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CS710 Series
AC Drive for Cranes

User Guide

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

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Legal Information

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The contents are subject to change without notice due to product upgrade.

Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Introduction

Thank you for purchasing Inovance's CS710 series AC drive for cranes.

This product is a new-generation AC drive with enhanced performance and enriched functions designed for cranes by Inovance. It supports high-performance vector control on asynchronous motors and supports built-in complex hoisting process control functions such as anti-sway and grab. It is mainly used to drive asynchronous motors for operations of cranes, such as hoisting, horizontal motion, and rotation.

This user guide describes how to use the CS710 series AC drive for cranes properly. Read through this user guide before use (including installation, operation, maintenance, and inspection). Comprehend the safety precautions before use.

Precaution
◆ The drawings in the user guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions. ◆ The drawings in the user guide are shown for descriptions only and may not match the product you purchased. ◆ The contents of this guide are subject to change at any time due to product upgrades, specification modifications, or improvement to the usability and accuracy of the guide. ◆ If the user guide is damaged or lost, contact our regional agents or customer service centers to order the user guide. ◆ Contact Inovance customer service center for concerns during use.

Revision history

Date	Version	Revision
June 2026	A18	● Updated parameters and faults. ● Added anti-sway function description in "Product Information". ● Updated "3.2.1 Standard Wiring Diagram." ● Updated dimensions of MD32NKE1. ● Added descriptions of MD500-EN1 and MD500-ECAT communication cards. ● Added the LCD operating panel model in section "Description of the Operating Panel".
October 2025	A17	● Added "Legal Information", "1.2 Industrial Information Security", and "Service and Support". ● Added descriptions of Er453 in "8.1 Safety Instructions". ● Updated the causes and solutions for fault Er453 in "8.5 Fault Information and Troubleshooting".
December 2024	A16	● Updated the front cover, back cover, and "Introduction". ● Added UL-certified cable selection instructions in "3.2.3 Main Circuit Cabling, Dimensions, and Recommended Cables". ● Updated the value range of A0.05 to 0 rpm to 65535 rpm in "6.1 Parameter List on Level One Menu (Group A)". ● Added information on the ECAT communication card, EIP communication card, Modbus TCP communication card, and CANlink communication card in "9.3 Option List". ● Added the selection guide table for electrical components in "9.4.1 Selection of Fuses, Contactors, and Circuit Breakers". ● Updated the quantity of 315 kW power braking components to 3 and added descriptions of the braking resistor in "9.5.3 Braking Resistor Selection". ● Updated the terminal layout of the expansion card and the description of DIP switches in "10.2.2 RS485 Expansion Card (MD38TX1)". ● Made minor corrections.

Date	Version	Revision
July 2024	A15	● Updated the front cover and back cover. ● Added a note for the nameplate and model number. ● Deleted all Y3-M3 throughout the document. ● Updated the resistance of the PE terminal grounding cable to 4 Ω. ● Updated "3.2.3 Layout and Dimensions of Main Circuit Terminals" to "3.2.3 Cabling, Dimensions, and Recommended Cable Selection of Main Circuit Terminals." ● Added the following communication modes for CS710 to b3.00: Modbus RTU, EtherCAT, EtherNet/IP, CANopen, PROFIBUS DP, and PROFINET. ● Added AO2 function selection, relay Y1 function selection, and P/A-P/C function selection (MD38IO3, CS700IO1) to the b3.20 parameter. ● Added the EtherCAT and EtherNet/IP communication cards as the expansion cards to the bd.08 parameter. ● Updated "8.2.2 Main Circuit Insulation Test". ● Added the note to "8.3.2 Number of Fans on the AC Drive": CS710-4T0.4GB to CS710-4T1.1GB models do not have cooling fans.
July 2024	A15	● Changed the overload capacity to "150% of the rated current for 60s at 40° C" in Table 9-1 CS710 series AC drive models and technical data. Added the allowed frequency range 47.5 Hz to 63 Hz for the power supply. ● Updated "Example of a command to write data to the slave". ● Made minor corrections.

Date	Version	Revision
June 2024	A14	● Updated the front cover, back cover, and preface. ● Deleted CS710 series AC drives of -L models from "1.1 Nameplate and Model". ● Updated the maximum power of CS710 series AC drives from 450 kW to 400 kW in the following sections: 1) "1.2 Components" 2) "3.1.2 Mounting Clearance and Orientation" 3) "3.1.4 Mounting in a Cabinet" 4) "3.1.5 Removing and Installing the Cover" 5) "3.2.1 Standard Wiring Diagram" 6) "3.2.2 Main Circuit Terminals" 7) "3.2.3 Layout and Dimensions of Main Circuit Terminals" 8) "3.2.4 Requirements on Main Circuit Wiring Tools" 9) "8.3.2 Number of Fans on the AC Drive" 10) "8.3.3 Replacement of Cooling Fans" 11) "9.1 Technical Data" 12) "9.2.3 Dimensions of 200-400 kW AC Drive Models (Without Reactor Base)" 13) "9.2.4 Dimensions of 200-400 kW AC Drive Models (with Reactor Base)" 14) "9.2.5 Mounting Bracket Dimensions" 15) "9.4.1 List of Peripheral Electrical Components" 16) "9.5.3 List of Braking Components" ● Updated parameter names and descriptions of b3.20 and U0.01 in "6.2 Level-2 Menu (Group b, Group E*, Group U) Parameter List." ● Updated the fault cause and solution for fault code Er*41 in "7.5 Error Codes and Solutions." ● Added the EMC filter selection list in "B.3 Selection of Peripheral EMC Devices."
November 2023	A13	● Updated the front cover, back cover, and preface. ● Added models of crane technique cards used for the bF.18 parameter and updated the CANopen communication protocol for bd.11 to bd.18 in "6.2 Level-2 Menu (Group b, Group E*, Group U) Parameter List." ● Added level descriptions for fault codes in "7.5 Error Codes and Solutions."
June 2023	A12	Updated some incorrectly displayed pictures.

Date	Version	Revision
March 2023	A11	Updated parameters b1.02, b6.00, b6.08, bc.00, and bE.01. Deleted parameters b6.10 to b6.11. Added parameters b6.20 to b6.25, bC.10, and bF.30, and the FD group. Added fault code Er*52. Updated fault code Er*47. Updated the allowable minimum braking resistance of MDBUN-200-5T in "9.5.1 Braking Unit Selection." Updated descriptions of jumper J2 and D4 functions in "10.1.4 Multi-functional I/O Expansion Card."
October 2021	A10	Added notes about encoder jumpers. Updated the parameter b3.15.
July 2021	A09	Added output magnetic ring codes.
November 2020	A08	Made minor corrections.
September 2020	A07	Made minor corrections.
June 2020	A06	Added data of the MD500-PN1 communication card. Updated "3.2.1 Standard Wiring Diagram." Updated "7.6 Fault Symptoms and Solutions." Updated Figure 5-5 in "5.8 Frequency Reference Selection." Updated descriptions of A0.07 in "6.1 Level-1 Menu (Group A) Parameter List." Updated descriptions of bb.03 in "6.2 Level-2 Menu (Group b, Group E*, Group U) Parameter List." Updated the mounting hole data of 200 kW to 450 kW models.
April 2019	A05	Added data of the CS700IO1 expansion card. Deleted data of the CS700RC1 expansion card and added data of the CS700RC2 expansion card instead. Added "8.3.5 Replacement of the Lightning Protection Board." Updated "7.6 Fault Symptoms and Solutions."
October 2018	A04	Updated Inovance's logo. Updated the jumper of AI1 to J9 in "5.9.2 AI Descriptions." Updated the default setting of b3.14 to 1. Updated T to "Applicable Reactor Type" in "1.1 Nameplate and Model Number." Updated the fault description of 50# to 7.
June 2020	A03	Updated "5.9.2 AO Descriptions." Updated parameters b3.14, b3.20, b6.10, b6.17, bF.11, bd.07, and U0.26. Updated applicable models for the optional cards in "Table 9-6 List of optional parts." Added reactor models of 0.4 kW to 15 kW AV drives in "Table B-11 Recommended AC input reactor models." Added reactor models of 0.4 kW to 15 kW AV drives in "Table B-13 Recommended AC output reactor models."

Date	Version	Revision
July 2017	A02	Standardized the guide chapters, resorted the chapters, and added data of 0.4 kW to 15 kW models. Updated the guide as follows: Updated "1.2 Components." Added installation of new models in Chapter 3. Added the one-key quick auto-tuning function in 5.10.2. Updated AF.02, b3.14 to b3.18, b3.19 to b3.20, and bd.07, added b6.09, bb.08, and bc.00, and deleted group b9 in "6 Parameter List." Added new models, and updated main circuit cable selection, and "Table 9-12 Recommended braking components" and "Table 9-7 Recommended peripheral electrical components for CS710 series AC drives" in Chapter 9. Updated "10.2.1 CANopen Expansion Card (MD38CAN2)." Updated "PZD Zone Data Definition." Added "Definition of PDO Data and Parameter Addresses."
March 2017	A01	Updated "Table B-13 Recommended AC output reactor models."
May 2015	V0.0	First release

§ Access to the guide

The guide is not delivered along with the product. You can obtain the PDF version in the following ways:

- Visit https://www.inovance.com/global, and choose "Service&Support > Support > Documentation Download".
- Scan the QR code on the product with your smartphone.
- Scan the QR code below to install the My Inovance app, and search for the user guide in the app.

§ Warranty disclaimer

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. Maintenance will be charged after the warranty expires.

Even within the warranty period, maintenance can be charged for the following product damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by using the product for unintended functions
- Damage caused by using the product outside the specified scope
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

When applicable, relevant maintenance fee will be charged according to the latest Price List of Inovance. If otherwise agreed upon, the agreed terms and conditions shall prevail.

For details, see the Warranty Card.

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1 Fundamental Safety Instructions

1.1 General Safety Precautions

Safety Disclaimer

- This chapter provides essential safety instructions for proper use of the product. Before using this product, read through the guide and comprehend all the safety instructions. Failure to comply with the safety instructions may result in death, severe injury, or equipment damage.
- "DANGER", "WARNING", and "CAUTION" signs in this guide are only supplements to the safety instructions, and do not reflect all safety instructions to be followed.
- Use this product according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injury or property damage caused by improper use.

Safety levels and definitions



Indicates that failure to comply with the notice can result in death or severe personal injury.



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



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

General Safety Instructions

- Drawings in the guide are sometimes shown without covers or protective guards. Install the covers or protective guards as specified, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.
- Operators must take mechanical precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking

WARNING

- Do not install the product in the case of any damage, rust, or signs of use on the product or accessories upon unpacking.
- Do not install the product in the case of water seepage into the product or missing or damaged components upon unpacking.
- Do not install the product in the case of any discrepancy between the product you received and the product name on the packing list.

CAUTION

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the unpacking sequence. Do not strike the package violently.
- Check the equipment and its accessories for any signs of damage, rust, or scratches upon unpacking.
- Check whether the package contents are consistent with the packing list before unpacking.

Storage and transportation

WARNING

- Large or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply could result in personal injury or equipment damage.
- Before hoisting the equipment, ensure that components such as the front cover and terminal blocks are secured firmly with screws. Loosely connected components may fall off and result in personal injury or equipment damage.
- Do not stand or stay below the product which is being hoisted.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply could result in personal injury or equipment damage.


CAUTION

- Handle the equipment with care and mind your step during transportation to prevent personal injury or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply could result in personal injury.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply could result in equipment damage.
- Do not store or transport the equipment in locations where the equipment may be exposed to splashing water or rain, direct sunlight, strong electric field, strong magnetic field, or strong vibration.
- Store the equipment for up to three months. Take stricter protective measures and carry out the necessary inspections for a longer storage time.
- Pack the equipment securely and properly before transportation. Use a fully enclosed container for long-distance transportation.
- Do not transport the equipment with other devices or items that may impact or cause harm to the equipment.

Installation


DANGER

- This equipment must be operated only by trained and qualified electrical personnel. Non-professionals must not operate this equipment.
- Ensure peripheral power distribution requirements are met, and select air switches, fuses, cables, and cable terminals correctly.
- Use standard torque for screw fastening, and use appropriate terminal crimping design for crimping terminals.
- Ensure heat dissipation requirements are met and design inlet and outlet airflow duct properly.
- Avoid environments with dripping water and conductive foreign objects (such as carbon fiber filaments, conductive metal dust, and metal chips).

WARNING

- Read through the safety instructions and user guide before installation.
- The edges of the equipment metal enclosure are sharp. Note the following precautions during installation to avoid personal injury or cable damage:
- When performing installation, handling, or maintenance operations, always wear cut-resistant gloves.
- Avoid direct skin contact with enclosure edges and cut surfaces during operation.
- Do not install this equipment in places with strong electric or magnetic field.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply may result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in an enclosed environment (such as a cabinet or case), use cooling devices (such as fans or air conditioners) to cool the space and meet the installation environment requirements. Failure to do so can result in equipment overtemperature or fire accidents.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When this product is mounted in a cabinet or terminal device, protection measures such as a fireproofing shell, electric protection shell, or mechanical protection shell must be provided for the cabinet or terminal device. The IP level must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply may result in a fire.

CAUTION

- Cover the top of the product with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the product and causing faults. After installation, remove the cloth or paper on top of the product to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- Before wiring, switch off all power supplies of the device. Wait for at least 10 minutes before further operations because residual voltage still exists in the internal capacitor even after power-off.
- Do not perform wiring, remove the equipment cover, or touch the circuit board and other exposed live parts with power on. Failure to comply can result in electric shock.
- Make sure that the equipment and product are grounded properly. Failure to comply can result in the risk of electric shock.

WARNING

- Do not connect the power cable to output terminals of the equipment or product. Failure to comply may cause equipment damage or even a fire.
- Avoid direct skin contact with enclosure edges and cut surfaces during operation.
- Route cables carefully during wiring. Avoid pressing them against sharp edges, which may cause squeezing or cutting. It is recommended to use protective sleeves or route cables away from such edges.
- If the enclosure has a protective film, remove it only after installation is completed and all work involving sharp edges has been finished.
- When connecting a drive with the motor, make sure that the phase sequences of the AC drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used must comply with corresponding cross-sectional area and shielding requirements. The shield of the shielded cable must be grounded at one end properly.
- Tighten the terminal screws with the torque specified in the user guide. Insufficient or excessive torque may cause overheating and damage to the joint, which could result in fire. After wiring, make sure there are no fallen screws or exposed wire inside the cabinet or product.
- After wiring, be sure that all cables are connected properly with no screws, gaskets, or exposed cables inside the product, or it may result in an electric shock or equipment damage.

CAUTION

- During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply may result in damage to the equipment or internal circuits.
- Use the shielded twisted pair cable to wire the control circuit, and connect the shield to the grounding terminal of the equipment. Failure to comply may result in equipment malfunction.

Power-on



- Before power-on, check that the equipment is installed properly with secure wiring and the motor can be restarted.
- Before power-on, ensure that the power supply meets equipment requirements. Failure to comply will result in equipment damage or even a fire.
- After power-on, do not open the cabinet door or protective cover of the equipment. Do not touch any terminals, or remove any part of the equipment at power-on. Failure to comply will result in an electric shock.



- Perform a trial run after wiring and parameter setting to ensure that the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in a fire. Using an incorrect supply voltage may cause a fire.
- Before power-on, check that no one is near the equipment, motor, or other mechanical parts. Failure to comply may result in personal injuries or even death.

Operation



- The equipment must be operated only by professionals. Failure to comply can result in injury or death.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply could result in electric shock.



- Do not touch the enclosure, fan, or resistor with bare hands. Failure to comply may result in burns.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

Maintenance

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment with power-on. Failure to comply may result in an electric shock.
- Before maintenance, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.
- When using a permanent magnet (PM) motor, do not touch the motor terminals while the motor is rotating, because induced voltage may be present at the terminals even after the product is powered off. Failure to comply may result in electric shock.

WARNING

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

Repair

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not repair the equipment with power-on. Failure to comply may result in electric shock.
- Before inspection or repair, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.

WARNING

- Submit a request for repair based on the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time specified on the warning label before power-on or other operations. Failure to comply may result in personal injury or death and equipment damage.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not operate damaged equipment. Failure to comply may result in worse damage.
- Recheck the wiring and reset the parameters after equipment replacement.

Disposal

WARNING

- Dispose of the retired equipment in accordance with applicable national regulations and standards. Failure to comply could result in property damage, personal injury, or death.
- Recycle retired equipment in accordance with industry waste disposal standards to avoid environmental pollution.

Safety Labels

To ensure safe operation, comply with safety labels on the equipment and do not damage or remove the labels. See the following table for descriptions of the safety labels.

Safety Labels	Description
	● Before using the equipment, read the guide and safety precautions carefully. Failure to comply may result in personal injury, death, or equipment damage. ● Do not touch the terminals or remove the cover with power-on or within 10 min after power-off. Failure to comply may result in an electric shock.

1.2 Industrial Information Security

The product provides an interface to connect to the network and transmits data through the network interface. To protect factories, systems, machines, and networks from cyberattacks, it is essential to implement proper protection mechanism for industrial security.

Customers are responsible for providing and maintaining a secure connection between the product and their network or any other network to protect their factories, systems, machines, and networks from unauthorized access. Such systems or machines can be connected to an enterprise network or the Internet only when a secure connection is established and appropriate security measures (such as using antivirus software or installing firewalls) are in place.

Inovance continuously develops and improves its products and solutions to enhance safety. It is strongly recommended that you update the product promptly and always use the latest version.

CAUTION

Malware (such as viruses, Trojans, and worms) can bring the device into an unsafe operating state, resulting in death, serious injury, and property damage. Observe the following precautions:

- Always use the latest software version. If the product version is no longer supported or the latest version is not used, you will be exposed to increased risk of cyber attacks.
- Develop and maintain appropriate protective measures (including but not limited to antivirus software, firewalls, WAF, IPS/IDS, situational awareness system, identity authentication, data encryption) to prevent the files in mobile storage devices from being damaged by malware, and to protect the products, networks, systems, and interfaces from unauthorized access, tampering, hacking, data leakage, or information theft.
- Check all safety-related interfaces and settings after commissioning.

2 Product Information

2.1 Nameplate and Number

CS 710 - 4T 55 G B -T

Code	Product name
CS	AC drive for cranes

Code	Product series
710	710 series

Code	Voltage class
4T	Three-phase 380-480 V

Code	Applicable motor
...	...
22	22 kW
...	...
110	110 kW
...	...

Code	Reactor
N/A	18.5 to 22 kW models without DC reactors
-T	18.5 to 22 kW models with DC reactors

Code	Built-in braking unit
N/A	Without the braking unit
B	With the braking unit

Code	Applicable motor type
G	Heavy-load model

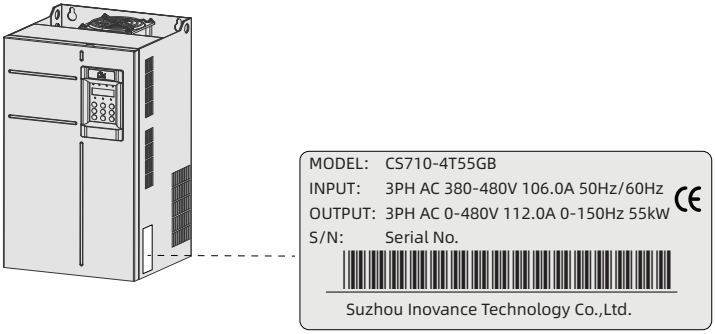


Figure 2-1 Nameplate and model

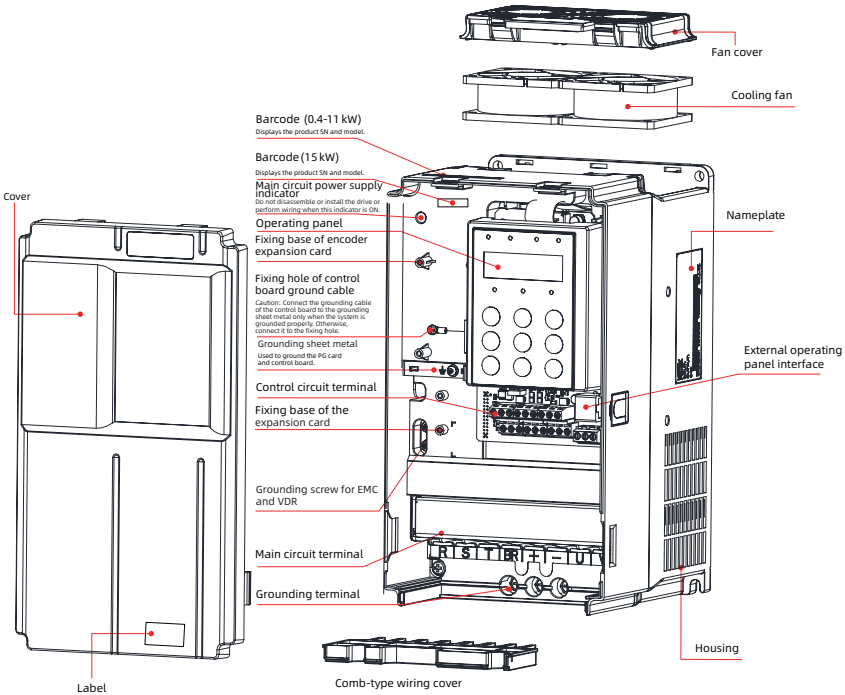
NOTE

The preceding nameplate is for reference purpose only. Actual nameplates may vary.

If you need the anti-sway function, select the -F model.

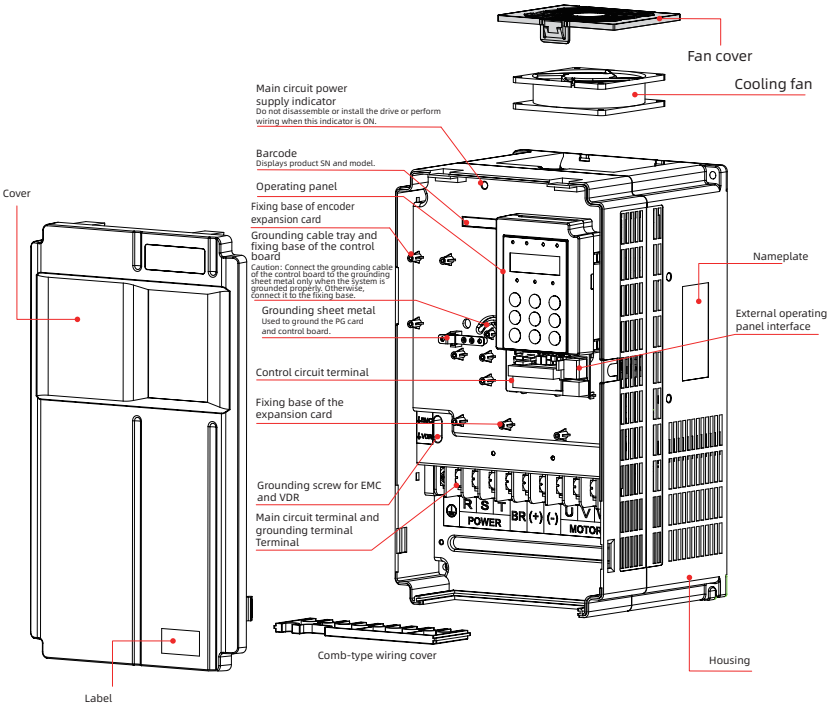
2.2 Component Descriptions

Depending on the voltage and power rating, the CS710 series AC drive has either a plastic housing or a sheet metal housing, as shown below.



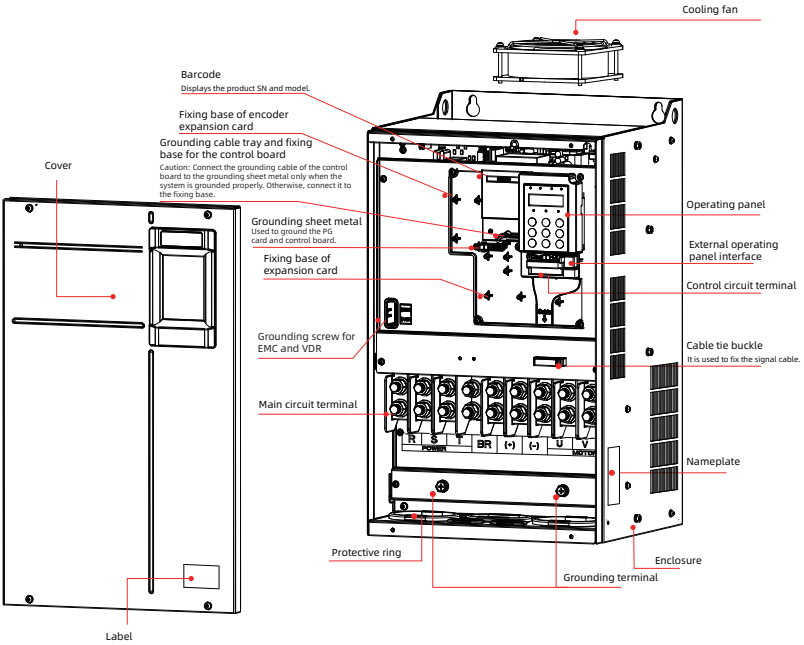
Label		Lable Description
⚠	📖	Caution! Please read and understand this user manual before installation and operation.
⚠	10min	Danger! Do not remove the cover with power-on or within 10 minutes after power-off.

Figure 2-2 Components (three-phase 380–480 V, 0.4–15 kW)



Label		Label description
⚠	📖	Caution! Please read and understand this user manual before installation and operation.
⚠	10min	Danger! Do not remove the cover with power-on or within 10 minutes after power-off.

Figure 2-3 Components (three-phase 380–480 V, 18.5–37 kW)



Label	Label description
	Caution! Please read and understand this user manual before installation and operation.
	Danger! Do not remove the cover with power-on or within 10 minutes after power-off.

Figure 2-4 Components (three-phase 380–480 V, 45–160 kW)

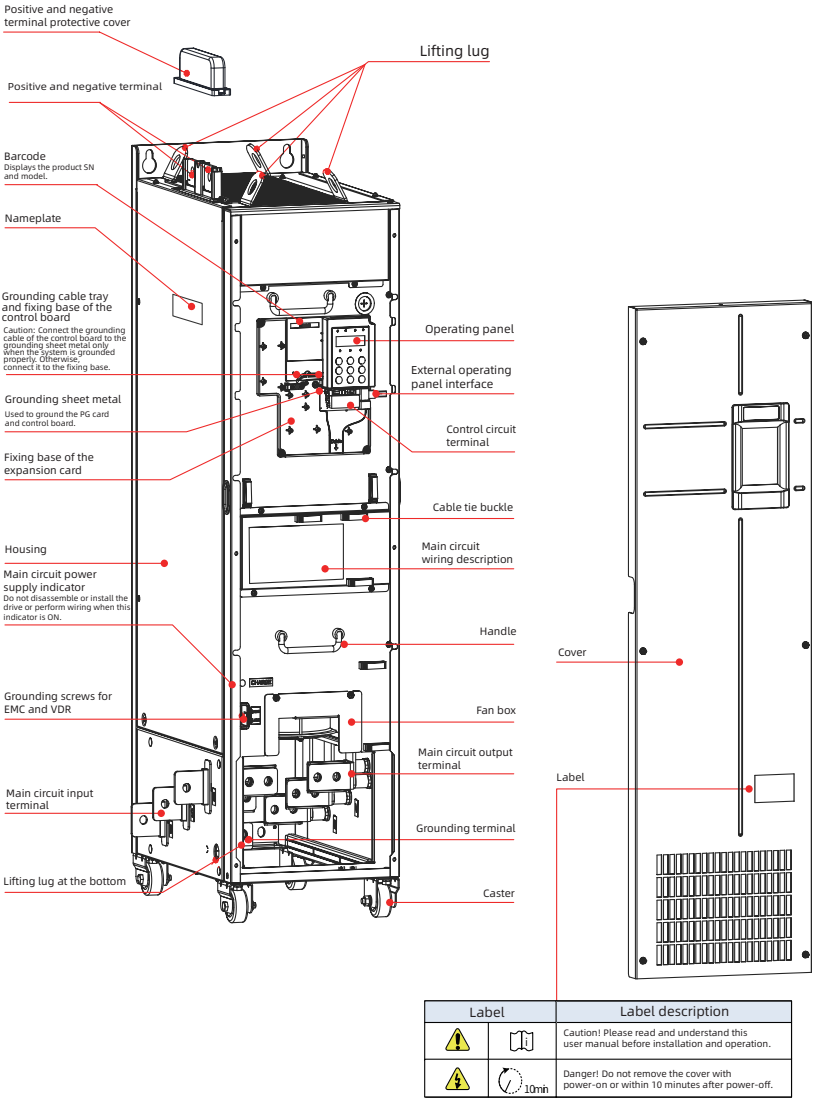


Figure 2-5 Components (three-phase 380–480 V, 200–400 kW)

3 System Connection

3.1 System Connection Diagram

To use the CS710 series AC drive to control a motor, install a variety of electrical components on both input and output sides to ensure system safety and stability. The following figure shows the system connection of a CS710 series AC drive with three-phase 380–480 V/0.4 kW or higher rating.

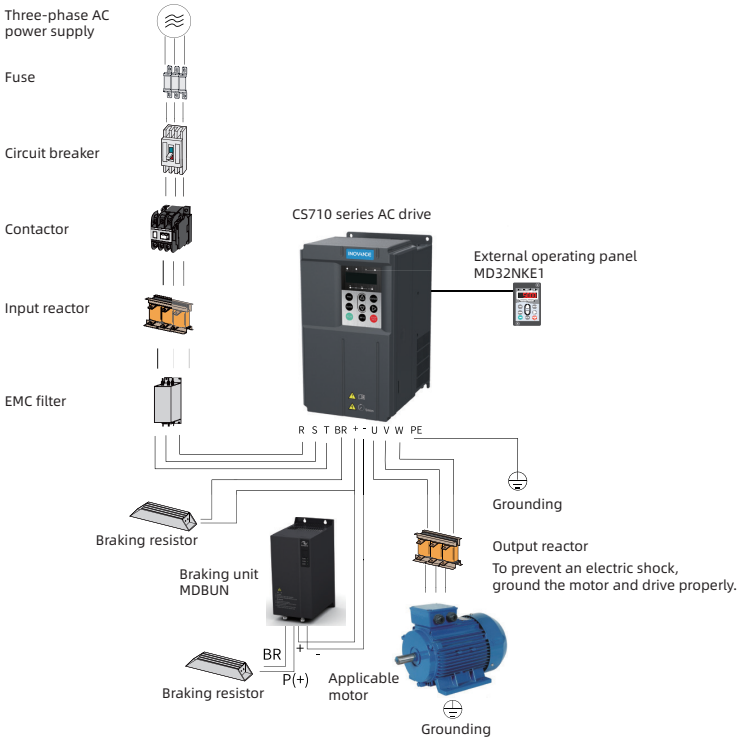


Figure 3-1 CS710 system connection

NOTE

The preceding figure is a connection diagram of the CS710 AC drive only for your , see "10 Specifications and Selection".

3.2 System Peripherals

Table 3-1 Instructions for using the peripheral electrical components of the CS710 system

Name	Installation position	Function description
Circuit breaker	Between the power supply and the AC drive input side	Circuit breaker: When overcurrent occurs on downstream devices, it cuts off the power supply to prevent accidents.
		Residual current device (RCD): The drive may generate high-frequency leakage current during running. To prevent electric shock which may cause a fire, select a proper RCD based on actual applications.
Fuse	Between the power supply and the AC drive input side	Prevents accidents caused by short circuit.
Electromagnetic contactor	Between the breaker and AC drive input side	Switches ON/OFF the AC drive. Do not start/stop the AC drive frequently by switching the contactor ON/OFF (interval: at least one hour) nor use it to directly start the AC drive.
Input reactor	Input side of the drive	Improves the power factor on the input side. Eliminates harmonics at the input side effectively and prevents damages to other devices caused by the distortion of voltage waveform. Eliminates input current unbalance due to inter-phase unbalance.
EMC filter	Input side of the drive	Reduces the conduction and radiation interference generated from the AC drive to the outside. Reduces conduction interference flowing from power supply to the AC drive and improves the anti-interference capacity of the AC drive.
DC reactor	Standard DC reactor of 30 kW or higher, and optional DC reactor of 18.5 kW to 22 kW	Improves the power factor on the input side. Improves the overall efficiency and thermal stability of the AC drive. Eliminates harmonics on the input side and reduces the conduction and radiation interference generated from the AC drive to the outside.
Braking Resistor	Models of 75 kW and below	Selects a braking resistor; Consumes the regenerative energy generated during deceleration.
Braking unit	Models of 90 kW and above	Uses the braking unit (MDBUN) of Inovance and the recommended braking resistor. Consumes the regenerative energy generated during deceleration.

Name	Installation position	Function description
Output reactor	Between the AC drive output side and the motor (close to the AC drive)	Harmonics are present in the output side of the drive. When motor is far from AC drive, there is excessive distributed capacitance in the circuit. Certain harmonics may cause resonance in the circuit, which can: (a) damage the motor after long-term operation due to deteriorated insulation performance. (b) trigger fault protections frequently due to high leakage current. If the distance between the AC drive and the motor is greater than 100 m, it is recommended to install an AC output reactor.
dv/dt reactor	Output side of the AC drive (close to the AC drive)	Protects the motor insulation and reduces the bearing current.
Output magnetic ring	Output side of the AC drive (close to the AC drive)	Reduces bearing current.
Motor	Output side of the drive	Use a proper motor.



- Do not install a capacitor or surge protection device (SPD) on the output side of drive. Failure to comply can result in faults or damage the capacitor and surge protection device.
- Inputs/Outputs (main circuit) of the AC drive contain harmonics, which may interfere with communication devices near the AC drive. Therefore, install an anti-interference filter to minimize the interference.

4 Installation and Wiring

4.1 Installation

4.1.1 Installation Environment

1) Ambient temperature: The AC drive's service life is greatly influenced by the ambient temperature. Do not run the AC drive under a temperature exceeding the allowed temperature range (-10° C to +50° C).

2) The AC drive generates large amount of heat during operation. Install the AC drive on the surface of an incombustible object and leave sufficient space for heat dissipation. The drive generates significant heat during working. In addition, install it to the mounting bracket vertically with screws.

3) Install the drive in a place that meets the following requirements:
1. Gravitational vibration not higher than 0.6 g and away from vibration sources such as a punch press

2. Free from direct sunlight, humidity, and water drops

3. Free from corrosive, flammable, and explosive gases

4. Free from greasy dirt and dust

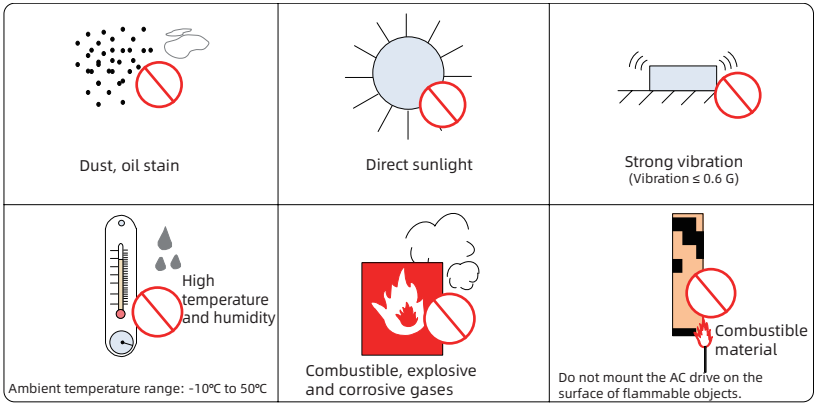


Figure 4-1 Installation Environment Requirements

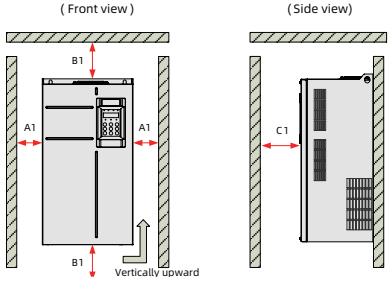
4) The CS710 series AC drive is a cabinet-mounted product and needs to be installed and used in a final system. The final system must provide corresponding enclosures for fireproof, electrical, and mechanical protection, and comply with local laws and regulations and relevant IEC standards.

4.1.2 Installation Clearance and Direction

1） Installation Clearance

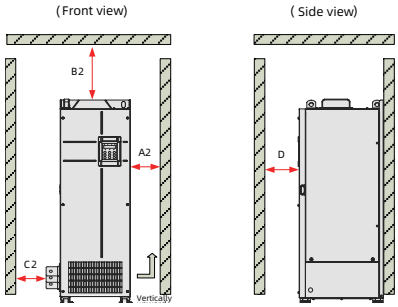
The mounting clearance varies with the power rating of the AC drive.

- Installing one drive



Power rating	Required clearance (mm)		
0.4 kW to 15 kW	A1 ≥ 10	B1 ≥ 200	C1 ≧ 40
18.5 kW to 22 kW	A1 ≥ 10	B1 ≥ 200	C1 ≧ 40
30 kW to 37 kW	A1 ≥ 50	B1 ≥ 300	C1 ≧ 40
45 kW to 160 kW	A1 ≥ 50	B1 ≥ 300	C1 ≧ 40

Figure 4-1 Installation clearance for a single drive (three-phase 380–480 V, 0.4–160 kW)

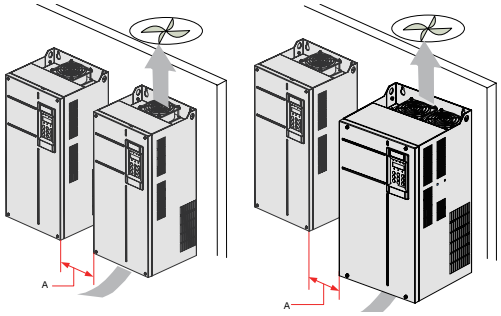


Power rating	Required clearance (mm)	
200 kW to 400 kW	A2 ≥ 10	B2 ≥ 250
	C2 ≥ 20	D2 ≧ 20

Figure 4-2 Installation clearance for a single drive [three-phase 380–480 V, 200–400 kW]

- Installing multiple drives

The CS710 series AC drive dissipates heat upward. When multiple AC drives are required to work together, install them side by side.



Power rating	Required clearance (mm)
0.4 kW to 15 kW	A ≥ 10
18.5 kW to 22 kW	A ≥ 10
30 kW to 37 kW	A ≥ 50
45 kW to 160 kW	A ≥ 50

Figure 4-3 Installation clearance for side-by-side installation of multiple drives

In applications requiring servo drives to be installed in two rows, install an air guide plate to prevent the overtemperature/overload fault that may occur due to heat dissipated from the lower row to the upper row.

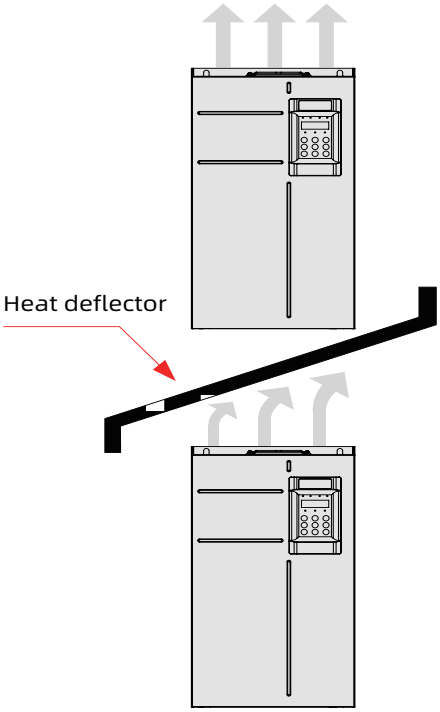


Figure 4-4 Dual-row installation requirement

NOTE

Models of 200 to 400 kW cannot be installed above one another.

2) Installation Direction

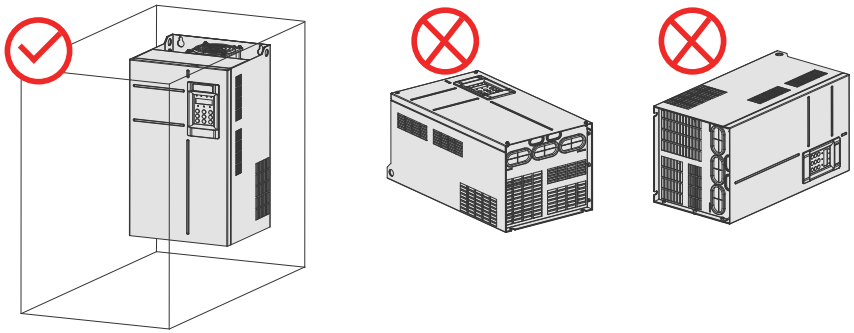


Figure 4-5 Installation direction

4.1.3 Mounting Direction

The applicable installation method varies with power ratings of different models of the CS710 series. Observe the following requirements during installation.

1) Backplate mounting and through hole mounting for 0.4–160 kW models

- Backplate mounting

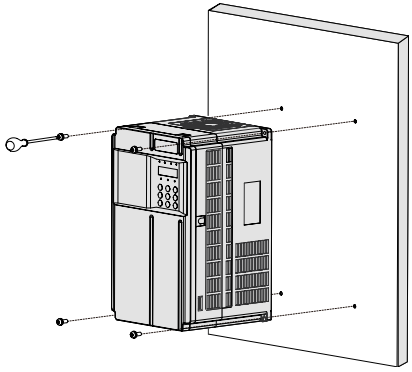


Figure 4-6 Backplate mounting for 0.4–37 kW models

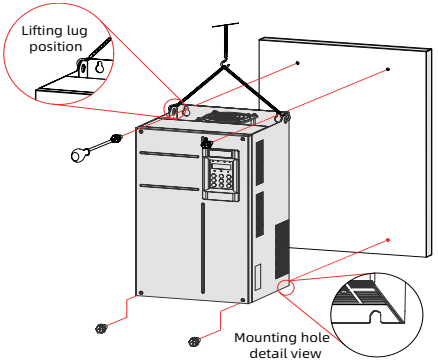
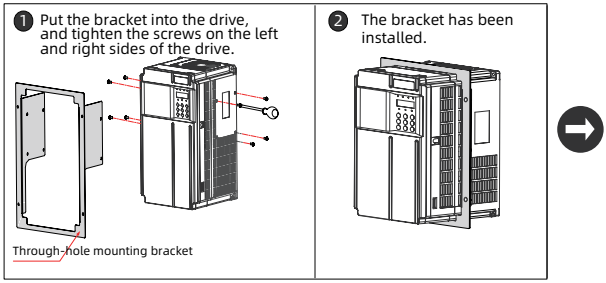


Figure 4-7 Backplate mounting for 45-160 kW models

NOTE

Fix the drive with four nuts. Do not fasten only the upper two nuts on the drive. Otherwise, the drive may fall off due to uneven stress distribution during long-time operation.

- Through-hole Mounting



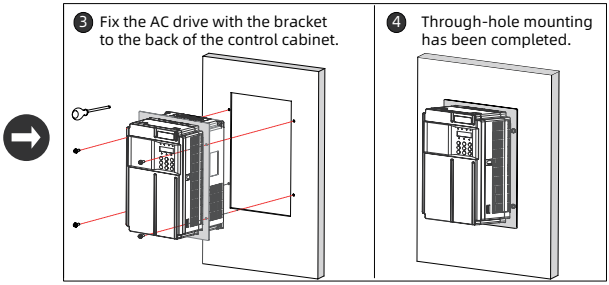
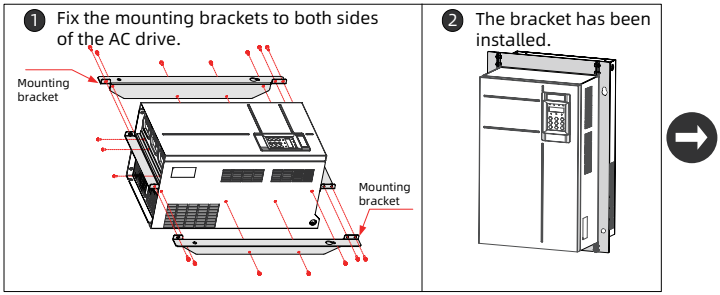


Figure 4-8 Through-hole mounting for 0.4–37 kW models



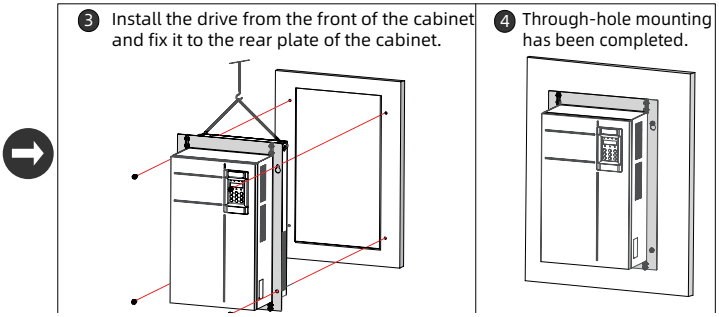


Figure 4-9 Through-hole mounting for 45–160 kW models

- Through-hole mounting bracket model

Table 4-1 Models of through-hole mounting brackets

Through-hole mounting bracket model	Applicable model
MD500-AZJ-A1T1	CS710-4T0.4GB
	CS710-4T0.7GB
	CS710-4T1.1GB
	CS710-4T1.5GB
	CS710-4T2.2GB
	CS710-4T3.0GB
MD500-AZJ-A1T2	CS710-4T3.7GB
	CS710-4T5.5GB

Through-hole mounting bracket model	Applicable model
MD500-AZJ-A1T3	CS710-4T7.5GB
	CS710-4T11GB
MD500-AZJ-A1T4	CS710-4T15GB
MD500-AZJ-A1T5	CS710-4T18.5GB(-T)
	CS710-4T22GB(-T)
MD500-AZJ-A1T6	CS710-4T30GB
	CS710-4T37GB
MD500-AZJ-A1T7	CS710-4T45GB
	CS710-4T55GB
MD500-AZJ-A1T8	CS710-4T75GB
	CS710-4T90G
	CS710-4T110G
MD500-AZJ-A1T9	CS710-4T132G
	CS710-4T160G

4.1.4 Mounting in the Cabinet

1) Ventilation

Only one AC drive of models CS710-4T200G to CS710-4T400G can be mounted in a cabinet. Reserve sufficient ventilation space around the AC drive. Follow the following instructions for specific model and application scenarios.

- Self-ventilated cabinet (without fans on the top)

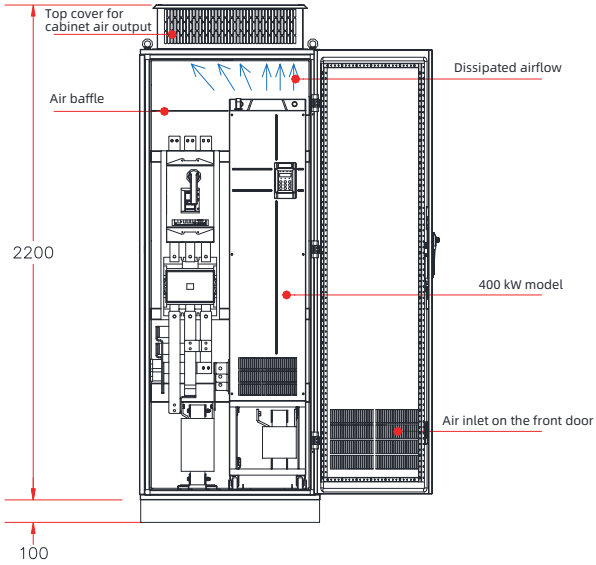


Figure 4-10 Cabinet supporting passive exhaust (unit: mm)

Table 4-2 Parameters of a passive-ventilated cabinet

Model	Quantity of fans	Total airflow at operating point (CFM)	Effective Area of the Cabinet Air Inlet (mm2)	Effective Area of the Cabinet Air Outlet (mm2)
CS710-4T132G	2	541	31809	50894
CS710-4T160G	2	620	31809	50894
CS710-4T200G	2	586	31809	50894
CS710-4T220G	2	722	31809	50894
CS710-4T250G	3	789	47713	76341
CS710-4T280G	3	882	47713	76341
CS710-4T315G	3	644	47713	76341
CS710-4T355G	3	796	47713	76341
CS710-4T400G	3	796	47713	76341
Note: 1. CFM = 0.0283 m^3/min 2. "Effective Area" indicates the through-hole area.				

- Cabinet with fans on the top

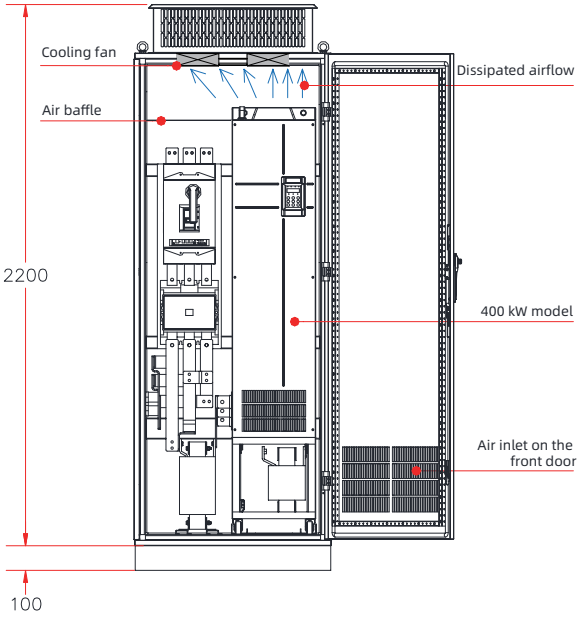


Figure 4-11 Cabinet with top-mounted fan (unit: mm)

Table 4-3 Parameters of a forced-ventilated cabinet

Model	Quantity of fans	Total airflow at operating point (CFM)	Actual effective area of the air inlet of top-mounted exhaust fan cabinet (mm^2)	Max. air volume required by the exhaust fan in the top-mounted exhaust fan cabinet (CFM)	Actual effective area of the air outlet of the top-mounted exhaust fan cabinet (mm^2)
CS710-4T132G	2	541	31809	649	S = 0.942 x N x (Dout2 - DHUB2) In the preceding formula, N indicates the number of top-mounted exhaust fans, Dout indicates the diameter of the top-mounted exhaust fan, and DHUB indicates the diameter of the top-mounted exhaust fan hub.
CS710-4T160G	2	620	31809	744	
CS710-4T200G	2	586	31809	703	
CS710-4T220G	2	722	31809	866	
CS710-4T250G	3	789	47713	947	
CS710-4T280G	3	882	47713	1058	
CS710-4T315G	3	644	47713	773	
CS710-4T355G	3	796	47713	955	
CS710-4T400G	3	796	47713	955	
Note: 1. CFM = 0.0283 m3/min2. "Effective Area" indicates the through-hole area.					

As shown in the following figure, an insulation barrier is required to prevent hot air exhausted by the CS710 series AC drive from flowing back into the cabinet.

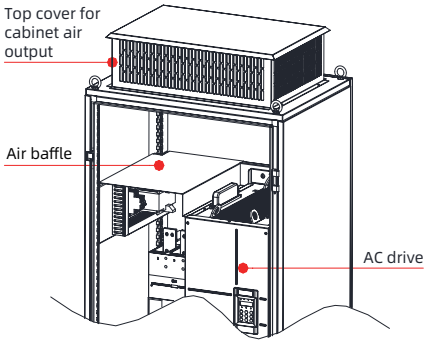


Figure 4-12 Air baffle in a cabinet

2） Pre-installation precautions

The nine-fold profile cabinet (PS cabinet) is recommended. Before installing the AC drive, install the bottom mounting bracket and guide rail inside the cabinet and use a mounting beam drilled with holes for fixing the drive. Reserve enough clearance inside the cabinet for connecting the copper busbar of the AC drive.

The drive can be pushed into and pulled out of the cabinet via mounting guide rails and four casters at its bottom. Note: Align the drive casters with guide rails before pushing in or pulling out. For safety purposes, the drive must be held by two persons during push-in or pull-out.

CAUTION

- The installation clearance is shown in the figure. Reserve sufficient clearance for heat dissipation of the AC drive, taking into account heat dissipation of other devices in the same cabinet.
- Operate the copper busbar of the main circuit power cable with a socket tool with an extension rod.
- Before pushing/pulling the drive in/out of the cabinet, align the casters of the drive with the guide rails. Ensure that these operations are performed by two operators working together to ensure safety.
- Refer to the cabinet layout diagram when installing the AC drive in a cabinet. The cabinet frame is 2200 x 800 x 600 (in mm, including the H200 cabinet ventilation top cover). Add the H100 cabinet base to ensure proper installation of the cabinet. Install an insulation barrier at the top inside the cabinet to prevent the heat dissipated by the CS710 from circulating in the cabinet. Reserve air vents at the lower part of the cabinet door.
- For details about dimensions of the mounting bracket (delivered with the drive), see "10 Specifications and Selection". Besides, check that the strength and stiffness of the guide rail meet requirements.
- After the drive is pushed into the cabinet, remove the paperboard from the air outlet of the drive to exhaust the hot air, preventing the overtemperature fault.
- Backplate mounting is not available for AC drives of 200 kW to 400 kW because suspended devices may be damaged during transportation or in environments with strong vibration. These models can only be installed in a cabinet, which requires a mounting bracket or base at the bottom of the AC drive.

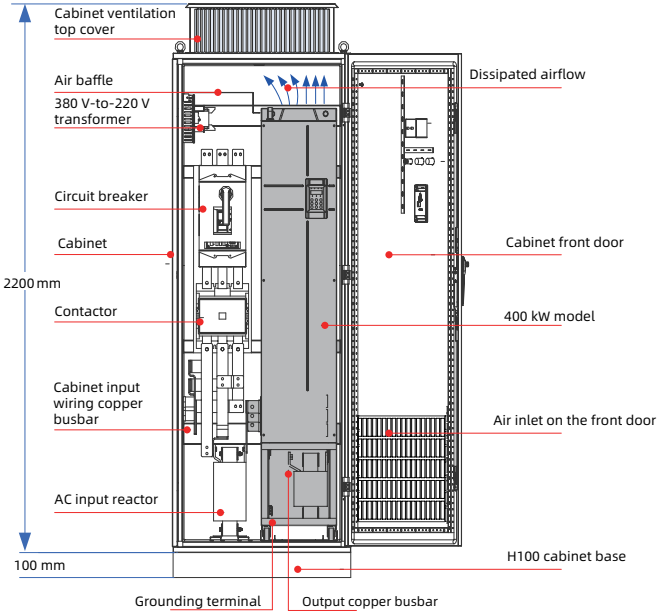


Figure 4-13 Recommended cabinet layout

3） Installation inside the cabinet

No.	Procedure
1	Install the mounting beam in the nine-fold profile cabinet.
2	Fix the bottom mounting bracket in the nine-fold profile cabinet.
3	Assemble the guide rail (option) and connect the guide rail to the cabinet.
4	Remove the cover from the AC drive to expose the auxiliary handle on the drive.
5	Align the AC drive caster with the guide rail and push the drive slowly into the cabinet. Use auxiliary lifting ropes during installation to prevent the drive from tipping over when being pushed in or pulled out.
6	Remove the soft strap. There are two mounting holes at the back of the AC drive. Secure the mounting holes at the top and bottom parts at the back of the AC drive to secure the AC drive to the mounting beam.
7	After installation is done, remove the guide rail.

- Fixing the mounting beam and reserving fixing holes

1. A nine-fold profile cabinet (PS cabinet) is recommended for installation of the drive. The cross sectional area of the nine-fold profile cabinet is shown in Figure 4-15.

2. To install the CS710-4T200G to CS710-4T400G models into a nine-fold profile cabinet with the depth of 600 mm, bend the fixing beam inwards (as shown in Figure 4-16). (This step is unnecessary if the AC drive is installed in a standard cabinet with the depth of 800 mm or above.)

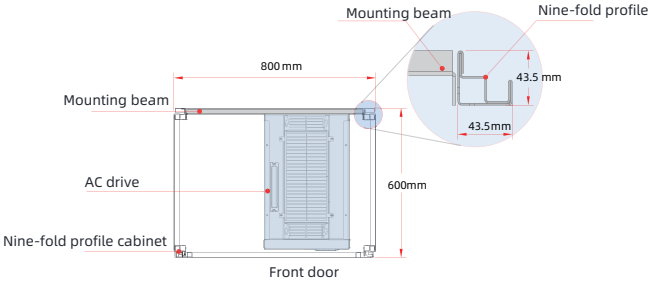


Figure 4-14 Top view of a 200-400 kW cabinet

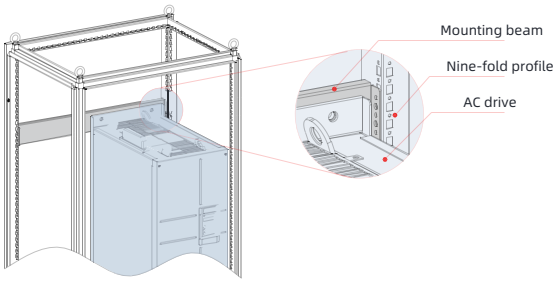


Figure 4-15 3D view of a 200–400 kW cabinet

NOTE

However, if the standard cabinet with the depth of 600 mm has both front and rear doors, it cannot house the CS710-4T200G to CS710-4T400G models. In this case, install the AC drive into a standard cabinet with the depth of 800 mm.

- Fixing the bottom mounting bracket

1. Fix the mounting bracket to the base of the nine-fold profile cabinet by using six M5 self-tapping screws.

2. If the cabinet used is not a nine-fold profile cabinet, the fixing holes of the mounting bracket need to be drilled and assembled on site.

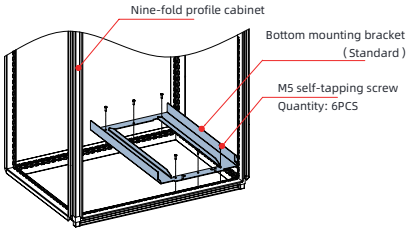


Figure 4-16 Installation of the bottom mounting bracket

Optional guide rail model: MD500-AZJ-A3T10

Install the guide rail properly as shown in Figure A. Figure B show what it looks like when the guide rail is installed.

Then, align the two round holes in the front end of the guide rail with the screws of the mounting bracket, and tighten with two M6 nuts, as shown in Figure C.

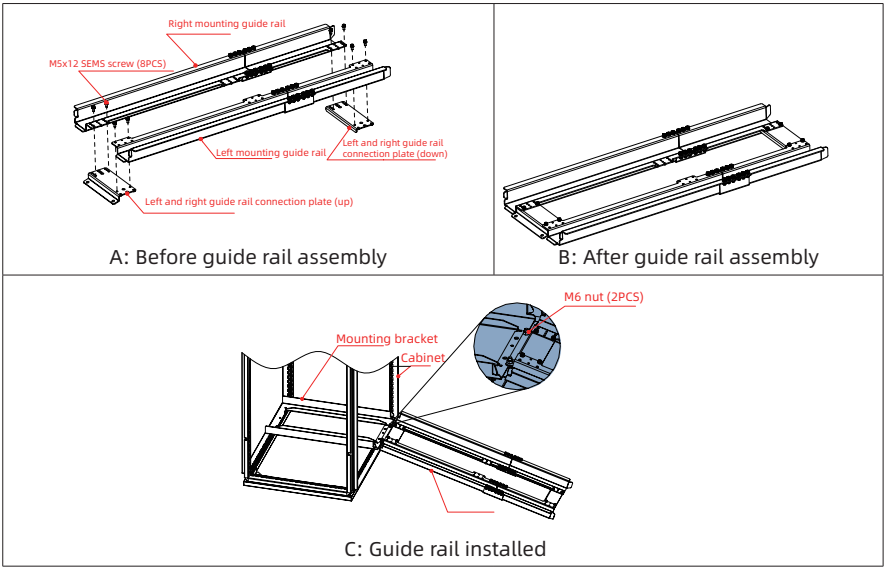


Figure 4-17 Installation of the guide rails in the cabinet

Read through the operation instructions for the guide rail before use.

- Pushing the drive into the cabinet

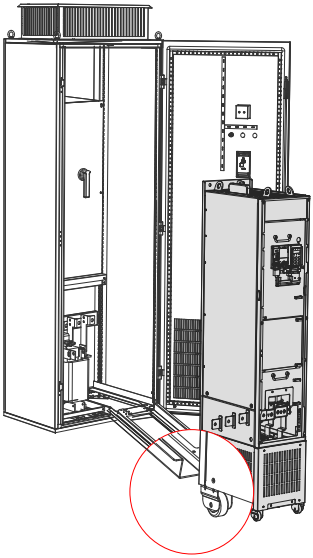


Figure 4-18 Aligning the drive casters with the guide rail

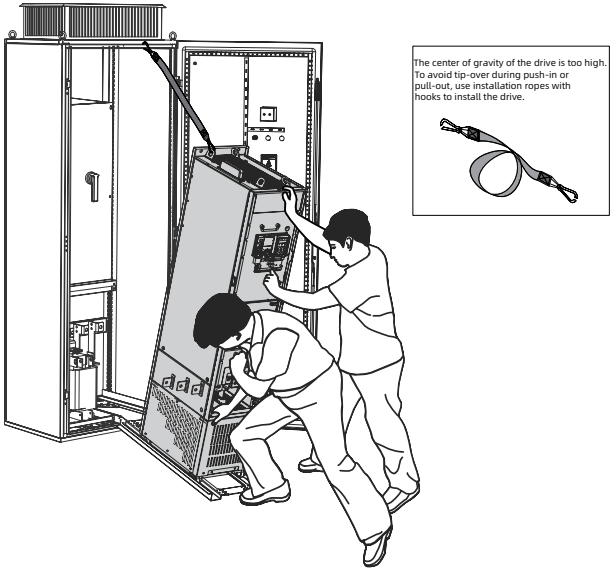


Figure 4-19 Slowly pushing the drive into the cabinet

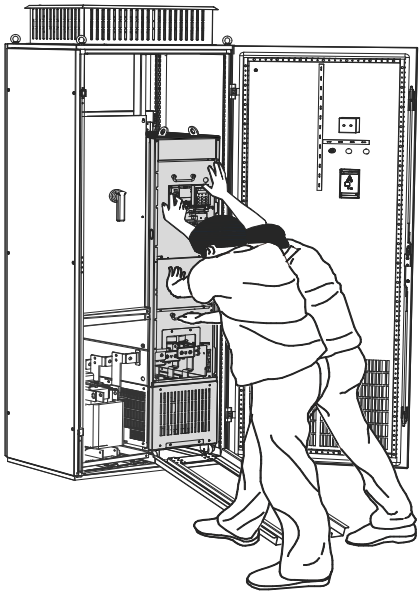


Figure 4-20 Drive mounted in cabinet

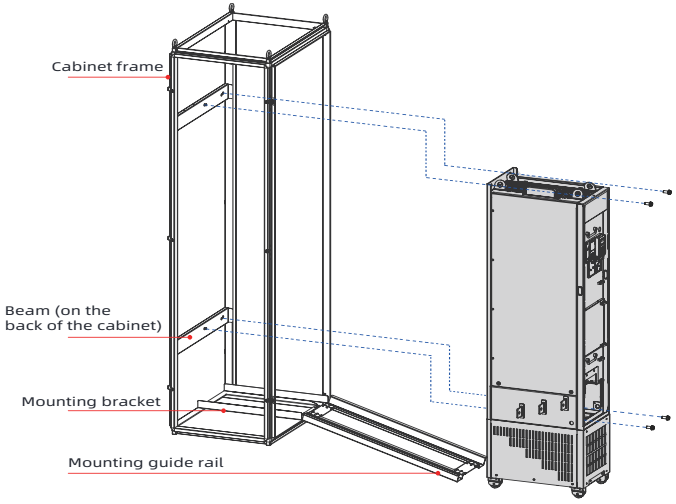


Figure 4-21 Fixing the drive to the cabinet beam through the four fixing holes on the back of the drive

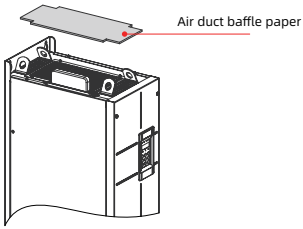
4） Precautions for Installing the AC drive inside the cabinet

Remove the drive from the cabinet based on the same procedure, but in the reverse

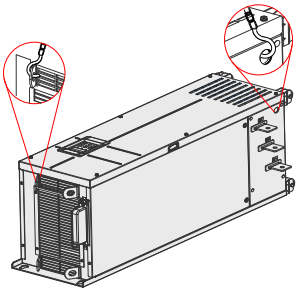
order.

