INOVANCE

FORWARD, ALWAYS PROGRESSING

MD050N Series AFE Unit

User Manual

Industrial Automation | Intelligent Elevator | New Energy Vehicle | Industrial Robot | Rail Transit

Doc. No. 19011872 A02

Preface

Thank you for purchasing the MD050N series active front end (AFE) unit independently developed and produced by Inovance Technology.

The MD050N series active front end (AFE) unit (hereinafter referred to as AFE unit) can feed back energy generated by the motor during braking to the power grid. In this way, more than 95% of the regenerated electrical energy can be recycled while satisfying the effective braking of the AFE unit. The AFE unit provides multiple protective functions, including overtemperature, overvoltage, and overcurrent protection. In addition, the AFE unit features low noise, low harmonics pollution, and high power factor.

This manual describes the functions and proper use of the AFE unit, including selection, parameter setting, commissioning, maintenance and inspection. Read and understand the manual before use and forward the manual to the end user.

Notes
◆ For illustration purposes, the drawings in this document 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 User Manual. ◆ The drawings in this document are shown for description only and may not match the product you purchased. ◆ The instructions are subject to change without notice, due to product upgrading, specification change as well as efforts to increase the accuracy and convenience of the document. ◆ If the manual is damaged or lost, order a replacement from your agent or the customer service center of Inovance. ◆ Contact the customer service center of Inovance if you have problems during the use.

§ Unpacking and checking:

Upon unpacking, check:

1) Whether the model as indicated on the nameplate and the rated values of the AFE unit are consistent with your order. The box contains the equipment, certificate of conformity, user manual, and warranty card.

2) Check the overall appearance of the product. If there is any omission or damage, contact Inovance or your supplier immediately.

§ First-time use:

Read this user manual carefully if you use the AFE unit for the first time. If you have any problem concerning the functions or performance, contact the technical support personnel of Inovance to ensure correct use.

The instructions are subject to change without notice due to product upgrading.

Revision History

Date	Version	Revision Description
July 2020	A00	First release
October 2021	A01	Deleted all Ethernet related contents
May 2022	A02	Added quick-access contents Updated the voltage regulator description in the wiring diagram for 4-quadrant mode Added selection of circuit breakers and fuses Corrected minor mistakes

§ Manual and Acquisition

This manual is not delivered with the product. If you want to purchase another copy, contact your product distributor.

Visit the official website (http://www.inovance.com) of Inovance Technology to download the PDF version.

Contents

Safety Instructions

Safety Precautions

1) Before installing, using, and maintaining this product, read the safety instructions and precautions thoroughly, and comply with them during operations.
2) To ensure the safety of personnel and products, follow the signs on the product and all the safety instructions in this user manual.
3) "CAUTION", "WARNING", and "DANGER" items in the user 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 use is not covered by the 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 or moderate personal injuries or equipment damage.

Safety Instructions

Unpacking
Note ◆ Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation. ◆ Unpack the package by following the unpacking sequence. Do not strike the package violently. ◆ Check whether there is damage, rust, or scratch on the surface of the equipment and equipment accessories. ◆ Check the package contents against the packing list before unpacking.
Alarm ◆ Do not install the equipment if you find damage, rust, or signs 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

Note

- Store this equipment based on the storage and transportation requirements for humidity and temperature.
- Avoid transporting the equipment in environments with 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 transport. Use a sealed box for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

Alarm

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

Installation

Alarm

- Thoroughly read the safety instructions and user manual before installation.
- Do not modify this product.
- Do not rotate the bolts used to fix equipment components or the bolts marked in red.
- Do not install this equipment in places with strong electric or magnetic fields.
- When this product is installed in a cabinet or terminal device, the cabinet or terminal device must be equipped with a protective shell. The IP rating must comply with relevant IEC standards and local regulations.

DANGER

- Do not allow non-professionals to perform product installation, wiring, maintenance, inspection or parts replacement.
- The installation, wiring, maintenance, inspection, and parts replacement are intended to be performed by professionals only.
- Installation personnel must be familiar with product installation requirements and relevant technical materials.
- Before installing equipment with strong electromagnetic interference, such as a transformer, install an electromagnetic shielding device for this product 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 after power-off so that residual voltage can discharge safely.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.
- Follow the proper electrostatic discharge (ESD) procedures, and wear an anti-static wrist strap to perform wiring. Failure to comply may result in damage to the equipment or the internal circuit of the product.


Alarm

- When connecting a drive with the AFE unit, make sure that the phase sequences of the drive and AFE terminals are consistent to prevent reverse motor rotation.
- Wiring cables must meet diameter and shielding requirements. The shield of the shielded cable must be reliably grounded at one end.
- Upon completion of wiring, make sure that no screws are omitted and cables are exposed in the equipment.

Power-on


DANGER

- Before power-on, make sure that the equipment and product are installed properly with reliable wiring.
- Before power-on, make sure that the power supply meets equipment requirements to prevent equipment damage or even a fire.
- During power-on, unexpected operations may be triggered on equipment or the product. Therefore, stay away from the equipment or the product.
- 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 or the product 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 or the product during operation. Failure to comply will result in an electric shock.
- Do not touch the equipment casing, fan, or resistor to check the temperature. Failure to comply will result in a burn.
- Signal detection must be performed only by professionals during operation. Failure to comply will result in personal injuries or equipment damage.


Alarm

- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in equipment damage.
- Do not start or stop the equipment using the 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.


Alarm

- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep maintenance records.

Repair
DANGER ◆ 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.
Alarm ◆ Report your repair requests according to the product warranty agreement. ◆ When the equipment is faulty or damaged, ask professionals to perform troubleshooting and repair by following repair instructions, and keep repair records. ◆ Replace quick-wear parts of the product according to the replacement instructions. ◆ 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
Alarm ◆ Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death. ◆ Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

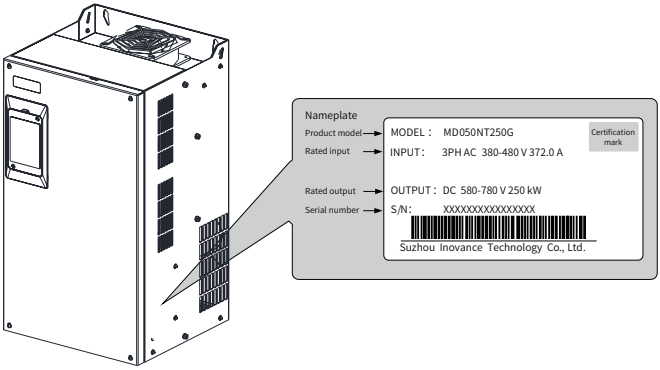
Safety Signs

For safe equipment operation and maintenance, comply with safety signs on the equipment, and do not damage or remove the safety labels. See the following table for descriptions of the safety labels:

Safety Signs	Description
	◆ Read the user manual 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.

Chapter 1 Product Information

1.1 Nameplate and Model



MD050 N T 55 G

Label	Product Series
MD050	Active front end (AFE) series

Label	Structure
N	New structure
None	Old structure

Label	Voltage Class
T	Three-phase 380 V to 480 V
7T	Three-phase 690 V

Label	Applicable Models
G	General type

Label	Rated Power (kW)
55	55
…	…
500	500

Figure 1-1 Nameplate information and model number

1.2 Technical Specifications

Table 1-1 Technical specifications of MD050N series AFE unit

Model	Power Capacity kVA	Direct Current A	Alternating Current A	Rated Power kW	Bus Voltage Range V DC
Three-phase 380 V to 480 V					
MD050NT55G	85	73.2	86	55	580 to 780
MD050NT75G	114	100	120	75	
MD050NT90G	134	120	140.8	90	
MD050NT110G	160	147.2	168	110	
MD050NT132G	192	176.8	202.4	132	
MD050NT160G	231	213.6	243.2	160	
MD050NT200G	250	267.2	301.6	200	
MD050NT220G	280	294.4	340.8	220	

Model	Power Capacity kVA	Direct Current A	Alternating Current A	Rated Power kW	Bus Voltage Range V DC
MD050NT250G	355	334.4	372	250	580 to 780
MD050NT280G	396	373.6	416	280	
MD050NT315G	445	420	468	315	
MD050NT355G	500	473.6	520	355	
MD050NT400G	565	533.6	580	400	
Three-phase 690 V					
MD050-7T55G	84	42.4	52	55	1000 to 1120
MD050-7T75G	107	57.6	68.8	75	
MD050-7T90G	125	69.6	80	90	
MD050-7T110G	155	84.8	96	110	
MD050-7T132G	192	101.6	120	132	
MD050-7T160G	231	123.2	140	160	
MD050-7T200G	250	153.6	172	200	
MD050-7T220G	280	169.6	196	220	
MD050-7T250G	355	192.8	208	250	
MD050-7T280G	396	215.2	239.2	280	
MD050-7T315G	445	242.4	264	315	
MD050-7T355G	500	273.6	299.2	355	
MD050-7T400G	565	308	328	400	
MD050-7T450G	630	346.4	372	450	
MD050-7T500G	700	384.8	440	500	

1.3 General Technical Characteristics

Table 1-2 General technical characteristics of MD050N series

Specifications		
Basic specifications	Input voltage	Three-phase 380 VAC to 480 VAC (-15% to +10%) Three-phase 690 VAC (-15% to +10%)
	Input frequency	48 Hz to 63 Hz
	Output voltage	4T: 580 VDC to 780 VDC 7T: 1000 VDC to 1120 VDC
	Carrier frequency	3 kHz
	Controlled rectifier power factor	⩾ ± 0.98 (The grid voltage harmonic is less than 3% at rated load).
	Controlled rectifier harmonic current	＜ 5% (The grid voltage harmonic is less than 3% at rated load).
	Working efficiency	＞ 97%
	Overload capability	30 minutes for 120% of the rated current, 1 min for 150% of the rated current
Individualized functions	Regenerative power checking	The regenerative power (active) is expressed as a negative number with an accuracy error of less than 5% at the rated power.
	Differentiation of rectified current and regenerative current	The flow direction of "rectified current" is positive and the flow direction of "regenerative current" is negative.
	Measurement of regenerative energy	For example, you can record and check how much energy is regenerative within one hour with accuracy within ± 10%.
HMI	Analog input	Two AIs: 0 V to 10 V or 4 mA to 20 mA jumper
	Analog output	Two AIs: 0 V to 10 V or 0 mA to 20 mA jumper
	Digital input	Four DIs: 9 V to 30 V voltage input, optional PNP or NPN input
	Digital output	One open collector output: Configurable terminal for isolated drain/source output, 24 VDC/50 mA 2 relays: Programmable normally open (NO)/normally closed (NC) contact
	Operating panel display	Operating panel (nine buttons on 5 LEDs)
	Communication/ fieldbus	Standard RS485, optional Profibus-DP
Protective functions		Overvoltage protection, overcurrent protection, overtemperature protection, overload protection, and undervoltage protection

1.4 Outline Dimensions

1.4.1 Outline Dimensions and Mounting Hole Dimensions

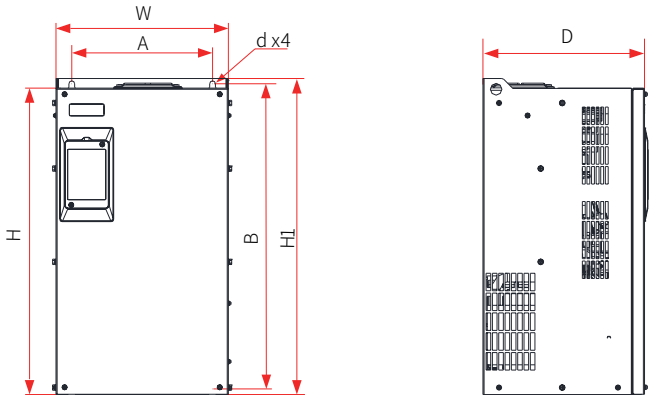


Figure 1-2 Schematic diagram of outline dimensions and mounting hole dimensions of MD050NT55G to MD050NT160G models

Table 1-3 Outline dimensions and mounting hole dimensions of MD050NT55G to MD050NT160G models (mm)

Model	Mounting Hole (mm)		Outline Dimensions (mm)				Mounting Hole Diameter (mm)	Weight kg
	A	B.	H	H1	W	D		
MD050NT55G	245	523	525	542	300	275	Ø10	35.0
MD050NT75G	270	560	554	580	338	315	Ø10	51.5
MD050NT90G								
MD050NT110G								
MD050NT132G	320	890	874	915	400	320	Ø10	85.0
MD050NT160G								

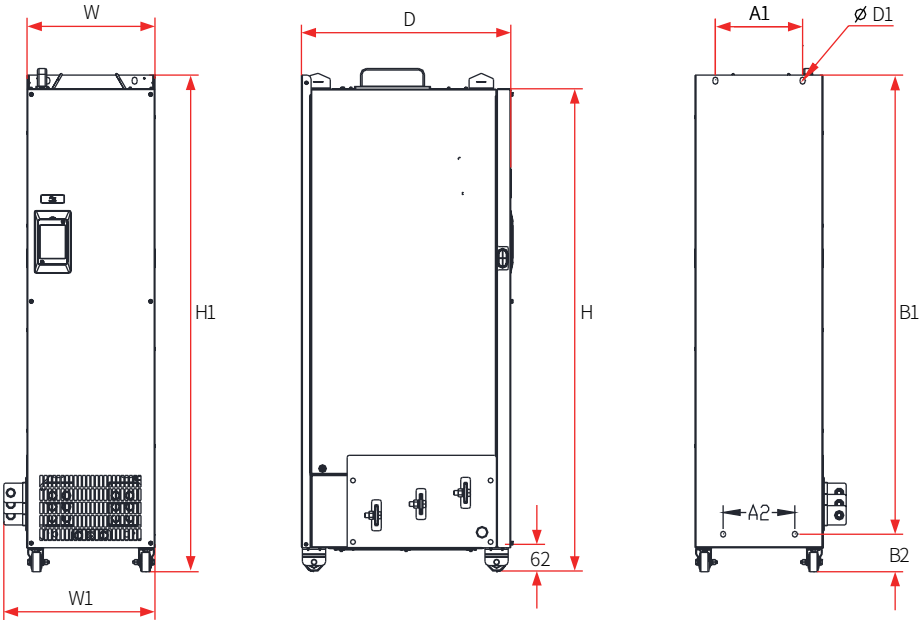


Figure 1-3 Schematic diagram of outline dimensions and mounting hole dimensions of MD050NT200G to MD050NT400G models

Table 1-4 Outline dimensions and mounting hole dimensions of MD050NT200G to MD050NT400G models (mm)

Model	Mounting Hole (mm)				Outline Dimensions (mm)					Hole Diameter (mm)	Weight (kg)
	A1	A2	B1	B2	H	H1	W	W1	D	D1	
MD050NT200G	240	150	1035	86	1086	1134	300	360	500	Ø13	110
MD050NT220G											
MD050NT250G	225	185	1175	97	1248	1284	330	390	545	Ø13	155
MD050NT280G											
MD050NT315G	240	200	1280	101	1355	1405	340	400	545	Ø16	185
MD050NT355G											
MD050NT400G											

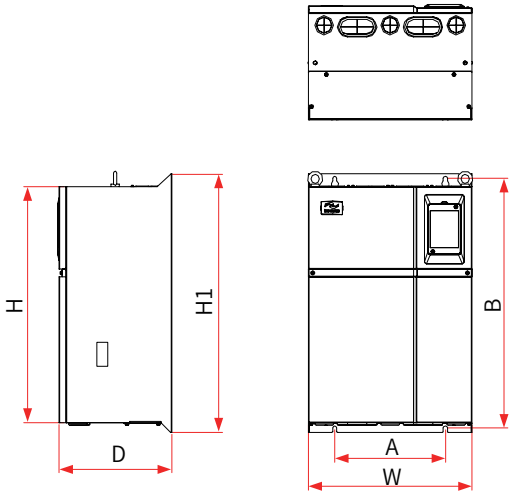


Figure 1-4 Schematic diagram of outline dimensions and mounting hole dimensions MD050-7T55G to MD050-7T500G models

Table 1-5 Outline dimensions and mounting hole dimensions MD050-7T55G to MD050-7T500G models (mm)

Model	Mounting Hole (mm)		Outline Dimensions (mm)				Mounting Hole Diameter (mm)	Weight kg
	A	B.	H	H1	W	D		
MD050-7T55G	250	570	557	600	400	330	Ø10	47
MD050-7T75G								
MD050-7T90G								
MD050-7T110G								
MD050-7T132G								
MD050-7T160G	320	1166	1090	1192	440	310	Ø10	90
MD050-7T200G								
MD050-7T220G								
MD050-7T250G								
MD050-7T280G	420	1030	983	1060	650	377	Ø12	130
MD050-7T315G								
MD050-7T355G								
MD050-7T400G	520	1300	1203	1358	800	400	Ø16	200
MD050-7T450G								
MD050-7T500G								

1.4.2 Outline Drawing and Mounting Hole Dimensions of Accessories

1) Outline drawing and mounting hole dimensions of PFC reactor

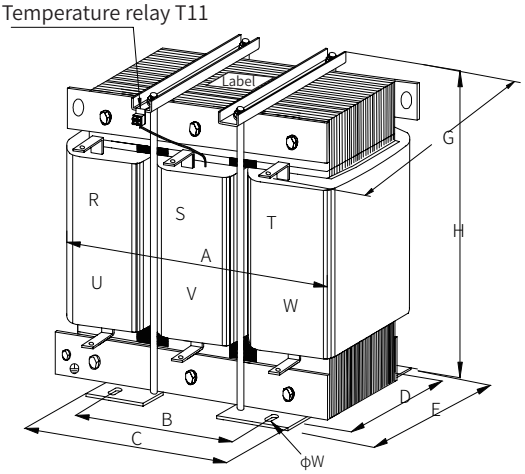


Figure 1-5 Outline drawing of PFC reactor

Table 1-6 Mounting hole dimensions of PFC reactor

Model	PFC Reactor Model	Outline and Mounting Dimensions (mm±2)								Weight kg
		A	B.	C	D	E	G	H	W	
Three-phase 380 V to 480 V										
MD050NT55G	MT553T1	435	290	N/A	120	150	180	310	13×18	50
MD050NT75G	MT753RT1	450	230	290	190	250	390	370	10×20	125
MD050NT90G										
MD050NT110G	MT134RT1	440	230	290	190	250	400	410	10×20	152
MD050NT132G										
MD050NT160G										
MD050NT200G	MT204RT1	390	200	270	210	270	375	510	13×20	175
MD050NT220G										
MD050NT250G	MT224RT1	415	230	290	210	270	400	610	10×20	228
MD050NT280G										
MD050NT315G	MT284RT1	480	290	370	250	310	390	630	12×20	268
MD050NT355G										
MD050NT400G	MT364RT1	540	290	370	250	310	450	600	12×20	290

Model	PFC Reactor Model	Outline and Mounting Dimensions (mm±2)								Weight kg
		A	B.	C	D	E	G	H	W	
Three-phase 690 V										
MD050-7T55G	M7T753R-SJ-T1	380	220	300	160	220	250	420	12×20	98
MD050-7T75G										
MD050-7T90G										
MD050-7T110G	M7T114R-SJ-T1	410	220	300	160	220	260	440	12×20	120
MD050-7T132G										
MD050-7T160G	M7T164R-SJ-T1	440	240	300	190	250	290	460	12×20	150
MD050-7T200G										
MD050-7T220G	M7T204R-SJ-T1	450	240	300	190	250	340	450	10×20	160
MD050-7T250G										
MD050-7T280G	M7T284RT1	500	240	300	190	270	340	550	10×20	230
MD050-7T315G										
MD050-7T355G										
MD050-7T400G	M7T364R-SJT1	500	300	360	220	280	380	560	10×20	250
MD050-7T450G										
MD050-7T500G	M7T454RT1	580	300	380	220	280	380	600	10×20	310

2) Outline drawing and mounting hole dimensions of filter reactor

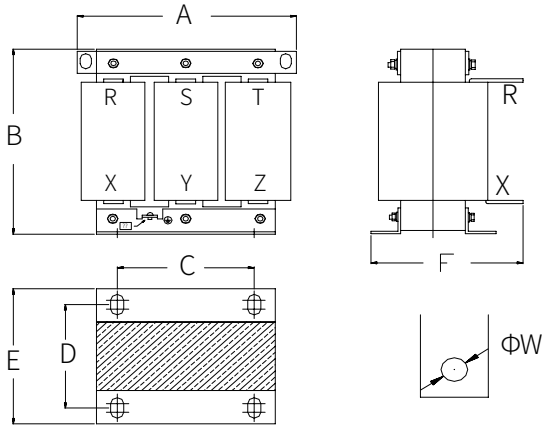


Figure 1-6 Outline drawing of filter reactor

Table 1-7 Mounting hole dimensions of filter reactor

Model	Filter Reactor Model	Outline and Mounting Dimensions (mm)							Weight kg
		A	B.	C	D	E	F	W	
Three-phase 380 V to 480 V									
MD050NT55G	ACL-0090	195	160	120	72	92	150	8.5	8.5
MD050NT75G	ACL-0200	250	230	182	96	122	175	11	20
MD050NT90G									
MD050NT110G	ACL-0250	250	260	182	96	122	175	11	24
MD050NT132G									
MD050NT160G									
MD050NT200G	ACL-0390	320	270	243	112	142	190	12	38
MD050NT220G									
MD050NT250G	ACL-0490	320	305	243	122	152	220	12	47
MD050NT280G									
MD050NT315G									
MD050NT355G									
MD050NT400G	ACL-0660	395	350	275	175	198	N/A	12	85
Three-phase 690 V									
MD050-7T55G	ACL-0090	195	160	120	72	92	150	8.5	8.5
MD050-7T75G									
MD050-7T90G									
MD050-7T110G	ACL-0120	195	160	120	92	112	135	9	12
MD050-7T132G									
MD050-7T160G	ACL-0200	250	230	182	96	122	175	11	20
MD050-7T200G									
MD050-7T220G	ACL-0250	250	260	182	96	122	175	11	24
MD050-7T250G									
MD050-7T280G	ACL-0290	290	270	214	100	126	180	12	28
MD050-7T315G									
MD050-7T355G									

Model	Filter Reactor Model	Outline and Mounting Dimensions (mm)							Weight kg
		A	B.	C	D	E	F	W	
MD050-7T400G	ACL-0390	320	270	243	112	142	190	12	38
MD050-7T450G									
MD050-7T500G	ACL-0490	320	305	243	122	152	220	12	47

