ABB INDUSTRIAL DRIVES

ACS880-1607LC DC/DC converter units

Hardware manual

ACS880-1607LC DC/DC converter units

Hardware manual

3AXD50000431342 Rev C
EN
Original instructions
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Introduction to the manual

Contents of this chapter

This chapter gives basic information on the manual.

Applicability

The manual is applicable to ACS880-1607LC DC/DC converter units that form a part of an ACS880 multidrives system.

Safety instructions

Obey all safety instructions of the drive.

- Read the **complete safety instructions** before you install, commission, use or service the drive. The complete safety instructions are given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]).
- Read the warnings of the software function before you take the function in use or change its default parameter settings. Read the warnings of the parameter before you change its default setting. Refer to the firmware manual.

Target audience

This manual is intended for people who plan the installation, install, commission and do maintenance work on the drive, or create instructions for the end user of the drive concerning the installation and maintenance of the drive.

Read the manual before you work on the drive. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Categorization by frame size and option module

Some descriptions, instructions and technical data which concern only certain module or frame sizes are marked with the size identifier (such as "2×R8i", etc.). The marking derives from the quantity and basic construction of the converter modules that form the converter unit. For example, frame size "2×R8i" indicates that the converter unit consists of two frame size R8i converter modules connected in parallel.

The frame size is marked on the type designation labels. The frame size of each drive module is also shown in the rating tables.

The instructions and technical data which concern only certain optional selections are marked with option codes (such as +E205). The options included in the drive can be identified from the option codes visible on the type designation label.

Use of component designations

Some device names in the manual include the component designation in brackets (for example, [Q20]). This will help you to identify the components in the circuit diagrams of the drive.

Terms and abbreviations

Term	Description
BAMU	Auxiliary measurement unit
BCU	Type of control unit
BDCL	Series of L-filters, for example BDCL-14-5
CIO	I/O module for controlling cooling fans
Control unit	The part in which the control program runs.
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 unit, and related components
DDC	DC/DC converter unit
DI	Digital input
DOL	Direct-on-line
Drive	Frequency converter for controlling AC motors
Energy storage	Device that stores electrical energy, for example, a battery or a super capacitor.
Frame, frame size	Physical size of the drive or power module
INU	Inverter unit
Inverter	Converts direct current and voltage to alternating current and voltage.
Inverter unit	Inverter module(s) under control of one control unit, 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. For example, variable, constant, or signal.
PLC	Programmable logic controller
Single drive	Drive for controlling one motor

Term	Description
Supply unit	Supply module(s) under control of one control unit, and related components.
UCU	Type of control unit
UPS	Uninterruptible power supply
USCA-02	Adapter for installing F-series option modules onto the UCU control unit.

Related documents

You can find manuals on the Internet. See below for the relevant code/link. For more documentation, go to www.abb.com/drives/documents.

	Manuals for ACS880 multidrives cabinets

2

Operation principle and hardware description

Contents of this chapter

This chapter describes the DC/DC converter operation basics and the hardware of the converter.

Operation principle

The DC/DC converter unit (DDC) transfers energy from a common DC bus of a drive into an external energy storage and discharges energy back to the DC bus. The energy storage can be, for example, a battery or super capacitor. The energy storage is not included in the converter unit delivery.

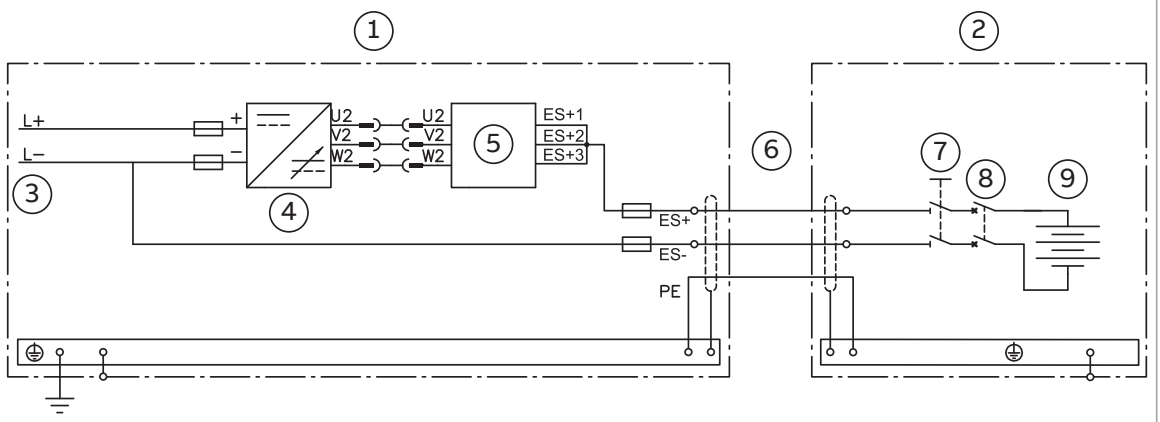
The DC/DC converter unit has a single converter module or parallel converter modules under the command of one control unit. Parallel DC/DC converter modules must have a common energy storage. Each parallel module must have the output cabling of its own. ABB also recommends that you use identical cablings (cable type, cross-sectional area, and length) and have identical load for each module. For other solutions, contact ABB.

Typically, the DC/DC converter is used in marine applications for heave compensation, peak load compensation, propulsion supply in harbors, energy storing instead of an additional generator and so on. The DC/DC converter can also be used in automotive applications such as electric car charging systems and also in several other applications where energy storing and reuse is needed.

Main circuit diagram

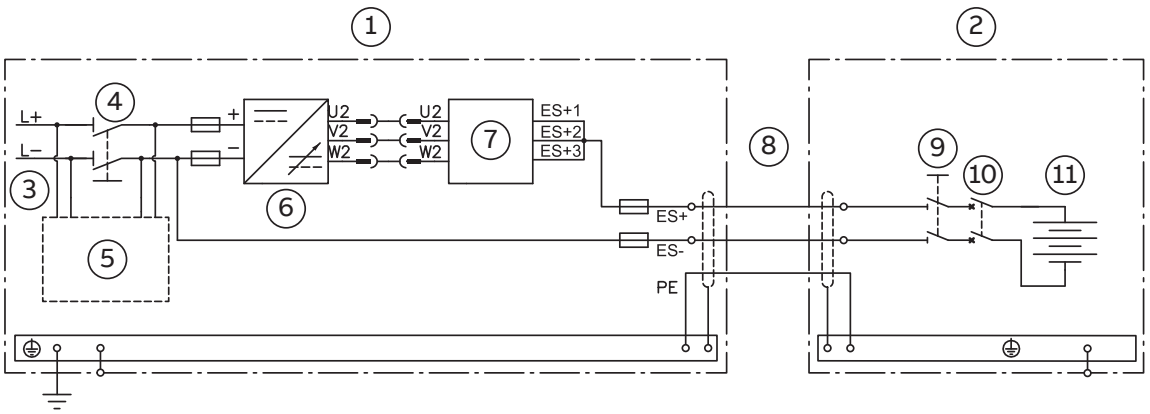
The DC/DC converter has output DC fuses and DC fuses on the drive DC bus side. A DC switch-disconnector is available as option +F286.

This figure shows a simplified main circuit diagram of a DC/DC converter without a DC switch-disconnector or charging circuit.



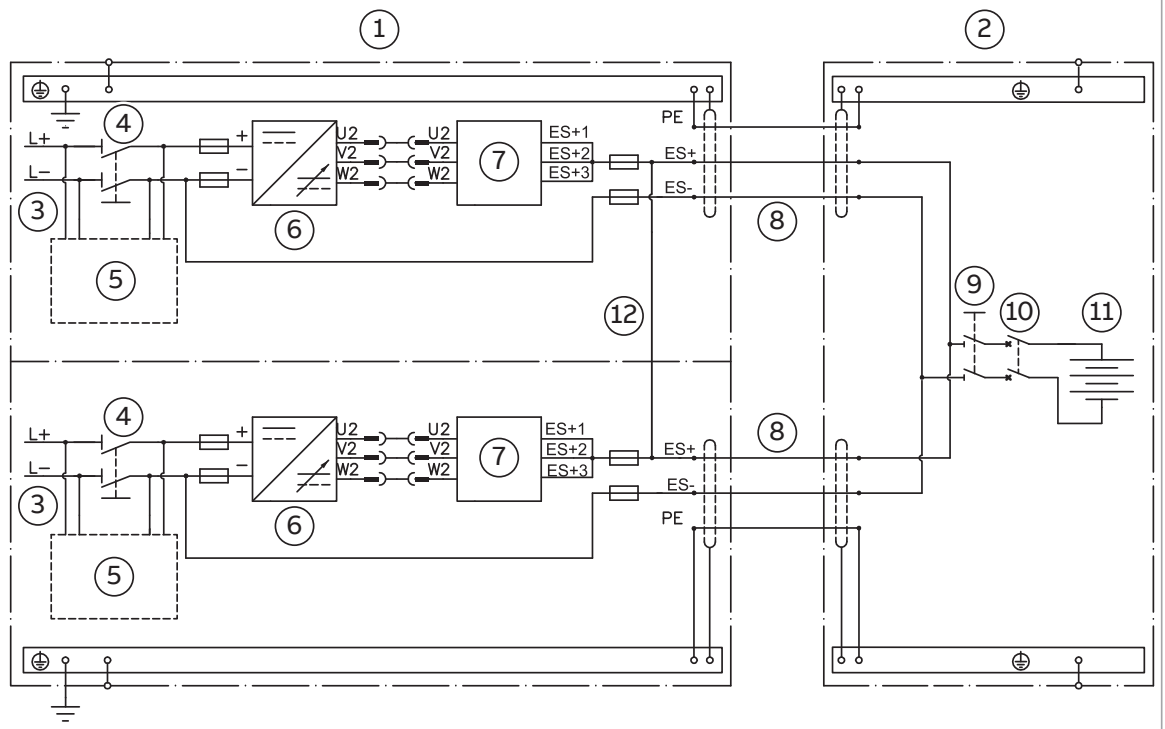
1	DC/DC converter cubicle
2	Energy storage cabinet
3	Drive DC bus
4	DC/DC converter module
5	Filter module
6	Cabling between DC/DC converter unit and energy storage
7	Energy storage disconnecting device
8	Energy storage protective circuit breaker
9	Energy storage

This figure shows a simplified main circuit diagram of a DC/DC converter with the DC switch-disconnector (option +F286) and charging circuit.