Ensure the four backplate mounting holes on the back of the drive are connected to the mounting beam securely.

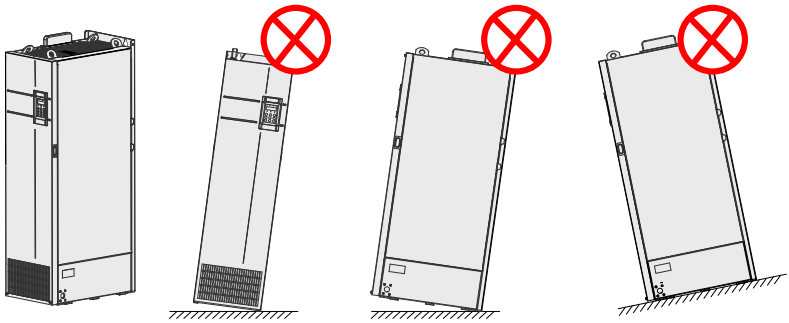
Remove the air filter damper at the top of the AC drive after installation. (The air filter damper is used to prevent foreign objects such as screws from falling into the air filter during installation of the AC drive into the cabinet.)



Use the eye bolt on the top of the AC drive to lift or move the drive. To lift an AC drive that is lying flat, use the lift fittings on the top and bottom of the drive. Do not apply force on the positive and negative bus terminals.



If the AC drive needs to be placed in an upright position, ensure the tilt angle of the place that holds the drive does not exceed 5° . Failure to comply may lead to rollover of the drive due to its heavy weight (nearly 200 kg) and large size.



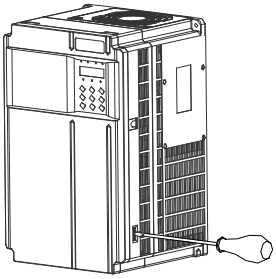
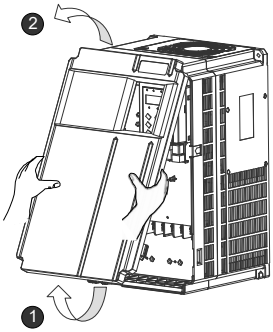
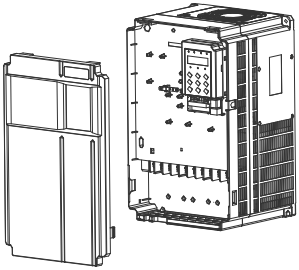
4.1.5 Removing and Installing the Cover

To wire the main circuit and control circuit of the CS710 series AC drive, remove its cover.

DANGER

- Before removing the cover, ensure that the drive is in the power-off state for over 10 minutes.
- Prevent the cover from falling off during disassembly to avoid personal injury and equipment damage.

1) Removing and Installing the Cover of 0.4–37 kW Models

Disassembly procedure		
Use a tool to push the snap-fit joints inwards at both sides of the drive to release the cover. 	Hold the cover by both hands (①) to lift up the lower part of the cover. Push the cover up slightly to lift up the upper part of the cover (②). 	The front cover is removed. 
Installation Procedure		

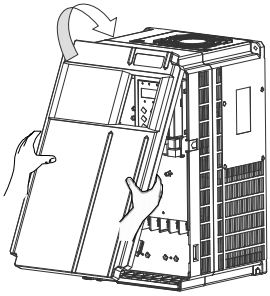
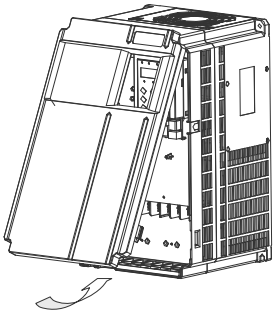
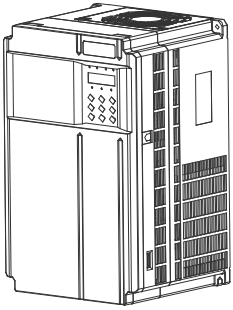
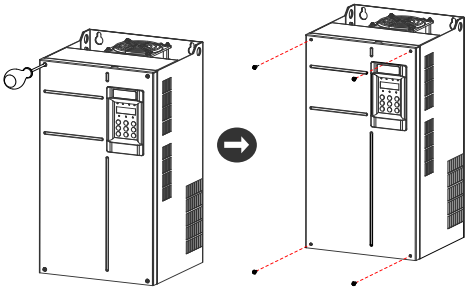
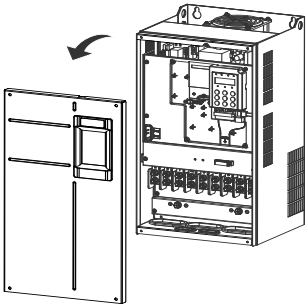
Hold the front cover with both hands, and buckle the snap-fit joints at the top of the cover into the holes on the drive.	Then, press down the cover in the direction indicated by the arrow.	The cover is installed.
		

Figure 4-22 Removing and installing the cover of 0.4-37 kW models

2) Removing and installing the cover of 45 kW to 160 kW

Disassembly procedure	
Release the four fixing screws on the cover with a screwdriver.	Lift the cover following the arrow direction.
	
Installation Procedure	

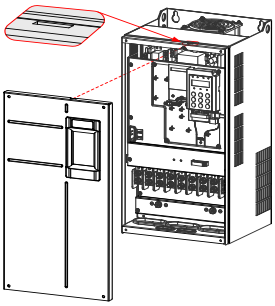
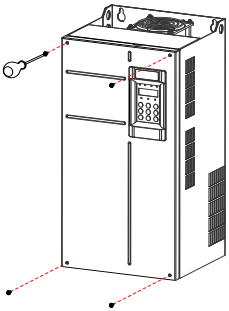
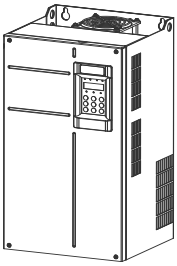
Hold the cover with both hands, align the cover with the snap-fit joint on the upper edge of the chassis and push it in place as shown in the following figure. 	Screw down the four retaining screws with a screwdriver. 	The cover is installed. 

Figure 4-23 Removing and installing the cover of 45-160 kW models

3） Removing and installing the cover of 200-400 kW models

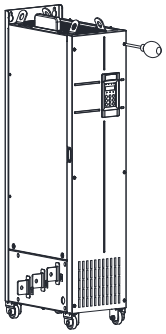
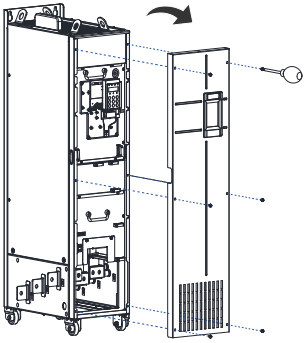
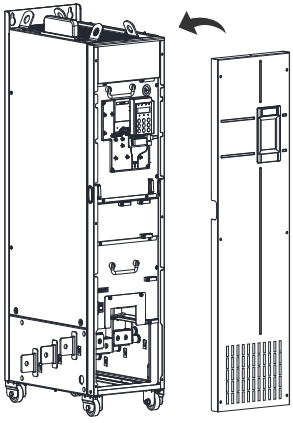
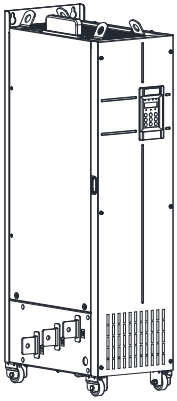
Disassembly procedure	
Use a screwdriver to remove the six fixing screws on the cover. 	Hold the cover with both hands, and lift it up in the direction indicated by the arrow to remove it. 
Installation Procedure	
Hold the cover with both hands, align the upper edge of the cover with the upper edge snap-fit joint on the chassis, and snap them together, as shown in the following figure. Then align the six screw mounting holes in the cover with the cover fixing holes in the chassis and press them tightly against each other. 	Install six fixing screws into the holes with a screwdriver to fasten the cover. 

Figure 4-24 Removing and installing the cover of 200-400 kW models

4.2 Unpacking, Storage, and Transportation

4.2.1 Storage

The drive must be stored in a clean and dry room, where the temperature ranges from -20° C and +60° C and temperature change rate is smaller than 1° C/min.

If the drive needs to be stored for a long period of time, cover it or take other appropriate measures to keep it from contamination and adverse environmental impacts.

Pack the drive with the original packing box provided by Inovance.

Do not expose the equipment to environments with moisture, high temperatures, or direct sunlight for a long time.

The electrolytic capacitor will deteriorate after long-term storage. Therefore, switch on the drive once for at least 5 hours every 6 months. Increase the input voltage slowly to the rated value by using a voltage regulator. Contact Inovance for technical support if necessary.

4.2.2 Transportation Before Unpacking

The following precautions must be observed for transporting T1 to T12 models (0.4 kW to 400 kW):

T1 to T6 models are small and light and therefore can be handled manually. T7 to T12 models, however, must be transported with an appropriate lifting tool.

Fix the drive to a wooden pallet when handling with a forklift. When handling the drive with a crane, fix the drive to a pallet and lift them together, as shown in the following figure.

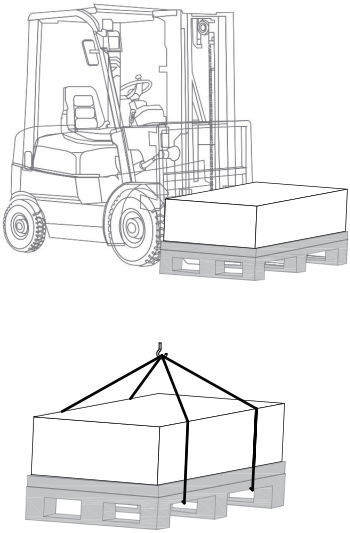


Figure 4-25 Hoisting

T9 to T12 models are heavy with a high center of gravity. Therefore, avoid placing them on an inclined surface with an inclination greater than 5 degrees. Place the equipment on a flat surface that is firm enough to bear the weight of the equipment.

Transport the device only when it is upright as indicated on the packaging box, as shown in the following figure. Never turn it upside down or place it on its side.

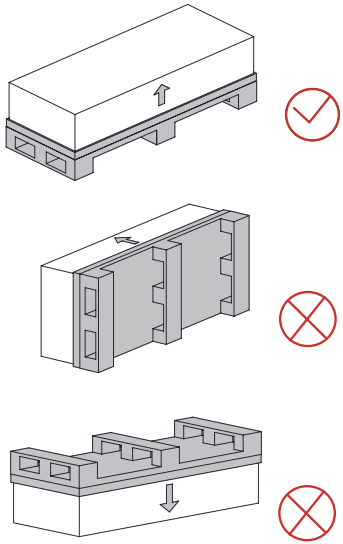


Figure 4-26 Placement

4.2.3 Acceptance

When receiving goods from the shipping company, check that you have received all the items specified on the delivery note. Notify the shipping company immediately of any missing components or damage. If necessary, contact technical support from the Inovance office or your local agent.

AC drives of different structural dimensions are different in size and weight, and hence are packed in different methods with different components incorporated.

> **CAUTION**
>
> The electrical safety performance of the AC drive may be affected if it is damaged during transportation. Do not connect the equipment prior to professional high-voltage testing.

Packing list for T1 to T9 models

- T1 to T6 models are packed using cartons.
- T7 to T9 models are packed using cartons and plywood pallets.

The following figure shows the packing list.

Packing list for T1 to T6 models

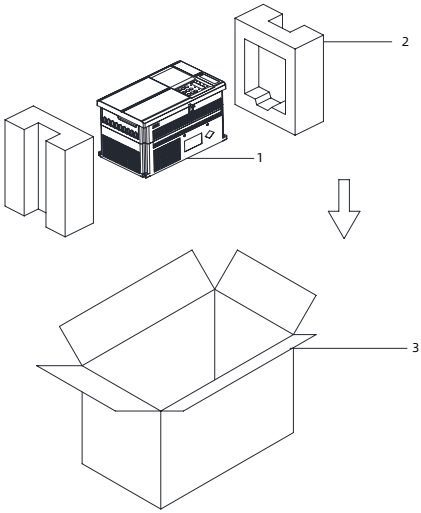


Figure 4-27 Packing list for T1 to T6 models

No.	Name
1	AC drive
2	Cushion
3	Carton box

Packing list of T7 to T9 models

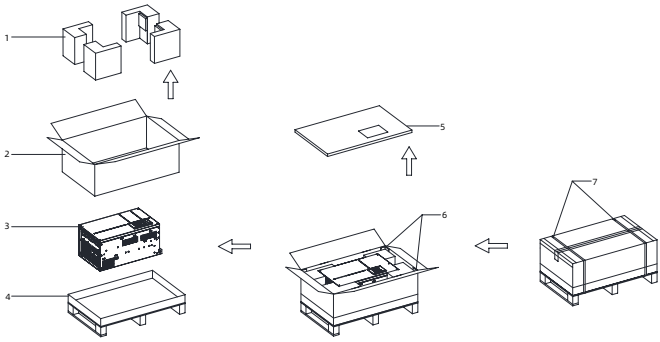


Figure 4-28 Packing list for T7 to T9 models

No.	Name
1	Cushion
2	Carton box
3	AC drive

No.	Name
4	Plywood pallet
5	Honeycomb cardboard
6	Paper corner protector
7	Packing strap

Packing list for T10 to T12 models

- T10 to T11 models are packed using cartons and plywood pallets.
- T12 models are packed using wooden crates.

The following figure shows the packing list.

Packing list for T10 models

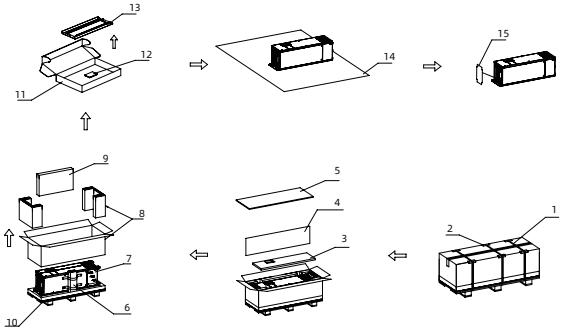


Figure 4-29 Packing list for T10 models

No.	Name
1	Packing strap
2	Paper corner protector
3	Honeycomb cardboard
4	Corrugated cardboard
5	Wooden board
6	Paper column
7	Product
8	Carton box
9	Bracket box
10	Wooden pallet
11	Carton
12	User guide
13	Bracket
14	Plastic bag
15	Corrugated cardboard

Packing list for T10 models

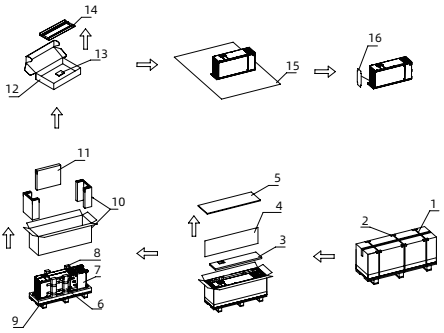


Figure 4-30 Packing list for T11 models

No.	Name
1	Packing strap
2	Paper corner protector
3	Honeycomb cardboard
4	Corrugated cardboard
5	Wooden board
6	Paper column
7	Product
8	Paper column
9	Wooden pallet
10	Carton box
11	Bracket box
12	Carton
13	User guide
14	Bracket
15	Plastic bag
16	Corrugated cardboard

Packing list for T12 model

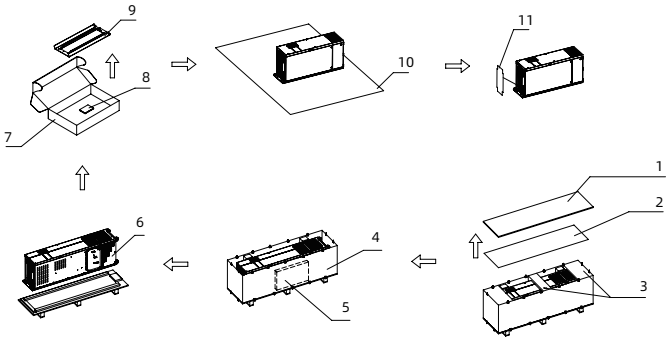


Figure 4-31 Packing list for T12 models

No.	Name
1	Cover
2	Corrugated cardboard
3	Expanded polyethylene foam
4	Wooden crate
5	Bracket box
6	Product
7	Carton box
8	User guide
9	Bracket
10	Plastic bag
11	Corrugated cardboard

4.2.4 Unpacking

The documentation suite and accessories are placed in different partitions in the package. Follow the following unpacking procedure.

1. Remove all the straps and ties and open the cover of the box.

2. Remove all filler materials.

3. Take out the product.

4. Cut and remove the plastic film wrap on the drive.

5. Check the product for any damage.

6. Dispose of or recycle the packing material according to local regulations.

4.2.5 Transportation and Hoisting After Unpacking

T1 to T6 models (0.4 kW to 37 kW) are compact and lightweight, allowing manual

handling. T7 to T13 models (45 kW to 400 kW) must be handled using a suitable lifting device.

AC Drive Weight	Personnel Required for Handling
< 15 kg	1
≥ 15 kg	2, with proper lifting device

Precautions for handling and hoisting:

- Handle the equipment in accordance with local laws and regulations.
- Avoid handling the AC drive by directly holding its upper cover or enclosure. Before handling, check that all screws have been tightened. Failure to comply may result in AC drive fall-off, causing personal injury.
- For T10 to T12 models (200-400 kW), fasten the AC drive to the mounting beam through the four mounting holes on the back of the AC drive
- Straighten the flat-lying equipment before further handling.
- The load-carrying capacity of the crane must be greater than the weight of the equipment.
- Ensure that the upper cover, terminals, and other components of the AC drive are secured firmly with screws before vertical lifting. Failure to comply can lead to personal injury.
- When lifting the AC drive with the lifting rope, avoid subjecting the AC drive to excessive vibration or impact. Failure to comply can lead to personal injury.
- When lifting the AC drive with the lifting rope, do not turn the AC drive over or leave it suspended for long time. Failure to comply can lead to personal injury.

T1 to T9 models (0.4 kW to 160 kW)

To lift T1 to T9 models, do as follows:

1. Hook the lifting rope to the two auxiliary lifting lugs at the top of the drive.

It is recommended that the lifting angle be greater than 45 degrees and the height fluctuation be no greater than 0.3 m.

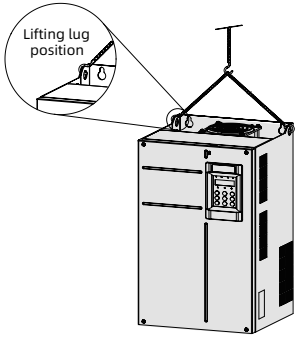


Figure 4-31 Hoisting

2. Roll up the lifting rope slowly with a crane. After the lifting rope is fully stressed, lift the drive up.

3. Lower the drive slowly, pause midway to steady the drive, and then continue until the drive reaches the ground or mounting surface. Finally, install the drive to the control cabinet.

T10 to T12 models (200 kW to 400 kW)

To hoist T10 to T12 models, follow these steps:

1. Hook the lifting lugs at the top of the drive and the lifting holes at the bottom of the drive, take out the AC drive from the packing box, and lay it flat on the floor.

Ensure that there is no stress on the positive and negative bus terminals.

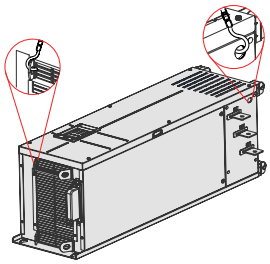


Figure 4-32 Hoisting

2. Hook the lifting rope to the lifting lugs diagonally placed at the top of the AC drive, slowly place the AC drive upright, and install it to the cabinet.

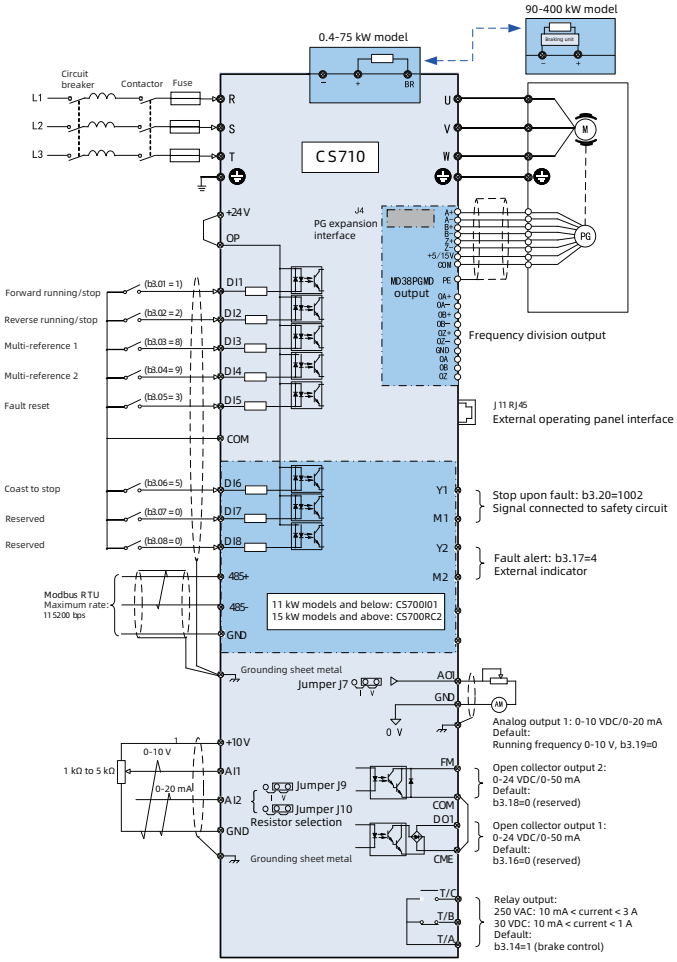
CAUTION

If the AC drive needs to be placed in an upright position, ensure the tilt angle of the place that holds the drive does not exceed 5° . Failure to comply may lead to rollover of the drive due to its heavy weight (nearly 200 kg) and large size.

4.3 Wiring

4.3.1 Standard Wiring Diagram

The wiring parts marked by the double-headed arrow are different for 0.4–75 kW models and 90–400 kW models, as shown in the figure below.



Note: ——Shield; ——Twisted pair

Figure 4-33 Typical wiring of three-phase 380 V to 480 V models

4.3.2 Main Circuit Terminals

1) Main circuit terminals of CS710 series AC drives

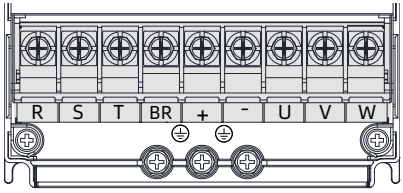


Figure 4-34 Layout of main circuit terminals for 0.4-15 kW models

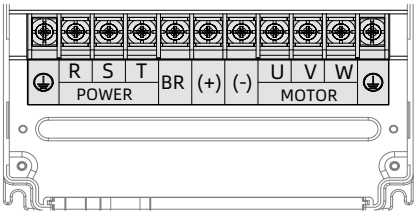
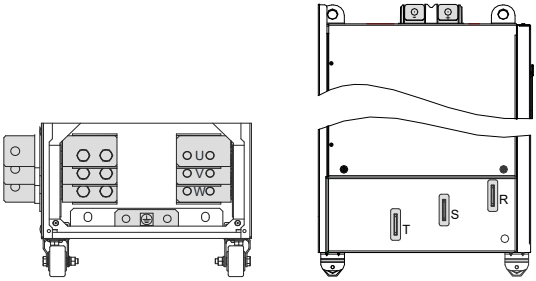


Figure 4-35 Layout of main circuit terminals for 18.5-160 kW models



(Front view) (Side view)

Figure 4-36 Layout of main circuit terminals for 200-400 kW models

Table 4-4 Descriptions of main circuit terminals of CS710 series AC drives

Terminal mark	Terminal	Function description
R, S, T	Three-phase power input terminals	Connected to the three-phase AC power supply.
(+), (-)	Positive and negative terminals of the DC bus	Common DC bus input point that connected to the external braking unit of 90 kW and above models
(+), BR	Terminals for connecting the braking resistor	Connected to the braking resistor of 75 kW models and below

U, V, W	AC drive output terminals	Used to connect the three-phase motor.
⏚	Grounding terminal (PE)	Used for protective grounding.

2） Main circuit cable selection

It is recommended to use symmetrical shielded cables as input and output main circuit cables. Compared with four-core cables, symmetrical shielded cables can reduce electromagnetic radiation in the whole drive system.

- Power cables recommended (symmetrical shielded cables)

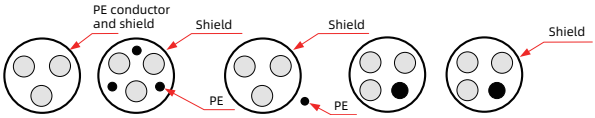


Figure 4-37 Recommended power cable

- Power cables not recommended

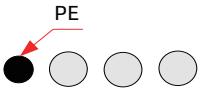


Figure 4-38 Power cable not recommended

3） R, S, and T terminals of the input power supply

- No specific phase sequence is required for wiring on the input side of the drive.
- The specifications and installation method of external main circuit cables must comply with local regulations and related IEC standards.
- Select copper wires of appropriate sizes for main circuit cables according to recommendations in "10 Technical Data and Model Selection."
- Install the filter close to the input side of the drive. The cable between the filter and the drive must be shorter than 30 cm. Connect the grounding terminal of the filter and that of the AC drive together. Install the filter and the AC drive on the same conductive mounting plane, which is connected to the main grounding terminal of the cabinet.

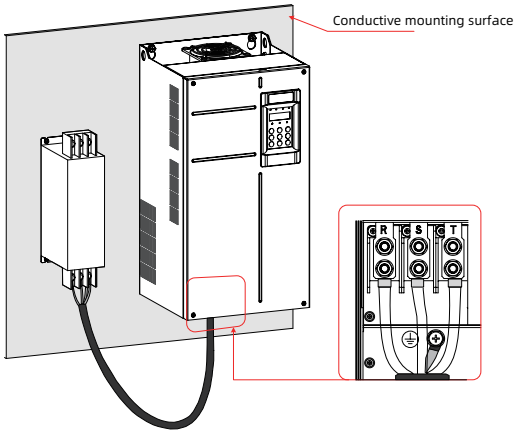


Figure 4-39 Filter installation diagram

4) DC bus terminals (+) and (-)

- The DC bus terminals (+) and (-) carry residual voltage for a period after the AC drive is switched off. To prevent electric shocks, connect cables to the terminals only when the CHARGE indicator is off, the AC drive has been kept power-off for more than 10 minutes, and the bus voltage is less than 36 V.
- When using external braking components for models with 90 kW or higher power, ensure that (+) and (-) terminals are connected correctly. Failure to comply will result in damage to the AC drive and the braking components or even fire.
- The cable for the braking unit cannot exceed 10 m. Use twisted pair cables or closely-paired cables for parallel connection.
- Do not connect the braking resistor directly to the DC bus. Failure to comply may result in damage to the AC drive or even fire.

5) Braking resistor terminals (+) and BR

- Terminals (+) and BR are connected to braking resistors of 75 kW drives and below.
- Select a recommended braking resistor and use a cable within 5 m in length to connect the braking resistor. Failure to comply may result in damage to the AC drive.
- Keep the braking resistor free from combustible materials to prevent it from causing fire when it heats up.

6) Power output terminals U, V, W

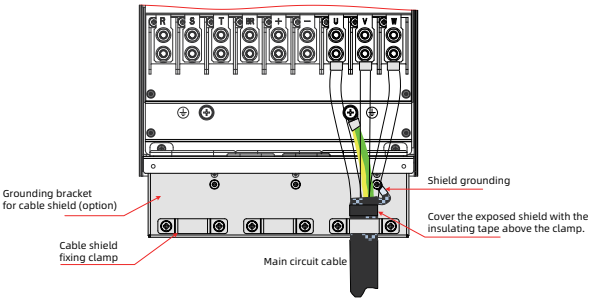


Figure 4-40 Shield wiring

The grounding bracket of cable shield needs to be purchased separately for an AC drive of 160 kW or below. See the following instructions to install the bracket.

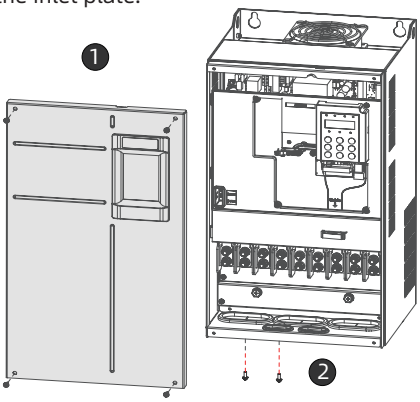
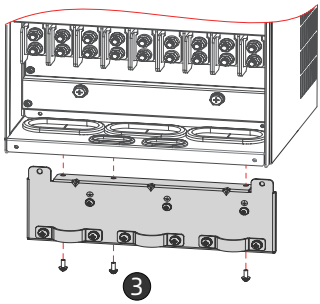
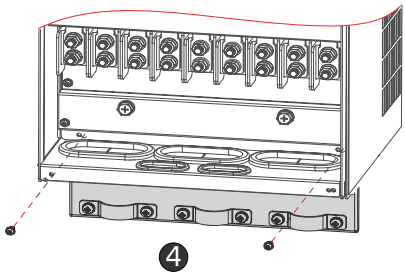
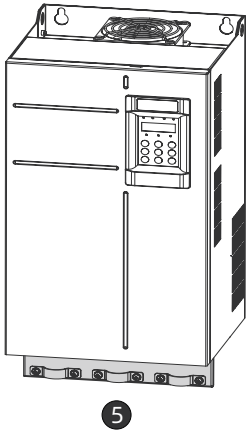
<table>
<tr><th colspan="2">Installation Instructions</th></tr>
<tr><td>① Remove the cover.
② Remove the two M4x12 SEMS screws on the inlet plate.

</td><td>③ Install the grounding bracket of cable shield on the AC drive chassis, and fasten the three positions shown in the figure by using three M4x12 SEMS screws.

</td></tr>
<tr><td>④ Fasten the two positions shown in the figure by using two M4x12 SEMS screws.

</td><td>⑤ Reinstall the cover.

</td></tr>
</table>

Figure 4-41 Installation of the grounding bracket of cable shield

Table 4-5 Grounding bracket models of the cable shield

Grounding bracket model of the cable shield	Applicable model
MD500-AZJ-A2T1	CS710-4T0.4GB
	CS710-4T0.7GB
	CS710-4T1.1GB
	CS710-4T1.5GB
	CS710-4T2.2GB
	CS710-4T3.0GB
MD500-AZJ-A2T2	CS710-4T3.7GB
	CS710-4T5.5GB
MD500-AZJ-A2T3	CS710-4T7.5GB
	CS710-4T11GB
MD500-AZJ-A2T4	CS710-4T15GB
MD500-AZJ-A2T5	CS710-4T18.5GB(-T)
	CS710-4T22GB(-T)
MD500-AZJ-A2T6	CS710-4T30GB
	CS710-4T37GB
MD500-AZJ-A2T7	CS710-4T45GB
	CS710-4T55GB
MD500-AZJ-A2T8	CS710-4T75GB
	CS710-4T90G
	CS710-4T110G
MD500-AZJ-A2T9	CS710-4T132G
	CS710-4T160G

- Do not connect a capacitor or surge absorber to the output side of the AC drive. Failure to comply will result in failure or even damage to the AC drive.
- If the motor cable is too long, electrical resonance may be generated due to distributed capacitance, which may damage the motor insulation or generate higher leakage current, triggering overcurrent protection. If the motor cable length is greater than 100 m, an AC output reactor must be installed close to the AC drive.
- It is recommended to use shielded cable as the output cables to the motor. Tie the shield with a grounding support fully to the ground, and connect the lead-out wire of the shield to the PE terminal.
- Ensure that the drain wire of the motor cable shield is as short as possible, with its width not shorter than 1/5 of its length.

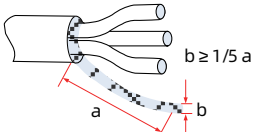


Figure 4-42 Lead-out wire of the motor cable shield

7) Grounding terminal (PE)

- The terminal must be grounded properly with grounding cable resistance lower than 4 Ω. Failure to comply may lead to device malfunction or even damage the drive.
- The grounding terminal cannot be shared with the neutral terminal (N) of the power supply.
- Select the protective grounding conductor of an appropriate size according to "9.4 Selection of Peripheral Electrical Components."
- Use a yellow-green cable as the protective grounding conductor.
- Ground the main circuit shield correctly.
- It is recommended that the AC drive be installed on a metal mounting surface. Ensure that the bottom of the AC drive is closely attached to the mounting surface.
- Install the filter and the drive on the same mounting surface to ensure the filtering effect.

CAUTION

- To prevent electric shock, ground the grounding terminal properly. Observe related national or regional regulations during grounding.
- To prevent electric shocks, ensure that the protective grounding conductor meets the technical specifications and local safety standards, and shorten the grounding cable length as much as possible. The leakage current of the product can exceed 3.5 mA. Therefore, the cross-sectional area of the protective grounding conductor must be at least 10 mm^2 or two protective grounding conductors of the same specification must be connected according to EN 61800-5-1.
- When using multiple devices, follow the instructions for grounding all devices. Incorrect grounding can result in misoperation of devices.
- This product is equipped with the optional VDR ground screw. Before performing a voltage test, disconnect the optional VDR ground screw; otherwise, the test may fail.

8) Requirements for protection of main circuit cables

- Use the heat-shrinkable tube to wrap the copper tube of the terminal and the cable conductor completely, as shown below.

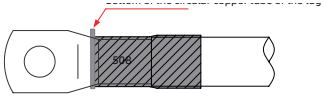


Figure 4-43 Cable conductor with the heat-shrinkable tube

9) Requirements on upstream protection device

- Install a proper protection device on the power input side to provide protections on overcurrent, short-circuit and electrical isolation.
- Select protection devices according to main circuit cable current capacity, system overload capacity, and short circuit capacity of upstream power distribution. Use recommended values in "10 Technical Data and Model Selection."

10. Power grid system requirements

- The AC drive is applicable to power systems with neutral grounding. If the AC drive is used in an IT power system (without neutral grounding), remove the screws of ground jumpers of the voltage dependent resistor (VDR) and safety capacitor (EMC) (screw 1 and screw 2 shown in the following figure). Do not install a filter. Failure to comply may result in danger or damage to the AC drive.
- When a residual current operated protector is configured, if the leakage protector is tripped during power-on, remove the screw of the EMC ground jumper (screw 2 shown in the following figure).

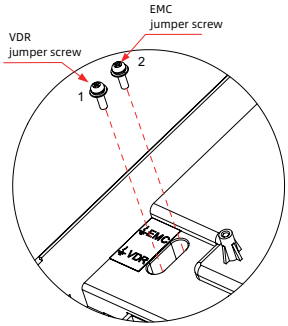


Figure 4-44 Positions of ground jumpers of the VDR and EMC

4.3.3 Cabling, Dimensions, and Recommended Cable Selection of Main Circuit Terminals

NOTE

- By default, CS710-4T200G to CS710-4T400G are equipped with copper bars, which can be removed as required.
- The data and models recommended in this section are for reference only. The cross-sectional area of the cables selected by users cannot be higher than the terminal width specified in the figure.
- Select IEC cables according to the following requirements:
  - EN 60204-1- and IEC 60364-5-52-compliant
  - PVC insulated
  - Copper conductor
  - Maximum surface temperature of 70℃ under 40℃ ambient temperature
  - Symmetrical cable with copper-braided shield
  - Lower than or equal to 9 cables placed in parallel in the same cable tray
- In the following tables, 3 x 10 indicates one 3-conductor 10 mm2 cable, and 2 x (3 x 95) indicates two 3-conductor 95 mm2 cables.

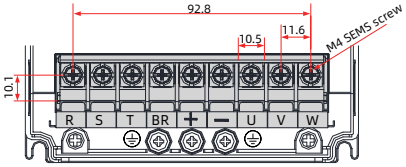


Figure 4-45 Dimensions (unit: mm) of the main circuit terminals for CS710-4T0.4GB to CS710-4T5.5GB models (three-phase 380-480 V)

Table 4-6 Recommended main circuit cables for CS710-4T0.4GB to CS710-4T5.5GB (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable (mm^2) [1]	Terminal model		
CS710-4T0.4GB	1.8	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	M4	1.2
CS710-4T0.7GB	2.4	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	M4	1.2
CS710-4T1.1GB	3.7	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	M4	1.2
CS710-4T1.5GB	4.6	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	M4	1.2
CS710-4T2.2GB	6.3	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	M4	1.2
CS710-4T3.0GB	9	3x1	TNR1.25-4	1	TNR1.25-4	M4	1.2
CS710-4T3.7GB	11.4	3x1.5	TNR1.25-4	1.5	TNR1.25-4	M4	1.2
CS710-4T5.5GB	16.7	3x2.5	TNR2-4	2.5	TNR2-4	M4	1.2

Table 4-7 Recommended UL-certified main circuit cables for CS710-4T0.4GB to CS710-4T5.5GB models (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cable (AWG/ kcmil)[2]	Terminal model	Cables (AWG/ kcmil)[2]	Terminal model		
CS710-4T0.4GB	1.8	14	TLK2.5-4	14	TLK2.5-4	M4	1.2
CS710-4T0.7GB	2.4	14	TLK2.5-4	14	TLK2.5-4	M4	1.2
CS710-4T1.1GB	3.7	14	TLK2.5-4	14	TLK2.5-4	M4	1.2
CS710-4T1.5GB	4.6	14	TLK2.5-4	14	TLK2.5-4	M4	1.2
CS710-4T2.2GB	6.3	14	TLK2.5-4	14	TLK2.5-4	M4	1.2
CS710-4T3.0GB	9	14	TLK2.5-4	14	TLK2.5-4	M4	1.2
CS710-4T3.7GB	11.4	14	TLK2.5-4	14	TLK2.5-4	M4	1.2
CS710-4T5.5GB	16.7	12	TLK4-4	12	TLK4-4	M4	1.2

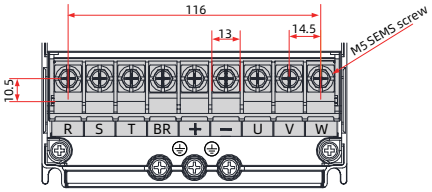


Figure 4-46 Dimensions (unit: mm) of the main circuit terminals for CS710-4T7.5GB and

CS710-4T11GB models (three-phase 380–480 V)

Table 4-8 Recommended main circuit cables for CS710-4T7.5GB/CS710-4T11GB (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable (mm^2) [1]	Terminal model		
CS710-4T7.5GB	21.9	3x4	TNR3.5-5	4	TNR3.5-5	M5	2.8
CS710-4T11GB	32.2	3x6	TNR5.5-5	6	TNR5.5-5	M5	2.8

Table 4-9 Recommended UL-certified main circuit cables for CS710-4T7.5GB and CS710-4T11GB models (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cables (AWG/ kcmil)[2]	Terminal model	Cables (AWG/ kcmil)[2]	Terminal model		
CS710-4T7.5GB	21.9	10	TLK6-5	10	TLK6-5	M5	2.8
CS710-4T11GB	32.2	8	TLK10-5	8	TLK10-5	M5	2.8

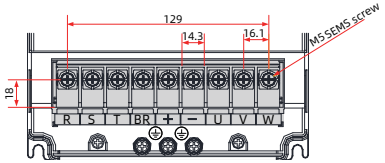


Figure 4-47 Dimensions (unit: mm) of the main circuit terminals for CS710-4T15GB models (three-phase 380–480 V)

Table 4-10 Recommended main circuit cables for CS710-4T15GB (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable (mm^2) [1]	Terminal model		
CS710-4T15GB	41.3	3 x 10	TNR8-5	10	TNR8-5	M5	2.8

Table 4-11 Recommended UL-certified main circuit cables for CS710-4T15GB (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cables (AWG/ kcmil)[2]	Terminal model	Cables (AWG/ kcmil)[2]	Terminal model		
CS710-4T15GB	41.3	6	TLK16-5	6	TLK16-5	M5	2.8

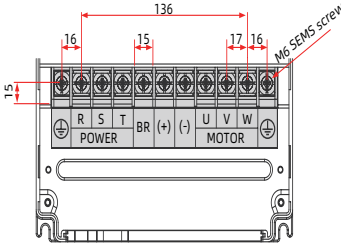


Figure 4-48 Dimensions (unit: mm) of the main circuit terminals for CS710-4T18.5GB(-T) and CS710-4T22GB(-T) models (three-phase 380-480 V)

Table 4-12 Recommended main circuit cables for CS710-T18.5GB(-T)/CS710-4T22GB(-T) (three-phase 380-480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable (mm2) [1]	Terminal model		
CS710-4T18.5GB(-T)	49.5	3 x 10	TNR8-6	10	TNR8-6	M6	4.8
CS710-4T22GB(-T)	59	3 x 16	GTNR16-6	16	GTNR16-6	M6	4.8

Table 4-13 Recommended UL-certified main circuit cables for CS710-T18.5GB(-T) and CS710-4T22GB(-T) models (three-phase 380-480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cables (AWG/ kcmil)[2]	Terminal model	Cables (AWG/ kcmil)[2]	Terminal model		
CS710-4T18.5GB (-T)	49.5	6	TLK16-6	6	TLK16-6	M6	4.8
CS710-4T22GB (-T)	59	4	TLK25-6	6	TLK16-6	M6	4.8

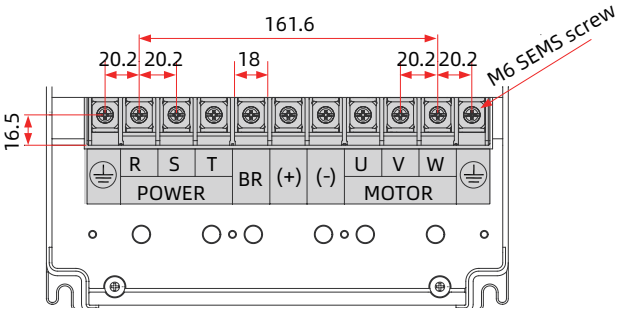


Figure 4-49 Dimensions (unit: mm) of the main circuit terminals for CS710-4T30GB and CS710-4T37GB models (three-phase 380–480 V)

Table 4-14 Recommended main circuit cables for CS710-4T30GB/CS710-4T37GB (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable (mm^2) [1]	Terminal model		
CS710-4T30GB	57	3 x 16	GTNR16-6	16	GTNR16-6	M6	4.8
CS710-4T37GB	69	3 x 25	GTNR25-6	16	GTNR16-6	M6	4.8

Table 4-15 Recommended UL-certified main circuit cables for CS710-4T30GB and CS710-4T37GB models (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cable (AWG/ kcmil)[2]	Terminal model	Cable (AWG/ kcmil)[2]	Terminal model		
CS710-4T30GB	57	4	TLK25-6	6	TLK16-6	M6	4.8
CS710-4T37GB	69	2	TLK35-6	4	TLK25-6	M6	4.8

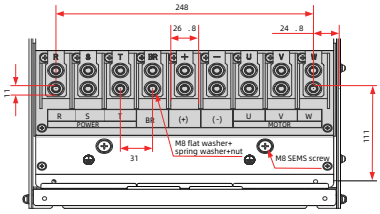


Figure 4-50 Dimensions (unit: mm) of the main circuit terminals for CS710-4T45GB and CS710-4T55GB models (three-phase 380–480 V)

Table 4-16 Recommended main circuit cables for CS710-4T45GB/CS710-4T55GB (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable (mm^2) [1]	Terminal model		
CS710-4T45GB	89	3x35	GTNR35-8	16	GTNR16-8	M8	13.0
CS710-4T55GB	106	3 x 50	GTNR50-8	25	GTNR25-8	M8	13.0

Table 4-17 Recommended UL-certified main circuit cables for CS710-4T45GB and CS710-4T55GB models (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cable (AWG/ kcmil)[2]	Terminal model	Cables (AWG/ kcmil)[2]	Terminal model		
CS710-4T45GB	89	2	TLK35-8	4	TLK25-8	M8	13.0
CS710-4T55GB	106	1/0	TLK50-8	2	TLK35-8-	M8	13.0

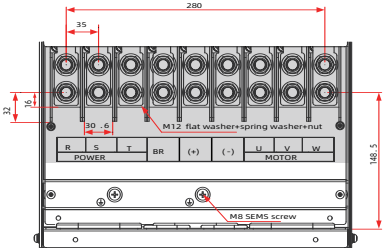


Figure 4-51 Dimensions (unit: mm) of the main circuit terminals for CS710-4T75GB to CS710-4T110G models (three-phase 380–480 V)

Table 4-18 Recommended main circuit cables for CS710-4T75G to CS710-4T110G (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable ($mm^{2)}$ [1]	Terminal model		
CS710-4T75GB	139	3 x 70	GTNR70-12	35	GTNR35-8	M12	35.0

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable ($mm^{2)}$ [1]	Terminal model		
CS710-4T90G	164	3 x 95	GTNR95-12	50	GTNR50-8	M12	35.0
CS710-4T110G	196	3 x 120	GTNR120-12	70	GTNR70-8	M12	35.0

Table 4-19 Recommended UL-certified main circuit cables for CS710-4T75G to CS710-4T110G models (three-phase 380–480 V)

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cables (AWG/ kcmil)[2]	Terminal model	Cable (AWG/ kcmil)[2]	Terminal model		
CS710-4T75GB	139	3/0	TLK95-8	1/0	TLK50-8-	M12	35.0
CS710-4T90G	164	4/0	TLK12012	2/0	TLK70-8-	M12	35.0
CS710-4T110G	196	300 kcmil	SQNBS150-12	3/0	TLK95-8-	M12	35.0

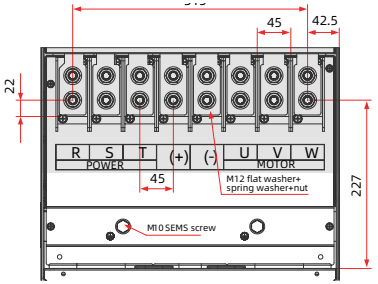


Figure 4-52 Dimensions (unit: mm) of the main circuit terminals for CS710-4T132G and CS710-4T160G models

Table 4-20 Recommended main circuit cables for CS710-4T132G/CS710-4T160G

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable (mm^2) [1]	Terminal model		
CS710-4T132G	240	3 x 150	BC150-12	95	GTNR95-10	M12	35.0
CS710-4T160G	287	3 x 185	BC185-12	95	BC95-10	M16	35.0

Table 4-21 Recommended UL-certified main circuit cables for CS710-4T132G and CS710-4T160G models

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cable (AWG/ kcmil)[2]	Terminal model	Cable (AWG/ kcmil)[2]	Terminal model		
CS710-4T132G	240	400 kcmil	SQNBS250-12	4/0	TLK120-8	M12	35.0
CS710-4T160G	287	500 kcmil	SQNBS250-12	300 kcmil	SQNBS150-10	M16	35.0

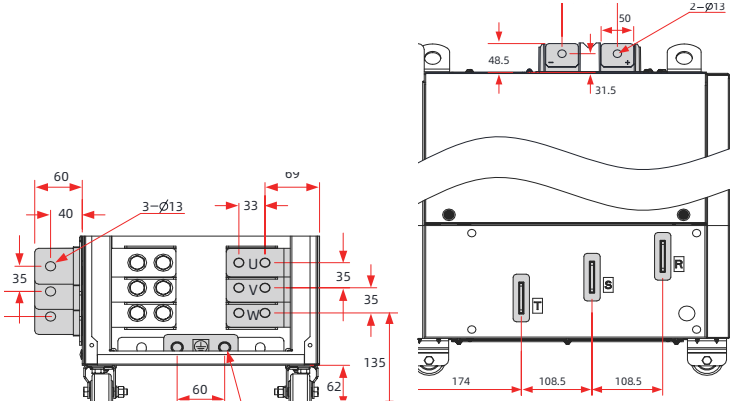


Figure 4-53 Dimensions (unit: mm) of the main circuit terminals for CS710-4T200G and CS710-4T220G models without output

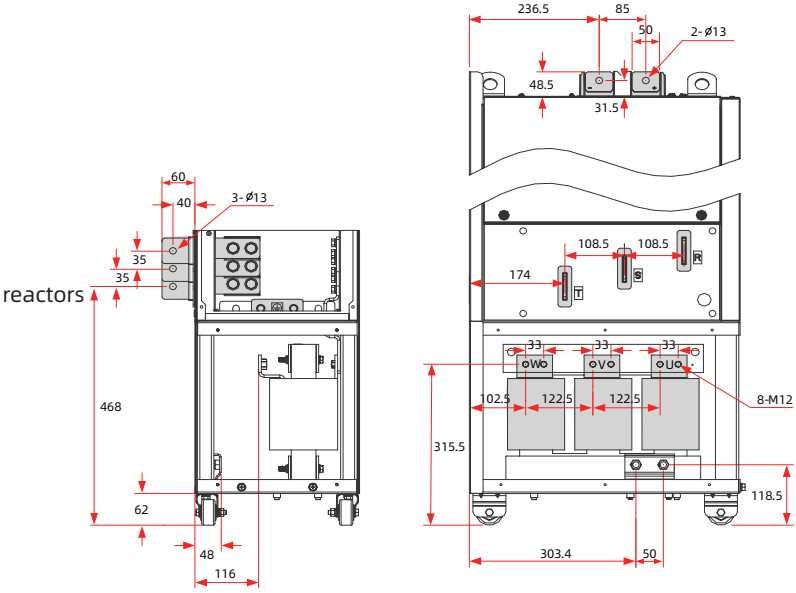


Figure 4-54 Dimensions (unit: mm) of the main circuit terminals for CS710-4T200G and CS710-4T220G models with output reactors

The copper busbars in the preceding figures can be removed as required. The following figure shows the dimensions of the main circuit terminals without copper busbars.

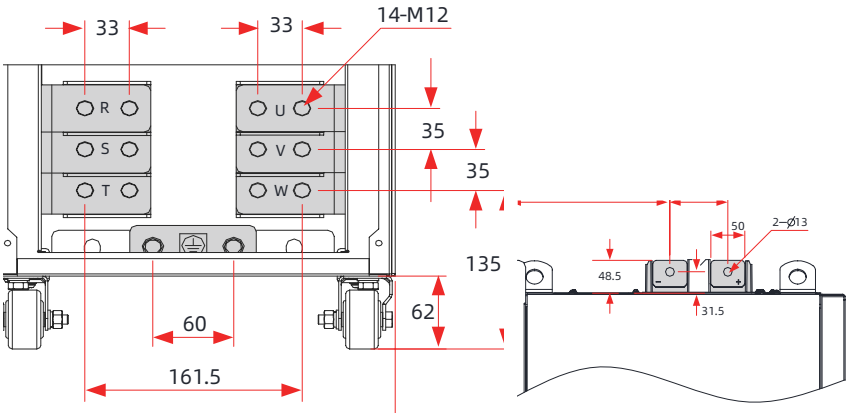


Figure 4-55 Dimensions (unit: mm) of the main circuit terminals for CS710-4T200G and CS710-4T220G models without side copper busbars or output reactors)

Table 4-22 Recommended main circuit cables for CS710-4T200G/CS710-4T220G

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable (mm^2) [1]	Terminal model		
CS710-4T200G	365	2x(3x95)	BC120-12	95	BC120-10	M12	35.0
CS710-4T220G	410	2x(3x120)	BC150-12	120	BC150-12	M12	35.0

Table 4-23 Recommended UL-certified main circuit cables for CS710-4T200G and CS710-4T220G models

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cable (AWG/ kcmil)[2]	Terminal model	Cable (AWG/ kcmil)[2]	Terminal model		
CS710-4T200G	365	2 x 300 kcmil	SQNBS150-12	300 kcmil	SQNBS150-10	M12	35.0
CS710-4T220G	410	2x350 kcmil	SQNBS180-12	350 kcmil	SQNBS180-12	M12	35.0

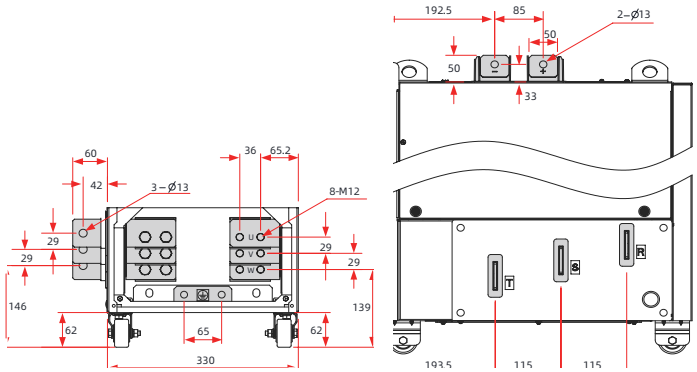


Figure 4-56 Dimensions (unit: mm) of the main circuit terminals for CS710-4T250G and CS710-4T280G models without output reactors

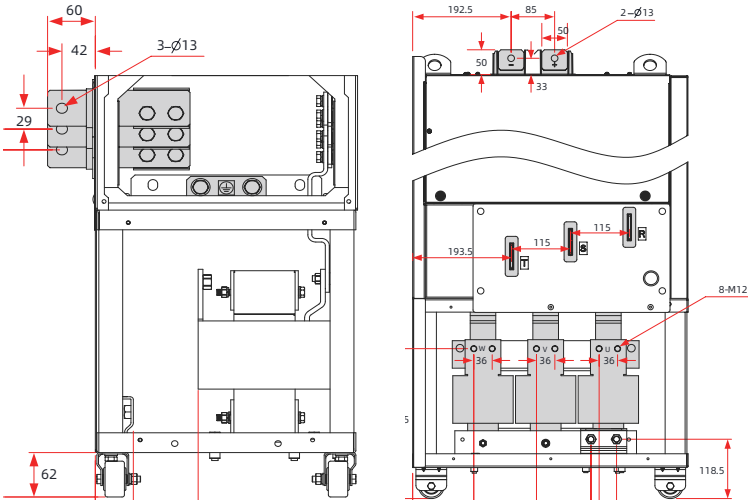


Figure 4-57 Dimensions (unit: mm) of the main circuit terminals for CS710-4T250G and CS710-4T280G models with output reactors

The copper busbars in the preceding figures can be removed as required. The following figure shows the dimensions of the main circuit terminals without copper busbars.

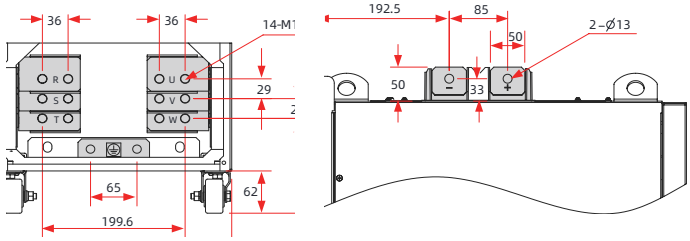


Figure 4-58 Dimensions (unit: mm) of the main circuit terminals for CS710-4T250G and CS710-4T280G models without side copper busbars or output reactors

Table 4-24 Recommended main circuit cables for CS710-4T250G/CS710-4T280G

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable ($mm^{2)}$ [1]	Terminal model		
CS710-4T250G	441	2 × (3 × 120)	BC150-12	120	BC150-12	M12	35.0
CS710-4T280G	495	2 x (3 x 150)	BC185-12	150	BC185-12	M12	35.0

Table 4-25 Recommended UL-certified main circuit cables for CS710-4T250G and CS710-4T280G models

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cable (AWG/ kcmil)[2]	Terminal model	Cable (AWG/ kcmil)[2]	Terminal model		
CS710-4T250G	441	2 x 400 kcmil	SQNBS250-12	400 kcmil	SQNBS250-12	M12	35.0
CS710-4T280G	495	2 x 500 kcmil	SQNBS250-12	500 kcmil	SQNBS250-12	M12	35.0

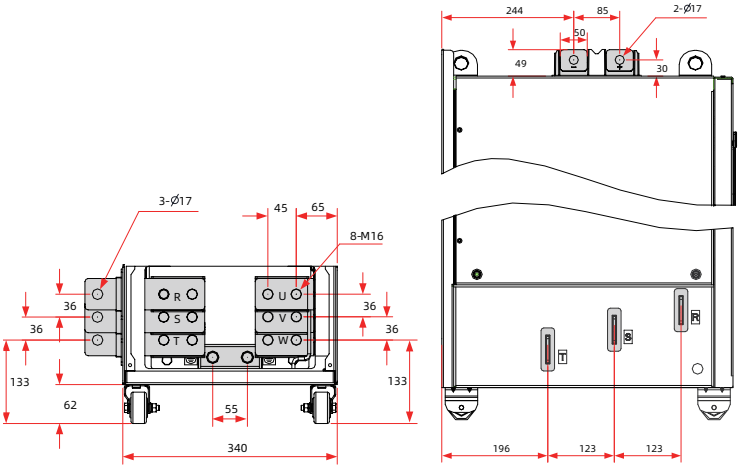


Figure 4-59 Dimensions (unit: mm) of the main circuit terminals for CS710-4T315G to CS710-4T400G models without output reactors

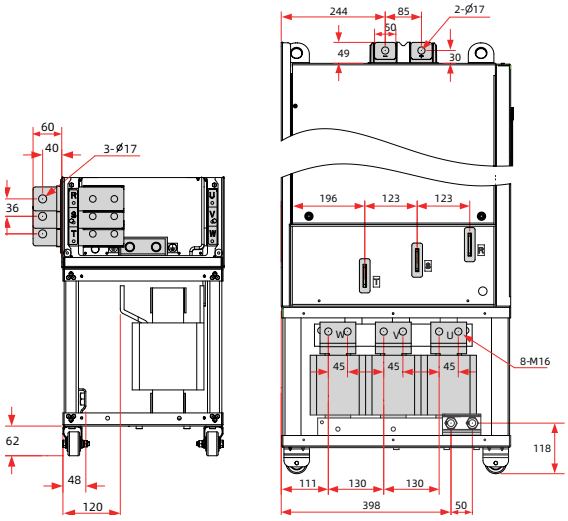


Figure 4-60 Dimensions (unit: mm) of the main circuit terminals for CS710-4T315G to CS710-4T400G models with output reactors

The copper busbars in the preceding figures can be removed as required. The following figure shows the dimensions of the main circuit terminals without copper busbars.

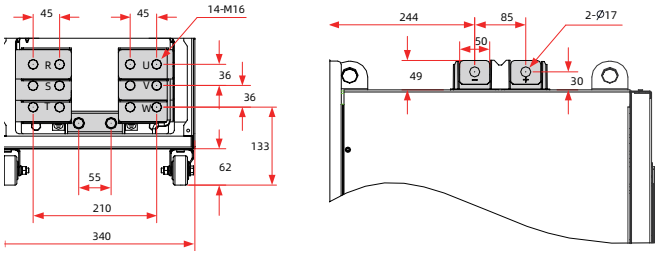


Figure 4-61 Dimensions (unit: mm) of the main circuit terminals for CS710-4T315G to CS710-4T400G models without side copper busbars or output reactors

Table 4-26 Recommended main circuit cables for CS710-4T315G/CS710-4T355G/CS710-4T400G

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N m)
		Cable (mm^2) [1]	Terminal model	Cable (mm^2) [1]	Terminal model		
CS710-4T315G	565	2 x (3 x 185)	BC150-16	185	BC120-16	M16	85.0
CS710-4T355G	617	2 x (3 x 185)	BC185-16	185	BC150-16	M16	85.0
CS710-4T400G	687	2 x (3 x 240)	BC240-16	240	BC185-16	M16	85.0

Table 4-27 Recommended UL-certified main circuit cables for CS710-4T315G, CS710-4T355G, and CS710-4T400G models

CS710 model	Rated input current (A)	RST/UVW		Grounding cable		Screw	Tightening torque (N·m)
		Cable (AWG/ kcmil)[2]	Terminal model	Cable (AWG/ kcmil)[2]	Terminal model		
CS710-4T315G	565	4 x 250 kcmil	TLK150-16	2x250 kcmil	TLK150-16	M16	85.0
CS710-4T355G	617	4 x 300 kcmil	TLK150-16	2 x 300 kcmil	TLK150-16	M16	85.0
CS710-4T400G	687	4 x 350 kcmil	TLK185-16	2x350 kcmil	TLK185-16	M16	85.0

The terminals recommended in the preceding table are the GTNR and BC series terminals of Suzhou Yuanli.

The appearances of the recommended terminals (manufacturer: Suzhou Yuanli Metal Enterprise Co., Ltd) are as follows.



GTNR series



TNR series



BC series

Figure 4-62 Appearances of the recommended terminals

NOTE

For details on terminal selection, see "10.4.2 Cable Terminal Models and Dimensions".

4.3.4 Requirements on Main Circuit Wiring Tools

When wiring the main circuit terminal, select an appropriate installation tool based on the terminal size. The following table describes the wiring tools.

Table 4-28 Requirements on main circuit wiring tools (three-phase 380-480 V)

AC drive model	Main Circuit Terminal Fastener	Tool
CS710-4T0.4GB	M4 SEMS screw	Phillips screwdriver (#3 slot)
CS710-4T0.7GB		
CS710-4T1.1GB		
CS710-4T1.5GB		
CS710-4T2.2GB		
CS710-4T3.0GB		
CS710-4T3.7GB		
CS710-4T5.5GB		
CS710-4T7.5GB	M5 SEMS screw	Phillips screwdriver (#3 slot)
CS710-4T11GB		
CS710-4T15GB		
CS710-4T18.5GB(-T)	M6 SEMS screw	Phillips screwdriver (#3 slot)
CS710-4T22GB(-T)		
CS710-4T30GB		
CS710-4T37GB		
CS710-4T45GB	M8 nut, spring pad, and flat washer	Socket wrench (#13 socket wrench)
CS710-4T55GB		
CS710-4T75GB	M12 nut, spring washer, and flat washer	Socket wrench (#19 socket) and socket wrench extension bar (150 mm)
CS710-4T90G		
CS710-4T110G		
CS710-4T132G		
CS710-4T160G		
CS710-4T200G	M12 bolt, spring washer, and flat washer	Socket wrench (#19 socket) and socket wrench extension bar (250 mm)
CS710-4T220G		
CS710-4T250G		
CS710-4T280G		
CS710-4T315G	M16 bolt, spring washer, and flat washer	Socket wrench (#24 socket) and socket wrench extension bar (250 mm)
CS710-4T355G		
CS710-4T400G		

4.3.5 Control Board

If the wiring of the control circuit involves the jumper, PG card or function extension card, remove the outer cover of the AC drive first. The locations of the control board, jumpers, and expansion cards are shown in the following figure.

