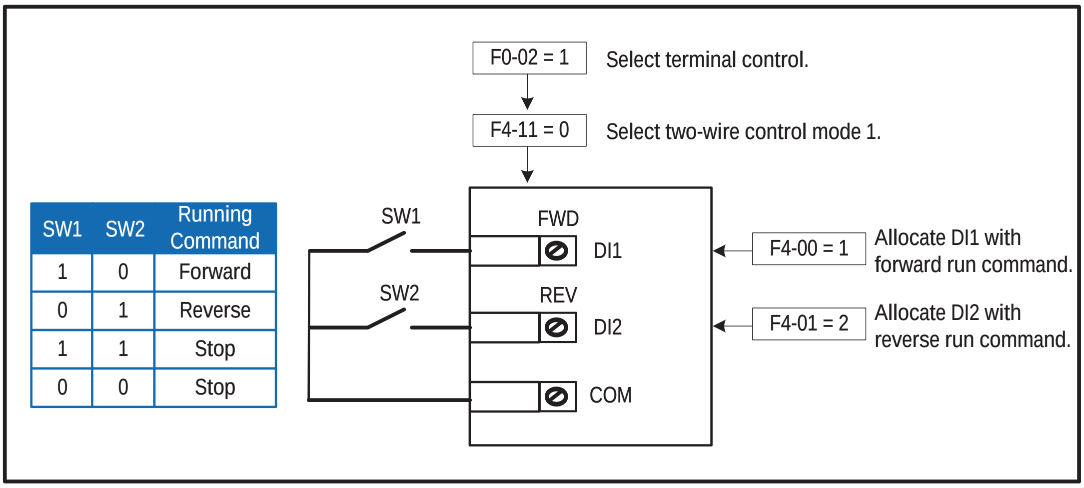
The parameters are set as below:

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)

In this mode,

- When SW1 is closed, the motor rotates in the forward direction. When SW1 is open, the motor stops.
- When SW2 is closed, the motor rotates in the reverse direction. When SW2 is open, the motor stops.
- When SW1 and SW2 are both open or closed simultaneously, the motor stops.

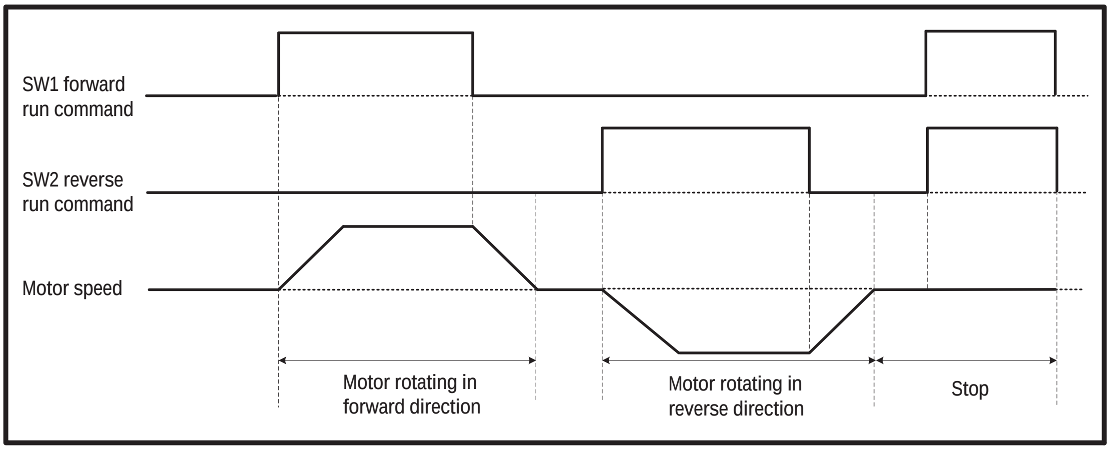
Figure 7-2 Wiring diagram of the two-wire control mode 1



SW1	SW2	Running Command
1	0	Forward
0	1	Reverse
1	1	Stop
0	0	Stop

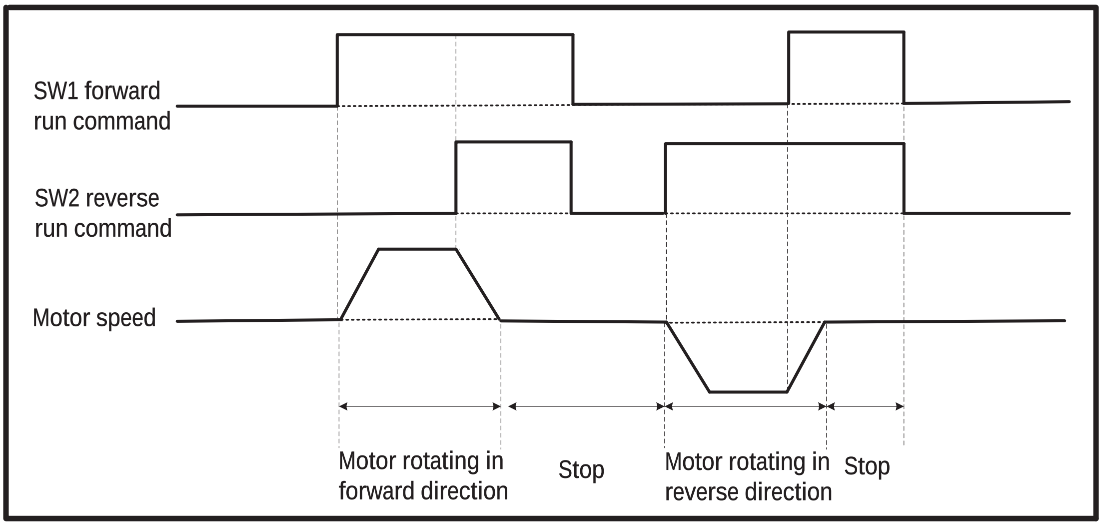
The timing diagram of the two-wire control mode 1 on normal condition is shown in the following figure.

Figure 7-3 Timing diagram of the two-wire control mode 1 on normal condition



The timing diagram of the two-wire control mode 1 on abnormal condition is shown in the following figure.

Figure 7-4 Timing diagram of the two-wire control mode 1 on abnormal condition



■ F4-11 = 1: Two-wire Control Mode 2

In this mode, DI1 is RUN enabled terminal, and DI2 determines the running direction. Allocate the DI1 with the run enabled function and the DI2 with the running direction.

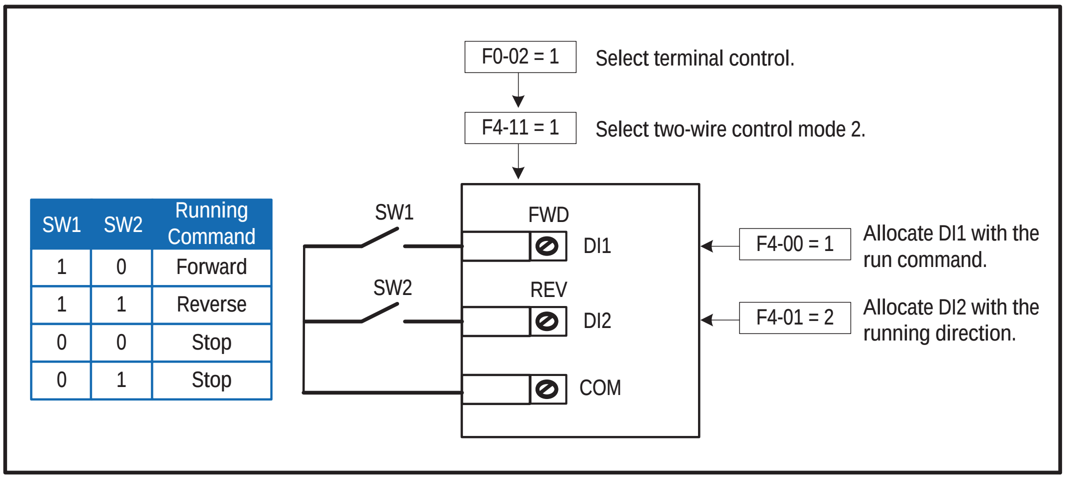
The parameters are set as below:

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

In this mode,

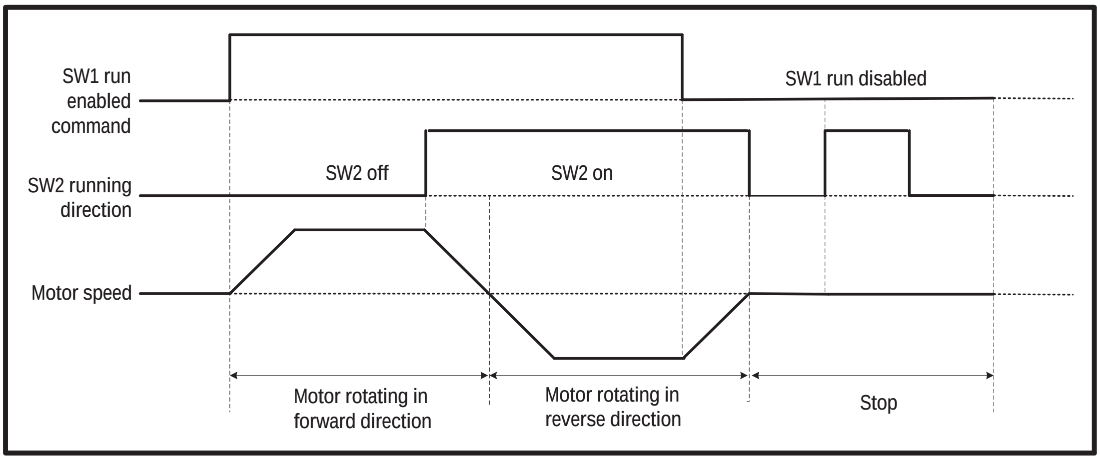
- When SW1 is closed, the motor rotates in the forward direction after you keep SW2 open.
- When SW1 is closed, the motor rotates in the reverse direction after you close SW2.
- When SW1 is open, the motor stops no matter whether SW2 is open or closed.

Figure 7-5 Wiring diagram of the two-wire control mode 2



The timing diagram of the two-wire control mode 2 is shown in the following figure.

Figure 7-6 Timing diagram of the two-wire control mode 2



■ F4-11 = 2: Three-wire Control Mode 1

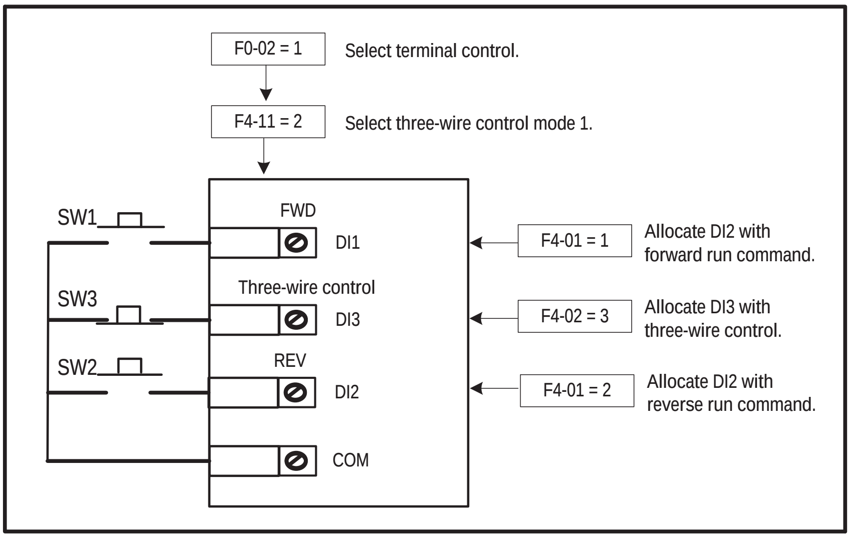
In this mode, DI3 is the three-wire control terminal. The DI1 is allocated with the forward run function and the DI2 is allocated with the reverse run function. The parameters are set as below:

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

SW3 is a normally-closed button and SW1 and SW2 are normally-open buttons.

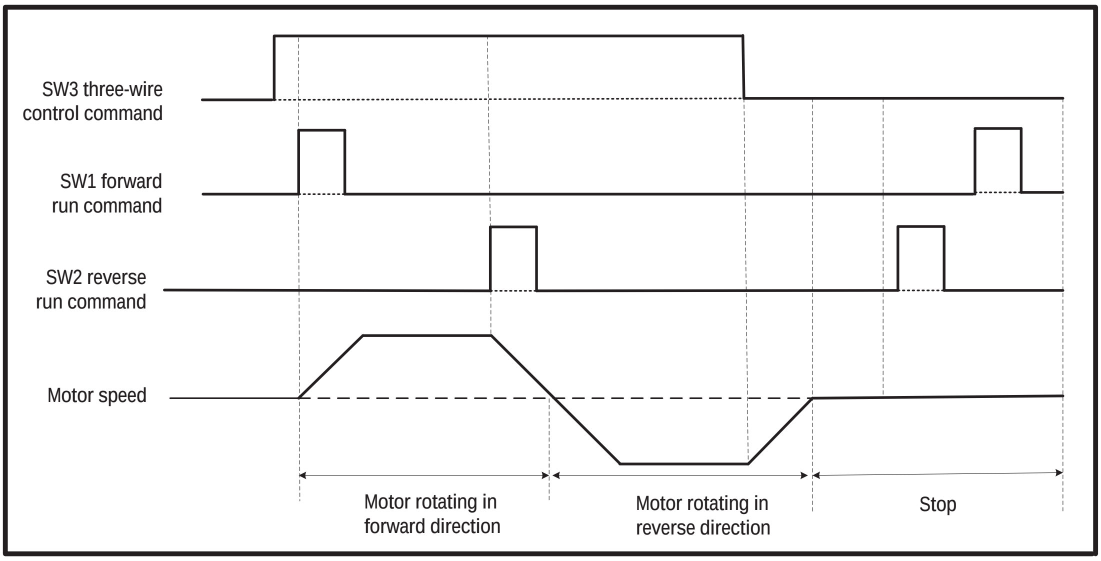
- SW3 must remain closed during the start sequence and during normal run operation.
- The motor stops immediately after SW3 opens.
- Signals from SW1 and SW2 are valid only after SW3 closes.
- On the condition that SW3 is closed, after you press down SW1, the motor rotates in the forward direction. After you press down SW2, the motor rotates in the reverse direction.

Figure 7-7 Wiring diagram of the three-wire control mode 1



The timing diagram of the three-wire control mode 1 is shown in the following figure.

Figure 7-8 Timing diagram of the three-wire control mode 1



■ F4-11 = 3: Three-wire Control Mode 2

In this mode, DI3 is the three-wire control command terminal. DI1 determines whether the run command is enabled and DI2 determines the running direction.

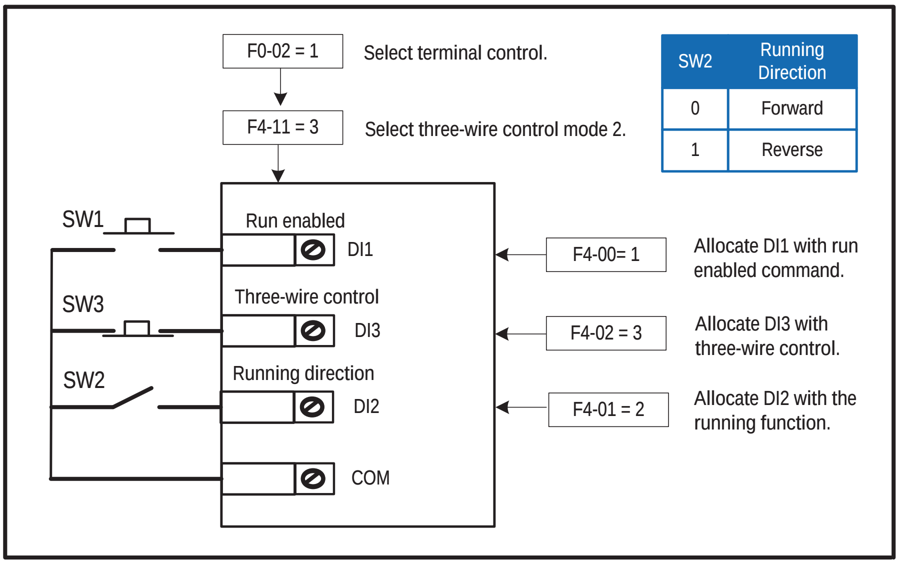
The parameters are set as below:

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

SW3 is a normally-closed button. SW1 is a normally-open button and SW2 is a switch..

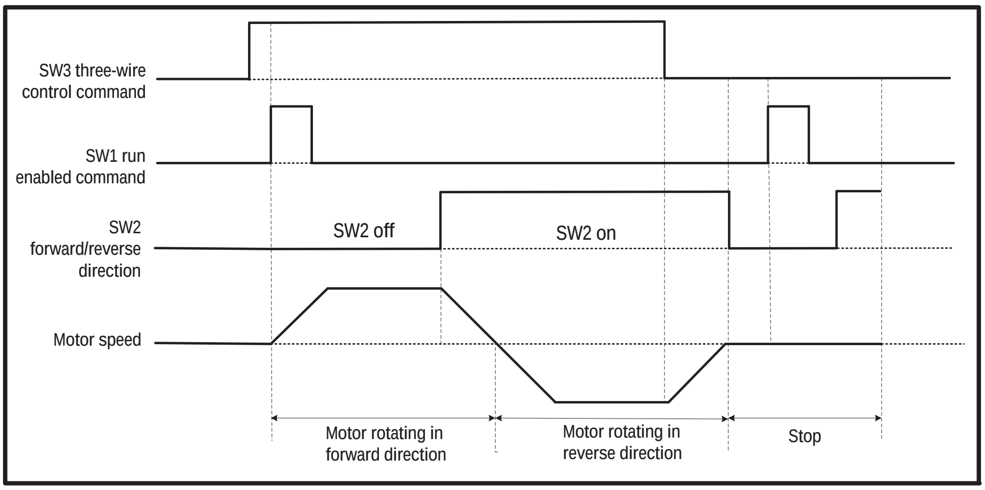
- SW3 must remain closed during the start sequence and during normal run operation.
- The motor stops immediately after SW3 opens.
- Signals from SW1 and SW2 are valid only after SW3 closes.
- On the condition that SW3 is closed and you press down SW1, if you keep SW2 off, the motor rotates in the forward direction. After you turns SW2 on, the motor rotates in the reverse direction.

Figure 7-9 Wiring diagram of the three-wire control mode 2



The timing diagram of the three-wire control mode 2 is shown in the following figure.

Figure 7-10 Timing diagram of the three-wire control mode 2



7.1.2 Communication Control

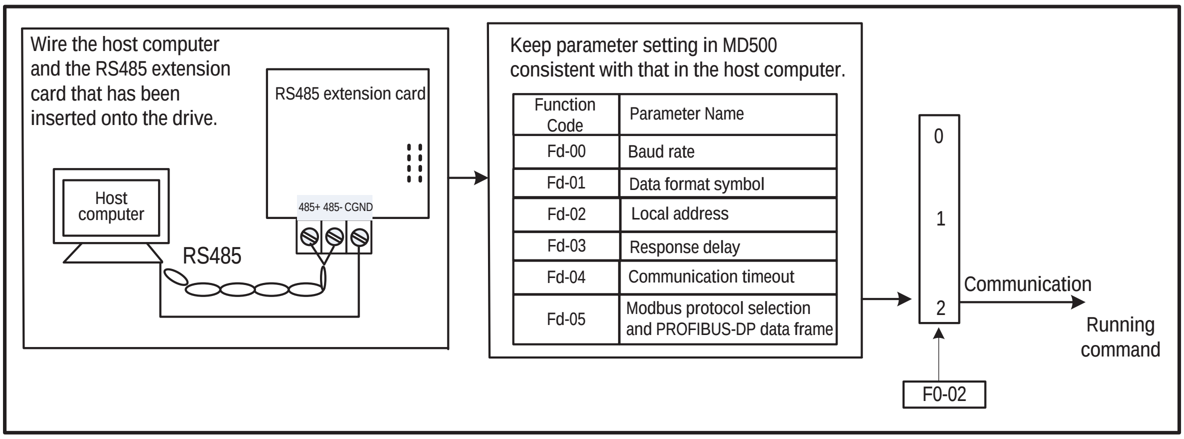
The most common configuration for the MD500 uses a host computer to control the AC drive through a communication link such as Modbus, PROFIBUS-DP, CANlink, or CANopen.

To use communication with the MD500, the matching communication card must be installed. If the communication protocol is Modbus, PROFIBUS-DP or CANopen, select the proper serial communication protocol in F0-28.

The CANlink protocol is always valid.

Function Code	Parameter Name	Setting Range	Default
F0-28	Serial port communication protocol	0: Modbus protocol 1: PROFIBUS-DP protocol or CANopen protocol	0

Figure 7-11 Diagram of setting run command via communication



When the AC drive is controlled via communication, the host computer must send write command to the AC drive. Here takes the Modbus protocol as an example to describe the process of giving run command via communication.

To make the AC drive run in the reverse direction, the host computer sends the write command 01 06 20 00 00 02 03 CB (hexadecimal). In the command,

- 01H (settable): AC drive address
- 06H: write command
- 2000H: communication address
- 02H: reverse run
- 03CBH: CRC check

For definition of other communication addresses and control commands, see section 8.4 "Definition of Communication Data Address".

Master Command		Slave Response	
ADDR	01H	ADDR	01H
CMD	06H	CMD	06H
Parameter address high bits	20H	Parameter address high bits	20H
Parameter address low bits	00H	Parameter address low bits	00H
Data content high bits	00H	Data content high bits	00H
Data content low bits	02H	Data content low bits	02H
CRC high bits	03H	CRC high bits	03H
CRC low bits	CBH	CRC low bits	CBH

7.2 Frequency Reference Settings

The MD500 provides the following four methods to input the final frequency reference:

- Main frequency reference
- Auxiliary frequency reference
- Main & auxiliary superposition
- Binding command source to main frequency reference

7.2.1 Setting the Main Frequency Reference

The main frequency reference has nine setting modes.

0. Digital setting (up/down modification, non-retentive at power down)

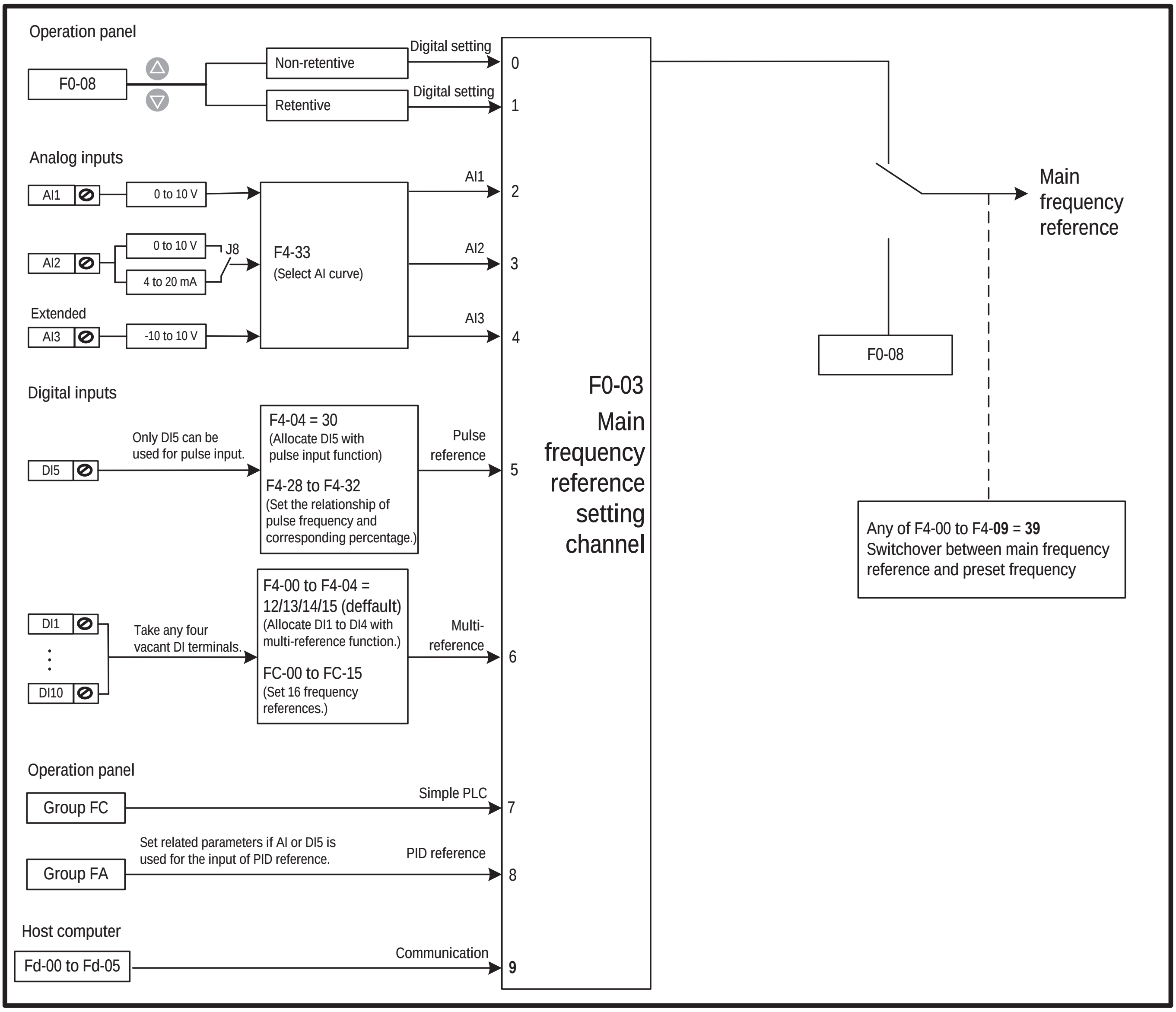
1. **Digital setting (up/down modification, retentive at power down)**
2. AI1
3. AI2
4. AI3
5. Pulse reference
6. Multi-reference
7. Simple PLC
8. PID reference

9. Communication reference

F0-03 selects a proper channel to set the main frequency reference.

Function Code	Parameter Name	Setting Range	Default
F0-03	Main frequency reference setting channel 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 6: Multi-reference 7: Simple PLC 8: PID **9: Communication reference**	0

Figure 7-12 select a proper channel to set the main frequency reference



■ Digital Setting (Non-retentive at Power Down)

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

When the MD500 is powered on again after power down, the frequency reference continues from the value of F0-08.

■ Digital Setting (Retentive at Power Down)

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

When the MD500 is powered on again after power down, the frequency reference continues from where it last reached.

Function Code	Parameter Name	Setting Range	Default
F0-08	Preset frequency	0.00 to max. frequency (F0-10)	50.00 Hz
F0-10	Max. frequency	50.00 to 500.00 Hz	50.00 Hz

Note

F0-23 (Retentive selection of digital setting frequency upon stop) determines whether to save **the frequency reference modification by pressing** △ and ▽ **or via the up/down function** when the AC drive stops, unrelated to retentive selection at power down.

Function Code	Parameter Name	Setting Range	Default
F0-23	Retentive selection of digital setting frequency upon stop	0: Not retentive 1: Retentive	50.00 Hz

F0-23 is valid only when the frequency source is digital setting.

- F0-23 = 0: Non-retentive

  The AC drive resumes the frequency reference to the value set in F0-08 at stop. The frequency reference continues from the value of F0-08 at next power-on.

- F0-23 = 1: retentive

  The AC drive retains the frequency reference that was last reached at stop. The frequency reference continues from the retained value at next power-on.

■ Analog Input

2. AI1 (0 to 10 V voltage input)

3. AI2 (0 to 10 V voltage input or 0 to 20 mA current input, determined by the setting of jumper J9)

4. AI3 (-10 to 10 V voltage input)

The frequency reference is entered from an analog input (AI) terminal. To input the frequency reference from an AI terminal, do as follows:

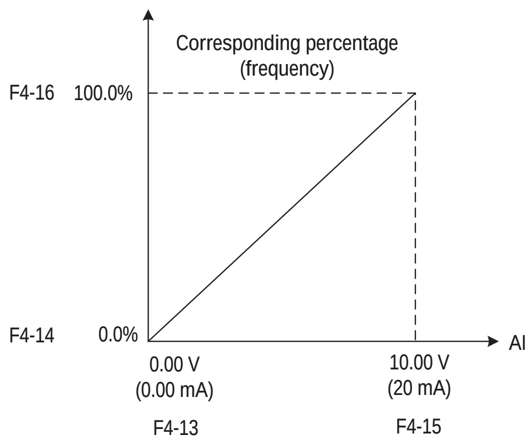
Steps	Related Parameters	Descriptions	
1. Set the AI curve. Set the correspondence relationship between the AI **voltage/current input and the** corresponding percentage.	F4-13 to F4-16	Set AI curve 1.	
	F4-18 to F4-21	Set AI curve 2.	
	F4-23 to F4-27	Set AI curve 3.	
	A6-00 to A6-07	Set AI curve 4.	
	A6-08 to A6-15	Set AI curve 5.	
	F4-34 (Selection when AI lower than min. input setting)	When an analog input is used as the frequency reference **setting channel, 100% of the voltage/current input** corresponds to the value of F0-10 (max. frequency).	
2. Select a proper curve for the AI terminal.	F4-33 (AI curve selection)	You can select any AI curve for the AI terminal. Generally, use the default value F4-33 = 321. That is, select curve 1 for AI1, curve 2 for AI2 and curve 3 for AI3.	
	F4-17, F4-22, F4-27	**Set the filter time of terminals AI1 to AI3.**	
3. Select a proper AI terminal as the main frequency reference setting channel.	F0-03 (Main frequency reference setting channel selection)	F0-03 = 2	Select AI1.
		F0-03 = 3	Select AI2.
		F0-03 = 4	Select AI3.
	F4-40 (AI2 signal selection)	F4-40 = 0 (default)	AI2 is voltage input.
		F4-40 = 1	AI2 is current input.

Step 1: Set the AI curve.

The MD500 provides five curves to indicate the mapping relationship between the input voltage entered from AI1, AI2 or AI3 and the target frequency. Three of the curves have a linear (point-point) correspondence, and two have four-point correspondence. 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 function code F4-33.

Here takes the AI curve 1 as an example to describe how to set the AI curve. The AI curve 1 is set by F4-13 to F4-16.

Figure 7-13 Set the AI curve 1



F4-13 to F4-16: These five function parameters set the relationship between the analog input and the corresponding percentage.

- When the analog input voltage exceeds the value of F4-15, the AC drive uses the maximum value.
- When the analog input voltage is below the value of F4-13, the AC drive uses the minimum value or 0.0%, determined by the setting of F4-34.

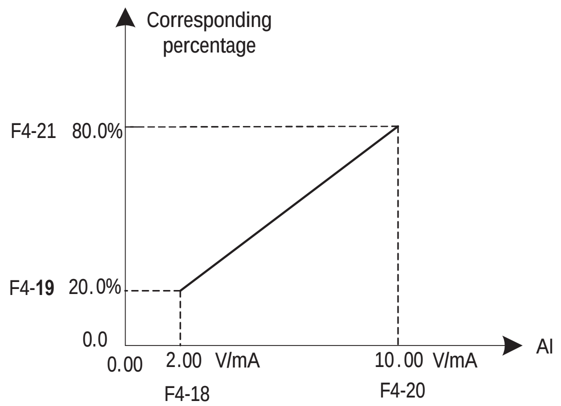
Function Code	Parameter Name	Setting Range	Default
F0-13	AI curve 1 min. input	0.00 V to F4-15	0.00 V
F0-14	Corresponding percentage of AI curve 1 min. input	-100.00% to 100.0%	0.0%
F0-15	AI curve 1 max. input	F4-13 to 10.00 V	10.00 V
F0-16	Corresponding percentage of AI curve 1 max. input	-100.00% to 100.0%	100.0%

Note

When an analog input is used as the frequency reference setting channel, 100% of the voltage/current input corresponds to the value of F0-10 (max. frequency). If the analog input is current, 1 mA current is equal to 0.5 V voltage.

F4-18 to F4-21 and F4-23 to F4-26 define the AI curve 2 and AI curve 3, respectively. The AI curve 2 and AI curve 3 have the same function and usage as the AI curve 1 does. Refer to the description of AI curve 1.

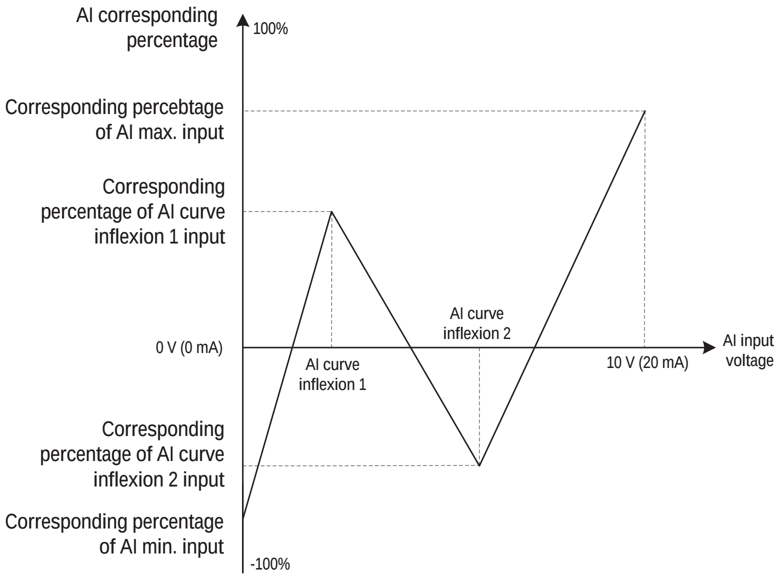
Figure 7-14 Set the AI curve 2



Function Code	Parameter Name	Setting Range	Default
F4-18	AI curve 2 min. input	0.00 V to F4-20	0.00 V
F4-19	Corresponding percentage of AI curve 2 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 AI curve 2 max. input	-100.00% to 100.0%	100.0%
F4-23	AI curve 3 min. input	0.00 V to F4-25	0.00 V
F4-24	Corresponding percentage of AI curve 3 min. input	-100.00% to 100.0%	0.0%
F4-25	AI curve 3 max. input	F4-23 to 10.00 V	10.00 V
F4-26	Corresponding percentage of AI curve 3 max. input	-100.00% to 100.0%	100.0%

A6-00 to A6-15 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 7-15 Diagram of curve 4 and curve 5



Note

When setting curve 4 and curve 5, the curve min. input, inflexion 1 voltage, inflexion 2 voltage and the curve max. input increase successively.

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	0.00 V
A6-09	Corresponding percentage of AI curve 5 min. input	-100.0% to 100.0%	0.0%
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	6.00 V
A6-13	Corresponding percentage of **AI curve 5 inflexion 1 input**	-100.0% to 100.0%	60.0%
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%

Step 2: Select a proper curve for the AI terminal.

F4-33 selects the curve of AI1, AI2 and AI3 from the five curves, respectively. Curve 1, curve 2 and curve 3 are 2-point curves, set in group F4. Curve 4 and curve 5 are 4-point curves, set in group A6.

The MD500 provides two AI terminals (AI1, AI2). An extra AI terminal (AI3) is provided by the I/O extension card.

Function Code	Parameter Name	Setting Range	Default
F4-33	AI curve selection	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) Unit’s digit: AI1 curve selection Ten’s digit: AI2 curve selection Hundred’s digit: AI3 curve selection	321
F4-17	**AI1 filter time**	0.00s to 10.00s	0.10s
F4-22	**AI2 filter time**	0.00s to 10.00s	0.10s
F4-27	**AI3 filter time**	0.00s to 10.00s	0.10s

F4-17, F4-22 and F4-27 set the AI software filter time. If the analog input is liable to interference, increase this parameter to stabilize the detected analog input. But too large setting slows the response of analog detection. Set it properly based on actual conditions.

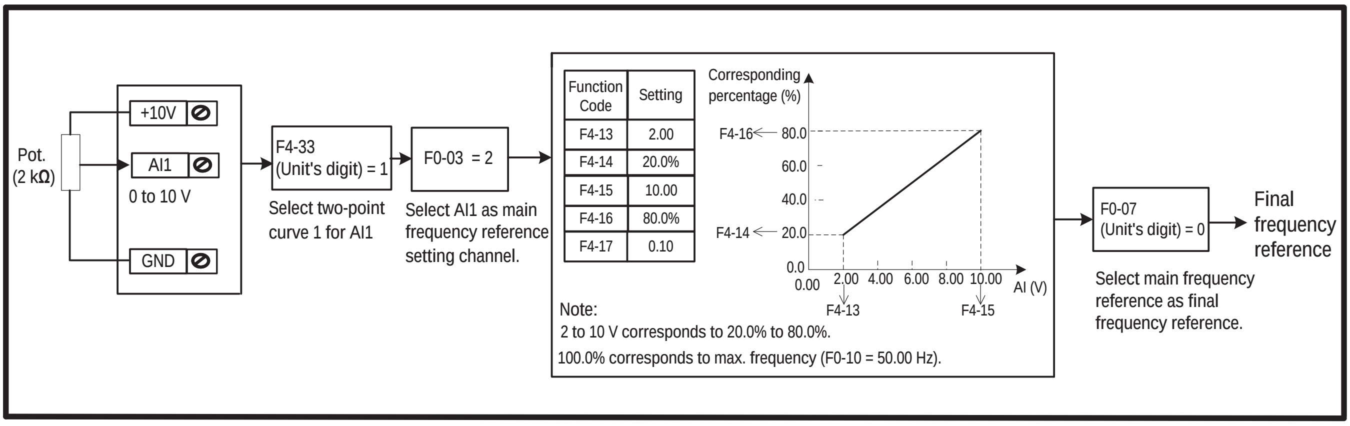
Step 3: Select a proper AI terminal as the main frequency reference setting channel.

The MD500 provides two AI terminals (AI1, AI2). An extra AI terminal (AI3) is provided by the I/O extension card.

Here takes the each AI terminal as examples to show how to use the AI terminal to control the main frequency reference.

Example 1: To make the voltage input at AI1 to control the frequency reference and correspond 2 to 10 V to 10 to 40 Hz, the settings **are shown in the following figure.**

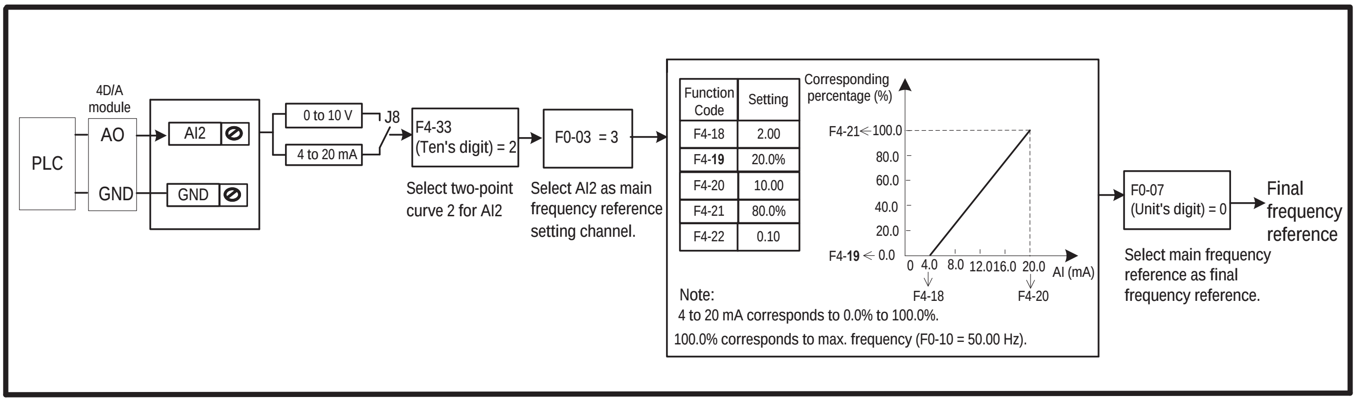
Figure 7-16 Voltage input at AI1 to control the frequency reference



Example 2: On the condition that the analog input from AI2 is current, if the input is 0 to 20 mA, it corresponds to voltage input of 0 to 10 V. If the input is 4 to 20 mA, it corresponds to 2 to 10 V.

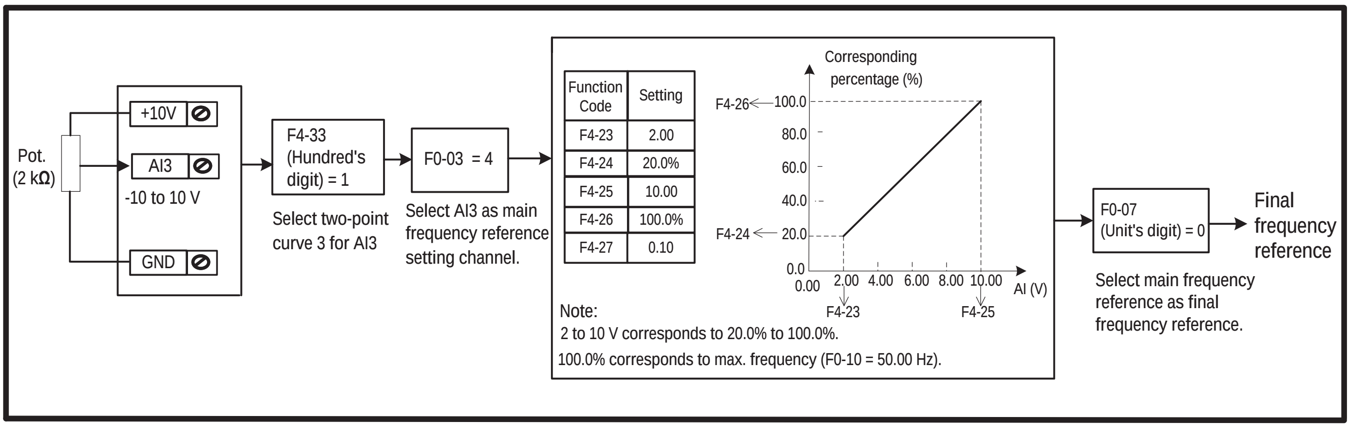
To make the current input at AI2 to control the frequency reference and correspond 4 to 20 mA to 0 to 50 Hz, the settings are shown **in the following figure.**

Figure 7-17 Current input at AI2 to control the frequency reference



Example 3: To make the voltage input at AI3 to control the frequency reference and correspond 2 to 10 V to 10 to 50 Hz, the settings **are shown in the following figure.**

Figure 7-18 Voltage input at AI3 to control the frequency reference



■ Pulse Reference (DI5)

The frequency reference is input by means of DI5 (high-speed pulse). The signal specification of pulse reference is 9 to 30 V (voltage range) and 0 to 100 kHz (frequency range). The corresponding value 100% of the pulse reference corresponds to the value of F0-10 (Max. frequency).

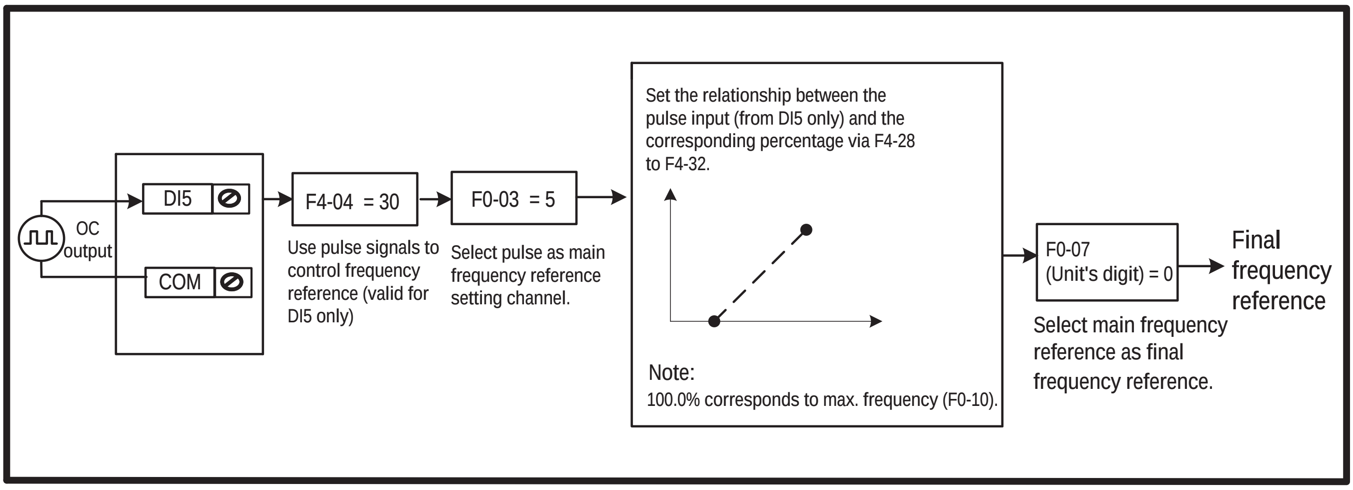
Note

The main frequency reference set via pulse reference and the pulse output of the FM terminal (F5-00 = 1) cannot be used simultaneously.

F4-28 to F4-32 set the relationship between the pulse input (from DI5 only) and the corresponding percentage. It has the same function and usage as the AI curve 1 does. Refer to the description of AI curve 1.

Function Code	Parameter Name	Setting Range	Default
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 50.00 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

Figure 7-19 Pulse input at DI5 to control frequency reference



Multi-reference

Multi-reference control mode is for use in the cases where it is not necessary to adjust the frequency reference of the AC drive continuously, and where only several frequencies are required.

The multi-reference is a relative value and is a percentage of F0-10 (max. frequency). Whether the setting is positive or negative determines the drive running direction. If negative, it indicates that the AC drive runs in the reverse direction.

The multiple references are set in group FC, as listed in the following table.

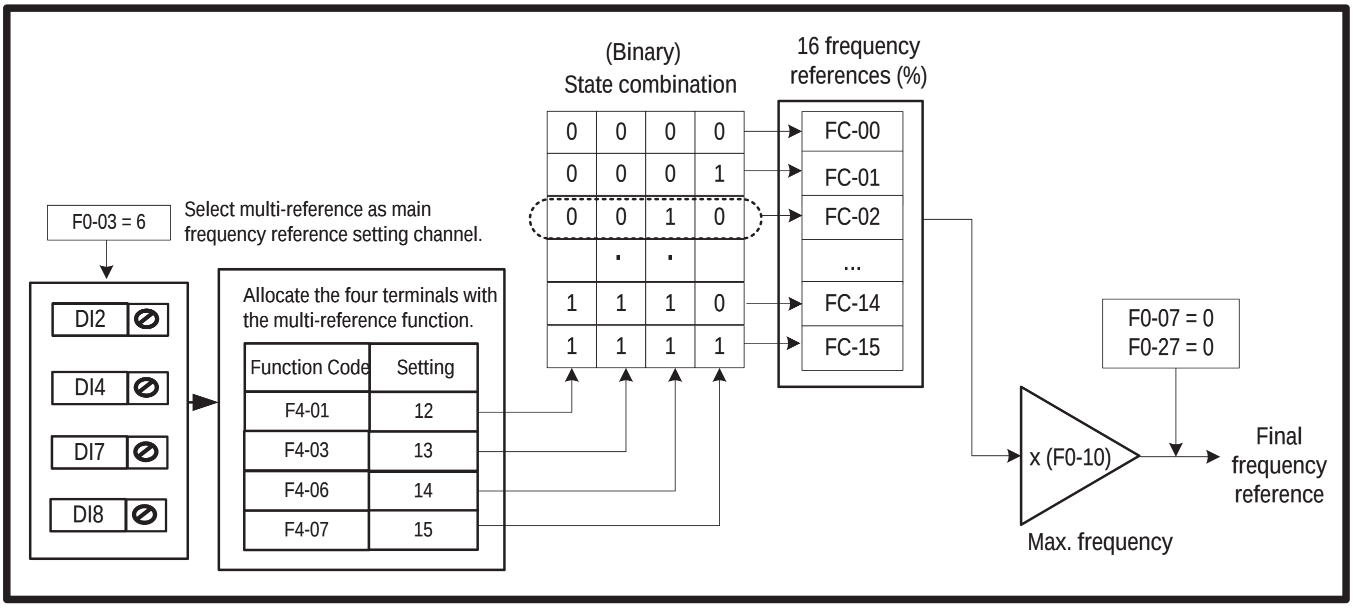
Function Code	Parameter Name	Setting Range	Default
FC-00	Reference 0	-100.0% to 100.0%	0.0%
FC-01	Reference 1	-100.0% to 100.0%	0.0%
FC-02	Reference 2	-100.0% to 100.0%	0.0%
FC-03	Reference 3	-100.0% to 100.0%	0.0%
FC-04	Reference 4	-100.0% to 100.0%	0.0%
FC-05	Reference 5	-100.0% to 100.0%	0.0%
FC-06	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%

In multi-reference mode, combinations of different DI terminal states correspond to different frequency references. The MD500 supports a maximum of 16 references implemented by 16 state combinations of four DI terminals (allocated with functions 12 to 15) in Group FC.

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

Here uses DI2, DI4, DI7 and DI8 for setting the multi-reference function. The diagram and related parameter setting of the multi-reference function is shown in the following figure.

Figure 7-20 Using multi-reference to control the frequency reference



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

K4	K3	K2	K1	Reference Setting	Corresponding Pr.
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

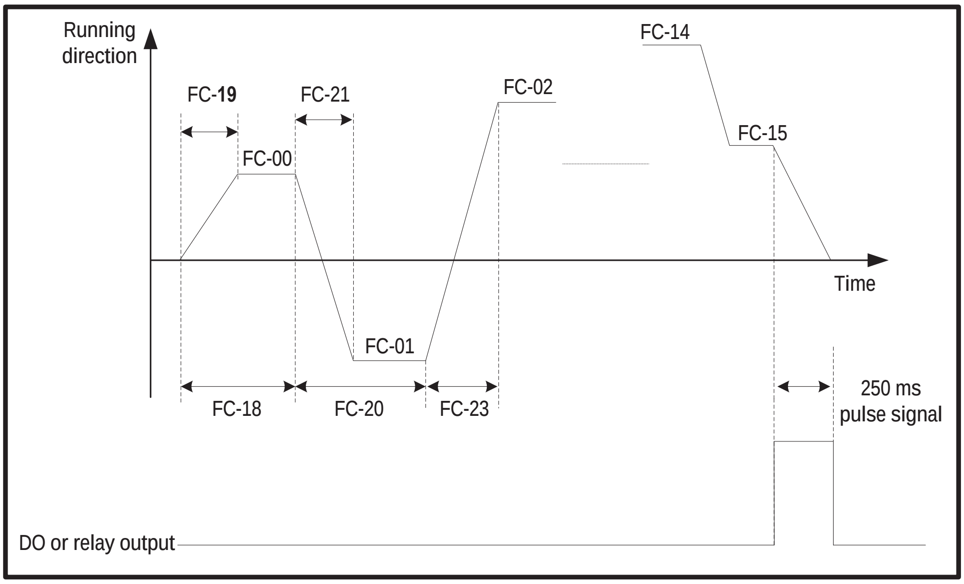
Note

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.

Simple PLC

When using the simple PLC mode as the frequency reference setting channel, the MD500 running frequency can be switched among the 16 frequency references.

Figure 7-21 Using the simple PLC mode to control the frequency reference



You can set the holding time and acceleration/deceleration time of the 16 frequency references in FC-18 to FC-49.

Function Code	Parameter Name	Setting Range	Default
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)

Function Code	Parameter Name	Setting Range	Default
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
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-16 determines the simple PLC running mode.

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 = 0: Stop after running one cycle

  The AC drive stops after running one cycle, and will not start up until receiving new RUN command.

- **FC-16 = 1: Keep final values after running one cycle**

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

- FC-16 = 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.

FC-17 determines whether simple PLC is retentive at power down or when the AC drive stops.

If yes, the AC drive memorizes the PLC running stage and running frequency before power down or the AC drive stops 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-17	Simple PLC retentive selection	0: No 1: Yes	00
		Unit's digit: Retentive at power down	
		Ten's digit: Retentive at stop	

FC-50 determines the running time unit in simple PLC mode. FC-51 selects the setting channel of reference 0.

Function Code	Parameter Name	Setting Range	Default
FC-50	Time unit of simple PLC running	0: s (second) 1: h (hour)	0
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

Note

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

■ PID Reference

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.**

- 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.

