



User Guide

MD051N Series AFE



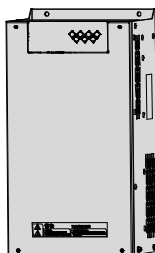
Preface

Thank you for purchasing the active front end (AFE) series products of Inovance.

By working with the integrated controller AC drive, the AFE of Inovance can achieve the four-quadrant running of AC drive, and fulfill the three-phase controllable rectification and regenerative braking of the control system. Capable of increasing the input power factor, reducing the harmonic content fed into the mains by the control system, and feeding back to the mains the energy generated during AC drive braking, the product can accomplish effective braking at the same time that over 95% electric energy is recovered and recycled.

Complete with the protection for overtemperature, overvoltage and overcurrent, the product features low noises, low harmonic pollution, and high power factors among others.

This user guide is intended to provide users with relevant notes and guidance regarding model selection, installation, parameter setting, on-site commissioning, troubleshooting, and routine maintenance and care. Read and understand the user guide before using the product, and keep it carefully for reference in the future.



Precautions

- ◆ The drawings in the user guide are sometimes shown without covers or protective guards. During use, remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- ◆ The drawings in the user guide 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 user guide.

§ **Product checking**

Upon unpacking, check:

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

§ **First-time use**

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

§ **Approvals**

The AFE complies with the following directives and standards:

Directives	Name of Directives	Standards
EMC directives	2004/18/EC	EN 61800-3: 2004+A1: 2012 EN 12015: 2004 EN 12016: 2004+A1: 2008
LVD directives	2006/95/EC	EN 61800-5-1

Contents

Preface	2
Safety Instructions	6
Safety Precautions.....	6
Safety Levels and Definitions	6
Safety Instructions.....	6
Safety Signs.....	11
1 Product Information	13
1.1 Nameplate and Model Number	13
1.2 Components	14
1.3 Overall Dimensions	14
1.4 Technical Data.....	15
1.5 Model Description and Recommendations on Model Selection.....	16
1.5.1 Standalone Running.....	17
1.5.2 Parallel Running.....	17
2 Installation and Wiring.....	18
2.1 Installation	18
2.1.1 Preparation for Installation	18
2.1.2 Installation Guide.....	19
2.1.3 Cover Dismantling and Installation	20
2.2 Wiring.....	21
2.2.1 Wiring of Main Circuit Terminals	21
2.2.2 Wiring of Control Signal Terminals	28
2.2.3 Peripheral Electrical Devices	35
3 Commissioning and Typical Applications	36
3.1 Introduction to the Commissioning Tools	36
3.2 Common Parameter Setting	37
3.2.1 Viewing and Modifying.....	37
3.2.2 Viewing Status Parameters.....	38
3.2.3 Setting the Password.....	38
3.3 Examples of Typical Applications	39
3.3.1 Operating Panel Control	39
3.3.2 Communication Command Control	39
3.3.3 DI Input Command Control.....	39

3.3.4 Energy Feedback Running Command Control	39
3.3.5 Auto Running Control upon Power-on	40
3.4 Parameter Setting Procedure upon the First Power-on on Site	41
4 Function Parameter Table	42
Group b0: Rectification Control Parameters.....	42
Group b1: I/O Parameters	44
Group b2: Fault and Protection Parameters	46
Group b3: Monitoring Parameters	48
Group b4: Fault Parameter Query	49
Group b5: Factory Parameters	52
Group b6: User Parameters	52
5 Troubleshooting	54
6 Maintenance and Care	57
6.1 Routine Maintenance	57
6.1.1 Routine Inspection	57
6.1.2 Periodic Inspection	57
6.2 Replacement of Vulnerable Components.....	58
6.2.1 Service Life of Vulnerable Components	58
6.2.2 Cooling Fan.....	58
6.2.3 Electrolytic capacitor.....	58
6.3 Storage	58
Appendix A Electro Magnetic Compatibility (EMC)	59
A.1 Definition of Terms	59
A.2 Introduction to EMC Standard	59
A.2.1 Installation Environment	59
A.2.2 Requirements on Satisfying the EMC Directive.....	60
A.3 Selection of Peripheral EMC Devices.....	60
A.4 Shielded Cable.....	61
A.4.1 Requirements for the Shielded Cable.....	61
A.4.2 Installation Precautions of the Shielded Cable.....	62
A.4.3 Cabling Requirement.....	62
Revision History	63
Warranty Agreement.....	64

Safety Instructions

Safety Precautions

- 1) Before installing, using, and maintaining this equipment, read the safety information and precautions thoroughly, and comply with them during operations.
- 2) To ensure the safety of humans and equipment, follow the signs on the equipment and all the safety instructions in this user guide.
- 3) "CAUTION", "WARNING", and "DANGER" items in the manual do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- 4) Use this equipment according to the designated environment requirements. Damage caused by improper usage is not covered by warranty.
- 5) Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions



DANGER

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



WARNING

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



CAUTION

indicates that failure to comply with the notice may result in minor personal injuries or damage to the equipment.

Safety Instructions

Unpacking



CAUTION

- ◆ Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation.
- ◆ Unpack the package by following the package sequence. Do not hit the package with force.
- ◆ Check whether there are damage, rust, or injuries on the surface of the equipment or equipment accessories.
- ◆ Check whether the number of packing materials is consistent with the packing list.

 WARNING

- ◆ Do not install the equipment if you find damage, rust, or indications of use on the equipment or accessories.
- ◆ Do not install the equipment if you find water seepage, component missing or damage upon unpacking.
- ◆ Do not install the equipment if you find the packing list does not conform to the equipment you received.

Storage and Transportation

 CAUTION

- ◆ Store and transport this equipment based on the storage and transportation requirements for humidity and temperature.
- ◆ Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- ◆ Avoid storing this equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- ◆ Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- ◆ Never transport this equipment with other equipment or materials that may harm or have negative impacts on this equipment.

 WARNING

- ◆ Use professional loading and unloading equipment to carry large-scale or heavy equipment.
- ◆ When carrying this equipment with bare hands, hold the equipment casing firmly with care to prevent parts falling. Failure to comply may result in personal injuries.
- ◆ Handle the equipment with care during transportation and mind your step to prevent personal injuries or equipment damage.
- ◆ Never stand or stay below the equipment when the equipment is lifted by hoisting equipment.

Installation

 WARNING

- ◆ Thoroughly read the safety instructions and user guide before installation.
- ◆ Do not modify this equipment.
- ◆ Do not loosen fixed bolts (especially those marked in red) on equipment components.
- ◆ Do not install this equipment in places with strong electric or magnetic fields.
- ◆ When this equipment is installed in a cabinet or final equipment, protection measures such as a fireproof enclosure, electrical enclosure, or mechanical enclosure must be provided. The IP rating must meet IEC standards and local laws and regulations.

**DANGER**

- ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- ◆ Installation, wiring, maintenance, inspection, or parts replacement must be performed only by experienced personnel who have been trained with necessary electrical information.
- ◆ Installation personnel must be familiar with equipment installation requirements and relevant technical materials.
- ◆ Before installing equipment with strong electromagnetic interference, such as a transformer, install an electromagnetic shielding device for this equipment to prevent malfunctions.

Wiring**DANGER**

- ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- ◆ Never perform wiring at power-on. Failure to comply will result in an electric shock.
- ◆ Before wiring, cut off all equipment power supplies. Wait at least 10 minutes before further operations because residual voltage exists after power-off.
- ◆ Make sure that the equipment is well grounded. Failure to comply will result in an electric shock.
- ◆ During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply will result in damage to internal equipment circuits.

**WARNING**

- ◆ Never connect the power cable to output terminals of the equipment. Failure to comply may cause equipment damage or even a fire.
- ◆ When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- ◆ Wiring cables must meet cross sectional area and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at one end.
- ◆ After wiring, make sure that no screws are fallen and cables are exposed in the equipment.

Power-on
 DANGER ◆ Before power-on, make sure that the equipment is installed properly with reliable wiring and the motor can be restarted. ◆ Before power-on, make sure that the power supply meets equipment requirements to prevent equipment damage or even a fire. ◆ At power-on, unexpected operations may be triggered on the equipment. Therefore, stay away from the equipment. ◆ After power-on, do not open the cabinet door and protective cover of the equipment. Failure to comply will result in an electric shock. ◆ Do not touch any wiring terminals at power-on. Failure to comply will result in an electric shock. ◆ Do not remove any part of the equipment at power-on. Failure to comply will result in an electric shock.
Operation
 DANGER ◆ Do not touch any wiring terminals during operation. Failure to comply will result in an electric shock. ◆ Do not remove any part of the equipment during operation. Failure to comply will result in an electric shock. ◆ Do not touch the equipment enclosure, fan, or resistor for temperature detection. Failure to comply will result in heat injuries. ◆ Signal detection must be performed only by professionals during operation. Failure to comply will result in personal injuries or equipment damage.
 WARNING ◆ Prevent metal or other objects from falling into the device during operation. Failure to comply may result in equipment damage. ◆ Do not start or stop the equipment using a contactor. Failure to comply may result in equipment damage.
Maintenance
 DANGER ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. ◆ Do not maintain the equipment at power-on. Failure to comply will result in an electric shock. ◆ Before maintenance, cut off all equipment power supplies and wait at least 10 minutes.



- ◆ Perform daily and periodic inspection and maintenance for the equipment according to maintenance requirements and keep a maintenance record.

Repair



- ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- ◆ Do not repair the equipment at power-on. Failure to comply will result in an electric shock.
- ◆ Before inspection and repair, cut off all equipment power supplies and wait at least 10 minutes.



- ◆ Require for repair services according to the product warranty agreement.
- ◆ When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- ◆ Replace quick-wear parts of the equipment according to the replacement guide.
- ◆ Do not operate damaged equipment. Failure to comply may result in worse damage.
- ◆ After the equipment is replaced, perform wiring inspection and parameter settings again.

Disposal



- ◆ Dispose of retired equipment by following local regulations or standards. Failure to comply may result in property damage, personal injuries, or even death.
- ◆ Recycle retired equipment by following industry waste disposal standards to avoid environmental pollution.

Safety Signs

■ Description of safety signs in the user guide



Read the user guide before installation and operation.



Reliably ground the system and equipment.



Danger!



High temperature!



Prevent personal injuries caused by machines.



High voltage!



Wait xx minutes before further operations.

■ Description of safety signs on the equipment

For safe equipment operation and maintenance, comply with safety signs on the equipment, and do not damage or remove the safety labels. The following table describes the safety signs.

Safety Sign	Description
	◆ Read the user guide before installation and operation. Failure to comply will result in an electric shock. ◆ Do not remove the cover at power-on or within 10 minutes after power-off. ◆ Before maintenance, inspection, and wiring, cut off input and output power, and wait at least 10 minutes until the power indicator is off.

§ Altitude and de-rating

In places where the altitude is above 1000 m and the cooling effect of the AFE drops due to thin air, the AFE must be derated. Contact the agent or Inovance. for technical

support.

§ **Special needs**

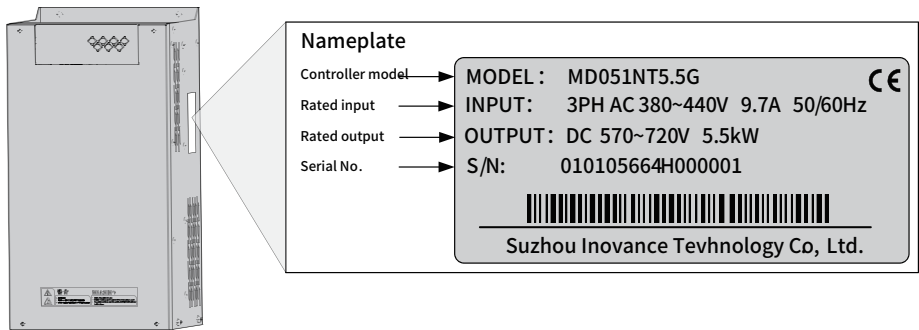
If your needs are not covered by the wiring drawings recommended in the user guide, Contact the agent or Inovance. for technical support.

§ **During the disposal of the AFE unit, be reminded:**

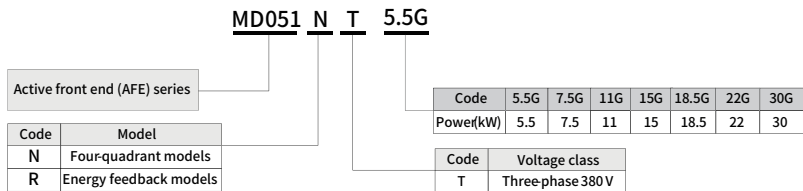
The electrolytic capacitors on the main circuits and PCB may explode when they are burnt. Poisonous gas is generated when the plastic parts are burnt. Treat them as ordinary industrial waste.

1 Product Information

1.1 Nameplate and Model Number



Controller model number



Serial No.