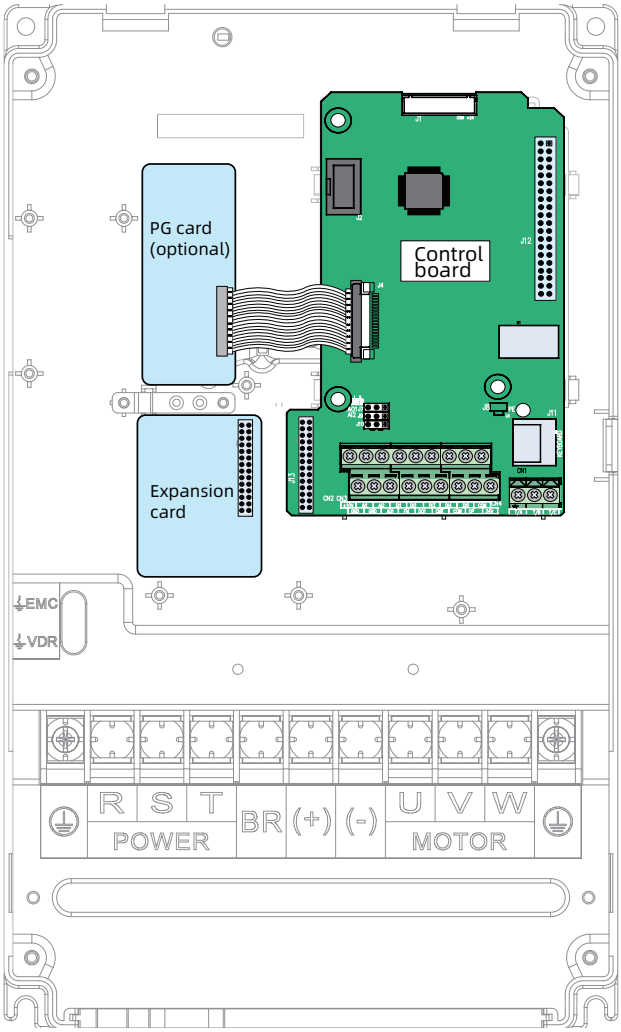


Figure 4-63 Installation position of the CS710 AC drive control board

- Control circuit terminal arrangement

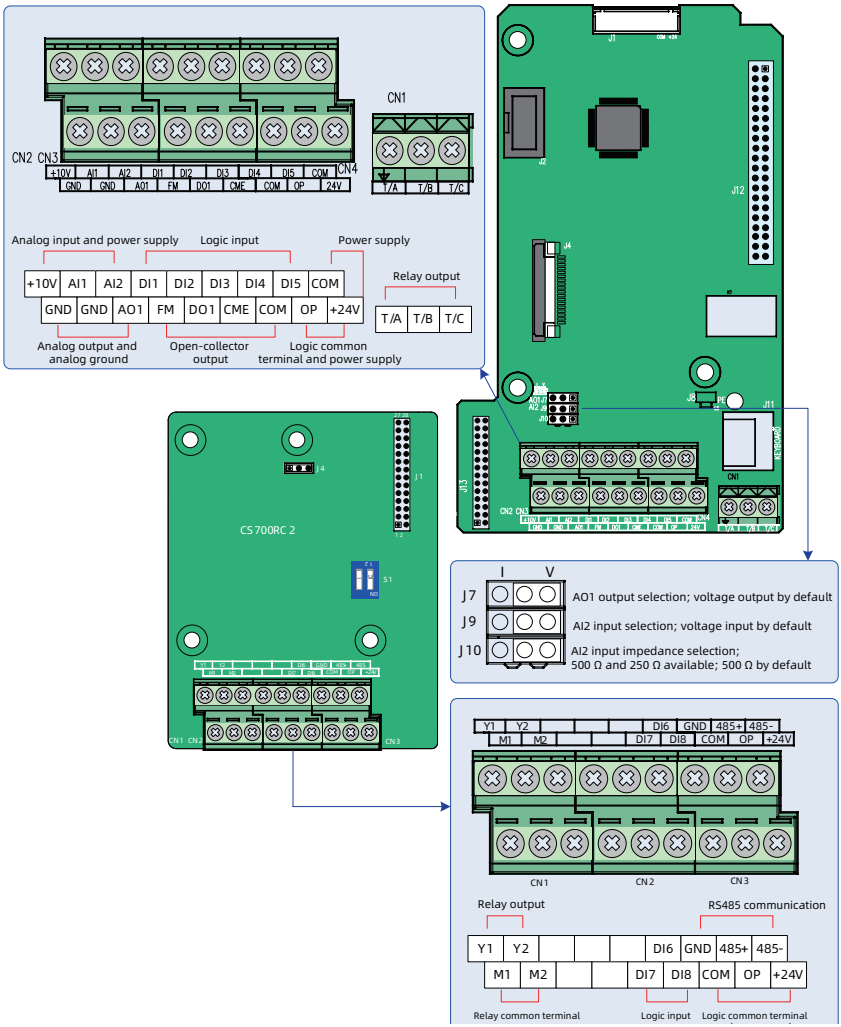


Figure 4-64 Control circuit terminals

NOTE

11 kW and below models carry CS700IO1 as standard. 15 kW and above models carry CS700RC2 as standard.

Table 4-29 Functions of control circuit terminals

Category	Symbol	Terminal	Function description
Power supply	+10V-GND	External +10 V power supply	Provide +10 V power supply externally. Generally used to supply an external potentiometer of 1 to 5 kΩ
	+24V-COM	External +24 V power supply	Provide 13 V±10% power supply externally. Generally, it supplies power to the DI/DO terminals and external sensor. Maximum output current: 200 mA [1]
	OP	Input terminal for external power supply	It is connected to +24V by default. When DI1 to DI5 are driven by external signals, OP must be disconnected from +24 V and connected to the external power supply.
Analog input	AI1-GND	AI1	Input voltage range: 0 VDC to 10 VDC Input impedance: 22 kΩ
	AI2-GND	AI2	Input voltage range of 0–10 VDC or input current range of 0–20 mA, which is determined by jumper J9 Input impedance: 22 kΩ at voltage input; 500 Ω or 250 Ω (selectable by jumper J10) at current input. (Note 2)
Digital input	DI1- OP	Digital input 1	Photocoupler isolation; compatible with dual-polarity input. Input impedance: 1.39 kΩ Operating voltage range: 9 V to 30 V
	DI2-OP	DI2	
	DI3-OP	DI3	
	DI4-OP	DI4	
	DI5-OP	DI5	
	DI6-OP	DI5	
	DI7-OP	DI6	
	DI8-OP	DI7	
Analog output	AO1-GND	AO1	Either a voltage or current output, determined by jumper J7. Output voltage range: 0–10 V Output current range: 0–20 mA
Digital output	DO1-CME	DO1	Optocoupler isolation; dual-polarity open collector output Output voltage range: 0 V to 24 V Output current range: 0 mA to 50 mA Note that CME and COM are internally insulated, but are shorted externally by a jumper. In this case, DO1 is driven by +24 V by default. Remove the jumper link if you need to apply external power to DO1.
	FM-CME	DO2	

Category	Symbol	Terminal	Function description
Relay output	T/A-T/B	Normally closed (NC) terminal 1	Driving capacity of the contact: 250 VAC, 3 A, COS ∅ = 0.4 30 VDC, 1 A
	T/A-T/C	NO terminal 1	
	Y1-M1	NO terminal 2	
	Y2-M2	NO terminal 3	
Auxiliary Interface	J13	Extension card interface	28-core terminal, connected to the interface of the optional card (including I/O extension cards, PLC cards, and various bus cards)
	J4	SD card interface	The open-collector, differential, and resolver interfaces are selectable options.
	J11	External operating panel Interface	External operating panel
Jumper (Note 3)	J7	AO1 output	Either voltage or current output (voltage output by default)
	J9	AI2 input selection	Either voltage or current input (voltage input by default)
	J10	AI2 input Impedance selection	Selectable between 500 Ω or 250 Ω (500 Ω by default)

NOTE

- When the ambient environment is above 23℃ , the output current must be de-rated for 1.8 mA per 1℃ rise. The maximum output current is 170 mA at 40℃ . When OP is shorted to 24 V, the current of the DI must also be considered.
- Select 500 Ω or 250 Ω input impedance according to the with-load capacity of signal source. For example, if 500 Ω is selected, the maximum output voltage of signal source cannot be lower than 10 V so that AI2 can measure 20 mA current.
- [Note 3] For positions of jumpers J7, J9 and J10, see Control circuit terminal arrangement.

Table 4-30 Parameter settings for standard expansion cards on the CS710 series AC drives

Function selection	Description of parameter setting
Models of 15 kW and above (CS700RC2)	
DI6 input	B3.06 is used to select the input function of DI6. Use it the same way as other DI points.
DI7 input point	b3.07 is used to select the input function of the DI7 input point. Use it the same way as other DI points.
DI8 input point	b3.08 is used to select the input function of the DI8 input point. Use it the same way as other DI points.
Models of 11 kW and below (CS700IO1)	
PA-PC	b3.20 is used to control the output of the PA-PC. Set the thousands place to 1 (Digital output), which is used in the same way as other DOs.
DI6 input	B3.06 is used to select the input function of DI6. Use it the same way as other DI points.
DI7 input point	b3.07 is used to select the input function of the DI7 input point. Use it the same way as other DI points.

4.3.6 Control Circuit Terminal Wiring

◆ Control circuit cable selection

All control circuit cables must be shielded cables. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables as digital signal cables.

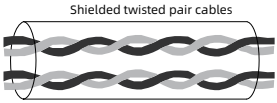


Figure 4-65 Twisted pair cable

◆ Control circuit wiring

Lay the motor cable far from all control circuit cables.

Route the motor cable, the input power cable, and the control circuit cable through different routes. Avoid long-distant parallel routing of the motor cable and control circuit cable, thereby reducing electromagnetic interference caused by coupling.

When the control circuit and the drive cable must be intersected, the intersection angle shall be 90 degrees.

Recommended cabling diagram:

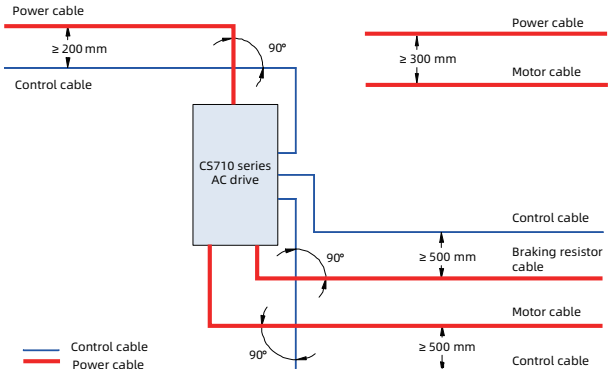


Figure 4-66 Wiring of cables

◆ Wiring of AI1

Weak analog voltage signals are prone to suffer external interference. Therefore, the shielded cable must be used and the cable length must be as short as possible (within 20 m), as shown in Figure 4-60. In scenarios where analog signals experience severe external interference, install a filter capacitor or a ferrite core on the analog signal source, as shown in Figure 4-62.

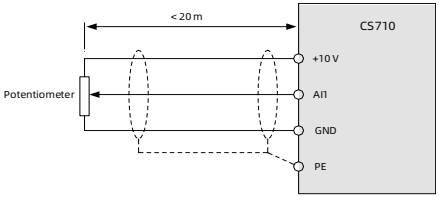


Figure 4-67 AI terminal wiring

Connect the lead wire of the AI shield to the PE terminal of the AC drive.

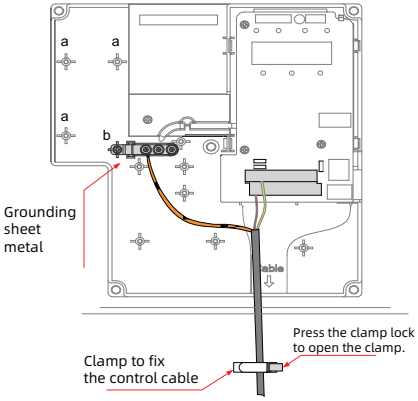


Figure 4-68 Grounding the AI shield

◆ Wiring of AI2

When you select voltage input for AI2, use the same wiring method as AI1.

When AI2 is to be used for current signal input, the current flows to AI2 and flows from GND. The jumper J9 is set to "I" at the same time.

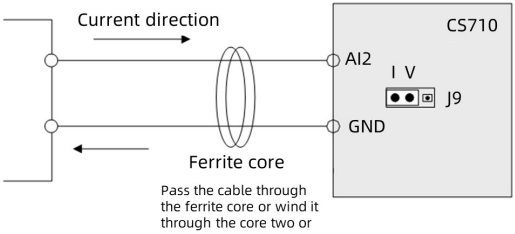


Figure 4-69 AI2 wiring

◆ Wiring of DI1 to DI5

1) Sink wiring

● Sink wiring

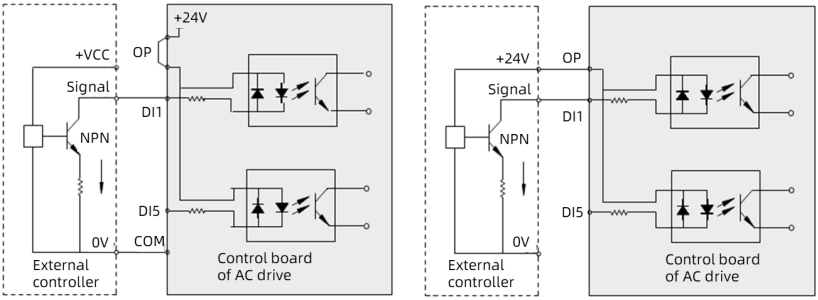


Figure 4-70 Wiring in SINK mode

Applying internal 24 V power supply is the most commonly used wiring mode. In this mode, short the +24 V terminal and OP and connect COM of the AC drive to 0 V of the external controller.

To use an external power supply, remove the jumper bar between terminals +24 V and OP, and connect the 24 V positive pole of the external power supply to OP, and 0 V terminal of the external power supply to the DI terminal through the control contact on the controller.

CAUTION

● This wiring method does not allow DI terminals of different AC drives to be connected in parallel because parallel connection may cause malfunction of the DI terminals. If parallel connection is needed, connect a diode in series to each DI terminal (connect the anode to DI). The diode must meet the following requirements: IF > 40 mA, VR > 40 V. Figure 4-64 shows such parallel connection.

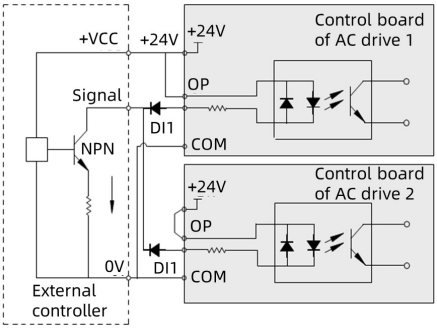


Figure 4-71 Sink wiring mode where DIs of multiple AC drives are connected in parallel

2) Source wiring

● Source wiring

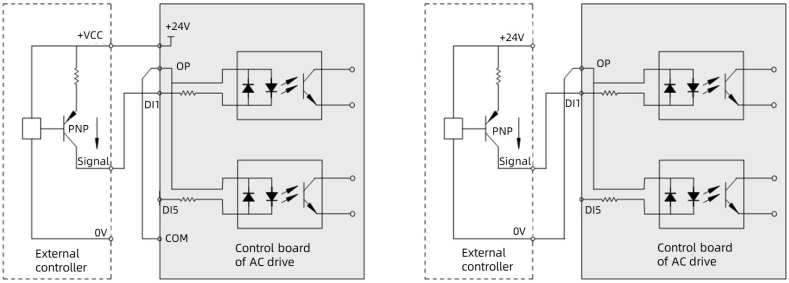


Figure 4-72 Wiring in SOURCE mode

If you intend to use the internal 24 V power supply of the AC drive, remove the jumper between terminals +24 V and OP, connect OP to COM, and connect +24 V to the common terminal of the external controller.

To use an external power supply, remove the jumper bar between +24 V and OP, connect OP to 0 V of the external power supply, and connect +24 V positive pole of the external power supply to the DI terminal through the control contact on the controller.

3) Wiring of DI5 (high-speed pulse input)

When DI4 is used for high-speed input, the allowed maximum frequency is 100 kHz.

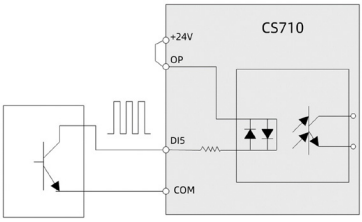


Figure 4-73 High-speed pulse input

◆ Wiring of DO

To use the DO terminal to drive a relay, connect a snubber diode to both ends of the relay coil. Otherwise, it may cause damage to the 24 VDC power supply. Ensure that the driving capacity does not exceed 50 mA.

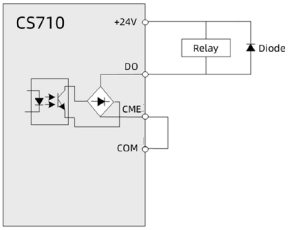


Figure 4-74 DO wiring

CAUTION

- Do not reverse the polarity of the snubber diode during installation, as shown in the following figure. as shown in Figure 4-67. Otherwise, the 24 VDC power supply will be damaged immediately once there is digital output.
- CME and COM are internally insulated. By default, CME and COM are shorted externally (DO1 is driven by +24 V by default). Remove the jumper link if you need to apply external power to DO1.

◆ Wiring of high-speed DO FM

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

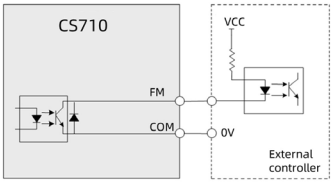


Figure 4-75 High-speed DO wiring

◆ Relay output terminal

The inductive load (relay, contactor, and motor) causes voltage peak after the current is removed. To minimize the interference at cutoff, use a voltage dependent resistor (VDR) at the relay contact for protection and install absorption circuits such as VDRs, RC absorption circuits, and diodes on the inductive load.

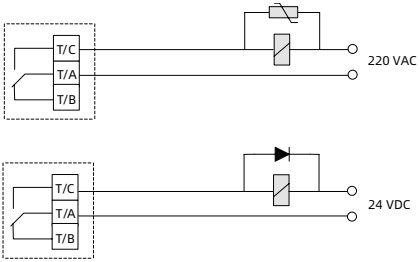


Figure 4-76 Anti-interference processing of relay output terminals

4.3.7 Wire Size and Tightening Torque of the Control Circuit Terminal

● Tubular terminal

Use tubular terminals with bushing.

When the single-wire or twisted-pair cable is used, it must have stripped wire ends of 6 mm.

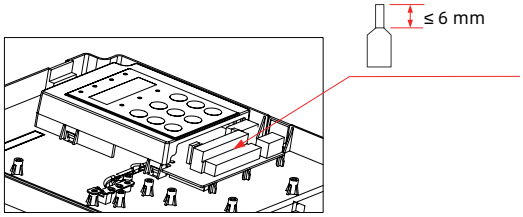


Figure 4-77 Requirements on tubular terminals of the control circuit cable

Table 4-31 Control circuit cable specifications

Control circuit terminal block	Single-conductor cable mm² (AWG)	Twisted pair mm² (AWG)	Tightening torque (N m)
	0.2 to 0.75 (AWG 24 to 18)		0.565

4.3.8 Wiring of the External Operating Panel

To connect an external operating panel, connect the cable to the RJ45 interface of the AC drive and run the cable through either side of the AC drive, as shown below.

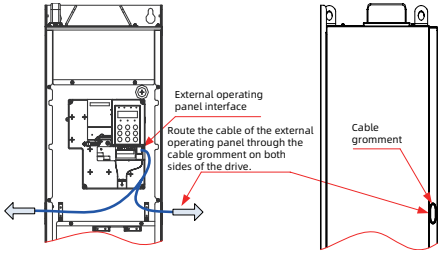


Figure 4-78 Wiring of the external operating panel

NOTE

For dimensions of the operating panel, see "Figure Dimensions of external operating panel (mm)". For use of the operating panel, see "5.2 LED Operation Panel"and "5.3 Viewing and Modifying Parameters".

4.3.9 Wiring Checklist

Check wiring according to the checklist and check the "Checked" column for the passed items.

Table 4-32 Wiring checklist

No.	Description	Result
1	The drive model is consistent with the model specified in the order.	
2	The peripheral devices (braking resistor, braking unit, AC reactor, filter, and circuit breaker) meet the design requirements.	
3	The option list is consistent with that is the order.	
4	The installation method and mounting location of the drive meet requirements.	
5	The input voltage of the drive is in the range of 323 V to 528 V.	
6	The rated motor voltage is consistent with the output specification of the drive.	
7	The power supply input cables are connected to R, S, and T terminals.	
8	The motor input cables are connected to the U, V, and W terminals.	
9	The cross sectional area of the main circuit cable meets the requirements.	
10	Heat-shrink tubing is applied to copper tube terminals and conductors of main circuit cables, and completely covers the cable conductors.	
11	Motor output cable does not exceed 50 m. Otherwise, you need to reduce the carrier frequency (F0.15).	
12	The grounding cable is connected properly.	
13	The output terminals and control signal cable terminals of the drive are connected securely.	
14	The braking resistor and braking unit with proper resistance are wired properly.	
15	Shielded twisted pair cables are used for the control circuit signals.	
16	The optional cards are connected correctly.	
17	The control circuit cables and main circuit cables are routed separately.	

5 Operating Panel

5.1 Operating Panel Description

The CS710 series AC drive has a built-in LED operating panel, which allows you to set parameters and monitor/control system status.

In addition to the built-in LED operating panel, an external LED (MD32NKE1) or LCD operating panel (MDKE9) is available as an option. The LED operating panel allows you to modify and view parameters. For its appearance and use, see section "5.2 LED Operation Panel". The LCD operating panel allows you to modify parameters and copy/download parameters.

5.2 LED Operation Panel

The LED operating panel allows you to set/modify parameters, monitor operating status, and start/stop the AC drive. The following figure shows the appearance and keys of the operating panel.

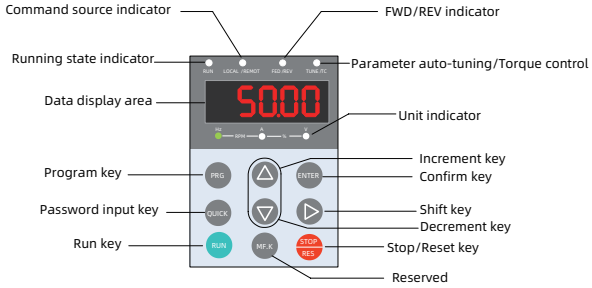


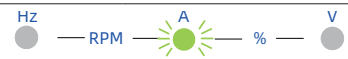
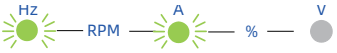
Figure 5-1 Operating panel

5.2.1 Indicators

indicates ON. indicates OFF. and indicates flash.

Table 5-1 Indicators on the operating panel

Indicator Status		Description
RUN Operation indicator	RUN	Off: shut down
	RUN	On: Running [1]
LOCAL/REMOT Command source indicator	LOCAL /REMOT	OFF: Operation panel control

Indicator Status		Description
LOCAL/REMOT Command source indicator		ON: Terminal control
		Blinking: Communication control
FWD/REV FWD/REV indicator		Off: Forward running
		On: Reverse running
TUNE/TC Auto-tuning/ Torque control/ Fault indicator		OFF: Normal running
		ON: Torque control mode
		Flashing once per second: Auto-tuning state
		Flashing quickly (flashing four times per second): Faulty state
		Frequency unit: Hz
		A: unit of current
		V: unit of voltage
		RPM for motor speed
		Percentage: %

[1] The RUN indicator is steady on when the AC drive is in the DC braking, pre-excitation, and magnetic flux state.

5.2.2 LED Display Area

There is a five-digit LED display on the operating panel, displaying information including the frequency setpoint, output frequency, monitoring data, and warning code.

Table 5-2 LED display and actual data

Display	Actual data	Display	Actual data	Display	Actual data	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

Display	Actual data	Display	Actual data	Display	Actual data	Display	Actual data
3	3	9	9	E	E	T	T
4	4	A	A	F	F	U	U
5	5, S	b	B	L	L	u	u

The operating panel carries a 5-bit LED display that displays various monitoring data, alarm codes, and function parameters.

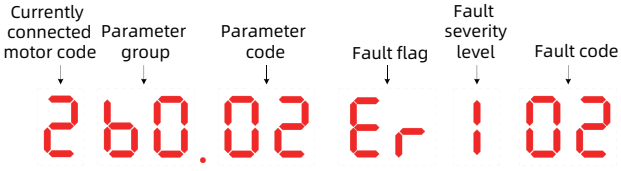


Figure 5-2 Example of LED display

NOTE

When the DI is not set to motor switchover function (input functions 27 and 28), the serial number bit of the motor connected will not be displayed.

5.2.3 Descriptions of Keys

Table 5-3 Functions of the keys

Key	Name	Function
PRG	Program key	Used to enter or exit from the level I menu.
ENTER	Confirm key	Used to enter each level of menu interface and confirm parameter settings.
△	Increment key	Used to increase the data or parameter.
▽	Decrement key	Used to decrease the data or parameter.
▷	Shift key	Used to select the displayed parameters cyclically in the stop or running interfaces. Select the parameter bit to be modified
RUN	Run key	Used to operate the device in operating panel control mode.

Key	Name	Function
STOP RES	Stop/Reset	Used to stop the operation in operating panel control mode. Reset the operation upon fault/alarm
MF.K	Reserved	Reserved.
QUICK	Shortcut	Press the key to quickly enter the password input interface. Long-press the key for 5s to quickly enter the parameter auto-tuning mode.

5.3 Viewing and Modifying Parameters

The operating panel of the CS710 series AC drive provides three interfaces: status display → parameter numbers → parameter settings. When you enter a menu and see the displayed data blinking, you can press the , , or key to modify the data.

The following figure shows the operation flowchart.

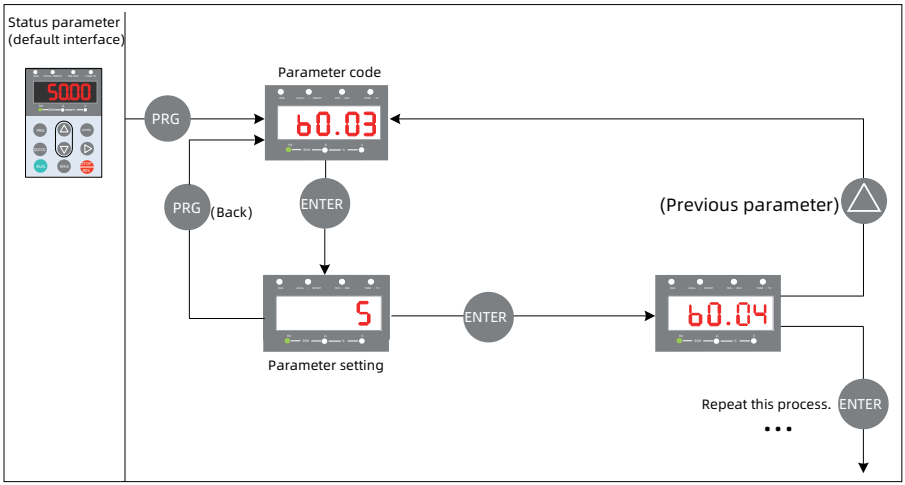


Figure 5-3 Flowchart for different interfaces

Here is an example of changing the value of b1.02 from 10.00 Hz to 15.00 Hz.

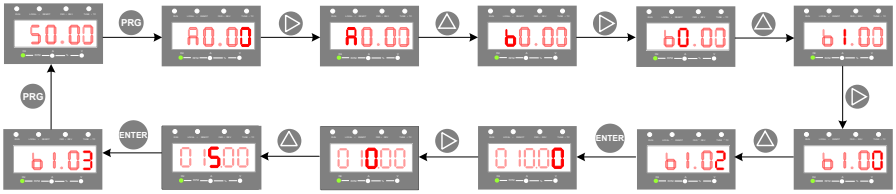


Figure 5-4 Parameter modification Diagram

In the parameter setting interface, if a parameter has no blinking digit, the parameter cannot be modified. Possible causes include:

1) This parameter is read-only, such as the monitoring parameters and operation log parameters.

2) This parameter can be modified only after stop.

5.4 parameter Structure

Table 5-4 Parameter classification

Parameter group	Function overview	Description
Group A	Basic parameters for crane	Used to set motor parameters and basic information of the crane.
Group B	AC drive function group	Used to set the running command, frequency reference, speed curve, and braking time sequence.
Group F	AC drive performance group	Used to set critical performance parameters of the AC drive.
Group U	Monitoring parameter group	Used to display basic monitoring parameters of the AC drive.
Group E	Fault parameter group	Used to display the fault log.

5.5 Viewing Status Parameters

In the stop or operational state, you can press key on the operating panel to display multiple status parameters. In the running status, you can view the frequency reference, synchronous frequency output, current output, voltage output, and bus voltage. In the stop status, you can only view the target frequency and bus voltage.

6 System Commissioning

This chapter describes the basic commissioning procedure for trial run of the AC drive, including frequency reference setting and start/stop control.



Check whether the brake acts properly during trial run. If not, adjust related brake parameters according to actual situation.

6.1 Quick Commissioning Guide

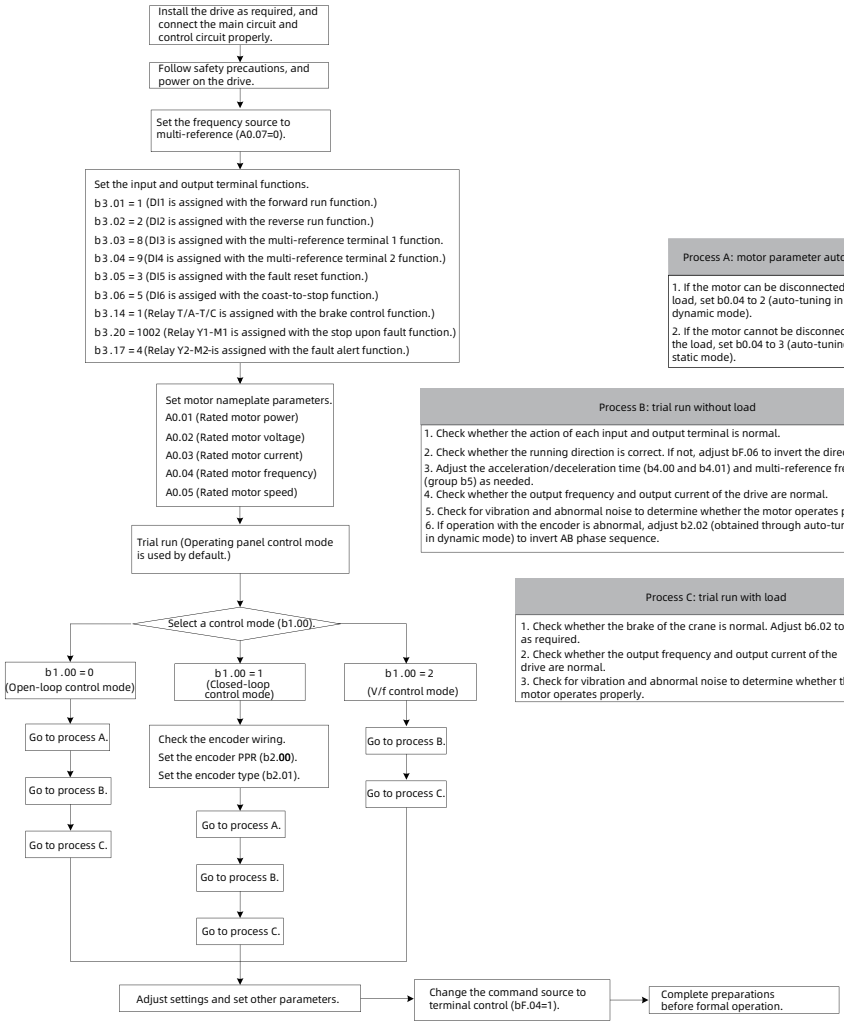


Figure 6-1 Quick commissioning flowchart

6.2 Precautions Before Power-on

Check the following items before powering on the drive.

Item	Inspection
Power supply voltage	The power supply voltage is correct (3PH, 380-480 VAC, 50/60 Hz).
	The power supply input terminals (R/S/T) are connected properly.
	The AC drive and motor are reliably grounded.
Wiring of the drive output terminals and motor terminals	The output terminals (U/V/W) of the drive are connected to the motor terminals properly.
Wiring of control circuit terminals	The control circuit terminals of the drive are connected to other control devices properly.
Status of control circuit terminals	The control circuit terminals of the AC drive are all in the OFF state (the AC drive is not running).
Load	The motor is in the no-load state and is not connected to any mechanical system.

6.3 Status Display After Power-on

After power-on, the keypad displays the following information in normal state.

Status	Display	Description
Normal		8.00 Hz displayed by default
Upon occurrence of the fault		Fault type displayed (The AC drive stops upon fault.)

6.4 Parameter Initialization

The CS710 series defines three levels of menus for parameters. Each menu allows you to restore to factory settings (except for certain parameters) and check user-defined settings. The operating panel displays only parameters whose default values are changed.

Menu No.	Param.	Function overview	Remarks
Level 1 menu	AF.01	Restore parameters in level 1 menu to default settings.	In level I menu, the following parameters cannot be restored to default settings: A0.00–A0.05, A0.08–A0.09, and AF.00.
	AF.02	Check user settings in level I menu	Display only the parameters with non-default values in level I menu

Menu No.	Param.	Function overview	Remarks
Level 2 menu	bF.01	Restore parameters in level 2 menu to default	Support level I and level II menus to be restored simultaneously Note: In level II menu, the following parameters cannot be restored to default settings: b0.02-b0.03, b2.00-b2.02, b7.10-b7.11, and bF.00.
	bF.02	Check user settings in level II menu	Used to display only the parameters with non-default values in level II menu.
	bF.03	Clear records	Clear all the parameters saved at power failure, which is to clear all the parameters in groups E* and U1.
Level 3 menu	FF.10	Restore parameters in level III menu to default	Support parameters in level III menu or all the parameters to be restored simultaneously. Note: In level I menu, the following parameters cannot be restored to default settings: F0.00-F0.04, F0.16, F2.01, F2.11, and FF.00.
	FF.11	Check user settings in level III menu	Used to display only the parameters with non-default values in level III menu.

6.5 Motor Control Mode Selection

Parameter	Description	Scenario
b1.00: Motor control mode selection	0: Sensorless vector control (SVC)	Indicates open-loop vector control that applies to common applications.
	1: Feedback vector control (FVC)	It indicates closed-loop vector control. The motor must be configured with an encoder and the AC drive provides the PG card (optional part) matching the encoder type. This mode is applicable to high-accuracy speed control or torque control occasions.
	2: V/f control	Applicable to low load occasions or applications where multiple motors are driven by one AC drive.

CAUTION

For vertical lifting scenarios (such as cranes, elevators, and hoists), only the closed-loop vector control (FVC) mode is allowed. The speed-sensorless vector control (SVC) or V/f control mode is prohibited. Using the SVC or V/f control mode may result in insufficient torque, causing the load to fall, equipment damage, or even personal injury.

Performance differences among control methods are described below:

- Constant voltage-to-frequency ratio (V/f control): In this mode, the drive cannot compensate for stator voltage drop at low frequencies, resulting in significant drop in output torque. As a result, the motor may not deliver enough torque for lifting operations, which may cause hook slipping and stalling.

- Speed-sensorless vector control (SVC): In this mode, the speed is estimated based on motor models. At very low or zero speed, flux orientation becomes inaccurate, preventing continuous rated torque output. This creates a slipping risk when the load is suspended or during startup.
- Closed-loop vector control (FVC): This mode uses an encoder for real-time speed and position feedback. This enables full torque at zero speed and excellent dynamic response. It also ensures precise torque and speed control for smooth lifting and reliable load holding. For these reasons, FVC is the only safe and reliable control method for vertical lifting applications.

6.6 Start/Stop Command

There are three sources of start/stop commands for the AC drive: operating panel control, terminal control, and communication control. You can select the command source using bF.04.

bF.04	Command source		Default	0
	Setting range	0	0: Operating panel control (LED indicator OFF)	
		1	1: Terminal control (LED indicator ON)	
		2	Communication control (LED blinking)	

Used to select the control command source of the AC drive. The control commands include start, stop, forward run, and reverse run.

B0-02 = 0: Operation panel (LOCAL/REMOT indicator is OFF);

Commands are given by pressing keys and on the operation panel.

B0-02 = 1: Terminal (LOCAL/REMOT indicator is ON);

Running commands controlled by multi-function input terminals

2: Communication control (LOCAL/REMOT indicator blinking)

6.6.1 Start/Stop Control through the Operating Panel

Set bF.04 to 0 to enable operating panel control. To start the AC drive, press RUN on the panel and the RUN indicator turns on. To stop the AC drive, press STOP on the panel and the RUN indicator turns off.

6.6.2 Start/Stop Control through DI terminals

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

The CS710 series AC drive can be controlled using terminals. Parameters b3.01 to b3.13 determine the functions of the AC drive control signals. For details, see the description of these parameters.

Example 1:
Use the DIP switch as the start/stop command source, and allocate the forward running switch signal to DI2 and the reverse running switch signal to DI4. The corresponding setting mode is shown in the following figure.

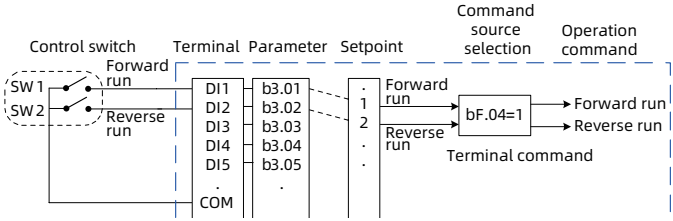


Figure 6-2 Example of terminal control mode

In the preceding figure, when SW1 is switched on, the AC drive runs forwardly; when SW1 is switched off, the AC drive stops. When SW2 is switched on, the AC drive runs reversely; when SW2 is switched off, the AC drive stops. When SW1 and SW2 are switched on simultaneously, the AC drive reports NO. 44 fault (Both forward and reverse running commands activated).

In operating panel control, when the RUN key is pressed, the AC drive drives the motor to run, and the motor direction at this point is regarded as the forward direction. If the motor direction is in reverse to the direction required by the equipment, power off the AC drive first (wait until the main capacitor of the AC drive is completely discharged), and then exchange any two of the output UVW cables or set bF.06 to 1 to reverse the motor direction.

6.6.3 Start/Stop Through Communication

AC drive control through communication with a host controller becomes more and more widely used. After you install an RS485 interface card in the AC drive and select communication as the source of AC drive control commands (bF.04 = 2), you can control the AC drive in communication mode. The following figure shows how to set the parameter for this control mode.

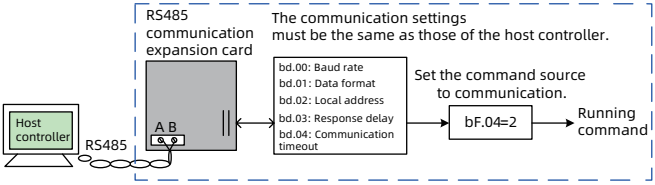


Figure 6-3 Example of AC drive control through communication with a host controller

When the communication timeout interval (bd.04) is set to a non-zero value, the AC drive will automatically stop after the timeout interval ends. This function prevents uncontrollable AC drive running due to faults of the communication cable or the host controller. This function applies to some applications.

6.7 Start/Stop Setting

6.7.1 Start Mode

The CS710 supports the direct startup mode and provides professional brake sequence control dedicated for cranes. (For details, see the description of parameters in group b6.)

6.7.2 Stop Mode

The CS710 supports two stop modes: decelerate to stop and coast to stop, which can be set using b4.03. The default stop mode is "decelerate to stop" (b4.03 = 0).

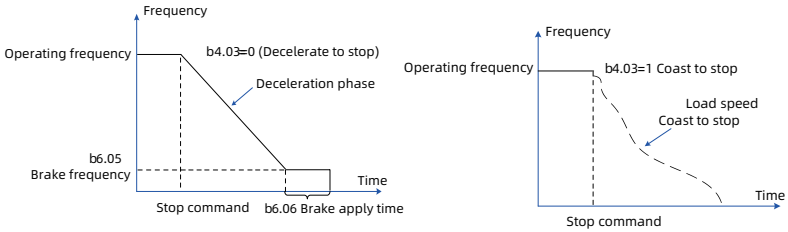


Figure 6-4 Stop mode

6.8 Setting Frequency Reference Source

The CS710 series AC drive supports five frequency reference sources, namely, multi-reference, analog AI1, analog AI2, acceleration/deceleration, and communication. You can select the sources using A0.07 and b3.00. For details, see the description of the two parameters.

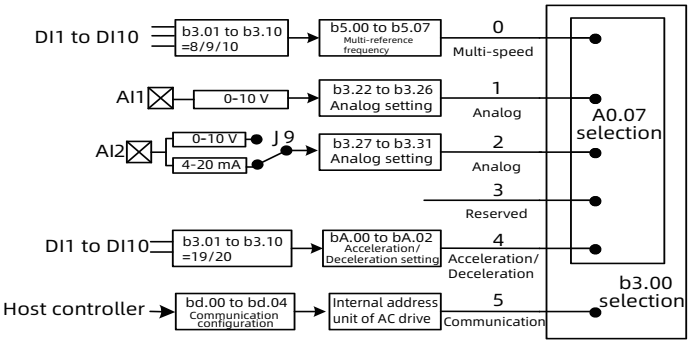


Figure 6-5 Frequency reference source

The preceding figure lists parameters related to the frequency source setting, see the description of the parameter for details.

6.8.1 Setting Multi-speed Mode

Multi-speed control applies to applications where only several frequency values are used without the need for continuous reference frequency adjustment. For the CS710 series AC drive, you can set a maximum of eight frequencies using a maximum of three DI functions. To designate multi-speed reference input terminal, set the parameter corresponding to DI terminal to 8-10. The multi-speed is defined by parameters in group b5. Set the "Frequency source" in the following figure to multi-speed reference.

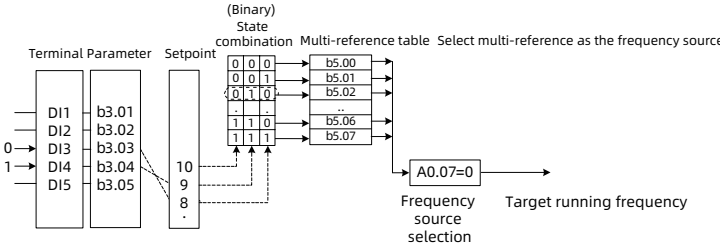


Figure 6-6 Multi-speed mode setting

In the preceding figure, DI3 and DI4 act as the designated multi-speed signal input terminal. The blank set bit is calculated as 0 and each three bits forms a binary number, and each binary number corresponds to a specific multi-speed rate. As shown in the preceding figure, when the input status of DI3 and DI4 is set to 0 and 1 respectively, a binary number consisted by 0, 1 and 0 is formed, and the corresponding status combination value is 2, indicating the frequency value defined by b5.02 will be selected. As the frequency source has been set to "multi-speed", the value of b5.02 determines the target reference frequency.

For the CS710 series AC drive, you can select a maximum of three DIs as multi-frequency command input terminals (as described above). The empty bits are calculated as 0.

6.8.2 Setting Analog Reference Frequency

The following figure shows how to adjust the reference frequency by a potentiometer. In the following figure, the output frequency of the AC drive changes between 0 to the maximum frequency during adjustment of the potentiometer within the whole range.

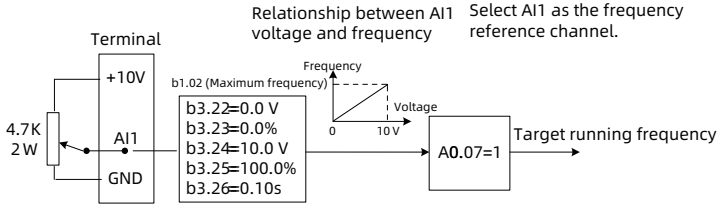


Figure 6-7 Analog reference frequency setting

6.9 Instructions for Use of AC Drive Terminals

6.9.1 Usage of DI Terminals

The internal hardware of DIs is configured with a 24 VDC power supply for detection. You only need to short the DI to COM terminal to input the DI signal to the drive.

The AC drive also provides b3.21 (DI filter time) for the DI signal to improve the anti-interference capacity.

The functions of preceding eight DI terminals are defined by parameters b3.01 to b3.08. For details, see descriptions of b3.01 to b3.08.6.9.2 Usage of AI Terminals

The ITD500 series AC drive carries two AI terminals, AI1 and AI2.

Terminal	Input signal characteristic
AI1-GND	Receives a voltage signal of 0–10 VDC.
AI2-GND	If jumper J9 is in position "V", the drive can receive 0–10 VDC voltage signals. If jumper J9 is in position "I", the drive can receive 4 -20 mA current signals.

As an external voltage/current signal, AI is used frequency source setting and torque setting. The corresponding relationship of the voltage or current and actual setting or feedback is defined by b3.22–b3.31.

The sampling value of AI terminals can be read in U0.12 and U0.13. The calculation value after conversion is used for subsequent internal calculation and cannot be directly read by users.

6.9.3 Usage of DO Terminals

The control board provides five DOs: FM, DO1, T/A-T/B-T/C, Y1-M1, and Y2-M2. FM and DO1 are transistor outputs capable of driving a 24 VDC low-voltage signal circuit. T/A-T/B-T/C, Y1-M1, and Y2-M2 are relay outputs capable of driving a 250 VAC control circuit.

Name	Corresponding Parameters	Output characteristics
FM-CME	b3.18	Transistor; drive capacity: 24 VDC, 50 mA
DO1-CME	b3.16	Transistor; drive capacity: 24 VDC, 50 mA
T/A-T/B-T/C	b3.14	Relay; driving capacity: 250 VAC, 3 A
Y1-M1	b3.20	
Y2-M2	b3.17	

6.9.4 Usage of AO Terminals

The AC drive supports a total of two AO terminals, among which AO1 is provided on the control board and AO2 is provided on the extension card.

Terminal	Input signal characteristic

AO1-GND	Outputs 0–10 VDC voltage signals when J7 is in the position marked by "V".
	Outputs 0–20 mA current signals when J7 is in the position marked by "I".
AO2-GND	Located on an expansion board and outputs 0–10 VDC voltage signals.

AO1 and AO2 can be used to indicate the internal running parameters in the analog mode. The attribute of parameter indicated is defined by b3.19 and b3.20.
The running parameters indicated can be rectified before output. The rectification characteristic curve is shown by the oblique line in the following figure, which is Y = kX+b. In this formula, the letter X indicates the running parameters to be output, for AO1, the letter k and b can be defined by b3.44 and b3.43.

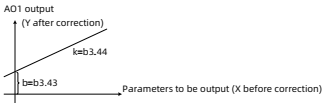


Figure 6-8 Output characteristic curve of AO1

6.9.5 Usage of PG Terminals

To apply closed-loop vector control (b1.00=1) to improve the frequency conversion and speed regulation performance, users need to install an encoder on the motor shaft, and send the encoder signal to the AC drive through PG card (encoder signal interface card). The CS710 series AC drive supports five PG cards with different signal characteristics.

The AC drive supports four types of encoders, including differential encoders, UVW encoders, resolvers, and open collector encoders.

You can set different encoder-related parameters based on the encoder used. Take motor parameter group 1 as example:

1) For differential encoders, the encoder pulses per revolution is defined by b2.00, and b2.01 is set to 0 (ABZ incremental encoder/differential encoder).

2) 1) For UVW encoder, the encoder pulses per revolution is defined by b2.00, and b2.01 is set to 1 (UVW incremental encoder)

3) 3) For the resolver, b2.01 is set to 2 (Resolver)

4) 4) For the open-collector/push-pull encoder, set the encoder pulses per revolution by b2.00, and set b2.01 to 0 (ABZ incremental encoder)

5) For details on how to use the encoder, see section "11.3 Encoder Expansion Card".

6.10 Motor Parameter Auto-tuning

6.10.1 Motor Parameter Settings

When the AC drive runs in vector control mode (b1.00 = 0 or 1), accurate motor parameters are required to ensure excellent drive performance and running efficiency.

This is one of major differences between the vector control mode and the V/f control mode (b1.00 = 2).

6.10.2 Motor Parameter Auto-tuning

The AC drive can automatically obtain internal electrical parameters of the motor in the following ways: dynamic auto-tuning and static auto-tuning.

Auto-tuning method	Applicable scenario	Auto-tuning effect	Parameter Settings
Static auto-tuning (Complete auto-tuning)	Applicable to all the occasions	Good	b0.04 = 3
No-load dynamic auto-tuning (complete auto-tuning)	This mode applies to scenarios where the motor is easily disconnected from the application system. If the motor load is the roller type (pure inertia load), parameters can be directly tuned without the roller removed.	Optimal	b0.04 = 2
Static auto-tuning (partial auto-tuning)	Applicable to scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed (no auto-tuning for motor mutual inductance and no-load current).	Good	b0.04 = 1

1. Procedure for implementing dynamic auto-tuning of motor parameters:

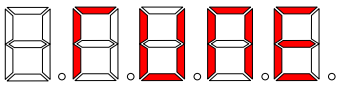
1. If the motor can be fully disconnected from the load, mechanically disconnect the motor from the load after power-off to ensure motor can rotate freely without load.

2. After power-on, set bF.04 (Command source selection) to 0 (Operating panel control).

Step 3: Input the motor nameplate parameters (such as A0.01 to A0.05) correctly and input the following parameters based on the motor specifications.

Manual input
A0.01: Rated motor power A0.02: Rated motor voltage A0.03: Rated motor current A0.04: Rated motor frequency A0.05: Rated motor speed

Step 4: If the motor can be disconnected from the load, set parameter b0.04 to 2 (asynchronous motor dynamic auto-tuning) and press ENTER. In this case, the operating panel displays:



Next, press RUN on the operating panel, and the AC drive drives the motor to run (acceleration/deceleration time defined by b4.06 and b4.07). In this case, the RUN indicator turns on. Then, the preceding display disappears and the operating panel returns to parameter display state, indicating completion of the parameter auto-tuning.

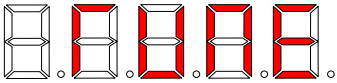
After dynamic parameter auto-tuning, the AC drive automatically obtains the following motor parameters:

Parameters updated automatically after auto-tuning
F0.00: Asynchronous motor stator resistance F0.01: Asynchronous motor rotor resistance F0.02: Asynchronous motor leakage inductive reactance F0.03: Asynchronous motor mutual inductive reactance F0.04: No-load current of asynchronous motor

If the motor cannot be disconnected from the load, set b0.04 to 1 or 3 (recommended) to start static auto-tuning of motor parameters. Static auto-tuning mode 3 can be used to obtain all motor parameters but takes a relatively long time.

2. One-key quick auto-tuning:

Hold down the QUICK key on the AC drive panel for 5s until "TUNE" is displayed, and then press RUN to start auto-tuning.



When you need to perform parameter auto-tuning again after the motor parameters have been set, you can enable the quick auto-tuning function. In this case, auto-tuning mode 3 (complete static auto-tuning) is used by default. You do not need to disconnect the motor from the load or change the value of bF.04 or any other parameters.

6.11 Password Setting

The CS710 series AC drive provides user password protection.

Param.	Function overview	Inspection
AF.00	Password for all the parameters	Defines the password for groups A, b, E, U, and F.
bF.00	Password for level 2 menus	Defines the password for groups b, E, U, and F.
FF.00	Password for level III menus	Defines the password for group F.

The password function is enabled when AF.00, bF.00, and FF.00 are set to non-zero

values. In this case, after you press the QUICK key, the operating panel displays -----. You can enter the menu only after entering the correct password. If you enter wrong passwords for three consecutive times, the system is locked. You can continue inputting the password after power off and on again. Set AF.00, bF.00, and FF.00 to 0 to clear the password.

6.12 Application Examples

6.12.1 Braking of Crane System

■ Introduction to the brake sequence

The CS710 provides the built-in brake time sequence control function. To use this function, set the function of an output terminal to output function 1 (brake control). The brake control sequence is shown below.

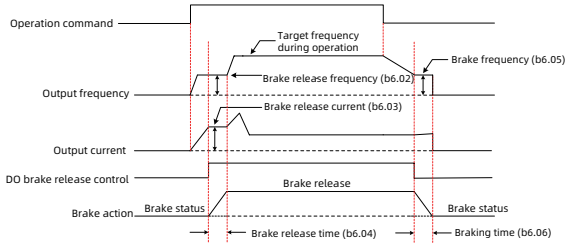


Figure 6-9 Typical control process of a crane system and parameter settings

A de-energized braking mechanism is in the braking state. The brake can be released only after the braking mechanism is energized. Set b6.04 (Brake release time) and b6.06 (Brake apply time) based on the actual mechanical delay of the brake. In theory, the setpoints of these two parameters should be slightly higher than the mechanical delay to avoid load sag.

6.12.2 Safety Limit and Stop upon Faults

The electrical wiring diagram for safety limit and stop at fault is shown below. Install a limit switch on each end of the rail. When the mechanism hits the limit switch, the control cabinet cuts off the running command in this direction, without affecting the reverse running direction. In this case, press the reverse run switch to restore normal operation of the equipment.

When a level-one fault occurs on the drive, the relay terminal Y1-M1 on the I/O expansion card closes. This outputs a stop-at-fault signal to the control cabinet, triggering the fault contactor KM to act accordingly (such as disconnecting the running circuit). In this case, a fault reset is required before the equipment can resume normal operation.

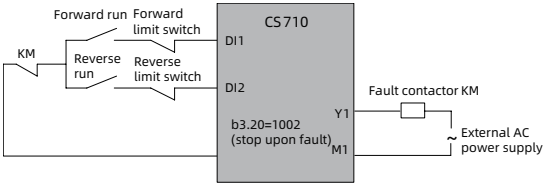


Figure 6-10 Wiring for safety limit and stop-at-fault application

NOTE

This wiring diagram shows the most commonly-used wiring method for the limit switch, which can be changed as needed.

7 Parameter Table

The CS710 series AC drive has some manufacturer-reserved parameters, and their parameter numbers are not listed in the parameter tables. Therefore, the parameter numbers in the parameter tables are discontinuous. Do not modify the parameters that are not described in this user guide as doing so may cause errors in equipment operation.

Some functional parameters can be modified only when the AC drive is in the stop state. Do not attempt to modify these parameters when the AC drive is running. Monitored parameters that displayed on the operating panel only cannot be modified.

7.1 Level-1 Menu (Group A) Parameter List

The level-1 menu contains motor parameters and basic feature parameters of the crane. Correct settings of level-1 menu parameters can ensure normal running of the motor driven by the AC drive. Parameters for enhanced functions of the AC drive need to be set in the level-2 menu.

Parameter	Name	Parameter description	Setting range	Default
Group A0: Basic crane parameters				
A0.00	Motor type selection	1 (default): Asynchronous motor 2: Inactive	1 to 2	1
A0.01	Rated power of the motor	Indicates the rated motor power shown on the motor nameplate.	0.4 to 1000.0	0.4 kW
A0.02	Rated voltage of the motor	Indicates the rated voltage of the motor displayed on the motor nameplate.	0 to 2000	380 V
A0.03	Rated current of the motor	Indicates the rated current of the motor displayed on the motor nameplate.	0.01 to 655.35	2.10 A
A0.04	Rated frequency of the motor	Indicates the rated frequency of the motor shown on the motor nameplate.	0.01 Hz to b1.02	50.00 Hz
A0.05	Rated speed of the motor	Indicates the rated speed of the motor displayed on the motor nameplate.	0 to 65535	1400 rpm

Parameter	Name	Parameter description	Setting range	Default
A0.07	Frequency source selection A	This parameter is used with b3.00 (Frequency source selection B) in the level 2 menu. A0.07 in the level 1 menu only lists 4 common frequency sources, and b3.00 in the level 2 menu lists all frequency sources. If b3.00 > 4, the frequency source specified by b3.00 takes effect. If b3.00 ≤ 4, the frequency source specified by A0.07 takes effect. 0: Multi-speed reference Input functions 8, 9, and 10 are combined in binary format to provide eight speed segments, corresponding to the frequencies set by b5.00 to b5.07. For details, see the description of parameters in group b5. 1: AI1 Only voltage input of 0 V to 10 V is supported. 2: AI2 Supports 0 V to 10 V voltage input or 4 mA to 20 mA current input, as defined by jumper J8 on the control board.	0: Multi-speed reference 1: AI1 2: AI2 3: Reserved	0
A0.07	Frequency source selection A	The analog input and target frequency are linearly proportional, and the reference frequency is determined by b1.02 (maximum frequency). 3: Reserved 4: Acceleration/Deceleration reference It must be used together with input functions 19 and 20. For details, see the description of parameters in group bA.	0: Multi-speed reference 1: AI1 2: AI2 3: Reserved	0

<table>
<tr><th>Parameter</th><th>Name</th><th>Parameter description</th><th>Setting range</th><th>Default</th></tr>
<tr><td>A0.08</td><td>Crane mechanism selection</td><td>Used to select the crane mechanism driven by the drive.
0: Hoisting mechanism
1: Translation mechanism
2: Rotation mechanism
<table>
<tr><th>Mechanism Type</th><th>Para.</th><th>Definition</th></tr>
<tr><td rowspan="5">Hoisting mechanism</td><td>b1.00 = 0</td><td>Control mode changed to open loop</td></tr>
<tr><td>b6.03 = 30.0%</td><td>Brake release current changed to 30.0%</td></tr>
<tr><td>bC.02 = 0.50s</td><td>No. 37 fault enable</td></tr>
<tr><td>bC.04 = 0.50s</td><td>No. 38 fault enable</td></tr>
<tr><td>F1.00 = 60</td><td>Speed loop gain changed from 1 to 60</td></tr>
<tr><td rowspan="5">Translation mechanism</td><td>b1.00 = 2</td><td>The control mode is changed to V/f control.</td></tr>
<tr><td>b6.03=0.0%</td><td>Brake release current changed to 0.0%</td></tr>
<tr><td>bC.02 = 0.0s</td><td>No. 37 fault invalid</td></tr>
<tr><td>bC.04 = 0.0s</td><td>No. 38 fault inactive</td></tr>
<tr><td>F1.00 = 30</td><td>Speed loop gain changed from 1 to 30</td></tr>
<tr><td>Rotation mechanism</td><td colspan="2">Same as the translation mechanism</td></tr>
</table></td><td>0: Hoisting mechanism
1: Translation mechanism
2: Rotation mechanism</td><td>0</td></tr>
<tr><td colspan="5">Group AF: Auxiliary parameters in level I menu</td></tr>
<tr><td>AF.00</td><td>User password</td><td>It is the password for the display and modification of all the parameters. If this parameter is set to a non-zero value, password protection will be enabled for all the menus. If you enter the wrong password consecutively three times, all menus are locked. In this case, you must power off and restart the drive. If you set this parameter to 0, the password is canceled.</td><td>0 to 65535</td><td>0</td></tr>
</table>

Parameter	Name	Parameter description	Setting range	Default
AF.01	Restore parameters in level 1 menu to default settings.	0: Not restored 1: Restore parameters in level 1 menu to defaults In level 1 menu, the following parameters cannot be restored to defaults: A0.00 to A0.05, A0.08, A0.09, and AF.00.	0: No action 1: Restore parameters in level 1 menu (Group A)	0
AF.02	Level 1 menu setting verification	0: Display all the parameters in level 1 menu 1: Display only parameters with non-default values in level 1 menu 2: In the level-one menu, all LEDs are on and "88888" is displayed.	0: Display all in the level 1 menu 1: Display parameters with default values changed only 2: In the level-one menu, all LEDs are on and "88888" is displayed.	0

7.2 Level-2 Menu (Group b, Group E*, Group U) Parameter List

The level-2 menu contains basic functional parameters, monitoring parameters, and fault record parameters of the AC drive. You can implement all functions of the AC drive by setting parameters in the level-2 menu. To improve the output performance of the AC drive, you need to set parameters in the level-3 menu.

Input the password defined by bF.00 (Level II menu password) to enter level II menu.

