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CS710 Series AC Drive for Cranes

User Guide

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

Data code 19010423 A13

Preface

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

This product is a new-generation AC drive designed for cranes by Inovance. Featuring rich functions, the AC drive supports high-performance vector control on asynchronous motors. With the optional crane technique card installed, the AC drive can implement anti-sway and grab bucket control. It is mainly used to drive and control 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 this guide before installing, running, maintaining, or checking the AC drive. In addition, use this product only after comprehending all safety precautions.

Precautions
◆ For the illustration purpose, the drawings in this user guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified before using the product, and perform operations in accordance with the instructions.
◆ The drawings in the user guide are for illustration only and may be different from the product you purchased.
◆ The instructions are subject to change without notice due to product upgrade, specification modification as well as efforts to improve the accuracy and convenience of the guide.
◆ Contact the regional agent or customer service center of Inovance if you need a new user guide.
◆ Contact the customer service center of Inovance if you have problems during the use.

Revision History

Date	Version	Change Description
July 2024	A13	● Updated the front cover, back cover, and preface. ● Deleted CS710 series AC drives of -L models from "1.1 Nameplate and Model Number." ● Updated the maximum power of CS710 series AC drives 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 Cabling, Dimensions, and Recommended Cable Selection 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."

July 2024	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." ● 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 the b3.00 parameter: 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": Models CS710-4T0.4GB to CS710-4T1.1GB do not provide a cooling fan. ● Changed 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 to the frequency range for the power supply. ● Updated "Example of a command to write data to the slave."
June 2023	A12	Updated some incorrectly displayed pictures.
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	Corrected minor errors.
September 2020	A07	Corrected minor errors.
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.
May 2018	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."
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.

Contents

Safety Precautions

Safety Disclaimer

1) Read the safety precautions before installing, operating, and maintaining this product.
2) To ensure personal and equipment safety, follow all safety precautions marked on the product and described in the user guide when installing, operating, and maintaining this product.
3) "CAUTION", "WARNING", and "DANGER" messages in the guide are only examples and do not cover all safety precautions.
4) Use this product in an environment that complies with the design specifications. Malfunctions or component damage caused by improper use is not covered by warranty.
5) Inovance shall not be liable for any physical injuries or property loss caused by improper use.

Safety Categories and Definitions

Danger "DANGER" indicates that failure to comply with the notice will result in severe physical injuries or even death.

Warning "WARNING" indicates that failure to comply with the notice may result in severe physical injuries or even death.

Caution "CAUTION" indicates that failure to comply with the notice may result in minor or moderate physical injuries or equipment damage.

Safety Precautions

Unpacking
Caution ◆ Before unpacking, check whether the package is intact without damage, water seepage, damp, and deformation. ◆ Unpack the product layer by layer. Do not strike the package violently. ◆ Check the surface of the product and accessories for damage or rust. ◆ Check the product, accessories, and materials in the package against the packing list to ensure that all items are complete.

Warning

- Do not install the product if you find damage, rust, or signs of use on it or its accessories upon unpacking.
- Do not install the product if you find water seepage or any components being missing or damaged upon unpacking.
- Do not install the product if the packing list does not match the product you received.

Storage and Transportation

Caution

- Store and transport the product in accordance with the storage and transportation requirements regarding humidity and temperature.
- Avoid storage and transportation in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storage for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the product properly before transportation by vehicle. Use an enclosed box for long-distance transportation.
- Never transport the product with devices or materials that may damage or negatively impact the product.

Warning

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

Installation

Warning

- Read through the user guide and safety precautions before installation.
- Do not modify the product.
- Do not fiddle with the bolts used to fix parts and components or the bolts marked in red.
- Do not install the product in places with strong electric or magnetic fields.
- When installing the product in a cabinet or final assembly, make sure that the enclosure of the cabinet or final assembly provides adequate fire prevention, electrical protection, and mechanical protection conforming to relevant IEC standards and local laws and regulations.

Danger

- Never allow non-skilled personnel to carry out installation, wiring, maintenance, inspection, or part replacement.
- Installation, wiring, maintenance, inspection, and part replacement must be carried out only by trained technicians with electrical expertise.
- The installation personnel must be familiar with the installation requirements and relevant technical information.
- If any equipment with strong electromagnetic interference, such as a transformer, is needed, install a shielding device to prevent malfunction of this product.

Wiring

Danger

- Never allow non-skilled personnel to carry out installation, wiring, maintenance, inspection, or part replacement.
- Never perform wiring while the equipment is energized. Failure to comply will result in an electric shock.
- Before wiring, cut off all the power supplies of the equipment. Wait at least 10 minutes before further operations because residual voltage exists after power-off.
- Ensure that the equipment is well grounded. Failure to comply will result in an electric shock.
- During wiring, follow the proper electrostatic discharge (ESD) procedures and wear an anti-static wrist strap. Failure to comply will result in damage to the equipment or internal circuits of the product.

Warning

- Do not connect the input power supply to the output end of the equipment. Failure to comply may result in equipment damage or even fire.
- 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.
- Use cables with required diameter and shield. Properly ground one end of the shield if a shielded cable is used.
- After wiring, make sure that no loosened screws or exposed cables are left inside the device.

Power-on

Danger

- Before power-on, make sure that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage and fire.
- Stay away from the equipment at power-on because unexpected mechanical operations may be triggered on the equipment.
- Never open the cabinet door or protective cover of the equipment after power-on. Failure to comply will result in an electric shock.
- Never touch any wiring terminals of the equipment while power is on. Failure to comply will result in an electric shock.
- Never disassemble any unit or component of the equipment when it is powered on. Failure to comply will result in an electric shock.

Operation

Danger

- Never touch any wiring terminals of the equipment during operation. Failure to comply may result in an electric shock.
- Never disassemble any unit or component of the equipment during operation. Failure to comply will result in an electric shock.
- Do not touch the equipment casing, fan, or resistor to check the temperature. Failure to comply may result in burns.
- Never allow non-skilled personnel to detect signals during operation. Failure to comply may result in physical injury or equipment damage.

Warning

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

Maintenance
Danger ◆ Never allow non-skilled personnel to carry out installation, wiring, maintenance, inspection, or part replacement. ◆ Do not maintain the equipment while power is on. Failure to comply will result in an electric shock. ◆ Cut off all power supplies to the equipment and wait for at least 10 minutes before maintenance.
Warning ◆ Carry out daily and periodic inspection and maintenance on the equipment according to maintenance requirements and retain a maintenance record.
Repair
Danger ◆ Never allow non-skilled personnel to carry out installation, wiring, maintenance, inspection, or part replacement. ◆ Do not repair the equipment while power is on. Failure to comply will result in an electric shock. ◆ Cut off all power supplies to the equipment and wait for at least 10 minutes before equipment inspection or repair.
Warning ◆ Submit the repair request according to the warranty agreement. ◆ Upon equipment failure or damage, arrange for qualified technicians to troubleshoot and repair the equipment in accordance with the maintenance instructions and retain a maintenance record. ◆ Replace quick-wear parts of the product according to the replacement instructions. ◆ Do not use a damaged machine. Failure to comply may result in further damage. ◆ After equipment replacement, check the wiring and set parameters again.
Disposal
Warning ◆ Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, physical injuries, or even death. ◆ Recycle retired equipment in accordance with waste disposal standards of the industry to avoid environmental pollution.

Safety Label

For safe operation and maintenance, follow the instructions on safety labels on the equipment. Do not stain or remove the safety labels. The following table describes the safety labels.

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

1 Product Information

1.1 Nameplate and Model Number

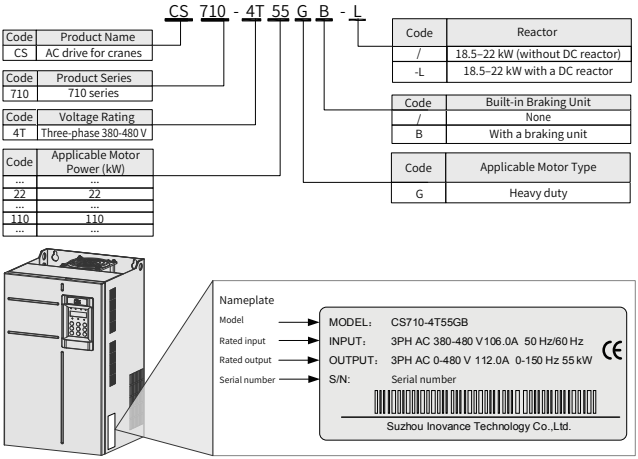


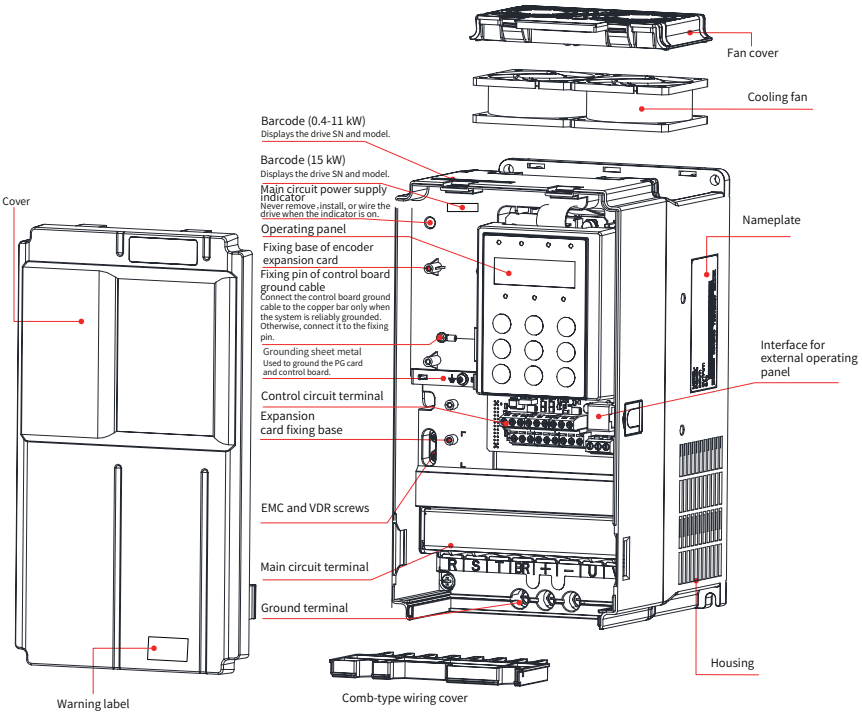
Figure 1-1 Nameplate and model number

NOTE

- The nameplate in the figure above is for reference only and may be different from that of the product you order.

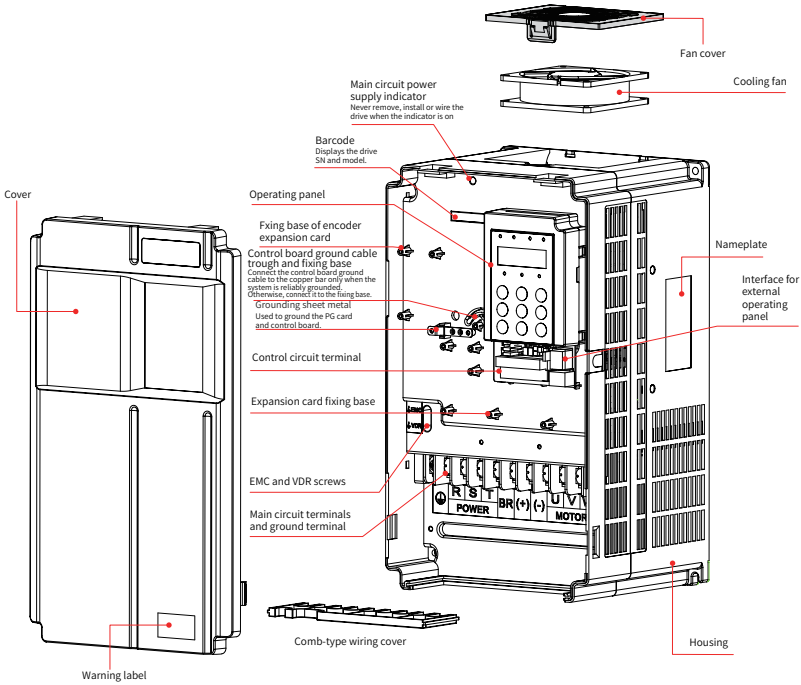
1.2 Components

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



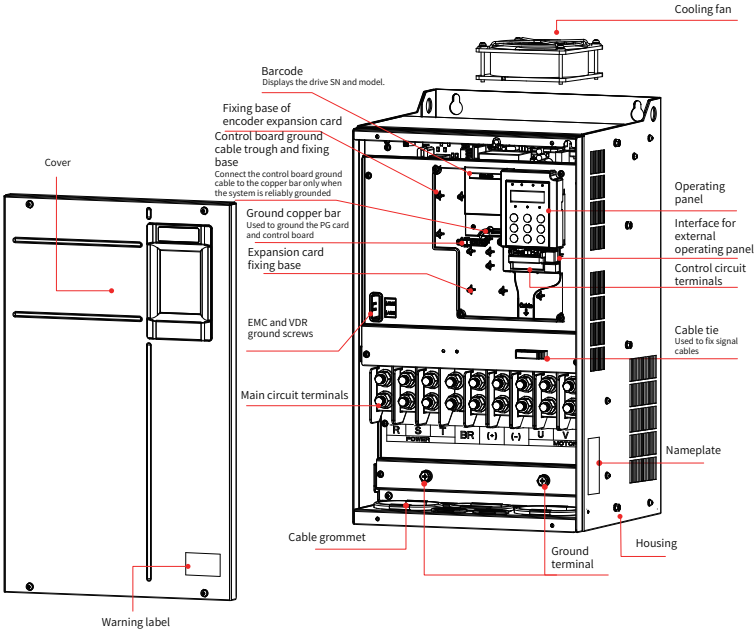
Warning Label		Description
⚠	📖	Caution! Read the user guide before installing and running the drive.
⚠	10min	Danger! Do not remeve the front cover with power on or within10 minutes after power-off.

Figure 1-2 Components (three-phase 380–480 V, 0.4–15 kW)



Warning Label		Description
⚠	📖	Caution! Read the user guide before installing and running the drive.
⚠	10min	Danger! Do not remeve the front cover with power on or within10 minutes after power-off.

Figure 1-3 Components (three-phase 380–480 V, 18.5–37 kW)



Warning Label	Description
	Caution! Read the user guide before installing and running the drive.
10min	Danger! Do not remove the front cover with power on or within 10 minutes after power-off.

Figure 1-4 Components (three-phase 380–480 V, 45–160 kW)

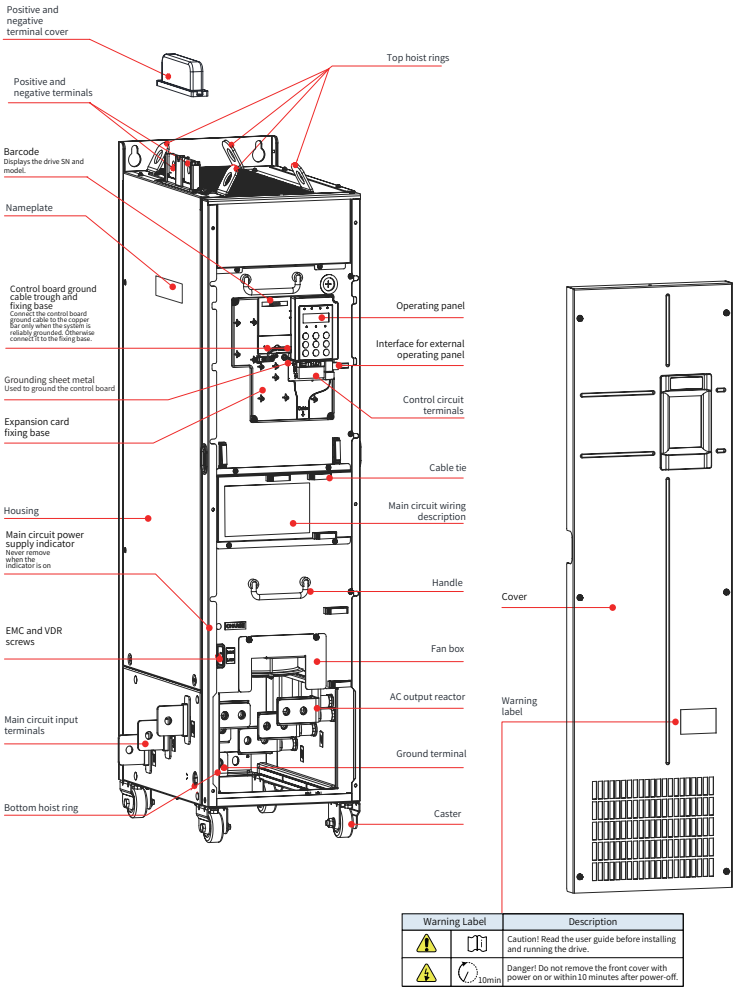


Figure 1-5 Components (three-phase 380–480 V, 200–400 kW)

2 System Connection

2.1 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.

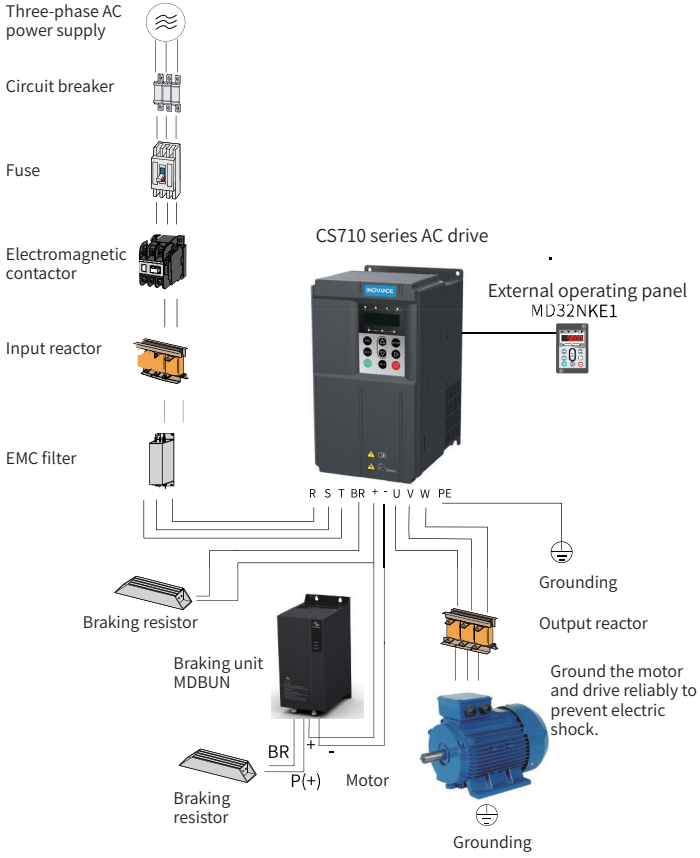


Figure 2-1 CS710 series AC drive system composition

NOTE

◆ The preceding figure is only a schematic system connection diagram of the CS710 series AC drive. For the selection of peripherals, see "9 Technical Data and Model Selection."

2.2 Description of Peripheral Electrical Components

Table 2-1 Description of peripheral electrical components of the CS710 series AC drive

Component	Installation position	Function
Circuit breaker	Between the power supply and AC drive input side	Circuit breaker for protection against short circuit: Cuts off power supply when overcurrent occurs on downstream devices.
		Residual current device (RCD): Provides protection against potential high-frequency leakage current during AC drive operation to prevent electric shock and even a fire. Select an appropriate RCD as needed.
Fuse	Between the power supply and AC drive input side	Protects downstream semiconductor components in case of short circuit.
Electromagnetic contactor	Between the circuit breaker and the AC drive input side	Switches ON/OFF the AC drive. Do not use the contactor to power on/off the AC drive frequently (ensure an interval of at least one hour between power-on and power-off) or use it to directly start the AC drive.
Input reactor	AC drive input side	Improves the input-side power factor. 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 interphase unbalance.
EMC filter	AC drive input side	Reduces external conduction and radiation interference of the AC drive. Reduces conduction interference from the power supply to the AC drive, thereby improving the anti-interference capability 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 input-side power factor. Improves the efficiency and thermal stability of the AC drive. Eliminates the impact of input high-order harmonics on the AC drive effectively and reduces external conduction and radiation interference.
Braking resistor	75 kW and below	Selects a braking resistor; Dissipates regenerative energy during motor deceleration.
Braking unit	90 kW and above	Uses the braking unit (MDBUN) of Inovance and the recommended braking resistor. Dissipates regenerative energy during motor deceleration.
output Reactor	Between the AC drive output side and the motor (close to the AC drive)	The output side of the AC drive generally has much harmonics. When a motor is far away from the AC drive, much distributed capacitance exists in the circuit and certain harmonics may cause resonance in the circuit, which will: (a) Degrade motor insulation performance and damage the motor in the long run. (b) Generate large leakage current and trigger AC drive protection frequently. If the distance between the AC drive and motor is greater than 100 m, install an AC output reactor.

Component	Installation position	Function
dv/dt reactor	AC drive output side (close to the AC drive)	(Optional) Ensures motor insulation and reduces bearing current.
Output magnetic ring	AC drive output side (close to the AC drive)	Reduces bearing current.
Motor	AC drive output side	Select an applicable motor.

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

3 Installation and Wiring

3.1 Installation

3.1.1 Installation Environment

1) Install the AC drive in an environment where the temperature falls between –10°C and +50°C since the ambient temperature has a great impact on the service life of the AC drive.
2) Install the AC drive on a flame-retardant surface, with sufficient clearance reserved for heat dissipation, as the AC drive generates significant heat during operation. Use screws to fasten the module onto the mounting support vertically.
3) Install the AC drive in a place without strong vibration. Ensure that the mounting location is not affected by levels of vibration that exceeds 0.6 g. Keep the AC drive away from punch machines.
4) Avoid places with direct sunlight exposure, moisture, and water drop.
5) Corrosive, inflammable, or explosive gas
6) Greasy dirt or dust

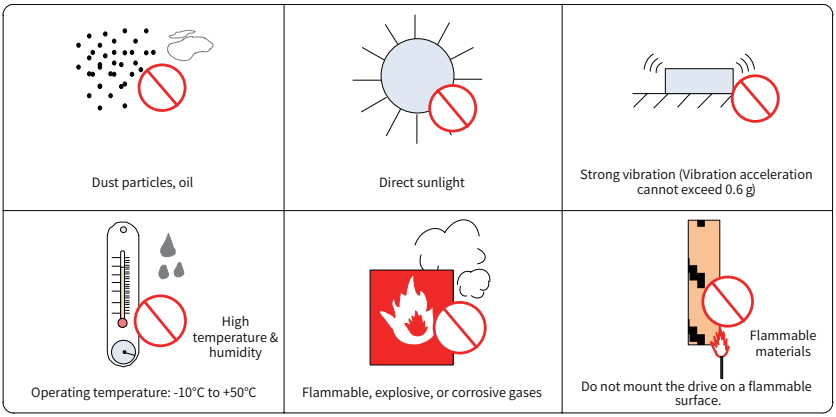


Figure 3-1 Installation Environment Requirements

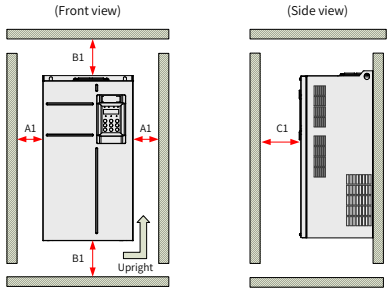
7) The CS710 series AC drive is a cabinet-mounted product and needs to be installed and used in a final system. The final system must provide corresponding enclosures for fireproof, electrical, and mechanical protection, and comply with local laws and regulations and relevant IEC standards.

3.1.2 Mounting Clearance and Orientation

1) Mounting Clearance

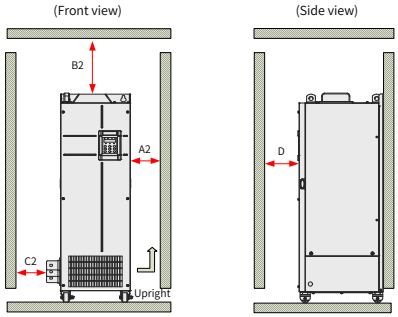
The mounting clearance varies with the power rating of the AC drive.

- Mounting of a single drive



Power Rating	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 3-2 Installation clearance for a single drive (three-phase 380–480 V, 0.4–160 kW)

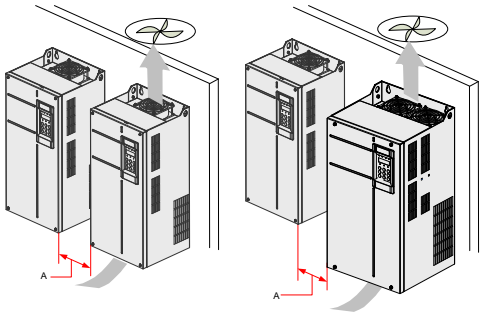


Power Rating	Clearance (mm)	
200 kW to 400 kW	A2 ⩾ 10	B2 ⩾ 250
	C2 ⩾ 20	D2 ⩾ 20

Figure 3-3 Installation clearance for a single drive [three-phase 380–480 V, 200–400 kW]

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

If one row of the AC drive needs to be installed above another row, install an air guide plate to prevent the AC drive in the lower row from heating that in the upper row, which may cause over-temperature or overload of the upper drive.

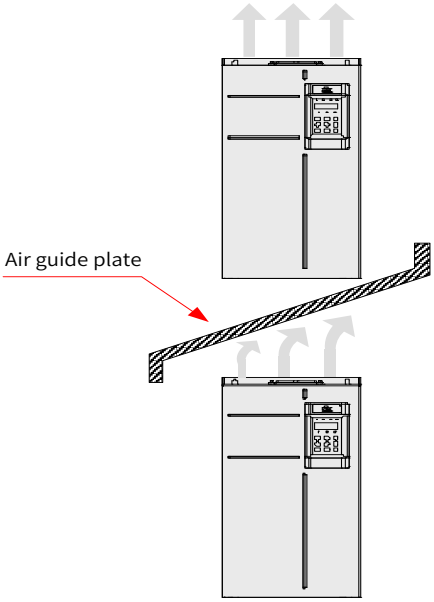


Figure 3-5 Installation of drives in dual-row

NOTE

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

2) Mounting Orientation

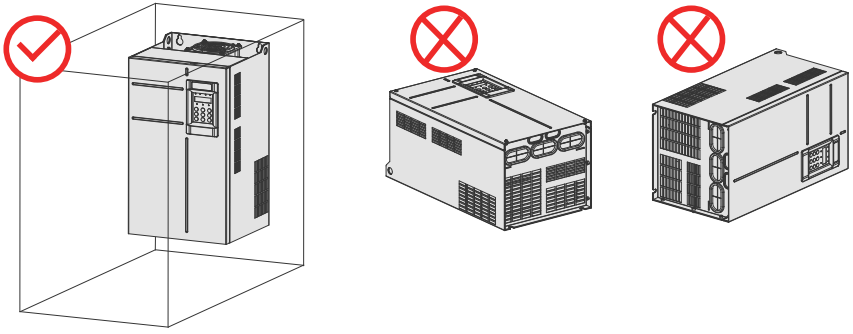


Figure 3-6 Correct and incorrect mounting orientations

3.1.3 Installation Instructions

The applicable installation method varies with power ratings of different models of the CS710 series. Follow the following guidance for the specific model and application scenario.

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

- Backplate mounting

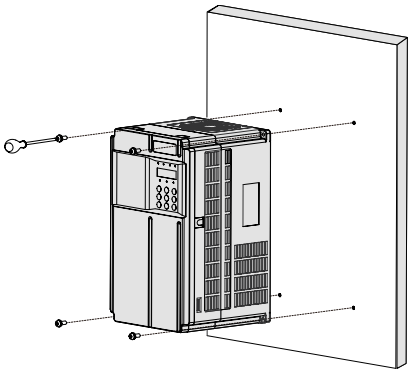


Figure 3-7 Backplate mounting for 0.4–37 kW models

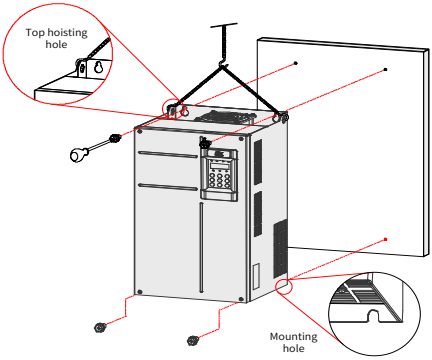


Figure 3-8 Backplate mounting for 45–160 kW models

NOTE

◆ When using this installation method, do not secure the AC drive with only the upper two retaining nuts, because the AC drive may fall due to uneven force after long-time running.

- Through hole mounting

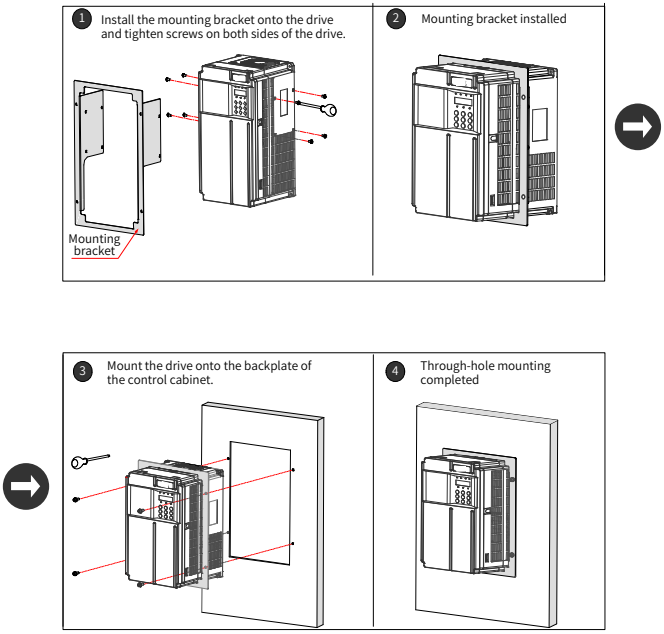


Figure 3-9 Through hole mounting of 0.4–37 kW models

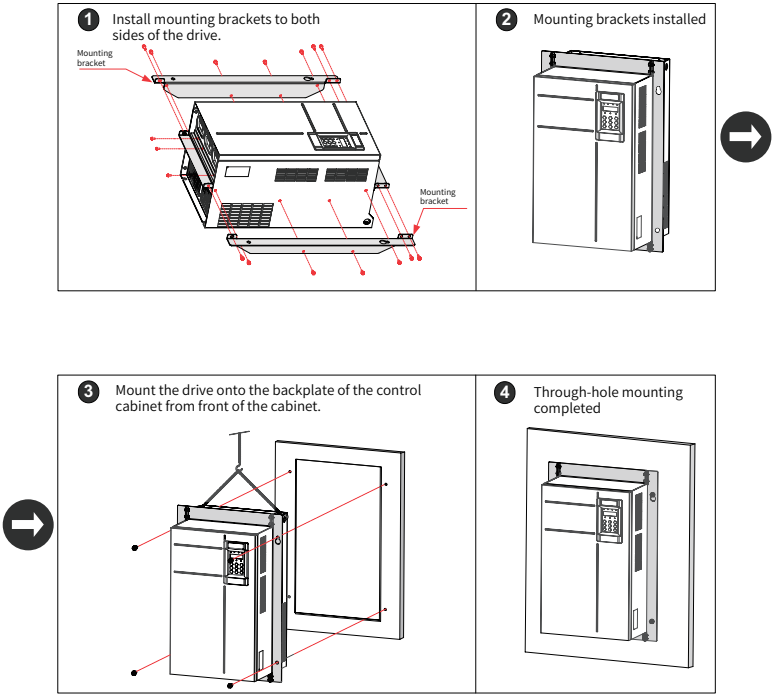


Figure 3-10 Through hole mounting of 45–160 kW models

- Models for through-hole mounting brackets

Table 3-1 List of models for through-hole mounting brackets

Models for through-hole mounting brackets	Applicable Drive 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
MD500-AZJ-A1T3	CS710-4T7.5GB
	CS710-4T11GB

Models for through-hole mounting brackets	Applicable Drive Model
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

3.1.4 Mounting in a Cabinet

1) Heat dissipation

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 guidance for the specific model and application scenario.

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

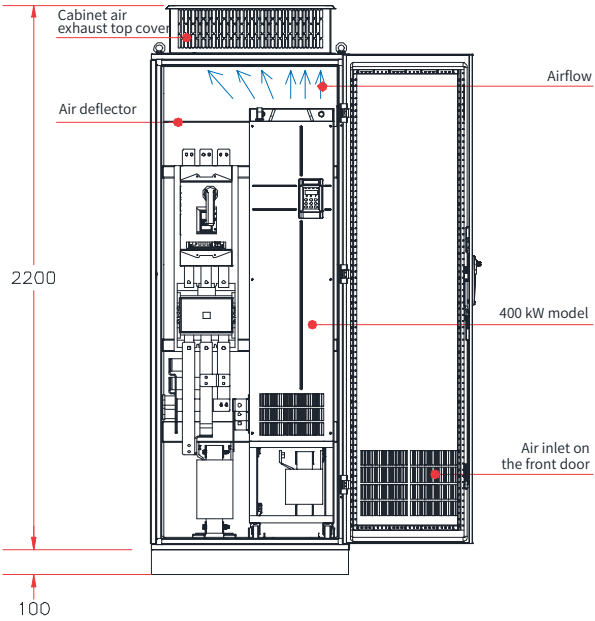


Figure 3-11 Self-ventilated cabinet (without fans on the top)

Table 3-2 Specifications of a self-ventilated cabinet without fans on the top

Model	Quantity of Fans	Total Air Volume (CFM)	Effective Area of Self-Ventilated Cabinet Air Inlet (mm^2)	Effective Area of Self-Ventilated Cabinet Air Outlet (mm^2)
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.				

- Forced ventilated cabinet (with fans on the top)

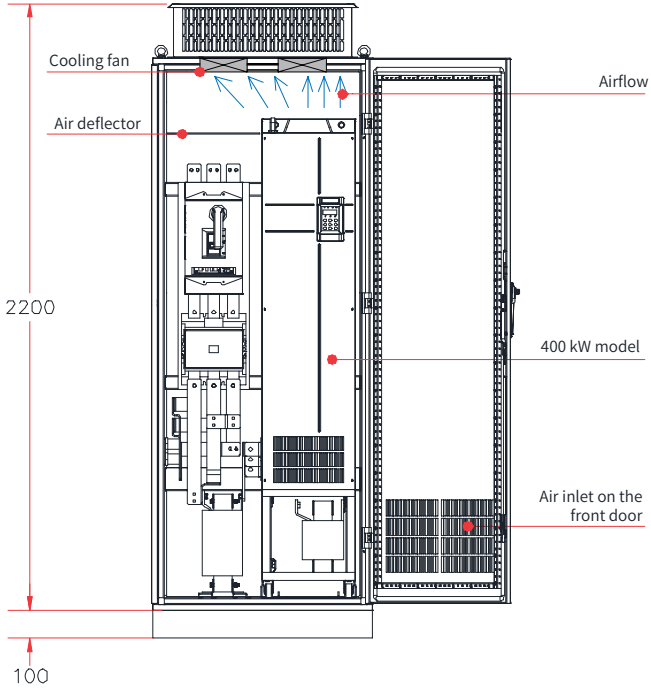


Figure 3-12 Force-ventilated cabinet (with top-mounted fans) (mm)

Table 3-3 Specifications of a force-ventilated cabinet with top-mounted fans

Model	Quantity of Fans	Total Air Volume (CFM)	Effective Area of Cabinet Air Inlet (mm^2)	Max. Airflow of Fans (CFM)	Effective Area of Cabinet Air Outlet (mm^2)
CS710-4T132G	2	541	31809	649	S = 0.942 x N x ($Dout^2$ – $DHUB^2$) In the preceding formula, N means the number of top fans, Dout means the diameter of the top fan, and DHUB means the diameter of the top fan center 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 m^3/min
2. "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.

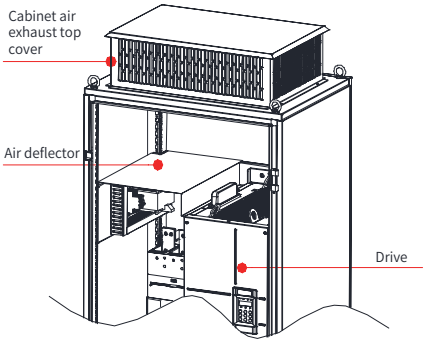


Figure 3-13 Insulation barrier in the cabinet

2) Precautions for installation in a cabinet

A nine-fold profile cabinet (PS cabinet) is recommended. Before installation, install a bottom mounting bracket and guide rail in the cabinet and design a fixing beam for the AC drive. Reserve mounting holes on the beam and reserve sufficient space in the cabinet for installing the copper bar of the AC drive.

After aligning the four casters at the bottom of the AC drive with the guide rails, you can push the AC drive into or pull it out of the cabinet easily. Be sure to align the casters of the AC drive with the guide rails before push-in or pull-out. To ensure safety, two people should work together to push the AC drive in or pull it 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 AC drive in/out of the cabinet, align the casters of the AC drive with the guide rails. Ensure that these operations are performed by two people 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 the dimensions of the mounting bracket (delivered with the AC drive) in the cabinet, see "9 Technical Data and Model Selection." Ensure that the guide rails are strong and rigid enough.
- After the AC drive is pushed into the cabinet, remove the cardboard on its air outlet to avoid the overheating fault due to failure in dissipating the heat.
- 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.

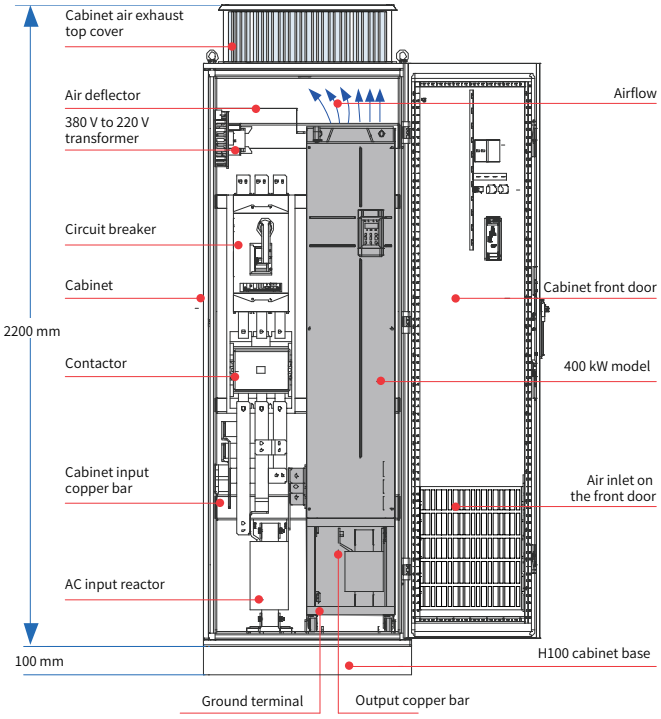


Figure 3-14 Recommended cabinet layout

3) Steps of installing the AC drive in the cabinet

Step	Operation Instructions
1	Install the fixing beam for fixing the AC drive in the nine-fold profile cabinet.
2	Fix the bottom mounting bracket in the nine-fold profile cabinet.
3	Assemble the guide rails (option), and then install the guide rails inside the cabinet.
4	Remove the cover of the AC drive to expose the auxiliary handle on the AC drive.
5	Cooperate with another person to align the AC drive casters with the guide rails and push the AC drive slowly into the cabinet. During the push-in or pull-out process, use the auxiliary strap to prevent the AC drive from rolling over.
6	Remove the auxiliary strap. Looking in from the wiring compartment of the AC drive, you can see two mounting holes at the rear lower part of the AC drive. Fasten the mounting holes at the rear top and bottom of the AC drive with screws and fix the AC drive to the fixing beam inside the cabinet.
7	Verify that the AC drive is securely installed, and remove the guide rails.

- Fixing the fixing beam and reserving mounting holes

1. The nine-fold profile cabinet (PS cabinet) is recommended. Figure 3-15 shows the enlarged view of the nine-fold profile.

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 3-16). (This step is unnecessary if the AC drive is installed in a standard cabinet with the depth of 800 mm or above.)

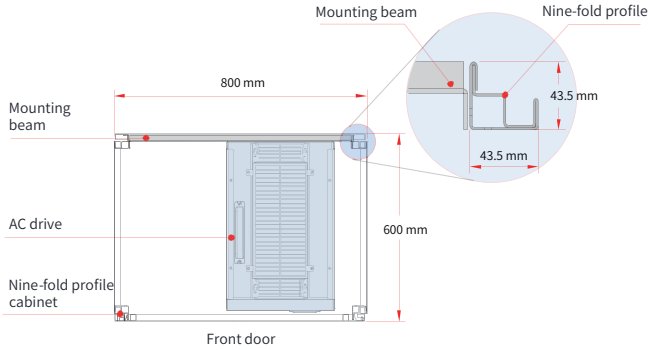


Figure 3-15 Top view of a 200–400 kW cabinet

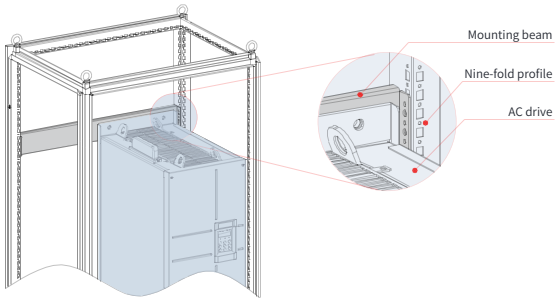


Figure 3-16 3D view of a 200–400 kW cabinet

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. Use six M5 self-tapping screws to fix the mounting bracket onto the rack base of the nine-fold profile cabinet, as shown in the following figure.

2. If the cabinet used by the customer is not a nine-fold profile cabinet, drill and assemble the mounting holes of the mounting bracket on site.

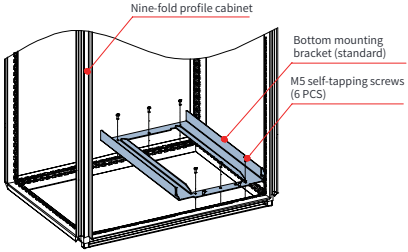


Figure 3-17 Installing the bottom mounting bracket

Assembling the guide rails (MD500-AZJ-A3T10)

Assemble the guide rails for the model, as shown in Figure A. Figure B shows the guide rails after assembly is completed.

Align the two round holes at the front end of the guide rails with the screws of the mounting bracket, and then lock the guide rails to the cabinet with two M6 nuts, as shown in Figure C.

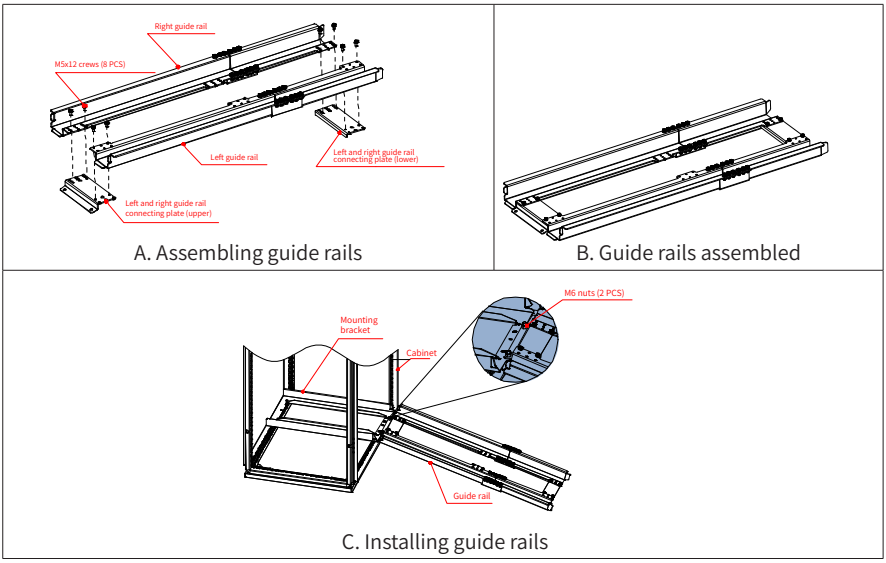


Figure 3-18 Mounting guide rails on the cabinet

* Read the MD500-AZJ-A3T10 Guide Rail Assembly Instruction (data code: 19010353) before assembling the guide rails.

- Pushing the AC drive into the cabinet

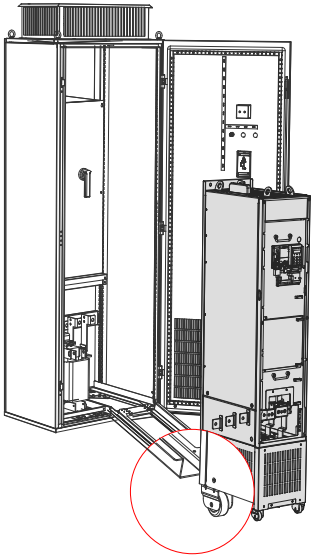


Figure 3-19 Aligning the AC drive casters with the guide rails

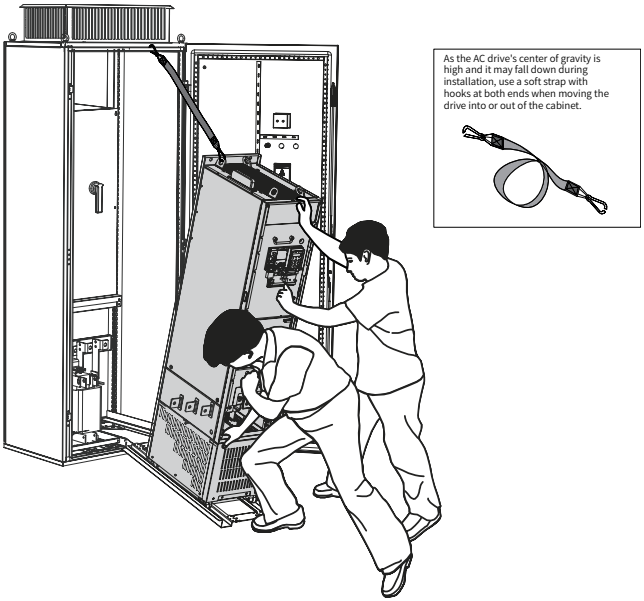


Figure 3-20 Pushing the AC drive slowly into the cabinet

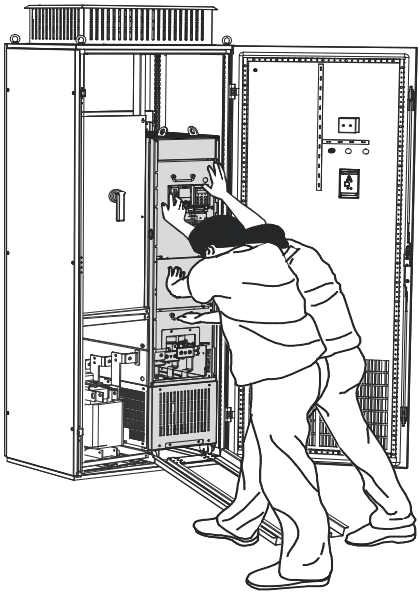


Figure 3-21 AC drive pushed into the cabinet

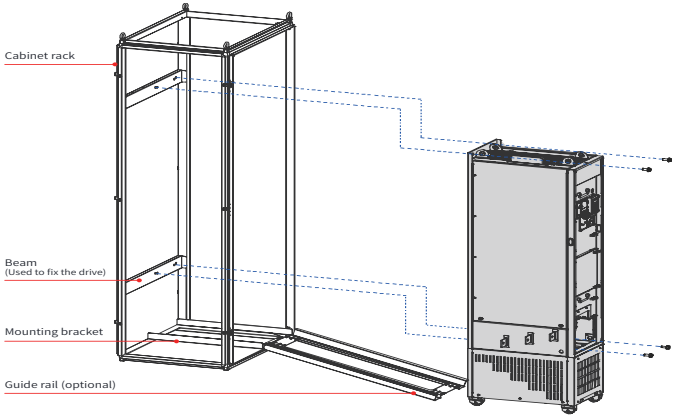


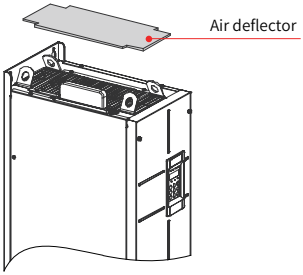
Figure 3-22 Fixing the AC drive to the fixing beam by using the four mounting holes on the back of the AC drive

4) Precautions for installation in a cabinet

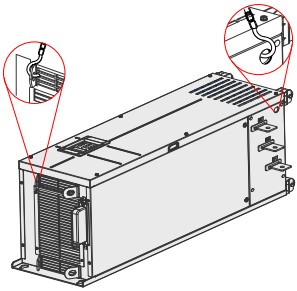
Remove the AC drive from the cabinet in steps reverse to the preceding procedure.

Ensure that the four wall-mounting holes on the back of the AC drive are firmly secured to the fixing beam.

