
ABB INDUSTRIAL DRIVES

ACS880 liquid-cooled multidrive cabinets and modules

Safety instructions



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Safety instructions

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2. Safety instructions



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Introduction to the manual

Contents of this chapter

This chapter contains general information of the manual, a list of related manuals, and a list of terms and abbreviations.

Applicability

This manual applies to ACS880 liquid-cooled multidrive cabinets and modules.

Target audience

This manual is intended for people who plan the installation, install, start up, or do service work. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Terms and abbreviations

Term	Description
ACS-AP-x	Assistant control panel
BCU	Type of control unit
BLCL	Series of LCL-filters, for example BLCL-15-5
Brake unit	Brake chopper modules under control of one control board, and related accessories
Cabinet	An enclosure that consists of one or more cubicles
Control unit	Control board built in a housing (often rail-mountable)
Cubicle	One section of a cabinet-installed drive. A cubicle is typically behind a door of its own.
DC/DC converter	Charges or discharges an external energy storage (such as a battery or capacitor bank) from or into the DC bus
DC/DC converter module	Converter power electronics, related components and DC capacitors enclosed in a metal frame or enclosure. Intended for cabinet installation.
DC/DC converter unit	DC/DC converter module(s) under control of one control board, and related components
DC link	DC circuit between rectifier and inverter
Diode supply module	Diode rectifier and related components enclosed in a metal frame or enclosure. Intended for cabinet installation.
Diode supply unit	Diode supply modules under control of one control board, and related components.
Drive	Frequency converter for controlling AC motors
EMC	Electromagnetic compatibility
FSO-12, FSO-21	Optional functional safety modules
IGBT supply module	IGBT bridge and related components enclosed inside a metal frame or enclosure. Intended for cabinet installation.
IGBT supply unit	IGBT supply module(s) under control of one control board, and related components.
Incoming unit	Part of the cabinet line-up that contains the input power cable terminals. Can also contain switching equipment etc.
Intermediate circuit	DC circuit between rectifier and inverter
Inverter	Converts direct current and voltage to alternating current and voltage.
Inverter module	Inverter bridge, related components and drive DC link capacitors enclosed in a metal frame or enclosure. Intended for cabinet installation.
Inverter unit	Inverter module(s) under control of one control board, and related components. One inverter unit typically controls one motor.
Multidrive	Drive for controlling several motors which are typically coupled to the same machinery. Includes one supply unit, and one or several inverter units.
Parameter	In the drive control program, user-adjustable operation instruction to the drive, or signal measured or calculated by the drive. In some (for example fieldbus) contexts, a value that can be accessed as an object, eg, variable, constant, or signal.
SIL	Safety integrity level (1...3) (IEC 61508)
Single drive	Drive for controlling one motor
STO	Safe torque off (IEC/EN 61800-5-2)
Supply module	Rectifier bridge and related components enclosed in a metal frame or enclosure. Intended for cabinet installation.
Supply unit	Supply module(s) under control of one control board, and related components.
ZCU	Type of control unit

Related documents

■ Cabinet-installed multidrive manuals

Manual	Code
General manuals	
<i>ACS880 liquid-cooled multidrive cabinets and modules safety instructions</i>	3AXD50000048633
<i>ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions</i>	3AXD50000048634
<i>ACS880 liquid-cooled multidrive cabinets mechanical installation instructions</i>	3AXD50000048635
<i>CIO-01 I/O module for distributed I/O bus control user's manual</i>	3AXD50000126880
Supply unit manuals	
<i>ACS880-207LC IGBT supply units hardware manual</i>	3AXD50000174782
<i>ACS880 IGBT supply control program firmware manual</i>	3AUA0000131562
Inverter unit manuals	
<i>ACS880-107LC inverter units hardware manual</i>	3AXD50000196111
<i>ACS880 primary control program firmware manual</i>	3AUA0000085967
<i>ACS880 primary control program quick start-up guide</i>	3AUA0000098062
Manuals for application programs (Crane, Winder, etc.)	
Brake unit and DC/DC converter unit manuals	
<i>ACS880-607LC 1-phase brake units hardware manual</i>	3AXD50000481491
<i>ACS880 (3-phase) brake control program firmware manual</i>	3AXD50000020967
<i>ACS880-1607LC DC/DC converter units hardware manual</i>	3AXD50000431342
<i>ACS880 DC/DC converter control program firmware manual</i>	3AXD50000024671
Option manuals	
<i>ACS880-1007LC liquid cooling unit user's manual</i>	3AXD50000129607
<i>ACS880 +C132 marine type-approved cabinet-built drives supplement</i>	3AXD50000039629
<i>ACS-AP-x assistant control panels user's manual</i>	3AUA0000085685
<i>Drive composer start-up and maintenance PC tool user's manual</i>	3AUA0000094606
Manuals for I/O extension modules, fieldbus adapters, safety options etc.	