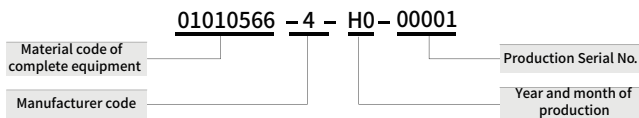


Figure 1-1 Nameplate and model number

1.2 Components

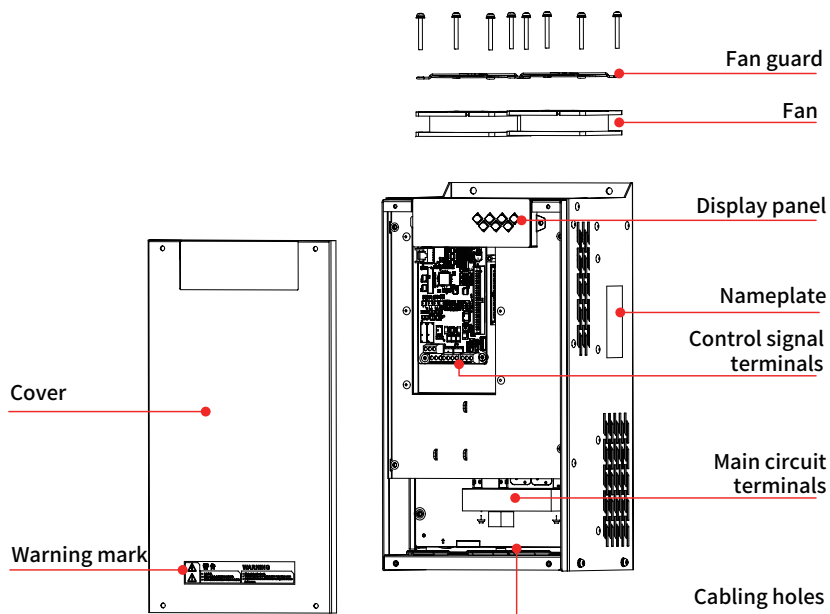


Figure 1-2 Diagram of product components

1.3 Overall Dimensions

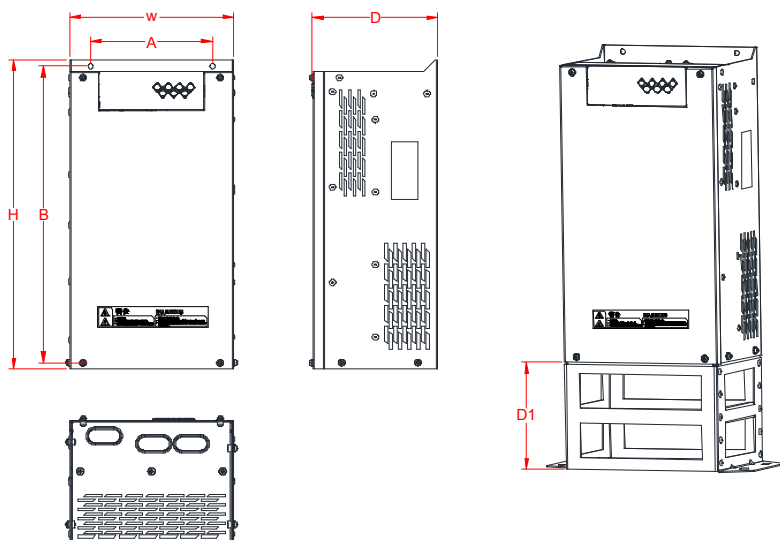


Figure 1-3 Overall dimensions of the AFE

Table 1-1 Mounting dimensions of the AFE (unit: mm)

AFE Model	Dimensions			Mounting Bracket	Hole Position		Hole Diameter	Weight (kg)
	H	W	D	D1	A	B	Φ	
MD051NT5.5G	365	200	153	121	160	350	6.0	8.5
MD051NT7.5G								8.7
MD051NT11G								9.0
MD051NT15G	405	215	165	142	160	390	7.0	14.0
MD051NT18.5G								14.8
MD051NT22G	505	260	171	161	160	490	7.0	18.2
MD051NT30G								20.0

1.4 Technical Data

Table 1-2 Technical specifications of the AFE

Item		Specification
Basic performance specifications	Input voltage	Three-phase, 380 VAC (-15% to +15%)
		Unbalance $\leq 2\%$
	Input frequency	50/60 Hz (± 0.5 Hz)
	Carrier frequency	10 kHz
	Power factor	≥ 0.99
	Input harmonic current	$< 4\%$ ^[1]
	Bus voltage range	570–720 VDC
	Operating efficiency	$> 95\%$
	Overload capacity	One minute for 140% of the rated current
	Operating noises	< 59 dB
Protection functions	Bus overvoltage protection	
	Bus undervoltage protection	
	Overcurrent protection	
	Overheat protection	
	Overload protection	
	Mains abnormal protection	



[1] Test conditions: Under the mains THDu $\leq 3\%$, the AFE runs under the rated load in the four-quadrant mode.

1.5 Model Description and Recommendations on Model Selection

At present, the AFE products include two series, N and R. You can distinguish the two series by the letter that the model numbers end with.

- N series are for general purposes or the scenarios where type tests are not required.
- R series are for the scenarios where type tests are required, meeting requirements for reverse discharge protection and reverse polarity protection.

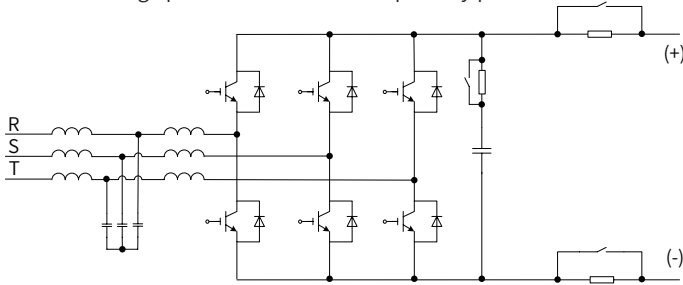


Figure 1-4 Topology diagram of the main power of N series

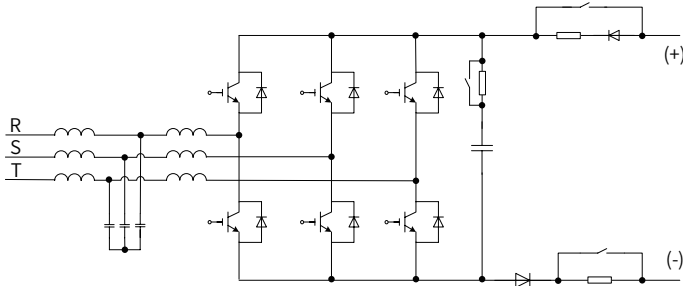


Figure 1-5 Topology diagram of the main power of R series



- ◆ The instructions in the user guide are for both the N series and R series, except for those that have been specified.

1.5.1 Standalone Running

For the AC drive, the model selection is based on motor power only in the four-quadrant mode and the energy feedback mode, independent of the motor current or controller power. The detailed information is as follows:

Table1-3 Recommended model selection for the AFE

AFE Model	Adaptable Motor/kW	
	Four-quadrant Mode	Energy Feedback Mode
MD051NT5.5G	4.9	11
MD051NT7.5G	6.7	15
MD051NT11G	9.8	18.5
MD051NT15G	11.6	22
MD051NT18.5G	14.3	30
MD051NT22G	19.6	37
MD051NT30G	26.8	45



- ◆ MD051NT is used for the four-quadrant running mode. The model selection should be made according to the power of the motor in the middle row. In the scenarios where reverse discharge protection and reverse polarity protection are not required, it can also be used for the energy feedback mode, with model selection based on the power of the motor in the right row. In this case, the AFE models can be selected with the power reduced by two or more levels for the same application scenarios.
- ◆ MD051RT can only be used for the energy feedback mode, with model selection based on the power of the motor in the right row.
- ◆ The model selection applies to the AC drive. For general-purpose AC drives, refer to the model selection of Inovance MD051.

1.5.2 Parallel Running

At present, parallel running is allowed for a maximum of two AFEs.

During parallel running, the AFE must be de-rated according to the de-rating coefficient 0.95. That is, the maximum throughput of the AFE parallel control system is 1.9 times of that in the table above.

2 Installation and Wiring

2.1 Installation

2.1.1 Preparation for Installation

1) Installation environment requirements

- Ambient temperature: The service life of the AFE is significantly affected by the ambient temperature. The operating temperature of the AFE unit should not exceed the allowable temperature range (-10°C to $+50^{\circ}\text{C}$).
- Install the AFE on the surface of an incombustible object, and ensure that there is sufficient space around for heat dissipation. See Figure 2-2 for information.
- Install the AFE in places free from vibration. Vibration must be less than 0.6 g.
- Install the AFE in places free from direct sunlight, high humidity and condensation.
- Install the AFE in places free from corrosive, explosive and combustible gas.
- Install the AFE in places free from oil dirt, dust and metal powder.

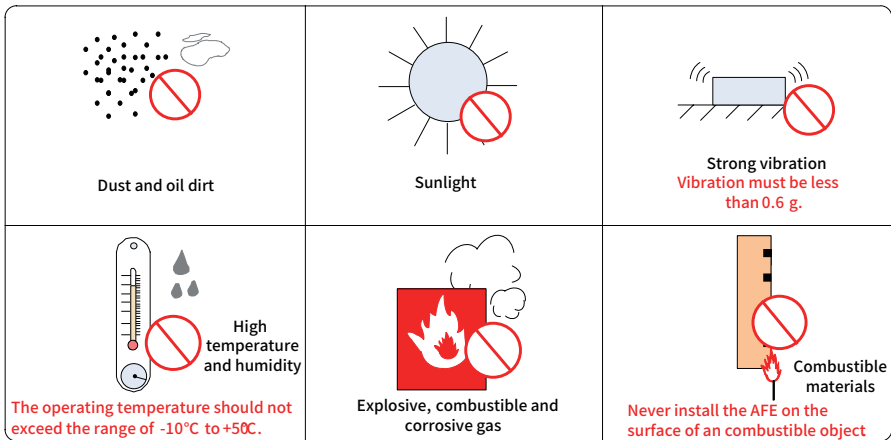


Figure 2-1 Installation environment requirements

2) Installation space requirements

Pay attention to heat dissipation during the AFE installation. Ensure that sufficient space is kept for heat dissipation. For the installation inside the control cabinet, consideration should be given to the heat dissipation of other components inside the cabinet. See the following figure for the dimensions of the AFE installation space:

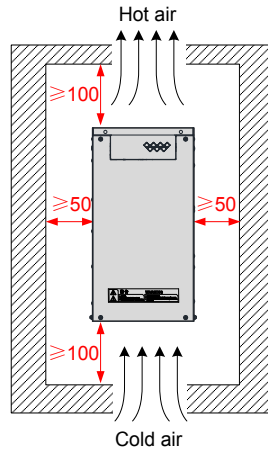


Figure 2-2 Dimensions of the AFE installation space (mm)

2.1.2 Installation Guide

According to the on-site requirements of customers, wall-mounting or standing installation can be adopted for the AFE. See the detailed installation procedures as follows:

■ Wall-mounting Installation

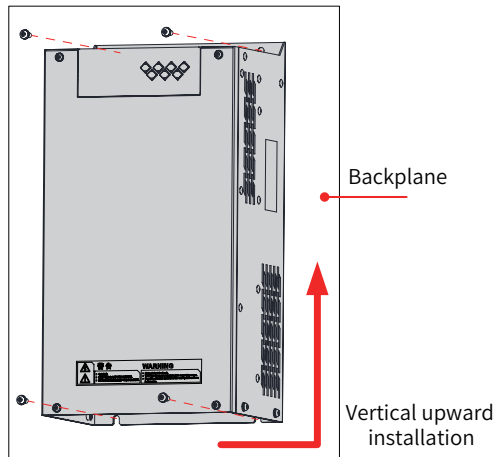


Figure 2-3 AFE wall-mounting installation



◆ Vertically install the AFE to facilitate upward heat dissipation. Upside down placement is prohibited!

■ Standing Installation

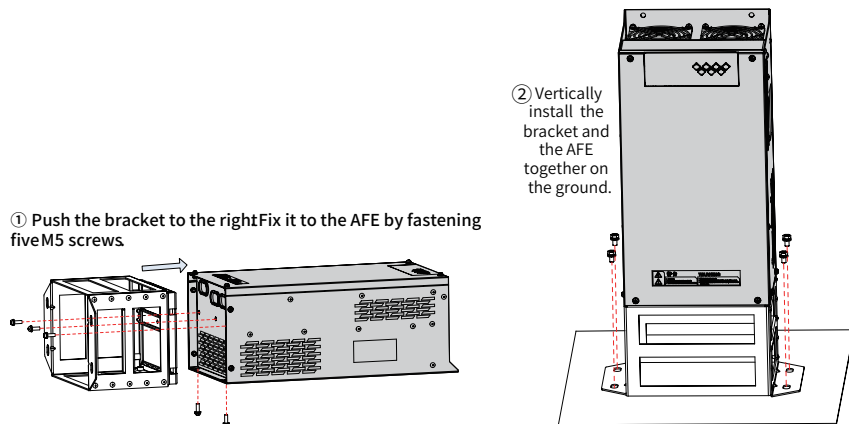


Figure 2-4 AFE standing installation



◆ The mounting bracket is an optional part that is sold separately!