Figure7-22 Function block diagram of the PID function

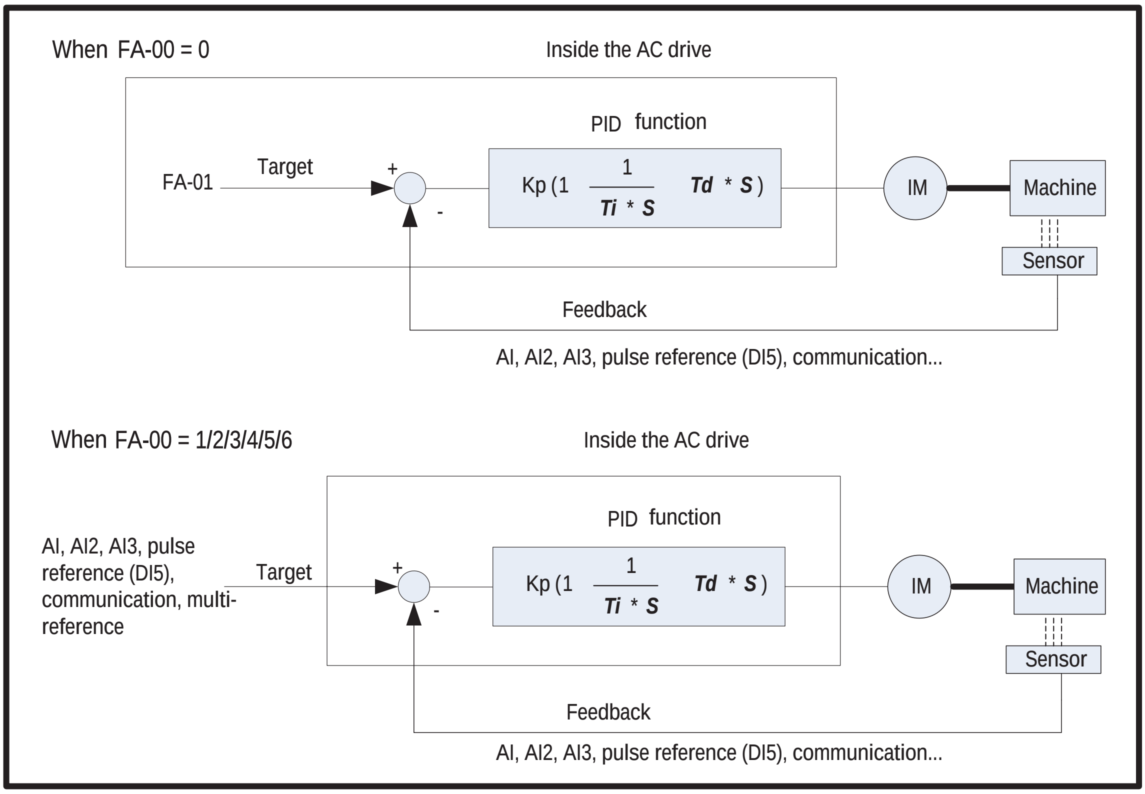
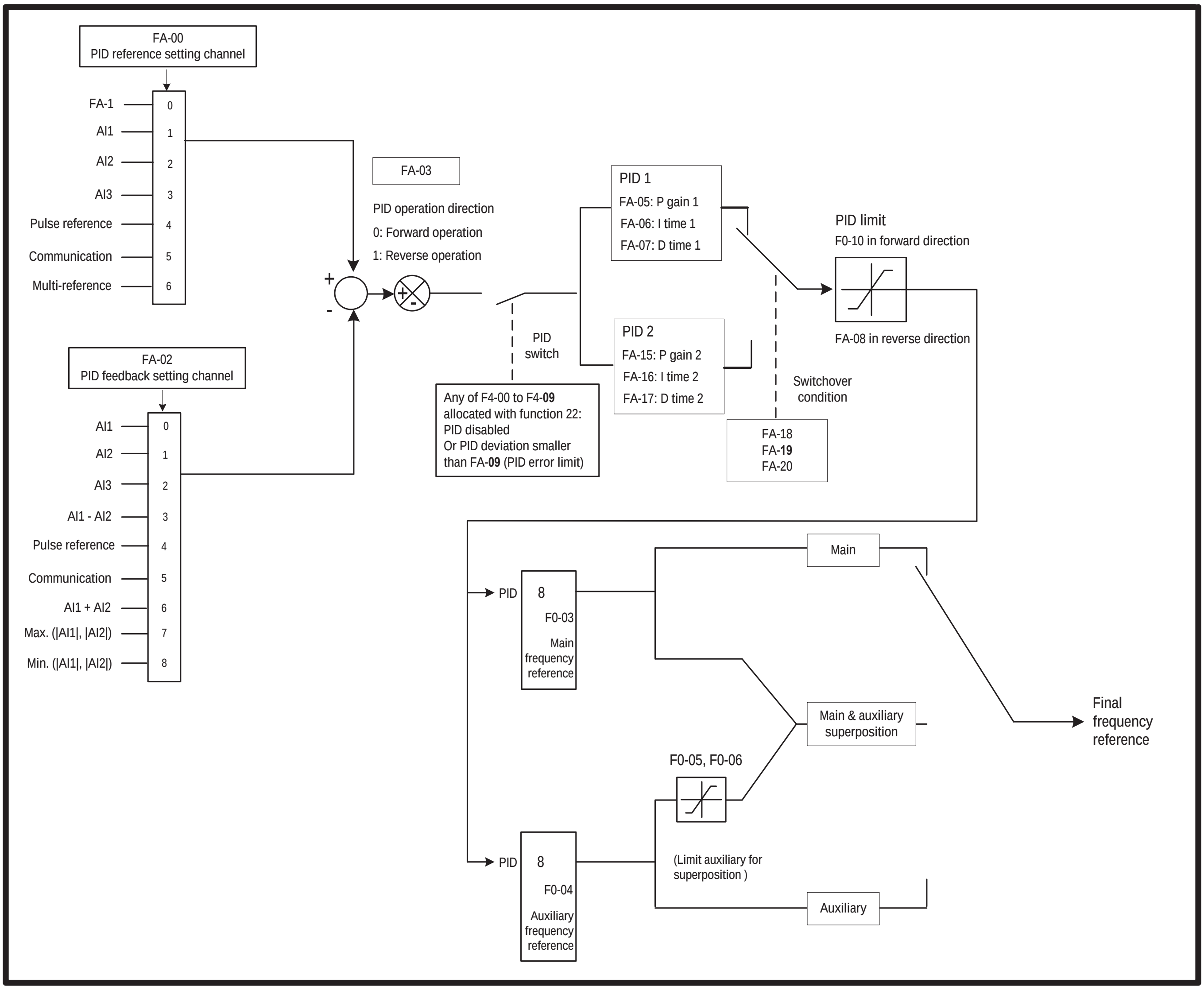


Figure 7-23 Function block diagram of the PID control



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-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

Function Code	Parameter Name	Setting Range	Default
FA-03	PID operation direction	0: Forward operation 1: Reverse operation	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	0.00s 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-00 and FA-01 set the input channel of the PID reference. The PID reference is a relative value and ranges from 0.0% to 100.0%.

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

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

- FA-03 = 0: 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.

- FA-03 = 1: 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.

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 = PID reference (percentage) x FA-04
- U0-16 = PID feedback (percentage) x 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.

FA-08 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.

FA-09 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	Derivative limit	0.00% to 100.00%	0.10%

FA-10 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 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

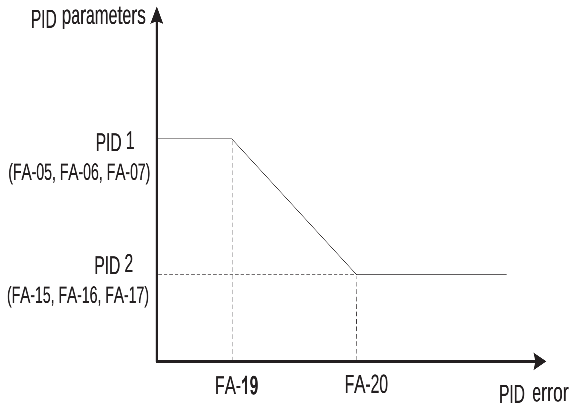
FA-12 and FA-13 provide filter function to the PID feedback and PID output, lowering interference on the PID feedback and weakening sudden change of the PID change but slowing the response of the process closed-loop system.

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 3: Auto switchover based on running frequency	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.

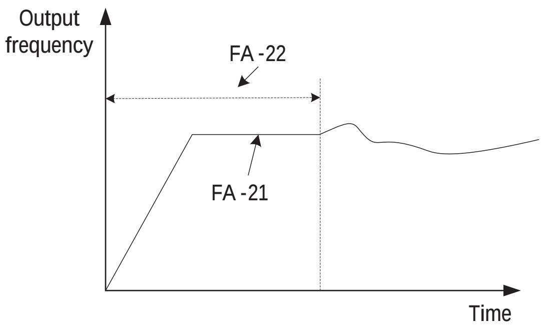
Figure 7-24 Switchover of two groups of PID parameters



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 7-25 The PID initial value function



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.

Function Code	Parameter Name	Setting Range	Default
FA-25	PID integral property	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 determines whether to enable the integral separation function 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 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.

■ Communication Reference

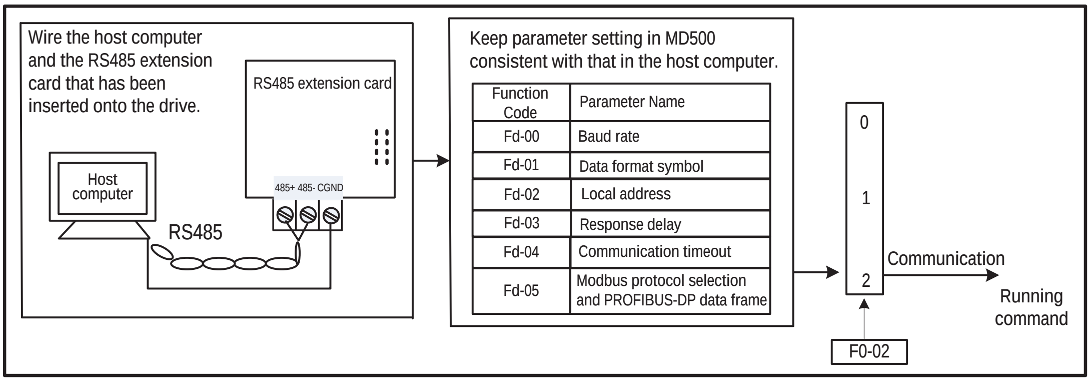
The most common configuration for the MD500 uses a host computer to control the AC drive through a communication link such as Modbus, PROFIBUS-DP, CANlink, or CANopen.

To use communication with the MD500, the matching communication card must be installed. If the communication protocol is Modbus, PROFIBUS-DP or CANopen, select the proper serial communication protocol in F0-28.

The CANlink protocol is always valid.

Function Code	Parameter Name	Setting Range	Default
F0-28	Serial port communication protocol	0: Modbus protocol 1: PROFIBUS-DP protocol or CANopen protocol	0

Figure 7-26 Diagram of setting setting the main frequency reference via communication



When the AC drive is controlled via communication, the host computer must send write command to the AC drive. Here takes the Modbus protocol as an example to describe the process of giving run command via communication.

To set the frequency reference to 10000, the host computer sends the write command 01 06 10 00 27 10 97 36 (hexadecimal). In the command,

- 01H (settable): AC drive address
- 06H: write command
- 1000H: frequency reference address
- 2710H: frequency reference (converted into decimal 10000)
- **9736H: CRC check**

Master Command		Slave Response	
ADDR	01H	ADDR	01H
CMD	06H	CMD	06H
Parameter address high bits	10H	Parameter address high bits	10H
Parameter address low bits	00H	Parameter address low bits	00H
Data content high bits	27H	Data content high bits	27H
Data content low bits	10H	Data content low bits	10H
CRC high bits	**97H**	CRC high bits	**97H**
CRC low bits	36H	CRC low bits	36H

Note

The frequency reference range set via communication is -10000 to 10000, corresponding to -100.00% to 100.00%.

- -100.00% corresponds to negative max. frequency.
- 0.00% corresponds to min. frequency.
- 100.00% corresponds to max. frequency.

Suppose that F0-10 = 50 Hz, if the frequency reference in the write command is 2710, converted into decimal 10000. The input frequency reference is 50 x 100% = 50 Hz.

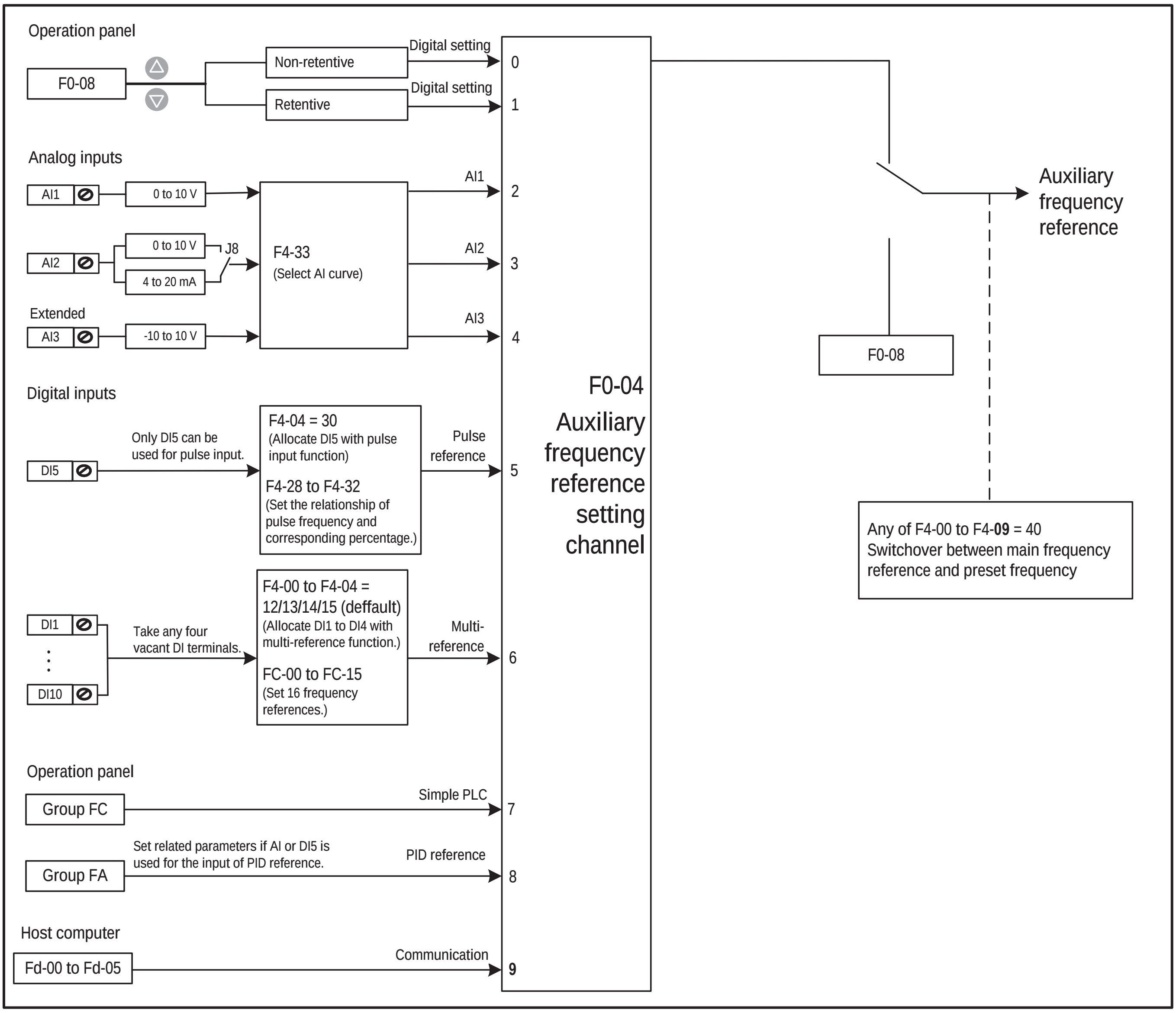
7.2.2 Setting the Auxiliary Frequency Reference

The auxiliary frequency reference has the same nine setting modes as the main frequency reference does.

F0-04 selects a proper channel to set the auxiliary frequency reference.

Function Code	Parameter Name	Setting Range	Default
F0-04	Auxiliary frequency reference setting channel 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 6: Multi-reference 7: Simple PLC 8: PID **9: Communication reference**	0

Figure 7-27 select a proper channel to set the auxiliary frequency reference

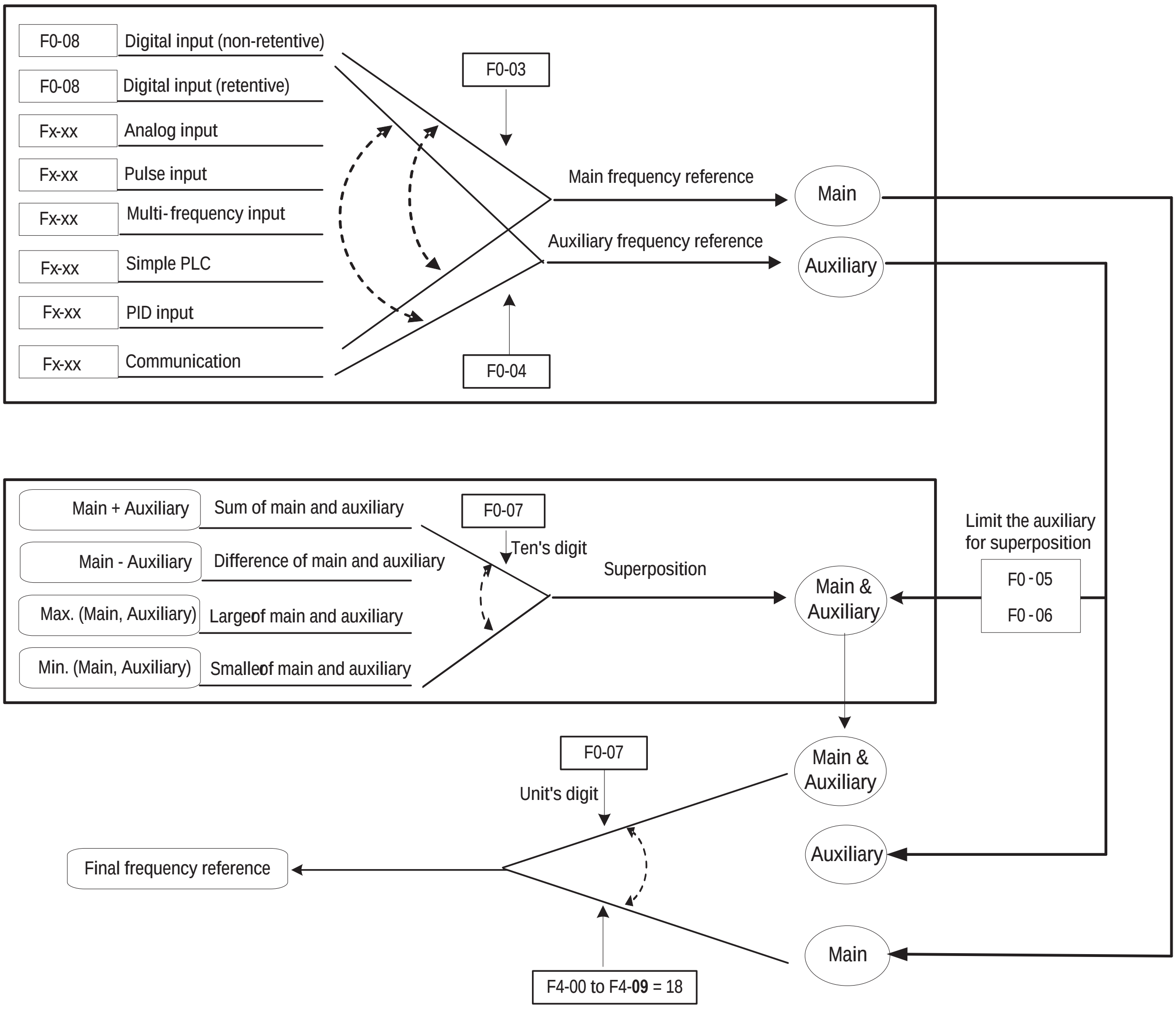


7.2.3 Main & Auxiliary Superposition

You can set the relationship between the final frequency reference and the main frequency reference and the auxiliary frequency reference in F0-07.

- Use the main frequency reference as the final frequency reference.
- Use the auxiliary frequency reference as the final frequency reference.
- Use main & auxiliary superposition as the final frequency reference.
- The final frequency reference is switched over between main and auxiliary, between main and main & auxiliary superposition and between auxiliary or main & auxiliary superposition.

Figure 7-28 Set the final frequency reference



Function Code	Parameter Name	Setting Range	Default
F0-07	Final frequency reference setting selection	Unit's digit: Frequency reference selection 0: Main frequency reference 1: Main and auxiliary superposition (superposition relationship determined by ten's digit) 2: Switchover between main and auxiliary 3: Switchover between main and "main & auxiliary superposition" 4: Switchover between auxiliary and " main & auxiliary superposition "	00
		Ten's digit: main and auxiliary superposition relationship) 0: Main + auxiliary 1: Main - auxiliary 2: Max. (main, auxiliary) 3: Min. (main, auxiliary)	
F0-05	Base value of range of auxiliary frequency reference for main and auxiliary superposition	0: Relative to maximum frequency 1: Relative to main frequency reference	0
F0-06	Range of auxiliary frequency reference for main and auxiliary superposition	0% to 150%	100%

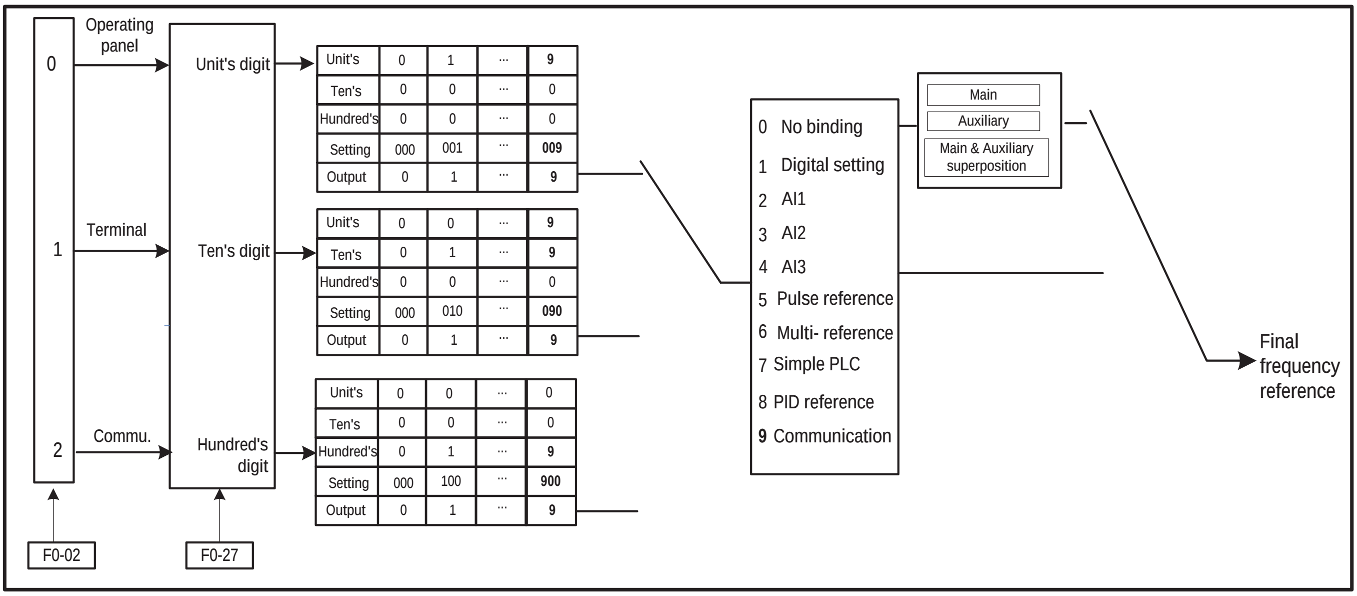
When the main frequency reference and the auxiliary frequency reference are used for superposition (the final frequency reference is set by "main and auxiliary superposition"), pay attention to the following aspects:

- If the auxiliary frequency reference is digital setting, the preset frequency (F0-08) does not take effect. You can directly adjust the auxiliary frequency reference by pressing keys △ and ▽ on the operation panel (or using the UP/DOWN function of the input terminals) based on the main frequency reference.
- If the auxiliary frequency reference is set via analog input (AI1, AI2 and AI3) or pulse reference, 100% of the input corresponds to the range of the auxiliary frequency reference (set in F0-05 and F0-06). This is valid for the main and auxiliary superposition.
- The main frequency reference and the auxiliary frequency reference must not use the same setting channel. That is, F0-03 and F0-04 cannot be set to the same value.
- The main & auxiliary superposition can be used for closed-loop speed control. An example of this is to use the main frequency reference to set the required frequency and to use the auxiliary frequency source for automatic adjustment. Closed-loop control is implemented when this method is used with switchover performed by an external DI terminal signal.

7.2.4 Binding Command Source to Frequency Reference Setting Channel

It is possible to bind the three command sources separately to any of the frequency reference setting channel.

Figure 7-29 Binding command source to frequency reference setting channel



When the specified command source (set by F0-02) is bound to a frequency reference setting channel (set by the F0-27), the final frequency reference is determined by the frequency setting channel set in F0-27. In this case, both the main and the auxiliary frequency reference setting channels become disabled.

Function Code	Parameter Name	Setting Range	Default
F0-27	Binding command source to frequency source	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**	000
		Unit's digit: Binding operation panel control to frequency reference setting channel	
		Ten's digit: Binding terminal control to frequency reference setting channel	
		Hundred's digit: Binding communication control to reference setting channel	

7.2.5 Frequency Reference Limit

Function Code	Parameter Name	Setting Range	Default
F0-10	Max. frequency	50.00 to 500.00 Hz	50.00 Hz
F0-11	Setting channel of frequency reference upper limit	0: Set by F0-12 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference	0
F0-12	Frequency reference upper limit	0.00 Hz to maximum frequency (F0-10)	0.00 Hz
F0-14	Frequency reference lower limit	0.00 Hz to frequency upper limit (F0-12)	0.00 Hz

- F0-12: The motor is not allowed to run at the frequency reference above the setting in this function parameter.
- F0-14: The motor is not allowed to run at the frequency reference below the setting in this function parameter.
- F0-10: It limits the max. output frequency of the AC drive.
- F0-11: It selects the setting channel of the frequency reference upper limit.

7.2.6 Running Mode When Frequency Reference Below Lower Limit

Function Code	Parameter Name	Setting Range	Default
F8-14	Running mode when frequency reference lower than frequency lower limit	0: Run at frequency reference 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.

- F8-14 = 0: The motor runs at the frequency reference lower limit.
- F8-14 = 1: The motor stops and the RUN indicator on the operation panel becomes off.
- F8-14 = 2: The motor runs at 0 Hz and the RUN indicator on the operation panel is on.

7.3 Start/Stop the AC Drive

This section describes how to start/stop the AC drive.

7.3.1 Start Mode

You can set the start mode of the AC drive in F6-00, direct start, catching a spinning motor and pre-excited start.

The related function parameters are listed as follows:

Function Code	Parameter Name	Setting Range	Default
F6-00	Startup mode	0: Direct start 1: Catching a spinning motor 2: Pre-excited start	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

- F6-00 = 0: Direct start

  It is applicable to most loads, as shown in Figure 6-30 (1).

  The start with start frequency (F6-03) is applicable to the hoist application, such as elevator and crane, as shown in Figure 6-30 (2).

  The start with DC injection braking function is applicable to the application, where the motor may rotate, as shown in Figure 6-30 (3).

  Figure 7-30 (1) Timing diagram of direct start

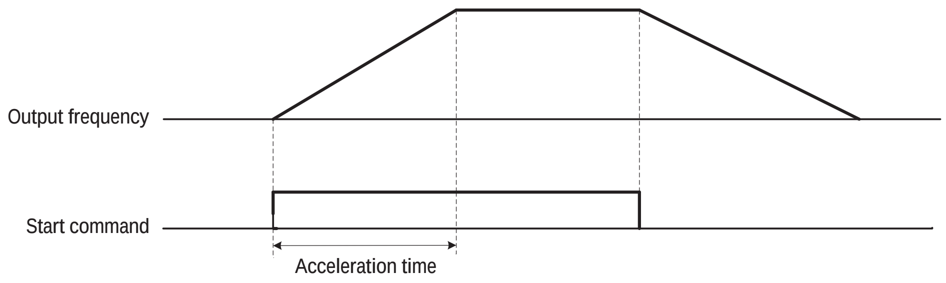


Figure 7-30 (2) Timing diagram of start with start frequency

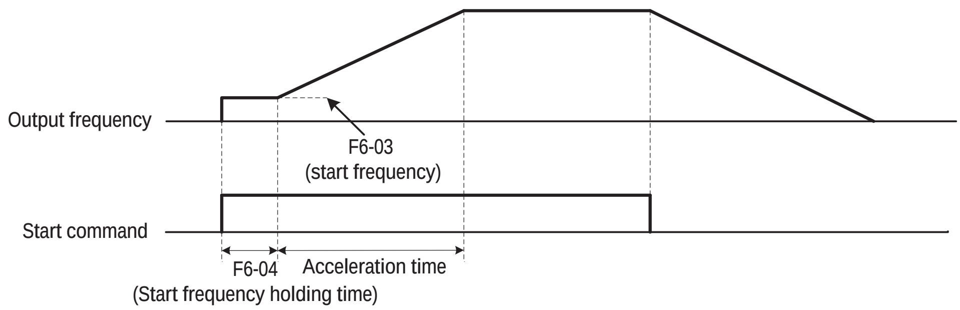
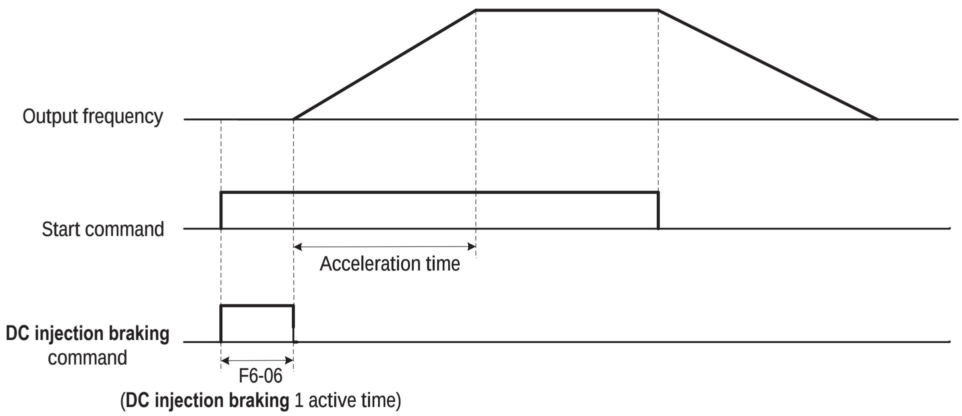


Figure 7-30 (3) Timing diagram of start with DC injection braking

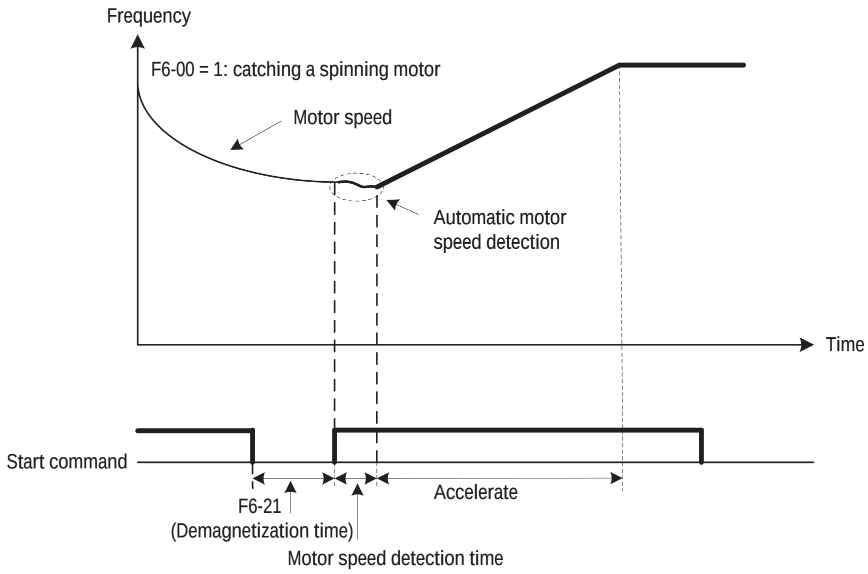


- F6-00 = 1: Catching a spinning motor

  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 start mode, ensure that the motor parameters in group F1 are set correctly.

  Figure 7-31 Catching a spinning motor



- F6-00 = 2: Pre-excited start

  It is valid only for asynchronous motor and used for building the magnetic field before the motor runs. For pre-excited current and pre-excited time, see parameters of F6-05 and F6-06.

  – If the pre-excited time is 0, the AC drive cancels pre-excitation and starts to run from the start frequency.
  – If the pre-excited time is not 0, the AC drive pre-excites first and then starts to run, improving the motor dynamic response.

6.3.2 Stop Mode

You can set the stop mode of the AC drive in F6-10, decelerate to stop and coast to stop.

The related function parameters are listed as follows:

Function Code	Parameter Name	Setting Range	Default
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**	0.0 to 36.0s	0.0s
F6-13	**DC injection braking 2 level**	0% to 100%	0%
F6-14	**DC injection braking 2 active time**	0.0s to 36.0s	0.0s

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.

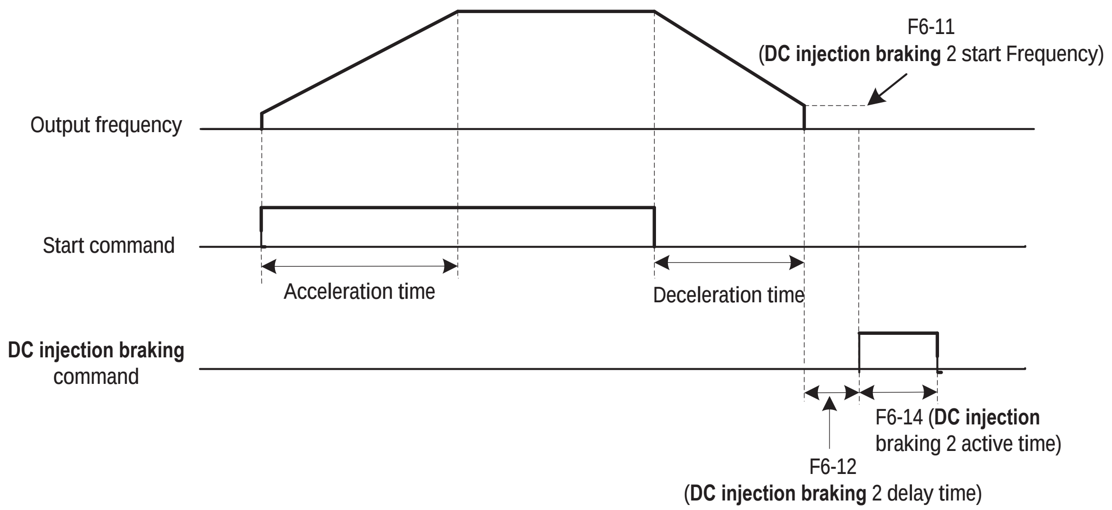
F6-12: When the running frequency decreases to the value set in F6-11, the AC drive stops output for a time and then starts DC **injection braking. This prevents the occurrence of fault such as overcurrent caused by direct DC injection braking at high speed.**

F6-13: It has the following two different 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.

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

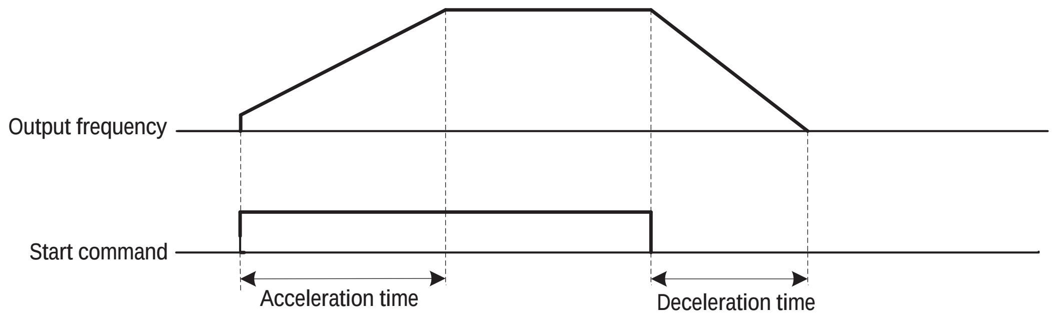
Figure 7-32 Timing diagram of DC injection braking for stop



- F6-10 = 0: Decelerate to stop

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

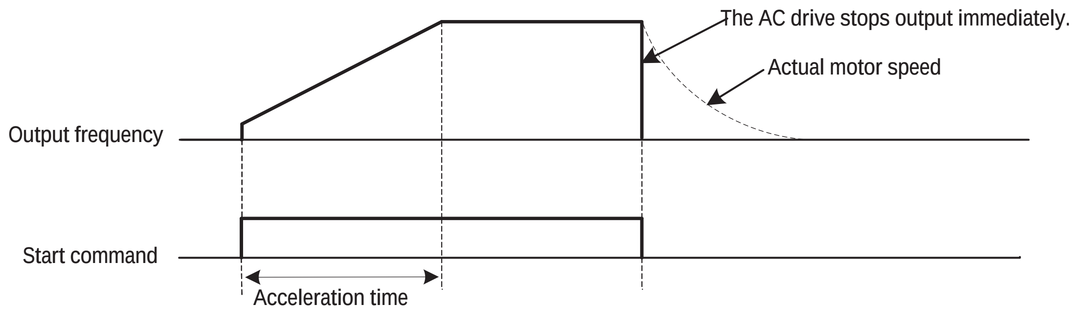
  Figure 7-33 Decelerate to stop



- F6-10 = 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.

  Figure 7-34 Coast to stop

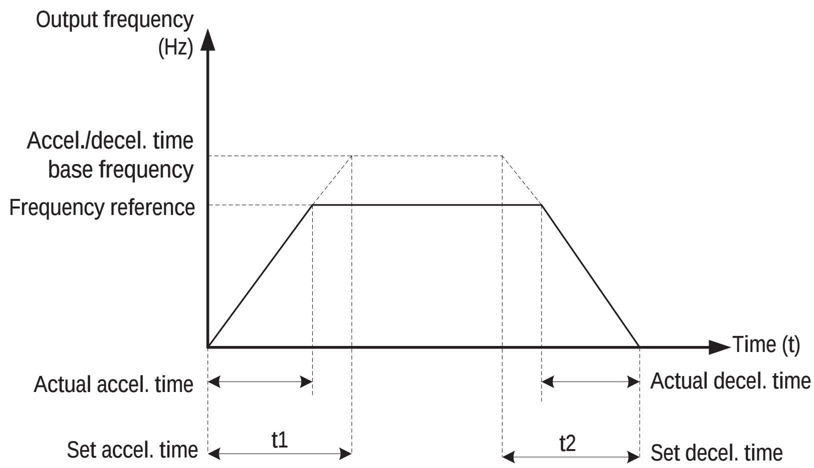


6.3.3 Acceleration/Deceleration Time and S-curve Setting

Acceleration time indicates the time required by the AC drive to accelerate from 0 Hz to the acceleration/deceleration time base frequency (F0-25).

Deceleration time indicates the time required by the AC drive to decelerate from the acceleration/deceleration time base frequency (F0-25) to 0 Hz.

Figure 7-35 Acceleration/Deceleration time



The MD500 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

For example, select DI7 and DI8 for switchover.

The related function parameters are set as follows:

Function Code	Parameter Name	Setting	Function Description
F4-06	DI7 function selection	16	**Terminal 1 for acceleration/deceleration time selection**
F4-07	DI8 function selection	17	**Terminal 2 for acceleration/deceleration time selection**

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

Terminal 2	Terminal 1	Accel/Decel Time Selection	Corresponding Pr.
OFF	OFF	**Accel/Decel time 1**	F0-17, F0-18
OFF	ON	**Accel/Decel time 2**	F8-03, F8-04
ON	OFF	**Accel/Decel time 3**	F8-05, F8-06
ON	ON	**Accel/Decel time 4**	F8-07, F8-08

The function parameters related acceleration/deceleration time are as follows:

Function Code	Parameter Name	Setting Range	Default
F0-17	Acceleration time 1	**0.00 to 650.00s (F0-19 = 2)** **0.0 to 6500.0s (F0-19 = 1)** **0 to 65000s (F0-19 = 0)**	Model dependent
F0-18	Deceleration time 1	**0.00 to 650.00s (F0-19 = 2)** **0.0 to 6500.0s (F0-19 = 1)** **0 to 65000s (F0-19 = 0)**	Model dependent
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
F0-19	**Acceleration/Deceleration** time unit	0:1s 1: 0.1s 2: 0.01s	1
F0-25	**Acceleration/Deceleration** time base frequency	0: Maximum frequency (F0-10) 1: Frequency reference 2: 100 Hz	0
F6-07	**Acceleration/Deceleration mode**	**0: Linear acceleration/deceleration** **1: Static S-curve acceleration/deceleration** **2: Dynamic 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%

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

- **F6-07 = 0: Linear acceleration/deceleration**

  The output frequency increases or decreases linearly. The MD500 provides four groups of acceleration/deceleration time, selected via F4-00 to F4-08.

- **F6-07 = 1: Static S-curve acceleration/deceleration**

  The output frequency increases or decreases along 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.

- **F6-07 = 2: Dynamic S-curve acceleration/deceleration**

  The output frequency increases or decreases along the S curve on the condition that the target frequency is changing at real time. This mode is applicable to the applications requiring supreme riding comfort and fast response.

F6-08 and F6-09 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 ≤ 100.0%.

7.4 Motor Auto-tuning

You can obtain the parameters of the controlled motor through motor auto-tuning.

The motor auto-tuning methods are static auto-tuning 1, static auto-tuning 2 and dynamic auto-tuning. You can select a proper auto-tuning method in F1-37.

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

- F1-37 = 0: The motor auto-tuning is not performed.
- F1-37 = 1: Only the stator resistance, the rotor resistance and the leakage inductance are obtained through the static auto-tuning 1.
- F1-37 = 2: All the motor parameters are obtained through the dynamic auto-tuning. If the AC drive is in the CLVC mode, you must make clear of the encoder parameters (F1-27 to F1-34).
- F1-37 = 3: All the motor parameters are obtained through the static auto-tuning 2.
- The three motor auto-tuning methods are compared as follows:

Auto-tuning Method	Application	Result
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.	OK
Dynamic auto-tuning	It is applied to applications where the motor can be disconnected from the load.	Better
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.	Best

Here takes the motor 1 (F0-24 = 0) as an example to describe the motor auto-tuning methods. If you need to perform motor 2 auto-tuning, set F0-24 = 1 and refer to related parameters in group A2.

■ F1-37 = 1: Static auto-tuning 1

If the control mode is V/F and the motor cable exceeds 50 m, keep the motor connected to the load and use the static auto-tuning 1.

The static auto-tuning 1 process is as follows:

Steps	Description
Step 1	Power on the AC drive. Set F0-02 = 0 to select the operation panel as the command source.
Step 2	Input the motor nameplate parameters (F1-00 to F1-05) correctly.
Step 3	Set F1-37 = 1 to select the static auto-tuning 1. Press ENTER on the operation panel. The operation panel displays TUNE.
Step 4	Press RUN on the operation panel. The motor does not rotate but the motor get energized. The RUN indicates becomes ON. After the preceding display disappears and the operation panel returns to the normal parameter display state, it indicates that the auto-tuning is completed. Parameters F1-06 to F1-08 are obtained.

■ F1-37 = 2: Dynamic auto-tuning

If the motor has the constant output characteristic and is used for high-accuracy application, disconnect the motor from the load and use the dynamic auto-tuning. It is applicable to the SVC or CLVC mode.

The dynamic auto-tuning process is as follows:

Steps	Description
Step 1	Power on the AC drive. Set F0-02 = 0 to select the operation panel as the command source.
Step 2	Input the motor nameplate parameters (F1-00 to F1-05) correctly.
Step 3	Set F1-37 = 2 to select the dynamic auto-tuning. Press ENTER on the operation panel. The operation panel displays TUNE.
Step 4	Press RUN on the operation panel. **The AC drive drives the motor to accelerate/decelerate and run in the forward/reverse** direction. The RUN indicates becomes ON and the auto-tuning lasts for a period. After the preceding display disappears and the operation panel returns to the normal parameter display state, it indicates that the auto-tuning is completed. Parameters F1-06 to F1-10 are obtained.

■ F1-37 = 3: Static auto-tuning 2

If the motor cannot be disconnected from the load, use the static auto-tuning 2. It is applicable to the SVC or CLVC mode.

The static auto-tuning 2 process is as follows:

Steps	Description
Step 1	Power on the AC drive. Set F0-02 = 0 to select the operation panel as the command source.
Step 2	Input the motor nameplate parameters (F1-00 to F1-05) correctly.
Step 3	Set F1-37 = 3 to select the static auto-tuning 2. Press ENTER on the operation panel. The operation panel displays TUNE.
Step 4	Press RUN on the operation panel. The motor does not rotate but the motor get energized. The RUN indicates becomes ON. After the preceding display disappears and the operation panel returns to the normal parameter display state, it indicates that the auto-tuning is completed. Parameters F1-06 to F1-10 are obtained.

Note

- If it is impossible to perform motor auto-tuning on site, input the motor parameters of the same motor model with successful auto-tuning into function parameters F1-00 to F1-10.
- You can also perform the motor auto-tuning via the terminal control or communication control (F0-02 = 1 or 2).

The related parameters are described as follows:

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 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

F1-00 to F1-05 are motor nameplate parameters. Set them correctly according to the motor nameplate to ensure accurate motor **auto-tuning result. The advantages of V/F or vector control can be obtained only after correct motor parameters are applied.**

Function Code	Parameter Name	Setting Range	Default
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)**	Model 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)**	Model 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)	Model 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)	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

F1-06 to F1-10: These function parameters are obtained by means of motor auto-tuning. Each time F1-01 (Rated motor power) or **F1-02 (Rated motor voltage) is modified, the AC drive automatically restores F1-06 to F1-10 to common standard Y series motor** parameters.

If motor auto-tuning cannot be performed on site, set these parameters according to the data provided by motor manufacturer.

Function Code	Parameter Name	Setting Range	Default
F1-27	Encoder pulses per revolution	1 to 65535	1024

F1-27 sets pulses per revolution (PPR) of the encoder. In the CLVC control mode, F1-27 must be set correctly. Otherwise, the motor cannot run properly.

Function Code	Parameter Name	Setting Range	Default
F1-28	Encoder type	0: ABZ incremental encoder 2: Resolver	0

F1-28: Different types of encoders require different PG cards. Set this function parameter correctly after installation of a proper PG card is completed. Otherwise, the AC drive may run abnormally.

Function Code	Parameter Name	Setting Range	Default
F1-30	**A/B phase sequence of ABZ** incremental encoder	0: Forward 1: Reserve	0

F1-30 sets the A/B phase sequence of ABZ incremental encoder and thus is valid for ABZ incremental encoder (F1-28 = 0).

- F1-30 = 0: Forward

  Phase A is ahead for forward motor rotation. Phase B is ahead for reverse motor rotation.

- F1-30 = 1: Reverse

  Phase B is ahead for forward motor rotation. Phase A is ahead for reverse motor rotation.

Function Code	Parameter Name	Setting Range	Default
F1-31	Encoder installation angle	**0.0° to 359.9°**	0.0°

Function Code	Parameter Name	Setting Range	Default
F1-34	Number of pole pairs of resolver	1 to 65535	1

F1-34: If a resolver is applied, set the number of pole pairs of the resolver properly.

Function Code	Parameter Name	Setting Range	Default
F1-36	Encoder wire-break fault detection time	0.0s: No detection 0.1s to 10.0s	0.0s

F1-36 sets the wire-break detection time. If it is set to 0.0s, the detection is disabled. If the wire-break detection time exceeds the value set in F1-36, the AC drive reports Err20.

7.5 Control Performance

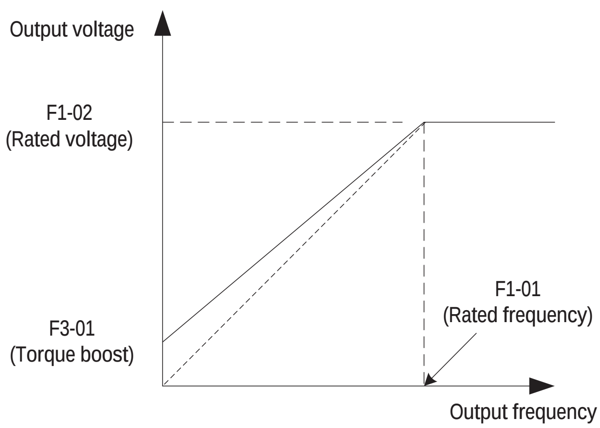
7.5.1 V/F Curve

■ Linear, Multi-point and Square V/F Curve

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** **10: V/F complete separation** **11: V/F half separation**	0
F3-01	Torque boost	**0.0%: fixed boost** 0.1% 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**	0.00 Hz to F3-05	0.00 Hz
F3-04	**Multi-point V/F voltage 1**	0.0% to 100.0%	0.0%
F3-05	**Multi-point V/F frequency 2**	F3-03 to F3-07	0.00 Hz
F3-06	**Multi-point V/F voltage 2**	0.0% to 100.0%	0.0%
F3-07	**Multi-point V/F frequency 3**	F3-05 to rated motor frequency (F1-04)	0.00 Hz
F3-08	**Multi-point V/F voltage 3**	0.0% to 100.0%	0.0%

1. **General constant-torque linear V/F curve**

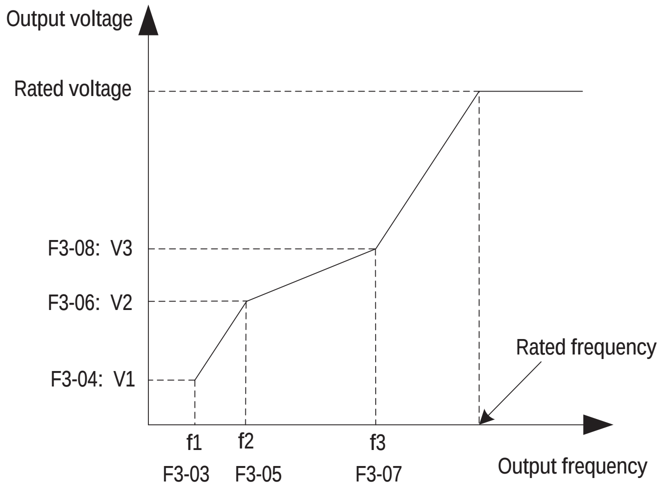
Figure 7-36 General constant-torque linear V/F curve



The output voltage and the output frequency change linearly when below the rated frequency. It is applicable to general mechanical drive applications, such as large-inertia fan acceleration, punching machine, centrifuge and water pump.

2. **User-defined Multi-point V/F curve**

Figure 7-37 User-defined Multi-point V/F curve

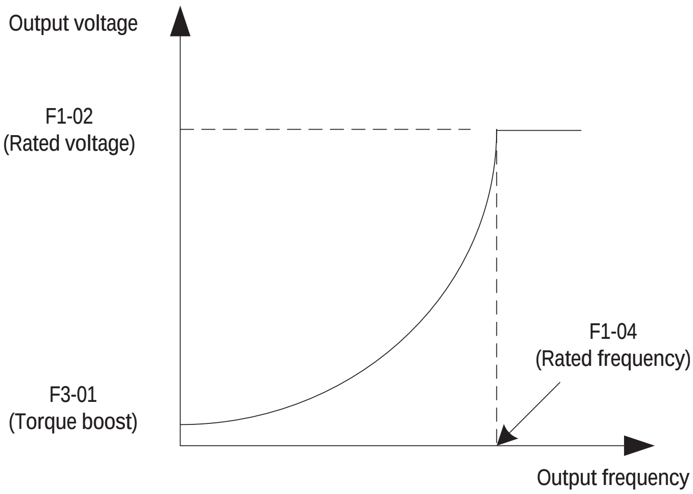


F3-03 to F3-08 define the multi-point V/F curve.

You must set the multi-point V/F curve based on the motor's load characteristic. The three voltage points and frequency points must satisfy: V1 < V2 < V3, f1 < f2 < f3. When you set F1 (F3-03), F2 (F3-05) and F3 (F3-07), set F3-07 first, then F3-05 and finally F3-03.

3. **Variable-torque Square V/F curve**

Figure 7-38 Variable-torque Square V/F curve



The output voltage and the output frequency change according to the square curve when below the rated frequency. It is applicable to light-load application where the load does change usually, such as fan and water pump.

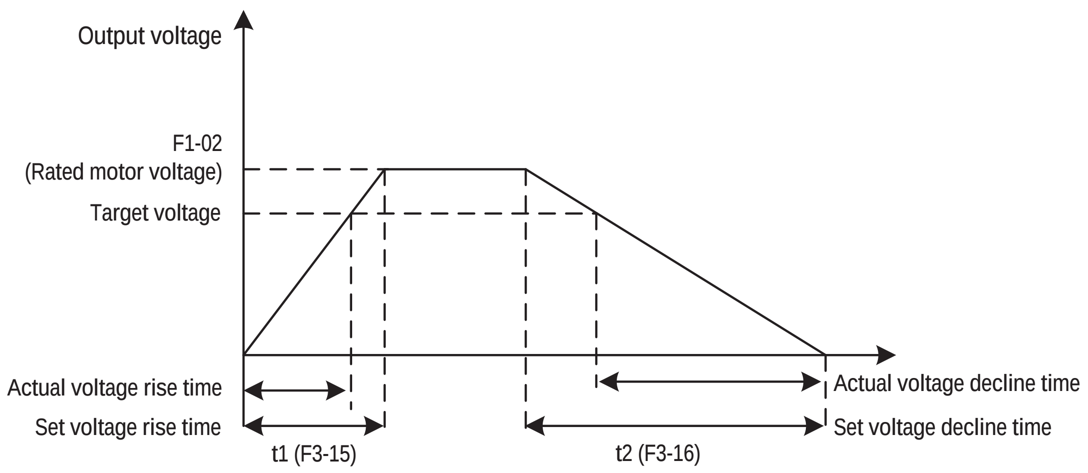
V/F Separation Curve

Function Code	Parameter Name	Setting Range	Default
F3-13	**Voltage source for V/F separation**	0: Set by 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	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

The voltage rise time of V/F separation indicates the time required by the voltage to rise from 0 to the rated motor voltage.

The voltage decline time of V/F separation indicates the time required by the voltage to decline the rated motor voltage to 0.

Figure 7-39 V/F separation



7.5.2 Torque Boost and Slip Compensation

■ Torque Boost

The torque compensation function compensates for insufficient torque production at low frequency.

Function Code	Parameter Name	Setting Range	Default
F3-01	Torque boost	**0.0%: fixed boost** 0.1% to 30%	Model dependent
F3-02	Cut-off frequency of torque boost	0.00 Hz to max. frequency	50.00 Hz

F3-01 compensates for insufficient torque production by boosting output voltage of the AC drive. But very large setting will result in motor overheat and AC drive overcurrent.

- **Increase this parameter when a heavy load is applied but the startup torque of the motor is insufficient.**
- Decrease this parameter when a light load is applied.

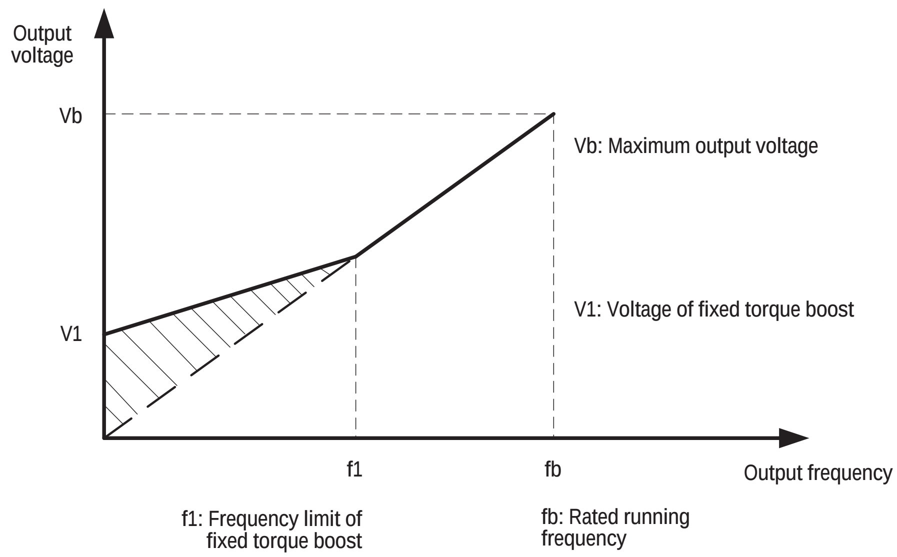
If it is set to 0.0%, fixed torque boost is enabled. This moment the AC drive automatically calculates the torque boost value based on motor parameters including the stator resistance.

F3-02 sets the cutoff frequency under which torque boost is active. If the frequency reference exceeds the value set in F3-02, torque boost becomes inactive.