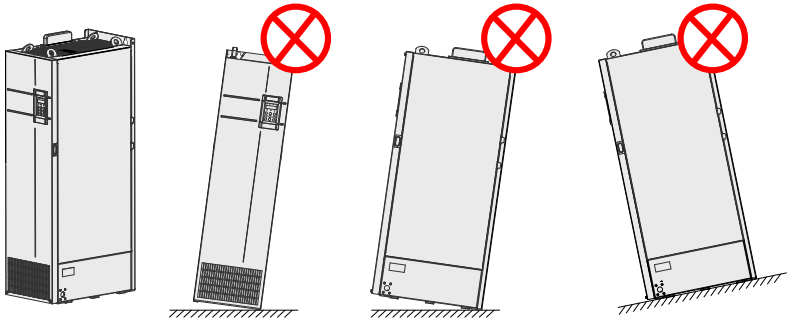
Remove the air filter damper at the top of the AC drive after installation. (The air filter damper is used to prevent foreign objects such as screws from falling into the air filter during installation of the AC drive into the cabinet.)



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 is placed vertically, do not apply force on two sides of the AC drive or place the AC drive on an inclined surface. The AC drive weighs almost 200 kg and may fall down if the slope exceeds 5° .



3.1.5 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 machine is powered off for over 10 minutes.
- Be careful when removing the cover to prevent fall-off, which may cause device damage or personal injury.

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

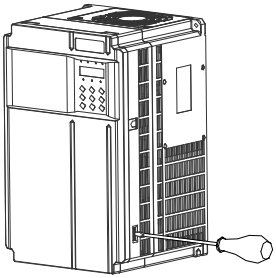
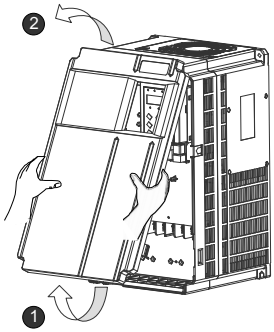
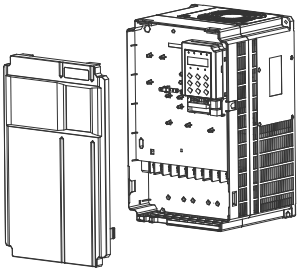
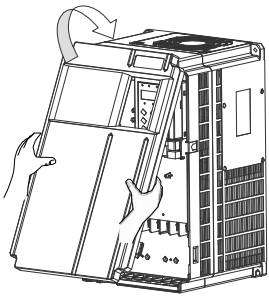
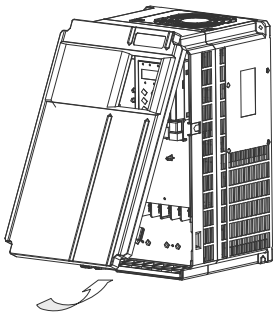
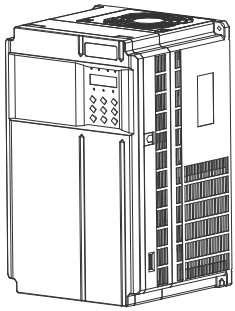
Removal procedure		
Use appropriate tools to push the snap-fit joints inwards at both sides of the drive to release the cover.	Hold the cover by both hands. ① Lift up the lower part of the cover. ② Push the cover up slightly to lift up the upper part of the cover.	The cover is removed.
		
Installation procedure		
Hold the cover with both hands, and buckle the snap-fit joints at the top of the cover into the holes on the AC drive.	Align the cover with the AC drive body and push down the cover by following the arrow direction.	The cover is reattached.
		

Figure 3-23 Removing and installing the cover of 0.4–37 kW models

2) Removing and Installing the cover of 45–160 kW Models

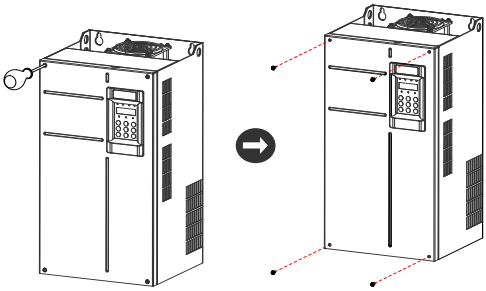
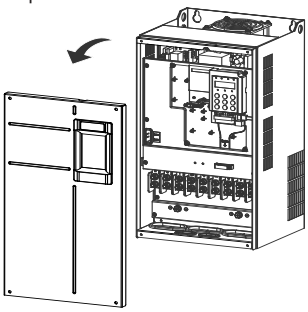
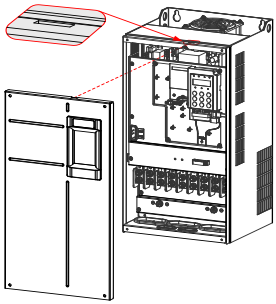
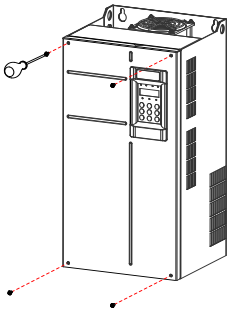
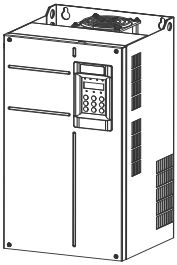
<table>
<tr><th colspan="3">Removal procedure</th></tr>
<tr><td colspan="2">Unscrew the four fixing screws from the cover with a screwdriver.
  </td><td>Hold the cover with both hands and lift it up in the arrow direction to complete the removal.
  </td></tr>
<tr><th colspan="3">Installation procedure</th></tr>
<tr><td>Hold the cover with both hands, align the cover with the snap-fit joints on the upper edge of the chassis, and buckle it into the position shown in the figure.
  </td><td>Tighten the four fixing screws with a screwdriver.
  </td><td>The cover is reattached.
  </td></tr>
</table>

Figure 3-24 Removing and installing the cover of 45–160 kW models

3) Removing and Installing the cover of 200–400 kW Models

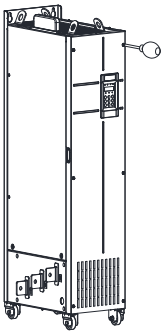
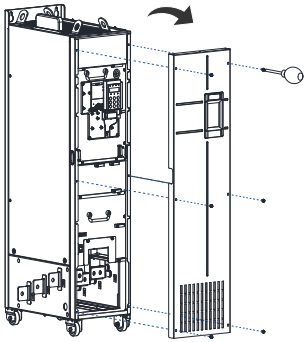
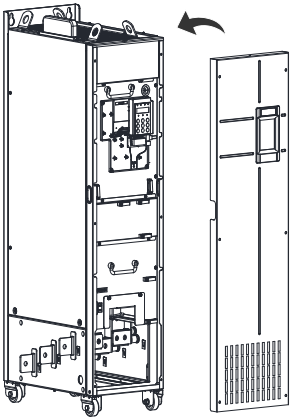
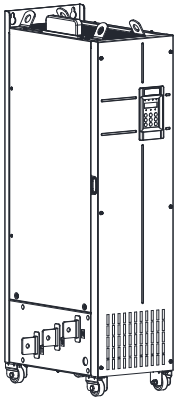
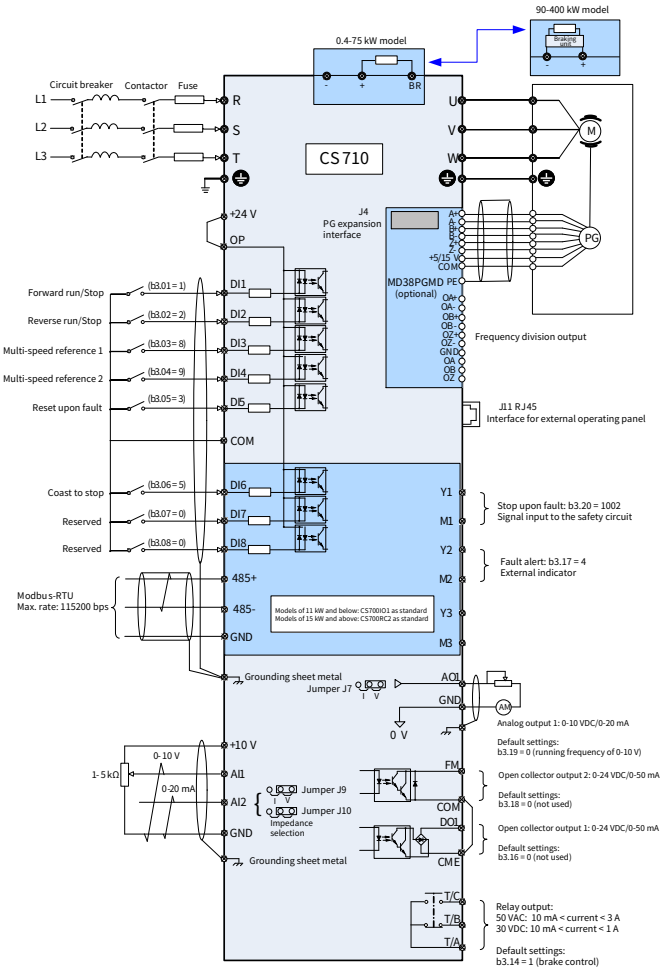
Removal procedure	
Remove the six fixing screws from the cover with a screwdriver. 	Hold the cover with both hands and lift it up in arrow direction to complete the removal. 
Installation procedure	
Hold the cover with both hands, align its upper edge with the upper edge snap-fit joint on the chassis, and snap them together, as shown in the following figure. Then, align the six screw mounting holes on the cover with the cover mounting holes on the chassis and press them tightly against each other. 	Drive six fixing screws into the holes with a screwdriver to fasten the cover. 

Figure 3-25 Removing and installing the cover of 200–400 kW models

3.2 Wiring

3.2.1 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 3-26 Typical wiring of three-phase 380–480 V drive

3.2.2 Main Circuit Terminals

1) Main circuit terminals of CS710 series AC drives

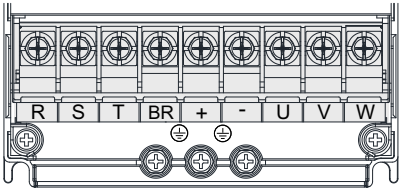


Figure 3-27 Layout of main circuit terminals of 0.4–15 kW models

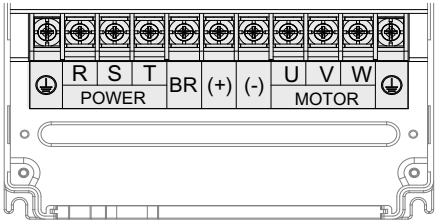
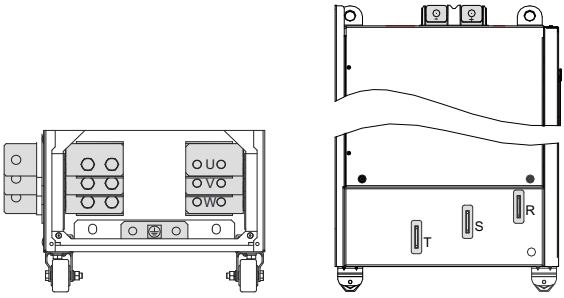


Figure 3-28 Layout of main circuit terminals of 18.5–160 kW models



(Front view) (Side view)

Figure 3-29 Layout of main circuit terminals of 200–400 kW models

Table 3-4 Descriptions of main circuit terminals of CS710 series AC drives

Symbol	Terminal Name	Function
R, S, T	Three-phase power input terminals	Connected to a three-phase AC input power supply
(+), (-)	DC bus positive and negative terminals	Common DC busbar input, connected to the external braking unit for AC drives with 90 kW or higher power
(+), BR	Braking resistor connection terminals	Connected to the braking resistor for AC drives with 75 kW or lower power
U, V, W	AC drive output terminals	Connected to a three-phase motor
⏚	Grounding (PE) terminal	Connected to the ground

2) Main circuit cable selection

The symmetrical shielded cables are recommended as the input and output main circuit cables. Compared with four-conductor cables, symmetrical shielded cables can reduce electromagnetic radiation of the entire transmission system.

- Recommended power cables: symmetrical shielded cables

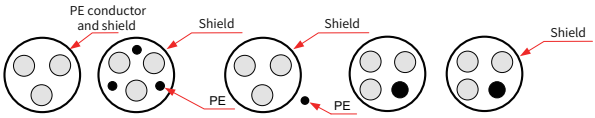


Figure 3-30 Recommended power cable types

- Deprecated power cables

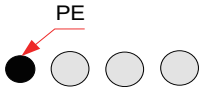


Figure 3-31 Deprecated power cables

3) Power input R/S/T

- There are no requirements on the phase sequence for wiring on the input side of the AC drive.
- Specifications and connections of external main circuit cables must comply with local regulations and IEC requirements.
- Select copper wires of appropriate sizes for main circuit cables according to recommendations in "9 Technical Data and Model Selection."
- Install the filter close to the input terminals of the AC drive, and keep the connection cable between them 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.

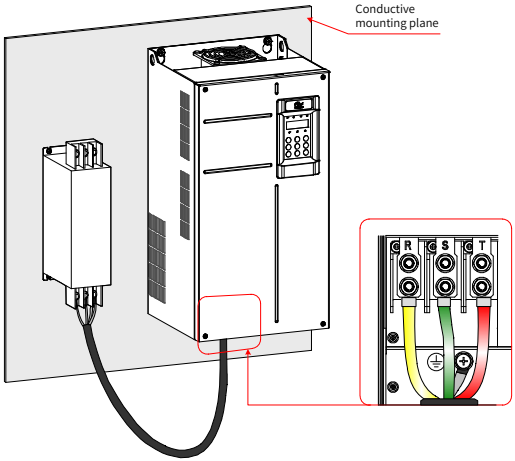


Figure 3-32 Mounting the filter

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

- 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.
- Keep the wiring length for the braking unit less than 10 m, and use the twisted pairs or tight pair wires 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

- They are connected to the terminals for connecting braking resistors of AC drives with 75 kW or lower power.
- 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 surroundings of the braking resistor free from combustibles to prevent the braking resistor from causing fire when heating up.

6) U, V, W terminals at the AC drive output side

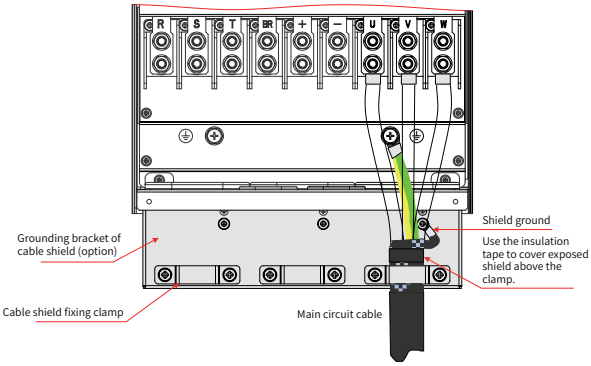


Figure 3-33 Shield wiring

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.

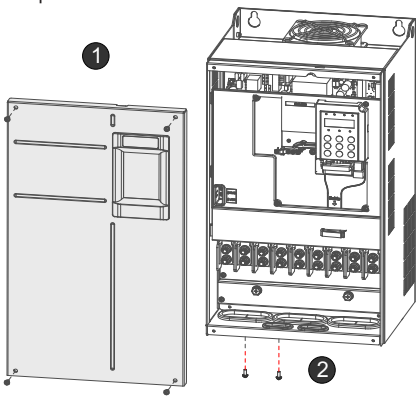
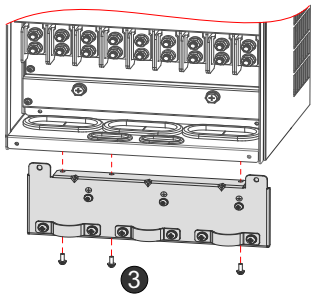
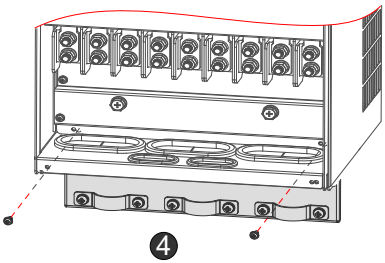
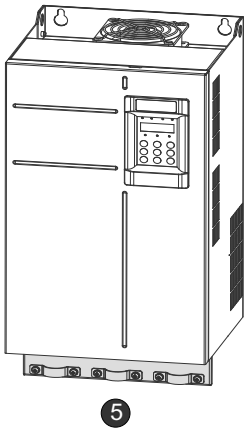
<table>
<tr><th colspan="2">Installation Instructions</th></tr>
<tr><td>① Remove the cover.
② Remove the two M4x12 SEMS screws on the inlet plate.
 
</td><td>③ Install the grounding bracket of cable shield on the AC drive chassis, and fasten the three positions shown in the figure by using three M4x12 SEMS screws.
 
</td></tr>
<tr><td>④ Fasten the two positions shown in the figure by using two M4x12 SEMS screws.
 
</td><td>⑤ Install the cover.
 
</td></tr>
</table>

Figure 3-34 Installation of the grounding bracket of cable shield

Table 3-5 Grounding bracket models for cable shield

Grounding Bracket Model for Cable Shield	Applicable Drive 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.
- Due to distributed capacitance, overlong motor cables are very likely to cause electrical resonance, which damages the motor insulation or generates large leakage current, thereby triggering the overcurrent protection mechanism of the AC drive. To avoid these problems, install an AC output reactor close to the AC drive when the motor cable length exceeds 100 m.
- Use shielded cables as motor output cables. Use a grounding bracket of cable shield to achieve all-round connection with the shield, and crimp the drain wire of the shield to the PE terminal.
- Keep the shield drain wire of the motor cable as short as possible, and ensure that its diameter is no less than one-fifth of its length.

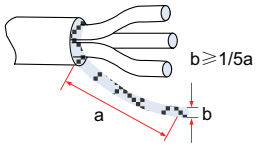


Figure 3-35 Drain wire of the motor cable shield

7) Grounding (PE) terminal

- Ground the PE terminal properly. The resistance value of the PE cable must be less than 4 Ω. Failure to comply may result in device fault or damage.
- Do not connect the PE terminal to the N terminal for the neutral wire 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 to connect the protective grounding conductor.
- Connect the main circuit shield to the PE terminal.
- 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 AC drive on the same mounting surface to ensure performance of the filter.

8) Requirements for protection of main circuit cables

- Add heat-shrink tubing to the copper tube lugs and cable conductors of the main circuit cables, and ensure that the tubes cover the cable conductors completely.

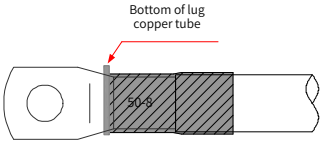


Figure 3-36 Heat-shrink tubing for cable conductor

9) Requirements on the upstream protection device

- Install a proper protection device on the input power line to provide isolation protection and protection against overcurrent and short circuit.
- 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 "9 Technical Data and Model Selection."

10) Requirements on the power system

- 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).

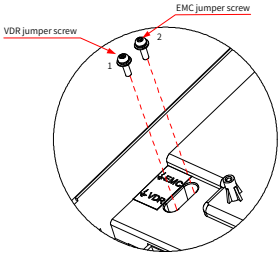


Figure 3-37 Positions of VDR and EMC ground jumpers

3.2.3 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 recommended data and models in this section are only for reference. The cable diameter you select cannot be greater than the size in the figures.
* IEC cables must meet the following requirements:
  - EN 60204-1 and IEC 60364-5-52 standards
  - PVC insulation
  - Copper conductor
  - 40° C ambient temperature and 70° C surface temperature
  - Symmetrical cables with copper mesh shield
  - No more than nine cables are placed side by side in the same cable tray.
* In the following tables, 3 x 10 indicates one 3-conductor 10 mm^2 cable, and 2 x (3 x 95) indicates two 3-conductor 95 mm^2 cables.

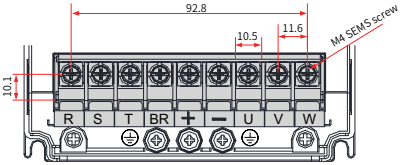


Figure 3-38 Dimensions of the main circuit terminals (CS710-4T0.4GB to CS710-4T5.5GB, three phase 380–480 V) (mm)

Table 3-6 Recommended main circuit cables for CS710-4T0.4GB to CS710-4T5.5GB (three phase 380–480 V)

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T-0.4GB	1.8	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	1.2
CS710-4T-0.7GB	2.4	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	1.2
CS710-4T-1.1GB	3.7	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	1.2
CS710-4T-1.5GB	4.6	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	1.2
CS710-4T-2.2GB	6.3	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	1.2
CS710-4T-3.0GB	9.0	3 x 1	TNR1.25-4	1	TNR1.25-4	1.2
CS710-4T-3.7GB	11.4	3 x 1.5	TNR1.25-4	1.5	TNR1.25-4	1.2
CS710-4T-5.5GB	16.7	3 x 2.5	TNR2-4	2.5	TNR2-4	1.2

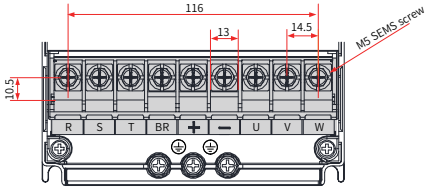


Figure 3-39 Dimensions of the main circuit terminals (CS710-4T7.5GB/CS710-4T11GB, three phase 380–480 V) (mm)

Table 3-7 Recommended main circuit cables for CS710-4T7.5GB/CS710-4T11GB (three phase 380–480 V)

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T7.5GB	21.9	3 x 4	TNR3.5-5	4	TNR3.5-5	2.8
CS710-4T11GB	32.2	3 x 6	TNR5.5-5	6	TNR5.5-5	2.8

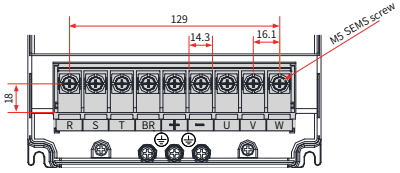


Figure 3-40 Dimensions of the main circuit terminals (CS710-4T15GB, three phase 380–480 V) (mm)

Table 3-8 Recommended main circuit cables for CS710-4T15GB (three phase 380–480 V)

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T15GB	41.3	3 x 10	TNR8-5	10	TNR8-5	2.8

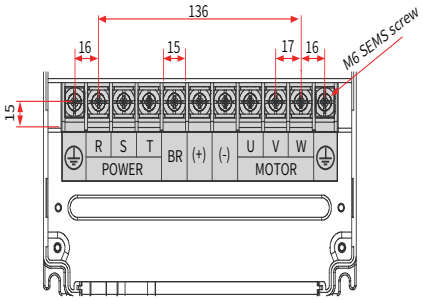


Figure 3-41 Dimensions of the main circuit terminals (CS710-4T18.5GB(-T)/CS710-4T22GB(-T), three phase 380–480 V) (mm)

Table 3-9 Recommended main circuit cables for CS710-T18.5GB(-T)/CS710-4T22GB(-T) (three phase 380–480 V)

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T18.5GB(-T)	49.5	3 x 10	GTNR10-6	10	GTNR10-6	4.0
CS710-4T22GB(-T)	59	3 x 16	GTNR16-6	16	GTNR16-6	4.0

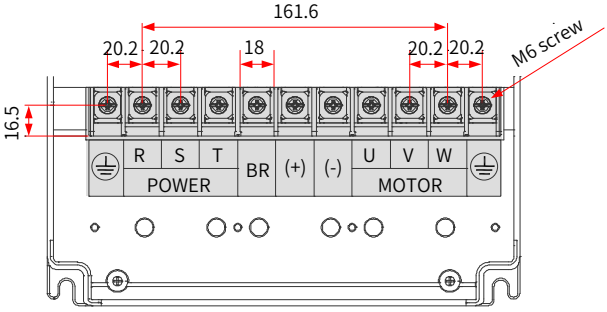


Figure 3-42 Dimensions of the main circuit terminals (CS710-4T30GB/CS710-4T37GB, three phase 380–480 V) (mm)

Table 3-10 Recommended main circuit cables for CS710-4T30GB/CS710-4T37GB (three phase 380–480 V)

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T30GB	57	3 x 16	GTNR16-6	16	GTNR16-6	4.0
CS710-4T37GB	69	3 x 25	GTNR25-6	16	GTNR16-6	4.0

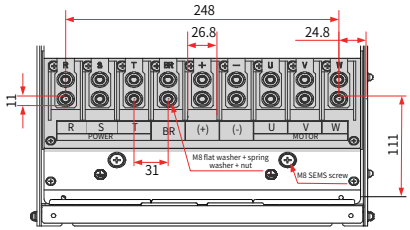


Figure 3-43 Dimensions of the main circuit terminals (CS710-4T45GB/CS710-4T55GB, three phase 380–480 V) (mm)

Table 3-11 Recommended main circuit cables for CS710-4T45GB/CS710-4T55GB (three phase 380–480 V)

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T45GB	89	3 x 35	GTNR35-8	16	GTNR16-8	10.5
CS710-4T55GB	106	3 x 50	GTNR50-8	25	GTNR25-8	10.5

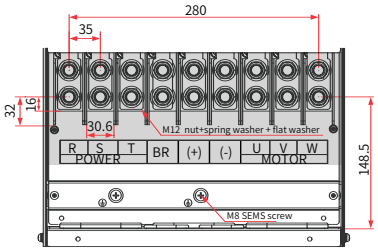


Figure 3-44 Dimensions of the main circuit terminals (CS710-4T75GB to CS710-4T110G, three phase 380–480 V) (mm)

Table 3-12 Recommended main circuit cables for CS710-4T75G to CS710-4T110G (three phase 380–480 V)

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T75GB	139	3 x 70	GTNR70-12	35	GTNR35-12	35.0
CS710-4T90G	164	3 x 95	GTNR95-12	50	GTNR50-12	35.0
CS710-4T110G	196	3 x 120	GTNR120-12	70	GTNR70-12	35.0

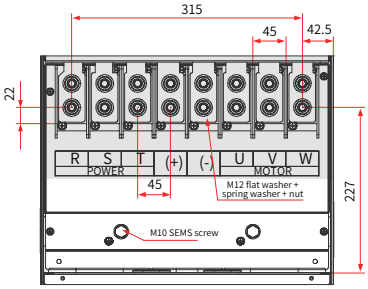


Figure 3-45 Dimensions of the main circuit terminals (CS710-4T132G/CS710-4T160G) (mm)

Table 3-13 Recommended main circuit cables for CS710-4T132G/CS710-4T160G

AC Drive Model	Rated Input Current (A)	Input/Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T132G	240	3 x 150	BC150-12	95	BC95-12	35.0
CS710-4T160G	287	3 x 185	BC185-12	95	BC95-12	35.0

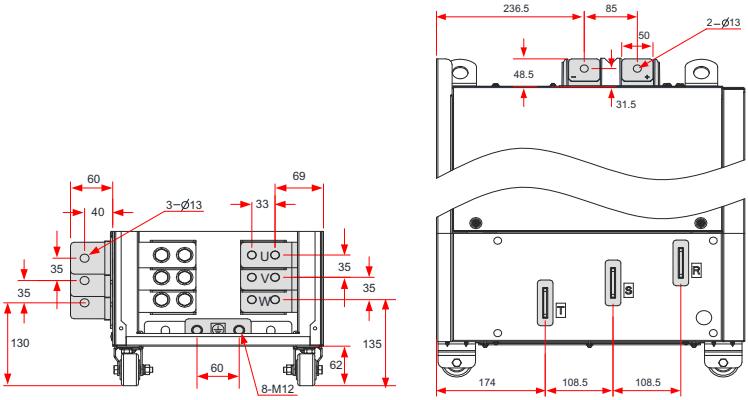


Figure 3-46 Dimensions of the main circuit terminals
(CS710-4T200G/CS710-4T220G, without the output reactor)

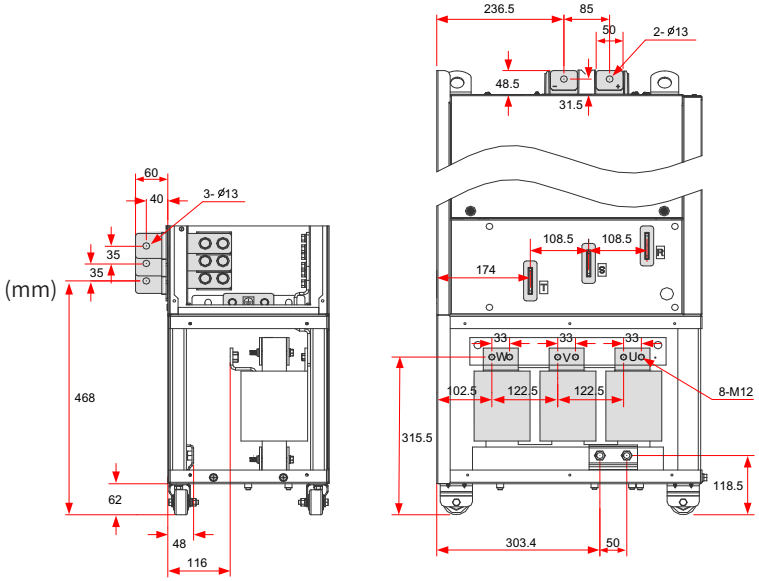


Figure 3-47 Dimensions of the main circuit terminals (CS710-4T200G/CS710-4T220G, with the output reactor) (mm)

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

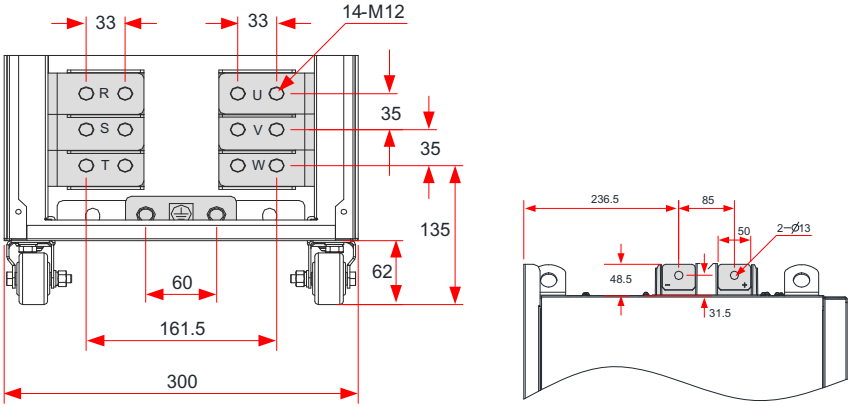


Figure 3-48 Dimensions of the main circuit terminals (CS710-4T200G/CS710-4T220G, without the side copper busbars or output reactor) (mm)

Table 3-14 Recommended main circuit cables for CS710-4T200G/CS710-4T220G

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T200G	365	2 x (3 x 95)	BC95-12	95	BC95-12	35.0
CS710-4T220G	410	2 x (3 x 120)	BC120-12	120	BC120-12	35.0

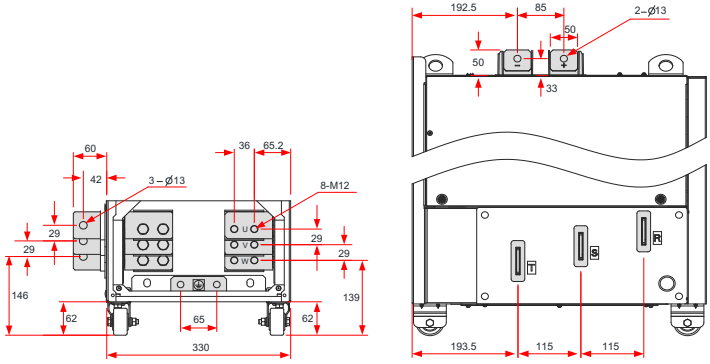


Figure 3-49 Dimensions of the main circuit terminals (CS710-4T250G/CS710-4T280G, without the output reactor) (mm)

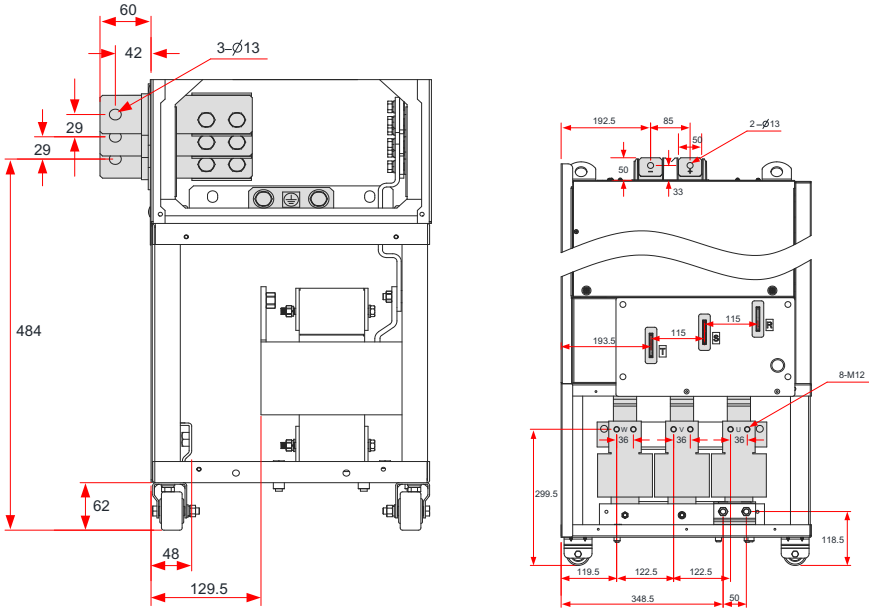


Figure 3-50 Dimensions of the main circuit terminals (CS710-4T250G/CS710-4T280G, with the output reactor) (mm)

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

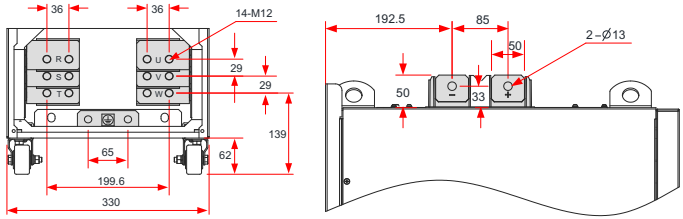


Figure 3-51 Dimensions of the main circuit terminals (CS710-4T250G/CS710-4T280G, without the side copper busbars or output reactor) (mm)

Table 3-15 Recommended main circuit cables for CS710-4T250G/CS710-4T280G

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T250G	441	2 x (3 x 120)	BC120-12	120	BC120-12	35.0
CS710-4T280G	495	2 x (3 x 150)	BC150-12	150	BC150-12	35.0

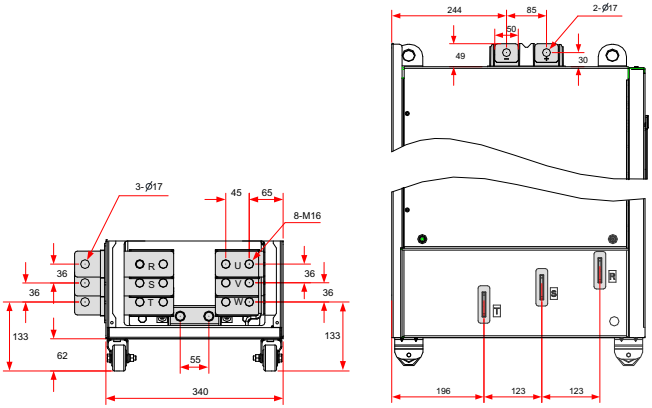


Figure 3-52 Dimensions of the main circuit terminals (CS710-4T315G to CS710-4T400G, without the output reactor) (mm)

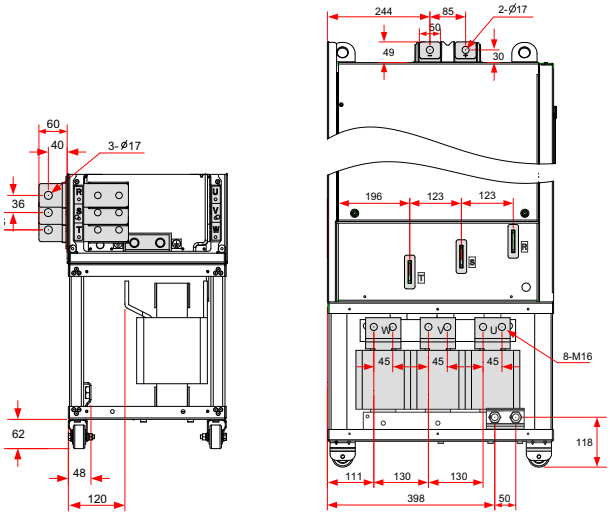


Figure 3-53 Dimensions of the main circuit terminals (CS710-4T315G to CS710-4T400G, with the output reactor) (mm)

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

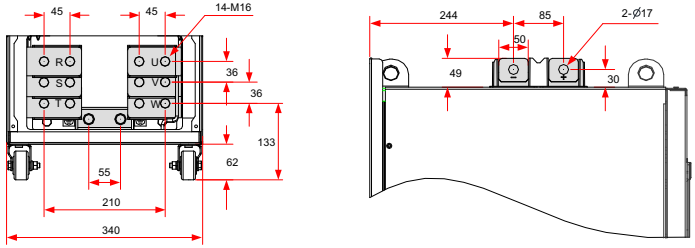


Figure 3-54 Dimensions of the main circuit terminals (CS710-4T315G to CS710-4T400G, without the side copper busbars or output reactor) (mm)

Table 3-16 Recommended main circuit cables for CS710-4T315G/CS710-4T355G/ CS710-4T400G

AC Drive Model	Rated Input Current (A)	Input/ Output Power Cable (mm^2)	Lug Model	Ground Cable (mm^2)	Ground Cable Lug Model	Tightening Torque (N·m)
CS710-4T315G	565	2 x (3 x 185)	BC185-16	185	BC185-16	85.0
CS710-4T355G	617	2 x (3 x 185)	BC185-16	185	BC185-16	85.0
CS710-4T400G	687	2 x (3 x 240)	BC240-16	240	BC240-16	85.0

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

The following table lists the data of recommended cable lugs (manufacturer: Suzhou Yuanli Metal Enterprise Co., Ltd) for your reference.

GTNR series TNR series BC series

Figure 3-55 Appearance of cable lugs

NOTE

For details about the selection of cable lugs, see “9.4.2 Lug Models and Dimensions”.

3.2.4 Requirements on Main Circuit Wiring Tools

For wiring of main circuit terminals, use installation tools appropriate to terminal dimensions and secure the joints well. The following table describes the wiring tools.

Table 3-17 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 washer, and flat washer	Socket wrench (#13 socket)
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		

3.2.5 Control Board

For wiring of the control circuit, remove the cover of the AC drive before connecting any jumper, PG card, or functional expansion card. The following figure shows the positions of the control board, jumpers, and expansion cards on the AC drive after the cover is removed.

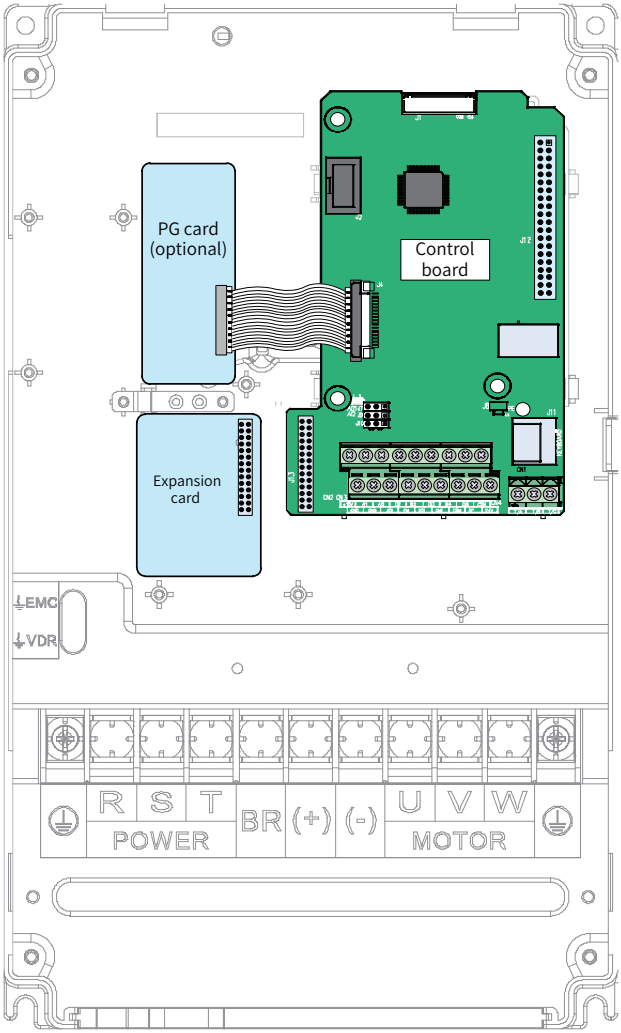


Figure 3-56 Installation position of the CS710 series AC drive control board

- Control circuit terminal layout

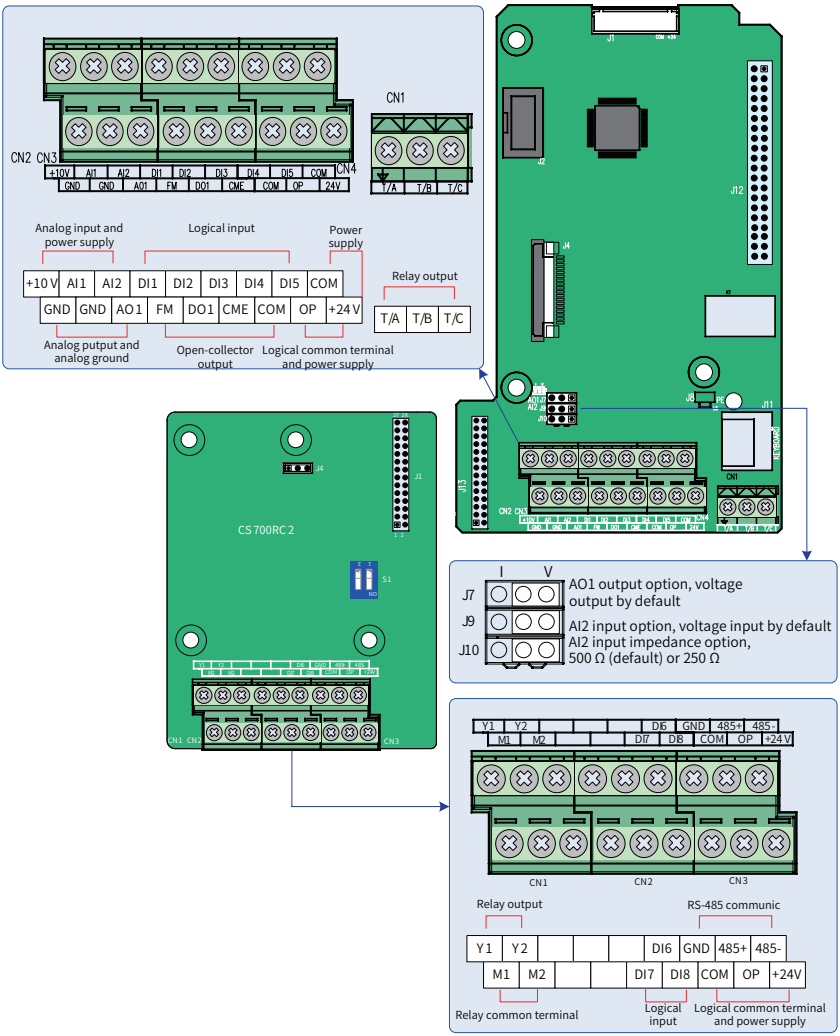


Figure 3-57 Control circuit terminal layout

NOTE

* CS700IO1 is the standard configuration for AC drives of 11 kW and below, and CS700RC2 is the standard configuration for AC drives of 15 kW and above.

Table 3-18 Functions of control circuit terminals

Type	Identifier	Terminal Name	Function
Power supply	+10V-GND	+10 V external power supply	It provides +10 V power supply to an external device. Maximum output current: 10 mA It is generally used to power an external potentiometer with resistance ranging from 1 kΩ to 5 kΩ.
	+24V-COM	+24 V external power supply	It provides +24 V power supply to external devices, such as DIs, DOs, and external sensors. Maximum output current: 200 mA [1]
	OP	External power supply input terminal	It connects to +24 V by default. It is disconnected from the +24 V power terminal and connected to an external power supply when DI1 to DI5 are driven by external signals.
Analog input (AI)	AI1-GND	AI terminal 1	Input voltage range: 0 VDC to 10 VDC Input impedance: 22 kΩ
	AI2-GND	AI terminal 2	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 (voltage input); 500 Ω or 250 Ω (current input) determined by jumper J10 [2]
Digital input (DI)	DI1-OP	DI 1	Photocoupler isolation, compatible with dual-polarity inputs Input impedance: 1.39 kΩ Operating voltage range: +9 V to +30 V
	DI2-OP	DI 2	
	DI3-OP	DI 3	
	DI4-OP	DI 4	
	DI5-OP	DI 5	
	DI6-OP	DI 5	
	DI7-OP	DI 6	
	DI8-OP	DI 7	
Analog output (AO)	AO1-GND	AO1	Voltage or current output, determined by jumper J7 on the control board Output voltage range: 0 V to 10 V Output current range: 0 mA to 20 mA
Digital output (DO)	DO1-CME	DO1	Photocoupler isolation, dual-polarity open-collector output Output voltage range: 0 V to 24 V Output current range: 0 mA to 50 mA Note: CME and COM are internally insulated. By default, CME and COM are shorted externally (DO1 is driven by +24 V by default). To drive DO1 by an external power supply, disconnect the short connection between CME and COM.
	FM-CME	DO2	

Type	Identifier	Terminal Name	Function
Relay output	T/A-T/B	Normally closed (NC) terminal 1	Driving capacity of the contact: 250 VAC, 3 A, cosϕ = 0.4 30 VDC, 1 A
	T/A-T/C	Normally open (NO) terminal 1	
	Y1-M1	NO terminal 2	
	Y2-M2	NO terminal 3	
Auxiliary interface	J13	Function expansion card interface	28-core terminal, interface for optional cards (I/O expansion card, PLC card, and various bus cards)
	J4	PG card interface	Open-collector, differential, UVW, or resolver interface
	J11	External operating panel interface	External operating panel
Jumper [3]	J7	AO1 selection	Either voltage or current output (voltage output by default)
	J9	AI2 input Select	Either voltage or current input (voltage input by default)
	J10	AI2 input Impedance selection	500 Ω or 250 Ω; 500 Ω by default

NOTE

- [1] When the ambient environment is above 23° C, the output current must be de-rated by 1.8 mA for every additional 1° C. The maximum output current is 170 mA at 40° C. When OP is shorted to 24 V, the current of the DI shall also be considered.
- [2] Based on the maximum output voltage of the signal source, select the impedance of 500 Ω or 250 Ω. For example, if 500 Ω is selected, the maximum output voltage cannot be lower than 10 V so that AI2 can measure 20 mA current.
- [3] Positions of jumpers J7, J9, and J10 on the control board are shown in the control circuit terminal layout diagram.

Table 3-19 Parameter settings for standard expansion cards on the CS710 series AC drives

Function	Setting parameters
Models of 15 kW and above (CS700RC2)	
Y1 relay	b3.20 is used to control the output of the Y1 relay. Set the thousands position to 1 (indicating DO) and use it the same way as other DO points.
Y2 relay	b3.17 is used to control the output of the Y2 relay. Use it the same way as other DO points.
Y3 relay	b3.15 is used to control the output of the Y3 relay. Use it the same way as other DO points.
DI6 input point	b3.06 is used to select the input function of the DI6 input point. 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 position to 1 (indicating DO) and use it the same way as other DO points.
DI6 input point	b3.06 is used to select the input function of the DI6 input point. 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.

3.2.6 Control Circuit Terminal Wiring

◆ Control circuit cable selection

All control circuit cables must be shielded cables. Use a separate shielded cable for each type of analog signal. Use shielded twisted pair (STP) cables for digital signals.

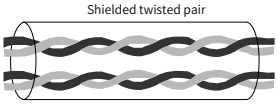


Figure 3-58 STP cables

◆ Cabling requirements

Lay the motor cable far from all control circuit cables.

Route the motor cable, input power supply cable, and control circuit cable through different troughs. Avoid long-distant parallel routing of the motor cable and control circuit cable to reduce electromagnetic interference caused by coupling.

If the control circuit cable must run across the power cable, arrange them at an angle of 90° .

The recommended cabling diagram is as follows.

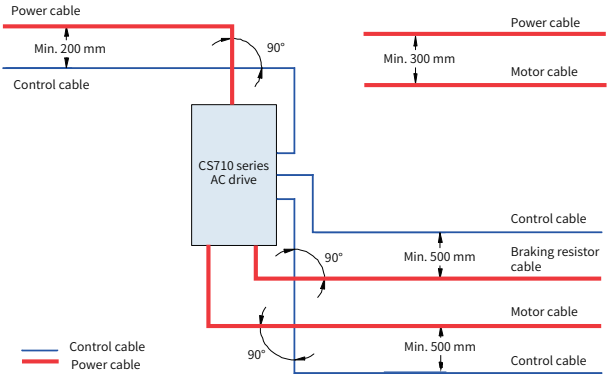


Figure 3-59 Cabling

◆ 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 3-60. 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 3-62.