3) Outline drawing and mounting hole dimensions of the filter capacitor

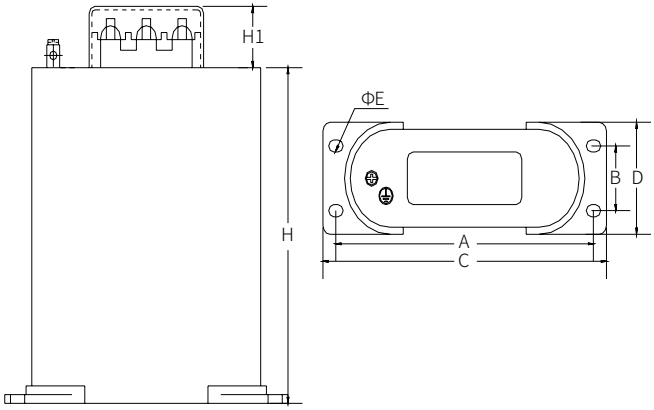


Figure 1-7 Outline drawing of the filter capacitor

Table 1-8 Mounting hole dimensions of the filter capacitor

Model	Filter Capacitor Model	AC Filter Capacitor (mm±2)						
		A	B.	C	D	E	H	H1
Three-phase 380 V to 480 V								
MD050NT55G	NWC1-0.69-15-3	206	N/A	224	67	6×10	220	34.5
MD050NT75G	NWC1-0.69-25-3	224	N/A	254	132	12×16	230	41
MD050NT90G								
MD050NT110G	NWC1-0.69-40-3	224	N/A	254	132	12×16	270	
MD050NT132G								
MD050NT160G								
MD050NT200G	BZMJ0.69-50-3	288	50	306	78	(7×10)×2	315	37
MD050NT220G								
MD050NT250G	BZMJ0.69-60-3	288	50	306	78	(7×10)×2	315	
MD050NT280G								

Model	Filter Capacitor Model	AC Filter Capacitor (mm±2)						
		A	B.	C	D	E	H	H1
MD050NT315G	NWC1-0.69-40-3	224	N/A	254	132	12×16	270	41
MD050NT355G								
MD050NT400G								
Three-phase 690 V								
MD050-7T55G	NWC1-0.69-15-3	206	N/A	224	67	6×10	220	34.5
MD050-7T75G								
MD050-7T90G								
MD050-7T110G	NWC1-0.69-25-3	224	N/A	254	132	12×16	230	41
MD050-7T132G								
MD050-7T160G	NWC1-0.69-30-3	224	N/A	254	132	12×16	230	
MD050-7T200G								
MD050-7T220G	NWC1-0.69-40-3	224	N/A	254	132	12×16	270	
MD050-7T250G								
MD050-7T280G	BZMJ0.69-50-3	288	50	306	78	(7×10)×2	315	37
MD050-7T315G								
MD050-7T355G								
MD050-7T400G	BZMJ0.69-60-3	288	50	306	78	(7×10)×2	315	
MD050-7T450G								
MD050-7T500G								

4) Outline drawing and mounting hole dimensions of contactor

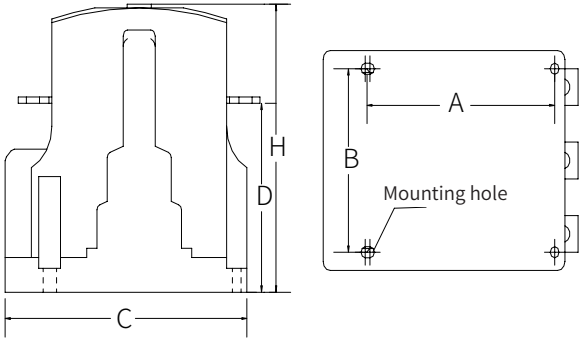


Figure 1-8 Outline drawing of AC contactor

Table 1-9 Mounting hole dimensions of AC contactor

Model	Specification and Model	AC Input Contactor (mm) - Coil Voltage = AC 220 V					
		A	B.	C	D	H	Mounting Hole
Three-phase 380 V to 480 V							
MD050NT55G	GMC-100	125	90	165.8	102.5	146.5	4×M4
MD050NT75G	GMC-180	190	120	203	118	181	4×M6
MD050NT90G							
MD050NT110G	GMC-300	225	145	243	132.5	198	4×M8
MD050NT132G							
MD050NT160G							
MD050NT200G	GMC-400						
MD050NT220G							
MD050NT250G							
MD050NT280G	GMC-600	250	250	290	149	242	4×M10
MD050NT315G							
MD050NT355G							
MD050NT400G	GMC-800						
Three-phase 690 V							
MD050-7T55G	GMC-100	125	90	165.8	102.5	146.5	4×M4
MD050-7T75G							
MD050-7T90G							
MD050-7T110G	GMC-180	190	120	203	118	181	4×M6
MD050-7T132G							
MD050-7T160G	GMC-220						
MD050-7T200G							

Model	Specification and Model	AC Input Contactor (mm) - Coil Voltage = AC 220 V					
		A	B.	C	D	H	Mounting Hole
MD050-7T220G	GMC-300	225	145	243	132.5	198	4×M8
MD050-7T250G							
MD050-7T280G	GMC-400						
MD050-7T315G							
MD050-7T355G							
MD050-7T400G	GMC-600	250	250	290	149	242	4×M10
MD050-7T450G							
MD050-7T500G							

5) Outline drawing and mounting hole dimensions of pre-charge resistor

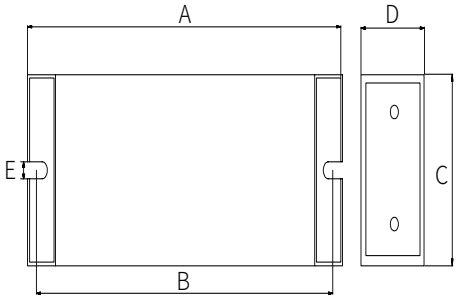


Figure 1-9 Outline drawing and mounting hole dimensions of pre-charge resistor

Table 1-10 Mounting hole dimensions of pre-charge resistor

Model	Specifications	Power (w)	Dimensions (mm)					Wire (mm^2)	Wire Length (mm)	Terminal
			A	B.	C	D	E			
MD050NT	RXLG-300W-10RJ	300	215	197	60	30	5.6	1.5	500	M4
MD0507T	RXLG-200W-40RJ	200	165	147	60	30	5.6	1.5	500	M4

NOTE

- The MD050N series models have the same pre-charge resistor, qty: 3 pcs.
- The MD050 series models have the same pre-charge resistor, qty: 3 pcs.

6) Selection of Fuse and Circuit Breakers

Table 1-11 Specifications of Fuses and Circuit Breakers

Model	Recommended Specifications of Fuses		Recommended Specifications of Circuit Breakers
	Rated Current (A)	Model	Rated Current (A)
MD050NT55G	200	FWH-200B	200
MD050NT75G	250	FWH-250A	250
MD050NT90G	275	FWH-275A	250
MD050NT110G	325	FWH-325A	250
MD050NT132G	400	FWH-400A	400
MD050NT160G	500	FWH-500A	400
MD050N200G	600	FWH-600A	500
MD050NT220G	700	FWH-700A	630
MD050NT250G	800	FWH-800A	630
MD050NT280G	800	FWH-800A	800
MD050NT315G	1000	170M5016	800
MD050NT355G	1000	170M5016	800
MD050NT400G	1400	170M6017	1000
MD050NT450G	1400	170M6017	1000
MD050-7T55G	100	FWH-100B	100
MD050-7T75G	100	FWH-100B	125
MD050-7T90G	125	FWH-125B	160
MD050-7T110G	150	FWH-150B	180
MD050-7T132G	200	FWH-200B	250
MD050-7T160G	250	FWH-250A	315
MD050-7T200G	275	FWH-275A	350
MD050-7T220G	325	FWH-325A	350
MD050-7T250G	325	FWH-325A	350
MD050-7T280G	400	FWH-400A	400
MD050-7T315G	400	FWH-400A	500

Model	Recommended Specifications of Fuses		Recommended Specifications of Circuit Breakers
	Rated Current (A)	Model	Rated Current (A)
MD050-7T355G	500	FWH-500A	500
MD050-7T400G	500	FWH-500A	630
MD050-7T450G	700	FWH-700A	700
MD050-7T500G	800	FWH-800A	800

NOTE

◆ The specifications of circuit breakers and fuses described above are recommended for the power grid. You can choose to install either or both of them.

Chapter 2 Installation and Wiring

2.1 Installation

2.1.1 Installation Environment

1) Ambient temperature: The ambient temperature greatly affects the service life of an AFE. Do not run the AFE unit under ambient temperature exceeding the allowed temperature range (-10°C to 40°C).

2) Install the AFE unit on a flame-retardant surface, and ensure that sufficient space is left around it for efficient heat dissipation. The AFE unit generates significant heat during working. Use screws to install the product on the mounting bracket vertically.

3) Install the equipment in a place not prone to vibration. The vibration shall not exceed 1 G. Keep away from devices such as punch presses.

4) Install the equipment in a place free from direct sunlight, dampness, and water drops.

5) Install the equipment in a place free from corrosive, combustible, or explosive gas.

6) Install the equipment in a place free from greasy dirt and dust.

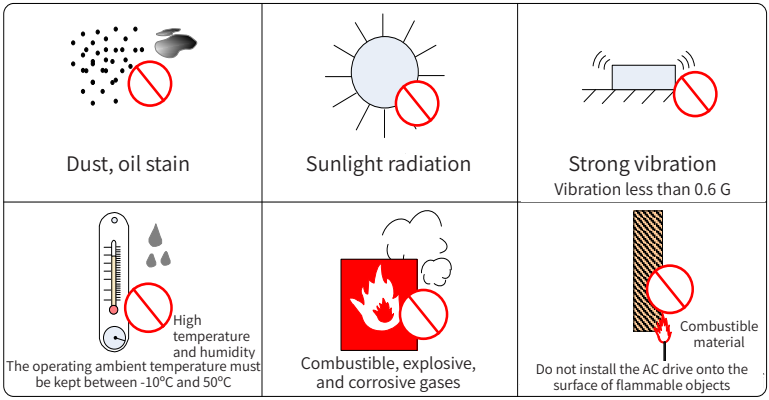
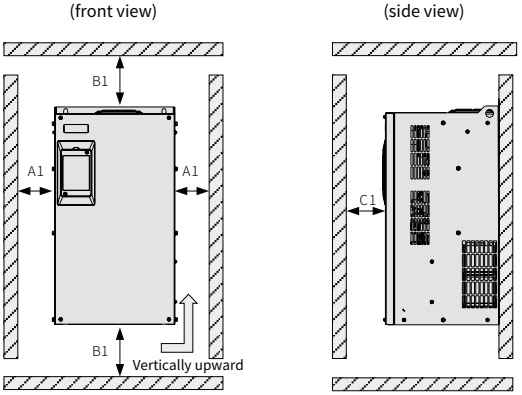


Figure 2-1 Installation environment requirements

7) The MD050N series product 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 relevant IEC requirements.

2.1.2 Installation Space

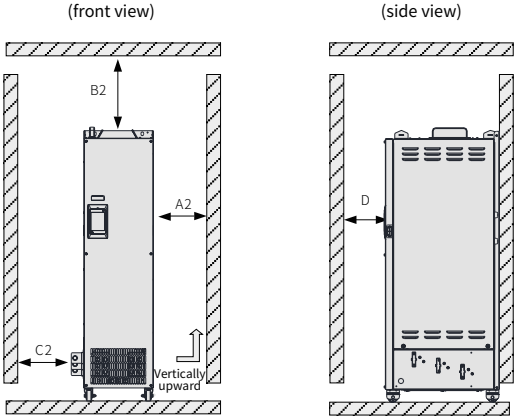
Proper installation space and clearance shall be reserved for the MD050N series AFE unit, depending on the power rating.



Requirements for Installation Clearances

Power Rating	Dimensions (unit: mm)		
55 kW ~ 160 kW	A1≥50	B1≥300	C1≥40

Figure 2-2 Installation space for MD050NT55G to MD050NT160G models



Requirements for Installation Clearances

Power Rating	Dimensions (unit: mm)			
200 kW ~ 400 kW	A2≥10	B2≥250	C2≥20	D≥20

Figure 2-3 Installation space for MD050NT200G to MD050NT400G models

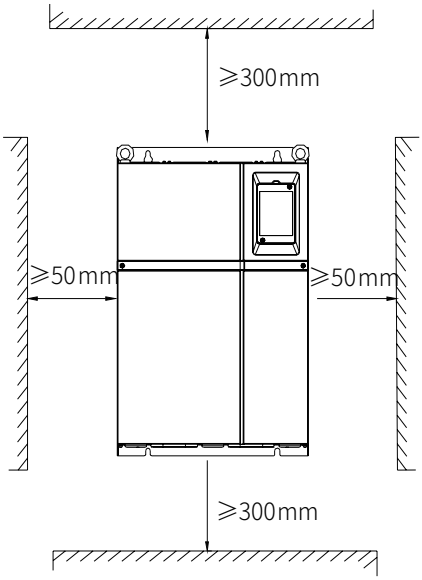


Figure 2-4 Installation space for MD050N7T55G to MD050N7T500G models

2.1.3 Installation Precautions

Heat dissipation is the main focus. Pay attention to the following points:

- Install the energy recovery unit upright to facilitate heat dissipation. Do not lay it upside down.
- Reserve the installation clearance as shown in Figure 2-2 and Figure 2-3 to ensure sufficient heat dissipation space for the energy recovery unit. Take into account the heat dissipation of other components (energy recovery reactor, filter reactor, etc.) in the cabinet.
- The mounting bracket must be made of incombustible materials.
- In scenarios with heavy metal powder, install the heatsink outside the cabinet, and ensure that the room inside the fully-sealed cabinet is as large as possible. In this case, maintain an ample space in the fully-sealed cabinet where possible.

2.1.4 Removing and Installing Cover

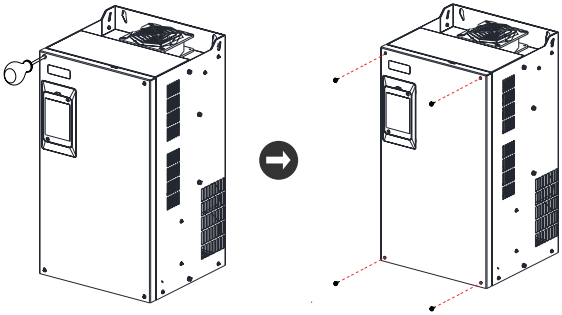
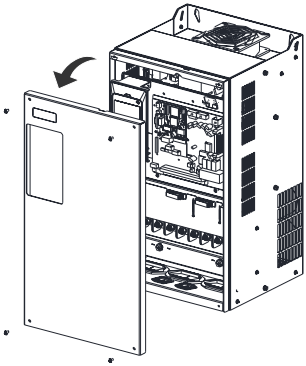
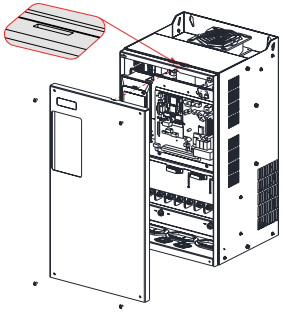
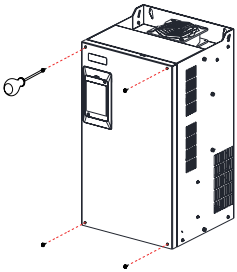
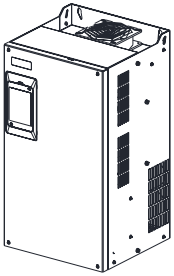
<table>
<tr><td colspan="3">Removal Procedure</td></tr>
<tr><td colspan="2">Remove the four fixing screws on the cover with a screwdriver.
  </td><td>Hold the cover with both hands and lift it up in the arrow direction to remove it.
  </td></tr>
<tr><td colspan="3">Reattachment Procedure</td></tr>
<tr><td>Hold the cover with both hands, and align it to the snap-fit joint on the upper edge of the casing, as shown in the figure.
  </td><td>Install the four fixing screws and tighten them separately with a screwdriver.
  </td><td>The front cover is reattached.
  </td></tr>
</table>

Figure 2-5 Removing and installing covers of MD050NT55G to MD050NT160G models

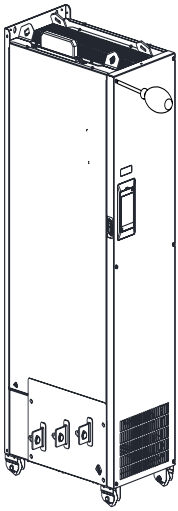
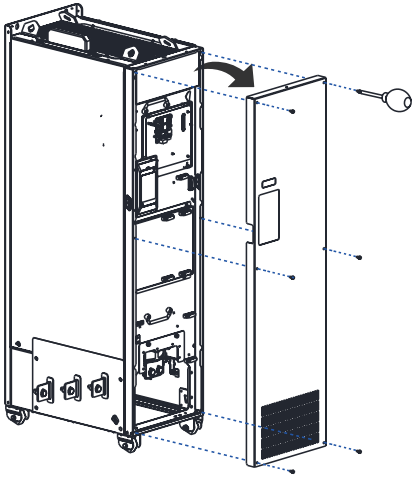
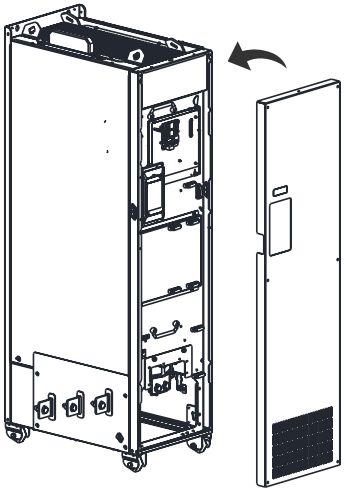
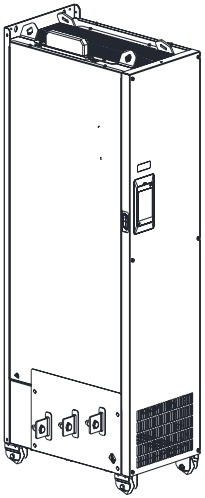
Removal Procedure	
Remove the six fixing screws on the cover with a screwdriver.	Hold the cover with both hands and lift it up in the arrow direction to remove it.
	
Reattachment Procedure	
① Hold the cover with both hands, and align it to the snap-fit joint on the upper edge of the casing, as shown in the figure. Align the six screw mounting holes on the cover with the cover fixing holes on the casing, and secure the cover.	② Install the six fixing screws and tighten them with a screwdriver to secure the cover.
	

Figure 2-6 Removing and installing covers of MD050NT200G to MD050NT400G models

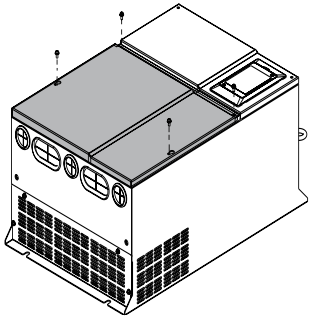
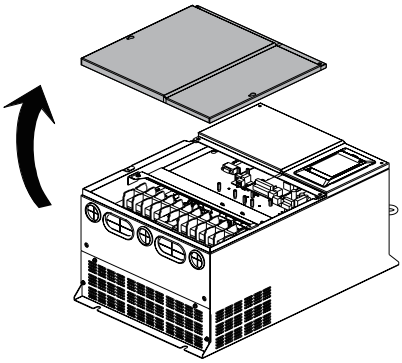
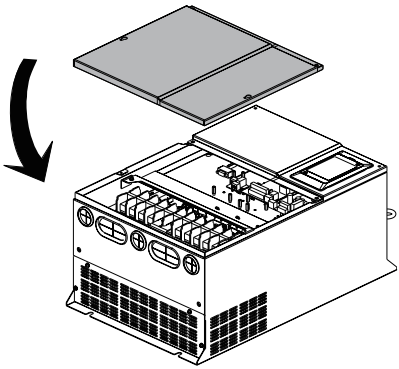
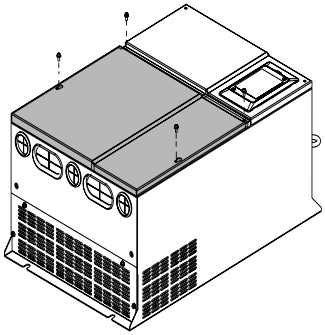
Removal Procedure	
Remove the four fixing screws on the cover with a screwdriver. 	Hold the cover with both hands and lift it up in the arrow direction to remove it. 
Reattachment Procedure	
① Hold the cover with both hands, and align it to the snap-fit joint on the upper edge of the casing, as shown in the figure. Align the four screw mounting holes on the cover with the cover fixing holes on the casing, and secure the cover. 	② Install the four fixing screws and tighten them with a screwdriver to secure the cover. 

Figure 2-7 Removing and installing covers of MD050N7T55G to MD050N7T500G models

2.2 Wiring

2.2.1 Main Circuit Terminals and Wiring

DANGER

- Perform wiring only after the power supply is cut off. Failure to comply may result in an electric shock.
- Wiring can be performed only by qualified personnel. Failure to comply may result in equipment damage or personal injury.
- The AFE unit must be grounded reliably. Failure to comply may result in electric shock or fire.

Note

- Ensure that the power input U, V, and W terminals of the AFE unit are wired correctly. Otherwise, the equipment may be damaged.
- Connect the DC bus terminals (+) and (-) of the AFE unit to the AC drive terminals (+) and (-) in correct polarity. Failure to comply will result in a fire.

1) Description of main circuit terminals of the AFE unit

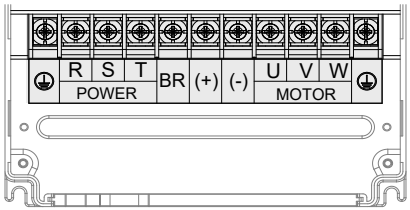
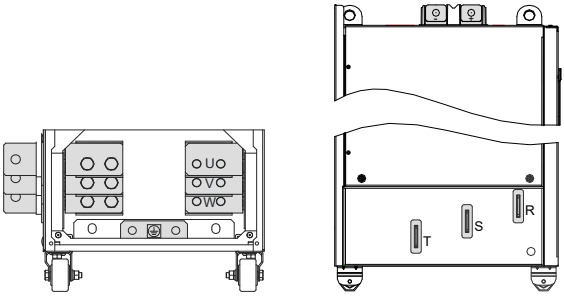


Figure 2-8 Arrangement of main circuit terminals of MD050NT55G to MD050NT160G models



(front view) (side view)

Figure 2-9 Arrangement of main circuit terminals of MD050NT200G to MD050NT400G models

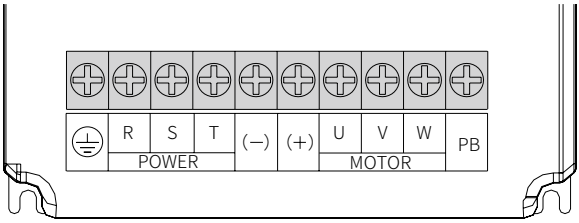


Figure 2-10 Arrangement of main circuit terminals of MD050N7T55G to MD050N7T500G models

Terminal Mark	Name	Description
R, S, and T	N/A	This terminal is unavailable.
(+), (-)	Positive and negative terminals of DC bus	Common DC bus input point.
U, V, and W	Wiring terminals on the AC side	Connect to the grid power supply.
⏚	Ground terminal	Grounding

2) Pay attention to the following precautions at wiring:

◆ (+) and (−) terminals of DC bus:

Note that there is a residual voltage at the DC bus (+, –) terminals just after power-off. Before touching the terminals, wait until the CHARGE indicator becomes off and the voltage is smaller than 36 V. Failure to comply may result in electric shock.