1	DC/DC converter cubicle
2	Energy storage cabinet
3	Drive DC bus
4	DC switch-disconnector (option +F286)
5	Charging components (with option +F286)
6	DC/DC converter module
7	Filter module
8	Cabling between DC/DC converter unit and energy storage
9	Energy storage disconnecting device
10	Energy storage protective circuit breaker
11	Energy storage

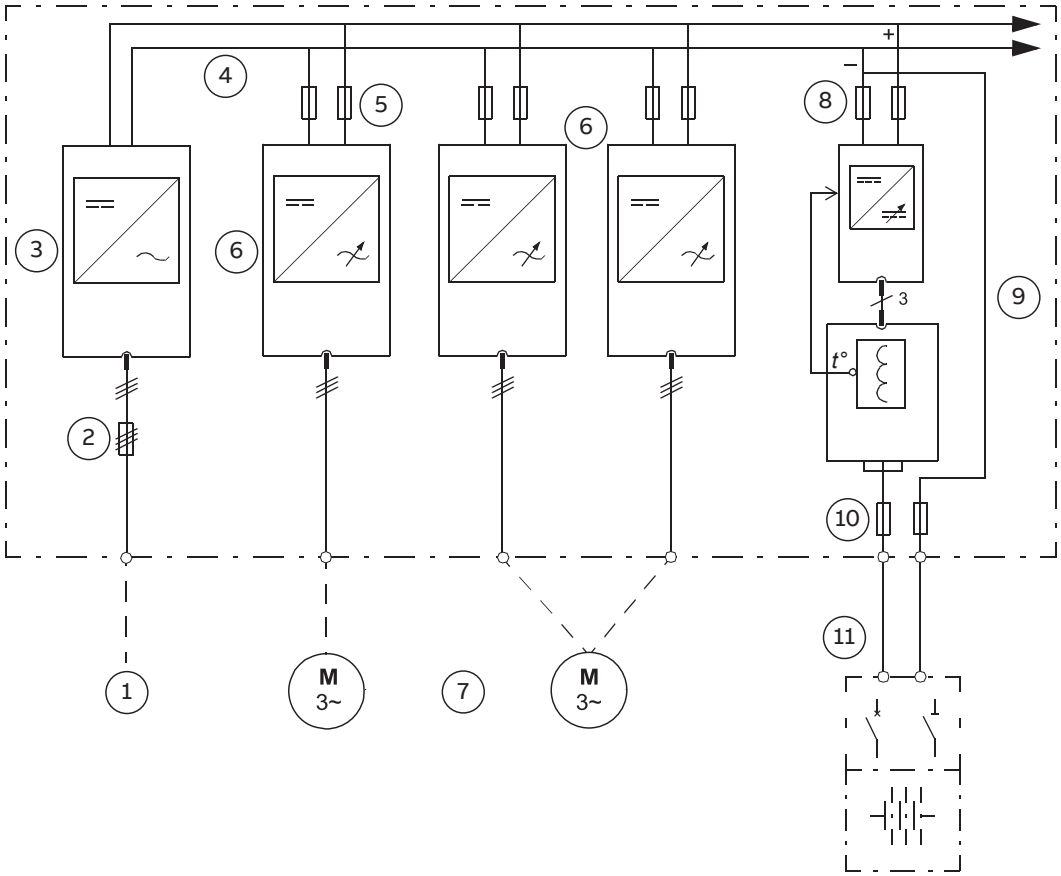
This figure shows a simplified main circuit diagram of parallel-connected DC/DC converter modules with the DC switch-disconnector (option +F286) and charging circuit. Also the energy storage and related cabling and equipment are visible.



1	DC/DC converter cubicles
2	Energy storage cabinet
3	Drive DC bus
4	DC switch-disconnector (option +F286)
5	Charging components (with option +F286)
6	DC/DC converter module
7	Filter module
8	Cabling between DC/DC converter unit and energy storage
9	Energy storage disconnecting device
10	Energy storage protective circuit breaker
11	Energy storage
12	Bridging busbar

Overview diagram of a drive with a DC/DC converter unit

This diagram shows a possible application of a converter unit in an example system. The DC/DC converter unit includes a DC/DC converter module and a filter module.

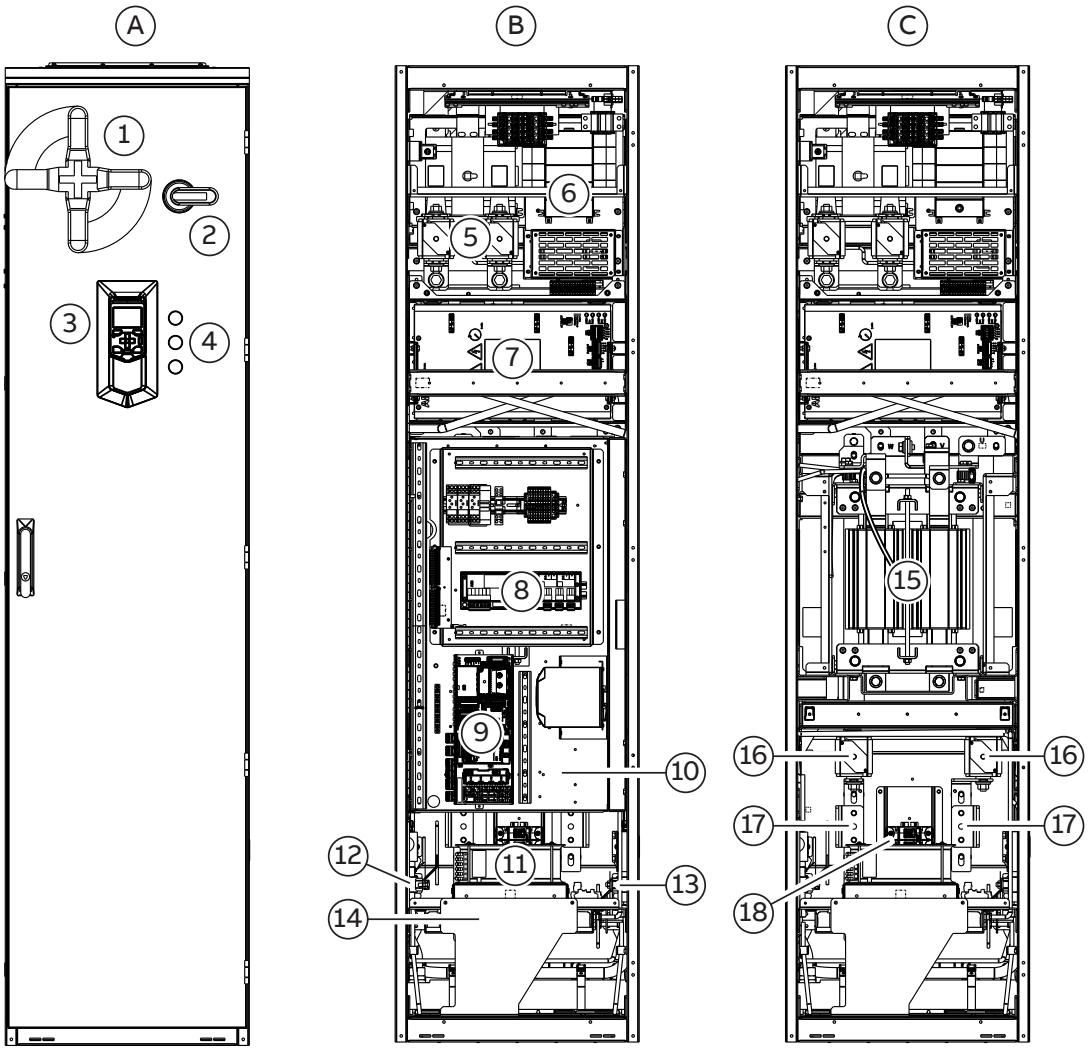


1	AC supply
2	Input (AC) fuses
3	Supply module
4	DC bus (-,+)
5	Inverter DC fuses (with or without a DC switch-disconnector, option +F286)
6	Inverter modules
7	Motors
8	DC fuses (DC bus side, with or without a DC switch-disconnector, option +F286)
9	DC/DC converter unit (converter and filter module)
10	Output DC fuses
11	Customer-defined energy storage with disconnecting and protection devices

Converter unit hardware

Cabinet layout – Frame R7i converter module

This figure shows an example converter unit cubicle.