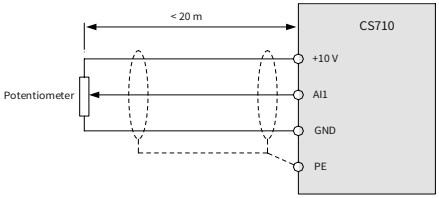


Figure 3-60 Wiring of AI1

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

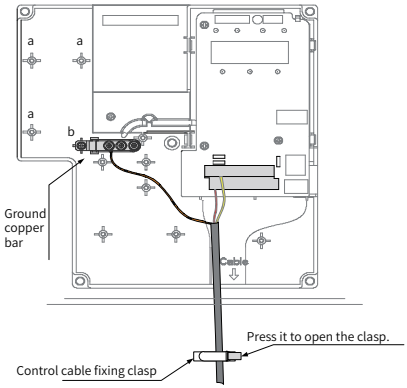


Figure 3-61 Grounding the shield of AI cable

◆ Wiring of AI2

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

When you select current input for AI2, set jumper J9 to the I side. The current flows to AI2 and flows from GND.

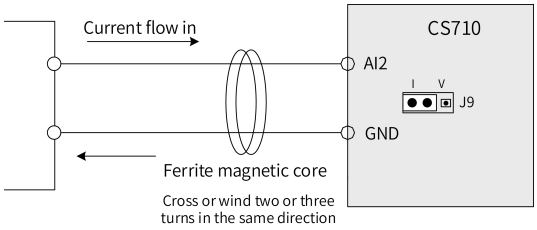


Figure 3-62 Wiring of AI2

◆ Wiring of DI1 to DI5

1) Sink wiring

● Sink wiring

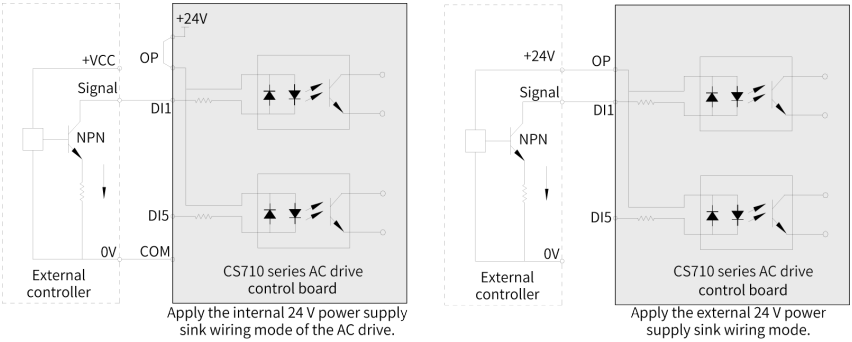


Figure 3-63 Sink wiring

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 3-64 shows such parallel connection.

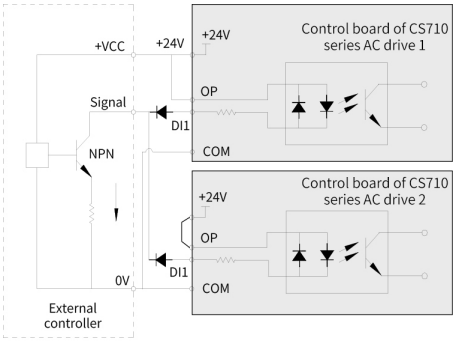


Figure 3-64 Wiring for parallel connection of DI terminals of multiple AC drives in sink mode

2) Source wiring

● Source wiring

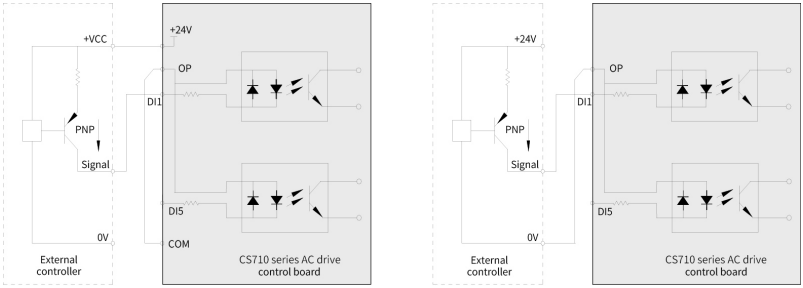


Figure 3-65 Source wiring

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)

As a high-speed pulse input terminal, DI5 supports the maximum frequency of 100 kHz.

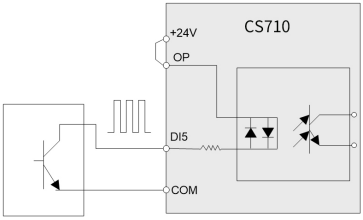


Figure 3-66 High-speed pulse input

◆ Wiring of DO

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

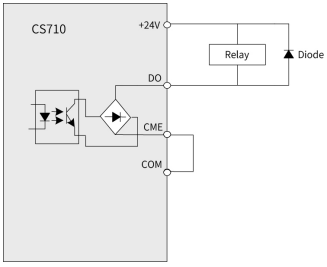


Figure 3-67 Wiring the DO

Caution

* Do not reverse the polarity of the snubber diode, as shown in Figure 3-67. Otherwise, the 24 VDC power supply will be damaged immediately once there is DO.
* CME and COM are internally insulated. By default, CME and COM are shorted externally (DO1 is driven by +24 V by default). To drive DO1 by an external power supply, disconnect the short connection between CME and COM.

◆ Wiring of high-speed DO FM

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

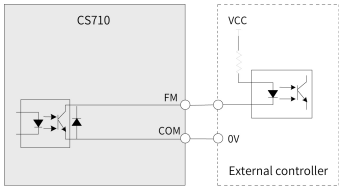


Figure 3-68 Wiring of high-speed DO FM

◆ Wiring of the relay output terminal

Inductive loads (relays, contactors, and motors) cause voltage spikes at cutoff of current. To minimize such interference, connect a VDR to the relay contact. In addition, connect absorption circuits, such as VDRs, RC absorption circuits, and diodes, to the inductive loads.

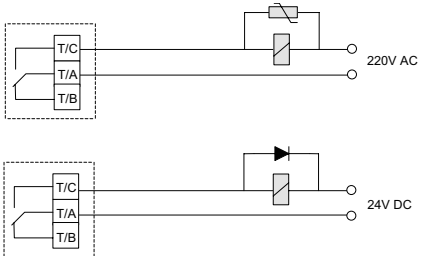


Figure 3-69 Anti-interference treatment for the relay output terminal

3.2.7 Wire Size and Tightening Torque of the Control Circuit Terminal

● Tubular terminal

Use tubular terminals with bushing.

Keep the exposed conductor of a single or stranded wire no longer than 6 mm.

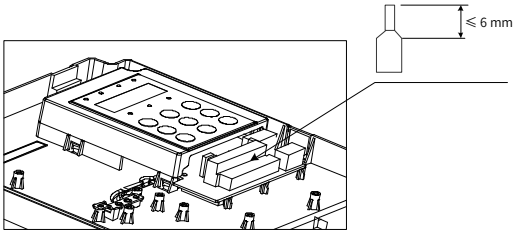


Figure 3-70 Requirements on the tubular terminal of a control cable

Table 3-20 Wire size and torque specification

Control Circuit Terminal Block	Single Wire Size mm^2 (AWG)	Stranded Wire Size mm^2 (AWG)	Tightening Torque (N·m)
	0.2 to 0.75 (AWG 24 to AWG 18)		0.565

3.2.8 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.

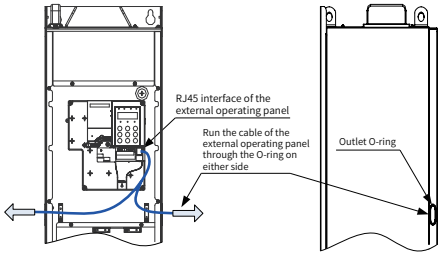


Figure 3-71 Wiring for connecting the external operating panel

NOTE

For details about the installation dimensions and usage of the external operating panel, see “Figure 9-23 Dimensions of the external operating panel (mm)” and "4.2 LED Operating Panel" and "4.3 Viewing and Modifying Parameters."

3.2.9 Wiring Checklist

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

Table 3-21 Wiring checklist

No.	Check Item	Checked
1	Check that you receive a correct model.	
2	Ensure correct peripheral devices (braking resistor, braking unit, AC reactor, filter, and circuit breaker) are used.	
3	Check that the models of optional cards are correct.	
4	Check that the mounting method and location meet the requirements.	
5	Check that the voltage on the input side is within 323 V to 528 V.	
6	Check that the rated motor voltage matches the AC drive output specification.	
7	Connect the power supply to the R, S, and T terminals of the AC drive properly.	
8	Connect motor cables to the U, V, and W terminals of the AC drive properly.	
9	Check that the cable diameter of the main circuit complies with specifications.	
10	Check that heat-shrink tubing is added to lug copper tubes and cable conductors of the main circuit and ensure the heat-shrink tubing completely covers the cable conductor.	
11	Decrease F0.15 (carrier frequency) if the length of the motor output cable exceeds 50 m.	
12	Ground the AC drive properly.	
13	Check that output terminals and control signal terminals are connected securely and reliably.	
14	When using the braking resistor and braking unit, check that they are wired properly and that their resistance values are proper.	
15	Use STP cables as control circuit signal cables.	
16	Connect optional cards correctly.	
17	Route control circuit cables and main circuit power cables through different routes.	

4 Operating Panel Operations

4.1 Instruction

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 is available as an option. The external LED operating panel allows you to modify and view parameters. For its appearance and use, see "4.2 LED Operating Panel." The LCD operating panel allows you to view, modify, copy, and download parameters.

4.2 LED Operating Panel

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

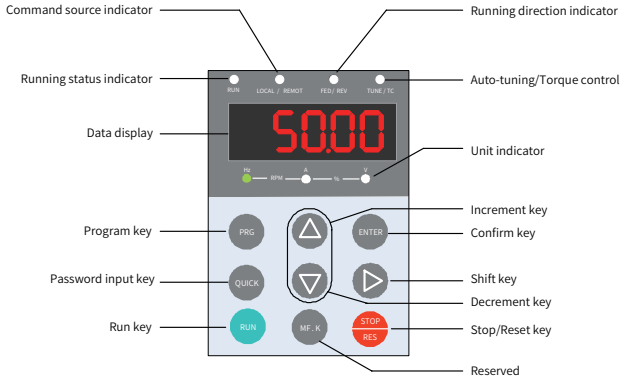


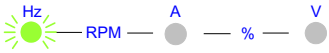
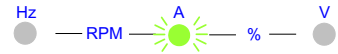
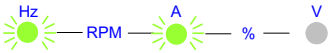
Figure 4-1 LED operating panel

4.2.1 Function Indicators

In the following table, indicates that an indicator is on, indicates that an indicator is off, and  indicates that an indicator is blinking.

Table 4-1 Indicators on the operating panel

State		Indication
RUN Running status indicator	 RUN	Off: Stopped
	 RUN	On: Running [1]

State		Indication
LOCAL/REMOT Command source indicator		Off: Operating panel control
		On: Terminal control
		Blinking: Communication control
FWD/REV Forward/Reverse run indicator		Off: Forward running
		On: Reverse running
TUNE/TC Tuning, torque control, and fault indicator		Off: Running normally
		On: Torque control mode
		Blinking once per second: Auto-tuning state
		Blinking four times per second: Faulty
		Hz for frequency
		A for current
		V for 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.

4.2.2 LED Display

The five-digit LED display shows the frequency reference, output frequency, monitoring information, and fault code.

Table 4-2 Indication of the LED display

LED Display	Indication	LED Display	Indication	LED Display	Indication	LED Display	Indication
0	0	6	6	C	C	N	N
1	1	7	7	c	c	P	P

LED Display	Indication	LED Display	Indication	LED Display	Indication	LED Display	Indication
2	2	8	8	d	D	r	R
3	3	9	9	E	E	T	T
4	4	A	(A)	F	F	U	U
5	5 or S	b	B	L	L	u	u

The five-digit LED display shows monitoring data, fault codes, and parameters.

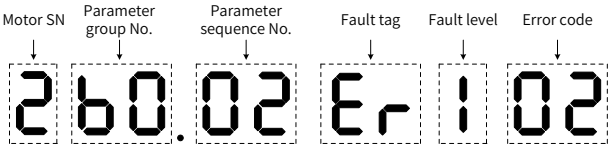


Figure 4-2 Example of the LED display

NOTE

◆ If DI is not set to motor switching (input functions 27 and 28), the LED display does not show the sequence number of the currently connected motor.

4.2.3 Keys on the LED Operating Panel

Table 4-3 Functions of keys on the operating panel

Key	Key Name	Function
PRG	Programming	Enter or exit level I menu.
ENTER	Enter	Access the menu interfaces level by level and confirm parameter settings.
△	Up	Used to increase the data or parameter.
▽	Down	Used to decrease the data or parameter.
▷	Shift	Used to select any parameters displayed cyclically in the STOP or RUNNING status. Select the bit to modify when modifying a parameter.
RUN	Run	Start the AC drive in the operating panel running mode.
STOP RES	Stop/Reset	Stop the AC drive in the operating panel control mode. Reset the AC drive in the faulty state.

Key	Key Name	Function
MF.K	Reserved	Function reserved.
QUICK	Quick	Press the key to quickly enter the password input interface. Long-press the key for 5s to quickly enter the parameter auto-tuning mode.

4.3 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.

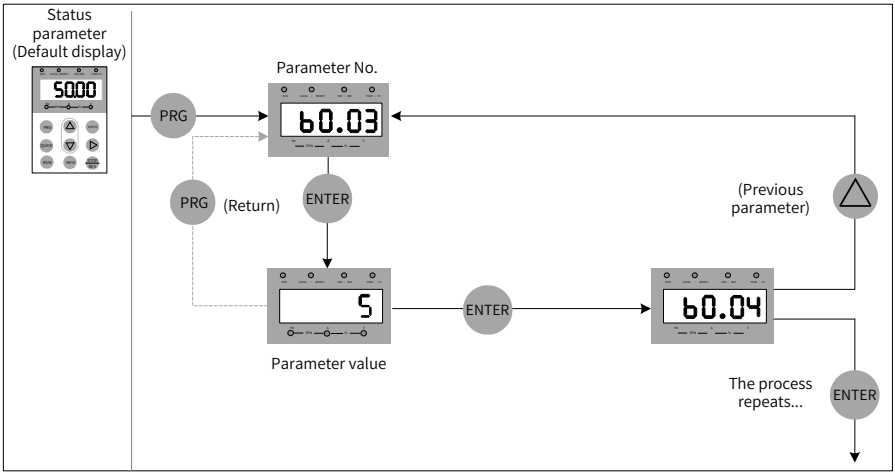


Figure 4-3 Switching between different operation interfaces

Example: Change the value of parameter b1.02 from 10.00 Hz to 15.00 Hz.

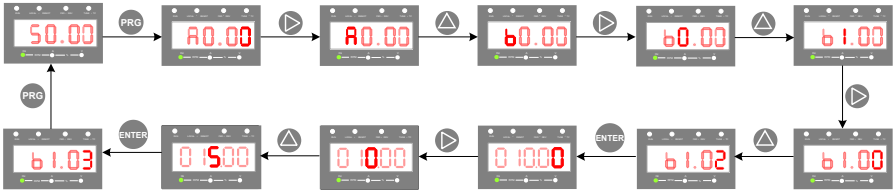


Figure 4-4 Changing the value of a parameter

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

1) The parameter is read-only. For example, it indicates the monitoring information and running status.

2) The parameter cannot be modified while the AC drive is running. You can modify it only after stopping the AC drive.

4.4 Parameter Group

Table 4-4 Parameter groups

Parameter Group	Function Description	Description
Group A	Basic crane parameter group	Used to set motor parameters and basic information about the crane
Group b	AC drive function parameter group	Function parameters such as operation command, frequency command, speed curve, and brake time sequence
Group F	AC drive performance parameter group	Core performance parameters of the AC drive
Group U	Monitoring parameter group	Basic monitoring parameters of the AC drive
Group E	Fault parameter group	Fault record display

4.5 Viewing Status Parameters

When the AC drive is in the stop or running state, you can view multiple status parameters by pressing the  key on the operating panel. In the operation state, you can view five parameters: reference frequency, output synchronous frequency, output current, output voltage, and bus voltage. In the stop state, you can view only the target frequency and bus voltage.

5 System Commissioning

This chapter describes basic commissioning operations for a trial run of the AC drive, including setting the frequency reference, and stopping and starting the AC drive.

5.1 Quick Commissioning Guide

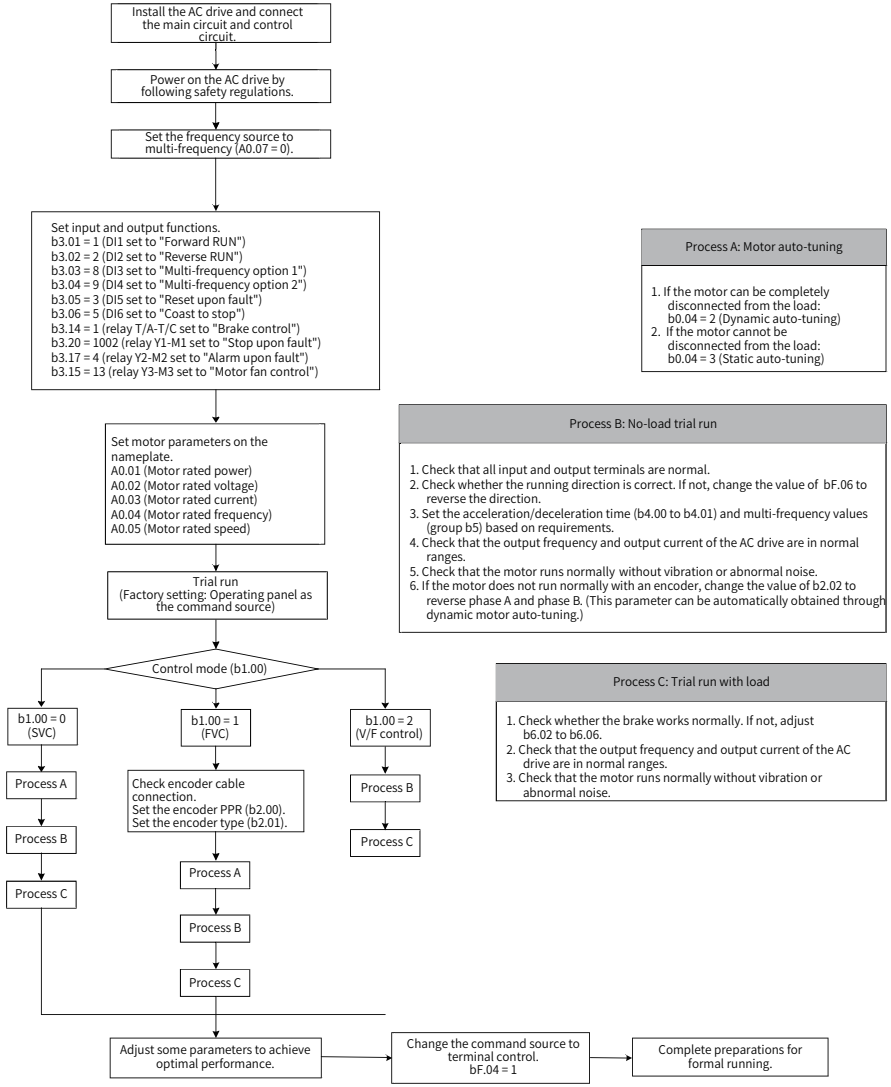


Figure 5-1 Quick commissioning steps

5.2 Precautions Before Power-on

Check the following items before powering on the AC drive.

Item	Requirement
Power supply voltage	The input voltage is in the range of three-phase 380 VAC to 480 VAC, 50/60 Hz.
	The input terminals R, S, and T are connected reliably.
	The AC drive and motor are reliably grounded.
Connection between AC drive output terminals and motor terminals	The AC drive output terminals U, V, and W are correctly and firmly connected to the motor terminals.
Connection of control circuit terminals	Control circuit terminals of the AC drive are correctly and firmly connected to other control devices.
Status of AC drive control terminals	All terminals of the AC drive control circuit are OFF (the AC drive is not running).
Load	The motor is off load and disconnected from the mechanical system.

5.3 Status Display After Power-on

After power-on, the operating panel displays the following information.

State	Display	Description
Normal		The default value 8.00 Hz is displayed.
Faulty		The AC drive stops and the error type is displayed.

5.4 Restoring to Factory Settings

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 Level	Parameter	Function Description	Remarks
Level-1 menu	AF.01	Restoration of parameters in the level-2 menu to factory settings	Some parameters cannot be restored to the factory settings. For details, see the description of AF.01.
	AF.02	Display of user-defined parameter settings in the level-1 menu	The operating panel displays only parameters whose default values are changed in the level-1 menu.

Menu Level	Parameter	Function Description	Remarks
Level-2 menu	bF.01	Restoration of parameters in the level-2 menu to factory settings	You can restore parameters in the level-2 menu or in the level-1 and level-2 menus to factory settings. Some parameters cannot be restored to factory settings. For details, see the description of bF.01.
	bF.02	Display of user-defined parameter settings in the level-2 menu	The operating panel displays only parameters whose default values are changed in the level-2 menu.
	bF.03	Removal of historical records	This parameter is used to clear parameters stored upon a power failure of the AC drive, including the monitoring parameters in group U1 and fault record parameters. For the usage of bF.03, see its description.
Level-3 menu	FF.10	Restoration of parameters in the level-3 menu to factory settings	You can restore parameters in the level-3 menu or all parameters to factory settings. Some parameters cannot be restored to factory settings. For details, see the description of FF.10.
	FF.11	Display of user-defined parameter settings in the level-3 menu	The operating panel displays only parameters whose default values are changed in the level-3 menu.

5.5 Motor Control Modes

Parameter	Description	Scenario
b1.00: Motor control mode	0: SVC	SVC is the sensorless vector control mode applicable to common hoisting scenarios.
	1: FVC	FVC is the feedback vector control mode. The motor must have an encoder, and the AC drive must have a PG card of the same type as the encoder. This control mode is applicable to scenarios requiring high precision speed or torque control.
	2: V/f control	This control mode is applicable to scenarios that do not require high load capacity or where one drive is used to drive multiple motors.

5.6 Start and Stop Commands

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 selection		Default	0
	Value range	0	Operating panel control (LED off)	
		1	Terminal control (LED on)	
		2	Communication control (LED blinking)	

This parameter defines the input channel of the AC drive control commands, such as start, stop, forward running, and reverse running.

0: Operating panel control (LOCAL/REMOT indicator off)

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

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

The commands are given by using multi-functional input terminals.

2: Communication control (LOCAL/REMOT indicator blinking)

5.6.1 Operating Panel Control

Set bF.04 to 0 to select the operating panel as the input channel for the AC drive control commands. After you press the RUN key on the operating panel, the AC drive starts to run (the RUN indicator is on). After you press the STOP key while the AC drive is running, the AC drive stops running (the RUN indicator is off).

5.6.2 Terminal Control (DI)

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

The 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: To use the DIP switch to start and stop the AC drive, and allocate the forward rotation switch signal to DI1 and the reverse rotation switch signal to DI2, perform the settings according to the following figure.

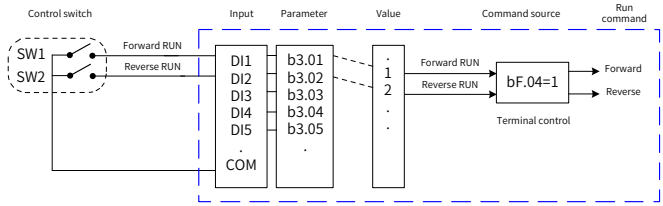


Figure 5-2 Example of AC drive control using terminals

In the figure above, when SW1 is closed, the AC drive runs in the forward direction; when SW1 is open, the AC drive stops. When SW2 is closed, the AC drive runs in the reverse direction; when SW2 is open, the AC drive stops. When both SW1 and SW2 are closed, the AC drive reports error 44# (both forward and reverse running commands are active).

In operating panel control mode, the AC drive drives the motor to operate in the forward direction after you press the RUN key. If the rotating direction is reverse to the direction required by the device, power off the AC drive (after the main capacitor of the AC drive is discharged) and exchange any two of the output U, V, and W cables. You can also set bF.06 to 1 to reverse the rotating direction of the motor.

5.6.3 Communication Control

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.

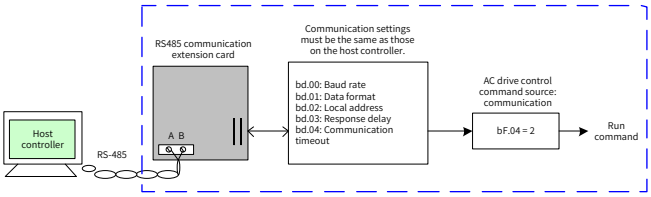


Figure 5-3 Example of AC drive control through communication with a host controller

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 can be enabled in some application scenarios.

5.7 Start and Stop Settings

5.7.1 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.)

5.7.2 Stop Mode

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

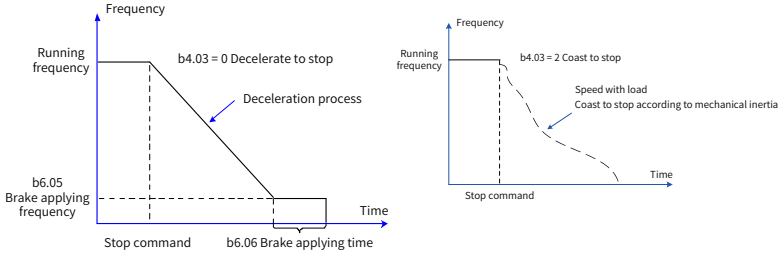


Figure 5-4 Stop modes

5.8 Frequency Reference Source Selection

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.

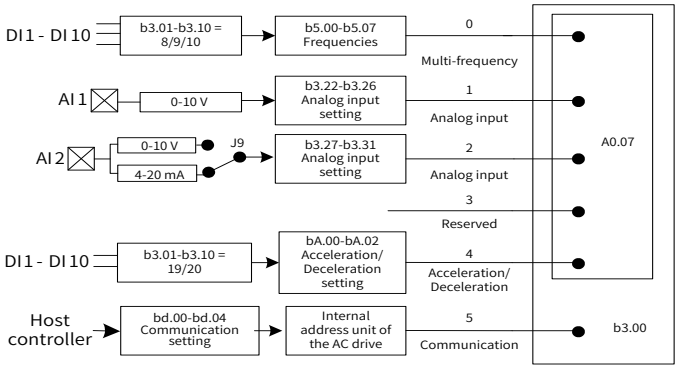


Figure 5-5 Frequency reference source selection

Set the related parameters for each frequency reference source according to the preceding figure.

5.8.1 Setting the Multi-Reference Mode

You can select the multi-reference mode in scenarios where only several frequencies are required and continuous adjustment of frequencies are not required. For the CS710 series AC drive, you can set a maximum of eight frequencies using a maximum of three DI functions. To specify multi-frequency command input terminals, set the parameters corresponding to the DIs to values in the range of 8 to 10. You can set the multi-frequency values according to the multi-frequency table of b5 group parameters. Set the frequency source to multi-frequency, as shown in the following figure.

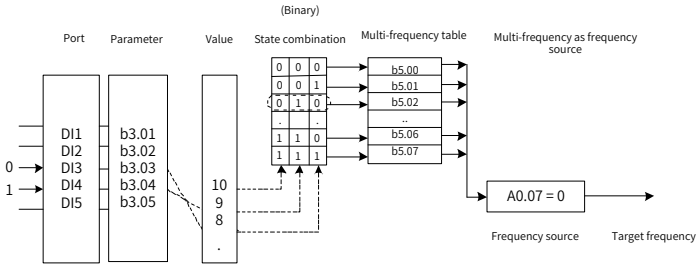


Figure 5-6 Setting the multi-reference mode

In the preceding figure, DI3 and DI4 are used as the multi-frequency input terminals. Each state combination is a 3-bit binary value. Therefore, if only two DIs are used, supplement bit 0 after the binary values of the two DIs. For example, when the input states of DI3 and DI4 are set to 0 and 1, respectively, the binary value is 0 1 0 and therefore the state combination value is 2. In this case, the frequency set by b5.02 is used. As the frequency source is multi-frequency, the value of b5.02 determines the target 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.

5.8.2 Using the AI to Set Frequency Reference

The following figure shows how to use a potentiometer to adjust the frequency reference of the AC drive. When the potentiometer is adjustable in the full range, the output frequency of the running AC drive can change between 0 and the maximum frequency.

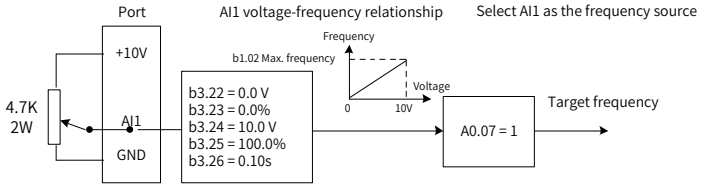


Figure 5-7 Using the AI to set frequency reference

5.9 Terminal Descriptions

5.9.1 DI Descriptions

The internal hardware of a DI is configured with a 24 VDC power supply for detection. After you short the DI and the COM terminal, the DI can input signals to the AC drive.

You can also set the software filter time (b3.21) for input signals from the DI to improve the anti-interference capability of the AC drive.

Parameters b3.01 to b3.08 can be used to select functions for the eight DIs. For details, see the description of parameters b3.01 to b3.08.

5.9.2 AI Descriptions

The CS710 series AC drive supports two AIs, which are designated as AI1 and AI2 on the control board.

Terminal	Input Signal Specification
AI1-GND	Receives a voltage signal of 0–10 VDC.
AI2-GND	Receives a voltage signal of 0–10 VDC when jumper J9 is in the position marked by "V" and receives a current signal of 4–20 mA when J9 is in the position marked by "I".

The AI can be used when external voltage or current signals are used to set the frequency source reference and torque reference for the AC drive. The mapping between voltage or current values and the actual setting or feedback is defined by b3.22 to b3.31.

The sampling values of AIs can be obtained from parameters U0.12 and U0.13. The calculated values are used for subsequent internal calculation of the AC drive and are not open to users.

5.9.3 DO Descriptions

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.

Terminal	Parameter	Output Specification
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; drive capacity: 250 VAC, 3 A
Y1-M1	b3.20	
Y2-M2	b3.17	

5.9.4 AO Descriptions

The AC drive supports two AOs, AO1 and AO2. AO1 is on the control board of the AC drive, and AO2 is provided by an external expansion card.

Terminal	Input Signal Specification
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 specify internal running parameters in analog mode. The specified parameter attributes are set using b3.19 and b3.20.
The specified running parameters can be corrected before being output. The correction characteristic curve is Y = kX + b, where X indicates the running parameter, and k and b of AO1 can be set using b3.44 and b3.43.

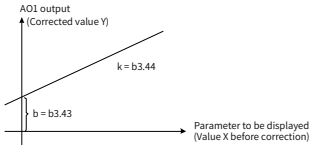


Figure 5-8 Output characteristic curve of AO1

5.9.5 PG Terminal Descriptions

The FVC mode (b1.00 = 1) can improve the frequency control performance of the AC drive. To use this mode, install an encoder on the motor shaft. Signals sent from the encoder are transmitted to the AC drive through the 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.

The encoder parameters must be set based on the actual type of encoder used. The following example describes the settings of motor parameter group 1.

1) When a differential encoder is used, use b2.00 to set the encoder pulses per revolution and set b2.01 to 0 (ABZ incremental encoder/differential encoder).

2) When a UVW encoder is used, use b2.00 to set the encoder pulses per revolution and set b2.01 to 1 (UVW incremental encoder).

3) When a resolver is used, set b2.01 to 2 (resolver).

4) When an open collector encoder or a push-pull encoder is used, use b2.00 to set the encoder pulses per revolution and set b2.01 to 0 (ABZ incremental encoder).

5) For details about the encoder usage, see “10.3 Encoder Expansion Cards”.

5.10 Auto-tuning

5.10.1 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).

5.10.2 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 Mode	Application	Auto-tuning Effect	Parameter Setting
Static auto-tuning (complete auto-tuning)	Applicable to all scenarios.	Good	b0.04 = 3
No-load dynamic auto-tuning (complete auto-tuning)	Applicable to scenarios where the motor can be disconnected from the load. If the motor load is of the roller type (pure inertia load), the roller can remain attached during the parameter auto-tuning process.	Optimal	b0.04 = 2
Static auto-tuning (incomplete 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).	Acceptable	b0.04 = 1

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

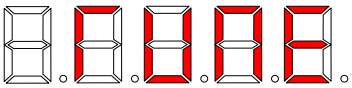
Step 1: If the motor can be disconnected from the load, cut off the power and disconnect the motor from the load so that the motor runs without load.

Step 2: Power on the AC drive, and then set the command source (bF.04) of the AC drive to operating panel control.

Step 3: Correctly set the nameplate parameters (A0.01 to A0.05) of the motor. Set the following parameters based on motor selection:

Manually Set Parameters
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**. The display on the operating panel is as follows:



Press "RUN" on the operating panel. The AC drive then drives the motor (acceleration time and deceleration time set by b4.06 and b4.07 respectively), and 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.

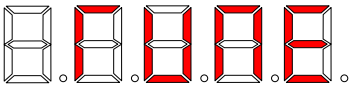
After dynamic parameter auto-tuning, the AC drive automatically obtains the following motor parameters:

Automatically Refreshed Parameters 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: Asynchronous motor no-load current

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.



The quick auto-tuning function can be used when a new round of auto-tuning is required after motor parameters are set. Auto-tuning mode 3 (complete static auto-tuning) is used by default in this case. You do not need to disconnect the motor from the load or change the value of bF.04 or any other parameters.

5.11 Password Settings

The CS710 series AC drive provides user password protection.

Parameter	Function Description	Content
AF.00	Password for all functional parameters	Password for groups A, b, E, U, and F
bF.00	Level-2 menu password	Password for groups b, E, U, and F
FF.00	Level-3 menu password	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. In this case, restart the system to unlock it. To disable the password protection function, set AF.00, bF.00, and FF.00 to 0.

5.12 Application Examples

5.12.1 Crane System Braking

■ Brake time sequence overview

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 following figure shows the brake control time sequence.

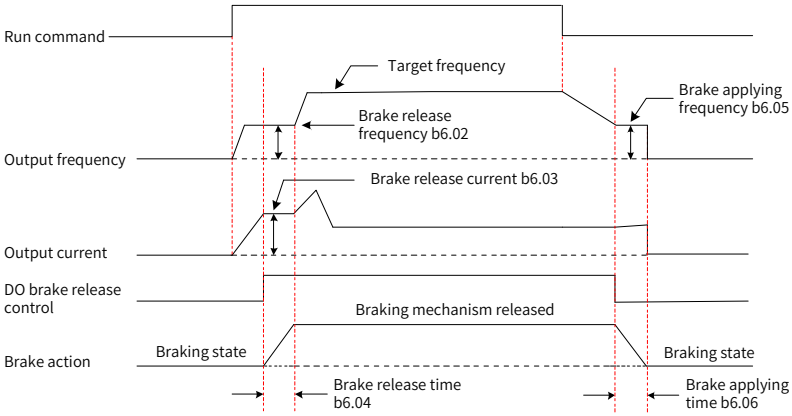


Figure 5-9 Typical control process of a crane system and parameter settings

The brake is engaged when it is powered off and is released after it is powered on. Actions of the brake are controlled with mechanical operations; therefore, there is a delay between brake signal output and braking state change. Set the brake time (6.06) and brake release time (b6.04) based on the mechanical operation delay of the brake. Theoretically, the time set by the two parameters should be slightly longer than the mechanical operation delay to prevent unintentional slip.

5.12.2 Safety Limit and Stop upon Faults

The following figure shows the electrical wiring for safety limit and stop upon faults. A limit switch is installed on each end of the rail. When the mechanism touches a limit switch, the control cabinet automatically stops running of the AC drive in this direction. Running of the AC drive in the opposite direction is not affected, and you can press the opposite running switch to restore running of the equipment.

When a level-I fault occurs on the AC drive, relay terminal Y1-M1 on the I/O expansion card sends a fault stop signal to trigger an action of contactor KM in the control cabinet. (For example, the contactor may cut off power to the running circuit. In this case, the equipment can resume normal running only after being reset).

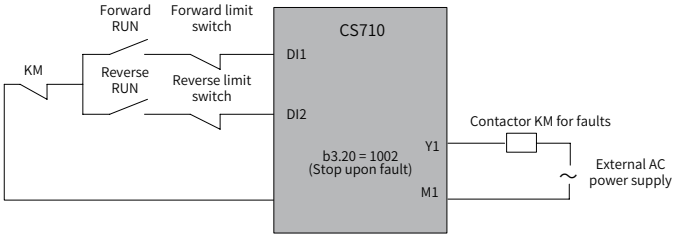


Figure 5-10 Circuit for safety limit and stop upon faults

NOTE

◆ The figure shows a commonly used connection of limit switches. You can change the connection based on your own requirements.

6 Parameter List

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.

You can modify some functional parameters only after the AC drive stops. Do not modify these parameters when the AC drive is running. The monitoring parameters are displayed on the operating panel only for view and cannot be modified.

6.1 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 No.	Parameter Name	Description	Value Range	Default
Group A0: Basic crane parameters				
A0.01	Rated motor power	This parameter sets the rated motor power displayed on the motor nameplate.	0.4 kW to 1000.0 kW	Depending on drive model
A0.02	Rated motor voltage	This parameter sets the rated motor voltage displayed on the motor nameplate.	0 V to 2000 V	380 V
A0.03	Rated motor current	This parameter sets the rated motor current displayed on the motor nameplate.	(≤ 55 kW) 0.01 A to 655.35 A (> 55 kW) 0.1 A to 6553.5 A	Depending on drive model
A0.04	Rated motor frequency	Indicates the rated motor frequency displayed on the motor nameplate.	0.01 Hz to b1.02 (maximum frequency)	50.00 Hz
A0.05	Rated motor speed	Indicates the rated motor speed displayed on the motor nameplate.	0 RPM to 65535 RPM	1400 RPM

Parameter No.	Parameter Name	Description	Value Range	Default
A0.07	Frequency source selection A	This parameter is used together with b3.00 (frequency source selection B) in the level-2 menu. A0.07 in the level-1 menu lists only four commonly used frequency sources, whereas b3.00 in the level-2 menu lists all frequency sources. If b3.00 is greater than 4, the frequency source specified by b3.00 takes effect. If b3.00 is less than or equal to 4, the frequency source specified by A0.07 takes effect. 0: Multi-frequency The binary value combinations of input functions 8, 9, and 10 can provide eight frequencies, which corresponds the frequencies set by b5.00 to b5.07. For details, see the description of parameters in group b5. 1: AI1 AI1 supports only the voltage input of 0 V to 10 V. 2: AI2 AI2 supports voltage input of 0 V to 10 V or current input of 4 mA to 20 mA, which is determined by jumper J9 on the control board. The AI is linearly proportional to the target frequency. The reference frequency is b1.02 (frequency top). 3: Reserved 4: Acceleration/Deceleration This mode must be used together with input terminals that are assigned with functions 19 and 20. For details, see the description of parameters in group bA.	0 to 4	0

<table>
<tr><th>Parameter No.</th><th>Parameter Name</th><th>Description</th><th>Value Range</th><th>Default</th></tr>
<tr><td>A0.08</td><td>Crane mechanism selection</td><td>This parameter is used to select the crane mechanism driven by the AC drive.
0: Hoisting mechanism
1: Translation mechanism
2: Rotation mechanism
<table>
<tr><th>Mechanism Type</th><th>Parameter</th><th>Description</th></tr>
<tr><td rowspan="5">Hoisting mechanism</td><td>b1.00 = 0</td><td>The control mode is changed to SVC.</td></tr>
<tr><td>b6.03 = 30.0%</td><td>The brake release current is changed to 30.0%.</td></tr>
<tr><td>bC.02 = 0.50s</td><td>Error 37# is triggered.</td></tr>
<tr><td>bC.04 = 0.50s</td><td>Error 38# is triggered.</td></tr>
<tr><td>F1.00 = 60</td><td>Speed loop gain 1 is changed 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>The brake release current is changed to 0.0%.</td></tr>
<tr><td>bC.02 = 0.0s</td><td>Error 37# is invalid.</td></tr>
<tr><td>bC.04 = 0.0s</td><td>Error 38# is invalid.</td></tr>
<tr><td>F1.00 = 30</td><td>Speed loop gain 1 is changed to 30.</td></tr>
<tr><td>Rotation mechanism</td><td colspan="2">Same as the translation mechanism.</td></tr>
</table>
Note:
When the value of A0.08 is changed, the values of parameters listed in the preceding table are also changed.</td><td>0 to 2</td><td>0</td></tr>
<tr><td colspan="5">Group AF: Level-1 menu auxiliary parameters</td></tr>
<tr><td>AF.00</td><td>User password</td><td>This parameter is used to set the password for displaying and modifying all functional parameters. If this parameter is set to a non-zero value, you must enter the password before accessing any menu. If you enter wrong passwords for three consecutive times, all menus are locked. In this case, you must power off and restart the AC drive to view or modify parameters. After this parameter is set to 0, the password protection function is disabled.</td><td>0 to 65535</td><td>0</td></tr>
<tr><td>AF.01</td><td>Restoration of parameters in the level-1 menu to factory settings</td><td>0: No operation
1: Restore parameters in level-1 menu to factory settings
A0.00 to A0.05, A0.08 to A0.09, and AF.00 in the level-1 menu cannot be restored to factory settings.</td><td>0 to 1</td><td>0</td></tr>
</table>

Parameter No.	Parameter Name	Description	Value Range	Default
AF.02	Level-1 menu setting display	0: Display level-1 menu parameters normally 1: Display level-1 menu parameters with default values changed 2: Display level-1 menu parameters with all indicators on	0 to 2	0

6.2 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.

You can enter the level-2 menu only after entering the correct password set by bF.00.