Parameter	Name	Parameter description	Setting range	Default
Group b0: Basic motor parameters				
b0.00	Protection frequency for shaft-cooled motor during low-speed operation	The drive reports error Er#43 when the frequency of the drive stays below the value of b0.00 for a period longer than the value of b0.01.	0.01 Hz to 20.00 Hz	5.00 Hz
b0.01	Low-speed operation time of shaft-cooled motor		0s to 1000s	0s

Parameter	Name	Parameter description	Setting range	Default
b0.04	Parameter auto-tuning selection	0: No action 1: Auto-tuning on some parameters of an asynchronous motor in static state 2: Auto-tuning on all parameters of an asynchronous motor in dynamic state 3: Auto-tuning on all parameters of an asynchronous motor in static state	0: No action 1: Static partial auto-tuning of asynchronous motor 2: Dynamic auto-tuning of asynchronous motor 3: Static complete auto-tuning of asynchronous motor	0
b0.05	Parameter auto-tuning upon power-on	The drive supports auto-tuning of stator resistance upon power-on. If this function is enabled, the drive takes 2 to 3 seconds in static auto-tuning to achieve the optimal control effect every time it is powered on.	0: Disable 1: Enable	0
Group b1: Motor control parameters				
b1.00f	Control mode	0: SVC (open-loop control mode) 1: FVC (closed-loop control mode) 2: V/f control	0: Sensorless vector control 1: Feedback vector control 2: V/f control	0
b1.01	Slip compensation	Used to adjust the motor speed stability accuracy in SVC mode. Increase the value of this parameter during low speed at heavy load, or decrease the value during high speed at light load. In FVC mode, it is used to adjust the drive output current under the same load.	50% to 200%	100%
b1.02	Maximum frequency	This parameter is used as the base value for calculating the target frequency when the frequency source is set to the analog or communication. It is the upper limit of the drive output frequency at any time.	50.00 Hz to 300.00 Hz	50.00 Hz

Parameter	Name	Parameter description	Setting range	Default
b1.03	Minimum frequency	This parameter is used as the base value for calculating the target frequency when the frequency source is set to the analog or communication. Defines the lower limit of the drive output frequency at any time.	0.00 Hz to 15.00 Hz	0.00 Hz
b1.04	Positive torque upper limit	Defines the output torque upper limit value when the drive runs forwardly, which is expressed as a percentage to the rated torque of the motor. The torque upper limit is still 50.0% even if the setpoint is lower than 50.0% when the drive is not in FVC mode.	0.0% to 500.0%	180.0 %
b1.05	Negative torque upper limit	Defines the output torque upper limit when the drive runs reversely, which is expressed as a percentage to the rated torque of the motor. The torque upper limit is still 50.0% even if the setpoint is lower than 50.0% when the drive is not in FVC mode.	0.0% to 500.0%	180.0 %
b1.06	Positive torque upper limit upon brake release	This parameter is valid when b6.00 is set to 2 (manual brake control). When the drive starts in forward direction, the torque limit is the value of this parameter during the brake release time (b6.04). After the brake is fully opened, the torque limit switches to the values set in b1.04 and b1.05.	0.0% to 500.0%	150.0%
b1.07	Negative torque upper limit during brake release	This parameter is valid when b6.00 is set to 2 (manual brake control). When the drive starts in reverse direction, the torque limit is the value of this parameter during the brake release time (b6.04). After the brake is fully opened, the torque limit switches to the values set in b1.04 and b1.05.	0.0% to 500.0%	130.0 %
Group b2: Encoder parameters				

Parameter	Name	Parameter description	Setting range	Default
b2.00	Encoder pulses per revolution	It is used to set the pulses per revolution (PPR) of the ABZ or UVW incremental encoder. In FVC mode, the motor can run properly only if this parameter is set correctly.	0 to 8192	1024
b2.01	Encoder type	0: ABZ incremental encoder/ differential encoder (applicable cards: MD38PG5/ MD38PG1/ MD38PG6/ MD38PGMD) 1: UVW incremental encoder (applicable interface card: MD38PG3) 2: Resolver Use the MD38PG4 PG card for this type of encoder. 3: Reserved 4: Reserved The CS710 series AC drive supports multiple types of encoders, which are used with different PG cards. Choose an appropriate PG card for the encoder used. After installed the PG card, set b2.01 based on actual conditions to enable the motor to run properly.	0: ABZ incremental encoder, differential encoder 1: UVW incremental encoder 2: Resolver 3: Reserved 4: Reserved	0
b2.02	Encoder A/B phase sequence inversion	It is valid only for the ABZ incremental encoder (b2.01=0). Used to set the A/B phase sequence of the ABZ incremental encoder. During auto-tuning for an asynchronous motor, the AC drive automatically identifies the AB phase sequence.	0: Same direction 1: Opposite direction	0
b2.03	Encoder open circuit detection	It is used to enable the Er#20 fault (Encoder open-circuit detection). When it is set to 1, Er#20 is detected. When it is set to 0, Er#20 is masked.	0: Disable 1: Enable	1
b2.04	Speed feedback PG card selection	When the speed feedback source is set to 2 in FVC mode, the speed feedback is generated by DI5.	0: Local PG card 1: Expansion PG card 2: Pulse input	0

Parameter	Name	Parameter description	Setting range	Default
b2.06	Number of resolver pole pairs	Defines the number of pole pairs of the resolver. The higher the number of pole pairs, the higher the precision. A resolver is an electromagnetic transducer, also known as a synchronous resolver. It is a small AC motor used to measure angles, and measure shaft angular displacement and angular velocity of a rotating object. It consists of stators and rotors. If a resolver is used, set the number of pole pairs of the resolver properly. The number of resolver pole pairs must be lower than or equal to the number of motor pole pairs, and the number of motor pole pairs divided by the number of resolver pole pairs must be an integer.	1 to 65535	1
b2.07	Encoder open circuit detection time	Used to set the encoder hardware disconnection detection time, and this function is only valid for MD38PGMD. If this parameter is set to 0, the hardware disconnection detection will be disabled. When signals of the encoder are abnormal, the AC drive reports error 120#.	0.0 to 10.0	0.0
Group b3 Input/Output Function Parameters				

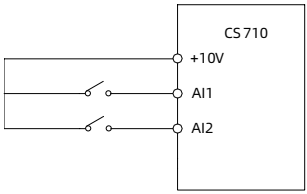
Parameter	Name	Parameter description	Setting range	Default
b3.00	Frequency source selection B	0 to 4: The frequency source is set by A0.07. 5: Communication The CS710 supports four types of communication modes, including Modbus, EtherCAT, CANopen, and PROFIBUS DP. Different communication modes require different expansion cards and different settings of bd.07. For details, see descriptions of communication expansion cards and bd.07 in section 11.2. For the frequency reference data format in each communication mode, see details of the specific communication mode. 6: High-speed pulse reference DI5 terminal serves as a pulse input terminal. Combined with parameters b3.37 to b3.41, the product of actual pulse input frequency percentage and maximum frequency (b1.02) is the frequency source.	0: Based on setting of A0.07 1: Based on setting of A0.07 2: Based on setting of A0.07 3: Based on setting of A0.07 4: Based on setting of A0.07 5: Communication 6: High-speed pulse reference	0
b3.01	DI1 function selection	The setpoint 0 of the hundreds indicates the normally open contact. The DI function is inactive by default. The setpoint 1 of the hundreds indicates the normally closed contact. The DI function is active by default. (Continued->)	0: No function (normally open contact) 1: Forward run (normally open contact) (Continued->)	1
b3.02	DI2 function selection	(<-continued) 1: Forward run 2: Reverse run This terminal is used to control forward or reverse run of the drive. 3: Fault reset Fault reset is performed through terminals. This is the same as the function of RESET key on the operating panel. Remote fault reset can be implemented through this function. (Continued->)	(<-continued) 2: Reverse run (normally open contact) 3: Fault reset (normally open contact) 4: Quick stop (normally open contact) (Continued->)	2

Parameter	Name	Parameter description	Setting range	Default
b3.03	DI3 function selection	(<-continued) 4: Quick stop The drive outputs the brake frequency (b6.05) immediately and executes the brake time sequence normally. 5: Coast to stop The drive blocks output. In this case, the stop process of the motor is not controlled by the drive. This stop mode is the same as coast-to-stop described in b4.03. (Continued->)	(<-continued) 5: Coast to stop (normally open contact) 6: Decelerate to stop (normally open contact) 7: External fault input (normally open contact) (Continued->)	8
b3.04	DI4 function selection	(<-continued) 6: Decelerate to stop The drive decelerates and stops after being executed with the brake time sequence, which is the same process after the operation command is canceled. 7: External fault input When the drive receives this signal, it reports Er#50 (External input) fault. (Continued->)	(<-continued) 8: Multi-speed 1 (normally open contact) 9: Multi-speed 2 (normally open contact) 10: Multi-speed 3 (normally open contact) 11: Brake release feedback (normally open contact) 12: Brake feedback (normally open contact) 13: 2nd acceleration ramp switchover (normally open contact) (Continued->)	9

Parameter	Name	Parameter description	Setting range	Default
b3.05	DI5 function selection	(<-continued) 8: Multi-speed 1 9: Multi-speed 2 10: Multi-speed 3 The multi-speed selections are valid only when the frequency source is set to "multi-speed reference". See parameters in group b5 for details. (Continued->)	(<-continued) 14: 2nd deceleration ramp switchover (normally open contact) 15: 3rd acceleration ramp switchover (normally open contact) 16: 3rd deceleration ramp switchover (normally open contact) 17: Forward jog (normally open contact) 18: Reverse jog (normally open contact) (Continued->)	3
b3.06	DI6 terminal function selection (expansion card MD380IO1)	(<-continued) 11: Brake release feedback 12: Brake close feedback for input signals of Er#41 and Er#42 For details, see the description of the two faults. (Continued->)	(<-continued) 19: Acceleration (normally open contact) 20: Deceleration (normally open contact) 21: Speed/ Torque switchover (normally open contact) (Continued->)	5
b3.07	DI7 unction selection (expansion card MD380IO1)	(<-Continued) 13: Second acceleration ramp switchover 14: Second deceleration ramp switchover 15: Third acceleration ramp switchover 16: Third deceleration ramp switchover Used to set the input function of DI switchover point of acceleration/deceleration time of special curve. For details, see the description of group b8. (Continued->)	(<-Continued) 22: Forward stop switch (normally open contact) 23: Reverse stop switch (normally open contact) 24: Forward deceleration switch (normally open contact) 25: Reverse deceleration switch (normally open contact) (Continued->)	0

Parameter	Name	Parameter description	Setting range	Default
b3.08	DI8 function selection (expansion card MD380IO1)	(<-Continued) 19: Acceleration 20: Deceleration If the frequency is determined by external terminals, the terminals with the two functions are used as increment and decrement commands for frequency modification. The terminal is active only when the frequency source is set to "Acceleration/ Deceleration reference". 21: Torque/Speed control switchover If this function is activated, the drive enters torque control mode. If it is deactivated, the drive enters speed control mode. See torque control parameters in group bb for details. 22: Forward stop switch 23: Reverse stop switch 24: Forward deceleration switch 25: Reverse deceleration switch After the stop switch is activated, the drive performs a quick stop operation (same as input function 4). After the deceleration switch is activated, the maximum output frequency of the drive is limited to the frequency set by bF.16 (Frequency limit for deceleration switch). Through these two inputs, the simple positioning function can be realized. (Continued->)	(<-Continued) 26: Fixed-point shield (normally open contact) 27: Motor switchover switch 1 (normally open contact) 28: Motor switchover switch 2 (normally open contact) 29: Reserved (normally open contact) 30: Reserved (normally open contact) (Continued->)	0

<table>
<tr><th>Parameter</th><th>Name</th><th>Parameter description</th><th>Setting range</th><th>Default</th></tr>
<tr><td>b3.09</td><td>DI9 function selection (expansion card MD380IO1)</td><td>(<-Continued)
26: Mask positioning point
When the function input is valid, the stop and deceleration switch inputs are invalid.
27: Motor switchover switch 1
28: Motor switchover switch2
The CS710 supports three sets of functional parameters for switchover among three motors. The motor switchover function is active only after the drive stops output. Once these two input functions are selected, the same DI of other two sets of parameters will be assigned with these two input function forcibly.
(Continued->)</td><td>(<-Continued)
31: Counter reset (normally open contact)
32: Reserved (normally open contact)
33: Reserved (normally open contact)
100: No function (normally closed contact)
101: Forward run (normally closed contact)
(Continued->)</td><td>0</td></tr>
<tr><td>b3.10</td><td>DI10 function selection (expansion card MD380IO1)</td><td>(<-Continued)
<table><tr><th>Input function 28</th><th>Input Function 27</th><th>Motor code</th></tr><tr><td>Inactive</td><td>Inactive</td><td>No. 1 motor</td></tr><tr><td>Inactive</td><td>Active</td><td>No. 2 motor</td></tr><tr><td>Active</td><td>Inactive</td><td>No. 3 motor</td></tr><tr><td>Active</td><td>Active</td><td>No. 3 motor</td></tr></table>31: Counter reset
Once this function input is active, the number of cumulative pulses of the drive will be reset to b7.10 x b7.11. The position data will be reset to the setpoint of b7.11. See descriptions of b7.10 and b7.11 for details.</td><td>(<-Continued)
102: Reverse run (normally closed contact)
103: Fault reset (normally closed contact)
104: Quick stop (normally closed contact)
105: Coast to stop (normally closed contact)
106: Decelerate to stop (normally closed contact)</td><td>0</td></tr>
</table>

Parameter	Name	Parameter description	Setting range	Default
b3.11	AI1 function	When this parameter is set to 0, the corresponding AI input is used as the target frequency input or is not used. When this parameter is set to a non-zero value, the corresponding AI acts as a DI, which has the same function as b3.01 to b3.10. When the input voltage is higher than 7.00 V, the terminal input is valid. When the input voltage is lower than 3.00 V, the terminal input is invalid.  (Continued->)	107: External fault input (normally closed contact) 108: Multi-speed 1 (normally closed contact) 109: Multi-speed 2 (normally closed contact) 110: Multi-speed 3 (normally closed contact) 111: Brake release feedback (normally closed contact) 112: Brake feedback (normally closed contact) (Continued->)	0
b3.12	AI2 function selection			

Parameter	Name	Parameter description	Setting range	Default
b3.13	AI3 function selection (expansion card MD380IO1)	(<-Continued) When S1 switches 1, 2, and 3 are set to ON, and this parameter is set to 0, the corresponding AI input is used as the target frequency input or is not used. When this parameter is set to a non-zero value, the corresponding AI acts as a DI, which has the same function as b3.01 to b3.10. When the input voltage is higher than 7.00 V, the terminal input is valid. When the input voltage is lower than 3.00 V, the terminal input is invalid. (Continued->)	(<-Continued) 113: 2nd acceleration ramp switchover (normally closed contact) 114: Second deceleration ramp switchover (normally closed contact) 115: 3rd acceleration ramp switchover (normally closed contact) 116: 3rd deceleration ramp switchover (normally closed contact) 117: Reserved 118: Reserved 119: Acceleration (normally closed contact) 120: Deceleration (normally closed contact) (Continued->)	0

Parameter	Name	Parameter description	Setting range	Default
b3.13	AI3 function selection (expansion card MD380IO1)	(<-Continued) When S1 switches 4, 5, and 6 are set to ON, this terminal can be used as a temperature detection sensor PT1000. When S1 switches 6, 7, and 8 are set to ON, this terminal can be used as a temperature detection sensor PT100.	(<-Continued) 121: Speed/ Torque switchover (normally closed contact) 122: Forward stop switch (normally closed contact) 123: Reverse stop switch (normally closed contact) 124: Forward deceleration switch (normally closed contact) 125: Reverse deceleration switch (normally closed contact) 126: Fixed-point shield (normally closed contact) 127: Motor switchover switch 1 (normally closed contact) 128: Motor switchover switch 2 (normally closed contact) 129: Reserved 130: Reserved 131: Counter reset (normally closed contact) 132: Reserved 133: Reserved (normally closed contact)	0

Parameter	Name	Parameter description	Setting range	Default
b3.14	Control board relay function (T/A-T/B-T/C)	The setpoint 0 of the hundreds indicates the normally open contact. The DO is inactive by default. The setpoint 1 of the hundreds indicates the normally closed contact. The DO function is active by default. 1: Brake control Activated when the condition for brake-release is fulfilled in the brake time sequence. For details, see description of parameters in group b6. 2: Stop at fault This output becomes valid after a level-1 fault occurs on the AC drive. 3: Fault alarm The terminal outputs an active signal when the drive reports a level-two or level-three fault. 4: Fault indication The terminal outputs an active signal when the drive reports a level-four fault. (Continued->)	0: No function (normally open contact) 1: Brake control (normally open contact) 2: Stop at fault (normally open contact) 3: Fault alarm (normally open contact) 4: Fault indication (normally open contact) 5: Motor parameter 1 (normally open contact) 6: Motor parameter 2 (normally open contact) 7: Motor parameter 3 (normally open contact) 8: Drive overload pre-alarm (normally open contact) 9: Motor overload pre-alarm (normally open contact) (Continued->)	0

Parameter	Name	Parameter description	Setting range	Default
b3.15	Expansion card relay function (P/A-P/B-P/C)	(<-Continued) 5: Motor parameter 1 6: Motor parameter 2 7: Motor parameter 3 The drive supports up to 3 sets of motor parameters, which can be switched through the DI terminal assigned with No. 27 and No. 28 functions. During switchover, the corresponding DO terminal outputs an active signal. 8: Drive overload pre-alarm Activated 10s before AC drive overload protection applied (Continued->)	(<-Continued) 10: Reserved (normally open contact) 11: Overload protection (normally open contact) 12: Over-torque (normally open contact) 13: Motor fan control (normally open contact) 14: FDT frequency arrival (normally open contact) (Continued->)	13
b3.16	DO1 function selection	(<-Continued) 9: Motor overload pre-alarm Before triggering motor overload protection, the drive determines whether the load of motor exceeds the overload pre-alarm threshold. If the pre-alarm threshold is exceeded, an active signal is outputted. For motor overload parameter settings, see descriptions of bE.00 to bE.02. 11: Overload protection started Activated after the drive enters overload protection state. See the description of bE.13 for details. (Continued->)	(<-Continued) 15: Running (normally open contact) 16: Auto-start status (normally open contact) 17: Reserved (normally open contact) 18: Communication control (normally open contact) 100: No function (normally closed contact) 101: Brake control (normally closed contact) (Continued->)	0

Parameter	Name	Parameter description	Setting range	Default
b3.17	DO2 function selection (expansion card MD380IO1)	(<-Continued) 12: Over-torque output Activated after the output torque exceeds the set value of bF.17; deactivated if the output torque is less than 90% of the set value For details, see the description of bF.17. 13: Motor fan control When the drive starts running, the terminal outputs an active signal. When the drive stops running, the terminal stops outputting an active signal after the delay time set by bF.21 elapses. (Continued->)	(<-Continued) 102: Stop at fault (normally closed contact) 103: Fault alarm (normally closed contact) 104: Fault prompt (normally closed contact) 105: Motor parameter 1 (normally closed contact) 106: Motor parameter 2 (normally closed contact) 107: Motor parameter 3 (normally closed contact) 108: Drive overload pre-alarm (normally closed contact) 109: Motor overload pre-alarm (normally closed contact) 110: Reserved (normally closed contact) (Continued->)	4

Parameter	Name	Parameter description	Setting range	Default
b3.17	DO2 function selection (expansion card MD380IO1)	(<-Continued) 14: Frequency arrival See descriptions of bF.07 and bF.08 for details. 15: AC drive running This function output is active when the AC drive starts running, and inactive after the AC drive stops running. 16: Automatic start function output When this function is active, the terminal outputs an active signal. For details, see descriptions of bC.00. 17: Reserved 18: Communication control The output function is controlled by communication commands.	(<-Continued) 111: Overload protection (normally closed contact) 112: Over-torque (normally closed contact) 113: Motor fan control (normally closed contact) 114: FDT frequency arrival (normally closed contact) 115: Running (normally closed contact) 116: Auto-run status (normally closed contact) 117: Reserved (normally closed contact) 118: Communication control (normally closed contact)	4

Parameter	Name	Parameter description	Setting range	Default
b3.18	FM function selection	When the thousands is set to 1, the FM output terminal outputs a digital signal. The output function is the same as b3.14 to b3.17. When the thousands of the parameter setpoint is set to 0, the FM output terminal outputs a pulse signal. The output function is determined by the ones.	Ones: FM output function selection 0: The output frequency ranges from 0 to the maximum frequency. 1: The output current ranges from 0 to two times the rated motor current. 2: The output torque ranges from 0 to two times the rated motor torque. 3: The output power ranges from 0 to two times the rated motor power. 4: The output voltage ranges from 0 to 1.2 times the rated motor voltage. 5: The target frequency ranges from 0 to the maximum frequency. 6: Communication-controlled output Tens: Reserved Hundreds: Reserved Thousands: Digital/High-speed pulse output selection 0: High-speed pulse output 1: Digital output Ten-thousands: Reserved	0

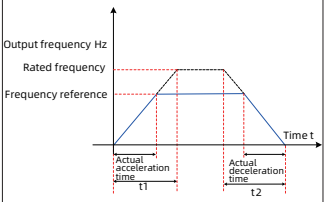
Parameter	Name	Parameter description	Setting range	Default
b3.19	AO1 function selection	When the thousands places of these two parameters are set to 1, the AO acts as the DO with the same function as b3.14 to b3.17. When the terminal is valid, 10.00 V is output; when the terminal is invalid, 0.00 V is output. When the thousands places of these two parameters are set to 0, the AO acts as the AO with a range corresponding to 0.0% to 100.0%. 0: The output frequency ranges from 0 to the maximum frequency. 1: The output current ranges from 0 to two times the rated motor current. 2: The output torque ranges from 0 to two times the rated motor torque. 3: The output power ranges from 0 to two times the rated motor power. 4: The output voltage ranges from 0 to 1.2 times the rated motor voltage. 5: The target frequency ranges from 0 to the maximum frequency. 6: Communication-controlled output The output functions are controlled through peripheral communication. For details, see the description of U0.15 and U0.16.	Ones: AO function selection 0: The output frequency ranges from 0 to the maximum frequency. 1: The output current ranges from 0 to two times the rated motor current. 2: The output torque ranges from 0 to two times the rated motor torque. 3: The output power ranges from 0 to two times the rated motor power. 4: The output voltage ranges from 0 to 1.2 times the rated motor voltage. 5: The target frequency ranges from 0 to the maximum frequency. 6: Communication-controlled output Tens: Reserved Hundreds: Reserved Thousands: Digital/Analog output selection 0: Analog output 1: Digital output Ten-thousands: Reserved	0
				0
b3.20	AO2 output function selection (expansion card MD380IO1)			1001

Parameter	Name	Parameter description	Setting range	Default
b3.21	DI filter time	It is used to set the software filter time of DI terminal status. If DI terminals are susceptible to interferences, which may cause malfunction, increase the value this parameter to enhance the anti-interference capability. However, increasing the DI filter time will slow the response of DI terminals.	0.000 to 1.000	0.010s

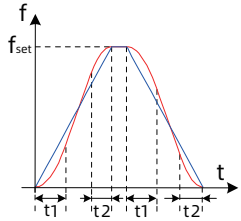
Parameter	Name	Parameter description	Setting range	Default
b3.22	Minimum input on AI1 curve	b3.22–b3.26 are used to define the relation between the analog input voltage and the corresponding set value. When the analog input voltage exceeds the set maximum input, the analog voltage will be calculated according to the max. input. When the analog input voltage is less than the set minimum input, the analog voltage will be calculated based on the minimum input or 0.0%. When the analog input is current input, 1 mA current corresponds to 0.5 V voltage. b3.26 (AI1 filter time) is used to set the software filter time of AI1. If the on-site analog input is susceptible to interferences, increase the value of b3.26 to stabilize the analog input detected. However, increasing of the AI filter time will slow the response of analog detection. Set b3.26 properly based on actual conditions. The definition of the nominal value corresponding to 100.0% of the analog input varies with actual applications.	0.00 V to b3.24	0.00 V
b3.23	Percentage corresponding to AI1 minimum input		0.0% to 100.0%	0.0%
b3.24	Maximum input on AI1 curve		b3.22 to 10.00 V	10.00 V
b3.25	Percentage corresponding to maximum input on AI1 curve 1		0.0% to 100.0%	100.0%
b3.26	AI1 filter time		0.00s to 10.00s	0.10s

Parameter	Name	Parameter description	Setting range	Default
b3.27	Minimum input on AI2 curve	b3.27 to b3.31 are used to define the relationship between the analog input voltage and the corresponding setpoints. When the analog input voltage exceeds the set maximum input, the analog voltage will be calculated according to the maximum input. When the analog input voltage is lower than the set minimum input, the analog voltage will be calculated based on the minimum input or 0.0%. When current input applies to AI, 1 mA current corresponds to 0.5 V voltage. The input filter time is used to set the software filter time of AI. If the on-site analog input is susceptible to interferences, increase the filter time to stabilize the analog input detected. However, increasing of the AI filter time will slow the response of analog detection. Set the filter time properly based on actual conditions. In different applications, 100.0% of the analog setting corresponds to Their meanings vary with different applications. For details, see the description of each application.	0.00 V to b3.29	0.00 V
b3.28	Percentage corresponding to minimum input on AI2 curve		0.0% to 100.0%	0.0%
b3.29	Maximum input on AI2 curve		b3.27 to 10.00 V	10.00 V
b3.30	Percentage corresponding to maximum input on AI2 curve		0.0% to 100.0%	100.0%
b3.31	AI2 filter time		0.00s to 10.00s	0.10s

Parameter	Name	Parameter description	Setting range	Default
b3.32	Minimum input on AI3 curve	b3.32 to b3.36 are used to define the relationship between the analog input voltage and the corresponding setpoint. When the analog input voltage exceeds the set maximum input, the analog voltage will be calculated according to the maximum input. When the analog input voltage is lower than the set minimum input, the analog voltage will be calculated based on the minimum input or 0.0%. When current input applies to AI, 1 mA current corresponds to 0.5 V voltage. The input filter time is used to set the software filter time of AI. If the on-site analog input is susceptible to interferences, increase the filter time to stabilize the analog input detected. However, increasing of the AI filter time will slow the response of analog detection. Set the filter time properly based on actual conditions. In different applications, 100.0% of the analog setting corresponds to Their meanings vary with different applications. For details, see the description of each application.	0.00 V to b3.34	0.00 V
b3.33	Percentage corresponding to minimum input on AI3 curve		0.0% to 100.0%	0.0%
b3.34	Maximum input on AI3 curve		b3.32 to 10.00 V	10.00 V
b3.35	Percentage corresponding to maximum input on AI3 curve		0.0% to 100.0%	100.0%
b3.36	AI3 filter time		0.00s to 10.00s	0.10s
b3.37	Pulse minimum input	This parameter is used together with DI function 33 of DI5. When b3.00 [Frequency source] is set to "High-speed pulse input", see the description for b3.00 for details.	0.00 kHz to b3.39	0.00 kHz
b3.38	Corresponding setting of pulse minimum input		0.0% to 100.0%	0.0%
b3.39	Pulse maximum input		b3.37 to 100.00 kHz	50.00 kHz
b3.40	Corresponding setting of pulse maximum input		0.0% to 100.0%	100.0%
b3.41	Pulse filter time		0.00s to 100.00s	0.10s
b3.42	Maximum FM output setting		0.01 kHz to 100.00 kHz	50.00 kHz

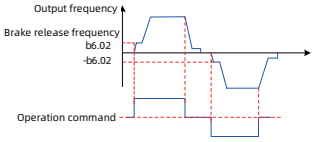
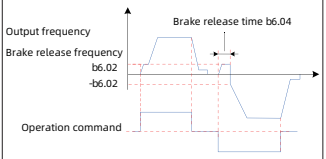
Parameter	Name	Parameter description	Setting range	Default
b3.43	AO1 zero offset coefficient	These parameters are used to correct the deviation between the analog output zero drift and the output amplitude, or they can also be used to define the required AO curve. If zero offset is represented by "b", the gain by "k", actual output by "Y" and standard output by "X", the formula for actual output will be as follows: Y = kX + b In the preceding formula, 100% zero offset coefficient of AO1 and AO2 corresponds to 10 V (or 20 mA), and the standard output is the value corresponding to analog output of 0- 10 V (or 0-20 mA) without zero offset or gain adjustment. For example: In cases where the analog output is used as the reference frequency, to output 8 V at zero frequency and 3 V at maximum frequency, set the gain to "-0.50" and the zero offset to "80%".	-100.0% to +100.0%	0.0%
b3.44	AO1 gain		-100.0 to +100.0	10.0
b3.45	AO2 zero offset coefficient		-100.0% to +100.0%	0.0%
b3.46	AO2 gain		-100.0 to +100.0	0.0
b4 Ramp parameters				
b4.00	Acceleration time	The acceleration time indicates the time required for the drive to accelerate from 0 to rated frequency (A0.04). Deceleration time is the time required for the drive to decelerate from the rated frequency (A0.04) to 0.  	0.0 to 600.0	3.0s
b4.01	Deceleration time			

Parameter	Name	Parameter description	Setting range	Default
b4.02	Running curve mode selection	0: Linear The output frequency increases or decreases linearly. 1: S-curve The output frequency increases or decreases along the S curve. S curve applies to occasions where soft start/ stop is required.	0: Linear 1: S-curve	0
b4.03	Stop mode selection	0: Decelerate to stop After the stop command takes effect, the AC drive ramps to stop based on the deceleration time set by b4.01. 1: Coast to stop After the stop command is activated, the drive stops output immediately and the motor coasts to stop based on the mechanical inertia.	0: Decelerate to stop 1: Coast to stop	0

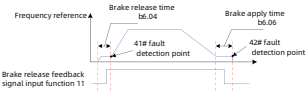
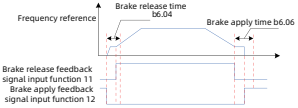
Parameter	Name	Parameter description	Setting range	Default
b4.04	Proportion of S curve start segment	This parameter is active when the acceleration/deceleration curve (b4.02) is set to S1 curve. This parameter defines the initial time ratio at the start segment of the S-curve acceleration/deceleration. During this time period, the slope of the output frequency gradually increases.	0.0% to 40.0%	30.0%
b4.05	Proportion of S-curve end segment	This parameter is active when the acceleration/deceleration curve (b4.02) is set to S1 curve. This parameter defines the initial time ratio at the end segment of the S-curve acceleration/deceleration. During this time period, the slope of the output frequency gradually decreases. 		
b4.06	Acceleration time of dynamic parameter auto-tuning	Indicates the time to accelerate from zero frequency to the rated frequency (A0.04) when b0.04 is set to "Dynamic auto-tuning".	0.1 to 600.0	20.0s
b4.07	Deceleration time of dynamic parameter auto-tuning	Indicates the time to decelerate from the rated frequency (A0.04) to zero frequency when b0.04 is set to "Dynamic auto-tuning".		
Group b5: Multi-speed parameters				

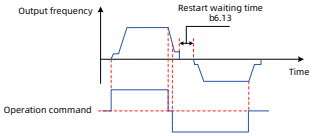
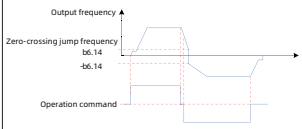
<table>
<tr><th>Parameter</th><th>Name</th><th>Parameter description</th><th>Setting range</th><th>Default</th></tr>
<tr><td>b5.00</td><td>Multi-speed 1</td><td rowspan="8">Multi-speed functions are determined by input terminal functions 8, 9 and 10. Eight multi-speed references can be achieved by the numeric combination of the three terminals.
<table><tr><th>Input Function 10</th><th>Input Function 9</th><th>Input Function 8</th><th>Target Speed</th></tr><tr><td>Inactive</td><td>Inactive</td><td>Inactive</td><td>b5.00</td></tr><tr><td>Inactive</td><td>Inactive</td><td>Active</td><td>b5.01</td></tr><tr><td>Inactive</td><td>Active</td><td>Inactive</td><td>b5.02</td></tr><tr><td>Inactive</td><td>Active</td><td>Active</td><td>b5.03</td></tr><tr><td>Active</td><td>Inactive</td><td>Inactive</td><td>b5.04</td></tr><tr><td>Active</td><td>Inactive</td><td>Active</td><td>b5.05</td></tr><tr><td>Active</td><td>Active</td><td>Inactive</td><td>b5.06</td></tr><tr><td>Active</td><td>Active</td><td>Active</td><td>b5.07</td></tr></table></td><td rowspan="8">b1.03 to b1.02</td><td>5.00 Hz</td></tr>
<tr><td>b5.01</td><td>Multi-speed 2</td><td>20.00 Hz</td></tr>
<tr><td>b5.02</td><td>Multi-speed 3</td><td>35.00 Hz</td></tr>
<tr><td>b5.03</td><td>Multi-speed 4</td><td>50.00 Hz</td></tr>
<tr><td>b5.04</td><td>Multi-speed 5</td><td rowspan="4">0.00 Hz</td></tr>
<tr><td>b5.05</td><td>Multi-speed 6</td></tr>
<tr><td>b5.06</td><td>Multi-speed 7</td></tr>
<tr><td>b5.07</td><td>Multi-speed 8</td></tr>
<tr><td colspan="5">Group b6: Brake logic control parameters</td></tr>
</table>

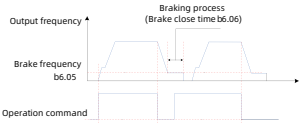
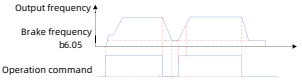
Parameter	Name	Parameter description	Setting range	Default
b6.00	Braking curve type	0: No brake control The brake release frequency, brake release time, or brake apply time are not supported. In this case, DO function 1 is equivalent to the DO function "AC drive operating". 1: Automatic brake control The AC drive automatically retains current (with torque upper limits set by b1.04 and b1.05) within the brake release time. When the output current reaches the product of b6.03 multiplied by the motor's rated current, the AC drive activates the signal to release the brake. 2: Manual brake control The AC drive uses values set by b1.06 and b1.07 as torque upper limits. When the output current reaches the product of b6.03 multiplied by the motor's rated current, the AC drive turns on the output signal to release the brake. For details, see the description of b1.06 and b1.07. Note: When the brake curve function is set through this parameter, namely b6.00 is set to 1 or 2, flying start is inactive. When this parameter is set to 0, brake release control cannot be started normally.	0: No brake control 1: Automatic brake control 2: Manual control curve	1

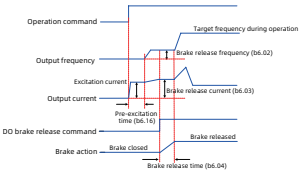
Parameter	Name	Parameter description	Setting range	Default
b6.01	Output torque direction	Used to set the output torque direction of the drive during brake release. 0: Brake release torque in the same direction as operation  1: Brake release torque always in the forward direction 	0: Brake release torque in the same direction as operation 1: Brake release torque always in the forward direction	0
b6.02	Brake release frequency	Used to set the output frequency of the AC drive before the brake releases completely, namely, the minimum frequency at which the motor can have full torque.	b1.03 to 15.00 Hz	2.00 Hz
b6.03	Brake release current	Indicates the percentage to the rated current of the motor (A0.03). When the output current of the drive reaches this value, the drive outputs the brake release command immediately (DO function 1 active).	0.0 to 150.0	30.0%
b6.04	Brake release time	Defines the time required for the mechanical brake from the start of release to the end of release. The drive keeps outputting the brake release frequency throughout the process.	0.00s to 5.00s	0.50s
b6.05	Brake frequency	When the output frequency during deceleration (after the RUN command is canceled) falls below this value, the brake apply command is immediately outputted (output function 1 disabled).	b1.03 to 20.00 Hz	2.00 Hz

Parameter	Name	Parameter description	Setting range	Default
b6.06	Braking time	Defines the time required for the mechanical brake from the start of applying to the end of applying. The drive keeps outputting the brake frequency throughout the process.	0.00s to 5.00s	0.50s
b6.07	Brake delay	The drive waits for the delay defined by this parameter elapses before outputs the brake apply command when the conditions for brake apply are met. This function is inactive when quick stop or coast-to-stop is selected, or the crane mechanism type (A0.08) is set to 0.	0.00s to 3.00s	0.0s

Parameter	Name	Parameter description	Setting range	Default
b6.08	Brake feedback purpose	This parameter involves detection of Er#41 and Er#42. For details, see the description of these two faults. 0: Brake feedback not used The brake feedback signals are not connected to the AC drive or the brake feedback function is not needed. 1: Detected upon action The drive detects brake feedback signals only during brake apply/release. This application requires only one brake feedback contact input.  2: Monitored during the whole process The brake release time and apply time are determined by the brake feedback contact signals. The AC drive starts to check brake feedback signals immediately after power-on. In this application, both the brake release contact and brake apply contact need to be connected to the drive. 	0: Brake feedback not used 1: Detected upon action 2: Monitored during the whole process	0

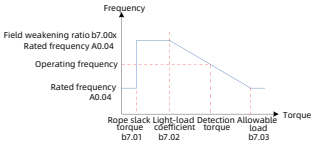
Parameter	Name	Parameter description	Setting range	Default
b6.09	Command reversal control	0: Direct reversal disabled during operation When a reverse run command is received by the drive during operation, the drive stops normally and stops all the outputs, then it starts reverse run again.  1: Reversal allowed during operation If a reverse run command is received by the drive during operation, the drive decelerates to b6.14 and then starts reverse run directly, without brake switch control during the whole process. When the crane mechanism type is set to hoisting mechanism (A0.08 = 0), this function is active only in closed-loop control mode. When other mechanism types are selected, this function is active in all control modes.  	0: Disabled during operation 1: Allowed during operation	0

Parameter	Name	Parameter description	Setting range	Default
b6.12	Restarting during braking	0: Restart not allowed during braking If the brake has been applied during stop, then a new start command will be rejected until the drive stops output after the brake is fully applied.  1: Restart allowed during braking A new start command can be executed even if the brake has been applied during stop. 	0: Restart not allowed during braking 1: Direct start allowed during braking	0
b6.13	Restart waiting time	Used to set the delay time that the drive must wait before a restart every time it stops. For details, see the description of b6.09.	0.0s to 15.0s	0.3s
b6.14	Zero-crossing jump frequency	When b6.09 is set to 1, this parameter is used to make the output frequency jump from b6.14 to -b6.14 when the output frequency is lower than b6.14 during deceleration. The actual value of this parameter must be higher than the brake release frequency b6.02 and brake apply frequency b6.05. For details, see the description of b6.09.	0.00 to 20.00	2.00 Hz

Parameter	Name	Parameter description	Setting range	Default
b6.16	Pre-excitation time	 Used to set the time that the pre-excitation stage lasts during startup. This function takes effect only in closed-loop vector control mode. When it is set to 0, the pre-excitation function is invalid.	0.00s to 5.00s	0.30s
b6.17	Excitation hold time at stop	Used to set the hold time of the excitation state after the drive stops. In the excitation hold stage, the drive provides zero speed output and keeps the excitation current. If the drive receives an operation command during this period, it can skip the pre-excitation stage and release the brake quickly.	0s to 65535s	30s
b6.18	Droop adjustment speed	See the description of b6.19.	0 to 65535	0

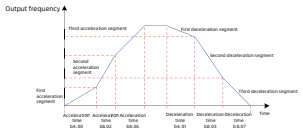
Parameter	Name	Parameter description	Setting range	Default
b6.19	Droop frequency	Used to set the droop rate for droop control. Droop control is applicable to application where two AC drives work together to drive two motors in rigid connection, preventing operation conflict between the two motors through allowing minor speed deviation between the two motors. The droop speed is calculated using the following formula: Droop speed = Synchronous frequency x Output torque x Droop rate/10 Suppose that b6.19 is set to 1.00, synchronous frequency to 50 Hz, and output torque to 50%, then: Droop speed = 50 Hz x 50% x 1.00/10 = 2.5 Hz Actual frequency of the drive = 50 Hz - 2.5 Hz = 47.5 Hz Note: When it is set to 0, the droop control function is turned off.	0.00 to 20.00	0.00 Hz
b6.21	Stator resistor auto-tuning before startup	After the auto-tuning is enabled, if successful stator resistor auto-tuning is not detected before startup, the startup command is not responded to.	0: Inactive 1: Enable	0
b6.22	Brake release timeout period	When the DI terminal enables the brake feedback signal, and b6.08 [Brake feedback function] is greater than 0, if the release brake condition is met but no DI release brake feedback signal is received within the time set by this parameter, Er#41 [Brake release timeout fault] can be reported.	0.00s to 5.00s	3.00s

Parameter	Name	Parameter description	Setting range	Default
B6.23	Brake apply detection time	When the motor is not rotating and the brake is fully applied, check the output current of the drive. If the current keeps exceeding the product of b6.24 and the rated motor current for the time defined by b6.23, the device is in the brake apply state. In this case, to reduce the speed loop response speed in vector control, the actual effective Kp speed loop gain value is F1.01 x b6.25 or F1.04 x b6.25.	0.10s to 1.00s	0.1s
B6.24	Brake apply detection current	When the motor is not rotating and the brake is fully applied, check the output current of the drive. If the current keeps exceeding the product of b6.24 and the rated motor current for the time defined by b6.23, the device is in the brake apply state. In this case, to reduce the speed loop response speed in vector control, the actual effective Kp speed loop gain value is F1.01 x b6.25 or F1.04 x b6.25.	0% to 500%	0%
B6.25	Brake apply coefficient	When the motor is not rotating and the brake is fully applied, check the output current of the drive. If the current keeps exceeding the product of b6.24 and the rated motor current for the time defined by b6.23, the device is in the brake apply state. In this case, to reduce the speed loop response speed in vector control, the actual effective Kp speed loop gain value is F1.01 x b6.25 or F1.04 x b6.25.	10% to 100%	50%
b7 High-speed under light load and positioning control parameters				

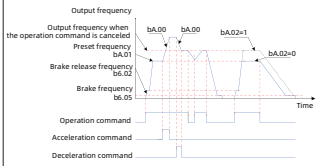
Parameter	Name	Parameter description	Setting range	Default
b7.00	Field weakening ratio	The high-speed function under light load enables the drive to automatically calculate the maximum output frequency when the target frequency is greater than the rated frequency, thereby preventing faults caused by a heavy load, such as overload and overcurrent. The parameters b7.00 to b7.07 are used to set the high-speed function under light load. When the output frequency of the AC drive reaches the value specified by b7.07, the AC drive retains the output frequency for the time set in b7.06. After the time expires, the AC drive detects the output torque T and uses it to calculate the maximum operation frequency F according to the curve shown in the following figure. If the target operation frequency is higher than the rated frequency and b7.00 is higher than 100.0%, the high-speed function under light load is enabled. When the T ≤ loosing rope torque or T ≥ allowed load condition is met, the maximum value of F is the rated frequency. When the loosing rope torque < T ≤ light-load coefficient condition is met, the maximum value of F is b7.00 x rated frequency. When the light-load coefficient < T < allowed load condition is met, F is automatically adjusted according to the following curve. 	100.0 to 300.0	100.0%
b7.01	Rope-loosening torque		0.0% to light-load coefficient (b7.02)	5.0%
b7.02	Low-load coefficient		Rope-loosening torque (b7.01) to Allowed load (b7.03)	35.0 %
b7.03	Allowable load		Light-load coefficient (b7.02) to 100.0%	80.0%
b7.06	Detection time		0.0s to 5.0s	0.5s
b7.07	Detection frequency		Brake release frequency (b6.02) to Rated frequency (A0.04)	40.00 Hz

Parameter	Name	Parameter description	Setting range	Default
b7.08	Forward calibration	During forward operation, adjust the maximum frequency in the field weakening range. The final field weakening maximum frequency needs to be multiplied by this parameter.	0% to 100%	100%
b7.09	Reverse calibration	During reverse operation, adjust the maximum frequency in the field weakening range. The final field weakening maximum frequency needs to be multiplied by this parameter.	0% to 100%	100%
b7.10	Position display proportion	Set this parameter based on the position display accuracy, which is used to convert the number of pulses into position data. Position data displayed in U0.08 and U0.09 is the current number of pulses divided by b7.10. Note: The pulses provided to CS710 series AC drive are quadruplicated.	1 to 65535	1
b7.11	Position verification value	When input function 31 (Position check) is active, the cumulative number of pulses in the AC drive is reset to b7.10 x b7.11, and the position data is reset to the value of b7.11.	0 to 65535	0
Group b8 Special curve settings				

Parameter	Name	Parameter description	Setting range	Default
b8.00	Special acceleration	0: Not used The special acceleration/ deceleration function is not used. 1: Two-segment (frequency switchover) When the output frequency exceeds rated frequency x b8.04 during the acceleration process, the acceleration time changes to the value of b8.02. When the output frequency falls below rated frequency x b8.05 during the deceleration process, the deceleration time changes to the value of b8.03. 2: Three-segment (frequency switchover) On the basis of the 2nd segment, when the output frequency exceeds rated frequency x b8.08 during the acceleration process, the acceleration time changes to the value of b8.06. When the output frequency falls below rated frequency x b8.09 during the deceleration process, the deceleration time changes to the value of b8.07. (Continued->)	0: N/A 1: Two-segment mode (frequency switchover) 2: Three-segment mode (frequency switchover)	0

Parameter	Name	Parameter description	Setting range	Default
b8.01	Special deceleration	(<-Continued) 3: Two-segment (DI switchover) When input function 13 takes effect during the acceleration process, the acceleration time changes to the value of b8.02. When input function 14 takes effect during the deceleration process, the deceleration time changes to the value of b8.03. 4: Three-segment (DI switchover) On the basis of the 2nd segment, when input function 15 is active during acceleration, the acceleration time changes to the value of b8.06. When input function 16 is active during deceleration, the deceleration time changes to the value of b8.07. 	3: Two-segment mode (DI switchover) 4: Three-segment mode (DI switchover)	0

Parameter	Name	Parameter description	Setting range	Default
b8.02	Acceleration time of the 2nd segment	See descriptions of b8.00 and b8.01 for details.	0.0 to 600.0	3.0s
b8.03	Deceleration time of 2nd segment		0.0 to 600.0	3.0s
b8.04	Acceleration frequency switchover threshold of 2nd segment		0% to b8.08	0%
b8.05	Deceleration frequency switchover threshold of 2nd segment		b8.09 to 99%	99%
b8.06	Acceleration time of third segment		0.1 to 600.0	3.0s
b8.07	Deceleration time of third segment		0.1 to 600.0	3.0s
b8.08	Acceleration frequency switchover threshold of 3rd segment		b8.04 to 99%	99%
b8.09	Deceleration frequency switchover threshold of 3rd segment		0% to b8.05	0%
Group bA: Acceleration/Deceleration parameters				
bA.00	Acceleration/ Deceleration change rate	This parameter defines the frequency change value per second when DI function 19 (Acceleration) and DI function 20 (Deceleration) are active. In this case, the acceleration/ deceleration is not controlled by b4.00 and b4.01.	0.01 Hz/s to 50.00 Hz/s	5.00 Hz/s
bA.01	Preset frequency	Used to set the initial value of the target frequency when the frequency source is acceleration/deceleration reference.	b6.02 to b1.02	50.00 Hz

Parameter	Name	Parameter description	Setting range	Default
bA.02	Speed retention type	0: Not save The value of bA.01 is used as the initial target frequency every time upon operation. 1: Retained until power-off The value of bA.01 is used as the initial target frequency for initial operation of the AC drive after power-on. If the power is not disconnected, the initial target frequency is always the output frequency of the AC drive when it receives the STOP command last time. 2: Always retained The initial target frequency is the frequency set when the drive starts to decelerate upon deactivation of the last operation command. This frequency value is saved upon power failure. 	0: Not save 1: Retained until power-off 2: Always retained	0
bA.03	Minimum frequency for acceleration/ deceleration	Used to set the lower limit of the output frequency during deceleration when the deceleration switch is active.	0.00 Hz to 15.00 Hz	0.00 Hz
Group bb: Torque control parameters				

Parameter	Name	Parameter description	Setting range	Default
bb.00	Torque control function	0: Torque control not used, speed control mode applied all along 1: Torque control applied all along 2: The torque control mode applies when the output torque of the drive is greater than the value of bb.01. Otherwise, the speed control mode applies. 3: The torque control mode applies when the output torque of the drive is greater than the value of bb.02. Otherwise, the speed control mode applies. 4: The torque control mode applies when the output frequency of the drive is greater than the value of bb.01 and the output torque is greater than the value of bb.02. Otherwise, the speed control mode applies. 5: The torque control mode applies when input function 21 is active, and the speed control mode applies when this function is inactive. 6: Torque control (communication-based switchover)	0: Torque control not used 1: Torque control used in the whole process 2: Torque control (frequency switchover) 3: Torque control (torque switchover) 4: Torque control (frequency-torque switchover) 5: Torque control (DI switchover) 6: Torque control (communication-based switchover)	0
bb.01	Torque switchover frequency	This parameter is active when bb.00 is set to 3 or 4. See the description of bb.00 for details.	0.00 Hz to b1.02	25.00 Hz
bb.02	Torque switchover threshold		0.0 to 150.0	50.0%

Parameter	Name	Parameter description	Setting range	Default
bb.03	Torque source	1: AI1 Only voltage input of 0 V to 10 V is supported. 2: AI2 Supports 0 V to 10 V voltage input or 4 mA to 20 mA current input, as defined by jumper J8 on the control board. When AI is used as the frequency source, 100.0% of voltage/current input corresponds to 200.0% of the output torque. 4: Operating panel, with the value set by bb.08 5: Communication, writing the torque to address 0xbb08	0: Without LC filter 1: AI1 2: AI2 3: Reserved 4: bb.08 5: Communication	0
bb.04	Positive frequency upper limit in torque control	Used to set the maximum positive/negative frequency in torque control mode. In torque control, if the load torque is smaller than the motor output torque, the motor rotational speed will rise continuously. To avoid runaway of the mechanical system, the motor maximum rotating speed must be limited in torque control.	0.00 Hz to b1.02	50.00 Hz
bb.05	Negative frequency upper limit in torque control			

Parameter	Name	Parameter description	Setting range	Default
bb.06	Acceleration time in torque control	In torque control, the difference between the motor output torque and the load torque determines the speed change rate of the motor and load. Therefore, the motor speed may change quickly, which can result in noise or excessive mechanical stress. These two parameters can make the motor rotational speed change smoothly. If the motor needs to respond to torque changes quickly, set the torque control acceleration/deceleration time to 0.0s. For example, two AC drives are connected to drive the same load. To balance the load allocation, set one AC drive as master in speed control and the other as slave in torque control. The slave receives the output torque of the master as the torque command and must follow the master rapidly. In this case, the acceleration/ deceleration time of the slave in torque control is set to 0.0s. The time base of the two parameters is 200.0% of the output torque.	0.0 to 600.0	0.0s
bb.07	Deceleration time in torque control			
bb.08	Target torque reference	Used to set the torque setpoint when bB.03 is set to 4 or 5.	-500.0% to 500.0 %	0.0%
bb.09	Connection method	The torque mode is typically applied to master/slave control of multiple AC drives. In this case, the master uses the speed mode and the slave uses the torque mode. This parameter is used to select the connection mode between the master and slave. 0: Rigid connection 1: Flexible connection	0: Rigid connection 1: Flexible connection	1
Group bC: Overspeed protection parameters				

Parameter	Name	Parameter description	Setting range	Default
bC.00	Number of pulses for automatic start	Used to set the automatic start function of the drive. When the drive runs in closed-loop FVC mode with the brake stopped, the drive can automatically run with 0 Hz output if it detects that the encoder pulse change value reaches the value of this parameter. Meanwhile, the drive enters zero speed operation state and reports fault E453, with the output function 16 activated. This function prevents unexpected movement caused by loose brake and triggers brake loose alarm in advance.	0 to 1000	0
bC.01	Detection time for excessive speed deviation in V/f mode	In V/f mode, if the difference between the theoretically calculated operating frequency and the motor magnetic field synchronous frequency exceeds the product of rated frequency A0.04 and bC.03, and such state persists for the time defined by bC.01, the fault E152 "Excessive speed deviation in V/f mode" is reported.	0.0s to 60.0s	5.0s
bC.02	Frequency direction error detection cycle	Used to set the detection time for Er#37. When the motor feedback frequency keeps in an opposite direction to the set frequency for a period longer than the value set by bC.02, the drive reports fault Er#37. If this parameter is set to 0, Er#37 is masked.	0.00s to 1.00s	0.50s
bC.03	Frequency following error	In FVC/SVC mode, if the difference between the theoretically calculated operating frequency and the motor magnetic field synchronous frequency exceeds the product of rated frequency A0.04 and bC.03, and such state persists for the time set by bC.04, the fault Er#38 is reported.	0% to 30%	20%

Parameter	Name	Parameter description	Setting range	Default
bC.04	Frequency following detection cycle	Used to set detection time for Er#38. When the difference between the motor feedback frequency and frequency setpoint keeps exceeding bC.03 x rated frequency for longer than the time set by bC.04, the AC drive reports Er#38 fault. If this parameter is set to 0, Er#38 is masked. This fault is cleared after the frequency reference and output frequency are higher than the rated frequency.	0.00s to 1.00s	0.50s
Group bd Communication control parameters				
bd.00	Baud rate	Used to set the data transmission rate between the host controller and the drive during Modbus communication. Note that the baud rate of the host controller must be the same as that of the drive. Otherwise, communication fails. The higher the baud rate, the quicker the communication speed can be.	5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5
bd.01	Data format	Used to select the drive data format during Modbus communication. The data format on the host controller must be the same as that on the AC drive. Otherwise, communication will fail. 0: No parity: Data format <8, N, 2> 1: Even parity: Data format <8, E, 1> 2: Odd parity: Data format <8, O, 1> 3: No check: Data format <8, N, 1>	0: No parity (8, N, 2) 1: Even parity (8, E, 1) 2: Odd parity (8, O, 1) 3: No check (8, N, 1)	0

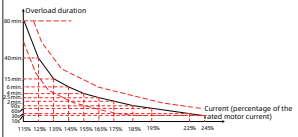
Parameter	Name	Parameter description	Setting range	Default
bd.02	Local address	When the local address is set to 0 (Broadcast address), the drive communicates with the host controller in broadcast mode. The local address (except the broadcast address) is unique, which is the prerequisite for point-to-point communication between the host controller and AC drive.	0 to 247	1
bd.03	Communication response delay	Used to set the interval time from the end of data reception to the start of data transmission. If the response delay is shorter than the system processing time, the system processing time will prevail. If the response delay is longer than the system processing time, the drive will not send data to the host controller unless the response delay elapses. bd.03 is valid for RS485 communication only.	0 to 20	0 ms
bd.04	Communication timeout period	When the communication interval time of the host controller exceeds the value defined by this parameter, the drive reports the fault Er#48. Generally, set it to an invalid value. In a continuous communication system, you can monitor the communication state by setting this parameter. If this parameter is set to 0, Er48# (communication error) is masked. This parameter is active only in Modbus, PROFIBUS DP, and CANopen communication modes.	0.0 to 60.0	0.0s

Parameter	Name	Parameter description	Setting range	Default
bd.06	Communication data content selection	-	Ones: Frequency source set through communication 0: Based on the maximum frequency percentage defined by b1.02 1: Based on the communication data content Tens: Reserved Hundreds: Output torque display (U0.06) selection 0: Motor feedback current 1: Current reference in torque control	0
bd.07	Expansion card type	0: Modbus communication 1: PROFIBUS DP communication 2: CANopen/PN/EtherNet/EtherCAT/CANlink Different communication modes require different expansion cards.	0: Modbus communication 1: PROFIBUS DP communication 2: CANopen/PN/EIP/ECT/CANlink	0
bd.08	Expansion card software version	Used to set the software version of the optional expansion cards, such as a PROFIBUS DP or CANopen card.	0.00 to 655.35	0.00

Parameter	Name	Parameter description	Setting range	Default
bd.11	User-defined parameter 1	bd.11 to bd.30 are user-defined parameters. to redefine parameter and address mapping for the AC drive. For example, if bd.11 is mapped to A0.01, you can obtain the value of A0.01 by reading the bd.11 address. By mapping user-defined parameters, inconsecutive parameters can be read continuously. For example, in Modbus RTU communication, reading A0.01, b0.05, and F0.04 cyclically normally requires three separate data frames. However, if A0.01, b0.05, and F0.04 are mapped to bd.11, bd.12, and bd.13, respectively, only one data frame is needed to read the three continuous parameters starting from bd.11. In PROFIBUS DP and CANopen communication, each user-defined parameter corresponds to a specific communication protocol address. In PROFIBUS DP communication, bd.11 to bd.20 are mapped to PZD3 to PZD12 sent from the master to the slave. bd.21 to bd.30 are mapped to PZD3 to PZD12 sent from the slave to the master. In CANopen communication, bd.11 to bd.18 correspond to RPDO1 to RPDO3. bd.21 to bd.28 are mapped to TPDO2 to TPDO3.	0x0 to 0xFFFF	0xFFFF
bd.12	User-defined parameter 2			
bd.13	User-defined parameter 3			
bd.14	User-defined parameter 4			
bd.15	User-defined parameter 5			
bd.16	User-defined parameter 6			
bd.17	User-defined parameter 7			
bd.18	User-defined parameter 8			
bd.19	User-defined parameter 9			
bd.20	User-defined parameter 10			
bd.21	User-defined parameter 11			
bd.22	User-defined parameter 12			
bd.23	User-defined parameter 13			

Parameter	Name	Parameter description	Setting range	Default
bd.24	User-defined parameter 14	bd.11 to bd.30 are user-defined parameters. to redefine parameter and address mapping for the AC drive. For example, if bd.11 is mapped to A0.01, you can obtain the value of A0.01 by reading the bd.11 address. By mapping user-defined parameters, inconsecutive parameters can be read continuously. For example, in Modbus RTU communication, reading A0.01, b0.05, and F0.04 cyclically normally requires three separate data frames. However, if A0.01, b0.05, and F0.04 are mapped to bd.11, bd.12, and bd.13, respectively, only one data frame is needed to read the three continuous parameters starting from bd.11. In PROFIBUS DP and CANopen communication, each user-defined parameter corresponds to a specific communication protocol address. In PROFIBUS DP communication, bd.11 to bd.20 are mapped to PZD3 to PZD12 sent from the master to the slave. bd.21 to bd.30 are mapped to PZD3 to PZD12 sent from the slave to the master. In CANopen communication, bd.11 to bd.18 correspond to RPDO1 to RPDO3. bd.21 to bd.28 are mapped to TPDO2 to TPDO3.	0x0 to 0xFFFF	0xFFFF
bd.25	User-defined parameter 15			
bd.26	User-defined parameter 16			
bd.27	User-defined parameter 17			
bd.28	User-defined parameter 18			
bd.29	User-defined parameter 19			
bd.30	User-defined parameter 20			
bE Protection parameters				

Parameter	Name	Parameter description	Setting range	Default
bE.00	Motor overload protection	After this function is enabled, if the motor is overloaded, the drive reports fault Er#11.	0: Disable 1: Enable	1

Parameter	Name	Parameter description	Setting range	Default
bE.01	Motor overload protection gain	 When motor operating current reaches 175% of rated motor current and such state lasts for 2 minutes, the drive reports motor overload fault (Er#11). When the motor operating current reaches 115% of rated motor current and such state lasts for 80 minutes, the drive reports fault Er#11. Example: If the rated current of the motor is 100 A, and bE.01 is set to 1.00, when the operating current of the motor reaches 125 A (125% of 100 A), the drive reports a motor overload fault after the motor runs in this state for 40 minutes. If bE.01 is set to 1.20 and the operating current of the motor reaches 125 A (125% of 100 A), the drive reports a motor overload fault after the motor runs in this state for 48 (40 x 1.2) minutes. The maximum overload duration is 80 minutes, and the minimum overload duration is 10s. Example of setting motor overload protection:	0.01 to 10.00	1.00

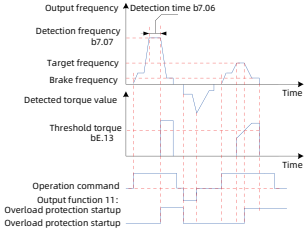
Parameter	Name	Parameter description	Setting range	Default
bE.01	Motor overload protection gain	To make the drive report an overload fault two minutes after the motor runs at 150% of the rated current, set the motor overload protection gain to 0.4. The value 0.4 is calculated based on the following: By default, overload time for operation at 150% of the rated current (T) is five minutes according to T=T1+(T2-T1)x(I-I1)/(I2-I1), where T indicates overload time for operation at 150% of the rated current (5 min.), T1 indicates overload time for operation at 145% of the rated current (6 min.), T2 indicates overload time for operation at 155% of the rated current (4 min), I indicates current of 150%, I1 indicates current of 145%, and I2 indicates current of 155%. Therefore, T=T1+(T2-T1)x(I-I1)/(I2-I1)=4+(6-4)x(150%-145%)/(155%-145%)=5. In this case, the motor protection gain is 0.4 (bE.01 = 2/5 = 0.4).	0.01 to 10.00	1.00

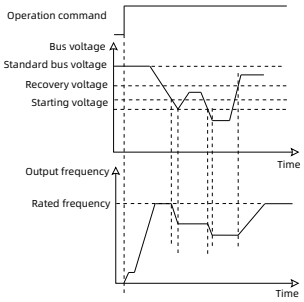
Parameter	Name	Parameter description	Setting range	Default
bE.01	Motor overload protection gain	Note: Set bE.01 properly based on the actual overload capacity. If the value of bE.01 is set too high, the motor may be damaged because the motor overheats but the AC drive does not report the alarm timely. The motor overload prewarning coefficient is the percentage to the time during which the motor runs at an overload current but a motor overload error is not reported. When the motor overload detection time reaches the value set by this parameter, DO function 9 (motor overload pre-warning) takes effect. For example, if the motor overload protection gain is set to 1.00 and the overload alarm coefficient is set to 80%, DO function 9 (motor overload alarm) takes effect after the motor runs consecutively for 4.8 minutes (80% x 6 minutes) at 145% of rated current.	0.01 to 10.00	1.00
bE.02	Motor overload pre-alarm coefficient	It is used to send a pre-warning signal to the control system by a DO terminal before motor overload fault protection applies. The motor overload pre-alarm coefficient is used to determine how early the pre-alarm signal is sent before the motor overload protection applies. The higher the value is, the later the pre-alarm signal is sent. When the accumulative output current of the AC drive is larger than the value of the overload inverse-time curve multiplied by bE.02, the output function 9 (Motor overload pre-warning) will be activated.	50% to 100%	80%

Parameter	Name	Parameter description	Setting range	Default
bE.03	Overvoltage stall gain	If the DC bus voltage exceeds the value defined by bE.04 during deceleration, the drive stops decelerating and stays at present reference frequency to wait for the bus voltage to drop before continuing deceleration. This parameter is used to adjust the overvoltage suppression capacity of the drive. The higher the value is, the greater the overvoltage suppression capacity can be. Set this value as low as possible without triggering overvoltage. In applications with low inertia load, set the overlvoltage stall gain to a low value because a high value may slow down the dynamic response of the system. In applications with large inertia load, set bE.03 to a large value because a small value may weaken the suppression effect and cause overvoltage fault. When the overvoltage stall gain is set to 0, the overvoltage stall function is disabled. This function is invalid for the hoisting mechanism (A0.08 = 0).	0 to 100	0
bE.04	Overvoltage stall protection voltage		330.0–800.0 V	670.0 V

Parameter	Name	Parameter description	Setting range	Default
bE.05	Overcurrent stall gain	If the output current exceeds the overcurrent stall protection current during acceleration/deceleration, the drive stops accelerating/decelerating and stays at present reference frequency to wait for the output current to drop before continuing acceleration/deceleration. The overcurrent stall gain is used to adjust the overcurrent suppression capacity of the drive during acceleration/deceleration. The higher the value is, the greater the overcurrent suppression capacity can be. Set this value as low as possible without triggering overcurrent. In applications with small-inertia load, set the overcurrent stall gain to a low value because a high value may slow down the dynamic response of the system. In applications with large-inertia load, set the overcurrent stall gain to a high value because a low value may weaken the suppression effect and cause overcurrent. Setting bE.05 to 0 will cancel the overcurrent stall function. bE.05 and bE.06 are valid only in V/f control mode.	0 to 100	20
bE.06	Overcurrent stall protection current		100% to 200%	150 %
bE.07	Protection against ground short circuit	Used to detect whether the motor is short-circuited to the ground when the drive is powered on. If this function is enabled, UVW terminals of the AC drive will have voltage output a while after power-on. 0: Short circuit-to-ground protection not enabled at power-on 1: Enable	0: Disable 1: Enable	1

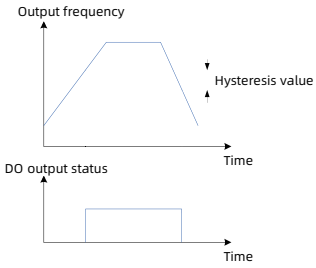
Parameter	Name	Parameter description	Setting range	Default
bE.08	Input phase loss protection	Used to set the input phase loss protection function. 0: Disable 1: Enable hardware input phase loss protection Note: This function is available in 18.5 kW and above models only. 2: Enable hardware and software input phase loss protection	0: Disable 1: Detecting input phase loss by hardware only 2: Detecting input phase loss by both the software and hardware	2
bE.09	Output phase loss protection	When the ones is set to 0, output phase loss protection is disabled. The output detection function before operation is also inactive.	Ones: Protection against output phase loss 0: Disable 1: Enable Tens: Output phase loss detection before operation 0: Disable 1: Enable	1
bE.10	Brake duty cycle	Determines the duty cycle for braking transistor ON. The value 100% indicates continuous ON (active for models with built-in braking unit). When the braking transistor duty cycle is set to a value lower than 50%, the off-time of each cycle is 2 ms. The on-time increases as the set braking transistor duty cycle increases. When the braking transistor duty cycle is set to a value higher than 50%, the on-time is 2 ms per cycle. The off-time decreases as the braking transistor duty cycle increases. For models that support braking sampling, if the resistance of the braking resistor is low, the actual current is higher than the maximum current of the braking transistor. In this case, overcurrent is reported and overload protection of the braking transistor is triggered.	0% to 100%	100%

Parameter	Name	Parameter description	Setting range	Default
bE.13	Torque threshold for overload protection	Used to set the starting torque for overload limit. When it is set to 0, the overload protection function is disabled. In forward operation state, the AC drive detects the output torque when the output frequency reaches b7.17 or keeps a constant value. For details, see the description of b7.16 and b7.17. If the output torque exceeds the value of bE.13, the AC drive stops automatically and halts forward run. Such halt is canceled immediately after the AC drive starts reverse operating. 	0.0 to 150.0	0.0%
bE.14	Voltage-dependent speed reduction function	After the function is enabled, speed reduction with voltage is enabled. This function allows the drive to automatically reduce the output frequency to maintain full torque output when the DC bus voltage stays low.	0: Disable 1: Enable	0