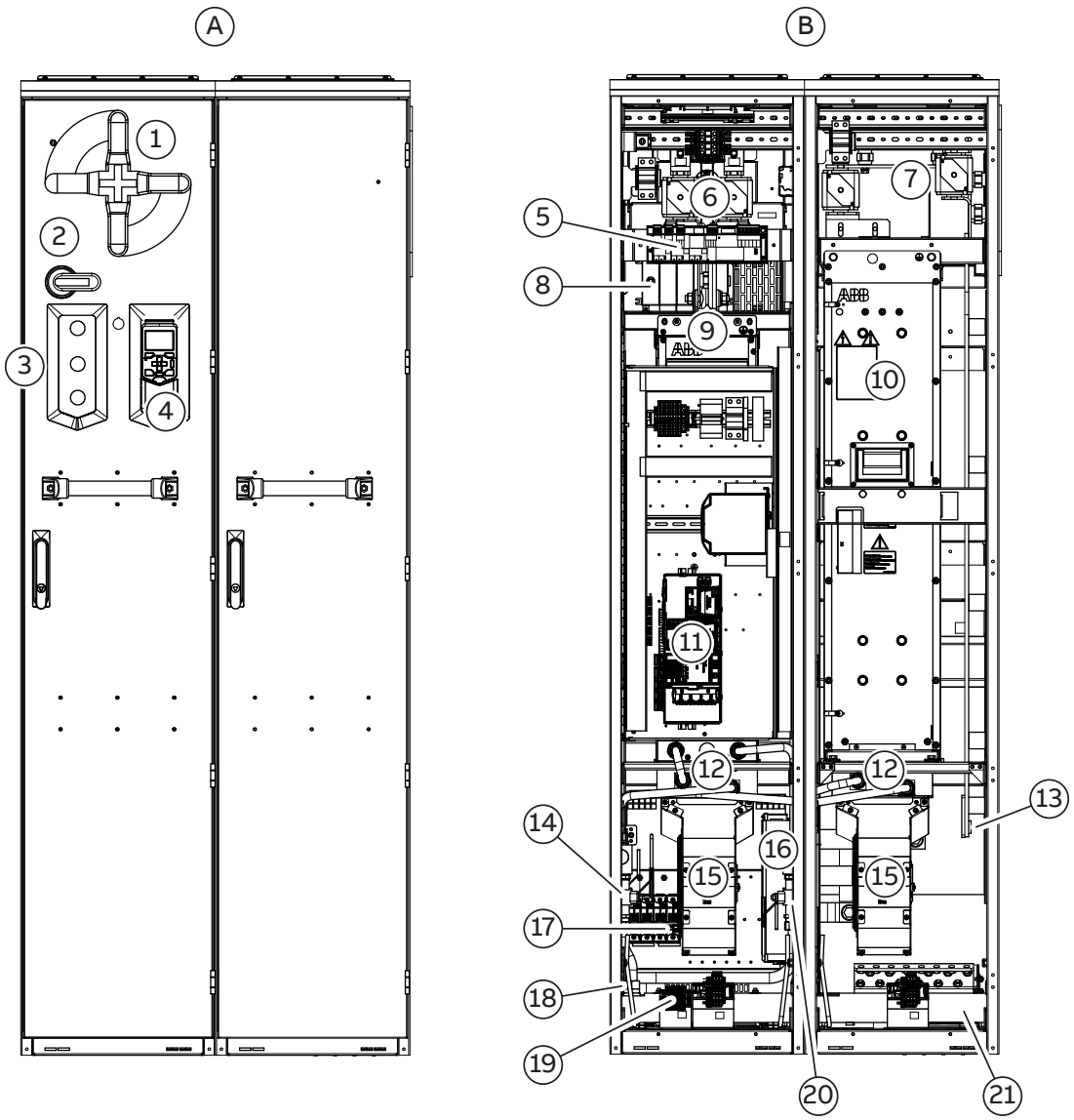


Symbol	Item designation	Description
A	-	Door closed
B	-	Door open
C	-	Door open and shrouds removed
1	Q11.1	DC switch-disconnector handle (with option +F286)
2	Q10.1	Charging switch handle (with option +F286)
3	A49	Control panel
4	P11.1 P12.1 P13.1	Door lights: • Charging OK [P11.1] (green) • DC/DC converter disconnected [P12.1] (white) • Load disconnected [P13.1] (white).
5	F11.11 F11.12	Input DC fuses (DC bus side)
6	Q10.1	Charging switch shaft (with option +F286)

7	T11.1	R7i DC/DC converter module
8	A11.1	Charging controller (with option +F286)
9	A41	Control unit
10	-	Swing-out frame (with BAMU voltage measurement unit [A7] on the other side)
11	G115.10	Cooling fan
12	-	Inlet manifold with stop and drain valves
13	-	Outlet manifold with stop and drain valves
14	-	Heat exchanger (behind shrouding)
15	R13.1	BDCL filter module
16	F13.11 F13.12	Output DC fuses
17	ES+, ES-	Energy storage connection
18	F7	BAMU voltage measurement unit fuses

Cabinet layout – Frame R8i converter module

This figure shows an example converter unit cubicle.



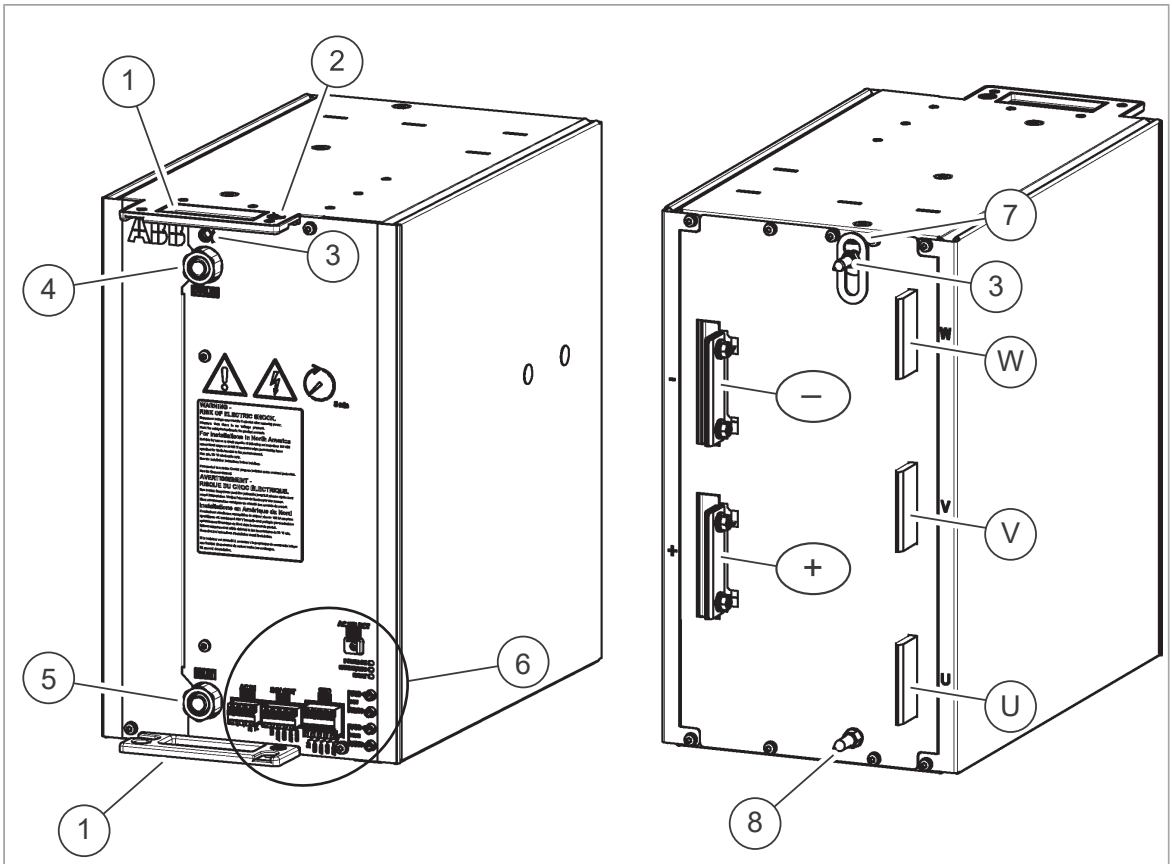
Symbol	Item designation	Description
A	-	Doors closed
B	-	Doors open and shrouds removed
1	Q11.1	DC switch-disconnector handle (with option +F286)
2	-	Charging switch handle (with option +F286)
3	P11.1…P13.1	Door lights: • Charging OK ([P11.x], green) • DC/DC converter disconnected ([P12.x], white) • Load disconnected ([P13.x], white).
4	-	Control panel
5	A11.1	Charging controller (with option +F286). Charging resistors [R1.x…R4.x] are behind the charging controller.
6	F11.xx	Input DC fuses (DC bus side)

7	F13.xx	Output DC fuses
8	Q10.1	Charging switch shaft (with option +F286)
9	T11.1	R8i DC/DC converter module
10	R13.1	BDCL filter module
11	A41	Control unit
12	-	Heat exchanger
13	ES+, ES-	Energy storage connection
14	-	Inlet manifold with stop and drain valves
15	-	Module cooling fans
16	-	Auxiliary measurement unit
17	-	Auxiliary measurement unit fuses
18	-	Coolant IN Coolant OUT (back)
19	X33.1	Connection from the energy storage disconnecting device to the load disconnected indicator [P13.x]
20	-	Outlet manifold with stop and drain valves
21	-	Cable entries for energy storage cables

Converter module hardware

Frame R7i

Module layout



1	Handle
2	Lifting eye, front
3	Locking screw (for 6 mm hex key). Torque: 5 N·m (3.7 lbf·ft) maximum.
4	Coolant out connector
5	Coolant in connector
6	Connectors X50, X52 and X53; fiber optic connectors; LEDs; auxiliary voltage selector X59.
7	Lifting ring, rear
8	Guide pin
+ –	DC connection busbars. The busbars engage with the quick connectors of the installation frame.
U V W	AC connection busbars. The busbars engage with the quick connectors of the installation frame.