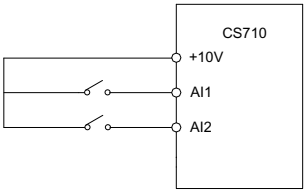
Parameter No.	Parameter Name	Description	Value Range	Default
Group b0: Basic motor parameters				
b0.00	Protection frequency of shaft-cooling motor running at a low speed	The two parameters are used when error 43# occurs, and are used for shaft-cooling motor protection. When the reference frequency of the AC drive keeps below the value set in b0.00 for a period longer than the value specified by b0.01, the AC drive reports error 43#. This function is invalid when b0.01 is set to 0.	0.01 Hz to 20.00 Hz	5.00 Hz
b0.01	Low-speed running time of shaft-cooling motor		0s to 1000s	0s
b0.04	Parameter auto-tuning selection	0: No operation 1: Static auto-tuning for an asynchronous motor (some motor parameters obtained) 2: Dynamic auto-tuning for an asynchronous motor (all motor parameters obtained) 3: Static auto-tuning for an asynchronous motor (all motor parameters obtained)	0 to 3	0
b0.05	Auto-tuning upon power-on	The CS710 series AC drive supports auto-tuning of stator resistance upon power-on. If this function is enabled, the AC drive takes 2s to 3s in static auto-tuning to achieve the optimal control effect every time it is powered on. 0: Disable 1: Enable	0 to 1	0
Group b1: Motor control parameters				
b1.00	Control mode	0: SVC control (open-loop control) 1: FVC control (closed-loop control) 2: V/f control	0 to 2	0

Parameter No.	Parameter Name	Description	Value Range	Default
b1.01	Slip compensation	This parameter is used to adjust the speed stability accuracy of the motor in SVC control mode. When the motor is connected to a heavy load and runs at a too low speed, increase the value of this parameter; otherwise, decrease the value of this parameter. In FVC control mode, this parameter can be used to change the output current of the AC drive under the same load.	50.0% to 200.0%	100.0%
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 indicates the maximum output frequency of the AC drive at any time.	50.00 Hz to 300.00 Hz	50.00 Hz
b1.03	Minimum frequency	This parameter is used to set the minimum output frequency of the AC drive at any time.	0.00 Hz to 15.00 Hz	0.00 Hz
b1.04	Forward torque upper limit	Used to set the output torque upper limits when DI function 1 (Forward RUN) and DI function 2 (Reverse RUN) are enabled. The values are percentages of the rated motor torque. In SVC mode, even if the parameters are set to below 50.0%, the AC drive will regard the output torque upper limit as 50.0%.	0.0% to 500.0%	180.0%
b1.05	Reverse torque upper limit			
b1.06	Forward torque upper limit during brake release	The two parameters are valid only when b6.00 is set to 2 (manual brake control). The torque upper limits specified by the two parameters are used within the brake release time (b6.04) after the AC drive starts. After the brake is released completely, the torque upper limits change to the values specified by b1.04 and b1.05.		150.0%
b1.07	Reverse torque upper limit during brake release			130.0%
Group b2: Encoder parameters				
b2.00	Encoder pulses per revolution	This parameter is used to set the pulses per revolution of an ABZ or a UVW incremental encoder. In FVC mode, the pulses per revolution must be set properly to ensure normal running of the motor.	0 to 8192	1024

Parameter No.	Parameter Name	Description	Value Range	Default
b2.01	Encoder type	0: ABZ incremental encoder/Differential encoder Use the MD38PGMD PG card for this type of encoder. 1: UVW incremental encoder Use the MD38PG3 PG card for this type of encoder. 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 installing the PG card, set this parameter properly to ensure normal running of the AC drive.	0 to 4	0
b2.02	AB phase sequence of ABZ incremental encoder	This parameter is valid only for an ABZ incremental encoder (b2.01 = 0). It is used to set the AB phase sequence of the ABZ incremental encoder. During auto-tuning for an asynchronous motor, the AC drive automatically identifies the AB phase sequence.	0 to 1	0
b2.03	Encoder disconnection detection	This parameter is used to enable or disable detection of error 20# (encoder disconnection). When it is set to 1, detection of error 20# is enabled. When it is set to 0, error 20# is shielded.	0 to 1	1
b2.07	Encoder disconnection detection time	This parameter is used to set the encoder hardware disconnection detection time and is valid only for a PG card of the MD38PGMD model. When it is set to 0, encoder disconnection detection is disabled. When signals of the encoder are abnormal, the AC drive reports error 120#.	0.000s to 1.000s	0.000s
Group b3: I/O control parameters				
b3.00	Frequency source selection B	0–4: Same as A0.07 5: Communication The CS710 series AC drive supports setting of the frequency source in the following six communication modes: Modbus RTU, EtherCAT, EtherNet/IP, CANopen, PROFIBUS DP, and PROFINET. To implement different communication modes, applicable communication expansions cards must be selected, which is set in bd.07. For details, see "10.2 Communication Extension Cards" and descriptions of bd.07. For the frequency reference data format in each communication mode, see details of the specific communication mode.	0 to 6	0

Parameter No.	Parameter Name	Description	Value Range	Default
b3.01	DI1 function selection	1: Forward run 2: Reverse run An external terminal is used to control forward or reverse operation of the AC drive. 3: Reset upon fault A terminal is used the reset the AC drive when a fault occurs. It functions the same as the RESET key on the operating panel. This function allows you to reset the AC drive remotely. 4: Quick stop The AC drive outputs brake frequency (b6.05) immediately and executes the brake time sequence normally. 5: Coast to stop The AC drive blocks output and does not control the stop process of the motor. This stop mode is the same as coast to stop described in b4.03. 6: Decelerate to stop The AC drive decelerates normally and stops the motor after the brake time sequence is complete. The effect of this stop mode is the same as that of cancellation of the running command. 7: External fault input When this signal is sent to the AC drive, the AC drive reports error 50# (external input fault). 8: Multi-frequency selection 1 9: Multi-frequency selection 2 10: Multi-frequency selection 3 These options are valid when the frequency source is set to multi-frequency. For details, see the description of parameters in group b5. 11: Brake release feedback 12: Brake feedback They are feedback input signals of errors 41# and 42#. For details, see the description of the two errors. 13: Second acceleration ramp switching 14: Second deceleration ramp switching 15: Third acceleration ramp switching 16: Third deceleration ramp switching They are the DI switching point input functions for the acceleration and deceleration time during a special curve running. For details, see the description of special curve parameters in group b8.	0 to 133 (Input functions 1 to 33 are NO inputs. Input functions 101 to 133 are NC inputs. Input functions 0 and 100 are invalid.)	1
b3.02	DI2 function selection			2
b3.03	DI3 function selection			8
b3.04	DI4 function selection			9
b3.05	DI5 function selection			3
b3.06	DI6 function selection			5

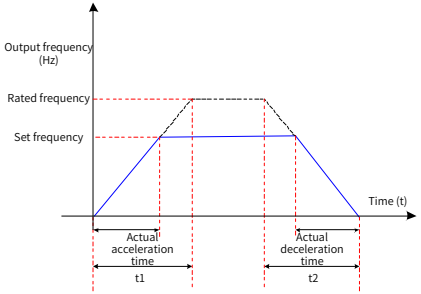
<table>
<tr><th>Parameter No.</th><th>Parameter Name</th><th>Description</th><th>Value Range</th><th>Default</th></tr>
<tr><td>b3.07</td><td>DI7 function selection</td><td rowspan="4">19: Acceleration
20: Deceleration
They are used as the frequency increment and decrement commands when the frequency is determined by external terminals. They are valid when the frequency source is set to acceleration/deceleration.
21: Torque/Speed control switchover
If the function is valid, the AC drive changes to the torque control mode. If the function is invalid, the AC drive changes to the speed control mode. For details, see the description torque control parameters in group bb.
22: Forward stop switch
23: Reverse stop switch
24: Forward deceleration switch
25: Reverse deceleration switch
After a stop switch takes effect, the AC drive performs the quick stop action (the same as input function 4). After a deceleration switch takes effect, the maximum output frequency of the AC drive is limited below the value specified by bF.16 (deceleration frequency limit). Using functions 22 and 24 and functions 23 and 25 can implement simple positioning function.
26: Positioning point shielding
If this function is active, the stop and deceleration switch inputs are both invalid.
27: Motor switchover switch 1
28: Motor switchover switch 2
A CS710 series AC drive has three sets of functional parameters for switchover between three motors. The motor switchover function takes effect only after the AC drive stops output. If you select functions 27 and 28 for one motor, they are also forcibly selected for the same DIs of the other two motors. The two input functions are used in combination in binary format, with the logic in the following table.
<table><tr><th>Input Function 28</th><th>Input Function 27</th><th>Motor SN</th></tr><tr><td>Off</td><td>Off</td><td>1#</td></tr><tr><td>Off</td><td>On</td><td>2#</td></tr><tr><td>On</td><td>Off</td><td>3#</td></tr><tr><td>On</td><td>On</td><td>3#</td></tr></table>
31: Position check
If the function becomes active, the accumulative number of pulses in the AC drive is reset to b7.10 x b7.11, and the position value is reset to b7.11. For details, see the description of b7.10 and b7.11.</td><td rowspan="4">0 to 133
(Input functions 1 to 33 are NO inputs.
Input functions 101 to 133 are NC inputs. Input functions 0 and 100 are invalid.)</td><td>0</td></tr>
<tr><td>b3.08</td><td>DI8 function selection</td><td>0</td></tr>
<tr><td>b3.09</td><td>DI9 function selection</td><td>0</td></tr>
<tr><td>b3.10</td><td>DI10 function selection</td><td>0</td></tr>
</table>

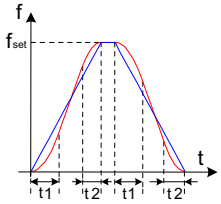
Parameter No.	Parameter Name	Description	Value Range	Default
b3.11	AI1 function selection	When this parameter is set to 0, the corresponding AI input is used as the target frequency input or is not used. When it is set to a non-zero value, the input function is the same as that of b3.01 to b3.10. The input is valid when the input voltage is greater than 7.00 V and is invalid when the input voltage is lower than 3.00 V. The wiring shown in the following figure is recommended for DI. 	0 to 133 (Input functions 1 to 33 are NO inputs. Functions 101–133 are NC inputs. 0 and 100 are invalid.)	0
b3.12	AI2 function selection			

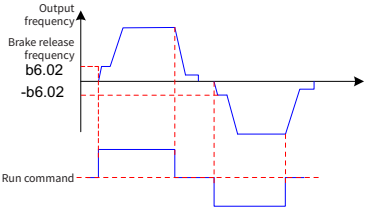
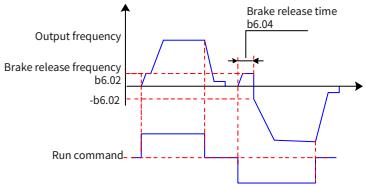
Parameter No.	Parameter Name	Description	Value Range	Default
b3.14	Relay 1 function selection (T/A-T/B-T/C)	1: Brake control This output is valid when the brake release condition is met in the brake sequence. For details, see the description of parameters in group b6. 2: Stop upon fault This output becomes valid after a level-1 fault occurs on the AC drive. 3: Alarm upon fault This output becomes valid after a level-2 or level-3 fault occurs on the AC drive. 4: Fault prompt This output becomes valid after a level 4 fault occurs on the AC drive. 5: Motor 1 connected indication 6: Motor 2 connected indication 7: Motor 3 connected indication If you select output functions 5 to 7 for one motor, they are also forcibly selected for the same outputs of the other two motors. 8: AC drive overload pre-warning This output becomes valid signals 10s before the AC drive performs overload protection. 9: Motor overload pre-warning Before triggering motor overload protection, the AC drive determines whether the load of the motor exceeds the overload pre-warning threshold. If the pre-warning threshold is exceeded, the output becomes valid. For details, see the description of the motor overload parameters bE.00 to bE.02. 11: Overload protection start This output function becomes valid after the AC drive enters the overload protection state. For details, see the description of bE.13. 12: Over-torque output This output function becomes valid when the output torque of the AC drive exceeds the threshold set in bF.17 and becomes invalid when the output torque is less than 90% of the threshold. For details, see the description of bF.17. 13: Motor fan control This output function becomes valid after the AC drive starts to operate and become invalid when the delay time set in bF.21 expires after the AC drive stops operation. 14: Output upon frequency reached For details, see the description of the parameters bF.07 and bF.08. 15: AC drive running This output function becomes valid when the AC drive is under operation and becomes invalid after the AC drive stops operation. 16: Automatic start output This output function is valid when the automatic start function of the AC drive is enabled. For details, see the description of bC.00. 17: Reserved 18: Communication control The output function is controlled by communication commands. For details, see the description of U0.11.	0 to 118 (Output functions 1 to 18 are NO outputs, 101 to 118 are NC outputs, and 0 and 100 are invalid.)	1
b3.15	Relay 2 (P/A-P/B-P/C)			-
b3.16	DO1 function selection			0
b3.17	DO2/Relay Y2 function selection			4

Parameter No.	Parameter Name	Description	Value Range	Default
b3.18	FM function selection	When the thousands position is set to 1, the FM output terminal is used as the DO. In this case, the parameter has the same output function as parameters b3.12 to b3.17. When the thousands position is set to 0, the FM output terminal is used as the high-speed pulse output terminal. In this case, the parameter has the same output function has parameters b3.19 to b3.20.	0 to 118 (Output functions 1 to 18 are NO outputs, 101 to 118 are NC outputs, and 0 and 100 are invalid.)	0
b3.19	AO1 function selection	When the thousands positions of the two parameters are set to 1, the AOs are used as the DOs. In this case, the parameters have the same output functions as parameters b3.14 to b3.17, with the output range from 0.00 V to 10.00 V. When the thousands position is set to 0, the output range 0.00 V to 10.00 V corresponds to 0.0% to 100.0%. Ones (position): AO function selection 0: Output frequency, 0 to the maximum frequency 1: Output current, 0 to 2 times the rated motor current 2: Output torque, 0 to 2 times the rated motor torque 3: Output power, 0 to 2 times the rated motor power 4: Output voltage, 0 to 1.2 times the rated motor voltage 5: Target frequency, 0 to the maximum frequency 6: Communication control output Tens (position): Reserved Hundreds (position): Reserved Thousands (position): DO/AO selection 0: AO 1: DO Ten thousands (position): Reserved The output is controlled through communication. For details, see the descriptions of U0.15 and U0.16.		0
b3.20	AO2 function selection			0
	Relay Y1 function selection			
	P/A-P/C function selection (MD38IO3, CS700IO1)			1001
b3.21	DI filter time	This parameter is used to set the software filter time of DI status. If DIs are prone to suffer from interference, which may cause malfunction, increase the value of this parameter to enhance the anti-interference capability. However, increasing the DI filter time will slow the response speed of DIs.	0.000s to 1.000s	0.010s

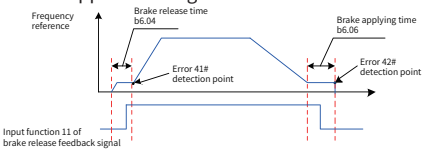
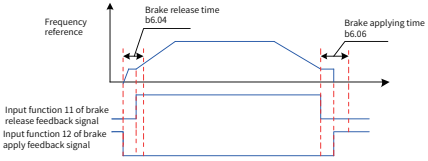
Parameter No.	Parameter Name	Description	Value Range	Default
b3.22	AI1 minimum input	Parameters b3.22 to b3.26 are used to define the relationship between AI voltages and setpoints. When the AI voltage exceeds the maximum value, the maximum value is used. When the AI voltage is less than the minimum value, the value set for the condition of "AI lower than minimum input" or 0.0% is used. When the AI is current input, 1 mA current corresponds to 0.5 V voltage. The input filter time is used to set the software filter time of the AI. If the AI is prone to suffer interference, increase the value of this parameter to stabilize the detected AI. However, increasing the AI filter time will slow the response speed of analog detection. Set this parameter properly based on actual conditions. In different applications, 100.0% of analog setting corresponds to different nominal values. For details, see the descriptions of different applications.	0.00 V to b3.24	0.00 V
b3.23	Settings corresponding to AI1 minimum input		0.0% to 100.0%	0.0%
b3.24	AI1 maximum input		B3.22 to 10.00 V	10.00 V
b3.25	Percentage corresponding to AI1 maximum input		0.0% to 100%	100.0%
b3.26	AI1 fitter time		0.00s to 10.00s	0.10s
b3.27	AI2 minimum input	For the specific function and usage, see the descriptions of b3.22 to b3.26.	0.00 V to b3.29	0.00 V
b3.28	Settings corresponding to AI2 minimum input		0.0% to 100.0%	0.0%
b3.29	AI2 maximum input		B3.27 to 10.00 V	10.00 V
b3.30	Percentage corresponding to AI2 maximum input		0.0% to 100%	100.0%
b3.31	AI2 fitter time		0.00s to 10.00s	0.10s
b3.43	AO1 zero offset coefficient	These parameters are used to correct the offset of the AO zero drift and the output amplitude. They can also be used to define the required AO curve. If b represents zero offset, k represents gain, Y represents actual output, and X represents standard output, the actual output is Y = kX + b. The zero offset coefficient 100% of AO1 and AO2 corresponds to 10 V (or 20 mA). The standard output refers to the value corresponding to the AO of 0 V to 10 V (or 0 mA to 20 mA) with no zero offset or gain adjustment. For example, the AO is frequency. If you want the AC drive to provide 8 V output when the frequency is 0 and provide 3 V output when the frequency reaches the maximum value, set the gain to -0.50 and the zero offset to 80%.	-100.0% to +100.0%	0.0%
b3.44	AO1 gain		-10.00 to +10.00	1.00
b3.45	AO2 zero offset coefficient		-100.0% to +100.0%	0.0%
b3.46	AO2 gain		-10.00 to +10.00	1.00

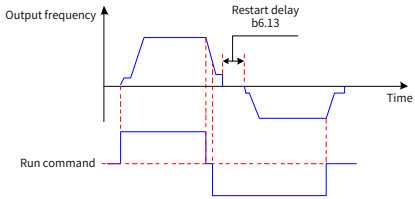
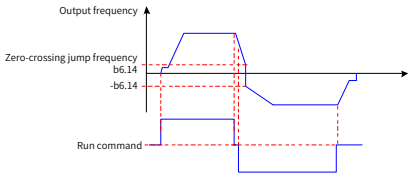
Parameter No.	Parameter Name	Description	Value Range	Default
Group b4: Ramp parameters				
b4.00	Acceleration time	Acceleration time (t1 in the following figure) is the time required for the AC drive to accelerate from 0 to the rated frequency (A0.04). Deceleration time (t2 in the following figure) is the time required for the AC drive to decelerate from the rated frequency (A0.04) to 0.  	0.0s to 600.0s	3.0s
b4.01	Deceleration time			
b4.02	Running curve mode selection	0: Linear acceleration/deceleration The output frequency increases or decreases linearly. 1: S-curve acceleration/deceleration The output frequency increases or decreases along the S curve. This mode is applicable to the scenarios that require soft start or stop.	0 to 1	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 becomes valid, the AC drive immediately stops output. Then, the motor coasts to stop based on the mechanical inertia.	0 to 1	0

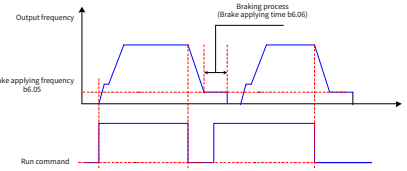
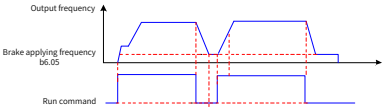
<table>
<tr><th>Parameter No.</th><th>Parameter Name</th><th>Description</th><th>Value Range</th><th>Default</th></tr>
<tr><td>b4.04</td><td>Time proportion of S-curve initial segment</td><td rowspan="2">The two parameters define the time proportions of the initial and final segments for S-curve acceleration and deceleration, respectively.
In the following figure, t1 is defined by b4.04, during which the slope of the output frequency increases gradually. t2 is defined by b4.05, during which the slope of the output frequency change gradually decreases to 0. Within the time between t1 and t2, the slope of the output frequency remains unchanged. That is, the output frequency increases or decreases linearly.
 
</td><td rowspan="2">0.0% to 40.0%</td><td rowspan="2">30.0%</td></tr>
<tr><td>b4.05</td><td>Time proportion of S-curve final segment</td></tr>
<tr><td colspan="5">Group b5: Multi-frequency parameters</td></tr>
<tr><td>b5.00</td><td>Multi-frequency 1</td><td rowspan="8">The multi-frequency functions are selected by input terminal functions 8, 9, and 10. The AC drive supports eight speed through digital status combinations of the three input functions, as shown in the following table.
<table><tr><th>Input Function 10</th><th>Input Function 9</th><th>Input Function 8</th><th>Target Speed</th></tr><tr><td>Off</td><td>Off</td><td>Off</td><td>b5.00</td></tr><tr><td>Off</td><td>Off</td><td>On</td><td>b5.01</td></tr><tr><td>Off</td><td>On</td><td>Off</td><td>b5.02</td></tr><tr><td>Off</td><td>On</td><td>On</td><td>b5.03</td></tr><tr><td>On</td><td>Off</td><td>Off</td><td>b5.04</td></tr><tr><td>On</td><td>Off</td><td>On</td><td>b5.05</td></tr><tr><td>On</td><td>On</td><td>Off</td><td>b5.06</td></tr><tr><td>On</td><td>On</td><td>On</td><td>b5.07</td></tr></table></td><td rowspan="8">Minimum frequency (b1.03) to maximum frequency (b1.02)</td><td>5.00 Hz</td></tr>
<tr><td>b5.01</td><td>Multi-frequency 2</td><td>20.00 Hz</td></tr>
<tr><td>b5.02</td><td>Multi-frequency 3</td><td>35.00 Hz</td></tr>
<tr><td>b5.03</td><td>Multi-frequency 4</td><td>50.00 Hz</td></tr>
<tr><td>b5.04</td><td>Multi-frequency 5</td><td rowspan="4">0.00 Hz</td></tr>
<tr><td>b5.05</td><td>Multi-frequency 6</td></tr>
<tr><td>b5.06</td><td>Multi-frequency 7</td></tr>
<tr><td>b5.07</td><td>Multi-frequency 8</td></tr>
</table>

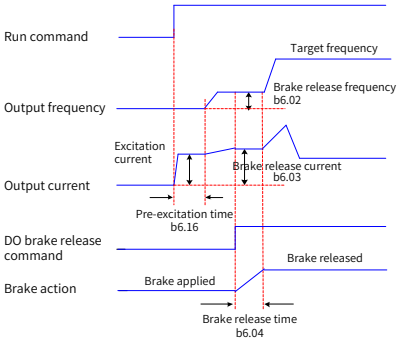
Parameter No.	Parameter Name	Description	Value Range	Default
Group b6: Brake logic control parameters				
b6.00	Brake curve type	0: No brake control The AC drive does not define the brake release frequency, brake release time, or brake applying time. Output function 1 is equivalent to the output function of "AC drive under operation." 1: Automatic brake control The AC drive automatically retains current (with upper torque limits specified by b1.04 and b1.05) within the brake release time. When the output current reaches the product of b6.03 multiplied by the rated motor current, the AC drive delivers the brake release command. 2: Manual brake control The AC drive uses values specified by b1.06 and b1.07 as torque upper limits. When the output current reaches the product of b6.03 multiplied by the rated motor current, the AC drive delivers the brake release command. For details, see the descriptions of the parameters b1.06 and b1.07.	0 to 2	1
b6.01	Startup direction	This parameter defines the output torque direction of the AC drive within the brake release time. 0: The direction of brake release torque is the same as the running direction.  1: The direction of brake release torque is always forward. 	0 to 1	0
b6.02	Brake release frequency	This parameter is 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.	Minimum frequency (b1.03) to 15.00 Hz	2.00 Hz

Parameter No.	Parameter Name	Description	Value Range	Default
b6.03	Brake release current	This parameter is used to set the percentage of the output current to the rated motor current (A0.03). When the output current of the AC drive reaches this value, the AC drive delivers the brake release command immediately (output function 1 valid).	0.0% to 150.0%	30.0%
b6.04	Brake release time	This parameter is used to set the time from start to complete of mechanical brake release. The AC drive keeps the output at the brake release frequency within this period of time.	0.00s to 5.00s	0.50s
b6.05	Brake apply frequency	When the output frequency of the AC drive falls below this value during deceleration after the RUN command is canceled, the AC drive delivers the brake command immediately (output function 1 invalid).	Minimum frequency (b1.03) to 20.00 Hz	2.00 Hz
b6.06	Brake time	This parameter defines the time required for the mechanical brake to apply completely. The AC drive maintains the output at the brake applying frequency within this period of time.	0.00s to 5.00s	0.50s
b6.07	Brake delay	This parameter defines the delay time for the AC drive to output the brake applying command when the brake applying condition is met. This function is invalid when quick stop or coast to stop is selected and the crane mechanism type (A0.08) is set to 0, 3, or 4.	0.0s to 30.0s	0.0s

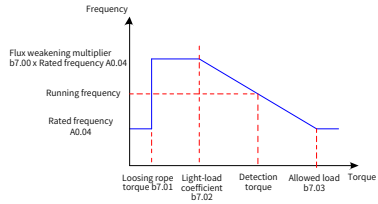
Parameter No.	Parameter Name	Description	Value Range	Default
b6.08	Brake feedback purpose	It is used when errors 41# and 42# occur. For details, see the description of the two errors. 0: Brake feedback not used No brake feedback contact is not connected to the AC drive, or the brake feedback function is not required. 1: Feedback over one terminal The AC drive detects brake feedback signals only during brake applying and release processes. This application requires only one brake feedback contact input. The following figure shows the correct application logic.  2: Feedback over two terminals The brake release time and brake applying time are determined by the brake feedback contact signal. The AC drive starts to check brake feedback signals immediately after being powered on. In this application, both the brake release contact and brake contact must be connected to the AC drive. The following figure shows the correct application logic.  	0 to 2	0

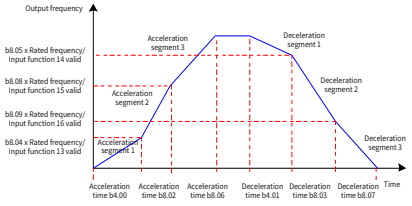
Parameter No.	Parameter Name	Description	Value Range	Default
b6.09	Command reverse control	0: Direct reverse not allowed during operation When the operating AC drive receives the reverse run command, it decelerates following the normal stop process and then starts reverse operation.  1: Reverse allowed during operation When the operating AC drive receives the reverse run command, it decelerates to the zero-crossing jump frequency (b6.14) and then directly starts reverse operation from the reversed zero-crossing jump frequency. Brake applying and release control are not performed in this process.  When the crane mechanism type is set to hoisting mechanism (A0.08 = 0), this function is valid only in closed-loop control mode. When other mechanism types are selected, this function is valid in all control modes.	0 to 1	0

Parameter No.	Parameter Name	Description	Value Range	Default
b6.12	Restart during braking	0: Restart not allowed during braking The AC drive does not accept the start command if the braking has started in the stop process. The AC drive can restart only after the brake is applied completely and the AC drive stops output.  1: Restart allowed during braking The AC drive accepts a new operation command even if the braking has started in the stop process.  	0 to 1	0
b6.13	Restart delay time	This parameter defines the delay time for the AC drive to 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	If the AC drive can change to run in the reverse direction to the current direction during running (b6.09 = 1) and the output frequency falls below the value of b6.14 during deceleration, the output frequency will jump from b6.14 to -b6.14. The actual value of this parameter must be greater than the brake release frequency b6.02 and braking frequency b6.05. For details, see the description of b6.09.	0.00 Hz to 20.00 Hz	2.00 Hz

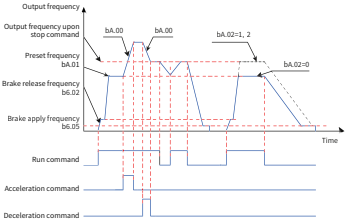
Parameter No.	Parameter Name	Description	Value Range	Default
b6.16	Pre-excitation time	 This parameter is used to set how long the pre-excitation stage lasts during AC drive startup. This function takes effect only in closed-loop vector control mode. When it is set to 0, the pre-excitation function is invalid.	0.00s to 5.00s	0.30s
b6.17	Excitation holding time after stop	This parameter defines the holding time of the excitation state after the AC drive stops. During this holding time, the AC drive provides zero speed output and retains the exciting current. If the AC drive receives the RUN command during this period, it can skip the pre-excitation stage and release the brake quickly.	0s to 65535s	30s
b6.18	Droop adjustment frequency	This parameter is read-only. It shows the difference value between the set frequency and actual frequency after droop calculation. See the description of b6.19 for more details.	-	-
b6.19	Droop control	This parameter is used to set the droop rate for droop control. When it is set to 0, the droop control function is disabled. Droop control is applicable to scenarios where two AC drives drive two motors in rigid connection. To prevent running conflict between the two motors, droop control allows minor speed deviation between the two motors. The droop rate is calculated using the following formula: Droop adjustment frequency (b6.18) = Set frequency x Output torque x Droop rate (b6.19)/10 Example: If b6.19 is 1.00, the set frequency is 50.00 Hz, and the output torque is 50.0%, then: Droop adjustment frequency = 50.00 Hz x 50.0% x 1.00/10 = 2.50 Hz Actual frequency of the AC drive = 50.00 Hz - 2.50 Hz = 47.50 Hz	0.00 to 20.00	0.00

Parameter No.	Parameter Name	Description	Value Range	Default
b6.21	Stator auto-tuning before startup	This parameter is used to enable or disable stator auto-tuning before startup. 0: Disable 1: Enable	0 to 1	0
b6.22	Brake release timeout interval	If brake release is not implemented after the time set by this parameter, a brake release error is reported.	0s to 5.00s	3.00s
B6.23	Delay time before braking	This parameter indicates the delay time before braking.	0s to 1.00s	0.1s
B6.24	Current threshold for braking	This parameter indicates the current threshold for braking.	0% to 500%	0%
B6.25	Coefficient for braking	This parameter indicates the coefficient for braking.	100% to 1000%	500%

Parameter No.	Parameter Name	Description	Value Range	Default
Group b7: Light-load and positioning control parameters				
b7.00	Flux weakening multiplier	The light-load high-speed function enables the AC drive to automatically calculate the maximum output frequency based on the load 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 light-load high-speed function. 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. When the time expires, the AC drive measures the output torque T and uses it to calculate the maximum frequency F for operation according to the curve, as shown in the following figure. If the target frequency is greater than the rated frequency and the value of b7.00 exceeds 100.0%, the light-load high-speed function 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 multiplied by the rated frequency. When the light-load coefficient < T < allowed load condition is met, F is automatically adjusted according to the following curve.  b7.08 and b7.09 indicate that when the light-load coefficient ⩽ T ⩽ allowed load condition is met, the target frequency is calculated as follows: F x b7.08 (forward run) or F x b7.09 (reverse run). The actual running frequency is limited by the maximum torque of the AC drive or motor.	100.0% to 300.0%	100.0%
b7.01	Loosing rope torque		0.0% to light-load coefficient (b7.02)	5.0%
b7.02	Light-load coefficient		Loosing rope torque (b7.01) to Allowed load (b7.03)	35.0%
b7.03	Load capacity		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
b7.08	Forward correction		0% to 100%	100%
b7.09	Reverse correction		0% to 100%	100%
b7.10	Position display proportion	This parameter is set based on the position display accuracy. It 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 the value of b7.10. Note: The pulses provided to CS710 series AC drive are quadruplicated.	1 to 65535	1

Parameter No.	Parameter Name	Description	Value Range	Default
b7.11	Position check value	When input function 31 (position check) is valid, the accumulative number of pulses in the AC drive is reset to the value of b7.10 multiplied by the value of b7.11, and the position data is reset to the value specified by b7.11.	0 to 65535	0
Group b8: Special curve parameters				
b8.00	Special acceleration	0: Disabled Special acceleration/deceleration is not used. 1: Two-segment (frequency switchover) Two-segment acceleration/deceleration is used. When the output frequency exceeds the rated frequency multiplied by b8.04 during acceleration, the acceleration time changes to the value of b8.02. When the output frequency falls below the rated frequency multiplied by b8.05 during deceleration, the deceleration time changes to the value of b8.03. 2: Three-segment (frequency switchover) Three-segment acceleration/deceleration is used. Functions in the two segments (frequency switchover) are supported in the three segments. Moreover, when the output frequency exceeds the rated frequency multiplied by b8.08 during acceleration, the acceleration time changes to the value of b8.06. When the output frequency falls below the rated frequency multiplied by b8.09 during deceleration, the deceleration time changes to the value of b8.07. 3: Two-segment (DI switchover) Two-segment acceleration/deceleration is used. When input function 13 is valid during acceleration, the acceleration time changes to the value of b8.02. When input function 14 is valid during deceleration, the deceleration time changes to the value of b8.03. 4: Three-segment (DI switchover) Three-segment acceleration/deceleration is used. Functions in the two segments (DI switchover) are supported in the three segments. Moreover, when input function 15 is valid during acceleration, the acceleration time changes to the value of b8.06. When input function 16 is valid during deceleration, the deceleration time changes to the value of b8.07.  	0 to 4	0
b8.01	Special deceleration			

Parameter No.	Parameter Name	Description	Value Range	Default
b8.02	Segment-2 acceleration time	For details, see the descriptions of b8.00 and b8.01.	0.1s to 600.0s	3.0s
b8.03	Segment-2 deceleration time		0.1s to 600.0s	3.0s
b8.04	Segment-2 acceleration switchover frequency		0% to segment-3 acceleration switchover frequency (b8.08)	0%
b8.05	Segment-2 deceleration switchover frequency		Segment-3 deceleration switchover frequency (b8.09) to 99%	99%
b8.06	Segment-3 acceleration time		0.1s to 600.0s	3.0s
b8.07	Segment-3 deceleration time		0.1s to 600.0s	3.0s
b8.08	Segment-3 acceleration switchover frequency		Segment-2 acceleration switchover frequency b8.04 to 99%	99%
b8.09	Segment-3 deceleration switchover frequency		0% to segment-2 deceleration switchover frequency (b8.05)	0%
Group bA: Acceleration/Deceleration parameters				
bA.00	Acceleration/ Deceleration rate	This parameter is used to set the frequency change rate when the frequency source is set to acceleration/deceleration or input function 19 (acceleration) and input function 20 (deceleration) are valid.	0.01 Hz/s to 50.00 Hz/s	5.00 Hz/s
bA.01	Preset frequency	This parameter is used to set the initial value of the target frequency when the frequency source is set to acceleration/deceleration.	Brake release frequency (b6.02) to Maximum frequency (b1.02)	50.00 Hz

Parameter No.	Parameter Name	Description	Value Range	Default
bA.02	Frequency retentive option	0: Not save The value of bA.01 is used as the initial target frequency each time. 1: Retentive until power failure The value of bA.01 is used as the initial target frequency for the first run of the AC drive after power-on. If the power is not cut off, the initial target frequency is always the output frequency of the AC drive when it cancels the run command last time. 2: Retentive all along The initial target frequency is the frequency set when the AC drive cancels the run command and starts to decelerate last time. This frequency is retentive upon power failure. 	0 to 2	0
bA.03	Minimum frequency for acceleration/ deceleration	This parameter is 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

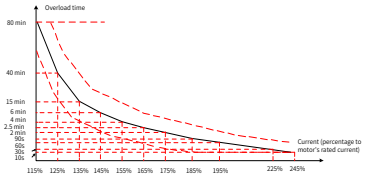
Parameter No.	Parameter Name	Description	Value Range	Default
Group bb: Torque control parameters				
bb.00	Torque control function selection	0: Disable torque control The speed control mode is used all the time. 1: Torque control all along The torque control mode is used all the time. 2: Torque/Speed control mode switchover by frequency The torque control mode is used when the output frequency of the AC drive is greater than the value of bb.01. Otherwise, the speed control mode is used. 3: Torque/Speed control mode switchover by torque The torque control mode is used when the output torque of the AC drive is greater than the value of bb.02. Otherwise, the speed control mode is used. 4: Torque/Speed control mode switchover by frequency and torque The torque control mode is used when the output frequency of the AC 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 is used. 5: Torque/Speed control mode switchover by DI The torque control mode is used when input function 21 is valid, and the speed control mode is used when the function is invalid. 6: Torque/Speed control mode switchover by communication	0 to 6	0
bb.01	Frequency threshold	For details, see the description of bb.00.	0.00 Hz to maximum frequency (b1.02)	25.00 Hz
bb.02	Torque threshold		0.0% to 150.0%	50.0%
bb.03	Torque source	1: AI1 AI1 supports only the voltage input of 0 V to 10 V. 2: AI2 AI2 supports voltage input of 0 V to 10 V or current input of 4 mA to 20 mA, which is determined by jumper J9 on the control board. When AI is used as the torque reference, 100.0% of voltage/current input corresponds to 200.0% of output torque. 4: Operating panel, with the value set by bb.08 5: Communication, with the torque written into address 0xbb08	0 to 5	0

Parameter No.	Parameter Name	Description	Value Range	Default
bb.04	Maximum forward frequency in torque control mode	These two parameters set the maximum frequency in the forward or reverse direction when the torque control mode is used. In torque control mode, if the load torque is less than the output torque of the motor, the motor speed keeps rising. Therefore, to prevent accidents such as runaway in the mechanical system, the motor speed must be controlled within a proper range.	0.00 Hz to maximum frequency (b1.02)	50.00 Hz
bb.05	Maximum reverse frequency in torque control mode			
bb.06	Torque control acceleration time	In torque control mode, the difference between the output torque of the motor and the load torque determines the speed change rate of the motor and load. The motor speed may change quickly, which may result in too loud noise or high mechanical stress. Setting the acceleration and deceleration time properly in torque control mode can ensure smooth change of the motor speed. If the motor needs to respond to torque changes quickly, set the torque control acceleration/deceleration time to 0.0s. For example, two motors are connected in the hard connection mode to drive the same load. To ensure balanced load distribution, set one AC drive as the master to work in speed control mode and the other as the slave to work in torque control mode. The slave receives the master's output torque as the torque command and must follow the master rapidly. In this case, the acceleration/deceleration time of the slave in torque control mode is set to 0.0s. The time base of the two parameters is 200.0% of the output torque.	0.0s to 600.0s	0.0s
bb.07	Torque control deceleration time			
bb.08	Target torque	This parameter is used to set the target torque used when bb.03 is set to 4 or 5.	-500.0% to +500.0%	180.0%
bb.09	Connection method selection	The torque control mode is usually used for master-slave control among multiple AC drives. The master AC drive uses the speed control mode, and the slave drives use the torque control mode. This parameter determines the type of connection used between master and slave drives. 0: Hard connection 1: Soft connection	0 to 1	0

Parameter No.	Parameter Name	Description	Value Range	Default
Group bC: Overspeed protection parameters				
bC.00	Number of pulses for automatic start	This parameter is used to set the automatic start function of the AC drive. When the AC drive stops in the closed-loop mode with the brake in the stop state, the AC drive can automatically run with 0 Hz output if the system detects that the change of encoder pulses reaches the value of this parameter multiplied by the encoder pulses per revolution. Meanwhile, the AC drive reports error E453#, and output function 16 takes effect. This function prevents shorting stator braking mode (for PMSM) caused by loose brake and enables the AC drive to send loose brake warning.	0 to 100.00	0
bC.01	Detection time of V/f speed error	When the difference between the motor actual running speed and the synchronous speed is above the deviation threshold specified by bC.03, Er*52 is reported after the time specified by bC.01.	0s to 60.0s	5.0s
bC.02	Abnormal frequency detection period	This parameter is used to set the error 37# detection time. When the motor feedback frequency keeps in an opposite direction to the reference frequency in a period longer than the value specified by bC.02, the AC drive reports error 37#. If this parameter is set to 0, error 37# is shielded.	0.00s to 1.00s	0.50s
bC.03	Frequency following error	This parameter is used to set the error 38# detection threshold. For details, see the description of bC.04 or error 38#.	0% to 30%	20%
bC.04	Frequency following detection period	This parameter is used to set the error 38# detection time. When the difference between the motor feedback frequency and reference frequency stays above the value of bC.03 multiplied by the rated frequency for a period longer than the value specified by bC.04, the AC drive reports error 38#. If this parameter is set to 0, error 38# is shielded. After the reference frequency and output frequency are higher than the rated frequency, this fault is invalid.	0.00s to 1.00s	0.50s
Group bd: Communication parameters				
bd.00	Baud rate	This parameter is used to set the speed of data transmission between the host controller and the AC drive in the Modbus communication mode. The baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail. A higher baud rate results in a faster communication speed. 5: 9600BPS 6: 19200BPS 7: 38400BPS 8: 57600BPS 9: 115200BPS	5 to 9	5

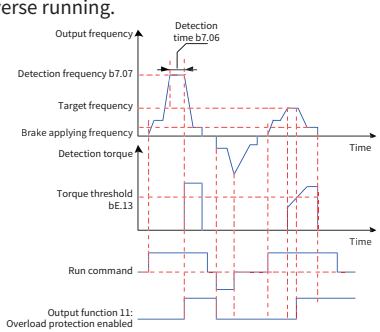
Parameter No.	Parameter Name	Description	Value Range	Default
bd.01	Data format	This parameter is used to set the data format used in the Modbus communication mode. The data format on the host controller must be the same as that on the AC drive. Otherwise, communication will fail. 0: No check, with the data format of <8,N,2> 1: Even parity check, with the data format of <8,E,1> 2: Odd parity check, with the data format of <8,O,1> 3: No check, with the data format of <8,N,1>	0 to 3	0
bd.02	Local address	When the local address is set to 0 (broadcast address), host controller broadcast is enabled. 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	Expansion card response delay	This parameter is used to set the time that the AC drive waits before sending data to the host controller after it finishes receiving data. If the response delay is shorter than the system processing time, the system processing time prevails. If the response delay is longer than the system processing time, the AC drive sends data to the host controller only after the response delay elapses. This parameter is valid only for RS485 communication.	0 ms to 20 ms	2 ms
bd.04	Expansion card timeout interval	If the communication interval between the AC drive and communication expansion card exceeds the value set by bd.04, the AC drive reports error 48#. This parameter is valid only for Modbus RTU, EtherCAT, EtherNet/IP, CANopen, PROFIBUS DP, and PROFINET communication modes.	0.0s to 60.0s	0.0s
bd.07	Expansion card selection	0: Modbus RTU communication 1: PROFIBUS DP communication 2: CANopen, PROFINET, EtherCAT, or EtherNet/IP communication Different communication modes require different expansion cards.	0 to 2	0
bd.08	Expansion card software version	This parameter sets the software version of the optional expansion card in use, such as the PROFIBUS DP, CANopen PROFINET, EtherCAT, or EtherNet/IP card.	0 to 65535	0

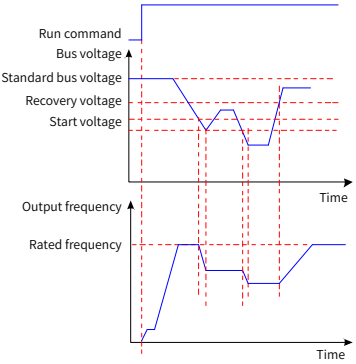
Parameter No.	Parameter Name	Description	Value Range	Default
bd.11 to bd.30	User-defined parameters 1 to 20	You can use the 20 user-defined parameters to redefine parameter and address mapping for the AC drive. For example, if bd.11 is mapped to A0.01, you can obtain the value of A0.01 by reading the bd.11 address. With settings of the user-defined parameters, inconsecutive parameters can be read continuously. For example, if values of A0.01, b0.05, and F0.04 need to be read circularly in Modbus RTU communication, three data frames need to be sent. However, after mapping bd.11, bd.12, and bd.13 to A0.01, b0.05, and F0.04, respectively, only one data frame needs to be sent to read the three continuous parameters starting with bd.11. In PROFIBUS DP communication and CANopen communication, each user-defined parameter is mapped to a communication address (one-to-one mapping). 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. CANopen communication: bd.11 to bd.18 are mapped to RPDO1 to RPDO3. bd.21 to bd.28 are mapped to TPDO2 to TPDO3.	A0-00 to A*-** b0-00 to b*-** U0-00 to U*-** F0-00 to F*-**	0

Parameter No.	Parameter Name	Description	Value Range	Default
Group bE: Fault and protection parameters				
bE.00	Motor overload protection	To provide effective protection for motors with different loads, you need to set bE.00 properly based on motor overload capacity. See the following inverse time curve for motor overload protection.  When the motor runs at 175% of the rated motor current for 2 minutes, the AC drive reports a motor overload error (11#). When the motor runs at 115% of the rated motor current for 80 minutes, the AC drive reports a motor overload error (11#). Example: The rated motor current is 100 A. bE.01 = 1.00: When the motor runs at 125 A (125% of 100 A) for 40 minutes, the AC drive reports a motor overload error. bE.01 = 1.20: When the motor runs at 125 A (125% of 100 A) for 48 (40 x 1.2) minutes, the AC drive reports a motor overload error. The maximum time for reporting a motor overload error is 80 minutes, and the minimum time is 10 seconds. Example of setting the motor overload protection function: The AC drive needs to report a motor overload error after the motor runs for 2 minutes at 150% of the rated current.	0: Motor overload protection is disabled. 1: Motor overload protection is enabled.	1
bE.01	Motor overload protection gain	In the preceding figure, 150% (I) is between 145% (I1) and 155% (I2). The overload error reporting time for 145% of the rated current is 6 minutes (T1), and that for 155% is 4 minutes (T2). Therefore, the overload error reporting time for 150% of the rated current is calculated as follows by default: T = T1 + (T2 - T1) x (I – I1)/(I2 – I1) = 4 + (6 - 4) x (150% – 145%)/(155% – 145%) = 5 (minutes) If you want the AC drive to report a motor overload error after the motor runs for 2 minutes at 150% of the rated current, the motor overload protection gain should be: bE.01 = 2/5 = 0.4 Caution: Set bE.01 properly based on the actual overload capacity of the motor. If the value is too large, the AC drive may not report an alarm timely when the motor is damaged caused by overheating. The motor overload pre-warning coefficient indicates the percentage of the time the motor can continuously run at a certain overload point without reporting an overload fault. When the motor overload detection level reaches the value of this parameter, output function 9 (motor overload pre-warning) is active. For example, if the motor overload protection gain is set to 1.00 and the motor overload pre-warning coefficient is set to 80%, output function 9 (motor overload pre-warning) is active after the motor runs consecutively for 4.8 minutes (80% x 6 minutes) at 145% of the rated current.	0.01 to 10.00	1.00

Parameter No.	Parameter Name	Description	Value Range	Default
bE.02	Motor overload pre-warning coefficient	The AC drive can send a pre-warning signal to the control system through the DO before triggering motor overload protection. The pre-warning coefficient determines how early the AC drive sends the pre-warning signal before motor overload protection. The larger the value is, the later the pre-warning signal is sent. When the accumulative output current of the AC drive is greater than the product of overload inverse time-lag curve multiplied by the value of bE.02, output function 9 (motor overload pre-warning) becomes valid.	50% to 100%	80%
bE.03	Overvoltage stall gain	When the DC bus voltage exceeds the overvoltage stall protective voltage during deceleration of the AC drive, the AC drive stops deceleration and keeps the present operation frequency. After the bus voltage drops, the AC drive continues to decelerate. This parameter is used to adjust the overvoltage suppression capacity of the AC drive. A larger value indicates a greater the overvoltage suppression capacity. The value should be kept as small as possible as long as overvoltage does not occur. For small-inertia load, the value should be small. Otherwise, the system dynamic response will be slow. For large-inertia load, the overvoltage stall gain should be large, because a small gain cannot achieve good overvoltage suppression effect. 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		330–800 V	Three-phase 380–400 V models: 670 V Three-phase 200–240 V models: 380 V

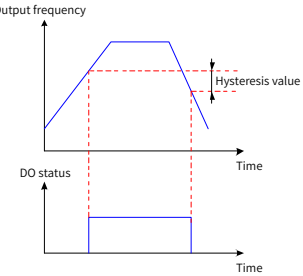
Parameter No.	Parameter Name	Description	Value Range	Default
bE.05	Overcurrent stall gain	When the output current exceeds the overcurrent stall protective current during acceleration/deceleration of the AC drive, the AC drive stops acceleration/deceleration and keeps the current frequency. After the output current decreases, the AC drive continues acceleration/deceleration. This parameter is used to adjust the overcurrent suppression capacity of the AC drive during acceleration/deceleration. A larger the value indicates a greater the overcurrent suppression capacity. The value should be kept as small as possible as long as overcurrent does not occur. For small-inertia load, the value should be small. Otherwise, the system dynamic response will be slow. For large-inertia load, the overcurrent stall gain should be large, because a small gain cannot achieve good overcurrent suppression effect. If the overcurrent stall gain is set to 0, the overcurrent stall function is disabled. bE.05 and bE.06 are valid only in V/f control mode.	0 to 100	20
bE.06	Overcurrent stall protective current		100% to 200%	150%
bE.07	Protection against short circuit to ground upon power-on	This parameter is used to check whether the motor is short-circuited to the ground after the AC drive is powered on. If this function is enabled, the U, V, and W terminals of the AC drive will have voltage output for a while after power-on. 0: Disable 1: Enable	0 to 1	1
bE.08	Input phase loss protection	This parameter determines whether to enable input phase loss protection. 0: Disable 1: Enable hardware input phase loss protection Note: CS710 series AC drive models with power ratings lower than 18.5 kW do not support this function. 2: Enable both hardware and software input phase loss protection 3: Enable software input phase loss protection	0 to 3	2
bE.09	Output phase loss protection	If this parameter is set to 1, output phase loss protection is enabled. If it is set to 0, output phase loss protection is disabled.	0 to 1	1

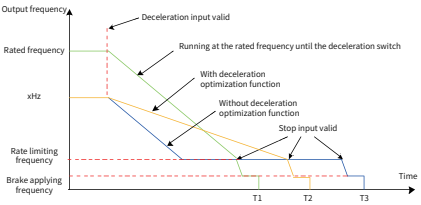
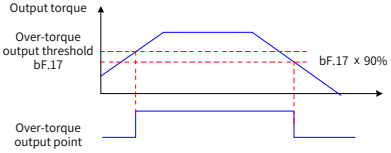
Parameter No.	Parameter Name	Description	Value Range	Default
bE.13	Overload protective torque limit	This parameter is used to set the start torque for triggering the overload protection function. When the parameter is set to 0, the overload protection function is disabled. During forward running, the AC drive measures the output torque when the output frequency reaches the value of b7.07 or keeps at a constant value. For details, see the descriptions of b7.06 and b7.07. If the output torque exceeds the value of bE.13, the AC drive stops automatically and restricts forward running. The restriction is disabled immediately after the AC drive starts reverse running. 	0.0% to 150.0%	0

Parameter No.	Parameter Name	Description	Value Range	Default
bE.14	Power dip ride-through function Select	The two parameters are used to set the power dip ride-through function. The power dip ride-through function enables the AC 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 voltage for triggering power dip ride-through. This parameter sets the percentage to the standard DC bus voltage.	0 to 1	0
bE.15	Power dip ride-through Voltage		70% to 95%	85%
bE.16	Built-in braking unit action voltage	This parameter is used to set the built-in braking unit applied voltage Vbreak. The value range is as follows: 800 ⩾ Vbreak ⩾ (1.414Vs + 30) Vs is the input AC voltage of the AC drive. Note: If Vbreak is not set properly, the built-in braking unit may run abnormally.	330–800 V	Three-phase 380–480 V models: 660 V Three-phase 200–240 V models: 370 V
bE.17	Contactor fault detection	When this parameter is set to 1, contactor fault (17#) detection is enabled. When it is set to 0, contactor fault detection is disabled. Note: CS710 series AC drive models with power ratings lower than 18.5 kW do not support this function.	0 to 1	1

Parameter No.	Parameter Name	Description	Value Range	Default
Group bF: Auxiliary parameters in the level-2 menu				
bF.00	Level-2 menu password	This parameter is used to set the password for displaying and modifying level-2 menu parameters. If this parameter is set to a non-zero value, you must enter the password before accessing the level-2 menu. If you enter wrong passwords for three consecutive times, all menus are locked. In this case, you must power off and restart the AC drive to view or modify parameters. After this parameter is set to 0, the password protection function is disabled.	0 to 65535	0
bF.01	Restoration of parameters in the level-2 menu to factory settings	0: No operation 1: Restore in the level-2 menu to factory settings b0.02 to b0.03, b2.00 to b2.02, b7.10 to b7.11, and bF.00 in the level-2 menu cannot be restored to factory settings. 2: Restore parameters in the level-1 and level-2 menus to factory settings	0 to 2	0
bF.02	Display of user-defined parameter settings in the level-2 menu	0: Display all level-2 menu parameters 1: Display parameters with default values changed in the level-2 menu	0 to 1	0
bF.03	Clearing of historical data	0: No operation 1: Clear historical data When this parameter is set to 1, all parameters stored upon power failure and fault records (parameters in groups E* and U1) are cleared.	0 to 1	0

Parameter No.	Parameter Name	Description	Value Range	Default
bF.04	Command source selection	This parameter determines the input channel of AC drive control commands, including start, stop, forward run, and reverse run 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. When the operating panel is used as the input channel of AC drive control commands, all DI and DO terminals and the brake control logic sequence are invalid. When the AC drive receives the RUN command, output function 1 (brake control) becomes valid. When the AC drive receives the STOP command, it decelerates to the braking frequency (b6.05) and then stops output. Output function 1 becomes invalid. 1: Terminal I/O control (LOCAL/REMOT indicator on) AC drive control commands are given through terminal input functions 1 (Forward RUN) and 2 (Reverse RUN). 2: Communication control (LOCAL/REMOT indicator blinking) AC drive control commands are given by a host controller, PLC, or touch screen through communication.	0 to 2	0
bF.05	Operation frequency in operating panel control	This parameter is used to set the target operation frequency of the AC drive when bF.04 (command source selection) is set to 0.	Minimum frequency (b1.03) to Maximum frequency (b1.02)	50.00 Hz
bF.06	Running direction	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 the U, V, and W wires of the motor. Note that the motor will resume operation in the original direction after parameter initialization. Do not use this function in applications where changing the motor rotation direction is prohibited after system commissioning is completed. 0: Run in the same direction 1: Enable	0 to 1	0

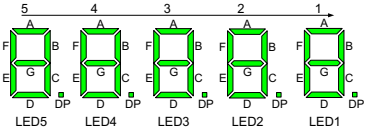
<table>
<tr><th>Parameter No.</th><th>Parameter Name</th><th>Description</th><th>Value Range</th><th>Default</th></tr>
<tr><td>bF.07</td><td>Frequency detection value</td><td rowspan="2">When the reference frequency is greater than the frequency detection value, output function 7 (output upon frequency limit) of the AC drive becomes valid. When the reference frequency is lower than the detection value, output function 7 becomes invalid.
These two parameters are used to set the detection value of the output frequency and hysteresis value upon output cancellation, respectively. bF.07 sets the detection value, and bF.08 sets the hysteresis level (percentage to the value set in bF.07).
 