2.1.3 Cover Dismantling and Installation

For the AFE unit, the sheet metal housing is used. To dismantle or install the upper cover from the sheet metal housing, see the following figures:

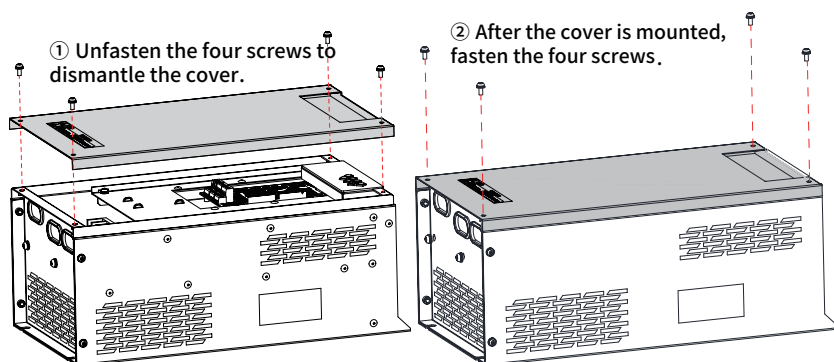


Figure 2-5 Cover dismantling and installation



◆ When the upper cover is dismantled, be cautious about the possible damage to equipment or personal injuries due to the falling off of the upper cover.

2.2 Wiring

Wiring Precautions	
 Danger	◆ Ensure that the power switch is in the OFF state before wiring operations. Failure to comply may result in electric shock. ◆ Wiring must be performed only by qualified personnel. Failure to comply may result in damage to the equipment and human beings. ◆ Reliable grounding is required. Failure to comply may result in electric shock or a fire.
 Caution	◆ Ensure that the input voltage is consistent with the rated values of the AFE unit. Failure to comply may result in damage to the equipment. ◆ Ensure that the R, S and T terminals of the AFE unit are connected correctly. Failure to comply may result in damage to the equipment. ◆ Ensure that the DC bus (+) and (-) of the AFE unit are correctly connected to the controller bus according to the polarities. Failure to comply may result in damage to the equipment.

2.2.1 Wiring of Main Circuit Terminals

- Description of main circuit terminals

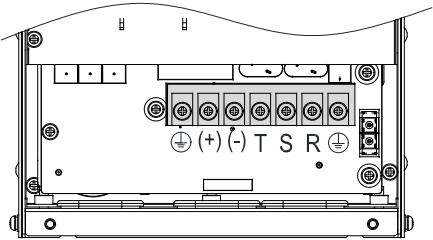


Figure 2-6 Main circuit terminal arrangement

Table 2-1 Functions of main circuit terminals

Terminal Code	Name	Description
R, S, T	Input terminals on the AC side	Input terminals of three-phase AC power supply
(+), (-)	Positive and negative terminals of DC bus	Output point of DC bus
	Grounding terminal	Grounding terminal

■ Wiring methods of the main circuit

For standalone running, the AFE supports two wiring methods for the main circuit:

- 1) Four-quadrant wiring method that corresponds to the four-quadrant running mode
- 2) Energy feedback wiring method that corresponds to the energy feedback running mode

In the four-quadrant mode, the controlled rectifier module of the AFE and the inverter module of the AC drive are connected to constitute a back-to-back structure, where the AFE is connected to the three-phase mains, sharing a common bus with the AC drive, and the three-phase input terminals of the AC drive are disconnected. When the rectifier module and the inverter module work at the same time, the current phase of the AFE input terminal is the same as or opposite to the mains (depending on the state of the backend AC drive), always maintaining the power factor with the absolute value of approximately 1, and the waveform of sine wave.

In the energy feedback mode, the AFE and the AC drive both have their three-phase input terminals connected to the mains, and share a common bus. When the AC drive is in the motor driving state and the AFE is not working, most of the energy is input from the input rectifier bridge of the controller, and a small part of the energy is input from the fly-wheel diode inside the AFE module. When the AC drive is in the power generating state, the rectifier bridge of the AC drive enters the interrupted state, and the AFE is started under the corresponding command source, feeding back to the mains the backend energy.

Allowing the wiring through both the four-quadrant method or the energy feedback method, the N series can run in the desired mode with parameter setting defined as needed.

Allowing the wiring through the energy feedback method only, the R series run in the energy feedback mode.



- ◆ In the energy feedback mode, the AFE does not work when the system is in the motor driving mode, thus resulting in the high harmonic content in the system input current waveform. So, if you have high requirements for the power factor and THD among others in the running and power generating states, the four-quadrant mode must be adopted.
- ◆ Generally speaking, the energy fed back is significantly smaller than that driven by motor. In the case where only backend energy feedback is required, the energy feedback method is more cost-saving.

■ Four-quadrant Wiring Method

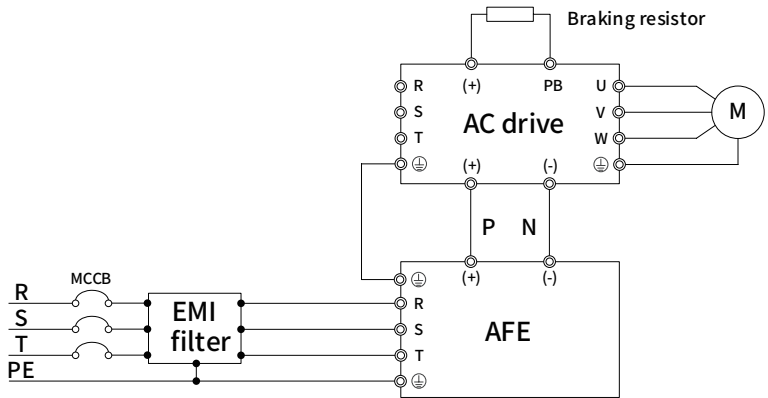


Figure 2-7 Four-quadrant wiring method of the AFE

For parallel running, the AFE should be wired as follows:

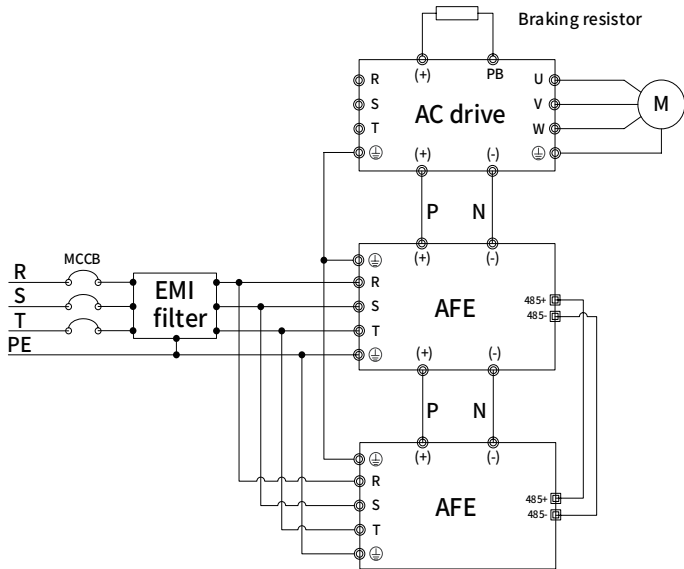


Figure 2-8 Four-quadrant wiring method of the AFEs in parallel running



- ◆ In the four-quadrant mode, no AC reactor should be retained or installed in the circuit for standalone or parallel running.
- ◆ After the AFE is installed, the braking resistor of the AC drive should still be retained. Otherwise, when the AFE is stopped upon faults and the AC drive is in the feedback state, the braking energy cannot be transmitted to the mains, resulting in a report of overvoltage fault due to the increased voltage on the AC drive bus.
- ◆ For parallel running, a 485 communication cable must be wired between the AFEs.

■ Energy Feedback Wiring Method

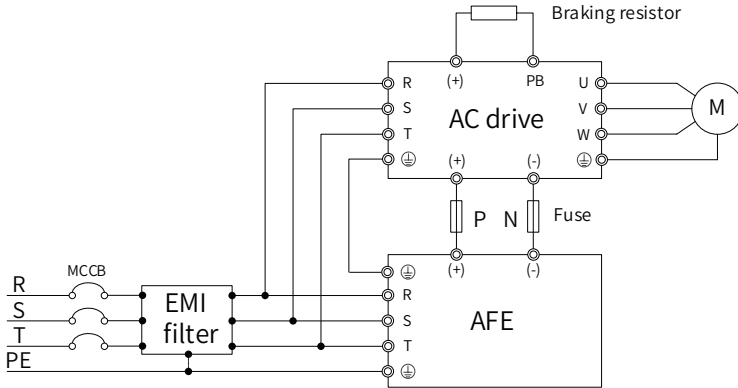


Figure 2-9 Energy feedback wiring method of the AFE

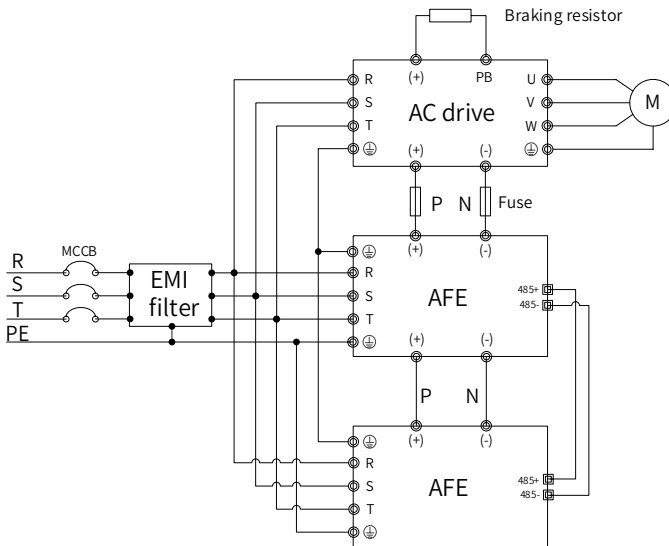


Figure 2-10 Energy feedback wiring method of the AFEs in parallel running

In the energy feedback mode, if an AC reactor is required in the forefront, the AC reactor must be placed in front of the EMI filter. The wiring should be conducted as follows:

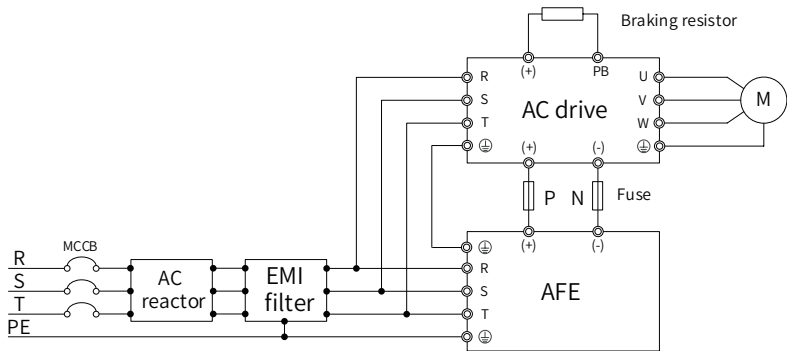


Figure 2-11 Energy feedback mode where a reactor is included in the forefront



- ◆ In the energy feedback mode, the braking resistor of the AC drive should still be retained.
- ◆ In the energy feedback mode, an AC reactor should be installed in front of the AFE and the common wiring point of the AC drive, instead of between the three-phase input of the AC drive and the common wiring point. Otherwise, serious heating may happen to the AC reactor.
- ◆ If thyristor rectification is in the forefront of the AC drive, an EMI filter must be installed in the system. Otherwise, leakage protection may happen to the forefront.
- ◆ To better protect the AC drive and the AFE, in the energy feedback wiring method, a fuse should be installed respectively in the bus (+) and the bus (-) of the AFE that are connected to the AC drive. The recommended models are as follows:

Model	Fuse Model and Manufacturer	Rated Current
MD051NT11G	RS309-MF-70A (medium-acting fuse)	70 A
MD051NT18.5G	RS309-MF-100A (medium-acting fuse)	100 A
MD051NT30G	RS309-MF-175A (medium-acting fuse)	175 A

- ◆ Under the AFEs under parallel control, the fuse of a new model should be selected, with the rated current doubled accordingly.

§ Precautions about the Cable Selection of Main Circuit

■ Input power R, S, T:

- 1) Wired on the input side of the AFE unit, without requirements for phase sequence.
- 2) For external power cables, the specifications and installation method must meet the requirement of local regulations and relevant IEC standards.
- 3) For the selection of power cables, see "Table 2-5 Recommended specification of peripheral electrical devices for the AFE series products".

■ DC bus (+), (-):

- 1) The AFE and the AC drive share a common bus. Ensure that the polarities of the bus are not reversely connected. Otherwise, damage may happen to the AFE N series.
- 2) Ensure that wiring operations are carried out 10 minutes after power-off, as the residual voltage remains in the DC bus (+) and (-) just after power-off. Otherwise, there will be the risk of electric shock.

■ Grounding terminal

- 1) Grounding terminals must be reliably grounded, with the resistance of grounding cable smaller than 0.1Ω . Otherwise, damage may happen to the AFE N series.
- 2) The grounding terminal should not be used as  the N terminal of neutral wire, or vice versa.
- 3) For the protective earthing conductor, the impedance should be able to bear the large short-circuit current that possibly occurs upon faults.
- 4) For the protective earthing conductor, the size should be selected according to the following table.