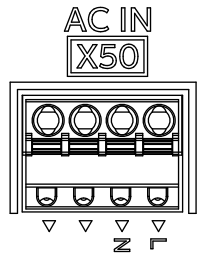
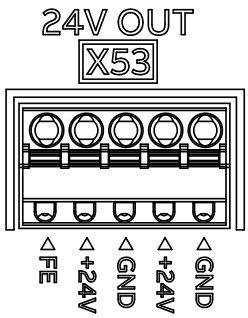
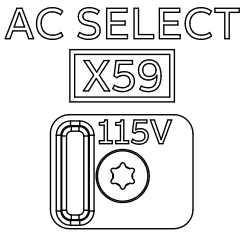
Coolant connectors

The coolant pipe inlet and outlet connectors are located at the bottom front and top front of the module respectively. The connectors are for 16/13 millimeter PA (polyamide) pipe.

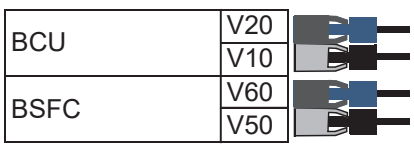
Connectors X50, X52 and X53; Auxiliary voltage selector X59

R7i modules contain a power supply board that provides 24 V DC for the circuit boards of the module.

The power supply board of the module is powered internally from the DC link.

	Auxiliary voltage input for internal power supply of module. Voltage selected by X59.
	24 V DC output (for eg. control unit)
	Auxiliary voltage: 230 V AC
	Auxiliary voltage: 115 V AC

Fiber optic connectors



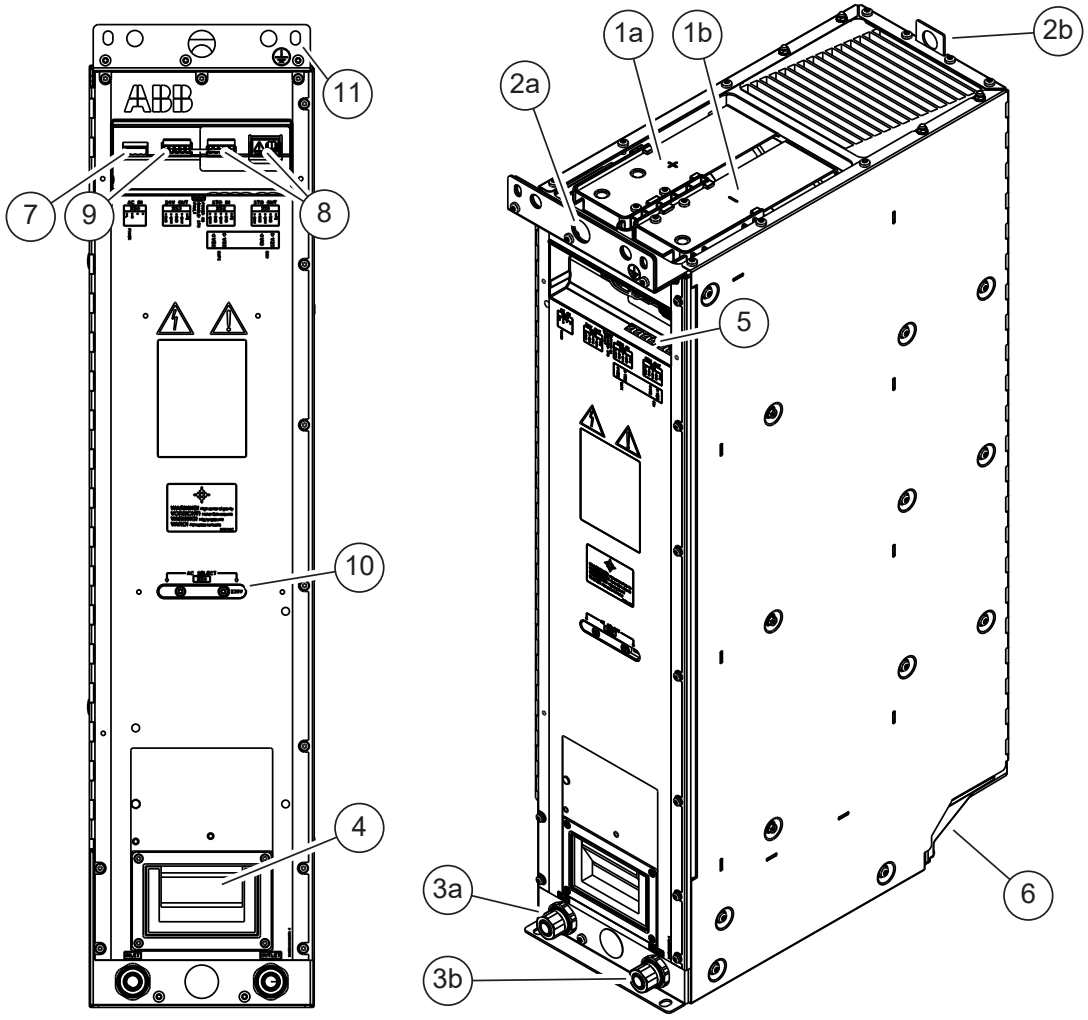
Name	Description
BCU or UCU	Control unit connection.
BSFC	Charging controller connection.

LEDs

LED	Color	Indication
FAULT	Continuous red	There is an active fault in the module.
ENABLE / STO	Continuous green	The module is ready for use.
ENABLE / STO	Continuous yellow	XSTO connectors are de-energized.
POWER OK	Continuous green	Supply voltage of the internal circuit boards is OK (> 21 V).

Frame R8i

Module layout



1	DC connection busbars, + (a) and - (b)
2	Lifting eyes, front (a) and back (b)
3	Coolant in (a) and out (b) connectors
4	Handle
5	Fiber optic connectors
6	Quick connector (AC connection) (the counterpart fastened to the cabinet behind the module)

7	Terminal block X50 (auxiliary power input for internal boards)
8	Terminal block X51 and X52 (Safe torque off in inverter modules only)
9	Terminal block X53 (24 V DC power output)
10	Auxiliary voltage selector X59 (115 or 230 V)
11	Unpainted fastening hole. The grounding point between module frame and cabinet frame.

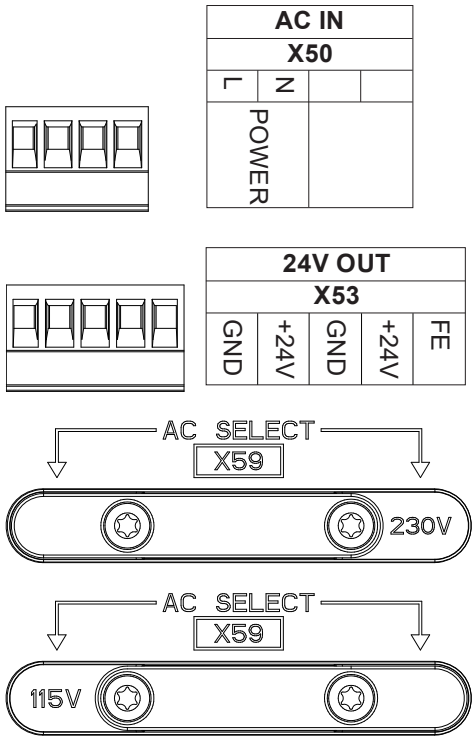
Coolant connectors

The coolant pipe inlet and outlet connectors are located at the bottom front of the module. The connectors are for 16/13 millimeter PA (polyamide) pipe.

Connectors X50...X59

R8i modules contain a power supply (BDPS) that provides 24 V DC for the circuit boards of the module.

The BDPS is powered internally from the DC link.



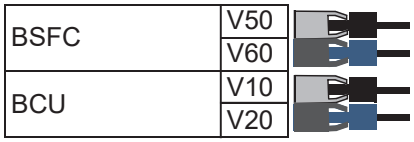
Auxiliary voltage inputs for internal power supply (BDPS)