You can find manuals on the Internet. See www.abb.com/drives/documents. For manuals not available in the document library, contact your local ABB representative.

■ Multidrive module manuals

Manual	Code
General manuals	
<i>ACS880 liquid-cooled multidrive cabinets and modules safety instructions</i>	3AXD50000048633
<i>ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions</i>	3AXD50000048634
<i>Drive modules cabinet design and construction instructions</i>	3AUA0000107668
<i>BCU-02/12/22 control units hardware manual</i>	3AUA0000113605
<i>CIO-01 I/O module for distributed I/O bus control user's manual</i>	3AXD50000126880
Supply module manuals	
<i>ACS880-204LC IGBT supply modules hardware manual</i>	3AXD50000284436
<i>ACS880 IGBT supply control program firmware manual</i>	3AUA0000131562

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Manual	Code
<i>ACS880-304LC+A019 diode supply modules hardware manual</i>	3AXD50000045157
<i>ACS880 diode supply control program firmware manual</i>	3AUA0000103295
Inverter module manuals and guides	
<i>ACS880-104LC inverter modules hardware manual</i>	3AXD50000045610
<i>ACS880 primary control program firmware manual</i>	3AUA0000085967
<i>ACS880 primary control program quick start-up guide</i>	3AUA0000098062
Brake module and DC/DC converter module manuals	
<i>ACS880-604LC 1-phase brake chopper modules hardware manual</i>	3AXD50000184378
<i>ACS880-1604LC DC/DC converter modules hardware manual</i>	3AXD50000371631
<i>ACS880 DC/DC converter control program firmware manual</i>	3AXD50000024671
Option manuals	
<i>ACS880 +C132 marine type-approved drive modules and module packages supplement</i>	3AXD50000037752
<i>ACS880-1007LC liquid cooling unit user's manual</i>	3AXD50000129607
<i>ACX-AP-x assistant control panels user's manual</i>	3AUA0000085685
<i>BAMU-12C auxiliary measurement unit hardware manual</i>	3AXD50000117840
<i>Drive composer start-up and maintenance PC tool user's manual</i>	3AUA0000094606
<i>Drive application programming (IEC 61131-3) manual</i>	3AUA0000127808
Manuals and quick guides for I/O extension modules, fieldbus adapters, safety functions modules, etc.	

See www.abb.com/drives/documents for all manuals on the Internet.

You can find all documentation related to the multidrive modules on the Internet at <https://sites-apps.abb.com/sites/lvacdrivesengineeringsupport/content>.

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Safety instructions

Contents of this chapter

This chapter contains the safety instructions which you must obey when you install, start up, operate and do maintenance work on the drive. If you ignore the safety instructions, injury, death or damage can occur.

Use of warnings and notes

Warnings tell you about conditions which can cause injury or death, or damage to the equipment. They also tell you how to prevent the danger. Notes draw attention to a particular condition or fact, or give information on a subject.

The manual uses these warning symbols:

**WARNING!**

Electricity warning tells about hazards from electricity which can cause injury or death, or damage to the equipment.

**WARNING!**

General warning tells about conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.

**WARNING!**

Electrostatic sensitive devices warning tells you about the risk of electrostatic discharge which can cause damage to the equipment.



General safety in installation, start-up and maintenance

These instructions are for all personnel who do work on the drive.



WARNING!

Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- Keep the drive in its package until you install it. After unpacking, protect the drive from dust, debris and moisture.
- Use the required personal protective equipment: safety shoes with metal toe cap, safety glasses, protective gloves, etc.
- Lift a heavy drive with a lifting device. Use the designated lifting points. See the dimension drawings.
- The lifting bars attached to large drive cabinets are heavy. Be careful when removing or reinstalling the bars. Whenever possible, use a lifting device attached to the designated lifting points.
- Secure the drive cabinet to the floor to prevent it from toppling over. The cabinet has a high center of gravity. When you pull out heavy components or power modules, there is a risk of overturning. Secure the cabinet also to the wall when necessary.



- Do not stand or walk on the cabinet roof. Make sure that nothing presses against the roof, side or back plates or door. Do not store anything on the roof while the drive is in operation.
- Be careful when handling a tall module. The module overturns easily because it is heavy and has a high center of gravity. Whenever possible, secure the module with chains. Do not leave an unsupported module unattended especially on a sloping floor.



- Beware of hot surfaces. Some parts, such as heatsinks of power semiconductors, and brake resistors, remain hot for a while after disconnection of the electrical supply.
- Make sure that debris from borings and grindings does not enter the drive during the installation. Electrically conductive debris inside the drive may cause damage or malfunction.
- Make sure that there is sufficient cooling. See the technical data.
- Keep the cabinet doors closed when the drive is powered. With the doors open, a risk of a potentially fatal electric shock, arc flash or high-energy arc blast exists. If you cannot avoid working on a powered drive, obey the local laws and regulations on live working (including – but not limited to – electric shock and arc protection).
- Before you adjust the drive operation limits, make sure that the motor and all driven equipment can operate throughout the set operation limits.
- Before you activate the automatic fault reset or automatic restart functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault or supply break. If these functions are activated, the installation must be clearly marked as defined in IEC/EN 61800-5-1, subclause 6.5.3, for example, "THIS MACHINE STARTS AUTOMATICALLY".
- The maximum drive power cycles is once every 2 minutes. Power cycling the drive too often can damage the charging circuit of the DC capacitors.
- Validate any safety circuits (for example, Safe torque off or emergency stop) in start-up. See separate instructions for the safety circuits.

Note:

- If you select an external source for the start command and it is on, the drive will start immediately after fault reset unless you configure the drive for pulse start. See the firmware manual.
- Depending on the wiring and parametrization of the drive, the stop key on the control panel may not stop the drive.
- Only authorized persons are allowed to repair a malfunctioning drive.

■ Work on the liquid cooling system

These instructions are intended for all personnel that do installation, commissioning and maintenance work on the liquid cooling system.

**WARNING!**

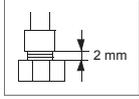
Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- Use the required personal protective equipment. See the Safety data sheet for Antifrogen® L coolant by Clariant (www.clariant.com) for the instructions on the respiratory, hand and eye protection when handling the coolant.
- Beware of hot, high-pressure coolant (6 bar, max. 50 °C) that is present in the internal cooling circuit when it is in operation. Before you disconnect a pipe, release the pressure. Close the appropriate stop valve(s). If necessary, stop the cooling circuit pumps.
- Avoid skin contact with coolant. If coolant splashes onto the skin or in the eyes, rinse immediately with plenty of water. Do not syphon it by mouth. If you swallow or get it into the eyes, seek medical advice.
- Before the drive power up, make sure that the internal cooling circuit is filled up with coolant, and the cooling is in operation (coolant circulates).



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- Make sure that coolant meets the ABB specification. See the appropriate hardware manual of the drive/unit.
- To avoid breaking the coolant pipes, do not overtighten the nuts of the unions. Leave 2 to 3 millimeters (0.08 to 0.12 inches) of thread visible.



- Do not drain coolant into the sewer system.
- If you need to store the drive in temperature below -15 °C (5 °F), drain the cooling circuit, or make sure that it is filled with the coolant specified by ABB.
- Drives with the cooling unit: Do not open the cooling unit pump inlet or outlet valves before filling up the coolant circuit. The pumps are filled with a mixture at the factory to prevent corrosion and the valves are closed at the factory.
- Drives with the cooling unit: Do not run the cooling unit pump dry.