Parameter	Name	Parameter description	Setting range	Default
bE.15	Voltage threshold for triggering voltage-dependent speed reduction	 These two parameters are used to set the voltage-dependent speed reduction function. This function allows the drive to automatically reduce the output frequency to maintain full torque output when the DC bus voltage stays low. When bE.14 is set to 1, the power dip ride-through function is enabled. When bE.14 is set to 0, this function is disabled. bE.15 is used to set the starting voltage for power dip ride-through function. This parameter defines the percentage to the standard DC bus voltage.	70% to 100%	85%
bE.16	Voltage for triggering the built-in braking unit	Defines the voltage threshold (Vbreak) for triggering the built-in braking unit. Set this parameter based on the following formula: 800 ≥ Vbreak ≥ (1.414Vs + 30)Vs - AC input power supply voltage of the drive. Note: Improper setting may lead to improper operation of the built-in braking unit.	330.0–800.0 V	660.0 V

Parameter	Name	Parameter description	Setting range	Default
bE.17	Contactor fault detection	When this parameter is set to 1, contactor fault (Er#17) detection is enabled. When it is set to 0, contactor fault detection is disabled. Note: This function is available in 18.5 kW and above models only.	0: Disable1: Enable	1
bF User-defined parameters				
bF.00	Password for level 2 menus	Used to set the password for displaying and modifying parameters in level 2 menu. If it is set to a non-zero value, password protection will be enabled for level 2 menu. If you enter the wrong password consecutively three times, all menus are locked. In this case, you must power off and restart the AC drive. If you set this parameter to 0, the password is canceled.	0 to 65535	0
bF.01	Restore parameters in level 2 menu to default	0: Not restored 1: Restore parameters in level 2 menu to default Note: In level 2 menu, the following parameters cannot be restored to default values: b0.02–b0.03, b2.00–b2.02, b7.10–b7.11, and bF.00. 2: Restore parameters in level 1 and level 2 menus to default	0: No action 1: Restore parameters in level 2 menu (group b) 2: Restore parameters in level 1 and level 2 menus (groups A and b)	0
bF.02	Check on level 2 menu setting	0: Display all parameters in level 2 menus 1: Display parameters with default values changed in level 2 menu	0: Display all parameters in group b 1: Display parameters with default values changed in group b	0
bF.03	Clear historical log	0: Not clear 1: Clear log Clear all the parameters saved at power failure and the fault records, which is to clear all the parameters in groups E* and U1.	0: Not clear 1: Clear fault log (group E)	0

Parameter	Name	Parameter description	Setting range	Default
bF.04	Command source selection	This parameter determines the input channel of AC drive control commands, including start, stop, forward, and reverse commands. 0: Operating panel control (LOCAL/REMOT indicator off) The commands are given by pressing the RUN and STOP/RES keys on the operating panel. In the operating panel control mode, all the terminal inputs/outputs of the AC drive and the logic sequence function controlled by the brake are inactive. In this case, the output function 1 (Brake control) is activated after the AC drive receives the RUN command, and the AC drive starts to decelerate after receiving the STOP command and stops output after decelerating to the brake frequency (b6.05), and the output function 1 is deactivated. 1: Terminal control (LOCAL/REMOT indicator on) AC drive control commands are given through terminal input functions 1 (Forward running) and 2 (Reverse running). 2: Communication control (LOCAL/REMOT indicator blinking) AC drive control commands are given by a host controller, PLC, or touch screen through communication.	0: Operating panel 1: Terminal 2: Communication	0
bF.05	Operating frequency in operating panel control mode	It is used to set the target running frequency of the AC drive in cases where bF.04 is set to 0.	b1.03 to b1.02	8.00

Parameter	Name	Parameter description	Setting range	Default
bF.06	Running direction selection	You can change the rotation direction of the motor by modifying this parameter without changing the motor wiring. Modifying this parameter is equivalent to exchanging any two of U, V, W cables of the motor. Note: The motor continues to operate in the original state after parameter initialization. Do not use this function in applications where changing the motor direction is inhibited after system commissioning is done. 0: Same direction 1: Opposite direction	0: Same direction 1: Opposite direction	0
bF.07	Frequency detection value	If the reference frequency is higher than the value defined by bF.07, DO output function 7 (Frequency arrival output) is valid. If the reference frequency is lower than bF.07, DO output function 7 is invalid. These two parameters are used to set the detection value of the output frequency and hysteresis value upon output cancellation. bF.07 sets the detection value, and bF.08 sets the hysteresis frequency (percentage to the value of bF.07).  	b1.03 to b1.02	50.00 Hz
bF.08	Frequency detection hysteresis value		0.0% to 100.0%	5.0%

Parameter	Name	Parameter description	Setting range	Default
bF.09	Cooling fan control	Used to set the working mode of the cooling fan. 0: Fan working during operation The cooling fan works when AC drive is running. When the AC drive stops running, if and the heatsink temperature is still higher than 40℃ , the fan will keep working until the heatsink temperature falls below 40℃ . 1: Working continuously after power-on	0 to 1	0

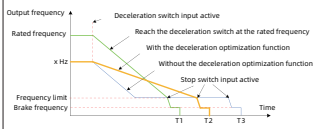
Parameter	Name	Parameter description	Setting range	Default
bF.10	Fault protection action 1	These parameters define the fault level of faults Er#41 to Er#45.	Ten-thousands: Er#41 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Thousands: Er#42 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Hundreds: Er#43 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Tens: Er#44 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Ones: Er#45 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked	11115

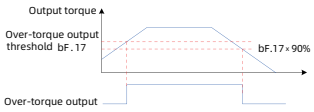
Parameter	Name	Parameter description	Setting range	Default
bF.11	Fault protection action 2	These parameters determine the fault level of faults Er#46 to Er#50.	Ones: Er#46 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Tens: Er#47 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Hundreds: Er#48 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Thousands: Er#49 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Ten-thousands: Er#50 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked	11111

Parameter	Name	Parameter description	Setting range	Default
bF.12	Fault protection action 3	These parameters determine the fault level of faults Er#51 to Er#55.	Ten-thousands: Er#51 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Thousands: Er#52 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Hundreds: Er#53 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Tens: Er#54 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Ones: Er#55 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked	11411

Parameter	Name	Parameter description	Setting range	Default
bF.13	Fault protection action 4	These parameters determine the fault level of faults Er#56 to Er#60.	Ten-thousands: Er#56 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Thousands: Er#57 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Hundreds: Er#58 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Tens: Er#59 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Ones: Er#60 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked	11111

Parameter	Name	Parameter description	Setting range	Default
bF.14	Fault protection action 5	These parameters determine the fault level of faults Er#61 to Er#65.	Ten-thousands: Er#61 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Thousands: Er#62 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Hundreds: Er#63 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Tens: Er#64 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked Ones: Er#65 fault level setting 1: Level-one fault 2: Level-two fault 3: Level-three fault 4: Prompt 5: Masked	11111

Parameter	Name	Parameter description	Setting range	Default
bF.15	Deceleration switch optimization selection	When the deceleration switch (DI functions 24 and 25) input is active, the output frequency of the AC drive is limited to a value below bF.16. After the stop switch (DI functions 22 and 23) input is active, the AC drive executes quick stop. bF.15 is used to set the deceleration mode after selecting the deceleration switch. 0: Without deceleration optimization function Decelerationi is performed based on the deceleration time set in parameter group b4. 1: With deceleration optimization function After the deceleration switch input is active, the drive recalculates the deceleration time based on the deceleration distance from the rated frequency to the frequency set by bF.16. This minimizes the operating time during the deceleration process.	0: Disable 1: Enable	0
bF.16	Deceleration switch limit frequency	When the deceleration switch (DI functions 24 and 25) input is active, the output frequency of the AC drive is limited to a value below bF.16. After the stop switch (DI functions 22 and 23) input is active, the AC drive executes quick stop. 	b1.03 to A0.04	5.00

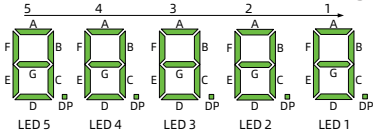
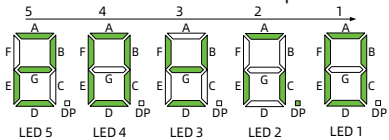
Parameter	Name	Parameter description	Setting range	Default
bF.17	Over-torque output threshold	Intended to be used in combination with DO function 12. When the output torque reaches the value defined by bF.17, the DO function 12 is active. When the output torque falls below 90% of the threshold, DO function 12 becomes inactive. In vector control mode, the AC drive controls DO function 12 based on the output torque. In V/f control mode, the AC drive controls this function based on the percentage of the output current to the rated current of the motor. If bF.17 is set to 0, the DO function 12 is inactive. 	0.0% to 200.0%	0.0%
bF.19	Commissioning mode selection	0: Application mode Set this parameter to 0 in general cases. 1: Commissioning mode The commissioning mode is only used in pre-delivery inspection on the AC drive/control cabinet. In this mode, functions such as brake release time sequence and output phase loss protection are shielded, and the V/f control mode is used forcibly. This parameter is cleared automatically upon power-on.	0: Application mode 1: Commissioning mode	0
bF.20	Constant power function selection	When this function is enabled, the target frequency output is limited after brake release, and the maximum frequency is limited to the maximum value that can be reached in the field weakening range.	0: Disabled 1: Enabled	1
bF.21	Fan control delay	Intended to be used in combination with the output function 13. See the description of DO function 13 for details.	0s to 3000s	30s

Parameter	Name	Parameter description	Setting range	Default
bF.25	Frequency limit selection	Deceleration frequency handling during overcurrent suppression Ones position: Enable frequency limit in the SVC mode. Tens position: Enable frequency limit in the FVC mode. Hundreds position: Enable frequency limit in the V/f mode.	Ones: Frequency limit in SVC mode Tens: Frequency limit in FVC mode Hundreds: Frequency limit in V/f mode	1
bF.26	Whether to responds to coast-to-stop command during parameter auto-tuning upon power-on	0: Inactive 1: During parameter auto-tuning upon power-on, if the coast-to-stop command is triggered by an active DI terminal, the parameter auto-tuning state is deactivated.	0: Not respond 1: Respond	0
bF.30	Auto-tuning selection upon motor parameter switchover	Defines whether to enable stator resistance auto-tuning when DI functions 27 and 28 are active and motor parameters are switched.	0: Disable stator resistance auto-tuning 1: Enable stator resistance auto-tuning	1

Groups E0 to E9 display fault information. Each group of parameters indicate information of one fault. Group E0 displays information about the latest fault, and group E9 displays information of the earliest fault. The displayed information in each group is the same. Group E* is the displayed value, which cannot be modified but can be saved at power failure.

Parameter	Name	Min. unit	Parameter description
E*.00	Fault code	0.00	The hundreds place of the integer part indicates the fault level, and the tens and ones places indicate the current fault code. The decimal part is reserved and has no actual meaning. For example, for fault code 104.00 (coast to stop), 1 indicates that the fault level is level-one, and 04 indicates the fault code.
E*.01	Frequency reference upon fault	-999.9	The displayed value of U0.00 upon fault.

Parameter	Name	Min. unit	Parameter description
E*.02	Feedback frequency upon fault	-999.9	It displays the value of U0.01 upon fault. (In V/F control, it displays the value of U0.00.)
E*.03	Output current upon fault	0.00	The displayed value of U0.03 upon fault.
E*.04	Output voltage upon fault	0	It displays the value of U0.04 when a fault occurs.
E*.05	Output power upon fault	-999.9	It displays the value of U0.05 when a fault occurs.
E*.06	Output torque upon fault	-999.9	It displays the value of U0.06 when a fault occurs.
E*.07	Bus voltage upon fault	0.0	It displays the value of U0.07 when a fault occurs.

Parameter	Name	Min. unit	Parameter description
E*.08	Input function state 1 upon fault	0	Output status of DO functions 1 to 16 upon fault The parameters E*.08 to E*.11 indicate the status of multi-functional input/output functions. Each parameter can indicate the states of 16 DI/DO functions with its bits. When you select a parameter, its decimal value is displayed on the operating panel. Press △ to switch to the user view mode. In this mode: The five LEDs on the operating panel are numbered 5, 4, 3, 2, and 1 from left to right.  The 5th and 4th LEDs show the number of the current input/output function. The 1st LED shows validity of this function (0: inactive; 1: active). You can press △ and ▽ to change the input/output function number. The 2nd and 3rd LEDs show the states of 16 functions, in which functions 1 to 8 correspond to A to DP of the 2nd LED, and functions 9 to 16 correspond to A to DP of the third LED. Example:  In this figure: Status of DI function 20 is displayed (No. 5 and No. 4 bits) currently and DI function 20 is inactive (No. 1 bit). In DI functions 17 to 32, DI functions 17, 19, 21, 24, 26, 28, 30, and 31 are active, and others are inactive (No. 2 and No. 3 bits).
E*.09	Input function state 2 upon fault	0	Active state of DI functions 17 to 32 upon fault
E*.10	Input function state 3 upon fault	0	Active state of DI functions 33 to 48 upon fault
E*.11	Output state upon fault	0	Output status of DO functions 1 to 16 upon fault

<table>
<tr><th>Parameter</th><th>Name</th><th>Min. unit</th><th>Parameter description</th></tr>
<tr><td>E*.12</td><td>Operation state upon fault</td><td>0</td><td>Hundreds: Switch-off state (0: Switched off completely; 1: Switch-off in progress)
Tens: Switch-on state, switch-on status monitoring
Ones: System operation status monitoring</td></tr>
<tr><td>E*.13</td><td>Control mode upon fault</td><td>0</td><td>This parameter records the setpoint of command source, frequency source, and control mode upon fault, with the hundreds recording the command source, the tens recording the frequency source, and the ones recording the current control mode.
<table>
<tr><th>bit</th><th>Definition</th><th>Description</th></tr>
<tr><td>Ten thousands</td><td>Reserved</td><td>-</td></tr>
<tr><td>Thousands</td><td>Reserved</td><td>-</td></tr>
<tr><td>Hundreds</td><td>Command source</td><td>See bF.04 for the meaning of the data.</td></tr>
<tr><td>Tens</td><td>Frequency source</td><td>See A0.07 for the meaning of the data</td></tr>
<tr><td>Ones</td><td>Drive control mode</td><td>See b1.00 for data description.</td></tr>
</table></td></tr>
<tr><td>E*.14</td><td>Operation state upon fault</td><td>0</td><td>bit0: Operation state or static state
bit1: Operating direction
bit2: Brake release
bit3: Jogging (not supported at present)
bit4: Operating panel in operation state
bit5 to bit6: Acceleration/Deceleration status (0 - Constant speed; 1 - Acceleration; 2 - Deceleration)
bit7 to bit8: Acceleration/Deceleration control procedure
bit9: Brake torque detection
bit10: Torque control
bit11: Operation state of operating panel</td></tr>
<tr><td>E*.15</td><td>Synchronization frequency upon fault</td><td>0</td><td>Records the instantaneous value of "Synchronization frequency" displayed in the menu of the operating panel upon fault.</td></tr>
</table>

Parameter	Name	Min. unit	Parameter description
E*.16	Braking transistor current upon fault	-999.9	Records the instantaneous brake transistor upon fault.
E*.17	Cumulative operating time upon fault	0.00	Records the cumulative operating time (U1.05) upon fault.
E*.18	Cumulative power-on time upon fault	0	Records the cumulative power-on time (U1.06) upon fault.

Parameters in groups U0 and U1 display the monitoring information of the AC drive in real time. Group U0 parameters, which cannot be saved upon power failure, will be updated in real time. Group U1 parameters, which can be saved upon power failure, need to be calculated cumulatively.

Parameter	Name	Min. unit	Parameter description
U0.00	Frequency reference	0.00 Hz	Used to set the frequency reference of the drive.
U0.01	Feedback frequency	0.00 Hz	Displays the feedback value of the actual motor operating frequency. This parameter indicates the rotor synchronous frequency calculated by the software of the drive when an encoder is not equipped. For a drive equipped with an encoder, this parameter indicates the feedback frequency. During on-site commissioning, if the encoder circuit is suspected to be working improperly, check whether the feedback frequency is normal during operation in V/f control mode. If yes, the encoder operates properly.
U0.02	Target frequency	0.00 Hz	Displays the target frequency of the AC drive in present operation.
U0.03	Output current	0.00 A	Displays the output current of the drive during operation.
U0.04	Output voltage	0 V	Displays the output voltage of the drive during operation.
U0.05	Output power	-999.9 kW	Displays the output power of the drive during operation.
U0.06	Output torque	-999.9 kW	Displays the output torque (percentage to the rated torque of the motor) of the drive during operation.
U0.07	Bus voltage	0.0	Displays the bus voltage of the drive.

Parameter	Name	Min. unit	Parameter description
U0.08	High-order bits of position data	-9999	These two parameters display the current position of the hoisting mechanism, that is, accumulative number of pulses/b7.10. U0.08 shows the upper 16 bits (with negative or positive signs) of current position, and U0.09 shows the lower 16 bits (only positive values) of current position.
U0.09	Lower-order bits of position data	0	
U0.10	DI state	0	Indicates the input status of DI1 to DI10. Convert the displayed value to binary for display. If bit0 is valid, then the input at the DI1 terminal is valid..., if bit9 is valid, then the input at the DI10 terminal is valid.
U0.11	DO state	0	Displays the output status of the DO terminals of the drive, which is displayed in binary. The meaning of each bit is as follows. bit0: Relay output bit1: Reserved bit2: DO1 output state bit3: Reserved bit4: FM terminal output status bit5: Fault indicator status bit6: Operation indicator bit7: Reserved bit8: Motor fan operating bit9: Output status of AO1 used as DO bit10: Output function status of AO2 used as DO
U0.12	AI1 input voltage	0.00 V	Displays the input voltage of AI1 on the AC drive.
U0.13	AI2 input voltage	0.00 V	It displays the voltage input value of AI2 terminal.
U0.15	AO1 output voltage	0.00 V	Displays the output voltage of AO1 on the AC drive.
U0.17	High-speed pulse input frequency	0.00 kHz	When the frequency source of the drive is set to DI5, this parameter displays the real-time pulse frequency input at the DI5 terminal.
U0.18	High-speed pulse output frequency	0.00 kHz	When the thousands of the parameter setpoint is set to 0, the FM output terminal outputs pulses, and the output function is determined by the ones. See the description in b3.18 for details. This function displays the product of the current output ratio and the value displayed in b3.42.

Parameter	Name	Min. unit	Parameter description
U0.19	CAN communication quality	0	Displays the CAN communication quality between the drive and an external CANlink device. The drive detects the communication quality every time after it sends 100 frames of data.
U0.20	SPI communication quality	0	It displays the communication quality between the AC drive and the process sheet. The drive detects the communication quality every time after it sends 100 frames of data.
U0.21	Brake release time	0.00s	When the DI terminal assigned with the brake release feedback function is enabled, this parameter indicates the time required for the brake to fully release after the drive triggers the brake release condition.
U0.22	Brake apply time	0.00s	When the DI terminal assigned with the brake apply input feedback function is enabled, this parameter indicates the time required for the brake to fully apply after the drive triggers the brake apply condition.
U0.23	Heatsink temperature	-1000	It is used to display the insulated gate bipolar transistor (GBT) temperature of the inverter module.
U0.24	Function software version	0.00	Displays the version of the function software.
U0.25	Performance software version	0.00	Displays the version of the performance software.
U0.27	Encoder feedback frequency	0	Displays the encoder feedback frequency in real time in the FVC mode.
U0.28	Active fault code	0	Displays the code of the fault occurred. The hundreds indicates the fault level, while the tens and ones together display the current fault code.
U0.29	Braking transistor current	0	Displays the output current of the braking transistor when the built-in braking unit of the drive is working.
U0.30	Maximum allowable frequency in field weakening	0	Defines the theoretical maximum output frequency that the drive can achieve through internal calculation.

Parameter	Name	Min. unit	Parameter description
U0.31	Temporary function software version of the drive	0	Defines the temporary function software version for version iteration control.
U0.32	Temporary performance software version of the drive	0	Defines the temporary performance version for version iteration control.
U1.00	Emergency stop count	0	Displays the level 1 fault count of the drive after power-on.
U1.01	Quick stop count	0	Displays the level 2 fault count of the drive after power-on.
U1.02	High-order bits of brake actuation count	0	Displays the high-order bits of cumulative actuation count of the brake. When the number of faults recorded by U1.03 exceeds 65535, the value of this parameter increases by 1 automatically.
U1.03	Low-order bits of brake actuation count	0	This parameter is incremented by 1 every time the brake is released.
U1.04	Time for torque limit arrival	0.0h	Defines the cumulative time when the drive output torque reaches or exceeds the torque upper limit (b1.04 and b1.05).
U1.05	Cumulative operating time of the drive	0 h	Displays the cumulative operating time of the drive after power-on.
U1.06	Cumulative power-on time of the drive	0 h	Displays the cumulative power-on time of the drive.

7.3 Level-3 Menu (Group F) Parameter Table

The level III menu mainly includes output performance parameters and manufacturer parameters. Generally, the level III menu needs no adjustment.

To enter the level III menu, users must input the password defined by FF.00.

No.	Name	Parameter description	Setting range	Default
F0 Motor parameters				

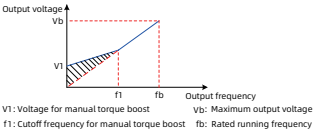
No.	Name	Parameter description	Setting range	Default
F0.00	Asynchronous motor stator resistance	In auto-tuning mode 1, only parameters F0.00 to F0.02 can be obtained. In auto-tuning mode 3, all the five parameters can be obtained. In auto-tuning mode 2, the five parameters as well as other parameters, such as the encoder phase sequence and current loop PI parameters can be obtained. When the rated motor power (A0.01) changes, the AC drive modifies the value of these five parameters automatically to restore them to common parameters of Y-standard motors.	0.001 to 65.535	1.239 Ω
F0.01	Rotor resistance of asynchronous motor		0.001 to 65.535	0.512 Ω
F0.02	Leakage inductance of asynchronous motor		0.01 to 655.35	5.63 mH
F0.03	Mutual inductance of asynchronous motor		0.01 to 655.35	50.00 mH
F0.04	No-load current of asynchronous motor		0.01 to 655.35	12.20 A
F0.15	Braking transistor enable mode selection	When this parameter is set to 1, the built-in braking unit is allowed to operate even in the stop state.	0: Enabled during operation 1: Enabled allowed at stop	0

<table>
<tr><th>No.</th><th>Name</th><th>Parameter description</th><th>Setting range</th><th>Default</th></tr>
<tr><td>F0.16</td><td>Carrier frequency</td><td>Used to adjust the carrier frequency of the drive. You can reduce the motor noise, avoid the resonance point of the mechanical system, and reduce the ground leakage current and interference generated by the drive through adjusting the carrier frequency. When the carrier frequency is low, the output current higher order harmonics increase, causing high power loss and temperature rise of the motor. If the carrier frequency is high, power loss and temperature rise of the motor decline. However, the AC drive has an increase in power loss, temperature rise, and interference.<table><tr><td>Carrier frequency</td><td>Low → High</td></tr><tr><td>Motor noise</td><td>High → Low</td></tr><tr><td>Output current waveform</td><td>Poor → Good</td></tr><tr><td>Motor temperature rise</td><td>High → Low</td></tr><tr><td>AC drive temperature rise</td><td>Low → High</td></tr><tr><td>Leakage current</td><td>Low → High</td></tr><tr><td>External radiation interference</td><td>Low → High</td></tr></table></td><td>1.0 kHz to 12.0 kHz</td><td>6.0</td></tr>
<tr><td colspan="5">Group F1: Vector control parameters</td></tr>
</table>

No.	Name	Parameter description	Setting range	Default
F1.00	Speed loop proportional gain 1	Speed loop PI parameters vary with operating frequencies of the drive. If the frequency reference is lower than switchover frequency 1 (F1.02), speed loop PI parameters F1.00 and F1.01 are used. If the frequency reference is greater than the switchover frequency 2, speed loop PI parameters F1.03 and F1.04 are used. If the frequency reference is between switchover frequency 1 and switchover frequency 2, the speed loop PI parameters are obtained from linear switchover between the two groups of PI parameters. You can adjust the dynamic response characteristics of the speed loop in vector control by setting the proportional coefficient and integral time of the speed regulator. Increasing the proportional gain or reducing the integral time can quicken the dynamic response of the speed loop. Be aware that this may lead to system oscillation. If the default setting cannot meet the requirements, make proper adjustment. Increase the proportional gain first to ensure that the system does not oscillate, and then reduce the integral time to ensure that the system has quick response and small overshoot. Note: Improper PI parameter settings may cause high speed overshoot. In addition, overvoltage may occur when overshoot drops.	1 to 100	60
F1.01	Speed loop integral time 1		0.01 to 10.00	0.50s
F1.02	Switchover frequency 1		0.00 Hz to 150.00 Hz	5.00 Hz
F1.03	Speed loop proportional gain 2		1 to 100	20
F1.04	Speed loop integral time 2		0.01 to 10.00	1.00s
F1.05	Switchover frequency 2		F1.02 to b1.02	10.00

No.	Name	Parameter description	Setting range	Default
F1.06	Speed loop filter time	In vector control mode, the output of the speed loop regulator is torque current reference. This parameter is used to filter the torque references. This parameter need not be adjusted generally. When speed fluctuates violently, increase the filter time properly. When the motor oscillates, decrease the setpoint. A low setpoint quickens speed responses but may lead to output torque fluctuation.	0.000 to 1.000	0.080s
F1.07	Over-excitation gain in vector control	When the generating energy generated during deceleration is excessive, enable over-excitation to consume some generating energy. The higher the overexcitation gain, the better the suppression effect can be.	0 to 200	64
F1.08	M-axis current loop proportional gain	They are current loop PI parameters for vector control. Their values are automatically obtained after the asynchronous motor completes auto-tuning mode 2, and do not need to be changed. The current loop integral regulator does not use the integral time as the dimension. Instead, set the integral gain directly. Note that too large current loop PI gain may lead to oscillation of the entire control loop. Therefore, when current oscillation or torque fluctuation is great, manually decrease the proportional gain or integral gain here.	1 to 500	10
F1.09	M-axis current loop integral time		1s to 500s	10s
F1.10	T-axis current loop proportional gain		1 to 500	10
F1.11	T-axis current loop integral time		1s to 500s	10s
Group F2: V/f control parameters				

No.	Name	Parameter description	Setting range	Default
F2-00	V/f curve selection	Used to set different V/f curves according to different applications in V/f mode. 0: Linear V/f curve The output voltage changes linearly with the output frequency when the frequency is lower than the rated frequency. This curve applies to general mechanical transmission applications such as acceleration of high-inertia fans, punch presses, centrifuges, and water pumps. 1 to 9: Reserved 10: Fully-decoupled V/f mode The output frequency and output voltage of the drive are independent of each other. The output frequency is determined by the frequency source, and the output voltage is determined by the V/f separation voltage source. This curve applies to torque motor control applications. 11: Partially-decoupled V/f mode In this mode, the voltage and frequency are proportional, which can be set through the voltage source. The relationship between the voltage and frequency is also related to the rated motor voltage and rated motor frequency. If the voltage source input is X (0% to 100%), the relationship between the voltage (V) and frequency (f) is as follows: V/f = 2 x Voltage source input x (Rated motor voltage)/(Rated motor frequency)	0 to 11	0

No.	Name	Parameter description	Setting range	Default
F2.01	Torque boost in V/f	To compensate for the low frequency torque of V/f control, you can boost the output voltage of the drive during operation at low frequency. If the torque boost is set to an excessively high value, the motor may be overheated, leading to overcurrent. If the motor is connected to a heavy load but does not have sufficient starting torque, increase the torque boost. If the motor is connected to light load, decrease the torque boost. If the torque boost is set to 0.0, the drive automatically calculates the torque boost value based on motor parameters such the stator resistance. Cutoff frequency of torque boost: Torque boost is valid when the running frequency within this value and becomes invalid when the running frequency exceeds this value.  V1: Voltage for manual torque boost Vb: Maximum output voltage f1: Cutoff frequency for manual torque boost fb: Rated running frequency	0.0 to 30.0	1.0%
F2.02	Cutoff frequency of torque boost		0.00 Hz to b1.02	50.00 Hz
F2-03	Frequency point 1 on multi-point V/f curve	Indicates frequency point 1 set in the multi-point V/f curve.	0.00 Hz to F2.05	0.00 Hz
F2-04	Voltage point 1 on multi-point V/f curve	Indicates voltage point 1 set in the multi-point V/f curve.	0.0 V to F2.06	0.0
F2-05	Multi-point V/f frequency 2	Indicates the frequency point 2 set by multi-point V/f curve.	0.00 Hz to F2.07	0.00 Hz
F2-06	Voltage point 2 on multi-point V/f curve	Indicates voltage 2 set in the multi-point V/f curve.	0.0 V to F2.08	0.0

No.	Name	Parameter description	Setting range	Default
F2-07	Frequency point 3 on multi-point V/f curve	Indicates the frequency 3 set on the multi-point V/f curve.	0.00 Hz to A0.04	0.00 Hz
F2-08	Voltage point 3 on multi-point V/f curve	Indicates voltage 3 set in the multi-point V/f curve.	0.0 V to 100.0 V	0.0
F2.09	Slip compensation coefficient in V/f mode	This parameter is active only for the asynchronous motor. The V/f slip compensation is used to compensate for the motor speed deviation generated when the load on the asynchronous motor increases, keeping the motor speed stable when the load changes. If the V/f slip compensation gain is set to 100.0%, the slip compensation applied to the motor with the rated load is the rated motor slip. The drive automatically calculates the rated motor slip based on the motor's rated frequency and rated speed set by parameters in group F1. The principle of adjusting the V/F slip compensation gain is to make the motor rotational speed the same as the target rotational speed under the rated load. Generally, if the motor speed is different from the target speed, adjust this parameter.	0.0% to 100.0%	0.0%

No.	Name	Parameter description	Setting range	Default
F2.10	Overexcitation gain in V/f mode	During deceleration of the drive, over-excitation can restrain the rise of bus voltage to avoid overvoltage. The higher the overexcitation gain, the better the suppression effect can be. Increase the over-excitation gain if the AC drive is liable to overvoltage fault during deceleration. An excessively high over-excitation gain may lead to an increase in output current. Therefore, set this parameter to a proper value in actual applications. Set the over-excitation gain to 0 in the following conditions: 1. The inertia is small and the DC bus voltage will not rise during motor deceleration. 2. The AC drive is equipped with a braking resistor.	0 to 200	0
F2.11	Oscillation suppression gain	Set this parameter to a value as small as possible in the prerequisite of efficient oscillation suppression to avoid influence on V/F control. When the motor does not oscillate, set this gain to 0. Increase the value of F2.11 only when obvious motor oscillation occurred. The larger the gain, the better oscillation suppression effect. When oscillation suppression is enabled, the motor's rated current and no-load current must be accurate. Otherwise, the V/f oscillation suppression effect can be affected.	0 to 100	40
Group F3: Control optimization parameters				

No.	Name	Parameter description	Setting range	Default
F3.00	Frequency upper limit for DPWM switchover	This parameter determines the wave modulation mode of an asynchronous motor. If the operating frequency of the AC drive is lower than the upper limit, the 7-segment continuous modulation mode applies. If the operating frequency is higher than the upper limit, the 5-segment intermittent modulation mode applies. In the 7-segment continuous modulation mode, the switching loss is large but the current ripple is small. In the 5-segment intermittent modulation mode, the switching loss is small but the current ripple is large. This mode may lead to instability of the motor at high frequency. Do not modify this parameter in normal conditions. For details about power loss and temperature rise, see the description of F0.16.	5.00 Hz to 150.00 Hz	12.00 Hz
F3.01	PWM modulation mode	This parameter is valid only for V/f control. In synchronous modulation mode, the carrier frequency changes linearly with the output frequency, so the ratio between them (carrier ratio) remains unchanged. This modulation mode is generally used at high output frequency, which helps improve the output voltage quality. Synchronous modulation is not required at low output frequency (100 Hz or below). This is because asynchronous modulation is preferred when the ratio of carrier frequency to output frequency is high. Synchronous modulation takes effect only when the reference frequency is higher than 85 Hz. Asynchronous modulation is used when the reference frequency is below 85 Hz. 0: Asynchronous modulation 1. Synchronous modulation	0: Asynchronous modulation 1: Synchronous modulation	0

No.	Name	Parameter description	Setting range	Default
F3.02	Dead zone compensation mode selection	Generally, this parameter does not need to be modified. You need to try a different compensation mode only when there is any special requirement on the waveform quality of the output voltage or when oscillation occurs on the motor. For high power AC drive, set this parameter to 2. 0: No compensation 1: Compensation mode 1 2: Compensation mode 2	0: No compensation 1: Compensation mode 1 2: Compensation mode 2	1
F3.03	Random PWM depth	Random PWM can smooth noise of the motor and reduce electromagnetic interference. If this parameter is set to 0, random PWM is invalid. You will obtain different results by adjusting the random PWM depth. 0: Random PWM invalid 1 to 10: Random PWM depth	0 to 10	0
F3.04	Pulse-by-pulse current limiting enable	The fast current limit function helps minimize occurrence of overcurrent, ensuring continuous operation of the AC drive. However, if the AC drive stays in the current limiting state for a long time, it may be damaged due to high temperature or other reasons. To prevent this problem, the AC drive reports Er#40 (pulse-by-pulse current limiting) if current limiting lasts for a long time. This error indicates that the AC drive is overloaded and needs to stop. 0: Inactive 1: Enable	0: Disable 1: Enable	0
F3.05	Current detection delay compensation	Used to set the current detection compensation for the AC drive. If the compensation value is excessively high, the control performance may be degraded. Do not change the value of this parameter in normal conditions.	0 to 100	5

No.	Name	Parameter description	Setting range	Default
F3.06	Undervoltage threshold	Used to set the threshold for triggering an undervoltage fault (No. 09). If the bus voltage is lower than the value defined this parameter, the drive is in undervoltage state, with operation limited.	140.0 V to 630.0 V	350.0 V
F4 V/f optimization parameters				
F4.37	Overvoltage stall suppression voltage gain in V/f mode	Used to suppress the bus voltage. Increasing the setpoint can reduce bus voltage overshoot.	0% to 100%	30%
F4.38	Maximum rising limit frequency upon overvoltage stall	The operating frequency may increase during overvoltage stall suppression. This parameter limits the operating frequency increment.	0 Hz to 50 Hz	5 Hz
F4.39	Oscillation suppression mode in V/f control	In the V/f mode, speed or current oscillation can occur at low frequencies for most motors. Such oscillation may lead to drive overcurrent. In this case, you can enable oscillation suppression to eliminate oscillation.	0: Inactive 1: Reserved 2: Reserved 3: Mode 3 4: Mode 4	3
F4.40	Slip compensation time constant in V/f mode	Indicates the time constant of the slip compensation frequency. The higher the time constant, the smoother the slip compensation frequency, and the less it is affected by load disturbances and noise. However, the response to load change will be slower.	1s to 100s	5s
F4.46	Online torque compensation gain	In the V/f mode, F2.01 (Torque boost) increases the output voltage of the drive according to a fixed curve. When F4.46 ≥ 100 or F2.01 = 0, an additional boost related to the load size can be added to the output voltage after F2.01 boost, that is, automatic torque boost compensation. The greater the gain of F4.46, the greater the torque boost compensation. When F4.46 < 100 and F2.01 ≠ 0, the automatic torque boost compensation is disabled.	80 to 150	100

No.	Name	Parameter description	Setting range	Default
FD EtherCAT parameters				
FD.01	EtherCAT station alias backup	Displays the effective alias of the EtherCAT slave.	0 to 65535	0
FD.37	DHCP function	0: Disable 1: Enable	0 to 1	0
FD.38	Most significant byte of the IP address	Defines the most significant byte of the static IP address.	0 to 255	0
FD.39	Second most significant byte of the IP address	Defines the second most significant byte of the static IP address.	0 to 255	0
FD.40	Third most significant byte of the IP address	Defines the third most significant byte of the IP address.	0 to 255	0
FD.41	Least significant byte of the IP address	Defines the least significant byte of the IP address.	0 to 255	0
FD.42	Most significant byte of the subnet mask	Defines the most significant byte of the subnet mask in network communication.	0 to 255	0
FD.43	Second most significant byte of the subnet mask	Defines the second most significant byte of the subnet mask.	0 to 255	0
FD.44	Third most significant byte of the subnet mask	Defines the third most significant byte of the subnet mask.	0 to 255	0
FD.45	Least significant byte of the subnet mask	Defines the least significant byte of the subnet mask.	0 to 255	0
FD.46	Most significant byte of the gateway	Defines the most significant byte of the gateway.	0 to 255	0
FD.47	Second most significant byte of the gateway	Defines the second most significant byte of the gateway.	0 to 255	0
FD.48	Third most significant byte of the gateway	Defines the third most significant byte of the gateway.	0 to 255	0

No.	Name	Parameter description	Setting range	Default
FD.49	Least significant byte of the gateway	Defines the least significant byte of the gateway.	0 to 65535	0
FD.58	Communication error code	EtherCAT communication fault code	0 to 255	0
FD.61	Octets 1 and 2 of MAC address	-	0 to 65535	0
FD.62	Octets 3 and 4 of MAC address	-	0 to 65535	0
FD.63	Octets 5 and 6 of MAC address	-	0 to 65535	0

8 Troubleshooting

8.1 Safety Instructions

DANGER

- Perform wiring only when the power is disconnected (all circuit breakers must be shut off). Failure to comply may result in electric shock.
- Do not perform power-off and power-on repeatedly when the drive reports Er142 (brake fault) or Er453 (brake failure protection). Instead, stop the drive immediately to check the fault cause. Otherwise, the drive may fall.

WARNING

- Make sure to ground the AC drive according to local laws and regulations. Failure to comply can result in the risk of electric shock or fire.
- Do not remove the enclosure or touch the internal circuit while the power is on. Failure to comply can result in electric shock.
- Maintenance, inspection and repair of the AC drive can be carried out by professionals only. Failure to comply can result in the risk of electric shock or fire.
- When installing the drive inside an enclosed cabinet, use cooling fan or air conditioner to keep temperature below 50° C. Failure to comply will result in over-temperature or fire.
- Tighten all screws based on the specified tightening torque. Failure to comply may result in electric shock or fire.
- Ensure the input voltage is within the rated voltage range shown on the nameplate. Failure to comply may result in electric shock or a fire.
- Keep flammables and combustibles away from the drive.

CAUTION

- Cover the top of the drive with a temporary cloth or paper during installation so as to prevent unwanted objects such as metal filings, oil, and water from falling into the drive. If unwanted matters fall into the AC drive, the AC drive may become faulty.
- Remove the paper or cloth after installation is completed. Otherwise, overtemperature can occur due to poor ventilation.
- Follow proper electrostatic discharge (ESD) procedures when operating the AC drive. Failure to comply will damage internal circuit of the drive.

8.2 Troubleshooting Before Trial Run

1) Open-loop vector control (b1.00 = 0 (default))

In this mode, the drive controls the motor speed and torque without an encoder for speed feedback. Auto-tuning on motor parameters is required to obtain the motor parameters.

Description	Solution
Overload or overcurrent during start of the motor	◆ Set motor parameters (A0.01 to A0.05) according to values on the motor nameplate. ◆ Select a proper motor auto-tuning mode (b0.04) and perform motor auto-tuning.
Slow torque/speed response and motor oscillation occur at a frequency below 5 Hz.	◆ To speed up the torque and speed response, increase the value of F1.00 (speed loop proportional gain) in increments of 10 or decrease the value of F1.01 (speed loop integral time) in decrements of 0.05. ◆ If vibration occurs, decrease the values of F1.00 and F1.01.
Slow torque or speed response and motor vibration at a frequency above 5 Hz	◆ To speed up the torque and speed response, increase the value of F1.03 (speed loop proportional gain) in increments of 10 or decrease the value of F1.04 (speed loop integral time) in decrements of 0.05. ◆ If vibration occurs, decrease the values of F1.03 and F1.04.
Low speed accuracy	◆ Increase the value of b1.01 (Slip compensation gain in vector control) by 10% every time when the with-load speed deviation of the motor is too large.
Obvious speed fluctuation	◆ Increase the value of F1.06 (Filter time constant of speed loop) in a unit of 0.001s when motor speed fluctuates abnormally.
Excessive motor noise	◆ Increase the value of F0.16 (carrier frequency) in increments of 1.0 kHz. (Note that increasing the carrier frequency will result in a capacity decrease of the AC drive and an increase in the leakage current of the motor. For details about capacity decrease, contact the manufacturer.)
Insufficient motor torque or force	◆ Check whether the torque upper limit is low. If so, increase the torque upper limit (b1.04 and b1.05) in velocity mode or increase the torque demand value in torque mode.

2) Closed-loop vector control mode (b1.00 = 1)

This mode applies to applications with an encoder for speed feedback. Set the encoder pulses per revolution, encoder type and encoder direction correctly to finish motor parameter auto-tuning.

Description	Solution
Overload or overcurrent fault during start	◆ Set the encoder pulses per revolution, encoder type, and encoder direction correctly.
Overload or overcurrent detected during motor operation	◆ Set motor parameters (A0.01 to A0.05) according to values on the motor nameplate. ◆ Select a proper motor auto-tuning mode (b0.04) and perform motor auto-tuning.

Description	Solution
Slow torque/speed response and motor oscillation occur at a frequency below 5 Hz.	◆ To speed up the torque and speed response, increase the value of F1.00 (speed loop proportional gain) in increments of 10 or decrease the value of F1.01 (speed loop integral time) in decrements of 0.05. ◆ If vibration occurs, decrease the values of F1.00 and F1.01.
Slow torque/speed response and motor oscillation occur at a frequency above 5 Hz.	◆ To speed up the torque and speed response, increase the value of F1.03 (speed loop proportional gain) in increments of 10 or decrease the value of F1.04 (speed loop integral time) in decrements of 0.05. ◆ If vibration occurs, decrease the values of F1.03 and F1.04.
Obvious speed fluctuation	◆ Increase the value of F1.06 (Filter time constant of speed loop) in a unit of 0.001s when motor speed fluctuates abnormally.
Excessive motor noise	◆ Increase the value of F0.16 (carrier frequency) in increments of 1.0 kHz. (Note that increasing the carrier frequency will result in a capacity decrease of the AC drive and an increase in the leakage current of the motor. For details about capacity decrease, contact the manufacturer.)
Insufficient motor torque or force	◆ Check whether the torque upper limit is low. If so, increase the torque upper limit (b1.04 and b1.05) in velocity mode or increase the torque demand value in torque mode.

3) V/f Control (b1.00 = 2)

This mode applies to application without an encoder for speed feedback. Set the rated motor voltage and rated motor frequency correctly.

Description	Solution
Motor oscillation during operation	◆ Increase the value of F2.11 (oscillation suppression gain) in increments of 10. The permissible maximum value of this parameter is 100.
Overcurrent at startup with high power	◆ Decrease the value of F2.01 (torque boost) in decrements of 0.5%.
Excessively high current during operation	◆ Set the rated voltage (A0.02) and rated frequency (A0.04) of the motor correctly. ◆ Decrease the value of F2.01 (torque boost) in decrements of 0.5%.
Excessive motor noise	◆ Increase the value of F0.16 (carrier frequency) in increments of 1.0 kHz. (Note that increasing the carrier frequency will result in a capacity decrease of the AC drive and an increase in the leakage current of the motor. For details about capacity decrease, contact the manufacturer.)

8.3 Warning and Fault Display

The CS710 series AC drive monitors various input signals, operating conditions, and external feedback in real time. Once a fault occurs, the AC drive takes the corresponding protection action, and the operating panel displays fault information, such as Er 102 .

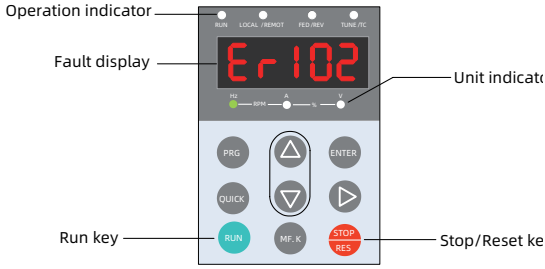


Figure 8-2 Diagram of fault interface

The number for each of the five LEDs on the operating panel is 5, 4, 3, 2, 1 from left to right. For example, if 103.02 is displayed on the operating panel, in 104.01, the No. 5, No. 4 and No.3 LEDs constitute the fault code. The digit "1" on the No. 5 LED indicates the fault level; digits "03" on the No. 4 and No. 3 LEDs indicate the fault number; and digits on No. 2 and No. 1 LEDs indicate the fault sub-code, which is reserved by the manufacturer and can be viewed through the fault log (parameters in group E*). The following figure shows details.

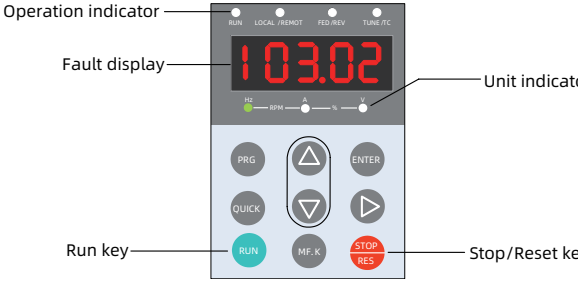


Figure 8-3 LED display of a fault

Perform troubleshooting based on this section.

The CS710 series AC drive is the core of a crane's electronic control system. Fault information provided by the AC drive is graded into five levels based on the impact on the system. The following table describes responses of the AC drive to different levels.

NOTE

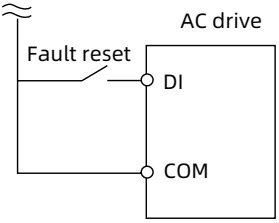
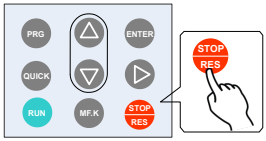
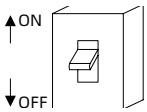
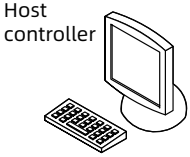
In the preceding table, the asterisk (*) represents the fault level, with a value range of 1 to 5. For example, in Er*52, 52 is the fault code, and the * represents the adjustable fault level.

Fault level	Solution	Display mode
Level-one fault	◆ The operating panel displays the fault code. ◆ DO function 1 (brake control) inactive ◆ DO function 2 (Stop-at-fault) active ◆ The drive coasts to stop.	
Level-two fault	◆ The operating panel displays the fault code. ◆ DO function 3 (Alarm-at-fault) active ◆ The drive performs quick stop.	
Level-three fault	◆ The operating panel displays the fault code. ◆ DO function 3 (Alarm-at-fault) active ◆ The drive decelerates to stop.	
Level-four fault	◆ The operating panel displays the fault code. ◆ DO function 4 (Fault alert) active ◆ The operation process is not affected by any operating condition.	
Level-five fault	◆ The operation process is not affected by any operating condition.	

NOTE

- ◆ Faults with error codes 1# to 40# are driving performance faults of CS710 series AC drive and are graded level-one by default. Their fault levels cannot be changed.
- ◆ No. 41 to No. 65 faults are the function faults of the AC drive. You can modify the corresponding fault level through bF.10 to bF.14.

8.4. Fault Reset

Stage	Solution	Remarks
Upon occurrence of the fault	View the record through the operating panel.	View the record through groups E0 to E9. 
Before the fault is reset	Before fault reset, find and remove the fault cause according to the fault type displayed on the operating panel.	Troubleshoot the fault according to "7.5 Error Codes and Solutions."
Eliminate the fault. Reset method	1) Allocate a DI terminal with function 3 (Fault reset) by setting any of b3.01 to b3.10 to 3. The reset terminal will be valid once the AC drive running command is canceled.	
	2. Confirm the AC operation command has been canceled and the STOP/RESET key is valid.	Press the red STOP key on the operating panel to reset the fault. 
	3. Restart the AC drive and the fault will be reset automatically. Cut off the power supply to the main circuit. When the error code on the operating panel disappears, resume the power supply.	
	4. Reset the AC drive on the host controller (Modbus RTU serial communication control). In communication control mode (bF.04 = 2), confirm that the RUN command has been canceled, and then write 7 (reset upon fault) to the 2000H communication address, so that the AC drive will reset after the fault is rectified[Note].	

NOTE

[Note]For details, see "Appendix A Modbus Communication Protocol".

8.5 Fault Information and Troubleshooting

The following faults may occur during use of the AC drive. Perform fault analysis according to the following solutions.

Fault code	Name	Cause	Solution
Er102	Overcurrent during acceleration	1. The output circuit of the drive is grounded or short-circuited. 2. Parameter auto-tuning is not performed in vector control mode. 3. The acceleration time is too short. 4. Manual torque boost or V/f curve is improper. 5. The voltage is excessively low. 6. The motor being started is already rotating. 7. A sudden load is applied during acceleration. 8. The power rating of the drive is low or external stall errors occur. 9. The resistance of the braking resistor is excessively low.	1. Rectify peripheral faults. 2. Perform motor parameter auto-tuning. 3. Increase the acceleration time. 4: Adjust the manual torque boost value or V/f curve. 5. Adjust the voltage to a value within the normal range. 6. Select flying start or restart after the motor stops. 7. Remove the load applied suddenly. 8. Select a drive of higher power rating. 9. Use a suitable braking resistor.
Er103	Overcurrent during deceleration	1. The output circuit of the drive is grounded or short-circuited. 2. Parameter auto-tuning is not performed in vector control mode. 3. The deceleration time is too short. 4. The voltage is too low. 5. A sudden load is applied during deceleration. 6. The braking unit or braking resistor is not installed. 7. The braking circuit is short-circuited.	1. Rectify peripheral faults. 2. Perform motor parameter auto-tuning. 3. Increase the deceleration time. 4. Adjust the voltage to a value within the normal range. 5. Remove the load applied suddenly. 6. Install the braking unit and braking resistor. 7. Check the braking resistor.
Er104	Overcurrent at constant speed	1. The output circuit of the drive is grounded or short-circuited. 2. Parameter auto-tuning is not performed in vector control mode. 3. The voltage is too low. 4. A sudden load is applied during operation. 5. The power rating of the drive is excessively low. 6. The braking circuit is short-circuited.	1. Rectify peripheral faults. 2. Perform motor parameter auto-tuning. 3. Adjust the voltage to a value within the normal range. 4. Remove the load applied suddenly. 5. Select a drive of a higher power rating. 6. Check the braking resistor.

Fault code	Name	Cause	Solution
Er105	Overvoltage during acceleration	1. The input voltage is too high. 2. An external force drives the motor during acceleration. 3. The acceleration time is too short. 4. The braking unit is not installed or the braking resistor is wired improperly.	1. Adjust the voltage to a value within the normal range. 2. Remove the external force or install a braking resistor. 3. Increase the acceleration time. 4. Install the braking unit and braking resistor.
Er106	Overvoltage during deceleration	1. The input voltage is too high. 2. An external force drives the motor during deceleration. 3. The deceleration time is too short 4. The braking unit or braking resistor is not installed.	1. Adjust the voltage to a value within the normal range. 2. Remove the external force or install a braking resistor. 3. Increase the acceleration time. 4. Install the braking unit and braking resistor.
Er107	Overvoltage at constant speed	1. The input voltage is too high. 2. An external force drives the motor during operation.	1. Adjust the voltage to a value within the normal range. 2. Remove the external force or install a braking resistor.
Er108	Control circuit power supply fault	Input voltage fluctuation causes the bus voltage to repeatedly jump above and below the undervoltage threshold.	Adjust the input voltage to a value within the normal range.
Er109	Undervoltage fault	1. An instantaneous power failure occurs. 2. The input voltage of the drive is not within the allowable range. 3. The bus voltage is abnormal. 4. The rectifier bridge and pre-charge resistor are faulty. 5. The driver board is faulty. 6. The control board is faulty.	1. Reset the fault. 2. Adjust the voltage to a value within the normal range. 3. Contact Inovance for technical support. 4. Contact Inovance for technical support. 5. Replace the driver board. 6. Replace the control board
Er110	Drive overload	1. The load is excessive or the motor is stalled. 2. The power rating of the drive model is low. 3. The drive model is set improperly. 4. Motor parameters are set improperly. 5. The encoder feedback is abnormal in FVC mode.	1. Reduce the load and check the motor and mechanical conditions. 2. Select a drive of a higher power rating. 3. If the power of the drive does not match that indicated on the nameplate, change the drive model. 4. Set the motor parameters according to the motor nameplate and perform motor auto-tuning. 5. Replace the motor or encoder.

Fault code	Name	Cause	Solution
Er111	Motor overload	1. Check whether motor protection parameter bE.01 is set properly. 2. Check whether the load is excessive or the motor is stalled. 3. The power rating of the drive is low.	1. Correctly set bE.01. 2. Reduce the load and check the motor and mechanical conditions. 3. Select a drive of higher power rating.
Er112	Input phase loss	1. The three-phase power supply input is abnormal. 2. The drive board, lightning protection board, main control board, or rectifier bridge is abnormal.	1. Rectify faults in peripheral circuits. 2. Contact Inovance for technical support.
Er114	Heatsink overtemperature	1. The ambient temperature is too high. 2. The air duct is blocked. 3. The fan is damaged. 4. The thermistor of the IGBT is damaged. 5. The inverter module is faulty.	1. Reduce the ambient temperature. 2. Clean the air duct. 3: Replace the damaged fan. 4: Replace the damaged thermistor. 5: Replace the inverter module.
Er115	Braking transistor overload	1. The resistance of the braking resistor is excessively low. 2. The braking resistor is short-circuited. 3. The built-in braking unit is damaged. 4. The power generated by external load is excessive.	1. Select a braking resistor of higher resistance. 2. Check whether the wiring between the drive and the braking resistor is proper. 3. Contact Inovance for technical support. 4. Reduce the load, or reduce friction resistance of mechanical structure.
Er116	Brake transistor short circuit		
Er117	Contactor fault	1. The driver board and power supply are abnormal. 2. The contactor is abnormal.	1: Replace the driver board or power supply board. 2: Replace the contactor.
Er118	Current detection fault	1. The hall device is abnormal. 2. The driver board is abnormal.	1. Replace the Hall element. 2. Replace the driver board.
Er119	Motor parameter auto-tuning fault	1. The motor parameters are not set according to the nameplate. 2. Motor auto-tuning times out.	1. Set the motor parameters according to the nameplate. 2. Check the cables connecting the drive and the motor.
Er120	Encoder/PG fault	1. The encoder type does not match the drive. 2. The encoder cable is connected improperly. 3. The encoder is damaged. 4. The PG card is abnormal.	1. Set the encoder type correctly based on the actual conditions. 2. Rectify circuit faults. 3. Replace the damaged encoder. 4. Replace the PG card.

Fault code	Name	Cause	Solution
Er123	Output ground fault of the drive	1. Output cables are short-circuited to ground. 2. The output end of the drive is short-circuited to ground.	1. Replace cables. 2. Replace the motor.
Er125	Output phase loss	1. The cable connecting the drive and the motor is improper. 2. The three-phase outputs of the drive are unbalanced during operation of the motor. 3. The drive board is abnormal. 4. The IGBT is abnormal.	1. Rectify peripheral faults. 2. Check whether the motor three-phase winding is normal and eliminate the fault. 3. Contact Inovance for technical support. 4. Contact Inovance for technical support.
Er137	Frequency direction fault	1. The direction of the frequency reference is opposite to the direction of the motor feedback frequency. 2. The power rating of the drive model is low. 3. bC.02 is set to an excessively low, leading to a false fault.	1. Check whether the motor parameters are set properly. 2. Check whether the load is excessive. 3. Adjust the value of bC.02.
Er138	Frequency following fault	1. The following error between the frequency reference and the motor feedback frequency is excessive. 2. The power rating of the drive model is low. 3. bC.04 is set to an excessively low value, leading to a false fault.	1. Check whether the motor parameters are set properly. 2. Check whether the load is excessive. 3. Adjust the values of bC.03 and bC.04.
Er140	Pulse-by-pulse current limiting fault	1. The load is excessive or the motor is stalled. 2. The power rating of the drive model is low.	1. Reduce the load and check the motor and mechanical conditions. 2. Select a drive of a higher power rating.
Er142	Brake fault	After the brake curve is enabled through b6.00 and brake feedback purpose is enabled through b6.08: 1. The brake feedback signal input hardware is faulty. 2. A certain period of time is needed for brake apply, but the detection time defined by b6.06 is excessively low.	1. Repair the hardware DI brake feedback error. 2. Increase the detection time (b6.06).
Er*51	Parameter fault	1. Parameters are set improperly. 2. The EEPROM memory integrated circuit is abnormal.	1. Parameters are set improperly. 2. The EEPROM memory integrated circuit is abnormal.

Fault code	Name	Cause	Solution
Er152	Excessive speed deviation in V/f mode	1. The actual motor operating frequency and synchronous frequency exceed the speed deviation threshold. 2. bC.03 is set improperly.	1. Check the encoder, the motor operation status, and the load conditions. 2. Check that motor parameters are set properly.
Er453	Brake failure protection	Encoder pulse feedback accumulation is detected in the stop state of the drive, which indicates the brake is released, and the load is not held properly. In this case, the drive operates at 0 Hz automatically, which is active when b1.00 is set to 1 (FVC).	Perform inspection on the brake.
Er*41	Brake release fault	After the brake curve is enabled through b6.00 and brake feedback purpose is enabled through b6.08: 1. The brake release feedback signal input hardware is faulty. 2. A certain period of time is needed for brake release, but the detection time defined by b6.04 is excessively low.	1. Repair the hardware DI brake release feedback error. 2. Increase the detection time (b6.04).
Er*42	Brake fault	The brake feedback signal input is wrong. See the description of b6.08 for details.	1) Check the brake circuit wiring. 2. Check the function of the brake feedback input point of the control board (DI function 12)
Er*43	Shaft-cooling motor operation timeout	See the description of b0.00 and b0.01 for details.	Extend the operating time defined by b0.01.
Er*44	The forward run and reverse run terminals are activated at the same time.	The forward run and reverse run commands are detected at the same time.	The forward run and reverse run signals cannot be activated at the same time.
Er*45	Control lever not in neutral position	An operating command or frequency reference signal input is detected by the AC drive during power-on.	After power-up, the startup command assigned to the DI terminal is inactive.
Er*47	CAN bus fault	1. The CANlink expansion card operates improperly. 2. The communication cable does not work normally.	1. Check the CAN expansion card. 2. Check the communication cable.

Fault code	Name	Cause	Solution
Er*48	SCI fault	1. The host controller works improperly. 2. The communication cable does not work normally. 3. The communication parameter bd.04 is set to an excessively low value.	1. Check the operating conditions of the host controller. 2. Check the communication cable or the RS485 expansion card. 3. Increase the setpoint of bd.04. View the subcode through group E parameters E*.00. The ones place indicates the fault subcode, which is defined as follows: 1: If the drive does not receive the command from the master within the time set by bd.04 during Modbus communication, a timeout fault occurs. 2. Communication interference, Modbus communication data frame error, or CRC check error occurs. 3. The PLC command word in PROFINET, PROFIBUS DP, or CANopen communication is abnormal. The high-order 8 bits of the command word are not 0.
Er*49	EEPROM read/ write fault	The EEPROM integrated circuit is damaged.	Contact the technical support. Replace the internal control board of the drive.
Er*50	External input fault	The DI function 7 is active.	Check the DI function 7.
Er*51	Function logic error	1. Parameters are set improperly. 2. The EEPROM memory integrated circuit is abnormal.	1. Parameters are set improperly. 2. The EEPROM memory integrated circuit is abnormal.

8.6 Fault Symptoms and Solutions

No.	Fault symptom	Possible cause	Solution
1	There is no display upon power-on.	The drive is not connected to the grid or the grid voltage is too low.	Check the input power supply.
		The switched-mode power supply on the drive board of the AC drive is faulty.	Check the bus voltage or contact the agent or Inovance.
		The cable connecting the control board and the drive board and the operating panel is broken.	Re-connect the 8-pin wire and 40-pin wire.
		The pre-charge resistor of the AC drive is damaged.	Contact Inovance for technical support.
		The control board or the operating panel is faulty.	
		The rectifier bridge is damaged.	
2	"CrAnE" is displayed after power-on.	The cable connecting the drive board and the control board is in poor contact.	Re-connect the 8-pin and 28-pin flat cables.
		Related components on the control board are damaged.	Contact Inovance for technical support.
		The motor or the motor cable is short-circuited to ground.	
		The Hall sensor is faulty.	
		The grid voltage is excessively low.	
3	"Er123" is Displayed upon power-on. Alarm	The motor or the output cable is short-circuited to ground.	Check the insulation status of the motor and the output cable with a megger.
		The AC drive is damaged.	Contact Inovance for technical support.
4	The AC drive display is normal upon power-on. But after operating, "CrAnE" is displayed and the drive stops immediately.	The cooling fan is damaged or does not rotate.	Replace the fan.
		The cable of the external control terminal is short-circuited.	Eliminate the external short-circuit fault.

No.	Fault symptom	Possible cause	Solution
5	Err14 (Module overheat) is reported frequently.	The carrier frequency is set to a too high value.	Reduce the carrier frequency (F0.15).
		The cooling fan is damaged or the ventilation duct is blocked.	Replace the fan or clean the ventilation duct.
		Components (thermistor or others) inside the drive are damaged.	Contact Inovance for technical support.
6	The motor does not rotate after the drive runs.	Check the motor and motor cables.	Check that the wiring between the AC drive and the motor is proper.
		AC drive parameters (motor parameters) are set improperly.	◆ Restore the factory parameters and reset related parameters properly. ◆ Ensure proper settings of the encoder parameters and rated motor parameters (such as the rated motor frequency and rated motor speed). ◆ Check that b1.00 (control mode) and bF.04 (command source selection) are set correctly. ◆ Adjust F2.01 (torque boost) in V/f control mode under heavy load.
		The cable connecting the drive board and control board is in poor contact.	Re-connect the cable and ensure that the cable is connected firmly.
		The driver board is faulty.	Contact Inovance for technical support.
7	DI terminals are deactivated.	Parameters are set improperly.	Check and reset parameters in group b3.
		The external signal is incorrect.	Re-connect the external signal cable.
		The jumper across OP and +24V becomes loose.	Secure the jumper across OP and +24V.
		The control board is faulty.	Contact Inovance for technical support.

No.	Fault symptom	Possible cause	Solution
8	The motor speed does not rise in FVC mode.	Encoder fault	Replace the encoder and check the cable connection.
		The encoder connection is incorrect or in poor contact.	Replace the PG card.
		The PG card is faulty.	Contact Inovance for technical support.
		The driver board is faulty.	
9	The AC drive reports overcurrent and overvoltage faults frequently.	Settings of the motor parameters are incorrect.	Set the motor parameters again or perform motor parameter auto-tuning.
		The acceleration/deceleration time is improper.	Set a proper acceleration/deceleration time.
		The load fluctuates.	Contact Inovance for technical support.
10	Err17 is reported upon power-on or during running.	The soft start contactor is not closed or it is not conductive in a low-temperature and high-humidity environment.	● Check whether the contactor cable is loose. ● Check whether the contactor is faulty. ● Check whether +24 V power supply of the contactor is faulty. ● Contact Inovance for technical support. ● Apply a heating device in the electric cabinet.
11	The lightning protection board is abnormal, with Err12 reported.	The wiring between the control board and driver board is loosened.	Check whether the input phase loss signal cable between the surge protection board and driver board is connected.
		The lightning protection board is corroded or damaged.	Check whether the lightning protection board is damaged or corroded. If yes, replace it.