24 V DC output (for eg. BCU control unit)

Auxiliary voltage: 230 V AC

Auxiliary voltage: 115 V AC

Fiber optic connectors



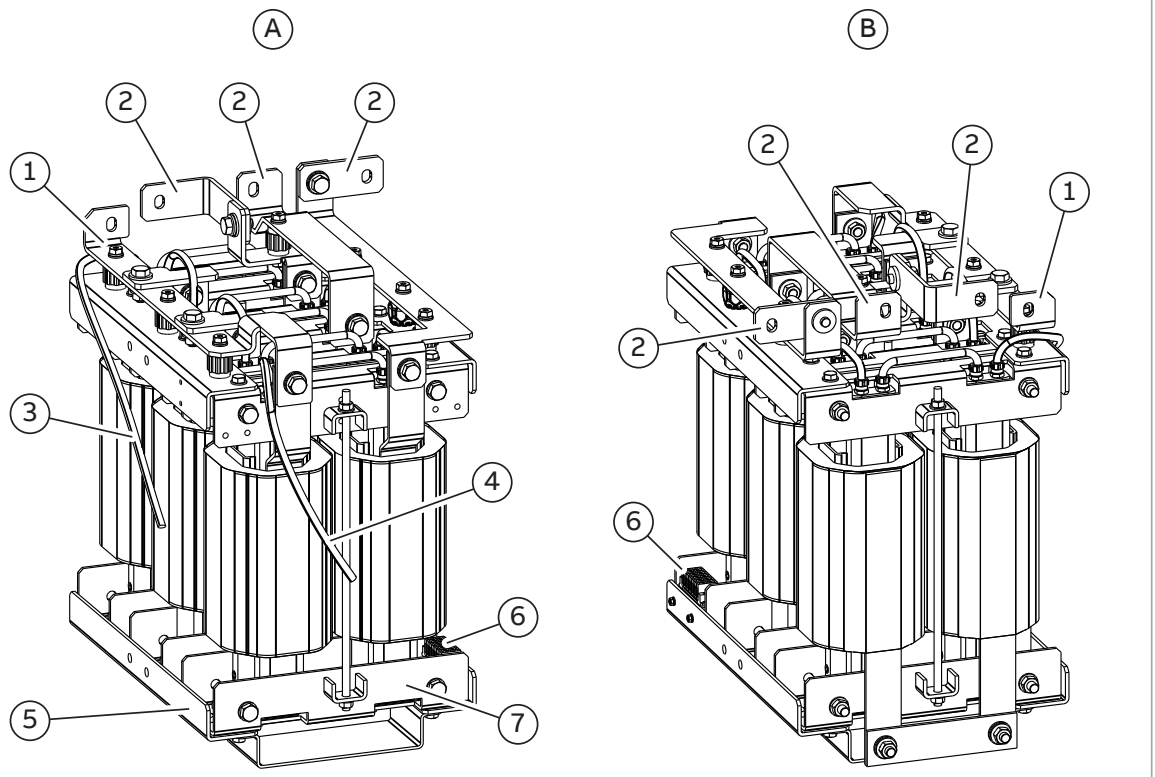
Name	Description
BSFC	Charging controller connection.
BCU	Control unit connection.

LEDs

LED	Color	Indication
FAULT	Continuous red	There is an active fault in the module.
ENABLE / STO	Continuous green	The module is ready for use.
ENABLE / STO	Continuous yellow	XSTO connectors are de-energized.
POWER OK	Continuous green	Supply voltage of the internal circuit boards is OK (> 21 V).

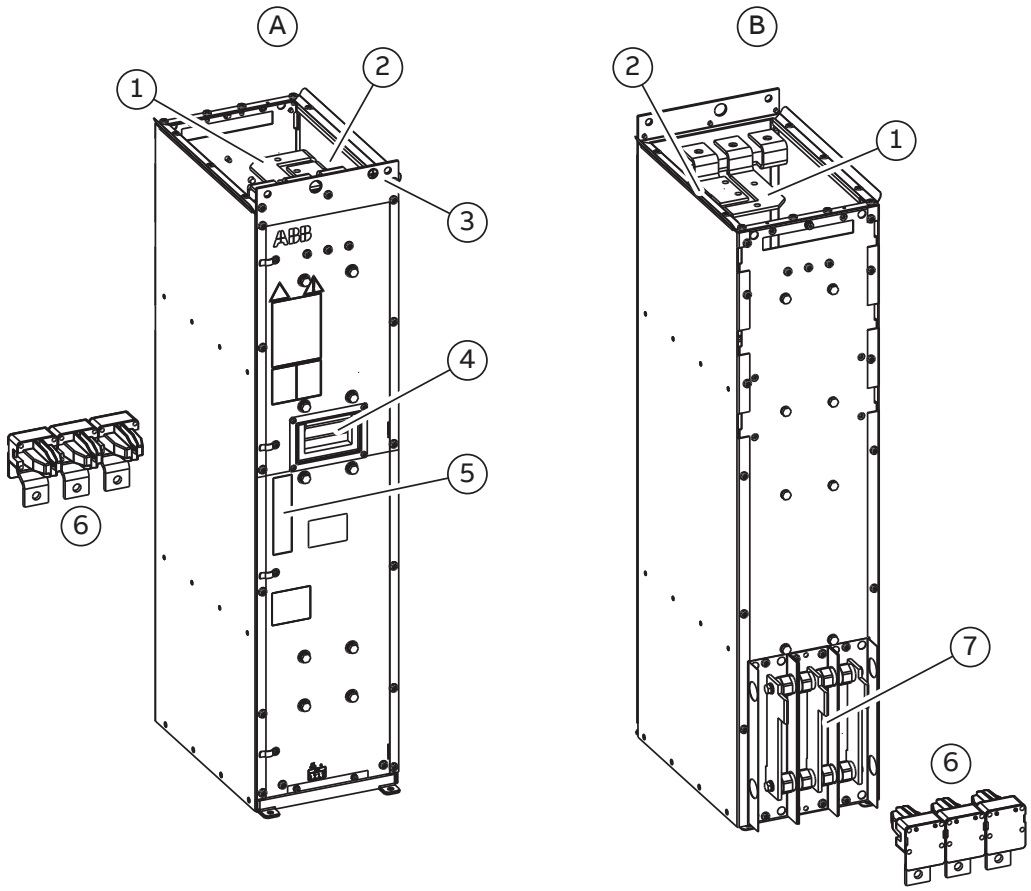
BDCL filter module

BDCL filter module for frame R7i converter module



A	Filter module, front
B	Filter module, back
1	Energy storage connection (DC+)
2	Converter module connection
3	Coolant outlet pipe
4	Coolant inlet pipe
5	Grounding point
6	Terminal block [X30], temperature control
7	Type designation label of the module

BDCL filter module for frame R8i converter module

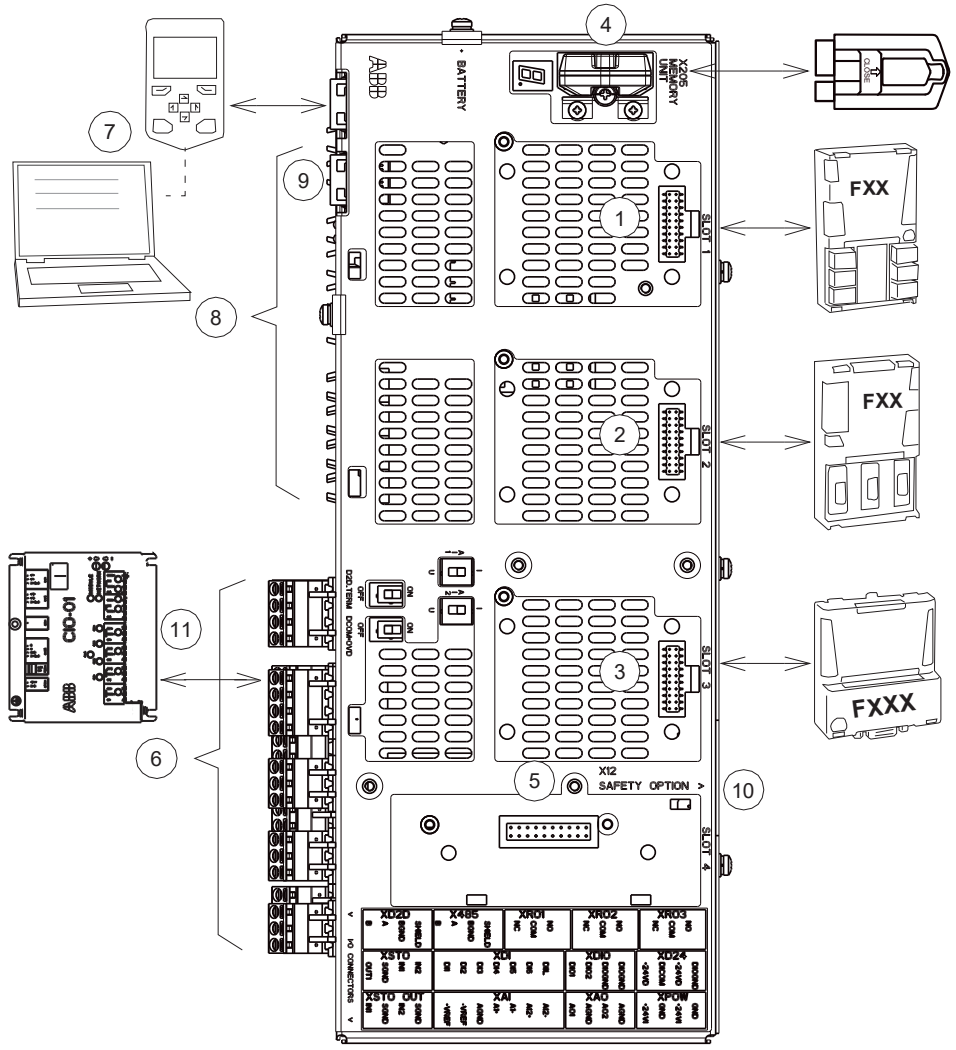


A	Filter module, front
B	Filter module, back
1	Energy storage connection (DC+)
2	Terminal block [X30], temperature control
3	Unpainted grounding point
4	Handle
5	Type designation label of the module
6	Quick connector
7	Converter module connection

Overheating protection of the filter

By default, the BDCL filter is protected against overheating (caused by, for example, a fan malfunction or loss of coolant flow) with a thermistor and the temperature monitoring function of the control program. If the filter temperature becomes too high, the temperature monitoring function stops the DC/DC converter automatically.