Function Code	Parameter Name	Setting Range	Default
F3-33	Fixed torque compensation gain	80% to 150%	100%

The recommended setting of F3-33 is 100%. If it is set to below 100%, it is valid for fixed torque boost only.

Figure 7-40 Customized torque boost



Slip Compensation

The slip compensation function compensates for the motor speed slip when load increases.

Function Code	Parameter Name	Setting Range	Default
F1-05	Rated motor speed	1 to 65535 RPM	Model dependent
F3-09	**V/F slip compensation gain**	0% to 200.0%	0.0%

Setting 100.0% of F3-09 indicates compensation for rated motor speed slip when rated load is applied. The rated motor speed slip is obtained from calculation of the rated motor frequency and rated motor speed.

Slightly adjust F3-09 to minimize the difference between the actual motor speed and target motor speed.

For example, the frequency reference of the AC drive is 50 Hz, the rated motor frequency is 50 Hz, the rated motor speed is 1460 **rpm. If the motor runs with no load, the actual motor speed is approximately 1498 rpm. If the motor runs with rated load, the motor** speed drops to approximately 1460 rpm.

In this case, you can set F3-09 to 100% to compensate for the motor speed slip to reach the motor speed of approximately 1496 rpm. The AC drive performs automatic compensation according to the load size to ensure the motor speed accuracy.

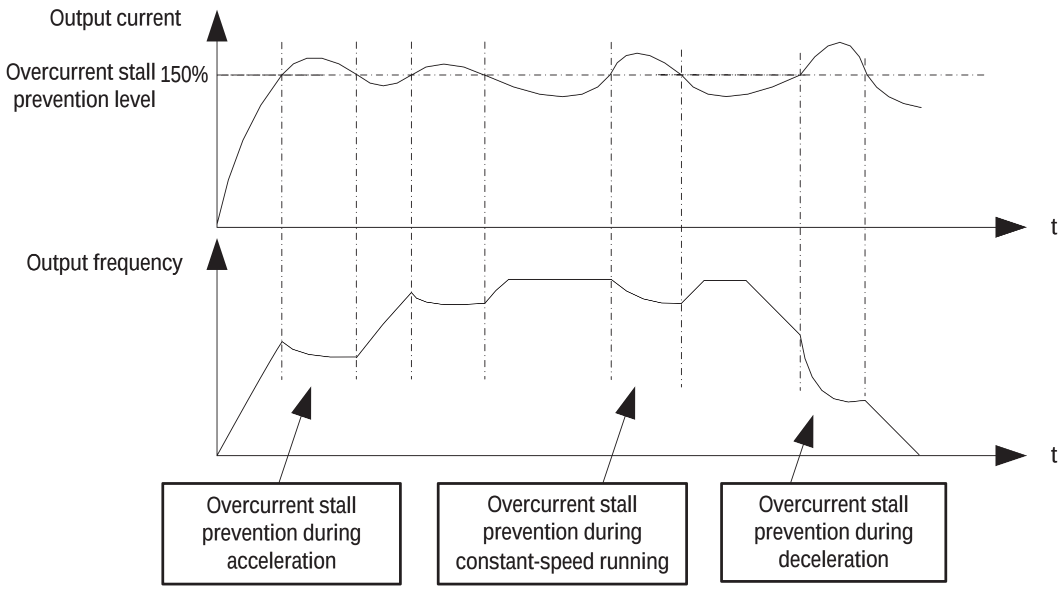
Note

- Set the rated motor speed, rated motor current and rated motor power before using this function.
- Perform the static auto-tuning 1 (F1-37 = 1) before using this function.
- The best slip compensation result will be achieved if this function is used **together with the fixed torque boost function (F3-01 = 0.0%).**
- **Adjust F3-09 at approximately 100%.**

7.5.3 Overcurrent Stall Prevention

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.

Figure 7-41 Overcurrent stall prevention



Function Code	Parameter Name	Setting Range	Default
F3-18	Overcurrent stall prevention level	50% to 200%	150%
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	50% to 200%	0

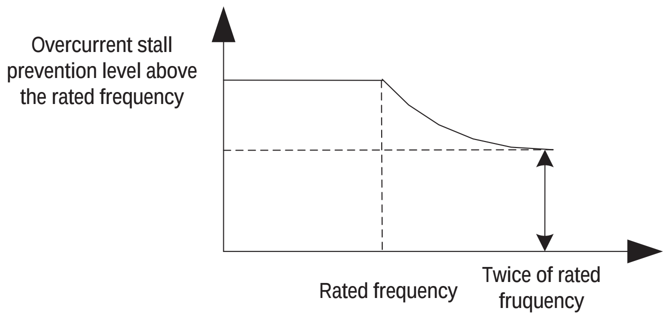
In the high frequency area, the motor drive current is small and bigger motor speed drop is caused by stall current compared with below the rated frequency. To improve the motor running characteristic, you can lower the overcurrent stall prevention level above the rated frequency.

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 = (fs/fn) x k x LimitCur.

- fs: running frequency
- fn: rated motor frequency
- k: speed multiplying overcurrent stall prevention level compensation factor (F3-21)
- LimitCur: Overcurrent stall prevention level (F3-18)

Figure 7-42 Overcurrent stall prevention above the rated frequency



Note

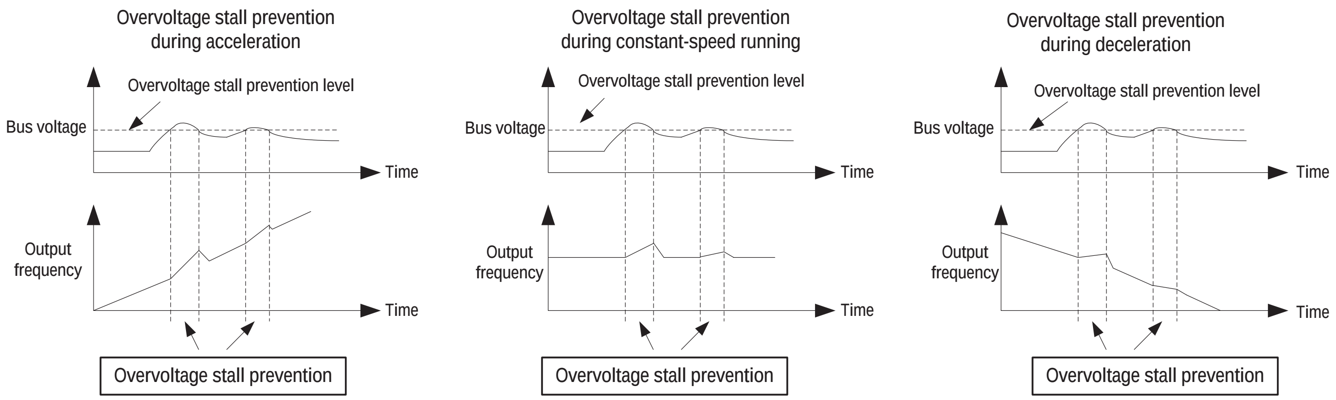
- The overcurrent stall prevention level 150% indicates 1.5 times of the rated current of the AC drive.
- For high-power motor with carrier frequency below 2 kHz, lower the overcurrent stall prevention level. This is because the fast current limit function is enabled in advance of the overcurrent stall prevention **function due to increase of pulsating current, which will result in insufficient torque output.**

7.5.4 Overvoltage Stall Prevention and Braking Unit Action Voltage

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 7-43 Overvoltage stall prevention



Function Code	Parameter Name	Setting Range	Default
F3-22	Overvoltage stall prevention voltage	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	0 to 50 Hz	5 Hz
F9-08	Braking unit action voltage	700 to 800 V	780 V
F3-10	**V/F over-excitation gain**	0 to 200	64
F3-11	**V/F oscillation suppression gain**	0 to 100	40

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, too large current may result during the drive running.**
- Set F3-23 (overvoltage stall prevention selection) to 0 (disabled). Otherwise, the deceleration time may be become longer.

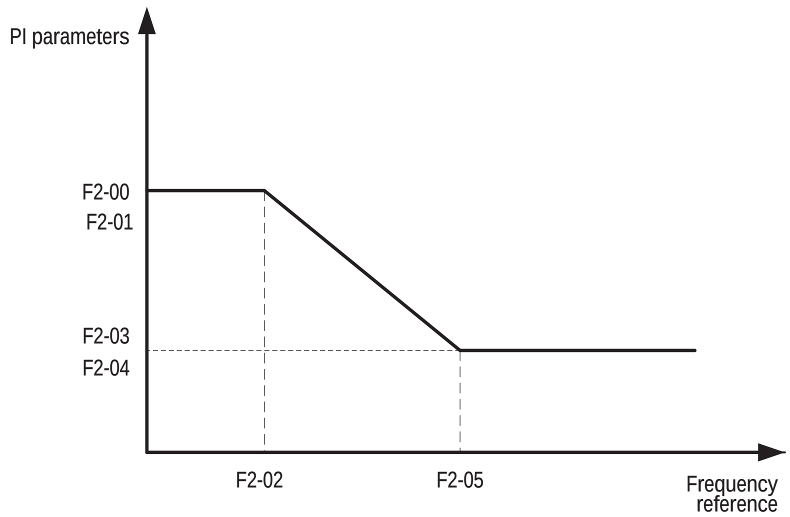
7.5.5 Speed Loop

Function Code	Parameter Name	Setting Range	Default
F2-00	Speed loop proportional gain 1	0 to 100	30
F2-01	Speed loop integral time 1	0.01 to 10.00s	0.50s
F2-02	Switchover frequency 1	0.00 to F2-05	5.00 Hz
F2-03	Speed loop proportional gain 2	0 to 100	20
F2-04	Speed loop integral time 2	0.01 to 10.00s	1.00s
F2-05	Switchover frequency 2	F2-02 to max. frequency	10.00 Hz

F2-00 to F2-05 are speed loop PI parameters.

- If the running frequency is less than or equal to F2-02 (Switchover frequency 1), the PI parameters are F2-00 and F2-01.
- If the running frequency is equal to or greater than F2-05 (Switchover frequency 2), PI parameters are F2-03 and F2-04.
- If the running frequency is between F2-02 and F2-05, the PI parameters are obtained from linear switchover between the two **groups of PI parameters, as shown in Figure 9-2.**

Figure 7-45 Speed loop PI parameters



You can improve the system response by either increasing the proportional gain or reducing the integral time. Be aware that this may lead to system oscillation.

You are suggested to Increase the proportional gain first to ensure that the system does not oscillate, and then reduce the integral time to ensure that the system has quick response and small overshoot.

Note

Improper PI setting may cause too large speed overshoot and even overvoltage during overshoot drop.

7.5.6 Vector Control Slip Compensation Gain

Function Code	Parameter Name	Setting Range	Default
F2-06	Vector control slip compensation gain	50% to 200%	100%

This function parameter adjusts the output current of the AC drive with same load in CLVC (F0-01 = 1). Decrease this parameter gradually for a large AC drive with poor loading capacity. Generally, this parameter rarely need be modified.

7.5.7 SVC Speed Feedback Stability

Function Code	Parameter Name	Setting Range	Default
F2-07	**Speed feedback filter time in SVC**	0.000s to 1.000s	0.050s

This parameter takes effect only when F0-01 = 0. You can improve the motor stability by increasing F2-07. Be aware that this may slow the dynamic response. Decreasing it will obtain quick system response but may lead to motor oscillation. Generally, this **parameter rarely need be modified.**

7.5.8 Torque Limit

The torque limit function can be used to limit the torque in each of the four quadrants separately to protect the system. The torque limit can be either set by parameters in group F2 or by parameters in group A0.

The output torque must be limited when the AC drive is in speed control or in torque control (determined by A0-00) in CLVC (F0-01 = 1). The torque limit varies with the control mode.

Function Code	Parameter Name	Setting Range	Default
A0-00	**Speed/Torque control selection**	0: Speed control 1: Torque control	0

This function parameter determines whether the AC drive is in speed control or torque control.

MD500 has two digital input functions related to torque control, function 29 "Torque control prohibited" and function 46 "Speed **control/Torque control".**

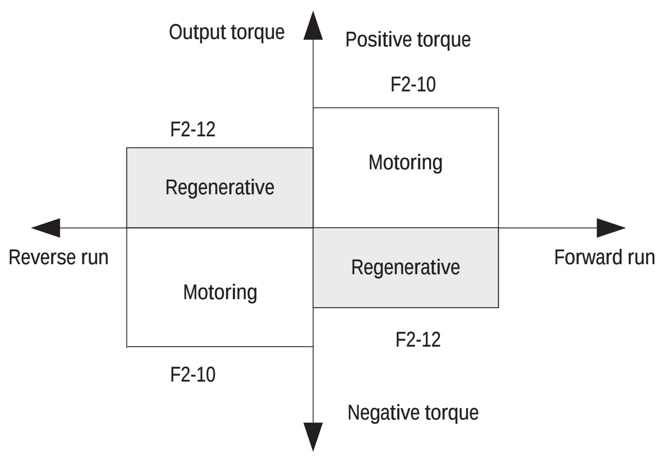
- When the DI terminal set for the function 46 is off, A0-00 determines the control mode.
- When the DI terminal set for the function 46 is on, the control mode is reverse to the value of A0-00.
- **When the DI terminal set for the function 29 is on, the AC drive always run in speed control.**

Setting Torque Limit in Speed Control

Function Code	Parameter Name	Setting Range	Default
F2-09	Torque limit source in speed control (motoring)	0: F2-10 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference 6: Min. (AI1, AI2) 7: Max. (AI1, AI2)	0
F2-10	Digital setting of torque limit in speed control (motoring)	0.0% to 200.0%	150.0%
F2-11	Torque limit source in speed control (regenerative)	0: F2-10 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference 6: Min. (AI1, AI2) 7: Max. (AI1, AI2) The full range of 1 to 7 corresponds to F2-10.	0
F2-12	Digital setting of torque limit in speed control regenerative)	0.0% to 200.0%	150.0%

This function parameter restricts the output torque of the AC drive in the speed control mode. If the torque limit source is analog input, pulse or communication reference, 100% of the setting corresponds to F2-10 (motoring) or F2-12 (regenerative), and 100% of F2-10 and F2-12 corresponds to the rated AC drive current torque.

Figure 7-46 Torque limit in speed control



Setting Torque Limit in Torque Control

Function Code	Parameter Name	Setting Range	Default
A0-01	Torque reference source in torque control	0: Set by A0-03 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference 6: MIN (AI1, AI2) 7: MAX (AI1, AI2)	0
A0-03	Torque digital setting in torque control	-200.0% to 200.0%	150.0%

These two function parameters select the channel of setting the torque reference in torque control.

The torque reference is a relative value. 100.0% corresponds to the rated AC drive torque (can be viewed in U0-06). When the torque reference is a positive value, the AC drive runs in the forward direction. When the torque reference is a negative value, the AC drive runs in the reverse direction.

Function Code	Parameter Name	Setting Range	Default
A0-05	Forward max. frequency in torque control	0.00 Hz to max. frequency (F0-10)	50.00 Hz
A0-06	Reverse max. frequency in torque control	0.00 Hz to max. frequency (F0-10)	50.00 Hz

These function parameters set the maximum frequency of the AC drive in forward and reverse directions in torque control.

The motor speed will rise continuously if the load torque is smaller than the motor output torque. This function limits the motor speed in torque control to prevent runaway.

Function Code	Parameter Name	Setting Range	Default
A0-07	Acceleration time in torque control	0.00s to 65000s	0.00s
A0-08	Deceleration time in torque control	0.00s to 65000s	0.00s

These function parameters set the acceleration/deceleration time in torque control to implement smooth change of motor speed. This helps to prevent problems such as big noise or too large mechanical stress caused by quick change of motor speed.

But in applications where rapid torque response is required, for example, two motors are used to drive the same load, you need to set these two parameters to 0.00s.

For example, two motors drive the same load. To balance the load level the two motors, set one drive as the master in speed control and set the other as the slave in torque control.

The slave will follow the output torque of the master as its torque reference, which requires quick response to the master output **torque. In this case, set the acceleration/deceleration time of the slave in torque control to 0.00s.**

7.5.9 Current Loop

Function Code	Parameter Name	Setting Range	Default
F2-13	Excitation adjustment proportional gain	0 to 60000	2000
F2-14	Excitation adjustment integral gain	0 to 60000	1300
F2-15	Torque adjustment proportional gain	0 to 60000	2000
F2-16	Torque adjustment integral gain	0 to 60000	1300

These function parameters are vector control current loop PI parameters. They are obtained from motor auto-tuning and rarely need be modified.

The dimension of the current loop integral regulator is integral gain rather than integral time. Very large current loop PI gain may lead to control loop oscillation. When current oscillation or torque fluctuation is great, decrease the proportional gain or integral gain.

7.5.10 Improving Field Weakening Area Performance

Function Code	Parameter Name	Setting Range	Default
F2-20	Max. output voltage coefficient	100% to 110%	105%

This parameter indicates the boost capacity of the maximum voltage of the AC drive. Increasing F2-20 will improve the max. loading capacity in the motor field weakening area. Be aware that this may lead to an increase in the motor current ripple and an increase in motor heating.

Decreasing it will reduce the motor current ripple and the motor heating. Be aware that this will lower the max. loading capacity in the motor field weakening area. F2-20 rarely need be modified.

Function Code	Parameter Name	Setting Range	Default
F2-21	Max. torque coefficient of field weakening area	50% to 200%	100%

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

When the motor must accelerate to twice of the rated motor frequency urgently and the actual acceleration time is long, decrease F2-21 properly.

When the motor that runs above twice of the rated motor frequency sees a big speed drop after a load is added, increase F2-21 properly. F2-21 rarely need be modified.

7.5.11 Auxiliary Control

Function Code	Parameter Name	Setting Range	Default
A5-00	DPWM switchover frequency upper limit	0.00 to 15.00 Hz	12.00 Hz

Increasing this parameter to the max. frequency will reduce the motor noise.

Function Code	Parameter Name	Setting Range	Default
A5-01	PWM modulation pattern	0: Asynchronous modulation 1: Synchronous modulation	0

When the result of dividing the running frequency by the carrier frequency is smaller than 10, the output current oscillation or large current harmonics will result. In this case, set A5-01 = 0 to reduce the current harmonics.

Function Code	Parameter Name	Setting Range	Default
A5-03	Random PWM depth	0: Random PWM invalid 1 to 10	0

This function parameter aims at lower the unpleasant motor noise and reducing the electromagnetic interference.

7.6 Protections

This section introduces the functions on protecting the AC drive and the motor.

7.6.1 Motor Overload Protection

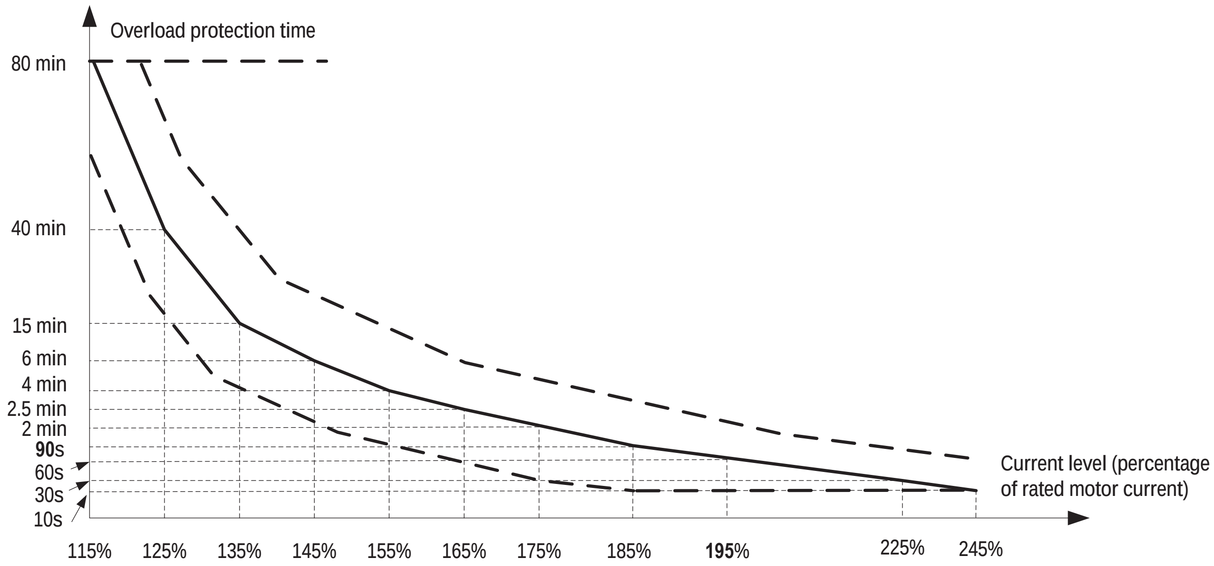
Function Code	Parameter Name	Setting Range	Default
F9-00	Motor overload protection selection	0: Disabled 1: Enabled	1
F9-01	Motor overload protection gain	0.20 to 10.00	1.00

- **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 7-47 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 x 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) x (I - I1) / (I2-I1) = 4 + (6 - 4) x (150% - 145%) / (155%-145%) = 5 minutes

Then you can calculate the motor overload protection gain from the following formula: F9-01 = Desired overload protection time / 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%

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

On the condition that F9-01 = 1.00 and F9-02 = 80%, when the motor running current reaches 145% of rated motor current and the motor runs at this level for 80% x 6 = 4.8 minutes, the DO terminal or the fault relay outputs the motor overload pending signal.

When F9-02 = 100%, the motor overload pending and the motor overload protection are performed simultaneously.

7.6.2 Phase Loss Protection

Function Code	Parameter Name	Setting Range	Default
F9-12	Selection of power input phase **loss/contactor close protection**	0: Disabled 1: Enabled	11
		Unit's digit: Power input phase loss protection	
		Ten's digit: Contactor close protection	

This function parameter determines whether to perform power input phase loss or contactor close protection.

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

This function parameter determines whether to perform power output phase loss protection. If the protection is disabled but power output phase loss occurs, the AC drive does not report the fault. This moment, the actual current is larger than the panel displayed current.

7.6.3 Fault Reset

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

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.

Note

- **Undervoltage (Err09) is reset automatically when the bus voltage recovers** to normal. It is not included in the auto reset times.
- Short-circuit to ground (Err23) cannot be reset automatically or manually. It can only be reset after power down.

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

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

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

7.6.4 Fault Protection Action Selection

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	Fault protection action selection 2	Unit's digit: Encoder fault (Err20) 0: Coast to stop **1: Switch over to V/F control, stop according to the stop mode** **2: Switch over to V/F control, continue to run**	00000
		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: Motor overheat (Err25) **Same as F9-47**	
		Ten thousand's digit: Accumulative running time reached (Err26) **Same as F9-47**	

Function Code	Parameter Name	Setting Range	Default
F9-49	Fault protection action selection 3	**Unit's digit: User-defined fault 1 (Err27)**	00000
		Ten's digit: User-defined fault 2 (Err28)	
		Hundred's digit: User-defined fault 3 (Err29)	
		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 recovers	
		Ten thousand's digit: PID feedback lost during drive running (Err31) **Same as F9-47**	
F9-50	Fault protection action selection 4	0: Coast to stop 1: Stop according to the stop mode 2: Continue to run	00000
		Unit's digit: Too large speed feedback error (Err42)	
		Ten's digit: Motor overspeed (Err43)	
		Hundred's digit: Initial position fault (Err51)	
		Thousand's digit: Speed feedback fault (Err52)	
		Ten thousand's digit: Reserved	

These function parameters set the action mode of the AC drive at occurrence of fault.

0. 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%

These function parameters define the running frequency of the AC drive when "Continue to run" is selected at occurrence of fault.

7.6.5 Motor Overheat Protection

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 MD500 supports both PT100 and PT1000. Make sure to set the sensor type correctly. You can view the motor temperature in U0-34.

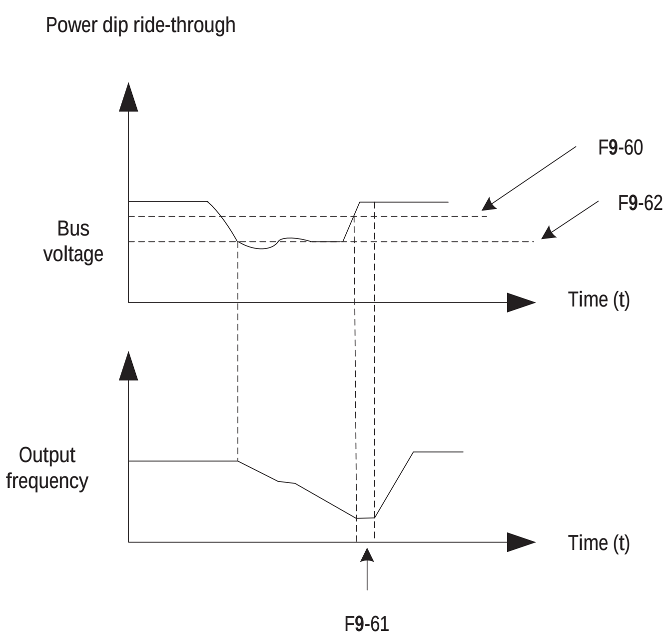
7.6.6 Power Dip Ride-through

The power dip ride-through function ensures the system to run continuously at occurrence of momentary power down.

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, preventing the AC drive from stopping due to undervoltage.

- **F9-59 = 1: It is applicable to the large-inertia applications such as fan, water pump and centrifuge**
- **F9-59 = 2: It is applicable to the textile industry.**

Figure 7-48 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 120%	85%
F9-61	Judging time of bus voltage recovering from power dip	0.1s to 10.0s	0.5s
F9-62	Voltage level of power dip ride-through function enabled	60% to 85% (standard bus voltage)	80.0%
F9-71	Power dip ride-through gain Kp	0 to 100	30
F9-72	Power dip ride-through **integral coefficient**	0 to 100	40
F9-73	Power dip ride-through gain Kp	0.0s to 300.0s	20.0s

Note

- In the bus voltage constant control mode, when the line voltage recovers, the AC drive accelerates 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 AC drive will not be started until it receives the RUN command again.

7.6.7 Load Lost Protection

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.

7.6.8 Overspeed Protection

Function Code	Parameter Name	Setting Range	Default
F9-67	Overspeed detection level	0.0% to 50.0% (max. frequency)	20.0%
F9-68	Overspeed detection time	0.0s to 60.0s	1.0s

These function parameters define the motor overspeed detection function that is effective only for the vector control with speed sensor.

When the detected motor speed exceeds the maximum frequency and the excess is larger than the value set in F9-67 for longer than the time set in F9-68, the AC drive reports Err43 and acts as selected in the ten's digit in F9-50.

If F9-68 is set to 0, motor overspeed detection is disabled.

7.6.9 Too Large Speed Feedback Error Protection

Function Code	Parameter Name	Setting Range	Default
F9-69	Detection level of too large speed feedback error	0.0% to 50.0% (max. frequency)	20.0%
F9-70	Detection time of too large speed feedback error	0.0s to 60.0s	5.0s

These function parameters define the too large speed feedback error detection function that is effective only for the vector control with speed sensor.

When the detected motor speed is different from the frequency reference and the difference is larger than the value set in F9-69 for longer than the time set in F9-70, the AC drive reports Err42 and acts as selected in the unit's digit in F9-50.

7.6.10 Undervoltage & Overvoltage Threshold and Fast Current Limit

Function Code	Parameter Name	Setting Range	Default
A5-06	Undervoltage threshold	210 to 420 V	350 V
A5-09	Overvoltage threshold	650 to 820 V	820 V
A5-04	Selection of fast current limit	0: Disabled 1: Enabled	1

When the DC bus voltage exceeds the setting of A5-06/A5-09, the AC drive reports Err09/Err05–Err07.

It is suggested that the fast current limit function is disabled (A5-04 = 0) in the hoist applications such as crane.

7.7 Monitoring

The monitoring function enables you to view the AC drive state in the LED display area on the operation panel.

You can monitor the AC drive state in the following two ways:

1. View F7-03, F7-04 and F7-05 by pressing ▷ on the operation panel.
2. View parameters in group U0 via the operation panel

■ View F7-03, F7-04 and F7-05 by Pressing the Shift Key

A maximum of 32 parameters in the running state can be viewed in F7-03 and F7-04. The display starts from the lowest bit of F7-03. A total of 13 parameters in the stop can be viewed in F7-05.

If a parameter needs to be displayed during the running, set the corresponding bit to 1, convert the binary number to hexadecimal equivalent, and set the related parameter to the hexadecimal number.

For example, to view the running frequency, bus voltage, output voltage, output current, output power and the PID reference, do as follows:

1. Set bit 0, bit 2, bit 3, bit 4, bit 5 and bit 15 of F7-03 to 1 and convert the binary number 1000 0000 0011 1101 to the hexadecimal number 803D.

High ◄──────────────────── Low

F7-03	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Binary	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
Hexadecimal	8				0				3				D			

2. Press the ENTER key on the operation panel.

   The operation panel displays F7-04.

3. Press the PRG key twice on the operation panel.

   The display of the operation panel starts from bit 0 (the lowest bit) in F7-03.

4. Press the ▷ key to view the running frequency, bus voltage, output voltage, output current, output power and the PID reference.

   You can view the other parameters in the same way.

Conversion of Numbers

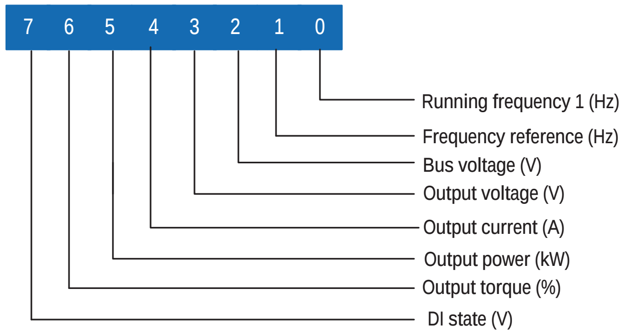
The following table tells you how to convert a binary number into the hexadecimal equivalent.

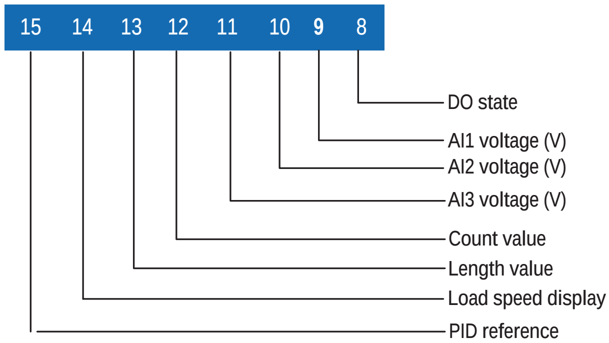
Binary	1111	1110	1101	1100	1011	1010	1001	1000	0111	0110	0101	0100	0011	0010	0001	0000
Decimal	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Hexadecimal	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0

Every four binary digits from right to left corresponds to a hexadecimal digit. If the highest binary digit is 0, fill up it with 0. Then convert the binary number into the decimal equivalent and then convert the decimal number into the hexadecimal equivalent.

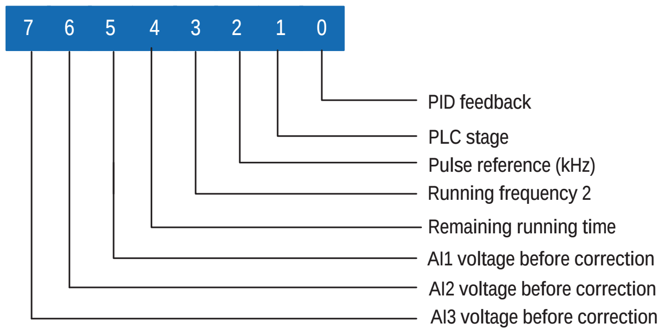
For example, the binary number is 011 1101 1111 1001. The highest binary digit is 0 and you need to fill up it with 0. The complete binary number is 0011 1101 1111 1001. According to the preceding table, the hexadecimal equivalent is 3DF9.

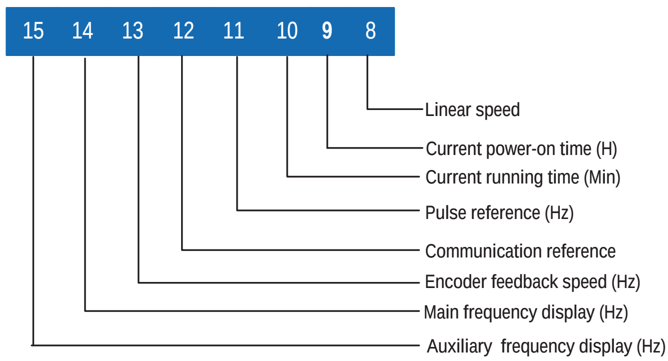
<table>
<tr><th>Function Code</th><th>Parameter Name</th><th>Setting Range</th><th>Default</th></tr>
<tr><td>F7-03</td><td>LED display running parameters 1</td><td>0000 to FFFF





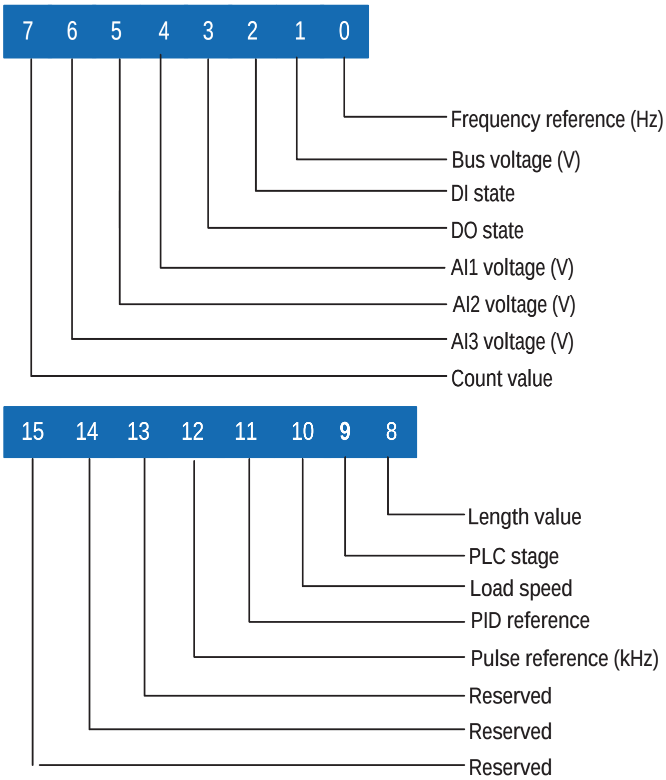
If a parameter needs to be displayed during the running, set the corresponding bit to 1, and set F7-03 to the hexadecimal equivalent.</td><td>1F</td></tr>
<tr><td>F7-04</td><td>LED display running parameters 2</td><td>0000 to FFFF





If a parameter needs to be displayed during the running, set the corresponding bit to 1, and set F7-04 to the hexadecimal equivalent.</td><td>0</td></tr>
</table>

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



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

Note

- Once the AC drive is re-powered on after power down, the displays are the selected parameters before power down by default.
- If the parameter to be monitored cannot be found in F7-03, F7-04 and F7-05, view it in group U0.

■ View Parameters in Group U0

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
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 (AC drive power ≤ 55 kW)** 0.0 to 6553.5 A (AC drive power > 55 kW)
U0-05	Output power	0 to 32767
U0-06	Output torque	-200.0% to 200.0%

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	Bit10	Bit11	Bit12	Bit13	Bit14	Bit15
VDI1	VDI2	VDI3	VDI4	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	VDO4	VDO5	-	-

Function Code	Parameter Name	Display Range
U0-10	**AI2 voltage (V)/current (mA)**	0.00 to 10.57 V 0.00 to 20.00 mA

U0-10: When F4-40 is set to 0, AI2 sampling data is displayed in the unit of V. When F4-40 is set to 1, AI2 sampling data is displayed in the unit of mA.

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 100.00 kHz

Function Code	Parameter Name	Display Range
U0-19	Feedback speed	-320.00 to 320.00 Hz -500.0 to 500.0 Hz

U0-19: It displays the actual output frequency of the AC drive.

The ten's digit of F7-12 (Number of decimal places for load speed display) determines the number of decimal places of U0-19/U0-29.

- If the ten's digit is set to 2, the display range is -320.00 to 320.00 Hz.
- If the ten's digit is set to 1, the display range is -500.0 to 500.0 Hz.

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 0.00 to 20.00 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). The actually used AI input voltage after correction **are displayed in U0-09, U0-10 and U0-11.**

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
U0-29	Encoder feedback speed	-320.00 to 320.00 Hz -500.0 to 500.0 Hz

U0-29: It displays the motor running frequency measured by the encoder.

The ten's digit of F7-12 (Number of decimal places for load speed display) determines the number of decimal places of U0-19/U0-29.

- If the ten's digit is set to 2, the display range is -320.00 to 320.00 Hz.
- If the ten's digit is set to 1, the display range is -500.0 to 500.0 Hz.

Function Code	Parameter Name	Display Range
U0-30	Main frequency X	0.00 to 500.00 Hz
U0-31	Auxiliary frequency Y	0.00 to 500.00 Hz
U0-34	Motor temperature	0°C to 200°C
U0-35	Target torque	-200.0% to 200.0%
U0-36	Resolver position	**0 to 4095**
U0-37	Power factor angle	-

Function Code	Parameter Name	Display Range
U0-38	ABZ position	0 to 65535

U0-38: It displays the phase A and B pulse counting of the current ABZ or UVW encoder. This value is four times the number of **pulses that the encoder runs. For example, if the display is 4000, the actual number of pulses that the encoder runs is 4000/4 =** 1000.

The value increases when the encoder rotates in forward direction and decreases when the encoder rotates in reverse direction. After increasing to 65535, the value restarts to increase from 0. After decreasing to 0, the value restarts to decrease from 65535.

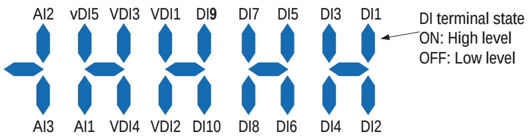
You can check whether the installation of the encoder is normal by viewing U0-38.

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.

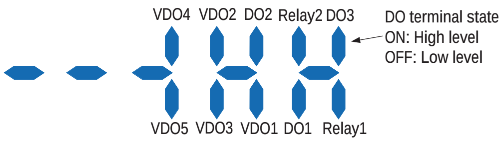
Function Code	Parameter Name	Display Range
U0-41	DI state display	-

U0-41: It displays the DI state and the display format is shown as below:



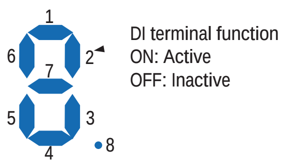
Function Code	Parameter Name	Display Range
U0-42	DO state display	-

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
U0-58	Phase Z counting	0 to 65535

U0-58: It displays the phase Z counting of the current ABZ or UVW encoder. The value increases or decreases by 1 every time the encoder rotates one revolution forwardly or reversely. You can check whether the installation of the encoder is normal by viewing U0-58.

Function Code	Parameter Name	Display Range
U0-59	Frequency Reference	-100.00% to 100.00%
U0-60	Running frequency	-100.00% to 100.00%

Function Code	Parameter Name	Display Range
U0-61	AC drive 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 Bit1	0: Stop 1: Forward 2: Reverse
Bi2 Bit3	0: Constant 1: Accelerate 2: Decelerate
Bit4	0: Bus voltage normal 1: Undervoltage

Function Code	Parameter Name	Display Range
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
U0-65	Torque upper limit	-200.00% to 200.00%

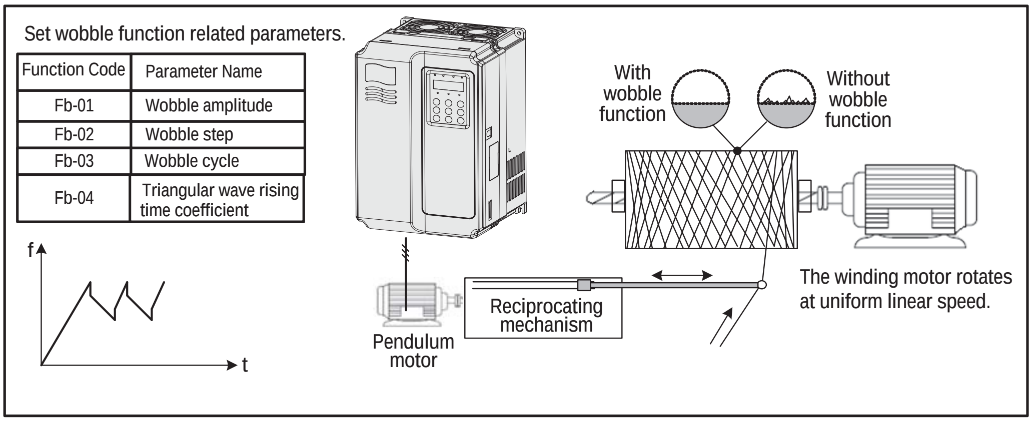
7.8 Process

This section introduces the three commonly used process functions, the wobble function, the fixed length control and the counting function.

7.8.1 The Wobble Function

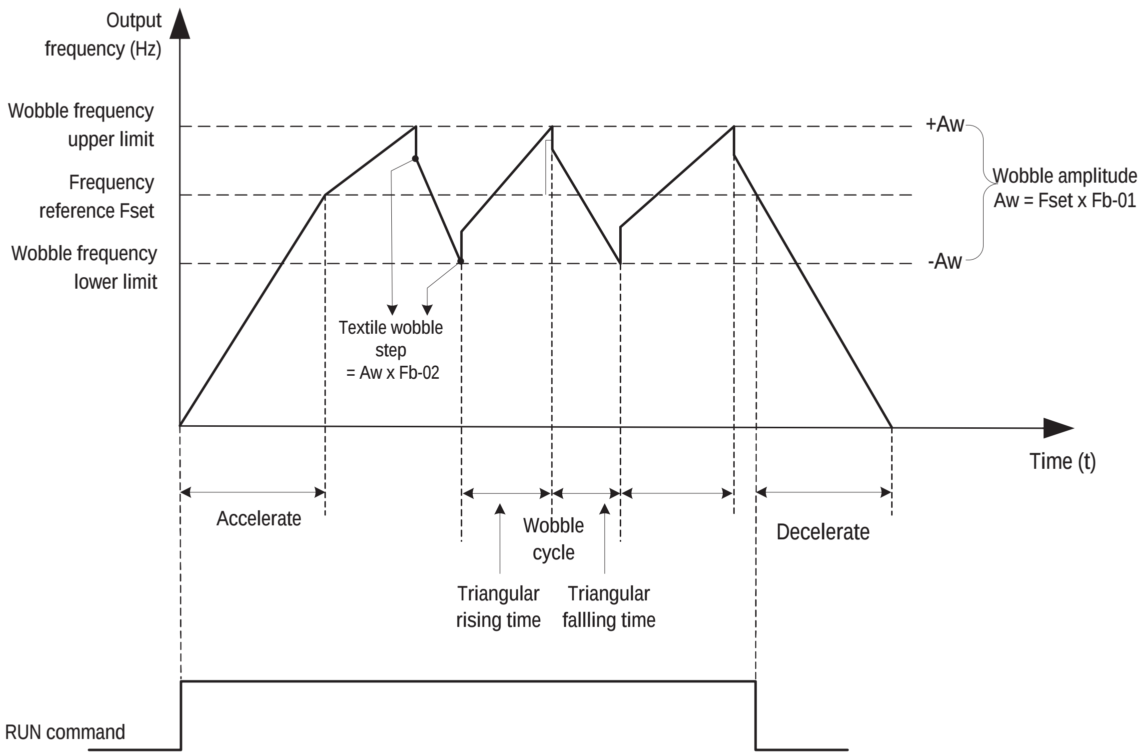
The wobble function is applicable to the industries such as textile and chemical fiber and the winding and unwinding applications. It indicates the output frequency wobbles up and down with the frequency reference as the center.

Figure 7-49 Application of the wobble function



The trace of the running frequency at the time axis is shown in the following figure.

Figure 7-50 The wobble function schematic diagram



The related function parameters are as follows:

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

This function parameter selects the base value of the wobble amplitude.

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, Aw (wobble amplitude) = F0-07 (Frequency source superposition selection) x Fb-01.
- When Fb-00 = 1, Aw (wobble amplitude) = F0-10 (Max. frequency) x Fb-01.

Wobble step frequency = Aw (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	0.0s to 3000.0s	10.0s
Fb-04	Triangular wave rising **time coefficient**	0.0% 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)**

7.8.2 Fixed Length Control

The MD500 has the fixed length control function. The length pulses can only be sampled by the DI5. Set the DI5 for the function 27 "Length signal pulses count".

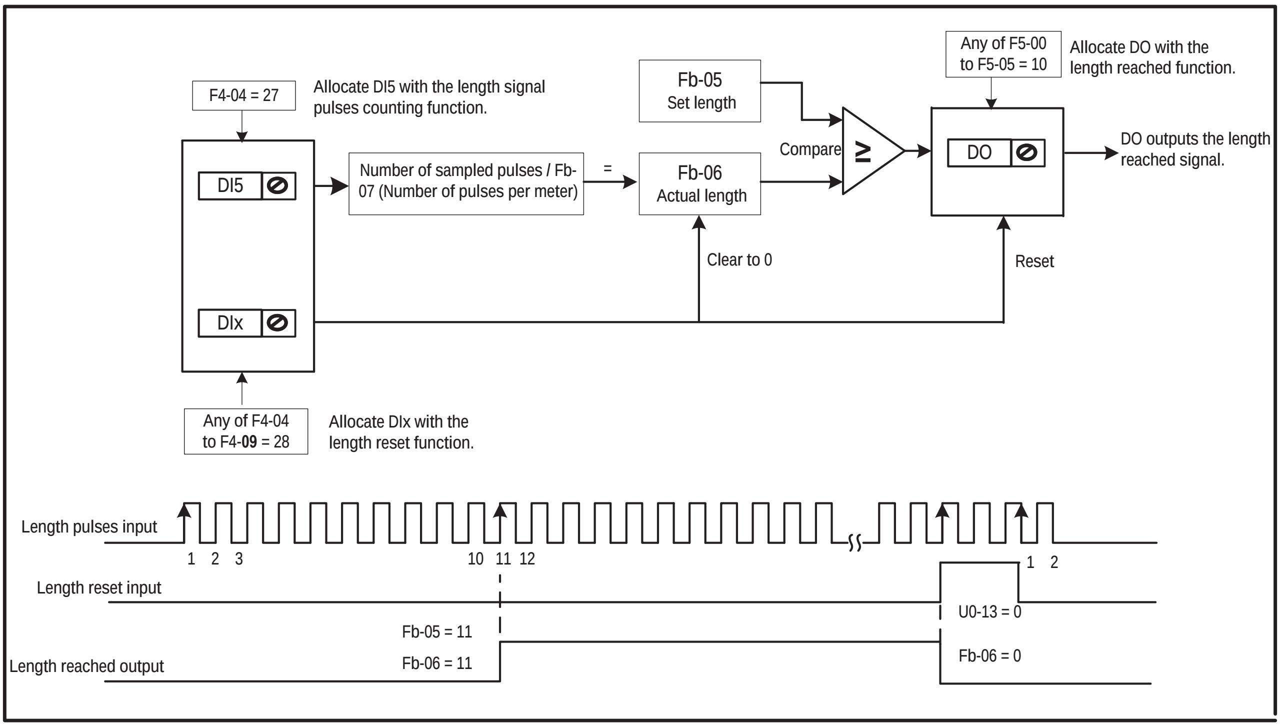
Function Code	Parameter Name	Setting Range	Default
Fb-05	Set length	0 to 65535 m	1000 m
Fb-06	Actual length	0 to 65535 m	0 m
Fb-07	Number of pulses per meter	0.1 to 6553.5	100.0

In the following figure, the actual length is a monitored value.

Actual length (Fb-06) = Number of pulses sampled by DI divided by Fb-07 (Number of pulses each meter).

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".

Figure 7-51 The fixed length control schematic diagram



The settings of related function parameters in the preceding figure are as follows:

Function Code	Parameter Name	Setting	Description
F4-04	DI5 function selection	27	Length pulses counting input
Any of F4-00 to F4-09	DIx function selection	28	Length reset
Any of F5-00 to F5-05	DOx function selection	10	Length reached

Note

- Only the length can be calculated according the number of pulses but the rotation **direction will not be obtained in the fixed length control mode.**
- An automatic stop system can be implementing by connecting the output length reached signal of the relay to the stop input terminal.

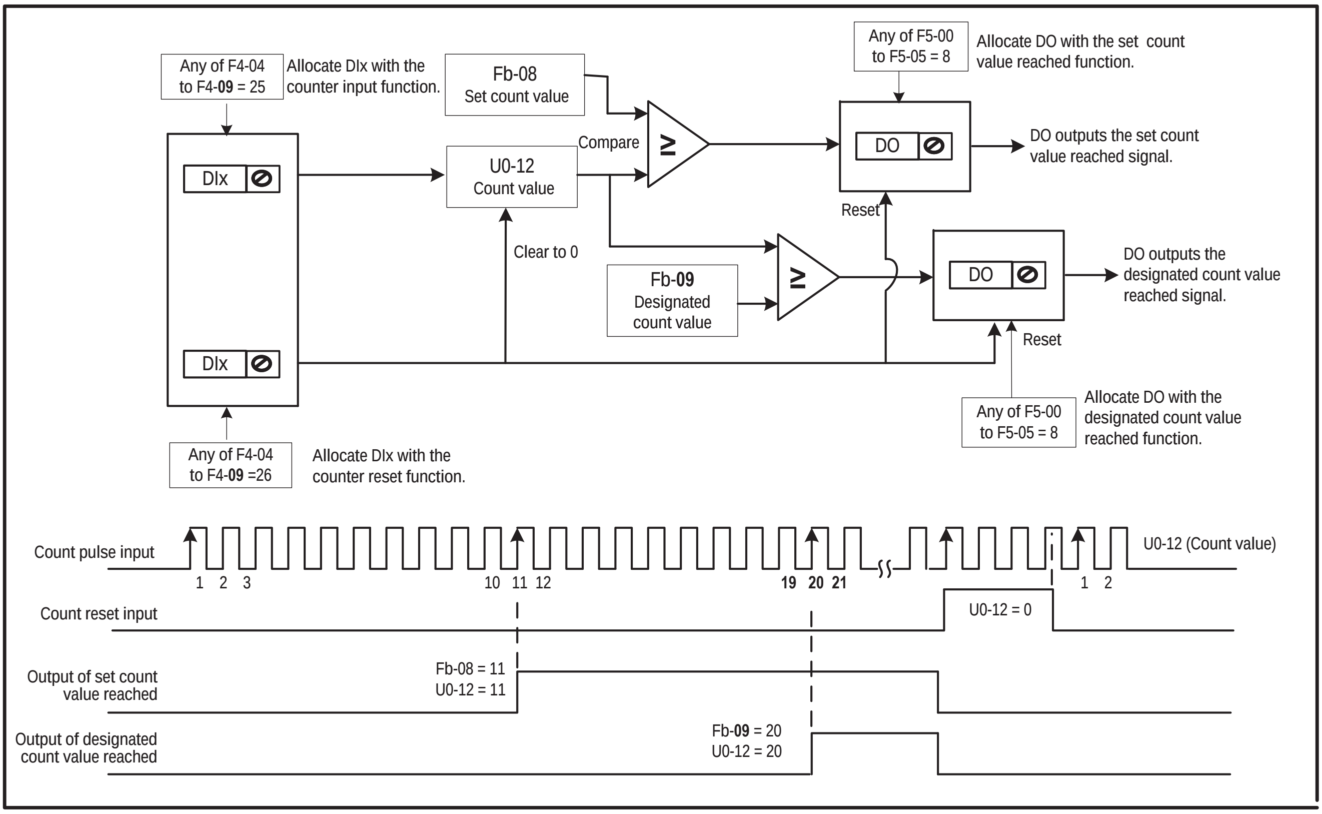
7.8.3 The Counting Function

The MD500 has the counting function. The sampling DI terminal must be set for the function 25 "Counter input ". For high pulse frequency, use terminal DI5.

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

In the following figure, 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.

Figure 7-52 The counting function schematic diagram



The settings of related function parameters in the preceding figure are as follows:

Function Code	Parameter Name	Setting	Description
Any of F4-00 to F4-09	DIx function selection	25	Counter input
Any of F4-00 to F4-09	DIx function selection	26	Counting reset
Any of F5-00 to F5-05	DOx function selection	8	Set counting value reached
Any of F5-00 to F5-05	DOx function selection	**9**	Designated counting value reached

Note

- For high pulse frequency, use terminal DI5.
- You cannot allocate the "Set counting value reached" function and the "Designated counting value reached" function to the same DO terminal.
- **The counter keeps counting in the drive running/stop state. It stops counting until the set counting value is reached.**
- The counting value is retentive at power down.
- An automatic stop system can be implementing by connecting the output counting value reached signal of the DO to the stop input terminal.

7.8.4 Motor 2 Parameters

The MD500 supports driving two motors at different time. For the two motors, you can:

- Set motor nameplate parameters respectively
- Perform motor auto-tuning respectively
- **Select V/F control or vector control respectively**
- Set encoder-related parameters respectively
- **Set parameters related to V/F control or vector control independently**

Motor 2 parameters are defined the same as motor 1 parameters. For details, see the descriptions of groups F1 and F2.

You can select the desired motor parameter group in F0-24 or via a DI terminal

1. Select the desired motor parameter group in F0-24.

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

2. Select the desired motor parameter group via a DI terminal.

Set any of F4-00 to F4-09 for the function 41 "Motor selection". If the DI is off, the motor parameter group 1 is selected. If the DI is on, the motor parameter group 2 is selected.

Function Code	Parameter Name	Setting	Description
Any of F4-00 to F4-09	DIx function selection	41	Motor selection

Note

- **If any of F4-00 to F4-09 is set for the function 41 "Motor selection", the DI terminal overrides F0-24. If none of F4-00 to F4-09 is set for the function 41 "Motor selection", the motor selection is determined by F0-24.**
- Switchover of the two groups of motor parameters is prohibited during the drive running. Otherwise, the drive reports Err41.