</td><td>Minimum frequency (b1.03) to Maximum frequency (b1.02)</td><td>50.00 Hz</td></tr>
<tr><td>bF.08</td><td>Frequency detection hysteresis value</td><td>0.0 to 100.0%.</td><td>5.0%</td></tr>
<tr><td>bF.09</td><td>Cooling fan working mode</td><td>This parameter is used to set the working mode of the cooling fan.
0: Working during motor operation
The cooling fan works when the AC drive is in the operation state. When the AC drive stops, the cooling fan works if the heatsink temperature is higher than 40° C, and stops working when the heatsink temperature is lower than 40° C.
1: Working continuously after power-on</td><td>0 to 1</td><td>0</td></tr>
<tr><td>bF.10</td><td>Fault protection action 1</td><td rowspan="5">These parameters are used to determine the fault level of errors 41# to 65#. The value of each parameter is a 5-digit number, representing levels of five faults. The following table describes the relationship between digits and fault meanings.
<table>
<tr><th>Parameter</th><th>Bit</th><th>Description</th></tr>
<tr><td>bF.10</td><td>Ten thousands</td><td>Fault level of 41#</td></tr>
<tr><td>bF.10</td><td>Thousands</td><td>Fault level of 42#</td></tr>
<tr><td>...</td><td>...</td><td>...</td></tr>
<tr><td>bF.10</td><td>Ones</td><td>Fault level of 45#</td></tr>
<tr><td>bF.11</td><td>Ten thousands</td><td>Fault level of 46#</td></tr>
<tr><td>...</td><td>...</td><td>...</td></tr>
<tr><td>bF.11</td><td>Ones</td><td>Fault level of 50#</td></tr>
<tr><td>...</td><td>...</td><td>...</td></tr>
<tr><td>bF.14</td><td>Ten thousands</td><td>Fault level of 61#</td></tr>
<tr><td>...</td><td>...</td><td>...</td></tr>
<tr><td>bF.14</td><td>Ones</td><td>Fault level of 65#</td></tr>
</table></td><td rowspan="5">11111 to 55555</td><td>11115</td></tr>
<tr><td>bF.11</td><td>Fault protection action 2</td><td>11111</td></tr>
<tr><td>bF.12</td><td>Fault protection action 3</td><td>11411</td></tr>
<tr><td>bF.13</td><td>Fault protection action 4</td><td>11111</td></tr>
<tr><td>bF.14</td><td>Fault protection action 5</td><td>11111</td></tr>
</table>

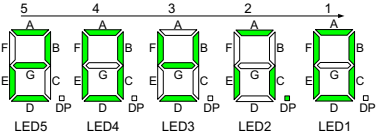
Parameter No.	Parameter Name	Description	Value Range	Default
bF.16	Deceleration frequency limit	When the deceleration switch (input functions 24 and 25) becomes valid, the output frequency of the AC drive is limited below the value specified by bF.16. After the stop switch (input functions 22 and 23) becomes valid, the AC drive performs a quick stop. bF.15 is used to select the deceleration mode after the deceleration switch becomes valid. 0: Disable deceleration optimization The AC drive decelerates normally according to the deceleration time specified by the corresponding parameter in group b4. 1: Enable deceleration optimization After the deceleration switch is turned on, the AC drive recalculates the optimal deceleration time based on the deceleration distance from the rated frequency to the frequency set in bF.16. This minimizes the operation time in the deceleration process. 	Minimum frequency (b1.03) to Rated frequency (A0.04)	5.00 Hz
bF.17	Over-torque output threshold	This parameter is used together with output function 12. When the output torque reaches the threshold specified by this parameter, output function 12 becomes valid. When the output torque falls below 90% of the threshold specified by this parameter, output function 12 becomes invalid. In vector control mode, the AC drive controls the output function based on the output torque. In V/f control mode, the AC drive controls this function based on the percentage of the output current divided by the rated motor current. When this parameter is set to 0, the output function 12 is invalid. 	0.0 to 200.0%.	0.0%

Parameter No.	Parameter Name	Description	Value Range	Default
bF.19	Operation mode selection	0: Application mode This parameter must be set to 0 for normal use of the AC drive. 1: Commissioning mode The commissioning mode is used for AC drive or control cabinet inspection before delivery. 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. The parameter value is automatically cleared after the AC drive is powered on.	0 to 1	0
bF.20	Constant power function	0: Disable 1: Enable	0 to 1	1
bF.21	Motor fan control delay	This parameter is used together with output function 13. For details, see the description of output function 13.	0s to 3000s	30s
bF.25	Frequency limit	This parameter is used to enable frequency limit in different modes. 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.	0 to 111	1
bF.26	Execution of coast to stop during auto-tuning upon power-on	0: Disable 1: Enable	0 to 1	0
bF.30	Stator resistance auto-tuning upon motor switchover	By default, the stator resistance will be tuned upon motor switchover.	0 to 1	1

Groups E0 to E9 display fault information. Each group of parameters indicates a fault record. Group E0 displays information about the latest fault, and group E9 displays information about the earliest fault. All groups display the information using the same structure. Parameters of group E* cannot be modified and are retentive at power failure.

Parameter No.	Parameter Name	Minimum Unit	Description
E*.00	Fault codes	0.01	The five LEDs on the operating panel are numbered 5, 4, 3, 2, and 1 from left to right. Take the display of 104.01 as an example. LEDs 5, 4, and 3 display the error code, where 1 on LED 5 indicates the fault level, and 04 on LEDs 4 and 3 indicate the error code. LEDs 2 and 1 are reserved by the manufacturer.
E*.01	Frequency reference upon fault	Display on the operating panel: 0.1 Hz Value read by communication: 0.01 Hz	It displays the value of U0.00 when a fault occurs.
E*.02	Feedback frequency upon fault	Display on the operating panel: 0.1 Hz Value read by communication: 0.01 Hz	It displays the value of U0.01 when a fault occurs.
E*.03	Output current upon fault	0.01 A	It displays the value of U0.03 when a fault occurs.
E*.04	Output voltage upon fault	1 V	It displays the value of U0.04 when a fault occurs.
E*.05	Output power upon fault	0.1%	It displays the value of U0.05 when a fault occurs.
E*.06	Output torque upon fault	0.1%	It displays the value of U0.06 when a fault occurs.
E*.07	Bus voltage upon fault	0.1 V	It displays the value of U0.07 when a fault occurs.

<table>
<tr><th>Parameter No.</th><th>Parameter Name</th><th>Minimum Unit</th><th>Description</th></tr>
<tr><td>E*.08</td><td>State of input functions 1 to 16 upon fault</td><td>1</td><td rowspan="4">The four parameters indicate the status of input and output functions. Each parameter can indicate the states of 16 input or output functions with its bits. When you select a parameter, its decimal value is displayed on the operating panel. Press △ to switch 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.
 

Digits 5 and 4 show the number of the current input/output function. Digit 1 shows the validity of this function (0: invalid; 1: valid). You can press △ and ▽ to change the number of the input/output function to be displayed. Digits 2 and 3 show 16 functions and their status in combination using the following mappings: A to DP on LED2 mapping functions 1 to 8 and A to DP on LED3 mapping functions 9 to 16. The following is an example.
 

The above figure shows that input function 20 (display of LEDs 5 and 4) is invalid (display of LED 1), and among functions 17 to 32, functions 17, 19, 21, 24, 26, 28, 30, and 31 are valid, while the others are invalid (display of LEDs 2 and 3).</td></tr>
<tr><td>E*.09</td><td>State of input functions 17 to 32 upon fault</td><td>1</td></tr>
<tr><td>E*.10</td><td>State of input functions 33 to 48 upon fault</td><td>1</td></tr>
<tr><td>E*.11</td><td>State of output functions 1 to 16 upon fault</td><td>1</td></tr>
<tr><td>E*.12</td><td>Running step upon fault</td><td>1</td><td>This parameter records the step performed in the AC drive when a fault occurs. For details, see the description of U0.26.</td></tr>
<tr><td>E*.13</td><td>Control mode upon fault</td><td>1</td><td>This parameter records settings of the command source, frequency source, and control mode when a fault occurs.
<table>
<tr><th>Bit</th><th>Description</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 data description.</td></tr>
<tr><td>Tens</td><td>Frequency source</td><td>See A0.07 for data description.</td></tr>
<tr><td>Ones</td><td>Drive control mode</td><td>See b1.00 for data description.</td></tr>
</table></td></tr>
</table>

Parameter No.	Parameter Name	Minimum Unit	Description
E*.15	Synchronous frequency upon fault	Display on the operating panel: 0.1 Hz Value read by communication: 0.01 Hz	This parameter records the instantaneous value of the synchronous frequency displayed on the operating panel when a fault occurs.
E*.16	Braking transistor current upon fault	0.01 A	This parameter records the instantaneous current of the braking transistor when a braking transistor overload fault (15#) occurs.
E*.17	Accumulative running time upon fault	1 h	It displays the value of U1.05 when a fault occurs.
E*.18	Accumulative power-on time upon fault	1 h	It displays the value of U1.06 when a fault occurs.

Groups U0 and U1 display real-time monitoring information of the AC drive. Parameters in group U0 are refreshed in real time and are not saved upon power-off. Parameters in group U1 display accumulated information and are saved upon power-off.

Parameter No.	Parameter Name	Minimum Unit	Description
U0.00	Running frequency	Display on the operating panel: 0.1 Hz Value read by communication: 0.01 Hz	It displays the current reference frequency of the AC drive.
U0.01	Feedback frequency	Display on the operating panel: 0.1 Hz Value read by communication: 0.01 Hz	It displays the feedback value of the actual motor operation frequency. If the AC drive runs without an encoder, this parameter shows the feedback frequency calculated by the AC drive software. If the AC drive operates with an encoder, this parameter shows the actual motor operation frequency provided by the encoder.
U0.02	Target frequency	Display on the operating panel: 0.1 Hz Value read by communication: 0.01 Hz	It displays the final frequency of the AC drive in this operation process.
U0.03	Output current	0.01 A	It displays the output current of the operating AC drive.
U0.04	Output voltage	1 V	It displays the output voltage of the operating AC drive.
U0.05	Output power	0.1%	It displays the output power of the operating AC drive.

Parameter No.	Parameter Name	Minimum Unit	Description
U0.06	Output torque	0.1%	It displays the output torque (percentage of the rated motor torque) of the running AC drive.
U0.07	Bus voltage	0.1 V	It displays the bus voltage of the AC drive.
U0.08	High-order bits of position data	1	These two parameters display the current position of the hoisting mechanism, that is, accumulative number of pulses/b7.10. U0.08 shows the high-order 16 bits (with negative or positive signs) of the current position, and U0.09 shows the low-order 16 bits (only positive values) of the current position. For details, see the descriptions of b7.10 and b7.11.
U0.09	Low-order bits of position data	1	
U0.10	DI state	1	It displays the DI state of the AC drive (Y1 delay state or state when an AO functions as a DO). The display mode is the same as that of E*.08 to E*.11.
U0.11	DO state	1	It displays the DO state of the AC drive. The display mode is the same as that of E*.08 to E*.11.
U0.12	AI1 voltage	0.01 V	It displays the input voltage of AI1 on the AC drive.
U0.13	AI2 voltage	0.01 V	It displays the input voltage of AI2 on the AC drive.
U0.15	AO1 output voltage	0.01 V	It displays the output voltage of AO1 on the AC drive.
U0.16	AO2 output voltage	0.01 V	It displays the output voltage of AO2 on the AC drive.
U0.19	CAN communication quality	1%	It displays the CAN communication quality between the AC drive expansion card and an external device in the percentage of correct received frames to total received frames. The AC drive detects the communication quality every time after it sends 100 data frames.
U0.20	SPI communication quality	1%	It displays the communication quality between the AC drive and the process sheet. The AC drive detects the communication quality every time after it sends 100 data frames.
U0.23	Drive unit heatsink temperature	1° C	It displays temperature of the insulated gate bipolar transistor (IGBT) in the inverter.
U0.24	Function software version	0.01	It displays the function software version of the AC drive.
U0.25	Performance software version	0.01	It displays the performance software version of the AC drive.

<table>
<tr><th>Parameter No.</th><th>Parameter Name</th><th>Minimum Unit</th><th>Description</th></tr>
<tr><td>U0.26</td><td>AC drive internal status</td><td>1</td><td>It displays the internal operation approach of the AC drive. This parameter facilitates field commissioning and troubleshooting. The LEDs are numbered 5 to 1 from left to right. The following table describes the information displayed on the LEDs.
<table>
<tr><th>LED No.</th><th>Description</th><th>Content</th><th>Description</th></tr>
<tr><td>5</td><td>Reserved</td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Brake applying approach</td><td>0</td><td>No brake applying command delivered</td></tr>
<tr><td>1</td><td>Brake applying command delivered</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Brake release approach</td><td>0</td><td>No brake release command delivered</td></tr>
<tr><td>1</td><td>Brake release command delivered</td></tr>
<tr><td rowspan="8">1</td><td rowspan="8">Operation step</td><td>0</td><td>Standby</td></tr>
<tr><td>1</td><td>Brake release in progress</td></tr>
<tr><td>2</td><td>The system runs normally.</td></tr>
<tr><td>3</td><td>Run command canceled and brake applying in progress</td></tr>
<tr><td>4</td><td>Operation state in operating panel control</td></tr>
<tr><td>6</td><td>Motor auto-tuning state</td></tr>
<tr><td>7</td><td>AC drive stop in progress</td></tr>
</table></td></tr>
<tr><td>U0.28</td><td>Fault codes</td><td>1</td><td>It displays the code of the fault that occurs on the AC drive.</td></tr>
<tr><td>U0.29</td><td>Braking transistor current</td><td>0.01 A</td><td>It displays the output current of the braking transistor when the built-in braking unit of the AC drive is working.</td></tr>
<tr><td>U0.30</td><td>Maximum frequency in flux weakening area</td><td>0.01 Hz</td><td>It displays the maximum frequency in the flux weakening area.</td></tr>
<tr><td>U0.31</td><td>Temporary function software version</td><td>0.01</td><td>It displays the temporary function software version.</td></tr>
<tr><td>U0.32</td><td>Temporary performance software version</td><td>0.01</td><td>It displays the temporary performance software version.</td></tr>
</table>

Parameter No.	Parameter Name	Minimum Unit	Description
U1.00	Number of emergency stops	1	It displays the total number of level-1 faults that have occurred in the AC drive.
U1.01	Number of quick stops	1	It displays the total number of level-2 and level-3 faults that have occurred in the AC drive.
U1.02	High bits in the number of brake operations	1	The two parameters display the total number of operations of the brake when controlled by the AC drive. When the value of low bits reaches 65535, the value of high bits increases by 1 and the low bits are reset to 0.
U1.03	Low bits in the number of brake operations	1	
U1.04	Total time used to reach the torque limit	0.1 h	It displays the total time elapsed before the output torque of the AC drive reaches or exceeds the torque upper limits (b1.04 and b1.05).
U1.05	Accumulative running time	1 h	It displays the accumulative running time of the AC drive.
U1.06	Accumulative power-on time	1 h	It displays the accumulative power-on time of the AC drive.

6.3 Level-3 Menu (Group F) Parameter Table

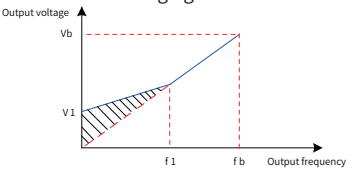
Level-3 menu parameters include output performance adjusting parameters and factory parameters of the AC drive. You do not need to change the values of level-3 menu parameters in most cases.

To access a level-3 menu, you need to enter the password specified by FF.00.

No.	Parameter Name	Description	Value Range	Default
Group F0: Motor parameters				
F0.00	Asynchronous motor stator resistance	The five parameters are asynchronous motor parameters, and they are unavailable on the motor nameplate and are obtained by means of AC drive auto-tuning. 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 you change the rated motor power (A0.01), the AC drive automatically restores values of these five parameters to commonly used settings for standard Y series asynchronous motors. If the motor parameters are known, you can manually input the five parameters.	(≤ 55 kW) 0.001 Ω to 65.535 Ω (> 55 kW) 0.0001 Ω to 6.5535 Ω	Motor OK
F0.01	Asynchronous motor rotor resistance		(≤ 55 kW) 0.001 Ω to 65.535 Ω (> 55 kW) 0.0001 Ω to 6.5535 Ω	Motor OK
F0.02	Asynchronous motor leakage inductance		(≤ 55 kW) 0.01 mH to 655.35 mH (> 55 kW) 0.001 mH to 65.535 mH	Motor OK
F0.03	Asynchronous motor mutual inductance		(≤ 55 kW) 0.1 mH to 6553.5 mH (> 55 kW) 0.01 mH to 655.35 mH	Motor OK
F0.04	Asynchronous motor no-load current		(≤ 55 kW) 0.01 A to A0.03 (> 55 kW) 0.1 A to A0.03	Motor OK

<table>
<tr><th>No.</th><th>Parameter Name</th><th>Description</th><th>Value Range</th><th>Default</th></tr>
<tr><td>F0.16</td><td>Carrier frequency</td><td>This parameter is used to adjust the carrier frequency of the AC drive. It helps reduce the motor noise, avoid the resonance of the mechanical system, and reduce the leakage current to the earth and interference generated by the AC drive.
A low carrier frequency will cause an increase in the high-order harmonic components of the output current and the power loss and temperature rise of the motor.
A high carrier frequency can reduce the power loss and temperature rise of the motor. However, it will cause an increase in interference, power loss, and temperature of the AC drive.
Adjusting the carrier frequency will affect the parameters in the following table.<table><tr><td>Carrier frequency</td><td>Low → High</td></tr><tr><td>Motor noise</td><td>Large → Small</td></tr><tr><td>Output current waveform</td><td>Bad → 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>Small → Large</td></tr><tr><td>External radiation interference</td><td>Small → Large</td></tr></table></td><td>1.0 kHz to 12.0 kHz</td><td>Depending on drive model
OK</td></tr>
</table>

No.	Parameter Name	Description	Value Range	Default
Group F1: Vector control parameters				
F1.00	Speed loop proportional gain 1	Speed loop PI parameters vary with operation frequencies of the AC drive. If the operation frequency is less than switchover frequency 1 (F1.02), the speed loop PI parameters F1.00 and F1.01 are used. If the operation frequency is greater than the switchover frequency 2, the speed loop PI parameters F1.03 and F1.04 are used. If the operation frequency 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. The speed dynamic response characteristics in the vector control mode can be adjusted by setting the proportional gain and integral time of the speed regulator. To achieve a faster system response, increase the proportional gain or reduce the integral time. Be aware that either a too big gain or a too short time may lead to system oscillation. We recommend that you adjust these parameters as follows: 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. Caution: Improper PI parameter settings may cause high speed overshoot. Even worse, overvoltage may occur when overshoot drops.	1 to 100	60
F1.01	Speed loop integral time 1		0.01s to 10.00s	0.50s
F1.02	Switchover frequency 1		0.00 Hz to F1.05	5.00 Hz
F1.03	Speed loop proportional gain 2		1 to 100	20
F1.04	Speed loop integral time 2		0.01s to 10.00s	1.00s
F1.05	Switchover frequency 2		F1.02 to b1.02	10.00 Hz
F1.06	Filter time constant of speed loop	In VC mode, the output of the speed loop regulator is torque current command. This parameter is used to filter the torque commands. This parameter need not be adjusted generally and can be increased in the case of large speed fluctuation. In the case of motor oscillation, decrease the value of this parameter properly. If the value of this parameter is small, the output torque of the AC drive may fluctuate greatly, but the response is quick.	0.000s to 1.000s	0.070s

<table>
<tr><th>No.</th><th>Parameter Name</th><th>Description</th><th>Value Range</th><th>Default</th></tr>
<tr><td>F1.08</td><td>Excitation adjustment proportional gain</td><td rowspan="4">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 dimension of the current loop integral regulator is integral gain rather than integral time. 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.</td><td>0 to 20000</td><td>2000</td></tr>
<tr><td>F1.09</td><td>Excitation adjustment integral gain</td><td>0 to 20000</td><td>1300</td></tr>
<tr><td>F1.10</td><td>Torque adjustment proportional gain</td><td>0 to 20000</td><td>2000</td></tr>
<tr><td>F1.11</td><td>Torque adjustment integral gain</td><td>0 to 20000</td><td>1300</td></tr>
<tr><td colspan="5">Group F2: V/f control parameters</td></tr>
<tr><td>F2.01</td><td>Torque boost</td><td rowspan="2">To compensate for the low frequency torque of V/f control, you can boost the output voltage of the AC drive running at low frequency. A very large setting will result in motor overheat and AC drive overcurrent.
If the motor is connected to heavy load but does not have sufficient startup torque, increase the torque boost. If the motor is connected to light load, decrease the torque boost.
If torque boost is set to 0.0, the AC drive performs automatic torque boost. In this case, the AC drive automatically calculates the torque boost value based on motor parameters including the stator resistance.
Cutoff frequency of torque boost: Torque boost is valid when the operation frequency within this value and becomes invalid when the operation frequency exceeds this value, as shown in the following figure.
 

V1: Manual torque boost voltage Vb: Max. output voltage
f1: Manual torque boost cutoff frequency fb: Rated running frequency</td><td>0.0% to 30.0%</td><td>Motor power dependent</td></tr>
<tr><td>F2.02</td><td>Cut-off frequency of torque boost</td><td>0.00 Hz to b1.02</td><td>50.00 Hz</td></tr>
</table>

No.	Parameter Name	Description	Value Range	Default
F2.09	V/f slip compensation coefficient	This parameter is valid only for the asynchronous motor. It can compensate for the speed slip of an asynchronous motor when the load increases, reducing the variation in the motor speed in case of load change. If this parameter is set to 100.0%, it indicates that the compensation when the motor bears rated load is the rated motor slip. The rated motor slip is automatically obtained by the AC drive through calculation based on the rated motor frequency and rated motor speed in group F1. When adjusting the V/f slip compensation gain, confirm that the motor speed under the rated load is the same as the target motor speed. Generally, if the motor speed is different from the target speed, slightly adjust this parameter.	0.0% to 100.0%	0.0%
F2.10	V/f overexcitation gain	During deceleration of the AC drive, over-excitation control can suppress rise of the bus voltage to avoid the overvoltage fault. A larger overexcitation gain indicates better suppression effect. Increase the over-excitation gain if the AC drive is liable to overvoltage fault during deceleration. However, too large over-excitation gain may lead to an increase in the output current. Set this parameter to a proper value in actual applications. Set the over-excitation gain to 0 in the applications where the inertia is small and the bus voltage will not rise during motor deceleration or where there is a braking resistor.	0 to 200	0
F2.11	Oscillation suppression gain	To avoid negative influence on V/f control, keep this gain as small as possible while ensuring efficient oscillation suppression. Set this parameter to 0 if the motor has no oscillation. Increase the value properly only when the motor has obvious oscillation. A larger oscillation suppression gain indicates a better suppression effect. When oscillation suppression is enabled, the rated motor current and no-load current must be accurate. Otherwise, the V/f oscillation suppression effect will not be satisfactory.	0 to 100	40

No.	Parameter Name	Description	Value Range	Default
Group F3: Control optimization parameters				
F3.00	DPWM switchover frequency upper limit	This parameter determines the wave modulation mode of an asynchronous motor. If the frequency reference of the AC drive is lower than the upper limit, the waveform is modulated continuously in seven segments. If the frequency reference is higher than or equal to the upper limit, the waveform is modulated intermittently in 5 segments. The 7-segment continuous modulation causes more loss to switches of the AC drive but smaller current ripple. The 5-segment intermittent modulation causes less loss to switches of the AC drive but larger current ripple. This may lead to motor operation instability at high frequency. Generally, you do not need to modify this parameter. For details about AC drive loss and temperature rise, see the description of F0.16.	0.00 Hz to maximum frequency (b1.02)	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 lower). 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 commissioning	0 to 1	0
F3.02	Deadzone compensation	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. Mode 2 is recommended for high-power drives. 0: Disabled 1: Compensation mode 1 2: Compensation mode 2	0 to 2	1

No.	Parameter Name	Description	Value Range	Default
F3.03	Random PWM depth	This parameter is used to lower the unpleasant motor noise and reduce the 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	Fast current limit	Rapid current limit minimizes risks of overcurrent, ensuring uninterrupted operation of the AC drive. However, if the AC drive stays in the fast current limit state for a long time, it may be damaged due to over-temperature or other reasons. To prevent this problem, the AC drive reports error 40# (pulse-by-pulse current limit) if current limit lasts for a long time. This error indicates that the AC drive is overloaded and needs to be stopped. (This parameter must be set to 0 for the hoisting mechanism to prevent unintentional slip.) 0: Disable 1: Enable	0 to 1	0
F3.05	Current detection delay compensation	This parameter is used to set the current detection compensation for the AC drive. If the compensation value is too large, the control performance may deteriorate. Generally, you do not need to change this parameter.	0 to 100	5
F3.06	Undervoltage threshold	This parameter is used to set the voltage value for triggering an undervoltage error (09#). When the bus voltage falls below this value, the AC drive changes to the undervoltage state and stops running.	140–630 V	Three-phase 380–480 V models: 350 V Three-phase 200–240 V models: 200 V
FD group: EtherCAT and EtherNet/IP parameters				
FD.01	EtherCAT station alias backup	This parameter is used to back up the EtherCAT station alias.	0 to 65535	0
FD.02	EtherCAT station	This parameter indicates the EtherCAT station.	0 to 65535	0
FD.37	DHCP	This parameter is used to set whether the Dynamic Host Configuration Protocol (DHCP) is used for a local area network (LAN).	0 to 1	0
FD.38	Highest byte of the IP address	This parameter indicates the highest byte of an IP address.	0 to 255	0

No.	Parameter Name	Description	Value Range	Default
FD.39	Second highest byte of the IP address	This parameter indicates the second highest byte of an IP address.	0 to 255	0
FD.40	Third highest byte of IP address	This parameter indicates the third highest byte of an IP address.	0 to 255	0
FD.41	Lowest byte of IP address	This parameter indicates the lowest byte of an IP address.	0 to 255	0
FD.42	Highest byte of subnet mask	This parameter indicates the highest byte of a subnet mask.	0 to 255	0
FD.43	Second highest byte of subnet mask	This parameter indicates the second highest byte of a subnet mask.	0 to 255	0
FD.44	Third highest byte of subnet mask	This parameter indicates the third highest byte of a subnet mask.	0 to 255	0
FD.45	Lowest byte of subnet mask	This parameter indicates the lowest byte of a subnet mask.	0 to 255	0
FD.46	Highest byte of gateway	This parameter indicates the highest byte of a gateway.	0 to 255	0
FD.47	Second highest byte of gateway	This parameter indicates the second highest byte of a gateway.	0 to 255	0
FD.48	Third highest byte of gateway	This parameter indicates the third highest byte of a gateway.	0 to 255	0
FD.49	Lowest byte of gateway	This parameter indicates the lowest byte of a gateway.	0 to 255	0
FD.58	Communication error code	This parameter indicates the communication error code.	0 to 255	0
FD.61	First two bytes of MAC address	This parameter indicates the first two bytes of a MAC address.	0 to 65535	0
FD.62	Two bytes in the middle of MAC address	This parameter indicates the two bytes in the middle of MAC address.	0 to 65535	0
FD.63	Last two bytes of MAC address	This parameter indicates the last two bytes of the MAC address.	0 to 65535	0

No.	Parameter Name	Description	Value Range	Default
Group FF: Factory parameters				
FF.00	Level-3 menu password	This parameter is used to set the password for displaying and modifying level-3 menu parameters. If this parameter is set to a non-zero value, you must enter the password before accessing the level-3 menu. If you enter wrong passwords for three consecutive times, all menus are locked. In this case, you must power off and restart the AC drive to view or modify parameters. After this parameter is set to 0, the password protection function is disabled.	0 to 65535	0
FF.10	Restoration of parameters in the level-3 menu to factory settings	0: No operation 1: Restore parameters in the level-3 menu to factory settings Parameters F0.00 to F0.04, F0.16, F2.01, F2.11, and FF.00 in the level-1 menu cannot restore to factory settings. 2: Restore all parameters to factory settings	0 to 2	0
FF.11	Display of user-defined parameter settings in the level-3 menu	0: Display all level-3 menu parameters 1: Display parameters whose default values are changed in the level-3 menu	0 to 1	0

7 Troubleshooting

7.1 Safety Precautions

Danger

* Perform wiring only when the power is disconnected (all circuit breakers must be shut off). Failure to comply may result in an electric shock.

Warning

* Ground the AC drive according to local laws and regulations. Failure to comply may result in an electric shock or fire.
* Never remove the front cover or touch internal circuit while the power is on. Failure to comply may result in an electric shock.
* Never allow unqualified personnel to perform any maintenance, inspection, or repair. Failure to comply may result in an electric shock or fire.
* When installing the AC drive inside an enclosed cabinet or chassis, use a cooling fan or air conditioner to keep the temperature below 50° C. Failure to comply will result in overheat or fire.
* Tighten all screws with the specified tightening torque. Failure to comply may result in an electric shock or a fire.
* Ensure that the input voltage of the AC drive is not higher than the rated voltage on the nameplate. Failure to comply may result in an electric shock or fire.
* Keep flammable and combustible materials away from the AC drive.

Caution

* Cover the top of the AC drive with a piece of cloth or paper during installation to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment. Failure to comply may cause malfunction of the AC drive.
* Remove the paper or cloth after installation is done. Failure to comply will deteriorate ventilation and result in overheating.
* Follow the proper ESD procedure when operating the AC drive. Failure to comply will damage the internal circuit of the AC drive.

7.2 Troubleshooting Before Trial Run

1) SVC (b1.00 = 0: Factory Default)

In this mode, the drive controls the speed and torque of the motor in scenarios without an encoder for speed feedback. Motor auto-tuning is required to obtain motor-related parameters.

Problem	Solution
Overload or overcurrent detected during motor start	◆ 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 or speed response and motor vibration 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	◆ If there is an excessive deviation in the motor's load speed, increase the value of b1.01 (slip compensation gain) in increments of 10%.
Large speed fluctuation	◆ If the motor speed fluctuates severely, increase the value of F1.06 (speed filter time) in increments of 0.001s.
Loud 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	◆ 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) FVC (b1.00 = 1)

This mode is applicable to scenarios with an encoder for speed feedback. In this mode, you need to set the encoder pulses per revolution, encoder type, and encoder direction correctly and perform auto-tuning on motor parameters.

Problem	Solution
Overload or overcurrent detected during motor start	◆ Set the encoder pulses per revolution, encoder type, and encoder direction correctly.
Overload or overcurrent during motor running	◆ 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 or speed response and motor vibration 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.

Problem	Solution
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.
Large speed fluctuation	◆ If the motor speed fluctuates severely, increase the value of F1.06 (speed filter time) in increments of 0.001s.
Loud 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	◆ 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 is applicable to scenarios without an encoder for speed feedback. You only need to set rated motor voltage and rated motor frequency correctly.

Problem	Solution
Oscillation of the running motor	◆ Increase the value of F2.11 (oscillation suppression gain) in increments of 10. The permissible maximum value of this parameter is 100.
Overcurrent during high-power start	◆ Decrease the value of F2.01 (torque boost) in decrements of 0.5%.
Large current during running	◆ 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%.
Loud 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.)

7.3 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  .

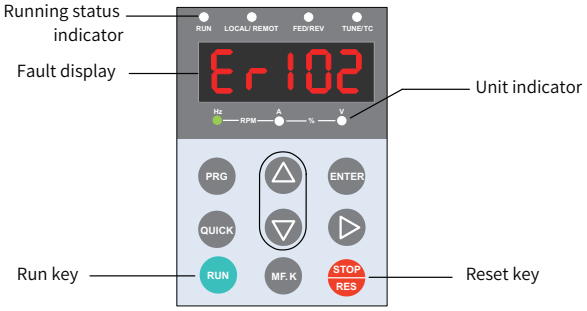


Figure 7-1 Fault display

The five digits on the operating panel are numbered 5, 4, 3, 2, and 1 from left to right. Take the display of 103.02 as an example. Digits 5, 4, and 3 show the fault code, in which 1 on digit 5 indicates the fault level, and 03 on digits 4 and 3 indicates the fault code. 02 on digits 2 and 1 indicates the fault subcode, which is reserved by the manufacturer. You can obtain fault information by checking parameters in E* group. The following figure shows the display in this example.

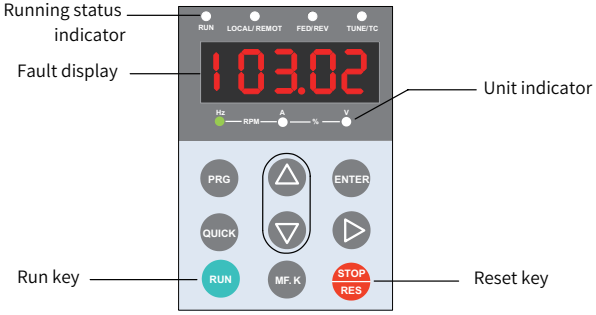


Figure 7-2 LED display of a fault

Before asking Inovance engineers for help, you can perform self-check according to instructions in this section, analyze the fault causes, and find solutions.

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.

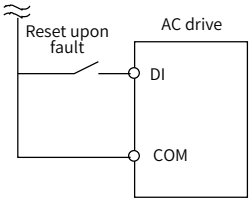
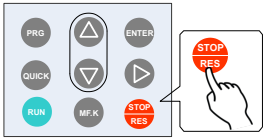
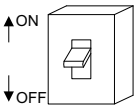
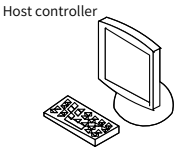
Fault Level	Response	Display
Level 1	◆ The operating panel displays the error code. ◆ Output function 1 (brake control) is inactive. ◆ Output function 2 (stop upon fault) is active. ◆ The AC drive coasts to stop.	Er 1**
Level 2	◆ The operating panel displays the error code. ◆ Output function 3 (fault alarm) is active. ◆ The AC drive performs a quick stop.	Er2**
Level 3	◆ The operating panel displays the error code. ◆ Output function 3 (fault alarm) is active. ◆ The AC drive decelerates to stop.	Er3**
Level 4	◆ The operating panel displays the error code. ◆ Validate output function 4 (fault prompt). ◆ System operation is not affected.	Er4**
Level 5	◆ System operation is not affected.	

NOTE

◆ Faults with error codes 1# to 40# are driving performance faults of CS710 series AC drive and are graded level 1 by default. Their fault levels cannot be changed.

◆ Faults with error codes 41# to 65# are function faults. You can change their fault levels by setting parameters bF.10 to bF.14. (See the descriptions of bF.10 to bF.14.)

7.4 Reset upon Fault

Stage	Solution	Remarks
When the fault occurs	Check fault information on the operating panel.	View groups E0 to E9. 
Before reset	Find the cause of the fault based on the fault type displayed on the operating panel and rectify the fault. Then reset the AC drive.	Troubleshoot the fault according to "7.5 Error Codes and Solutions."
Reset method	1. Set the DI to function 3 (b3.01 to b3.10 = 3: reset upon fault). Verify that the RUN command has been canceled, and the reset terminal is valid.	
	2. Press the stop/reset key on the operating panel to reset the AC drive.	Press the red STOP key on the operating panel to reset the fault. 
	3. Power off and then power on the AC drive to reset it. 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."

7.5 Error Codes and Solutions

The following table lists the faults that may occur during use of the AC drive and solutions to these faults.

Fault Code	Fault Name	Cause	Solution
Er102	Overcurrent during acceleration	1. The output circuit of the AC drive is grounded or short-circuited. 2. The control mode is vector control but motor auto-tuning is not performed. 3. The acceleration time is too short. 4. The customized torque boost or V/f curve is not appropriate. 5. The voltage is too low. 6. The motor is started while rotating. 7. A sudden load is applied during acceleration. 8. The AC drive power rating is too low.	1. Eliminate external faults. 2. Perform motor auto-tuning. 3. Increase the acceleration time. 4. Adjust the customized torque boost or V/f curve. 5. Adjust the voltage to the normal range. 6. Enable the flying start function or start the motor after it stops. 7. Remove the sudden load. 8. Select an AC drive of a higher power rating.
Er103	Deceleration Overcurrent	1. The output circuit of the AC drive is grounded or short-circuited. 2. The control mode is vector control but motor auto-tuning is not performed. 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 and braking resistor are not installed. 7. The braking circuit is short-circuited.	1. Eliminate external faults. 2. Perform motor auto-tuning. 3. Increase the deceleration time. 4. Adjust the voltage to the normal range. 5. Remove the sudden load. 6. Install the braking unit and braking resistor. 7. Check whether the braking resistor is faulty.
Er104	Constant speed Overcurrent	1. The output circuit of the AC drive is grounded or short-circuited. 2. The control mode is vector control but motor auto-tuning is not performed. 3. The voltage is too low. 4. A sudden load is applied during operation. 5. The AC drive power rating is too low. 6. The braking circuit is short-circuited.	1. Eliminate external faults. 2. Perform motor auto-tuning. 3. Adjust the voltage to the normal range. 4. Remove the sudden load. 5. Select an AC drive of a higher power rating. 6. Check whether the braking resistor is faulty.

Fault Code	Fault Name	Cause	Solution
Er105	Acceleration Overvoltage	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 and braking resistor are not installed.	1. Adjust the voltage to the normal range. 2. Cancel the external force or install a braking resistor. 3. Increase the acceleration time. 4. Install the braking unit and braking resistor.
Er106	Deceleration Overvoltage	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 and braking resistor are not installed.	1. Adjust the voltage to the normal range. 2. Cancel the external force or install a braking resistor. 3. Increase the deceleration time. 4. Install the braking unit and braking resistor.
Er107	Constant speed Overvoltage	1. The input voltage is too high. 2. An external force drives the motor during operation.	1. Adjust the voltage to the normal range. 2. Cancel the external force or install a braking resistor.
Er108	Control power supply fault	The input voltage is out of the specified range.	Adjust the input voltage to the specified range.
Er109	Undervoltage Fault	1. An instantaneous power failure occurs. 2. The input voltage of the AC drive is out of the allowable range. 3. The bus voltage is lower than the voltage specified by F3.06. 4. The rectifier bridge and pre-charge resistor are faulty. 5. The driver board is faulty. 6. The control board is faulty.	1. Reset to clear the fault. 2. Adjust the voltage to the normal range. 3. Contact the agent or Inovance for technical support. 4. Contact the agent or Inovance for technical support. 5. Contact the agent or Inovance for technical support. 6. Contact the agent or Inovance for technical support.
Er110	AC drive Overload	1. The load is too heavy or locked-rotor occurs on the motor. 2. The AC drive power rating is too low.	1. Reduce the load and check the motor and machinery. 2. Select an AC drive of a higher power rating.
Er111	Motor overload	1. The motor overload protection gain (bE.01) is set incorrectly. 2. The load is too heavy or locked-rotor occurs on the motor. 3. The AC drive power rating is too low.	1. Set the parameter properly. 2. Reduce the load and check the motor and machinery. 3. Select an AC drive of a higher power rating.
Er112	Input phase loss	1. Three-phase power input is abnormal. 2. The driver board, lightning protection board, main control board, or rectifier bridge is abnormal.	1. Check and eliminate external wiring problems. 2. Contact the agent or Inovance for technical support.

Fault Code	Fault Name	Cause	Solution
Er114	AC drive overheating	1. The ambient temperature is too high. 2. The air filter is blocked. 3. The fan is damaged. 4. The thermistor of the IGBT is damaged. 5. The inverter module is faulty.	1. Reduce the ambient temperature. 2. Clean the air filter. 3. Replace the fan. 4. Replace the thermistor. 5. Replace the inverter module.
Er115	Built-in braking unit overloaded	1. The resistance of the braking resistor is too small. 2. The braking resistor is short-circuited. 3. The built-in braking unit is damaged. 4. The power rate of the external load is too high.	1. Use a braking resistor with larger resistance. 2. Check the wiring between the AC drive and braking resistor. 3. Contact the agent or Inovance for technical support.
Er116	Built-in braking unit short-circuited		
Er117	Contactor Fault	1. The driver board and power supply are faulty. 2. The contactor is faulty.	1. Replace the driver board or power supply board. 2. Replace the contactor.
Er118	Current detection fault	1. The Hall device is faulty. 2. The driver board is faulty.	1. Replace the Hall device. 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 properly. 2. Check the wiring between the AC drive and the motor.
Er120	Encoder Fault	1. The encoder model does not match the AC drive. 2. The encoder wiring is incorrect. 3. The encoder is damaged. 4. The PG card is faulty.	1. Set the encoder model correctly based on the actual situation. 2. Eliminate the wiring fault. 3. Replace the encoder. 4. Replace the PG card.
Er123	Short circuit to ground	1. The motor is short-circuited to the ground.	1. Replace the cable or motor.
Er125	Output phase loss	1. The wiring between the AC drive and the motor is faulty. 2. The three-phase outputs of the AC drive are unbalanced when the motor is running. 3. The driver board is faulty. 4. The IGBT is faulty.	1. Eliminate external faults. 2. Check whether the motor three-phase winding is normal and eliminate the fault. 3. Contact the agent or Inovance for technical support. 4. Contact the agent or Inovance for technical support.
Er137	Abnormal frequency direction	The directions of operation frequency and motor feedback frequency are reverse.	1. Check whether motor parameters are set properly. 2. Check whether the load is too heavy. 3. Adjust the setting of bC.02.

Fault Code	Fault Name	Cause	Solution
Er138	Abnormal frequency following	The error between the frequency reference and motor feedback frequency is too large.	1. Check whether motor parameters are set properly. 2. Check whether the load is too heavy. 3. Adjust the settings of bC.03 and bC.04.
Er140	Pulse-by-pulse current limit fault	1. The load is too heavy or locked-rotor occurs on the motor. 2. The AC drive power rating is too low.	1. Reduce the load and check the motor and machinery. 2. Select an AC drive of a higher power rating.
Er453	Brake failure protection	When b1.00 is set to 1 (FVC) and the AC drive stops and detects accumulated encoder pulse feedback, the brake is loose and has not completely gripped the motor shaft. In this case, the AC drive automatically runs at 0 Hz.	1. Check whether the brake is loose. If yes, increase the braking torque or contact the manufacturer. 2. Check whether bC.00 is set correctly. If its value is too small, increase the value as required. When it is set to 0, this function is disabled.
Er*41	Brake release fault	1. The brake release time exceeds the timeout interval specified by B6.22. 2. The input brake release feedback signal is incorrect. For details, see the description of b6.08.	1. Check whether the brake output signal is correct. 2. Check the wiring of the brake circuit. 3. Check the function selection (input function 11) of the brake release feedback input point on the control board.
Er*42	Brake applying fault	The brake applying feedback signal input is abnormal. For details, see the description of b6.08.	1. Check the wiring of the brake circuit. 2. Check the function selection (input function 12) of brake applying feedback input point on the control board.
Er*43	Timeout of shaft-cooling motor at low-speed operation	See the descriptions of b0.00 and b0.01.	1. Adjust the settings of b0.00 and b0.01. 2. Protect the motor from overheating.
Er*44	Forward and reverse run commands valid simultaneously	The AC drive detects the forward and reverse run commands at the same time.	1. Check the external circuit of the forward and reverse run command input points. 2. Increase the terminal filter time properly.
Er*45	Joystick not reset	A run command or frequency reference signal input is detected when the AC drive is powered on.	1. Ensure that all the NO input signals are invalid during the power-on process. 2. Input a run command after the system initialization is completed.
Er*46	Process sheet communication fault	Communication between the AC drive and process sheet (CS70CF*) is abnormal.	1. Check that bF.18 is set correctly. 2. Contact the agent or Inovance for technical support.

Fault Code	Fault Name	Cause	Solution
Er*47	CAN bus fault	1. The CANlink expansion card does not work normally. 2. The communication cable does not work normally.	1. Check that communication cables between expansion cards are securely connected. 2. Check that the expansion card interfaces are securely connected. 3. Shorten the distances between communication nodes.
Er*48	Communication error	1. The host controller does not work normally. 2. The communication cable does not work normally. 3. Communication parameters in group bd are not set properly.	1. Check the wiring of the host controller. 2. Check the communication cable connection. 3. Set the communication expansion card type correctly. 4. Set the communication parameters correctly.
Er*49	Parameter read-write fault	The EEPROM chip is damaged.	Replace the main control board.
Er*50	External input fault	DI function 7 is valid.	Reset the AC drive.
Er*51	Parameter Fault	1. Parameters are set incorrectly. 2. The EEPROM memory chip is damaged.	1. Use the parameter self-check function and correct the parameters that are set incorrectly. 2. Replace the main control board.
Er*52	Excessive speed deviation in V/f mode	The difference between the motor actual running frequency and the synchronous frequency exceeds the speed difference threshold.	1. Check whether the load is too heavy. 2. Adjust the settings of bC.01 and bC.03. 3. Check whether motor parameters are set properly.

◆ 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.

7.6 Fault Symptoms and Solutions

No.	Fault Description	Possible Cause	Solution
1	No information is displayed upon power-on.	The drive is not connected to the grid or the grid voltage is too low.	Check the power supply.
		The switched-mode power supply (SMPS) on the driver board of the AC drive is faulty.	Check the bus voltage or contact the agent or Inovance.
		The control board is disconnected from the driver board or the operating panel.	Reconnect the 8-pin and 40-pin cables.
		The pre-charge resistor of the AC drive is damaged.	Contact the agent or Inovance for technical support.
		The control board or operating panel is faulty.	
		The rectifier bridge is damaged.	
2	"CrAnE" is displayed after power-on.	The cable connection between the driver board and control board is poor.	Reconnect the 8-pin and 28-pin cables.
		Related components on the control board are damaged.	Contact the agent or Inovance for technical support.
		The motor or motor cable is short-circuited to the ground.	
		The Hall sensor is faulty.	
		The grid voltage is too low.	
3	"Er123" is displayed upon power-on. Alarm	The motor or output cable is shorted to ground.	Check the insulation status of the motor and the output cable with a megohmmeter.
		The AC drive is damaged.	Contact the agent or Inovance for technical support.
4	The display is normal after power-on, but "CrAnE" is displayed in the running state and the AC drive stops immediately.	The cooling fan is damaged or locked-rotor occurs.	Replace the fan.
		A short circuit occurs on external control terminals.	Rectify the short circuit fault.
5	Er114 (IGBT overtemperature) is reported frequently.	The carrier frequency is set too high.	Reduce the carrier frequency (F0.15).
		The fan is damaged or the air duct is clogged.	Replace the fan or clean the air duct.
		Components (thermistor or others) inside the AC drive are damaged.	Contact the agent or Inovance for technical support.

No.	Fault Description	Possible Cause	Solution
6	The motor does not rotate after the AC drive runs.	The motor or motor cable is abnormal.	Check that wiring between the AC drive and motor is normal.
		Motor parameters on the AC drive are set incorrectly.	◆ Restore the servo drive to default settings and reset related parameters correctly. ◆ 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 connection between the driver board and control board is poor.	Re-connect the cables and ensure secure connection.
		The driver board is faulty.	Contact the agent or Inovance for technical support.
7	DI terminals are invalid.	Incorrect parameter	Check and reset parameters in group b3.
		External signal transmission errors occurred.	Re-connect the external signal cable.
		The jumper across OP and +24 V becomes loose.	Connect the jumper across OP and +24 V securely.
		The control board is faulty.	Contact the agent or Inovance for technical support.
8	The motor speed fails to rise in FVC mode.	The encoder is faulty.	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 the agent or Inovance for technical support.
		The driver board is faulty.	
9	Frequent overcurrent and overvoltage faults	Motor parameters are set incorrectly.	Set the motor parameters or perform motor auto-tuning again.
		The acceleration/deceleration time is improper.	Set a proper acceleration/deceleration time.
		The load fluctuates.	Contact the agent or Inovance for technical support.

No.	Fault Description	Possible Cause	Solution
10	Er117 is displayed when the AC drive is powered on or is 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 the +24V power supply of the contactor is faulty. * Contact the agent or Inovance for technical support. * Apply a heating device in the electric cabinet.
11	The lightning protection board reports Err12.	The cable between the lightning protection board and the driver board is loosen.	Check that the input phase loss signal cable between the lightening protection board and the driver board is connected reliably.
		The lightning protection board is damaged or corroded.	Replace the lightening protection board.

7.7 Fault Subcodes

The CS710 series AC drive provides fault subcodes to facilitate fault analysis and location. The two digits after the decimal point in a parameter of group E* indicate the fault subcode.

The following table describes fault subcodes.

Fault Code	Code Meaning	Fault Subcode	Subcode Meaning
02# to 04#	Overcurrent	1	Overcurrent on the drive unit hardware
		10	Overcurrent on the built-in braking unit
05# to 07#	Overvoltage	1	Software overvoltage fault 1
		2	Software overvoltage fault 2
08#	Pre-charge resistor overheat or control power supply fault	1	The voltage fluctuates during power-on, and the power-on process repeats more than five times within a short time due to undervoltage.
09#	Undervoltage	1	The bus voltage of the running AC drive is lower than the value of F3.06.
10#	AC drive overload	1	The overload fault is detected based on the overload curve of the AC drive.
		2	The output pulse-by-pulse current limit time of any phase reaches 5s.
11#	Motor overload	1	The overload fault is detected based on the overload curve of the motor.