8.7 Fault Subcodes

The CS710 series AC drive provides fault subcodes to facilitate fault analysis and location. The fault subcode is indicated by the latter two digits of E*.00 in group E*.

See the following table for details on fault subcodes.

Fault code	Code Meaning	Subcode	Meaning
02-04	Overcurrent	1	Drive unit hardware overcurrent
		10	Built-in braking unit hardware overcurrent

Fault code	Code Meaning	Subcode	Meaning
05-07	Overvoltage	1	Software overvoltage fault 1
		2	Software overvoltage fault 2
08	Pre-charge resistor overtemperature fault or control power supply fault	1	The voltage fluctuates during power-on, which leads to undervoltage after power-on. The AC drive is powered on again and again by more than five times within a short period of time.
09	Undervoltage	1	The AC drive bus voltage is lower than the voltage defined by F3.06 during running.
10	AC drive overload	1	The overload fault is reported based on the AC drive overload curve.
		2	The pulse-by-pulse current limit time of any one of the phase output is 5s.
11	Motor overload	1	The overload fault is reported based on the AC drive overload curve.
12	Input phase loss	1	Hardware input phase loss 1
		2	Hardware input phase loss 2
		3	Software input phase loss 1
		4	Software input phase loss 2
14	Heatsink or module overtemperature	1	The inverter temperature exceeds the overtemperature threshold.
#15	Built-in braking tube overload	1	The instantaneous current of the braking tube is more than two times the rated braking current.
		2	The instantaneous current of the braking tube is larger than the result of the AC drive overvoltage threshold divided by the min. resistance.
		3	The fault is reported according to the overload curve of the built-in braking transistor.
16#	Built-in braking transistor short-circuited	1	The braking transistor current detected during power-on or stop is higher than the detection threshold.
No. 17	Pre-charge resistor close fault	1	Hardware pre-charge resistor detection fault 1
		2	Hardware pre-charge resistor detection fault 2
18	Detected zero drift of the output current too large or current sensor fault	1	The detected zero drift of phase U is too large.
		2	The detected zero drift of phase V is too large.
		3	The detected zero drift of phase W is too large.
No. 19	Parameter auto-tuning failed.	1	No-load current error

Fault code	Code Meaning	Subcode	Meaning
No. 20	Encoder fault	1	Hardware encoder disconnection detection (supported by MD38PGMD only)
		2	Software encoder disconnection detection
		9	The encoder pulses per revolution is incorrect during dynamic complete auto-tuning in closed-loop mode.
		10	The encoder is disconnected during dynamic complete auto-tuning in closed-loop mode.
23	Ground fault	1	Hardware overcurrent occurred during short-circuit-to-ground detection.
		2	Hardware overvoltage occurred during short-circuit-to-ground detection.
		3	The current detected during short-circuit-to-ground detection is higher than the peak value of the rated current of the AC drive.
25	Output phase loss	1	Phase U output loss
		2	Phase V output loss
		3	Phase W output loss
		4	The output voltage is too large in closed-loop mode.
		5	The fault is reported upon output phase loss during stator resistance auto-tuning.
37	Stall alarm 1	1	See description of bC.02.
No. 38	Stall alarm 2	1	See the description of bC.03-bC.04 for details.
40	Pulse-by-pulse current limiting fault	1	Pulse-by-pulse current limit fault occurs continuously at a short period of time.

9 Inspection and Maintenance

9.1 Routine Maintenance

DANGER

- Do not perform wiring with power ON. Failure to comply can result in the risk of electric shock.
- Before inspection, disconnect all power supplies. After the power supply of the drive is disconnected, residual voltage remains in the internal DC capacitor of the drive. Therefore, wait for several minutes until the power indicator becomes off before proceeding. Before powering on the drive again, observe an interval specified by the drive.
- Do not change the wiring, remove cables or optional expansion cards, or replace the cooling fan during operation of the drive.
- Ground the grounding terminal of the motor. Failure to comply may result in electric shock due to a touch with the motor enclosure.
- Maintenance and repair can be performed by professionals only.
- Installation, wiring, commissioning, maintenance, and component replacement must be performed only by qualified technicians.

WARNING

- Do not run the AC drive with front cover removed.
- Drawings in the manual are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with instructions.
- Tighten all terminal screws based on specified tightening torque.
- Ensure that input voltage is within permissible range. Incorrect input voltage of main circuit may result in abnormal running.
- Keep combustible materials far away from the AC drive or mount the AC drive on incombustible surfaces such as a metal wall.

CAUTION

- Replace the cooling fan in correct ways as specified in this guide. Ensure correct air outlet direction of the fan. Incorrect air direction will result in poor cooling performance.
- Do not assemble or disassemble the motor when the AC drive is running. Failure to comply may result in electric shock and damage the AC drive.
- Use shielded cables for wiring the control circuit.
- Perform single-end grounding on the shield to prevent misoperation of the AC drive.
- Do not modify the drive circuitry. Failure to comply will damage the AC drive.
- Connect the output terminals of the AC drive and the wiring terminals of the motor properly.
- If you need to change the motor rotating direction, exchange the sequence of any two phases among the UVW phases.
- Do not operate on a damaged AC drive. This is to prevent further damage to other devices connected to the AC drive.

● Routine Checklist

The internal components of the drive may be aged due to temperature, humidity, dust, and vibration, leading to potential faults or shortening the service life of the drive. Therefore, it is necessary to carry out routine and periodic maintenance. More frequent inspection will be required if it is used in harsh environments, such as high ambient temperature, frequent start and stop, fluctuations in the AC power supply or load, excessive vibrations or shock, dust, and hydrochloric acid corrosion.

Check the following items on a daily basis to ensure proper operation of the drive. It is recommended to make a copy of this checklist and sign the "Checked" column after each inspection.

Item	Description	Solution	Tick
Motor	The motor encounters unusual vibration and noise.	● Ensure normal mechanical connection. ● Ensure no motor phase loss. ● Tighten all loose screws.	
Fan	Check whether the cooling fans of the drive and the motor operate properly.	● Ensure that the cooling fan of the drive operates properly. ● Ensure that the cooling fan of the motor operates properly. ● Ensure that the air duct is not clogged. ● Ensure that the ambient temperature is within the allowable range.	

Item	Description	Solution	Tick
Installation Environment	The power cabinet and cable trays are abnormal.	● Ensure the insulation of the cables at the inlet and outlet is not damaged. ● Ensure that the mounting bracket does not vibrate. ● Ensure that the copper busbar and terminals are tightened and not corroded.	
Load	Check whether the AC drive running current exceeds the rated current of the AC drive or motor on the nameplate for an extended period of time.	● Check that motor parameters are set properly. ● Ensure no motor overload. ● Check for excessive mechanical vibration (< 0.6 g under normal conditions).	
Input voltage	Ensure normal power voltage between the main circuit and control circuit.	● Ensure that the input voltage is within the allowable range. ● Check that no heavy load is started around the drive.	
With brake	Check whether the brake circuit is normal.	● Check that the control circuit is connected properly and free from abnormalities (discoloration, melting). Check that the brake acts properly. Perform the brake test separately.	

9.2 Regular Inspection

9.2.1 Regular Checklist

Perform regular inspection on components that can be hardly checked during operation. Keep the AC drive clean all the time. Remove the dust on the surface of the AC drive, especially the metal dust, to prevent it from entering into the drive. Clear the oil stain on the cooling fan.

DANGER

- Do not perform inspection when the power supply is switched on.
- Before the inspection, cut off all the power supplies and wait for 10 minutes to avoid risks caused by the residual voltage in the capacitor of the AC drive.

Item	Description	Description	Inspection cycle	Checked
Drive	There are wastes, dirt, or dust on the surface.	● Check that the AC drive cabinet is powered off. ● Use a vacuum cleaner to suck up waste and dust to prevent them from coming into contact with the components. ● For stubborn surface dirt, wipe up the dirt with a piece of soft cloth immersed in alcohol.	Half a year	
Cable	Discoloration occurs on power cables or connections. The insulation layer ages or cracks.	● Replace the cracked cable. ● Replace the damaged terminal.	Half a year	
Peripheral devices of the contactor	The contactor cannot fully be closed and has abnormal sound when it operates. There are short circuits, water stain, expansion or cracking occurs on any peripheral device.	● Replace such defective peripheral components.	Half a year	
Air duct	The air duct and heatsink are clogged. Check whether the fan is damaged.	● Clean the air duct. ● Replace the fan.	Half a year	
Control circuit	Poor contact occurs on the control component, terminal screws are loose, and cracked insulation occurs on the control cable.	● Clean up the surface of control circuit cables and terminals. ● Replace control circuit cables that are damaged or corroded.	Half a year	

9.2.2 Insulation Test on the Main Circuit

Remove the voltage dependent resistor (VDR) screws before testing and disconnect the voltage dependent resistor.

Before measuring insulation resistance with a megameter (500 VDC megameter recommended), disconnect the main circuit from the AC drive. Do not conduct the insulation test on the control circuit with an insulation resistance meter. See the following figure for details.

DANGER

- Do not perform a high voltage (> 500 V) test because it has been completed before delivery.

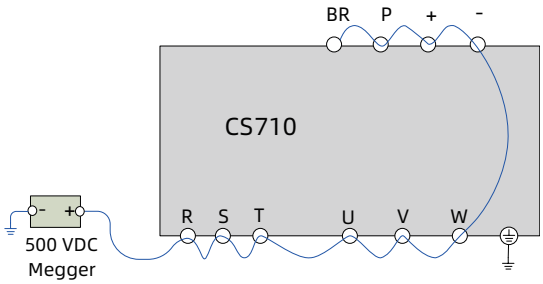


Figure 9-1 Diagram for main circuit insulation test

The measured insulation resistance must be greater than 5 MΩ.

DANGER

Remove the selective grounding screw for VDR before the voltage resistance test. Failure to comply may cause the drive to fail the test.

9.3 Part Replacement

9.3.1 Service Life of Quick-Wear Parts

The wear parts of the drive include the cooling fan and electrolytic capacitor. The service life of such devices is closely related to the operating environment and maintenance conditions. The general service life is shown in the following table.

Part	Service Life
Fan	≥ Five years
Electrolytic capacitor	≥ Five years

NOTE

- [Note] The preceding service life is obtained in the following conditions. You can determine when to replace these parts based on the actual operating time.
- Ambient temperature: 40° C
- Load rate: 80%
- Running time: 24 hours per day

9.3.2 Number of Fans on the Power Supply Unit

Model	Cooling fan	Model	Cooling fan
Three-phase 380 VAC to 480 VAC, 50/60 Hz			
CS710-4T0.4GB	-	CS710-4T45GB	1
CS710-4T0.7GB	-	CS710-4T55GB	1
CS710-4T1.1GB	-	CS710-4T75GB	2
CS710-4T1.5GB	1	CS710-4T90G	2
CS710-4T2.2GB	1	CS710-4T110G	2
CS710-4T3.0GB	1	CS710-4T132G	2
CS710-4T3.7GB	1	CS710-4T160G	2
CS710-4T5.5GB	1	CS710-4T200G	2
CS710-4T7.5GB	1	CS710-4T220G	2
CS710-4T11GB	2	CS710-4T250G	3
CS710-4T15GB	2	CS710-4T280G	3
CS710-4T18.5GB(-T)	1	CS710-4T315G	3
CS710-4T22GB(-T)	1	CS710-4T355G	3
CS710-4T30GB	1	CS710-4T400G	3



AC drives of models CS710-4T0.4GB to CS710-4T1.1GB are not equipped with a cooling fan.

9.3.3 Replacing the Cooling Fan

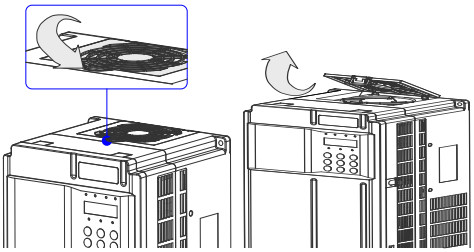
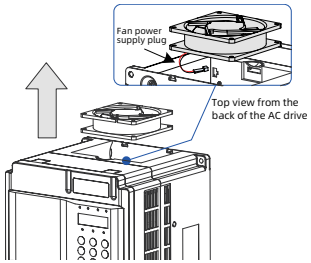
1) The possible fan damages include the worn-out bearing or aging blades.

2) How to determine whether the cooling fan needs to be replaced:
   1. Check whether there are signs of cracking on the blade.
   2. Check whether the fan generates an unexpected noise during start.
   3. Check whether the blade works properly.

3) Replacement of the cooling fan:

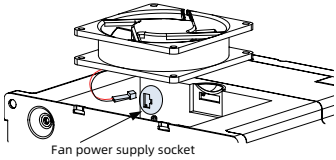
- To remove the cooling fan, press the snap-fit joint of the fan cover and pull the cover out.

After replacing the fan, ensure the fan blows the air upward.

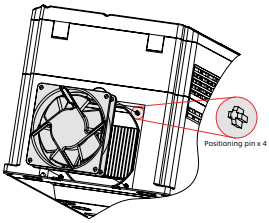
Removing the fan (1.5 kW to 37 kW)	
Press the snap-fit joint on the fan cover and remove the cover. 	Pull the fan upwards and unplug the power cable connector from the socket. 

Installing the fan (1.5 kW to 37 kW)

1. Install the fan in the reverse procedure to fan removal. Pay attention to the direction of the fan.
2. Insert the fan power cable into the socket, as shown by the following figure.

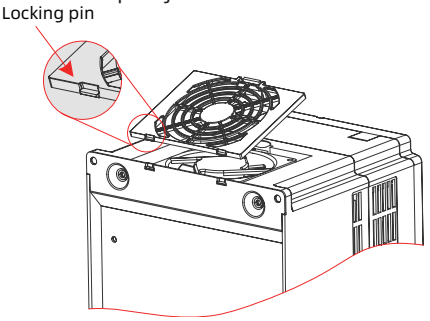


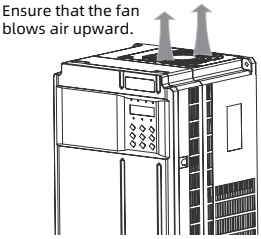
3) Install the fan into the AC drive and ensure that the four fixing holes at the bottom of the fan are aligned with the guide pin.



Installing the fan (1.5 kW to 37 kW)

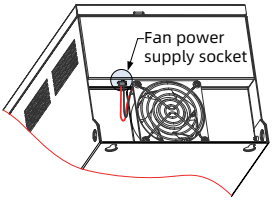
4. Insert the two small snap-fit joints on the fan cover into the slot and then press down to fix the snap-fit joints.



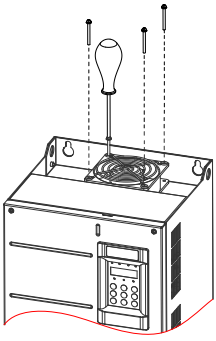


Removing the fan (45 kW to 160 kW)

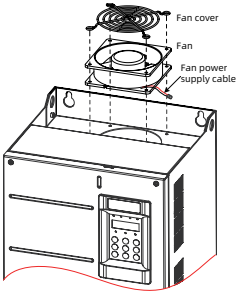
Unplug the fan power cable from the socket (top view).
Unplug (top view)



Remove the four fixing screws from the fan cover with a screwdriver.

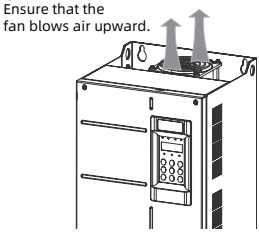


Remove the fan and fan cover from the AC drive.

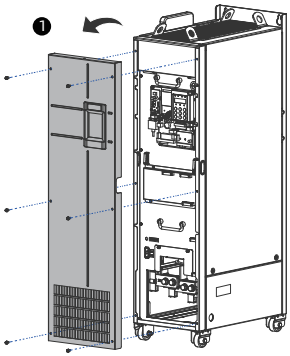
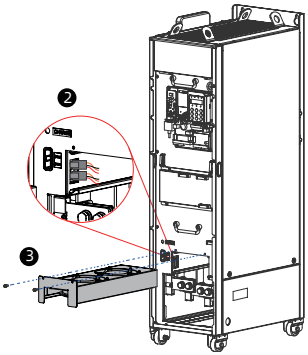
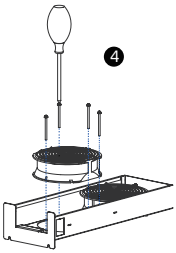


Installing the fan (45–160 kW)

① Install the fan in a reverse procedure to removal. Pay attention to the direction of the fan.
② Install the fan and fan cover on the AC drive. Note that the mounting holes are aligned, as shown in figure 3 of the removal procedure.
3. After the replacement is completed, check that the air flows upwards.

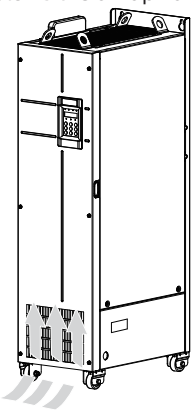


Removing the fan (200–400 kW)

① Remove the six screws on the cover. Then, hold the cover with both hands and lift it up in the arrow direction shown below to remove the cover. 	② Disconnect the fan power cable connectors from the AC drive. Each fan has a power cable connector. ③ Remove screws from the fan box and draw the fan box out in the arrow direction. 	④ Loosen screws from each fan cover and remove the fans. 

Installing the fan (200 kW to 400 kW)

① Install the fan in a reverse procedure to removal. Pay attention to the direction of the fan.
② Align the fan box to the mounting rail and push it into the drive.
③ Connect the fan power cable connector first before fixing the fan box. After replacing the fan, ensure the fan blows the air upward.



9.3.4 Electrolytic Capacitor

1) The possible causes for capacitor damage include unstable input power supply, high ambient temperature, frequent load jump, and aging electrolyte.

2) Condition to determine whether the capacitor needs to be replaced:

1) Check whether there is liquid leakage.
2) Check whether the safety valve has protruded.
3) Measure the static capacitance and the insulation resistance.

3) Replacement of the filter electrolytic capacitor: To avoid damage to other components inside the drive, contact Inovance for replacing the filter electrolytic capacitor.

9.3.5 Replacing the Lightning Protection Board

An independent lightning protection board is equipped for models of 45 kW or above. For models of 37 kW or below, the lightning protection board is integrated into the driver board.

1) The lightning protection board is connected to the R/S/T input terminals. Therefore, it is usually installed near the R/S/T input terminals. Blue or yellow VDRs can be found on the lightning protection board. With an input phase loss detection circuit equipped, the lightning protection board is connected to the driver board using a 2-pin terminal, as shown in the following figure.

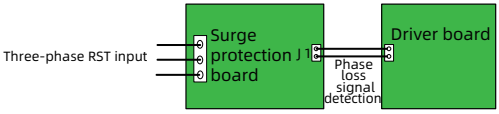


Figure 9-2 Connection between the lightning protection board and driver board for the AC drive of 45 kW and above

2) Check whether the surge protection board is damaged or corroded. If yes, replace it.

NOTE

The lightning protection board is equipped with input phase loss detection circuit for phase loss signal detection. Do not remove this circuit.

9.4 Storage

To store the AC drive properly, observe the following:

1) Pack the drive with the original packing box provided by Inovance.

2) Do not expose the AC drive to the environment with moisture, high temperature, or direct sunlight for a long time.

3) The electrolytic capacitor will deteriorate after long-term storage. Therefore, the AC drive must be switched on once for at least 5 hours every 6 months. The input voltage must be increased slowly to the rated value by using a voltage regulator.

10 Specifications and Selection

10.1 Technical Data

Table 10-1 CS710 series AC drive models and technical data

Item		Specifications									
Model: CS710-4TxxG(B)[1]		0.4	0.7	1.1	1.5	2.2	3	3.7	5.5	7.5	11
Applicable motor capacity (kW)		0.4	0.75	1.1	1.5	2.2	3	3.7	5.5	7.5	11
Input	Rated input current (A)	1.8	2.4	3.7	4.6	6.3	9	11.4	16.7	21.9	32.2
Output	Rated output current (A)	1.5	2.1	3.1	3.8	5.1	7.2	9	13	17	25
	Maximum output voltage	Three-phase 380–480 V (varying with the input voltage)									
	Maximum output frequency	150 Hz									
	Carrier frequency	Vector control: 1.0–6.0 kHz; V/f control: 1.0–12 kHz									
	Overload capacity	Overload is reported when the drive operates for more than 60s at 150% of the rated current continuously under 40℃ .									
Power supply	Rated voltage and frequency	Three-phase 380 VAC to 480 VAC, 50/60 Hz									
	Allowed voltage fluctuation range	–15% to +10%; allowed voltage range: 323 VAC to 528 VAC									
	Allowed frequency fluctuation range	±5%; actual allowed range: 47.5 Hz to 63 Hz									
	Power Capacity (kVA)	2	2.8	4.1	5	6.7	9.5	12	17.5	22.8	33.4
Thermal power consumption (kW)		0.039	0.046	0.057	0.068	0.081	0.109	0.138	0.201	0.24	0.355

Item	Specifications									
Exhaust flow (CFM)	-	-	-	9	9	9	20	24	30	40
Overvoltage category	OVCIII									
Rated short-circuited current (SCCR)	5 kA									
Pollution degree	PD2									
IP rating	IP20 (open type, applicable to IEC-certified products) Type 1 (enclosed type, applicable to UL-certified products)									
Protection class	Class I									
Grid type	TN-S, TN-T, TN-CS, TT/IT (non-angular grounding)									

Item		Specifications									
Model: CS710-4TxxG(B)[1]		15	18.5	22	30	37	45	55	75	90	110
Applicable motor capacity (kW)		15	18.5	22	30	37	45	55	75	90	110
Input	Rated input current (A)	41.3	49.5	59	57	69	89	106	139	164	196
Output	Rated output current (A)	32	37	45	60	75	91	112	150	176	210
	Maximum output voltage	Three-phase 380–480 V (varying with the input voltage)									
	Maximum output frequency	150 Hz									
	Carrier frequency	Vector control: 1.0–6.0 kHz; V/f control: 1.0–12 kHz									
	Overload capacity	150% of the rated current for 60s at 40° C									
Power supply	Rated voltage and frequency	Three-phase 380 VAC to 480 VAC, 50/60 Hz									
	Allowed voltage fluctuation range	–15% to +10%; allowed voltage range: 323 VAC to 528 VAC									
	Allowed frequency fluctuation range	±5%; allowed frequency range: 47.5–63 Hz									
	Power Capacity (kVA)	42.8	45	54	52	63	81	97	127	150	179
Thermal power consumption (kW)		0.454	0.478	0.551	0.694	0.815	1.01	1.21	1.57	1.81	2.14
Exhaust flow (CFM)		42	51.9	57.4	118.5	118.5	122.2	122.2	218.6	287.2	342.2
Overvoltage category		OVCIII									
Rated short-circuited current (SCCR)		5 kA									
Pollution degree		PD2									

Item	Specifications
IP rating	IP20 (open type, applicable to IEC-certified products) Type 1 (enclosed type, applicable to UL-certified products)
Protection class	Class I
Grid type	TN-S, TN-T, TN-CS, TT/IT (non-angular grounding)

Item		Specifications								
Model: CS710-4TxxG(B)[1]		132	160	200	220	250	280	315	355	400
Applicable motor capacity (kW)		132	160	200	220	250	280	315	355	400
Input	Rated input current (A)	240	287	365	410	441	495	565	617	687
Output	Rated output current (A)	253	304	377	426	465	520	585	650	725
	Maximum output voltage	Three-phase 380–480 V (varying with the input voltage)								
	Maximum output frequency	150 Hz								
	Carrier frequency	Vector control: 1.0–6.0 kHz; V/f control: 1.0–12 kHz								
	Overload capacity	150% of the rated current for 60s at 40° C								
Power supply	Rated voltage and frequency	Three-phase 380 VAC to 480 VAC, 50/60 Hz								
	Allowed voltage fluctuation range	-15% to +10%; actual allowable range: 323 VAC to 528 VAC								
	Allowed frequency fluctuation range	±5%; allowed frequency range: 47.5–63 Hz								
	Power Capacity (kVA)	220	263	334	375	404	453	517	565	629
Thermal power consumption (kW)		2.85	3.56	4.15	4.55	5.06	5.33	5.69	6.31	6.91
Exhaust flow (CFM)		547	627	638.4	722.5	789.4	882	645	860	860
Overvoltage category		OVCIII								
Rated short-circuited current (SCCR)		5 kA								
Pollution degree		PD2								
IP rating		IP20 (open type, applicable to IEC-certified products) Type 1 (enclosed type, applicable to UL-certified products)				IP00 (open type, applicable to IEC products)				

Item	Specifications
Protection class	Class I
Grid type	TN-S, TN-T, TN-CS, TT/IT (non-angular grounding)



[1]The rated power of the AC drive is measured at the 440 VAC input voltage.

Table 10-2 Technical specifications of CS710 series AC drives

Item		Technical Specifications	
Basic functions	Resolution of input frequency	Digital setting: 0.01 Hz Analog setting: maximum frequency x 0.025%	
	Control mode	Sensorless vector control (SVC) Feedback vector control (FVC) V/f control	
	Start torque	0.25 Hz/150% (SVC); 0 Hz/180% (FVC)	
	Speed regulation range	1:200 (SVC)	1:1000 (FVC)
	Stable and accurate speed	±0.5% (SVC)	±0.02% (FVC)
	Torque control accuracy	FVC: ±3%; SVC: ±5% for above 10 Hz	
	Torque boost	Automatic torque boost; Customized torque boost: 0.1% to 30.0%	
	DC braking	DC braking frequency: Min. frequency to rated frequency DC injection braking current: 0.0% to 120.0% of the rated current	
	Acceleration/ Deceleration curve	Straight-line or S-curve acceleration/deceleration mode	
	Auto voltage regulation (AVR)	Keeps constant output voltage automatically when the mains voltage changes.	
	Overvoltage/ Overcurrent stall control	Limits the current and voltage automatically during operation to prevent frequent tripping caused by overvoltage/overcurrent.	
	Quick current limit	Prevents frequent overcurrent faults to ensure normal operation of the drive.	
	Torque limit and control	Limits the torque during operation to avoid frequent tripping due to overcurrent and achieves torque control in vector control mode.	

Item		Technical Specifications
Customized Functions	Overload protection	Identifies load conditions automatically. When overload occurs, hoisting is inhibited and only lowering is allowed.
	Dual-motor switchover	Parameters of the AC drive are available in three sets to achieve control on three motors.
	Supported field buses	The AC drive supports six types of field buses: Modbus, PROFIBUS DP, CANopen, PROFINET, EtherNet/IP, and EtherCAT.
	Motor overheat protection	The optional I/O expansion card 1 enables AI3 to receive the motor temperature sensor input (PT100 and PT1000). (PT100 and PT1000)
	Multiple encoder types	The differential type, open-collector type, UVW type, and resolver type are supported.
	Speed reduction with voltage	Keeps the voltage at a normal level upon low bus voltage, which is achieved through the regenerative energy of the load.
	Brake sequence control	Built-in with professional brake sequence control.
	High-speed under light load	The maximum output frequency can be calculated automatically through detecting the output torque of the drive.
	Special curve	Three optional acceleration/Deceleration curves
	Load overspeed detection	Load overspeed is detected by the frequency direction error and frequency following error of the encoder feedback frequency.
	Deceleration/ Stop switch	Simple positioning function
	Multiple types of alarms	Optional AC drive fault types and solutions
	Static auto-tuning on motor parameters	Supports static auto-tuning of all motor parameters.
	Advanced software tool	Operations on the drive parameter and virtual oscilloscope are supported. You can monitor the internal state of the AC drive through the virtual oscilloscope.
Operation	Operation command	Operation commands can be delivered by using the operating panel, control terminals, and communication (RS485, CANopen, and PROFIBUS DP).
	Frequency reference	Frequency reference can be set by using the multi-frequency, analog voltage, analog current, and communication.

Item		Technical Specifications
Operation	Input terminals	Standard: 5 DI terminals Two AIs. One AI supports only 0–10 V voltage input and the other AI supports 0–10 V voltage input and 4–20 mA current input. Extension capacity For 11 kW models and below, the CS700IO1 expansion card providing two input terminals is standard. For 15 kW models and above, the CS700RC2 expansion card providing three DIs is standard.
	Output terminals	Standard: Two DO terminals 1 relay output terminal One AO that supports 0–10 V voltage output and 0–20 mA current output Extension capacity The expansion card CS700IO1 is included in the standard configuration of 11 kW and below models, with one output terminal added. The expansion card CS700RC2 is included in the standard configuration of 15 kW and above models, with two relay output terminals added.
Display and operating panel	Display	Displays parameters.
	Parameter clone	Allows quick parameter copy using the parameter copy panel (optional).
Protective functions	Open-phase protection	Input and output phase loss protection
	Instantaneous overcurrent protection	The AC drive stops when the operating current exceeds 250% of the rated current.
	Overvoltage protection	Stops when the DC voltage of the main circuit is above 820 V
	Undervoltage protection	Stops when the DC voltage of the main circuit is below 350 V
	Over-temperature protection	Triggers protection when the inverter bridge overheats
	Overload protection*1	Stops after running at 150% of the rated current for 60 seconds
	Brake protection	Braking protection indicates protection against braking unit overload and braking resistor short circuit.
	Short-circuit protection	Protection against output interphase short circuit and output short circuit to ground

Item		Technical Specifications
Environment	Applicable scenarios	Indoors without direct sunlight, dust, corrosive gas, combustible gas, oil mist, water vapor, drip, or salt
	Altitude	Derating is not required for altitudes lower than 1000 m. For altitudes above 1000 m, derate 1% for every additional 100 m above 1000 m. The maximum altitude is 3000 m.
	Ambient temperature	-10° C to +40° C, de-rated by 1.5% per 1° C increase when the ambient temperature exceeds 40° C Maximum ambient temperature: 50° C
	Humidity	< 95% RH, non-condensing
	Vibration	Operation scenario: Tested according to IEC 60068-2-6. Amplitude at 5 Hz to 8.4 Hz: 3.5 mm; acceleration at 8.4 Hz to 200 Hz: 1 g; 10 cycles/axis Transportation scenario: Tested according to IEC 60068-2-64. Power spectrum density at 5 Hz to 100 Hz: 0.01 g^2/Hz; power spectrum density at 200 Hz: 0.001 g^2/Hz; Grms: 1.14 g
	Shock	Operating/Transport environment: Tested according to IEC 60068-2-27. Acceleration: 15 g; pulse width; 11 ms; 18 times in directions of three axes
	Storage temperature	-20° C to +60 ° C

Note:

*1: The CS710-4T400GB model is below the specification. Do not make the model run with overload.

10.2 Mounting Dimensions

10.2.1 Dimensions of 0.4–160 kW Models

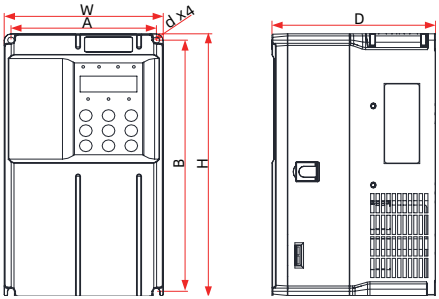


Figure 10-3 Outline dimensions and installation dimensions of 0.4–15 kW AC drive models

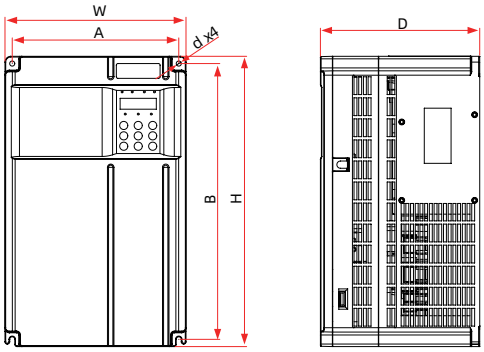


Figure 10-4 Outline and mounting dimensions of 18.5–37 kW models

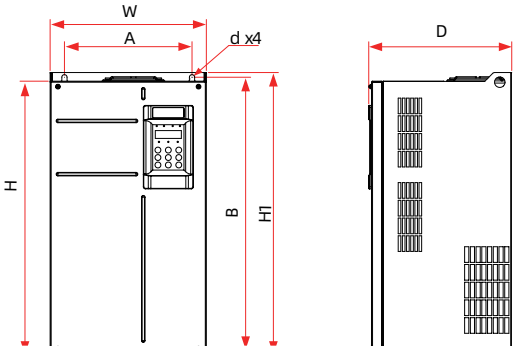


Figure 10-5 Outline and mounting dimensions of 45–160 kW models

Table 10-3 Outline dimensions and mounting hole dimensions of 0.4–160 kW AC drive models

AC drive model	Mounting hole (mm)		Outline dimensions (mm)				Mounting hole diameter (mm)	Weight (kg)
	A	B	H	H1	W	D		
CS710-4T0.4GB	119	189	200	-	130	152	Φ5	1.6
CS710-4T0.7GB								
CS710-4T1.1GB								
CS710-4T1.5GB								
CS710-4T2.2GB								
CS710-4T3.0GB								
CS710-4T3.7GB	119	189	200	-	130	162	Φ5	2.0
CS710-4T5.5GB								
CS710-4T7.5GB	128	238	250	-	140	170	Φ6	3.3
CS710-4T11GB								
CS710-4T15GB	166	266	280	-	180	170	Φ6	4.3
CS710-4T18.5GB(-T)	195	335	350	-	210	192	Φ6	9.1
CS710-4T22GB(-T)								10
CS710-4T30GB	230	380	400	-	250	220	Φ7	17.5
CS710-4T37GB								
CS710-4T45GB	245	523	525	542	300	275	Φ10	35
CS710-4T55GB								
CS710-4T75GB	270	560	554	580	338	315	Φ10	51.5
CS710-4T90G								
CS710-4T110G								
CS710-4T132G	320	890	874	915	400	320	Φ10	85
CS710-4T160G								

10.2.2 Outline Dimensions of 0.4–160 kW Models with Through-Hole Mounting Brackets

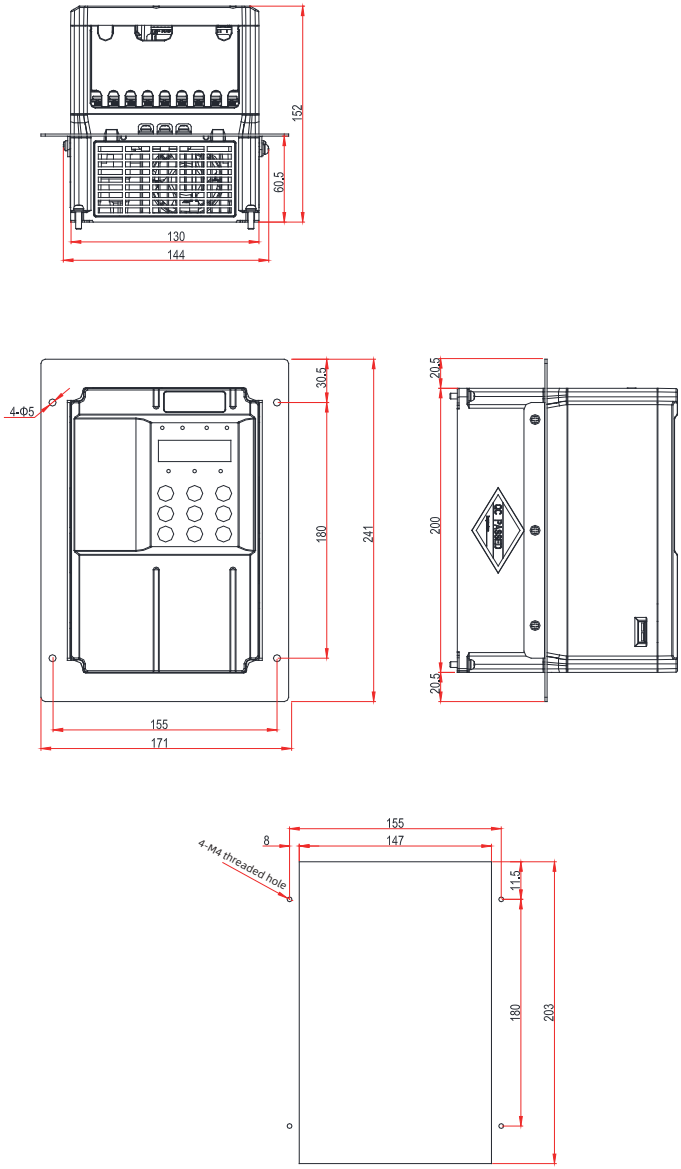


Figure 10-6 Through-hole mounting bracket and mounting hole dimensions for 0.4–3.0 kW AC drive models (mm)

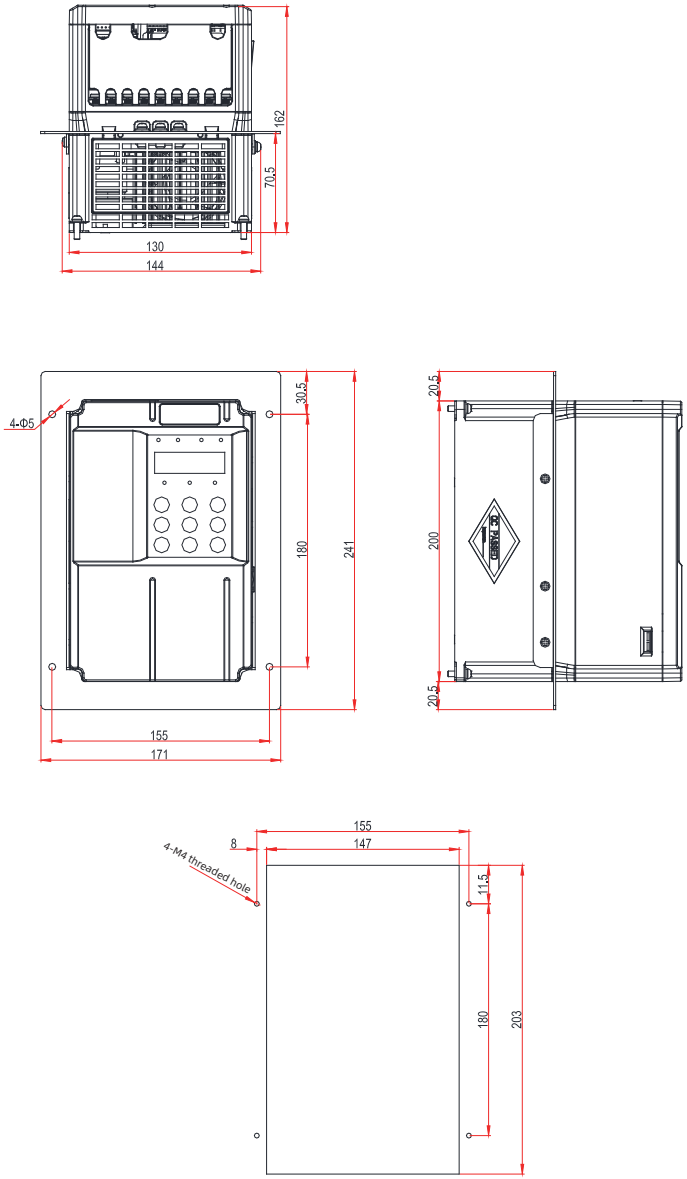


Figure 10-7 Through-hole mounting bracket and mounting hole dimensions for 3.7-5.5 kW AC drive models (mm)

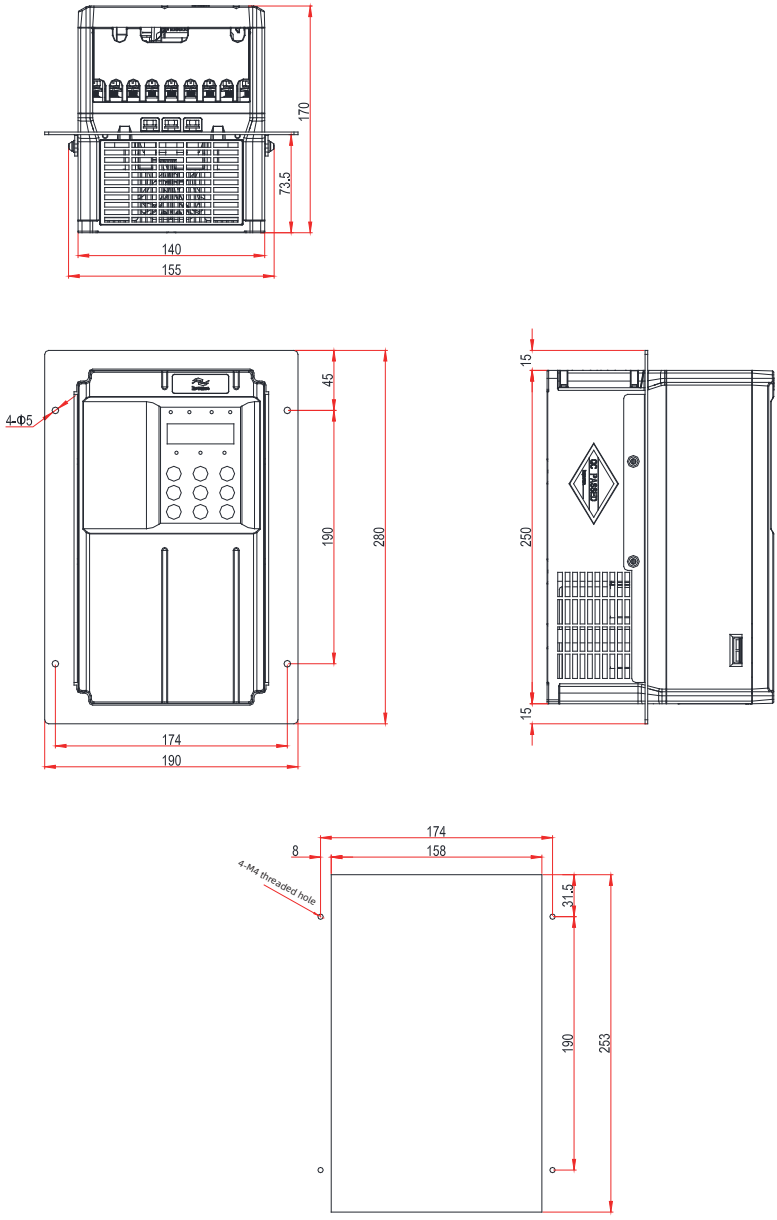


Figure 10-8 Through-hole mounting bracket and mounting hole dimensions for 7.5–11 kW AC drive models (mm)

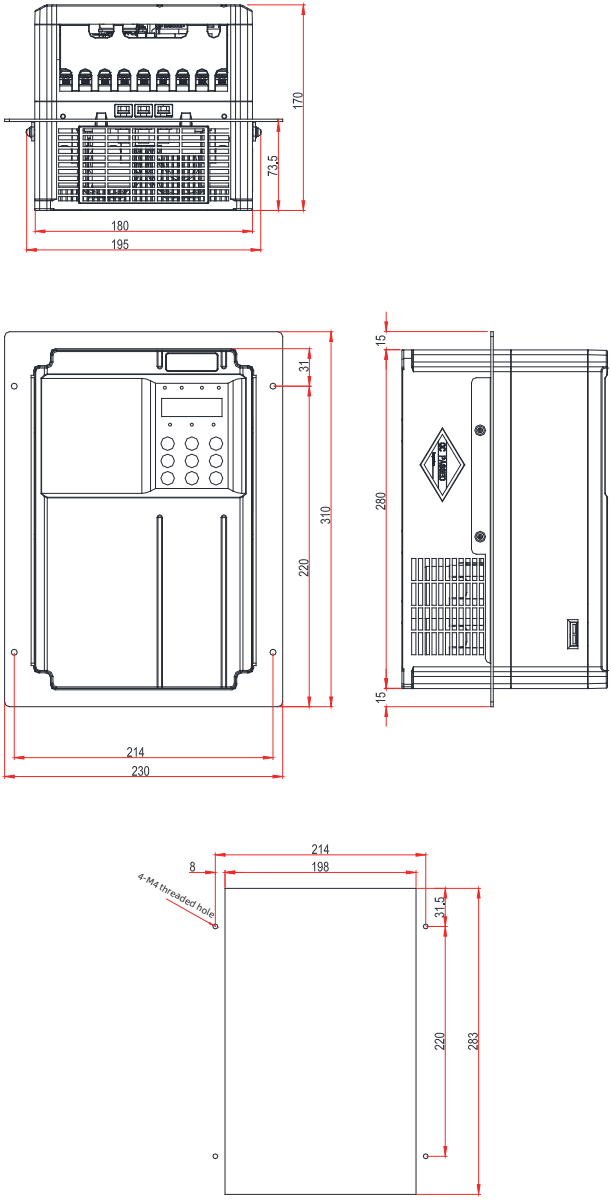


Figure 10-9 Through-hole mounting bracket and mounting hole dimensions for 15 kW AC drive models (mm)

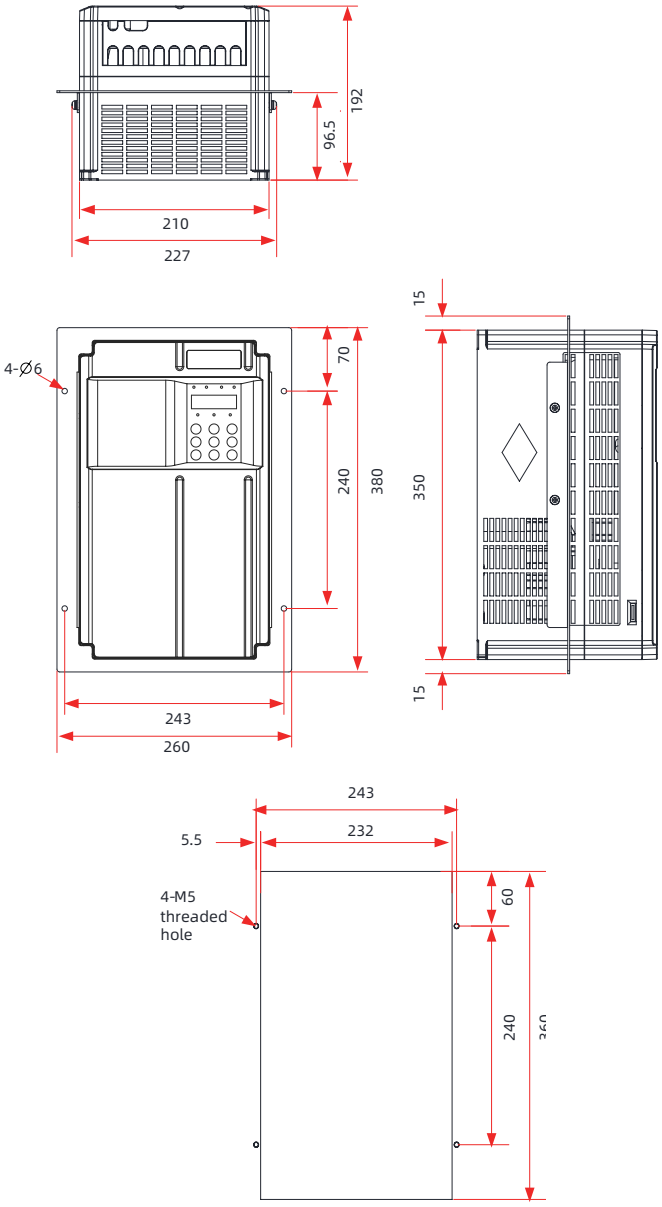


Figure 10-10 Through-hole mounting bracket and mounting hole dimensions for 18.5-22 kW AC drive models (mm)

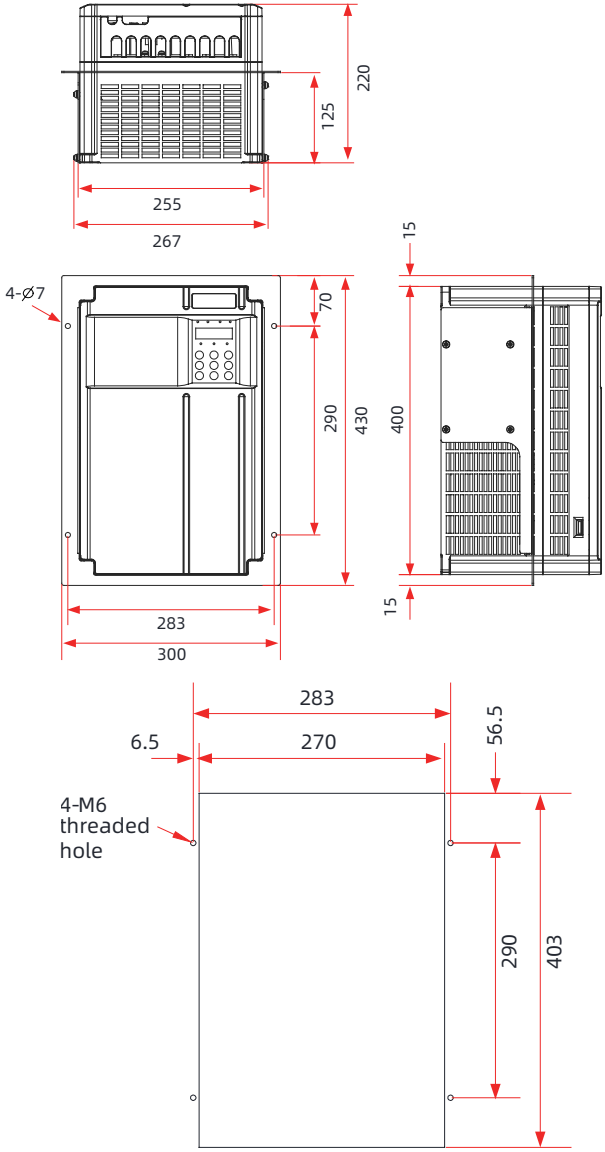


Figure 10-11 Through-hole mounting bracket and mounting hole dimensions for 30-37 kW AC drive models (mm)

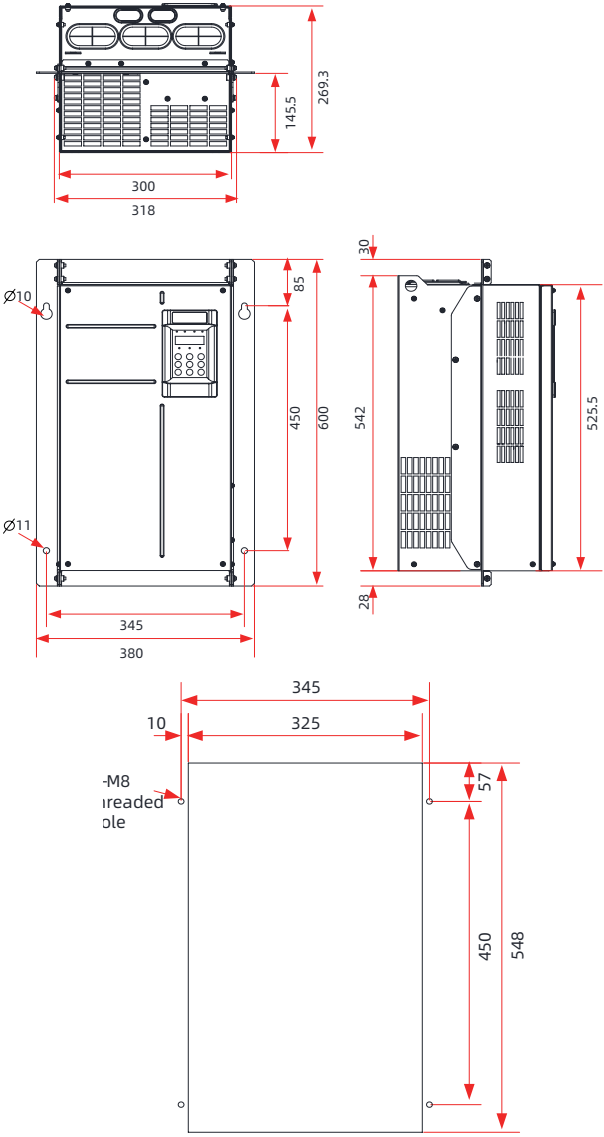


Figure 10-12 Through-hole mounting bracket and mounting hole dimensions for 45–55 kW AC drive models (mm)

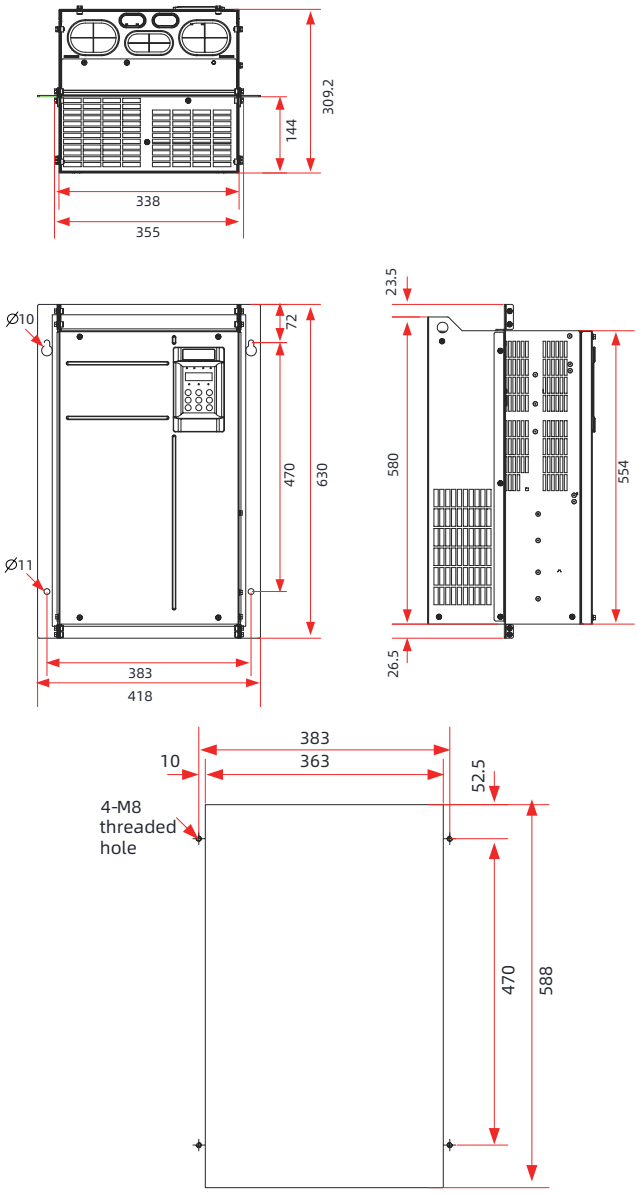


Figure 10-13 Through-hole mounting bracket and mounting hole dimensions for 75-110 kW AC drive models (mm)

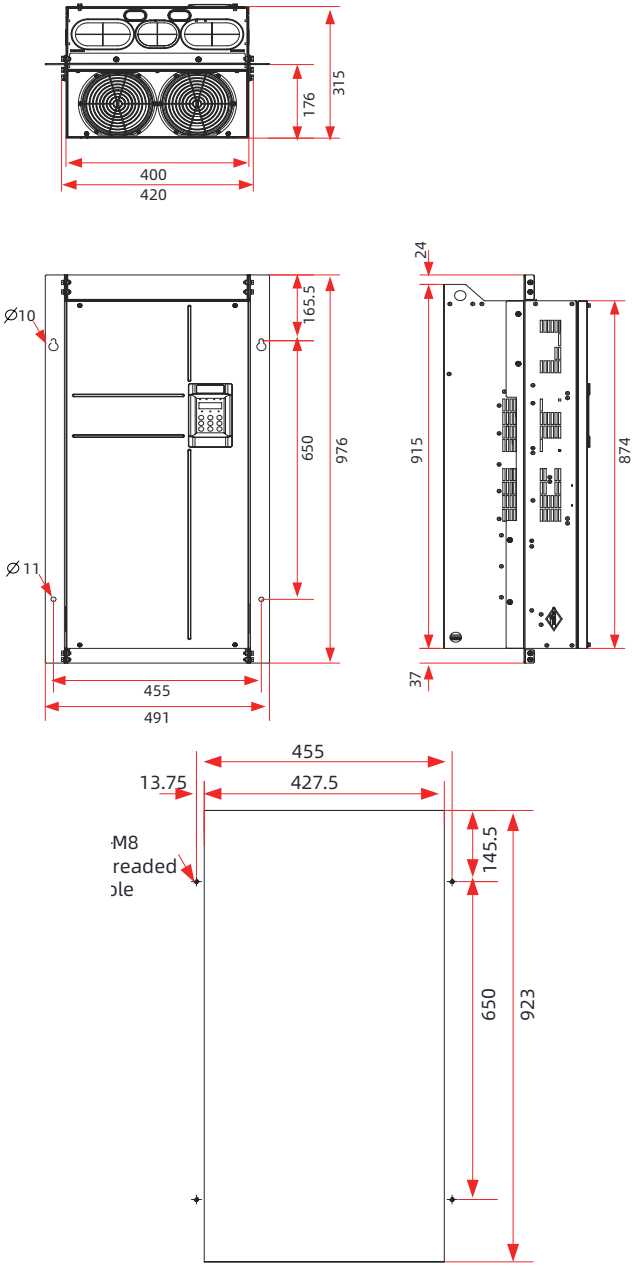


Figure 10-14 Through-hole mounting bracket and mounting hole dimensions for

132-160 kW AC drive models (mm)

10.2.3 Dimensions of 200-400 kW Models (Without Reactor Base)

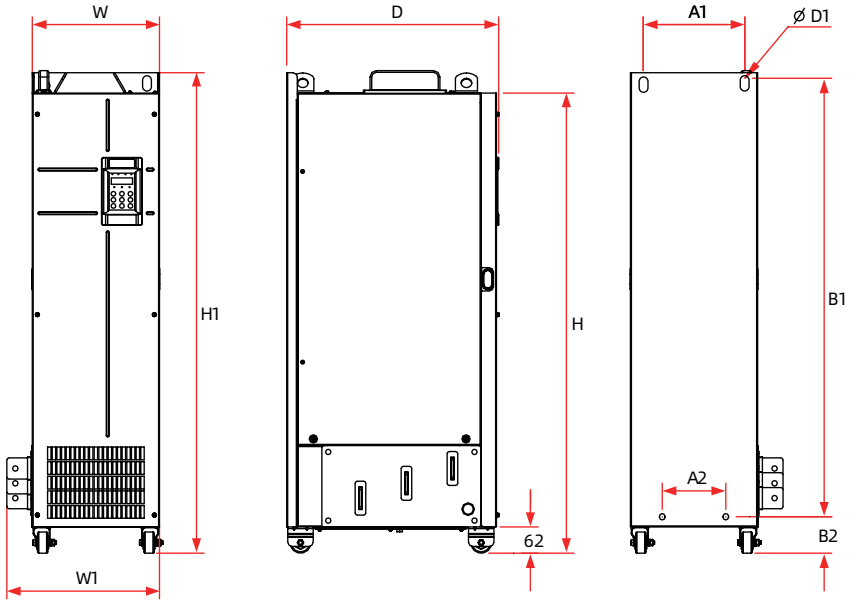


Figure 10-15 Outline dimensions and installation dimensions of 200-400 kW AC drive models (without the reactor base)

Table 10-4 Mounting hole dimensions of 200-400 kW AC drive models (without the reactor base)

AC drive model	Mounting hole (mm)				Overall Dimensions (mm)					Mounting hole diameter (mm)	Weight (kg)
	A1	A2	B1	B2	H	H1	W	W1	D	D1	
CS710-4T200G	240	150	1035	86	1086	1134	300	360	500	Φ13	110
CS710-4T220G											
CS710-4T250G	225	185	1175	97	1248	1284	330	390	545	Φ13	155
CS710-4T280G											
CS710-4T315G	240	200	1280	101	1355	1405	340	400	545	Φ16	185
CS710-4T355G											
CS710-4T400G											

10.2.4 Dimensions of 200-400 kW Models (with Reactor Base)

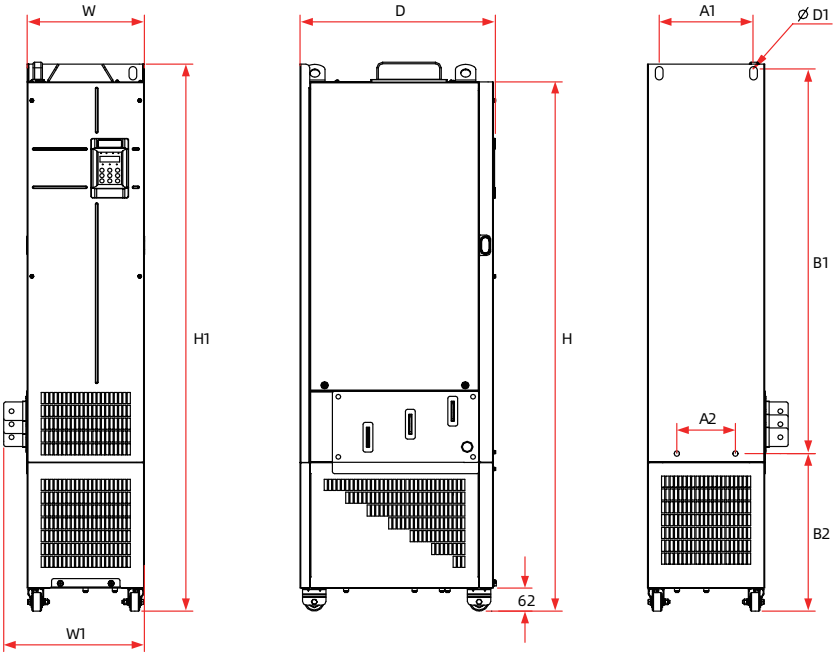


Figure 10-16 Outline dimensions and installation dimensions of 200-400 kW AC drive models (with the reactor base)

Table 10-5 Mounting hole dimensions of 200-400 kW AC drive models (with the reactor base)

AC drive model	Mounting hole (mm)				Overall Dimensions (mm)					Mounting hole diameter (mm)	Weight (kg)
	A1	A2	B1	B2	H	H1	W	W1	D	D1	
CS710-4T200G	240	150	1035	424	1424	1472	300	360	500	Φ13	160
CS710-4T220G											
CS710-4T250G	225	185	1175	435	1586	1622	330	390	545	Φ13	215
CS710-4T280G											

AC drive model	Mounting hole (mm)				Overall Dimensions (mm)					Mounting hole diameter (mm)	Weight (kg)
	A1	A2	B1	B2	H	H1	W	W1	D	D1	
CS710-4T315G	240	200	1280	432	1683	1733	340	400	545	Φ16	245
CS710-4T355G											
CS710-4T400G											

10.2.5 Mounting Bracket Dimensions

- Dimensions of the mounting bracket for 200–220 kW AC drives

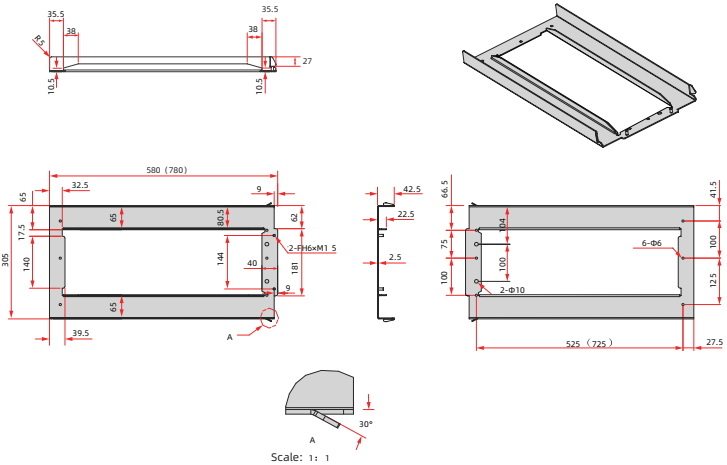


Figure 10-17 Dimensions of the mounting bracket for 200–220 kW AC drives (standard configuration) (mm)

- Dimensions of the mounting bracket for 250–280 kW AC drives

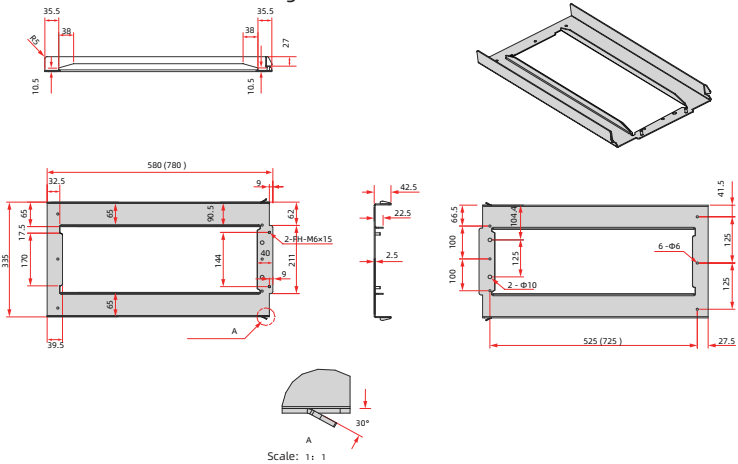


Figure 10-18 Dimensions of the mounting bracket for 250–280 kW AC drives (standard configuration) (mm)

- Dimensions of the mounting bracket for 315–400 kW AC drives

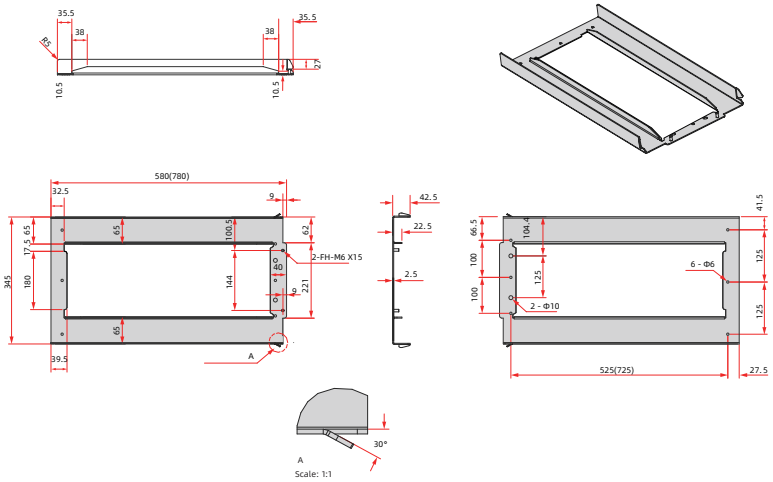


Figure 10-19 Dimensions of the mounting bracket for 315–400 kW AC drives (standard configuration) (mm)

10.3 List of Optional Components

Peripheral options include braking units, function expansion cards, and external operating panels, as listed in the following table. For use of each option, see its user guide. If any optional part is required, specify it in your order.