Function Code	Parameter Name	Setting Range	Default
A2-00	Motor type selection	0 to 1	0
A2-01	Rated motor power	0.1 to 1000.0	Model dependent
A2-02	Rated motor voltage	1 to 2000	Model dependent
A2-03	Rated motor current	**0.01 to 655.35 (AC drive power ≤ 55 kW)** 0.1 to 6553.5 (AC drive power > 55 kW)	Model dependent
A2-04	Rated motor frequency	0.01 to max. frequency	Model dependent
A2-05	Rated motor speed	1 to 65535	Model dependent
A2-06	Stator resistance	**0.001 to 65.535 (AC drive power ≤ 55 kW)** 0.0001 to 6.5535 (AC drive power > 55 kW)	Auto-tuning parameter
A2-07	Rotor resistance	**0.001 to 65.535 (AC drive power ≤ 55 kW)** 0.0001 to 6.5535 (AC drive power > 55 kW)	Auto-tuning parameter
A2-08	Leakage inductive reactance	**0.01 to 655.35 (AC drive power ≤ 55 kW)** 0.001 to 65.535 (AC drive power > 55 kW)	Auto-tuning parameter
A2-09	Mutual inductive reactance	**0.1 to 6553.5 (AC drive power ≤ 55 kW)** 0.01 to 655.35 (AC drive power > 55 kW)	Auto-tuning parameter

Function Code	Parameter Name	Setting Range	Default
A2-10	No-load current	**0.01 to F1-03 (AC drive power ≤ 55 kW)** 0.1 to F1-03 (AC drive power > 55 kW)	Auto-tuning parameter
A2-27	Encoder pulses per revolution	1 to 65535	1024
A2-28	Encoder type	0 to 2	0
A2-29	Speed feedback PG selection	0 to 2	0
A2-30	**A/B phase sequence of ABZ** incremental encoder	0 to 1	0
A2-31	Encoder installation angle	**0.0 to 359.9**	0.0
A2-34	Number of pole pairs of resolver	1 to 65535	1
A2-37	Auto-tuning selection	0 to 3	0

7.8.5 User Programmable Card

You can implement control of the AC drive by PLC programming by connecting the user programmable card MD38PC1 to the drive to satisfy various process requirements.

For detailed usage of the MD38PC1, see the User Programmable Card User Manual. The function of the card must be used together with the parameters in group A7.

Figure 7-53 The user programmable use schematic (1)

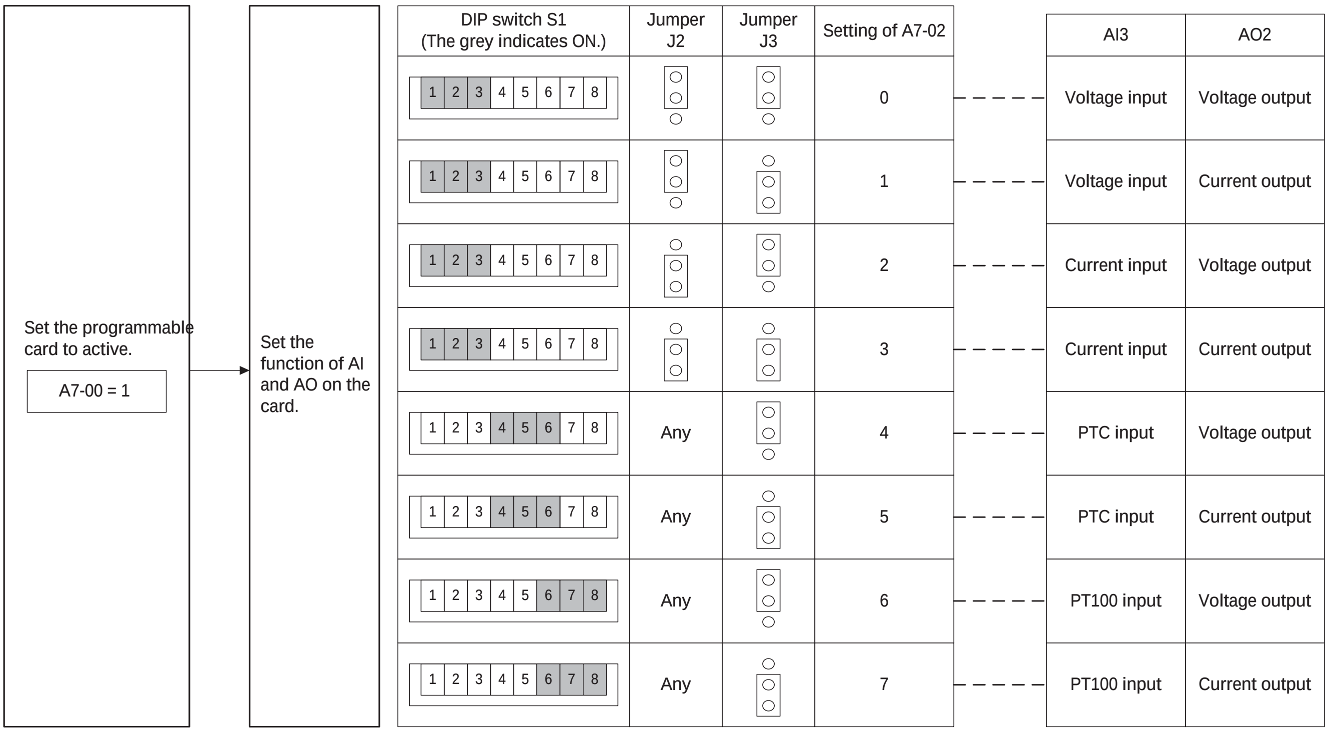


Figure 7-54 The user programmable use schematic (2)

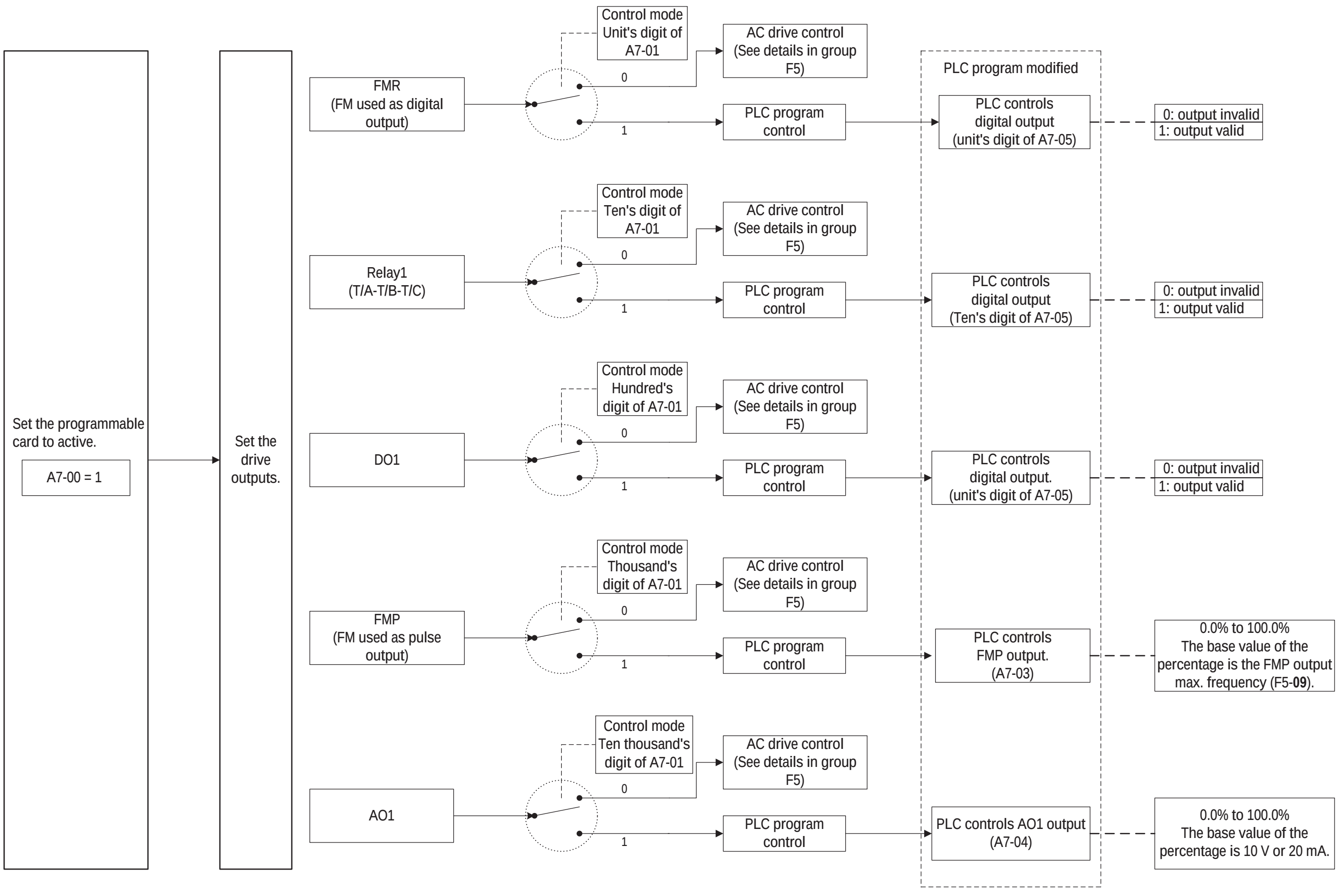
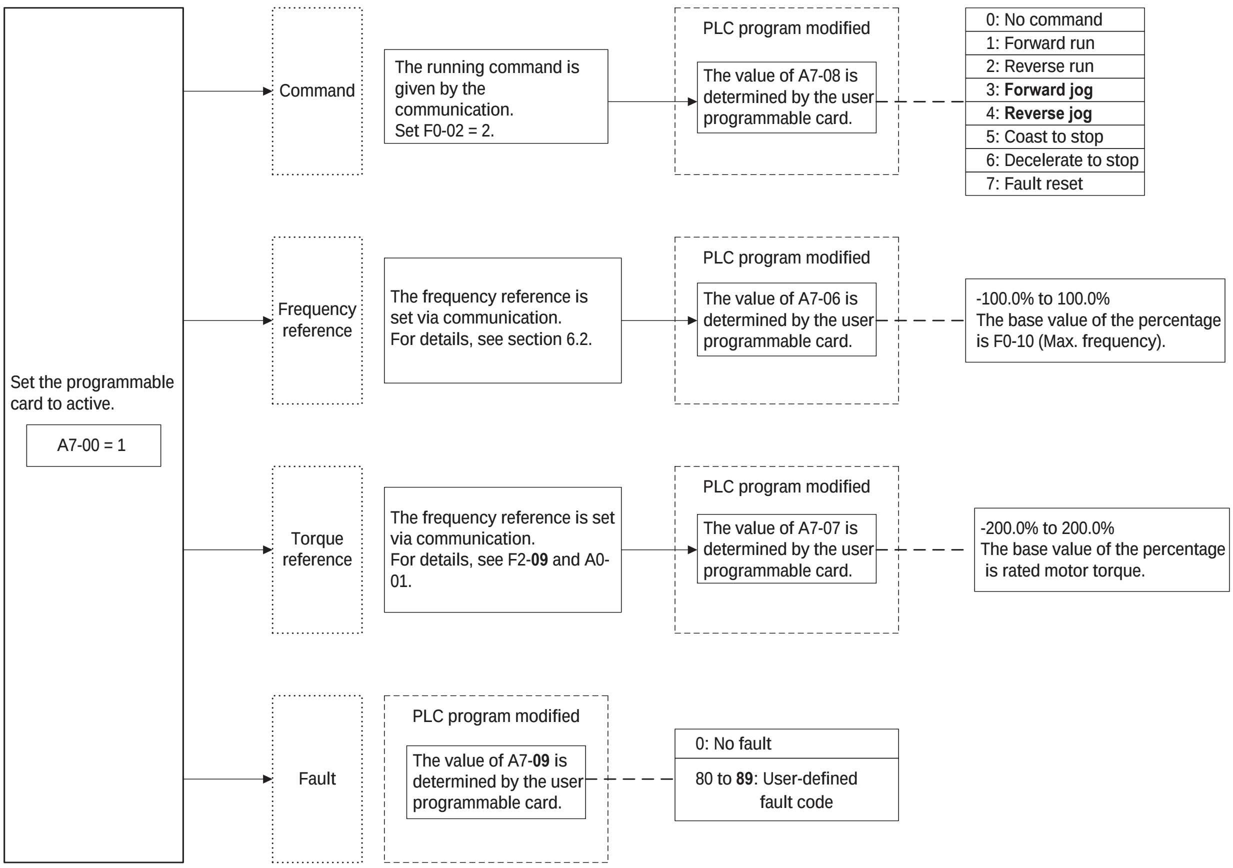


Figure 7-55 The user programmable use schematic (3)



1. Set whether the user programmable card is valid.

Function Code	Parameter Name	Setting Range	Default
A7-00	User programmable function selection	0: Disabled 1: Enabled	0

2. Set the AI3 and AO2 function on the user programmable card.

Function Code	Parameter Name	Setting Range	Default
A7-02	User programmable card AI3 and AO2 function selection	0 to 7 0: AI3 (voltage input), AO2 (voltage output) 1: AI3 (voltage input), AO2 (current output) 2: AI3 (current input), AO2 (voltage output) 3: AI3 (current input), AO2 (current output) 4: AI3 (PTC input), AO2 (voltage output) 5: AI3 (PTC input), AO2 (current output) 6: AI3 (PT100 input), AO2 (voltage output) 7: AI3 (PT100 input), AO2 (current output)	0

The user programmable card provides an analog input terminal AI3 and an analog output terminal AO2. Set the DIP switch S1, the **jumper J2 and the jumper J3 on the card and then perform corresponding setting in A7-02. The setting of S1, S2 and J3 must be** consistent with the setting in A7-02. Otherwise, the communication will be abnormal.

3. Set the AC drive output signals

When A7-00 = 1 (the user programmable card is enabled), you can set the control source of the output terminals (FMR, relay, DO1, FMP and AO1) of the AC drive in A7-01.

When an output terminal is controlled by the PLC program, the output of the terminal is determined by the setting of corresponding **function parameter A7-03/A7-04/A7-05.**

You can implement control of the output terminal via the PLC program by modifying A7-03/A7-04/A7-05.

Function Code	Parameter Name	Setting Range	Default
A7-01	AC drive output terminal control source selection	00000 to 11111 0: AC drive control 1: PLC program control	00000
		Unit's digit: FMR (FM used as digital output)	
		Ten's digit: Relay (T/A-T/B-TC)	
		Hundred's digit: DO1	
		Thousand's digit: FMP (FM used as pulse control)	
		Ten thousand's digit: AO1	
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 0: Disabled 1: Enabled	000
		Unit's digit: FMR	
		Ten's digit: Relay	
		Hundred's digit: DO1	

The base value of A7-03 is F5-09 (Max. FMP output frequency). The base value of A7-04 is 10 V (voltage output) or 20 mA (current output).

4. Set the running command

When F0-02 = 2 (the command source is communication) and A7-00 = 1 (the user programmable card is enabled), the drive running is controlled by the setting of A7-08.

You can implement control of the AC drive via the PLC program by operating the corresponding D component.

Function Code	Parameter Name	Setting Range	Default
A7-08	Setting running command via the user programmable card	0 to 7 0: No command 1: Forward run 2: Reverse run **3: Forward jog** **4:Reverse jog** 5: Coast to stop 6: Decelerate to stop 7: Fault reset	0

5. Set the frequency reference

When the frequency reference setting channel is communication and A7-00 = 1 (the user programmable card is enabled), the frequency reference of the AC drive is determined by the setting of A7-06.

You can implement control of the frequency reference of AC drive via the PLC program by operating the corresponding D component.

Function Code	Parameter Name	Setting Range	Default
A7-06	Setting frequency reference via the user programmable card	-100.00% to 100.00%	0.00%

The base value of this parameter is F0-10 (Max. frequency).

6. Set the torque reference.

When the torque reference setting channel is communication and A7-00 = 1 (the user programmable card is enabled), the torque reference of the AC drive is determined by the setting of A7-07.

You can implement control of the torque reference of AC drive via the PLC program by operating the corresponding D component.

Function Code	Parameter Name	Setting Range	Default
A7-07	Setting torque reference via the user programmable card	-200.00% to 200.00%	0.00%

The base value of this parameter is rated motor torque.

7. **Set the user-defined faults.**

When A7-00 = 1 (the user programmable card is enabled), you can set the user defined faults Err80 to Err89 by operating the corresponding D component to change the setting of A7-09 in the range of 80 to 89.

Function Code	Parameter Name	Setting Range	Default
A7-09	Setting torque reference via the user programmable card	0: No fault **80 to 89: User defined fault code**	0

If the setting of A7-09 is out of the range of 80 to 89, the setting will not take effect.

7.8.6 Master and Slave Control

The master and slave control is designed for the multi-drive application, where the system is driven by multiple AC drives and the motor shafts are coupled by gear, chain or conveyor belt.

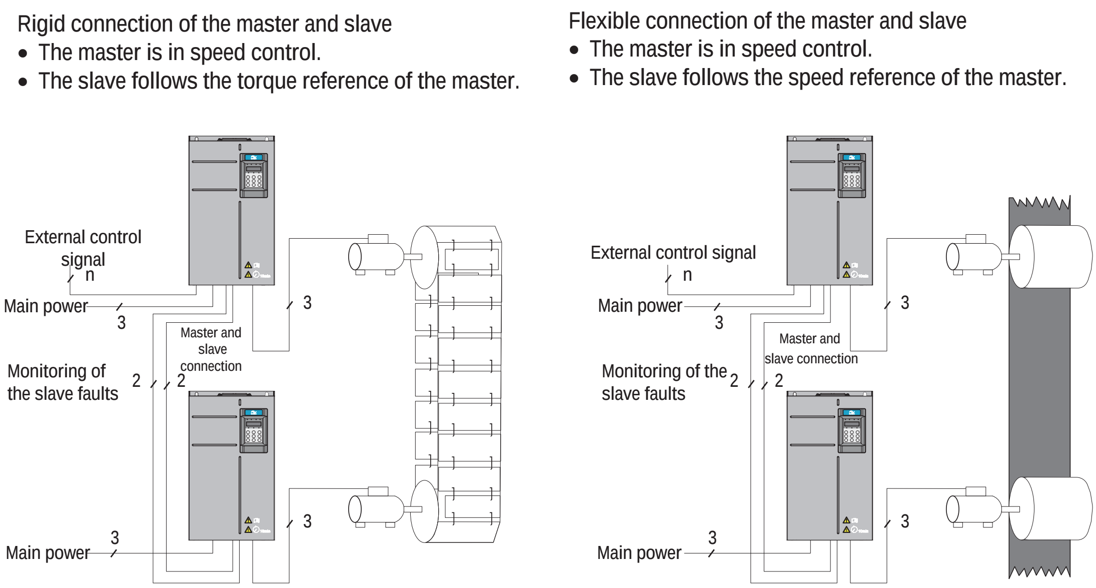
The load is averagely allocated to the AC drives in the master and slave control mode. The external control signal need be connected to the master only, and the master controls the slaves via serial communication.

The master must be in the speed control and the slaves follow the torque or speed reference of the master.

- When the motor shafts are connected rigidly by chain or gear, the slaves must adopt the torque control mode to remove the speed difference amongst the drives.
- **When the motor shafts are connected flexibly, the slaves must adopt the speed control mode because slight speed difference** amongst AC drives is allowed.

When the master and slaves are in the speed control, the droop rate must be used. See Figure-56.

Figure 7-56 Rigid/Flexible connection of the master and slave



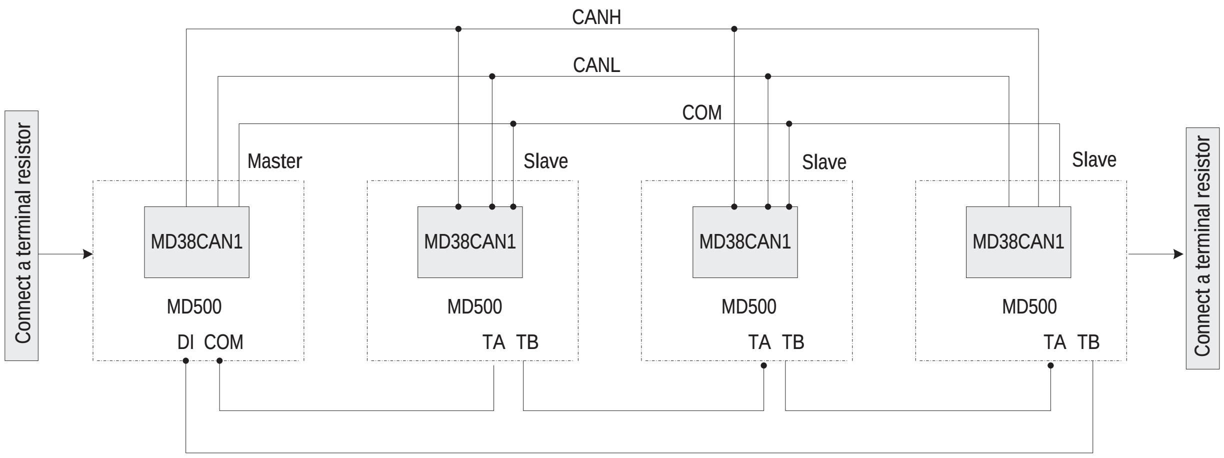
⚠WARNING

To avoid control conflict, please:

- Connect all the external control signals to the master only.
- **Never use the operation panel or the field bus to control the slave .**

Installation

Figure 7-57 Connection of the master and slaves



Note

You can use a relay for the slave fault feedback or set the ten's digit of A8-02 to 1 to send the salve fault information to the master via communication. Then when the slave stops due to occurrence of a fault, the master stops running.

Parameter Setting

1. Rigid connection

For the master in speed control, perform the following settings. Note that only the setting of F2-10 can be modified.

Function Code	Parameter Name	Setting Range	Setting
Fd-00	Baud rate	**0000 to 6009**	Keep the same setting of the thousand's digit of this parameter for the master and slave.
A8-00	Selection of point-point communication	0: Disabled 1: Enabled	1
A8-01	Master and slave selection	0: Master 1: Slave	0
F0-10	Max. frequency	5.00 to 500.00 Hz	50.00 Hz Keep the same setting of this parameter for the master and slave.
F2-10	Digital setting of torque upper limit in speed control mode	0.0% to 200.0%	130.0%

For the slave in torque control, perform the following settings. Note that only the setting of F2-10 can be modified, and the setting of A0-03 must be consistent with that of F2-10 for the master.

Function Code	Parameter Name	Setting Range	Setting
Fd-00	Baud rate	**0000 to 6009**	Keep the same setting of the thousand's digit of this parameter for the master and slave.
A8-00	Selection of point-point communication	0: Disabled 1: Enabled	1
A8-01	Master and slave selection	0: Master 1: Slave	1

Function Code	Parameter Name	Setting Range	Setting
A8-02	Selection of action of the slave in point-point communication	000 to 111 0: No 1: Yes	
		Unit's digit: Whether to follow the master's command	1
		Ten's digit: Whether to send fault information to the master when a fault occurs on it	1
		Hundred's digit: Whether to alarm **when it becomes offline**	-
A8-03	Selection of purpose of the slave received data	0: Torque reference 1: Speed reference	0
A8-11	Window width	0.20 to 10.00 Hz	0.5 Hz
F0-10	Max. frequency	5.00 to 500.00 Hz	50.00 Hz Keep the same setting of this parameter for the master and slave.
F8-07	Acceleration time 4	0.0s to 6500.0s	0.0s
F8-08	Deceleration time 4	0.0s to 6500.0s	0.0s
F0-02	Command source selection	0: Operation panel control (LED off) 1: Terminal control (LED on) **2: Communication control (LED flashing)**	2
A0-00	**Speed/Torque** control selection	0: Speed control 1: Torque control	1
A0-01	Torque reference source in torque control	0: Set by A0-03 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI5) 5: Communication reference 6: MIN (AI1, AI2) 7: MAX (AI1, AI2)	0
A0-03	Torque digital setting in torque control	-200.0% to 200.0%	130.0%
A0-07	Acceleration time in torque control	0.00s to 65000s	0.00s
A0-08	Deceleration time in torque control	0.00s to 65000s	0.00s

Note

- Do not set the startup frequency in the torque control mode. Otherwise, larger rush-in current result at startup.
- Reduce the setting of A8-11 of the slave in the master and slave control but the setting must be larger than 0.20 Hz. Meanwhile, if the deceleration time is very short, increase the setting of A8-11 properly. The larger the setting of A8-11 is, the weaker window effect will be obtained.

Set the initial value to half of the rated motor slip. You can obtain the rated motor slip according to the following formulas:

- **Number of pole pairs of the motor (take an integer) = (60 x rated motor frequency)/rated motor speed**
- **Synchronous motor speed = (60 x rated motor frequency)/number of pole pairs of the motor**
- **Rated motor slip = (synchronous motor speed - rated motor speed)/synchronous motor speed x rated motor frequency**

2. Flexible connection

For the master in speed control, perform the following settings. Note that only the setting of F8-15 can be modified.

Function Code	Parameter Name	Setting Range	Setting
Fd-00	Baud rate	**0000 to 6009**	Keep the thousand's digit of this parameter to the same value for the master and slave.
A8-00	Selection of point-point communication	0: Disabled 1: Enabled	1
A8-01	Master and slave selection	0: Master 1: Slave	0
F0-10	Max. frequency	5.00 to 500.00 Hz	50.00 Hz Keep the same setting of this parameter for the master and slave.
F8-15	Droop rate	0.00 to 10.00 Hz	1.00 Hz
F0-17	Acceleration time 1	0.0 to 6500.0s	Keep the same setting of this parameter for the master and slave.
F0-18	Deceleration time 1	0.0 to 6500.0s	Keep the same setting of this parameter for the master and slave.

For the slave in speed control, perform the following settings. Note that only the setting of F8-15 can be modified.

Function Code	Parameter Name	Setting Range	Setting
Fd-00	Baud rate	**0000 to 6009**	Keep the thousand's digit of this parameter to the same value for the master and slave.
A8-00	Selection of point-point communication	0: Disabled 1: Enabled	1
A8-01	Master and slave selection	0: Master 1: Slave	1
A8-02	Selection of action of the slave in point-point communication	000 to 111 0: No 1: Yes	
		Unit's digit: Whether to follow the master's command	1
		Ten's digit: Whether to send fault information to the master when a fault occurs on it	1
		Hundred's digit: Whether to **alarm when it becomes offline**	-
A8-03	Selection of purpose of the slave received data	0: Torque reference 1: Speed reference	1
F0-02	Command source selection	0: Operation panel control (LED off) 1: Terminal control (LED on) 2: Communication control **(LED flashing)**	2

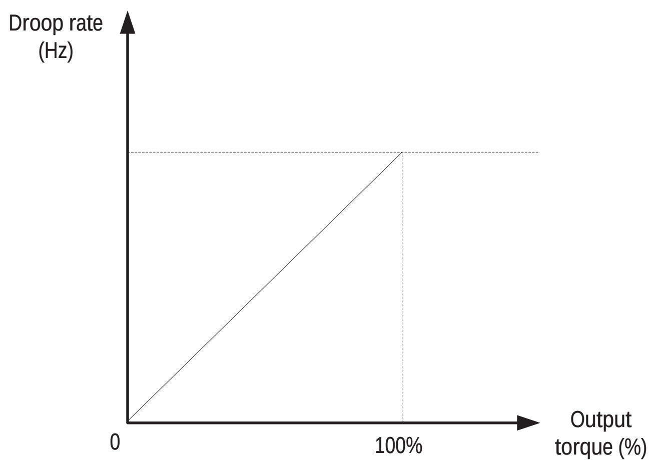
Function Code	Parameter Name	Setting Range	Setting
F0-03	Main frequency reference setting channel selection	0: Digital setting (non-retentive at power down) 1: Digital setting (retentive at power down) 2: AI1 3: AI2 4: AI3 5: Pulse reference 6: Multi-reference 7: Simple PLC 8: PID **9: Communication reference**	**9**
F0-10	Max. frequency	5.00 to 500.00 Hz	50.00 Hz Keep the same setting of this parameter for the master and slave.
F0-17	Acceleration time 1	0.0 to 6500.0s	Keep the same setting of this parameter for the master and slave.
F0-18	Deceleration time 1	0.0 to 6500.0s	Keep the same setting of this parameter for the master and slave.
F8-15	Droop rate	0.00 to 10.00 Hz	1.00 Hz
A0-00	**Speed/Torque control selection**	0: Speed control 1: Torque control	0

■ Droop Control

The droop control function aims at balancing the load level of two motors that drive the same load. This function is required only when both master and slave are in speed control.

A proper droop rate is gradually obtained during the drive running. Therefore, do not set F8-15 to a very large value. Otherwise, the steady speed will decline obviously when the load is very large. You must set this parameter in both master and slave.

Figure 7-58 Relationship between the droop rate and output torque



- Droop speed = rated motor frequency x output torque x droop rate
- Actual AC drive frequency = frequency reference - droop speed

Suppose that F8-15 is set to 10%, the rated motor frequency is 50 Hz, and the output torque is 50%. The actual drive frequency = 50 **Hz – 50 x 50% x (1.00/10) = 47.5 Hz.**

Function Code	Parameter Name	Setting Range	Default
A8-00	Selection of point-point communication	0: Disabled 1: Enabled	0

This function parameter determines whether to enable the point-point communication function.

The point-point communication indicates direct communication between two or more MD500 AC drives via CANlink. The master sends frequency or torque reference to the slaves based on the frequency or torque signal it received.

When connecting multiple AC drives via the CANlink card, install a terminal resistor to the CANlink card of the end drive.

Once this function is enabled, the CANlink communication addresses of the master and slaves are matched automatically. The baud rate is set in Fd-00.

Function Code	Parameter Name	Setting Range	Default
A8-01	Master and slave selection	0: Master 1: Slave	0

This function parameter determines whether the AC drive is master or slave.

Function Code	Parameter Name	Setting Range	Default
A8-02	Selection of action of the slave in point-point communication	0: No 1: Yes	011
		Unit's digit: Whether to follow the master's command	
		Ten's digit: Whether to send fault information to the master when a fault occurs on it	
		Hundred's digit: Whether to alarm when it becomes offline	

When the AC drive is slave (A8-01 = 1) and is in communication control (F0-02 = 2), this function determines whether it follows the **master to run/stop, whether it sends the fault information to the master when a fault occurs on it, and whether it alarms when it becomes offline.**

Function Code	Parameter Name	Setting Range	Default
A8-03	Selection of purpose of the slave received data	0: Torque reference 1: Speed reference	0

Function Code	Parameter Name	Setting Range	Default
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

These two function parameters correct the received data.

- When A8-03 = 0, they correct the frequency reference.
- When A8-03 = 1, they correct the torque reference.

Function Code	Parameter Name	Setting Range	Default
A8-06	Point-point communication interruption detection time	0.0s to 10.0s	1.0s

This function parameter sets time required to detect communication interruption of the master or slave. To disable the detection function, set this parameter to 0.

Function Code	Parameter Name	Setting Range	Default
A8-07	Master data sending cycle in point-point communication	0.001s to 10.000s	0.001s

This function parameter sets 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% to 100.00%	0.00%
A8-09	Gain of received data (frequency)	-10.00 to 10.00	1.00

These two function parameters correct the received frequency data.

Function Code	Parameter 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%.

Function Code	Parameter Name	Setting Range	Default
A8-11	Window width	0.20 to 10.00 Hz	0.5 Hz

This function parameter is effective only for the master and slave control mode. Modify the setting to ensure synchronization of the master and slave speed within the window width.

7.9 Input and Output Terminals

This section describes the functions of the DI, DO, virtual DI, virtual DO, AI and AO terminals.

7.9.1 Function of the DI Terminals

Function Code	Parameter Name	Setting Range	Default
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

These function parameters allocate the ten digital terminals with functions. There are five digital terminals on the control board, DI1 to DI5. There are five additional digital terminals on the optional I/O extension board, DI6 to DI10.

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.
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	

Value	Function	Description
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	Torque control prohibited	When the terminal set for this function becomes on, the torque control is disabled and the AC drive enters speed control.
30	Pulse input as frequency reference (valid only for DI5)	DI5 is used for pulse input as frequency reference.
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.

Value	Function	Description
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	**Speed control/Torque control**	This function enables the AC drive to switch over between speed control and torque control. When the terminal set for this function becomes off, the AC drive runs in the mode set in A0-00. When the terminal set for this function becomes on, the AC drive switches over to the other control mode.
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.
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.
53 to 59	Reserved	-

Function Code	Parameter Name	Setting Range	Default
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

When the state of DI terminals changes, these three function parameters set the delay time of the change. Now the MD500 supports the delay function on DI1, DI2 and DI3 only.

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

These two function parameters set the active mode of DI terminals.

- 0: High level active

  If a high level voltage is applied to DI terminal, the DI signal will be seen as active. That is, the DI terminal becomes active when being connected with COM, and inactive when being disconnected from COM.

- 1: Low level active

  If a low level voltage is applied to DI terminal, the DI signal will be seen as active. That is, the DI terminal becomes active when being disconnected from COM, and inactive when being connected with COM.

7.9.2 Function of the DO Terminals

The MD500 provides a digital output (DO) terminal, an analog output (AO) terminal, a relay terminal and an FM terminal (either high-speed pulse output or open-collector output).

Extra AO terminal (AO2), relay terminal (relay2) and DO terminal (DO2) are provided by the I/O extension card.

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

This function parameter is a programmable multiplexing terminal and determines whether the FM terminal is high-speed pulse output (FMP) or open-collector output (FMR). When used for high-speed pulse output, the max. output frequency is 100 kHz. For details, see the description of F5-06.

Function Code	Parameter Name	Setting Range	Default
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

These five function parameters select the function of the five digital output terminals. T/A-T/B-T/C is the relay of the MD500 and P/A-P/B-P/C is the relay on the I/O extension card.

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

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 set for this function becomes on.
2	Fault output	When a fault occurs and the AC drive stops due to the fault, the terminal set for this function becomes on.
3	Frequency level detection 1 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)	When the output frequency is 0 during drive running, the terminal set for this function becomes on. When the drive stops, the terminal becomes off.
6	Motor overload pending	**The AC drive judges the motor overload pending according to the** pending threshold before performing overload protection. If the pending threshold is exceeded, the terminal set for this function becomes on. **For motor overload parameters, see the descriptions of F9-00 to F9-02.**
7	AC drive overload pending	The terminal set for this function becomes on 10s before the AC drive performs overload protection.
8	Set count value reached	The terminal set for this function becomes on when the count value reaches the value set in Fb-08.
9	Designated count value reached	The terminal set for this function becomes on when the count value **reaches the value set in Fb-09.**
10	Length reached	The terminal set for this function becomes on when the detected actual length exceeds the value set in Fb-05.
11	PLC cycle completed	The terminal set for this function outputs a pulse signal with width of 250 ms when simple PLC completes one cycle.

Value	Function	Description
12	Accumulative running time reached	The terminal set for this function becomes on when the accumulative running time of the AC drive exceeds the value set in F8-17.
13	Frequency limited	The terminal set for this function becomes on when the frequency reference exceeds the frequency upper or lower limit, and the output frequency of the AC drive also reaches the upper or lower limit.
14	Torque limited	The terminal set for this function becomes on when the AC drive enters stall protection because the output torque reaches the toque limit in the speed mode.
15	Ready for RUN	The terminal set for this function becomes on when the AC drive ready to operate the motor (The power applied the main circuit and control circuit is normal, and no fault is detected).
16	AI1 > AI2	When the AI1 input value is greater than the AI2 input value, the terminal set for this function becomes on.
17	Frequency upper limit reached	When the running frequency reaches the frequency upper limit, the terminal set for this function becomes on.
18	Frequency lower limit reached (no output at stop)	When the running frequency reaches the frequency lower limit, the terminal set for this function becomes on. When the AC drive is in the stop state, the terminal set for this function becomes off.
19	Undervoltage state	The terminal set for this function becomes on when the AC drive is in the undervoltage state.
20	Communication setting	Whether the terminal is active or inactive is determined by the setting of the communication address 0x2001.
21	Reserved	-
22	Reserved	-
23	Zero-speed running 2 (having output at stop)	When the output frequency is 0 during drive running, the terminal set for this function becomes on. When the drive stops, the terminal remains on.
24	Accumulative power-on time reached	The terminal set for this function becomes on when the accumulative power-on time of the AC drive (F7-13) exceeds the value set in F8-16.
25	Frequency level detection 2	**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	On the condition that the timing function is enabled (F8-42 = 1), the terminal set for this function becomes on when the current running time of the AC drive reaches the set timing time.
31	AI1 input exceeding limit	The terminal set for this function becomes on when AI1 input is larger than the value set in F8-46 (AI1 input voltage upper limit) or smaller than the value set in F8-45 (AI1 input voltage lower limit).
32	Load lost	The terminal set for this function becomes on when the load gets lost.
33	Reverse running	The terminal set for this function becomes on when the AC drive runs in the reverse direction.
34	Zero current state	Refer to the descriptions of F8-34 and F8-35.
35	Module temperature reached	The terminal set for this function becomes on when the heatsink temperature of the inverter module (F7-07) reaches the module temperature threshold (F8-47).
36	Output current exceeding limit	Refer to the descriptions of F8-36 and F8-37.
37	Frequency lower limit reached (having output at stop)	The terminal set for this function becomes on when the running frequency reaches the frequency lower limit. When the drive stops, the terminal remains on.

Value	Function	Description
38	Alarm output	If a fault occurs on the AC drive and the AC drive continues to run, the terminal outputs an alarm signal.
39	Motor overheat pending	The terminal set for this function becomes on when the motor **temperature reaches the value set in F9-58 (Motor overheat pending** threshold). You can view the motor temperature by using U0-34.
40	Current running time reached	The terminal set for this function becomes on when the current running time of the AC drive exceeds the value set in F8-53.
41	Fault output	When a fault occurs on the AC drive and the fault is not undervoltage, the terminal set for this function outputs the ON signal.

Function Code	Parameter Name	Setting Range	Default
F5-17	FMR output delay	0.0s to 3600.0s	0.0s
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

These function parameters set the output delay of terminals FMR, relay1, relay2, DO1 and DO2 from state change.

Function Code	Parameter Name	Setting Range	Default
F5-22	DI active mode selection 1	0: Positive logic active 1: Negative logic active	00000
		Unit's digit: FMR active mode	
		Ten's digit: Relay1 active mode	
		Hundred's digit: Relay2 active mode	
		Thousand's digit: DO1 active mode	
		Ten thousand's digit: DO2 active mode	

This function parameter sets the active mode of terminals FMR, relay1, relay2, DO1 and DO2.

- 0: Positive logic active

  The digital output terminal becomes active when being connected with COM, and inactive when being disconnected from COM.

- 1: Negative logic active

  The digital output terminal becomes active when being disconnected from COM, and inactive when being connected with COM.

7.9.3 Function of the VDI Terminals

The VDI terminals have the same functions as the DI terminals do. They can be used for multifunctional digital inputs.

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

These function parameters set function to the five virtual DI terminals VDI1 to VD15, which have the same digital input functions (0 to 59) 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 1: Decided by A1-06	00000
		Unit's digit: VDI1	
		Ten's digit: VDI2	
		Hundred's digit: VDI3	
		Thousand's digit: VDI4	
		Ten thousand's digit: VDI5	
A1-06	Selection of VDI active state	0: Inactive 1: Active	00000
		Unit's digit: VDI1	
		Ten's digit: VDI2	
		Hundred's digit: VDI3	
		Thousand's digit: VDI4	
		Ten thousand's digit: VDI5	

These function parameters determine the active mode of the VDI1 to VD15.

- 0: Decided by state of VDOx

  To enable the AC drive to report a fault and stop when the input from AI1 input reaches the limit, perform the following settings:

  – **Set A1-00 to 44 to allocate VDI1 to the function 44 "User-defined fault 1".**
  – Set A1-05 to xxx0 to decide the VDI1 active state by state of VDOx.
  – **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:

  – **Set A1-00 to 1 to allocate VDI1 to the function 1 "Forward RUN (FWD)".**
  – Set A1-05 to xxx1 to decide the VDI1 active state by state of A1-06.
  – Set F0-02 to 1 to use terminal control as the command source.
  – Set F8-18 to 0 to disable the startup protection.

  After completing initialization at power-on, the AC drive detects that VDI1 set for the function FWD is active. This means the AC drive receives the FWD command from VDI1 and starts forward running.

7.9.4 Function of the VDO Terminals

The VDO terminals have the same digital output functions (1 to 41) as the DO terminals do. The VDO can be used together with VDIx to implement some simple logic control.

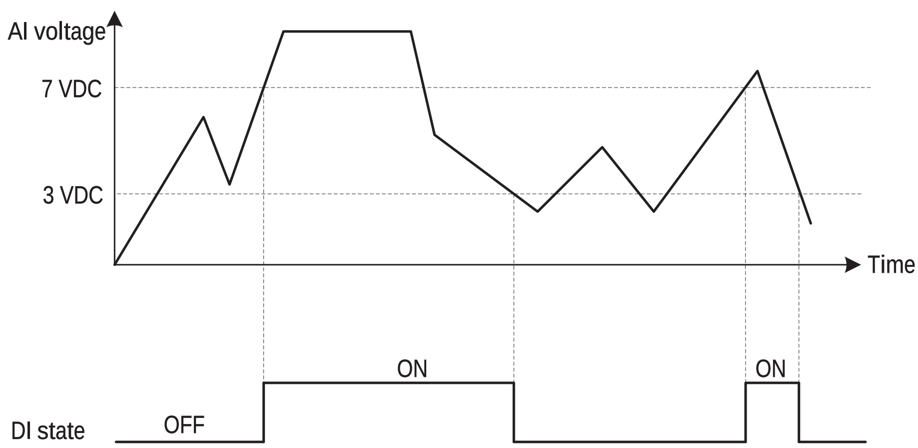
Function Code	Parameter Name	Setting Range	Default
A1-11	VDO1 function selection	0: Short with physical DIx internally 1 to 40	0
A1-12	VDO2 function selection	0: Short with physical DIx internally 1 to 40	0
A1-13	VDO3 function selection	0: Short with physical DIx internally 1 to 40	0
A1-14	VDO4 function selection	0: Short with physical DIx internally 1 to 40	0
A1-15	VDO5 function selection	0: Short with physical DIx internally 1 to 40	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
A1-10	VDO active mode selection	0: High level active 1: Low level active	00000
		Unit's digit: VDO1	
		Ten's digit: VDO2	
		Hundred's digit: VDO3	
		Thousand's digit: VDO4	
		Ten’s thousand's digit: VDO5	

7.9.5 Function of the AI Terminals

The MD500 provides two AI terminals (AI1, AI2). An extra AI terminal (AI3) is provided by the I/O extension card.

Here use the AI terminals 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 7-59 Relationship between the AI input voltage and the DI state



Function Code	Parameter Name	Setting Range	Default
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	0: High level active 1: Low level active	000
		Unit's digit: AI1	
		Ten's digit: AI2	
		Hundred's digit: AI3	

7.9.6 Function of the AO and Pulse Output Terminals

The MD500 provides an AO terminal (AO1). An extra AO terminal (AO2) is provided by the I/O extension card (MD38IO1).

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

These three function parameters select the function of the pulse output terminal and the two analog output terminals.

The pulse output frequency range of the FMP terminal is 0.01 kHz to F5-09 (Max. FMP output frequency). F5-09 must be set in the range of 0.01 to 100.00 kHz.

The output range of AO1 and AO2 is 0 to 10 V or 0 to 20 mA.

The functions of the three terminals are listed in the following table.

Value	Output Function	Range (Corresponding to 0.0% to 100.0% of Pulse or Analog Output Range)
0	Running frequency	0 to max. frequency
1	Frequency reference	0 to max. 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 to 100.00 kHz
7	AI1	0 to 10 V
8	AI2	0 to 10 V (or 0 to 20 mA)
9	AI3	0 to 10 V
10	Length	0 to max. set length
11	Counting value	0 to max. count value
12	Communication reference	0.0% to 100.0%
13	Motor speed	0 to motor speed corresponding to max. output frequency
14	Output current	0.0 to 1000.0 A
15	Output voltage	0.0 to 1000.0 V
16	Output torque of the motor (actual value, a percentage of the rated motor torque)	-2 times of rated motor torque to 2 times of rated motor torque
17	Output torque of the AC drive (actual value, a percentage of the rated AC drive torque)	-

Note

The max. value in the range indicates Xmax in the following formulas to **calculate the AO gain and the AO zero offset coefficient.**

Function Code	Parameter Name	Setting Range	Default
F5-09	Max. FMP output frequency	0.01 to 100.00 kHz	50.00 kHz

This function parameter sets the maximum pulse output frequency when the FM terminal is used for 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
F5-23	AO1 output signal selection	0: Voltage signal 1: Current signal	0

These four function parameters generally correct the zero offset of analog output and the output amplitude error. They can also **define the required AO curve.**

The zero offset coefficient 100% of AO1 and AO2 corresponds to 10 V or 20 mA. You can calculate the gain and the zero offset coefficient from the following formulas:

$$K = \frac{(Y1 - Y2) \times Xmax}{(X1 - X2) \times Ymax} \qquad b = \frac{(X1 \times Y2 - X2 \times Y1)}{(X1 - X2) \times Ymax}$$

In the formulas:

- "b" represents the zero offset.
- "k" represents the gain.
- "X" represents the output frequency.
- "Y" represents the actual output of the AO.
- " Xmax " represents the max. output frequency (determined by F0-10).
- "Ymax" represents the max. output 10 V or 20 mA.

For example, the AO is used for output of frequency reference. To implement output of 8 V (Y1) at 0 Hz (x1) and output of 4 V (Y2) **at 40 Hz (X2) according to the formulas, you can obtain the gain and the zero offset coefficient as follows:**

$$K = \frac{(8 - 4) \times 50}{(0 - 40) \times 10} = -0.5 \qquad b = \frac{(0 \times 4 - 40 \times 8)}{(0 - 40) \times 10} = 80\%$$

Then you can set F5-11 to -0.5 and set F5-10 to 80%.

The AO output signal type and corresponding max. value are as follows:

AO1 output signal	Corresponding Max. Output (Ymax)
Voltage	10 V
Current	20 mA

7.10 Communication

MD500 supports the communication links, Modbus, PROFIBUS-DP, CANlink (always valid), or CANopen.

You can monitor and control of the AC drive, for example, view or modify the function parameters by using a host computer.

Make sure to set the communication parameters correctly. Otherwise, the communication may not be implemented.

Function Code	Parameter Name	Setting Range	Default
F0-28	Serial port communication protocol	0: Modbus protocol 1: PROFIBUS-DP or CANopen protocol	0
Fd-00	Baud rate	**0000 to 9999**	6005
Fd-01	Modbus data format symbol	0 to 3	0
Fd-02	Local address	0: Broadcast address 1 to 247	1
Fd-03	Modbus response delay	0 to 20	2
Fd-04	Serial port communication timeout	0.0 (Invalid) 0.1 to 60.0	0.0
Fd-05	Modbus protocol selection and PROFIBUS-DP data frame	00 to 31	30
Fd-06	Current resolution read by communication	0 to 1	0
Fd-08	CANlink communication timeout time	0.0 (Invalid) 0.1 to 60.0	0

7.10.1 Read and Write Function Parameters

■ Read Function Parameters

For function parameters in groups F0 to FF and A0 to AF, the highest eight bits in the communication address indicate the function code group, while the lowest eight bits indicate the hexadecimal number converted from the SN in the function code group.

For example, the communication address of F0-16 is F010H, in which F0H indicates function code group F0 and 10H is the hexadecimal number converted from 16.

The communication address of AC-08 is AC08H, in which ACH indicates function code group AC and 08H is the hexadecimal number converted from 8.

To read the desired function parameter, the host computer needs to send a read command to the AC drive. Here takes the Modbus protocol as an example to describe the communication process of reading the drive data.

For example, to read F0-10, the read command is 01 03 F0 0A 01 DE D7 (hexadecimal). In the command,

- 01H (settable): AC drive address
- 03H: read command
- F00AH: communication address of F0-10
- 01H: number of function parameters
- DED7H: CRC check

Master Command		Slave Response	
ADDR	01H	ADDR	01H
CMD	03H	CMD	03H
Parameter address high bits	F0H	Parameter address high bits	F0H
Parameter address low bits	0AH	Parameter address low bits	0AH
Number of function parameters	01H	Number of function parameters	01H
CRC high bits	DEH	CRC high bits	DEH
CRC low bits	D7H	CRC low bits	D7H
-	-	-	-

■ Write Function Parameters

For function parameters in groups F0 to FF, the highest eight bits in the communication address indicate 00 to 0F or F0 to FF according to whether to write the parameter to EEPROM, while the lowest eight bits indicate the hexadecimal number converted from the SN in the function code group.

For example, the host computer writes data to F0-16. If not writing to EEPROM, the communication address is 0010H. If writing to EEPROM, the communication address is F010H.

For function parameters in groups A0 to AF, the highest eight bits in the communication address indicate 40 to 4F or A0 to AF according to whether to write the parameter to EEPROM, while the lowest eight bits indicate the hexadecimal number converted from the SN in the function code group.

For example, the host computer writes data to AC-08. If not writing to EEPROM, the communication address is 4C08H. If writing to EEPROM, the communication address is AC08H.

To write data, the host computer needs to send a write command to the AC drive. Here takes the Modbus protocol as an example to describe the communication process of writing data to the AC drive.

For example, to write 2 to AC-16 (not writing to EEPROM), the write command is 01064C1000021F5E (hexadecimal). In the command,

- 01H (settable): AC drive address
- 06H: write command
- 4C10H: communication address of AC-16
- 02H: writing data
- 1F5EH: CRC check

Master Command		Slave Response	
ADDR	01H	ADDR	01H
CMD	06H	CMD	06H
Parameter address high bits	4CH	Parameter address high bits	4CH
Parameter address low bits	10H	Parameter address low bits	10H
Writing data high bits	00H	Number of function parameters	00H
Writing data low bits	02H	CRC high bits	02H
CRC high bits	1FH	CRC high bits	1FH
CRC low bits	5EH	CRC low bits	5EH

7.10.2 Read and Write State Parameters

The state parameters include the monitoring parameters in group U (U0 to UF), the drive fault information and the drive running state.

- The highest 8 bits in the communication of parameters in U0 to UF is 70 to 7F, while lowest eight bits indicate the hexadecimal number converted from the SN in the function code group. For example, the communication address of U0-11 is 700BH.
- The communication address of the drive fault information is 8000H. You can obtain the current fault codes by using the host computer to read the address.
- **The communication address of the drive running state is 3000H. The word in the read information is defined as 1: forward run,** 2: reverse run, 3: stop.

Here takes the CANopen protocol as an example to describe the communication process of the host computer to read the drive running state.

First set F0-28 = 1 to select the CANopen protocol. Suppose that the DIP setting of the Node-ID of the AC drive is 0x05 (modifiable, range: 1 to 63), and the drive running state is 1: forward run.

The format of the message sent by the master is as follows:

Message ID (Hex)	RTR	Data (Hex)
0x605	0	40 30 00 00 00 00 00 00

0x605 = 0x600 + 0x05 (Node-ID DIP setting)

The format of the response message returned by the slave is as follows:

Message ID (Hex)	RTR	Data (Hex)
0x585	0	40 30 00 00 00 00 00 00

0x585 = 0x580 + 0x05 (Node-ID DIP setting)

The sending message and the response message are described as follows:

Sending Message		Response Message	
Message ID	605H	Message ID	605H
RTR	0 (binary)	RTR	0 (binary)
Read command	40H	Response to read command	4B
Communication address high bits	30H	Communication address high bits	30H
Mapping address	00H	Mapping address	00H
Communication address low bits	00H	Communication address low bits	00H
Reserved	00H	Data low byte	01H
Reserved	00H	Data high byte	00H
Reserved	00H	Data 3	00H
Reserved	00H	Data 4	00H

Note

To read the monitoring parameters, the drive fault information and other drive running state via the CANopen protocol, refer to the sending message format and response message format in the following tables to organize the message.

The sending message format of the read operation is described as follows:

CAN	CANopen Data	Description
11-bit ID	0x600 + Node-ID	The Node-ID of the equipment is set via the DIP switch.
RTR	0	Remote frame sign "0"
DATA0	Command code returned	Correct: 0x4B Incorrect: 0x80
DATA1	Index low byte	Function parameter group (0xF0 for group F0)
DATA2	Index high byte	Mapping address
DATA3	Sub-index	SN in the function parameter group (0x02 for 02)
DATA4	Data 1	Data low byte
DATA5	Data 2	Data high byte
DATA6	Data 3	Correct: 0 Incorrect: SDO operation failed error code
DATA7	Data 4	

The returned message format of the read operation is described as follows:

CAN	CANopen Data	Description
11-bit ID	0x580 + Node-ID	The Node-ID of the equipment is set via the DIP switch.
RTR	0	Remote frame sign "0"
DATA0	Command code (0x40)	0x40 read command
DATA1	Index low byte	Function parameter group (0xF0 for group F0)
DATA2	Index high byte	Mapping address
DATA3	Sub-index	SN in the function parameter group (0x02 for 02)
DATA4	Data 1	Reserved
DATA5	Data 2	Reserved
DATA6	Data 3	Reserved
DATA7	Data 4	Reserved

7.10.3 Write Running Command

When F0-02 = 2, you can write the running command via communication on the host computer, such as forward run, reverse run, **forward jog, reverse jog and stop of the AC drive.**

The communication address and descriptions of the running command are defined in the following table.

RUN Command Communication Address	RUN Command Description
2000H	1: Forward run
	2: Reverse run
	3: Forward jog
	4: Reverse jog
	5: Coast to stop
	6: Decelerate to stop
	7: Fault reset

Here takes the CANlink protocol as an example to describe the communication process of the host computer to write running command to the AC drive.

Before writing the running command, set the baud rate and local address. The settings of related parameters are as follows:

Function Parameter	Setting Description
Fd-00 (Baud rate)	Select the CANlink baud rate in the thousand's digit of Fd-00. You must set the same baud rate in the master and slave. Otherwise, the communication will not be implemented.
Fd-02 (Local address)	The CANlink address range is 1 to 63.

Suppose that the CANlink master address is 0x01 and the AC drive address is 0x02 (settable, range: 1 to 63). The running **command to be written is reverse jog. The communication address is 0x2000.**

The format of the message sent by the master is as follows:

Message ID (Hex)	Data Length	Data (Hex)
0x11050201	4	00 04 20 00

The format of the response message returned by the slave is as follows:

Message ID (Hex)	Data Length	Data (Hex)
0x10050102	4	00 04 20 00

The sending message and the response message are described as follows:

Sending Message			Response Message		
Message ID 11050201H	Arbitration sign	1000 (binary)	Message ID 11050102H	Arbitration sign	1000 (binary)
	Q&A sign	1 (binary)		Q&A sign	1 (binary)
	Command code	05H		Command code	05H
	Target address	02H		Target address	01H
	Source address	01H		Source address	02H
Data length		4 (decimal)	Data length		4 (decimal)
Write data high byte		00H	Write data high byte		00H
Write data low byte		04H	Write data low byte		04H
Write address high byte		20H	Write address high byte		20H
Write address low byte		00H	Write address low byte		00H

Note

To write other running commands via the CANlink protocol, refer to the sending message format and response message format in the following tables to organize the message.

The sending CANlink frame of the write operation is as follows:

CAN	CANlink	Description
IDbit28–25	Arbitration sign	The arbitration sign of the command frame is 1000.
IDbit24	Q&A sign	Q&A sign: 1 is the question frame.
IDbit23–16	Command code	Write register command is 0x05.
IDbit15–8	Target address	CANlink target address
IDbit7–0	Source address	CANlink local address
DATA1	Data	Write data high byte
DATA2	Data	Write data low byte
DATA3	Data	Write address high byte
DATA4	Data	Write address low byte

The returned CANlink frame of the write operation is as follows:

CAN	CANlink	Description
IDbit28–25	Arbitration sign	The arbitration sign of the command frame is 1000.
IDbit24	Q&A sign	Q&A sign: 0 is the answer frame.
IDbit23–16	Command code	Write register command is 0x05.
IDbit15–8	Target address	CANlink target address
IDbit7–0	Source address	CANlink local address
DATA1	Data	Write data high byte
DATA2	Data	Write data low byte
DATA3	Data	Write address high byte
DATA4	Data	Write address low byte

7.10.4 Write Frequency/Torque Reference

You can set the frequency reference, torque upper limit, V/F separation voltage, PID reference and PID feedback via the communication address 1000H. The data range is -10000 to 10000, corresponding to -100.00% to 100.00%.