◆ Ground terminal ⏚ (PE):

This terminal must be reliably grounded with the grounding resistance less than 0.1 Ω. Otherwise, it may cause electric shock, malfunction or even damage to the equipment.

Do not ⏚ connect the grounding terminal to the N terminal of the power supply.

Do not connect the grounding terminal to the N terminal of the power supply.

The impedance of the protective grounding conductor must be able to withstand the large short-circuit current that may occur when a fault occurs.

The size of protective grounding conductors shall be selected according to Table 2-1.

Table 2-1 Size of protective grounding conductors

Cross-sectional Area of the Phase Wire (S)	Minimum Cross-sectional Area of Protective Conductor (Sp)
$S \leqslant 16\ mm^2$	S
$16\ mm^2 < S \leqslant 35\ mm^2$	$16\ mm^2$
$35\ mm^2 < S$	S/2

● Use proper grounding cables with yellow/green insulation for a protective grounding conductor.

3) Requirements for upstream protection devices are as follows:

- Install a proper protection device on the power input side to provide protections on overcurrent, short-circuit, and electrical isolation.
- Take into account the current capacity of the power cable, system overload capacity and upstream power distribution short-circuit capacity when selecting the protection device. Refer to the recommended specifications in Section 2.2.2.

2.2.2 Power Terminals and Mounting Dimensions

NOTE

- The recommended data and models in the table are for reference only. The cable diameter you select cannot be larger than the size in the following figures.
- Prerequisites for cable selection: under an ambient temperature of 40°C in a steady state. For the recommended diameters of the PVC insulation copper conductor or cable, see section 12.4 of the IEC 60204-1-2005.

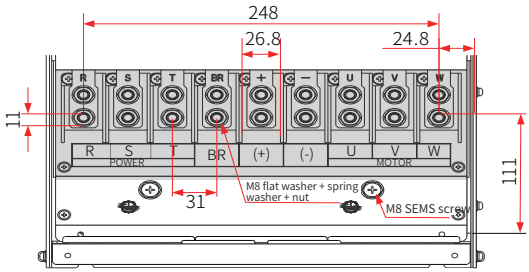


Figure 2-11 Dimensions of main circuit terminals of MD050NT55G

Table 2-2 Selection of main circuit cables of MD050NT55G

Model	Rated Input Current (A)	Recommended Input/Output Power Cable (mm^2)	Recommended Cable Lug	Recommended Grounding Cable (mm^2)	Recommended Grounding Cable Lug	Torque of Torque Driver (N·m)
MD050NT55G	106.0	3×50	GTNR50-8	25	GTNR25-8	10.5

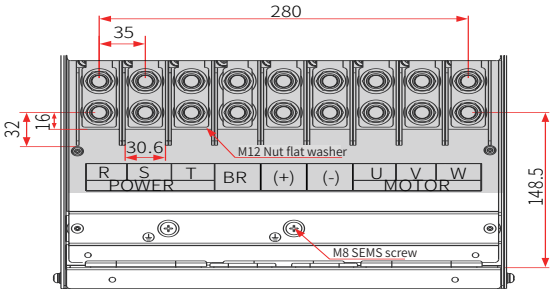


Figure 2-12 Dimensions of main circuit terminals of MD050NT75G to MD050NT110G models

Table 2-3 Selection of main circuit cables of MD050NT75G to MD050NT110G models

Model	Rated Input Current (A)	Recommended Input/Output Power Cable (mm^2)	Recommended Cable Lug	Recommended Grounding Cable (mm^2)	Recommended Grounding Cable Lug	Torque of Torque Driver (N·m)
MD050NT75G	139.0	3×70	GTNR70-12	35	GTNR35-12	35.0
MD050NT90G	164.0	3×95	GTNR95-12	50	GTNR50-12	35.0
MD050NT110G	196.0	3×120	GTNR120-12	70	GTNR70-12	35.0

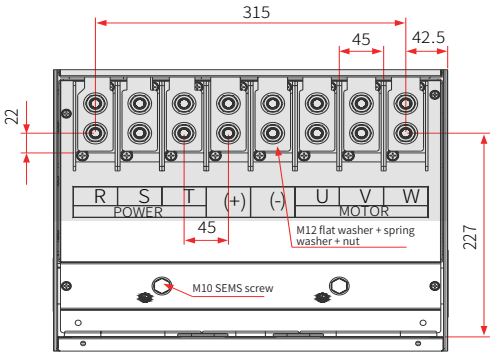


Figure 2-13 Dimensions of main circuit terminals of MD050NT132G/MD050NT160G

Table 2-4 Selection of main circuit cables of MD050NT132G/MD050NT160G

Model	Rated Input Current (A)	Recommended Input/Output Power Cable (mm^2)	Recommended Cable Lug	Recommended Grounding Cable (mm^2)	Recommended Grounding Cable Lug	Torque of Torque Driver (N·m)
MD050NT132G	240.0	3×150	BC150-12	95	BC95-12	35.0
MD050NT160G	287.0	3×185	BC185-16	95	BC95-16	35.0

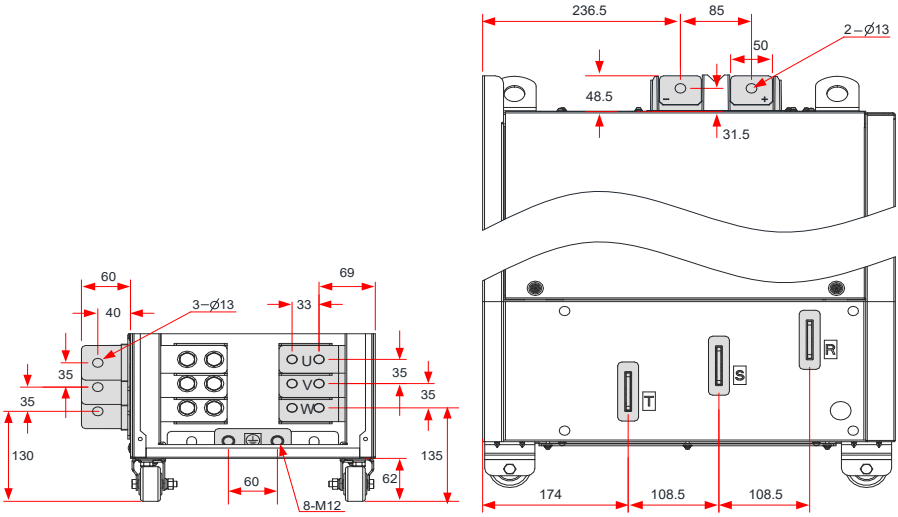


Figure 2-14 Dimensions of main circuit terminals of MD050NT200G/MD050NT220G

Table 2-5 Selection of main circuit cables of MD050NT132G/MD050NT160G

Model	Rated Input Current (A)	Recommended Input/Output Power Cable (mm^2)	Recommended Cable Lug	Recommended Grounding Cable (mm^2)	Recommended Grounding Cable Lug	Torque of Torque Driver (N·m)
MD050NT200G	365.0	2×(3×95)	BC95-12	95	BC95-12	35.0
MD050NT220G	410.0	2×(3×120)	BC120-12	120	BC120-12	35.0

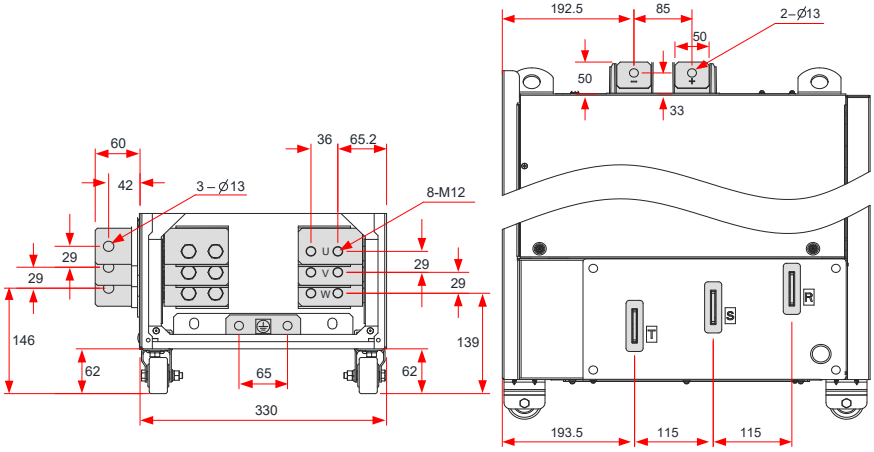


Figure 2-15 Dimensions of main circuit terminals of MD050NT250G/MD050NT280G

Table 2-6 Selection of main circuit cables of MD050NT250G/MD050NT280G

Model	Rated Input Current (A)	Recommended Input/Output Power Cable (mm^2)	Recommended Cable Lug	Recommended Grounding Cable (mm^2)	Recommended Grounding Cable Lug	Torque of Torque Driver (N·m)
MD050NT250G	441.0	2×(3×120)	BC120-12	120	BC120-12	35.0
MD050NT280G	495.0	2×(3×150)	BC150-12	150	BC150-12	35.0

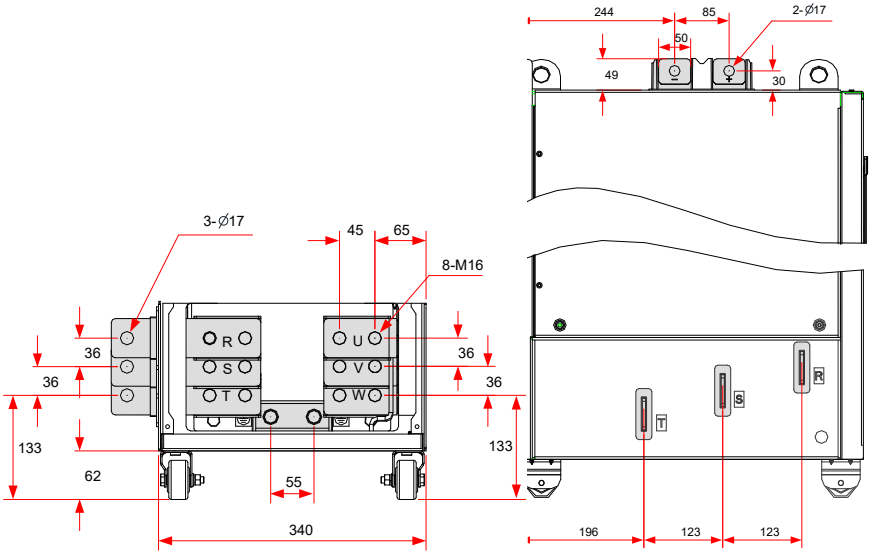


Figure 2-16 Dimensions of main circuit terminals of MD050NT315G to MD050NT400G models

Table 2-7 Selection of main circuit cables of MD050NT315G to MD050NT400G models

Model	Rated Input Current (A)	Recommended Input/Output Power Cable (mm^2)	Recommended Cable Lug	Recommended Grounding Cable (mm^2)	Recommended Grounding Cable Lug	Torque of Torque Driver (N·m)
MD050NT315G	565.0	2×(3×185)	BC185-16	185	BC185-16	85.0
MD050NT355G	617.0	2×(3×185)	BC185-16	185	BC185-16	85.0
MD050NT400G	687.0	2×(3×240)	BC240-16	240	BC240-16	85.0

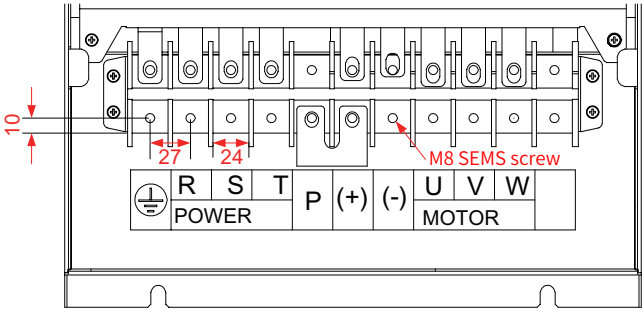


Figure 2-17 Dimensions of main circuit terminals of MD0507T55G

Table 2-8 Selection of main circuit cables of MD0507T55G

MD050 Model	Recommended Cable of Input Side Main Circuit (mm^2)	Recommended Cable of Output Side Main Circuit (mm^2)	Cable of Control Circuit (mm^2)
MD050-7T55G	16	16	1.0

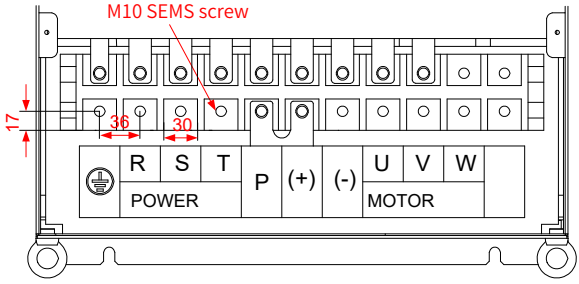


Figure 2-18 Dimensions of main circuit terminals of MD0507T75G to MD0507T90G models

Table 2-9 Selection of main circuit cables of MD0507T75G to MD0507T90G models

MD050 Model	Recommended Cable of Input Side Main Circuit (mm^2)	Recommended Cable of Output Side Main Circuit (mm^2)	Cable of Control Circuit (mm^2)
MD050-7T75G	25	25	1.0
MD050-7T90G	35	35	1.0

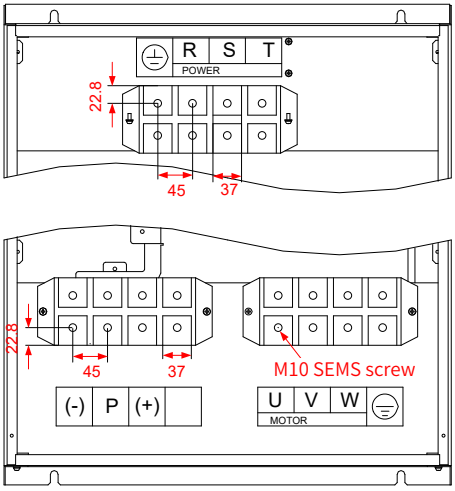


Figure 2-19 Dimensions of main circuit terminals of MD0507T110G to MD0507T160G models

Table 2-10 Selection of main circuit cables of MD0507T110G to MD0507T160G models

MD050 Model	Recommended Cable of Input Side Main Circuit (mm^2)	Recommended Cable of Output Side Main Circuit (mm^2)	Cable of Control Circuit (mm^2)
MD050-7T110G	50	50	1.0
MD050-7T132G	70	70	1.0
MD050-7T160G	95	95	1.0

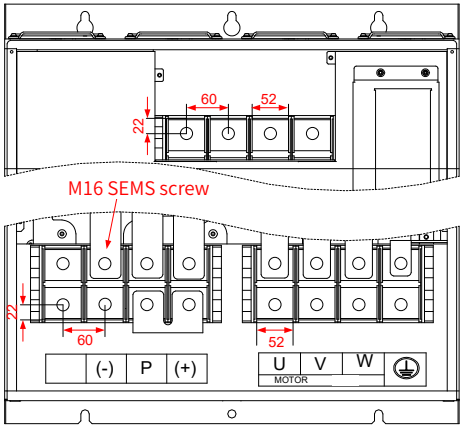


Figure 2-20 Dimensions of main circuit terminals of MD0507T200G to MD0507T280G models

Table 2-11 Selection of main circuit cables of MD0507T200G to MD0507T280G models

MD050 Model	Recommended Cable of Input Side Main Circuit (mm^2)	Recommended Cable of Output Side Main Circuit (mm^2)	Cable of Control Circuit (mm^2)
MD050-7T200G	120	120	1.0
MD050-7T220G	120	120	1.0
MD050-7T250G	150	150	1.0
MD050-7T280G	150	150	1.0

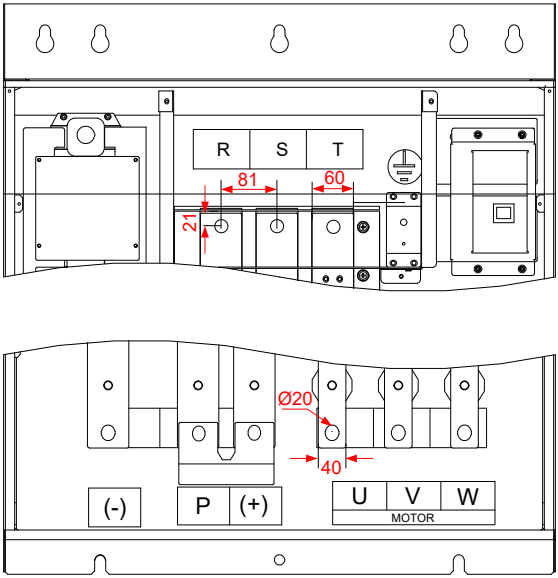


Figure 2-21 Dimensions of main circuit terminals of MD0507T315G to MD0507T500G models

Table 2-12 Selection of main circuit cables of MD0507T315G to MD0507T500G models

MD050 Model	Recommended Cable of Input Side Main Circuit (mm^2)	Recommended Cable of Output Side Main Circuit (mm^2)	Cable of Control Circuit (mm^2)
MD050-7T315G	185	185	1.0
MD050-7T355G	185	185	1.0
MD050-7T400G	240	240	1.0
MD050-7T450G	2×120	2×120	1.0
MD050-7T500G	2×150	2×150	1.0

The GTNR and BC series lugs manufactured by Suzhou Yuanli are recommended lugs.

Recommended cable lug (Suzhou Yuanli Metal Enterprise Co., Ltd)

GTNR series

BC series

Figure 2-22 Appearance of lug series

2.2.3 Control Circuit Terminals and Wiring

1) The control circuit terminals are arranged as follows:

AO1	AO2	CME	GND	+10V	COM	485+	485-	HDO	DI4	OP	24V
AI1	AI2	DO1	GND	PE	COM	CANH	CANL	HDI	DI1	DI2	DI3

RA1	RB1	RC1	RA2	RB2	RC2	R/U	S/V	T/W

Figure 2-23 Control circuit terminal arrangement

2) Function Description of Control Circuit Terminals

Table 2-13 Function description of control circuit terminals of the MD050N AFE unit

Category	Terminal Symbol	Function Description	Technical Specifications
Digital input	DI1-DI4	Ordinary multi-functional input terminal	Isolated drain/source input programmable terminal, input frequency: < 100 Hz, input impedance: 3.7 kΩ.
	HDI	Multi-functional high-speed pulse input terminal	Maximum input frequency: 100 kHz, 14 V to 30 V, duty cycle: 50% pulse, input impedance: 1.75 kΩ.
	OP	Common terminal for multi-functional input terminal	Internally isolated from COM and 24 V, short-circuited to +24 V by a jumper by default
24 V power supply	24 V	24 V power supplied in the board	24 V ± 10%, no-load ghost voltage: ≤ 30 V, maximum output current: 200 mA, internally isolated from OP/CME/GND
	COM	Common ground of internal 24 V ground and HD0	Internally isolated from CME and GND

Digital output	DO1	DO1: open collector output	Configurable terminal for isolated drain/source output, 24 VDC/50 mA
	HDO	FM: programmable pulse frequency output	As digital output, the internal emitter is connected with CME (which can be used as a common programmable open collector terminal). Maximum output frequency: 100 kHz.
	CME	Open collector output common terminal	Internally isolated from COM and GND, short-circuited to COM by a jumper by default
AI/AO	10 V	10 V analog voltage output	10 V±10%, maximum: 10 mA
	GND	Analog ground: Common ground of AI and AO	Internally isolated from COM and CME
	AI1/AI2	Analog input channel	0 V to 10 V/0 mA to 20 mA, resolution: 12 bits, correction accuracy: 0.5%
	AO1/AO2	Analog output channel	0 V to 10 V/0 mA to 20 mA, resolution: 12 bits, correction accuracy: 1%
RS485 communication	RS485 +	Positive terminal of RS485 differential signal	Standard RS485 communication interface
	RS485 −	Negative terminal of RS485 differential signal	Standard RS485 communication interface
CAN communication	CANH	Positive CAN input	-
	CANL	CAN negative input	-
Relay output	RA1/ RB1/ RC1	Relay 1 output	RA1-RB1: Normally closed, RA1-RC1: Normally open, contact capacity: 250 VAC/3 A
	RA2/ RB2/ RC2	Relay 2 output	RA2-RB2: Normally closed, RA2-RC2: Normally open, contact capacity: 250 VAC/3 A
Three-phase input voltage detection	R/U	Three-phase grid voltage sampling input	Used for detecting the grid voltage input in the controlled rectifier
	S/V		
	T/W		

The wiring of the control circuit is shown in the following figure.

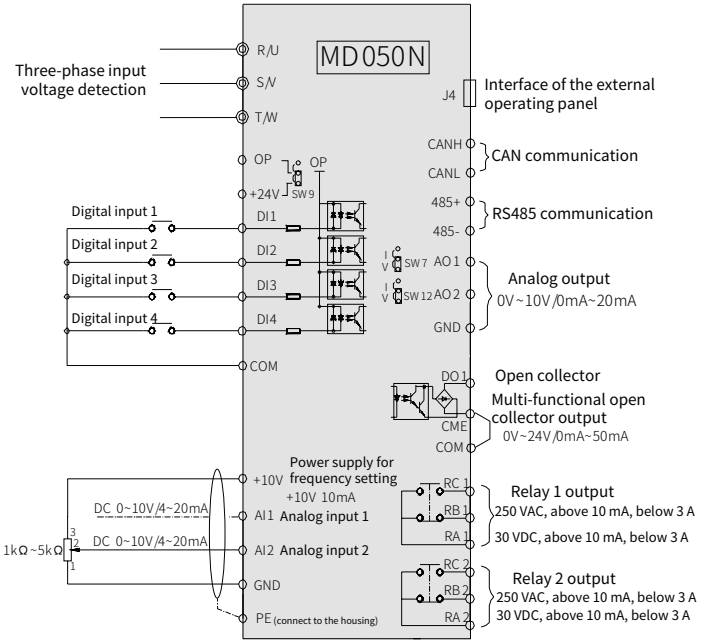


Figure 2-24 Wiring diagram of the control circuit

3) Wiring description of signal inputs and output terminals

A. Digital input terminal:

Generally, use the shielded cable not longer than 20 m. When active driving is adopted, necessary filtering measures shall be taken to prevent interference with the power supply. The contact control mode is recommended.