Table 10-6 Option List

Name	Model	Functions	Remarks
Built-in braking unit	AC drive model ending with letter "B"	Optional for models of 0.4–75 kW	-
External braking unit	MDBUN	Needed by 90 kW and above models	Parallel connection of multiple braking units available for 90 kW and above models
I/O extension card 1	MD38IO1	Five DIs and one AI (voltage input); AI3 (isolated AI), which can connect to PT100 and PT1000; one relay output terminal, one DO, and one AO Modbus supported	Applicable to 15 kW and above models
I/O expansion card 2	MD38IO2	Provides three additional DI terminals	Available for all models

Name	Model	Functions	Remarks
I/O expansion card 3	CS700RC2	Two relay output terminals, three DIs, and one RS485 interface	Included in the standard configuration of 15 kW and above models
I/O expansion card 4	CS700IO1	One relay output terminal, two DIs, and one RS485 interface	Included in the standard configuration of 11 kW and below models
RS485 communication card	MD38TX1	Modbus communication card with the isolation feature	Available for all models
CANopen communication expansion card	MD38CAN2	CANopen communication adapter card	Available for all models
PROFIBUS DP communication card	MD38DP2	PROFIBUS DP communication card	Applicable to 15 kW and above models
PROFINET communication expansion card	MD500-PN1	PROFINET communication adapter card	Available for all models
EtherCAT communication card	MD500-ECAT	EtherCAT communication adapter card	Available for all models
Ethernet/IP communication card	MD500-EN1	Ethernet/IP communication adapter card	Available for all models
Modbus TCP communication card	MD500-EM1	Modbus TCP field bus adapter	Available for all models
Multi-functional encoder card	MD38PGMD	The MD38PGMD card supports differential input, collector input, push-pull input, as well as differential output and collector output. Therefore, it can be used to connect different encoders and supports A/B phase input of the host controller.	Available for all models
Resolver interface card	MD38PG4	Applicable to resolvers with an excitation frequency of 10 kHz and the DB9 interface	Available for all models
External LED operating panel	MD32NKE1	External LED display and operating panel	Available to MD series RJ45 interface
LCD operating panel	MDKE9	Supports parameter copy/download.	RJ45 interface
Extension cable	MDCAB	Standard 8-core network cable to be connected to MD32NKE1, MD32KC, and MDCP	The standard length is 3 m.

Name	Model	Functions	Remarks
Through-hole Mounting Bracket	MD500-AZJ-A1T	Fulfills the through-hole mounting demands of the customer	Each model corresponds to a specific optional bracket. For details, see Table 4-1 Through-hole mounting bracket models in chapter 4.
Grounding bracket for Cable Shield	MD500-AZJ-A2T*	Supports repetitive power cable fixation and 360° grounding of the shield.	Each model has its own bracket.

10.4 Peripherals and Options

10.4.1 Selection of Fuses, Contactors, and Circuit Breakers

Table 10-7 Selection of fuses, contactors, and circuit breakers

Model CS710 series	Rated input current (A)	Recommended fuse Bussmann UL-compliant		Recommended contactor specifications (A Series of ABB)	Recommended circuit breaker (Tmax Series of ABB)
		Rated current (A)	Model	Rated current (A)	Rated current (A)
Three-phase 380–480 V, 50/60 Hz					
CS710-4T0.4GB	1.8	5	FWP-5B	9	4
CS710-4T0.7GB	2.4	5	FWP-5B	9	4
CS710-4T1.1GB	3.7	5	FWP-5B	9	6.3
CS710-4T1.5GB	4.6	10	FWP-10B	9	6.3
CS710-4T2.2GB	6.3	10	FWP-10B	12	10
CS710-4T3.0GB	9	15	FWP-15B	16	16
CS710-4T3.7GB	11.4	15	FWP-15B	26	16
CS710-4T5.5GB	16.7	25	FWP-25B	26	25
CS710-4T7.5GB	21.9	30	FWP-30B	38	32
CS710-4T11GB	32.2	40	FWP-40C	50	50
CS710-4T15GB	41.3	60	FWP-60C	50	63
CS710-4T18.5GB(-T)	49.5	70	FWP-70C	63	80
CS710-4T22GB(-T)	59	80	FWP-80C	75	80
CS710-4T30GB	57	80	FWP-80C	75	80
CS710-4T37GB	69	90	FWP-90C	95	100
CS710-4T45GB	89	125	170M1368	110	125
CS710-4T55GB	106	160	170M1369	145	160
CS710-4T75GB	139	200	170M1370	175	200
CS710-4T90G	164	250	170M1371	210	250
CS710-4T110G	196	250	170M1371	260	320
CS710-4T132G	240	315	170M1372	300	400
CS710-4T160G	287	400	170M4412	400	400
CS710-4T200G	365	500	170M4414	400	500
CS710-4T220G	410	550	170M4415	460	630

Model CS710 series	Rated input current (A)	Recommended fuse Bussmann UL-compliant		Recommended contactor specifications (A Series of ABB)	Recommended circuit breaker (Tmax Series of ABB)
		Rated current (A)	Model	Rated current (A)	Rated current (A)
CS710-4T250G	441	630	170M4416	460	630
CS710-4T280G	495	630	170M4416	580	800
CS710-4T315G	565	700	170M4417	750	800
CS710-4T355G	617	800	170M4418	750	800
CS710-4T400G	687	900	170M5415	750	1000

The recommended values in the preceding table are based on the following conditions.

1. The ambient temperature of the device is 40℃ without forced air cooling.
   The altitude is 2000 m.
   Only a single drive is installed.
   The conductor or copper busbar carrying current density is 1.3 A/mm².
2. If conditions vary, select the model according to actual conditions.
3. Fuses with the CE certification are recommended.

Table 10-8 Selection of fuses, contactors, and circuit breakers (UL-certified)

Model CS710 series	Rated input current (A)	Recommended fuseBussmannUL-compliant		Recommended contactor specifications (A Series of ABB)	Recommended circuit breaker (Tmax Series of ABB)
		Rated current (A)	Model	Rated current (A)	Rated current (A)
Three-phase 380-480 V, 50/60 Hz					
CS710-4T0.4GB	1.8	5	FWP-5B	9	4
CS710-4T0.7GB	2.4	5	FWP-5B	9	4
CS710-4T1.1GB	3.7	10	FWP-10B	9	6.3
CS710-4T1.5GB	4.6	10	FWP-10B	9	6.3
CS710-4T2.2GB	6.3	10	FWP-10B	12	10
CS710-4T3.0GB	9	15	FWP-15B	16	16
CS710-4T3.7GB	11.4	20	FWP-20B	26	16
CS710-4T5.5GB	16.7	25	FWP-25B	26	25
CS710-4T7.5GB	21.9	35	FWP-35C	38	32
CS710-4T11GB	32.2	50	FWP-50C	50	50
CS710-4T15GB	41.3	70	FWP-70C	50	63

Model CS710 series	Rated input current (A)	Recommended fuseBussmannUL-compliant		Recommended contactor specifications (A Series of ABB)	Recommended circuit breaker (Tmax Series of ABB)
		Rated current (A)	Model	Rated current (A)	Rated current (A)
CS710-4T18.5GB(-T)	49.5	80	FWP-80C	63	80
CS710-4T22GB(-T)	59	90	FWP-90C	75	80
CS710-4T30GB	57	100	FWP-100C	75	80
CS710-4T37GB	69	125	FWP-125C	95	100
CS710-4T45GB	89	150	FWP-150C	110	125
CS710-4T55GB	106	175	FWP-175C	145	160
CS710-4T75GB	139	225	FWP-225C	175	200
CS710-4T90G	164	250	FWP-250C	210	250
CS710-4T110G	196	300	FWP-300C	260	320
CS710-4T132G	240	400	FWP-400C	300	400
CS710-4T160G	287	450	FWP-450C	400	400
CS710-4T200G	365	600	FWP-600C	400	500
CS710-4T220G	410	700	FWP-700A	460	630
CS710-4T250G	441	700	FWP-700A	460	630
CS710-4T280G	495	800	FWP-800A	580	800
CS710-4T315G	565	900	FWP-900A	750	800
CS710-4T355G	617	1000	FWP-1000A	750	800
CS710-4T400G	687	1200	FWP-1200A	750	1000

The recommended values in the preceding table are based on the following conditions.

1. The ambient temperature of the device is 40℃ without forced air cooling.
   The altitude is 2000 m.
   Only a single drive is installed.
   The conductor or copper busbar carrying current density is 1.3 A/mm².
2. If conditions vary, select the model according to actual conditions.
3. Fuses with the UL certification are recommended.

10.4.2 Cable Terminal Models and Dimensions

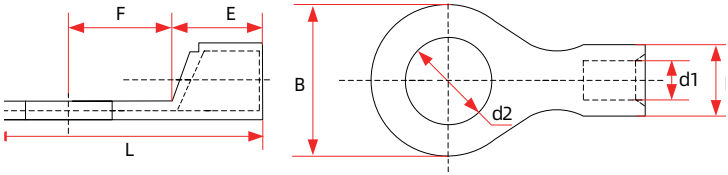


Figure 10-20 Dimensions of TNR series terminals

Table 10-9 Models and dimensions of TNR series terminals

Model	Specifications		D	d1	E	F	B	d2	L	Current (A)	Crimping Tool
	AWG/MCM	(mm2)									
TNR0.75-4.	22-16	0.25 to 1.0	2.8	1.3	4.5	6.6	8.0	4.3	15.0	10	RYO-8 AK-1M
TNR1.25-4	22-16	0.25 to 1.65	3.4	1.7	4.5	7.3	8	5.3	15.8	19	

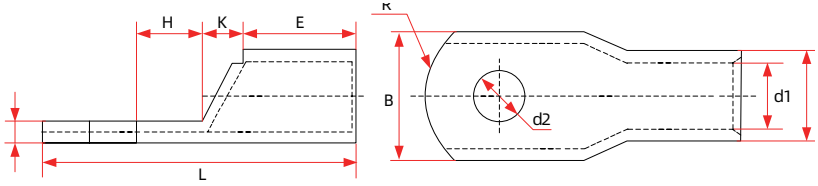


Figure 10-21 Dimensions of GTNR series terminals

Table 10-10 Models and dimensions of GTNR series terminals (unit: mm)

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR1.5-5	4.0	2.2	5.0	5.0	2.0	8.0	5.3	1.0	16.0	5	RYO-8 YYT-8 RYO-14
GTNR2.5-4	4.5	2.9	7.0	5.0	2.0	8.0	4.3	1.0	18.0		
GTNR2.5-5				6.0			5.3		20.0	7	
GTNR2.5-6						10.2	6.4	0.8			
GTNR4-5	5.2	3.6	7.0	6.0	2.0	10.0	5.3	1.0	20.0		
GTNR4-6							6.4				
GTNR6-5	6.0	4.2	9.0	6.0	3.0	10.0	5.3	1.2	23.0		
GTNR6-6				7.5			6.4		26.0		
GTNR6-8						12.0	8.4	1.0			
GTNR10-6	7.0	5.0	9.0	8.0	3.5	12.4	6.4	1.3	26.5		
GTNR10-8							8.4		27.5		
GTNR16-6	7.8	5.8	12.0	8.0	4.0	12.4	6.4	1.3	31.0		CT-38 CT-100
GTNR16-8							8.4				
GTNR25-6	9.5	7.5	12.0	8.0	4.5	14.0	6.4	2.0	32.0	10	
GTNR25-8				9.0		15.5	8.4	1.6	34.0		
GTNR25-10				10.5		17.5	10.5	1.4	37.0		
GTNR35-6	11.4	8.6	15.0	9.0	5.0	15.5	6.4	2.8	38.0		
GTNR35-8							8.4				
GTNR35-10				10.5		17.5	10.5	2.5	40.5		

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR50-8	12.6	9.6	16.0	11.0	6.0	18.0	8.4	2.8	43.5	10	CT-100
GTNR50-10							10.5				
GTNR70-8	15.0	12.0	18.0	13.0	7.0	21.0	8.4	2.8	50.0	14	
GTNR70-10							10.5				
GTNR70-12							13.0				
GTNR95-10	17.4	13.5	20.0	13.0	9.0	25.0	10.5	3.9	55.0		
GTNR95-12							13.0				
GTNR120-12	19.8	15.0	22.0	14.0	10.0	28.0	13.0	4.7	60.0	16	RYC-150
GTNR120-16				16.0			17.0		64.0		
GTNR150-12	21.2	16.5	26.0	16.0	11.0	30.0	13.0	4.7	69.0	24	
GTNR150-16							17.0				
GTNR185-16	23.5	18.5	32.0	17.0	12.0	34.0	17.0	5.0	78.0		
GTNR240-16	26.5	21.5	38.0	20.0	14.0	38.0	17.0	5.5	92.0		
GTNR240-20							21.0				

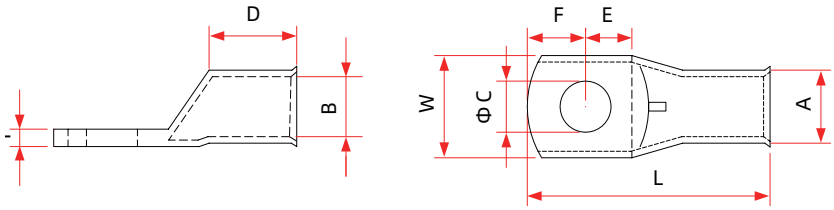


Figure 10-22 Dimensions of BC series terminals

Table 10-11 Models and dimensions of BC series terminals (unit: mm)

Model	A	B	W	E	D	L	T	C	F
120 - 8	19.0	15.0	27.2	16.5	27.0	73.0	4.0	8.5	16.5
October 120								10.5	
120 - 12								12.8	
120 - 14								14.7	
120 - 16								16.7	
120 - 20				18.8				20.7	14.3

Model	A	B	W	E	D	L	T	C	F
150 - 8	21.0	16.5	30.0	16.5	27.0	78.0	4.5	8.5	16.5
October 150								10.5	
150 - 12								12.8	
150 - 14								14.7	
150 - 16								16.7	
150 - 20				18.8				20.7	14.3
October 185	23	18.5	33.5	16.5	30	82	4.5	10.5	16.5
185 - 12								12.8	
185 - 14								14.7	
185 - 16								16.7	
185 - 20				18.8				20.7	14.3
October 240	26	21	37.7	18.0	32.0	88.0	5.0	10.5	17.0
240 - 12								12.8	
240 - 14								14.7	
240 - 16								16.7	
240 - 20								20.7	
October 300	28.0	23.0	41.0	18.0	37.0	97.0	5.0	10.5	17.0
300 - 12								12.8	
300 - 14								14.7	
300 - 16								16.7	
300 - 20								20.7	

10.4.3 Selection of RCDs

Select a proper earth leakage circuit breaker (ELCB) according to the following requirements when an ELCB is needed:

● The AC drive will generate certain high-frequency leakage current during operation. To avoid malfunction of the RCD, select an RCD with the action current of at least 100 mA for each AC drive.

● When multiple AC drives connected in parallel share one RCD, the operating current of the RCD must be not lower than 300 mA.

● Recommended leakage breaker manufacturers are CHINT and Schneider.

When malfunction occurs on the residual current device (RCD), take the following measures.

Table 10-12 Measures against current leakage

Fault	Possible cause	Solution
The RCD trips at the moment of power-on.	The anti-interference performance of the RCD is weak.	1. Use RCDs of recommended brands. 2. Use RCDs with higher tripping current. 3. Connect the unbalanced load to the front end of the RCD. 4. Disconnect the EMC screw or the ground end of the external EMC filter to reduce the ground capacitance at the input end.
	The tripping current of the RCD is excessively low.	
	An unbalanced load is connected to the downstream side of the RCD.	
	An excessive ground capacitance exists in the upstream side of the drive.	
The RCD trips during operation.	The anti-interference performance of the RCD is weak.	1. Use RCDs of recommended brands. 2. If only one single AC drive is used, check that the EMC screw is tightened. 3. If multiple AC drives are used, disconnect the EMC screws, as shown in the figure below. 4. Install a simple filter on the input side of the AC drive, and wind the LN/RST cable on a magnetic ring near the RCD, as shown in the figure below. 5. Use RCDs with higher rated tripping current. 6. Reduce the carrier frequency without compromising the performance. 7. Use a shorter motor cable.
	The tripping current of the RCD is excessively low.	
	An unbalanced load is connected to the downstream side of the RCD.	
	The distributed capacitance to ground of the motor cable and motor is excessively high.	

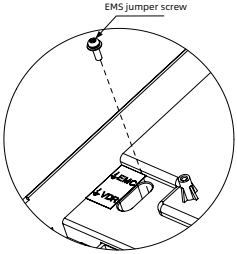


Figure 10-23 Disconnecting the EMC screw

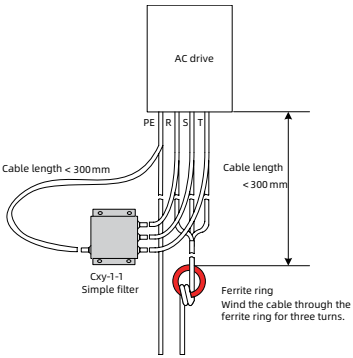


Figure 10-24 Installing a simple filter and magnetic ring on the input side

10.5 Selection of Braking Components

10.5.1 Selection of Braking Units

For an indoor translation mechanism, the allowable braking capacity of a braking unit is the top priority.

$$P_{zmax}=0.8\times P_{Bmax} \qquad \text{(Formula 1)}$$

In the preceding formula, Pzmax: Short-term allowable power of the braking unit (kW)

PBmax: Short-term allowable power of the AC drive (kW)

Pzmax is 0.8 x PBmax. The constant 0.8 is obtained by assuming the mechanical efficiency of the mechanism is 0.9 according to the principle that the maximum braking power is no larger than the square of result of the maximum motoring capacity multiplied by the efficiency.

For a hoisting mechanism, the short-term braking capacity and continuous braking capacity of a braking unit is the top priority.

If the hoisting height is small, the rated hoisting speed is high, and the total time of the lowering process of the hoisting mechanism is shorter than time allowed by the short-term overload capacity of the braking unit, the formula 1 applies. However, it is recommended to add a margin of 15% to 25% (Given the possibility that a full-load lowering task may be executed two times in a row).

If the hoisting height is large, the rated hoisting speed is low, and the total time of the lowering process of the hoisting mechanism is larger than the time allowed by the short-term overload capacity of the braking unit, select the braking unit based on the continuous braking capacity.

$$Pz=0.8\times PD \qquad \text{(Formula 2)}$$

In the preceding formula, Pz: Continuous braking power of the braking unit (kW)

PD is the power of the motor, in kW.

Select the braking unit based on Formula 1 and check the overload capacity based on Formula 2.

10.5.2 Selection of Braking Resistors

The resistance of the braking resistor is generally higher than the minimum braking resistance allowed by the AC drive.

The capacity required by the braking resistor of a translation mechanism can be calculated by using Formula 2 and checked according to the maximum current allowed by the braking resistor.

$$I_{zmax}=\frac{1.15\times V_{bz}}{R_{sc}} \qquad \text{(Formula 3)}$$

In the preceding formula, Izmax : Maximum allowable current of the braking resistor (A)

Vbz: Braking voltage threshold of the AC drive (V)

Rsc: Resistance of the braking resistor used (Ω)

The capacity required by the braking resistor of a translation mechanism can be calculated by using Formula 2 and checked according to Formula 1.

10.5.3 Selecting Braking Units

Table 10-13 Braking components selection table

AC drive model	Braking unit		Min. power for hoisting (kW)	Min. power for traversing	Min. braking resistance (Ω)
CS710-4T0.4GB	Built-in, standard		0.2	0.08	96
CS710-4T0.7GB	Built-in, standard		0.35	0.14	96
CS710-4T1.1GB	Built-in, standard		0.55	0.22	96
CS710-4T1.5GB	Built-in, standard		0.75	0.3	96
CS710-4T2.2GB	Built-in, standard		1.1	0.44	64
CS710-4T3.0GB	Built-in, standard		1.5	0.6	64
CS710-4T3.7GB	Built-in, standard		1.8	0.75	32
CS710-4T5.5GB	Built-in, standard		2.7	1.1	32
CS710-4T7.5GB	Built-in, standard		3.7	1.5	32
CS710-4T11GB	Built-in, standard		5.5	2.2	20
CS710-4T15GB	Built-in, standard		7.5	3	20
CS710-4T18.5GB(-T)	Built-in, standard		9	3.7	24
CS710-4T22GB(-T)	Built-in, standard		11	4.4	24
CS710-4T30GB	Built-in, standard		15	6	19.2
CS710-4T37GB	Built-in, standard		18	7.5	14.8
CS710-4T45GB	Built-in, standard		22	9	12.8
CS710-4T55GB	Built-in, standard		27	11	9.6
CS710-4T75GB	Built-in, standard		37	15	6.8
CS710-4T90G	Input voltage ≤ 440 VAC	MDBUN-200-T	45	18	2.5
CS710-4T90G	Input voltage > 440 VAC	MDBUN-200-5T	45	18	2.5
CS710-4T110G	Input voltage ≤ 440 VAC	MDBUN-200-T	55	22	2.5
CS710-4T110G	Input voltage > 440 VAC	MDBUN-200-5T	55	22	2.8
CS710-4T132G	Input voltage ≤ 440 VAC	MDBUN-200-T	66	26.4	2.5

AC drive model	Braking unit		Min. power for hoisting (kW)	Min. power for traversing	Min. braking resistance (Ω)
CS710-4T132G	Input voltage > 440 VAC	MDBUN-200-5T	66	26.4	2.5
CS710-4T160G	Input voltage ≤ 440 VAC	MDBUN-200-T	88	32	2.5
CS710-4T160G	Input voltage > 440 VAC	MDBUN-200-5T	88	32	2.5
CS710-4T200G	Input voltage ≤ 440 VAC	MDBUN-200-T x 2	50 x 2	20 x 2	2.5 x 2
CS710-4T200G	Input voltage > 440 VAC	MDBUN-200-5T x 2	50 x 2	20 x 2	2.5 x 2
CS710-4T220G	Input voltage ≤ 440 VAC	MDBUN-200-T x 2	55 x 2	22 x 2	2.5 x 2
CS710-4T220G	Input voltage > 440 VAC	MDBUN-200-5T x 2	55 x 2	22 x 2	2.5 x 2
CS710-4T250G	Input voltage ≤ 440 VAC	MDBUN-200-T x 2	63 x 2	25 x 2	2.5 x 2
CS710-4T250G	Input voltage > 440 VAC	MDBUN-200-5T x 2	63 x 2	25 x 2	2.5 x 2
CS710-4T280G	Input voltage ≤ 440 VAC	MDBUN-200-T x 2	70 x 2	28 x 2	2.5 x 2
CS710-4T280G	Input voltage > 440 VAC	MDBUN-200-5T x 2	70 x 2	28 x 2	2.5 x 2
CS710-4T315G	Input voltage ≤ 440 VAC	MDBUN-200-T x 3	80 x 3	31 x 3	2.5 x 3
CS710-4T315G	Input voltage > 440 VAC	MDBUN-200-5T x 3	80 x 3	31 x 3	2.5 x 3
CS710-4T355G	Input voltage ≤ 440 VAC	MDBUN-200-T x 3	60 x 3	24 x 3	2.5 x 3
CS710-4T355G	Input voltage > 440 VAC	MDBUN-200-5T x 3	60 x 3	24 x 3	2.5 x 3
CS710-4T400G	Input voltage ≤ 440 VAC	MDBUN-200-T x 3	67 x 3	26 x 3	2.5 x 3
CS710-4T400G	Input voltage > 440 VAC	MDBUN-200-5T x 3	67 x 3	26 x 3	2.5 x 3

NOTE

- In the preceding table, x 2 or x 3 indicates that two or three braking units with their respective braking resistors are connected in parallel mode.
- Default initial braking voltages of various braking units are as follows:
  Built-in braking units: 660 V
  MDBUN-60-T, MDBUN-90-T, MDBUN-200-T: 670 V, used when grid input voltage ≤ 440 VAC
  MDBUN-60-5T, MDBUN-90-5T, MDBUN-200-5T: 760 V, used when grid input voltage > 440 VAC.
- Users can adjust the braking voltage (U) to adapt to different main voltage. To increase the default braking voltage at start, increase the value of the corresponding braking resistor.
- The minimum braking resistance in the preceding table is the minimum resistance allowed by the braking unit. If the resistance is less than this value, overcurrent may occur to the braking unit.
- The resistor power is 1/2 of the motor power during hoisting and 1/4 of the motor power during translating. (The motor power is equal to the AC drive power by default.)
- Data provided in the table is for reference only. You can select resistance and power of braking resistors as needed. The resistance cannot be lower than the reference value, while the power can be higher than or equal to the reference value. The braking resistor model is dependent on the generating power of the motor in the actual system and is also related to the system inertia, deceleration time and potential energy load. You should select the braking resistor according to actual conditions. For systems featuring large inertia and requiring short deceleration time and frequency braking, select a braking resistor with high power and low resistance.

- When a braking resistor is installed, it is recommended to select one with a temperature switch to ensure safety and prevent overheating and burning. Connect the temperature switch output to the electromagnetic contactor control circuit on the front end of the drive (see figure blow) to implement interlock protection. When the resistor overheats, a tripping fault occurs, avoiding the resistor to be burned.

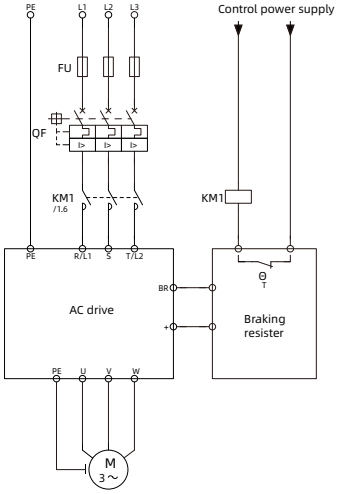


Figure 10-25 Control circuit of the electromagnetic contactor

10.5.4 Outline Drawings and Mounting Dimensions of Braking Units

For details about the outline and mounting dimensions of the MDBUN, see the MDBUN Series Braking Unit User Guide (data code: 19011140).

10.6 Mounting Dimensions of External Operating Panels

MD32NKE1 (option) is the external operating panel applicable to a CS710 series AC drive. It adopts the LED display and has the same operating mode as the operating panel on the AC drive. This external part facilitates AC drive commissioning. The following figure shows its outline and installation dimensions.

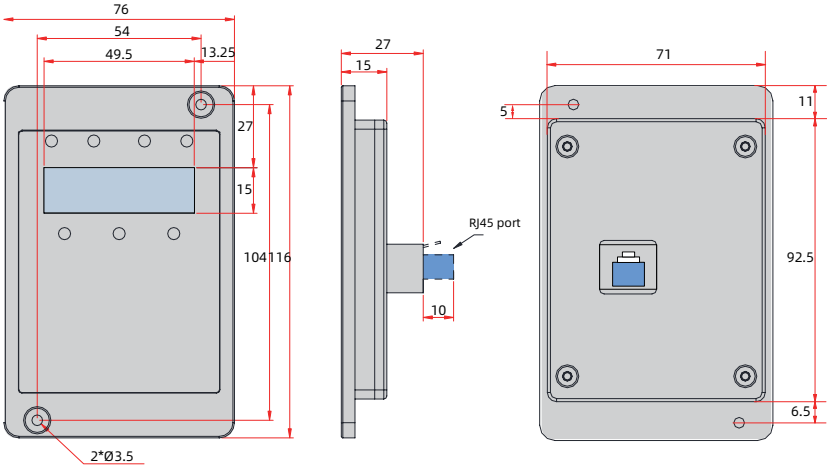


Figure 10-26 Dimensions of external operating panel (mm)

11 Options

11.1 I/O Expansion Card

11.1.1 Multi-functional I/O Expansion Card (MD38IO1)

(15 kW and above models)

MD38IO1 is a multi-functional expansion I/O card designed for CS710 series AC drives with the power of 15 kW and above. It provides five DIs, one AI, one AO, one relay output terminal, as well as CAN and RS485 interfaces for fieldbus control.

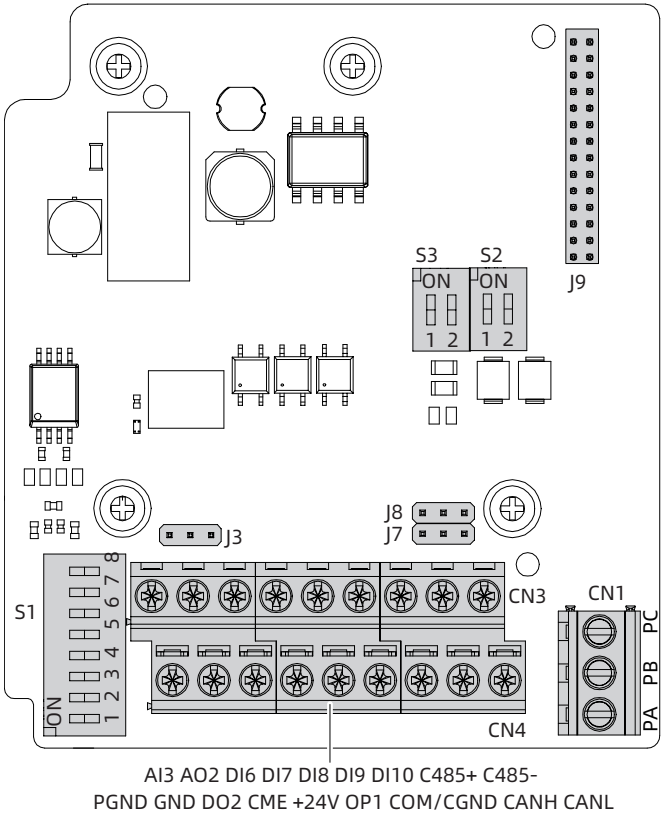
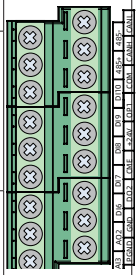


Figure 11-1 Diagram of MD38I01 terminal layout

Table 11-1 Terminal functions of the MD38I01 extension card

Mark		Terminal	Function description	Terminal layout
CN4	+24V/ COM/ CGND	External 24 VDC power supply	Provide +24 V power supply to an external unit. Generally used to supply DI/DO terminals and external sensors. Max. output current: 200 mA	
	OP1	Digital input power terminal	Connect to +24V by the jumper J8 by default. 2) When an external power supply is needed, remove J8 and connect OP1 to the external power supply.	
	DO2-CME	DO2	1. Optically-coupled isolation, dual-polarity open-collector output 2. Output voltage range: 0 V to 24 V 3. Output current range: 0 mA to 50 mA Note: The DO ground terminal CME and the DI ground terminal COM/CGND are internally isolated. They are connected by jumper J7 internally. Remove J7 if you need to power DO2 with an external power supply.	
	CANH/ CANL/ COM/ CGND	Communication terminal	-	
CN3	AI3-PGND	Analog input terminal 3	1. Optically-coupled isolation input. Differential voltage input and temperature detection resistor input allowed 2. Input voltage range: -10 V to +10 V PT100 and PT1000 temperature sensors 4. The input mode is set by the DIP switch S1. Only one mode can be enabled at a time.	
	AO2-GND	Analog output terminal 2	1. Output voltage range: 0 to +10 V Output current range: 0 to 20 mA Output current with resistance range: 0 to 500 Ω	
	DI6-OP1 to DI10-OP1	Five DIs Input	1. Optical coupling isolation, compatible with dual polarity input 2. Input impedance: 2.4 kΩ 3. Voltage upon level input: 9 V to 30 V	
	C485+/ C485-/ COM/ CGND	Communication port Terminal	Modbus RTU communication input and output signal terminals; isolated input	

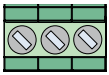
Mark		Terminal	Function description	Terminal layout
CN1	PA- PB	Normally closed terminal	Driving capacity of the contact: 250 VAC, 3 A, COS ∅ = 0.4 30 VDC, 1 A	
	PA-PC	Normally open terminal		

Table 11-2 Jumpers of MD38IO1 extension card

Mark	Terminal	Function description	Position of the Jumper/DIP Switch
J3	AO2 output type setting jumper	Voltage output: 0 V to 10 V	
		Current type: 0 mA to 20 mA	
S1	AI, PT100, or PT1000 function selection	AI3: 1, 2, and 3 set to ON	
		PT1000: 4, 5, and 6 set to ON	
		PT100: 6, 7, and 8 set to ON	-
S2	PROFIBUS terminal matching resistor selection	1 and 2 set to ON: Termination resistor enabled	
		DIP switches 1 and 2 set to OFF: Not matching the termination resistor	
S3	AI3: PT100/ PT1000 function selection	1 and 2 set to ON: Termination resistor enabled	-
		DIP switches 1 and 2 set to OFF: Not matching the termination resistor	-

NOTE

When the master and slave communication adopts the CAN protocol while the AC drive and display communication adopts the RS485 protocol, termination resistors on the first and last AC drive I/O1 expansion cards must be connected (through S3 and S2). In this case, keep the DIP switches on the intermediate AC drive I/O1 expansion cards in their factory default state.

11.1.2 Mini I/O Expansion Card (MD38IO2)

(Applicable to all models)

The mini I/O extension card, which provides three DIs, is the simplified version of a multi-function I/O extension card.

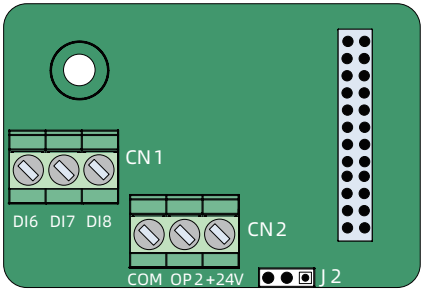


Figure 11-2 Terminal layout of MD38IO2

Table 11-3 Description of terminal functions

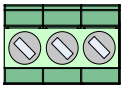
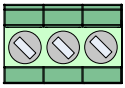
Mark		Terminal	Function description	Terminal layout
CN2	+24V/ COM	External 24 VDC power supply	Provide +24 V power supply to an external unit. Generally used to supply DI/DO terminals and external sensors. Max. output current: 200 mA	 COM OP2 +24V
	OP2	Digital input. Power supply terminal	It is not connected to power supply by default. It can be connected either to external power or +24V according to the actual need.	
CN1	DI6-OP2 to DI8-OP2	Three digital inputs Input	1. Optical coupling isolation, compatible with dual polarity input Input resistance: 3.3 kΩ for DI6 and DI7, 2.4 kΩ for DI8 3. Voltage upon level input: 9 V to 30 V DI6, DI7 and DI8 are common input terminals with input frequency < 100 Hz.	 DI6 DI7 DI8

Table 11-4 Description of jumpers on MD38IO2

Mark	Terminal	Function description	Position of the Jumper/DIP Switch
J2	DI terminal connecting mode setting jumper	If the DI is wired in sink mode, connect OP2 to +24V.	
		If the DI is wired in source mode, connect OP2 to COM.	

NOTE

The jumper setting is based on the top view with main terminal block at the bottom, which is subject to the jumpers silk-screened on the board.

11.1.3 Terminal Layout and Functions of the MD38IO3 Expansion Card

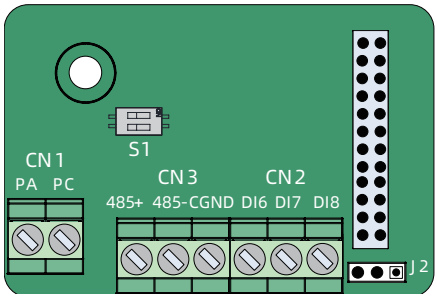


Figure 11-3 Terminal layout on MD38IO3

Table 11-5 Description of terminals on MD38IO3

Mark		Terminal	Function description	Diagram
CN3	485+	Positive RS485 communication signal	Modbus supported; input isolated	CN3 485+ 485- CGND
	485-	Negative RS485 communication signal		
	CGND	Ground of RS485 communication signal		
CN2	DI6 to DI8	3 DIs	1. Photocoupler isolation, compatible with dual-polarity inputs; maximum input frequency: 100 Hz 2. Input impedance: 3.4 kΩ 3. Voltage upon level input: +9 V to +24 V	CN2 DI6 DI7 DI8
CN1	PA-PC	Normally open terminal	Contact driving capacity: 250 VAC, 5 A 30 VDC/5 A	CN1 PA PC

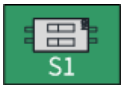
S1	PROFIBUS terminal matching resistor selection	2-bit DIP switch	Pins 1 and 2 set to ON: Connect the terminal resistor. DIP switches 1 and 2 set to OFF: Not matching the termination resistor	

Table 11-6 Description of jumpers on MD38IO3

Mark	Terminal	Function description	Position of the Jumper/DIP Switch
J2	DI terminal connecting mode setting jumper	Wire the DI terminal in sink mode. Connect OP to +24V.	
		Wire the DI terminal in source mode. Connect OP to COM.	

NOTE

Setting of the jumper is based on the top view with main terminal block at the bottom. Position of the jumper is subject to the jumper silk-screened on the board.

11.1.4 Multi-functional Expansion I/O Card (CS700IO1)

(Applicable to models of 11 kW and below)

CS700IO1 provides two DIs, one relay output terminal, and one RS485 interface. It is applicable to models of 11 kW and below.

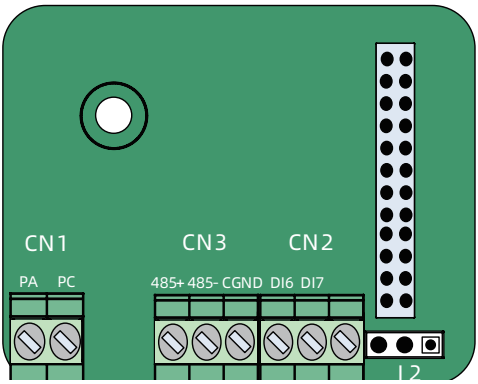


Figure 11-4 Layout of CS700IO1 terminals

Table 11-7 Description of CS700IO1 expansion card terminals

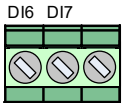
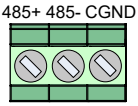
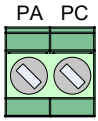
Mark		Terminal	Function description	Terminal layout
CN2	DI6-COM to DI7-COM	Two digital inputs	1. Optical coupling isolation, compatible with dual polarity input 2. Input impedance: 2.4 kΩ 3. Voltage upon level input: 9 V to 30 V	
CN3	485+/485-/ CGND	Communication terminal	Modbus RTU communication input and output signal terminals; isolated input	
CN1	PA-PC	Normally open terminal	Driving capacity of the contact: 250 VAC, 3 A, COS ☒ = 0.4 30 VDC, 1 A	

Table 11-8 Description of jumpers on CS700IO1

Mark	Terminal	Function description	Position of the Jumper/DIP Switch
J2	DI terminal connecting mode setting jumper	The DI is wired in the sink mode.	
		The DI is wired in the source mode.	

NOTE

Setting of the jumper is based on the top view with main terminal block at the bottom. Position of the jumper is subject to the jumper silk-screened on the board.

11.1.5 Multi-functional Expansion I/O Card (CS700RC2)

(15 kW and above models)

CS700RC2 provides three DIs, two relay output terminals, and one RS485 interface. It is applicable to models of 15 kW and above.

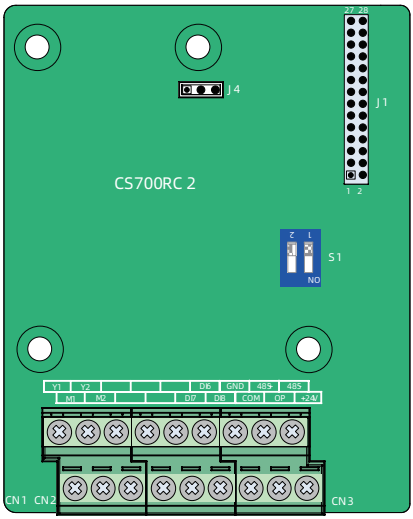
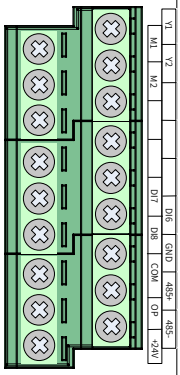


Figure 11-5 Terminal layout on CS700RC2

Table 11-9 Description of terminals on CS700RC2

Mark		Terminal	Function description	Terminal layout
Power supply	+24V to COM	External +24 V power supply	The terminal is used to provide +24 V power supply to external devices. Generally, it is used to power up the DI/DOs and external sensor. Maximum output current: 200 mA	
	OP	Digital input power terminal	Connected to +24V by a jumper by default. When an external power supply is needed, remove the jumper and connect OP to the external power supply.	
Relay output terminal	Y1 to M1 Y2 to M2	Relay output	Contact driving capacity: 250 VAC, 5 A, COS ☒ = 0.4 30 VDC, 1 A	
DI terminal	DI6-OP DI7-OP DI8-OP	Digital input	Photocoupler isolation; compatible with dual-polarity input. Input impedance: 2.4 kΩ Voltage upon level input: 9 V to 30 V	
RS485 Communication	485+ 485- GND	RS485 communication terminal	It is recommended to use the shielded twisted pair cables. See the RS485 communication protocol of CS700 for reference.	
DIP switch	S1	RS485 termination resistor connection selection	Connection of the RS485 termination resistor, which is not connected by default upon delivery	

NOTE

Setting of the jumper is based on the top view with main terminal block at the bottom. Position of the jumper is subject to the jumper silk-screened on the board.

11.2 Communication Expansion Cards

11.2.1 CANopen Expansion Card (MD38CAN2)

(Applicable to all models)

MD38CAN2 is available to all models. It is designed for CANopen communication and has the following characteristics:

- NodeGuarding: The master can query the device state with this function.
- Carrying four PDOs for transmission and receipt respectively (PDOs for transmission supports both synchronous and asynchronous transmission.)
- SDO only supporting accelerated transmission with up to four bytes
- COB-IDs of the TPDO, RPDO, and SDO correspond to the equipment IDs, which are set by software and do not need to be changed.
- Does not support emergency objects. Electrical parameters for CANopen communication comply with international standards.

1 Appearance of MD38CAN2

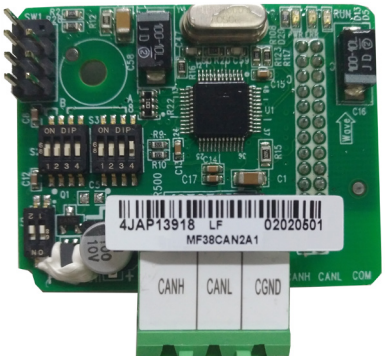


Figure 11-6 MD38CAN2 appearance

2. Function of wiring terminals

Table 11-10 Terminal function description

Category	Symbol	Terminal	Function description
CAN communication (CN1)	CANH/CANL	Communication terminal	CANopen communication input terminal with isolated input
	COM	CAN communication power supply ground	Connected to common mode choke of +24V power supply ground.
Programming	SW1	ARM programming interface	

3. DIP switch

The DIP switch S1 provides a 2-digit DIP switch for setting the CAN bus termination resistor. It is recommended to set the termination resistor on both ends of the network topology. Setting the DIP switch to ON represents “1”. Setting the DIP switch to OFF represents “0”.

Table 11-11 MD38CAN2 termination resistor

No.		Termination resistor
1	2	
0	0	Not using the termination resistor
1	1	The termination resistor is connected.

Note: In CANopen communication mode, connect the termination resistor to the AC drive located at the end of the network.

The DIP switches S2 and S3 of MD38CAN2 consist an 8-position DIP switch for setting the CAN bus communication baud rate and communication equipment address. Figure 10-6 shows the DIP switch numbers, in which 1 and 2 are used for setting the baud rate and 3 to 8 are used for setting the CANopen address. Setting the DIP switch to ON represents"1". Setting the DIP switch to OFF represents "0".

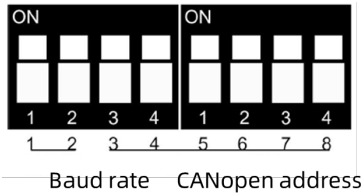


Figure 11-7 MD38CAN2 DIP switches

Bit No.	Functions	Description		
1 to 2	CAN bus baud rate	Digit 1	Digit 2	Baud rate
		0	0	125 kbps
		0	1	250 kbps
		1	0	500 kbps
		1	1	1 Mbps
3 to 8	CANopen network ID	The six binary bits can form 64 addresses, ranging from 0 to 63.		

Address	Switch setting
0	00 0000
7	00 0111
20	010100

4. PDO data definition and parameter address definition

1. RPDO data definition

<table>
<tr><th colspan="4">RPDO definition</th></tr>
<tr><td rowspan="2">RPDO1</td><td>Drive command</td><td>bit0: Decelerate to stop;
bit1: Coast to stop;
bit2: Forward run; bit3: Reverse run</td><td>bit4: Quick stop; bit5: Torque control
bit6: Fault reset; bit7: Command valid
bit8 to bit15: Reserved</td></tr>
<tr><td>Target frequency</td><td colspan="2">The frequency can be set in two different ways by bd.06.
If the lowest bit of bd.06 is 0, the frequency ranges from 0 to 10000, which corresponds to 0.00% to 100.00% of the maximum frequency (negative or positive).
2. If the least significant bit of bd.06 is 1, the frequency ranges from 0 Hz to the maximum frequency (negative or positive).</td></tr>
<tr><td rowspan="2">RPDO1</td><td>bd.11</td><td colspan="2" rowspan="9">The corresponding value is written to the RAM area of a parameter address.
The function parameter writing address is set in bd.11 to bd.20.
Example: Set bd.11 to b5.00, and write 500 to the third data in RPDO1. Then the value of b5.00 changes to 500.
Note:
All parameter addresses of CS710 series AC drives are defined following a unified rule. That is, the group number of a parameter is the high bits of its address, and the hexadecimal value converted from the parameter number forms the low bits of the address. For example, the address of A0.05 is 0xa005, and the address of b3.18 is 0xb312. Addresses of parameters in group U have a "d" followed by the group number. For example, the address of U0.18 is 0xd012.
PDO data can be configured using the EDS file of CS710 series AC drives. Obtain the latest EDS file from Inovance.</td></tr>
<tr><td>bd.12</td></tr>
<tr><td rowspan="4">RPDO2</td><td>bd.13</td></tr>
<tr><td>bd.14</td></tr>
<tr><td>bd.15</td></tr>
<tr><td>bd.16</td></tr>
<tr><td rowspan="4">RPDO3</td><td>bd.17</td></tr>
<tr><td>bd.18</td></tr>
<tr><td>bd.19</td></tr>
<tr><td>bd.10</td></tr>
</table>

2. TPDO data definition

RPDO definition		
TPDO1	Drive status	bit0: AC drive operating; bit1: Forward run; bit2: Reverse run; bit3: No fault; bit4: Coast to stop; bit5: No communication with the AC drive bit6: Frequency reached; bit7: Torque control valid bit8 to bit15: Reserved
	Feedback frequency	Return to current operating frequency.
	bd.21	These 10 data are used to obtain the value of a parameter. The address of the function parameter is set in bd.21...bd.30. Example: When you set bd.21 to b5.00, then the value of the third data of TPDO1 is the real-time value of b5.00. Note: All parameter addresses of CS710 series AC drives are defined following a unified rule. That is, the group number of a parameter is the high bits of its address, and the hexadecimal value converted from the parameter number forms the low bits of the address. For example, the address of A0.05 is 0xa005, and the address of b3.18 is 0xb312. Addresses of parameters in group U have a "d" followed by the group number. For example, the address of U0.18 is 0xd012. TPDO data can be configured using the EDS file of CS710 series AC drives. Obtain the latest EDS file from Inovance.
	bd.22	
TPDO2	bd.23	
	bd.24	
	bd.25	
	bd.26	
TPDO3	bd.27	
	bd.28	
	bd.29	
	bd.30	

11.2.2 RS485 Expansion Card (MD38TX1)

(Applicable to all models)

MD38TX1 is designed to provide the RS485 communication function for CS710 series AC drives. It is available for all models. It uses an isolation scheme with electrical parameters in compliance with international standards. You can use this card to control the AC drive and set parameters remotely through the serial port on the card.

For details about this card, see the CS710 Serial Communication Protocol. You can view the document on Inovance website www.inovance.com or obtain it from a local Inovance office or agent.

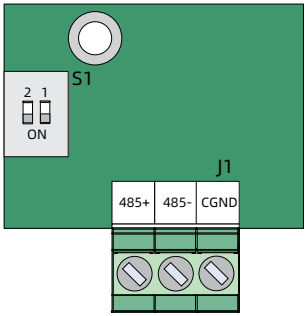


Figure 11-8 Terminal layout on MD38TX1

Table 11-12 Function description of terminals in MD38TX1 expansion card

Mark		Terminal	Function description	Terminal layout
J1	485+	RS485 communication signal (+)	RS485 communication input terminal with the isolation function	485+ 485- CGND
	485-	RS485 communication signal -	RS485 communication input terminal with the isolation function	
	CGND	Reference ground of RS485 communication signal	Isolated power supply applied	

Table 11-13 Description of DIP switches on the MD38TX1 expansion card

Mark	Terminal	Function description	Position of the Jumper/DIP Switch
S1	DIP switch of the RS485 communication termination resistor	Termination resistor is connected.	ON
		Termination resistor is not connected.	ON

NOTE

- The MD38TX1 expansion card is connected through the DIP switch.
- The DIP switch is set from the top view with main terminal block at the bottom. The DIP switch is subject to the silkscreen on the board.

11.2.3 PROFIBUS DP Expansion Card (MD38DP2)

(15 kW and above models)

The PROFIBUS DP expansion card is used to connect a CS710 series AC drive to the PROFIBUS DP bus. It provides data exchange to implement all functions of the AC drive, including function configuration, parameter updating, and control signal transmission, monitoring, and diagnosis.

Complying with the standard PROFIBUS fieldbus standard, the PROFIBUS DP card can be used to control fieldbus by working with Inovance AC drives.

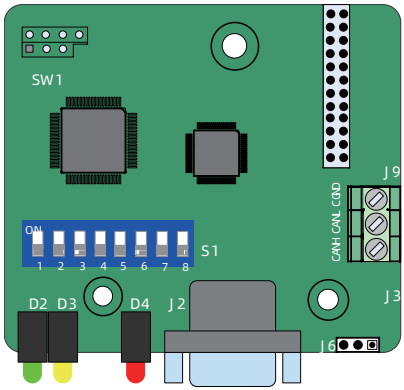


Figure 11-9 Layout of MD38DP2 terminals

Table 11-14 Description of terminal functions

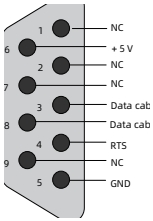
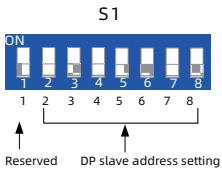
Symbol	Pin No.	Pin assignment	Function description	Terminal layout
PROFIBUS-DP communication terminal (J2)	1, 2, 7, and 9	NC	Not connected internally	
	3	Data cable B	Data cable (+)	
	4	RTS	Transmission signal request	
	5	GND	Isolated 5 V power ground	
	6	+5V	Isolated 5 V power supply	
	8	Data cable A	Data cable (-)	

Table 11-15 Description of status indicators on MD38DP2

Indicator	Status	Description
Power supply indicator (D4)	 D4	On: Normal
	 D4	OFF: The drive is not powered on or DP card is installed improperly.
Indicator for communication between DP card and master Communication indicator (D3)	 D3	On: The card is communicating with the master normally.
	 D3	Flashing: The master does not run or a fault occurs during communication between the DP card and PROFIBUS master.
	 D3	Off: The PROFIBUS DP card does not communicate with the master. (Check the PROFIBUS DP cable connection and master ID.)
Indicator for communication between the PROFIBUS-DP card and the drive (D2)	 D2	On: The PROFIBUS DP card is communicating with the AC drive normally.
	 D2	Blinking: The PROFIBUS DP card cannot communicate with the AC drive. (Check whether the baud rate is set correctly.)
	 D2	Off: There is interference to communication between the PROFIBUS DP card and AC drive, or the address of the expansion card is not in the range of 1 to 125.

Table 11-16 Description of DIP switches of MD38DP2 expansion card

PROFIBUS DP communication slave address settings								Slave address	DIP switch
1	2	3	4	5	6	7	8		
DP card type switchover ("OFF: MD38DP2" by default)	0	0	0	0	0	0	0	Reserved	
	0	0	0	0	0	0	1	1	
	0	0	0	0	0	1	0	2	
		0	0	0	0	1	1	3	
		...						...	
	1	1	1	1	1	0	1	123	
	1	1	1	1	1	1	0	124	
	1	1	1	1	1	1	1	125	

NOTE

When DIP switch 1 is turned on, it indicates MD38DP1 applies. The change of the DIP switch number is activated at next power-on. The change of slave address DIP switch is activated immediately.

11.2.4 PROFINET Communication Expansion Card (MD500-PN1)

(Applicable to all models)

The MD500-PN1 card is a PROFINET fieldbus adapter card that complies with PROFINET Ethernet standards.

The card can be used on the AC drive to increase the communication efficiency and implement the AC drive networking function, which enables the AC drive to be a slave controlled by the fieldbus master.

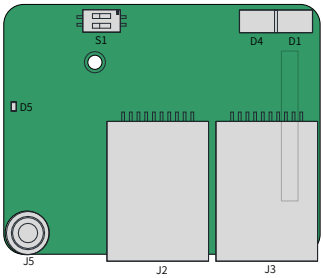


Figure 11-10 Terminal layout of MD500-PN1 card

Table 11-17 Description of the hardware of MD500-PN1 card

Mark	Hardware name	Function description
J1	Pin header	Used to connect the drive.

Mark	Hardware name	Function description
J2 J3	Network port	Used for communication of the PN card and PN card (PLC), which is direction-insensitive.
J5	EMC ground terminal	Used to connect the EMC grounding terminal of the drive.
D5	Power supply indicator	Used to indicate the status of the power supply. ON: Normal OFF: Abnormal. Check whether the card is installed properly.
D1	PC communication status indicator (PLCLINK)	Steady green: The communication is normal. Blinking in green: Master not found (Check the configuration and check whether the slave is assigned with a device name. Check whether the PN card is connected to the corresponding PLC.) Steady yellow: Configuration error (Check whether GSD is correct.) Steady red: Communication with the master is interrupted. Check the connection.
D4	Drive communication status indicator (DSPLINK)	Steady green: Normal Steady yellow: MAC address error (Replace the PN card.) Flashing in yellow: Drive fault (Rectify the drive fault.) Steady red: The communication with the AC drive is abnormal. Set bd.07 to 1 and check whether the AC drive supports the MD500-PN1 card.
S1	2-bit DIP switch	Used for upgrade only by the manufacturer.



- After MD500-PN1 is installed properly, J2 is on the left and J3 on the right when viewed from an angle facing RJ45. It is recommended to use shielded Cat 5e cables to ensure stable operation.
- For more details about the PROFINET communication expansion card (MD500-PN1), see MD500 Series PROFINET Expansion Card User Guide (data code: 19011287).

11.2.4 PROFINET Communication Expansion Card (MD500-PN2)

The MD500-PN2 card is a PROFINET fieldbus adapter card complying with PROFINET Ethernet standards.

It is installed in the MD series AC drive to increase the communication efficiency and implement the AC drive networking function, which enables the AC drive to be a slave controlled by the field bus master station.

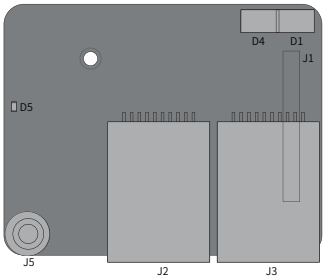


Figure 11-11 Terminal layout of MD500-PN2 card

Table 11-18 Hardware description of MD500-PN2 card

Mark	Hardware name	Function description
J1	Pin header	Check whether the device is installed properly and whether there is poor contact after installation.
J2	Network port	The ports are standard Ethernet RJ45 ports and are direction-insensitive. The port is used by the MD500-PN2 card to communicate with the PN card (PLC).
J3		
D5	Power supply indicator	Used to indicate the status of the power supply. ON: Normal OFF: Abnormal. Check whether the card is installed properly.
D1	PC communication status indicator (PLCLINK)	See Table 11-18 Description of MD500-PN2 card status indicators.
D4	Drive communication status indicator (DSPLINK)	

NOTE

- After the MD500-PN2 card is installed, J2 is on the left and J3 is on the right when you face the RJ45 interface. J2 and J3 are direction-insensitive. You can connect either one to the PLC.
- It is recommended to use shielded Cat 5e cables to ensure stable operation.
- For details about the PROFINET communication expansion card (MD500-PN2), see MD500-PN2 Communication Expansion Card User Guide (data code: 19012005).

Table 11-19 Status indicators of the MD500-PN2 card

Indicator		State	Function description
DSPLINK	Steady green	Normal	None
	Steady yellow	MAC address abnormal	Replace the PN card.
	Flashing yellow	Drive fault	Rectify the drive fault.
	Steady red	Error in communication with the drive	Set F0-28 to 1 and check whether the AC drive supports the MD500-PN1 card.
	Flashing red	Communication with the AC drive times out.	Check whether the AC drive software version supports the MD500-PN1 card. Restore the AC drive software to default settings.
PLCLINK	Steady green	No communication error	None
	Flashing green	Master not found	Check the configuration, and check whether a device name has been assigned to the slave. Check whether the corresponding PLC is connected.
	Steady yellow	Configuration error	Check whether the GSD is correct.
	Steady red	Communication with the master station is interrupted.	Check the wiring, and check whether the network cable shield is connected properly.
D1 and D4	Both in red	PN card software error	Power off and on the drive again. Replace the PN card.

11.2.5 EIP Communication Expansion Card (MD500-EN1)

As an EtherNet/IP fieldbus adapter that complies with EtherNet/IP bus standards, the EtherNet/IP communication expansion card (MD500-EN1 card for short) features high efficiency, flexible topology, and easy operation. It is installed on the CS710 series AC drive for cranes to improve the communication efficiency and implement the networking function, which enables the drive to become a slave controlled by the fieldbus master.

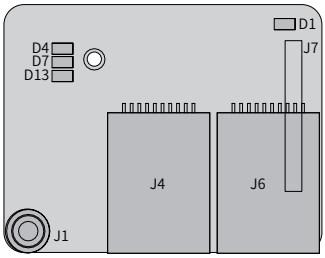


Figure 11-12 Terminal layout of MD500-EN1 card

Table 11-20 Descriptions of MD500-EN1 card terminals

Mark	Hardware name	Function description
J7	Pin header	Used to connect the drive.
J4	Network port	The ports are standard Ethernet RJ45 ports and are direction-insensitive. The MD500-EN1 card uses the ports to communicate with the EtherNet/IP master (or other slaves). The pin definition is consistent with the standard Ethernet pin definition. The crossed or straight cables are supported.
J6		
J1	EMC ground terminal	Used to connect the EMC grounding terminal of the drive.
D13	Power supply indicator (green)	Used to indicate the status of the power supply. ON: Normal OFF: Abnormal. Check whether the card is installed properly.
D1	Status indicator of communication with the AC drive (green)	See "Indicators of the MD500-EN1 card".
D4	Ethernet/IP master running indicator (green)	
D7	Ethernet/IP master fault indicator (red)	

Table 11-21 Indicators of the MD500-EN1 card

Indicator	State	Solution
D1 (green): steady on	Normal	None
D1 (green): off	Abnormal communication with the AC drive	Check that FD-00 is set to 9 and FD-01 is set to 3.
D4 (green): off; D7 (red): steady on	System fault	See the following AC drive fault codes and solutions.
D4 (green): off; D7 (red): blinking	Waiting for obtaining IP addresses	The DHCP function is enabled, and the expansion card is waiting for IP address assignment by using the BOOTP or DHCP.
D4 (green): blinking; D7 (red): blinking	The SI-EN card is disconnected or the connection times out.	Check whether the network cable is disconnected and whether the master is running.
D4 (green): blinking; D7 (red): off	Waiting for connecting to the master	Check whether the network cable is properly connected and whether the master is running.
D4 (green): steady on; D7 (red): off	Normal	None

11.2.6 EtherCAT Communication Card (MD500-ECAT)

As an EtherCAT fieldbus adapter that complies with EtherCAT bus standards, the EtherCAT communication expansion card (MD500-ECAT card for short) features high efficiency, flexible topology, and easy operation. It is installed on the CS710 series AC drive for cranes to improve the communication efficiency and implement the networking function, which enables the drive to become a slave controlled by the fieldbus master.