Section Area of Phase Wire (S)	Minimum Section Area of Protective Conductor (Sp)
$S \leq 16 \text{ mm}^2$	S
$16 \text{ mm}^2 < S \leq 35 \text{ mm}^2$	16 mm^2
$35 \text{ mm}^2 < S$	$S/2$

- 5) The yellow/green cable must be used for the protective earthing conductor.

§ Using with the ARD

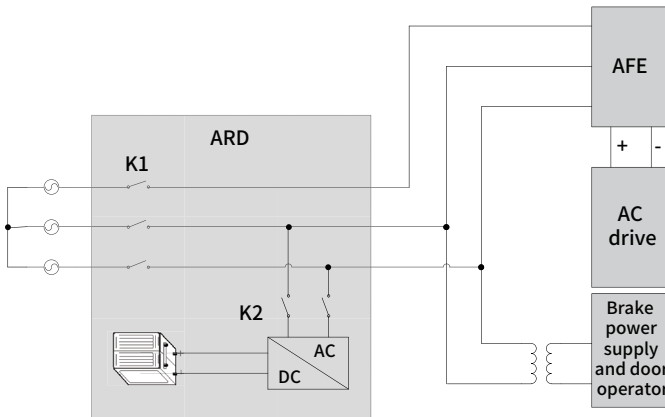


Figure 2-12 ARD used with the AFE that adopts the four-quadrant wiring

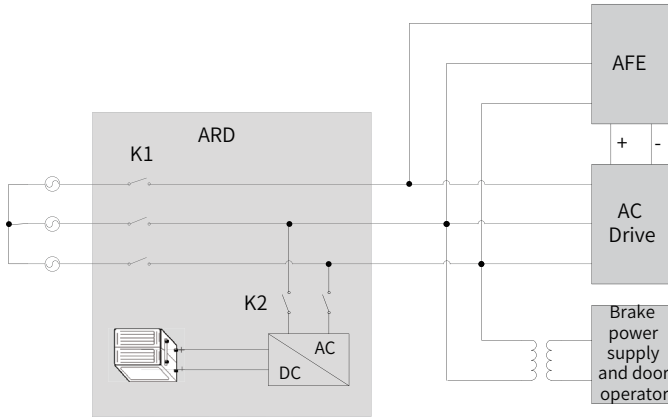
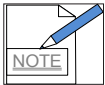


Figure 2-13 ARD used with the AFE that adopts the energy feedback wiring

Upon power-off of the mains, the ARD has the K1 disconnected and K2 connected, and outputs single-phase 380 VAC, supplying power for the AC drive, the brake, and the door motor. At this time, the AFE does not work.

After the AC drive is started, rescue activities are launched in the AC drive. When the rescue activities are completed, the K2 is disconnected automatically and the AC drive is powered off. K1 is connected next time the power supply resumes. The AFE and the AC drive start to work normally.



- ◆ The AFE can only work with the single-phase ARD. It cannot be used with the three-phase ARD.

§ Requirement for the Forefront Protective Gear

To install the appropriate protective gears in the input power cables, see "Table 2-5 Recommended specification of peripheral electrical devices for the AFE series products".

§ Requirement for the mains

The product applies to the TT mains system with neutral point earthing. To use the product in the IT system, remove the jumpers of the varistor group (the bridge screws marked with "HPT" on the driver board). Otherwise, personal injuries or damage to the AFE may occur.

2.2.2 Wiring of Control Signal Terminals

■ Description of Control Signal Terminals

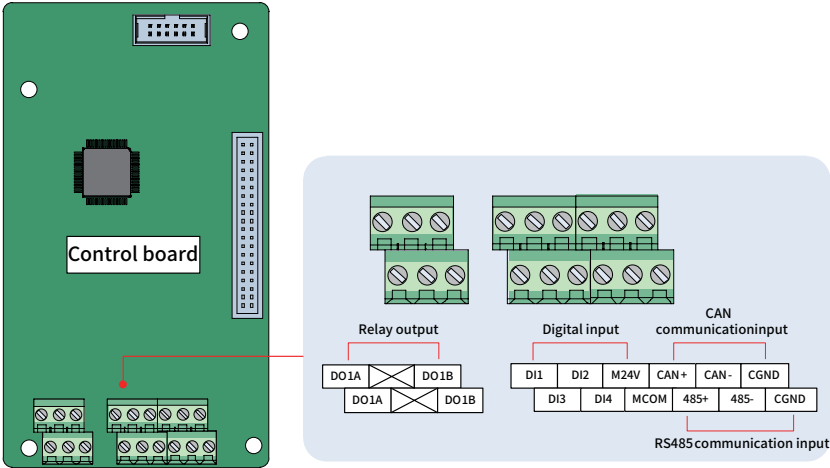


Figure 2-14 Control circuit terminal arrangement

Table 2-2 Functions of control circuit terminals

Classification	Terminal Code	Function Description	Remarks
Relay output DO	DO1A/DO1B	Normally-open terminal 1	Contact driving capacity 250 VAC, 1 A 30 VDC, 1 A
	DO2A/DO2B	Normally-open terminal 2	
Digital input DI	DI1-DI4	Digital input	1. Photocoupler isolation, compatible with dual-polarity input 2. Input impedance: 4.7 K Ω 3. Voltage range of level input: 9 V to 30 V
	M24V	Internal 24 V signal power	For the power supply of DI only.
	MCOM	Input reference ground of the DI terminal	/
CAN communication interface	CAN+/CAN-/CGND	CAN communication interface	Used to communicate with the AC drive controller of Inovance.
RS458 communication interface	485+/485-/CGND	RS485 communication interface for parallel control	Used for the AFE parallel control.
USB interface	CN1	Programming/background monitoring interface	/

■ Wiring of DI Terminals

Usually, a shielded cable is required, which should be as short as possible, not longer than 20 m. If an active driving mode is adopted, necessary filtering measures should be taken for the crosstalk of power sources. The contact control mode is recommended.

The following six wiring methods can be adopted:

1) Wiring with internal power supply and switch

Internal power supply, with pins 2 and 3 of J3 shorted and the dual switch S1 both turned to "ON".

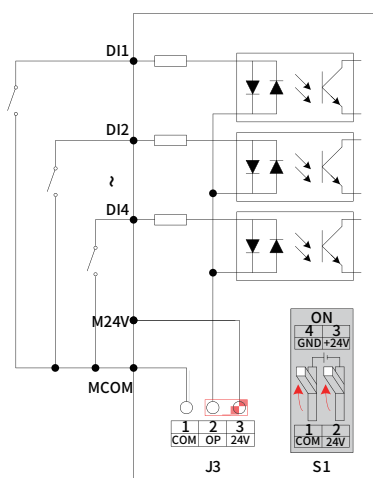


Figure 2-15 Wiring with internal power supply and switch

2) SINK wiring with internal power supply

Internal power supply, with pins 2 and 3 of J3 shorted and the dual switch S1 both turned to "ON".

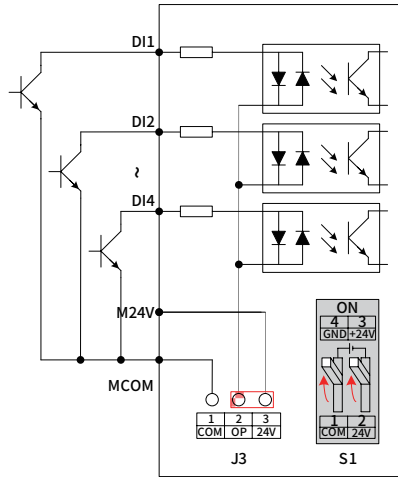


Figure 2-16 SINK wiring with internal power supply

3) SOURCE wiring with internal power supply

Internal power supply, with pins 1 and 2 of J3 shorted and the dual switch S1 both turned to "ON".

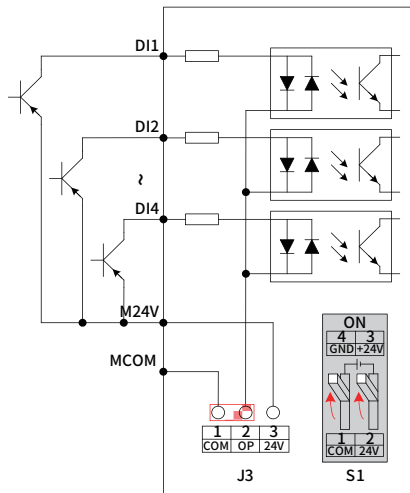


Figure 2-17 Wiring of the internally-powered source type

4) Wiring with external power supply and switch

External power supply, with pins 2 and 3 of J3 shorted and the dual switch S1 both turned to "OFF".

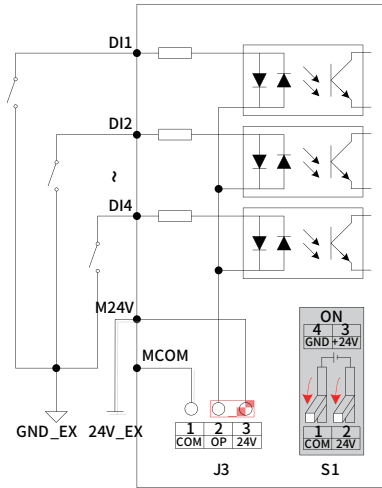


Figure 2-18 Wiring with external power supply and switch

5) SINK wiring with external power supply

External power supply, with pins 2 and 3 of J3 shorted and the dual switch S1 both turned to "OFF".

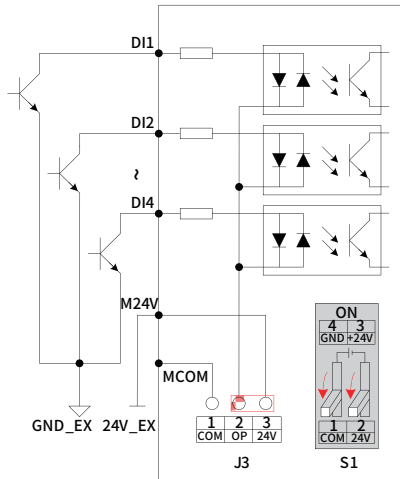


Figure 2-19 SINK wiring with external power supply

6) SOURCE wiring with external power supply

External power supply, with pins 1 and 2 of J3 shorted and the dual switch S1 both turned to "OFF".

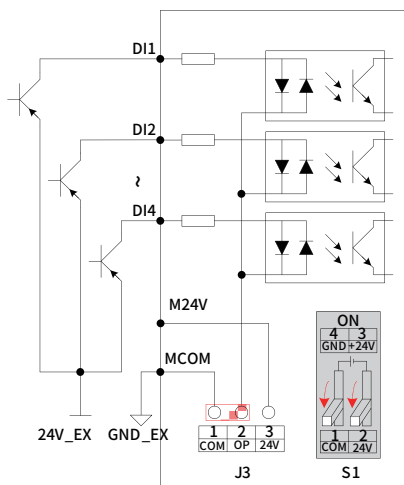


Figure 2-20 SOURCE wiring with external power supply

■ Wiring of DO Terminals

The DOs are two NO relay outputs, mainly serving to indicate the status and faults.

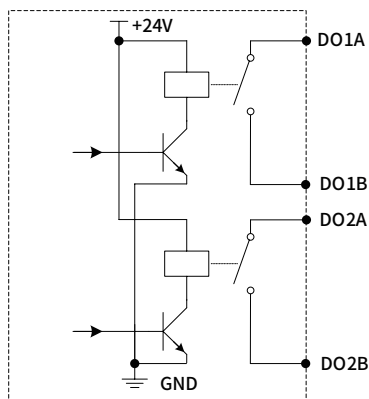


Figure 2-21 Wiring of DO terminals

■ Wiring of Communication Cables

For the parallel control of AFEs, the RS485 communication cable is required for information exchange.

To communicate with the AC drive, the CAN communication cable must be connected. For the MD051N, the CAN1 on the main control board functions as the communication interface.

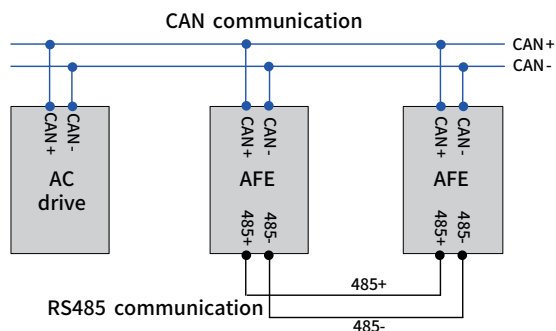


Figure 2-22 Wiring of the AFE communication cables

■ Instructions on Wiring

For the wiring convenience of users, all the control cables inside the unit have been wired properly before delivery. Before use, users only need to connect the main circuit cable and grounding cable. For cabling, see the following figure:

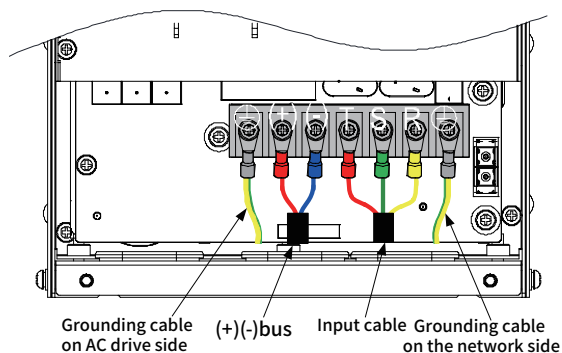


Figure 2-23 Wiring



- ◆ During wiring, the main circuit cable and the control cable must be laid separately to avoid the interference with signals.
- ◆ Use a twisted pair cable or shielded cable as the communication cable.