B. Wiring of DI terminals

● Drain wiring mode

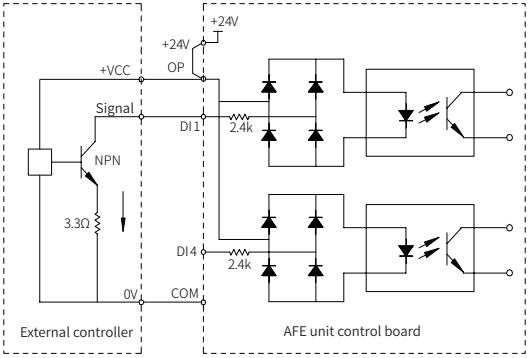


Figure 2-25 Drain wiring mode

This is the most commonly used wiring mode. To apply the external power supply, remove the jumper between +24 V and OP and the jumper between COM and CME, and connect the positive pole of the external power supply to OP and negative pole to CME.

- Source wiring mode

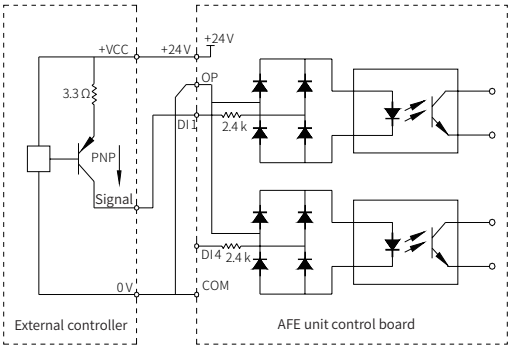


Figure 2-26 Source wiring mode

In such wiring mode, remove the jumper between +24 V and OP. Connect +24 V to the common terminal of the external controller and meanwhile connect OP to COM. If the external power supply is applied, remove the jumper between CME and COM.

C. Digital output terminal:

When the DO terminal needs to drive the relay, a snubber diode shall be installed on both sides of the relay coil. Otherwise, it may cause damage to the 24 VDC power supply.

Caution: Do not reverse the polarity of the absorption diode during installation, as shown in Figure 2-19. Otherwise, the 24 VDC power supply will be damaged immediately when the DO terminal works.

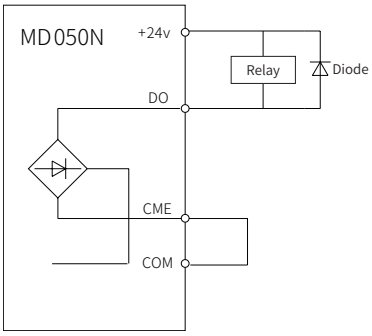


Figure 2-27 Wiring of DO terminals

2.2.4 Application of 4-quadrant Mode

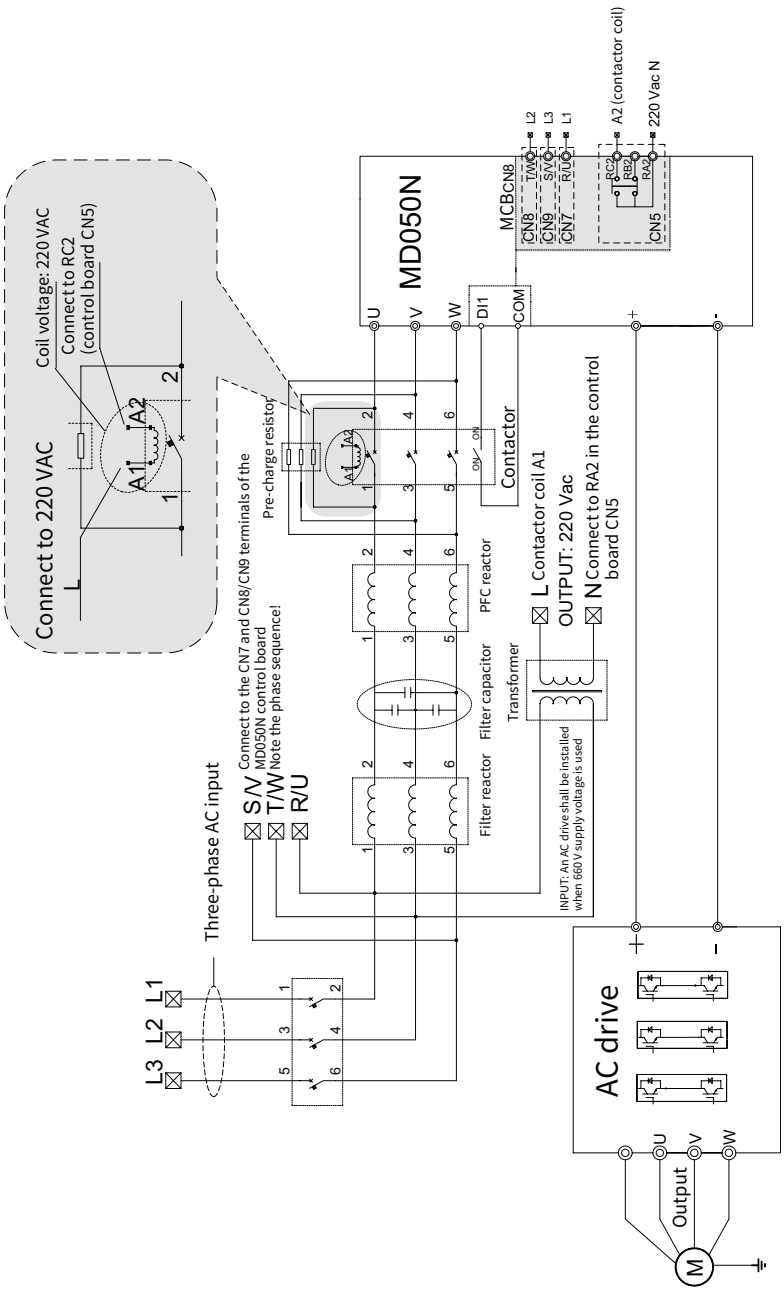


Figure 2-28 Wiring for 4-quadrant mode

Chapter 3 Panel Operations

3.1 Introduction

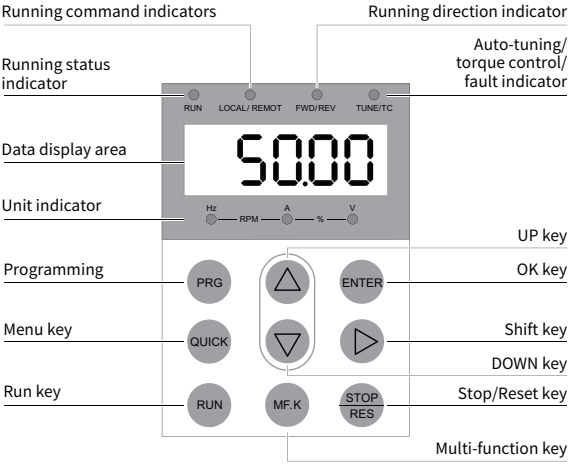


Figure 3-1 Details of the operating panel

3.1.1 Key Introduction

Key	Name	Function
PRG	Programming	Enter or exit the Level I menu.
ENTER	OK key	Used to enter each level of menu interface and confirm parameter change.
△	UP key	Increase the displayed value when editing a parameter value.
▽	DOWN key	Decrease the displayed value when editing a parameter value.
▷	Shift key	Select the displayed parameter in the STOP or RUNNING status. Select the digit to be modified when modifying a parameter value.
RUN	Run key	Start the equipment when using the operating panel control mode.
STOP RES	Stop/Reset key	Stop the equipment when the equipment is in the RUNNING state. Perform a reset operation when the equipment is in the FAULT status.
MF.K	Multi-function key	Used to switch between the selected function as specified by F7-01.
QUICK	Menu key	Switch over between menu modes as defined by the setting of FP-03 (Selection of individualized parameter display).

3.1.2 Indicators

The following table describes the meaning of indicator status. ☼ indicates that the indicator is on, ● indicates that the indicator is off, and ☼ indicates that the indicator blinks.

Indicator Status		Status Description
RUN Running status indicator	● RUN	OFF: The device is turned off.
	☼ RUN	ON: Run
LOCAL/REMOT Running command indicators	● LOCAL/ REMOT	OFF: Panel control
	☼ LOCAL/ REMOT	ON: Terminal control
	☼ LOCAL/ REMOT	Blink: Communication control
FWD/REV Running direction indicator	● FWD/ REV	OFF: Forward run
	☼ FWD/ REV	ON: Reverse run
TUNE/TC Auto-tuning/Torque control/Fault indicator	● TUNE/ TC	OFF: Normal operation mode
	☼ TUNE/ TC	ON: Torque control mode
	☼ TUNE/TC	Blink slowly: Auto-tuning status (once a second)
	☼ TUNE/TC	Blink quickly: Fault status (four times a second)
☼ Hz — RPM — ● A — % — ● V		Unit of frequency (Hz)
● Hz — RPM — ☼ A — % — ● V		Unit of current (A)
● Hz — RPM — ● A — % — ☼ V		Unit of voltage (V)
☼ Hz — RPM — ☼ A — % — ● V		RPM for motor speed
● Hz — RPM — ☼ A — % — ☼ V		Percentage %

3.1.3 Data Display

There is a five-digit LED display on the panel. It displays the set frequency, output frequency, various monitoring data, and fault codes.

Table 3-12 LED display and actual data

LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data
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	Where, T
4	4	A	A	F	F	U	U
5	5, S	b	B.	L	L	u	u

3.2 Basic Operations

The operating panel of the MD050N AFE unit adopts the three-level menu for operations such as parameter settings. Keypads are configured separately for the rectifier side and inverter side, and operations may be different.

3.2.1 Parameter View and Modification

The three levels of menus are as follows respectively: Parameter group (level I menu) → parameters (level II menu) → parameter settings (level III menu). The following figure shows the operation procedure.

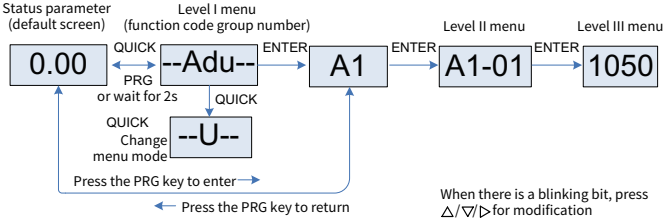


Figure 3-2 Operation flowchart for the 3-level menu structure

Note: You can return to the Level II menu from the Level III menu by pressing PRG or ENTER. The difference between the two keys is as follows: When you press "ENTER", the system saves the parameter setting first, and then goes back to the Level II menu and shifts to the next parameter. When you press PRG, the system directly returns to the Level II menu and remains at the current parameter without saving the parameter setting. When you press the PRG key, the system discards the current settings and returns to the level-II menu of the current parameter.

Example: This is an example of changing B6-10 from 0 to 25.

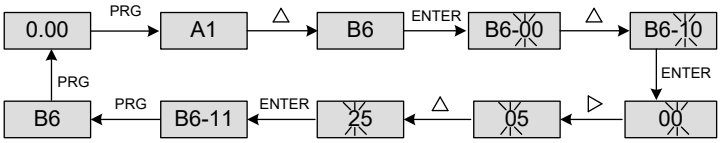


Figure 3-3 Example of changing the parameter value

3.2.2 Menu Mode Switching

The AFE unit has three menu modes that can be easily switched by pressing the QUICK key or setting the parameter DE-02.

1) Basic menu: Used to operate all parameters. The operating panel is displayed as "-Adu-".
2) Monitor menu: Used to check the operating parameters and fault information of the AFE unit. The operating panel is displayed as "--U--".
3) Check menu: Used to modify or check parameters that differ from default values. The operating panel is displayed as "--C--".

Note: On the Stop or Run interface, you can press the QUICK key to switch menus or select a different menu, and then press the ENTER key to enter the next menu. When you press the QUICK key to enter the menu switching mode, if you wait for 2s without pressing any key or press the PRG key, the previous screen is displayed, and the menu mode is not saved.

For example, select the monitor menu and check the set frequency U0-01. Figure 5-6 shows the procedure.

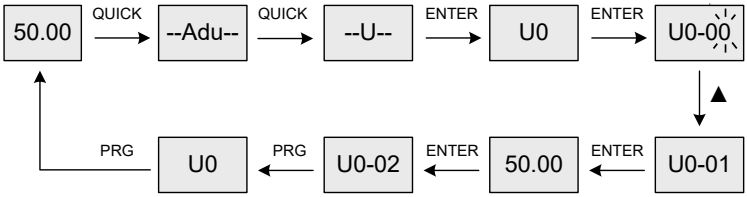


Figure 3-4 Example of operations in menu switching mode

3.2.3 Password Setting

The AFE unit provides the user password protective function. When DE-00 is set to a non-zero value, the password function is enabled. The password takes effect after you exit the parameter editing state. When you press the ENTER key again, "------" will be displayed, and you must enter the correct user password to enter the level I menu.

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

When a user password is set for the AFE unit (set DE-00 to a non-zero value), a read-only user password DE-04 can also be set. When DE-04 is set to a non-zero value, users can access the menu with the read-only user password. In this case, users can read parameters but not edit parameters.

3.3 Other Debugging Tools

3.3.1 External LED Operating Panel

In addition to the LED operating panel supplied with the product, users can also use an external LED operating panel (MD32NKE1) for parameter setting, state monitoring, and state control, as well as parameter editing and viewing.

Appearance and dimensions of the product:

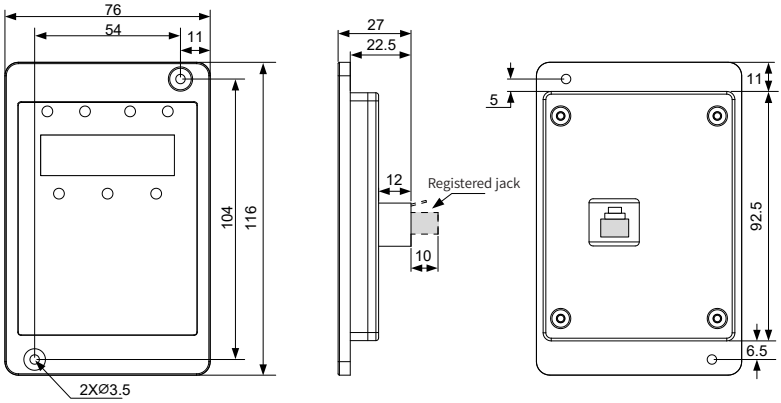


Figure 3-5 Schematic diagram of appearance and dimensions of the product (unit: mm)

For usage information, see "3.1 Introduction".

Chapter 4 Simple Commissioning

4.1 Check before Power-on

Please connect cables according to the wiring diagram (do not connect the power cable and motor cable). Without connecting the power cable, check whether the input and output terminals of the machine are short-circuited in the following steps:

1) Main circuit terminal to ground test.

- Set the multimeter to the resistance measurement mode, and connect the two leads to the R, S, T, +, -, U, V, and W main circuit terminals of the AFE unit respectively to test the resistance to PE of the housing to check whether there is a short circuit between terminals. Requirements: The terminals are not short-circuited to PE.
- Set the multimeter to the resistance measurement mode. Then touch the R, S, and T input terminals of the AFE unit respectively with the two leads to test the resistance between R-S, R-T, and S-T. This way, you can check whether there is a short circuit between input terminals.
- Set the multimeter to the diode measurement mode to measure the rectifier bridge: Touch the positive busbar (+) with the black lead and touch the R, S, and T input terminals respectively with the red lead to check whether the multimeter reads 0.4 V. Then, touch the negative busbar (-) with the red lead and touch the R, S, and T input terminals respectively with the black lead to check whether the multimeter reads about 0.4 V.

Requirements: There is no short circuit between the input terminals, and the rectifier bridge has diode characteristics.

2) Check the connection cable of the main circuit of the AFE unit and the control sampling cable. For wiring information, see Section 3.2.5 Wiring Diagram in Chapter 3.

Requirements:

① Connect the main circuit of the system according to the wiring diagram. The position order of accessories cannot be arbitrarily changed. Otherwise, equipment components may be easily damaged.

② The power supply is connected to the U/V/W terminals of the AFE unit after flowing through the LCL and pre-charge circuit, rather than R, S, and T terminals.

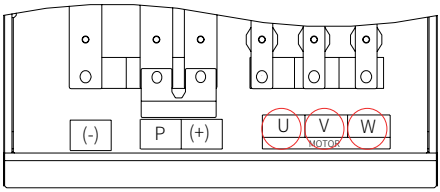


Figure 4-1 Main circuit wiring of the AFE unit

③ The control sampling cable shall be powered from the front-end grid side of the input filter reactor, and the consistent phase sequence shall be guaranteed. Set the multimeter to the Ohm measurement mode to measure the U, V, and W of the AFE unit, and the R/U, T/W, and S/V of the CN7, CN8, and CN9 terminals on the main control board. The U terminal (machine) corresponds to the R/U terminal (control board), V terminal to T/W terminal, and W terminal to S/V terminal. See Figures 4-1 and 4-2.

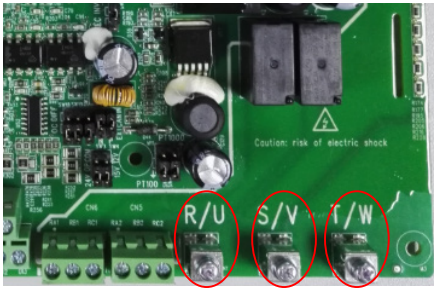


Figure 4-2 Sampling connection of grid phase sequence on control board

Requirements: Test the three phases of MD050NT. If the resistance is about 10 Ω (about 40 Ω for the MD050-7T model) three times, the phase sequence is correct. If the resistance is incorrect, change the phase sequence or check whether there is a transformer in upstream of the power grid that may result in this problem.

4.2 Power-on

1) After checking that the above connection is correct, turn on the power switch.
2) After the AFE unit is charged by the pre-charge resistor, the AC contactor has a loud and clear sound of engagement action.
3) When the AFE unit can be normally powered on: All the LEDs on the operating panel shall be on, then the function indicators and unit indicators are off, and the LED displays "-H-C-". This process may take about 2 to 3 seconds. Press the Shift key  to check whether the bus voltage is normal (range: 1.414 times the grid input voltage).

4.3 Commissioning Operation

For parameters, see Chapter 6. Reset parameters to their defaults after commissioning.

Commissioning procedure:

1) Check parameter U0-21 (measure the three-phase input voltage of the rectifier side) to check correspondence with the three-phase input voltage of the rectifier side (measure with a multimeter).

- Judgment: It is normal when the displayed value is basically consistent with the actual grid input voltage. Otherwise, the grid input voltage is abnormal, or the displayed value is incorrect. For incorrect display, check whether the wiring circuit and the DIP switches S1 and S2 on the control board are at their corresponding voltage classes.

2) Check parameter U0-45 (measure the three-phase input frequency of the rectifier side) to check correspondence with the three-phase input frequency of the rectifier side.

- Judgment: It is normal when the displayed value is about 50 Hz. Otherwise, the grid input voltage is abnormal, or the displayed value is incorrect. For incorrect display, check the wiring circuit or replace the control board.

3) Check that A1-00=1 and B0-02=0

Parameter	Name	Setting Range	Default
A1-00	Working mode	0: Uncontrolled rectifier 1: Controlled rectifier, energy can be regenerated to the power supply 2: Controlled rectifier, energy cannot be regenerated to the power supply	1
A1-01	Bus Voltage Setting	380: 580 V to 720 V 480: 740 V to 840 V 690: 1000 V to 1120 V	380: 610 V 480: 740 V 690: 1050 V
B0-02	Command Source Selection	0: Operating panel control (indicator OFF) 1: Terminal I/O control (indicator ON) 2: Communication control (indicator blinking) 3: Automatic running	0

4) Press the "RUN" key on the keypad, and press the "》" (Shift) key to check the input voltage (determined by the grid voltage). The displayed bus voltage shall be the same as the value set by A1-01, and the output current (3 A to 20 A) is normal.

5) If the above commissioning procedure is normal, then the test can start by slowly increasing the load to the rated load of the machine. Use a current clamp to test the three-phase current balance at the grid side, and the three phases of current are basically normal.

6) If no problem exists, press the "STOP" key on the keypad to finish the commissioning.

4.4 Troubleshooting During Commissioning

- Er101, check the position of the SW5 jumper (see Figure 4-3) on the control board. The jumper must be in the "REC" or parameter DF-16 is set to 1.
- Er178, check whether B4-00 is 47, and check whether the contactor engagement test cable is connected to a correct auxiliary contact.
- Er035, check whether the DIP switch on the control board is at the corresponding voltage class, check whether the phase sequence is correct, and at the same time, identify the DIP switch on the control board, as shown below:

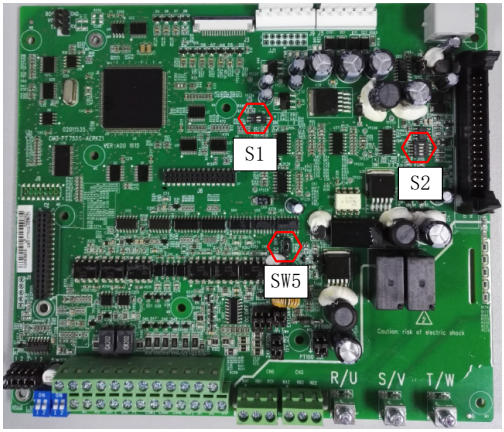


Figure 4-3 The DIP switch on the control board differs depending on the voltage system

The DIP switch is in the following position according to the voltage class of the machine.

Input Power	S1 Position	S2 Position
380 VAC	Toggle 12 to OFF	Toggle 123 to OFF
480 VAC	Toggle 12 to OFF	Toggle 123 to OFF
690 VAC	Toggle 2 to ON	Toggle 123 to ON

- Er005, check the sampling phase sequence on the control board. If the phase sequence is incorrect, change the phase sequence to ensure one-to-one correspondence.
- Er127, check the phase sequence test cable for phase sequence correctness.

Chapter 5 Description of Parameters

Group A1 Control Parameters

A1-00	Rectifier Operating Mode		Default	1
	Setting Range	0	Uncontrolled rectifier	
		1	Controlled rectifier, energy can be regenerated to the power supply	
		2	Controlled rectifier, energy cannot be regenerated to the power supply	

0: Uncontrolled rectifier

This is equivalent to the diode rectifier power supply mode. The bus voltage is uncontrolled.

1: Controlled rectifier, energy can be regenerated to the power supply

Allows absorbing energy from the power supply unit and regenerating energy to the power supply unit. The bus voltage can be maintained at the set value of A1-01.

2: Controlled rectifier, energy cannot be regenerated to the power supply

Mainly used in non-grid power supply mode. When the bus voltage exceeds the set value of A1-01, other energy consumers are required to maintain the bus voltage stable.