For example, to set the main frequency reference to 8000 by using the Modbus protocol, first set F0-03 = 9 and send the write command 01 06 10 00 1F 40 84 CA. In the command,

- 01H (settable): AC drive address
- 06H: write command
- 1000H: Communication address of giving the toque reference
- 1F40H: torque reference (converted into decimal 10000)
- 84CAH: CRC check

To set the torque reference to -8000, send the write command 01 06 10 00 E0 C0 C4 9A. In the command, E0C0 is the lowest four bits of the hexadecimal number converted from -8000.

Note

The range of the frequency reference given via communication is -10000 to 10000, corresponding to -100.00% to 100.00%. -100.00% corresponds to the negative max. frequency, 0.00% corresponds to the min. frequency, and 100.00% corresponds the max. frequency.

Suppose that F0-10 = 50 Hz, if the frequency reference in the write command is 1F40H, converted to decimal 8000, the frequency reference that is written is 50 x 80.00% = 40 Hz.

Sending Message		Response Message	
ADDR	01H	ADDR	01H
CMD	06H	CMD	06H
Parameter address high bits	10H	Parameter address high bits	10H
Parameter address low bits	00H	Parameter address low bits	00H
Data content high bits	1FH	Data content high bits	1FH
Data content low bits	40H	Data content low bits	40H
CRC high bits	84H	CRC high bits	84H
CRC low bits	CAH	CRC low bits	CAH

7.10.5 Control of Digital Output (DO, Relay, FMR)

If a digital output terminal is allocated with the function 20: Communication setting, you can control the digital output by using the host computer.

The communication address and the command of the digital outputs are defined in the following table.

The related communication address and command are as follows:

Communication Address	Command Description
2001H	Bit0: DO1 output
	Bit1: DO2 output
	Bit2: Relay1 output
	Bit3: Relay2 output
	Bit4: FMR output
	Bit5: VDO1
	Bit6: VDO2
	Bit7: VDO3
	Bit8: VDO4
	Bit9: VDO5

7.10.6 Control of Analog and High-speed Pulse Output (AO, FMR)

When F5-06, F5-07 or F5-08 = 12, you can control the analog and high-speed pulse output by using the host computer.

The communication address and the command of the analog and high-speed pulse outputs are defined in the following table.

The related communication address and command are as follows:

Communication Address		Command Description
AO1	2002H	0 to 7FFF indicates 0% to 100%.
AO2	2003H	
FMP	2004H	

7.10.7 Parameter Initialization

You can initialize the parameters via the host computer by using this function. If FP-00 (user password) is set to a non-zero value, verify the password on the host computer.

Once the password passes the verification, the host computer performs parameter initialization within 30s. The communication address of the password verification is 1F00H. Directly write the correct user password to this address to complete the verification.

The communication address and the command of the parameter initialization are defined in the following table.

Communication Address	Command Description
1F01H	1: Restore factory parameters
	2: Clear the records
	4: Restore the user backup parameters
	501: Back up the current user parameters

7.11 Auxiliary Function

7.11.1 Jog

Jog is required to test the equipment. In the jog running, F6-00 must be set to 0 (direct start) and F6-10 must be set to 0 (Decelerate to stop).

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
F8-00	Jog 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

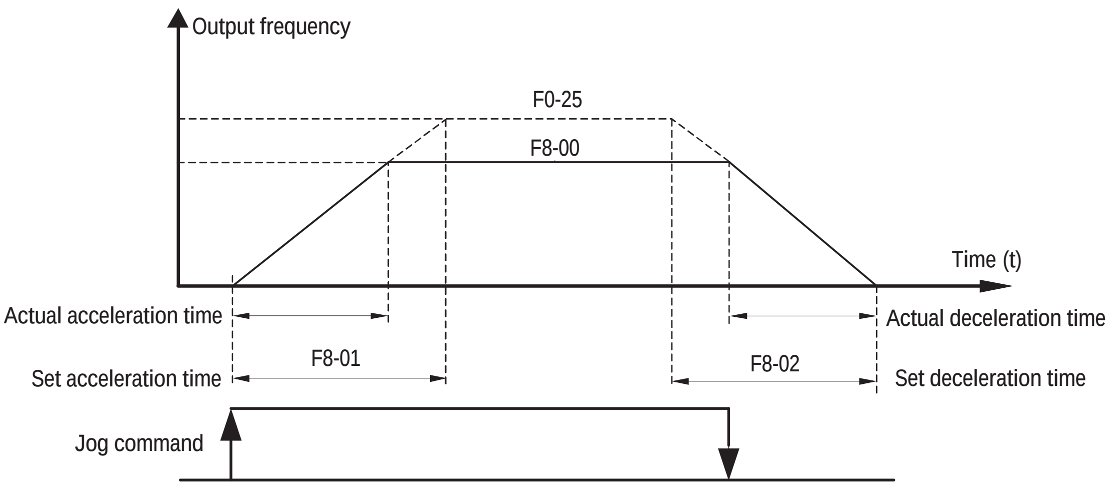
Jog acceleration time indicate the time required by the AC drive to accelerate from 0 Hz to F0-25.

Jog deceleration time indicate the time required by the AC drive to decelerate from F0-25 to 0 Hz.

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

This function parameter determines whether terminal jog overrides other commands. If this function is enabled, the AC drive will switch over to the jog running state when any of F4-00 to F4-09 is set to 4 (forward jog) or 5 (reverse jog).

Figure 7-60 Jog running



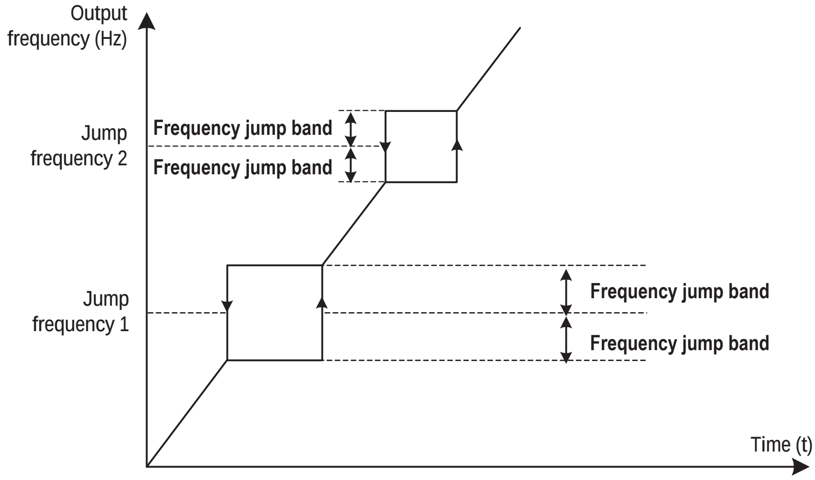
Follow the steps below to control the drive jog via the operation panel.

Steps	Forward jog	Reverse jog
1	**Set F7-01 = 3 to allocate the MF.K key with the forward jog** function.	**Set F7-01 = 4 to allocate the MF.K key with the reverse jog** function. Set F8-13 = 0 to allow reverse running.
2	Set F0-02 = 0 to select the operation panel as the command source.	Set F0-02 = 0 to select the operation panel as the command source.
3	Set F8-00, F8-01 and F8-02 properly.	Set F8-00, F8-01 and F8-02 properly.
4	In the drive stop state, press down the MF.K key. Then the AC **drive starts to jog in the forward direction. After you release the** MF.K key, the AC drive decelerates to stop.	In the drive stop state, press down the MF.K key. Then the AC **drive starts to jog in the reverse direction. After you release the** MF.K key, the AC drive decelerates to stop.

7.11.2 Jump Frequency

The frequency jump function enables the AC drive to avoid the mechanical resonance point of the load. The MD500 can be set with two separate frequencies. If both are set to 0, the frequency jump function is disabled.

Figure 7-61 Jump frequency



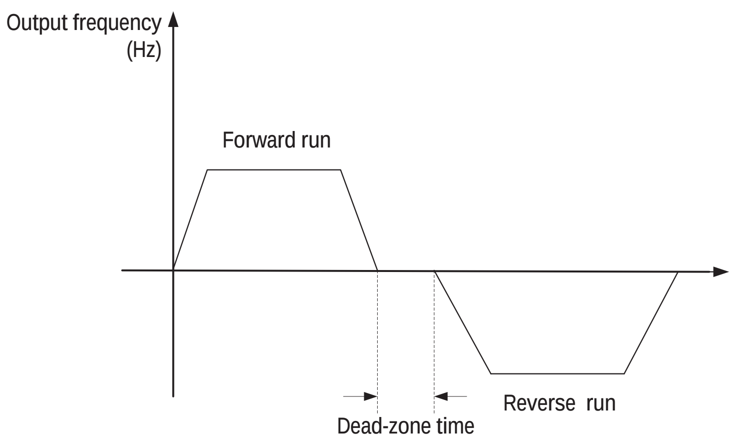
In the preceding figure, when the running frequency accelerates to the value that is close to the jump frequency during acceleration, the AC drive runs for a period at the current frequency reference and then jumps over the jump frequency. The jump width is twice of F8-11.

When the running frequency decelerates to the value close the jump frequency during deceleration, the AC drive runs for a period at the current frequency reference and then jumps over the jump frequency. The jump width is twice of F8-11.

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
F8-22	**Selection of the jump** frequency function during **acceleration/deceleration**	0: Disabled 1: Enabled	0

1. **Forward/Reverse run switchover dead-zone time**

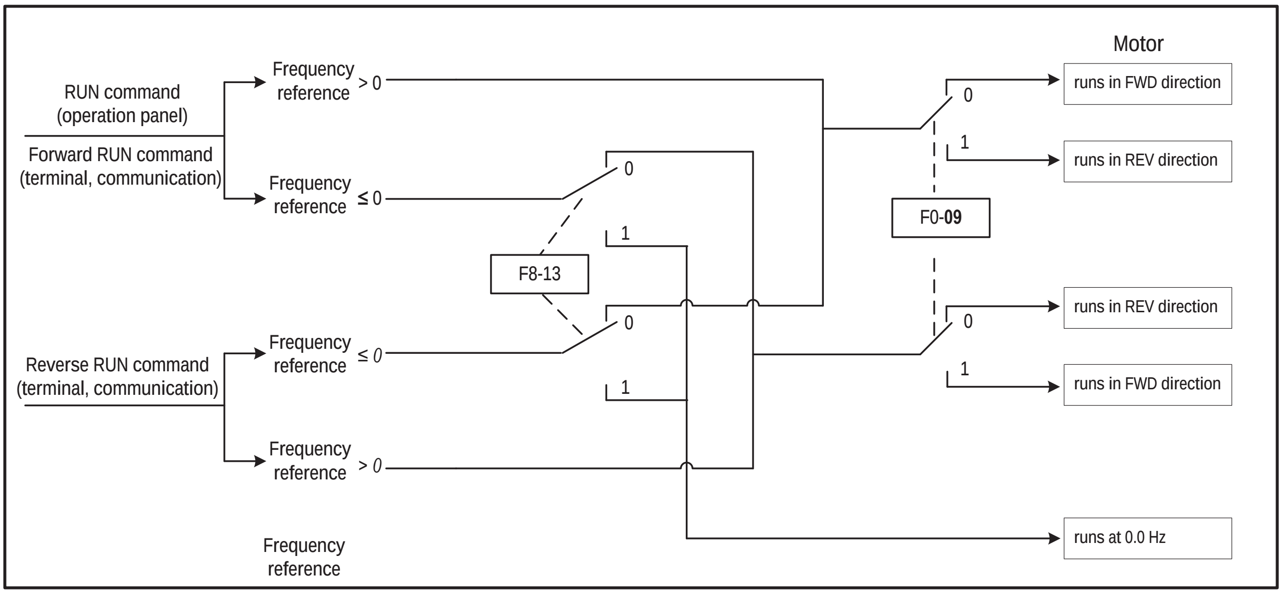
Figure 7-62 Forward/Reverse run switchover dead-zone time



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

2. Reverse run prohibited

Figure 7-63 Control of reverse run



Function Code	Parameter Name	Setting Range	Default
F8-13	Reverse RUN selection	0: Enabled 1: Disabled	0
F0-09	Running direction	**0: Run in the default direction (FWD/REV indicator off)** 1: Run in the direction reverse to the default **direction (FWD/REV indicator on)**	0

F0-09: To implement change of the rotation direction of motor, directly modify this function parameter, which is equivalent to exchanging any two of U, V, W cables of the motor.

Note

The original direction of motor will be resumed after parameter initialization. Never use this function in applications where changing the rotation direction of motor is prohibited after system commissioning is completed.

7.11.3 Droop Control

The droop control function aims at balancing the load level of two motors that drive the same load. This function is required only when both master and slave are in speed control. You must set this parameter in both master and slave.

- Droop speed = rated motor frequency x output torque x droop rate
- Actual AC drive frequency = frequency reference - droop speed

Suppose that F8-15 is set to 10%, the rated motor frequency is 50 Hz, and the output torque is 50%. The actual drive frequency = 50 **Hz – 50 x 50% x (1.00/10) = 47.5 Hz.**

Function Code	Parameter Name	Setting Range	Default
F8-15	Droop rate	0.00% to 100.00%	0.00%

1. Accumulative power-on time reached

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

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.

2. Accumulative running time reached

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

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

3. Startup protection

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

This function parameter determines whether to enable safety protection at drive startup.

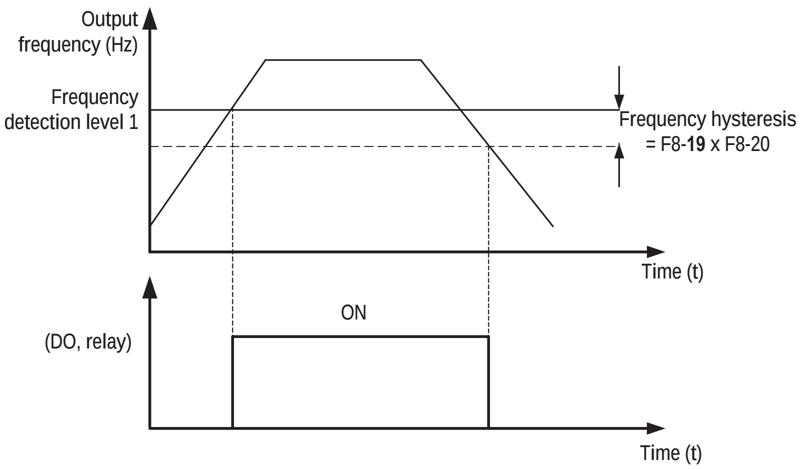
If such protection is enabled (F8-18 = 1), the AC drive will not respond to the RUN command that is input at power-on or fault reset. This helps to avoid unexpected motor running at power-on or fault reset.

The AC drive will not cancel the startup protection until you cancel the RUN command.

7.11.4 Frequency Detection (FDT)

This function sets the detection values of the output frequency and sets the hysteresis level for the frequency detection function.

Figure 7-64 Frequency detection



Function Code	Parameter Name	Setting Range	Default
F8-19	Frequency detection value 1	0.00 Hz to max. frequency	50.00 Hz
F8-20	Frequency detection hysteresis 1	0.0% to 100.0%	5.0%
F8-28	Frequency detection value 2	0.00 Hz to max. frequency	50.00 Hz
F8-29	Frequency detection hysteresis 2	0.0% to 100.0%	5.0%

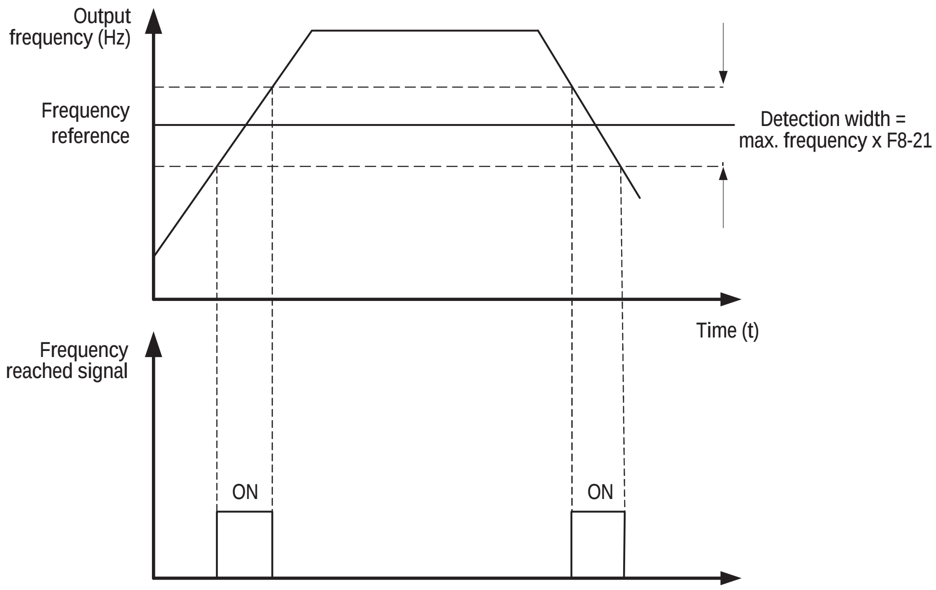
F8-19: It sets the detection value for the digital output function 3. When the drive running frequency exceeds the detection value, the digital output terminal set for function 3 becomes on.

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

7.11.5 Frequency Reference Reached Detection Width

This function sets the detection width of the frequency reference.

Figure 7-65 Frequency reached detection width

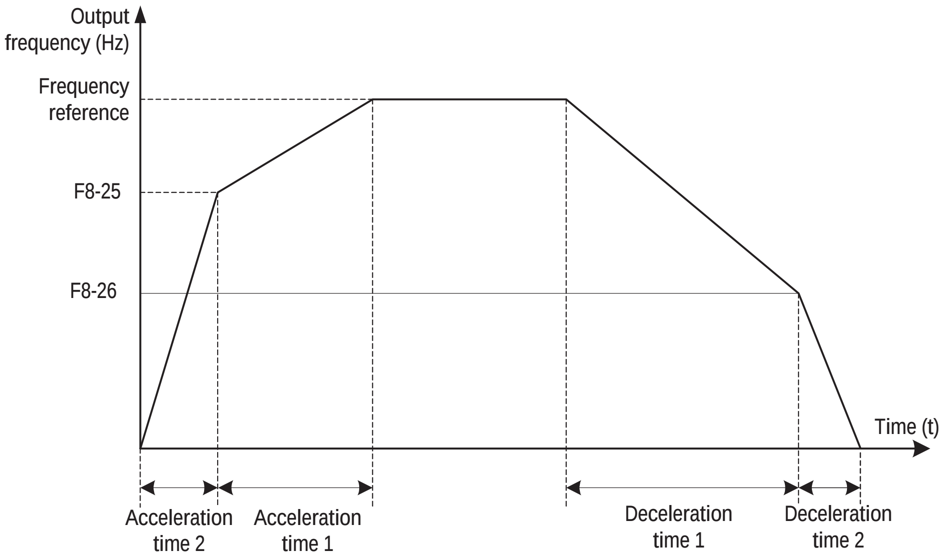


Function Code	Parameter Name	Setting Range	Default
F8-21	Detection width of target frequency reached	0.00 to 100%	0.0%

7.11.6 Acceleration/Deceleration Time Switchover Frequency Point

This function selects the acceleration/deceleration time according to the running frequency range during the drive running. This function is active only when motor 1 is selected and acceleration/deceleration time is not switched over via external DI terminal.

Figure 7-66 Acceleration/Deceleration time switchover



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.

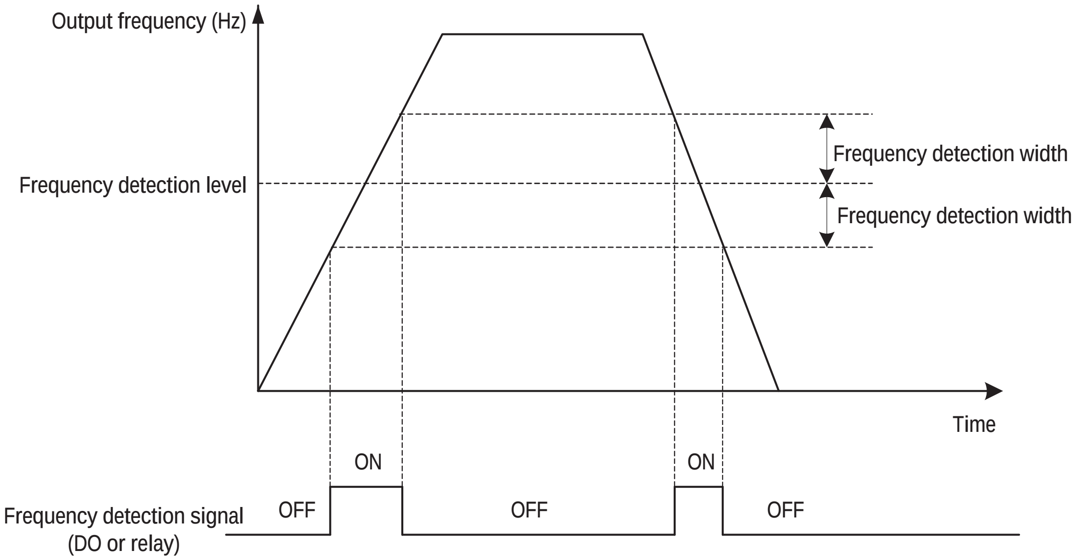
During deceleration, if the running frequency is above F8-26, deceleration time 1 is selected. If it is below F8-26, deceleration time 2 is selected.

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

7.11.7 Any Frequency Detection

This function sets the detection value and detection width any frequency.

Figure 7-67 Any frequency reached detection



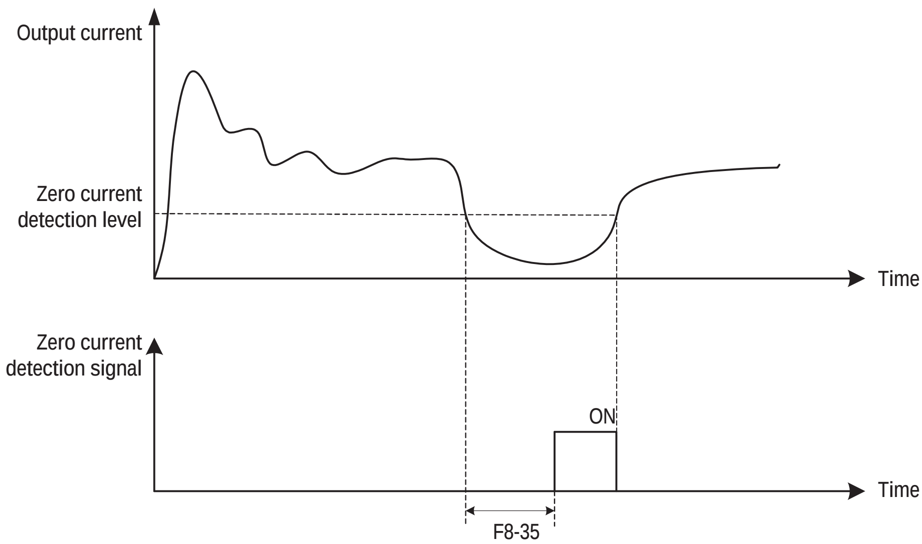
The MD500 provides two groups of frequency detection parameters for the digital output functions 26 and 27. When the output frequency is in the range of the detection width, the digital output terminal set for function 26 or 27 becomes on.

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%

7.11.8 Zero Current Detection

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 7-68 Zero current detection



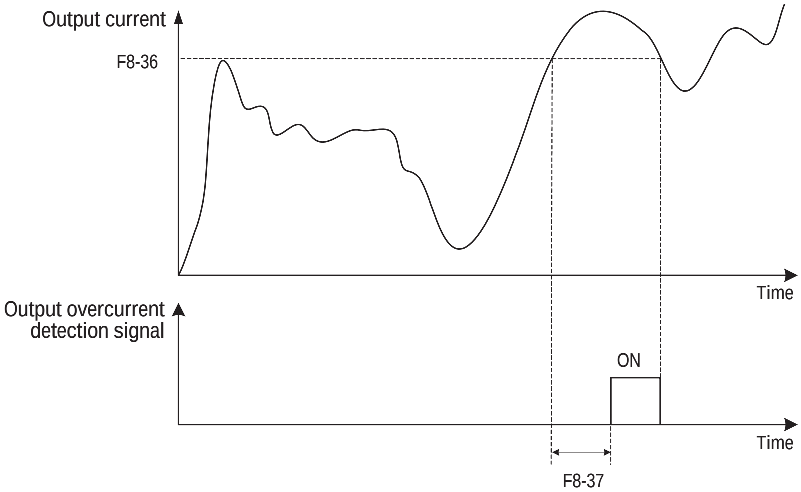
Function Code	Parameter Name	Setting Range	Default
F8-34	Zero current detection level	0.0% to 300.0% (rated motor current)	5.0%
F8-35	Zero current detection delay	0.00s to 600.00s	0.10s

7.11.9 Output Overcurrent Protection

This is to provide the overcurrent protection for the AC drive.

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 36 becomes on.

Figure 7-69 Output current limit



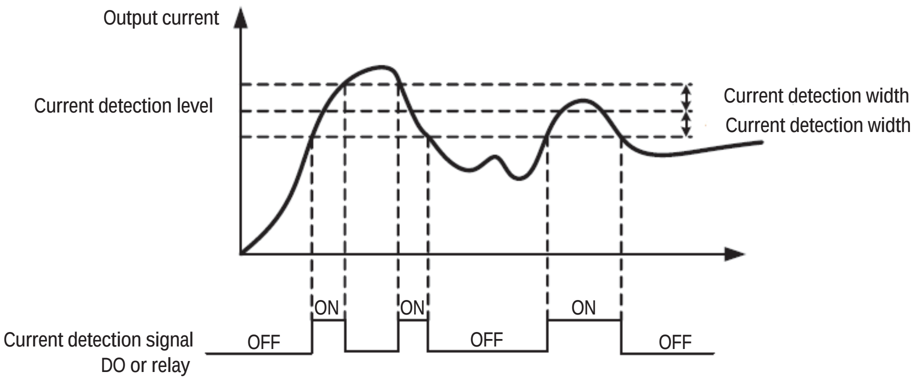
Function Code	Parameter Name	Setting Range	Default
F8-36	Output overcurrent threshold	0.0% (no detection) 0.1% to 300.0% (rated motor current)	200.0%
F8-37	Output overcurrent detection delay	0.00s to 600.00s	0.00s

7.11.10 Any Current Detection

The MD500 provides two groups of current detection level and width.

If the drive's output current reaches the width, the digital output terminals set for functions 28 and 29 become on.

Figure 7-70 Any current detection



Function Code	Parameter Name	Setting Range	Default
F8-38	Detection level 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 level 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%

7.11.11 Timing Function

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

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.

7.11.12 AI1 Input Voltage Upper/Lower Limit

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 10.00 V	6.80 V

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.

7.11.13 Module Temperature

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

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.

7.11.14 Cooling Fan

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

This function parameter sets the working mode of the cooling fan.

- F8-48 = 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.

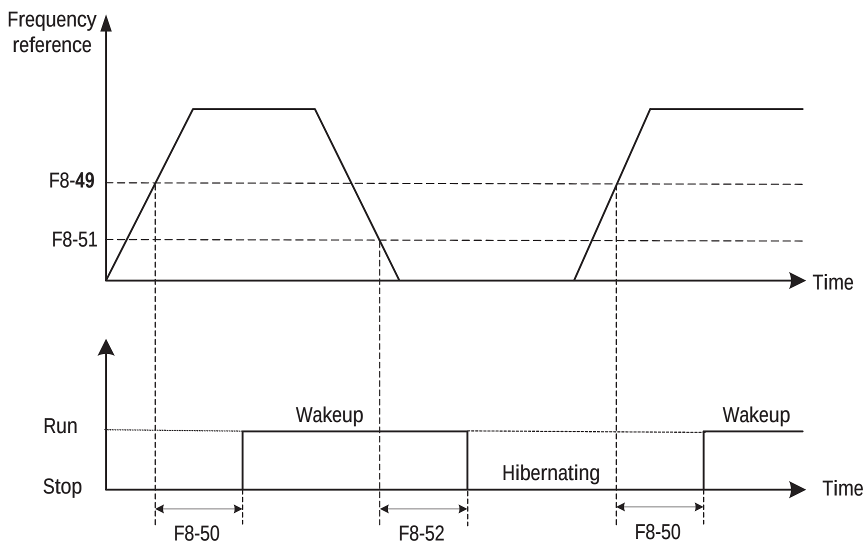
- F8-48 = 1: Working continuously

  The fan keeps working after power-on.

7.11.15 Hibernating and Wakeup

The hibernating and wakeup function is used 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.

Figure 7-71 Hibernating and wakeup



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

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).

7.11.16 Current Running Time Reached

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

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.

7.11.17 Output Power correction

Function Code	Parameter Name	Setting Range	Default
F8-54	**Output power correction coefficient**	0.00% to 200.0%	100.0%

This function parameter sets the output power correction coefficient. When the output power (U0-05) is not equal to the expected value, perform linear correction via this parameter.

8

Interfaces and Communication

8 Interfaces and Communication

8.1 About the Use of MD500 Terminals

■ Use of DI Terminals

There are five digital inputs on the control board, DI-1 to DI-5. There are five additional digital inputs on the optional I/O extension board, DI-6 to DI-10,which are available to use if you have this option installed.

All digital input terminals on the MD380 are two-state. DI configuration is by setting the values for function codes F4-38 (for DI1 to DI5) and F4-39 (forDI6 to DI10). The default value for both these function codes is 00000, which means all DI terminals use the following logic configuration:

- Logic 0 (terminal is inactive) is when the DI terminal 24 V line is not shorted to COM.
- Logic 1 (terminal is active) is when the DI terminal 24 V line is shorted to COM.

If necessary, you can change the logic configuration for any of the DI terminals by setting the relevant bit in the correct function code.

Function codes F4-00 to F4-09 define which of the 50 available functions is allocated to each of the ten DI terminals. See ## for more information about this.

Note

The hardware design allows only DI5 to receive high-speed pulse signals. If your application uses high-speed pulse counts, then you must use DI5 for this input.

■ Filter Time and Delay Functions

Function code F4-10 sets a filter time on the DI signal to improve the performance of the MD500 AC drive in conditions of strong electrical interference.

The MD500 also provides a signal delay function on digital inputs DI1 to DI3 to support some applications that require a delayed digital input. You can set the delay separately for each of the three DI terminals:

- Function code F4-35 controls the delay on DI1.
- Function code F4-36 controls the delay on DI2.
- Function code F4-37 controls the delay on DI3.

■ Use of DO Terminals

There are three digital output terminals on the control board:

- FM is a transistor output capable of driving a 24 V DC low-voltage circuit.
- DO-1 is a transistor output capable of driving a 24 V DC low-voltage circuit.
- **TA/TB/TC is a relay output that can drive a 250 V AC control circuit.**

There are two additional digital outputs on the optional I/O extension board, which are available to use if you have this option installed.

- DO-2 s a transistor output capable of driving a 24 V DC low-voltage circuit.
- **PA/PB/PC is a relay output that can drive a 250 V AC control circuit.**

Function codes F5-01 to F5-05 define how the DO terminals indicate the running state and alarm information for the AC Drive. There are 40 functions available to use for these function codes.

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: 50 VAC, 0.2 A/30 VDC, 1 A**
PA-PB-PC	F5-03	**Extension card, relay; drive capacity: 50 VAC, 0.2 A/30 VDC, 1 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 pulses on this DO terminal indicates the value of the internal running parameters. Higher values of internal running parameters produce higher pulse frequencies. The 100% value corresponds to a pulse frequency of 100 kHz.

■ Use of AI Terminals

The MD500 AC drive supports a maximum of three analog input terminals. Of these, AI1 and AI2 are on the control board, and AI3 is on the optional extension card.

Terminal	Input Signal Characteristic
AI1-GND	**It receives the signal of 0–10 VDC.**
AI2-GND	**If J8 jumps to the "V" position, the AI receives the voltage signal of 0–10 VDC.** **If J8 jumps to the "I" position, the AI receives the current signal of 0–20 mA.**
AI3-GND	It receives the signal of -10 to 10 VDC.

The analog inputs allow an external voltage or current signal to set the frequency source, the torque, the voltage setting at V/F separation, and the PID reference and feedback. Function codes F4-13 to F4-27 define the relationship between the analog input voltage or current signals and the actual controlled setting or feedback.

Sampling of the analog values on AI terminals is possible by reading function codes:

- **U0-09 shows the value of AI-1.**
- U0-10 shows the value of AI-2.
- U0-11 shows the value of AI-3.

■ Use of AO Terminals

The MD500 AC Drive supports a maximum of two analog output terminals. AO1 is on the control board and AO2 is on the optional extension card.

Terminal	Input Signal Characteristic
AO1-GND	**If J5 jumps to the "V" position, the AO outputs the voltage signal of 0 to 10 VDC.** **If J5 jumps to the "I" position, the AO outputs the current signal of 0 to 20 mA.**
AO2-GND	It outputs the voltage signal of 0 to 10 VDC.

Function codes F5-07 and F5-08 define how the AO terminals indicate the MD500 internal running parameters in analog mode.

It is possible to change the sense, offset and scaling of the parameters on the analog outputs. This is by correcting the outputs according to the formula:

Y = kX + b,

Where:

- Y = the output parameter after correction.
- X = the output parameter before correction.
- k = the scaling factor set by function code F5-11.
- b = the offset set by function code F5-10.

Note that the scaling and offset values can be positive or negative.

■ Use of PG Terminal

The closed-loop vector control (CLVC) mode with sensor, set by function code F0-01 = 1, helps to improve the stability and accuracy of motor speed control. In this case it is necessary to install an encoder on the motor to provide the sensor input to the PG card that the MD380 requires.

There are four versions of PG card to support the different encoder types:

- Differential encoder
- UVW encoder and wire-saving UVW encoder
- Resolver
- Open-collector encoder

The settings of encoder parameters F1-27 and F1-28 depend on the type of encoder used with the MD500. The following table describes the function code settings for each of the encoder types.

Encoder Type	Function Code	Description
Differential encoder	F1-27	Set to the number of pulses for each motor revolution.
	F1-28 = 0	ABZ incremental encoder
UVW encoder	F1-27	Set to the number of pulses for each motor revolution.
	F1-28 = 1	UVW incremental encoder.
Resolver	F1-28 = 2	Resolver
Open-collector encoder	F1-27	Set to the number of pulses for each motor revolution.
	F1-28 = 0	ABZ incremental encoder.
Wire-saving UVW encoder	F1-27	Set to the number of pulses for each motor revolution.
	F1-28 = 4	Wire-saving UVW encoder.

8.2 Serial Communication

You must install the relevant extension card in the MD380 and set the correct value for function code F0-28 before you can use one of the available serial communication protocols. The available serial communication protocols are:

- RS485
- PROFIBUS-DP
- CANopen
- CANlink

Note that function code F0-28 has the correct value for the CANlink communication protocol by default.

See the information about group Fd for instructions to set the hardware communication parameters for the relevant communication protocol. You must set the identical communication rate and data format for

the MD500 and for the host computer, otherwise the serial communications will not work.

The MD500 serial port supports the Modbus-RTU slave communication protocol. This port supports the following functions:

- Query and modify the MD500 function codes.
- Query various running state parameters.
- Send the Run command and the run frequency to the AC Drive from the host computer.

The MD500 arranges the function codes, the running state parameters and the run commands by using the register parameter **address mode. The host computer defines the protocol of the communication data interaction.**

8.3 About Multifunctional Extension Interfaces

The following table lists the extension cards that are available for use with the MD500 AC drive.

Name	Model	Function	Remark
I/O extension card 1	MD38IO1	Provides the following: ● Five extra DI terminals. ● Analog voltage input AI3 (with isolation) for connection to PT100 or PT1000. ● A relay output. ● A digital output. ● An analog output.	Available for models of 3.7 kW and above.
I/O extension card 2 Size B	MD38IO2	Provides three extra DI terminals.	Available for all models.
Modbus communication card	MD32-232	RS232 communication interface without isolation	Available for all models.
	MD38TX1	RS485 communication adapter with isolation	Available for all models.
CANlink communication card	MD38CAN1	CANlink communication adapter	Available for all models.
CANopen communication card	MD38CAN2	CANopen communication adapter	Available for all models.
Profibus-DP communication card	MD38DP1	**Profibus-DP communication card**	Available for models of 3.7 kW and above.
User programmable card	MD38PC1	User-programmable extension card, completely compatible with the Inovance H1U series PLC.	Available for models of 3.7 kW and above.
Differential encoder interface card	MD38PG1	Differential resolver interface card. Requires a 5 VDC power supply.	Available for all models.
Resolver interface card	MD38PG4	For use with a resolver that has an excitation **frequency of 10 kHz. The card has a DB9 interface.**	Available for all models.
Open-collector encoder interface card	MD38PG5	Open-collector encoder interface card. Requires a 15 VDC power supply.	Available for all models.
Open-collector encoder interface card	MD38PG5D	Open-collector encoder interface card with optional multiplying frequency division output. Requires a 15 VDC power supply.	Available for all models.
Differential encoder interface card	MD38PG6	Differential rotary encoder interface card Requires a 5 VDC power supply.	Available for all models.
Differential encoder interface card	MD38PG6D	Differential rotary encoder interface card with optional multiplying frequency division output. Requires a 5 VDC power supply.	Available for all models.

8.4 Definition of Communication Data Address

The MD500 series AC drive supports four communication protocols (Modbus-RTU, CANopen, CANlink, and PROFIBUS-DP). The user programmable card and point-to-point communication are derivation of the CANlink protocol. The host computer can **implement control such as monitoring and parameter viewing and modification on the AC drive through their protocols.**

MD500's communication data is classified into parameter data and non-parameter data. The non-parameter data includes running commands, running state, running parameters and alarm information.

8.4.1 Parameter Data

The paramter data provides important parameters of the AC drive. The parameter data is described as below:

MD500 parameter data	Group F (read-write)	**F0, F1, F2, F3, F4, F5, F6, F7, F8, F9, FA, FB, FC, FD, FE, FF**
	Group A (read-write)	**A0, A1, A2, A3, A4, A5, A6, A7, A8, A9, AA, AB, AC, AD, AE, AF**

The communication addresses of the parameter data are defined as follows:

1. When parameter data is read by means of communication

   For groups F0 to FF and A0 to AF, the high 16 bits of the communication address indicate the group number and the low 16 bits indicate the parameter number in the group.

   Example:

   The communication address of F0-16 is F010H, where F0H represents group F0 and 10H is the hexadecimal data format of serial number 16 in the group.

   The communication address of AC-08 is AC08H, where ACH represents group AC and 08H is the hexadecimal data format of serial number 8 in the group.

2. When function code data is written by means of communication

   For groups F0 to FF, whether the high 16 bits of the communication address are 00 to 0F or F0 to FF is decided by whether the high 16 bits are written to EEPROM. The lower 16 bits indicate the function code number in the group.

   Example:

   F0-16: If it need not be written to EEPROM, the communication address is 0010H. If it needs to be written to EEPROM, the communication address is F010H.

   For groups A0 to AF, whether the high 16 bits of the communication address are 40 to 4F or A0 to AF is decided by whether the high 16 bits are written to EEPROM. The lower 16 bits indicate the function code number in the group.

   AC-08: If it need not be written to EEPROM, the communication address is 4C08H. If it needs to be written to EEPROM, the communication address is AC08H.

8.4.2 Non-Parameter Data

MD500 non-parameter data	Status data (read-only)	Group U (monitoring parameters), AC drive fault information and AC drive running state
	Control parameters (write-only)	Control commands, communication setting values, DO control, AO1 control, AO2 control, high-speed pulse (FMP) output control and parameter initialization

■ Status Data

The status data includes group U (monitoring parameters), AC drive fault description and AC drive running state.

1. Group U (monitoring parameters)

   The high 16 bits of the communication address of U0 to UF is 70 to 7F and the low 16 bits indicate the function code number in the group. For example, the communication address of U0-11is 700BH.

2. AC drive fault description

   When the AC drive's fault description is read by means of communication, the communication address is 8000H. You can obtain the current fault code of the AC drive by reading the address.

3. AC drive running state

   When the AC drive's running state is read by means of communication, the communication address is 3000H. You can obtain **the current running state information of the AC drive by reading the address. The running state is defined in the following** table.

Communication Address of AC Drive's Running State	**Status Definition**
3000H	1: Forward run
	2: Reverse run
	3: Stop

■ Control Parameters

The control parameters include control command, communication setting values, DO control, AO1 control, AO2 control, high-speed pulse (FMP) output control and parameter initialization.

1. Control commands

   When F0-02 (command source) is set to 2 (Communication setting), you can implement control such as start/stop of the AC drive by using the communication address. The control commands are defined in the following table.

Communication Address of AC Drive's Running State	**Status Definition**
2000H	1: Forward run
	2: Reverse run
	3: Forward jog
	4: Reverse jog
	5: Coast to stop
	6: Decelerate to stop
	7: Fault reset

2. Communication reference

   The communication setting values include the data set by means of communication such as the frequency source, torque **upper limit source, V/F separation voltage source, PID setting source and PID feedback source. The communication address is 1000H. The range is -10000−10000 and the corresponding value range is -100.00% to 100.00%.**

3. DO control

When a DO terminal is allocated with function 20 (Communication setting), the host computer can implement control on DO **terminals of the AC drive through the communication address 2001H. The control on DO terminals of the AC drive is defined in** the following table.

Communication Address of AC Drive's Running State	Status Definition
2001H	BIT0: DO1 output control
	BIT1: DO2 output control
	BIT2: Relay1 output control
	BIT3: Relay2 output control
	BIT4: FMR output control
	BIT5: VDO1
	BIT6: VDO2
	BIT7: VDO3
	BIT8: VDO4
	BIT9: VDO5

4. AO1 control, AO2 control, high-speed pulse (FMP) output control

When AO1, AO2 and FMP are set to function 12 (Communication setting), the host computer can implement control on AO and **high-speed pulse outputs by means of the communication addresses. The definition is provided in the following table.**

Communication Address of AO1, AO2 and FMP Outputs		Command Definition
AO1	2002H	0 to 7FFF indicates 0% to 100%
AO2	2003H	
FMP	2004H	

5. Parameter initialization

This function is required when you need to perform parameter initialization on the AC drive by using the host computer.

If FP-00 (User password) is set to a non-zero value, pass password verification first. The host computer performs parameter initialization within 30s after password verification is successful.

The communication address of user password verification by means of communication is 1F00H. Directly write the correct user password to this address to perform password verification.

The communication address of parameter initialization by means of communication is 1F01H, defined in the following table.

Communication Address of Parameter Initialization	Command Definition
1F01H	1: Restore default settings
	2: Clear records
	4: Restore user backup parameters
	501: Back up current user parameters

8.5 Modbus Communication Protocol

The MD500 provides the RS485 communication interface and supports the Modbus-RTU communication protocol so that the user can implement centralized control, such as setting running commands and function codes, and reading working status and fault information of the AC drive, by using a PC or PLC.

This protocol defines the content and format of transmitted messages during serial communication, including master polling (or broadcasting) format and master coding method (function code for the action, transmission data, and error check). The slave uses **the same structure in the response, including action confirmation, data returning and error check. If an error occurs when the** slave receives a message, or the slave cannot complete the action required by the master, the slave returns a fault message as a response to the master.

8.5.1 Application

The AC drive is connected to a "single-master multi-slave" PC/PLC control network with the RS485 bus.

8.5.2 Bus Structure

6. Interface mode

   The RS485 extension card MD38TX1 must be inserted onto the AC drive.

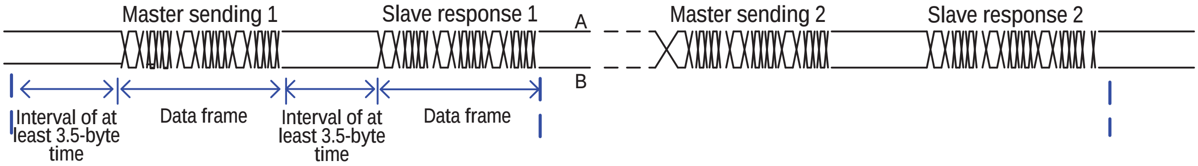
7. Topological structure

   The system consists of a single master and multiple slaves. In the network, each communication device has a unique slave address. A device is the master (can be a PC, a PLC or an HMI) and initiates communication to perform parameter read or write operations on slaves. The other devices (slaves) provide data to respond to the query or operations from the master. At the same moment, either the master or the slave transmits data and the other can only receives data.

   The address range of the slaves is 1 to 247, and 0 is the broadcast address. A slave address must be unique in the network.

8. Transmission mode

   The asynchronous serial and half-duplex transmission mode is used. During asynchronous serial communication, data is sent frame by frame in the form of message. In the Modbus-RTU protocol, an interval of at least 3.5-byte time marks the end of the the previous message. A new message starts to be sent after this interval.



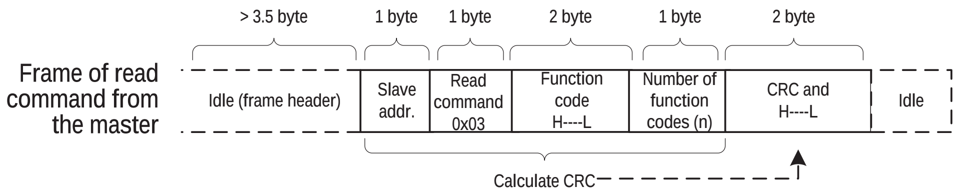
The communication protocol used by the MD500 is the Modbus-RTU slave communication protocol, which allows the MD500 **to provide data to respond to the "query/command" from the master or execute the action according to the "query/command"** from the master.

The master can be a PC, an industrial device, or a PLC. The master can communicate with a single slave or send broadcast messages to all slaves. When the master communicates with a single slave, the slave needs to return a message (response) to **the "query/command" from the master. For a broadcast message sent by the master, the slaves need not return a response.**

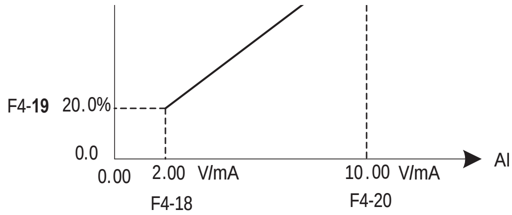
8.5.3 Data Format

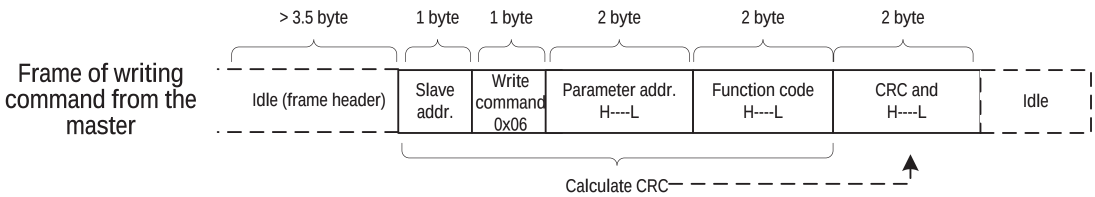
The MD500 supports reading and writing of word-type parameters only. The reading command is 0x03 and the writing command is 0x06. It does not support reading and writing of bytes or bits.

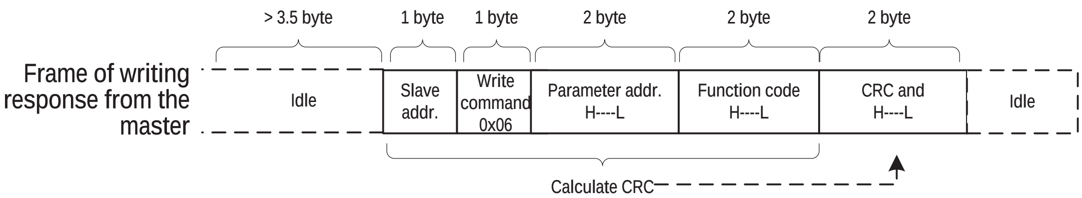
The Modbu-RTU protocol communication data format of the MD500 is as follows:



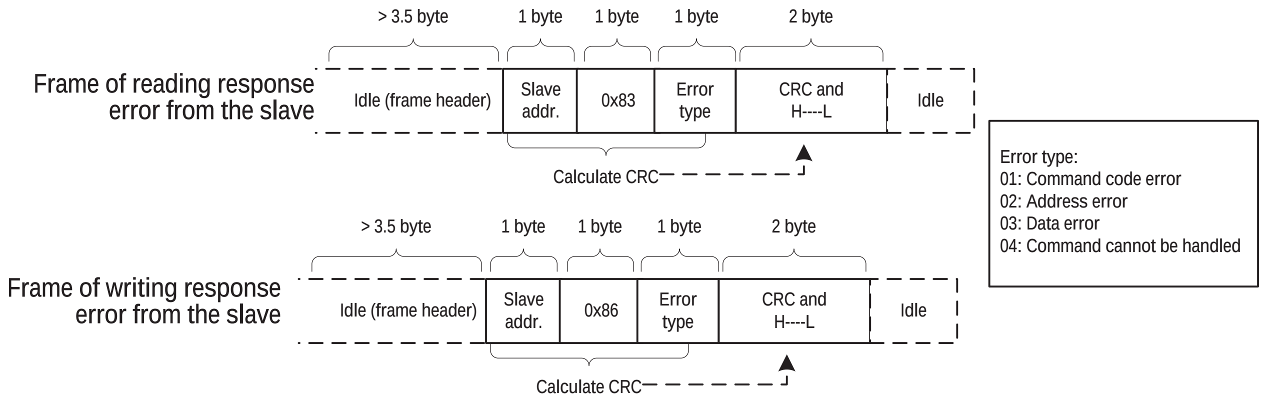
In theory, the host computer can read several consecutive parameters (n can reach up to 12) but the last parameter it reads must **not jump to the next paramter group. Otherwise, an error occurs on the response.**







If the slave detects a communication frame error or the reading/writing failure is caused by other reasons, an error frame will be returned as follows:



The frame format is described in the following table.

Frame header (START)	Greater than the 3.5-byte transmission idle time
Slave address (ADR)	Communication address : 1 to 247 0: Broadcast address
Command code (CMD)	03:Read slave parameters 06: Write slave parameters
Function code address (H) Function code address (L)	It is the internal parameter address of the AC drive, expressed in heximecal format. The parameters include functional parameters and non-functional parameters (running state and running command). During transmission, low-order bytes follow the high-order bytes.
Number of function codes (H) Number of function codes (L)	It is the number of function codes read by this frame. If it is 1, it indicates that one function code is read. During transmission, low bytes follow high bytes. **In the present protocol, only one function code is read once, and this field is unavailable.**
Data (H) Data (L)	It is the response data or data to be written. During transmission, low-order bytes follow the high-order bytes.
CRC CHK high bytes CRC CHK low bytes	**It is the detection value (CRC16 verification value). During** transmission, low-order bytes follow the high-order bytes.
END	It is 3.5-byte transmission time.

■ CRC check

In the Modbus-RTU mode, a message includes a CRC-based error-check field. The CRC field checks the content of the entire **message. The CRC field is two bytes, containing a 16-bit binary value. The CRC field is calculated by the transmitting device,** and then added to the message. The receiving device recalculates a CRC value after receiving the message, and compares the **calculated value with the CRC value in the received CRC field.**

The CRC is first stored to 0xFFFF. Then a procedure is invoked to process the successive 8-bit byte in the message and the value in the register. Only the eight bits in each character are used for the CRC. The start bit, stop bit and the parity bit do not apply to the CRC.

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

The CRC is added to the message from the low-order byte followed by the high-order byte. The CRC simple function is as follows:

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

8.5.4 Definication of Communication Parameter Addresses

■ Read and Written Parameters

Function parameters can be read and written (except the ones that cannot be changed because they are only for the factory use or for monitoring).

The parameter group No. and parameter identifying No. are used to express the parameter address.

- High-order bytes: F0 to FF (groups F), A0 to AF (groups A), 70 to 7F (group U)
- Low-order bytes: 00 to FF

For example, to read parameter F3-12, the communication address of F3-12 is expressed as 0xF30C.

Note

- Group FF: They are factory parameters. The parameters cannot be read or changed.
- Group U: These parameters can only be read.

Some parameters cannot be modified when the AC drive is running. Some parameter cannot be modified regardless of the state of the AC drive. In addition, pay attention to the setting range, unit and description of parameters when modifying them.

Parameter Group	Visited Address	Parameter Address in RAM
F0 to FE	0xF000 to 0xFEFF	0x0000 to 0x0EFF
A0 to AC	0xA000 to 0xACFF	0x4000 to 0x4CFF
U0	0x7000 to 0x70FF	-

Frequent storage to the EEPROM reduces its service life. Therefore, in the communication mode, users can change the values of certain function code parameters in the RAM rather than storing the setting.

- For groups F parameters, users only need to change high order F of the function code address to 0.
- For groups A parameters, users only need to change high order A of the function code address to 4.

The function code addresses are expressed as follows:

- High-order bytes: 00 to 0F (groups F), 40 to 4F (groups A)
- Low-order bytes: 00 to FF

For example, if function code F3-12 is not stored into EEPROM, the address is expressed as 030C; if function code A0-05 is not stored into EEPROM, the address is expressed as 4005.

It is an invalid address when being read.

Users can also use the command code 07H to implement this function.

■ **Stop/RUN Parameters:**

Parameter Address	Description	Parameter Address	Description
1000	Communication setting value (Decimal): -10000 to 10000	1010	PID reference
1001	Running frequency	1011	PID feedback
1002	Bus voltage	1012	PLC process
1003	Output voltage	1013	Pulse input frequency, unit: 0.01 kHz
1004	Output current	1014	Feedback speed, unit 0.1Hz
1005	Output power	1015	Remaining running time
1006	Output torque	1016	AI1 voltage before correction
1007	Running speed	1017	AI2 voltage before correction
1008	DI input indication	1018	AI3 voltage before correction
1009	DO output indication	**1019**	Linear speed
100A	AI1 voltage	101A	Current power-on time
100B	AI2 voltage	101B	Current running time
100C	AI3 voltage	101C	Pulse input frequency, unit 1Hz
100D	Counting value input	101D	Communication reference
100E	Length value input	101E	Actual feedback speed
100F	Load speed	101F	Main frequency reference display
-	-	1020	Auxiliary frequency reference display

Note

- The communication setting value indicates the percentage: 10000 corresponds to 100.00%, and -10000 corresponds to -100.00%.
- With regard to frequency, the communication reference is a percentage of F0-10 (maximum frequency).
- With regard to torque, the communication reference is a percentage of F2-10 and A2-48 (respectively corresponding to motors 1 and 2).