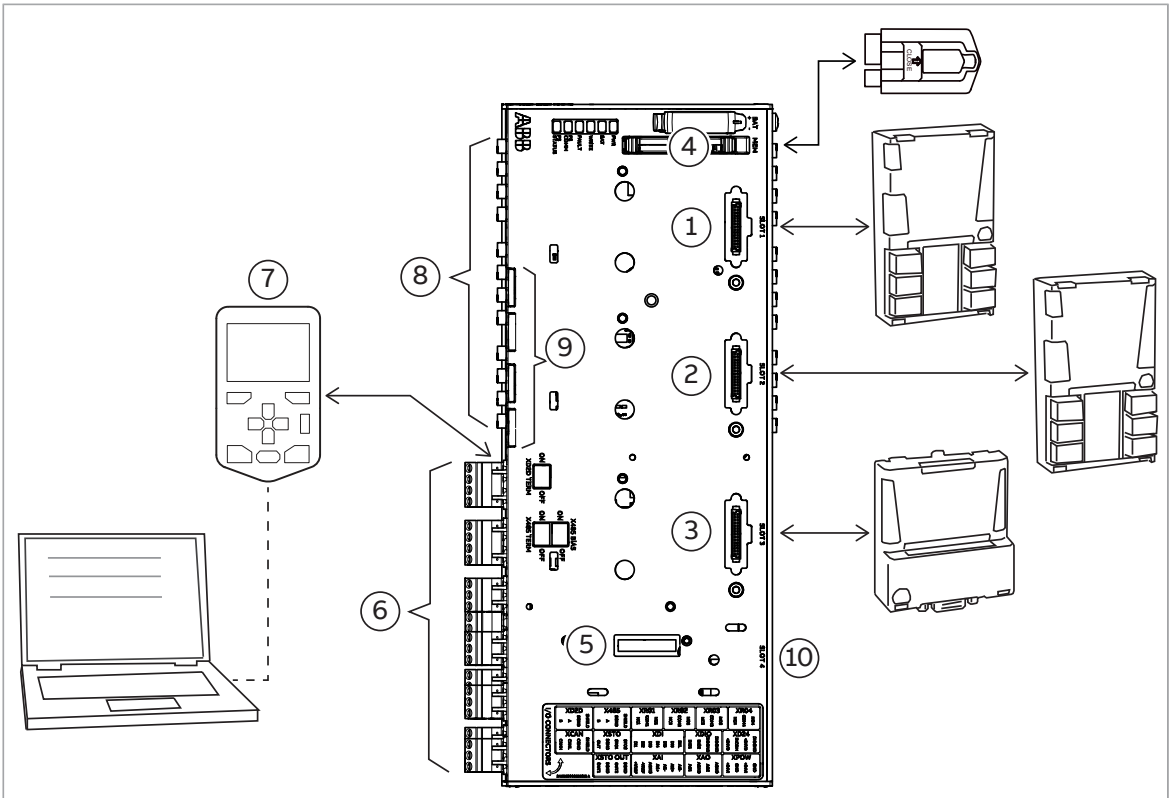
Overview of the control connections of the BCU control unit



1 2 3	Analog and digital I/O extension modules and fieldbus communication modules can be inserted into slots 1, 2 and 3.	7	Control panel.
4	Memory unit	8	Fiber optic links to power modules (inverter, supply, brake or converter)
5	Slot 4 for RDCO-0x	9	Ethernet port. Not in use.
6	Terminal blocks.	10	Safety option interface. Only in use for the inverter units.
11	Distributed I/O bus with CIO-02 modules for cooling fan monitoring and control.		

Overview of the control connections of the UCU control unit

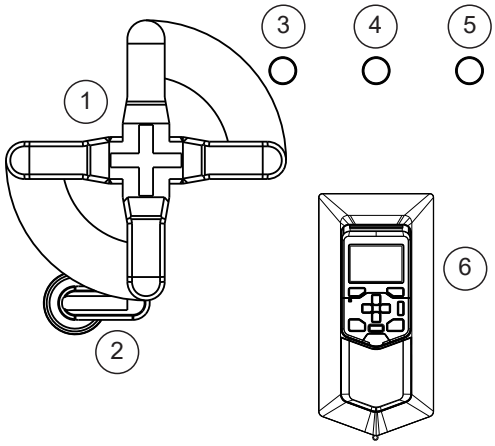
This diagram shows the control connections and interfaces of the UCU control unit.



1 2 3	Analog and digital I/O extension modules and fieldbus communication modules can be inserted into slots 1, 2 and 3.	7	Control panel
4	Memory unit	8	Fiber optic links to power modules (inverter, supply, brake or converter)
5	Slot 4 for RDCO module	9	Ethernet ports
6	Terminal blocks	10	Safety option interface. Reserved for future use.

Converter unit control devices

The figure shows an example of the door control devices of the DC/DC converter. The selection and exact location of control devices varies in different deliveries.



1	DC switch-disconnector (option +F286)
2	Charging switch (option +F286)
3	Charging OK indicator, green (option +F286)
4	DC/DC converter disconnected indicator, white (option +F286)
5	Load disconnected indicator, white
6	ACS-AP-W control panel (option +J400)

DC switch-disconnector

The DC switch-disconnector [Q11] is optional (option +F286). The DC switch-disconnector has an operating handle on the cabinet door. A converter unit with a DC switch-disconnector also has a charging circuit including a charging switch on the door.

The DC switch-disconnector allows the isolation of the unit from the DC bus. Before the unit is connected to the DC bus, the capacitors of the converter modules must be charged through a charging circuit.

Charging switch

A converter unit with a DC switch-disconnector ([Q11], option +F286) also has a charging circuit and a charging switch [Q10] on the cubicle door. Before closing the DC switch-disconnector, close the charging switch. After the precharging is completed, the Charging OK indicator [P11] (green) on the cabinet door comes on, and you can close the DC switch-disconnector [Q11], and open the charging switch.

Door lights

The load disconnected indicator ([P13], white) is always installed on the cabinet door. This indicator shows the state of the energy storage disconnecting device (user-defined).

The charging OK indicator ([P11], green) and DC/DC converter disconnected indicator ([P12], white) are installed when the converter has the DC switch-disconnector (option +F286).

Control panel [A59]

The control panel is the user interface of the unit. An example control panel is shown below.

With the control panel, the user can:

- start and stop the unit
- view and reset the fault and warning messages, and view the fault history
- view actual signals
- change parameter settings
- change between local (control panel) and remote (external device) control.

To be able to start and stop the unit with the control panel, the Run enable signal and Start enable signal must be on (1) on the supply control unit. Normally, this is the case when the operating switch [S21] on the cabinet door is in ENABLE/RUN (1) position. The control mode selection on the control panel must also be Local. The Loc/Rem key of the panel selects between the local and remote control modes.

PC connection

There is an USB connector on the front of the panel that can be used to connect a PC to the converter. When a PC is connected to the control panel, the control panel keypad is disabled.

Fieldbus control

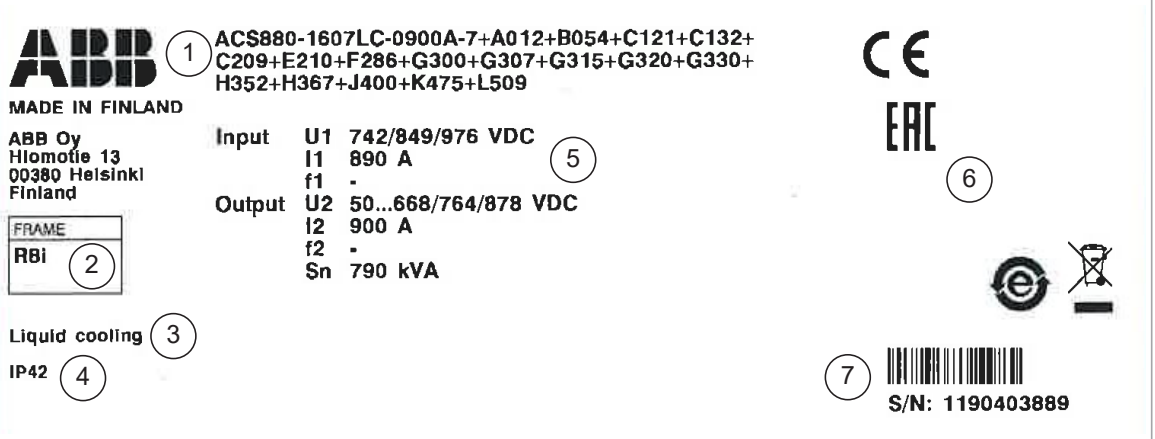
You can control the converter unit through a fieldbus interface if the unit is equipped with an optional fieldbus adapter, and when you have configured the control program for the fieldbus control with parameters. For more information on parameters, see ACS880 DC/DC converter control program firmware manual (3AXD50000024671 [English]).

Type designation labels

Type designation label of the DC/DC converter unit

Each converter unit has a type designation label attached onto the inside of the cubicle door. The type designation label includes the ratings, applicable markings, type designation and serial number of the unit.

An example label is shown below.