Fault Code	Code Meaning	Fault Subcode	Subcode Meaning
12#	Input phase loss	1	Hardware input phase loss 1 is detected.
		2	Hardware input phase loss 2 is detected.
		3	Software input phase loss 1 is detected.
		4	Software input phase loss 2 is detected.
14#	Heatsink or module overheat	1	The inverter temperature exceeds the over-temperature threshold.
15#	Built-in braking transistor overload	1	The instantaneous current of the braking transistor exceeds twice the rated braking current.
		2	The instantaneous current of the braking transistor exceeds the AC drive overvoltage threshold divided by the minimum resistance.
		3	The overload fault is detected based on the overload curve of the built-in braking transistor.
16#	Built-in braking transistor short circuit	1	The current of the braking transistor exceeds the detection threshold during the power-on or stop process of the AC drive.
17#	Pre-charge resistor not closed	1	Hardware pre-charge resistor fault 1 is detected.
		2	Hardware pre-charge resistor fault 2 is detected.
18#	Zero drift too large or current sensor fault	1	The zero drift on phase U is too large.
		2	The zero drift on phase V is too large.
		3	The zero drift on phase W is too large.
19#	Parameter auto-tuning failure	1	The no-load current is abnormal.
20#	Encoder fault	1	Hardware encoder disconnection is detected (supported only by MD38PGMD).
		2	Software encoder disconnection is detected.
		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#	Short circuit to ground	1	Hardware overcurrent occurs during detection of short circuit to ground.
		2	Hardware overvoltage occurs during detection of short circuit to ground.
		3	The detection current exceeds the rated peak current of the AC drive during detection of short circuit to ground.

Fault Code	Code Meaning	Fault Subcode	Subcode Meaning
25#	Output phase loss	1	Phase U output loss occurs.
		2	Phase V output loss occurs.
		3	Phase W output loss occurs.
		4	The output voltage in closed-loop mode is high.
		5	The fault is reported upon output phase loss during stator resistance auto-tuning.
37#	Stall warning 1	1	See the description of bC.02.
38#	Stall warning 2	1	See the descriptions of bC.03 to bC.04.
40#	Pulse-by-pulse current limit fault	1	Continuous pulse-by-pulse current limit occurs on any phase output in a short time.

8 Maintenance and Inspection

8.1 Routine Maintenance

Danger

- Do not connect or disconnect cables while the power is on. Failure to comply will result in an electrical shock.
- Before inspection, cut off all power supplies, and wait for at least several minutes until the power indicator is off. This is because there is residual voltage in the DC capacitor of the AC drive upon power-off. Power on the AC drive again only after a specified interval.
- Do not modify or disconnect cables, remove optional expansion cards, or replace the cooling fan during running of the AC drive. Failure to comply will result in an electric shock.
- Ensure that the motor ground terminal is grounded. Failure to comply will result in an electric shock when touching the motor housing.
- Never allow unqualified personnel to do the repair and maintenance work.
- Ensure that installation, wiring, commissioning, repair and maintenance, and component replacement are performed only by qualified technicians.

Warning

- Do not run the AC drive with its housing removed.
- The illustrations in this manual sometimes show the AC drive without covers or protective guards to explain the details. Remember to install the covers and protective guards as specified first, and then perform operations in accordance with instructions.
- Tighten all terminal screws with specified tightening torque to prevent fire caused by heating due to loose connection.
- Ensure that the input voltage of the main circuit is within permissible range. Failure to comply may result in abnormal running of the AC drive.
- Keep the AC drive away from combustible materials and install it on incombustible materials.

Caution

- Replace the cooling fan correctly as instructed in this guide. Ensure correct air outlet direction of the fan. Failure to comply will degrade the cooling performance.
- Do not connect or disconnect motor while the AC drive is running. Failure to comply may result in an electric shock and damage to the AC drive.
- Use shielded cables to wire the control circuit.
- Ground the shield reliably at one end to prevent malfunction of the AC drive.
- Do not modify the AC drive circuit. Failure to comply will damage the AC drive.
- Connect the output terminals of the AC drive and the wiring terminals of the motor correctly.
- If you need to change the motor rotating direction, exchange the sequence of any two phases among the U, V, and W phases.
- Do not operate the AC drive that has been damaged. Failure to comply may cause further damage to external equipment.

● Routine maintenance items

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

Check the following items daily to ensure that the AC drive functions properly. Make a copy of this checklist and sign the "Checked" column after each inspection.

Item	Check Item	Solution	Check
Motor	Check the motor for any abnormal sounds and vibration.	* Check mechanical connections. * Check for phase loss of the motor. * Tighten all loose screws.	
Fan	Check the cooling fans of the AC drive and motor.	* Check whether the cooling fan of the AC drive works properly. * Check whether the cooling fan of the motor works properly. * Check whether the ventilation duct is clogged. * Check whether the ambient temperature is within the permissible range.	

Item	Check Item	Solution	Check
Installation environment	Check the cabinet and cable trays.	* Check input and output cables for damaged insulation. * Check the mounting bracket for vibration. * Check whether copper bars and terminals become loose or get 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 whether the motor parameters are set properly. * Check whether the motor is overloaded. * Check whether mechanical vibration is within the permissible range (< 0.6 g).	
Input voltage	Check whether the power voltage of the main and control circuits is within the permissible range.	* Check whether the input voltage is within the permissible range. * Check whether heavy load starts around.	

8.2 Periodic Inspection

8.2.1 Periodic Inspection Items

Perform periodic inspection on items that are difficult to check during operation. Clear the dust especially metal powders on the surface of the drive to prevent the dust from entering the drive. Clear the greasy dirt from the cooling fan of the drive.

Danger

- Do not perform inspection while the power is on. Failure to comply will result in an electric shock.
- Before inspection, cut off all the power supplies and wait for at least 10 minutes to avoid risks caused by the residual voltage in the capacitor of the AC drive.

Item	Check Item	Check Item	Checked
System	Check the surface of the AC drive for wastes, strains, and dust.	* Check whether the AC drive cabinet is powered off. * Use a vacuum cleaner to suck up wastes and dust to avoid touching the parts. * Wipe stubborn stains with alcohol and do not operate the AC drive until the alcohol completely evaporates.	

Item	Check Item	Check Item	Checked
Cable	Check power cables and connections for discoloration. Check the cable insulation layer for aging or wear.	* Replace cracked cables. * Replace damaged terminals.	
Peripheral devices of the contactor	Check whether the contactor is loose or generates unexpected noise during closing. Check peripheral components for short circuit, water stains, swelling, and cracks.	* Replace defective peripheral components.	
Air vent	Check whether the air duct and heatsink are clogged. Check whether the fan is damaged.	* Clean the air duct. * Replace the fan.	
Control circuit	Check for control components with poor contact, loose terminal screws, and control cables with cracked insulation.	* Clear away foreign matters on the surface of control cables and terminals. * Replace damaged or corroded control cables.	

8.2.2 Main Circuit Insulation Test

Remove screws of the VDR and disconnect the resistor before testing.

Before measuring insulation resistance with a megger (500 VDC megger recommended), disconnect the main circuit from the AC drive. Do not conduct 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.

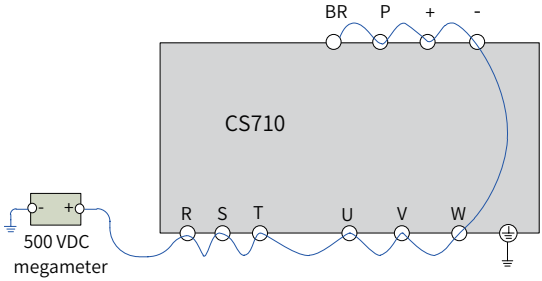


Figure 8-1 Insulation test on the main circuit

The measured insulation resistance must be greater than 5 mΩ.

Caution

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

8.3 Part Replacement

8.3.1 Service Life of Quick-Wear Parts

Quick-wear parts of the AC drive include the cooling fan and filter electrolytic capacitor. Their service life is related to the operating environment and maintenance. The standard service life of the two components is listed in the following table.

Device Name	Service Life [Note]
Fan	⩾ 5 years
Electrolytic capacitor	⩾ 5 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

8.3.2 Number of Fans on the AC Drive

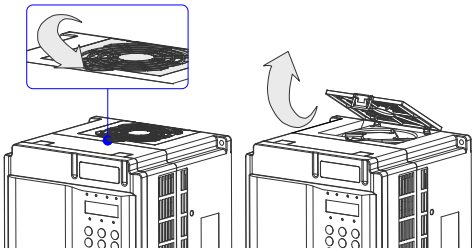
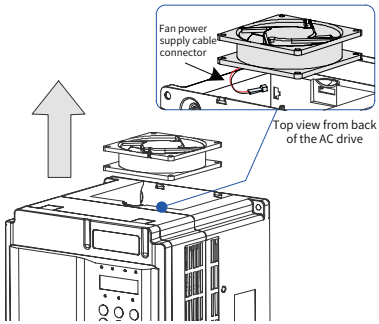
Model	Number of Fans	Model	Number of Fans
Three-phase 380 VAC to 480 VAC, 50 Hz/60 Hz			
CS710-4T0.4GB	/	CS710-4T45GB	1
CS710-4T0.7GB	/	CS710-4T55GB	1
CS710-4T1.1GB	/	CS710-4T75GB	2
CS710-4T1.5GB	1	CS710-4T90G	2
CS710-4T2.2GB	1	CS710-4T110G	2
CS710-4T3.0GB	1	CS710-4T132G	2
CS710-4T3.7GB	1	CS710-4T160G	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

NOTE

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

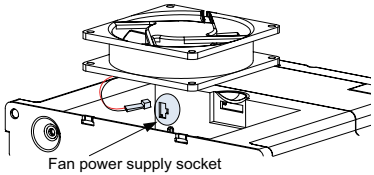
8.3.3 Replacement of Cooling Fans

1) Possible causes of damage: bearing wear and blade aging
2) Diagnosis: cracks on the blade, abnormal vibration noise upon startup, and abnormal running of fan blades
3) Replacement:
   - Press the snap-fit joint on the fan plastic cover and pull the fan outward.
   - After the replacement is completed, check that the air flows upwards.

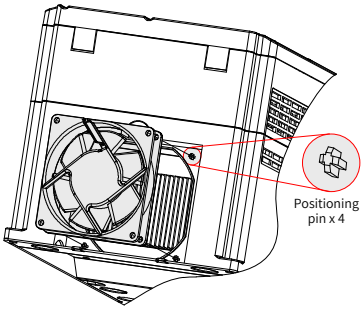
Removing the fan (1.5–37 kW)	
Press the snap-fit joint of the fan cover and remove the cover.	Pull the fan upward and unplug the power cable.
	

Installing the fan (1.5–37 kW)

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

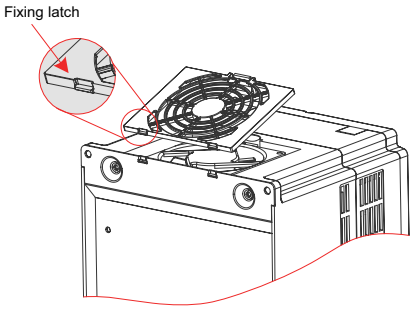


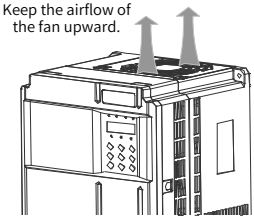
3. Install the fan into the AC drive and ensure that the four fixed holes are aligned with the positioning pins.

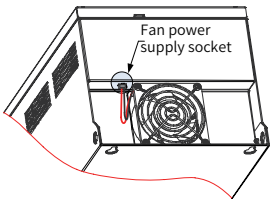
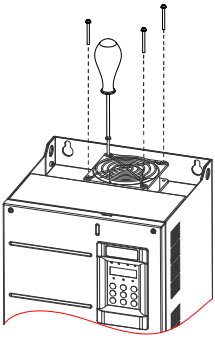
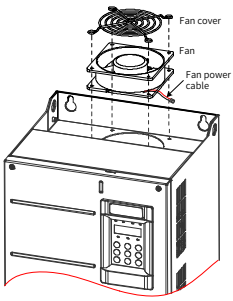


Installing the fan (1.5–37 kW)

4. Insert the two snap-fit joints into the groove and press down to fix the snap-fit joint.

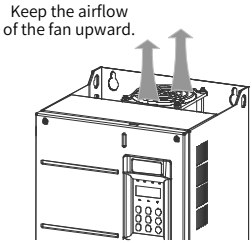




Removing the fan (45–160 kW)		
Unplug the fan power cable from the socket (top view). 	Remove the four screws from the fan cover using a screwdriver. 	Remove the fan and fan cover from the AC drive. 

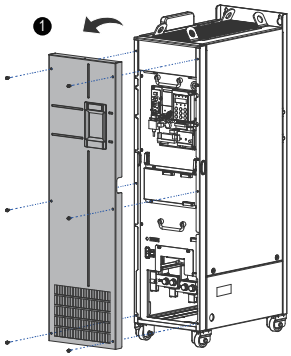
Installing the fan (45–160 kW)

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. Align the fixed holes of the fan cover and the fan with those in the AC drive, as shown in Figure 3 of the removal procedure.
3. After the replacement is completed, check that the air flows upwards.

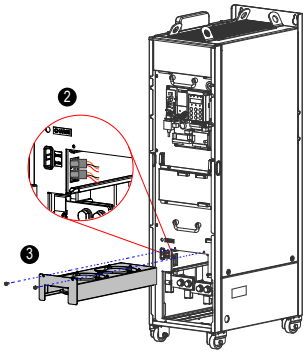


Removing the fan (200–400 kW)

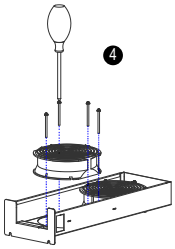
1. Remove the six screws on the cover. Hold the cover with both hands and lift it up in arrow direction to complete the removal.



2. Unplug the fan power supply cable connector from the socket. Each fan has a power supply cable connector.
3. Remove the fixing screws from the fan box and pull out the fan box in the direction of the arrow.

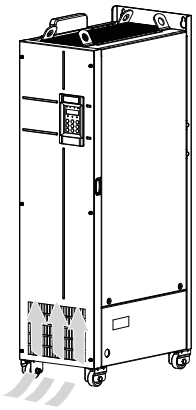


4. Remove screws from each fan cover and remove the fans.



Installing the fan (200–400 kW)

1. Install the fan in a reverse procedure to removal. Pay attention to the direction of the fan.
2. Align the fan box with the rails and push it into the AC drive.
3. Connect the power cable connector of the fan and fasten the fan box. After the replacement is completed, check that the air flows upwards.



8.3.4 Replacement of the Filter Electrolytic Capacitor

1) Possible causes of damage: poor input power supply, high ambient temperature, frequent load jumping, and electrolyte aging

2) Diagnosis: Check whether there is liquid leakage and whether the safety valve has protruded. 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.

8.3.5 Replacement of the Lightning Protection Board

An independent lightning protection board is equipped for the AC drive of 45 kW and above. For the AC drive of 37 kW and below, the lightning protection board is integrated with the driver board.

1) Installation position of the lightning protection board: The lightning protection board must be connected to R/S/T input terminals. Generally, the lightning protection board is installed near the R/S/T input terminals where some blue or yellow VDRs are installed. 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.

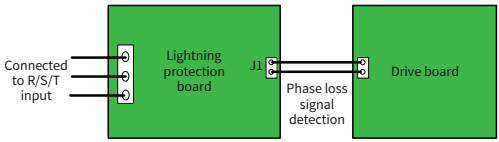


Figure 8-2 Connection between the lightning protection board and driver board for the AC drive of 45 kW and above

2) Replacement of the lightning protection board: If the lightning protection board is damaged or corroded severely, replace the board.

NOTE

- The input phase loss detection circuit on the lightning protection board is used for phase loss signal detection of the driver board and cannot be removed.

8.4 Storage

For temporary and long-term storage of the AC drive, pay attention to the following aspects:

1) Store the equipment in its original package provided by Inovance.

2) Do not expose the equipment to moisture, high temperature, or outdoor direct sunlight for a prolonged period.

3) Switch on the AC drive once every six months for at least five hours to prevent the electrolytic capacitor from deteriorating after long-term storage. Increase the input voltage slowly to the rated value by using a voltage regulator. You can also contact Inovance for technical support.

9 Technical Data and Model Selection

9.1 Technical Data

Table 9-1 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 (varies with the input voltage)									
	Maximum output frequency	150 Hz (can be adjusted by parameters)									
	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 380–480 VAC, 50/60 Hz									
	Voltage range	–15% to +10%; allowed voltage range: 323–528 VAC									
	Frequency range	±5%; allowed frequency range: 47.5–63 Hz									
	Power capacity (kVA)	2	2.8	4.1	5	6.7	9.5	12	17.5	22.8	33.4
Thermal design power (kW)		0.039	0.046	0.057	0.068	0.081	0.109	0.138	0.201	0.24	0.355
Air flow (CFM)		-	-	-	9	9	9	20	24	30	40
Overvoltage class		OVC III									
Pollution degree		PD2									
IP rating		IP20 (open type, for IEC products) Type1 (enclosed type, for UL products)									
Protection class		Class I									
Grid type		TN-S, TN-T, TN-CS, and TT/IT (star 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

Item		Specifications									
output	Rated output current (A)	32	37	45	60	75	91	112	150	176	210
	Maximum output voltage	Three-phase 380–480 V (varies with the input voltage)									
	Maximum output frequency	150 Hz (can be adjusted by parameters)									
	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 380–480 VAC, 50/60 Hz									
	Voltage range	–15% to +10%; allowed voltage range: 323–528 VAC									
	Frequency range	±5%; allowed frequency range: 47.5–63 Hz									
	Power capacity (kVA)	42.8	45	54	52	63	81	97	127	150	179
Thermal design power (kW)		0.454	0.478	0.551	0.694	0.815	1.01	1.21	1.57	1.81	2.14
Air flow (CFM)		42	51.9	57.4	118.5	118.5	122.2	122.2	218.6	287.2	342.2
Overvoltage class		OVC III									
Pollution degree		PD2									
IP rating		IP20 (open type, for IEC products) Type1 (enclosed type, for UL products)									
Protection class		Class I									
Grid type		TN-S, TN-T, TN-CS, and TT/IT (star 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 (varies with the input voltage)								
	Maximum output frequency	150 Hz (can be adjusted by parameters)								
	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 380–480 VAC, 50/60 Hz							
	Voltage range	–15% to +10%; allowed voltage range: 323–528 VAC							
	Frequency range	±5%; allowed frequency range: 47.5–63 Hz							
	Power capacity (kVA)	220	263	334	375	404	453	517	565	629
Thermal design power (kW)		2.85	3.56	4.15	4.55	5.06	5.33	5.69	6.31	6.91
Air flow (CFM)		547	627	638.4	722.5	789.4	882	645	860	860
Overvoltage class		OVC III								
Pollution degree		PD2								
IP rating		IP20 (open type, for IEC products) Type1 (enclosed type, for UL products)		IP00 (open type, applicable to IEC products)						
Protection class		Class I								
Grid type		TN-S, TN-T, TN-CS, and TT/IT (star grounding)								

NOTE

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

Table 9-2 Technical specifications of CS710 series AC drives

Item		Technical Specifications	
Basic functions	Input frequency resolution	Digital setting: 0.01 Hz Analog setting: maximum frequency x 0.025%	
	Control mode	SVC FVC V/f control	
	Starting torque	0.25 Hz/150% (SVC) 0 Hz/180% (FVC)	
	Speed range	1:200 (SVC)	1:1000 (FVC)
	Speed stability accuracy	±0.5% (SVC)	±0.02% (FVC)
	Torque control accuracy	±3% (FVC) ±5% above 10 Hz (SVC)	
	Torque boost	Automatic torque boost; customized torque boost: 0.1% to 30.0%	
	DC injection braking	DC injection braking frequency: Minimum 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	
	Automatic voltage regulation (AVR)	Automatically maintains a constant output voltage when the grid voltage changes.	
	Overvoltage/ Overcurrent stall control	Automatically limits the current and voltage during operation to avoid frequent tripping caused by overvoltage/overcurrent.	
	Fast current limit	This function reduces overcurrent to the minimum and guarantees normal running of the AC drive.	
	Torque limit and control	The system limits the torque automatically to prevent frequent trips caused by overcurrent during operation. Torque control is applied in vector control mode.	

Item		Technical Specifications
Customized functions	Crane process sheet	The AC drive can use a crane process sheet to implement complex crane process control for the built-in anti-sway device.
	Overload protection	Overloads are automatically identified to permit falling-down and deny rising in case of overload.
	Multi-motor switchover	Three backups for all parameters of the AC drive, allowing switchover between three motors
	Multiple field buses	The AC drive supports six types of field buses: Modbus, PROFIBUS DP, CANopen, PROFINET, EtherNet/IP, and EtherCAT.
	Motor overtemperature protection	The optional I/O expansion card 1 enables AI3 to receive the motor temperature sensor input (PT100 and PT1000).
	Multiple encoder types	The AC drive supports differential encoders, open collectors, UVW encoders, and resolvers.
	Speed reduction with the voltage drop	When the bus voltage is too low, the AC drive can keep the voltage at a normal level through load feedback energy.
	Brake sequence control	Provides professional brake sequence control dedicated for cranes.
	Light-load and high-speed	Automatically calculates the highest output frequency by detecting the output torque of the AC drive.
	Special curve	Three-segment acceleration/deceleration curves are supported.
	Load overspeed determination	Designs the frequency direction exception alarm and frequency following exception alarm according to the encoder feedback frequency.
	Deceleration/Stop switch	Provides a simple positioning function.
	Various fault alarms	Optional AC drive output fault types and handling modes
	Static auto-tuning of motor parameters	Supports static auto-tuning of all motor parameters.
	Advanced software tool	The AC drive software allows you to configure parameters, and provides a virtual oscilloscope to show the internal status of the AC drive.

Item		Technical Specifications
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.
	Input terminal	Standard: Five DIs 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. Expansion capability: For models with 11 kW and below, the CS700IO1 expansion card is standard. It provides two input terminals. For models with 15 kW and above, the CS700RC2 expansion card is standard. It provides three DI terminals.
	Output terminals	Standard: Two DOs One relay output terminal One AO that supports 0–10 V voltage output and 0–20 mA current output Expansion capability: For models with 11 kW and below, the CS700IO1 expansion card is standard. It provides one output terminal. For models with 15 kW and above, the CS700RC2 expansion card is standard. It provides two relay output terminals.
Display and operating panel	LED display	It shows parameter values.
	Parameter copy	The operating panel allows for quick parameter copy on the parameter copy interface.
Protection functions	Phase loss protection	The AC drive provides input phase loss protection and output phase loss protection.
	Instantaneous overcurrent protection	The AC drive stops when the operating current exceeds 250% of the rated current.
	Overvoltage protection	The AC drive stops when the DC voltage of the main circuit rises above 820 V.
	Undervoltage protection	The AC drive stops when the DC voltage of the main circuit falls below 350 V.
	Overtemperature protection	The AC drive triggers protection when the inverter bridge overheats.
	Overload protection*1	The AC drive stops after running at 150% of the rated current for 60 seconds.
	Braking protection	Braking protection indicates protection against braking unit overload and braking resistor short circuit.
	Short circuit protection	The AC drive triggers output interphase short-circuit protection and protection against output short-circuit to ground.

Item		Technical Specifications
Environment	Place of use	Install the AC drive in an indoor environment free from direct sunlight, dust, corrosive or combustible gases, oil mist, water vapor, drip, and salt.
	Altitude	⩽ 1000 m: not derated > 1000 m: derated by 1% for every additional 100 m Maximum altitude: 3000 m
	Ambient temperature	–10° C to +40° C; above 40° C: derated by 1.5% for every 1° C increase; maximum ambient temperature: 50° C
	Humidity	< 95% RH, non-condensing
	Vibration	Application scenario: Test according to IEC 60068-2-6 Vibration amplitude of 3.5 mm at 5 Hz to 8.4 Hz; acceleration rate of 1•g at 8.4 Hz to 200 Hz; 10 sweeps in each axial direction Transportation scenario: Test according to IEC 60068-2-64 Power spectral density of 0.01 g^2/Hz at 5 Hz to 100 Hz and of 0.001 g^2/Hz at 200 Hz; Grms of 1.14 g
	Shock	Application/Transportation scenario: Test according to IEC 60068-2-27 Acceleration rate of 15 g; pulse width of 11 ms; total of 18 sweeps in three axial directions
	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.

9.2 Installation Dimensions

9.2.1 Dimensions of 0.4–160 kW AC Drive Models

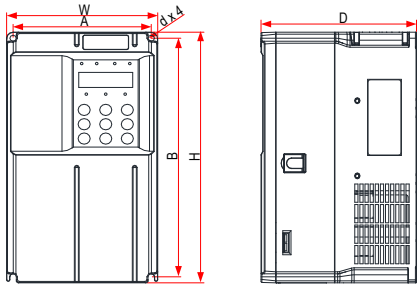


Figure 9-1 Outline dimensions and installation dimensions of 0.4–15 kW AC drive models

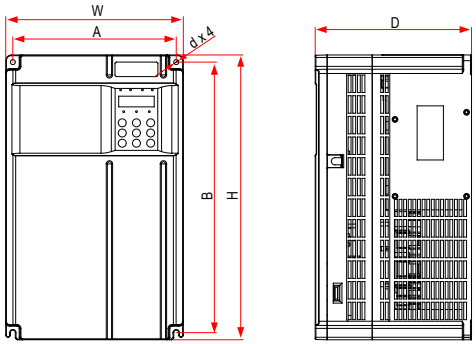


Figure 9-2 Outline dimensions and installation dimensions of 18.5–37 kW AC drive models

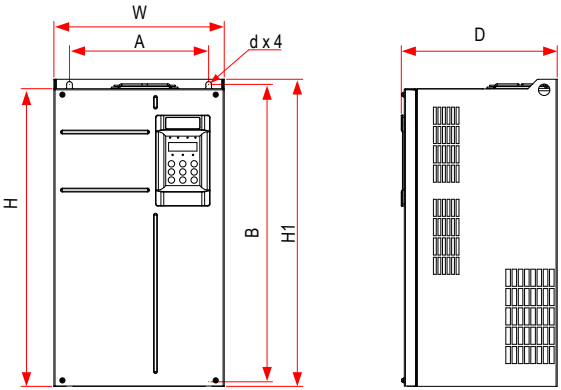


Figure 9-3 Outline dimensions and installation dimensions of 45–160 kW AC drive models

Table 9-3 Outline dimensions and mounting hole dimensions of 0.4–160 kW AC drive models

AC Drive Model	Mounting Hole Dimensions (mm)		Outline Dimensions (mm)				Mounting Hole Diameter (mm)	Weight (kg)
	(A)	B	H	H1	W	D		
CS710-4T0.4GB	119	189	200	-	130	152	Ø5	1.6
CS710-4T0.7GB								
CS710-4T1.1GB								
CS710-4T1.5GB								
CS710-4T2.2GB								
CS710-4T3.0GB								

AC Drive Model	Mounting Hole Dimensions (mm)		Outline Dimensions (mm)				Mounting Hole Diameter (mm)	Weight (kg)
	(A)	B	H	H1	W	D		
CS710-4T3.7GB	119	189	200	-	130	162	Ø5	2.0
CS710-4T5.5GB								
CS710-4T7.5GB	128	238	250	-	140	170	Ø6	3.3
CS710-4T11GB								
CS710-4T15GB	166	266	280	-	180	170	Ø6	4.3
CS710-4T18.5GB(-T)	195	335	350	-	210	192	Ø6	9.1
CS710-4T22GB(-T)								
CS710-4T30GB	230	380	400	-	250	220	Ø7	17.5
CS710-4T37GB								
CS710-4T45GB	245	523	525	542	300	275	Ø10	35
CS710-4T55GB								
CS710-4T75GB	270	560	554	580	338	315	Ø10	51.5
CS710-4T90G								
CS710-4T110G								
CS710-4T132G	320	890	874	915	400	320	Ø10	85
CS710-4T160G								

9.2.2 Outline Dimensions of 0.4–160 kW AC Drive Models with Through-Hole Mounting Brackets

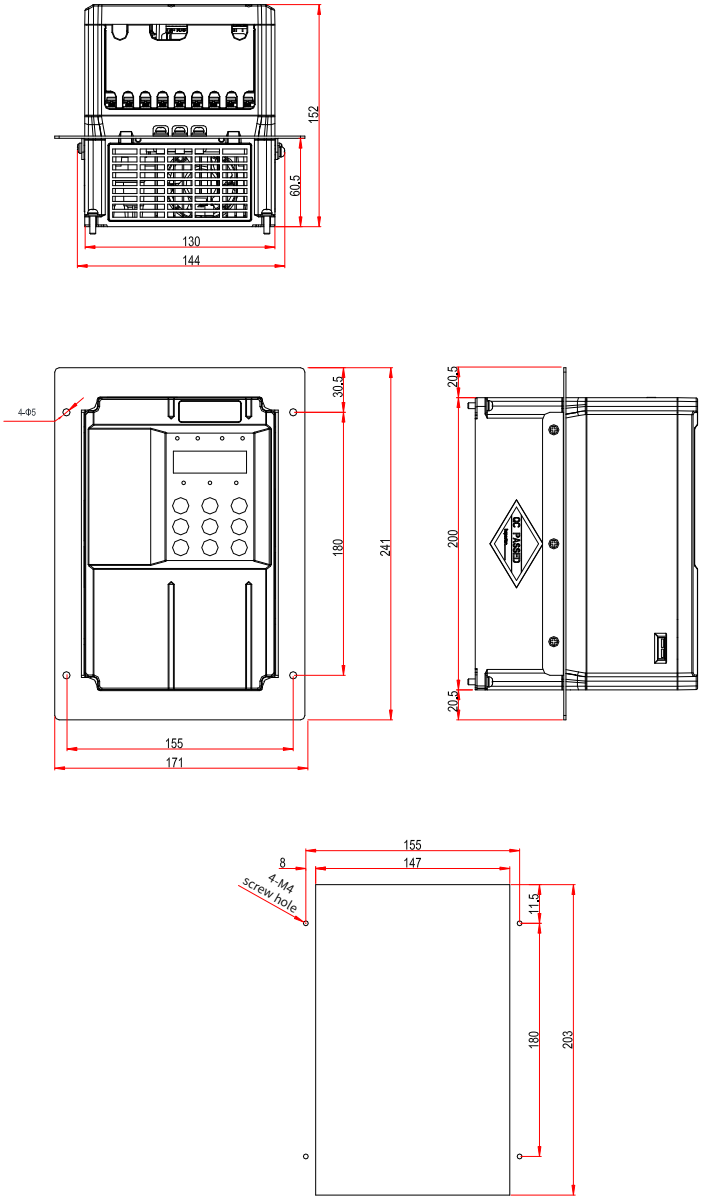


Figure 9-4 Through-hole mounting bracket and mounting hole dimensions for 0.4–3.0 kW AC drive models (mm)

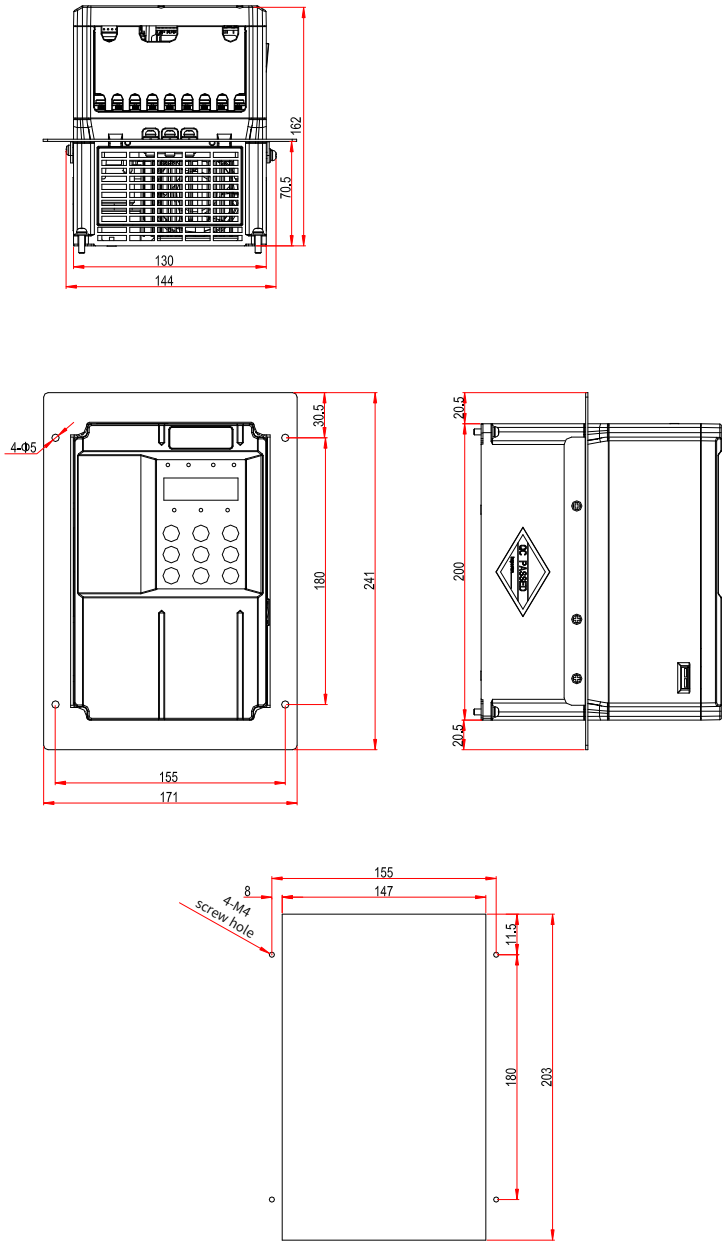


Figure 9-5 Through-hole mounting bracket and mounting hole dimensions for 3.7–5.5 kW AC drive models (mm)

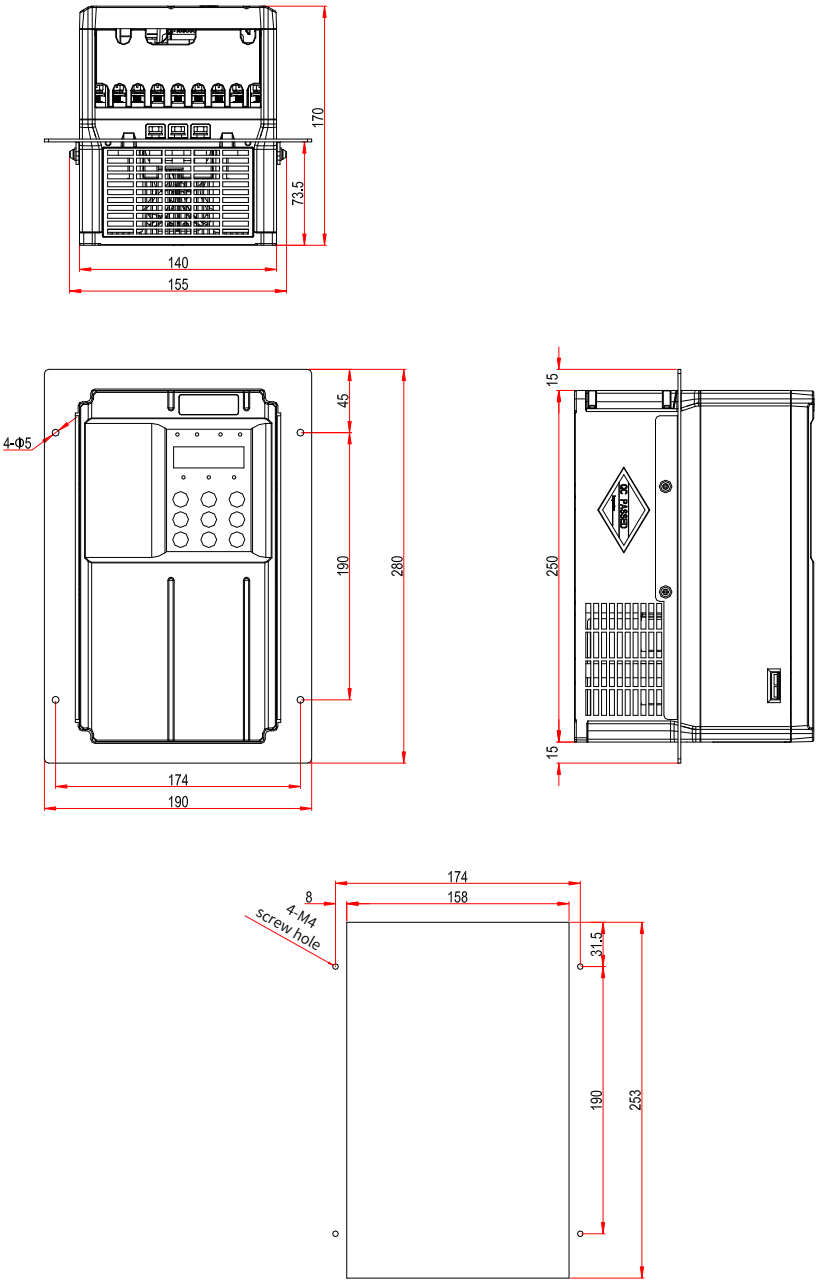


Figure 9-6 Through-hole mounting bracket and mounting hole dimensions for 7.5–11 kW AC drive models (mm)

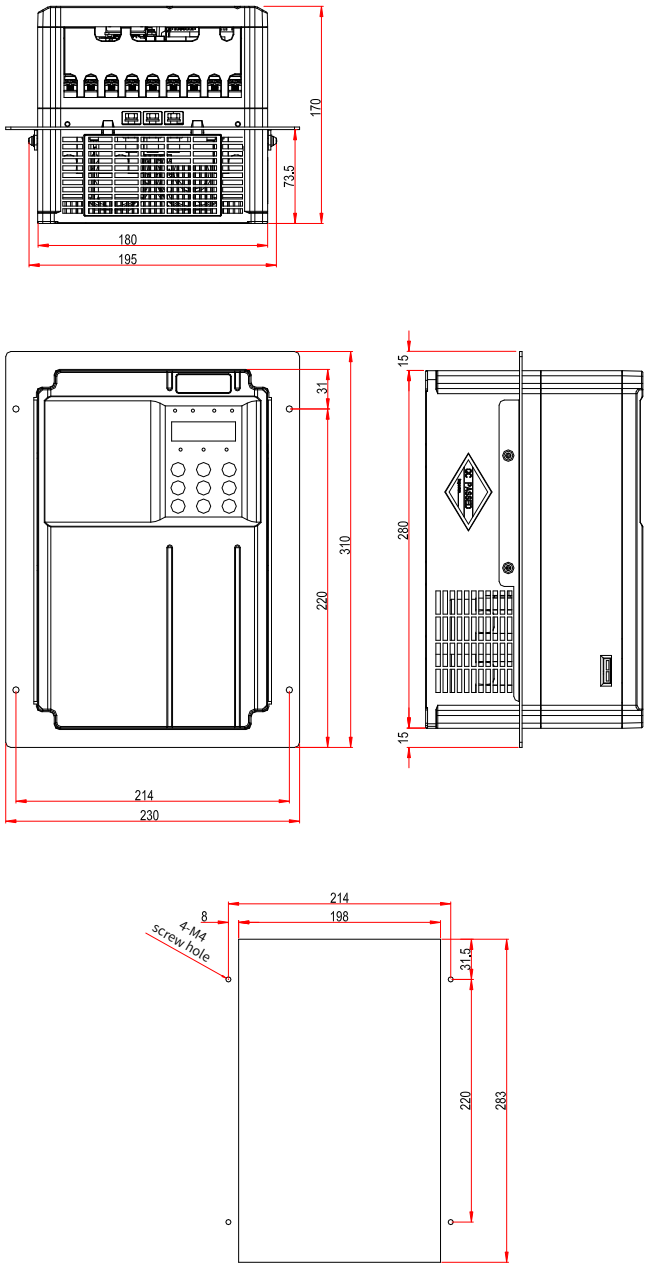


Figure 9-7 Through-hole mounting bracket and mounting hole dimensions for 15 kW AC drive models (mm)

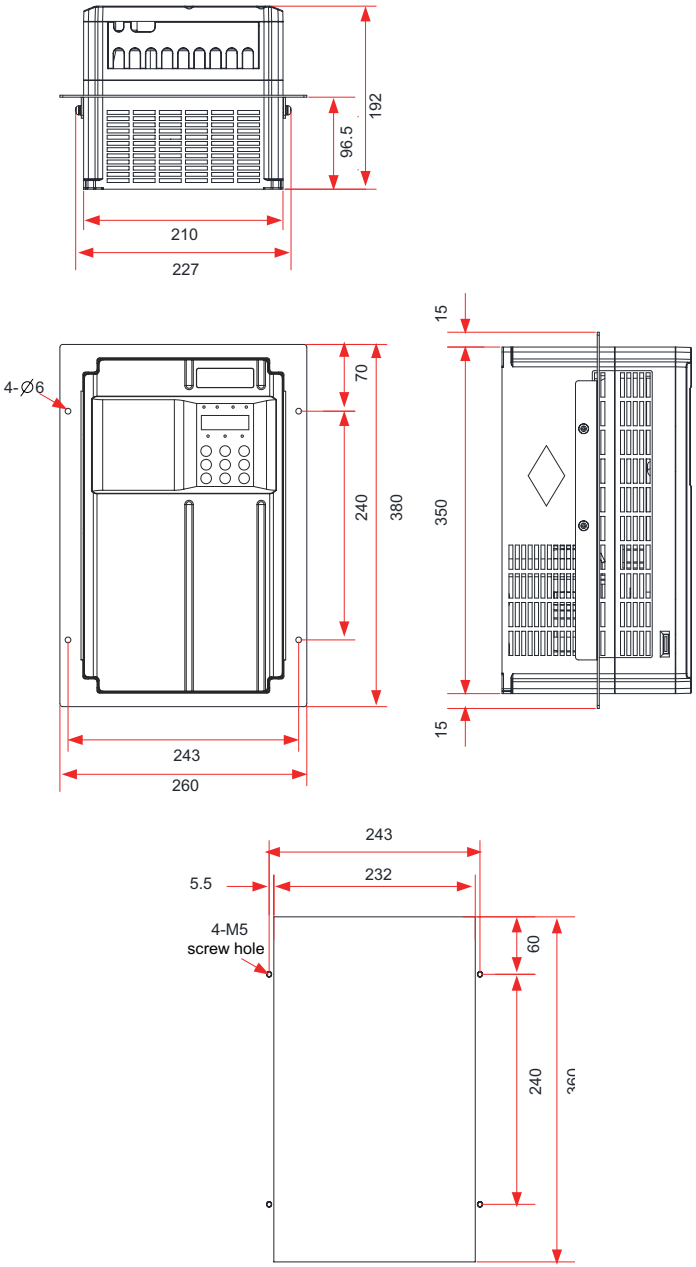


Figure 9-8 Through-hole mounting bracket and mounting hole dimensions for 18.5–22 kW AC drive models (mm)

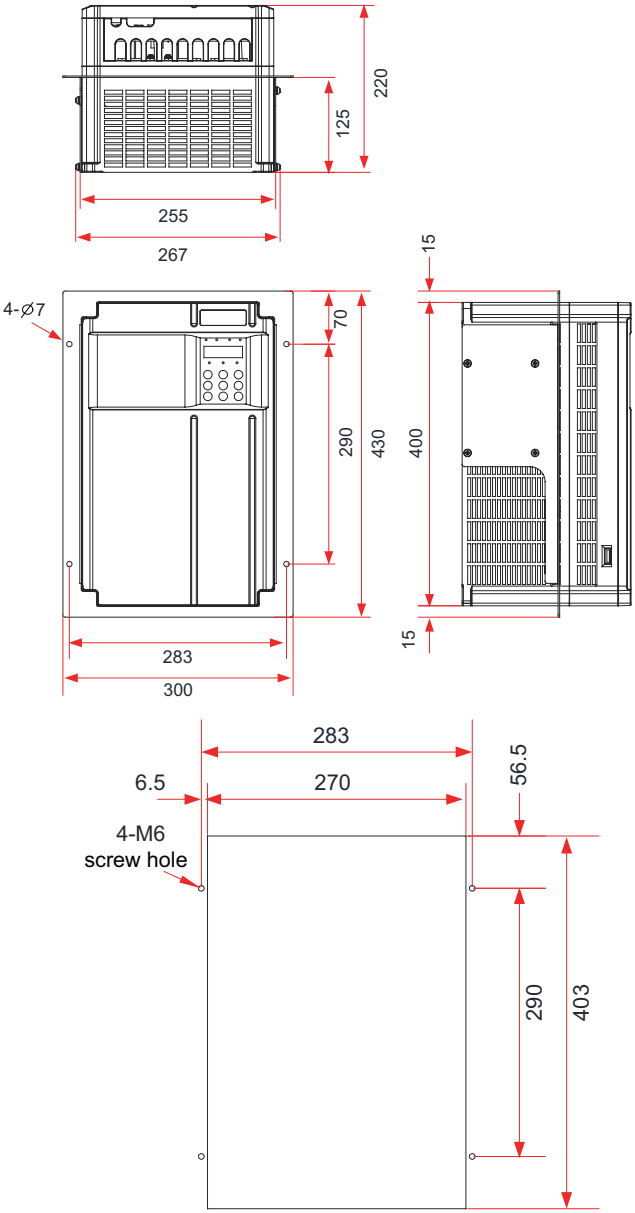


Figure 9-9 Through-hole mounting bracket and mounting hole dimensions for 30–37 kW AC drive models (mm)

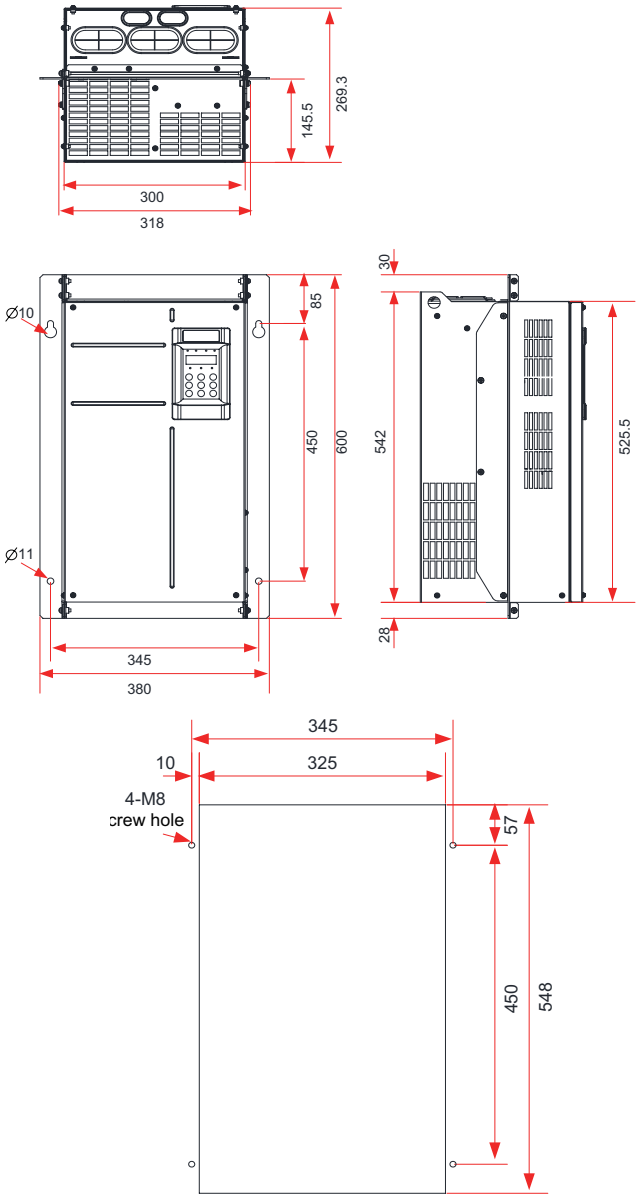


Figure 9-10 Through-hole mounting bracket and mounting hole dimensions for 45–55 kW AC drive models (mm)

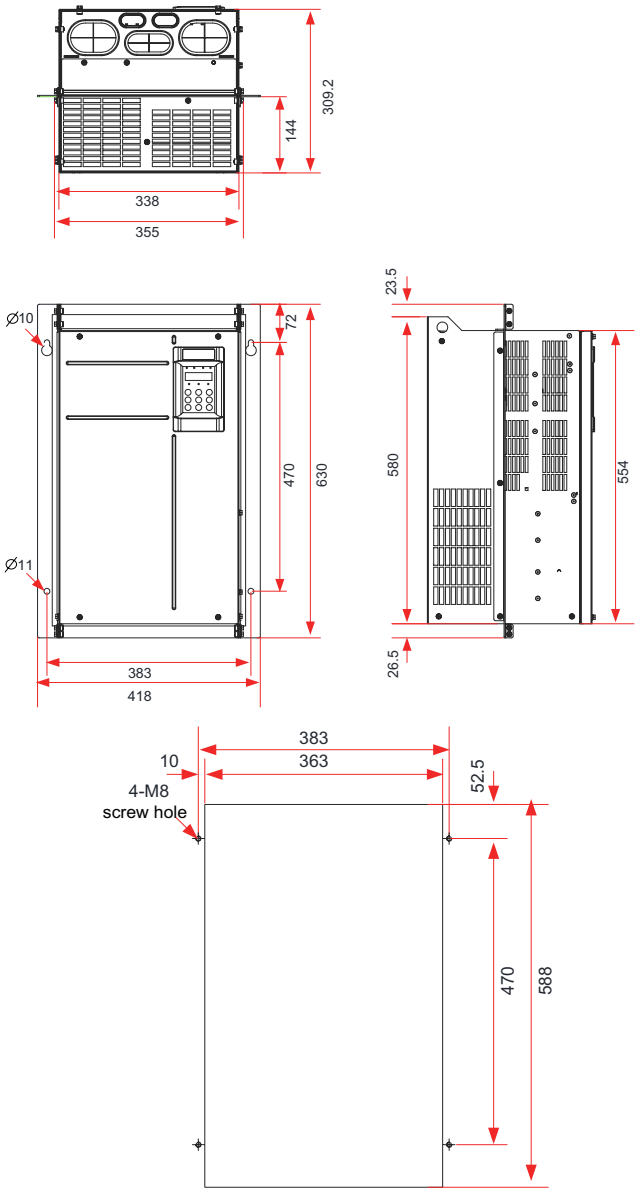


Figure 9-11 Through-hole mounting bracket and mounting hole dimensions for 75–110 kW AC drive models (mm)