Three cable inlets/outlets are located at the bottom of the AFE unit for connecting external cables. During wiring, be sure to confirm the function of each inlet/outlet. See the following figure for cable inlet/outlet arrangement:

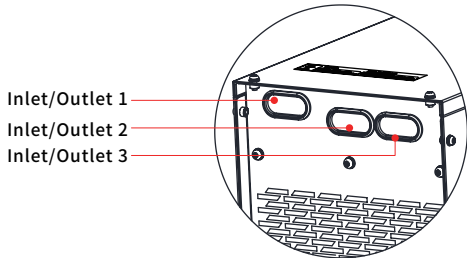


Figure 2-24 Cable inlet/outlet arrangement

Table 2-3 Function description of cable inlet/outlet

Name	Function Description
Inlet/Outlet 1	For connecting the DI, DO, CAN and RS485 communication signal cables.
Inlet/Outlet 2	For connecting the bus (+), (-) and the PE cable on the AC drive side.
Inlet/Outlet 3	For connecting the input power cables that are connected to the R, S, and T terminals, and the PE cable on the network side.

■ Terminal Wiring

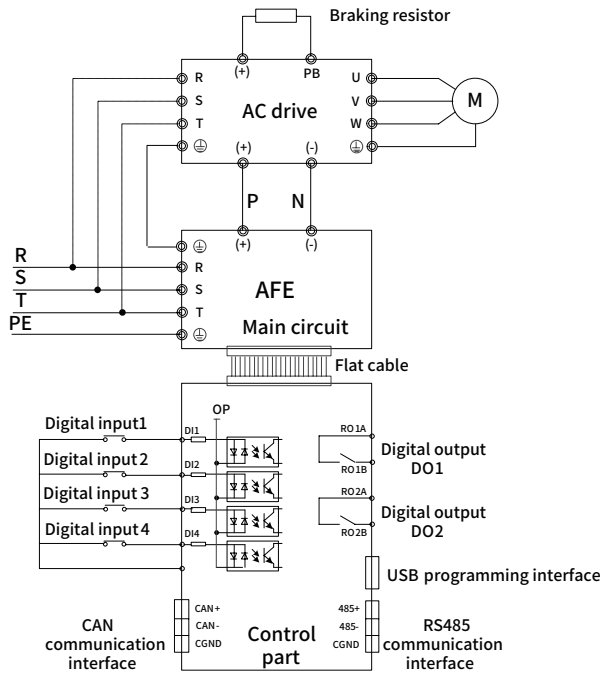


Figure 2-25 Wiring of the AFE system

2.2.3 Peripheral Electrical Devices

■ Description of peripheral Electrical Devices

In the input power circuit, protective devices must be installed, which should provide such functions as overcurrent protection, short-circuit protection and isolation protection.

For selection of protective devices, consideration should be given to such factors as the current capacity of power cables, the overload capacity requirement of the system, and the short-circuit capacity of the forefront power supply for equipment.

Table 2-4 Description of optional peripheral electrical devices

Part	Mounting Location	Function Description
Air switch	Front end of input circuit	Used to disconnect the power supply upon overcurrent of the downstream equipment.
Contactor	Between the air switch and the AFE three-phase input side	Controlled by the external safety circuit to power the controller on or off.
EMC input filter	AFE input side	Used to reduce the conduction and radiation interference output by the AFE and the conduction interference from the power supply to the AFE, and increase the anti-interference capability of the AFE.

■ Specifications of peripheral electrical devices for selection

By selecting conductive wires of right specifications and reasonable wiring methods, you can greatly improve the anti-interference and safety of the system, reduce unnecessary problems during installation and commissioning, and enhance the stability of system running.

Table 2-5 Recommended specifications of peripheral electrical devices

Model	Air Switch (A)	Input Contactor (A)	Main Circuit Cable (mm ²)	Control Circuit Cable (mm ²)	Grounding Cable (mm ²)
MD051NT5.5G	25	18	2.5	0.75	2.5
MD051NT7.5G	32	25	4	0.75	4
MD051NT11G	40	32	6	0.75	6
MD051NT15G	50	38	6	0.75	6
MD051NT18.5G	63	40	10	0.75	10
MD051NT22G	80	50	10	0.75	10
MD051NT30G	100	65	16	0.75	16

3 Commissioning and Typical Applications

3.1 Introduction to the Commissioning Tools

With the operating panel, you can carry out operations on the AFE, such as modification of function parameters, monitoring of running states, and running control (start and stop). Its appearance and function area are shown in the following figure:

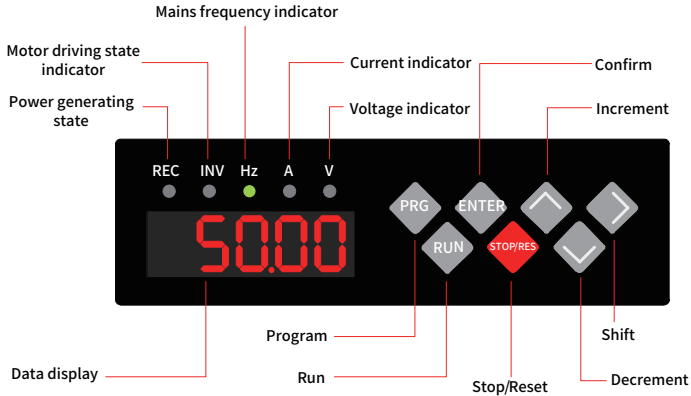


Figure 3-1 Operating panel

1) Description of function indicators

- REC: turns on when the AFE unit is in the motor driving state.
- INV: turns on when the AFE unit is in the power generating state.

2) Unit indicators

Turns on to indicate the unit of the value in the data display area.

- Hz: unit of the mains frequency
- A: unit of the AFE output current
- V: unit of the mains voltage and the AFE bus voltage

3) Data display area

- Five-digit LED display, indicating power-saving, mains frequency, mains voltage, bus voltage, output current, various monitoring data and alert codes.

4) Description of operating panel buttons

Table 3-1 Description of operating panel functions

Button	Name	Function
	Programming	Enter or exit Level-I menu.
	Confirm	Enter the menu interfaces level by level, and confirm the parameter setting.
	Increment	Increase data or parameter number.
	Decrement	Decrease data or parameter number.
	Shift	Select the displayed parameters in turn in the stop or running state, and select the digit to be modified when modifying parameters.
	Run	Start the AFE in the operating panel control mode.
	Stop/Reset	Stop the AFE when it is in the running state and perform the reset operation when it is in the faulty state. The Stop function is restricted by the parameter b3-02.

3.2 Common Parameter Setting

3.2.1 Viewing and Modifying

On the operating panel of the AFE unit, a three-level menu is adopted for operations like parameter setting.

The three-level menu consists of: function parameter groups (Level I menu) → parameters (Level II menu) → parameter value setting (Level III menu). The operation procedure is shown in the following figure.

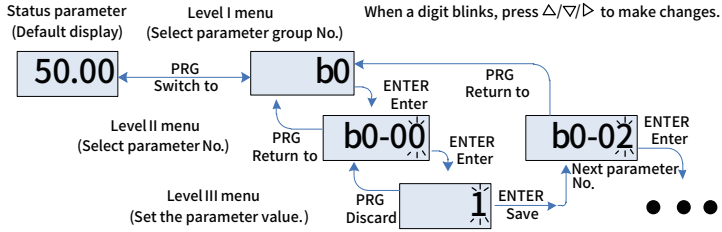
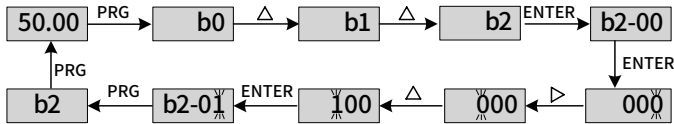


Figure 3-2 Operation procedure of the three-level menu

Note:

- 1) On the Level III menu, you can press "  " or "  " to return to the Level II menu. The difference lies in:
 - By pressing "  ", you will return to the Level II menu after saving the set parameter, and move to the next parameter automatically;
 - By pressing "  ", you will discard the changes to current parameter, and return to the Level II menu of current parameter number.

For example, change the parameter value of b2-00 from 0 to 100:



- 2) In the Level III menu, if no digit of the parameter blinks, the parameter cannot be changed. The possible reasons include:
 - The parameter is an unchangeable parameter, such as the parameters that record the model, actual measured values, and running logs.
 - The parameter cannot be changed in the running state. It can only be changed in the stop state.

3.2.2 Viewing Status Parameters

In the stop or running state, the operating panel can display multiple status parameters. Whether parameters are displayed is determined by the binary bits selected through parameters b3-00 (stop parameter) and b3-01 (running parameter). For the bit definition, see the description of parameters b3-00 and b3-01.

3.2.3 Setting the Password

The AFE unit provides password protection. When b6-00 is set to a non-zero value, a user password is created. Exit the parameter editing mode and the user password takes

effect. "-----" will be displayed when you press PRG again. The Level I menu can only be accessed after the user password is entered correctly.

To disable the password protection, access the menu by entering the password, and set b6-00 to 0. If b6-00 is a non-zero value upon power-on, the parameters are protected by a password.

3.3 Examples of Typical Applications

For the AFE unit, optimum parameters have been set before delivery, which can satisfy the needs in most application cases. Usually, most parameters do not require modification and only the running mode and the source of running commands for the AFE need to be set. See the following description for details:

3.3.1 Operating Panel Control

Parameter	Setting
b0-00	0
b0-02	1

In this mode, press "  " to start the AFE and press "  " to stop the AFE.

3.3.2 Communication Command Control

Parameter	Setting
b0-00	1
b0-02	1

This mode works with the AC drive, which starts or stops the AFE through the CAN communication.

Non-standard program should run on the AC drive, and bit 2 of F6-52 must be set to 1.

3.3.3 DI Input Command Control

Parameter	Setting
b0-00	2
b0-02	1

Take the DI1 input as an example with the running normally-open input selected. In this mode, when the external switch is closed, the AFE starts to run; when the external switch is open, the AFE stops.

3.3.4 Energy Feedback Running Command Control

Parameter	Setting
b0-00	3
b0-02	3

Here, the start/stop control applies to the energy feedback mode. In the motor driving state, the AFE does not work. In the power generating state, when the bus voltage reaches the startup level, the AFE is started, feeding energy to the mains and maintaining stable bus voltage. One minute after the motor stops running, the AFE stops, entering the standby state. Thus, energy feedback is achieved while the power consumption of AFE is reduced.

3.3.5 Auto Running Control upon Power-on

Parameter	Setting
b0-00	4
b0-02	1

In this mode, the AFE runs automatically upon power-on. Press " " to stop the AFE. Otherwise, the AFE keeps running until power-off or faults occur.

3.4 Parameter Setting Procedure upon the First Power-on on Site

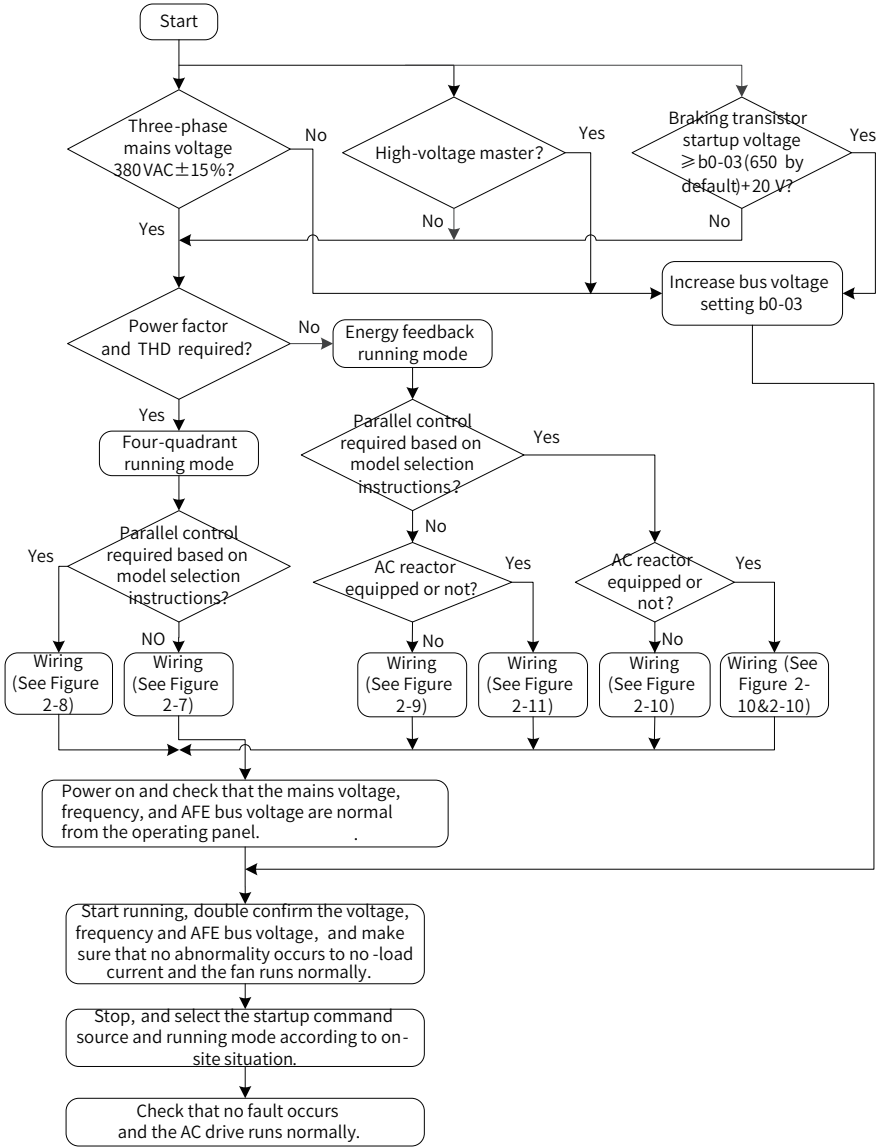


Figure 3-3 Parameter setting procedure upon the first power-on on site

4 Function Parameter Table

When b6-00 is set to a non-zero value, password protection is enabled for the parameters. The parameter menu can only be accessed after the password is entered correctly. To cancel the password protection, set b6-00 to 0.