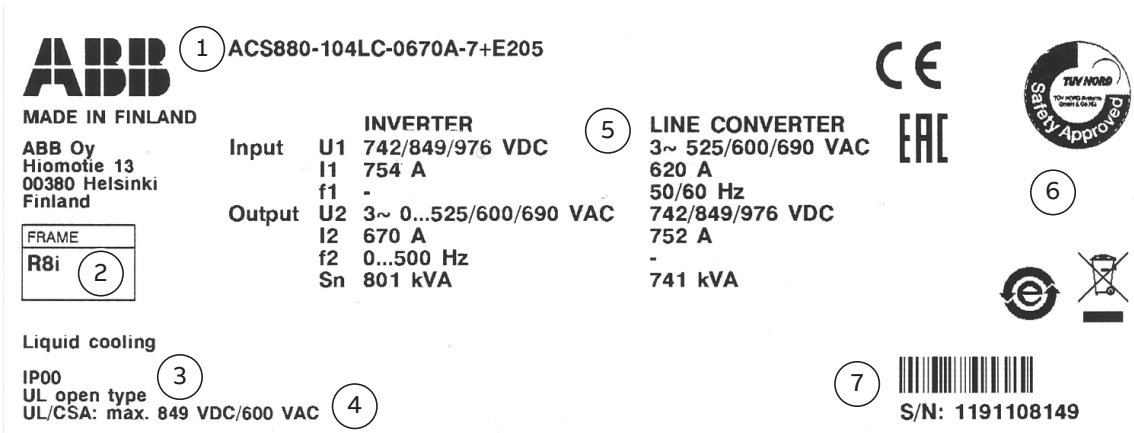


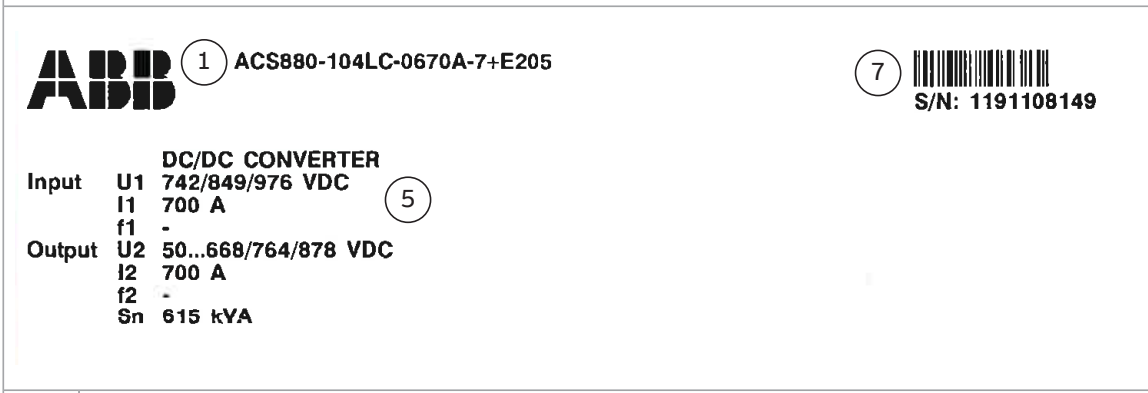
1	Type designation
2	Frame size
3	Cooling system and other additional data
4	Degree of protection
5	Ratings
6	Valid markings. See ACS880 liquid-cooled multidrives cabinets and modules electrical planning instructions (3AXD50000048634 [English]).
7	Serial number. The first digit of the serial number refers to the manufacturing plant. The next four digits refer to the unit's manufacturing year and week, respectively. The remaining digits complete the serial number so that there are no two units with the same number.

Type designation labels of the DC/DC converter module

Each DC/DC converter module has type designation labels attached to it. The type designation stated on the labels contains information on the specifications and configuration of the unit.

Example labels are shown below.



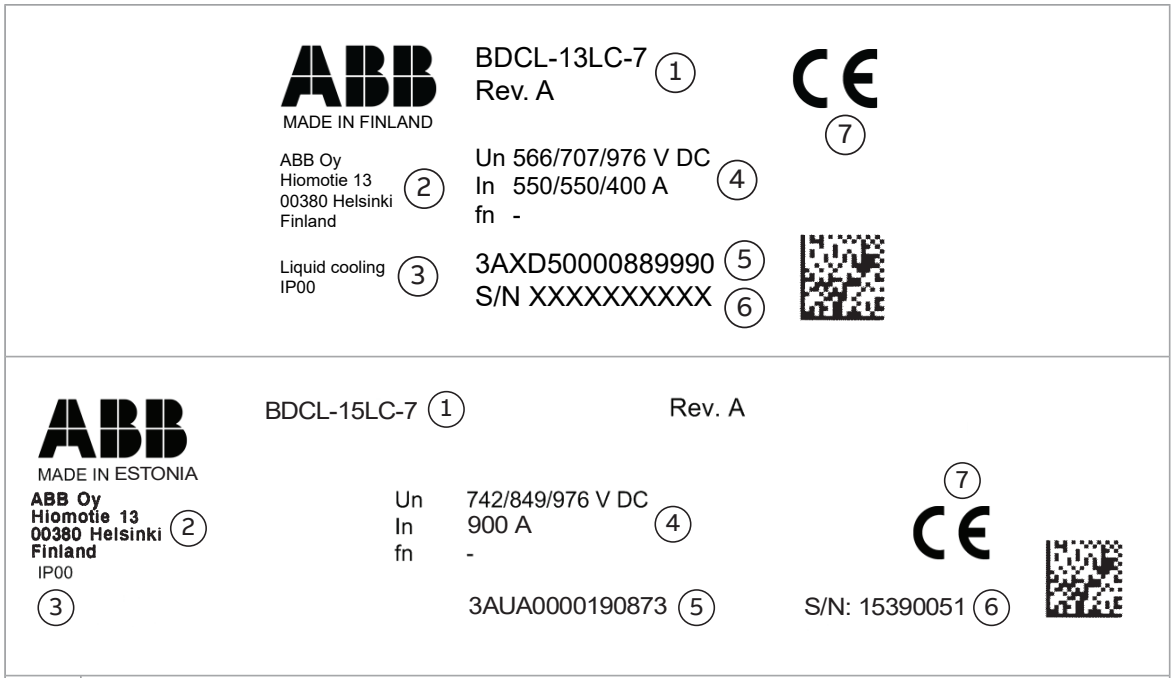


1	Type designation
2	Frame size
3	Degree of protection
4	UL/CSA data
5	Ratings
6	Valid markings. See ACS880 liquid-cooled multidrives cabinets and modules electrical planning instructions (3AXD50000048634 [English]).
7	Serial number. The first digit of the serial number refers to the manufacturing plant. The next four digits refer to the unit's manufacturing year and week, respectively. The remaining digits complete the serial number so that there are no two units with the same number.

Type designation label of the BDCL filter module

Each filter module has a type designation label attached to it.

Example labels are shown below.



1	Type designation
2	Manufacturer information
3	Degree of protection
4	Ratings
5	Code of the filter
6	Serial number
7	Valid markings. See ACS880 liquid-cooled multidrives cabinets and modules electrical planning instructions (3AXD50000048634 [English]).

Type designation key

Type designation key of the converter unit

The type designation contains information on the specifications and configuration of the converter unit. The first digits from left express the basic unit type. The optional selections are given thereafter, separated by plus signs, for example, +E202. Codes preceded by a zero (eg. +0J400) indicate the absence of the specified feature. The main selections are described below. Not all selections are available for all types. For more information, refer to the ordering instructions available separately on request.

Code	Description
Basic code	
ACS880	Product series

Code	Description
1607LC	Construction: cabinet-installed liquid-cooled DC/DC converter unit. When no options are selected: Supply frequency 50 Hz, control voltage 230 V AC, IP42, EN/IEC industrial cabinet construction, power and control cabling through the bottom of the cabinet, DC busbar material tin plated copper, cable supply conductors, standard wiring material, ACS880 DC/DC converter control program, complete documentation in English on a memory stick.
Size	
xxxxx	Refer to the ratings table in the technical data.
Voltage range	
5	DC voltage corresponding AC input voltages 3 ~ 380…500 V. This is indicated in the type designation label as typical input voltage level 566 / 679 / 707 V DC.
7	DC voltage corresponding AC input voltages 3 ~ 525…690 V. This is indicated in the type designation label as typical input voltage level 742 / 849 / 976 V DC.

Option codes

Code	Description
A012	50 Hz supply frequency
A013	60 Hz supply frequency
B054	IP42 (UL Type 1 Filtered)
B055	IP54 (UL Type 12)
C121	Marine construction
C129	UL Listed (evaluated to both U.S. and Canadian safety requirements)
C132	Marine type approval. Refer to ACS880…+C132 marine type-approved cabinet-built drives supplement (3AXD50000039629 [English]).
C134	CSA approved
C164	Plinth height 100 mm
C176	Door hinges on left
C179	Plinth height 200 mm
C205	Marine product certification issued by DNV GL
C206	Marine product certification issued by the American Bureau of Shipping (ABS)
C207	Marine product certification issued by Lloyd's Register (LR)
C209	Marine product certification issued by Bureau Veritas
C228	Marine product certification issued by China Classification Society (CCS)
C229	Marine product certification issued by Russian Maritime Register of Shipping (RS)
E205	d*u*/d*t* filtering
E208	Common mode filtering
E210	EMC/RFI filter for 2nd environment TN (grounded) or IT (ungrounded) system, category C3
F272	Internal charging circuit
F276	Capability of ride-through in voltage break max. 3 s. without tripping
F286	DC switch-disconnector
F290	DC switch-disconnector in DC feeder unit
G300	Cabinet and module heating elements (external supply)
G301	Cabinet lighting
G304	Control (auxiliary) voltage 115 V AC

Code	Description
G314	Aluminum busbars
G315	Tin-plated copper DC busbars
G320	Control (auxiliary) voltage 230 V AC
G330	Halogen-free wiring and materials
G338	Wire marking class A1
G339	Wire marking class A2
G340	Wire marking class A3
G341	Wire marking class B1
G342	Wire marking class C1
G353	Current transducers
G442	BAMU auxiliary measurement unit
G453	Common mode filter temperature monitoring
H352	Power cabling exit from bottom
H353	Power cabling exit from top
H358	Cable gland plates (3 mm steel, undrilled)
H364	Cable gland plates (3 mm aluminum, undrilled)
H365	Cable gland plates (6 mm brass, undrilled)
H367	Control cabling through floor of cabinet
H368	Control cabling through roof of cabinet
H390	Cable entry, 72 mm diameter
H394	Cable entry, Roxtec frame without sealing components
K490	FEIP-21 Ethernet adapter module for EtherNet/IP™
K491	FMBT-21 Ethernet adapter module for Modbus TCP
K492	FPNO-21 Ethernet adapter module for PROFINET IO
P913	Special color (RAL Classic)
P966	Special color (other than RAL Classic)
R700	Printed documents in English
R701	Printed documents in German[1)]
R702	Printed documents in Italian[1)]
R705	Printed documents in Swedish[1)]
R706	Printed documents in Finnish[1)]
R707	Printed documents in French[1)]
R708	Printed documents in Spanish[1)]
R711	Printed documents in Russian[1)]
R712	Printed documents in Chinese[1)]
V112	Module auxiliary and fan power supply connector change

1) The delivery can include documents in English if the requested language is not available.