A1-01	Bus Voltage Setting	Default	T (380 V) model: 610 V 5T (480 V) model: 740 V 7T (690 V) model: 1050 V
	Setting Range	T (380 V) model: 580 V to 720 V 5T (480 V) model: 740 V to 840 V 7T (690 V) model: 1000 V to 1120 V	

A1-03	Proportional Gain of Bus Voltage Closed-loop Regulator	Default	Power Class
	Setting Range	0 to 10000	
A1-04	Integral Gain of Bus Voltage Closed-loop Regulator	Default	Power Class
	Setting Range	0 to 10000	

The proportional gain and integral gain determine the bus voltage based on the set value. The greater these two values are, the higher the regulation strength is, and the faster the dynamic response is. When the bus voltage fluctuates, set the set value to a lower one.

A1-05	Proportional Gain of Current Component Closed-loop Regulator	Default	Power Class
	Setting Range	0 to 10000	
A1-06	Integral Gain of Current Component Closed-loop Regulator	Default	Power Class
	Setting Range	0 to 10000	

The proportional gain and integral gain determine the output current based on the set value. The larger the two values are, the higher the regulation strength is, and the faster the dynamic response is. When the bus voltage or current fluctuates greatly, set the set value to a lower value.

A1-09	Rectifier Current Upper Limit	Default	150.0% of the Rated Speed
	Setting Range	0.0% to 200.0%	

Limits the output current capacity of the rectifier. 100.0% means the rated current output. Users can set a lower limit value during commissioning.

A1-12	Detection Value of Too Large Rectifier Bus Voltage Deviation	Default	50.0 V
	Setting Range	0.0 V to 1000.0 V	
A1-13	Detection Time of Too High Rectifier Bus Voltage Deviation	Default	2.0s
	Setting Range	0.1s to 100.0s (0.0s: no detection)	

When the deviation between the set bus voltage and the actual bus voltage exceeds the set value of A1-12 and lasts longer than the set value of A1-13, the too-high bus voltage deviation is reported (Er033).

When the set value of A1-13 is 0.0s, the bus voltage deviation is not detected.

A1-17	Phase-locked Loop Proportional Gain	Default	1645
	Setting Range	0 to 65535	
A1-18	Phase-locked Loop Integral Gain	Default	1633
	Setting Range	0 to 65535	

Modify this parameter when Er127 is reported. Increase or decrease the set value in the same proportion.

A1-19	Power Factor	Default	1
	Setting Range	(-1.000 to -0.950 or 0.950 to 1.000)	

Users can use this parameter to adjust the power factor with a 5% allowance as required.

A1-20	Input Filter Capacitor	Default	Model-dependent
	Setting Range	100 to 3000 uF	

This parameter displays the capacitance of the filter capacitor in the LCL section of the AFE unit, enabling users to edit the capacitance when LCL is configured.

A1-21	Input Filter Capacitance Reactive Compensation	Default	1
	Setting Range	0: Invalid 1: Valid	

When the value is set to 1, the inductive reactive power component of the system can be adjusted by setting the value of A1-20 to offset the capacitive reactive power generated by the input filter capacitor. When the value is set to 0, the reactive power of the input filter capacitor is not offset.

A1-22	Start Voltage Hysteresis-loop Width Lower Limit in Non-regenerative Mode	Default	-10.0 V
	Setting Range	-200.0 V to +200.0 V	

Start the rectifier when the bus voltage is less than (1.4 times the grid voltage (U0-03) + A1-22).

A1-23	Stop Voltage Hysteresis-loop Width Upper Limit in Non-regenerative Mode	Default	50.0 V
	Setting Range	0.0 V to +200.0 V	

Stop the rectifier when the bus voltage is higher than (set value + A1-23).

A1-24	Regenerative Current Lower Limit	Default	5% of the Rated Speed
	Setting Range	-30% to 30% (rated current)	

Set the current allowed to be regenerated to the power grid when the controlled rectifier energy is not allowed to be regenerated to the power grid.

When -10 is set, 10% of the rated current can be regenerated. When 10 is set, the load current must be at least 10% of the rated current. If the load current is less than 10% of the rated current, the bus voltage will increase.

A1-25	Phase Sequence Auto-Tuning Enabling	Default	1
	Setting Range	0: Phase sequence auto-tuning disabled 1: Phase sequence auto-tuning enabled (press the Run key after power-on)	

During field assembly of MD050, three-phase (RST) voltage sampling may not correspond to three-phase (RST) current sampling correctly. Therefore, when MD050 is switched on and runs, there will be an over-current or over-voltage fault. The phase sequence auto-tuning function can identify the fault that the phase sequence of voltage and current cables does not correspond, allowing quick and accurate troubleshooting.

When A1-25=1, press the "Run" key after power-on to identify the phase sequence. The auto-tuning process takes 2 seconds. Stop the equipment after auto-tuning. If the phase sequence is correct, the function code automatically changes to 0. When you press the Run key again, the MD050 can run normally. If the phase sequence is incorrect, Er129 is displayed. You need to change the wiring for auto-tuning again. The auto-tuning results are shown in A1-27, and the sequence of the voltage sampling cable can be changed according to A1-27 until the wiring is correct.

Note: For any change to the field wiring, manually set A1-25=1 for phase sequence auto-tuning.

The phase sequence auto-tuning is disabled when A1-25=0.

A1-26	Zero Current Detection Threshold During Phase Sequence Auto-tuning	Default	100
	Setting Range	0 to 65535	

Set the zero threshold for judging current size during phase sequence auto-tuning.

A1-27	Results of Phase Sequence Auto-tuning	Default	0
	Setting Range	0 to 7	

0: No auto-tuning.

1: The wiring is correct.

2: Modify the voltage sampling cable and switch the wiring of the V phase and W phase.

3: Modify the voltage sampling cable and switch the wiring of the U phase and W phase.

4: Modify the voltage sampling cable and switch the wiring of the U phase and V phase, and then the W phase and V phase.

5: Modify the voltage sampling cable and switch the wiring of the U phase and V phase.

6: Modify the voltage sampling cable and switch the wiring of the U phase and W phase, and then the V phase and the W phase.

7: If auto-tuning fails, set A1-26 to a lower value and then run auto-tuning again. This may also be caused by a current sampling problem.

Note: Values 0 to 7 are the results of phase sequence auto-tuning of A1-27 that are read-only and cannot be edited.

A1-28	Grid Voltage Correction Coefficient	Default	100.0
	Setting Range	0 to 500.0	

Correct the grid voltage in percentage.

A1-29	Startup Protection Function	Default	0
	Setting Range	0: The startup protection function is invalid. 1: The startup protection function is valid.	

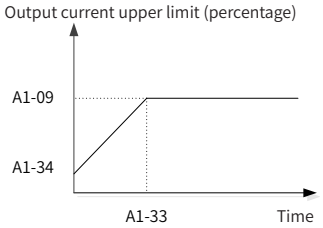
When the MD050 stops due to a fault, the function code determines whether the MD050 continues to run after the fault is automatically resumed and the run command is still valid. If A1-29=0, the MD050 will continue to run. If A1-29=1, the MD050 will shut down. The MD050 works normally only after it is manually stopped and the run command is instructed again.

A1-33	Current Pre-charge Time	Default	0s
	Setting Range	0s to 1000s (note: The current is not pre-charged when the value is set to 0).	

A1-34	Current Pre-charge Initial Value	Default	0%
	Setting Range	0 to 150%	

For some occasions with low grid capacity, such as power supply by diesel engine, the output current of the MD050 should be limited to a small value when it is started. Otherwise, the diesel generator may flame out due to a sudden increase in load when the MD050 is started.

A1-33, A1-34, and A1-09 determine the upper limit curve of output current when the system is started, as shown in the following figure. The output current upper limit is always A1-09 when A1-33 is set to 0.



Group B0 Commonly-used Functions

B0-00	Major Communication Mode		Default	0
	Setting Range	0	DP card	
		1	Modbus	

When B0-02 (command source selection) is set to 2 (communication control), this parameter determines the communication channel to which the run command the system responds.

B0-02	Command Source Selection		Default	0
	Setting Range	0	Operating panel control	
		1	Terminal I/O control	
		2	Communication control	

Selects the channel for the controlled rectifier control command.

0: Operating panel control (LOCAL/REMOT indicator OFF).

Commands are given by pressing the RUN, MF.K, STOP/RES keys on the operating panel.

1: Terminal I/O control (LOCAL/REMOT indicator ON).

Commands are given by means of multi-functional input terminals.

2: Communication control (LOCAL/REMOT indicator blinking)

Commands are given from the host controller by means of communication.
For communication protocols, see Appendix.

3: Automatic running (LOCAL/REMOT indicator blinking)

Automatically run upon power-on.

Caution: Modifying this parameter during running will change the command source channel. Exercise caution when using this parameter.

B0-15	Carrier Frequency	Default	Model-dependent
	Setting Range	2.0 kHz to 4.0 kHz	

This function adjusts the carrier frequency of the controlled rectifier. Users can adjust the carrier frequency to reduce current leakage to earth and interference.

When the carrier frequency is low, the high-order harmonic components of output current increase. When the carrier frequency is high, the loss of the controlled rectifier increases, and the temperature rises.

Group B4 Digital Input Terminals

B4-00	DI1 function selection	Default	47
B4-01	DI2 function selection	Default	1
B4-02	DI3 function selection	Default	9
B4-03	DI4 function selection	Default	0

This parameter is used to set the functions that can be set for DI terminals.

Set Value	Function	Description
0	No function	The rectifier side does not act even if there is a signal input. Disable terminals that are not used to prevent malfunction.
1	Run command	An external terminal is used to control the operation of the controlled rectifier.
9	Fault reset (RESET)	Used to reset an external fault. the same as the function of the RESET key on the operation panel. Remote fault reset is implemented by this function.
11	External fault normally closed (NC) input	When an external fault normally closed input is used, a fault occurs when the terminal is open.
20	Command source switchover	If the command source (B0-02) is set 1, this terminal is used to perform the switchover between terminal control and operating panel control. If the command source (B0-02) is set 2, this terminal is used to perform switchover between communication control and operating panel control.

Set Value	Function	Description
33	External fault normally open (NO) input	An external fault signal can be input through an external terminal, enabling the rectifier side of the AFE unit to monitor the fault of an external device. When the rectifier side detects the fault of an external device, the rectifier side stops and reports "Er015". The fault signal input can be normally open or normally closed. When normally open input of external fault is used, a fault occurs when the terminal is closed.
47	External pre-charge contactor detection signal input	An external fault signal can be input through the external pre-charge contactor auxiliary contact, enabling the rectifier side to monitor the fault of the external power-on pre-charge contactor. When the rectifier side detects the fault of the external pre-charge contactor, the rectifier side stops. The Er178 is reported. The fault signal input can be normally open or normally closed. When normally open input of external fault is used, a fault occurs when the terminal is closed.

B4-19	DI Filter Time	Default	0.010s
	Setting Range	0.000s to 1.000s	

Set the sensitivity of DI terminals. If DI terminals are liable to interference and may cause malfunction, increase the value of this parameter to enhance the anti-interference capability. However, this may reduce the sensitivity of DI terminals.

B4-22	DI1 Delay	Default	0.0s
	Setting Range	0.0s to 3600.0s	
B4-23	DI2 Delay	Default	0.0s
	Setting Range	0.0s to 3600.0s	
B4-24	DI3 Delay	Default	0.0s
	Setting Range	0.0s to 3600.0s	

These parameters indicate the effective impulse holding time of DI signals, as shown in Figure 5-1. The parameter can be identified only when the width of the input signal is larger than this parameter. t_{w1} in the figure can be identified and t_{w2} is ignored.

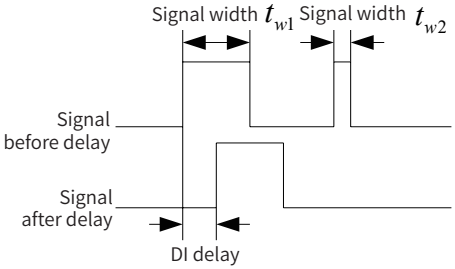


Figure 5-1 Schematic diagram of DI delay time

B4-25	DI Valid Status Setting 1	Default	0
	Setting Range	0 to 11111	

Set the valid state of the DI terminal according to the bit position.

0: Positive logic (valid when closed).

1: Negative logic (valid when open).

The mapping between BIT and DI is as follows:

BIT3	BIT2	BIT1	BIT0
DI4	DI3	DI2	DI1

To set a DI to negative logic (valid when open), set the corresponding BIT to 1.

B4-26	DI Valid Status Setting 2	Default	0
	Setting Range	0 to 111	

Set the valid state of the DI terminal according to the bit position.

0: Positive logic (valid when closed).

1: Negative logic (valid when open).

To set a DI to negative logic (valid when open), set the corresponding BIT to 1.

B4-29	VDI1 function selection	Default	0
B4-30	VDI2 function selection	Default	0
B4-31	VDI3 function selection	Default	0
B4-32	VDI4 function selection	Default	0

The functions of virtual input terminals (VDIx) are the same as those of digital multi-function input terminals (B4-00).

B4-34	VDI Valid State Source	Default	0
	Setting Range	0 to 11111	

Set the valid state source of the VDI terminal according to the bit position.

0: Connected to VDOx internally

1: Set by B4-35

The mapping between BIT and DI is as follows:

BIT3	BIT2	BIT1	BIT0
VDI4	VDI3	VDI2	VDI1

B4-35	VDI Parameter Setting Valid State	Default	0
	Setting Range	0 to 11111	

When the corresponding VDI terminal valid state source is set by B4-35, set the valid state of VDI terminals according to the bit position.

0: Invalid, 1: Valid

The mapping between BIT and DI is as follows:

BIT3	BIT2	BIT1	BIT0
VDI4	VDI3	VDI2	VDI1

B4-36	Function Selection When AI1 is Used As DI	Default	0
	Setting Range	0 to 45	
B4-37	Function Selection When AI2 is Used As DI	Default	0
	Setting Range	0 to 45	

AI can be used as DI, but try not to connect the grounding point (GND) of AI to the grounding point (COM) of DI.

B4-41	DI Valid Status Setting 5	Default	0
	Setting Range	0 to 111	

Set the valid state of the DI terminal according to the bit position.

0: Positive logic (valid when closed).

1: Negative logic (valid when open).

The mapping between BIT and DI is as follows:

Others reserved	BIT1	BIT0
	AI2 as DI	AI1 as DI

To set a DI to negative logic (valid when open), set the corresponding BIT to 1.

Group B5 Analog Input Terminals

The rectifier side has one high-speed pulse input terminal (HDI) and three analog input terminals (AI1 to AI2).

B5-00	Pulse Input Min. Frequency	Default	0.00 kHz
	Setting Range	0.00 kHz to B5-02	

B5-01	Corresponding Setting of Pulse Input Min. Frequency	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-02	Pulse Input Max. Frequency	Default	50.00 kHz
	Setting Range	B5-00 to 100.00 kHz	
B5-03	Corresponding Setting of Pulse Input Max. Frequency	Default	100.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-04	Pulse Input Filter Time	Default	0.10s
	Setting Range	0.00s to 10.00s	

The parameters in this group define the relationship between the pulse input and the set value represented by the pulse input when the input pulse is used as the frequency source, as shown in Figure 5-2.

Pulse input filter time: Filters the pulse input signal. The larger the value is, the stronger the anti-interference capability is, but the adjustment response will become slower. The smaller the value is, the faster the adjustment response is, but the anti-interference capability will be reduced. In different applications, 100% of analog input corresponds to different nominal values. For details, refer to the description of different applications.

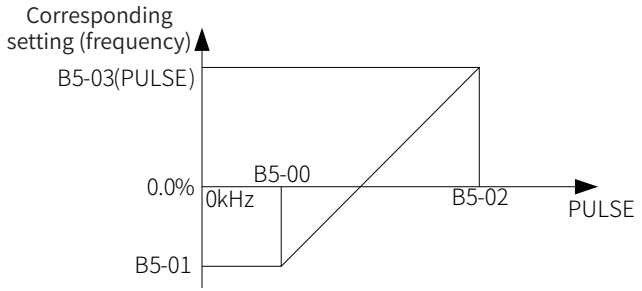


Figure 5-2 Relationship between pulse setting and set point

B5-05	AI Curve Selection 1	Default	321
	Setting Range	111 to 555	

Select a curve corresponding to AI according to the bit position. The curve is set by parameters B5-11 to B5-38.

1: Curve 1 (two points), 2: Curve 2 (two points),

3: Curve 3 (2 points), 4: Curve 4 (4 points),

5: Curve 5 (4 points).

The mapping between BIT and AI is shown in the following table:

Others	BIT1	BIT0
Reserved	AI2 curve selection	AI1 curve selection

To select a curve corresponding to an AI, set the corresponding BIT to the number corresponding to the curve.

B5-06	AI1 Filter Time	Default	0.10s
	Setting Range	0.00s to 10.00s	
B5-07	AI2 Filter Time	Default	0.10s
	Setting Range	0.00s to 10.00s	

The method to set the AI filter time is the same as that to set the pulse filter time.

B5-11	Curve 1 Minimum Input	Default	0.00 V
	Setting Range	0.00 V to B5-13	
B5-12	Corresponding Setting of Curve 1 Minimum Input	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-13	Curve 1 Maximum Input	Default	10.00 V
	Setting Range	B5-11 to +11.00 V	
B5-14	Corresponding Setting of Curve 1 Maximum Input	Default	100.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-15	Curve 2 Minimum Input	Default	0.00 V
	Setting Range	0.00 V to B5-17	
B5-16	Corresponding Setting of Curve 2 Minimum Input	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-17	Curve 2 Maximum Input	Default	10.00 V
	Setting Range	B5-15 to +11.00 V	
B5-18	Corresponding Setting of Curve 2 Maximum Input	Default	100.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-19	Curve 3 Minimum Input	Default	0.00 V
	Setting Range	0.00 V to B5-21	
B5-20	Corresponding Setting of Curve 3 Minimum Input	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-21	Curve 3 Maximum Input	Default	10.00 V
	Setting Range	B5-19 to +11.00 V	
B5-22	Corresponding Setting of Curve 3 Maximum Input	Default	100.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	

These parameters are used to define the two-point curve relationship between the analog input and the corresponding setting. When the AI range exceeds the set minimum or maximum input range, the minimum or maximum input is used. Analog input can be either voltage or current. For analog current input of 0 mA to 20 mA, the corresponding input voltage ranges from 0 V to 10 V. If the input current ranges from 4 mA to 20 mA, a current of 4 mA corresponds to a voltage of 2 V. To correspond the 4 mA-20 mA to 0%-100%, set the voltage to 2 V-10 V. as shown in Figure 5-3.

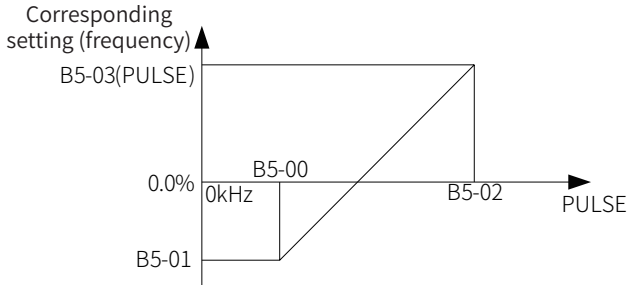


Figure 5-3 Two-point curve relationship between analog setting and set point

B5-23	Curve 4 Minimum Input	Default	0.00 V
	Setting Range	0.00 V to B5-25	
B5-24	Corresponding Setting of Curve 4 Minimum Input	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-25	Curve 4 Inflexion 1 Input	Default	3.00 V
	Setting Range	B5-23 to B5-27	
B5-26	Corresponding Setting of Curve 4 Inflection 1 Input	Default	30.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-27	Curve 4 Inflexion 2 Input	Default	6.00 V
	Setting Range	B5-25 to B5-29	
B5-28	Corresponding Setting of Curve 4 Inflexion 2 Input	Default	60.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-29	Curve 4 Maximum Input	Default	10.00 V
	Setting Range	B5-27 to +11.00 V	
B5-30	Corresponding Setting of Curve 4 Maximum Input	Default	100.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-31	Curve 5 Minimum Input	Default	0.00 V
	Setting Range	0.00 V to B5-33	

B5-32	Corresponding Setting of Curve 5 Minimum Input	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-33	Curve 5 Inflexion 1 Input	Default	3.00 V
	Setting Range	B5-31 to B5-35	
B5-34	Corresponding Setting of Curve 5 Inflexion 1 Input	Default	30.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-35	Curve 5 Inflexion 2 Input	Default	6.00 V
	Setting Range	B5-33 to B5-37	
B5-36	Corresponding Setting of Curve 5 Inflexion 2 Input	Default	60.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-37	Curve 5 Maximum Input	Default	10.00 V
	Setting Range	B5-35 to +11.00 V	
B5-38	Corresponding Setting of Curve 5 Maximum Input	Default	100.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	

These parameters are used to define the four-point curve relationship between the analog input and the corresponding setting, as shown in Figure 5-4.

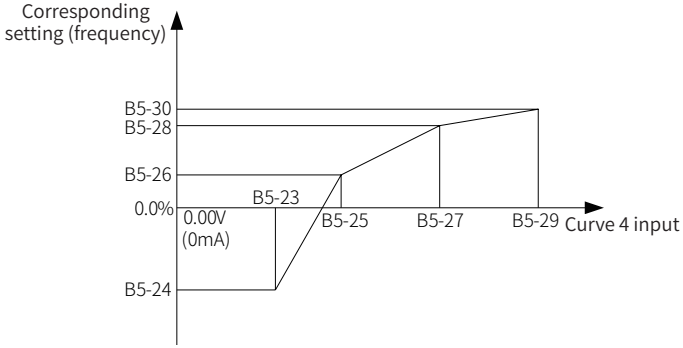


Figure 5-4 Four-point curve relationship between the analog input setting and the set point

B5-39	Jump Point of AI1 Setting	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B5-40	Jump Amplitude of AI1 Setting	Default	0.5% of the Rated Speed
	Setting Range	0.0% to 100.0%	
B5-41	Jump Point of AI2 Setting	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	

B5-42	Jump Amplitude of AI2 Setting	Default	0.5% of the Rated Speed
	Setting Range	0.0% to 100.0%	

Used to set the jump point and jump amplitude of AI.

Group B6 Digital Output Terminals

The rectifier side provides three multifunctional relay output terminals (RELAY1, RELAY2) and one multifunctional digital output terminal (DO1).

B6-00	RELAY1 Output Selection	Default	1
B6-01	RELAY2 Output Selection	Default	2
B6-10	DO1 Output Selection	Default	0

The relay output terminals are RxA/RxB/RxC, where RxA is the common output terminal of relay x, RxB is a normally closed (NC) terminal, and RxC is a normally open (NO) terminal.