Description of symbols in the function parameter table:

"☆": indicates that the parameter value can be changed when the AFE is in the stop or running state.

"★": indicates that the parameter value cannot be changed when the AFE is in running state.

"●": indicates that the parameter value is a recorded value from actual tests and cannot be changed.

Group b0: Rectification Control Parameters

Param. No.	Name	Setting Range	Default	Property
b0-00	Command source selection	0: Operating panel control 1: Communication command control 2: DI command control 3: Feedback mode auto running 4: Auto running	0	★
0: Operating panel control, with the start/stop control fulfilled through the "RUN" and "STOP" buttons on the operating panel. 1: Communication command control, serving to fulfill the communication between the AFE and the AC drive, with the start/stop control of AFE realized through the CAN communication command. For the AC drive, bit 2 of F6-52 must be set to 1. 2: DI command control, with the start/stop control of AFE realized through the DI input signals, and b1-00 must be set as needed. 3: Feedback mode auto running, used in the energy feedback mode (with b0-02 = 3) and for energy feedback to the mains only. When voltage is greater than the value of b0-03, the AFE starts automatically. If energy feedback does not happen for one minute, the AFE stops automatically. 4: Auto running, with the AFE starting to run upon power-on until power-off. You can also stop the AFE by pressing "STOP".				
b0-01	Selection of system main communication mode	0: Performance background 1: Programming mode	1	★
0: used in background monitoring and performance commissioning 1: used in programming				
b0-02	AFE running mode selection	1: Controlled rectification, allowing energy to be fed back to the mains 3: Energy feedback unit mode (valid only when b0-00 is set to 3)	1	★

4 Function Parameter Table

Param. No.	Name	Setting Range	Default	Property
1: controlled rectification, with energy moving in two ways 3: used in the energy feedback mode, started only when the backend AC drive is in the power generating state, and b0-00 must be set to 3				
b0-03	Bus voltage set value	570.0 to 720.0 V	650.0 V	★
When the AFE is in the running state, the bus voltage should be kept at a set value, which is 650 V by default. Before you start the AFE, check that the startup voltage higher than the set value 20 V has been set for the braking transistor of the AC drive. If the voltage of current mains is greater than 440 V, you need to increase the set value of bus voltage. Set value > 1.414*mains voltage +30 V.				
b0-04	Energy feedback control voltage hysteresis	0.0 to 100.0 V	20.0 V	●
In the energy feedback mode, voltage hysteresis happens to the bus where feedback stops.				
b0-05	Proportional gain of the voltage loop regulator	0 to 10000	Model dependent	★
b0-06	Integral gain of the voltage loop regulator	0 to 10000	Model dependent	★
b0-07	Proportional gain of the current loop regulator	0 to 10000	Model dependent	★
b0-08	Integral gain of the current loop regulator	0 to 10000	Model dependent	★
b0-09	Proportional gain of the phase lock loop regulator	0 to 65535	1645	★
b0-10	Integral gain of the phase lock loop regulator	0 to 65535	1633	★
For the AFE unit, b0-04 to b0-10 are the factory parameters. Be cautious about any change.				
b0-11	Upper limit of output current	0.0% to 200.0%	150.0%	★
In the controlled rectification mode, the maximum controlled current output by the AFE is determined by the upper current limit of the rectifier (set by b0-11).				
b0-12	Shut-down time delay	0.0s to 100.0	2.0s	●
b0-13	Frequency mode of power supply	0: 50 Hz 1: 60 Hz	0	★
For the input frequency of the mains voltage (AC power), 50 Hz is selected by default. To select the 60 Hz mains, set this parameter to 1.				

Param. No.	Name	Setting Range	Default	Property
b0-15	Input filter capacitance	100 to 3000 uF	Model dependent	★
b0-16	Filter suppression enabled	0: Invalid 1: Valid	1	★
b0-17	Carrier frequency	0.0 to 10.0 kHz	10.0 kHz	★
b0-18	Carrier frequency adjusted with model	0: Invalid 1: Valid	0	★
b0-19	Baud rate setting	1: 115200 2: 57600 3: 19200 4: 9600	1	★
The default baud rate is 9600 bps. For the performance background, the baud rate can be set as needed.				
b0-20	Address selection for parallel control	0: Standalone unit 1: Master address under parallel control 2: Slave address under parallel control	0	★
For the parallel control of two AFEs, set this parameter to 1 for the master and to 2 for the slave. For the standalone AFE, set this parameter to 0. Otherwise, the Err21 fault will be reported.				
b0-21	Notch filter coefficient of active damping	0 to 65535	7447	★
b0-22	Feedback coefficient of active damping	0 to 65535	Model dependent	★
b0-23	Active damping limit	0 to 65535	500	★
b0-24	Reverse connection fault enabled	0: Invalid 1: Valid	1	★
b0-24 applies to the energy feedback models only. It cannot work with the four-quadrant models. After wiring is complete, if the AFE and the AC drive are powered on simultaneously or the AC drive is powered on first, the parameters require no change. If a test is to be conducted for the R series separately, that is, three-phase input connected to the mains and the bus disconnected, set b0-24 to 0 before running. Otherwise, the Err23 fault will be reported. After the test is complete, set the parameter back to 1 immediately.				

Group b1: I/O Parameters

Param. No.	Name	Setting Range	Default	Property
b1-00	DI1 input	0: No function	0	★
b1-01	DI2 input	1: Running normally-open input 3: External fault normally-open input	0	★
b1-02	DI3 input	33: Running normally-closed input 35: External fault normally-closed input	0	★
b1-03	DI4 input	Others are reserved.	0	★

4 Function Parameter Table

Param. No.	Name	Setting Range	Default	Property
DI1 to DI4 are digital input terminals. The DI-controlled start/stop takes effect only when b0-00 is set to 2. The code for the same function cannot be reused. During use, external or internal 24 V power supply can be adopted. For details about wiring, see the section about the DI terminal wiring. The functions are represented by corresponding codes: ◆ 0: No function The system does not respond to any signal input. You can set the reserved terminals as no function to prevent operation errors. ◆ 1: Running normally-open input When the DI input state is selected as the AFE startup command source, the AFE starts to run as the external switch changes from the open state to the closed state, and the AFE stops as the external switch changes from the closed state to the open state. ◆ 3: External fault normally-open input When the signal works, the AFE starts the protection for the ERR20 fault. ◆ 33: Running normally-closed input When the DI input state is selected as the AFE startup command source, the AFE starts to run as the external switch changes from the closed state to the open state, and the AFE stops as the external switch changes from the open state to the close state. ◆ 35: External fault normally-open input Opposite to those in the state of 33. When the signal works, the AFE starts the protection for the ERR20 fault.				
b1-04	DO1 output	0: No function 1: Running instructions 2: DCBUS command arriving in place (reserved)	1	★
b1-05	DO2 output	3: Phase lock completed 4: Fault indication 5: Overheat alarm 6: Alarm output 7-15: Reserved	0	★
The DOs are two relay normally-open outputs. 0: No function No function in the output terminal. 1: Running instructions When the AFE is in the running state, the output relay is controlled. 3: Phase lock completed When the AFE phase lock is complete, the output relay is controlled. 4: Fault indication When faults occur on the AFE, the output relay is controlled. 5: Overheat alarm When the overheat alarm occurs on the AFE, the output relay is controlled. 6: Alarm output When alarms occur on the AFE, the output relay is controlled.				
b1-06	Reserved	-	0	☆
b1-07	Reserved	-	0	☆
b1-08	Reserved	-	0	☆

Param. No.	Name	Setting Range	Default	Property
b1-09	Reserved	-	0	☆

Group b2: Fault and Protection Parameters

Param. No.	Name	Setting Range	Default	Property
b2-00	Fault auto reset times setting	0 to 100	0	★
b2-01	Fault auto reset times	0 to 100	0	●
b2-02	Fault auto reset interval	0.1s to 1000.0s	10.0s	★
b2-03	Fault auto reset clearing time	0.1s to 1000.0h	1.0h	★

When a fault occurs, the fault is automatically reset for the times set by b2-01 at the interval of b2-02. When the reset times reduces to 0 from the set value, timing starts until the auto reset clearing time set by b2-03 is reached, and then the value of b2-00 is automatically given to b2-01. When b2-00 and b2-01 are set to 0, fault auto reset is disabled.

b2-04	Fault enabling code 1	0 to 65535	65535	★
b2-05	Fault enabling code 2	0 to 65535	65535	★
b2-06	Fault auto reset 1	0 to 65535	49032	★
b2-07	Fault auto reset 2	0 to 65535	3	★
b2-08	Alarm enabling code 1	0 to 65535	65535	★
b2-09	Alarm enabling code 2	0 to 65535	65535	★

Under the fault enabling code 1 (b2-04), Bit0 corresponds to fault Err01 and Bit1 corresponds to fault Err02; under the fault enabling code 2 (b2-05), Bit0 corresponds to fault Err17 and then, other correspondences follow accordingly. For b2-06 (Fault auto reset 1) and b2-07 (Fault auto reset 2), the Bit arrangement follows the same rule to correspond to that of faults. When the fault resetting conditions are met, resetting starts automatically.

b2-10	Alert temperature for IGBT overheat	0° C to 100° C	100	●
b2-11	Protection temperature for IGBT overheat	0° C to 110° C	110	●
b2-14	Alert value for bus undervoltage	0% to 100%	85%	★
b2-15	Protection threshold for software bus undervoltage	60.0% to 100.0%	100.0%	★

Select a protection threshold for bus undervoltage, and the bus voltage protection takes effect after system running.

b2-16	Protection threshold for software bus overvoltage	0.0 to 1000.0 V	0.0 V	★
-------	---	-----------------	-------	---

The bus overvoltage has two trigger sources, I/O signals and the software. The value is the overvoltage setting in the software.

b2-17	Alert value for mains overvoltage	100% to 150%	115%	★
b2-18	Protection threshold for mains overvoltage	100% to 150%	120%	★

4 Function Parameter Table

Param. No.	Name	Setting Range	Default	Property
b2-19	Alert value for mains undervoltage	0 to 100%	85%	★
b2-20	Mains undervoltage threshold	0 to 100%	75%	★
b2-21	Alert value for mains overfrequency	0 to 10 Hz	3 Hz	★
b2-22	Mains overfrequency threshold	0 to 10 Hz	5 Hz	★
b2-23	Alert value for mains underfrequency	-10 Hz to 0 Hz	-3 Hz	★
b2-24	Mains underfrequency threshold	-10 Hz to 0 Hz	-5 Hz	★
b2-25	Alert value for mains voltage unbalance	0 to 20%	10%	★
b2-26	Mains voltage unbalance	0 to 20%	15%	★
b2-17 to b2-26 are the set values for mains voltage alerts and faults. For special requests, such as too high user mains voltage, you can set a protection threshold for mains overvoltage through b2-18 to avoid the repeated fault reports on mains voltage. The default values can meet the needs of common users.				
b2-27	AFE current unbalance	0% to 50%	10%	★
b2-28	Alert value for zero sequence current	0 to 100%	25%	★
b2-29	Fault threshold of zero sequence current	0 to 100%	50%	★
b2-28 and b2-29 are used to set the zero sequence overcurrent faults. For systems with different requirements for zero sequence current, you can change the alert values and fault threshold.				
b2-30	Reserved	0.0 to 1000.0 V	30.0 V	★
b2-31	Reserved	0.0 to 1000.0 V	50.0 V	★
b2-32	Reserved	0.0 to 3600.0 0.0s: No test	2.0s	★
b2-33	Reserved	0 to 65535	0	☆
b2-34	Reserved	0 to 65535	0	☆
b2-35	Reserved	0 to 65535	0	☆
b2-36	Reserved	0 to 65535	0	☆
b2-37	Reserved	0 to 65535	0	☆

Group b3: Monitoring Parameters

Param. No.	Name	Setting Range	Default	Property
b3-00	Parameters displayed upon stop	Bit00: Power saving (/) Bit01: Mains frequency (Hz) Bit02: Mains voltage (V) Bit03: Bus voltage (V) BIT04 to BIT15: Reserved	65535	☆

With this parameter, the operating panel is controlled through a 16-digit binary number to display 16 running state parameters. Each parameter is controlled by a binary bit, with "1" indicating that the parameter is displayed and "0" indicating that the parameter is not displayed. To display parameters as follows for the AFE upon stop, the binary setting should be:

Binary Bit	Parameter Name	Default	Binary Bit	Parameter Name	Default
Bit0	Power saving	1	Bit8	Reserved	0
Bit1	Mains frequency	1	Bit9	Reserved	0
Bit2	Mains voltage	1	Bit10	Reserved	0
Bit3	Bus voltage	1	Bit11	Reserved	0
Bit4	Reserved	0	Bit12	Reserved	0
Bit5	Reserved	0	Bit13	Reserved	0
Bit6	Reserved	0	Bit14	Reserved	0
Bit7	Reserved	0	Bit15	Reserved	0

b3-01	Parameters displayed during running	Bit00: Power saving (/) Bit01: Mains frequency (Hz) Bit02: Mains voltage (V) Bit03: Bus voltage (V) Bit04: AFE current (A) Bit05: Module NTC temperature Bit06: Inductance temperature BIT07 to BIT15: Reserved	65535	☆
-------	-------------------------------------	--	-------	---

To set the state parameters that are displayed in the operating panel when the AFE is in the running state, follow the steps in b3-00.