Electrical safety in installation, start-up and maintenance

■ Electrical safety precautions

These electrical safety precautions are for all personnel who do work on the drive, motor cable or motor.



WARNING!

Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

If you are not a qualified electrician, do not do installation or maintenance work.

Go through these steps before you begin any installation or maintenance work.

1. Keep the cabinet doors closed when the drive is powered. With the doors open, a risk of a potentially fatal electric shock, arc flash or high-energy arc blast exists.
2. Clearly identify the work location and equipment.
3. Disconnect all possible voltage sources. Lock out and tag out.
 - Open the main disconnecting device of the drive.
 - Open the charging switch if present.
 - Open the disconnecter of the supply transformer. (The main disconnecting device in the drive cabinet does not disconnect the voltage from the AC input power busbars of the drive cabinet.)
 - Close the grounding switch or switches ([Q9], option +F259) if present. Do not use excessive force as the switch has electromagnetic interlocking.
 - If the drive is equipped with a DC/DC converter unit (optional): Open the DC switch/disconnector ([Q11], option +F286) of the DC/DC converter. Open the disconnecting device of the energy storage connected to the DC/DC converter unit (outside the drive cabinet).
 - Open the auxiliary voltage switch-disconnector (if present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
 - In the liquid cooling unit (if present), open the motor protective circuit breaker(s) of the cooling pumps.
 - If you have a permanent magnet motor connected to the drive, disconnect the motor from the drive with a safety switch or by other means.
 - Make sure that re-connection is not possible. Lock out and tag out.
 - Disconnect any dangerous external voltages from the control circuits.
 - After you disconnect power from the drive, always wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.
4. Protect any other energized parts in the work location against contact.
5. Take special precautions when close to bare conductors.
6. Measure that the installation is de-energized. If the measurement requires removal or disassembly of shrouding or other cabinet structures, obey the local laws and regulations applicable to live working (including – but not limited to – electric shock and arc protection).
 - Use a multimeter with an impedance greater than 1 Mohm.
 - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.



- Make sure that the voltage between the drive DC busbars (+ and -) and the grounding (PE) busbar is close to 0 V.
- If you have a permanent magnet motor connected to the drive, make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is close to 0 V.



WARNING!

The busbars inside the cabinet are partially coated. Measurements made through the coating are potentially unreliable, so only measure at uncoated portions. Note that the coating does not constitute a safe or touch-proof insulation.

7. Install temporary grounding as required by the local regulations.
8. Ask the person in control of the electrical installation work for a permit to work.

■ **Additional instructions and notes**



WARNING!

Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

If you are not a qualified electrician, do not do installation or maintenance work.

- Make sure that the electrical power network, motor/generator, and environmental conditions agree with the drive data. Verify that the network voltage matches with the input voltage on the drive type designation label.
- Do not do insulation or voltage withstand tests on the drive.
- ABB recommends not to secure the cabinet by arc welding. If you have to, obey the welding instructions in the drive manuals.
- Remove the code labels attached to mechanical parts such as busbars, shrouds and sheet metal parts before installation. They may cause bad electrical connections, or, after peeling off and collecting dust in time, cause arcing or block the cooling air flow.

Note:

- The motor cable terminals of the drive are at a dangerous voltage when the input power is on, regardless of whether the motor is running or not.
 - When the input power is on, the drive DC bus is at a dangerous voltage.
 - External wiring can supply dangerous voltages to the relay outputs of the control units of the drive.
 - The Safe torque off function does not remove the voltage from the main and auxiliary circuits. The function is not effective against deliberate sabotage or misuse.
-



Optical components



WARNING!

Obey these instructions. If you ignore them, damage to the equipment can occur.

- Handle the fiber optic cables with care.
- When you unplug the fiber optic cables, always hold the connector, not the cable itself.
- Do not touch the ends of the fibers with bare hands as the ends are extremely sensitive to dirt.
- Do not bend the fiber optic cables too tightly. The minimum allowed bend radius is 35 mm (1.4").

Printed circuit boards



WARNING!