The following table shows the function selection:

Set Value	Function	Description
0	No output	The output terminal has no function.
1	During running	When the rectifier side is in the running state, the ON signal is output, including brake status.
2	Fault output	When the rectifier side fails, the ON signal is output. Caution: When an under-voltage fault occurs, no ON signal is output.
7	Overload pre-warning	When the rectifier side is overloaded, the ON signal is output before overload protection is triggered.
15	Ready for RUN	When the rectifier side is not faulty, the bus voltage is normal, and the coast to stop terminal is invalid. When the rectifier side is capable of running, the ON signal is output. The ON signal is also output when the rectifier side runs.
16	AI1 > AI2	When the absolute value of the AI1 setting is greater than that of the AI2 setting, the ON is output.
19	Undervoltage state output	When the rectifier side is in the undervoltage state, the ON signal is output.
20	Communication control	Controlled by the host controller. For details, see the Appendix.
22	Rectifier side overtemperature pre-warning	When overtemperature is detected in the rectifier side, the ON signal is output before the overtemperature protection is triggered.

Set Value	Function	Description
24	Rectifier power-on pre-charge control	Controls the action of the rectifier power-on pre-charge resistor.
25	Bus voltage limit	For details, see parameter B9-23.
26	Ready for RUN 2	When the rectifier side is not faulty, the bus voltage is normal, and the coast to stop terminal is invalid. When the rectifier side is capable of running, the ON signal is output. The ON signal is not output when the rectifier side runs.

B6-13	RELAY1 output delay	Default	0.0s
B6-14	RELAY2 output delay	Default	0.0s
B6-23	DO1 Output Delay	Default	0.0s
	Setting Range	0.0s to 3600.0s	

These parameters indicate the effective impulse holding time of the RELAY signal and DO1, as shown in Figure 5-5. The parameter can be identified only when the width of the RELAY signal is larger than this parameter. t_{w1} in the figure can be identified and t_{w2} is ignored.

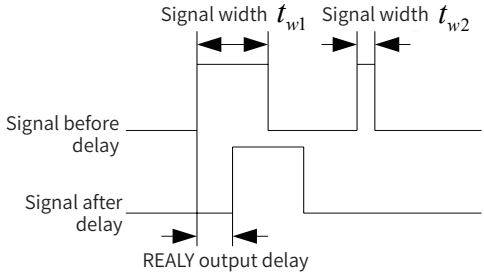


Figure 5-5 Schematic diagram of RELAY output delay time

B6-26	DO Valid Status Selection 1	Default	000
	Setting Range	0 to 111	

Set the valid state of DO terminals according to the bit position.

0: Positive logic (valid when closed).

1: Negative logic (valid when open).

The mapping between BIT and DO is as follows:

Others	BIT1	BIT0
Reserved	RELAY2	RELAY1

To set a DO to negative logic (valid when open), set the corresponding BIT to 1.

B6-28	DO Valid Status Selection 2	Default	0
	Setting Range	0 to 1	

Set the valid state of DO terminals according to the bit position.

0: Positive logic (valid when closed).

1: Negative logic (valid when open).

The mapping between BIT and DO is as follows:

Others	BIT0	Reserved	DO1

To set a DO to negative logic (valid when open), set the corresponding BIT to 1.

Group B7 Analog Output Terminals

The rectifier side provides one high-speed pulse output terminal (FMP) and two multifunctional analog output terminals (AO1 to AO2).

B7-00	FMP output	Default	0 (running frequency)
B7-01	AO1 selection	Default	0
B7-02	AO2 output selection	Default	0

The standard analog output (zero offset 0, gain 1) is 0 mA to 20 mA (or 0 V to 10 V). The FMP output ranges from 0 Hz to the setting of parameter B7-06.

The range of the corresponding setting is shown in the following table:

Set Value	Function	Range
2	Output current	0 to 2 times rated current
4	Output power	0 to 2 times rated power
5	Output voltage	0 to 1.2 times the rated voltage of the rectifier side
6	Pulse input	1 kHz to 100.0 kHz
7	AI1	0 V to 10 V/0 mA to 20 mA
8	AI2	0 V to 10 V/0 mA to 20 mA
12	Major communication control output	0.0% to 100.0% (see Appendix)
14	DC bus voltage	0 V to 1000 V
15	Grid input voltage	0 V to 600 V (for rectifier)
21	Frequency of rectifier input voltage	

B7-06	Maximum FMP output frequency	Default	50.0 kHz
	Setting Range	0.1 kHz to 100.0 kHz	

This can be used to set the maximum frequency of the output pulse.

B7-07	AO1 Zero Offset Coefficient	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B7-08	AO1 Gain	Default	1.00
	Setting Range	-10.00 to 10.00	
B7-09	AO2 Zero Offset Coefficient	Default	0.0% of the Rated Speed
	Setting Range	-100.0% to 100.0%	
B7-10	AO2 Gain	Default	1.00
	Setting Range	-10.00 to 10.00	

The standard AO is 0 V to 10 V or 0 mA to 20 mA, indicating the analog output of 0 to the maximum value.

The AO zero offset coefficient and gain are generally used to correct the zero drift of the analog output and the deviation of output amplitude, or to modify the standard output to any desired curve to correspond to the quantity represented by the analog output.

If "b" represents zero offset, "k" represents gain, "Y" represents actual output, and "X" represents the standard output, the formula for calculating the actual output is:

$Y=kX + b$

AO zero offset coefficient 100% corresponds to 10 V (20 mA).

Group BA Fault and Reset

BA-07	Rectifier side Overtemperature Pre-warning	Default	70°C
	Setting Range	0°C to 100°C	

BA-08	Detection Time for Rectifier Input Contactor Fault Err178	Default	0.50s
	Setting Range	0.50s to 30.0s	

BA-09	Fault Automatic Reset Count	Default	0
	Setting Range	0 to 100	

Used to set fault auto reset count of the rectifier side when automatic fault reset is selected. If the parameter value is exceeded, the rectifier side is protected against fault.

Caution:

1) The external fault and running time reached fault cannot be reset automatically.
2) The auto reset count will be cleared if a fault is manually reset.
3) The auto reset of the undervoltage fault will not be counted in the auto reset count.

BA-10	Action Selection of Faulty Relay during Automatic Fault Reset		Default	0
	Setting Range	0: Not act 1: Action	Determine whether the fault output terminal outputs a fault alarm signal during automatic reset.	

BA-11	Automatic Fault Reset Interval		Default	1.0s
	Setting Range	0.1s to 60.0s	Used to set the delay of auto reset after the rectifier side reports a fault.	

BA-12	Time of Clearing Auto Reset Count		Default	1.0h
	Setting Range	0.1 hours to 1000.0 hours	When the rectifier side runs normally for this period without failure, the auto reset count will be cleared.	

BA-22	Grid Fault Auto Reset Selection 1		Default	0
	Setting Range	0: Invalid 1: Valid Ones position: Incomplete phase lock Tens position: Too high AC input voltage Hundreds position: Too low AC input voltage Thousands position: Too high AC input frequency Ten thousands position: Too low AC input frequency	Determines whether to automatically reset these five faults.	

BA-23	Grid Fault Auto Reset Selection 2		Default	0
	Setting Range	0: Invalid 1: Valid Ones position: Unbalanced AC input voltage Tens position: Unbalanced AC input current Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Determines whether to automatically reset faults when the AC input voltage and input current are unbalanced.	

Here, grid faults refer to Er0127, Er034, Er035, Er036, Er037, Er038, and Er039. Whether to perform an automatic reset is determined by BA-22 and BA-23, instead of BA-09 (automatic reset count).

BA-24	Grid Fault Judgment Condition Selection 1		Default	11111
	Setting Range	0: No judgment 1: Judgment Ones position: Incomplete phase lock Tens position: Too high AC input voltage Hundreds position: Too low AC input voltage Thousands position: Too high AC input frequency Ten thousands position: Too low AC input frequency	Determines whether five faults are reported only during run time.	

BA-25	Grid Fault Judgment Condition Selection 2		Default	11
	Setting Range	0: Invalid 1: Valid Ones position: Unbalanced AC input voltage Tens position: Unbalanced AC input current Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Determines whether to report faults only during run time when the AC input voltage and input current are unbalanced.	

BA-38	Rectifier Voltage Upper Limit		Default	Voltage Class Dependent
	Setting Range	500.0 to 2000.0 V	380 V voltage class: 700 V 480 V voltage class: 800 V 690 V voltage class: 1120 V	

BA-41	Pre-charge Resistor Protection Selection		Default	1
	Setting Range	0: Invalid 1: Valid		

BA-42	Software Overvoltage Threshold		Default	0.0 V
	Setting Range	0.0: Invalid 0.0 to 5000.0 V	User-defined overvoltage setting. When the setting is exceeded, the overvoltage error (Er125) is reported.	

BA-43	Software Overcurrent Threshold		Default	0.00 A
	Setting Range	0.00: Invalid 0.00 to 655.35 A	User-defined overcurrent setting. When the setting is exceeded, the overcurrent error (Er126) is reported.	

BA-44	Grip Fault Protection Selection 1		Default	11111
	Setting Range	0: Invalid 1: Valid Ones position: Incomplete phase lock Tens position: Too high AC input voltage Hundreds position: Too low AC input voltage Thousands position: Too high AC input frequency Ten thousands position: Too low AC input frequency		

BA-45	Grip Fault Protection Selection 2		Default	11
	Setting Range	0: Invalid 1: Valid Ones position: Unbalanced AC input voltage Tens position: Unbalanced AC input current Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved		

BA-44 and BA-45 are used to select whether to implement grid fault protection. If bit 0 is selected, the protection mechanism is not triggered for the corresponding fault.

Group D3 Control Optimization Parameters

D3-03	Rapid Current Limiting Function		Default	1
	Setting Range	0	Invalid	
		1	Valid	

Rapid current limiting minimizes risks of overcurrent, ensuring the uninterrupted running of the rectifier side. After the fast current limiting state lasts for a certain period, the rectifier side reports a current limiting fault (Er040), indicating that the rectifier side is overloaded. Handle this fault by referring to the solution of Er010.

D3-09	Undervoltage Threshold	Default	100.0% of the Rated Speed
	Setting Range	60.0% to 300.0%	

This parameter can adjust the voltage setpoint at which the undervoltage fault (Er009) is reported at the rectifier side. The undervoltage threshold 100% of the rectifier side of different voltage classes corresponds to different nominal points, as listed in the following table.

380T (three-phase 380 V): 350 V, 480T (three-phase 480 V): 350 V,

690T (three-phase 690 V): 650 V.

D3-12	Grid Overvoltage Protection Threshold	Default	Voltage Class Dependent
	Setting Range	Grid undervoltage protection threshold (D3-12) to 1500 V	

D3-13	Grid Undervoltage Protection Threshold	Default	Voltage Class Dependent
	Setting Range	0 V to grid overvoltage protection threshold (D3-12)	

The default settings of these two parameters comply with the following rules:

Grid overvoltage protection threshold: Grid input voltage × (1 + 15%). Therefore,

Grid overvoltage protection threshold for 380 V voltage class: 437 V

Grid overvoltage protection threshold for 480 V voltage class: 552 V

Grid overvoltage protection threshold for 690 V voltage class: 793 V

When the grid voltage is greater than this value, fault Er034(grid input overvoltage) is reported.

Grid undervoltage protection threshold: Grid input voltage × (1 - 15%). Therefore,

Grid undervoltage protection threshold for 380 V voltage class: 323 V

Grid undervoltage protection threshold for 480 V voltage class: 408 V

Grid undervoltage protection threshold for 690 V voltage class: 586 V

When the grid voltage is lower than this value, the fault Er035 (grid input undervoltage) is reported.

D3-14	Grid Overfrequency Protection Threshold	Default	55.00 Hz
	Setting Range	Grid under-frequency protection threshold (D3-15) to 100.00 Hz	

D3-15	Grid Underfrequency Protection Threshold	Default	45.00 Hz
	Setting Range	0.00 Hz to grid over-frequency protection threshold (D3-14)	

When the grid frequency is greater than D3-14, fault Er036 (grid input over-frequency) is reported.

When the grid frequency is greater than D3-15, fault Er037 (grid input under-frequency) is reported.

Group DD AI/AO Correction

DD-00	AI1 measured voltage 1	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V	

DD-01	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V, see U3-09	

DD-02	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V	

DD-03	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V, see U3-09	

DD-04	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V	

DD-05	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V, see U3-10	

DD-06	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V	

DD-07	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V, see U3-10	

DD-08	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V	

DD-09	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V, see U3-11	

DD-10	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V	

DD-11	Grid Underfrequency Protection Threshold	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V, see U3-11	

The parameters in this group are used for calibrating analog inputs (AIs) to eliminate the effect of zero offset and gain of AI input ports. The parameters in this group have been corrected before delivery and are restored to the factory-corrected values during parameter initialization. Generally, you do not need to perform corrections in the applications.

Measured voltage indicates the voltage measured by instruments such as the multimeter. Displayed voltage indicates the voltage sampled and displayed by the rectifier side. See voltage values (U3-09, U3-10, and U3-11) before AI correction in Group U3.

During the correction, input two voltage values to each AI terminal, and save the value measured by the multimeter and the value read in group U3 to the above parameter. Then the rectifier side will automatically perform AI zero offset and gain correction.

For AI voltage value after correction, see AI voltage in group U1 (U1-09, U1-10, and U1-11).

DD-20	AO1 Target Voltage 1	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V	

DD-21	AO1 Measured Voltage 1	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V	

DD-22	AO1 Target Voltage 2	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V	

DD-23	AO1 Measured Voltage 2	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V	

DD-24	AO2 Target Voltage 1	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V	

DD-25	AO2 Measured Voltage 1	Default	Factory-corrected
	Setting Range	0.500 V to 3.500 V	

DD-26	AO2 Target Voltage 2	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V	

DD-27	AO2 Measured Voltage 2	Default	Factory-corrected
	Setting Range	6.500 V to 9.500 V	

These parameters are used to correct the AO. The parameters in this group have been corrected before delivery and are restored to the factory-corrected values during parameter initialization. Generally, you do not need to perform corrections in the applications.

Target voltage indicates the theoretical output voltage of the rectifier side. Measured voltage indicates the actual output voltage value measured by instruments such as the multimeter.

Group DE Parameter Management

DE-00	User Password	Default	0
	Setting Range	0 to 65535	

The password prohibits unauthorized personnel from viewing and modifying parameters. If this parameter is set to any non-zero number, the password protection function is enabled. If no password is required, set this parameter to 00000. After a password has been set and taken effect, you must enter the correct password in order to enter the menu. If the entered password is incorrect, you cannot view or modify parameters, but you can view the displayed parameters in the running or stop state.

Remember the password you set. If you set the password incorrectly or forget the password, contact the manufacturer.

DE-01	Parameter Initialization		Default	0
	Setting Range	0	No operation	
		1	Restores factory settings, without restoring AI/AO correction parameters (group DD)	
		2	Clear records	
		3	Restores AI/AO correction parameters only (group DD)	

0: No operation.

1: The rectifier side restores the default settings of all parameters, except the following ones:

- Working mode selection A1-00.
- Fault parameter querying in group U1 and parameter management in group DE.
- AI/AO correction parameters in group DD.

2: Clear records: Clears the fault history of the rectifier side (group U1).

3: Restore AI/AO correction parameters only (group DD).

DE-02	Menu Mode			Default	21
	Setting Range	BIT3 Same as BIT2	BIT2 0: No function 1: Advanced menu 2: Monitor menu 3: Check menu	BIT1 1: Advanced menu	

Select a menu mode. Users can use the QUICK key to switch among menu screens.

0: Advanced menu

All parameters are displayed.

1: Monitor menu

The menu in group U is displayed.

2: Check menu

Only parameters that are different from the default values are displayed.

DE-04	Read-only User Password	Default	0
	Setting Range	0 to 65535	

After a user password is set (DE-00 is set to a non-zero value), users can set this parameter to any non-zero value. The value of this parameter is used as the read-only user password. After entering the menu with this password, users can view but not edit parameters.

DE-05	LED running display parameter 1	Default	31
	Setting Range	0 to FFFF	

As shown in the following table, a 16-digit binary number is used to convert bit 1 corresponding to the parameter to be displayed at runtime into a four-digit hexadecimal number and enter it in the parameter.

For example, the bus voltage, output voltage, and output current need to be displayed at runtime. According to the binary bits corresponding to each parameter, the set parameter is 0000 0000 0001 1100, which is converted to 001C in hexadecimal. When DE-05 is set to 001C, bus voltage, output voltage, and output current parameters will be displayed at runtime.

Binary	Parameters Displayed at Runtime
xxxx xxxx xxxx x1xx	Bus voltage
xxxx xxxx xxxx 1xxx	Output voltage
xxxx xxxx xxx1 xxxx	Output current
xxxx xxxx xx1x xxxx	Output power
xxxx xxxx 1xxx xxxx	DI terminal state

Binary	Parameters Displayed at Runtime
xxxx xxx1 xxxx xxxx	DO terminal state
xxxx xx1x xxxx xxxx	AI1 input voltage
xxxx x1xx xxxx xxxx	AI2 input voltage

DE-06	LED running display parameter 2	Default	0
	Setting Range	0 to FFFF	

The parameter setting method is the same as that of DE-05. The following table lists the parameters.

Binary	Parameters Displayed at Runtime
xxxx xxxx xxxx xxx1	PID setting
xxxx xxxx xxxx xx1x	PID feedback
xxxx xxxx xx1x xxxx	Rectifier input voltage
xxxx xxxx 1xxx xxxx	Pulse input frequency 2

DE-07	LED display in the stop state	Default	31
	Setting Range	0 to FFFF	

The parameter setting method is the same as that of DE-05. The following table lists the parameters.

Binary	Parameters Displayed at Runtime
xxxx xxxx xxxx xx1x	Bus voltage (V)
xxxx xxxx xxxx x1xx	DI state
xxxx xxxx xxxx 1xxx	DO state
xxxx xxxx xxx1 xxxx	AI1 voltage (V)
xxxx xxxx xx1x xxxx	AI2 voltage (V)
xxxx 1xxx xxxx xxxx	PID setting

DE-09	STOP Key Function Selection		Default	0
	Setting Range	0	The STOP key is valid only in the operating panel control mode	
		1	The STOP key is valid in any control mode	

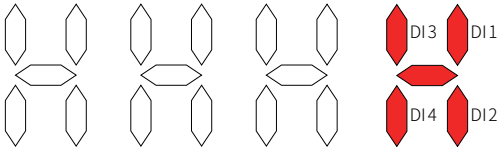
DE-10	Energy Regeneration Accumulative Value Resetting		Default	0
	Setting Range	0	Invalid	
		1	Reset	

The energy regeneration accumulative value will not be lost upon power failure. This parameter is used to reset the accumulative value. If users need to know the regenerative energy value in a certain period of time, the value can be reset first.

Group U0 Monitoring Parameters

Visual display of DI state (U0-51):

As shown in the figure, when DIx is valid (before negative logic), the corresponding LED is on. Otherwise, the LED is off.

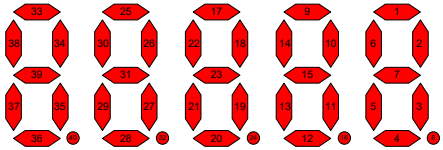


Visual display of DO state (U0-52):

As shown in the figure, when DOx is valid (before negative logic), the corresponding LED is on. Otherwise, the LED is off.

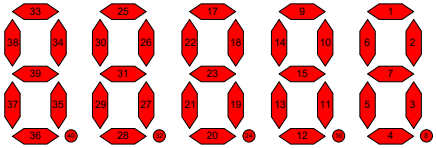
Visual display 1 of DI function state (U0-53):

As shown in the figure, when a function of DI is valid (01 to 40), the corresponding LED is on. Otherwise, the LED is off.



Visual display 2 of DI function state (U0-54):

As shown in the figure, when a function of DI is valid (41 to 43), the corresponding LED is on. Otherwise, the LED is off.



Chapter 6 Troubleshooting

6.1 Faults and Solutions

The AFE unit provides multiple pieces of fault information and protective functions. After a fault occurs, the AFE unit implements the protection function, stops the output, enables the fault relay contact to act, and displays the fault code on the operating panel. Before asking Inovance engineers for help, you can perform a self-check according to the following table, analyze the fault causes, and find solutions. If the fault is caused by the reasons given in the dashed box, contact your vendor or Inovance.

Table 6-1 Faults and solutions

Fault Code	Fault Description	Fault Cause	Solution
Er002 Er003 Er004	Overcurrent	1. The main circuit is short-circuited or grounded. 2. The phase detection cable is incorrectly connected. 3. The gain of the regulator is large, and the system oscillates. 4. The quick current limit function is disabled (default).	1. Eliminate external faults. 2. Check the connection of the phase detection cable. 3. Check the setting of the current loop and voltage loop regulator parameters. 4. Enable the quick current limit function (D3-03).
Er005 Er006 Er007	Bus overvoltage	1. The regulator gain is weak. 2. The phase detection cable is incorrectly connected. 3. The power of the controlled rectifier unit is small. 4. If the fault is reported during the loading of regenerative mode, it may be caused by phase loss at the grid side.	1. Enhance the proportional gain and integral gain of the voltage loop and current loop in the same proportion. 2. Check the connection of the phase detection cable. 3. Select a controlled rectifier unit with higher power.
Er008	Internal pre-charge resistor overload	The input voltage frequently falls below the lower limit allowed in the manual.	If the fault occurs, power off and wait at least five minutes and ensure that the input voltage is normal before powering on again.
Er009	Bus undervoltage	1. An instantaneous power failure occurs or too low supply voltage. 2. The contactor is not closed. 3. The internal contactor or pre-charge resistor is abnormal.	1. Reset the fault and check the power supply. 2. Check whether the contactor or control signal is normal. 3. Contact your vendor or Inovance for technical support.
Er010	Overload	Too high load. A controlled rectifier unit with low power is used.	Reduce the load or use a controlled rectifier unit with high power.

Fault Code	Fault Description	Fault Cause	Solution
Er012	Input phase loss	Power input phase loss. (Note: Input phase loss. When it is judged by software, other faults may be reported first under different working conditions due to priority problems).	1. Check the connection of the phase sequence detection cable. 2. Check whether the power supply is normal or it is caused by phase loss.
Er014	IGBT overtemperature	1. The ambient temperature is too high. 2. The air filter is blocked. 3. The fan is damaged. 4. The thermistor of the IGBT is damaged.	1. Reduce the ambient temperature. 2. Clean the air filter. 3. Replace the damaged fan. 4. Replace the damaged thermistor.
Er015	External device fault	1. An external fault signal is an input through DI. 2. An external fault signal is an input through virtual I/O.	1. Reset the fault. 2. Reset the fault.
Er016	Communication fault	1. The host controller is abnormal. 2. The communication cable is faulty. 3. The communication parameters are set incorrectly.	1. Check the wiring of the host controller. 2. Check the connection of the communication cable. 3. Set communication parameters properly (see Appendix).
Er017	Internal contactor fault	1. The drive board is faulty. 2. The contactor is faulty. 3. The control signal is abnormal.	1. Replace the drive board. 2. Replace the faulty contactor. 3. Check the control signal and whether the parameters are properly set.
Er018	Current detection fault	Hardware current sampling fault	Check whether the three-phase current sampling cable is properly connected.
Er021	EEPROM read-write fault	The EEPROM chip is damaged.	Replace the control board.
Er033	Too high bus voltage deviation	1. The regulator gain is weak. 2. The detection threshold is too low. 3. The load is too heavy and exceeds the output upper limit of the controlled rectifier unit.	1. Enhance the gain of the voltage loop and current loop. 2. Modify the detection condition of too high voltage deviation in group A1. 3. Modify the current upper limit of the rectifier (A1-09), or replace a controlled rectifier unit with a higher power.