The 16-bit binary number corresponds to the running state parameters as follows:

Binary Bit	Parameter Name	Default	Binary Bit	Parameter Name	Default
Bit0	Power saving	1	Bit8	Reserved	0
Bit1	Mains frequency	1	Bit9	Reserved	0
Bit2	Mains voltage	1	Bit10	Reserved	0
Bit3	Bus voltage	1	Bit11	Reserved	0
Bit4	AFE current	0	Bit12	Reserved	0
Bit5	Module NTC temperature	0	Bit13	Reserved	0
Bit6	Inductance temperature	0	Bit14	Reserved	0
Bit7	Reserved	0	Bit15	Reserved	0

4 Function Parameter Table

Param. No.	Name	Setting Range	Default	Property
b3-02	Function description of the STOP button	0: The STOP button works only in the operating panel control mode. 1: The STOP button works in any control mode.	1	☆
b3-03	Function software version No.	00.00 to 99.99	00.00	●
b3-04	Performance software version No.	00.00 to 99.99	00.00	●
b3-05	Software principal version No.	00.00 to 99.99	00.00	●
b3-06	Mains frequency	0.00 to 100.00 Hz	0.00 Hz	●
b3-07	Mains voltage	0.0 to 1000.0 V	0.0 V	●
b3-08	Bus voltage	0.0 to 1000.0 V	0.0 V	●
b3-09	Output current	0.00 to 100.00 A	0.00 A	●
b3-10	Module temperature	0 to 200°C	0°C	●
b3-11	System power	0.00 to 100.00 kW	0	●
b3-12	High bit of power consumption reading	0 to 65535	0	●
b3-13	Low bit of power consumption reading	0 to 65535 kWh	0	●
b3-14	High bit of power saving	0 to 65535	0	●
b3-15	Low bit of power saving	0 to 65535 kWh	0	●
b3-16	Reading update time	0 to 65535	9600	●
b3-17	High bit of total power saving	0 to 65535	0	●
b3-18	Low bit of total power saving	0 to 65535 kWh	0	●
The values of b3-12 and b3-14 are updated once every minute. When the counting of b3-13 exceeds 999.9, it is reset to 0 and the counting of b3-12 increases by 1. When the counting of b3-12 exceeds 9999, it is reset to 0. When the counting of b3-15 exceeds 999.9, it is reset to 0 and the counting of b3-14 increases by 1. When the counting of b3-14 exceeds 9999, it is reset to 0.				
b3-19	Reserved	0 to 65535	0	☆
b3-20	Reserved	0 to 65535	0	☆

Group b4: Fault Parameter Query

Param. No.	Name	Setting Range	Default	Property
b4-00	Latest fault	0 to 65535	0	●
b4-01	Latest mains frequency	0.00 to 100.00 Hz	0.00 Hz	●
b4-02	Latest mains voltage	0.0 to 1000.0 V	0.0 V	●

Param. No.	Name	Setting Range	Default	Property
b4-03	Latest bus voltage	0.0 to 1000.0 V	0.0 V	●
b4-04	Latest AFE current	0.00 to 100.00 A	0.00 A	●
b4-05	AFE temperature in the latest fault	0 to 200°C	0°C	●
b4-07	Accumulated running time in the latest fault	0 to 65535	0	●
b4-08	Information about the first fault	0 to 65535	0	●
b4-09	Mains frequency in the first fault	0.00 to 100.00 Hz	0.00 Hz	●
b4-10	Mains voltage in the first fault	0.0 to 1000.0 V	0.0 V	●
b4-11	Bus voltage in the first fault	0.0 to 1000.0 V	0.0 V	●
b4-12	AFE current in the first fault	0.00 to 100.00 A	0.00 A	●
b4-13	AFE temperature in the first fault	0 to 200°C	0°C	●
b4-15	Accumulated running time in the first fault	0 to 65535	0	●
b4-16	Information about the second fault	0 to 65535	0	●
b4-17	Mains frequency in the second fault	0.00 to 100.00 Hz	0.00 Hz	●
b4-18	Mains voltage in the second fault	0.0 to 1000.0 V	0.0 V	●
b4-19	Bus voltage in the second fault	0.0 to 1000.0 V	0.0 V	●
b4-20	AFE current in the second fault	0.00 to 100.00 A	0.00 A	●
b4-21	AFE temperature in the second fault	0 to 200°C	0°C	●
b4-23	Accumulated running time in the second fault	0 to 65535	0	●
b4-24	Information about the third fault	0 to 65535	0	●
b4-25	Mains frequency in the third fault	0.00 to 100.00 Hz	0.00 Hz	●
b4-26	Mains voltage in the third fault	0.0 to 1000.0 V	0.0 V	●
b4-27	Bus voltage in the third fault	0.0 to 1000.0 V	0.0 V	●

4 Function Parameter Table

Param. No.	Name	Setting Range	Default	Property
b4-28	AFE current in the third fault	0.00 to 100.00 A	0.00 A	●
b4-29	AFE temperature in the third fault	0 to 200°C	0°C	●
b4-31	Accumulated running time in the third fault	0 to 65535	0	●
b4-32	Information about the fourth fault	0 to 65535	0	●
b4-33	Frequency instructions in the fourth fault	0.00 to 100.00 Hz	0.00 Hz	●
b4-34	Mains voltage in the fourth fault	0.0 to 1000.0 V	0.0 V	●
b4-35	Bus voltage in the fourth fault	0.0 to 1000.0 V	0.0 V	●
b4-36	AFE current in the fourth fault	0.00 to 100.00 A	0.00 A	●
b4-37	AFE temperature in the fourth fault	0 to 200°C	0°C	●
b4-39	Accumulated running time in the fourth fault	0 to 65535	0	●
These parameters provide records about the latest four faults of the AFE. The fault records include fault codes, various monitoring parameters during faults, and running time of the AFE.				
b4-40	Reserved	0 to 65535	0	☆
b4-41	Reserved	0 to 65535	0	☆
b4-42	Reserved	0 to 65535	0	☆
b4-43	Reserved	0 to 65535	0	☆
b4-44	Reserved	0 to 65535	0	☆
b4-45	Reserved	0 to 65535	0	☆
b4-46	Reserved	0 to 65535	0	☆
b4-47	Reserved	0 to 65535	0	☆
b4-48	Reserved	0 to 65535	0	☆
b4-49	Reserved	0 to 65535	0	☆
b4-50	Reserved	0 to 65535	0	☆
b4-51	Reserved	0 to 65535	0	☆
b4-52	Reserved	0 to 65535	0	☆
b4-53	Reserved	0 to 65535	0	☆
b4-54	Reserved	0 to 65535	0	☆
b4-55	Reserved	0 to 65535	0	☆

Group b5: Factory Parameters

Param. No.	Name	Setting Range	Default	Property
b5-00	Factory password	0 to 65535	-	○
b5-01	AFE model	1 to 22	Model dependent	★
b5-02	Temperature curve	1 to 5	1	★
b5-03	Reserved	0 to 4	1	★
b5-04	Reserved	0 to 65535	0	☆
b5-05	Reserved	0 to 65535	0	☆
b5-06	Software undervoltage threshold	50.0% to 100.0%	100%	★
b5-07	Software overcurrent threshold	50.0% to 150.0%	100%	★
b5-08	Voltage calibration coefficient	50.0% to 150.0%	100%	★
b5-09	Current calibration coefficient	50.0% to 150.0%	100%	★
b5-10	Rated power	0 to 1000.0 kW	Model dependent	★
b5-11	Rated current	0 to 655.35 A	Model dependent	★
b5-12	Rated voltage	0 to 999 V	Model dependent	★
b5-13	Reserved	0 to 65535	0	☆
b5-14	Reserved	0 to 65535	0	☆
b5-15	Reserved	0 to 65535	0	☆
b5-16	Reserved	0 to 65535	0	☆

Group b6: User Parameters

Param. No.	Name	Setting Range	Default	Operation
b6-00	User password	0 to 65535	0	☆
Used for user password setting. Set the parameter to any non-zero value to enable the password protection function. The password will be required upon next access to the parameter settings. To disable the password protection, set this parameter to 00000. Bear in mind your password. If you set the password by mistake or forget the password, contact the agent or Inovance to replace the main control board.				
b6-01	Parameter initialization	0: No operation 1: Restore factory settings 2: Clear log information	0	★

4 Function Parameter Table

Param. No.	Name	Setting Range	Default	Operation
Used for partial parameter resetting. Possible values: ◆ 0: None ◆ 1: Restore factory settings. ◆ 2: Clear fault information				
b6-02	Reserved	0 to 65535	0	☆
b6-03	Reserved	0 to 65535	0	☆
b6-04	Reserved	0 to 65535	0	☆
b6-05	Reserved	0 to 65535	0	☆
b6-06	Reserved	0 to 65535	0	☆
b6-07	Reserved	0 to 65535	0	☆
b6-08	Reserved	0 to 65535	0	☆
b6-09	Reserved	0 to 65535	0	☆
b6-10	Reserved	0 to 65535	0	☆

5 Troubleshooting

The AFE unit provides multiple alarm and protection functions. Once any abnormality occurs, the protection function is enabled, with the AFE unit stopping output and fault codes displayed on the operating panel. You can carry out troubleshooting by yourself according to this section to analyze possible fault causes and find a solution.

Table 5-1 Fault information and solutions

Fault Name	Fault Code	Possible Causes	Solution
Overcurrent	Err01	◆ The AFE or AC drive is grounded or short circuited. ◆ Parameters of the controller are set improperly. ◆ The mains is abnormal, resulting in output vibrations. ◆ Internal faults of the equipment occur.	◆ Eliminate external faults. ◆ Restore factory settings. ◆ Contact the agent or Inovance. ◆ Contact the agent or Inovance.
AFE overheat	Err02	◆ The ambient temperature is too high. ◆ The fan is faulty. ◆ The air filter is blocked. ◆ The IGBT is damaged. ◆ Check for circuit faults.	◆ Reduce the ambient temperature. ◆ Replace the fan. ◆ Check the air filter. ◆ Replace the IGBT. ◆ Contact the agent or Inovance to check the circuit.
Bus undervoltage	Err04	◆ The load is too heavy. ◆ The bus voltage is tested as abnormal.	◆ Reduce the load. ◆ Contact the agent or Inovance to check the circuit.
Bus overvoltage	Err06	◆ The AC drive is not connected to the braking resistor. ◆ Input phase loss occurs. ◆ The feedback power is too high. ◆ The bus voltage is tested as abnormal. ◆ Control fails.	◆ Install a braking resistor to the AC drive. ◆ Check whether the mains voltage and wiring are normal. ◆ Check the model matching and working status. ◆ Contact the agent or Inovance to check the circuit. ◆ Contact the agent or Inovance to redress the unreasonable voltage loop settings.
AFE overload	Err07	◆ The AFE power class is too low. ◆ The load power is too high.	◆ Replace the AFE with one of higher power. ◆ Lower the load power.
Mains voltage overvoltage	Err08	◆ The input mains voltage is too high. ◆ A fault occurs in the detection circuit of the mains voltage.	◆ Check whether the mains voltage is too high. ◆ Contact the agent or Inovance to check the circuit.