Use a grounding wrist band when you handle printed circuit boards. Do not touch the boards unnecessarily. The boards contain components sensitive to electrostatic discharge.

■ Grounding

These instructions are for all personnel who are responsible for the grounding of the drive.



WARNING!

Obey these instructions. If you ignore them, injury or death, or equipment malfunction can occur, and electromagnetic interference can increase.

If you are not a qualified electrician, do not do grounding work.

- Always ground the drive, the motor and adjoining equipment. This is necessary for the personnel safety. Proper grounding also reduces electromagnetic emission and interference.
- Make sure that the conductivity of the protective earth (PE) conductors is sufficient. See the electrical planning instructions of the drive. Obey the local regulations.
- Connect the power cable shields to protective earth (PE) terminals of the drive to make sure of personnel safety.
- Make a 360° grounding of the power and control cable shields at the cable entries to suppress electromagnetic disturbances.
- In a multiple-drive installation, connect each drive separately to the protective earth (PE) busbar of the power supply.

Note:

- You can use power cable shields as grounding conductors only when their conductivity is sufficient.
 - As the normal touch current of the drive is higher than 3.5 mA AC or 10 mA DC, you must use a fixed protective earth (PE) connection. The minimum size of the protective earth conductor must comply with the local safety regulations for high protective earth
-



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conductor current equipment. See standard IEC/EN 61800-5-1, 4.3.5.5.2., and the electrical planning instructions of the drive.

In addition:

- use a protective earth conductor with a cross-section of at least 10 mm² Cu or 16 mm² Al,
or
- use a second protective earth conductor of the same cross-sectional area as the original protective earthing conductor,
or
- use a device which automatically disconnects the supply if the protective earth conductor breaks.

If the protective earth conductor is separate (ie, it does not form part of the input power cable or the input power cable enclosure), the cross section must be at least:

- 2.5 mm² (14 AWG) when the conductor is mechanically protected, or
- 4 mm² (12 AWG) when the conductor is not mechanically protected.



Additional instructions for permanent magnet motor drives

■ Safety in installation, start-up, maintenance

These are additional warnings concerning permanent magnet motor drives. The other safety instructions in this chapter are also valid.



WARNING!

Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

If you are not a qualified electrician, do not do installation or maintenance work.

- Do not do work on the drive when a rotating permanent magnet motor is connected to it. A rotating permanent magnet motor energizes the drive including its input and output power terminals.

Before installation, start-up and maintenance work on the drive:

- Stop the drive.
- Disconnect the motor from the drive with a safety switch or by other means.
- If you cannot disconnect the motor, make sure that the motor cannot rotate during work. Make sure that no other system, like hydraulic crawling drives, can rotate the motor directly or through any mechanical connection like felt, nip, rope, etc.
- Do the steps in section [Electrical safety precautions \(page 15\)](#)
- If the motor is connected to an inverter unit with a DC switch-disconnector, open the disconnector, lock it, and tag it. If the motor is connected to an inverter unit without the DC switch, remove the fuses in between the inverter module(s) and the drive DC link.
- Measure that the installation is de-energized.
 - Use a multimeter with an impedance greater than 1 Mohm.
 - Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is close to 0 V.
 - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.
 - Make sure that the voltage between the drive DC busbars (+ and -) and the grounding (PE) busbar is close to 0 V.
- Install temporary grounding to the drive output terminals (U2, V2, W2). Connect the output terminals together as well as to the PE. If the inverter unit is equipped with an output grounding/earthing switch (option +F270), close the switch.



WARNING! Before you close the output grounding/earthing switch (option +F270), make sure that the motor shaft is locked securely. Even a very slowly rotating motor generates a high short-circuit current which the switch does not withstand.

During the start up:

- Make sure that the motor cannot be run into overspeed, eg, driven by the load. Motor overspeed causes overvoltage that can damage or destroy the capacitors in the intermediate circuit of the drive.

■ Safety in operation



WARNING!

Make sure that the motor cannot be run into overspeed, e.g. driven by the load. Motor overspeed causes overvoltage that can damage or destroy the capacitors in the intermediate circuit of the drive.



Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/searchchannels.

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB manuals

Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet at www.abb.com/drives/documents.



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