<table>
<tr><th>Fault Code</th><th>Fault Description</th><th>Fault Cause</th><th>Solution</th></tr>
<tr><td>Er034</td><td>Grid overvoltage</td><td>The supply voltage is higher than the upper limit as specified in the manual.</td><td rowspan="6">1. Check the connection of the phase sequence detection cable.
2. Check whether the power supply is normal or it is caused by phase loss.
3. Check whether the DIP switches S1 and S2 on the control board are at the corresponding voltage class.
4. Check whether the pre-charge resistor is open.</td></tr>
<tr><td>Er035</td><td>Grid undervoltage</td><td>1. The supply voltage is lower than the lower limit as specified in the manual.
2. This fault may be reported at runtime in case of phase loss.</td></tr>
<tr><td>Er036</td><td>Grid voltage overfrequency</td><td rowspan="2">The grid frequency is not within the frequency range allowed in the manual.</td></tr>
<tr><td>Er037</td><td>Grid voltage underfrequency</td></tr>
<tr><td>Er038</td><td>Grid voltage unbalanced</td><td rowspan="2">1. The grid three-phase voltage and current deviation are not within the range allowed in the manual.
2. The fault is reported when loading in rectification mode, and the fault may be reported when phase loss occurs at the grid side.</td></tr>
<tr><td>Er039</td><td>Grid current unbalanced</td></tr>
<tr><td>Er040</td><td>Quick current limit fault</td><td>1. The load is too heavy or sudden change exceeds the rated load.
2. The selected unit has low power.</td><td>1. Reduce the load.
2. Select a controlled rectifier unit with higher power.</td></tr>
<tr><td>Er101</td><td>Incorrect controlled rectifier mode</td><td>Incorrect control board jumper</td><td>Bridge the SW5 jumper of the control board to the REC position.</td></tr>
<tr><td>Er125</td><td>Software overvoltage</td><td>The bus voltage is higher than BA-42.</td><td>Check whether the measured bus voltage is higher than the protection value.</td></tr>
<tr><td>Er127</td><td>Incorrect phase detection</td><td>1. The phase detection cable is improperly connected.
2. Incorrect parameter settings.</td><td>1. Check the connection of the phase sequence detection cable.
2. Contact your vendor or Inovance for technical support.</td></tr>
</table>

Fault Code	Fault Description	Fault Cause	Solution
Er129	Incorrect phase sequence	Incorrect phase sequence. Change the sequence of the sampling cable according to A1-27.	0: No auto-tuning. 1: The wiring is correct. 2: Modify the voltage sampling cable and switch the wiring of the V phase and W phase. 3: Modify the voltage sampling cable and switch the wiring of the U phase and W phase. 4: Modify the voltage sampling cable and switch the wiring of the U phase and V phase, and then the W phase and V phase. 5: Modify the voltage sampling cable and switch the wiring of the U phase and V phase. 6: Modify the voltage sampling cable and switch the wiring of the U phase and W phase, and then the V phase and the W phase. 7: If auto-tuning fails, set A1-26 to a lower value and then run auto-tuning again. Note: Values 0 to 7 are the results of phase sequence auto-tuning of function code A1-27 that are read-only and cannot be edited.
Er178	External pre-charge contactor fault	1. The external pre-charge contactor works abnormally. 2. The contactor fault detection signal is abnormal. 3. The bus voltage rises slowly when passing through the pre-charge resistor. 4. The main contactor is open, and the pre-charge completion signal is lost.	1. Change the external pre-charge contactor. 2. Check the fault detection circuit. 3. Extend the BA-08 measured value and modify it as required. 4. Do not cut off the main contactor when the AFE unit is running. 3. Contact your vendor or Inovance for technical support.

6.2 Symptoms and Solutions

The following symptoms may occur during the use of the AFE Unit. When these symptoms occur, perform a simple analysis based on the following table.

Table 6-2 Symptoms and Solutions

No.	Fault Symptom	Possible Cause	Solution
1	No display upon power-on or garbling	1. The power input of the AFE unit is abnormal. 2. The 34-core flat cable connecting the drive board and the control board is in poor contact. 3. The parts inside the AFE unit are damaged.	1. Check the power supply. 2. Re-connect the 34-core flat cable. 3. Contact your vendor or Inovance for technical support.
3	The display is normal when the AFE unit is powered on. But after running, "HC" is displayed and the AFE unit stops immediately.	The cooling fan is damaged, or a locked-rotor occurs.	Replace the cooling fan.
4	Er014 (module overtemperature) is reported frequently.	1. The carrier frequency is set too high. 2. The cooling fan is damaged, or the air filter is blocked. 3. The parts (thermoelement or others) inside the AFE unit are damaged.	1. Reduce the carrier frequency. 2. Replace the cooling fan and clean the air filter. 3. Contact your vendor or Inovance for technical support.
5	The "Er127" (incorrect phase detection) fault is reported frequently.	1. Poor quality of grid. 2. The main contactor is cut off, and the line is in poor contact.	1. Set the ones position of BA-22 to 1 where necessary, automatically reset the fault. 2. Shield the host controller. The host controller is only used for basic rectification, without affecting the operation of the whole system.
6	DI terminals are disabled.	1. Incorrect parameter setting. 2. Incorrect wiring. 3. The control board is faulty.	1. Check and re-set relevant parameters. 2. Perform the wiring again. 3. Contact your vendor or Inovance for technical support.

Appendix A Communication Protocol

The AFE unit provides the RS485 communication interface so that you can implement centralized control, such as setting running commands, setting parameters, and reading the working states and fault information of the AFE unit, by using a PC or PLC. If the communication interface provided by the external device is RS232, an additional RS232/RS485 converter needs to be installed.

A.1 Protocol Contents

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). Including: including master polling (or broadcasting) format and master coding method (parameter for the action, transmission data, and error check). The slave uses the same structure for 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.

A.2 Applications

The AFE unit is connected to a "single-master multi-slave" PC/PLC control network equipped with an RS485 bus.

A.3 Bus Structure

1. Interface mode

The RS485 hardware interface is used. If the communication interface provided by the external device is RS232, an additional RS232/RS485 converter needs to be installed.

2. Transmission mode

The asynchronous serial and half-duplex transmission modes are used. At the same moment, either the master or the slave transmits data, and the other can only receive data. During asynchronous serial communication, data is sent frame by frame in the form of a packet.

3. Topological structure

The system consists of a single master and multiple slaves. The address range of the slaves is 1 to 247, and 0 is the broadcast address. A slave must have a unique address in the network.

A.4 Protocol Description

The Modbus communication protocol used by the AFE unit is a serial master-slave communication protocol. In the network, only one device (master) can set up the protocol (that is, "query/command"), and other devices (slaves) can only 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 here is a PC, an industrial device, or a PLC, and a slave is an AFE unit. The master can communicate with a single slave or broadcast messages to all slaves. The slave returns a message (called a response) to any query/command that is accessed by the master separately. The slave does not need to respond to a broadcast message sent by the master.

A.5 Communication Data Structure

The data format of the Modbus protocol used by the AFE unit is as follows:

In RTU mode, messages are sent at an interval of at least 3.5-character time. The first field transmitted is the device address. The allowable transmitted characters are hexadecimal 0 ... 9, A ... F. The network devices keep detecting the network bus, even during the silent interval. After receiving the first field (the address field), each device decodes the field to determine whether itself is the destination device. Following the last transmitted character, an interval of at least 3.5-character time marks the end of the message. A new message starts to be sent after this interval.

The entire message frame must be transmitted as a continuous stream. If a silent interval of longer than 1.5-character time occurs before completion of the frame, the receiving device refreshes the incomplete message and assumes that the next byte is the address field of a new message. Similarly, if a new message begins earlier than 3.5-character time following a previous message, the receiving device considers the new message as a continuation of the previous message. This results in an error, as the value in the final cyclical redundancy check (CRC) field is incorrect for the combined messages.

1. RTU frame format:

<table>
<tr><td>Frame header: START</td><td>At least 3.5-character time</td></tr>
<tr><td>Slave address: ADDR</td><td>Communication address: 0 to 247</td></tr>
<tr><td>Command code: CMD</td><td>03: Read slave parameters, 06: Write slave parameters</td></tr>
<tr><td>Data content: DATA (N-1)</td><td rowspan="4">Information content: Parameter address, number of parameters, and parameter value.</td></tr>
<tr><td>Data content: DATA (N-2)</td></tr>
<tr><td>...</td></tr>
<tr><td>Data content: DATA0</td></tr>
<tr><td>CRC CHK low order</td><td rowspan="2">Detection value: CRC value.</td></tr>
<tr><td>CRC CHK high order</td></tr>
<tr><td>END</td><td>At least 3.5-character time</td></tr>
</table>

2. CMD and DATA

Command code: 03H, read N words (a maximum of 12 words can be read).

Example: The start address F002 of the AFE unit with slave address 01 reads two consecutive values.

ADDR	01H
CMD	03H
High order of the start address	F0H
Low order of the start address	02H
High order of the number of registers	00H
Low order of the number of registers	02H
CRC CHK low order	CRC CHK value to be calculated
CRC CHK high order	

Slave response information

ADDR	01H
CMD	03H
Number of bytes	04H
Data F002H high order	00H
Data F002H low order	00H
Data F003H high order	00H
Data F003H low order	01H
CRC CHK low order	CRC CHK value to be calculated
CRC CHK high order	

Command code: 06H, write a word.

Example: Write 5000 (1388H) into F004H of the AFE unit whose slave address is 02H.

Master command information

ADDR	02H
CMD	06H
Data address high order	F0H
Data address low order	04H
Data content high order	13H
Data content low order	88H
CRC CHK low order	CRC CHK value to be calculated
CRC CHK high order	

Slave response information

ADDR	02H
CMD	06H
Data address high order	F0H
Data address low order	04H
Data content high order	13H
Data content low order	88H
CRC CHK low order	CRC CHK value to be calculated
CRC CHK high order	

3. Check mode - CRC: CRC (Cyclical Redundancy Check)

In RTU frame format, 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 in the message, and compares the calculated value with the CRC value in the received CRC field. If the two CRC values are different, transmission errors occur.

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 parity bit do not apply to the CRC. During CRC, each eight-bit character is in exclusive or (XOR) with the content in the register. The result is shifted to the least significant bit (LSB), and 0 is filled in 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 to the high-order byte. The CRC simple function is as follows:

```
unsigned int CrcValueCalc(const unsigned int *data, unsigned int length)
{
  unsigned int crcValue = 0xffff;
  int i;
    while (length--)
  {
    crcValue ^= *data++;
    for (i = 8 - 1; i >= 0; i--)
    {
      if (crcValue & 0x0001)
      {
        crcValue = (crcValue >> 1) ^ 0xa001;
      }
      else
      {
        crcValue = crcValue >> 1;
      }
    }
  }
    return (crcValue);
}
```

4. Address definition of communication parameters

This part describes the communication content used to control the running, state, and parameter setting of the AFE unit.

Function parameters can be read and written (except those which cannot be changed because they are only for the factory use):

Rules for parameter address marking:

Parameter group No. and parameter identifying No. are used to express parameter addresses.

High order bytes: A0 to FF

Low-order bytes: 00 to FF

For example, B3-12, the address is expressed as B30C;

Caution:

Group DF: Factory parameter. The parameters in group DF cannot be read or edited.

Some parameters cannot be modified when the AFE unit is running. Some parameters cannot be modified regardless of the state of the AFE unit. In addition, modify parameters according to the setting range, unit, and description of the parameters.

Frequent writing to the EEPROM reduces its service life. Therefore, in communication mode, users can change the values of certain parameters in RAM without storing the settings. To achieve this function, you only need to convert the high order of the parameter address as required, and the corresponding relationship is as follows:

Ax - 0x	Bx - 1x
Cx - 2x	Dx - 3x
Ex - 4x	Fx - 5x

The parameter addresses are expressed as follows:

High order bytes: 00 to 5F

Low-order bytes: 00 to FF

For example, If parameter B3-12 is not stored in EEPROM, the address is expressed as 130C.

Such address is invalid when being read.

Running parameter setting:

Parameter Address	Parameter Description
7000H	Communication setting value (-10000 to +10000) (decimal)

NOTE

◆ The communication setting value is the percentage of a maximum value (maximum frequency or maximum torque) (-100.00% to 100.00%), and can be communicated and read and written.

Input control command to the AFE unit: (write-only)

Command Word Address	Command Function
7001H	0001: Run
	0008: Fault Reset

Setting of output ports: (write-only)

Parameter Address	Parameter Description
7010H	Communication setting value (-10000 to +10000) (decimal)
7020H	FM1 output (0 to 7fff indicate 0% to 100%)
7030H	AO1 (0 to 7fff indicate 0% to 100%)
7031H	AO2 (0 to 7fff indicate 0% to 100%)

State parameter query of the AFE unit: (read-only)

Parameter Address	Parameter Description
6000H to 60FFH	Common state monitoring (corresponding to parameters in group U0)
6100H to 61FFH	Fault parameter querying (corresponding to parameters in group U1)
6300H to 63FFH	Auxiliary variable monitoring (corresponding to parameters in group U3)

Description data of communication fault information (fault code)

Communication Fault Address	Fault Description
8001H	0000: No fault 0001: Password incorrect 0002: Command code error 0003: CRC error 0004: Invalid address 0005: Invalid parameter 0006: Invalid parameter change 0007: System locked 0008: Storing parameters

A.6 Group C1 Communication Parameter Description

	Baud Rate		Default	5
C1-00	Setting Range	0	300BPS	
		1	600BPS	
		2	1200BPS	
		3	2400BPS	
		4	4800BPS	
		5	9600BPS	
		6	19200BPS	
		7	38400BPS	
		8	57600BPS	
		9	115200BPS	
		10	128000BPS	
		11	256000BPS	
		12	512000BPS	

This parameter is used to set a data transmission rate between the host controller and the AFE unit.

Caution: The set baud rate of the host controller must be consistent with that of the AFE unit. Otherwise, communication will fail. The larger the baud rate is, the higher the communication speed will be.

C1-01	Data Format		Default	0
	Setting Range	0	No check: Data format <8-N-2>	
		1	Even parity check: Data format <8-E-1>	
		2	Odd parity check: Data format <8-O-1>	
		3	No check: Data format <8-N-1>	

When an even or odd parity check is used, the length of each byte is 11 bits, including 1 start bit, 8 data bits, 1 check bit, and 1 end bit.

When no check is used, the length of each byte is 11 bits, including 1 start bit, 8 data bits, and 2 or 1 end bit(s).

The set data format of the host controller must be consistent with that of the AFE unit. Otherwise, communication will fail.

C1-02	Local Address	Default	1
	Setting Range	0 to 247, 0 indicates a broadcast address	

This parameter is used to identify the address of the AFE unit. The local address is unique (except for the broadcast address) and is the basis for implementing point-to-point communication between the host controller and the AFE unit.

Caution: When the local address is set to 0 (that is, the broadcast address), the AFE unit can only receive and execute broadcast commands of the host controller, but not respond to the host controller.

C1-03	Response Delay	Default	2 ms
	Setting Range	0 ms to 20 ms	

Response delay: This parameter is used to set the delay from the time when the AFE unit receives the frame matching the local address to the time when it starts returning a response frame. Too short response delay may make the host controller 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 controller only after the response delay is up.

C1-04	Communication Timeout Time	Default	0.0s
	Setting Range	0.0s (invalid), 0.1s to 60.0s	

Starting the timer upon power-on, when the AFE unit does not receive the communication signal within the time set in this parameter, it will report the communication timeout fault (Er016).

When this parameter is set to 0.0s, the system does not detect communication timeout.

It is generally set to invalid. In applications with continuous communication, you can use this parameter to monitor communication status.

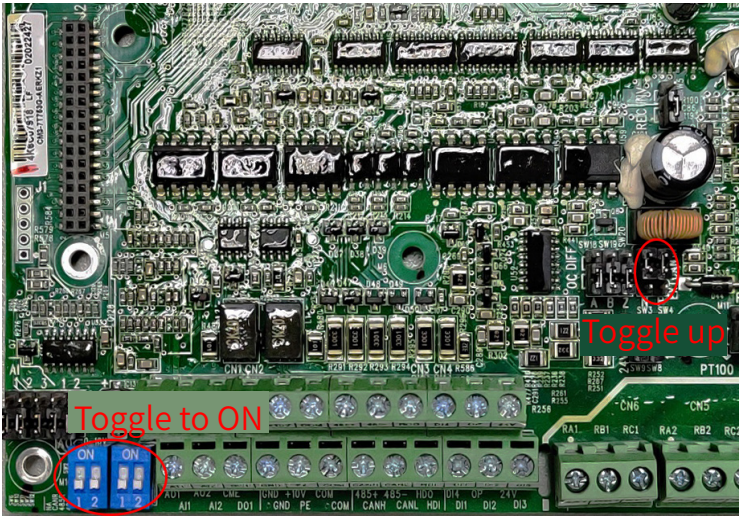
C1-05	Communication Protocol Selection	Default	0
	Setting Range	0: Non-standard Modbus 1: Standard Modbus	

C1-05 =1: Select a standard Modbus protocol.

C1-05 =0: The slave returns one more byte than that in the standard Modbus protocol at the read command.

Other read/write operations are similar to those in the standard Modbus protocol. For details, see "A.5 Communication Data Structure".

A.7 RS485 Communication Jumper and DIP Switch Setting



Appendix B Profibus-DP Communication Card

The Profibus-DP card is specially developed by Inovance to provide Profibus-DP communication function for active front End (AFE) units.

For details about the Profibus-DP communication card, see the respective manual, or consult your local office or vendor.

Appendix C Parameter Table

If DE-00 of the AFE unit is set to a non-zero value (which enables password protection), the parameter menu is accessible in base mode and modification mode only after the correct password is entered. To disable password protection, set DE-00 of the rectifier side to 0.

Groups A and B of the rectifier side are standard parameters, and group U is monitoring parameters.

The symbols in the parameter table are described as follows:

☆ : Parameter settings can be modified when the AFE unit is in the stop or run state.

" ★ ": Parameter settings cannot be modified when the AFE unit is in the run state.

" ● ": The parameter is the actual measured value and cannot be modified.

"*": The parameter is a "default parameter" that can be set only by the manufacturer.

C.1 Standard Parameters Table

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
Group A1 Rectifier Control Parameters					
A1-00	Working mode	0: Uncontrolled rectifier 1: Controlled rectifier, energy can be regenerated to the power supply. 2: Controlled rectifier, energy cannot be regenerated to the power grid.	1	1	★
A1-01	Bus voltage setting	380: 580 V to 720 V 480: 740 V to 840 V 690: 1000 V to 1120 V	0.1 V	380: 610 V 480: 740 V 690: 1050 V	☆
A1-03	Proportional gain of bus voltage closed-loop regulator	0 to 10000	1	Power Class	☆
A1-04	Integral gain of bus voltage closed-loop regulator	0 to 10000	1		☆
A1-05	Proportional gain of current component closed-loop regulator	0 to 10000	1		☆
A1-06	Integral gain of current component closed-loop regulator	0 to 10000	1		☆
A1-09	Rectifier current upper limit	0.0% to 200.0%	0.1% of the rated speed	150.0% of the rated speed	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
A1-12	Detection value of too large rectifier bus voltage deviation	0.0 V to 1000.0 V	0.1 V	50.0 V	☆
A1-13	Detection time of too high rectifier bus voltage deviation	0.1s to 100.0s 0.0s: No detection	0.1s	2.0s	☆
A1-16	Max. energy regenerative current	0 to A1-09 (valid only when A1-00=3)	0.1% of the rated speed	20.0% of the rated speed	☆
A1-17	Phase-locked loop proportional gain	0 to 65535	1	1645	★
A1-18	Phase-locked loop integral gain	0 to 65535	1	1633	★
A1-19	Power factor	(-1.000 to -0.950 or 0.950 to 1.000)	0.01	1	☆
A1-20	Input filter capacitor	100 to 3000 uF	1uF	Depending on models	★
A1-21	Input filter capacitance reactive compensation	0: Invalid, 1: Valid	1	1	☆
A1-22	Start voltage hysteresis-loop width lower limit in non-regenerative mode	-200.0 V to +200.0 V	0.1 V	-10.0 V	☆
A1-23	Stop voltage hysteresis-loop width upper limit in non-regenerative mode	0.0 V to +200.0 V	0.1 V	50.0 V	☆
A1-24	Regenerative current lower limit	-30% to 30% (rated current)	1% of the rated speed	5% of the rated speed	☆
A1-25	Phase sequence auto-tuning enabling	0: Phase sequence auto-tuning disabled 1: Phase sequence auto-tuning enabled (press the Run key after power-on).	1	1	★
A1-26	Zero current detection threshold during phase sequence auto-tuning	0 to 65535	1	100	★

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
A1-27	Results of phase sequence auto-tuning	0: No auto-tuning. 1: The wiring is correct. 2: Switch the wiring of the V phase and W phase; 3: Switch the wiring of the U phase and W phase; 4: Switch the wiring of the U phase and V phase, and then W phase and V phase; 5: Switch the wiring of the U phase and V phase; 6: Switch the wiring of the U phase and W phase, and then V phase and W phase; 7: Auto-tuning failed.	1	0	●
A1-28	Grid voltage correction coefficient	0 to 00.0	0.1	100.0	★
A1-29	Startup protection function	0: The startup protection function is invalid. 1: The startup protection function is valid.	1	0	★
A1-33	Current pre-charge time	0s to 1000s Note: The current is not pre-charged when the value is set to 0.	1s	0s	★
A1-34	Current pre-charge initial value	0 to 150%	1% of the rated speed	0%	★
Group B0 Commonly-used Functions					
B0-00	Main system communication mode	0: DP card 1: Modbus 2: Reserved When B0-02 (command source selection) is set to 2 (communication control), this parameter determines the communication channel to which the run command the system responds.	1	1	★