Fault Name	Fault Code	Possible Causes	Solution
Mains voltage undervoltage	Err09	◆ Power-off or too low input happens to the mains. ◆ A fault occurs on the detection circuit of the mains voltage.	◆ Check whether the mains voltage is too low. ◆ Contact the agent or Inovance to check the circuit.
Mains voltage overfrequency	Err10	◆ Phase loss occurs on the input. ◆ Overfrequency happens to the mains voltage. ◆ A fault occurs on the detection circuit of the mains voltage.	◆ Check whether the input wiring is normal. ◆ Check whether the mains frequency is too high. ◆ Contact the agent or Inovance to check the circuit.
Mains voltage underfrequency	Err11	◆ Input phase loss occurs. ◆ Underfrequency happens to the mains voltage. ◆ A fault occurs on the detection circuit of the mains voltage.	◆ Check whether the input wiring is normal. ◆ Check whether the mains frequency is too low. ◆ Contact the agent or Inovance to check the circuit.
Mains voltage asymmetric	Err12	◆ Phase loss happens to the mains voltage. ◆ A fault occurs on the detection circuit of the mains voltage.	◆ Check whether the three phases of the mains voltage are symmetric. ◆ Contact the agent or Inovance to check the circuit.
Phase lock fault of the mains voltage	Err13	◆ Input phase loss occurs. ◆ Phase lock failure happens to the mains voltage. ◆ A fault occurs on the detection circuit of the mains voltage.	◆ Check whether the input wiring is normal. ◆ Contact the agent or Inovance to redress the unreasonable settings of phase lock loop parameters. ◆ Contact the agent or Inovance to check the circuit.
AFE current asymmetric	Err14	◆ Phase loss occurs to the mains. ◆ A cable inside the unit is broken. ◆ The current detection circuit is abnormal.	◆ Check whether the three-phase input is normal. ◆ Contact the agent or Inovance to check the circuit. ◆ Contact the agent or Inovance to check the circuit.
Pulse-by-pulse current limit fault	Err15	◆ The load is too heavy. ◆ Control fails. ◆ The detection circuit is abnormal. ◆ Internal interference	◆ Check whether the load is normal. ◆ Contact the agent or Inovance to check the current loop parameters. ◆ Contact the agent or Inovance to check the circuit. ◆ Contact the agent or Inovance.

Fault Name	Fault Code	Possible Causes	Solution
Zero sequence current fault	Err16	◆ The earthing is short-circuited. ◆ A current detection fault occurs. ◆ Check whether the range setting is reasonable.	◆ Check whether the earthing of the system is short-circuited. ◆ Contact the agent or Inovance to check the circuit. ◆ Check whether reasonable values are set for the zero sequence current protection.
Zero-drift current fault	Err17	◆ A fault occurs in the current detection circuit.	◆ Contact the agent or Inovance to check the circuit.
CAN communication fault	Err19	◆ A wrong program version is used in the main control board of the AC drive. ◆ Communication parameters are not set for the AC drive. ◆ The communication cable is disconnected.	◆ Update the program on the main control board of the AC drive. ◆ Set bit 2 of F6-52 to 1 for the AC drive. ◆ Check whether the communication cable is disconnected or in bad contact.
External input fault	Err20	◆ The function settings on the input end is incorrect and an external signal is input.	◆ Check the function settings on the input end and external input signals.
Parallel control RS485 communication fault	Err21	◆ The master/slave address is not set correctly. ◆ The RS485 communication cable is disconnected.	◆ Correctly set the master/slave address. ◆ Check whether the communication cable is disconnected or in bad contact.
Shut-down fault upon the fault of the other unit under parallel control	Err22	◆ During parallel control, a fault is reported on the other unit.	◆ The fault reported on this unit is reset automatically after the fault on the other unit is resolved.
Bus reversely connected	Err23	◆ In the energy feedback mode, the AFE bus is connected to the wrong polarities of the AC drive bus.	◆ Check the bus wiring, and reconnect the bus to the correct polarities.

6 Maintenance and Care

6.1 Routine Maintenance

6.1.1 Routine Inspection

The influence of the ambient temperature, humidity, dust and vibration will age the components inside the AFE unit, which may cause potential faults or reduce the service life of the AFE unit. Therefore, it is necessary to carry out routine and periodic maintenance for the AFE unit.

■ Routine Inspection Items

- 1) Whether abnormal noise exists during the AFE running
- 2) Whether the installation environment of the AFE changes
- 3) Whether the cooling fan works properly
- 4) Whether the AFE overheats

■ Routine Cleaning Items

- 1) Keep the AFE clean all the time.
- 2) Remove the dust, especially metal powder on the surface of the AFE unit, to prevent the dust from entering the AFE.
- 3) Clear the oil stain on the cooling fan of the AFE unit.

6.1.2 Periodic Inspection

Perform periodic inspection on the items that are difficult to check during running.

■ Periodic Inspection Items

- 1) Check and clean the air filter periodically.
- 2) Check whether the screws become loose.
- 3) Check whether the AFE unit is corroded.
- 4) Check whether the wiring terminals have arc signs.

■ Main Circuit Insulation Test

Before measuring the insulating resistance with a megameter (500 VDC megameter recommended), disconnect the main circuit from the AFE unit. Do not use the insulating resistance meter to test the insulation of the control circuit. The high voltage test is not required because it has been completed before delivery.

6.2 Replacement of Vulnerable Components

6.2.1 Service Life of Vulnerable Components

Vulnerable components of the AFE unit include the cooling fan and filter electrolytic capacitor. Their service life is related to the operating environment and maintenance. Usually, the service life is as follows:

Table 6-1 Service life of vulnerable components

Component	Service Life ^[1]
Fan	≥ 5years
Electrolytic capacitor	≥ 5years

Note: The service life is obtained based on the following conditions:

- 1) Mean annual ambient temperature: 30°C
- 2) Load rate: below 80%;
- 3) Running time: less than 10 hours per day.

6.2.2 Cooling Fan

■ Possible Damage Cause

Bearing worn, blade aging

■ Judging Criteria

Check whether there is crack on the blade. Check whether there is abnormal vibration noise upon startup.

6.2.3 Electrolytic capacitor

■ Possible Damage Cause

Input power supply in poor quality, high ambient temperature, frequent load jumping, and electrolytic aging

■ Judging Criteria

Check whether there is liquid leakage; Check whether the safety valve has projected; Measure the static capacitance; Measure the insulating resistance.

6.3 Storage

For storage of the AFE unit, pay attention to the following two aspects:

- Pack the AFE unit with the original packing box provided by Inovance;
- Long-term storage degrades the electrolytic capacitor. Thus, the AFE unit 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.

Appendix A Electro Magnetic Compatibility (EMC)

A.1 Definition of Terms

EMC: 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. EMC includes two aspects: The electromagnetic interference generated by a device or system must be restricted within a certain limit; the device or system must have sufficient immunity to the electromagnetic interference in the environment.

First environment: Environment that includes domestic premises. It also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes.

Second environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.

Category C1 AC drive: Power Drive System (PDS) of rated voltage less than 1000 V, intended for use in the first environment.

Category C2 AC drive: PDS of rated voltage less than 1000 V, which is neither a plug in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by a professional.

Category C3 AC drive: PDS of rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment.

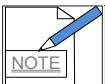
Category C4 AC drive: PDS of rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

A.2 Introduction to EMC Standard

A.2.1 Installation Environment

The system manufacturer using the AC drive is responsible for compliance of the system with the European EMC directive. Based on the application of the system, the integrator must ensure that the system complies with standard EN 61800-3: 2004 Category C2, C3 or C4.

The system (machinery or appliance) installed with the AFE must also have the CE mark. The system integrator is responsible for compliance of the system with the EMC directive and standard EN 61800-3: 2004 Category C2.



◆ If applied in the first environment, the AC drive may generate radio interference. Besides the CE compliance described in this chapter, users must take measures to avoid such interference, if necessary.

A.2.2 Requirements on Satisfying the EMC Directive

The AFE unit requires an external EMC filter. The recommended filter models (optional part) are listed in Table 8-1. The cable connecting the filter and the AFE should be as short as possible and be not longer than 30 cm. Furthermore, install the filter and the AFE on the same metal plate, and ensure that the grounding terminal of the AFE and the grounding point of the filter are in good contact with the metal plate.

Select the motor and the control cable according to the description in the cable section.

Install the AFE unit and arrange the cables according to the cabling and grounding sections.

A.3 Selection of Peripheral EMC Devices

■ Installation of EMC Input Filter on Power Input Side

An EMC filter installed between the AFE and the power supply can not only restrict the interference of electromagnetic noise in the surrounding environment on the controller, but also prevent the interference from the controller on the surrounding equipment. The AC drive controller satisfies the requirements of category C2 only with an EMC filter installed on the power input side. The installation precautions are as follows:

Strictly comply with the ratings when using the EMC filter. The EMC filter is category I electric apparatus, and therefore, the metal housing ground of the filter should be in good contact with the metal ground of the installation cabinet on a large area, and requires good conductive continuity. Otherwise, it will result in electric shock or poor EMC effect.

The grounds of the EMC filter and the PE conductor of the controller must be tied to the same common ground. Otherwise, the EMC effect will be affected seriously.

The EMC filter should be installed as closely as possible to the power input side of the controller.

The following table lists the recommended manufacturers and models of EMC filters. Select a proper one based on actual requirements.

Table A-1 Recommended manufacturers and models of EMC filter

AFE Model	AC Input Filter Model (SCHAFFNER)
MD051NT5.5G	FN3258-16-45
MD051NT7.5G	FN3258-16-45
MD051NT11G	FN3258-30-47
MD051NT15G	FN3258-30-47
MD051NT18.5G	FN3258-30-47
MD051NT22G	FN3258-42-47
MD051NT30G	FN3258-55-34

A.4 Shielded Cable

A.4.1 Requirements for the Shielded Cable

The shielded cable must be used to satisfy the EMC requirements. 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. See the following figure:

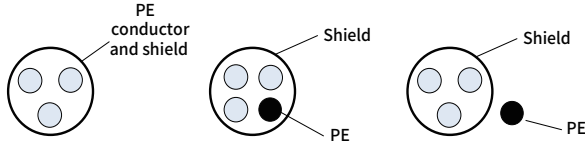


Figure A-1 Cross section of a shielded cable

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.

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. See the following figure:

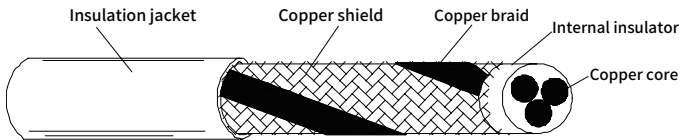


Figure A-2 Requirement for braided density of the shield

It is recommended that all control cables be shielded. The grounding area of the shielded cable should be as large as possible. A suggested method is to fix the shield on the metal plate using the metal cable clamp to achieve good contact, as shown in the following figure.

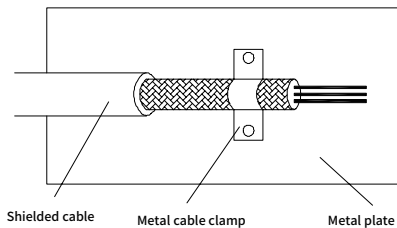


Figure A-3 Fixing the shield by using a metal cable clamp

A.4.2 Installation Precautions of the Shielded Cable

- 1) Symmetrical shielded cable is recommended. The four-conductor shielded cable can also be used as an input cable.
- 2) It is recommended that all control cables be shielded.
- 3) It is recommended that a shielded cable be used as the output power cable of the AFE; the cable shield must be well grounded. For devices suffering from interference, shielded twisted pair (STP) cable is recommended as the lead wire and the cable shield must be well grounded.

A.4.3 Cabling Requirement

- 1) Power cables of the AFE and motor must be laid far away from control cables, with recommended distance longer than 0.5 m. It is recommended that the AFE power input cables, motor cables, and control cables be laid in different ducts. The cable ducts must be in good connection and well grounded. Aluminum ducts can be used to improve electric potential.
- 2) 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 AFE.
- 3) The power input and output cables of the AFE and weak-current signal cables (such as control cable) should be laid vertically (if possible) rather than in parallel.
- 4) The filter and AFE should be connected to the cabinet properly, with spraying protection at the installation part and conductive metal in full contact.
- 5) The motor should be connected to the system (machinery or appliance) properly, with spraying protection at the installation part and conductive metal in full contact.

Revision History

Date	Version	Change Description
April 2021	A00	First release.

INOVANCE Warranty Agreement

- 1) Inovance provides an 18-month free warranty to the equipment itself from the date of manufacturing for the failure or damage under normal use conditions.
- 2) Within the warranty period, maintenance will be charged for the damage caused by the following reasons:
 - a. Improper use or repair/modification without prior permission
 - b. Fire, flood, abnormal voltage, natural disasters and secondary disasters
 - c. Hardware damage caused by dropping or transportation after procurement
 - d. Operations not following the user instructions
 - e. Damage out of the equipment (for example, external device factors)
- 3) The maintenance fee is charged according to the latest Maintenance Price List of Inovance.
- 4) If there is any problem during the service, contact Inovance's agent or Inovance directly.
- 5) Inovance reserves the rights for explanation of this agreement.

Suzhou Inovance Technology Co., Ltd.

Address: No.16, Youxiang Road, Yuexi Town, Wuzhong District, Suzhou 215104, P.R. China

Website: <http://www.inovance.com>

Shenzhen Inovance Technology Co., Ltd.

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

Tel: +86-755-2979 9595

Fax: +86-755-2961 9897

<http://www.inovance.com>

Suzhou Inovance Technology Co., Ltd.

Add.: No. 16 Youxiang Road, Yuexi Town, Wuzhong District, Suzhou 215104, P.R. China

Tel: +86-512-6637 6666

Fax: +86-512-6285 6720

<http://www.inovance.com>



19011473 A00

Copyright © Shenzhen Inovance Technology Co., Ltd.