Control command input to AC drive (write-only):

Command Word Address	Command Word Function
2000H	0001: Forward run
	0002: Reverse run
	0003: Forward jog
	0004: Reverse jog
	0005: Coast to stop
	0006: Decelerate to stop
	0007: Fault reset

Read AC drive state (read-only):

Command Word Address	Command Word Function
3000H	0001: Forward RUN
	0002: Reverse RUN
	0003: Stop

Parameter lock password check

If "8888H" is returned, it indicates that the password check is passed.

Password Address	Password Content
1F00H	*****

DO terminal control (write-only)

Command Address	Command Content
2001H	BIT0: DO1 control BIT1: DO2 control BIT2: RELAY1 control BIT3: RELAY2 control BIT4: FMR control BIT5: VDO1 BIT6: VDO2 BIT7: VDO3 BIT8: VDO4 **BIT9: VDO5**

AO1 control (write-only)

Command Address	Command Content
2002H	0 to 7FFF indicates 0% to 100%.

AO2 control (write-only)

Command Address	Command Content
2003H	0 to 7FFF indicates 0% to 100%.

Pulse output control (write-only)

Command Address	Command Content
2004H	0 to 7FFF indicates 0% to 100%.

AC drive fault description

AC Drive Fault Address	AC Drive Fault Information	
8000	0000: No fault	0015: Parameter read and write fault
	0001: Reserved 0002 Overcurrent during acceleration	0016: AC drive hardware fault
		0017: Motor short circuited to ground
	0003: Overcurrent during deceleration	0018: Reserved
	0004: Overcurrent at constant speed	**0019: Reserved**
	0005: Overvoltage during acceleration	001A: Accumulative running time reached
	0006: Overvoltage during deceleration	**001B: User-defined fault 1**
	0007: Overvoltage at constant speed	**001C: User-defined fault 2**
	0008: Buffer resistor overload	001D: Accumulative power-on time reached
	0009: Undervoltage	001E: Load lost
	000A: AC drive overload	001F: PID feedback lost during running
	000B: Motor overload	0028: Fast current limit timeout
	000C: Power input phase loss	**0029: Motor switchover error during running**
	000D: Power output phase loss	002A: Too large speed deviation
	000E: Module overheat	002B: Motor over-speed
	000F: External fault	002D: Motor overheat
	0010: Communication fault	005A: Incorrect setting of PPR of the encoder
	0011: Contactor fault	005B: Not connecting the encoder
	0012: Current detection fault	005C: Initial position error
	0013: Motor auto-tuning fault	005E: Speed feedback error
	0014: Encoder/PG card fault	

8.5.5 Group Fd Communication Parameter Description

Function Code	Parameter Name	Setting Range	Default
Fd-00	Baud rate	Unit's digit (Modubs) 0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps **5: 9600 bps** **6: 19200 bps** 7: 38400 bps 8: 57600 bps **9: 115200 bps**	6005

This parameter is used to set the data transmission speed between the host computer and the AC drive.

Note that the baud rate of the host computer must be the same as that of the AC drive. Otherwise, communication shall fail. The higher the baud rate is, faster the communication will be.

Function Code	Parameter Name	Setting Range	Default
Fd-01	Data format	**0: No check <8,N,2>** **1: Even parity check <8,E,1>** **2: Odd parity check <8,O,1>** **3: No check, data format <8,N,1>**	0

Note that the data format of the host computer must be the same as that of the AC drive. Otherwise, communication shall fail.

Function Code	Parameter Name	Setting Range	Default
Fd-02	Local address	**1 to 249** 0: Broadcast address	1

This parameter is used to set the address of the AC drive. This address is unique (except the broadcast address), which is the basis for point-to-point communication between the host computer and the AC drive.

When the local address is set to 0 (that is, the broadcast address), the AC drive can only receive and execute broadcast commands of the host computer, but will not respond to the host computer.

Function Code	Parameter Name	Setting Range	Default
Fd-03	Response delay	0 to 20 ms	2 ms

This parameter is used to set the delay from the time when AC drive receives the frame matching the local address to the time when it AC drive starts returning a response frame. Too short response delay may make the host computer fail to receive the frame in time. If the response delay is shorter than the system processing time, the system processing time shall prevail. If the response delay is longer than the system processing time, the system sends data to the host computer only after the response delay is up.

Function Code	Parameter Name	Setting Range	Default
Fd-04	Communication timeout	0.0s to 60.0s	0.0s

When the AC drive does not receive the communication signal within the time set in this parameter, it will report the communication timeout fault (Err16).

When this parameter is set to 0.0s, the system does not detect communication timeout.

Generally, this parameter is set to 0.0s. In applications with continuous communication, you can use this parameter to monitor the communication status.

Function Code	Parameter Name	Setting Range	Default
Fd-05	Communication protocol	0: Non-standard Modbus protocol 1: Standard Modbus protocol	0

Fd-05 = 1: Standard Modbus protocol

Fd-05 = 0: For the read command, the slave returns an additional byte. For details, see "Data Format" in this appendix.

Function Code	Parameter Name	Setting Range	Default
FD-06	Current resolution read by communication	0: 0.01 A 1: 0.1 A	0

This parameter is used to set the unit of the output current read by communication.

9

Peripherals and Options

9 Peripherals and Options

DANGER

To Prevent Electric Shock

- Never wire the AC drive while the power is on.
- Always keep the MCCB in the off state.

WARNING

To Prevent Overheating and Fire

- When installing the drive inside the enclosed cabinet, use the cooling fan or air conditioner to keep the air inlet temperature below 50°C.

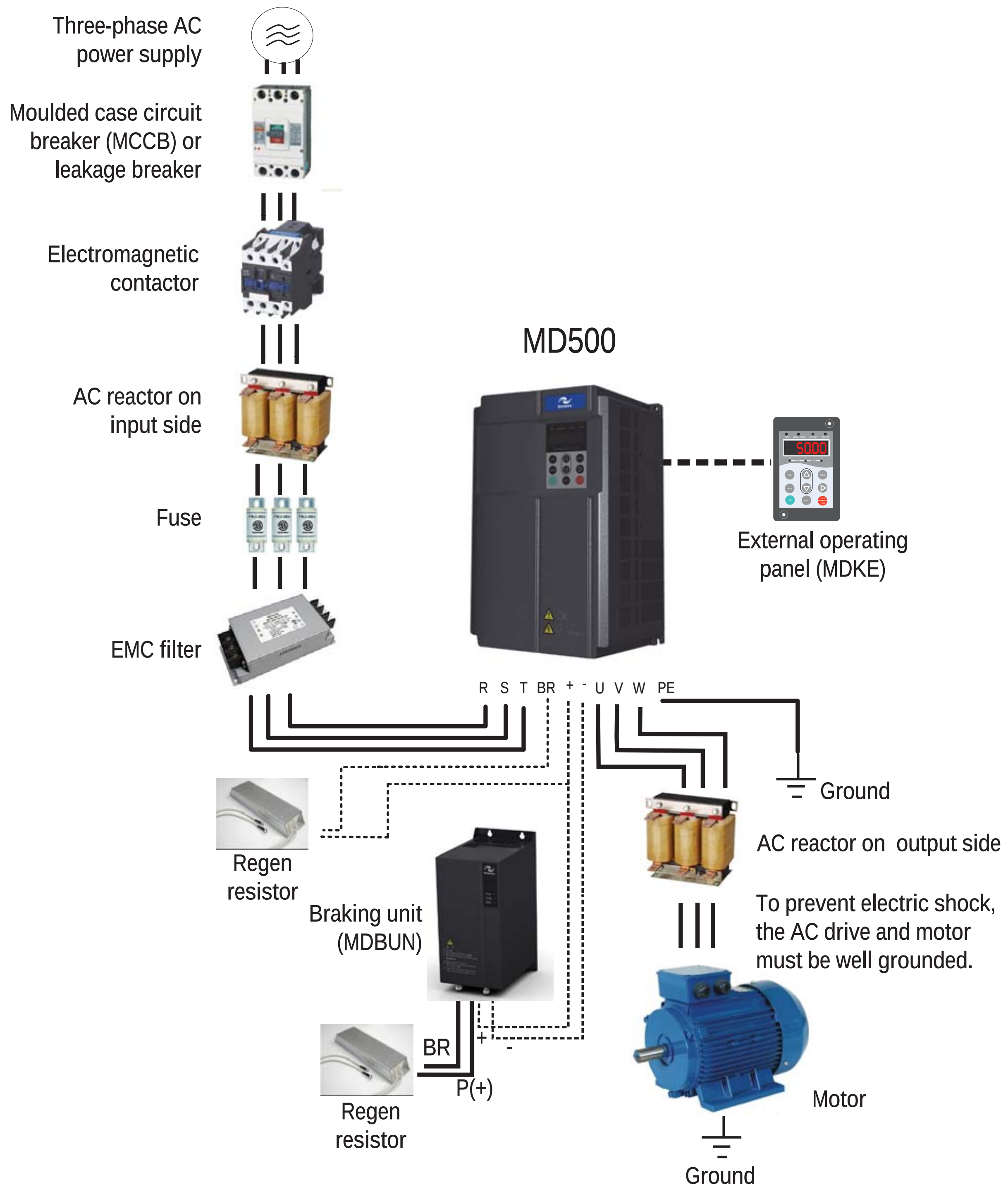
CAUTION

To Prevent Damage to the Equipment

- Cover the top of the drive with a temporary cloth or paper during installation so as to prevent foreign matter such as metal shavings, oil and water from falling into the drive. After the installation is completed, remove the temporary cloth or paper.
- Follow the proper electrostatic discharge (ESD) procedures when operating the AC drive. Failure to comply will damage the internal circuit of the drive.
- Operating the motor at low speed lowers the cooling effect and increases the motor temperature, which will result in damage to the motor. The motor speed range differs with the lubrication mode and the motor manufacturer. When operating the motor out of the speed range, contact the manufacturer.
- The torque characteristic is different with drive operation compared with operation by commercial power supply. Please check the load torque characteristic of the connected machine.
- Pay attention to the load torque characteristic when selecting the drive capacity. In addition, when the distance between the motor and drive is long, use a cable thick enough to connect the motor and the drive to prevent motor torque reduction
- **The current rating differs for a pole-changing motor from a standard motor. Please confirm the maximum current** of the motor and select corresponding drive. Always switch the motor poles after the motor is stopped.
- Never lift the AC drive while the front cover is removed. Failure to comply may result in damage to the PCB and terminal block.

9.1 Connecting Peripheral Devices

Figure 9-1 shows how to configure the AC drive (380 to 480 V, 18.5 kW and above) to operate with the peripheral devices.



Note

Figure 9-1 just illustrates the connection of peripheral devices. It is not a selection guidance of these devices.

Description of Peripheral Electrical Devices

Device	Mounting Location	Function Description
Breaker	Power input side	MCCB: Cut off power supply when overcurrent occurs on downstream devices Leakage breaker: Provide protection against potentially leakage current **during the drive running to prevent electric shock and even a fire.**
Contactor	Between breaker and AC drive input side	Start and stop the AC drive. 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.
AC reactor	AC drive input side	Improve the power factor of the power input side. Eliminate the higher harmonics of the input side effectively and prevent other devices from being damaged due to distortion of the voltage waveform. Eliminate the input current unbalance due to inter-phase unbalance.
Fuse	AC drive input side	Provide protection in case of short circuit.
EMC filter	AC drive input side	Reduce the external conduction and radiation interference of the AC drive. **Decrease the conduction interference flowing from the power supply to** the AC drive and improve the anti-interference capacity of the AC drive.
Regen resistor	-	Use regen resistor for the G-type model of 75 kW and below. Dissipate the regenerative energy during the motor deceleration
Braking unit	-	Use the braking unit MDBUN of Inovance and the recommended regen resistor for the P-type model of 75 kW and below. Dissipate the regenerative energy during the motor deceleration
Output side reactor	Between AC drive output side and the motor, close to the AC drive	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: Degrade the motor insulation performance and damage the motor in the long run. Generate large leakage current and cause frequent AC drive protection trips. If the distance between the AC drive and the motor is greater than 100 m, install an AC output reactor.
dv/dt reactor	Between AC drive output side and the motor, close to the AC drive	Provide the motor insulation protection and reduces the bearing current.
Common-**mode filter**	Between AC drive output side and the motor, close to the AC drive	Reduce the bearing current.
Motor	AC drive output side	Select an appropriate motor.
DC reactor	-	**It is standard configuration for the MD500 series AC drive of 30G/30P above.** Improve the power factor of the input side. **Improve the efficiency and thermal stability of the AC drive.** Eliminate the impact of higher harmonics of the AC drive input side and reduce the external conduction and radiation interference.

Note

- Do not 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.**

9.1.1 Selection Guidance on Input and Output Cables

MD500 Model	IEC Cable on Input Side (mm^2) <1>	Cable on Input Side (AWG/kcmil) <2>	IEC Ground Cable (mm^2)	NEC Ground Cable (AWG)	IEC Cable on Output Side (mm^2)	Cable on Output Side (AWG/kcmil)
Three-phase 380 to 480 V, 50/60 Hz						
MD500T18.5G	3 x 10	6	10	8	3 x 10	6
MD500T22G	3 x 16	4	16	8	3 x 16	4
MD500T30G	3 x 16	4	16	8	3 x 16	4
MD500T37G	3 x 16	3	16	6	3 x 16	3
MD500T45G	3 x 25	2	16	6	3 x 25	2
MD500T55G	3 x 50	**1/0**	25	6	3 x 50	**1/0**
MD500T75G	3 x 70	**2/0**	35	4	3 x 70	**2/0**
MD500T90G	**3 x 95**	**3/0**	50	4	**3 x 95**	**3/0**
MD500T110G	3 x 120	1 x 2P	70	3	3 x 120	1 x 2P
MD500T132	3 x 150	350	70	3	3 x 150	350
MD500T160	3 x 185	500	**95**	2	3 x 185	500
MD500T200	**2 x (3 x 95)**	700	**95**	1	**2 x (3 x 95)**	700
MD500T220	2 x (3 x 120)	**900**	120	**1/0**	2 x (3 x 120)	**900**
MD500T250	2 x (3 x 120)	1000	120	**1/0**	2 x (3 x 120)	1000
MD500T280	2 x (3 x 150)	1500	150	**1/0**	2 x (3 x 150)	1500
MD500T315	2 x (3 x 185)	500 x 2P	185	**2/0**	2 x (3 x 185)	500 x 2P
MD500T355	2 x (3 x 185)	500 x 2P	185	**2/0**	2 x (3 x 185)	500 x 2P
MD500T400	2 x (3 x 240)	600 x 2P	240	**3/0**	2 x (3 x 240)	600 x 2P

MD500 Model	Terminal Width(mm)	Screw Specification	JST Terminal Width (UL Certified)	
			Model	Terminal Width
Three-phase 380 to 480 V, 50/60 Hz				
MD500T18.5G	15.0	M6	14-6	12.0
MD500T22G			22-S6	12.0
MD500T30G	18.0	M6	22-6	16.5
MD500T37G			38-S6	15.5
MD500T45G	26.8	M8	38-8	22.0
MD500T55G			60-8	22.0
MD500T75G	30.6	M12	70-12	24.0
MD500T90G			80-12	27.0
MD500T110G			60-12	22.0
MD500T132	*	*	*	*
MD500T160	*	*	*	*
MD500T200	*	*	*	*
MD500T220	*	*	*	*
MD500T250	*	*	*	*
MD500T280	*	*	*	*
MD500T315	*	*	*	*
MD500T355	*	*	*	*
MD500T400	*	*	*	*

Note

- *** indicates the specification is unavailable now.**
- **<1> is applicable to the Chinese standard. 3 x 10 represents one three-core cable and 2 x (3 x 95) represents two three-core cables.**
- **<1> is applicable to the US standard.**

9.1.2 Selection Guidance on Fuse, Breaker, Contactor, Reactor and Filter

The selection of fuse, breaker, contactor, reactor and filter is described in Chapter 13 EMC. For details, see the chapter.

9.1.3 Braking Unit and Regen Resistor

■ Selection of Resistance of Regen Resistor

The AC drive transfers the regenerative energy generated during the braking of the motor to the externally mounted regen resistor.

According to the formula U x U/R = Pb:

- U refers to the braking voltage at system stable braking.
- The U value varies with the system. The 380 VAC system usually selects 700 V braking voltage.
- Pb refers to the braking power.

■ Selection of Power of Regen 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 × Pr = Pb × D

- K ranges from 15% to 30%.
- Pr 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 & unwinding	Centrifuge	Occasional braking load	General Application
Braking Frequency	20% to 30%	20% to 30%	50% to 60%	5%	10%

Note

The preceding table is for reference only. You can select the resistance and power of the regen resistor based on actual needs. However, the resistance must not be lower than the reference value. The power may be higher than the reference value. Selection of the regen resistor model is determined by the generation power of the motor and is also **related to the system inertia, deceleration time and potential energy load. For systems with high inertia, and/or short deceleration time, and/or frequent braking, select a regen resistor with higher power and lower resistance value.**

■ Selection Guidance

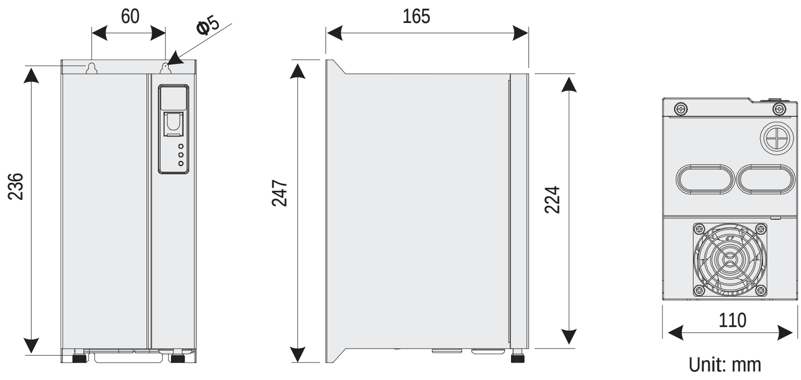
AC Drive Model	Resistance for Long Running (ohm)	Power for Long Running (W)	Min. Resistance (ohm)	Min. Power (W)	Braking Unit	Remark	
MD500T18.5GB MD500T22PB	82.2	38000	24	13000	Built-in	**AC drive model ending with letter "B"**	
MD500T22GB MD500T30PB	**69.1**	45000	24	13000			
MD500T30GB MD500T37PB	50.7	61000	**19.2**	16000			
MD500T37GB MD500T45PB	41.1	75000	12.8	24000			
MD500T45GB MD500T55PB	33.8	**91000**	12.8	24000			
MD500T55GB MD500T75PB	27.7	110000	**9.6**	32000			
MD500T75GB **MD500T90PB**	20.3	150000	6.8	45000			
MD500T90G MD500T110P	11.2 x 2	200000 x 2	**9.3 x 2**	24000 x 2	External	**Input voltage ≤ 440 VAC**	MDBUN-60-T x 2
	12.7 x 2	227000 x 2	10.6 x 2	27000 x 2		Input voltage > 440 VAC	MDBUN-60-5T x 2
MD500T110G MD500T132P	11.2 x 2	200000 x 2	**9.3 x 2**	24000 x 2	External	**Input voltage ≤ 440 VAC**	MDBUN-60-T x 2
	12.7 x 2	227000 x 2	10.6 x 2	27000 x 2		Input voltage > 440 VAC	MDBUN-60-5T x 2

Note

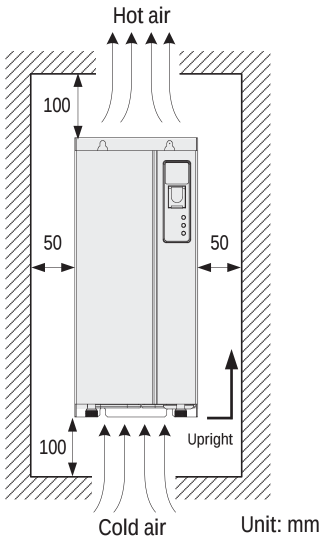
- Resistance for long running indicates the minimum resistance value of regen resistor that can support the braking unit to operate continuously for long time.
- Min. resistance supports the operating condition with braking frequency of 10% and longest time for single braking of 10s.
- The default initial braking voltage of the built-in braking unit is 780 V. The default initial braking voltage of the MDBUN-60-T is 670 V, and that of the MDBUN-60-5T is 760 V. If the default initial braking voltage is increased, the resistance value of corresponding regen resistor must also be increased.
- **" x 2" indicates two braking units with their respective regen resistor connected in parallel.**

Mounting Dimensions

The following figure shows the mounting dimensions of the MDBUN series braking unit.



Always mount the MDBUN series braking unit in an upright position.



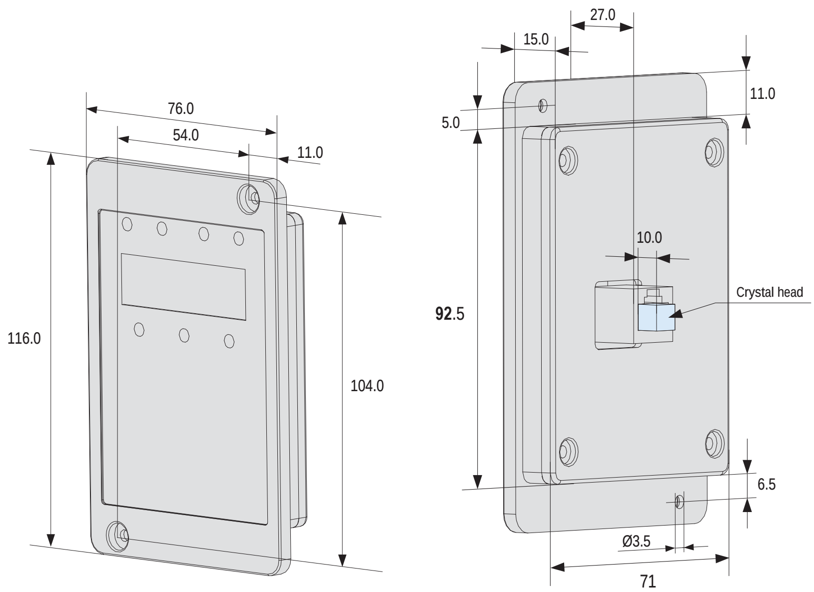
For use and installation of the MDBUN series braking unit, refer to the MDBUN Series Braking Unit User Manual.

9.2 Options

9.2.1 External Operating Panel

The MD32NKE1 is the external operating panel applicable to the MD500 drive. It adopts the LED display and has the same operation mode as the operating panel on the drive. It is designed to facilitate you to commission the drive.

The following figures show the physical appearance and mounting dimensions of the MD32NKE1.



9.2.2 Extension I/O Card (MD38IO1)

■ Overview

MD38IO1 is developed by Inovance and is designed for extension of input and output terminals of the MD500 drive.

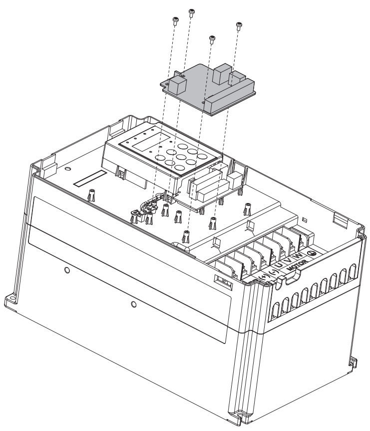
Item	Specification	Description
Input terminals	Five digital input (DI) terminals	**Supports 9 to 30 V dual-polarity input.**
	One analog input (AI) terminal that supports voltage input	Supports -10 to 10 V input.
Output terminals	One relay output terminal	250 VAC, 3 A; 30 VDC, 1 A
	One digital output (DO) terminal	0 to 24 V, 0 to 50 mA, Optically-coupled isolation
	One analog output (AO) terminal	0 to 10 V, 0 to 20 mA
Communication	RS485 communication interface	Supports the Modbus-RTU communication protocol (see Appendix I: MD500 Modbus Communication Protocol for details).
	CAN communication interface	Supports the CANlink communication protocol.

■ Physical Appearance

■ Mechanical Installation

The MD38IO1 an embedded extension card. Power off the drive and wait for a period of 10 minutes until the charging indicator goes off before starting the installation work.

As shown in the following figure, insert the MD38IO1 card into the drive and fix it with the prepared screws.



Note

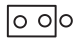
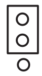
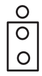
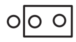
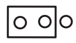
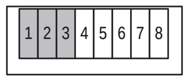
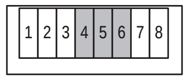
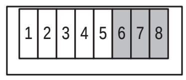
Never install or remove the MD38IO1 card at power-on. In dry season, touch the nearest grounding body to discharge before contacting the extension card so as to prevent damage to components of the card caused by human static electricity.

Description of Terminals and Jumpers

The following table describes the terminals of the MD38IO1.

Type	Terminal	Terminal Name	Function Description
Power supply	+24V-COM	External +24V power supply	Provide a +24 V power supply to an external unit. **Generally used to supply DI/DO terminals and external sensors.** Max. output current: 200 mA
	OP1	Digital input power terminal	**Connect to +24V by the jumper J8 by default.** When applying an external power supply, remove **the jumper J8 to disconnect the OP1 from +24V and** connect the OP1 to the external power supply.
Analog input	AI3-PGND	Analog input 3	Optically-coupled isolation input, supporting differential voltage input and temperature detection resistance input Input voltage range: -10 to 10 VDC Connect the PT100 or PT1000 temperature sensor Input mode determined by DIP switch S1, multiple functions not supported simultaneously
Digital inputs	DI6-OP1	Digital input 6	Optically-coupled isolation compatible with dual-polarity inputs **Input resistance: 2.4 kΩ** **Voltage range for inputs: 9 to 30 V**
	DI7-OP1	Digital input 7	
	DI8-OP1	Digital input 8	
	DI9-OP1	**Digital input 9**	
	DI10-OP1	Digital input 10	
Analog output	AO2-GND	Analog output 2	Output voltage range: 0 to 10 V Output current range: 0 to 20 mA **Output current with resistance range: 0 to 500 Ω**
Digital output	DO2-CME	Digital output 2	Optically-coupled isolation, dual-polarity open-collector output Output voltage range: 0 to 24 V Output current range: 0 to 50 mA Note that CME1 and COM are internally insulated, but are **shorted by the jumper J7 internally. Remove the jumper** J7 if you need to apply external power to DO2.
Relay outputs (RELAY2)	PA- PB	Normally-closed (NC) terminal	Contact driving capacity: 250 VAC, 3 A, Cos f = 0.4 30 VDC, 1 A
	PA- PC	Normally-closed (NC) terminal	
RS485 communication	**485+/485-/** COM	Communication interface	Modbus-RTU communication input and output terminal, isolated input
CAN communication	**CANH/CANL/** COM	Communication interface	CANlink communication input terminal, isolated input

The following table describes the jumpers of the MD38IO1.

Jumper	Description	Meaning	Setting
J3	AO2 output selection: voltage or current	Voltage	
		Current	
J4	CAN terminal resistor matching selection	Matching the terminal resistor	
		Not matching the terminal resistor	
S2	RS485 terminal resistor matching selection	Matching the terminal resistor	DIP switch set to ON
		Not matching the terminal resistor	DIP switch set to OFF
J7	CME1 connecting mode selection	CME1 connected to COM	
		CME1 connected to +24V	
J8	OP1 connecting mode selection	If DI connected in SINK mode, OP1 connected to +24V	
		If DI connected in SOURCE mode, OP1 connected to COM	
S1	AI3, PT100, PT1000 selection	AI3: 1, 2, 3 set to ON	
		PT1000: 4, 5, 6 set to ON	
		PT100: 6, 7, 8 set to ON	

Note

The setting of the jumpers takes the top view with the main terminals at the bottom of the card as the visual angle. The jumpers are silk-screened on the card.

■ Terminal Wiring

- For wiring of DI, DO, AI and AO terminals, see section 3.3 Control Circuit Wiring.
- For the Modbus communication, see section C.6.2 Modbus Communication Protocol.
- For the CAN communication, see section C.3 Extension CANlink Card (MD38CAN1).

When using the CANlink or Modbus protocol for communication, connect a terminal resistor to the end AC drive (via jumper J4 or S2) for long-distance communication or multi-node communication. COM is the ground terminal of the CANlink or Modbus communication.

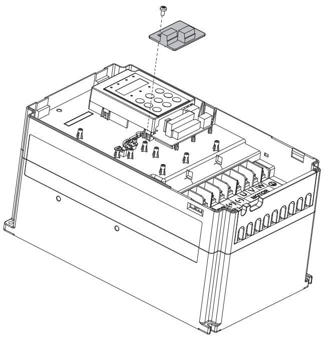
9.2.3 Extension Mini I/O Card (MD38IO2)

■ Overview

MD38IO2 is the simplified version of MD38IO1 and provides three DI terminals.

■ Physical Appearance

■ Mechanical Installation



■ Description of Terminals and Jumpers

The following table describes the terminals of the MD38IO1.

Type	Terminal	Terminal Name	Function Description
Power supply	+24V-COM	External +24V power supply	Provide a +24 V power supply to an external unit. **Generally used to supply DI/DO terminals and external sensors.** Max. output current: 200 mA
	OP2	Digital input power terminal	It is not connected to power supply by default. It can be connected either to external power or +24V according to the actual need.
Digital inputs	DI6-OP2	Digital input 6	Optically-coupled isolation compatible with dual-polarity inputs **Input resistance: 3.3 kΩ for DI6 and DI7, 2.4 kΩ for DI8** **Voltage range for inputs: 9 to 30 V** DI6, DI7 and DI8 are common input terminals **with input frequency < 100 Hz.**
	DI7-OP2	Digital input 7	
	DI8-OP2	Digital input 8	

The following table describes the jumpers of the MD38IO1.

Jumper	Description	Meaning	Setting
J2	OP2 connecting mode selection	If DI connected in SINK mode, OP1 connected to +24V	
		If DI connected in SOURCE mode, OP1 connected to COM	

■ Terminal Wiring

For wiring of DI terminals, see DI1-DI5 Wiring (Sink, Source).

9.2.4 Extension PC Card (MD38PC1)

■ Overview

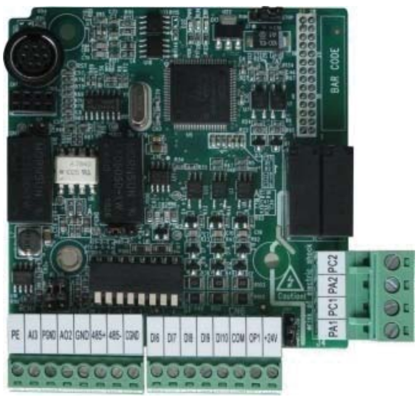
The MD38PC1 card is designed with the PLC function, which enables the MD500 drive to have the PLC (user programmable) function. The card can read special variables of the drive besides the standard function codes and is more advantageous than combination of PLC and AC drive.

MD38PC1 is compatible with Inovance's PLC programming environment. In the condition that the program capacity and peripheral **devices do not exceed the range of MD38PC1, programs of the user can be download to the MD38PC1 without modification.**

The MD38PC1 has the following I/O terminals and communication interface.

Item	Specification	Description
Input terminals	Five digital input (DI) terminals	**Supports 9 to 30 V dual-polarity input.**
	One analog input (AI) terminal that supports voltage input	Supports -10 to 10 V input.
Output terminals	One relay output terminal	250 VAC, 3 A; 30 VDC, 1 A
	One analog output (AO) terminal	0 to 10 V, 0 to 20 mA
Communication	RS485 communication interface	Isolation input

■ Physical Appearance



■ Mechanical Installation

The MD38PC1 has the same installation mode as the MD38IO1 does.

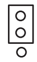
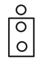
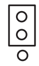
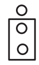
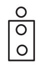
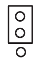
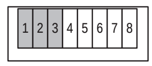
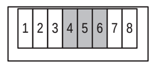
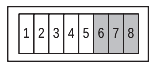
■ Description of Terminals and Jumpers

The following table describes the terminals of the MD38IO1.

Type	Terminal	Terminal Name	Function Description
Power supply	+24V-COM	External +24V power supply	Provide a +24 V power supply to an external unit. **Generally used to supply DI/DO terminals and external sensors.** Max. output current: 200 mA
	OP1	Digital input power terminal	**Connect to +24V by the jumper J8 by default.** When applying an external power supply, remove **the jumper J8 to disconnect the OP1 from +24V and** connect the OP1 to the external power supply.

Type	Terminal	Terminal Name	Function Description
Analog input	AI3-PGND	Analog input 3	Optically-coupled isolation input, supporting differential voltage input, current input and temperature detection resistance input Input voltage range: -10 to 10 VDC Input current range: -20 to 20 mA Connect the PT100 or PT1000 temperature sensor Input mode determined by DIP switch S1, multiple functions not supported simultaneously
Digital inputs	DI6-OP1	Digital input 6	Optically-coupled isolation compatible with dual-polarity inputs **Input resistance: 2.4 kΩ** **Voltage range for inputs: 9 to 30 V**
	DI7-OP1	Digital input 7	
	DI8-OP1	Digital input 8	
	DI9-OP1	**Digital input 9**	
	DI10-OP1	Digital input 10	
Analog output	AO2-GND	Analog output 2	Output voltage range: 0 to 10 V Output current range: 0 to 20 mA
Relay outputs (RELAY x 2)	PA1- PC1	Relay 1 NO terminal	Contact driving capacity: 250 VAC, 3 A, Cos f = 0.4 30 VDC, 1 A
	PA2- PC2	Relay 2 NO terminal	
RS485 communication	**485+/485-**	RS485 Communication interface	Modbus-RTU communication input and output terminal, isolated input
	CGND	RS485 communication isolation power ground	
CAN communication	CN1	User program downloading	**User program downloading port (9-pin mini port)**

The following table describes the jumpers of the MD38IO1.

Jumper	Description	Meaning	Setting
J2	AI3 input selection: voltage or current	Voltage	
		Current	
J3	AO2 output selection: voltage or current	Voltage	
		Current	
J1	RS485 terminal resistor matching selection	Matching the terminal resistor	
		Not matching the terminal resistor	
J7	**Run/Stop selection**	Run	
		Stop	
J8	OP1 connecting mode selection	If DI connected in SINK mode, OP1 connected to +24V	
		If DI connected in SOURCE mode, OP1 connected to COM	
S1	AI3, PT100, PT1000 selection	AI3: 1, 2, 3 set to ON	
		PT1000: 4, 5, 6 set to ON	
		PT100: 6, 7, 8 set to ON	

Note

The setting of the jumpers takes the top view with the main terminals at the bottom of the card as the visual angle. The jumpers are silk-screened on the card.

■ Terminal Wiring

For wiring of DI, DO, AI and AO terminals, see section 3.3 Control Circuit Wiring.

For the Modbus communication, see section C.6.2 Modbus communication protocol.

If you purchase the MD38PC1 card, the related user manual will be delivered together with the product. See the user manual for details.

9.2.5 Extension DP Card (MD38DP2)

■ Overview

MD38DP2, complying with the international PROFIBUS field bus standard, is designed to connect the MD500 drive to PROFIBUS-DP bus. This card can improve the communication efficiency and implement AC drive networking function. It enables the MD500 to be a slave in the bus, controller by the master.

Besides the PROFIBUS-DP communication, the MD38DP2 provides the CANlink communication interface.

■ Physical Appearance

■ Mechanical Installation

The MD38DP2 has the same installation mode as the MD38IO1 does.

■ Description of Terminals and Jumpers

The following table describes the terminals of the MD38IO1.

Type	Terminal	Terminal Name	Function Description
PROFIBUS communication terminal (J2)	**1, 2, 7, 9**	NC	Vacant internally
	3	Data line B	Data line positive
	4	RTS	Request of sending signal
	5	GND	Isolation 5 V power ground
	6	+5V	Isolation 5 V power supply
	8	Data line A	Data line negative
CANlink communication **terminals (J3, J9)**	+5V	Power supply	Isolation 5 V power supply
	CANH	CAN positive input	Data line positive
	CANL	CAN negative input	Data line negative
	GND	Power ground	Isolation 5 V power ground
Program write-in	SW1	Program write-in	It is the commissioning interface. Never use it.
Jumper	J6 (The white dot is pin 1.)	CANlink terminal resistor matching selection	1 and 2 shorted: matching the terminal resistor 2 and 3 shorted: not matching the terminal resistor

Type	Terminal	Terminal Name	Function Description
Indicators	D4 in red	Power supply indicator	ON: indicates that the drive is powered on. OFF: indicates that the drive is not powered on or the DP card is installed improperly.
	D3 in yellow	DP card and master communication indicator	ON: indicates normal communication between the DP card and the master. OFF: indicates no communication between the DP card and the master (check the PROFIBUS cable connection and station No. setting). Flashing: indicates that the master does not operate or wrong communication between the DP card and the master.
	D2 in green	DP card and drive communication indicator	ON: indicates normal communication between the DP card and the drive. OFF: indicates that communication between the DP card and the drive fails (check the baud rate setting). Flashing: indicates that interference exists on the communication between the DP card and the drive or the extension card address is not within the rang of 1 to 125.

The following table describes the jumpers of the MD38DP2.

Jumper	Description	Meaning	Setting
J6	CANlink terminal resistor matching selection	Matching the terminal resistor	
		Not matching the terminal resistor	

Description of DIP Switch and Address Setting

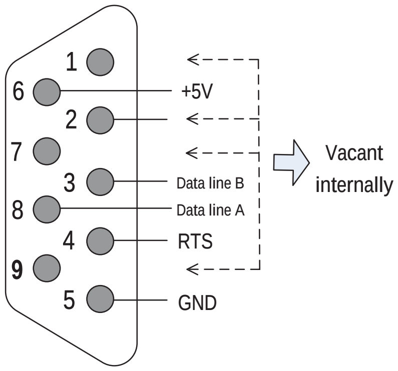
DIP Switch Bit	Function	Description
1 to 8	The PROFIBUS-DP communication slave address	The 8-bit binary DIP switch can set state addresses of 0 to 125. For example: Address DIP switch setting 0 00000000 7 00000111 20 00010100 125 01111101

Note

The setting of the jumpers takes the top view with the main terminals at the bottom of the card as the visual angle. The jumpers are silk-screened on the card.

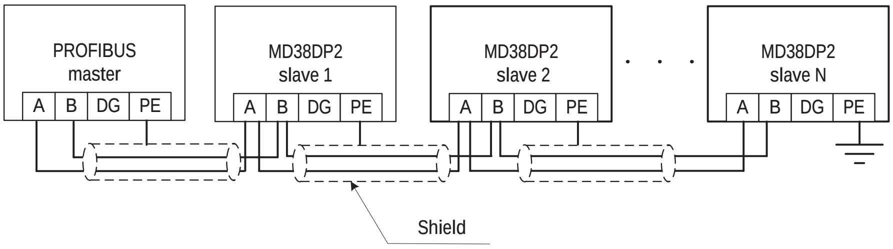
Description of PROFIBUS 9-Pin Port

The MD38DP2 card connects to the PROFIBUS-DP master with the DB9 connector. The connector defines the pin signals according to the Siemens DB9 connector standard, as shown in the following figure.



Terminal Wiring

Connection of the MD38DP2 and the PROFIBUS-DP master is shown in the following figure.



It is necessary to connect a matching terminal resistor to the end of the PROFIBUS bus and set the DIP switch properly. The PEs of the system must be reliably grounded.

The length of the communication cable between MD38DP2 and the PROFIBUS-DP master varies with different setting of the baud rate of the master. Restrict the communication cable lead length strictly according to the Siemens DB9 standard. The following table describes the requirements on the baud rate and the communication cable lead length.

Baud Rate (Kbps)	Max. Length of Lead A (m)	Max. Length of Lead B (m)
9.6	1200	1200
19.2	1200	1200
187.5	600	600
500	200	200
1500	100	70
3000	100	Not supported
6000	100	
12000	100	

If you purchase the MD38DP2 card, the related user manual will be delivered together with the product. See the user manual for details.

9.2.6 Extension CANlink Card (MD38CAN1)

■ Overview

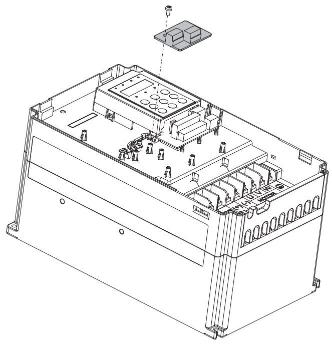
MD38CAN1 is designed to connect the MD500 drive to the high-speed CANlink bus. It complies with the CANlink bus standard.

CANlink is based on CAN bus and developed by Inovance. It is an open communication protocol and the equipments supporting this protocol can be connected to the CANlink bus. The products of Inovance such as AC drive, servo drive, HMI and PLC cal be connected to the CANlink bus seamlessly.

■ Physical Appearance

■ Mechanical Installation

The MD38CAN1 has the same installation mode as the MD38IO2 does.



■ Description of Terminals and Jumpers

The following table describes the terminals of the MD38CAN1.

Type	Terminal	Terminal Name	Function Description
CAN communication terminal	CANH	CAN positive input	Connect to the positive pole of the CAN bus.
	CANL	CAN negative input	Connect to the negative pole of the CAN bus.
	COM	Power ground	Connect to the reference ground of all CAN nodes.

The following table describes the jumpers of the MD38CAN1.

Jumper	Description	Meaning	Setting
J2	CANlink terminal resistor matching selection	Matching the terminal resistor	
		Not matching the terminal resistor	

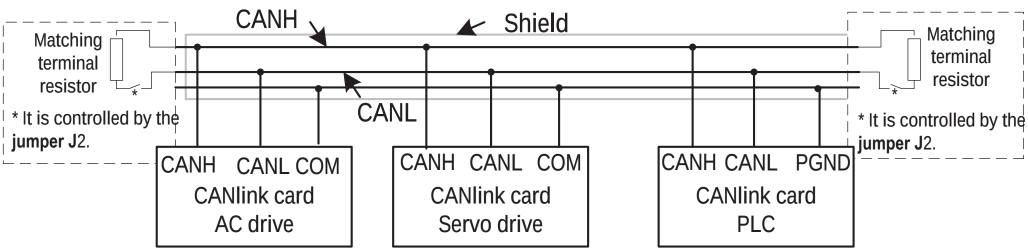
Note

The setting of the jumpers takes the top view with the main terminals at the bottom of the card as the visual angle. The jumpers are silk-screened on the card.

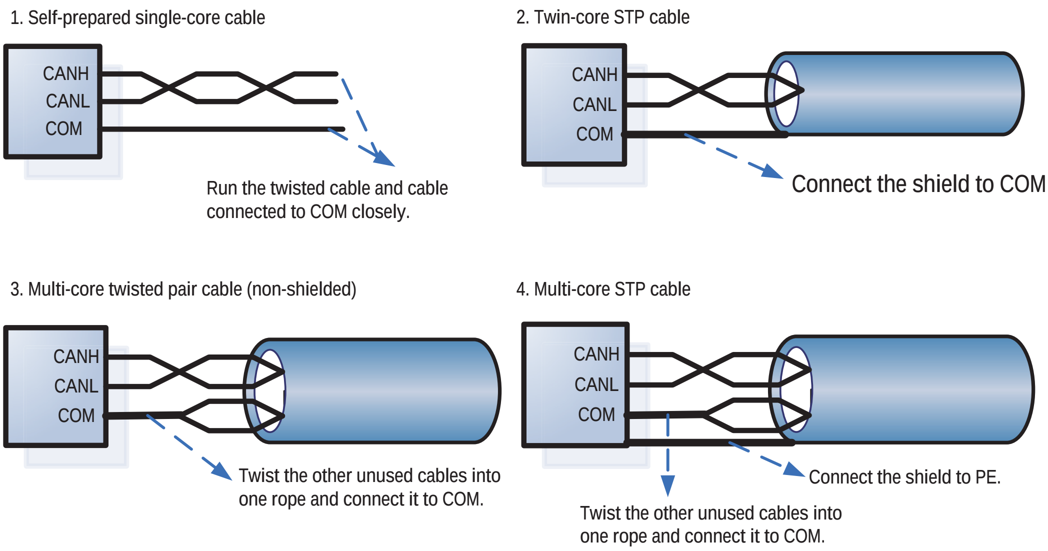
When applying the CANlink communication, connect a terminal resistor to the end AC drive and short pins 1 and 2 of the jumper J2.

■ Terminal Wiring

The CANlink bus topology is shown in the following figure.



It is recommended to use an STP cable as the CAN bus and use a twisted cable to connect CANH and CANL. Connect a matching terminal resistor of 120 Ω respectively at both ends of the bus to prevent signal reflection. The CAN bus allows connection of a maximum of 64 nodes and the distance of each node branch must be smaller than 0.3 m. Connect the reference ground of all nodes together.



■ CANlink Transmission Distance

The transmission distance of the CANlink bus is directly related to the baud rate and communication cable. The relationship between the maximum transmission distance of the CANlink bus and the baud rate is shown in the following table.

No.	Max. Transmission Distance	Baud Rate	Number of Nodes	Cable Diameter
1	25 m	1 Mbps	64	0.205 mm2
2	**95 m**	500 kbps	64	0.34 mm2
3	560 m	100 kbps	64	0. 5 mm2
4	1100 m	50 kbps	64	0.75 mm2

9.2.7 Extension CANopen Card (MD38CAN2)

■ Overview

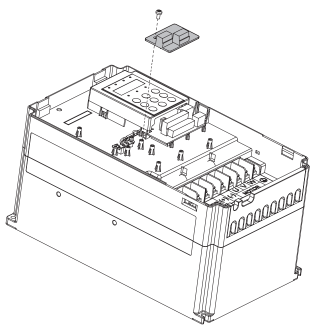
MD38CAN2 is designed to connect the MD500 drive to the high-speed CANopen bus. The CANopen is an international field bus standard. The equipments supporting this protocol can be connected to the CANopen bus.

The MD38CAN2 supports the following five protocols:

1. The Node Guard protocol, with which the master can read the equipment status
2. The Heartbeat protocol, with which the slave reports the current state to the master regularly
3. The SDO that supports accelerated transmission mechanism only and transmits one function code (two bytes)
4. Three TPDOs and three RPDOs
5. **Emergency object.**

■ Physical Appearance

■ Mechanical Installation



The MD38CAN2 has the same installation mode as the MD38IO2 does.

■ Description of Terminals and Jumpers

The following table describes the terminals of the MD38CAN2.

Type	Terminal	Terminal Name	Function Description
CAN communication terminal	CANH	CAN positive input	Connect to the positive pole of the CAN bus.
	CANL	CAN negative input	Connect to the negative pole of the CAN bus.
	COM	Power ground	Connect to the reference ground of all CAN nodes.

The following table describes the jumpers of the MD38CAN2.

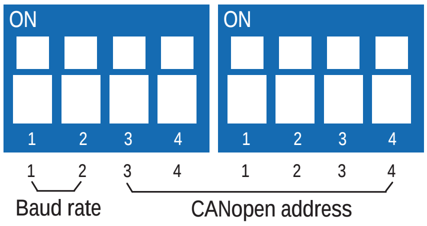
Jumper	Description	Meaning	Setting
J2	CANopen terminal resistor matching selection	Matching the terminal resistor	
		Not matching the terminal resistor	

Note

The setting of the jumpers takes the top view with the main terminals at the bottom of the card as the visual angle. The jumpers are silk-screened on the card.

■ DIP Switch Setting

The DIP switches S2 and S3 of the MDCAN2 form a 8-bit DIP switch to set the CAN bus baud rate and communication equipment address. As shown in the following figure, bits 1 and 2 are used to set the baud rate, while bits 3 to 8 are used to set the CANopen address. When the DIP switch is set to ON, it indicates 1. When the DIP switch is set to OFF, it indicates 0.



You can set the baud rate via the DIP switch according to the following table.

Bit Setting		Baud Rate
1	2	
0	0	125 kbps
0	1	250 kbps
1	0	500 kbps
1	1	1 Mbps

The bits 3 to 8 are used to set the CANopen communication address. 3 is the highest bit and 8 is the lowest bit. You can set the communication address 1 to 63 through these six bits according to the following figure.

Bit Setting						Communication Address
3	4	5	6	7	8	
0	0	0	0	0	0	Reserved
0	0	0	0	0	1	1
0	0	0	0	1	0	2
0	0	0	0	1	1	3
...						...
1	1	1	1	1	1	63

■ Indicators

Indicator	State	Description
PWR (in red)	ON	Power-on is normal.
	OFF	Power-on is abnormal. Check whether the installation is proper.
ERR (in red)	ON	The communication of the AC drive times out.
	Flashing quickly	The CANopen address is set incorrectly.
	Flashing twice	The CANopen messages emergently.
RUN (in green)	ON	The CANopen enters the "Operational" state.
	Flashing	The CANopen enters the "Pre-Operational" state.
	OFF	The CANopen enters the "Stopped" state.

■ Terminal Wiring

For wiring and use of the terminals of CANopen Card, see the terminal wiring part in the section 9.2.6 Extension CANlink Card (MD38CAN1).

If you purchase the MD38CAN2 card, the related user manual will be delivered together with the product. See the user manual for details.

9.2.8 Extension RS485 Card (MD38TX1)

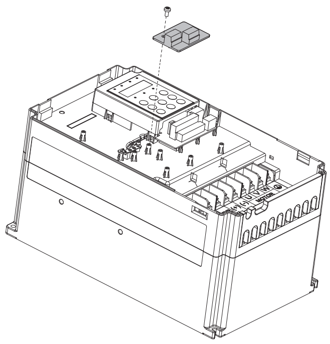
■ Overview

MD38TX1 is specially designed to provide the MD500 drive with the RS485 communication function. It adopts the isolation scheme and the electrical parameters conform to the international standard. It helps to implement control of the drive running and parameter setting through the remote serial port.

For details on this card, see the MD380 Serial Communication Protocol. You can log on to Inovance's website www.inovance.cn, or **contact the local representative office or agent to get the protocol.**

■ Physical Appearance

■ Mechanical Installation



The MD38TX1 has the same installation mode as the MD38IO2 does.

■ Description of Terminals and Jumpers

The following table describes the terminals of the MD38CAN2.

Type	Terminal	Terminal Name	Function Description
RS485 communication (CN1)	485+	RS485 positive input	RS485 communication terminal with isolation input
	485-	RS485 negative input	RS485 communication terminal with isolation input
	CGND	RS485 Power ground	Isolated power

The following table describes the jumpers of the MD38CAN2.

Jumper	Description	Meaning	Setting
J3	CANlink terminal resistor matching selection	Matching the terminal resistor	
		Not matching the terminal resistor	

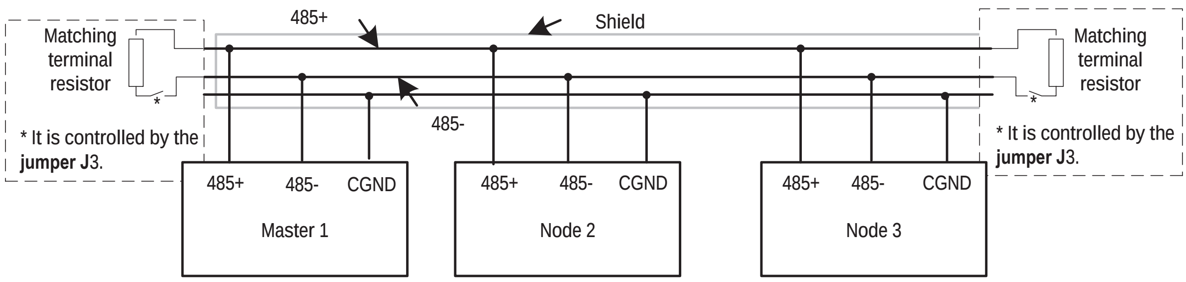
Note

The setting of the jumpers takes the top view with the main terminals at the bottom of the card as the visual angle. The jumpers are silk-screened on the card.

When applying the RS485 bus, connect a terminal resistor to the end AC drive through the jumper J3.

■ RS485 Bus Topology

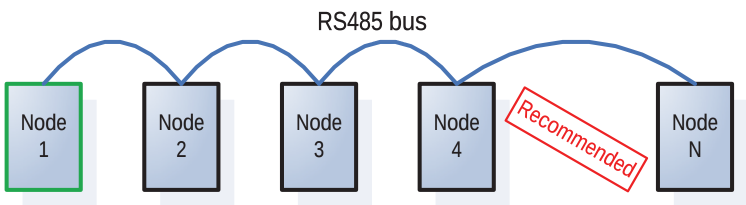
The RS485 bus topology is shown in the following figure.



It is recommended to use an STP cable as the RS485 bus and use a twisted cable to connect 485+ and 485-. Connect a matching **terminal resistor of 120 Ω respectively at both ends of the bus to prevent signal reflection. The RS485 bus allows connection of a** maximum of 128 nodes and the distance of each node branch must be smaller than 3 m. Connect the reference ground of all nodes together.

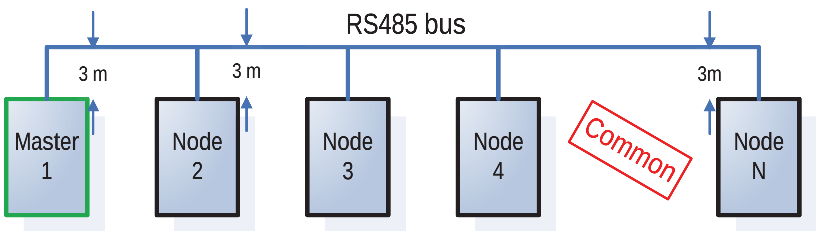
The connecting modes of multiple nodes are described as below:

1. Daisy chain connection mode (recommended)

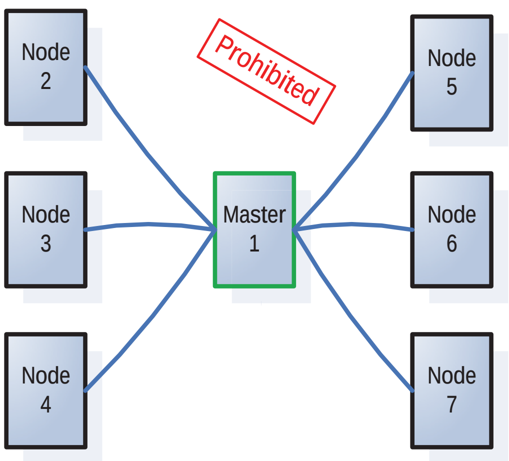


2. Branching connection mode (common)

The distance from the bus to the node cannot exceed 3 m.