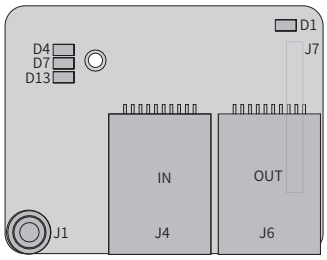


Figure 11-13 Terminal layout of MD500-ECAT card

Table 11-22 Descriptions of terminals and indicators

Mark	Hardware name	Function description
J7	Pin header	Used to connect the drive.

Mark	Hardware name	Function description
J4	Network port	The MD500-ECAT card provides two standard Ethernet RJ45 network ports J4 and J6 for communication with the master station (or previous slave station) and the next slave station (if any).
J6		
J1	EMC ground terminal	Used to connect the EMC grounding terminal of the drive.
D13	Power supply indicator (green)	Used to indicate the status of the power supply. ON: Normal OFF: Abnormal. Check whether the card is installed properly.
D1	Status indicator of communication with the AC drive (green)	See "Descriptions of MD500-ECAT status indicators".
D4	EtherCAT interaction indicator (green)	
D7	ESC fault indicator (red)	

Table 11-23 Descriptions of status indicators

Indicator		State	Solution
D1	Steady green	Normal	None
	Steady off	Abnormal communication with the AC drive	Set F0-28 to 1 and check whether the AC drive supports the MD500-ECAT card.
D4	Steady green	Working in the OP state	None
	Flashing green	The AC drive works in the PREOP/SAFEOP mode.	Check the configuration. Check whether the AC drive supports the MD500-ECAT card and whether F0-28 is set to 1. Check whether the network port is connected correctly.
	Steady off	The master station is not connected or the AC drive works in the Initial mode.	Check whether the master station and network port are connected correctly.
D7	Red indicator steady off	Normal	None
	Steady red	ESC internal fault	Contact Inovance or the agent for technical support.

11.2.7 PZD Process Data Description and Parameter Address Definition

1) Definition of the data in PZD area

Description of master-to-drive PZD

PZD1	bit0: Decelerate to stop; bit1: Coast to stop; bit2: Forward run; bit3: Reverse run bit4: Quick stop; bit5: Torque control bit6: Fault reset; bit7: Command valid bit8 to bit15: Reserved Note: For the PZD1 command to be effective, bit7 must be set to 1.
PZD2	It is used to set the target frequency of the AC drive. (The frequency reference source must be set to communication.) The frequency can be set in two different ways by bd.06. 1. When the least significant bit of bd.06 is set to 0, the target reference is set to a percentage (default mode). In this mode, the value range of the target reference is 0 to 10000, corresponding to 0.00% to 100.00% of the maximum frequency (positive and negative values not distinguished). 2. If the least significant bit of bd.06 is 0, the frequency ranges from 0 Hz to the maximum frequency (negative or positive).
PZD3 to PZD12	They are mapped to the PLC register by using parameter addresses. For example, the address of the B4.00 parameter is converted from 16#B400 to 10#46080 and then written into the PLC register.
PZD data sent by master	
PZD1	bit0: AC drive operating; bit1: Forward run; bit2: Reverse run; bit3: No fault; bit4: Coast to stop; bit5: No communication with the AC drive bit6: Frequency reached; bit7: Torque control valid bit8 to bit15: Reserved
PZD2	It indicates the AC drive running frequency. For example, if 2500 is returned, the AC drive running frequency is 25.00 Hz.
PZD3 to PZD12	PZD3 to PZD12 are used to return the current value of the corresponding parameter address. The address of the function parameter is set in bd.21 to bd.30. For example, if bd.21 is set to B5.01 and the value of B5.01 is 25.00, the value returned by PZD3 is 2500. The address of the function parameter can also be configured in the slave station properties (device-specific parameters) of the PLC. Once configured in the slave station properties, the address of the parameter specified by bd.21 to bd.30 will automatically be changed to that configured by the device-specific parameters. For details, see sub-section 4 "Device-specific Parameter Setting."

2） Definition of the data in PKW area

Master sending data PKW	
PKE	High 4 bits: command code 0: No request 1: Read function code parameter data 2: Modify function code parameter data Low 4 bits: Reserved Low 8 bits: high order of function code parameter address
IND	High 8 bits: low order of function code parameter address Eight lower bits: reserved
PWE	High 16 bits: Reserved Low 16 bits: not used in read request; indicating parameter value in write request
PKW data sent by the slave	
PKE	High 4 bits: response code 0: No request 1: Function code parameter operation correct 7: Cannot executed Low 8 bits: high order of function code parameter address
IND	High 8 bits: low order of function code parameter address Eight lower bits: reserved
PWE	Request successful: parameter value Request failed: Error code (consistent with standard Modbus) 1: invalid command 2: invalid address 3: Invalid data 4: Other errors

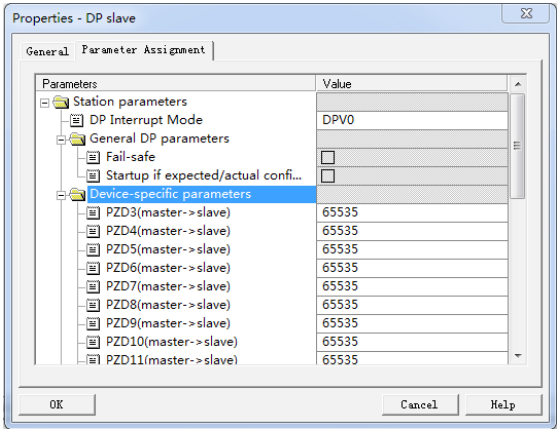
3） CS710 PROFIBUS DP Communication Parameter Address Definition

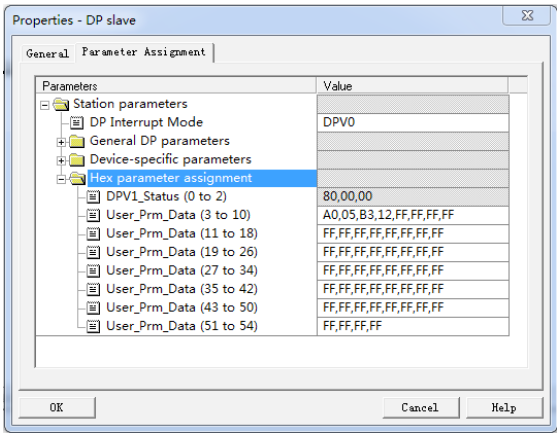
CS710 Parameter Address Definition	
Value range: A0.00 to FF.99	All parameter addresses of CS710 series AC drives are defined following a unified rule. That is, the group number of a parameter is the high bits of its address, and the hexadecimal value converted from the parameter number forms the low bits of the address. Example 1: The address of A0.05 (Rated motor speed) is A005. Example 2: The address of B3.18 is B312. Note: Addresses of parameters in group U start with D. For example, the address of U0.00 is D000, and the address of U0.12 is D00C.

4） Master parameter configuration

The device-specific parameters are in the slave properties, as shown below. Set the addresses of PZD3 to PZD12 in device-specific parameters.

See the parameter address in section 3. All the addresses are 65535 (0xffff in hexadecimal) by default. After you set these parameters, their values are displayed in the hexadecimal format.

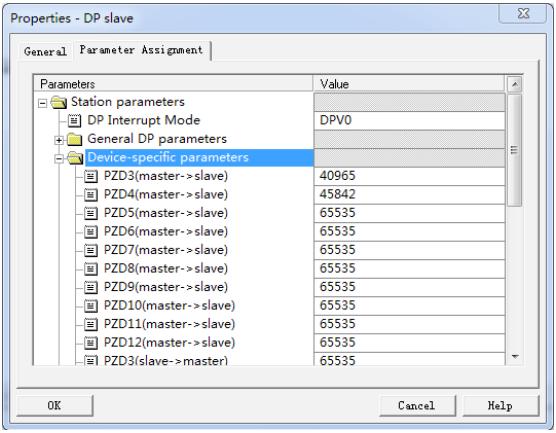


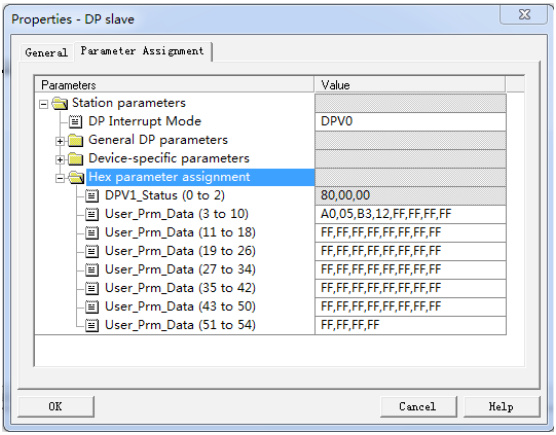


Write the value of A0.05 to PZD3 (master-to-slave) and B3.18 to PZD4.

Read the value of B5.00 in PZD3 and B5.01 in PZD4.

The address of A0.05 is 0xA005, which is 40965 in decimal. The address of B3.18 is 0xB312, which is 45842 in decimal. The address of B5.00 is 0xB500, which is 46336 in decimal. The address of B5.01 is 0xB501, which is 46337 in decimal. The corresponding settings are as follows.





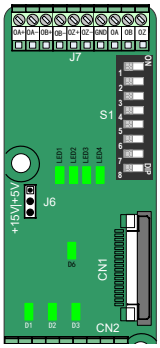
NOTE

If you set device-specific parameters, bd.11...bd.30 in the drive will be changed with the device-specific parameters every time upon power-on.

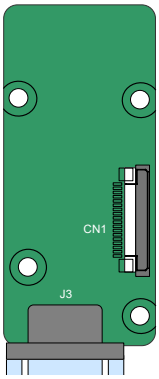
11.3 Encoder Expansion Cards

11.3.1 Specifications of Encoder Expansion Card

MD38PGMD



Specification of MD38PG6D	
Encoder power supply	5 V/200 mA, 15 V/100 mA
Maximum input frequency	Differential: 500 kHz; collector: 100 kHz
Encoder interface type	Differential, collector, push-pull
Type of frequency-division interface	Differential, collector
Cable specifications	16AWG to 26AWG. For details, see "Multi-function PG Card (MD38PGMD)".
Terminal spacing	3.5 mm
Terminal screw	Slotted
Terminal type	Angled terminal block
Frequency-division range	0 to 63

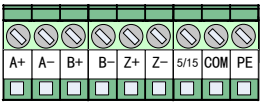
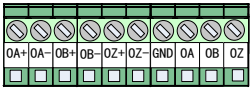


MD38PG4 Specification	
User interface	DB9 female connector
Pluggable	Yes
Cable specifications	> 22 AWG
Resolution	12-bit
Excitation Frequency	10 kHz
VRMS	7 V
VP-P	3.15±27%
Frequency-division range	Without frequency division

MD38PG4

11.3.2 Multi-functional PG Card (MD38PGMD)

Table 11-24 Function description of terminals in MD38PGMD

Mark		Function description	Terminal layout
CN2	A+	Encoder output A signal (+)	
	A-	Encoder output A signal (-)	
	B+	Encoder output signal B (+)	
	B-	Encoder output signal B (-)	
	Z+	Encoder output signal Z (+)	
	Z-	Encoder output Z signal (-)	
	5 V/15 V	5 V/15 V power supply of the encoder	
	COM	Encoder power supply ground	
	PE	Shield terminal	
J7	OA+	Differential frequency-division output A signal (+)	
	OA-	Differential frequency division output A signal (-)	
	OB+	Differential frequency-division output B signal (+)	
	OB-	Differential frequency division output B signal (-)	
	OZ+	Differential frequency division output Z signal (+)	
	OZ-	Differential frequency division output Z signal (-)	
	GND	Frequency-division output reference ground	
	OA	Collector frequency-division output A signal	
	OB	Collector frequency-division output B signal	
	OZ	Collector frequency-division output Z signal	
J6	Encoder power supply		-
CN1	18-pin flexible flat cable interface, connected to J4 on the control board of the AC drive		



To switch between the encoder power supply 5 V and 15 V, disconnect the power supply, and then select 5 V or 15 V as required by using the jumper. This can prevent damage to the encoder.

Table 11-25 Description of the DIP switch of MD38PGMD

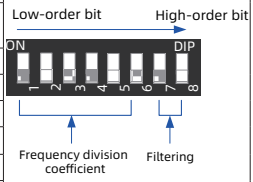
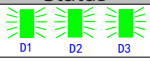
Filter Selection		Definition	Address setting						Value	Frequency-division coefficient	DIP switch
8	7		6	5	4	3	2	1			
0	0	Non-adaptive filter	0	0	0	0	0	0	Reserved	No output	
			0	0	0	0	0	1	1	1	
0	1	Adaptive filter	0	0	0	0	1	0	2	2	
			0	0	0	0	1	1	3	3	
1	0	Fixed interlock	...								
			1	1	1	1	0	1	61	61	
1	1	Automatic interlock	1	1	1	1	1	0	62	62	
			1	1	1	1	1	1	63	63	

Table 11-26 Description of MD38PGMD status indicators

Name	Indicator Status	Description
D1/D2/D3 Encoder input signal indicator		ON or flash: The encoder has signal input.
		OFF: The encoder does not have signal input.
D6 Power supply indicator		ON: Normal.
		OFF: Power is not connected.
LED1 Encoder input signal quality indicator		OFF: Input signal is normal, speed is stable and there is no interference.
		ON: Input signal is slightly instable, which occurs when motor accelerates/decelerates or encoder signal input suffers slight interference.
		Flash slowly: Input signal is moderately instable, which occurs when motor accelerates/decelerates or encoder signal input suffers moderate interference.
		Flash quickly: Input signal is seriously instable, which occurs when motor accelerates/decelerates quickly or encoder signal input suffers severe interference.
LED2 Signal processing quality indicator of PG card		OFF: The PG card signal is normal, the speed is stable and there is no interference.
		ON: Signal is slightly instable, which occurs when motor accelerates/decelerates or interference during signal input is not completely filtered (The number of interference pulses that are not filtered is less than 10 per time unit).
		Flash slowly: Signal is moderately instable, which occurs when motor accelerates/decelerates or interference during signal input is not completely filtered (The number of interference pulses that are not filtered is less than 30 per time unit).
		Flash quickly: Signal is seriously instable, which occurs when motor accelerates/decelerates or interference during signal input is not completely filtered (The number of interference pulses that are not filtered is more than 30 per time unit).
LED3 Inter-lock state indicator		OFF: Inter-lock disabled.
		ON: The interlock function is enabled.

Name	Indicator Status	Description
LED4 System state indicator		OFF: The system is not operating or abnormal.
		Flash: The encoder cable breaks.
		ON: Normal.

11.3.3 Resolver PG Card (MD38PG4)

Table 11-27 Function Description of MD38PG4 Terminals

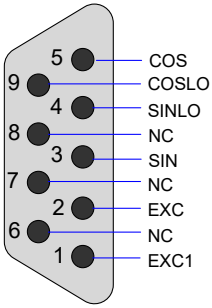
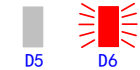
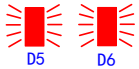
Mark	Pin No.	Pin assignment	Function description	Terminal layout
J3	1	EXC1	Resolver excitation (-)	
	2	Resolver excitation (+)	Resolver excitation (+)	
	3	SIN	Resolver feedback SIN (positive)	
	4	SINLO	Resolver feedback SIN (negative)	
	5	COS	Resolver feedback COS positive	
	6, 7, 8	NC	Not connected internally	
	9	COSLO	Resolver feedback COS positive	
CN1	18-pin flexible flat cable interface, connected to J4 on the control board of the AC drive			

Table 11-28 Description of status indicator of MD38PG4

Fault indicator	MD38PG4 Fault Status	Cause and Solution
	Normal	None
	The phase-lock loop is unlocked.	Phase lag of the resolver is large.
	The signal SIN/COS amplitude exceeds the upper limit.	A flashing D6 generally indicates interferences are present. Ground the motor properly and connect the ground point of the PG card to the PE terminal of the AC drive.
	The signal SIN/COS amplitude is too small.	This is usually caused by an improperly-connected or disconnected DB9. If the DB9 is connected properly, check whether the resolver model matches MD38PG4.

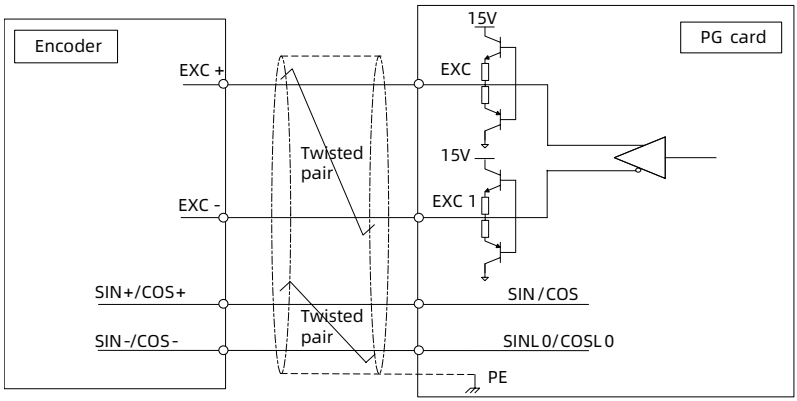


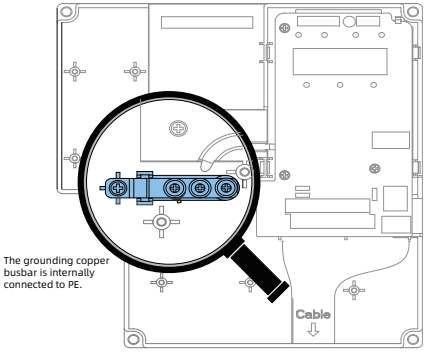
Figure 11-14 interface circuit on MD38PG4

NOTE

- The resolver model must fulfill the parameter requirements of MD38PG4, and the DC current resistance input of excitation must be larger than 17 Ω (measured by a multimeter). Otherwise, MD38PG4 cannot work properly;
- It is recommended to select a resolver with a maximum of four pole-pairs. Otherwise, MD38PG4 may be overloaded.

11.3.4 Grounding for PG Card Shield

If PG card feedback speed or position is unstable but the parameter settings are correct, it indicates the PG card suffers electromagnetic interference. In this case, connect the shield of encoder signal lines to the PE of the AC drive to control the electromagnetic interference.



CS710 has a grounding structure. After a PG card is installed, the PE terminal of the PG card can be connected to the AC drive internally. When connecting an encoder, connect

the shield of the signal cable to the PE terminal of the PG card to complete the shield grounding.

To install the PG card, remove the screw in the amplified position as shown in the following figure, align the other three fixing pillars (on the left of the amplified position), and fix the PG card with the M3 x 8 screws one by one.

11.3.5 EMC Guidance

1) During on-site installation and commissioning, route the signal cables (such as encoder cables) and power cables through different routes. Never bundle the signal cables and power cables together to prevent interference to the encoder.

2) Connect the motor housing to the PE terminal of the AC drive. Meanwhile, connect the grounding cable on the motor housing side properly. Failure to comply will result in poor grounding effect.

3) It is recommended to use shielded twisted pair cables. For differential encoders, connect the twisted pair cables based on the differential pairs, and connect the shield to the ground terminal (PE terminal) of the AC drive.

4) For large equipment applications where the AC drive is far away from the motor and the motor cable is longer than 10 m, grounding effect may be deteriorated due to cable inductance. In this case, encoder shield need not be connected to the PE terminal of AC drive.

5) Users can determine whether the MD38PGMD card input suffers from interference by checking the status indicator on the PG card. See the descriptions of the status indicator for details.

12 Compliance

The following table lists the certifications, directives, and standards that the product may comply with. For details about the acquired certificates, see the certification marks on the product nameplate.

Certification	Directive		Standard
CE	EMC directive	2014/30/EU	EN IEC 61800-3
	LVD directive	2014/35/EU	EN 61800-5-1
	RoHS directive	2011/65/EU	EN 50581
UL/cUL Certification	-		UL61800-5-1 C22.2 No.274-17



The three-phase 380 V to 480 V and single-phase 200 V to 240 V products meet the requirements of the latest instructions and standards of the CE/UL/cUL certification.

Appendix A Modbus Communication Protocol

CS710 series AC drives provide the RS232/RS485 interfaces and support the Modbus communication protocol. You can carry out centralized control through a PC or PLC and set the operation commands, modify or read parameters, and read the operating status and fault information of the drive through the communication protocol.

A.1 Data Rules

This protocol defines the content and format of transmitted messages during serial communication. including the master polling (or broadcasting) format and master coding method (parameter for the action, transmitted data, and error check). The slave uses the same structure for response, including action acknowledgment, data return, and error check. If an error occurs when the slave receives a message, or the slave cannot perform the action required by the master, the slave returns a fault message as a response to the master.

1 Application mode

The AC drive is connected to a PC/PLC control network with RS232/RS485 buses. The network consists of one master and multiple slaves.

2. Bus structure

● Interface type

RS232/RS485 hardware interface

● Transmission mode

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

● Topology

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

3 Protocol description

The CS710 series AC drive uses the master/slave Modbus protocol in asynchronous serial communication mode. In a network, only one device (master) can initiate communication (query/command). Other devices (slaves) can only respond to the "inquiry/command" from the master by providing the data or act accordingly based on the "inquiry/command" from the master. The master may be a PC, an industrial device, or a PLC, and a slave is a CS710 series AC drive. The master can communicate with a single slave or send broadcast messages to all slaves. The slave needs to return a message (response) to "query/command" from the master. For a broadcast message sent by the master, the slave does not need to return a response to the master.

4. Communication data structure

The data format defined by the Modbus protocol for the CS710 series AC drive is as follows:

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

The entire message frame must be transmitted as a continuous stream. If a silent interval of longer than 1.5-byte 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-byte time following a previous message, the receiving device considers the new message as a continuation of the previous message. This will lead to an error, as the value in the final cyclical redundancy check (CRC) field is incorrect.

● RTU frame format

Data content	Description
Frame header	3.5-byte time
Slave address	Communication address: 0 to 247
Command code	03H: Read the slave parameters 06H: Write the slave parameters
Data content (N-1)	Indicates the parameter address, number of parameters, and parameter values.
Data content (N-2)	
...	
Data content 0	
CRC CHK low order	Detection value: CRC value
High-order bit of CRC CHK	
Frame trailer	3.5-byte time

● Example of reading slave parameters

Example: Reading the value of two consecutive parameters starting from F0.02

Data sent by master

Data Name	Data content	Description
Slave address	01 h	Defined by bD.02
Command code	03H	Read command
Eight upper bits of the starting address	F0H	Reading from parameter F0.02
Eight lower bits of the starting address	02H	
Read eight upper bits of the data	00H	Read two data entries in total
Read eight low bits of data quantity	02H	
CRC, CHK lower bit	CRC CHK value to be calculated	-
CRC, CHK upper bit		

Response from the slave

Data Name	Data content	Description
Slave address	01 h	Same as the data sent by the master
Command code	03H	Same as the data sent by the master

Data Name	Data content	Description
Reading the total number of data bytes	04H	Number of data sent by the master x 2
High bit of Address F002H	00H	Value of F0.02
Low bit of Address F002H	00H	
High bits of address F003H	00H	Value of parameter F0.03
Low bits of address F003H	01 h	
CRC CHK low order	CRC CHK value to be calculated	-
High-order bit of CRC CHK		

● Example of writing slave parameters

Write 1388H into 1000AH of the AC drive whose slave address is 02H.

Data sent by master

Data Name	Data content	Description
Slave address	02H	Defined by bD.02
Command code	06H	Write command
Write the upper bit of the address	10H	Write data into the register address 1000H
Write the lower bit of the address	00H	
Write the upper bit of the content	13H	Write the value of 1388H into the register address 1000H
Write the lower bit of the content	88H	
CRC CHK low order	CRC CHK value to be calculated	
CRC CHK upper bit		

The response data of the slave is the same as the data sent by the master.

5. Check mode

The CRC check (Cyclical Redundancy Check) is applied for data check.

In RTU frame format, a message includes a CRC-based error-check field. The CRC field detects the content of the entire message. The CRC field consists of two bytes, including a 16-bit binary value. It is added to the message after being calculated by the transmission device. The reception device recalculates CRC of received messages that is compared with the value in the received CRC domain. If both CRC values are unequal, it indicates that a transmission error occurs.

The CRC calculation initializes the register with 0xFFFF, then executes a process that sequentially processes consecutive 8-bit bytes of the message using the current register value. Only the 8-bit data in each character is valid for the CRC. The start bit, stop bit and the parity bit do not apply to the CRC.
During the production process of CRC, each combination of eight bits is exclusive OR (XOR) with the register value. Then the result is shifted toward the least significant bit, with a zero filled into the most significant bit. The LSB is extracted and examined. If the LSB is 1, the register then performs XOR with a preset value. If the LSB is 0, no XOR is performed. This process is repeated until eight shifts have been performed. After the last (8th) 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 in the register, after all the bytes in the message have been applied, is the CRC value.
When appending the CRC to the message, the low-order byte is transmitted first, followed by the high-order byte. The CRC simple function is as follows.

```
unsigned int crc_chk_value(unsigned char *data_value,unsigned char length)
{
        unsigned int crc_value=0xFFFF;
        int i;
        while(length--)
        {
                crc_value^=*data_value++;
                for(i=0;i<8;i++)
                {
                        if(crc_value&0x0001)
                        {
                                crc_value=(crc_value>>1)^0xa001;
                        }
                        else
                        {
                                crc_value=crc_value>>1;
                        }
                }
        }
        return(crc_value);
}
```

A.2 Definition of the Data Address

This section describes the communication data used to control the running, status, and parameter setting of the AC drive.

Some parameters cannot be changed, and can only be used by the manufacturer or for monitoring.

1. Rules for marking the parameter address:

The group numbers and identifiers of parameters are used for indicating the parameter

address.

Menu	Function parameter group	Upper byte	Lower byte
Level 1 menu	Groups A0 to AF	A0 to AF	00 to FF
Level 2 menu	Groups b0 to bF	b0 to bF	00 to FF
	Groups U0 to U1	d0 to d1	00 to FF
	Groups E0 to EF	E0 to EF	00 to FF
Level 3 menu	Groups F0 to FF	F0 to FF	00 to FF

For example, the address of bF.12 is indicated as bF0C.



Certain parameters cannot be modified when the AC drive is running. Certain parameter cannot be modified regardless of the state of the AC drive. Pay attention to the parameter range, unit, and related description when modifying parameters.

2 Frequency reference setting (read-only):

Parameter address	Command function
1000H	Communication setting value (0 to 10000, decimal)



The communication setting value is a percentage. The value 10000 maps to 100.00% of the maximum frequency (b1.02).

3 Control command input to the AC drive (write only):

Command word address	Command function
2000H	0001: Forward run
	0002: Reverse run
	0005: Coast to stop
	0006: Stop as defined by F6-10
	0007: Fault reset
	0008: Quick stop

4 Read AC drive status (read-only):

Command word address	Command function
3000H	0：Stop
	bit0: Forward
	bit1:: Reverse
	bit2:: Fault

5: Present fault code (read-only)

Command word address	Command function
8000H	Displays current AC drive fault. For details, see "8.5 Error Codes and Solutions."

6 Format of Communication Error Messages (Response from the Slave)

Data Name	Data content	Description
Data 1	Slave address	Communication address
Data 2	Command code+0x80	When a communication error occurs, the slave returns an error message frame. The command code of this frame is the read or write command code plus 0x80.
Data 3	Error code	Explanation of the error code: 01: Command code error 02: Address error; 03: Data error 04: Commands cannot be processed.
Data 4	Low bit of CRC code	CRC check
Data 5	High bit of CRC code	

Appendix B EMC

B.1 Definition of Terms

1) Electromagnetic compatibility (EMC) describes the ability of electronic and electrical devices or systems to work properly in the electromagnetic environment and not to generate electromagnetic interference that influences other local devices or systems. In other words, EMC includes two aspects: The electromagnetic interference generated by a device or system must be restricted within a certain limit; the device or system must have sufficient immunity to the electromagnetic interference in the environment.

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

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

4) C1 equipment: Power drive systems with the rated voltage less than 1000 V, intended for use in the first environment:

5) C2 equipment: PDS with the rated voltage lower than 1000 V, which is neither a plug-in device nor a movable device and is intended to be installed and commissioned only by professionals when used in the first environment.

6) C3 equipment: PDS with the rated voltage lower than 1000 V, which is intended for use in the second environment and not intended for use in the first environment

7) C4 equipment: PDS with the rated voltage equal to or higher than 1000 V or rated current equal to or higher than 400 A, or intended for use in complex systems in the second environment

B.2 EMC Standards

B.2.1 EMC Standards

CS710 series AC drives comply with EN IEC 61800-3 Category C2, and are applicable to both the first and second environments.

B.2.2 EMC Requirements for the Installation Environment

The manufacturer of the system installed with the AC drive is responsible for compliance of the system with the European EMC directive and standard EN IEC 61800-3 Category C2, C3, or C4 according to the system application environment.

Machines and devices used in combination with this AC drive must also be CE certified and marked. The manufacturer who integrates the AC drive with the CE mark into other devices has the responsibility of ensuring compliance with European directives and verifying that conditions meet requirements of EN IEC 61800-3 Category C2.



When applied in the first environment, the AC drive may generate radio interference. Besides the CE compliance described in this chapter, take measures to avoid the radio interference if required.

B.3 Selection of Peripheral EMC Devices

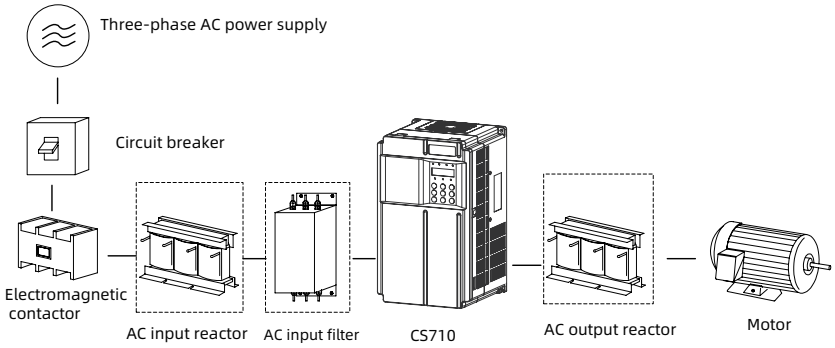


Figure B-1 Installation of EMC peripherals (as shown by the dotted line frame)

B.3.1 Installation of EMC Input Filter on Power Input Side

To comply with the radiated and conducted emission requirements of EN IEC 61800-3, install the EMC filter listed in the following table. The following EMC filters can be used. For 132 kW to 400 kW AC drives, built-in filters can meet requirements of EN IEC 61800-3 Category C3. Therefore, external filters are not required.

Table B-1 Standard EMC filter model and appearance

Filter model		Appearance
Schaffner series (Schaffner)	FN2090	
	FN 3258 series	
	FN 3359 series	
Jianli series (JIANLI)	EBK series	

Models and dimensions of Schaffner filters

Table B-2 Selection of Schaffner filters (three phase 380-480 V)

Model	Rated power (kW)	Rated current (A)	Filter model	Power consumption (W)
CS710-4T0.4GB	0.4	1.8	FN 3258-7-44	3.8
CS710-4T0.7GB	0.7	2.4	FN 3258-7-44	3.8
CS710-4T1.1GB	1.1	3.7	FN 3258-7-44	3.8
CS710-4T1.5GB	1.5	4.6	FN 3258-7-44	3.8
CS710-4T2.2GB	2.2	6.3	FN 3258-7-44	3.8
CS710-4T3.0GB	3.0	9.0	FN 3258-16-44	6.1
CS710-4T3.7GB	3.7	11.4	FN 3258-16-44	6.1
CS710-4T5.5GB	5.5	16.7	FN 3258-30-44	11.8
CS710-4T7.5GB	7.5	21.9	FN 3258-30-44	11.8
CS710-4T11GB	11	32.2	FN 3258-42-44	15.7
CS710-4T15GB	15	41.3	FN 3258-42-44	15.7
CS710-4T18.5GB(-T)	18.5	49.5	FN 3258-55-44	25.9
CS710-4T22GB(-T)	22	59.0	FN 3258-75-44	31.2
CS710-4T30GB	30	57.0	FN 3258-75-44	32.2
CS710-4T37GB	37	69.0	FN 3258-75-44	32.2
CS710-4T45GB	45	89	FN 3258-100-44	34.5
CS710-4T55GB	55	106	FN 3258-130-44	43.1
CS710-4T75GB	75	139	FN 3258-180-44	58.3
CS710-4T90G	90	164	FN 3258-180-44	58.3

Model	Rated power (kW)	Rated current (A)	Filter model	Power consumption (W)
CS710-4T110G	110	196	FN 3258-250-28	49
CS710-4T132G	132	240	FN 3258-250-28	49
CS710-4T160G	160	287	FN 3258-320-99	19
CS710-4T200G	200	365	FN 3359-400-99	29
CS710-4T220G	220	410	FN 3359-600-99	44
CS710-4T250G	250	441	FN 3359-600-99	44
CS710-4T280G	280	495	FN 3359-600-99	44
CS710-4T315G	315	560	FN 3359-600-99	44
CS710-4T355G	355	617	FN 3359-800-99	39
CS710-4T400G	400	687	FN 3359-800-99	39

Dimensions of FN 2090 series filters (8 A to 12 A)

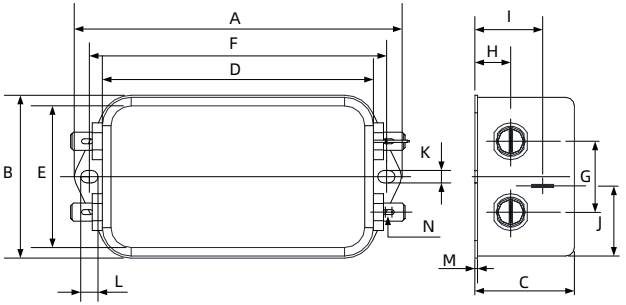


Figure B-2 Dimension drawing of FN 2090 series filters (8 A to 12 A)

Table B-3 Dimensions of FN 2090 series filters (8 A to 12 A, unit: mm)

Reactor model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
FN2090-8-06	113.5	57.5	45.4	94	56	103	25	12.4	32.4	15.5	4.4	6	0.9	6.3 × 0.8
FN 2090-12-06	113.5	57.5	45.4	94	56	103	25	12.4	32.4	15.5	4.4	6	0.9	6.3 × 0.8

The following figure shows the dimensions of FN 2090 series filters (20 A to 30 A).

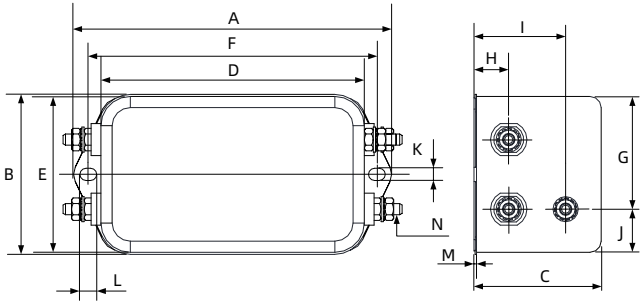


Figure B-3 Dimension drawing of FN 2090 series filters (20 A to 30 A)

Table B-4 Dimensions of FN 2090 series filters (20 A to 30 A, unit: mm)

Reactor model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
FN 2090-20-08	113.5	57.5	45.4	94	56	103	25	12.4	32.4	15.5	4.4	6	0.9	M4
FN 2090-30-08	113.5	57.5	45.4	94	56	103	25	12.4	32.4	15.5	4.4	6	0.9	M4

Dimensions of FN 3258 series filters (50 A to 180 A)

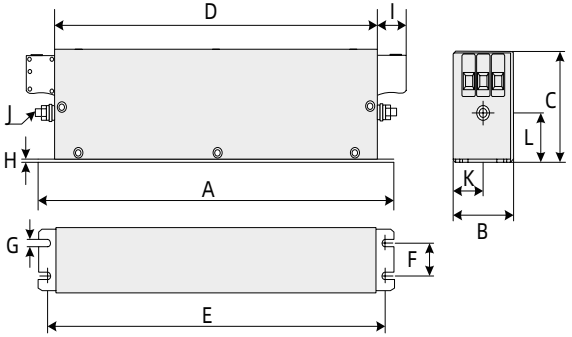


Figure B-4 Dimension drawing of FN 3258 series filters (50 A to 180 A)

Table B-5 Dimensions of FN 3258 series filters (50 A to 180 A, unit: mm)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L
7	190	40	70	160	180	20	4.5	1	22	M5	20	29.5
16	250	45	70	220	235	25	5.4	1	22	M5	22.5	29.5
30	270	50	85	240	255	30	5.4	1	25	M5	25	39.5
42	310	50	85	280	295	30	5.4	1	25	M6	25	37.5
55	250	85	90	220	235	60	5.4	1	39	M6	42.5	26.5
75	270	80	135	240	255	60	6.5	1.5	39	M6	40	70.5
100	270	90	150	240	255	65	6.5	1.5	45	M1	45	64
130	270	90	150	240	255	65	6.5	1.5	45	M10	45	64
180	380	120	170	350	365	102	6.5	1.5	51	M10	60	47

The following figure shows the dimensions of FN 3359 series filters (150 A to 250 A).

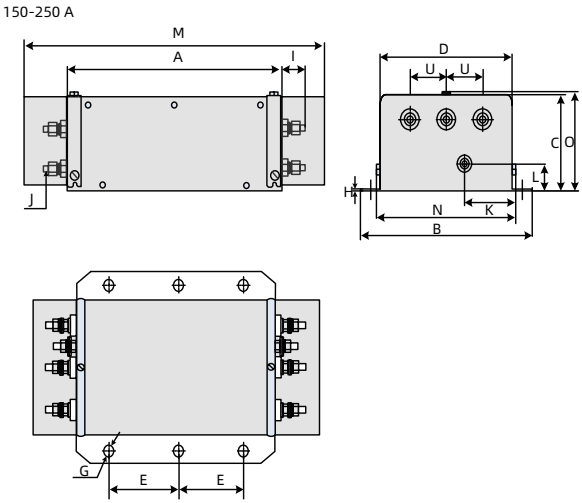


Figure B-5 Dimension drawing of FN 3359 series filters (150 A to 250 A)

Table B-6 Dimensions of FN 3359 series filters (150 A to 250 A, unit: mm)

Symbol	Rated current		
	150 A	180 A	250 A
A	300	300	300
B	210	210	230
C	120	120	125
D	160	160	180
E	120	120	120
F	185	185	205
G	ϕ12	ϕ12	ϕ12
H	2	2	2
I	33	33	33
J	M10	M10	M10
K	55	55	62.5
L	30	30	35
M	420	420	420
N	171	171	191
O	127	127	132
S	-	-	-
T	-	-	-
U	50	50	55
V	-	-	-
W	-	-	-
X	-	-	-
Y	-	-	-
Z	-	-	-

The following figure shows the dimensions of FN 3359 series filters (320 A to 2500 A).

320-2500 A

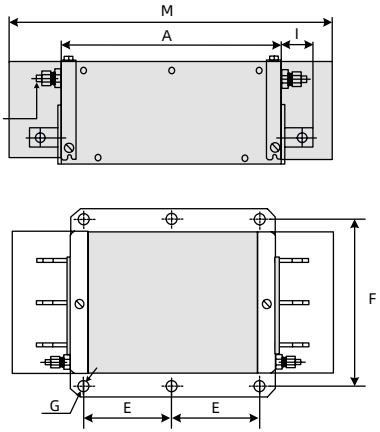


Figure B-6 Dimensions of FN 3359 series filters (320 A to 2500 A)

Dimensions of grounding copper busbar

320-1000 A

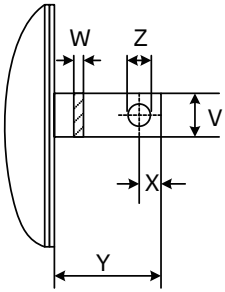


Figure B-7 Dimensions of grounding copper busbar

Table B-7 Dimensions of FN 3359 series filters (320 A to 2500 A, unit: mm)

Symbol	Rated current						
	320 A	400 A	600 A	800 A	1000 A	1600 A	2500 A
A	300	300	300	350	350	400	600
B	260	260	260	280	280	300	370
C	115	115	135	170	170	160	200
D	210	210	210	230	230	250	300
E	120	120	120	145	145	170	250
F	235	235	235	255	255	275	330
G	ϕ12	ϕ12	ϕ12	ϕ12	ϕ12	ϕ12	Φ14
H	2	2	2	3	3	3	3
I	43	43	43	53	53	93	98

Symbol	Rated current						
	320 A	400 A	600 A	800 A	1000 A	1600 A	2500 A
J	M12	M12	M12	M12	M12	M12	M16
K	20	20	20	25	25	25	25
L	20	20	20	25	25	25	25
M	440	440	440	510	510	-	-
N	221	221	221	241	241	-	-
O	122	122	142	177	177	-	-
S	-	-	-	-	-	26	35
T	-	-	-	-	-	26	35
U	60	60	60	60	60	60	100
V	25	25	25	40	40	60	70
W	6	6	8	8	8	10	15
X	15	15	15	20	20	17	20
Y	40	40	40	50	50	90	95
Z	Φ10.5	Φ10.5	Φ10.5	Φ14	Φ14	Φ14	Φ14

Models and dimensions of Jianli filters

Table B-8 Selection of Jianli filters (three-phase 380-480 V)

Model	Rated power (kW)	Rated current (A)	Filter model	Power consumption (W)
CS710-4T0.4GB	0.4	1.8	DL-5EBK5	6.9
CS710-4T0.7GB	0.7	2.4	DL-5EBK5	6.9
CS710-4T1.1GB	1.1	3.7	DL-5EBK5	6.9
CS710-4T1.5GB	1.5	4.6	DL-5EBK5	6.9
CS710-4T2.2GB	2.2	6.3	DL-10EBK5	6.9
CS710-4T3.0GB	3.0	9.0	DL-10EBK5	6.9
CS710-4T3.7GB	3.7	11.4	DL-16EBK5	8.5
CS710-4T5.5GB	5.5	16.7	DL-25EBK5	9.4
CS710-4T7.5GB	7.5	21.9	DL-25EBK5	11
CS710-4T11GB	11	32.2	DL-35EBK5	19.2
CS710-4T15GB	15	41.3	DL-50EBK5	21.7
CS710-4T18.5GB(-T)	18.5	49.5	DL-50EBK5	21.7
CS710-4T22GB(-T)	22	59.0	DL-65EBK5	27.4
CS710-4T30GB	30	57.0	DL-65EBK5	27.4
CS710-4T37GB	37	69.0	DL-80EBK5	32.6
CS710-4T45GB	45	89	DL-100EBK5	33
CS710-4T55GB	55	106	DL-130EBK5	37.5
CS710-4T75GB	75	139	DL-160EBK5	38.4
CS710-4T90G	90	164	DL-200EBK5	34
CS710-4T110G	110	196	DL-250EBK5	49
CS710-4T132G	132	240	DL-300EBK3	49
CS710-4T160G	160	287	DL-400EBK3	19
CS710-4T200G	200	365	DL-400EBK3	29
CS710-4T220G	220	410	DL-600EBK3	44
CS710-4T250G	250	441	DL-600EBK3	44
CS710-4T280G	280	495	DL-600EBK3	44
CS710-4T315G	315	560	DL-600EBK3	44

Model	Rated power (kW)	Rated current (A)	Filter model	Power consumption (W)
CS710-4T355G	355	617	DL-700EBK3	39
CS710-4T400G	400	687	DL-700EBK3	39

Dimensions of Jianli filters (10 A to 30 A)

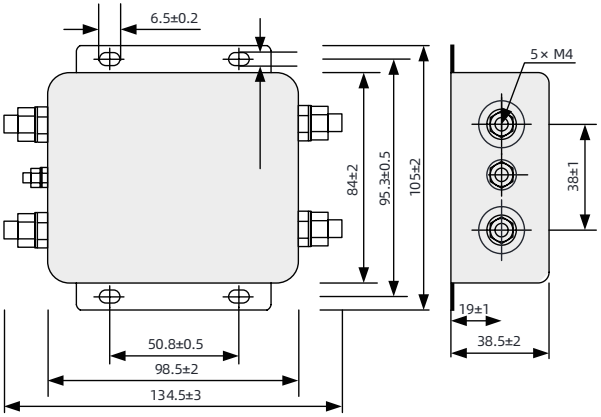


Figure B-8 Dimensions of Jianli filters (10 A)

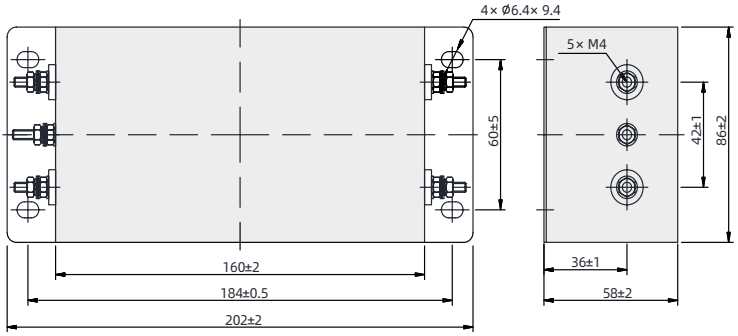


Figure B-9 Dimensions of Jianli filters (20 A to 30 A, unit: mm)

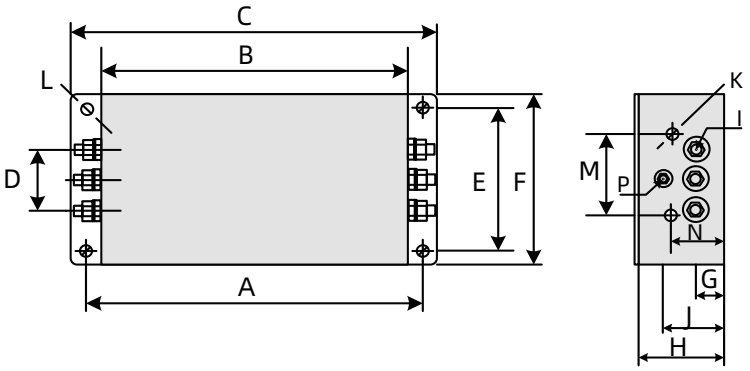


Figure B-10 Dimensions of Jianli filters (50 A to 200 A, unit: mm)

Table B-9 Dimensions of Jianli filters (50 A to 200 A, unit: mm)

Model	A	B	C	D	E	F	G	H	I	J	K	M	N	P	L
DL-25EBK5	243	224	265	58	70	102	25	92	M6	58	M4	74	49	M6	6.4x9.4
DL-35EBK5															
DL-50EBK5															
DL-65EBK5															
DL-80EBK5	354	323	388	66	155	188	30	92	M8	62	M4	86	56	M8	6.4x9.4
DL-100EBK5															
DL-130EBK5															
DL-160EBK5															
DL-200EBK5															

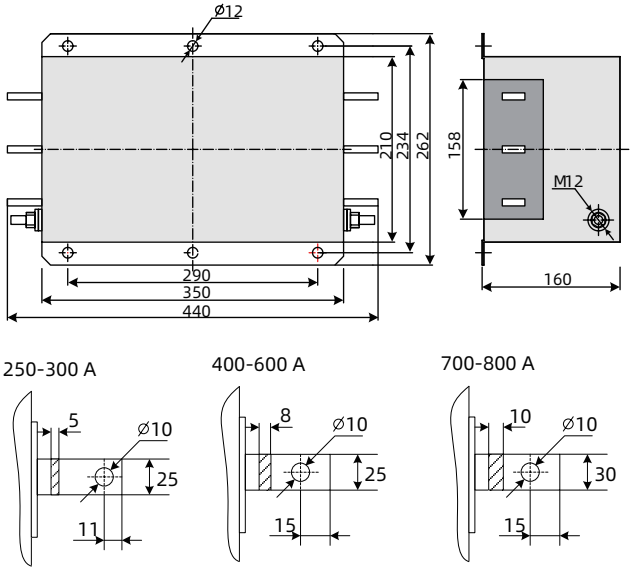


Figure B-11 Dimensions of Jianli filters (250-800 A, unit: mm)

Dimensions of Jianli filters (1000 A)

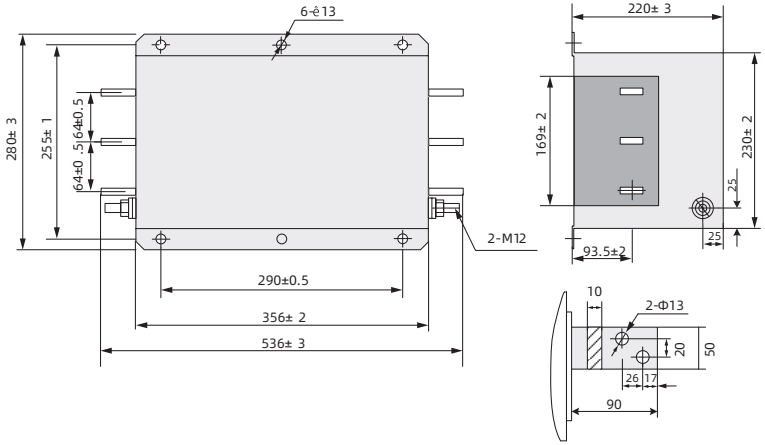


Figure B-12 Dimensions of Jianli filters (1000 A, unit: mm)

An EMC filter installed between the drive and the power supply can not only restrict the interference of electromagnetic noise in the surrounding environment on the controller, but also prevent the interference from the controller on the surrounding equipment. The CS710 series AC drive meets the requirements of Category C2 only with an EMC filter installed on the power input side. The installation precautions are as follows:

- Strictly comply with the ratings when using the EMC filter. The EMC filter is category I electric apparatus, and therefore, the metal housing ground of the filter should be in good contact with the metal ground of the installation cabinet in a large area, and requires good conductive continuity. Otherwise, it will result in electric shock or poor EMC effect.
- The filter GND and the PE GND of the drive must be connected to the same common GND. Failure to comply can affect the EMC effect seriously.
- Install the EMC filter as closely as possible to the power input side of the controller.

1) Installation of the simple filter:

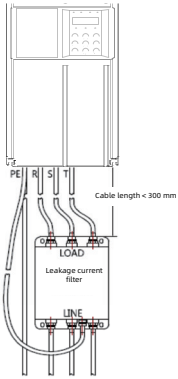


Figure B-13 Simple filter installation

2) Amorphous magnetic ring

Installing the amorphous magnetic ring on input lines R/S/T or output lines U/V/W of the AC drive can improve the EMC performance.

The magnetic ring is shown as follows.



Figure B-14 Appearance of the amorphous core

Select a proper magnetic ring based on the I/O cables used.

Table B-10 List of amorphous core models

Magnetic ring model	No.	Dimension (outer diameter x inner diameter x thickness) (unit: mm)
DY644020H	11013031	64 × 40 × 20
DY805020H	11013032	80 × 50 × 20
DY1207030H	11013033	120 × 70 × 30

B.3.2 Installing the AC Input Reactor on Power Input Side

The AC input reactor is an option used to suppress the harmonics in the input current. In applications where harmonics need to be suppressed, install an external AC input reactor. The following table lists the recommended manufacturers and models of input reactors.

Table B-11 Recommended manufacturers and models of AC input reactors

AC drive model	Inovance AC input reactor model
CS710-4T0.4GB	MD-ACL-10-5-4T
CS710-4T0.7GB	MD-ACL-10-5-4T
CS710-4T1.1GB	MD-ACL-10-5-4T
CS710-4T1.5GB	MD-ACL-10-5-4T
CS710-4T2.2GB	MD-ACL-10-5-4T
CS710-4T3.0GB	MD-ACL-10-5-4T
CS710-4T3.7GB	MD-ACL-15-3-4T
CS710-4T5.5GB	MD-ACL-15-3-4T
CS710-4T7.5GB	MD-ACL-40-1.45-4T
CS710-4T11GB	MD-ACL-40-1.45-4T
CS710-4T15GB	MD-ACL-50-1.2-4T
CS710-4T18.5GB(-T)	MD-ACL-50-0.28-4T-2%
CS710-4T22GB(-T)	MD-ACL-60-0.24-4T-2%
CS710-4T30GB	MD-ACL-90-0.16-4T-2%
CS710-4T37GB	MD-ACL-90-0.16-4T-2%
CS710-4T45GB	MD-ACL-120-0.12-4T-2%
CS710-4T55GB	MD-ACL-150-0.095-4T-2%
CS710-4T75GB	MD-ACL-200-0.07-4T-2%
CS710-4T90G	MD-ACL-250-0.056-4T-2%
CS710-4T110G	MD-ACL-250-0.056-4T-2%
CS710-4T132G	MD-ACL-330-0.042-4T-2%
CS710-4T160G	MD-ACL-330-0.042-4T-2%

AC drive model	Inovance AC input reactor model
CS710-4T200G	MD-ACL-490-0.028-4T-2%
CS710-4T220G	MD-ACL-490-0.028-4T-2%
CS710-4T250G	MD-ACL-490-0.028-4T-2%
CS710-4T280G	MD-ACL-660-0.021-4T-2%
CS710-4T315G	MD-ACL-660-0.021-4T-2%
CS710-4T355G	MD-ACL-800-0.017-4T-2%
CS710-4T400G	MD-ACL-800-0.017-4T-2%

B.3.3 Installation of an AC Output Reactor on the Power Input Side

Whether to install an AC output reactor on the output side depends on actual situations. The cable between the drive and motor cannot be excessively long. Otherwise, the distributed capacitance increases, which can result in high-order harmonic current.

Install an AC output reactor when the cables are too long. When the cable length is greater than or equal to the recommended value in the following table, install an AC output reactor around the AC drive.

Table B-12 Minimum length of the cable for output reactor

AC drive power (kW)	Rated voltage (V)	Minimum Length of Cables Requiring Output Reactors (m) Minimum cable length (m)
0.4 to 4	200 to 500	50
5.5	200 to 500	70
7.5	200 to 500	100
11	200 to 500	110
15	200 to 500	125
18.5	200 to 500	135
22	200 to 500	150
≥ 30	280 to 690	150

The recommended AC output reactor models are listed in the following table.

Table B-13 Recommended models of Inovance AC output reactors

AC drive model	Inovance AC output reactor model
CS710-4T0.4GB	MD-OCL-5-1.4-4T-1%
CS710-4T0.7GB	MD-OCL-5-1.4-4T-1%
CS710-4T1.1GB	MD-OCL-5-1.4-4T-1%
CS710-4T1.5GB	MD-OCL-5-1.4-4T-1%
CS710-4T2.2GB	MD-OCL-7-1.0-4T-1%
CS710-4T3.0GB	MD-OCL-10-0.7-4T-1%
CS710-4T3.7GB	MD-OCL-10-0.7-4T-1%
CS710-4T5.5GB	MD-OCL-15-0.47-4T-1%
CS710-4T7.5GB	MD-OCL-20-0.35-4T-1%
CS710-4T11GB	MD-OCL-30-0.23-4T-1%
CS710-4T15GB	MD-OCL-40-0.18-4T-1%
CS710-4T18.5GB(-T)	MD-OCL-50-0.14-4T-1%
CS710-4T22GB(-T)	MD-OCL-60-0.12-4T-1%

AC drive model	Inovance AC output reactor model
CS710-4T30GB	MD-OCL-80-0.087-4T-1%
CS710-4T37GB	MD-OCL-90-0.078-4T-1%
CS710-4T45GB	MD-OCL-120-0.058-4T-1%
CS710-4T55GB	MD-OCL-120-0.058-4T-1%
CS710-4T75GB	MD-OCL-200-0.035-4T-1%
CS710-4T90G	MD-OCL-250-0.028-4T-1%
CS710-4T110G	MD-OCL-250-0.028-4T-1%
CS710-4T132G	MD-OCL-330-0.021-4T-1%
CS710-4T160G	MD-OCL-330-0.021-4T-1%
CS710-4T200G	MD-OCL-490-0.014-4T-1%
CS710-4T220G	MD-OCL-490-0.014-4T-1%
CS710-4T250G	MD-OCL-490-0.014-4T-1%
CS710-4T280G	MD-OCL-660-0.011-4T-1%
CS710-4T315G	MD-OCL-660-0.011-4T-1%
CS710-4T355G	MD-OCL-800-0.0087-4T-1%
CS710-4T400G	MD-OCL-800-0.0087-4T-1%

B.4 Shielded Cables

B.4.1 Requirements for Shielded Cables

Shielded cables must be used to satisfy the EMC requirements. Shielded cables are classified into three-conductor cable and four-conductor cable. If conductivity of cable shield is not sufficient, add an independent PE cable. or use a four-conductor cable, of which one phase conductor is PE cable as shown below.

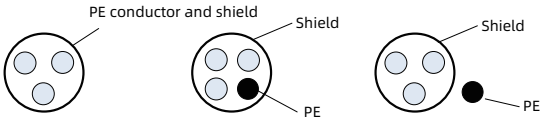


Figure B-15 Shielded cable

To suppress emission and conduction of radio frequency interference effectively, shield of cable is cooper braid. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%. as shown below.

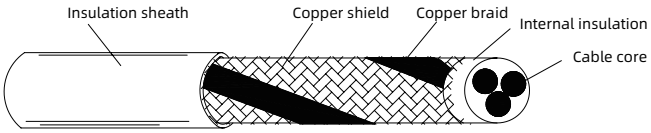


Figure B-16 Cable shield

The following figure shows the grounding method of the shielded cable.

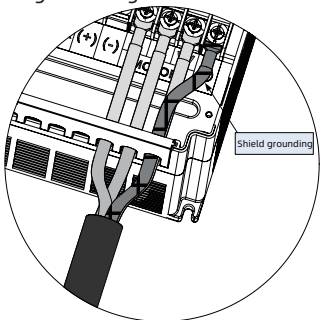


Figure B-17 Grounding of the shielded cable

Safety precautions:

- Symmetrical shielded cable is recommended. The four-conductor shielded cable can also be used as an input cable.
- Keep the motor cable and its PE shielded leads (twisted) as short as possible to reduce the electromagnetic radiation and external stray current and capacitive current. For the motor cable longer than 100 m, install an output filter or reactor.
- It is recommended that all control cables be shielded.
- The output power cable of the AC drive should use shielded cable, and the shield must

be reliably grounded. For lead cables in exposure to interference, twisted pair shielded control cable should be used, and the shield must be reliably grounded.

B.4.2 Cabling Requirements

1) Route the motor cables away from other cables. Motor cables of several drives can be laid in parallel.

2) It is recommended that motor cables, power input cables and control cables be laid in different ducts. To avoid electromagnetic interference caused by rapid change of output voltage of AC drive, motor cables and other cables must not be laid side by side for a long distance.

3) If the control cable must run across the power cable, make sure they are arranged at an angle of close to 90° . Other cables cannot run through the AC drive.

4) Power input and output cables of the AC drive and weak-current signal cables (such as control cable) must be laid at right angles (if possible) rather than in parallel.

5) Cable ducts must be in good connection and well grounded. Aluminum ducts can be used to improve equipotential performance.

6) Connect the filter, AC drive, and motor to the system (machines or devices) properly. Protect all connections with spray coating and ensure good contact of conductive metal.

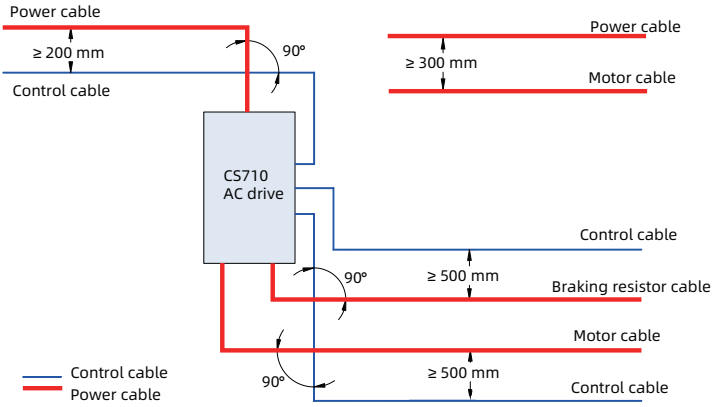


Figure B-18 Recommended cabling

B.5 Solutions to Leakage Current

1) The leakage current generated by the drive can exceed 100 mA. Therefore, the induced current of the residual current protection device must be above 100 mA.

2) The high-frequency pulse interference may cause the protection device to malfunction, thus the residual current protection device must have the high-frequency filtering function.

3) If multiple AC drives are required, each AC drive must be installed with a residual current protection device.

4) Factors that influence the residual current are as follows:

- AC drive capacity
- Carrier frequency
- Type and length of motor cable
- EMI filter

5) When the leakage current causes the residual current protection device to act, you should:

- Increase induced current of the residual current protection device.
- Replace the residual current protection device with a new one that carries high-frequency suppression function.
- Reduce the carrier frequency.
- Shorten the length of the output cable.
- Install a residual current suppression device.
- Install an EMC filter which can restrain leakage current. For details on how to select an EMC filter, see "B.3.1 Installation of EMC Input Filter on Power Input Side."

6) Jumper of the safety capacitor banks:

- An AC drive has the integrated EMC and VDR, which are connected by default. If the leakage circuit breaker trips upon power-on of the AC drive, remove the EMC jumper screw to disconnect the EMC, as shown in the figure.

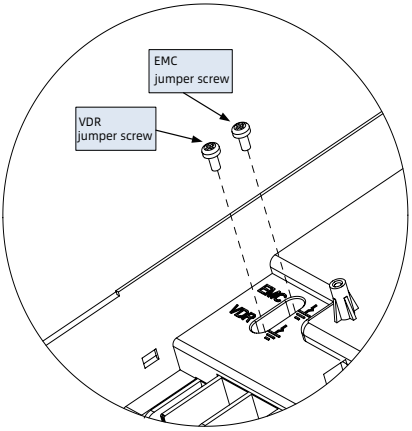


Figure B-19 Jumper position of the EMC

B.6 Solutions to Common EMC Interference

The AC drive generates strong interference during operation. Although EMC measures are taken, interference may still exist due to improper cabling or grounding. In this case, take the following measures.

Table B-14 Typical EMC interference problems and solutions

Interference type	Solution
Residual Current Device	◆ Connect the motor housing to the PE of the AC drive. ◆ Connect the PE of the AC drive to the PE of the grid. ◆ Add a safety capacitor to the power input cable. ◆ Add magnetic rings to the input drive cable.
Interference generated during operation of the drive	◆ Connect the motor housing to the PE of the AC drive. ◆ Connect the PE of the AC drive to the PE of the grid. ◆ Add a safety capacitor to the power input cable and wind the cable with magnetic rings. ◆ Add a safety capacitor to the interfered signal port or wind the signal cable with magnetic rings. ◆ Connect the equipment to the common ground.
Communication Interference	◆ Connect the motor housing to the PE of the AC drive. ◆ Connect the PE of the AC drive to the PE of the grid. ◆ Add a safety capacitor to the power input cable and wind the cable with magnetic rings. ◆ Add a termination resistor at the communication cable and the load side. ◆ Add a common grounding cable besides the communication cable. ◆ Use a shielded cable as the communication cable and connect the cable shield to the common ground.
I/O interference	◆ Increase the capacitor filtering of the low-speed DI, with a recommended maximum value of 0.1 μF. ◆ Increase the filtering capacitance of the AI. The recommended maximum value is 0.22 uF.

Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

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