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
B0-02	Command source selection	0: Operating panel control (indicator OFF) 1: Terminal I/O control (indicator ON) 2: Communication control (indicator blinking) 3: Automatic running	1	0	☆
B0-15	Carrier frequency	2.0 kHzHz to 4.0 kHz	0.1 kHz	3.0 kHz	●
Group B4 DI Terminals					
B4-00	DI1 function selection	0: No function 1: Running enabling 9: Fault reset (RESET) 11: External fault normally closed (NC) input 20: Command source switchover 33: External fault normally open (NO) input 47: Fault detection signal input of an external pre-charge contactor	1	47	★
B4-01	DI2 function selection		1	1	★
B4-02	DI3 function selection		1	9	★
B4-03	DI4 function selection		1	0	★
B4-19	DI filter time	0.000s to 1.000s	0.001s	0.010s	☆
B4-22	DI1 delay	0.0s to 3600.0s	0.1s	0.0s	☆
B4-23	DI2 delay	0.0s to 3600.0s	0.1s	0.0s	☆
B4-24	DI3 delay	0.0s to 3600.0s	0.1s	0.0s	☆
B4-25	DI valid status setting 1	Ones position: DI1. 0: Positive logic, valid when the contactor is closed. 1: Negative logic, valid when the contactor is open. Tens position: DI2 Hundreds position: DI3 Thousands position: DI4	1	0	☆
B4-26	DI valid status setting 2	Ones position: DI6. 0: Positive logic, valid when the contactor is closed. 1: Negative logic, valid when the contactor is open. Tens position: DI7 Hundreds position: DI8	1	0	☆
B4-29	VDI1 function selection	Same as B4-00	1	0	★

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
B4-30	VDI2 function selection	Same as B4-00	1	0	★
B4-31	VDI3 function selection	Same as B4-00	1	0	★
B4-32	VDI4 function selection	Same as B4-00	1	0	★
B4-34	VDI valid state source	Ones position: VDI1 0: Connected to VDOx internally. 1: Whether the parameter setting is valid. Tens position: VDI2 Hundreds position: VDI3 Thousands position: VDI4	1	00000	☆
B4-35	VDI parameter setting valid state	Ones position: VDI1 0: Invalid 1: Valid Tens position: VDI2 Hundreds position: VDI3 Thousands position: VDI4	1	00000	☆
B4-36	AI1 terminal function selection (used as DI)	Same as B4-00	1	0	★
B4-37	AI2 terminal function selection (used as DI)	Same as B4-00	1	0	★
B4-41	DI valid status setting 3	Ones position: AI1 as DI 0: Positive Logic 1: Negative logic Tens position: AI2 as DI	1	0	☆
Group B5 Analog Input Terminals					
B5-00	Pulse minimum input	0.00 kHz to pulse maximum input	0.01 kHz	0.00 kHz	☆
B5-01	Corresponding setting of pulse minimum input	-100.0% to 100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B5-02	Pulse maximum input	Pulse minimum input to 100.00 kHz	0.01 kHz	50.00 kHz	☆
B5-03	Corresponding setting of pulse maximum input	-100.0% to 100.0%	0.1% of the rated speed	100.0% of the rated speed	☆
B5-04	Pulse filter time	0.00s to 10.00s	0.01s	0.10s	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
B5-05	AI curve selection 1	Ones position: AI1 curve selection Tens position: AI2 curve selection 1: Curve 1 (2 points) 2: Curve 2 (2 points) 3: Curve 3 (2 points) 4: Curve 4 (4 points) 5: Curve 5 (4 points)	1	123	☆
B5-06	AI1 filter time	0.00s to 10.00s	0.01s	0.10s	☆
B5-07	AI2 filter time	0.00s to 10.00s	0.01s	0.10s	☆
B5-11	Curve 1 minimum input	0.00 V to curve 1 maximum input	0.01 V	0.00 V	☆
B5-12	Corresponding setting of curve 1 minimum input	-100.0% to +100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B5-13	Curve 1 maximum input	Curve 1 minimum input to +11.00 V	0.01 V	10.00 V	☆
B5-14	Corresponding setting of curve 1 maximum input	-100.0% to +100.0%	0.1% of the rated speed	100.0% of the rated speed	☆
B5-15	Curve 2 minimum input	0.00 V to curve 2 maximum input	0.01 V	0.00 V	☆
B5-16	Corresponding setting of curve 2 minimum input	-100.0% to +100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B5-17	Curve 2 maximum input	Curve 2 minimum input to +11.00 V	0.01 V	10.00 V	☆
B5-18	Corresponding setting of curve 2 maximum input	-100.0% to +100.0%	0.1% of the rated speed	100.0% of the rated speed	☆
B5-19	Curve 3 minimum input	0.00 V to curve 3 maximum input	0.01 V	0.00 V	☆
B5-20	Corresponding setting of curve 3 minimum input	-100.0% to +100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B5-21	Curve 3 maximum input	Curve 3 minimum input to +11.00 V	0.01 V	10.00 V	☆
B5-22	Corresponding setting of curve 3 maximum input	-100.0% to +100.0%	0.1% of the rated speed	100.0% of the rated speed	☆
B5-23	Curve 4 minimum input	0.00 V to curve 4 inflexion 1 input	0.01 V	0.00 V	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
B5-24	Corresponding setting of curve 4 minimum input	-100.0% to +100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B5-25	Curve 4 inflexion 1 input	Curve 4 minimum input to curve 4 inflexion 2 input	0.01 V	3.00 V	☆
B5-26	Corresponding setting of curve 4 inflection 1 input	-100.0% to +100.0%	0.1% of the rated speed	30.0% of the rated speed	☆
B5-27	Curve 4 inflexion 2 input	Curve 4 inflexion 1 input to curve 4 maximum input	0.01 V	6.00 V	☆
B5-28	Corresponding setting of curve 4 inflexion 2 input	-100.0% to +100.0%	0.1% of the rated speed	60.0% of the rated speed	☆
B5-29	Curve 4 maximum input	Curve 4 inflexion 2 input to +11.00 V	0.01 V	10.00 V	☆
B5-30	Corresponding setting of curve 4 maximum input	-100.0% to +100.0%	0.1% of the rated speed	100.0% of the rated speed	☆
B5-31	Curve 5 minimum input	0.00 V to curve 5 inflexion 1 input	0.01 V	0.00 V	☆
B5-32	Corresponding setting of curve 5 minimum input	-100.0% to +100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B5-33	Curve 5 inflexion 1 input	Curve 5 minimum input to curve 5 inflexion 2 input	0.01 V	3.00 V	☆
B5-34	Corresponding setting of curve 5 inflexion 1 input	-100.0% to +100.0%	0.1% of the rated speed	30.0% of the rated speed	☆
B5-35	Curve 5 inflexion 2 input	Curve 5 inflexion 1 input to curve 5 maximum input	0.01 V	6.00 V	☆
B5-36	Corresponding setting of curve 5 inflexion 2 input	-100.0% to +100.0%	0.1% of the rated speed	60.0% of the rated speed	☆
B5-37	Curve 5 maximum input	Curve 5 inflexion 2 input to +11.00 V	0.01 V	10.00 V	☆
B5-38	Corresponding setting of curve 5 maximum input	-100.0% to +100.0%	0.1% of the rated speed	100.0% of the rated speed	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
B5-39	Jump point of ai1 setting	-100.0% to 100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B5-40	Jump amplitude of ai1 setting	0.0% to 100.0%	0.1% of the rated speed	0.5% of the rated speed	☆
B5-41	Jump point of ai2 setting	-100.0% to 100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B5-42	Jump amplitude of ai2 setting	0.0% to 100.0%	0.1% of the rated speed	0.5% of the rated speed	☆
Group B6 Digital Output Terminals					
B6-00	Relay1 output selection	0: No output 1: During running 2: Fault output 7: Overload pre-warning 15: Ready for RUN (output available during running) 16: AI1 > AI2 19: Undervoltage state output 20: Communication setting 22: Overload pre-warning 24: External power-on pre-charge control output 25: Bus voltage limit 26: Ready for RUN 2 (no output during running) 31: Fan output 32: External pre-charge contactor control	1	1	☆
B6-01	Relay2 output selection		1	2	☆
B6-10	DO1 output selection	Same as B6-00	1	0	☆
B6-13	Relay1 output delay	0.0s to 3600.0s	0.1s	0.0s	☆
B6-14	Relay2 output delay	0.0s to 3600.0s	0.1s	0.0s	☆
B6-23	DO1 output delay	0.0s to 3600.0s	0.1s	0.0s	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
B6-26	DO valid status selection 1	Ones position: Relay1 0: Positive Logic 1: Negative logic Tens position: Relay2 Hundreds position: Reserved	1	000	☆
B6-28	DO valid status selection 2	Ones position: DO1 0: Positive Logic 1: Negative logic	1	0	☆
Group B7 Analog Output Terminals					
B7-00	FMP output	2: Output current 4: Output power 5: Output voltage 6: Pulse input 7: AI1 8: AI2 12: Major communication settings 14: DC bus voltage (100.0% corresponding to 2000 V) 15: Grid input voltage (used for the rectifier, 100.0% corresponding to 1300 V) 21: Frequency of rectifier input voltage (100.0% corresponding to 50 Hz)	-	0	☆
B7-01	AO1 selection		-	0	☆
B7-02	AO2 output selection		-	0	☆
B7-06	Maximum FMP output frequency	0.01 kHz to 100.00 kHz	0.01 kHz	50.00 kHz	☆
B7-07	AO1 zero offset coefficient	-100.0% to 100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B7-08	AO1 gain	-10.00 to 10.00	0.01	1.00	☆
B7-09	AO2 zero offset coefficient	-100.0% to 100.0%	0.1% of the rated speed	0.0% of the rated speed	☆
B7-10	AO2 gain	-10.00 to 10.00	0.01	1.00	☆
Group BA Faults and Protection					
BA-07	Overtemperature pre-warning	0° C to 100° C	1°C	70°C	☆
BA-08	Detection time for rectifier input contactor fault Err178	0.50s to 30.0s	0.1s	0.5s	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
BA-09	Fault automatic reset count	0 to 100	1	0	☆
BA-10	DO action during auto fault reset	0: Not act 1: Action	-	0	☆
BA-11	Automatic fault reset interval	0.1s to 100.0s	0.1s	1.0s	☆
BA-12	Time of clearing auto reset count	0.1 hours to 1000.0 hours	0.1h	1.0h	☆
BA-22	Grid fault auto reset selection 1	0: Invalid 1: Valid Ones position: Incomplete phase lock Tens position: Too high AC input voltage Hundreds position: Too low AC input voltage Thousands position: Too high AC input frequency Ten thousands position: Too low AC input frequency	-	0	★
BA-23	Grid fault auto reset selection 2	0: Invalid 1: Valid Ones position: Unbalanced AC input voltage Tens position: Unbalanced AC input current Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	-	0	★
BA-24	Grid fault judgment condition selection 1	1: Judgment Ones position: Incomplete phase lock Tens position: Too high AC input voltage Hundreds position: Too low AC input voltage Thousands position: Too high AC input frequency Ten thousands position: Too low AC input frequency	-	11111	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
BA-25	Grid fault judgment condition selection 2	0: No judgment 1: Judgment Ones position: Unbalanced AC input voltage Tens position: Unbalanced AC input current Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	-	11111	☆
BA-38	Rectifier voltage upper limit	500.0 to 2000.0	0.1	380 V: 800 V 480 V: 850 V 690 V: 1200 V	☆
BA-41	Pre-charge resistor protection selection	0: Invalid, 1: Valid	-	1	☆
BA-42	Software overvoltage threshold	0: Invalid 0.0 to 5000.0 V	0.1 V	0	☆
BA-43	Software overcurrent threshold	0: Invalid 0.00 A to 655.35 A	0.01 A	1	☆
BA-44	Grip fault protection selection 1	0: Invalid 1: Valid Ones position: Incomplete phase lock Tens position: Too high AC input voltage Hundreds position: Too low AC input voltage Thousands position: Too high AC input frequency Ten thousands position: Too low AC input frequency	1	11111	☆
BA-45	Grip fault protection selection 2	0: Invalid 1: Valid Ones position: Unbalanced AC input voltage Tens position: Unbalanced AC input current Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	1	11	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
Group C1 Modbus Communication					
C1-00	Baud rate	0: 300BPS 1: 600BPS 2: 1200BPS 3: 2400BPS 4: 4800BPS 5: 9600BPS 6: 19200BPS 7: 38400BPS 8: 57600BPS 9: 115200BPS	1	5	☆
C1-01	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, 8-N-1	1	0	☆
C1-02	Local address	1 to 247, 0: broadcast address	1	1	☆
C1-03	Response delay	0 ms to 20 ms	1 ms	2 ms	☆
C1-04	Communication timeout time	0.0s: No communication timeout detection 0.1s to 60.0s: Communication Timeout Time	0.1s	0.0s	☆
C1-05	Communication protocol	0: Non-standard Modbus 1: Standard Modbus	1	0	☆
Group C2 Profibus DP Communication					
C2-01	Profibus DP address	1 to 125 Set to the slave address configured for the DIP switch on the DP card	1	3	☆
C2-02	Data transmission format	1: PPO1 format 2: PPO2 format 3: PPO3 format 5: PPO5 format	1	5	☆
C2-03	Serial communication baud rate between DP card and AFE unit	0: 115.2 kbps 1: 200 kbps 2: 256 kbps 3: 512 kbps	1	2	☆
C2-04	The master station sends the mapping address of PZD2.	0 to 3000	1	–	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
C2-05 to C2-14	The master station sends the mapping address of PZD3 - The master station sends the mapping address of PZD12.	0 to 3000	1	–	☆
C2-15	The AFE unit responds to the mapping address of PZD2.	0 to 3000	1	–	☆
C2-16 to C2-25	The AFE unit responds to the mapping address of PZD3 - The AFE unit responds to the mapping address of PZD12.	0 to 3000	1	–	☆
Group D3 Control Optimization Parameters					
D3-03	Rapid current limiting function	0: Invalid, 1: Valid	1	1	☆
D3-09	Undervoltage threshold	60.0% to 300.0%	0.1% of the rated speed	100.0% of the rated speed	☆
D3-12	Grid overvoltage protection threshold	Grid undervoltage protection threshold (D3- 13) to 1500 V	1 V	Determined by voltage class	★
D3-13	Grid undervoltage protection threshold	0 V to grid overvoltage protection threshold (D3-12)	1 V	Determined by voltage class	★
D3-14	Grid overfrequency protection threshold	Grid under-frequency protection threshold (D3-15) to 100.00 Hz	0.01 Hz	55.00 Hz	★
D3-15	Grid underfrequency protection threshold	0.00 Hz to grid over-frequency protection threshold (D3-14)	0.01 Hz	45.00 Hz	★
Group DD AI/AO Correction					
DD-00	AI1 measured voltage 1	0.500 V to 3.500 V	0.001 V	Factory-corrected	☆
DD-01	AI1 displayed voltage 1	0.500 V to 3.500 V	0.001 V	Factory-corrected	☆
DD-02	AI1 measured voltage 2	6.500 V to 9.500 V	0.001 V	Factory-corrected	☆
DD-03	AI1 displayed voltage 2	6.500 V to 9.500 V	0.001 V	Factory-corrected	☆

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
DD-04	AI2 measured voltage 1	0.500 V to 3.500 V	0.001 V	Factory-corrected	☆
DD-05	AI2 displayed voltage 1	0.500 V to 3.500 V	0.001 V	Factory-corrected	☆
DD-06	AI2 measured voltage 2	6.500 V to 9.500 V	0.001 V	Factory-corrected	☆
DD-07	AI2 displayed voltage 2	6.500 V to 9.500 V	0.001 V	Factory-corrected	☆
DD-20	AO1 target voltage 1	0.500 V to 3.500 V	0.001 V	Factory-corrected	☆
DD-21	AO1 measured voltage 1	0.500 V to 3.500 V	0.001 V	Factory-corrected	☆
DD-22	AO1 target voltage 2	6.500 V to 9.500 V	0.001 V	Factory-corrected	☆
DD-23	AO1 measured voltage 2	6.500 V to 9.500 V	0.001 V	Factory-corrected	☆
DD-24	AO2 target voltage 1	0.500 V to 3.500 V	0.001 V	Factory-corrected	☆
DD-25	AO2 measured voltage 1	0.500 V to 3.500 V	0.001 V	Factory-corrected	☆
DD-26	AO2 target voltage 2	6.500 V to 9.500 V	0.001 V	Factory-corrected	☆
DD-27	AO2 measured voltage 2	6.500 V to 9.500 V	0.001 V	Factory-corrected	☆
Group DE Parameter Management					
DE-00	User password	0 to 65535	1	0	☆
DE-01	Parameter initialization	0: No operation 1: Restores factory settings, without restoring AI/AO correction parameters (group DD) 2: Clear records 3: Restore AI/AO correction parameters only (group DD)	1	0	★

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
DE-02	Menu mode	Ones position: 1: Advanced menu, with all parameters displayed Tens position: 0: No function 1: Advanced menu, with all parameters displayed 2: Monitor menu, with parameters in group U displayed 3: Check menu, only parameters that are different from the default values are displayed. Hundreds position: Same as tens position	1	21	☆
DE-04	Read-only user password	0 to 65535	1	0	☆
DE-05	LED running display parameter 1	Same as the sequence of U0-00 to U0-15	1	31	☆
DE-06	LED running display parameter 2	Same as the sequence of U0-16 to U0-31	1	0	☆
DE-07	LED display in the stop state	Bit01: Bus voltage (V) Bit02: DI state Bit03: DO state Bit04: AI1 voltage (V) Bit05: AI2 voltage (V) Bit11: PID setting	1	31	☆
DE-09	STOP key function	0: The STOP key is valid only in the operating panel control mode. 1: The STOP key is valid in any control mode.	1	0	☆
DE-10	Energy regeneration accumulative value resetting	0: Invalid 1: The energy regeneration accumulative value is reset.	1	0	☆
Group DF Reserved					

C.2 Monitoring Parameters

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
Group U0 Common State Monitoring					
U0-02	Bus voltage	-	0.1 V	-	●
U0-03	Mains voltage	-	1 V	-	●
U0-04	Grid current	-	0.1 A	-	●
U0-05	Output power	-	0.1 kW	-	●
U0-06	Regenerative energy		1°	-	●
U0-07	DI state	-	1	-	●
U0-08	DO state	-	1	-	●
U0-09	AI1 input voltage	-	0.01 V	-	●
U0-10	AI2 input voltage	-	0.01 V	-	●
U0-16	PID setting	-	1	-	●
U0-17	PID feedback	-	1	-	●
U0-20	Pulse input frequency	-	0.01 kHz	-	●
U0-21	Input voltage of the rectifier	Displayed only for the rectifier (valid value)	1 V	-	●
U0-23	Pulse input frequency 2	Pulse input frequency	1 Hz	-	●
U0-38	Running state	bit0: 1 - running bit1: 1 - faulty	1	-	●
U0-39	Current fault	Current fault, 0 indicating no fault currently	1	-	●
U0-45	Frequency of rectifier input voltage	-	0.01 Hz	-	●
U0-51	DI state display	-	-	-	●
U0-52	DO state display	-	-	-	●
U0-58	Output power 1	-	0.1 kW	-	●
U0-59	Output power 2	-	0.1 kW	-	●
U0-60	AI1 setting	-	0.1% of the rated speed	-	●
U0-61	AI2 setting	-	0.1% of the rated speed	-	●
Group U1 Fault Parameter Querying					
U1-00	Latest fault	-	1	-	●
U1-02	Grid voltage upon a fault	-	0.1 V		●
U1-01	Frequency instruction upon a fault	-	0.01 Hz	-	●
U1-03	Output current upon a fault	-	0.1 A	-	●
U1-04	Bus voltage upon a fault		0.1 V	-	●

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
U1-05	Current running time upon a failure	-	1s		●
U1-06	Heatsink temperature upon a fault	-	1	-	●
U1-07	DI state upon failure	-	1	-	●
U1-08	DO state upon failure	-	1	-	●
U1-09	Current running time upon a failure	-	1h	-	●
U1-10	Contents of the fault that occurred 1 time ago	-	1	-	●
U1-11	Grid frequency upon failure	-	0.01 Hz	-	●
U1-12	Grid voltage upon a fault	-	0.1 V		●
U1-13	Output current upon a fault	-	0.1 A	-	●
U1-14	Bus voltage upon a fault	-	0.1 V	-	●
U1-15	Current running time upon a failure	-	1s		●
U1-16	Heatsink temperature upon a fault	-	1	-	●
U1-17	DI state upon failure	-	1	-	●
U1-18	DO state upon failure	-	1	-	●
U1-19	Current running time upon a failure	-	1h	-	●
U1-20	Contents of the faults that occurred 2 times ago	-	1	-	●
U1-21	Grid frequency upon failure	-	0.01 Hz	-	●
U1-22	Grid voltage upon a fault	-	0.1 V		●
U1-23	Output current upon a fault	-	0.1 A	-	●
U1-24	Bus voltage upon a fault	-	0.1 V	-	●
U1-25	Current running time upon a failure	-	1s		●
U1-26	Heatsink temperature upon a fault	-	1	-	●
U1-27	DI state upon failure	-	1	-	●
U1-28	DO state upon failure	-	1	-	●
U1-29	Current running time upon a failure	-	1h	-	●

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
U1-30	Contents of the faults that occurred 3 times ago	-	1	-	●
U1-31	Grid frequency upon failure	-	0.01 Hz	-	●
U1-32	Grid voltage upon a fault	-	0.1 V		●
U1-33	Output current upon a fault	-	0.1 A	-	●
U1-34	Bus voltage upon a fault	-	0.1 V	-	●
U1-35	Current running time upon a failure	-	1s		●
U1-36	Heatsink temperature upon a fault	-	1	-	●
U1-37	DI state upon failure	-	1	-	●
U1-38	DO state upon failure	-	1	-	●
U1-39	Current running time upon a failure	-	1h	-	●
U1-40	Contents of the faults that occurred 4 times ago	-	1	-	●
U1-41	Grid frequency upon failure	-	0.01 Hz	-	●
U1-42	Grid voltage upon a fault	-	0.1 V		●
U1-43	Output current upon a fault	-	0.1 A	-	●
U1-44	Bus voltage upon a fault	-	0.1 V	-	●
U1-35	Current running time upon a failure	-	1s		●
U1-46	Heatsink temperature upon a fault	-	1	-	●
U1-47	DI state upon failure	-	1	-	●
U1-48	DO state upon failure	-	1	-	●
U1-49	Current running time upon a failure	-	1h	-	●
Group U3 Auxiliary Variable Monitoring					
U3-00	Heatsink temperature	-	1°C	-	●
U3-01	Software version	-	0.01	-	●
U3-02	Product version	-	0.001	-	●
U3-07	Performance software obj version No.	-		-	●

Parameter	Name	Setting Range	Minimum Unit	Default	Description of Change
U3-09	AI1 uncalibrated voltage	-	0.001 V	-	●
U3-10	AI2 uncalibrated voltage	-	0.001 V	-	●
U3-14	Temperature sensor voltage before correction	-	0.001 V	-	●

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