3. Star connection mode (prohibited)



■ Terminal Wiring

1. Terminal wiring if the node has the CGND terminal

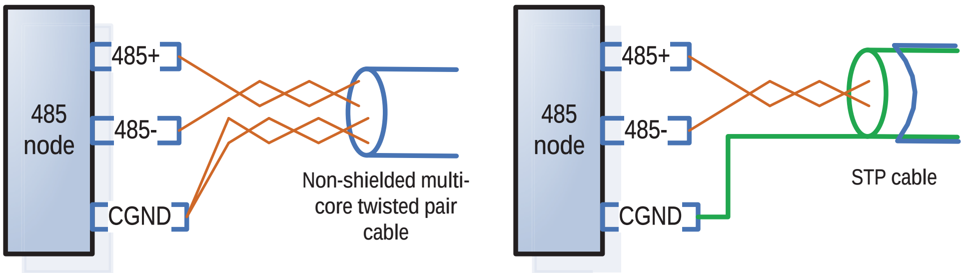
   The MD38TX1 has three cables to connect the 485+, 485- and CGND terminals respectively. Check that the RS485 bus on site has these three cables and the terminals are not connected reversely or wroingly.

   If a shielded cable is used, the shield must also be connected to the CGND terminal. Except this CGND terminal, prevent the shield from touching anywhere of the drive including the drive housing and the grounding terminal of the equipment.

   Due to cable attenuation, if the connection length is larger than 3 m, use the AGW26 or a thicker cable. Always use a twisted pair cable to connect 485+ and 485- respectively.

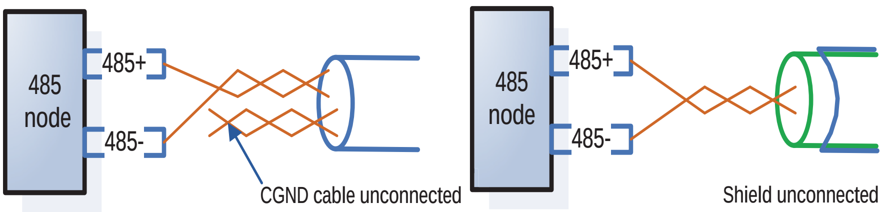
   Non-shielded multi-core twisted pair cable and STP cable are recommended. If non-shielded multi-core twisted pair cable is used, take the twisted pair to connect 485+ and 485- and twist the other unused cables into one rope and connect it to CGND.

   If an STP cable is used, connect the twisted pair to 485+ and 485- respectively and the shield to CGND. The shield can be connected to CGND only. It must not be connected to ground.



2. Terminal wiring if the node does not have the CGND terminal

   For the nodes without the CGND terminal, never connect the CGND cable or the shield to the PE of the node directly.



   Take the following steps to handle it.

   Step 1: Check whether a common reference ground of the 485 circuit exists on other ports of this node. If yes, connect the CGND cable or the shield to the pin.

   Step 2: Check whether the reference ground of the 485 circuit exists on the board of the node. If yes, connect the CGND cable or the shield to it.

   Step 3: If the reference ground of the 485 circuit is not found, keep the CGND cable or the shield unconnected and use an extra ground cable to connect this node to the PE of other nodes.

■ Transmission Distance

The maximum number of nodes and transmission distance of the standard RS485 circuit vary with different baud rates, as listed in **the following figure:**

No.	Baud Rate	Max. Transmission Distance	Number of Nodes	Cable Diameter
1	115.2 Kbps	100 m	128	AWG26
2	**19.2 Kbps**	1000 m	128	AWG26

For details of the Modbus communication protocol, see section 8.5 Modbus Communication Protocol.

9.2.9 Extension Encoder Cards

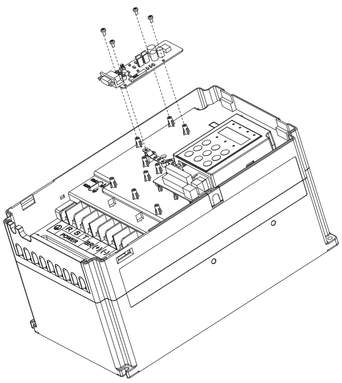
The MD500 provides multiple types of encoder extension cards (PG cards) for your choice. The PG card is necessary for closed-loop vector control. Select a proper PG card according to the encoder output mode. The PG card models are listed in the following table.

PG Card	Description	Others
MD38PG1	Differential input PG card with frequency dividing output	Terminal wiring
MD38PG4	Resolver PG card with 1:1 frequency dividing output	**DB9 female plug**
MD38PG5	OC input PG card with 1:1 frequency dividing output	Terminal wiring
MD38PG5D	OC input PG card with selectable frequency dividing output	Terminal wiring
MD38PG6	Differential input PG card with 1:1 frequency dividing output	**DB9 female plug**
MD38PG6D	Differential input PG card with selectable frequency dividing output	**DB9 female plug**

■ Physical Appearance

MD38PG1 MD38PG4 MD38PG5 MD38PG5D MD38PG6 MD38PG6D

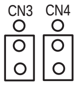
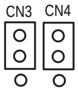
■ Mechanical Installation



■ Description of Terminals and Jumpers

The following table describes the specification, terminals and jumpers of the MD38PG1.

MD38PG1 Specification	
User interface	Oblique terminal block
Clearance	3.5 mm
Screw	Flathead
Pluggable	No
Cable specification	16 to 26 AWG
Max. frequency	500 kHz
Differential input limit	**≤ 7 V**

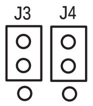
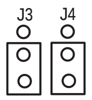
MD38PG1 Terminals		
No.	Mark	Description
1	A+	Encoder output signal A positive
2	A-	Encoder output signal A negative
3	B+	Encoder output signal B positive
4	B-	Encoder output signal B negative
5	Z+	Encoder output signal Z positive
6	Z-	Encoder output signal Z negative
7	5V	**Provide 5 V/100 mA power supply externally**
8	COM	Power ground
9	PE	Shield connecting point
MD38PG1 Jumpers		
CN3, CN4	Jumper Position	Description
	Shorting pins 1 and 2	Not supporting the "pulse + direction" function (default setting)
	Shoring pins 2 and 3	Supporting the "pulse + direction" function

The following table describes the specification and terminals of the MD38PG4.

MD38PG4 Specification	
User interface	**DB9 female plug**
Pluggable	Yes
Cable specification	> 22 AWG
Resolution	12-bit
Excitation frequency	10 kHz
VRMS	7 V
VP-P	3.15 ± 27%

MD38PG4 Terminals		
No.	Mark	Description
1	EXC1	Resolver excitation negative
2	EXC	Resolver excitation positive
3	SIN	Resolver feedback SIN positive
4	SINLO	Resolver feedback SIN negative
5	COS	Resolver feedback COS positive
6	-	
7	-	
8	-	
9	COSLO	Rotary encoder feedback COS negative

The following table describes the specification, terminals and jumpers of the MD38PG5/MD38PG5D.

MD38PG5 Specification		
User interface	Oblique terminal block	
Clearance	3.5 mm	
Screw	Flathead	
Pluggable	No	
Cable specification	**16–26 AWG**	
Max. frequency	100 kHz	
MD38PG5/ MD38PG5D Terminals		
No.	Mark	Description
1	A	Encoder output signal A
2	B	Encoder output signal B
3	Z	Encoder output signal Z
4	15V	**Provide 15 V/100 mA power supply externally**
5	COM	Power ground and frequency dividing ground
6	COM	Power ground and frequency dividing ground
7	A1	PG card frequency dividing output signal A (OC output, 0 to 24 V, 0 to 50 mA)
8	B1	PG card frequency dividing output signal B (OC output, 0 to 24 V, 0 to 50 mA)
9	PE	Shield connecting point
MD38PG5/ MD38PG5D Jumpers		
J3, J4	Jumper Position	Description
	Shorting pins 1 and 2	Not supporting the "pulse + direction" function (default setting)
	Shoring pins 2 and 3	Supporting the "pulse + direction" function

The following table describes the specification, terminals and jumpers of the MD38PG6/MD38PG6D.

MD38PG6 Specification	
User interface J3	**DB9 female plug**
Pluggable	Yes
Cable specification	> 22 AWG
Max. frequency	500 kHz
Differential input limit	**≤ 7 V**
User interfaces J7, J8	Oblique terminal block
Clearance	3.5 mm
Screw	Flathead
Pluggable	No
Frequency dividing rate	500 kHz
Frequency dividing range	4 to 62 (even number)

MD38PG6/ MD38PG6D Terminals		
DB9 Terminal No.	Mark	Description
1	A+	Encoder output signal A positive
2	A-	Encoder output signal A negative
3	B+	Encoder output signal B positive
4	B-	Encoder output signal B negative
5	Z+	Encoder output signal Z positive
6	Null	-
7	+5V	Encoder 5V power supply positive
8	COM	Encoder power supply negative
9	Z-	Encoder output signal Z negative
User interfaces J7, J8: MD38PG6 has the 1:1 frequency dividing output. MD38PG6D has the selectable frequency dividing output (1:4 by default).	A+	Frequency dividing output signal A positive
	A-	Frequency dividing output signal A negative
	B+	Frequency dividing output signal B positive
	B-	Frequency dividing output signal B negative
	Z+	Frequency dividing output signal Z positive
	Z-	Frequency dividing output signal Z negative
	COM	Signal power ground
	PE	Shield connecting point

■ **Description of Frequency Dividing of MD38PG5D/MD38PG6D**

The frequency dividing coefficient is determined by the DIP switch K1 on the PG card. The DIP switch has a total of five digits.

The coefficient is obtained by multiplying the binary number expressed by the DIP switch by 2. Bit 1 is the lowest bit, and bit 5 is the highest bit. If the bit is set to ON, it is effective. Minimum 1:4 and maximum 1:62 frequency dividing can be implemented.

The correspondence of the binary number expressed by the DIP switch and the frequency dividing coefficient is as listed in the following table.

	Binary Number	**Frequency Dividing Coefficient**
0	00000	No output
1	00001	No output
2	00010	22
...	...	...
i	i	i x 2
...	...	...
31	11111	31 x 2

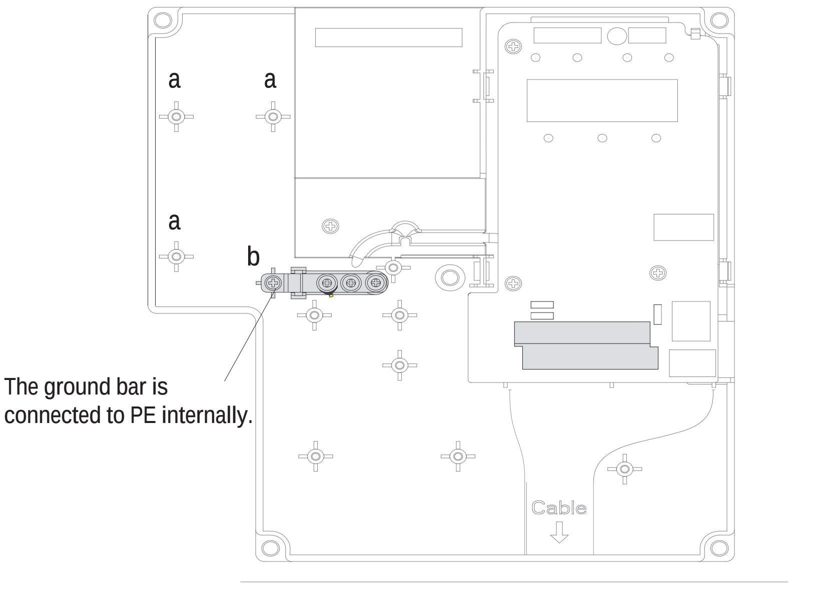
Description of Use of MD38PG4

1. The MD38PG4 card has two red LED indicators marked as D5 and D6. They are used to indicate the MD38PG4 state. The indicators are described in the following table.

D5	D6	MD38PG4 State	Solution
OFF	OFF	Normal	-
ON/Flashing	OFF	Phase-lock loop unlocked	Phase lag of the resolver is very large.
OFF	**ON/Flashing**	**The SIN/COS signal** exceeds the limit.	It is caused by interference. Ground the motor well and connect the ground point of the PG card to the PE terminals of the AC drive.
ON/Flashing	**ON/Flashing**	**The SIN/COS signal** is too small.	**Generally, it is because the DB9 connector is not connected,** connected wrongly or the wire breaks. If these caused are removed, check whether the resolver matches the MD38PG4 card.

2. Selection of the resolver must satisfy the parameter setting requirement of the MD38PG4. Especially the excited input DC **resistance must be larger than 17 Ω (can be measured by multimeter). Otherwise, the MD38PG4 cannot work normally.**
3. It is suggested to select a resolver with a maximum of four pole-pairs. Otherwise, the MD38PG4 will be in overloaded state.
4. On the condition that the software parameters of the AC drive are set correctly, the speed or position feedback of the MD38PG4 is instable, it indicates that the MD38PG4 gets electromagnetic interference. In this cause, connect the shield of the signal lines of the encoder to the PE terminal of the AC drive.

Description of Shield Grounding of the MD38PG4



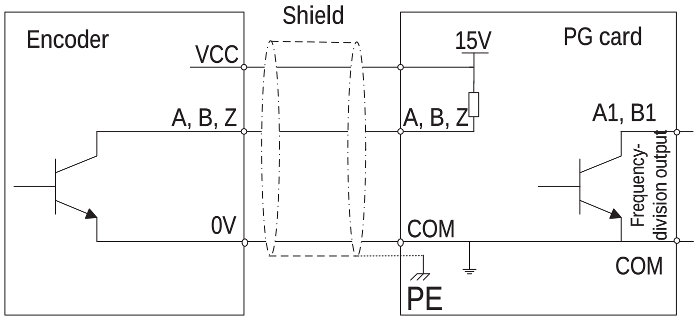
As shown in the preceding figure, grounding has been completed in position b. After installation of the PG card is done, the PE terminal of the PG card is connected automatically.

When connecting the signal lines of the encoder, connect the shield of the signal lines to the PE terminals of the PG card to complete the shield grounding.

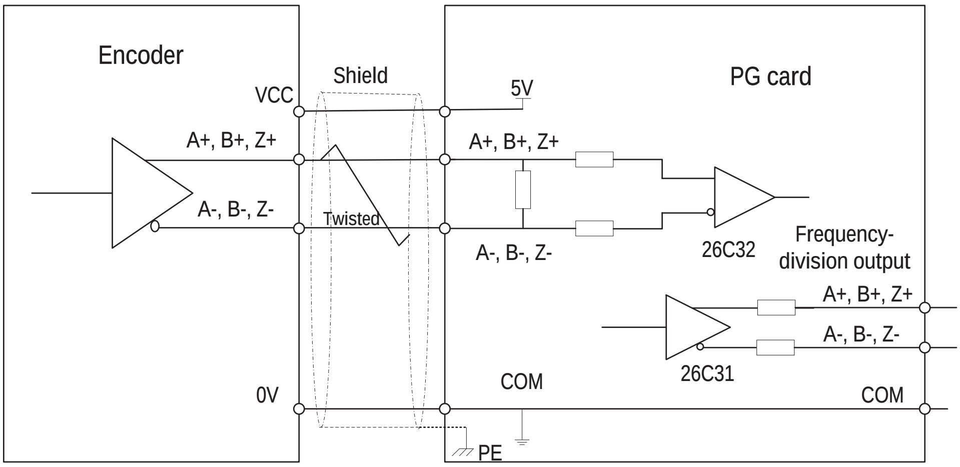
To install the PG card, remove the screw in position b and align the mounting holes of the PG card to the four fixing holes and fix the PG card with the prepared M3 x 8 screws.

Connecting Encoder to the PG Card

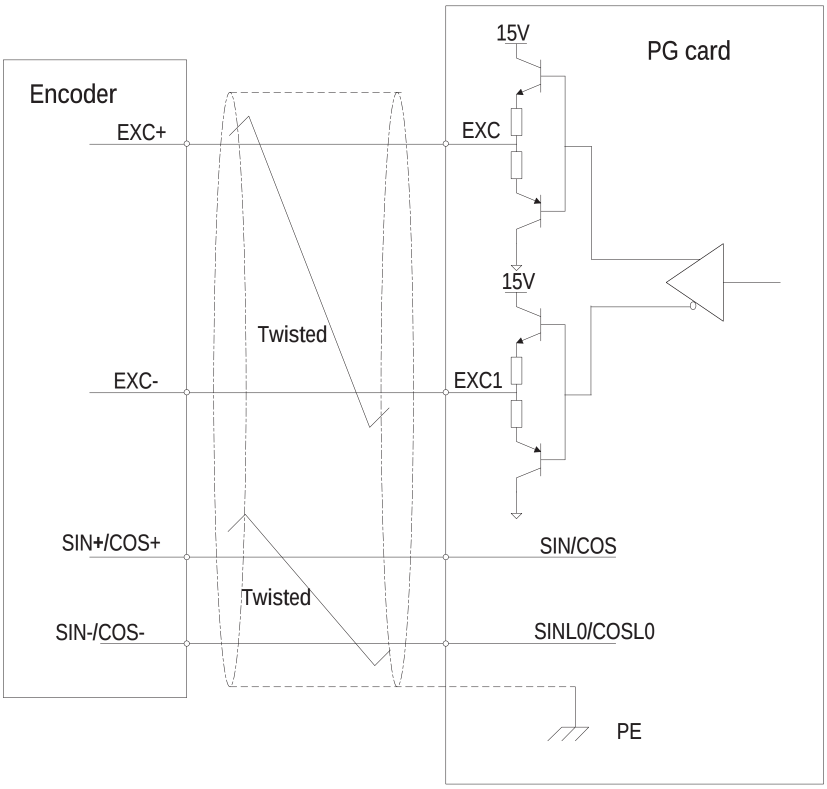
The following figure shows the circuit diagram of connecting the encoder to the MD38PG5/MD38PG5D.



The following figure shows the circuit diagram of connecting the encoder to the MD38PG1/MD38PG6/MD38PG6D.



The following figure shows the circuit diagram of connecting the encoder to the MD38PG4.



■ EMC Guidance

- Never bundle the encoder cables and the power cables together. Failure to comply will result in encoder interference.
- The motor housing must be connected to the grounding terminal of the AC drive. Meanwhile, connect the grounding cable of the motor to the motor housing reliably.
- An STP cable is suggested. For differential encoders, perform cable connection based on the differential pairs properly and connect the shield to the grounding terminal of the AC drive.
- For large equipment application where the AC drive is far away from the motor and the motor cable is longer than 10 m, the **grounding effect is not good due to the influence of cable inductance. In this case, the encoder shield need not be connect the** grounding terminal of the AC drive.

10

Specifications

10 Specifications

10.1 Technical Specifications

Table 10-1 Technical specifications of the MD500

Item		Description
Standard functions	Max. frequency	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	● Sensorless vector control (SVC) ● Closed-loop vector control (CLVC) ● **Voltage/Frequency (V/F) control**
	Startup torque	G type: ● **0.5 Hz/150% (SVC)** ● **0 Hz/180% (CLVC)** P type: ● **0.5 Hz/100%**
	Speed range	● 1:100 (SVC) ● 1: 1000 (CLVC)
	Speed stability accuracy	● ±0.5% (SVC) ● ±0.02% (CLVC)
	Torque control accuracy	±5% (CLVC)
	Overload capacity	G type: ● 60 seconds for 150 % of the rated current P type: ● 60 seconds for 110 % of the rated current
	Torque boost	● Fixed boost ● Customized boost 0.1 % to 30.0 %
	V/F curve	● **Straight-line V/F curve** ● **Multi-point V/F curve** ● **Square V/F curve** ● **Complete V/F separation** ● **Half V/F separation**
	V/F separation	● **Complete V/F separation** ● **Half V/F separation**
	Ramp mode	● Straight-line ramp ● S-curve ramp **Four separate acceleration/deceleration time** settings in the range of 0s to 6500s.
	DC injection braking	● **DC injection braking frequency: 0 Hz to max. frequency** ● **DC injection braking active time: 0.0s to 36.0s.** ● **Current level of DC injection braking: 0% to 100%.**

Item		Description
Standard functions	Jog running	● **Frequency range of jog running: 0.00 to 50.00 Hz** ● **Acceleration/Deceleration time of jog running:0.0s to 6500.0s**
	Onboard multiple preset speeds	The system implements up to 16 speeds by using simple PLC function or by using digital input signals.
	Onboard PID	The system implements the proportional-integral-derivative (PID) function in the closed-loop control.
	Automatic voltage regulation (AVR)	The system maintains a constant output voltage automatically when the line voltage changes through the allowable range.
	Overvoltage and overcurrent stall control	The system limits the output current and voltage automatically during operation to prevent frequent or excessive tripping.
	Torque limit and control	The system limits the torque automatically to prevent frequent overcurrent tripping during operation. Torque control is applied in the CLVC mode.
Individualized functions	High performance	The MD500 applies control of an asynchronous motor by using high-performance current vector control technology.
	Power dip ride-through	Load feedback energy compensates for any voltage reduction, allowing the MD500 to continue to operate for a short time during power dips.
	Fast current limit	The system applies fast current limiting techniques to avoid frequent overcurrent faults.
	Virtual I/O	**Five groups of virtual digital input/outputs (DI/** DO) support simple logic control.
	Timing control	Time range: 0.0 to 6500.0 minutes
	Dual-motor switchover	The MD500 can control up to two motors. It controls one motor at a time and then switches over to the other.
	Multiple field buses	**The MD500 supports four field buses:** ● Modbus-RTU ● PROFIBUS-DP ● CANlink ● CANopen
	Motor overheat protection	**Option: The optional input/output (I/O) extension card allows** AI3 to receive a signal from the motor temperature sensor input (PT100, PT1000) to implement motor overheat protection.
	Multiple encoder types	The MD500 supports a range of different encoder types: ● Differential encoder ● Open-collector encoder ● Resolver ● UVW encoder
	User programmable function	Option: The optional programming card supports secondary development in a programming environment compatible with the Inovance programmable logic controller (PLC).
	Advanced background software	Embedded software operating in the MD500 allows users to **configure some operating parameters, and provides a virtual** oscilloscope display that shows system status information

Item		Description
RUN	Command source	Allows different methods of switching between command sources: ● Operating panel control ● Terminal control ● Communication control
	Main frequency reference setting channel	Supports up to 10 frequency sources and allows different methods of switching between frequency source settings: ● Digital setting ● Analog voltage reference ● Analog current reference ● Pulse reference ● Communication reference
	Auxiliary frequency reference setting channel	**Supports up to 10 auxiliary frequency sources, and allows fine** tuning of the auxiliary frequency and frequency superposition.
	Input terminals	Standard: ● Five digital input (DI) terminals, one of which supports up to 100 kHz high-speed pulse inputs. ● Two analog input (AI) terminals, one of which supports only 0 to10 V input, and the other supports 0 to 10 V and 4 to 20 mA current input. Expanded capacity: ● Five digital input (DI) terminals. ● One AI terminal that supports –10 to 10 V voltage input **and PT100/PT1000 motor temperature sensor inputs.**
	Output terminals	Standard ● Single high-speed pulse output terminal (open-collector) for a square-wave signal output in the frequency range 0 to 100 kHz ● Single digital output (DO) terminal ● Single relay output terminal ● 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. Expanded capacity: ● Single extra DO terminal ● Single extra relay output terminal ● 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.

Item		Description
Display and operating panel	LED display	The 6-character LED display shows parameter values.
	LCD display	Option: Users can clone parameters easily by using the optional LCD control panel.
	Key locking and function selection	● Keys on the control panel can be locked or partially locked electronically to prevent accidental peration. ● The range of some functions can be limited to a permitted range to prevent incorrect settings.
	Protections	The MD500 supports the following protections: ● Motor short-circuit detection at power-on ● **Input/output phase loss protection** ● Overcurrent protection ● Overvoltage protection ● Undervoltage protection ● Overheat protection ● Overload protection
	Optional parts	The following optional parts are available for use with the MD500 AC drive system: ● LCD operating panel ● **I/O extension card 1** ● **I/O extension card 2** ● User programmable card ● RS485 communication card ● PROFIBUS-DP communication card ● CANlink communication card ● CANopen communication card ● Differential input pulse generator (PG) card ● UVW differential input PG card ● Resolver PG card ● OC input PG card.
Environment	Installation location	Install the MD500 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
	Humidity	**Less than 95 % RH non-condensing.**
	Vibration	**Less than 5.9 m/s² (0.6 g).**
	Storage temperature	–20°C to +60°C

10.2 De-rating

The drive can be operated at above the rated ambient temperature, altitude and default carrier frequency by de-rating the drive capacity.

■ Carrier Frequency De-rating

When the carrier frequency of the MD500 AC drive is increased above the default setting, you need to de-rate the drive's rated output current according to the following table:

Power	Carrier Frequency									
Phd (kW)	3 kHz	4 kHz	5 kHz	6 kHz	7 kHz	8 kHz	**9 kHz**	10 kHz	11 kHz	12 kHz
18.5	100.0%	100.0%	100.0%	100.0%	**95.7%**	**91.6%**	**87.9%**	84.3%	81.0%	**77.9%**
22	100.0%	100.0%	100.0%	100.0%	**95.5%**	**91.4%**	87.6%	**83.9%**	80.5%	77.3%
30	100.0%	100.0%	100.0%	100.0%	**93.5%**	87.7%	82.4%	77. 2%	72.5%	68.3%
37	100.0%	100.0%	100.0%	**94.4%**	**89.0%**	84.0%	**79.4%**	**74.9%**	70.8%	67.1%
45	100.0%	100.0%	100.0%	**94.0%**	88.6%	83.7%	**79.2%**	75.2%	71.5%	68.1%
55	100.0%	100.0%	**94.1%**	**88.9%**	84.0%	**79.5%**	75.5%	71.7%	68.3%	65.2%
75	100.0%	**91.8%**	84.2%	77.5%	**70.9%**	65.2%	60.1%	55.1%	50.6%	46.7%
90	100.0%	**90.8%**	82.3%	**74.9%**	67.7%	61.5%	56.0%	50.8%	46.2%	42.3%
110	100.0%	**91.9%**	84.4%	77.7%	71.3%	65.5%	60.4%	55.4%	51.1%	47.2%

■ Ambient Temperature De-rating

The drive operation between -10°C to 40°C is normal without de-rating. Operation between 40°C and 50°C requires output current de-rating. The rated output current must be de-rated for 1.5% per 1°C. The allowable maximum temperature is 50°C.

■ Altitude De-rating

The MD500 AC drive must be de-rated for an installation altitude of above 1000 meters because the cooling effect available from ambient air reduces. The rated output current must be de-rated for 1% per 100 meters. The maximum altitude is 3000 meters.

11

Maintenance

11 Maintenance and Inspection

11.1 Daily Inspection

DANGER

To Prevent Electric Shock

- Never wire the AC drive while the power is on. Cut off all power supplies and wait for at least ten minutes before any checking work so that the residual voltage on capacitors can discharge safely.
- Never modify wiring, disconnect the cable, remove the optional extension card or replace the cooling fan while the drive is running.
- Make sure to connect the grounding terminal of the motor to ground. Failure to comply may result in electric shock due to touching the motor housing.
- Installation, wiring, commissioning, repair & maintenance, and component **replacement must be performed only by qualified technicians.**

WARNING

To Prevent Fire

- Never run the AC drive with the protective cover removed.
- 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.**
- **Tighten all terminal screws based on the specified tightening torque.**
- This is to prevent the cable connection from overheating because the connection becomes loose.
- Never misconnect the main circuit.
- **This is to ensure that the input voltage is within the allowable range. Incorrect power voltage of the main circuit may result in a fire.**
- **Keep flammable materials far away from the AC drive or mount the AC drive on fire-** retardant or incombustible surfaces such as a metal wall.

CAUTION

- **Replace the cooling fan in correct ways as specified in this chapter.**

  Ensure correct air outlet direction of the fan. If the direction is incorrect, the cooling effects will diminish.
- Never install or remove the motor while the drive is running. Failure to comply may result in electric shock and damage to the AC drive.
- Use shielded cables for control circuit wiring. Meanwhile, connect the shield to ground reliably at one end to prevent the drive malfunction.
- Never modify the drive circuitry. Failure to comply will damage the AC drive.
- Make sure to connect the output terminals of the AC drive and the motor terminals correctly.

  If it is necessary to change the motor rotation direction, exchange any of U, V, W cables of the AC drive.
- Never operate the AC drive that has been damaged.

  This is to prevent further damage to external equipments.

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.

More frequent inspection will be required if it is used in harsh environments, such as:

- High ambient temperature
- Frequent starting and stopping
- Fluctuations in the AC power supply or load
- Excessive vibrations or shock loading
- Dust, metal dust, salt, sulfuric acid, chlorine atmospheres
- Poor storage conditions.

Check the following items every day to avoid deterioration in performance or product failure. Copy this checklist and sign the "checked" column after each inspection.

Inspection Item	Inspection Points	Solutions	Checked
Motor	Check whether abnormal oscillation or noise exists.	Check the mechanical connection. Check the power phases of the motor. Tighten all loose screws.	
Fan	Check whether the cooling fan of the AC drive and the motor works abnormally.	Check the running of the cooling fan of the AC drive. Check the running of the cooling fan of the AC drive. **Check for the clogged air filter.** Check whether the ambient temperature is within the allowable range.	
Installation environment	Check whether the cabinet and cable duct are abnormal.	Check for the input and output cables with insulation damaged. Check for vibration of hanging bracket. Check for loose and corroded ground bard and connecting cables.	
Load	Check whether the drive output current exceeds the drive rating and motor rating for a time.	Check for setting of motor parameters. Check for excessive load. **Check for mechanical vibration (< 0.6 g on normal condition).**	
Input voltage	Check the main power supply and the control voltage.	**Adjust the input voltage to the allowable range.** Check for starting of heavy load.	

11.2 Periodic Inspection

DANGER

To Prevent Electric Shock

- Never perform the inspection work while the power is on.
- Cut off all power supplies and wait for at least ten minutes before any checking work so that the residual voltage on capacitors can discharge safely.

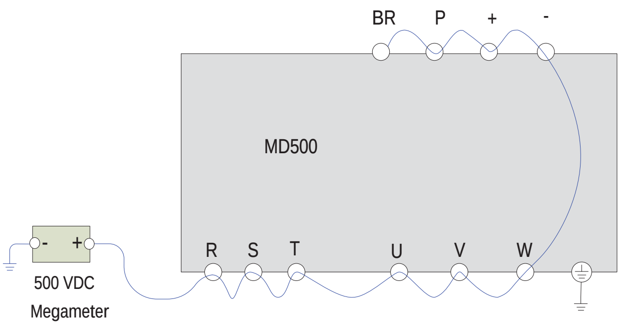
Perform periodic inspection in places where daily inspection is difficult. Always keep the AC drive clean. Clear away the dust especially metal powder on the surface of the AC drive, to prevent the dust from entering the drive. Clear the oil dirt from the cooling fan of the AC drive.

Check the following items every day to avoid deterioration in performance or product failure. Copy this checklist and sign the "checked" column after each inspection.

Inspection Item	Inspection Points	Solutions	Checked
General	Check for wastes, dirt and dust on the surface of the AC drive.	**Confirm that the drive cabinet is powered off.** Use a vacuum cleaner to suck up wastes and dust to prevent direct touching. Wipe the surface dirt with alcohol and wait until the surface becomes dry.	
Cables	Check whether the power cables and connections discolor. Check whether the insulation layer is aged or wears.	Replace the cracked cable. Replace the damaged terminals.	
Peripheral devices such as electromagnetic contactor	Check whether contactor pick up is not secure or abnormal noise exists for its operation. Check whether short-circuit, water seepage, swelling or bursting open occurs on any peripheral device	Replace the abnormal peripheral device.	
Air filter	**Check whether the air filter and** heatsink are clogged. Check whether the fan is damaged.	**Clean the air filter.** Replace the fan.	
Control circuit	Check for control components in poor contact. Check for loose terminal screws. Check for control cables with cracked insulation.	Clear away the foreign matters on the surface of control cables and terminals. Replace the damaged or corroded control cables.	

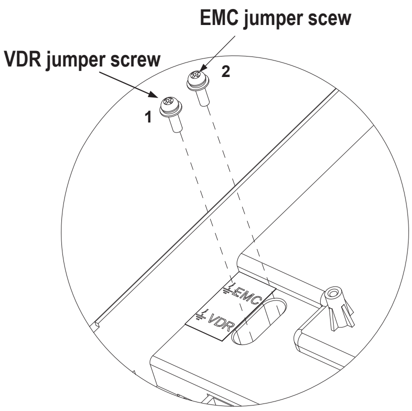
Note

- 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.



The measured insulating resistance must be greater than 5 MΩ.

Before the test loosen the VDR screw, as shown in the following position.



11.3 Replacement of Vulnerable Components

Vulnerable components of the AC drive include the 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 Cause	Judging Criteria
Fan	**≥ 5 years**	● Bearing worn ● Blade aging	● Whether there is crack on the blade ● Whether there is abnormal vibration noise upon startup
Electrolytic capacitor	**≥ 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.

The standard service time indicates the service time when the AC drive is used on the following conditions:

- Ambient temperature: about 40°C on average yearly
- Load rate: below 80%
- Operating rate: below 24 hours per day

You can determine when to replace these parts according to the actual operating time.

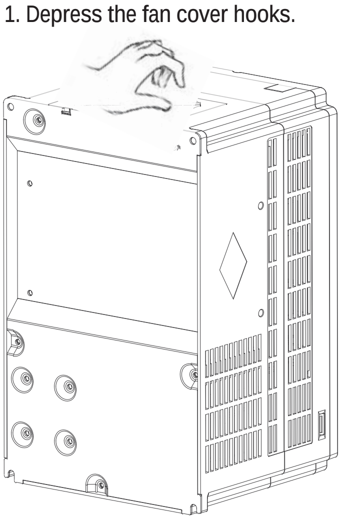
■ Number of Fans on the Drive

MD500 Model	Number of Fans
MD500T18.5G	1
MD500T22G	1
MD500T30G	1
MD500T37G	1
MD500T45G	1
MD500T55G	1
MD500T75G	2
MD500T90G	2
MD500T110G	2

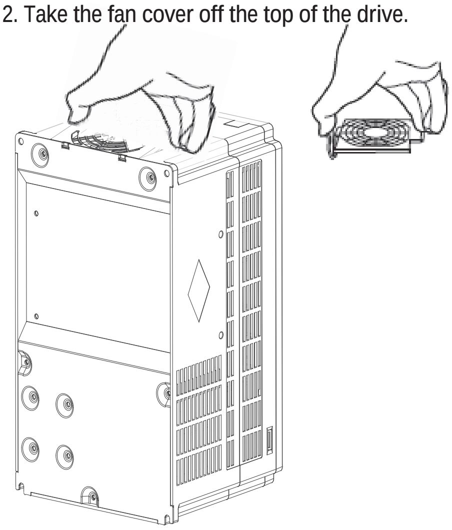
Removing and Installing the Fan of a Plastic Housing

Removal

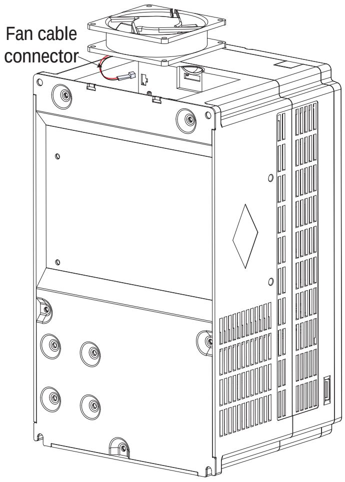
1. Depress the fan cover hooks.



2. Take the fan cover off the top of the drive.

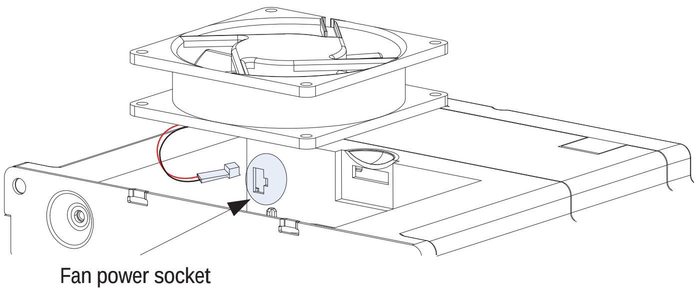


2. Pull the fan upward and disconnect the fan cable from the drive.

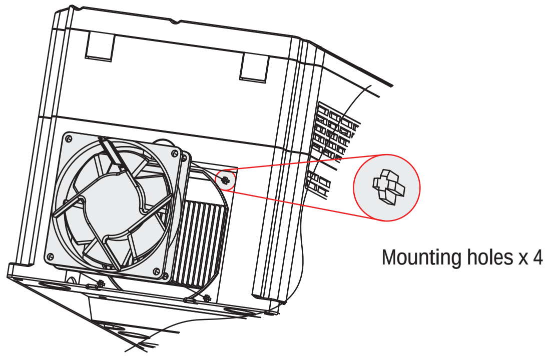


Installing

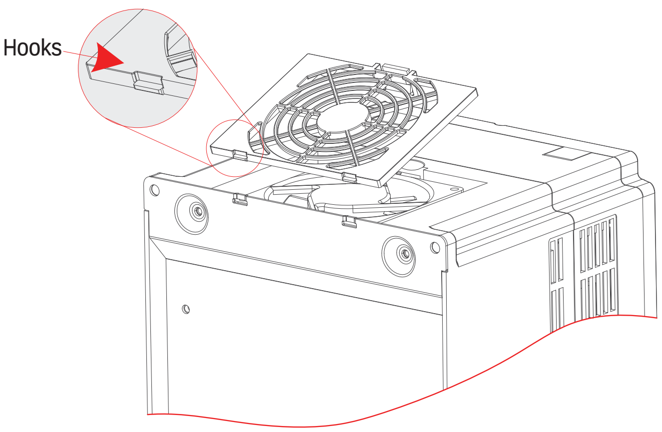
1. Connect the fan power cable to the fan power socket.



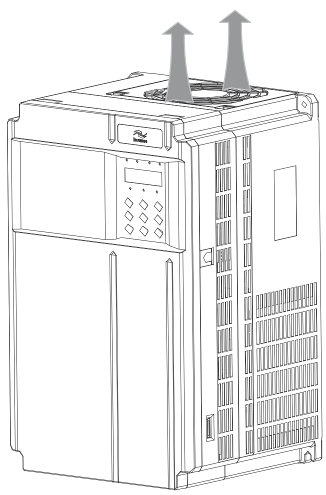
2. Install the fan into the drive and ensure mounting hole alignment.



3. Press in the hooks on the drive until the fan cover gets back to place.



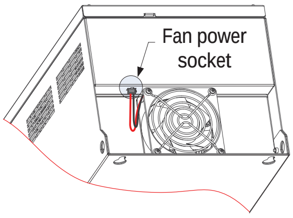
4. Ensure correct air flow direction.



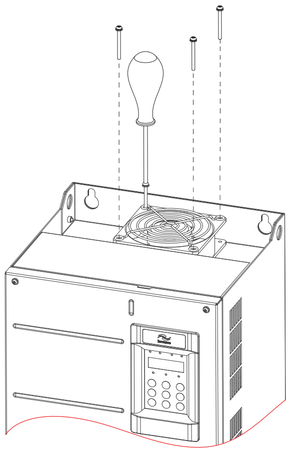
Removing and Installing the Fan of a Sheet Metal Housing

Removal

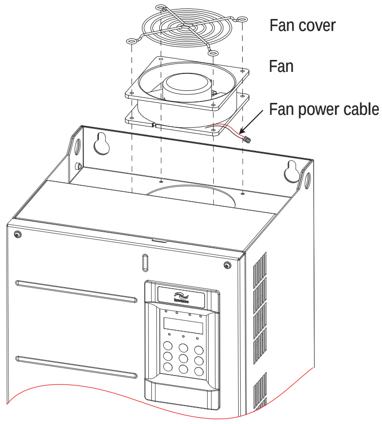
1. Disconnect the fan cable from the drive



2. Remove the four screws from the drive.



3. Recover the fan and the fan cover from the drive.



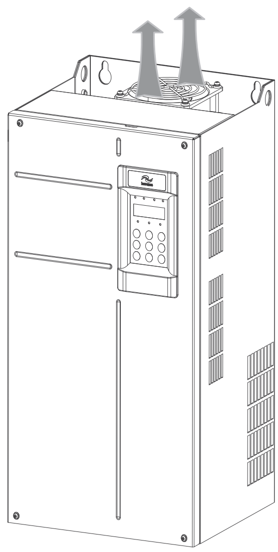
Installing

Keep the air flow direction upward.

1. Align the mounting holes of the fan and the fan cover to the mounting holes of the drive.

2. Install the fan and the fan cover on the AC drive.

3. Fix the screws and ensure correct air flow direction.



Replacement of Electrolytic Capacitor

Replacement of electrolytic capacitor will influence internal components of the drive. It is prohibited that you replace the electrolytic capacitor yourself. If replacement is required, contact Inovance.

11.4 Storage

For storage of the AC drive, pay attention to the following two aspects:

- Pack the AC drive with the original packing box provided by Inovance.
- 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.

11.5 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.
    - 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
    - The maintenance fee is charged according to Inovance's uniform standard. If there is an agreement, the agreement prevails.

12

Troubleshooting

12 Troubleshooting

12.1 Safety Information

DANGER

- Never wire the AC drive while the power is on, and keep all breakers in the OFF state. Failure to comply may result in electric shock.

WARNING

- **Make sure to ground the AC drive according to local laws and regulations. Failure to comply may result in electric shock or a fire.**
- Never wire the AC drive while the power is on, and keep all breakers in the OFF state. Failure to comply may result in electric shock.
- Never remove the protective cover or touch the internal circuit while the power is on. Failure to comply may result in electric shock.
- **Never allow unqualified personnel to perform any maintenance, inspection or part replacement work.**
- When installing the drive inside the enclosed cabinet, use the cooling fan or air conditioner to keep the **air inlet temperature below 50°C. Failure to comply may result in overheating or even a fire.**
- **Tighten all screws based on the stated tightening torque. Failure to comply may result in electric shock or a fire.**
- **Always confirm the input voltage is within the nameplate rating. Failure to comply may result in electric shock or a fire.**
- **Keep flammable and combustible materials away from the drive.**

CAUTION

To Prevent Crush

- Never transporting the drive by carrying the front cover. Failure to comply may **result in personal injury from main boby of the drive falling off.**
- Always handle the drive with care.
- Do not use the drive if there are damaged or missing parts.
- Cover the top of the drive with a temporary cloth or paper during installation so as to prevent foreign matter such as metal shavings, oil and water from falling into the drive. After the installation is completed, remove the temporary cloth or paper.
- Follow the proper electrostatic discharge (ESD) procedures when operating the AC drive. Failure to comply will damage the internal circuit of the drive.

12.2 Troubleshooting During Trial Run

This section provides the solutions to oscillation, poor torque or speed response, or other problems that occur while performing a trial run.

■ Drive in Open-loop Vector Control (F0-01 = 0: Default value)

The AC drive implements control of the motor speed and torque without an encoder for speed feedback. In this control mode, motor auto-tuning is required to obtain the motor related parameters.

Problem	Solutions
Overload or overcurrent reported during motor start	1. Set the motor parameters F1-01 to F1-05 according to the motor nameplate. 2. Select the proper motor auto-tuning mode by setting F1-37 and perform motor auto-tuning. If possible, select the dynamic auto-tuning.
Poor torque or speed response and motor oscillation at speeds below 10 Hz	1. If motor torque and speed response are too slow, increase the setting of F2-00 (speed loop proportional gain 1) or decrease the setting of F2-01 (speed loop integral time 1). 2. If motor oscillation occurs, decrease the setting of F2-00 and F2-01.
Poor torque or speed response and motor oscillation at speeds above 10 Hz	1. If motor torque and speed response are too slow, increase the setting of F2-03 (speed loop proportional gain 2) or decrease the setting of F2-04 (speed loop integral time 4). 2. If motor oscillation occurs, decrease the setting of F2-03 and F2-04.
Low speed accuracy	If the speed error of the motor with load is big, increase the setting of F2-06 (vector control slip compensation gain).
Big speed fluctuation	**If the motor speed fluctuates abnormally, increase the setting of F2-07 (SVC torque filter time) properly.**
Loud motor noise	Increase the setting of F0-15 (carrier frequency) properly. Note that increase in carrier frequency will result in an increase in the leakage current of the motor.
Insufficient motor torque	Check whether the torque upper limit is small. If yes, please: ● Increase the setting of F2-10 (digital setting of torque upper limit in speed control mode) in the speed control mode. ● Increase the torque reference (A0-03) in the torque control mode.

■ Drive in Closed-loop Vector Control (F0-01 = 1)

This mode is applicable to the application with an encoder for speed feedback. In this mode, you need to set the encoder pulses per revolution (F1-27), the encoder type (F1-28) and the encoder direction (F1-30) correctly.

Problem	Solutions
Overload or overcurrent fault reported during motor start	Set F1-27, F1-28 and F1-30 correctly.
Overload or overcurrent reported during motor rotation	1. Set the motor parameters F1-01 to F1-05 according to the motor nameplate. 2. Select the proper motor auto-tuning mode by setting F1-37 and perform motor auto-tuning. If possible, select the dynamic auto-tuning.
Poor torque or speed response and motor oscillation at speeds below 10 Hz	1. If motor torque and speed response are too slow, increase the setting of F2-00 (speed loop proportional gain 1) or decrease the setting of F2-01 (speed loop integral time 1). 2. If motor oscillation occurs, decrease the setting of F2-00 and F2-01.
Poor torque or speed response and motor oscillation at speeds above 10 Hz	1. If motor torque and speed response are too slow, increase the setting of F2-03 (speed loop proportional gain 2) or decrease the setting of F2-04 (speed loop integral time 4). 2. If motor oscillation occurs, decrease the setting of F2-03 and F2-04.
Low speed accuracy	If the speed error of the motor with load is big, increase the setting of F2-06 (vector control slip compensation gain).
Big speed fluctuation	**If the motor speed fluctuates abnormally, increase the setting of F2-07 (SVC torque filter time) properly.**

Problem	Solutions
Loud motor noise	Increase the setting of F0-15 (carrier frequency) properly. Note that increase in carrier frequency will result in an increase in the leakage current of the motor.
Insufficient motor torque	Check whether the torque upper limit is small. If yes, please: ● Increase the setting of F2-10 (digital setting of torque upper limit in speed control mode) in the speed control mode. ● Increase the torque reference (A0-03) in the torque control mode.

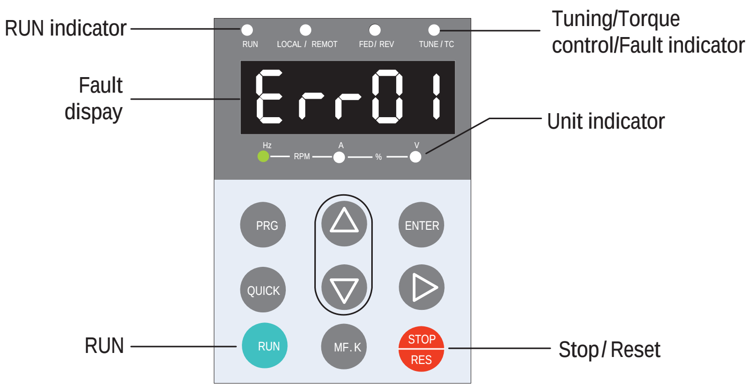
■ Drive in V/F Control (F0-01 = 2)

This mode is applicable to the application without an encoder for speed feedback. The motor parameters are not required. You just need to set the rated motor voltage (F1-02) and the rated motor frequency (F1-04) correctly.

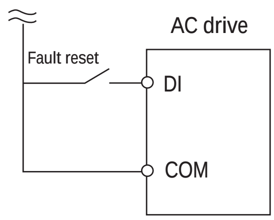
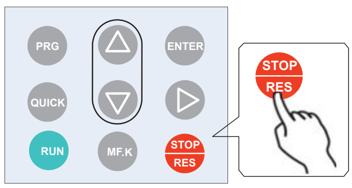
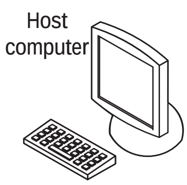
Problem	Solutions
Motor oscillation during running	**Increase the setting of F3-11 (V/F oscillation suppression gain)**
Overcurrent reported during large-power motor start	Decrease the setting of F3-01 (torque boost).
Very large current during running	1. Set the rated motor voltage (F1-02) and the rated motor frequency (F1-04) correctly. 2. Decrease the setting of F3-01 (torque boost). 3. Set F3-01 to 0.0% to enable the automatic torque boost function. (When using the **automatic torque boost function, perform the static motor auto-tuning first.)**
Loud motor noise	Increase the setting of F0-15 (carrier frequency) properly. Note that increase in carrier frequency will result in an increase in the leakage current of the motor.
Low speed accuracy	1. Set F3-01 to 0.0% to enable the automatic torque boost function. (When using the **automatic torque boost function, perform the static motor auto-tuning first.)** **2. Adjust the setting of F3-09 (V/F slip compensation gain) around 100%. The default value of F3-09 is 0.0%. (When using the V/F slip compensation function, perform the static motor auto-tuning first.)**
Overvoltage reported when heavy load is suddenly removed or during deceleration	1. Ensure that F3-21 (overvoltage suppression function selection) to 1 (enabled). Increase the setting of F3-22 (overvoltage stall prevention gain). The allowable maximum setting here is 40. The default value of F3-22 is 30. 2. Decrease the setting of F3-20 (overvoltage stall prevention voltage). The allowable minimum setting here is 700 V. The default value of F3-20 is 760 V.
Overcurrent reported when heavy load is suddenly added or during acceleration	1. Increase the setting of F3-20 (overcurrent stall prevention gain). The allowable maximum setting here is 40. The default value of F3-22 is 20. 2. Decrease the setting of F3-18 (Overcurrent stall prevention level). The allowable minimum setting here is 100%. The default value of F3-18 is 150%.

12.3 Fault Display

When a fault occurs during running, the AC drive stops output immediately, the fault indicator TUNE/TC **flashes, and the contact of the fault relay acts.** The operation panel displays the fault code such as Err01**, as shown in the following figure.**



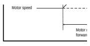
12.4 Resetting Fault

Stage	Solution	Remark
After the fault occurs	Check the operating panel for detailed information of the recent three faults, such as fault type and frequency, current, **bus voltage, DI/DO state, accumulative power-on time and** accumulative running time at occurrence of the faults.	**View these information via F9-14 to F9-44.**
Before the fault is reset	Find and remove the cause of the fault. Then follow the steps below to reset the fault.	Troubleshoot the fault according to section 8.5 "Faults and Diagnostics".
Fault resetting method	Fault resetting through a DI terminal **Allocate a DI terminal with function 9 "Fault reset (RESET)" by setting any of F4-00 to F4-09 to 9.**	
	Fault resetting via operating panel **Confirm that F7-02 = 1 (default value). Then** press the STOP/RES key on the operating panel.	
	Automatic resetting Cut off the main circuit power. Until the fault code disappears, re-power on the AC drive.	
	Fault resetting via host computer **Confirm that F0-02 = 2 and write 7 "fault reset"** to communication address 2000H.	

12.5 Faults and Diagnostics

Troubleshoot the fault according to the following table. If the fault cannot be eliminated, contact the agent or Inovance.

Operating Panel Display	Fault Name
Err02	Overcurrent during acceleration
Cause	**Possible Solution**
The output circuit is grounded or short circuited.	Eliminate external faults, and check whether short-circuit occurs on the motor or contactor.
The control mode is SVC or CLVC but motor auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform motor auto-tuning.
The acceleration time is too short.	Increase the acceleration time.
The overcurrent stall prevention parameters are set improperly.	**Ensure that the overcurrent stall prevention function is enabled (F3-19 = 1).** The setting of overcurrent stall prevention level (F3-18) **is too large. Adjust it between 120% and 150%.** The setting of overcurrent stall prevention gain (F3-20) **is too small. Adjust it between 20 and 40.**
Customized torque boost or V/F curve is not appropriate.	**Adjust the customized torque boost or V/F curve.**
The spinning motor is started.	Enable the catching a spinning motor function or start the motor after it stops.
The AC drive size is small.	Replace a large drive.
The AC drive suffers external interference.	View the historical fault records. If the current value is far from the **overcurrent level, find the interference source. If external interference** does not exists, it is the drive board or hall device problem.
Operating Panel Display	**Fault Name**
Err03	Overcurrent during deceleration
Cause	**Possible Solution**
The output circuit is grounded or short circuited.	Eliminate external faults, and check whether short-circuit occurs on the motor or contactor.
The control mode is SVC or CLVC but motor auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform motor auto-tuning.
The acceleration time is too short.	Increase the acceleration time.
The overcurrent stall prevention parameters are set improperly.	**Ensure that the overcurrent stall prevention function is enabled (F3-19 = 1).** The setting of overcurrent stall prevention level (F3-18) is too large. **Adjust it between 120% and 150%.** The setting of overcurrent stall prevention gain (F3-20) is too small. **Adjust it between 20 and 40.**
The braking unit and regen resistor are not installed.	**Install the braking unit and rejen resistor.**
The AC drive suffers external interference.	View the historical fault records. If the current value is far from the **overcurrent level, find the interference source. If external interference** does not exists, it is the drive board or hall device problem.

Operating Panel Display	Fault Name
	Overcurrent at constant speed
Cause	**Possible Solution**
The output circuit is grounded or short circuited.	Eliminate external faults, and check whether short-circuit occurs on the motor or contactor.
The control mode is SVC or CLVC but motor auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform motor auto-tuning.
The acceleration time is too short.	Increase the acceleration time.
The overcurrent stall prevention parameters are set improperly.	**Ensure that the overcurrent stall prevention function is enabled (F3-19 = 1).** The setting of overcurrent stall prevention level (F3-**18) is too large. Adjust it between 120% and 150%.** The setting of overcurrent stall prevention gain (F3-**20) is too small. Adjust it between 20 and 40.**
The AC drive size is small.	If the running current exceeds the rated motor current or rated output current of the AC drive during stable running, replace a large drive.
The AC drive suffers external interference.	View the historical fault records. If the current value is far from the **overcurrent level, find the interference source. If external interference** does not exists, it is the drive board or hall device problem.

Operating Panel Display	Fault Name
Err05	Overvoltage during acceleration
Cause	**Possible Solution**
The input voltage is too high.	**Adjust the voltage to normal range.**
An external force drives the motor during acceleration.	Cancel the external force or install a regen resistor.
The overvoltage stall prevention parameters are set improperly.	Ensure that the overvoltage stall prevention function is enabled (F3-23 = 1). The setting of overvoltage stall prevention voltage (F3-**22) is too large. Adjust it between 700 V and 760 V.** The setting of overvoltage stall prevention frequency gain (F3-**24) is too small. Adjust it between 30 and 50.**
The braking unit and regen resistor are not installed.	Install the braking unit and regen resistor.

Operating Panel Display	Fault Name
Err06	Overvoltage during deceleration
Cause	**Possible Solution**
The overvoltage stall prevention parameters are set improperly.	Ensure that the overvoltage stall prevention function is enabled (F3-23 = 1). The setting of overvoltage stall prevention voltage (F3-**22) is too large. Adjust it between 700 V and 760 V.** The setting of overvoltage stall prevention frequency gain (F3-**24) is too small. Adjust it between 30 and 50.**
An external force drives the motor during deceleration.	Cancel the external force or install the regen resistor.
The deceleration time is too short.	Increase the deceleration time.
The braking unit and regen resistor are not installed.	Install the braking unit and regen resistor.