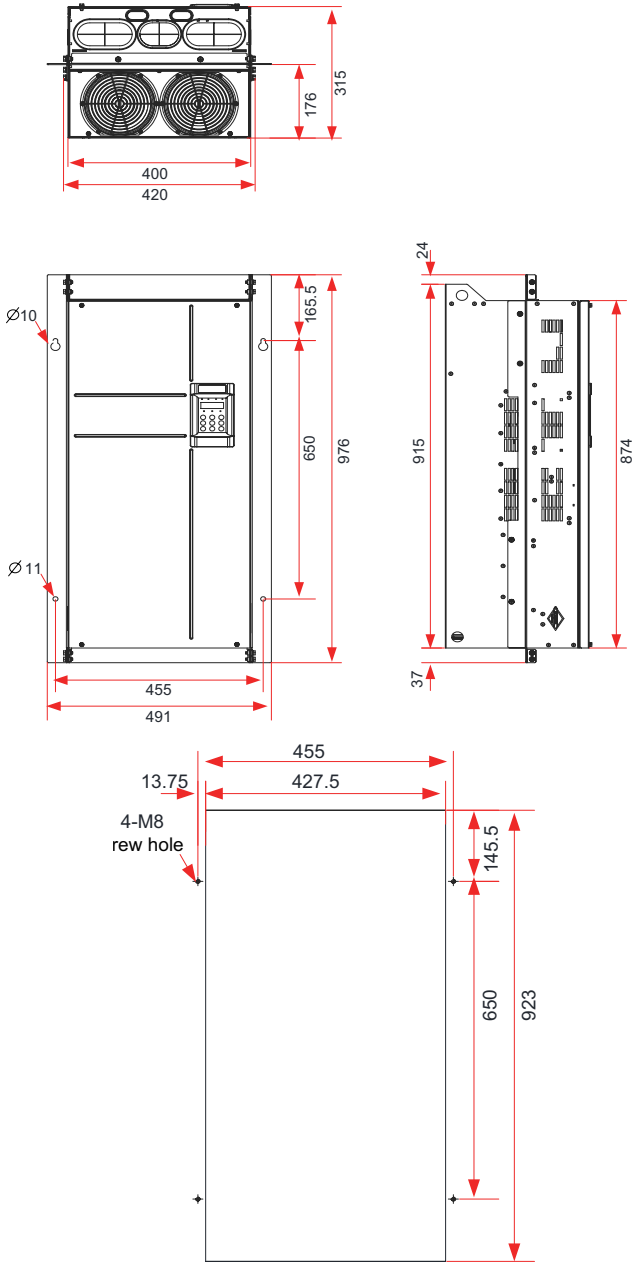


Figure 9-12 Through-hole mounting bracket and mounting hole dimensions for 132–160 kW AC drive models (mm)

9.2.3 Dimensions of 200–400 kW AC Drive Models (Without Reactor Base)

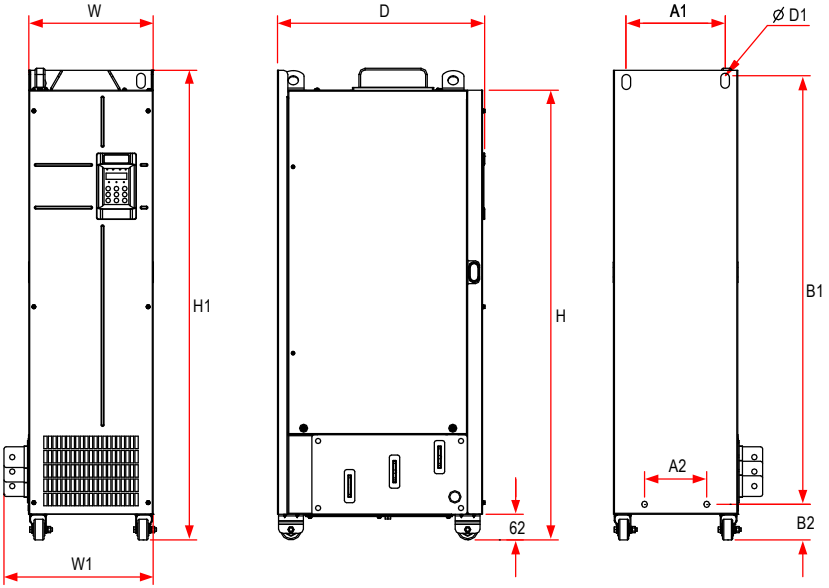


Figure 9-13 Outline dimensions and installation dimensions of 200–400 kW AC drive models (without the reactor base)

Table 9-4 Mounting hole dimensions of 200–400 kW AC drive models (without the reactor base)

AC Drive Model	Mounting Hole Dimensions (mm)				Outline 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	Ø13	110
CS710-4T220G											
CS710-4T250G	225	185	1175	97	1248	1284	330	390	545	Ø13	155
CS710-4T280G											
CS710-4T315G	240	200	1280	101	1355	1405	340	400	545	Ø16	185
CS710-4T355G											
CS710-4T400G											

9.2.4 Dimensions of 200-400 kW AC Drive Models (with Reactor Base)

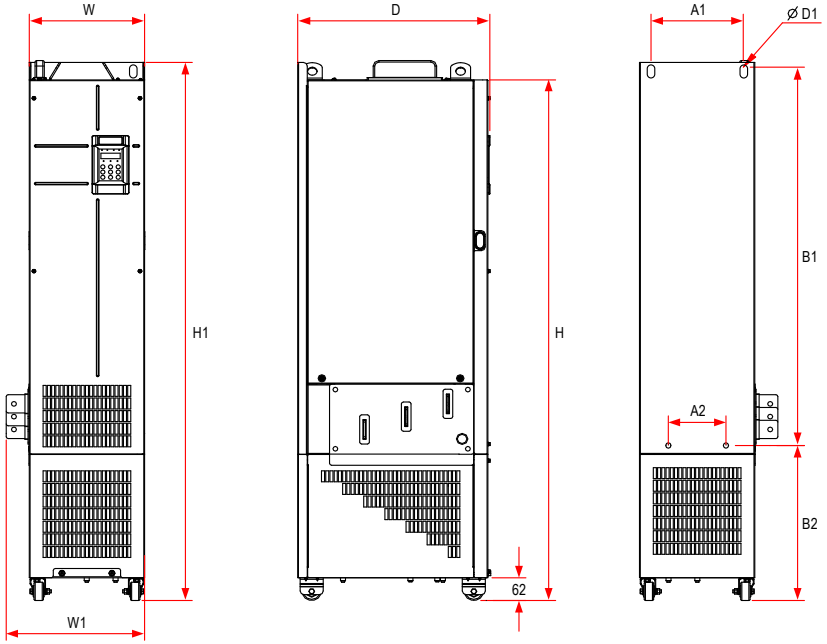


Figure 9-14 Outline dimensions and installation dimensions of 200–400 kW AC drive models (with the reactor base)

Table 9-5 Mounting hole dimensions of 200–400 kW AC drive models (with the reactor base)

AC Drive Model	Mounting Hole Dimensions (mm)				Outline 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	Ø13	160
CS710-4T220G											
CS710-4T250G	225	185	1175	435	1586	1622	330	390	545	Ø13	215
CS710-4T280G											
CS710-4T315G	240	200	1280	432	1683	1733	340	400	545	Ø16	245
CS710-4T355G											
CS710-4T400G											

9.2.5 Mounting Bracket Dimensions

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

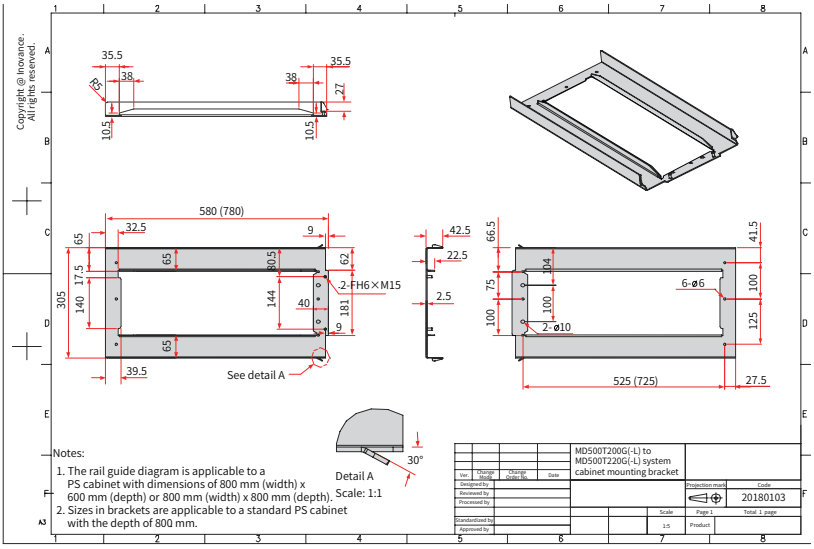


Figure 9-15 Dimensions of the mounting bracket for 200–220 kW AC drives (standard configuration) (mm)

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

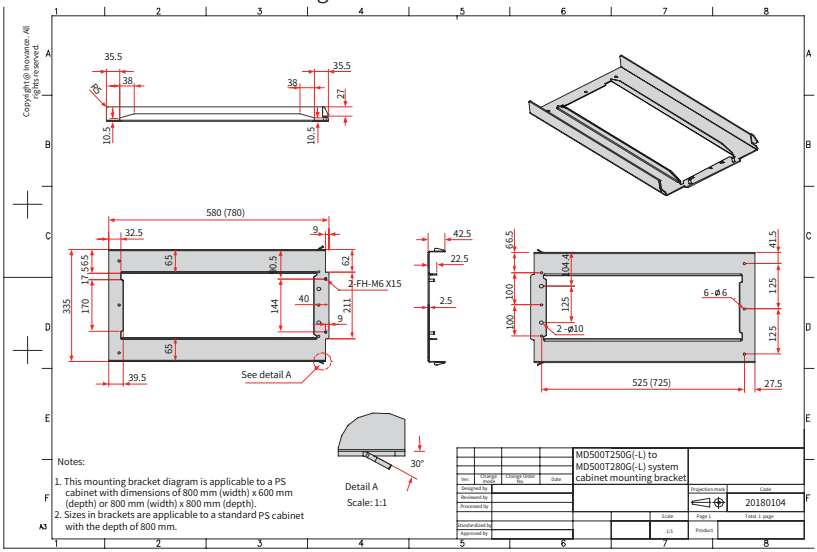


Figure 9-16 Dimensions of the mounting bracket for 250–280 kW AC drives (standard configuration) (mm)

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

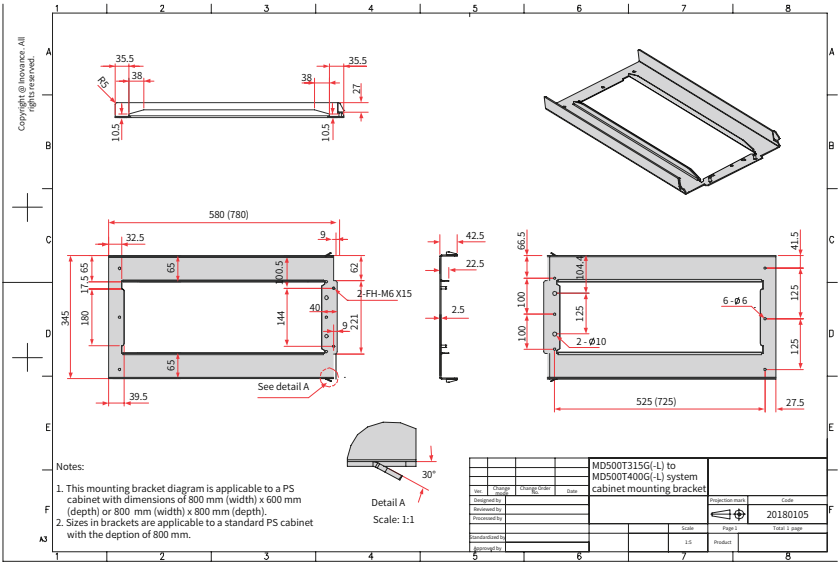


Figure 9-17 Dimensions of the mounting bracket for 315–400 kW AC drives (standard configuration) (mm)

9.3 Options

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

Table 9-6 Options

Parameter Name	Model	Function	Remarks
Built-in braking unit	Models containing letter "B"	Optional for models of 0.4–75 kW	-
External braking unit	MDBUN	Required for models of 90 kW and above	Parallel connection of multiple braking units supported by models of 90 kW and above
I/O expansion 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	Available for models of 15 kW and above
I/O expansion card 2	MD38IO2	Provides three extra DI terminals.	Available for all models

Parameter Name	Model	Function	Remarks
I/O expansion card 3	CS700RC2	Two relay output terminals, three DIs, and one RS485 interface	Standard for models of 15 kW and above
I/O expansion card 4	CS700IO1	One relay output terminal, two DIs, and one RS485 interface	Standard for models of 11 kW and below
RS485 communication card	MD38TX1	Isolated Modbus communication adapter card	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	Available for models of 15 kW and above
PROFINET communication card	MD500-PN1	PROFINET communication adapter card	Available for all models
Multi-function encoder card	MD38PGMD	Compatible with differential input, collector input, and push-pull input Supports differential output and collector output Meets the requirements of various commonly used interfaces such as encoder interfaces and host controller A/B phase input interfaces	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 for the MD series RJ45 port
LCD panel	MDKE9	Information display, parameter backup, and download	RJ45 port
Extension cable	MDCAB	Standard 8-core network cable, which can connect to MD32NKE1, MD32KC, and MDCP	The cable length is 3 meters in the standard configuration.
Through-hole mounting bracket	MD500-AZJ-A1T*	Meets requirements of through-hole mounting.	Each model has its own bracket. For details, see Table 3-1 "List of models for through-hole mounting brackets."
Cable shield grounding bracket	MD500-AZJ-A2T*	The bracket is used for secondary fixing of power cables and 360° reliable grounding of the shield.	Each model has its own bracket.

9.4 Selection of Peripheral Electrical Components

9.4.1 List of Peripheral Electrical Components

Table 9-7 Recommended peripheral electrical components for CS710 series AC drives

CS710 Series Model	RST/UVW Cable (mm^2)[1]	PE Cable (mm^2)	RST/UVW Cable (mm^2)	Terminal Width of the AC Drive (mm)	Screw Specifications	Recommended Bussmann Fuse (UL-Certified)		Recommended Contactor	Recommended Circuit Breaker
						Rated Current (A)	Model	Rated Current (A)	Rated Current (A)
Three-phase 380–480 V, 50/60 Hz									
CS710-4T0.4GB	3 x 0.75	0.75	3 x 0.75	10.2	M4	5	FWP-5B	9	3
CS710-4T0.7GB	3 x 0.75	0.75	3 x 0.75	10.2	M4	5	FWP-5B	9	4
CS710-4T1.1GB	3 x 0.75	0.75	3 x 0.75	10.2	M4	10	FWP-10B	9	6
CS710-4T1.5GB	3 x 0.75	0.75	3 x 0.75	10.2	M4	10	FWP-10B	9	6
CS710-4T2.2GB	3 x 0.75	0.75	3 x 0.75	10.2	M4	10	FWP-10B	9	10
CS710-4T3.0GB	3 x 1	1	3 x 1	10.2	M4	15	FWP-15B	12	13
CS710-4T3.7GB	3 x 1.5	1.5	3 x 1.5	10.2	M4	20	FWP-20B	16	16
CS710-4T5.5GB	3 x 2.5	2.5	3 x 2.5	10.2	M4	30	FWP-30B	26	25
CS710-4T7.5GB	3 x 4	4	3 x 4	13.0	M5	40	FWP-40B	26	32
CS710-4T11GB	3 x 6	6	3 x 6	13.0	M5	60	FWP-60B	38	50
CS710-4T15GB	3 x 10	10	3 x 10	14.3	M5	70	FWH-70B	50	63
CS710-4T18.5GB (-T)	3 x 10	10	3 x 10	15.0	M6	80	FWH-80B	65	63
CS710-4T22GB (-T)	3 x 16	16	3 x 16	15.0	M6	100	FWH-100B	65	80
CS710-4T30GB	3 x 16	16	3 x 16	18.0	M6	100	FWH-100B	65	80
CS710-4T37GB	3 x 25	16	3 x 25	18.0	M6	125	FWH-125B	80	100
CS710-4T45GB	3 x 35	16	3 x 35	26.8	M8	150	FWH-150B	95	160
CS710-4T55GB	3 x 50	25	3 x 50	26.8	M8	200	FWH-200B	115	160
CS710-4T75GB	3 x 70	35	3 x 70	30.6	M12	250	FWH-250A	150	250
CS710-4T90G	3 x 95	50	3 x 95	30.6	M12	275	FWH-275A	170	250
CS710-4T110G	3 x 120	70	3 x 120	30.6	M12	325	FWH-325A	205	250
CS710-4T132G	3 x 150	95	3 x 150	40	M12	400	FWH-400A	245	400
CS710-4T160G	3 x 185	95	3 x 185	40	M16	500	FWH-500A	300	400
CS710-4T200G	2 x (3 x 95)	95	2 x (3 x 95)	33	M12	600	FWH-600A	410	500
CS710-4T220G	2 x (3 x 120)	120	2 x (3 x 120)	33	M12	700	FWH-700A	410	630

CS710 Series Model	RST/UVW Cable (mm^2)[1]	PE Cable (mm^2)	RST/UVW Cable (mm^2)	Terminal Width of the AC Drive (mm)	Screw Specifi-cations	Recommended Bussmann Fuse (UL-Certified)		Recom-mended Contactor	Recom-mended Circuit Breaker
						Rated Current (A)	Model	Rated Current (A)	Rated Current (A)
CS710-4T250G	2 x (3 x 120)	120	2 x (3 x 120)	36	M12	800	FWH-800A	475	630
CS710-4T280G	2 x (3 x 150)	150	2 x (3 x 150)	36	M12	800	FWH-800A	620	800
CS710-4T315G	2 x (3 x 185)	185	2 x (3 x 185)	45	M16	1000	170M5016	620	800
CS710-4T355G	2 x (3 x 185)	185	2 x (3 x 185)	45	M16	1000	170M5016	620	800
CS710-4T400G	2 x (3 x 240)	240	2 x (3 x 240)	45	M16	1400	170M6017	800	1000

NOTE

◆ [1] indicates that Chinese standards are applicable. 3 x 10 indicates one 3-conductor 10 mm^2 cable, and 2 x (3 x 95) indicates two 3-conductor 95 mm^2 cables.

9.4.2 Lug Models and Dimensions

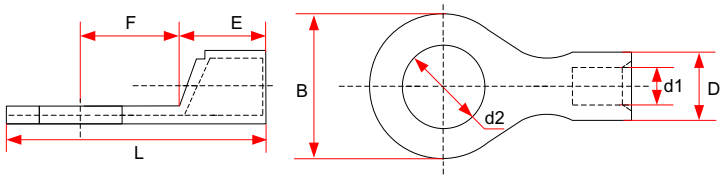


Figure 9-18 Dimensions of TNR series cable lugs

Table 9-8 Models and dimensions of TNR series cable lugs

Model	Cable Size		D	d1	E	F	B	d2	L	Current (A)	Crimping Tool
	AWG/MCM	(mm^2)									
TNR0.75-4	22–16	0.25–1.0	2.8	1.3	4.5	6.6	8.0	4.3	15.0	10	RYO-8 AK-1M
TNR1.25-4	22–16	0.25–1.65	3.4	1.7	4.5	7.3	8	5.3	15.8	19	

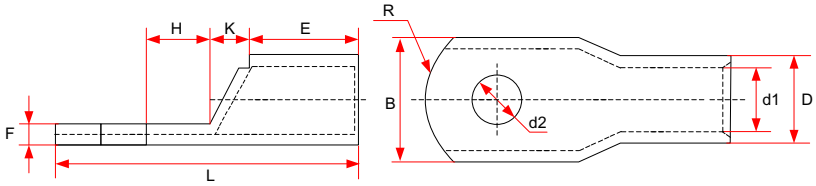


Figure 9-19 Dimensions of GTNR series cable lugs

Table 9-9 Models and dimensions of GTNR series cable lugs (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		
GTNR50-8	12.6	9.6	16.0	11.0	6.0	18.0	8.4	2.8	43.5		CT-100
GTNR50-10							10.5				
GTNR70-8	15.0	12.0	18.0	13.0	7.0	21.0	8.4	2.8	50.0	14	
GTNR70-10							10.5				
GTNR70-12							13.0				
GTNR95-10	17.4	13.5	20.0	13.0	9.0	25.0	10.5	3.9	55.0		
GTNR95-12							13.0				
GTNR120-12	19.8	15.0	22.0	14.0	10.0	28.0	13.0	4.7	60.0	16	RYC-150
GTNR120-16				16.0			17.0		64.0		
GTNR150-12	21.2	16.5	26.0	16.0	11.0	30.0	13.0	4.7	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				

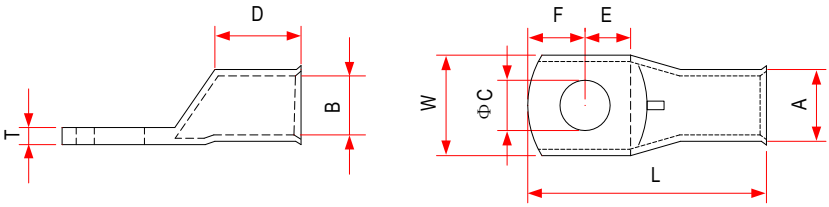


Figure 9-20 Dimensions of BC series cable lugs

Table 9-10 Models and dimensions of BC series cable lugs (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
120-10								10.5	
120-12								12.8	
120-14								14.7	
120-16								16.7	
120-20				18.8				20.7	14.3
150-8	21.0	16.5	30.0	16.5	27.0	78.0	4.5	8.5	16.5
150-10								10.5	
150-12								12.8	
150-14								14.7	
150-16								16.7	
150-20				18.8				20.7	14.3
185-10	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
240-10	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	
300-10	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	

9.4.3 RCD Selection

If an RCD is needed, select it according to the following requirements:

* Select an RCD with a rated tripping current of at least 100 mA for each AC drive, to avoid RCD malfunction due to high-frequency leakage current generated by the AC drive during operation.

* Select an RCD with a rated tripping current of at least 300 mA when multiple AC drives are connected in parallel and share a common RCD.

* Use RCDs from Chint or Schneider (recommended).

When an RCD malfunctions, perform troubleshooting according to the following table.

Table 9-11 Troubleshooting for RCD

Result	Possible Cause	Solution
The RCD trips immediately upon power-on.	The anti-interference performance of the RCD is poor.	1. Use an RCD from a recommended brand. 2. Use an RCD with a high operating 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 rated tripping current of the RCD is too low.	
	An unbalanced load is connected to the rear end of the RCD.	
	The ground capacitance at the front end of the AC drive is large.	
The RCD trips during running.	The anti-interference performance of the RCD is poor.	1. Use an RCD from a recommended brand. 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."Figure 9-22 Installing a simple filter and magnetic ring on the input side" 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 an RCD with a high rated operating current. 6. Reduce the carrier frequency without compromising the performance. 7. Use a shorter motor cable.
	The rated tripping current of the RCD is too low.	
	An unbalanced load is connected to the rear end of the RCD.	
	The ground distributed capacitance of the motor cable and the motor is too high.	

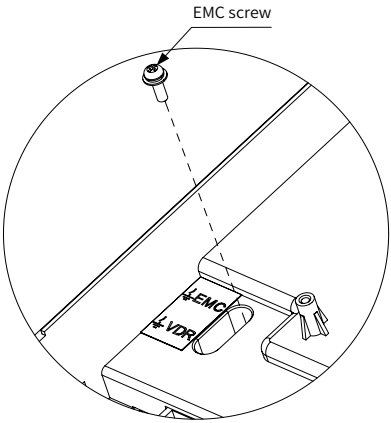


Figure 9-21 Disconnecting the EMC screw

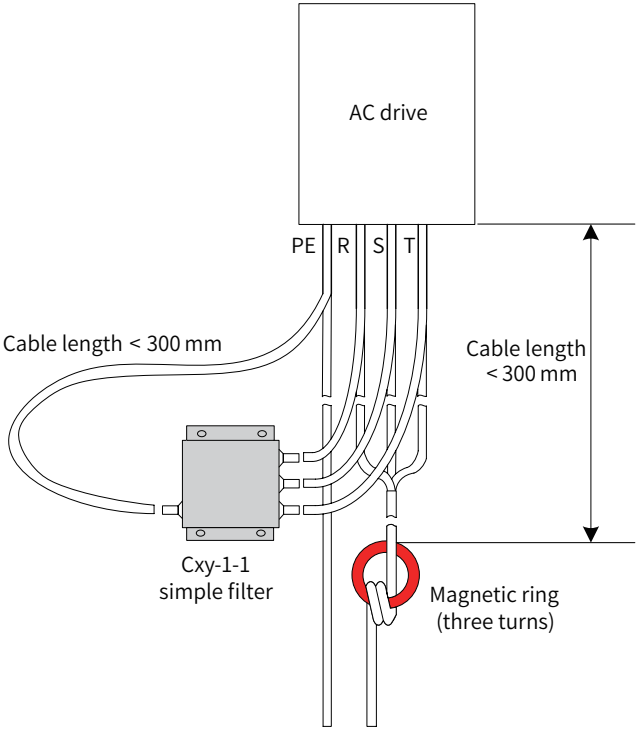


Figure 9-22 Installing a simple filter and magnetic ring on the input side

9.5 Selection of Braking Components

9.5.1 Selection of Braking Units

When selecting the braking unit for an indoor translation mechanism, you need to consider only the short-time permissible braking capability of the braking unit.

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

In formula 1, P_{zmax} is the short-time permissible power of the braking unit, in kW.

P_{Bmax} is the short-time permissible power of the AC drive, expressed in kW.

This formula indicates that the short-time permissible power of the braking unit is 0.8 times the short-time permissible motor power of the AC drive. The constant 0.8 is obtained based on the following prerequisite: The maximum braking power will not exceed the maximum motor power multiplied by square of the mechanical efficiency of the translation mechanism (assuming that the efficiency is 0.9).

When selecting the braking unit for a hoisting mechanism, you need to consider the short-time permissible braking capability and continuous braking capability.

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

$$P_z = 0.8 \times P_D \qquad \text{(formula 2)}$$

In formula 2, P_z is the continuous braking power of the braking unit, in kW.

P_D is the power of the motor, in kW.

If you select a braking unit based on formula 1, you need to verify its overload capacity based on formula 2.

9.5.2 Selection of Braking Resistors

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

When selecting braking resistors for a travel mechanism, calculate the required capacity using formula 2, and then check the maximum current allowed by the selected braking resistor.

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

In this formula, I_{zmax} is the maximum current allowed by the braking resistor, in A.

V_{bz} is the braking voltage threshold of the AC drive, in V.

R_{sc} is the resistance of the braking resistor, in Ω.

When selecting braking resistors for a hoisting mechanism, calculate the required capacity using formula 2, and then verify the selection using formula 1.

9.5.3 List of Braking Components

Table 9-12 Recommended braking components

AC Drive Model	Braking Unit		Min. Power for Hoisting (kW)	Min. Power for Translation (kW)	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
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

AC Drive Model	Braking Unit		Min. Power for Hoisting (kW)	Min. Power for Translation (kW)	Min. Braking Resistance (Ω)
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 2	80 x 2	31 x 2	2.5 x 2
CS710-4T315G	Input voltage > 440 VAC	MDBUN-200-5T x 2	80 x 2	31 x 2	2.5 x 2
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.

- The braking voltage can be adjusted depending on the grid voltage. If you increase the initial braking voltage, you also need to increase the braking resistance.
- The minimum braking resistance values listed in the preceding table are the minimum values allowed by braking units. If the resistance is less than the minimum value, the braking unit may encounter overcurrent.
- The resistor power for hoisting is 1/2 of the motor power, and that for translation is 1/4 of the motor power. (The default motor power is the same as the AC drive power.)
- 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. Select a braking resistor model based on the generation power of the motor in the actual application system, as well as system inertia, deceleration time, and potential energy load in the actual situation. If the system inertia is large and/or short deceleration time or frequent braking is needed, select a braking resistor with high power and low resistance.

9.5.4 Outline and Installation Dimensions of Braking Units

For details about the outline and installation dimensions of the MDBUN, see the MDBUN Series Braking Unit User Guide (data code: 19011004).

9.6 Installation 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.

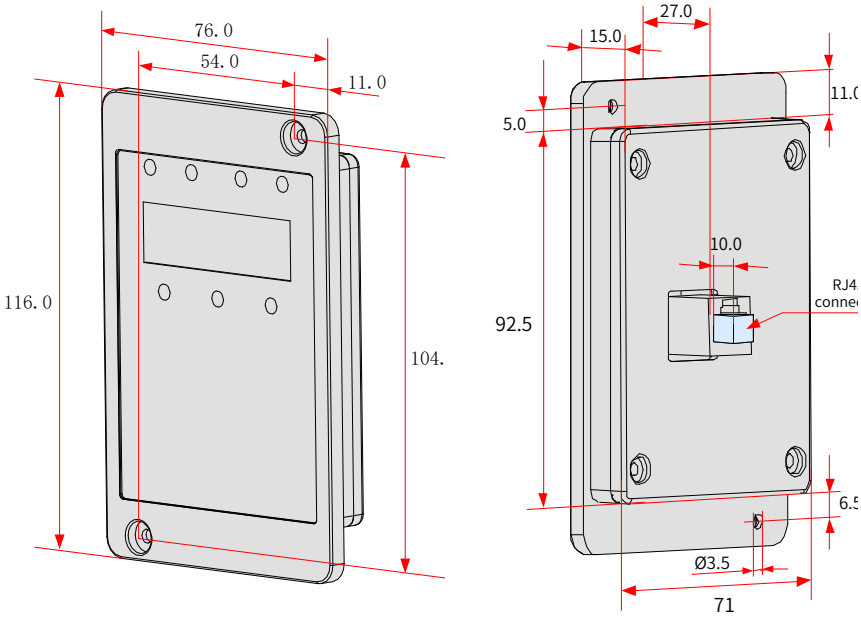


Figure 9-23 Dimensions of the external operating panel (mm)

10 Options

10.1 I/O Expansion Card

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

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.

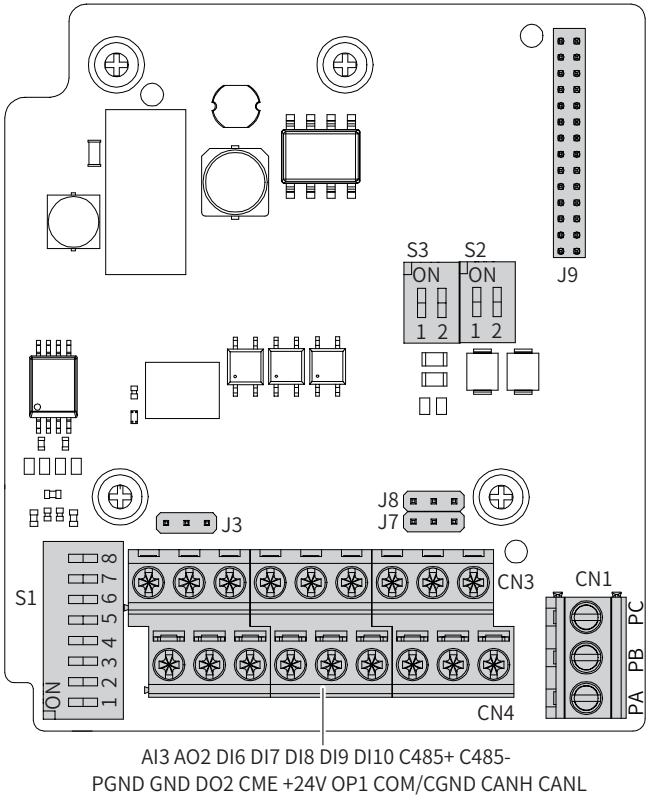


Figure 10-1 Terminal layout on MD38IO1

Table 10-1 Description of terminals on MD38IO1

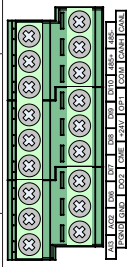
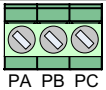
Identifier		Terminal Name	Function	Layout
CN4	+24V/COM/CGND	External 24 VDC power supply	1. It provides +24 V power supply to external devices, such as DIs, DOs, and external sensors. 2. The maximum output current is 200 mA.	
	OP1	DI power terminal	1. OP1 and +24V are connected by jumper J8 by default. 2. When an external power supply is applied, J8 must be removed and OP1 must be connected to the external power supply.	
	DO2-CME	DO2	1. Photocoupler 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	CANlink communication input terminal; isolated input	
CN3	AI3-PGND	AI terminal 3	1. Photocoupler isolation input, supporting differential voltage input and temperature detection resistance input 2. Input voltage: –10 VDC to +10 VDC 3. 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	AO2	1. Output voltage: 0 V to 10 V 2. Output current: 0 mA to 20 mA 3. Output current impedance: 0 Ω to 500 Ω	
	DI6-OP1 to DI10-OP1	Five DIs	1. Photocoupler isolation, compatible with dual-polarity inputs 2. Input impedance: 2.4 kΩ 3. Voltage upon level input: 9 V to 30 V	
	C485+/C485-/COM/CGND	Communication terminal	Modbus RTU communication input and output signal terminals; isolated input	
CN1	PA-PB	NC terminal	Driving capacity of the contact: 250 VAC, 3 A, cosϕ = 0.4 30 VDC, 1 A	
	PA-PC	NO terminal		

Table 10-2 Description of jumpers on MD38IO1

Identifier	Terminal Name	Function	Jumper/DIP Switch Setting
J3	AO2 output type selection	Voltage output: 0 V to 10 V	
		Current output: 0 mA to 20 mA	
S1	AI, PT100, and PT1000 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	RS485 termination resistor selection	1 and 2 set to ON: Connect the termination resistor.	
		1 and 2 set to OFF: Disconnect the termination resistor.	
S3	AI3, PT100, and PT1000 selection	1 and 2 set to ON: Connect the termination resistor.	-
		1 and 2 set to OFF: Disconnect 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.

10.1.2 Mini I/O Expansion Card (MD38IO2)

MD38IO2 is a simplified version of MD38IO1 and provides three DIs. It is available to all models.

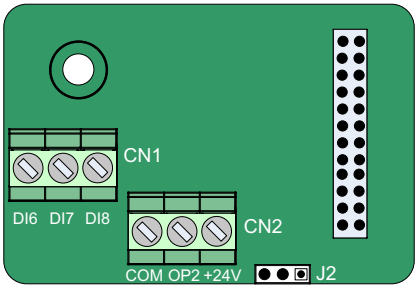


Figure 10-2 Terminal layout on MD38IO2

Table 10-3 Description of terminals on MD38IO2

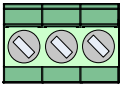
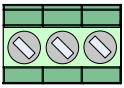
Identifier		Terminal Name	Function	Layout
CN2	+24V/COM	External 24 VDC power supply	1. It provides +24 V power supply to external devices, such as DIs, DOs, and external sensors. 2. The maximum output current is 200 mA.	 COM OP2 +24V
	OP2	DI power terminal	OP2 is not connected to power supply by default. You can connect it either to an external power supply or the +24V power supply as needed.	
CN1	DI6-OP2 to DI8-OP2	Three DIs	1. Photocoupler isolation, compatible with dual-polarity inputs 2. Input impedance: 3.3 kΩ for DI6 to DI7, 2.4 kΩ for DI8 3. Voltage upon level input: 9 V to 30 V 4. Input frequency: < 100 Hz (DI6 to DI8 are common input terminals.)	 DI6 DI7 DI8

Table 10-4 Description of jumpers on MD38IO2

Identifier	Terminal Name	Function	Jumper/DIP Switch Setting
J2	DI sink and source wiring mode selection	Wire the DI terminals in sink mode. Connect OP2 to +24V.	
		Wire the DI terminals in source mode. Connect OP2 to COM.	

NOTE

◆ The jumper setup is based on the top view of the expansion card with the main wiring terminal as the bottom side. For the position of the jumper, see the PCB silkscreen.

10.1.3 MD38IO3 Expansion Card

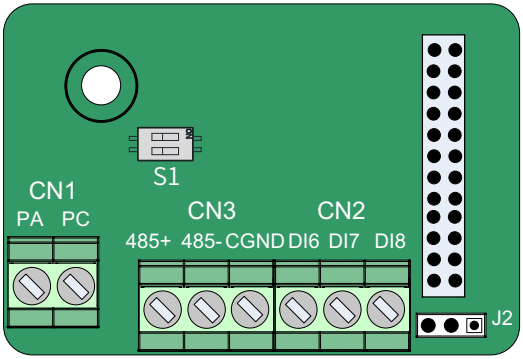


Figure 10-3 Terminal layout on MD38IO3

Table 10-5 Description of terminals on MD38IO3

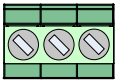
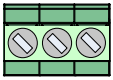
Identifier		Terminal Name	Function	Terminal Lay-out
CN3	RS485+	RS485 communication signal (+)	The Modbus protocol is supported. Isolated input is adopted.	CN3 485+ 485- CGND 
	RS485–	RS485 communication signal (–)		
	CGND	RS485 communication signal ground		
CN2	DI6 to DI8	Three DI terminals	1. Photocoupler 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	NO terminal	Driving capacity of the contact: 250 VAC/5 A 30 VDC/5 A	CN1 PA PC 
S1	RS485 termination resistor selection	2-position DIP switch	1 and 2 set to ON: Connect the termination resistor. 1 and 2 set to OFF: Disconnect the termination resistor.	

Table 10-6 Description of jumpers on MD38IO3

Identifier	Terminal Name	Function	Jumper/DIP Switch Setting
J2	DI sink and source wiring mode selection	Wire the DI terminal in sink mode. Connect OP to +24V.	
		Wire the DI terminal in source mode. Connect OP to COM.	

NOTE

- The jumper setup is based on the top view of the expansion card with the main wiring terminal as the bottom side. For the position of the jumper, see the PCB silkscreen.

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

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

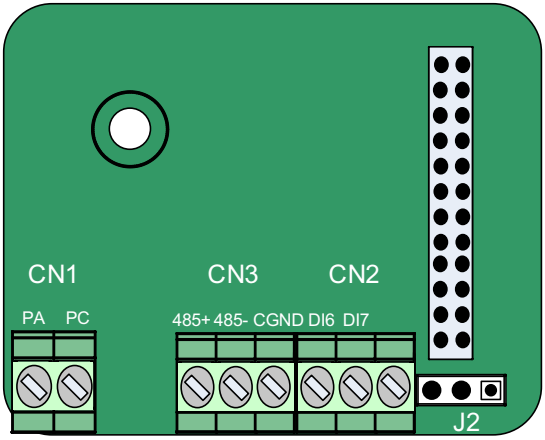
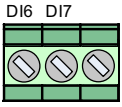


Figure 10-4 Terminal layout on CS700IO1

Table 10-7 Description of terminals on CS700IO1

Identifier		Terminal Name	Function	Layout
CN2	DI6-COM to DI7-COM	Two DIs	1. Photocoupler isolation, compatible with dual-polarity inputs 2. Input impedance: 2.4 kΩ 3. Voltage upon level input: 9 V to 30 V	

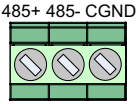
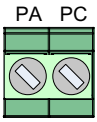
Identifier		Terminal Name	Function	Layout
CN3	485+/485-/CGND	Communication terminal	Modbus RTU communication input and output signal terminals, isolated input	
CN1	PA-PC	NO terminal	Driving capacity of the contact: 250 VAC, 3 A, cosϕ = 0.4 30 VDC, 1 A	

Table 10-8 Description of jumpers on CS700IO1

Identifier	Terminal Name	Function	Jumper/DIP Switch Setting
J2	DI sink and source wiring mode selection	The DI is wired in the sink mode.	
		The DI is wired in the source mode.	

NOTE

- The jumper setup is based on the top view of the expansion card with the main wiring terminal as the bottom side. For the position of the jumper, see the PCB silkscreen.

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

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

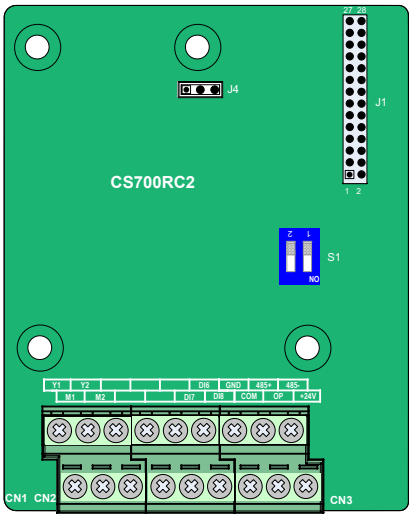
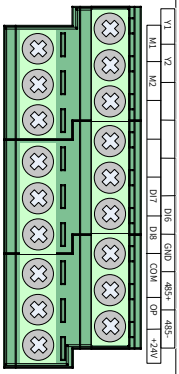


Figure 10-5 Terminal layout on CS700RC2

Table 10-9 Description of terminals on CS700RC2

Identifier		Terminal Name	Function	Layout
power supply	+24V to COM	+24 V external power supply	1. It provides +24 V power supply to external devices, such as DIs, DOs, and external sensors. The maximum output current is 200 mA.	
	OP	DI power terminal	OP and +24V are connected by jumper by default. When an external power supply is applied, the jumper must be removed and OP must be connected to the external power supply.	
Wiring of the relay output terminal	Y1 to M1 Y2 to M2	Relay output	Driving capacity of the contact: 250 VAC, 5 A, COSϕ = 0.4 30 VDC, 1 A	
DI	DI6-OP DI7-OP DI8-OP	DI	Photocoupler isolation, compatible with dual-polarity inputs Input impedance: 2.4 kΩ Voltage upon level input: 9 V to 30 V	
RS485 communication	RS485+ RS485– GND	RS485 communication terminal	STP cables are recommended. 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

- The jumper setup is based on the top view of the expansion card with the main wiring terminal as the bottom side. For the position of the jumper, see the PCB silkscreen.

10.2 Communication Expansion Cards

10.2.1 CANopen Expansion Card (MD38CAN2)

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

- Supports the Node Guard protocol, allowing the master to query device status.
- Provides four transmission process data object (PDO) channels and four receiving PDO channels. The transmission PDO channels support synchronous and asynchronous transmission.
- Supports expedited transfer of service data objects (SDOs) and allows at most four bytes to be transferred each time.
- 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 10-6 MD38CAN2 appearance

2 Terminal Function Description

Table 10-10 Terminal function description

Type	Identifier	Terminal Name	Function
CAN communication (CN1)	CANH/CANL	Communication terminal	CANopen communication input terminal with isolated input
	COM	CAN communication power supply ground	Connected to the common mode inductor of +24 V power supply ground
Programming	SW1	ARM programming interface	

3 DIP Switch Definition

The DIP switch S1 on the MD38CAN2 card consists of two switches. It is used to configure the CAN bus termination resistor. It is recommended to enable termination resistors at both ends of the network topology. On the DIP switch, "ON" represents 1, and "OFF" represents 0.

Table 10-11 MD38CAN2 termination resistor

DIP Switch No.		Termination Resistor
1	2	
0	0	Not connected
1	1	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. On the DIP switch, "ON" represents 1, and "OFF" represents 0.

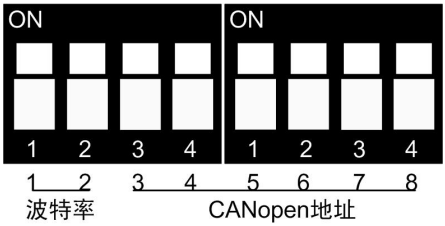


Figure 10-7 MD38CAN2 DIP switches

No.	Function	Description		
1 to 2	CAN bus baud rate	Bit 1	Bit 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	01 0100

4 Definition of PDO Data and Parameter Addresses

1) RPDO data definition

<table>
<tr><th colspan="4">RPDO Definition</th></tr>
<tr><td rowspan="2">RPDO1</td><td>AC drive control commands</td><td>Bit 0: Decelerate to stop; Bit 1: Coast to stop
Bit 2: Forward running; Bit 3: Reverse running</td><td>Bit 4: Quick stop; Bit 5: Torque control
Bit 6: Fault reset; Bit 7: Command enabled
Bits 8 to 15: Reserved</td></tr>
<tr><td>Target frequency</td><td colspan="2">The target reference can be set in two modes, determined 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. When the least significant bit of bd.06 is set to 1, the target reference is set to a specific value. In this mode, the value range of the target reference is 0 Hz to the maximum frequency (positive and negative values not distinguished).</td></tr>
<tr><td rowspan="5">RPDO2</td><td>bd.11</td><td colspan="2" rowspan="9">These ten parameters are used to write a value to the corresponding RAM position of the specified parameter address.
The parameter address to be written is specified by bd.11 to bd.20.
For example, if bd.11 is set to b5.00 and 500 is written into the third data of RPDO1, the value of b5.00 will change 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>bd.13</td></tr>
<tr><td>bd.14</td></tr>
<tr><td>bd.15</td></tr>
<tr><td rowspan="4">RPDO3</td><td>bd.16</td></tr>
<tr><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	Bit 0: AC drive running; Bit 1: AC drive running in forward direction Bit 2: AC drive running in reverse direction; Bit 3: AC drive healthy Bit 4: Coast to stop; Bit 5: No communication with the AC drive Bit 6: Target frequency reached; Bit 7: Torque control enabled Bits 8 to 15: Reserved
	Feedback frequency	Current running frequency
	bd.21	These ten parameters are used to obtain the value of the specified parameter. The parameter address is specified by bd.11 to bd.20. For example, if bd.21 is set to b5.00, the third parameter of TPDO1 is assigned the actual 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	

10.2.2 RS485 Expansion Card (MD38TX1)

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.

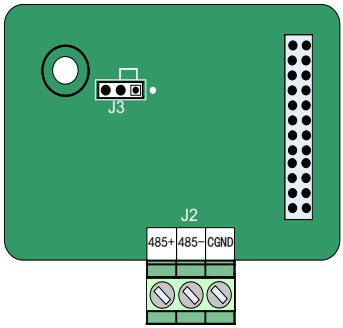


Figure 10-8 Terminal layout on MD38TX1

Table 10-12 Description of terminals on MD38TX1

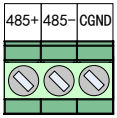
Identifier		Terminal Name	Function	Layout
CN1	RS485+	RS485 communication signal (+)	RS485 communication input terminal with isolated input	
	RS485–	RS485 communication signal (–)	RS485 communication input terminal with isolated input	
	CGND	RS485 communication signal reference ground	Isolated power supply	

Table 10-13 Description of jumpers on MD38TX1

Identifier	Terminal Name	Function	Jumper/DIP Switch Setting
J3	RS485 termination resistor connection selection	Termination resistor connected	
		Termination resistor not connected	

NOTE

- In RS485 communication mode, connect the termination resistor (jumper J3) to the AC drive located at the end of the network.
- To prevent external interference to the communication, use STP cables as the RS485 communication cables. Wiring in parallel mode is not recommended for this communication mode.

10.2.3 PROFIBUS DP Expansion Card (MD38DP2)

The PROFIBUS DP expansion card is available for models with 15 kW and above. It 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, control signal transmission, monitoring, and diagnosis.

This card is in compliance with standard PROFIBUS DP fieldbus standards and can be used to in an Inovance AC drive for fieldbus control.

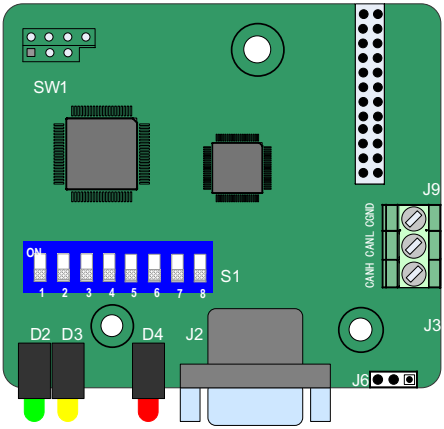


Figure 10-9 Terminal layout on MD38DP2

Table 10-14 Description of terminals on MD38DP2

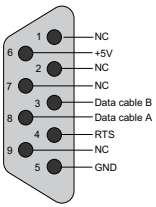
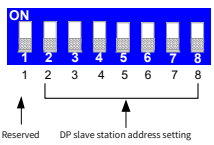
Terminal Name	Pin No.	Pin Definition	Function	Layout
PROFIBUS communication terminal (J2)	1, 2, 7, and 9	NC	Unconnected internally	
	3	Data cable B	Positive terminal of data cable	
	4	RTS	Request transmit signal	
	5	GND	Ground terminal of isolated 5 V power supply	
	6	+5 V	Isolated 5 V power supply	
	8	Data cable A	Negative terminal of data cable	

Table 10-15 Description of status indicators on MD38DP2

Indicator	State	Description
Power indicator (D4)	 D4	On: The card is powered on normally.
	 D4	Off: The card cannot be powered on. Check whether it is installed correctly.
PROFIBUS DP card and master communication indicator (D3)	 D3	On: The card is communicating with the master normally.
	 D3	Blinking: The master is not running or an error occurs in communication between the master and the PROFIBUS DP card.
	 D3	Off: The PROFIBUS DP card does not communicate with the master. (Check the PROFIBUS DP cable connection and master ID.)
PROFIBUS DP card and AC drive communication indicator (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 10-16 DIP switch on MD38DP2

PROFIBUS DP Slave Address Setting								Slave Address	DIP Switch
1	2	3	4	5	6	7	8		
PROFIBUS DP card model selection, which is defaulted to OFF: MD38DP2	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 position 1 is set to ON, the card model is MD38DP1. Change of this position takes effect after the card is powered on again. Changes of slave address DIP switches take effect immediately.

10.2.4 PROFINET Communication Expansion Card (MD500-PN1)

The MD500-PN1 expansion card is a PROFINET fieldbus adapter card, which meets the international PROFINET Ethernet standards. It is available to all models.

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.

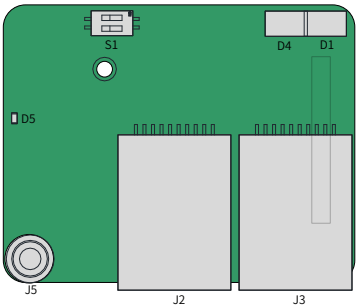


Figure 10-10 Terminal layout of MD500-PN1

Table 10-17 Hardware description of MD500-PN1

Identifier	Hardware Name	Function
J1	Pin header	It connects to the AC drive.
J2 J3	Network port	It is used by the MD500-PN1 card to communicate with that of the PROFINET card (PLC), with direction insensitive.
J5	EMC ground terminal	It connects to the EMC ground terminal of the AC drive.
D5	Power indicator	It indicates the power state. ON: The power is normal. OFF: The power is abnormal, and you need to check whether the installation is correct.
D1	Status indicator of communication with PLC (PLCLINK)	Steady green: The communication is normal. Blinking green: The master is not found. Check whether a device name is assigned to the slave, and whether the corresponding PLC is connected. Steady yellow: The configuration is incorrect. Check whether the GSD is correct. Steady red: Communication with the master is interrupted. Check the connection.
D4	Status indicator of communication with AC drive (DSPLINK)	Steady green: The communication is normal. Steady yellow: The MAC address is abnormal. Replace the MD500-PN1 card. Blinking yellow: The AC drive is faulty. Clear faults of the AC drive. 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-position DIP switch	It is used for upgrade only by the manufacturer.

- After the MD500-PN1 card is installed, J2 is on the left and J3 is on the right when facing the RJ45 interface. To ensure stability, it is recommended to use the Cat5e STP network cable.
- For more information about the PROFINET communication expansion card (MD500-PN1), see the Instructions of the MD500 Series PROFINET Expansion Card (data code: 19010951).

10.2.5 PZD Description and Parameter Address Definition

1) PZD Area Data Definition

PZD Sent by the Master	
PZD1	Bit 0: Decelerate to stop; Bit 1: Coast to stop Bit 2: Forward running; Bit 3: Reverse running Bit 4: Quick stop; Bit 5: Torque control Bit 6: Fault reset; Bit 7: Command enabled Bits 8 to 15: 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 target reference can be set in two modes, determined 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. When the least significant bit of bd.06 is set to 1, the target reference is set to a specific value. In this mode, the value range of the target reference is 0 Hz to the maximum frequency (positive and negative values not distinguished).
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 Returned by the Slave	
PZD1	Bit 0: AC drive running; Bit 1: AC drive running in forward direction Bit 2: AC drive running in reverse direction; Bit 3: AC drive healthy Bit 4: Coast to stop; Bit 5: No communication with the AC drive Bit 6: Target frequency reached; Bit 7: Torque control enabled Bits 8 to 15: Reserved
PZD2	It is used to return the current running frequency of the AC drive. For example, if 2500 is returned, the current running frequency of the AC drive is 25.00 Hz.

PZD3 to PZD12	It is used to return the current value of the corresponding parameter address. The parameter address is specified by bd.21 to bd.30. For example, if bd.21 is set to B5.01 and the current value of B5.01 is 25.00, the return value of PZD3 is 2500. Parameter addresses can also be configured using the device-specific parameters (PLC slave attributes). If a parameter address is specified by a device-specific parameter, it overrides the address specified by bd.21 to bd.30. For details, see sub-section 4 "Device-specific Parameter Setting."

2) PKW Area Data Definition

PKW Data Sent by the Master	
PKE	High-order 4 bits: Command code 0: No request 1: Read parameter data 2: Modify parameter data Low-order 4 bits: Reserved Low-order 8 bits: High-order bits of the parameter address
IND	High-order 8 bits: Low-order bits of the parameter address Low-order 8 bits: Reserved
PWE	High-order 16 bits: Reserved Low-order 16 bits: Reserved (in the case of read request) or parameter value (in the case of write request)
PKW Data Returned by the Slave	
PKE	High-order 4 bits: Response code 0: No request 1: Correct operation on parameters 7: Cannot execute Low-order 8 bits: High-order bits of the parameter address
IND	High-order 8 bits: Low-order bits of the parameter address Low-order 8 bits: Reserved
PWE	Request succeeded: Parameter value Request failed: Error code (consistent with standard Modbus) 1: Invalid command 2: Invalid address 3: Invalid data 4: Other errors

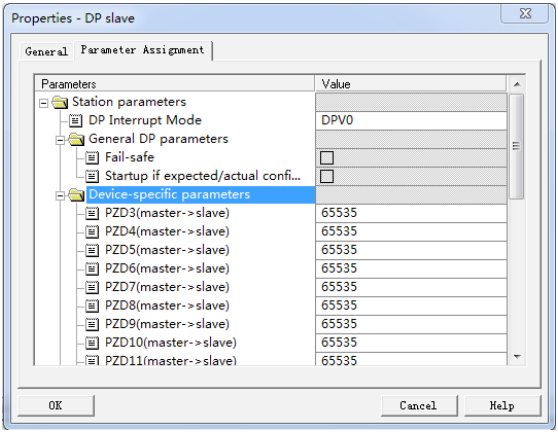
3) CS710 PROFIBUS DP Communication Parameter Address Definition

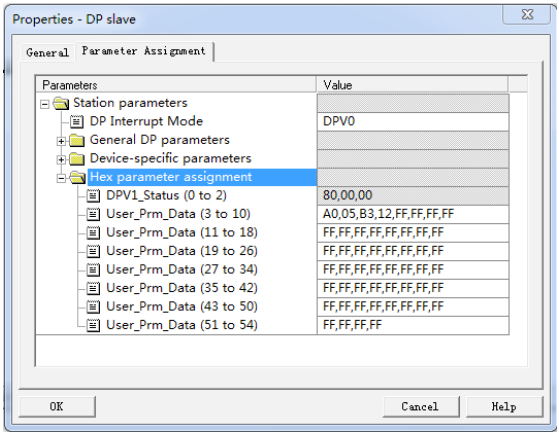
CS710 Parameter Address Definition	
Range: A0.00 to FF.99	All parameter addresses of CS710 series AC drives are defined following a unified rule. That is, the group number of a parameter is the high bits of its address, and the hexadecimal value converted from the parameter number forms the low bits of the address. Example 1: Parameter A0.05 indicates the rated motor speed, and its address is A005. Example 2: Parameter b3.18 indicates the FM output function, and its address 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) Device-specific Parameter Setting

Device-specific parameters are included in slave attributes, as shown in the following figure. You can use these parameters to set addresses of PZD3 to PZD12.

For details about parameter addresses, see sub-section 3 "CS710 PROFIBUS DP Communication Parameter Address Definition." By default, addresses of all parameters are 65535, that is, 0xffff in the hexadecimal format. After you set these parameters, their values are displayed in the hexadecimal format.

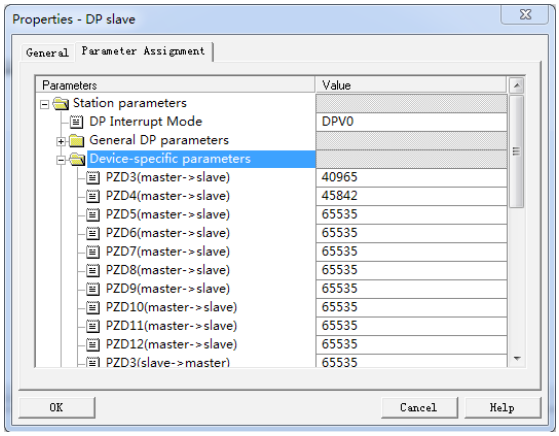


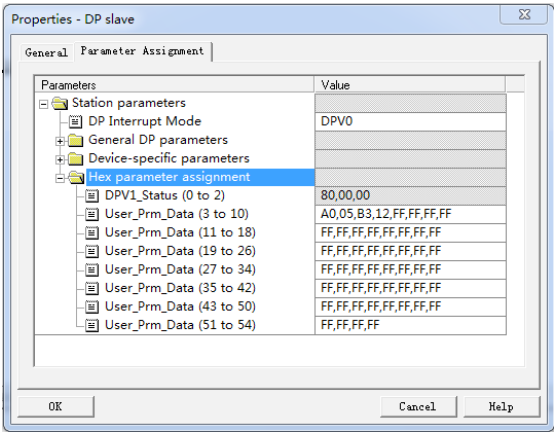


Example: Write the value of A0.05 into PZD3 sent from the master to the slave, and write the value of b3.18 into PZD4.

Read the value of b5.00 from PZD3 sent from the slave to the master, and read the value of b5.01 from PZD4.

The address of A0.05 is 0xA005 (40965 in decimal). The address of b3.18 is 0xB312 (45842 in decimal notation). The address of b5.00 is 0xB500 (46336 in decimal notation). The address of b5.01 is 0xB501 (46337 in decimal notation). The following figure shows the preceding settings.





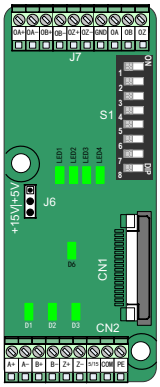
NOTE

- After you set device-specific parameters, settings of bd.11 to bd.30 will automatically change in accordance with device-specific parameter settings after the next power-on.

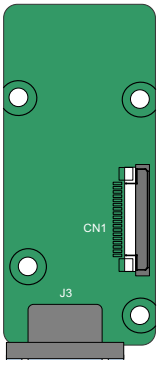
10.3 Encoder Expansion Cards

10.3.1 Specifications of Encoder Expansion Cards

MD38PGMD



MD38PGMD Specifications	
Encoder power supply	5 V/200 mA, 15 V/100 mA
Maximum input frequency	Differential frequency: 500 kHz; collector frequency: 100 kHz
Encoder interface type	Differential, collector, and push-pull
Frequency division interface type	Differential and collector
Cable specifications	16 AWG to 26 AWG. For details about the cable specifications, see relevant information.
Terminal clearance	3.5 mm
Terminal screw	Slotted
Terminal type	Slanted terminal block
Frequency division range	0 to 63

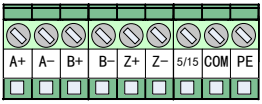
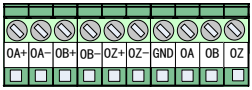


MD38PG4

MD38PG4 Specifications	
User interface	DB9 female connector
Plug-type	Yes
Cable specifications	> 22 AWG
Resolution	12-bit
Excitation frequency	10 kHz
VRMS	7 V
VP-P	3.15±27%
Frequency division range	Not supported

10.3.2 Multi-functional PG Card (MD38PGMD)

Table 10-18 Description of terminals on MD38PGMD

Identifier		Function	Layout
CN2	A+	Encoder output signal A (positive)	
	A–	Encoder output signal A (negative)	
	B+	Encoder output signal B (positive)	
	B–	Encoder output signal B (negative)	
	Z+	Encoder output signal Z (positive)	
	Z–	Encoder output signal Z (negative)	
	5 V/15 V	5 V/15 V encoder power supply	
	COM	Encoder power ground	
	PE	Shield connection terminal	
J7	OA+	Differential frequency division output signal A (positive)	
	OA–	Differential frequency division output signal A (negative)	
	OB+	Differential frequency division output signal B (positive)	
	OB–	Differential frequency division output signal B (negative)	
	OZ+	Differential frequency division output signal Z (positive)	
	OZ–	Differential frequency division output signal Z (negative)	
	GND	Frequency-division output reference ground	
	OA	Collector frequency division output signal A	
	OB	Collector frequency division output signal B	
	OZ	Collector frequency division output signal Z	
J6	Encoder power supply		-
CN1	18-pin FFC interface, connecting to J4 on the control board of the AC drive		

NOTE

- 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 10-19 Description of DIP switches on MD38PGMD

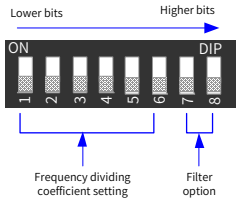
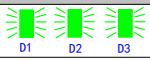
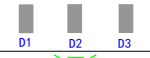
Filter		Meaning	Address Setting						Value	Frequency-Division Coefficient	DIP Switch
8	7		6	5	4	3	2	1			
0	0	Non-self-adaptive filter	0	0	0	0	0	0	Reserved	No output	
			0	0	0	0	0	1	1	Frequency division 1	
0	1	Adaptive filtering	0	0	0	0	1	0	2	Frequency division 2	
			0	0	0	0	1	1	3	Frequency division 3	
1	0	Fixed interlock	...								
			1	1	1	1	0	1	61	Frequency division 61	
1	1	Automatic interlock	1	1	1	1	1	0	62	Frequency division 62	
			1	1	1	1	1	1	63	Frequency division 63	

Table 10-20 Description of indicators on MD38PGMD

Indicator	State	Indication
D1/D2/D3 Encoder input signal indicators		On or blinking: The encoder has signal input.
		Off: The encoder has no signal input.
D6 Power indicator		On: The power supply is normal.
		Off: The power supply is not connected.
LED1 Encoder input signal quality indicator		Off: The input signal is normal. The speed is stable or there is no interference.
		On: The input signal is slightly unstable, which occurs when the motor accelerates/decelerates or the encoder input signal suffers slight interference.
		Blinking slowly: The input signal is moderately unstable, which occurs when the motor accelerates/decelerates or the encoder input signal suffers moderate interference.
		Blinking quickly: The input signal is highly unstable, which occurs when the motor accelerates/decelerates quickly or the encoder input signal suffers severe interference.

Indicator	State	Indication
LED2 PG card signal processing quality indicator		Off: The PG card signal is normal. The speed is stable or there is no interference.
		On: The PG card signal is slightly unstable, which occurs when the motor accelerates/decelerates or interference in the encoder input signal is not completely filtered out (the number of interference pulses that are not filtered out is less than 10 per unit time).
		Blinking slowly: The PG card signal is moderately unstable, which occurs when the motor accelerates/decelerates or interference in the encoder input signal is not completely filtered out (the number of interference pulses that are not filtered out is less than 30 per unit time).
		Blinking quickly: The PG card signal is highly unstable, which occurs when the motor accelerates/decelerates or interference in the encoder input signal is not completely filtered out (the number of interference pulses that are not filtered out is greater than 30 per unit time).
LED3 Inter-lock state indicator		Off: Inter-lock is disabled.
		On: Inter-lock is enabled.
LED4 System state indicator		Off: The system is not working or it is abnormal.
		Blinking: The encoder cable breaks.
		On: The system works properly.

10.3.3 Resolver PG Card (MD38PG4)

Table 10-21 Description of terminals on MD38PG4

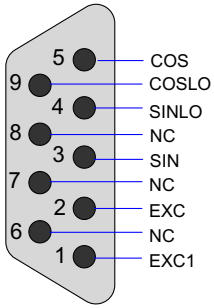
Identifier	Pin No.	Pin Definition	Function	Layout
J3	1	EXC1	Resolver excitation negative	
	2	EXC	Resolver excitation positive	
	3	SIN	Resolver feedback SIN positive	
	4	SINLO	Resolver feedback SIN negative	
	5	COS	Resolver feedback COS positive	
	6, 7, and 8	NC	Unconnected internally	
	9	COSLO	Resolver feedback COS negative	
CN1	18-pin FFC interface, connecting to J4 on the control board of the AC drive			

Table 10-22 Description of indicators on MD38PG4

Fault Indicator	MD38PG4 Fault State	Possible Cause and Solution
D5 D6	Normal	None
D5 D6	Phase-locked loop (PLL) loss of lock	The phase lag of the resolver is too large.
D5 D6	SIN/COS signal amplitude beyond upper limit	D6 blinking is usually caused by interference. To solve this problem effectively, ground the motor properly and connect the ground point on the PG card to the PE terminal of the AC drive.
D5 D6	SIN/COS signal amplitude too small	DB9 is not connected or incorrectly connected, or even the cable breaks. If the preceding conditions do not occur, check whether the resolver model matches MD38PG4.

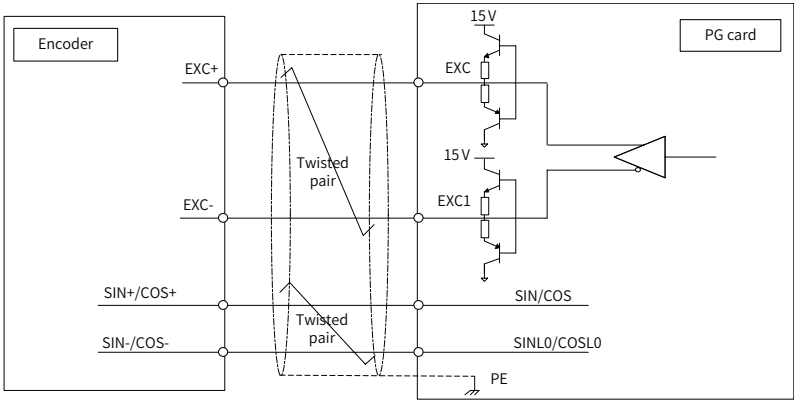


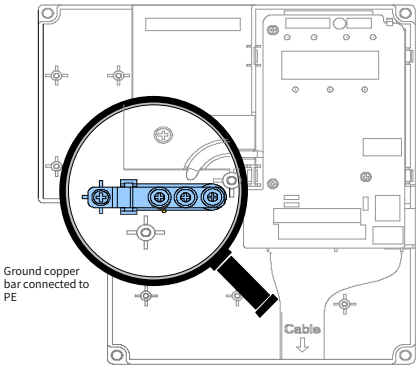
Figure 10-11 interface circuit on MD38PG4

NOTE

- The resolver model must fulfill parameter requirements of MD38PG4. The input DC resistance of the excitation must be greater than 17 Ω (you may measure it with a multimeter). Otherwise, MD38PG4 cannot work properly.
- Select a resolver with a maximum of four pole pairs. Otherwise, MD38PG4 will be overloaded.

10.3.4 Shield Grounding for a PG Card

On the premise that AC drive parameters are set correctly, if the speed or position fed back by the PG card is unstable, the PG card suffers electromagnetic interference. In this case, connecting shield of the encoder signal cable to PE of the AC drive can effectively suppress the 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 enlarged view of the figure above, align the mounting holes of the PG card with the three fixing posts (at the upper left of the enlarged view), and fix the PG card with the M3x8 screws.

10.3.5 EMC Guidance

1) During on-site installation and commissioning, route signal cables (such as encoder cables) and power cables in different cable troughs. Never bundle the encoder cables and power cables together. Failure to comply may result in encoder interference.
2) Connect the motor enclosure to PE of the AC drive and ensure that the ground cable of the enclosure is well grounded. Failure to comply will result in poor grounding effect.
3) Use STP cables. For differential encoders, wire the STP cables based on differential pairs and connect the shield to PE of the AC drive.
4) For large equipment applications where the AC drive is far away from the motor, the long motor cable (> 10 m) can result in high inductance, which weakens the grounding effect. In this case, the encoder shield need not be connected to PE of AC drive.
5) You can determine whether the input of the MD38PGMD card suffers interference based on the state indicators of the PG card. For details, see the related table above.

Appendix A Modbus Communication Protocol

CS710 series AC drives provide the RS232/RS485 interfaces and support the Modbus communication protocol. This protocol enables centralized control of the AC drive using a computer or PLC. For example, you can set AC drive control commands, modify or read parameters, and read AC drive running status and fault information on the computer or PLC by using the protocol.

A.1 Data Rules

This protocol defines the content and format of messages transmitted 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 confirmation, returned data, and error check. If the slave has an error upon receiving a message or fails to complete the action required by the master, it responds with a fault message to the master.

1. Application mode

The AC drive is connected to a "single-master multi-slave" PC/PLC control network with an RS232/RS485 bus.

2. Bus structure

* Interface type

RS232/RS485 hardware interface

* Transmission mode

The network adopts the asynchronous serial communication in half-duplex mode. In this mode, when the master or slave is sending data, the other can only receive data. During asynchronous serial communication, data is sent frame by frame in packet.

* Topology structure

The system consists of a single master and multiple slaves. The slave addresses range from 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 queries or commands with required data or perform required actions. 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. When the master communicates with a single slave, the slave needs to return a message (response) to every query or command from the master. For a broadcast message sent by the master, the slaves do not need to return a response.

4. Communication data structure

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

Data frames are in RTU format, the interval between two messages must be at least 3.5-byte transmission time. The first field transmitted is the device address. The allowable transmitted characters are hexadecimal numbers 0 ... 9, A ... F. The network devices

keep monitoring the network bus, even during the idle interval. After receiving the first field (address field), each device decodes the field to determine whether itself is the destination device. Following the last transmitted character, an interval of at least 3.5-byte transmission time marks the end of the message. A new message is sent after this interval. The entire message frame must be transmitted as a continuous stream. If there is an idle interval of longer than 1.5-byte transmission time before completion of the frame, the receiving device updates 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 transmission time following a previous message, the receiving device considers the new message as a continuation of the previous message. This results in an error, as the value in the final cyclical redundancy check (CRC) field is incorrect for the combined messages.

* RTU frame format

Field	Description
Frame header	3.5-byte transmission time
Slave address	Communication address: 0 to 247
Command code	03H: Read slave parameters 06H: Write slave parameters
Data field (N-1)	Parameter address, number of parameters, and values of parameters
Data field (N-2)	
...	
Data field 0	
CRC CHK low bits	Check value: CRC value
CRC CHK high bits	
Frame trailer	3.5-byte transmission time

* Example of a command to read slave parameters

Read values of two consecutive parameters starting from F0.02.

Data sent from the master

Data Name	Data Field	Description
Slave address	01H	Set by bD.02
Command code	03H	Read instruction
High-order eight bits of the start address	F0H	Read data from parameter F0.02
Low-order eight bits of the start address	02H	
High-order eight bits of the read data volume	00H	Read two parameters in total
Low-order eight bits of the read data volume	02H	
CRC CHK low bits	CRC CHK value to be calculated	-
CRC CHK high bits		

Slave response data

Data Name	Data Field	Description
Slave address	01H	Same as the data sent from the master
Command code	03H	Same as the data sent from the master
Total number of bytes that have been read	04H	Number of parameters sent by the master x 2
High bits of address F002H	00H	Value of parameter F0.02
Low bits of address F002H	00H	
High bits of address F003H	00H	Value of parameter F0.03
Low bits of address F003H	01H	
CRC CHK low bits	CRC CHK value to be calculated	-
CRC CHK high bits		

* Example of a command to write slave parameters

Write 1388H into 1000AH of the AC drive whose slave address is 02H.

Data sent from the master

Data Name	Data Field	Description
Slave address	02H	Set by bD.02
Command code	06H	Write instruction
High bits of the address where data will be written	10H	Write data into the register address 1000H
Low bits of the address where data will be written	00H	
High bits of the data to be written	13H	Write the value of 1388H into the register address 1000H
Low bits of the data to be written	88H	
CRC CHK low bits	CRC CHK value to be calculated	
CRC CHK high bits		

Slave response data: Same as the data sent from the master

5. Check Method

CRC is used for data check.

In RTU frame format, a message includes a CRC-based error-check field, which checks content of the entire message. The CRC field is two bytes, containing a 16-bit binary value. It is added to the message after being calculated by the TX device. Each receiving device recalculates a CRC value after receiving the message, and compares the calculated value with the CRC value in the CRC field of the message. If the two values are different, a transmission error occurs.

The CRC is first stored to 0xFFFF. Then a process is invoked to process the consecutive eight-bit byte in the message and the value in the register. Only the eight bits in each byte are used for CRC. The start bit, stop bit and parity bit do not apply to 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 checked. If the LSB is 1, the register is then XOR with a preset value. If the LSB is 0, no XOR operation is performed. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next eight-bit byte is XOR with the register's current value, and the process repeats for eight more shifts as described above. The final value of the register is the CRC value after the XOR operation is performed on all bytes in the message.
The CRC value is added to the message from the low-order bytes to high-order bytes. The simple CRC 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 Data Address Definition

This section describes the communication data used to control the running, status, and parameter setting of the AC drive.

Parameters can be read and written. (Some parameters cannot be modified because they are only for manufacturer use or monitoring).

1 Parameter Address Expression Rules

The address of a parameter is identified by its group number and code, as described in the following table.

Menu	Parameter Group	High-Order Byte	Low-Order 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 bF0C.

NOTE

- Some parameters cannot be modified when the AC drive is running. Some parameters cannot be modified in any status of the AC drive. In addition, pay attention to value ranges, units, and descriptions of parameters when modifying them.

2 Target Frequency Setting (Write-Only)

Parameter Address	Command Function
1000H	Communication setting value (0 to 10000, decimal)

NOTE

- 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 running
	0002: Reverse running
	0005: Coast to stop
	0006: Stop according to the stop mode specified by F6-10 (Stop mode)
	0007: Reset upon fault
	0008: Quick stop

4 Read AC Drive Status (Read-Only)

Command Word Address	Command Function
3000H	0: Stop
	Bit 0: Forward running
	Bit 1: Reverse running
	Bit 2: Fault

5 Read Current Error Code (Read-Only)

Command Word Address	Command Function
8000H	Display of the current error of the AC drive. For details, see "7.5 Error Codes and Solutions."

6 Format of Communication Error Messages (Response from the Slave)

Data Name	Data Field	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	Meanings of error codes: 01: Command code error 02: Address error 03: Data error 04: Command processing failure
Data 4	CRC low bits	CRC
Data 5	CRC high bits	

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: Environment that includes domestic premises. It also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes.
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) Category C1: power drive system (PDS) of rated voltage below 1000 V, intended for use in the first environment
5) Category C2: PDS of rated voltage below 1000 V, which is neither a plug-in device nor a removable device and, when used in the first environment, is intended to be installed and commissioned only by a professional
6) Category C3: PDS of rated voltage below 1000 V, intended for use in the second environment and not intended for use in the first environment
7) Category C4: PDS of rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment

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.

Warning

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

B.3 Selection of Peripheral EMC Devices

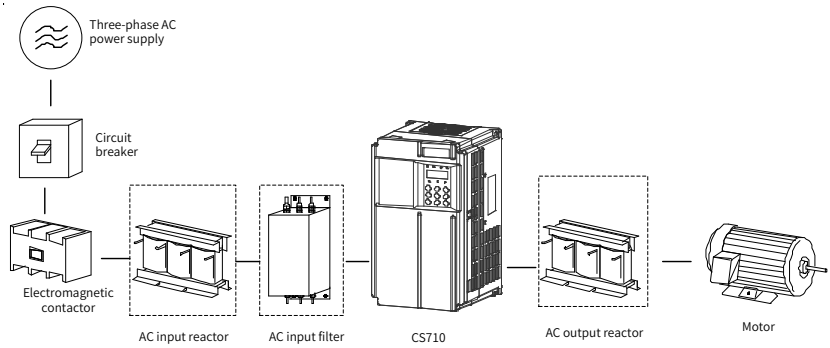


Figure B-1 Installation of peripheral EMC devices (in dashed boxes)

B.3.1 Installation of EMC Input Filter on Power Input Side

To comply with EN IEC 61800-3 requirements in terms of radiated and conducted emission, install an external EMC filter. EMC filter options for the drive are listed in the following table. 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 Models and appearance of standard EMC filters

Filter Model		Appearance
Schaffner series (SCHAFFNER)	FN2090 series	
	FN 3258 series	
	FN 3359 series	
Jianli series (JIANLI)	EBK series	

Models and dimensions (Schaffner Filters)

Table B-2 Selection of filters (Schaffner) (three-phase 380 V to 480 V)

Model	Rated Power (kW)	Rated current (A)	Filter Model	Loss (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	FN3258-16-44	6.1
CS710-4T3.7GB	3.7	11.4	FN3258-16-44	6.1
CS710-4T5.5GB	5.5	16.7	FN3258-30-44	11.8
CS710-4T7.5GB	7.5	21.9	FN3258-30-44	11.8
CS710-4T11GB	11	32.2	FN3258-42-44	15.7
CS710-4T15GB	15	41.3	FN3258-42-44	15.7
CS710-4T18.5GB(-T)	18.5	49.5	FN3258-55-44	25.9
CS710-4T22GB(-T)	22	59.0	FN3258-75-44	31.2
CS710-4T30GB	30	57.0	FN3258-75-44	32.2
CS710-4T37GB	37	69.0	FN3258-75-44	32.2
CS710-4T45GB	45	89	FN3258-100-44	34.5
CS710-4T55GB	55	106	FN3258-130-44	43.1
CS710-4T75GB	75	139	FN3258-180-44	58.3
CS710-4T90G	90	164	FN3258-180-44	58.3
CS710-4T110G	110	196	FN3258-250-28	49
CS710-4T132G	132	240	FN3258-250-28	49
CS710-4T160G	160	287	FN3258-320-99	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)

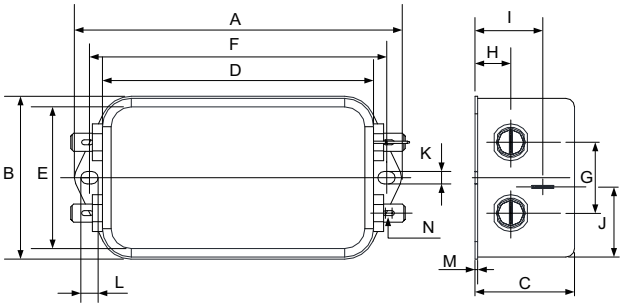


Figure B-2 Dimensions of FN 2090 series filters (8 A to 12 A)

Table B-3 Dimensions of FN 2090 series filters (8 A to 12 A) (mm)

Reactor Model	(A)	B	C	D	E	F	G	H	I	J	K	L	M	N
FN 2090-8-06	113.5	57.5	45.4	94	56	103	25	12.4	32.4	15.5	4.4	6	0.9	6.3 x 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 x 0.8

Dimensions of FN 2090 series filters (20 A to 30 A)

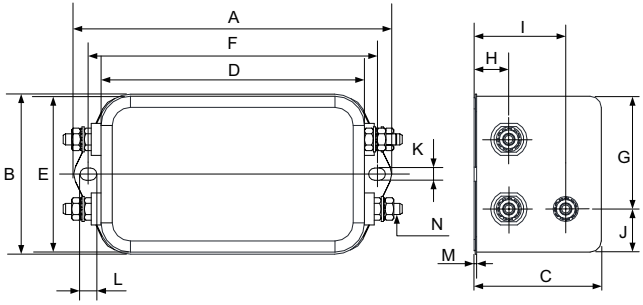


Figure B-3 Dimensions of FN 2090 series filters (20 A to 30 A)

Table B-4 Dimensions of FN 2090 series filters (20 A to 30 A) (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)

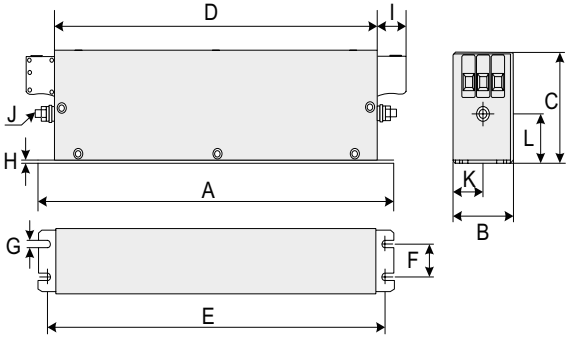


Figure B-4 Dimensions of FN 3258 series filters (50 A to 180 A)

Table B-5 Dimensions of FN 3258 series filters (50 A to 180 A) (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

Dimensions of FN 3359 series filters (150 A to 250 A)

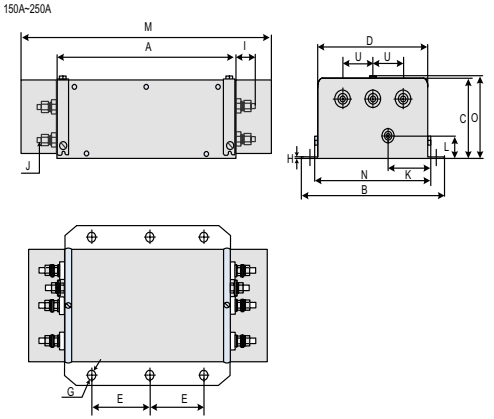


Figure B-5 Dimensions of FN 3359 series filters (150 A to 250 A)

Table B-6 Dimensions of FN 3359 series filters (150 A to 250 A) (mm)

Identifier	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	-	-	-

Dimensions of FN 3359 series filters (320 A to 2500 A)

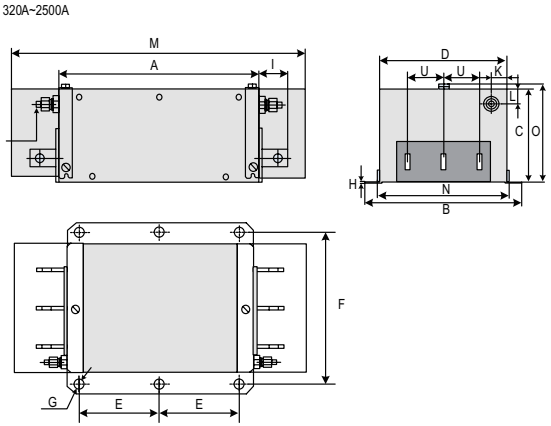


Figure B-6 Dimensions of FN 3359 series filters (320 A to 2500 A)

Dimensions of grounding copper busbar

320A~1000A

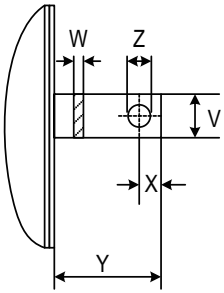


Figure B-7 Dimensions of grounding copper busbar

Table B-7 Dimensions of FN 3359 series filters (320 A to 2500 A) (mm)

Identifier	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
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 (JIANLI filters)

Table B-8 Selection of filters (JIANLI) (three-phase 380 V to 480 V)

Model	Rated Power (kW)	Rated current (A)	Filter Model	Loss (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
CS710-4T355G	355	617	DL-700EBK3	39
CS710-4T400G	400	687	DL-700EBK3	39

Dimensions of JIANLI filters (10 A to 30 A)

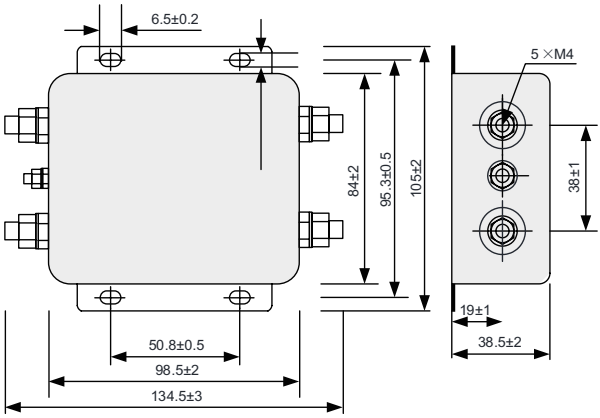


Figure B-8 Dimensions of JIANLI filters (10 A)

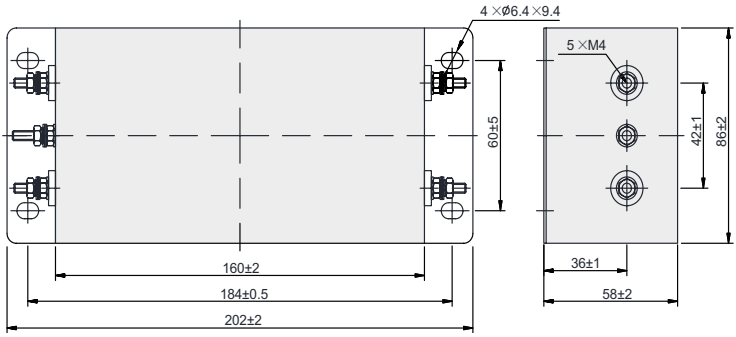


Figure B-9 Dimensions of JIANLI filters (20 A to 30 A)

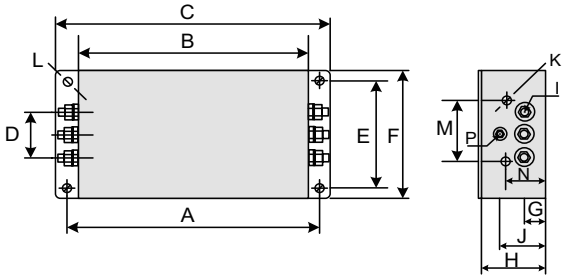


Figure B-10 Dimensions of JIANLI filters (50 A to 200 A)

Table B-9 Dimensions of JIANLI series filters (50 A to 200 A) (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	6.4 x 9.4
DL-35EBK5															
DL-50EBK5															
DL-65EBK5															
DL-80EBK5	354	323	388	66	155	188	30	92	M8	62	M4	86	56	M8	6.4 x 9.4
DL-100EBK5															
DL-130EBK5															
DL-160EBK5															
DL-200EBK5															

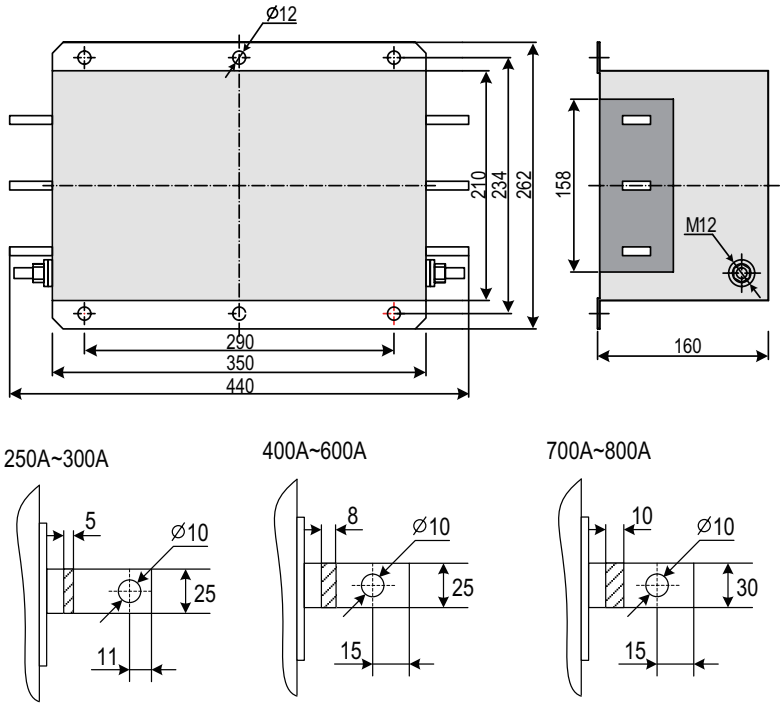


Figure B-11 Dimensions of JIANLI filters (250 A to 800 A) (mm)

Dimensions of JIANLI filters (1000 A)

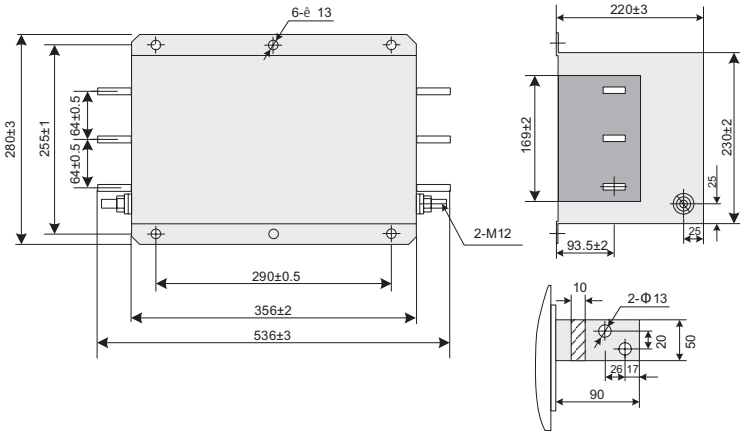


Figure B-12 Dimensions of JIANLI filters (1000 A) (mm)

An EMC input filter installed between the AC drive and the power supply can not only restrict the interference of electromagnetic noise in the surrounding environment on the AC drive, but also prevent the interference from the AC drive on the surrounding devices. 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 grounds of the EMC filter and the PE conductor of the AC drive must be tied to the same common ground. Otherwise, the EMC effect will be affected seriously.
- The filter should be installed as closely as possible to the power input side of the AC drive.

1) Simple filter installation

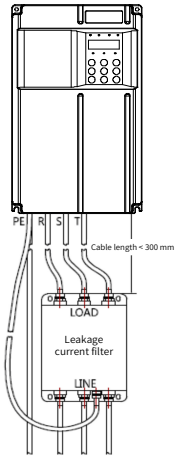


Figure B-13 Simple filter installation

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 following figure shows the appearance of the amorphous magnetic ring.

Figure B-14 Appearance of the amorphous magnetic ring

The following table lists the recommended amorphous magnetic ring models. Select an appropriate model based on specifications of the input and output lines.

Table B-10 Recommended amorphous magnetic ring models

Magnetic Ring Model	Code	Dimensions Outer Diameter (mm) x Inner Diameter (mm) x Thickness (mm)
DY644020H	11013031	64x40x20
DY805020H	11013032	80x50x20
DY1207030H	11013033	120x70x30

B.3.2 Installation of AC Input Reactor on the 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 strictly suppressed, install an external AC input reactor. The following table lists the recommended manufacturers and models of AC input reactors.

Table B-11 Recommended manufacturers and models of AC input reactors

AC Drive Model	AC Input Reactor Model (Inovance)
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%
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 of the AC drive depends on actual situations. The cables between the AC drive and motor cannot be too long. Overlong cables cause large distributed capacitance and therefore high harmonic current.

Install an AC output reactor when the output cables are too long. When the cable length is equal to or greater than the recommended values in the following table, install an AC output reactor close to the AC drive.

Table B-12 Minimum length of cables requiring output reactors

AC Drive Power (kW)	Rated Voltage (V)	Minimum Length of Cables Requiring Output Reactors (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 following table lists the recommended AC output reactor models.

Table B-13 Recommended manufacturers and models of AC output reactors

AC Drive Model	AC Output Reactor Model (Inovance)
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%
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%

AC Drive Model	AC Output Reactor Model (Inovance)
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

The shielded cable must be used to meet the EMC requirements of CE marking. 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 in the following figures.

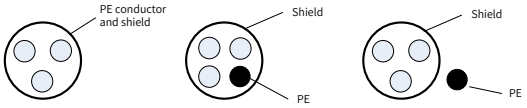


Figure B-14 Shielded cables

To suppress emission and conduction of the radio frequency interference effectively, the shield of the shielded cable is made of coaxial copper braid. Ensure that the braid density is greater than 90% to enhance the shielding performance and conductivity. as shown in the following figures.

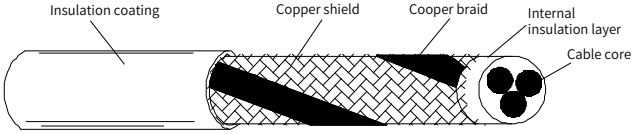


Figure B-15 Shield of a shielded cable

The following figure shows the grounding method of the shielded cable.

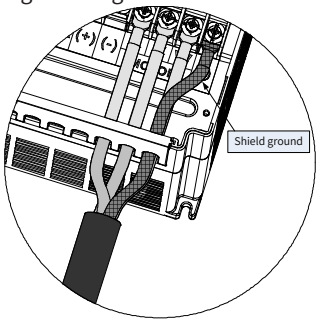


Figure B-16 Grounding of a shielded cable

Observe the following precautions for wiring:

- Symmetrical shielded cable is recommended. The four-conductor shielded cable can also be used as an input cable.
- The motor cable and PE shielded conducting wire (twisted shielded) should be as short as possible to reduce electromagnetic radiation and external stray current and capacitive current of the cable. If the motor cable is over 100 meters long, an output filter or a reactor is required.
- 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, shielded twisted-pair control cables should be used and the shield must be reliably grounded.

B.4.2 Cabling Requirements

1) Motor cables must be routed away from other cables. The several AC 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 the 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 must not run across the AC drive.
4) The power input and output cables of the AC drive and weak-current signal cables (such as control cables) should be laid vertically (if possible) rather than in parallel.
5) Cable ducts must be in good connection and well grounded. Aluminum ducts can be used to improve electric potential.
6) The filter, AC drive, and motor must be connected to the system (machines or devices) properly, with coating protection at installation part and conductive metal in full contact.

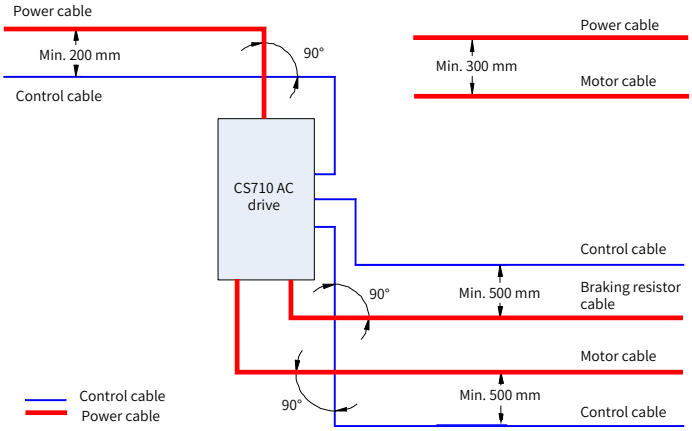


Figure B-17 Cabling

B.5 Leakage Current Requirements

1) Each AC drive produces more than 100 mA leakage current. Therefore, the current sensitivity of the RCD must be above 100 mA.
2) High-frequency pulse interference may cause the circuit breaker to malfunction, and therefore the RCD must have the high-frequency filter function.
3) If multiple AC drives are required, each AC drive must be equipped with an RCD.
4) The following factors influence the leakage current:
   - Capacity of the AC drive
   - Carrier frequency
   - Type and length of the motor cable
   - EMI filter
5) When the leakage current causes the RCD to trip, do as follows:
   - Increase the current sensitivity value of the RCD.
   - Use another RCD supporting high-frequency suppression.
   - Reduce the carrier frequency.
   - Shorten the length of the output cable.
   - Install a current leakage restraining 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) The EMC and VDR jumper screws described as follows:
   - An AC drive has the integrated EMC capacitor set and VDR, which are connected by default. If the leakage circuit breaker trips when the AC drive is powered on, remove the EMC jumper screw to disconnect the EMC capacitor set, as shown in the figure.

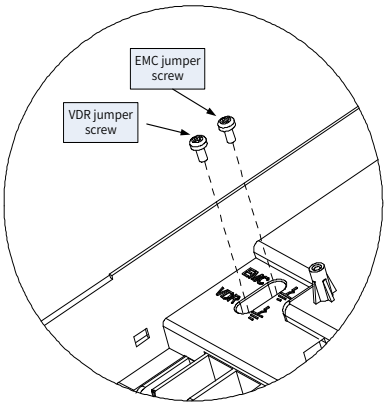


Figure B-18 EMC and VDR jumper screws

B.6 Solutions to EMC Interference

The AC drive generates very strong interference. Although EMC measures are taken, interference may still exist due to improper wiring or grounding during use. When the AC drive interferes with other devices, adopt the following solutions.

Table B-18 Common EMC interference issues and solutions

Interference Type	Solution
Earth leakage circuit breaker	◆ 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 from a running AC 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 devices 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 between the communication cable source and the load side. ◆ Add a common grounding cable besides the communication cable. ◆ Use a shielded cable as the communication cable and connect the shield to the common ground.
I/O interference	◆ Increase the filter capacitance at low-speed DIs. A maximum of 0.1 μF capacitance is recommended. ◆ Increase the filter capacitance at AIs. A maximum of 0.22 μF is recommended.

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