Operating Panel Display	Fault Name
Err07	Overvoltage at constant speed
Cause	**Possible Solution**
The overvoltage stall prevention parameters are set improperly.	Ensure that the overvoltage stall prevention function is enabled (F3-23 = 1). The setting of overvoltage stall prevention voltage (F3-22) is too large. Adjust it between 700 V and 760 V. The setting of overvoltage stall prevention frequency gain (F3-24) is too small. Adjust it between 30 and 50. The setting of overvoltage stall prevention max. frequency (F3-26) is too small. Adjust it between 5 Hz and 20 Hz.
An external force drives the motor during running.	Cancel the external force or install the regen resistor
Operating Panel Display	**Fault Name**
Err08	Control power supply fault
Cause	**Possible Solution**
The input voltage is not within the allowable range.	Adjust the input voltage to the allowable range.
Operating Panel Display	**Fault Name**
Err09	Undervoltage
Cause	**Possible Solution**
Instantaneous power failure occurs	Enable the power dip ride through function (F9-59 ≠ 0).
The AC drive's input voltage is not within the allowable range.	Adjust the voltage to normal range.
The bus voltage is abnormal.	Contact the agent or Inovance.
The rectifier bridge, the buffer resistor, the drive board or the control board are abnormal.	Contact the agent or Inovance.
Operating Panel Display	**Fault Name**
Err 10	AC drive overload
Cause	**Possible Solution**
The load is too heavy or locked-rotor occurs on the motor.	Reduce the load and check the motor and mechanical conditions.
The AC drive size is small.	Replace a large drive.
Operating Panel Display	**Fault Name**
Err 11	Motor overload
Cause	**Possible Solution**
F9-01 (Motor overload protection gain) is set improperly.	Set F9-01 correctly.
The load is too heavy or locked-rotor occurs on the motor.	Reduce the load and check the motor and mechanical conditions.
The AC drive size is small.	Replace a large drive.
Operating Panel Display	**Fault Name**
Err 12	Power input phase loss
Cause	**Possible Solution**
The three-phase power input is abnormal.	Eliminate external faults.
The drive board, the lightening protection board, the control board, or the rectifier bridge is abnormal.	Contact the agent or Inovance.

Operating Panel Display	Fault Name
Err 13	Power output phase loss
Cause	**Possible Solution**
It is the motor fault.	Check whether short circuit occurs on the motor.
The cable connecting the AC drive and the motor is abnormal.	Eliminate external faults.
The AC drive's three-phase outputs are unbalanced when the motor is running.	Check whether the motor three-phase winding is normal and eliminate the fault.
The drive board or the IGBT module is abnormal.	Contact the agent or Inovance.

Operating Panel Display	Fault Name
Err 14	Module overheat
Cause	**Possible Solution**
The ambient temperature is too high.	Lower the ambient temperature.
The air filter is blocked.	**Clean the air filter.**
The fan is damaged.	Replace the damaged fan.
The thermally sensitive resistor of the module is damaged.	Replace the damaged thermally sensitive resistor.
The inverter module is damaged.	Replace the inverter module.

Operating Panel Display	Fault Name
Err 15	External equipment fault
Cause	**Possible Solution**
External fault signal is input via DI.	**Eliminate external faults, confirm that the mechanical condition** allows restart (F8-18) and reset the operation.
External fault signal is input via virtual I/O.	**Confirm that the virtual I/O parameters in group A1** are set correctly and reset the operation.

Operating Panel Display	Fault Name
Err 16	Communication fault
Cause	**Possible Solution**
The host computer is in abnormal state.	Check the cabling of host computer.
The communication cable is abnormal.	Check the communication cables.
The serial port communication protocol (F0-28) of the extension communication card is set improperly.	Set F0-28 of the extension communication card correctly.
The communication parameters in group Fd are set improperly.	Set the communication parameters in group Fd properly.

Operating Panel Display	Fault Name
Err17	Contactor fault
Cause	**Possible Solution**
The drive board and power supply are abnormal.	Replace the faulty drive board or power supply board.
The contactor is abnormal.	Replace the contactor.
The lightening protection board is abnormal.	Replace the lightening protection board.
Operating Panel Display	**Fault Name**
Err18	Current detection fault
Cause	**Possible Solution**
The hall device is abnormal.	Replace the hall device.
The drive board is abnormal.	Replace the drive board.
Operating Panel Display	**Fault Name**
Err19	Motor auto-tuning fault
Cause	**Possible Solution**
The motor parameters are not set according to the nameplate.	Set the motor parameters correctly according to the nameplate.
The motor auto-tuning process times out.	Check the cable connecting the AC drive and the motor.
The encoder is abnormal.	Check whether F1-27 (encoder pulses per revolution) is set correctly. Check whether the signal lines of the encoder are connected correctly and securely.
Operating Panel Display	**Fault Name**
Err20	Encoder fault
Cause	**Possible Solution**
The encoder is not matched	Set the encoder type correctly.
The encoder connection is incorrect.	Check the PG card power supply and phase sequence.
The encoder is damaged.	Replace the encoder.
The PG card is abnormal.	Replace the PG card.
Operating Panel Display	**Fault Name**
Err21	EEPROM read-write fault
Cause	**Possible Solution**
The EEPROM chip is damaged.	Replace the main control board.
Operating Panel Display	**Fault Name**
Err23	Short circuit to ground
Cause	**Possible Solution**
The motor is short circuited to the ground.	Replace the cable or motor.
Operating Panel Display	**Fault Name**
Err26	Accumulative running time reached
Cause	**Possible Solution**
The accumulative running time reaches the setting value.	Clear the record through the parameter initialization function.
Operating Panel Display	**Fault Name**
Err27	**User-defined fault 1**
Cause	**Possible Solution**
The user-defined fault 1 signal is input via DI.	Reset the operation.
User-defined fault 1 signal is input via virtual I/O.	Reset the operation.

Operating Panel Display	Fault Name
Err28	**User-defined fault 2**
Cause	Possible Solution
The user-defined fault 2 signal is input via DI.	Reset the operation.
User-defined fault 2 signal is input via virtual I/O.	Reset the operation.

Operating Panel Display	Fault Name
Err29	Accumulative power-on time reached
Cause	Possible Solution
The accumulative power-on time reaches the setting value.	Clear the record through the parameter initialization function.

Operating Panel Display	Fault Name
Err30	Accumulative power-on time reached
Cause	Possible Solution
The running current of the AC drive is smaller **than F9-64 (load lost detection level).**	**Check whether the load is disconnected or the setting of F9-64 and F9-65 (load lost detection time) satisfies the actual running condition.**

Operating Panel Display	Fault Name
Err40	Pulse-by-pulse current limit fault
Cause	Possible Solution
The load is too heavy or locked-rotor occurs on the motor.	Reduce the load and check the motor and mechanical conditions.
The AC drive size is small.	Replace a large drive.

Operating Panel Display	Fault Name
Err41	Motor switchover fault during running
Cause	Possible Solution
Change the selection of the motor via terminal during running of the AC drive.	Perform motor switchover after the AC drive stops.

Operating Panel Display	Fault Name
Err42	Speed feedback error too large
Cause	Possible Solution
The encoder parameters are set improperly.	Set the encoder parameters properly.
The motor auto-tuning is not performed.	Perform the motor auto-tuning.
F9-69 (detection level of too large speed feedback error) and F9-70 (detection time of too large speed feedback error) are set incorrectly.	**Set F9-69 and F9-70 correctly based on the actual situation.**

Operating Panel Display	Fault Name
	Motor overspeed
Cause	Possible Solution
The encoder parameters are set improperly.	Set the encoder parameters properly.
The motor auto-tuning is not performed.	Perform the motor auto-tuning.
F9-67 (Overspeed detection level) and F9-68 (Overspeed detection time) are set incorrectly.	**Set F9-69 and F9-70 correctly based on the actual situation.**

Operating Panel Display	Fault Name
Err45	Motor overtemperature.
Cause	**Possible Solution**
Cable connection of the temperature sensor becomes loose	Check the cable connection of the temperature sensor and eliminate the fault.
The motor temperature is too high.	Decrease the carrier frequency or take other measures to cool the fan.
Operating Panel Display	**Fault Name**
Err61	Braking unit overload
Cause	**Possible Solution**
The resistance of the regen resistor is too small.	Replace a large regen resistor.
Operating Panel Display	**Fault Name**
Err62	Short-circuit of braking circuit
Cause	**Possible Solution**
The braking module is abnormal.	Contact the agent or Inovance.

12.6 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.

Operating Panel Display	Fault Description
	There is no display at power-on.
Cause	**Possible Solution**
There is no power supply to the AC drive or the power input to the AC drive is too low.	Check the power supply.
The switching mode power supply on the drive board of the AC drive is faulty.	Check the bus voltage.
The rectifier bridge is damaged.	Re-connect the 8-core and 28-core cables.
The buffer resistor of the AC drive is damaged.	Contact the agent or Inovance.
The control board or the operating panel is faulty.	
The cable connecting the control board and the drive board and the operating panel breaks.	

Operating Panel Display	Fault Description
HC	"HC" is displayed at power-on.
Cause	**Possible Solution**
The cable connecting the drive board and the control board is in poor contact.	Re-connect the 8-core and 28-core cables.
Related components on the control board are damaged	Contact the agent or Inovance.
The motor or the motor cable is short circuited to the ground.	
The hall device is damaged.	
The line voltage is too low.	

Operating Panel Display	Fault Description
Err23	"Err23" is displayed at power-on.
Cause	**Possible Solution**
The motor or the motor output cable is short-circuited to the ground.	Check insulation of the motor and the output cable with a megger.
The AC drive is damaged.	Contact the agent or Inovance.

Operating Panel Display	Fault Description
HC	The AC drive display is normal upon power-on. But after **running the AC drive displays "HC" and stops immediately.**
Cause	**Possible Solution**
The cooling fan is damaged or locked-rotor occurs.	Replace the damaged fan.
The external control terminal cable is short circuited.	Eliminate external short-circuit fault.

Operating Panel Display	Fault Description
Err 14	Err14 (module overheat) is reported frequently.
Cause	**Possible Solution**
The setting of carrier frequency is too high.	Reduce the carrier frequency (F0-15).
The cooling fan is damaged, or the air filter is blocked.	**Replace the fan and clean the air filter.**
Components inside the AC drive are damaged (thermal coupler or others).	Contact the agent or Inovance.

Operating Panel Display	Fault Description
-	The motor does not rotate after the AC drive runs.
Cause	**Possible Solution**
Check the motor and the motor cables.	Check that cabling between the AC drive and the motor is normal.
The related AC drive and motor parameters are set improperly.	Restore the factory parameters and re-set the following parameters properly: Encoder parameters Motor ratings, such as rate motor frequency and rated motor speed Motor 1 control mode (F0-01) and command source selection (F0-02) **F3-01 (torque boost) in V/F mode and heavy-load start.**
The cable connecting the drive board and the control board is in poor contact.	**Re-confirm the jumper bar across OP and +24 V.**
The drive board is faulty.	Contact the agent or Inovance.

Operating Panel Display	Fault Description
-	The DI terminals are disabled.
Cause	**Possible Solution**
The related parameters are set incorrectly.	Check and set the parameters in group F4 again.
The external signal is incorrect.	Re-connect the external signal cables.
The jumper across OP and +24 V becomes loose.	**Re-confirm the jumper bar across OP and +24 V.**
The control board is faulty.	Contact the agent or Inovance.

Operating Panel Display	Fault Description
-	The motor speed does not rise in the CLVC mode.
Cause	**Possible Solution**
The encoder is faulty.	**Replace the encoder and re-confirm the cable connection.**
The encoder cable connection is incorrect or in poor contact.	Replace the PG card.
The PG card is faulty.	Contact the agent or Inovance.
The drive board is faulty.	

Operating Panel Display	Fault Description
-	The AC drive reports overcurrent and overvoltage frequently.
Cause	**Possible Solution**
The motor parameters are set improperly.	Set the motor parameters or perform motor auto-tuning again.
The acceleration/deceleration time is improper.	**Set proper acceleration/deceleration time.**
The load fluctuates.	Contact the agent or Inovance.

Operating Panel Display	Fault Description
Err17	Err17 is reported upon power-on or running.
Cause	**Possible Solution**
The soft startup contactor is not closed.	Check whether the contactor cable is loose.
	Check whether the contactor is faulty.
	Check whether 24 V power supply of the contactor is faulty.
	Contact the agent or Inovance.

13

EMC

13 EMC

13.1 CE Mark

The CE mark indicates compliance with European safety and environmental regulations. It is required for engaging in business and commerce in Europe.

European standards include the Machinery Directive for machine manufacturers, the Low Voltage Directive for electronics manufacturers, and the EMC guidelines for controlling noise.

This drive is marked with the CE mark based on the following EMC guidelines and the Low Voltage Directive.

- **Low Voltage Directive: 2006/95/EC**
- **EMC Guidelines: 2004/108/EC**

Machines and devices used in combination with this drive must also be CE certified and marked. The integrator who integrates the drive with the CE mark in into other devices has the responsibility of ensuring compliance with CE standards and verifying that conditions meet European standards.

13.2 CE Low Voltage Directive Compliance

This drive has been tested according to IEC 61800-5-1: 2007, and it complies with the Low Voltage Directive completely.

To enable machines and devices integrating this drive to comply with the Low Voltage Directive, be sure to meet the following conditions:

■ Mounting Location

Mount the AC drive in places with pollution not higher than severity 2 and overvoltage category 3 in accordance with IEC60664.

Installing Fuse on the Input Side

To prevent accidents caused by short circuit, install fuse on the input side and the fuse must comply with the UL standard.

Select the fuse according to the following figure.

MD500 Model	FWH Series Fuse Manufacturer: Bussmann	
	Rated Current	Model
MD500T18.5G	80	FWH-80B
MD500T22G	100	FWH-100B
MD500T30G	100	FWH-100B
MD500T37G	125	FWH-125B
MD500T45G	150	FWH-150B
MD500T55G	200	FWH-200B
MD500T75G	250	FWH-250B
MD500T90G	275	FWH-275B
MD500T110G	325	FWH-325B
MD500T132	400	FWH-400B
MD500T160	500	FWH-500B
MD500T200	600	FWH-600B
MD500T220	700	FWH-700B
MD500T250	800	FWH-800B
MD500T280	800	FWH-800B
MD500T315	1000	FWH-1000B
MD500T355	1000	FWH-1000B
MD500T400	1200	FWH-1200B

Preventing Entry of Foreign Objects

The MD500 units 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.

Grounding

If using an AC drive of the 400 V class, tie the neutral point of the drive power supply to ground.

13.3 EMC Guidelines Compliance

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.**

The MD500 satisfies the European EMC directive 2004/108/EC and the standard EN 61800-3: 2004 +A1: 2012 Category C2. The AC drives are applied to both the first environment and the second environment.

WARNING

When applied in the first environment, the AC drive may generate radio interference. Besides the CE compliance described in this chapter, take measures to avoid the radio interference if required.

The integrator of the system installed with the AC drive is responsible for compliance of the system with the European EMC directive and standard EN 61800-3: 2004 +A1: 2012 Category C2, C3 or C4 according to the system application environment.

13.4 Definition of Terms

■ 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 1 000 V, intended for use in the first environment

■ Category C2 AC drive

PDS of rated voltage less than 1 000 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 person.

■ Category C3 AC drive

PDS of rated voltage less than 1 000 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 1 000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment

13.5 Selection of Peripheral EMC Devices

13.5.1 AC Input Filter Installation

Note

Select a cable as short as possible to connect the filter and the drive. The cable length must be less than 30 cm. Make sure to connect the filter and the drive to the same grounding reference surface to implement reliable grounding of the filter. Otherwise, the desired filtering effect will not be achieved.

■ Standard EMC Filter

This series filters satisfy the EN 61800-3 C2 emission requirement of the CE certification. Connect the filter to ground reliably and ensure that the length of the cable connecting the drive and the filter is less than 30 cm.

- Physical appearance

Schaffner FN3258 series filter

Schaffner FN3270H series filter

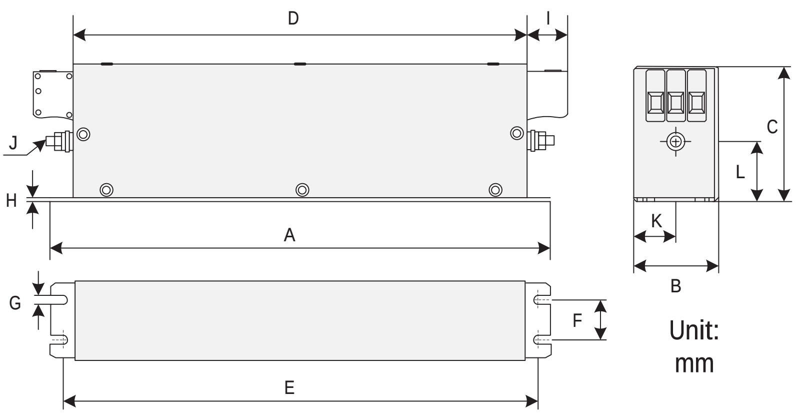
Changzhou Jianli EBK5 series filter

- Selection

MD500 Model	Input AC Filter Model (Schaffner)	Input AC Filter Model (Changzhou Jianli)
MD500T18.5	FN 3258-55-34	DL-50EBK5
MD500T22	FN 3258-75-34	DL-65EBK5
MD500T30	FN 3258-75-34	DL-65EBK5
MD500T37	FN 3258-100-35	DL-80EBK5
MD500T45	FN 3258-100-35	DL-100EBK5
MD500T55	FN 3258-130-35	DL-130EBK5
MD500T75	FN 3258-180-40	DL-160EBK5
MD500T90	FN 3258-180-40	DL-200EBK5
MD500T110	**FN 3270H-250-99**	DL-250EBK5

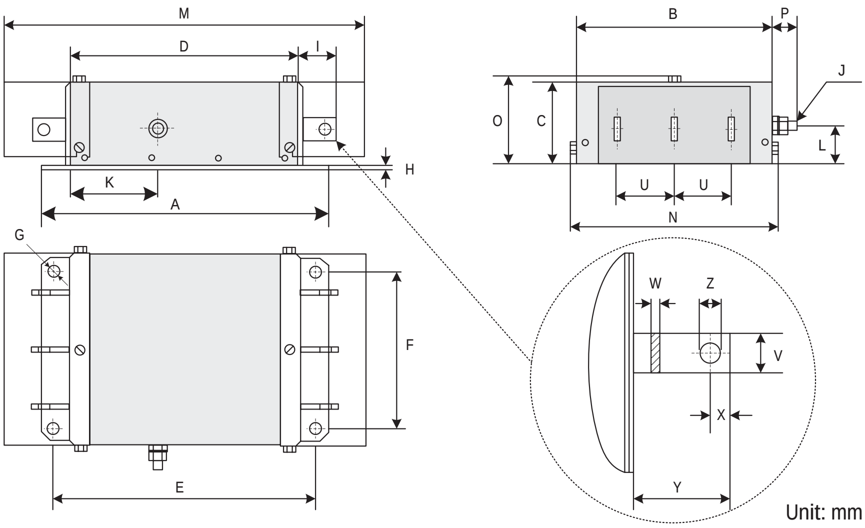
- Mounting Dimensions

1. **Dimensions of the Schaffner FN 3258 series 50-180A filter**



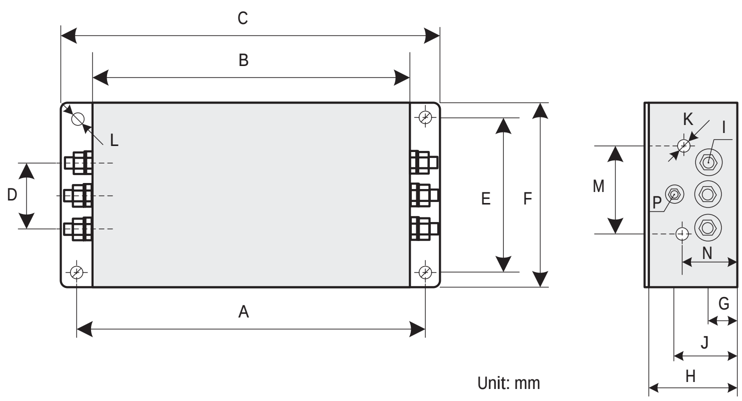
Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L
7	**190**	40	70	160	180	20	4.5	1	22	M5	20	**29.5**
16	250	45	70	220	235	25	5.4	1	22	M5	22.5	**29.5**
30	270	50	85	240	255	30	5.4	1	25	M5	25	**39.5**
42	310	50	85	280	**295**	30	5.4	1	25	M6	25	37.5
55	250	85	**90**	220	235	60	5.4	1	**39**	M6	42.5	26.5
75	270	80	135	240	255	60	6.5	1.5	**39**	M6	40	70.5
100	270	**90**	150	240	255	65	6.5	1.5	45	M10	45	64
130	270	**90**	150	240	255	65	6.5	1.5	45	M10	45	64
180	380	120	170	350	365	102	6.5	1.5	51	M10	60	47

2. **Dimensions of the Schaffner FN 3270H series 150-1000A filter**



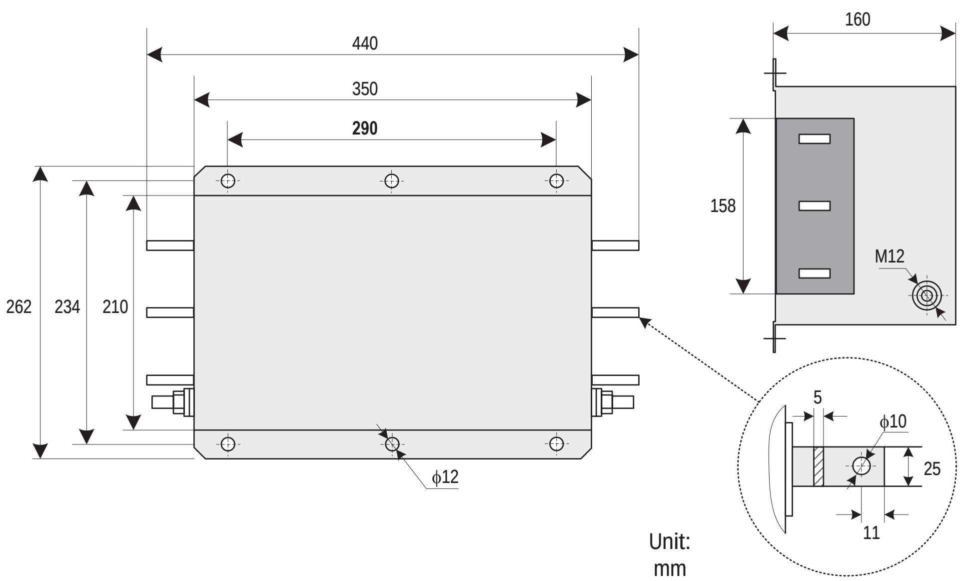
Rated Current (A)	150	200	250	320	400	600	800	1000
A	300	300	300	300	300	300	370	370
B	200	200	200	200	200	200	**190**	**190**
C	86	86	86	86	86	86	125	125
D	240	240	240	240	240	240	310	310
E	275	275	275	275	275	275	345	345
F	165	165	165	165	165	165	155	155
G	f11	f11	f11	f11	f11	f11	f11	f11
H	2	2	2	2	2	2	3	3
I	40	40	40	40	40	40	50	50
J	M10	M10	M10	M10	M10	M10	M12	M12
K	**92**	**92**	**92**	**92**	**92**	**92**	138	138
L	37	37	37	37	37	37	67	67
M	380	380	380	380	380	380	610	610
N	211	211	211	211	211	211	201	201
O	**93**	**93**	**93**	**93**	**93**	**93**	132	132
P	26.5	26.5	26.5	26.5	26.5	26.5	**29**	**29**
U	60	60	60	60	60	60	60	60
V	20	20	20	25	25	25	40	40
W	3	3	3	6	6	8	8	8
X	10	10	10	12.5	12.5	12.5	20	20
Y	37	37	37	37	37	37	47	47
Z	**f9**	**f9**	**f9**	f11	f11	f11	f13.5	f13.5

3. **Dimensions of the Jianli series 50-180A filter**



Filter Model	A	B	C	D	E	F	G	H	I	J	K	M	N	P	L
DL-25EBK5 DL-35EBK5 DL-50EBK5 DL-65EBK5	243	224	265	58	70	102	25	**92**	M6	58	M4	74	**49**	M6	6.4 x **9.4**
DL-80EBK5 DL-100EBK5 DL-130EBK5 DL-160EBK5 DL-200EBK5	354	323	388	66	155	188	30	**92**	M8	62	M4	86	56	M8	6.4 x **9.4**

4. **Dimensions of the Jianli series 250A filter**



■ Simple EMC Filter

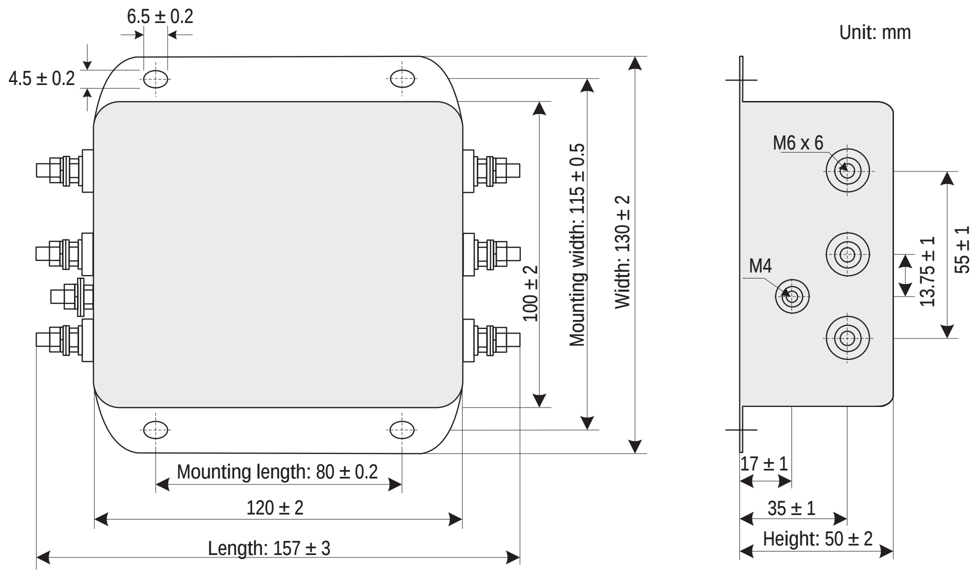
A simple EMC filter is installed to prevent the surrounding interference and prevent the interference from the AC drive during running.

Connect the simple EMC filter to ground reliably and ensure that the length of the cable connecting the drive and the filter is less than 30 cm.

- Selection

MD500 Model	Simple EMC filter
MD500T18.5	**DL65EB1/10**
MD500T22	
MD500T30	
MD500T37	**DL-120EB1/10**
MD500T45	
MD500T55	**DL-180EB1/10**
MD500T75	
MD500T90	Unavailable
MD500T110	Unavailable

- Mounting Dimensions

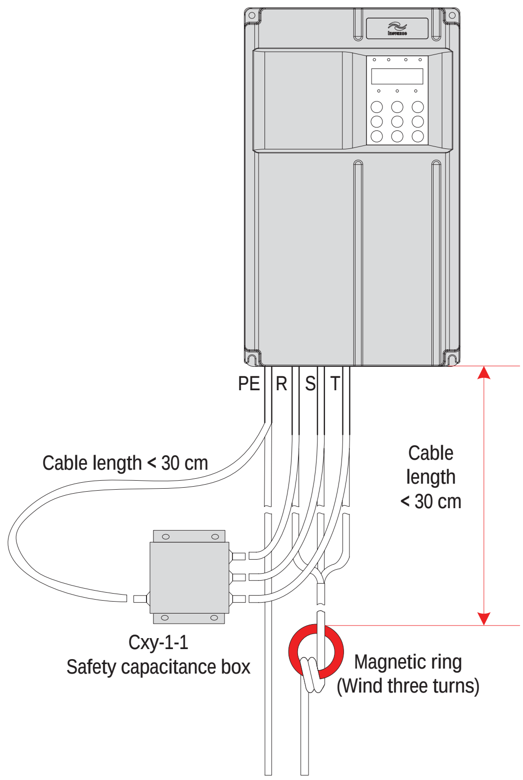


Simple EMC Filter Model	Overall Dimensions (Length x Width x Height)	Mounting Dimensions (Mounting Length x Mounting Width)
DL-15EB1/10	157 x 130 x 50	80 x 115
DL-35EB1/10	218 x 140 x 80	184 x 112
DL-65EB1/10	218 x 140 x 80	184 x 112
DL-120EB1/10	**334 x 185 x 90**	304 x 155
DL-180EB1/10	388 x 220 x 100	**354 x 190**

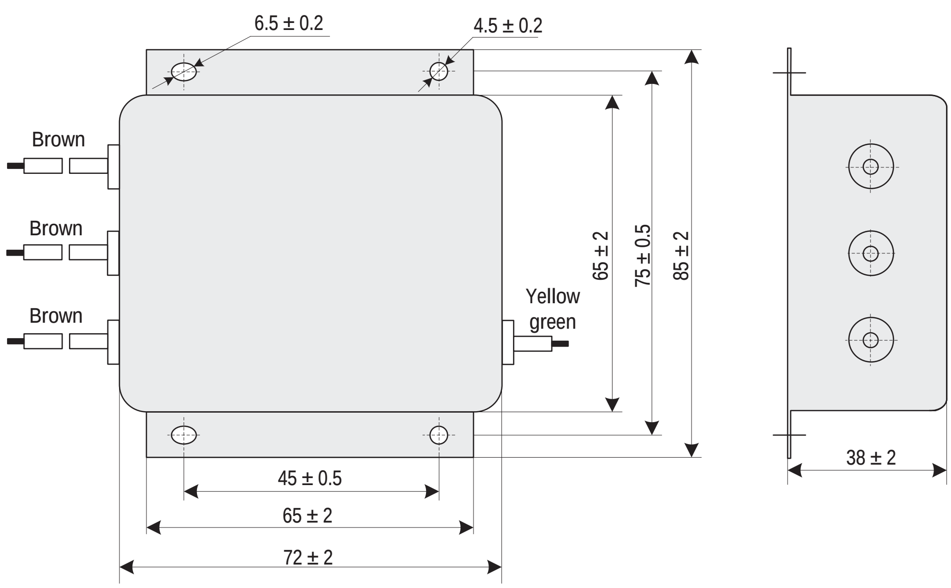
Safety Capacitance Box and Magnetic Ring

In some applications, connect the safety capacitance box and wind a magnetic ring to remove some interference during the drive running.

Connect the safety capacitance box to the grounding terminal of the drive, and the ground cable length cannot exceed 30 cm.



- Mounting dimensions of the safety capacitance box



Safety Capacitance Box Model	SN	Overall Dimensions (Length x Width x Height)	Mounting Dimensions (Mounting Length x Mounting Width)
Cxy-1-1	11025018	85 x 72 x 38	45 x 75

- Physical appearance of the magnetic ring

- Selection of the magnetic ring

Magnetic Ring Model	SN	Dimensions (Outer Diameter x Inner Diameter x Thickness) (mm)
DY644020H	11013031	64 x 40 x 20
DY805020H	11013032	80 x 50 x 20
DY1207030H	11013033	120 x 70 x 30

13.5.2 AC Input Reactor Installation

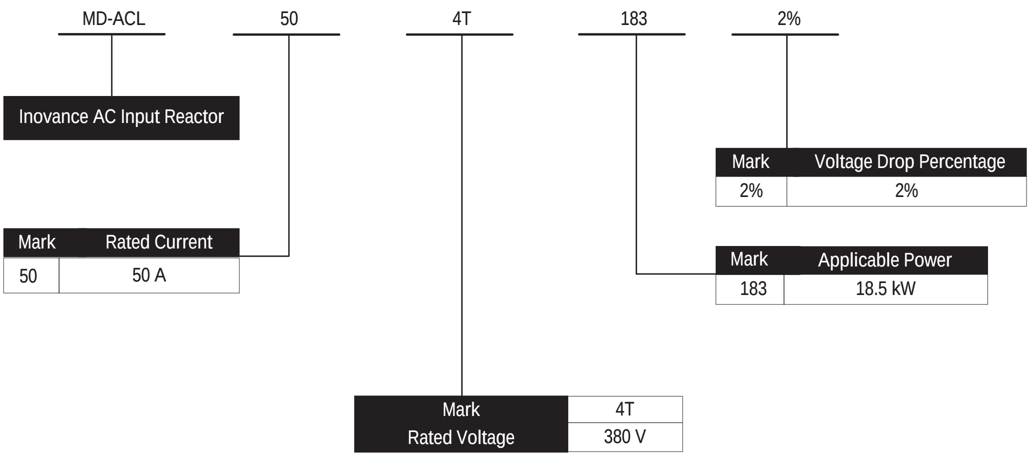
■ AC Reactor Model

The AC input reactor is connected to suppress harmonic current on the input side. Install an AC reactor when the application has higher requirements on harmonic suppression.

The recommended AC reactor manufacturer and models are listed in the following table.

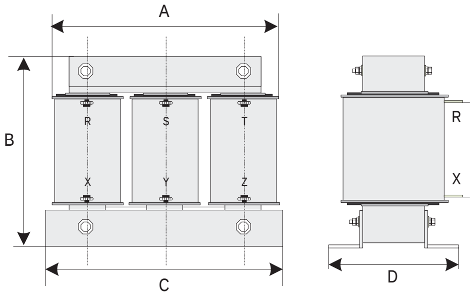
AC Drive Model	AC Reactor Model (Inovance)
MD500T18.5	MD-ACL-50-4T-183-2%
MD500T22	MD-ACL-60-4T-223-2%
MD500T30	MD-ACL-80-4T-303-2%
MD500T37	**MD-ACL-90-4T-373-2%**
MD500T45	MD-ACL-120-4T-453-2%
MD500T55	MD-ACL-150-4T-553-2%
MD500T75	MD-ACL-200-4T-753-2%
MD500T90	MD-ACL-250-4T-114-2%
MD500T110	MD-ACL-250-4T-114-2%

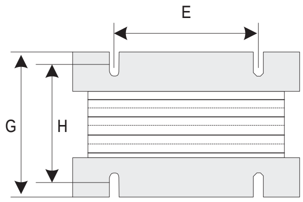
■ Designation Rule



Dimensions

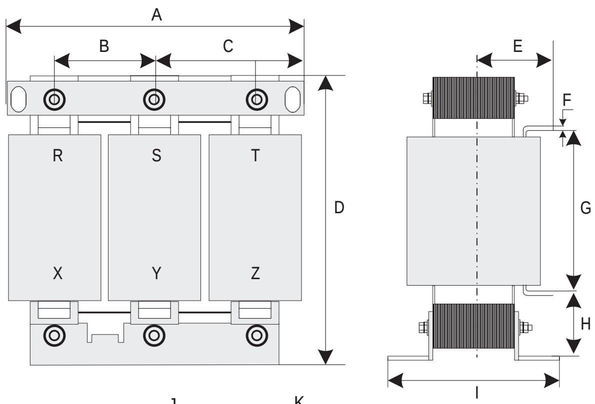
The dimensions of the AC reactor of 50 to 120 A are shown as below:

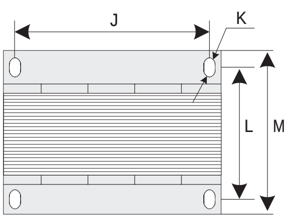




Rated Current A	A mm	B	C	D	E	F	G	H
50	155	130	148	150	**95**	6 x 15	**95**	80
60	**195**	160	188	135	120	8.5 x 20	**92**	72
80	**195**	160	188	150	120	8.5 x 20	**92**	72
90	**195**	160	188	150	120	8.5 x 20	**92**	72
120	**195**	160	188	135	120	8.5 x 20	112	72

The dimensions of the AC reactor of 150 to 250 A are shown as below:





Rated Current A	A mm	B	C	D	E	F	G	H	I	J	K	L	M
150	250	81	81	230	**92**	5	140	38	155	182	11 x 18	76	102
200	250	81	81	230	102	5	140	40	175	182	11 x 18	**96**	122
250	250	81	81	230	102	5	155	50	175	182	11 x 18	**96**	122

Note

The dimensions of the AC reactor are for reference only.

13.5.3 AC Output Reactor Installation

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 cable connecting the drive and the motor is equal to or longer than the value in the following table, connect an AC reactor on the output side to suppress the high-harmonic current.

AC Drive Power (kW)	Rated Voltage (V)	Cable Length Threshold (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	**280 to 690**	150

■ AC Reactor Model

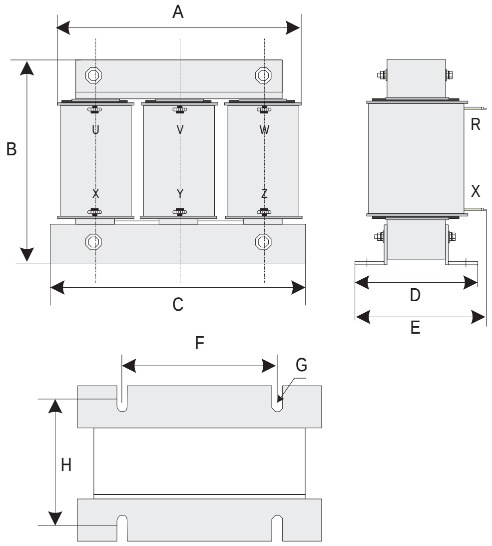
The recommended AC reactor manufacturer and models are listed in the following table.

AC Drive Model	AC Reactor Model (Inovance)
MD500T18.5	MD-OCL-50-4T-183-1%
MD500T22	MD-OCL-60-4T-223-1%
MD500T30	MD-OCL-80-4T-303-1%
MD500T37	**MD-OCL-90-4T-373-1%**
MD500T45	MD-OCL-120-4T-453-1%
MD500T55	MD-OCL-150-4T-553-1%
MD500T75	MD-OCL-200-4T-753-1%
MD500T90	MD-OCL-250-4T-114-1%
MD500T110	MD-OCL-250-4T-114-1%

■ Designation Rule

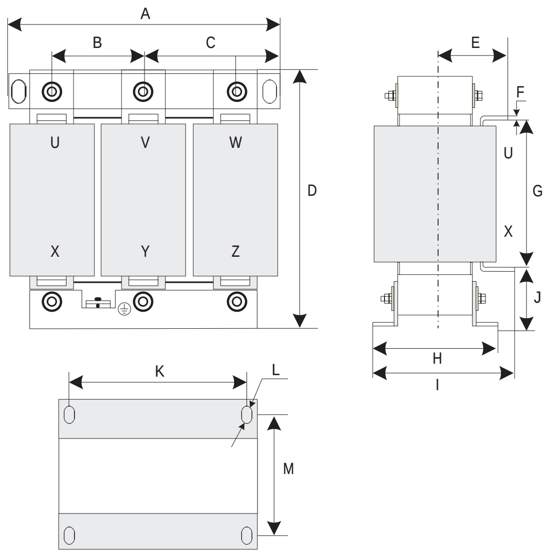
Mounting Dimensions

The dimensions of the AC reactor of 50 to 120 A are shown as below:



Rated Current A	A mm	B	C	D	E	F	G	H
50	155	130	148	**95**	135	**95**	6 x 15	80
60	**195**	165	188	**92**	130	120	8.5 x 20	72
80	**195**	165	188	**92**	130	120	8.5 x 20	72
90	**195**	165	188	**92**	130	120	8.5 x 20	72
120	**195**	165	188	112	135	120	8.5 x 20	72

The dimensions of the AC reactor of 150 to 250 A are shown as below:



Rated Current A	A mm	B	C	D	E	F	G	H	I	J	K	L	M
150	250	81	81	230	**97**	5	140	113	170	42	182	11 x 18	87
200	250	81	81	230	102	5	140	123	175	42	182	11 x 18	**97**
250	250	81	81	230	102	5	140	123	175	42	214	11 x 18	106

Note

The dimensions of the AC reactor are for reference only.

13.5.4 dv/dt Reactor Installation

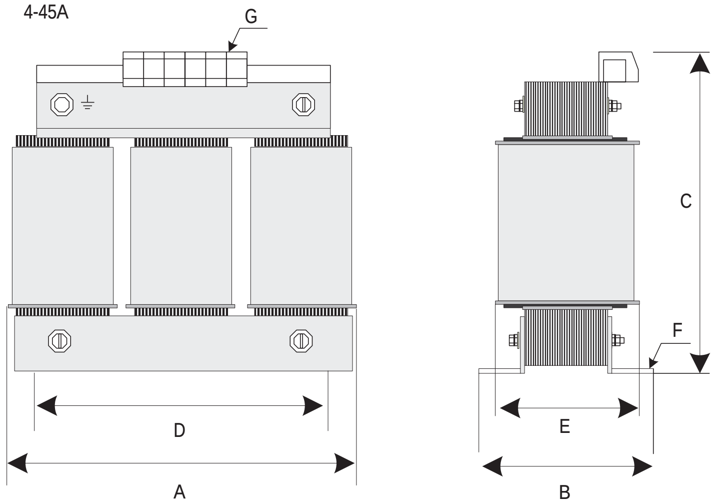
Connect a dv/dt reactor on the output side to reduce large dv/dt, protecting the motor winding from insulation breakdown, lowering motor temperature and extending the motor service life and meanwhile reduce interference on surrounding devices.

■ **Selection of the dv/dt Reactor (Schaffner)**

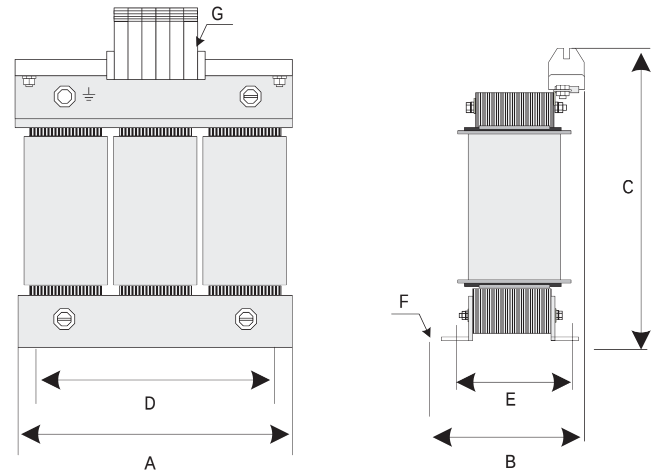
dv/dt Reactor Model	Rated Current at 40 °C (A)	Rated Power of Standard Motor (kW)	Rated Inductance (mH)	Power Consumption (W)	I/O Terminal Selection			Total (kg)
RWK 305-4-KL	4	1.5	1.47	22	KL			1.2
RWK 305-7.8-KL	7.8	3	0.754	25	KL			1.2
RWK 305-10-KL	10	4	0.588	30	KL			1.8
RWK 305-14-KL	14	5.5	0.42	34	KL			2.2
RWK 305-17-KL	17	7.5	0.346	38	KL			2.5
RWK 305-24-KL	24	11	0.245	45	KL			2.5
RWK 305-32-KL	32	15	0.184	55	KL			**3.9**
RWK 305-45-KL	45	22	0.131	60	KL			6.1
RWK 305-60-KL	60	30	**0.098**	65	KL			6.1
RWK 305-72-KL	72	37	0.082	70	KL			6.1
RWK 305-90-KL	**90**	45	0.065	75	KL			7.4
RWK 305-110-KL	110	55	0.053	**90**	KL			8.2
RWK 305-124-KS	124	55	0.047	110		KS		8.2
RWK 305-143-KS	143	75	0.041	115		KS		10.7
RWK 305-156-KS	156	75	0.038	120		KS		10.7
RWK 305-170-KS	170	**90**	0.035	130		KS		10.7
RWK 305-182-KS	182	**90**	0.032	140		KS		16
RWK 305-230-KS	230	132	0.026	180		KS		22
RWK 305-280-KS	280	160	0.021	220		KS		**29**
RWK 305-330-KS	330	160	0.018	240		KS		32
RWK 305-400-S	400	200	0.015	330			S	34
RWK 305-500-S	500	250	0.012	340			S	35
RWK 305-600-S	600	355	0.01	380			S	37
RWK 305-680-S	680	400	**0.009**	410			S	38
RWK 305-790-S	**790**	450	0.007	**590**			S	43
RWK 305-910-S	**910**	500	0.006	740			S	**49**
RWK 305-1100-S	1100	630	0.005	760			S	66

Mounting Dimensions

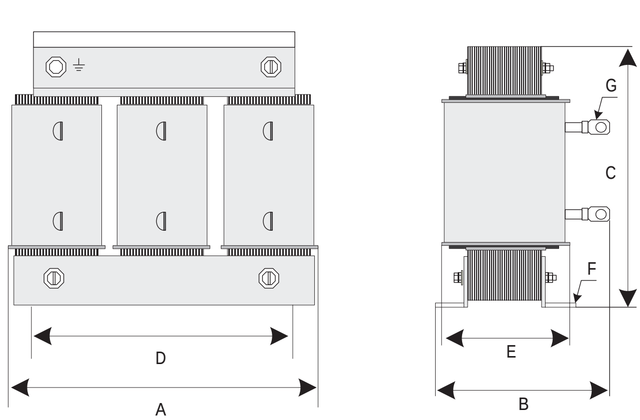
4-45A



60-110A



124-330A

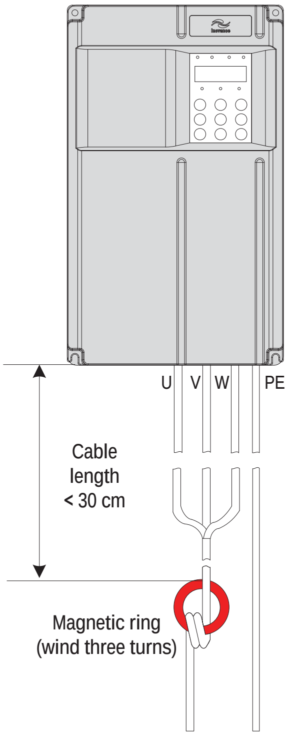


Reactor Series	A	B	C	D	E	F	G
4 and 7.8A	100	max.60	max.115	56	34	**4.8 x 9**	2.5m m^2
10A	100	max.70	max.115	56	43	**4.8 x 9**	2.5m m^2
14A	125	max.70	max.135	100	45	5 x 8	2.5m m^2
17A	125	max.75	max.135	100	55	5 x 8	2.5m m^2
24A	125	max.75	max.135	100	55	5 x 8	4m m^2
32A	155	**max.95**	max.170	130	56	8 x 12	10m m^2
45A	155	max.110	**max.190**	130	72	8 x 12	10m m^2
60 and 72A	155	max.125	**max.190**	130	70	8 x 12	16m m^2
90A	**190**	max.115	max.225	170	57	8 x 12	35m m^2
110A	**190**	max.130	max.220	170	67	8 x 12	35m m^2
124A	**190**	max.180	max.160	170	67	8 x 12	ϕ8
143A	**190**	max.180	max.160	170	77	8 x 12	ϕ8
156 and 170A	**190**	max.180	max.160	170	77	8 x 12	ϕ10
182A	210	max.180	max.185	175	**97**	8 x 12	ϕ10
230A	240	220		**190**	**119**	11 x 15	ϕ12
280A	240	235		**190**	133	11 x 15	ϕ12
330A	240	240		**190**	135	11 x 15	ϕ12
400 and 500A	240	220		**190**	**119**	11 x 15	ϕ11
600 and 680A	240	230		**190**	128	11 x 15	ϕ11
790A	300	218		240	136	11 x 15	ϕ11
910A	300	228		240	148	11 x 15	ϕ11
1100A	360	250		310	144	11 x 15	ϕ11

13.5.5 Common-mode Filter

The common-mode filter is installed on the output side (close to the AC drive) to reduce the bearing current and reduce interference on the surrounding devices.

The following figure shows installation of the common-mode filter.



The following figure shows the physical appearance of the magnetic ring

Common-mode Filter Model	SN	Dimensions (Outer Diameter x Inner Diameter x Thickness) (mm)
DY644020H	11013031	64 x 40 x 20
DY805020H	11013032	80 x 50 x 20
DY1207030H	11013033	120 x 70 x 30

13.6 Breaker & Fuse Selection

The earth leakage current of the AC drive is larger than 3.5 A, requiring grounding protection.

The AC drive produces DC leakage current inside protective conductor, thus a B-type (delay-type) leakage breaker must be used.

When the leakage breaker acts accidentally, you can:

- Use a leakage breaker of higher rated action current or use a delay-type leakage breaker.
- Lower the carrier frequency of the AC drive.
- Shorten the length of drive cables of the motor.
- Take leakage current suppression measures.

The recommended leakage breaker manufacturers are CHINT and Schneider.

The following table is the selection guidance of the breaker, contactor and fuse.

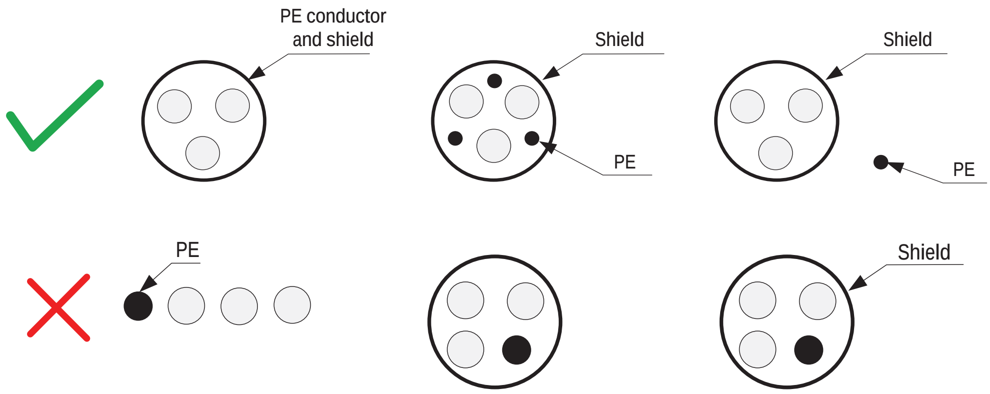
AC Drive Model	Recommended Fuse Bussmann FWH **Series (Passing UL Certification)**		Contactor	Breaker
	Rated Current (A)	Model	Rated Current (A)	Rated Current (A)
Three-phase 380 to 480 V, 50/60 Hz				
MD500T18.5G	80	FWH-80B	65	80
MD500T22G	100	FWH-100B	65	80
MD500T30G	100	FWH-100B	65	80
MD500T37G	125	FWH-125B	80	100
MD500T45G	150	FWH-150B	**95**	160
MD500T55G	200	FWH-200B	115	160
MD500T75G	250	FWH-250B	150	250
MD500T90G	275	FWH-275B	170	250
MD500T110G	325	FWH-325B	205	400
MD500T132	400	FWH-400B	245	
MD500T160	500	FWH-500B	300	
MD500T200	600	FWH-600B	410	
MD500T220	700	FWH-700B	410	
MD500T250	800	FWH-800B	475	
MD500T280	800	FWH-800B	620	
MD500T315	1000	FWH-1000B	620	
MD500T355	1000	FWH-1000B	620	
MD500T400	1200	FWH-1200B	800	

13.7 Shielded Cable

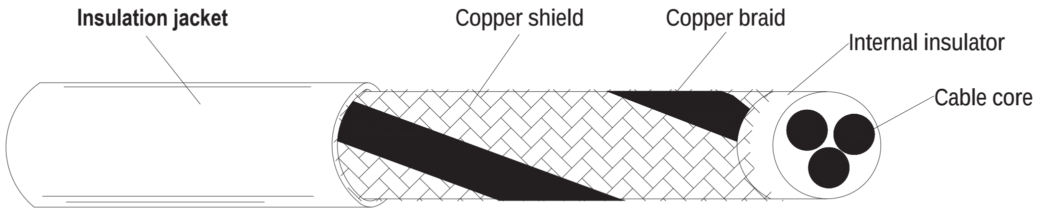
13.7.1 Requirements for Shielded Cable

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 cooper braid. The braided density of the cooper braid should be greater than 90% to enhance the shielding efficiency and conductivity, as shown in the following figure.



13.7.2 Cabling Requirements

1. 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.
2. It is recommended that all control cables be shielded.
3. 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.
4. 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.
5. 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.
6. The cable ducts must be in good connection and well grounded. Aluminium ducts can be used to improve electric potential.
7. 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.

13.8 Solutions to Current Leakage

The AC drive outputs high-speed pulse voltage, producing high-frequency leakage current during running of the AC drive. Each AC drive produces more than 100 mA leakage current. Therefore, it is necessary to select a residual current circuit-breaker with rated operating current of 100 mA above.

The AC drive generates DC leakage current in protective conductor. In this case, a time-delay B-type breaker must be used. If multiple AC drives are required, each AC drive must be installed with a circuit-breaker.

The factors that influence the leakage current are as follows:

- AC drive capacity
- Carrier frequency
- Type and length of motor cable
- **EMI filter**

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.

The recommended residual current circuit-breaker manufacturers are Chint Electric and Schneider.

13.9 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	● Reduce the carrier frequency. ● Shorten the length of the AC drive cables. ● Wind magnetic ring around the drive input cable except the PE cable. ● For tripping at the moment of power-on, cut off the large capacitance to ground on the **power input side by disconnecting the grounding terminal of the external or built-in filter and** disconnecting the grounding terminal of the Y capacitance to ground of the input terminals . ● For tripping during drive running or when drive enabled, take leakage current suppression measures **(install a leakage current filter, install safety capacitor + wind magnetic ring, wind magnetic ring).**
AC drive interference during running	● Connect the motor housing to the PE of the AC drive. ● Connect the PE of the AC drive to the PE of the line voltage. ● Wind the power input cable with magnetic ring. ● Add a safety capacitor or magnetic ring to the interfered signal terminal. ● Add an extra common ground.
Communication interference	● Connect the motor housing to the PE of the AC drive. ● Connect the PE of the AC drive to the PE of the mains voltage. ● Wind the power input cable with magnetic rings. ● Add a matching resistor between the communication cable source and the load side. ● Add a common grounding cable besides the communication cable. ● Use a shielded cable as the communication cable and connect the cable shield to the common grounding point. ● Adopt daisy chain mode for multi-node communication and reserve branch length of less than 30 cm.
I/O interference	● Enlarge the capacitance at the low-speed DI. A maximum of 0.11 uF capacitance is suggested. ● Enlarge the capacitance at the AI. A maximum of 0.22 uF is suggested.

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:
   - **Improper use or repair/modification without prior permission**
   - **Fire, flood, abnormal voltage, other disasters and secondary disaster**
   - Hardware damage caused by dropping or transportation after procurement
   - Improper operation
   - 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.

Inova Automation Co., Limited

Unit B01, 17/F

MG Tower, 133 Hoi Bun Road, Kwun Tong

Hong Kong

Tel: (852) 2751 6080

Fax: (852)2751 6933

Email: info@inova-automation.com

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:	