Type designation key of the converter module

The type designation contains information on the specifications and configuration of the module. The first digits from left express the basic unit type. The optional selections are given thereafter, separated by plus signs, for example, +E205.

Code	Description
Basic code	
ACS880	Product series
104LC	Construction: Liquid-cooled inverter, supply, converter or brake module.
Size	
xxxxx	Refer to the ratings table in the technical data.
Voltage range	
5	DC voltage corresponding AC input voltages 3 ~ 380…500 V. This is indicated in the type designation label as typical input voltage level 566 / 679 / 707 V DC.
7	DC voltage corresponding AC input voltages 3 ~ 525…690 V. This is indicated in the type designation label as typical input voltage level 742 / 849 / 976 V DC.
Option codes	
C132	Marine type approval
C209	Marine product certification issued by Bureau Veritas
E205	Internal d*u*/d*t* filtering

Type designation key of the filter module

The type designation contains information on the specifications and configuration of the filter module. The digits express the module type.

Code	Description
Basic code	
BDCL-13LC	Liquid-cooled BDCL-13 filter
BDCL-14LC	Liquid-cooled BDCL-14 filter
BDCL-15LC	Liquid-cooled BDCL-15 filter
Voltage range	
7	BDCL-13LC: DC voltage corresponding AC input voltages 3 ~ 380…690 V. This is indicated in the type designation label as typical input voltage level 566 / 707 / 976 V DC. BDCL-14LC and BDCL-15LC: DC voltage corresponding AC input voltages 3 ~ 525…690 V. This is indicated in the type designation label as typical input voltage level 742 / 849 / 976 V DC.
Option codes	
G304	115 V auxiliary voltage supply
V112	Module auxiliary and fan power supply connector version. Type of the connector is not mechanically backwards compatible with a module without option +V112.

3

Mechanical installation

Contents of this chapter

This chapter gives information on the mechanical installation of the converter units.

DC/DC converter units

For instructions how to examine the installation site, move the unit and install the cabinet, refer to ACS880 liquid-cooled multidrives cabinets mechanical installation instructions (3AXD50000048635 [English]).

Energy storage

Obey the instructions of the energy storage manufacturer.

Internal cooling system

See chapter Internal cooling circuit.

4

Guidelines for planning electrical installation

Contents of this chapter

This chapter contains electrical planning instructions.

Limitation of liability

The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover.

- **North America**

Installations must be compliant with NFPA 70 (NEC)[1)] and/or Canadian Electrical Code (CE) along with state and local codes for your location and application.

[1)] National Fire Protection Association 70 (National Electric Code).

ABB is not responsible for the energy storage selection or protection of the energy storage.

Generic guidelines

Refer to ACS880 liquid-cooled multidrives cabinets and modules electrical planning instructions (3AXD50000048634 [English]) for the generic guidelines for planning the electrical installation (selecting cables, routing cables, etc.) of multidrives cabinets and modules.

Selecting the energy storage

The energy storage is not included in the drive delivery. The customer (or the system integrator) must acquire a suitable energy storage system. The customer (or the system integrator) is also responsible for the protection of the energy storage. Additional guidelines:

- Connect parallel modules (if any) to the same energy storage.
- If the DC feeder unit has parallel strings, connect each string to a separate energy storage.
- Dimension the energy storage so that it withstands the required current cycles and the stored energy is sufficient. Take the depth of discharge into account in energy storage lifetime calculations.
- Make sure that the energy storage withstands the current ripple of the converter. See the technical data.
- The output voltage (energy storage voltage) is not allowed to exceed the drive DC bus voltage. Add sufficient voltage margin in the design to prevent this in case of voltage dips or grid faults.
- The recommended energy storage operating voltage is:
  U_{ES} = 150 V … 80% of U_{DC}
- Typical DC voltage values:
  - with diode supply units:
    $U_{DC} = 1.35 \times U_{AC}$
  - with IGBT supply units:
    $U_{DC} = 1.41 \times U_{AC}$ (can be changed with supply unit parameter group 123 DC volt ref.
  - where
    U_{DC} = Drive DC voltage (in the DC bus)
    U_{AC} = Drive input voltage (AC)
- ABB recommends to measure the energy storage voltage. If the energy storage is a super capacitor, voltage measurement is obligatory unless the capacitor withstands the maximum DC voltage of the drive or contains internal overvoltage protection.
  If the converter has the optional BAMU voltage/current measurement unit, the converter measures its output voltage (and thus also the energy storage voltage) automatically.
  If the converter does not have a BAMU, you must arrange the voltage measurement separately, and send the measured value to the converter control program, for example, through fieldbus communication or by some other means.
  For more information, see section Energy storage voltage measurement and estimation and parameter description in ACS880 DC/DC converter control program firmware manual (3AXD50000024671 [English]).
- Equip the energy storage with a circuit breaker capable of opening the circuit if there is a failure in the energy storage or cable. See Selecting a protective device for the energy storage and Energy storage disconnecting (isolating) device.

Implementing protections for the energy storage

General principles

The requirements for the customer-defined protections at the energy storage end:

- disconnecting device between the drive and energy storage system (for example, isolation disconnector switch, withdrawable circuit breaker)
- overload and short circuit protection for the cabling (for example, circuit breaker with thermal or electromagnetic trip unit)
- overload and short circuit protection for the energy storage elements itself (for example, integrated overload protection in batteries).

Selecting a protective device for the energy storage

The customer (or the system integrator) must equip the energy storage with a protective device. The protective device is not included in the drive delivery.

The protective device must provide an overload and short-circuit protection for the energy storage. If there is no other protection device for the cables at the energy storage end, the protective device of the energy storage must also provide the overload and short-circuit protection for the cable(s).

The customer (or the system integrator) must verify the operation of the protective device by short circuit calculations taking into account the impedances of the drive, filter (if any), cabling and energy storage, and minimum and maximum state of charge of the energy storage. The customer (or the system integrator) must take into account the impact of aging to storage impedances.

Energy storage disconnecting (isolating) device

The customer (or the system integrator) must equip the energy storage with an disconnecting (isolating) device. The disconnecting device is not included in the drive delivery.

Overload protection of the system by the DC/DC converter

There is a thermal protection function in the DC/DC converter control program. For more information on the thermal protection function, see the firmware manual.

Protecting the energy storage cable

There must be protective devices on the two ends of the energy storage cable:

- output DC fuses in the DC/DC converter unit (installed by ABB the factory)
- energy storage protective device (must be acquired and installed by the customer or system integrator).

On the converter side of the cable, the output DC fuses protect the DC/DC converter and the cable in a short-circuit situation.

On the energy storage side of the cable, the energy storage protective device protects the energy storage and the cable in a short-circuit or overload situation.

Energy storage discharging device

When necessary, the customer (or the system integrator) must equip the energy storage with a discharging device. If the energy storage is a super capacitor, ABB recommends to install a discharging device.

Implementing earth fault protection

If the converter unit does not have a built-in earth fault protection system, the customer (or the system integrator) must install an earth fault protection device and connect it to the converter unit.

The DC/DC converter control program can be configured to trip on a fault or give a warning when external earth leakage is detected. For more information, refer to the firmware manual.

Implementing an interlocking between the disconnecting devices

The customer (or the system integrator) must implement an interlocking circuit between the DC switch-disconnector of the drive [Q11] and the energy storage disconnector (isolator). The user must not be able to close the energy storage disconnector (isolator) before closing the DC switch-disconnector of the drive [Q11].

Selecting and routing the energy storage cables

Cable selection procedure

Select each power cable as follows. Obey the local regulations.

1. Select the cable type. Obey the general guidelines and recommendations for the drive power cabling.
2. Select the cable size.
   Cabinet-installed multidrives: Refer to the listing of typical power cable sizes given in the technical data of the multidrives unit hardware manual.
3. Make sure that the short-circuit rating of the cable is sufficient. Take into account the disconnection time of the protective device. If the rating is not sufficient, select a larger cable, increase the number of parallel cables or change the cable to a type with higher conductor temperature rating.
4. Select the cable lugs.
5. Make sure that the cable can enter the cabinet through the cable entry plate.
   Cabinet-installed multidrives: Refer to the dimension drawings of the drive delivery or technical data in the multidrives unit hardware manual. For special cable entry solutions, consult ABB.
6. Make sure that there is sufficient space to install the cable(s) and cable lugs to the terminals.
   Cabinet-installed multidrives: Refer to the terminal and cable entry data given in the technical data of the multidrives unit hardware manual.

Recommended cables

The customer (or the system integrator) must acquire and connect the energy storage cables. It is possible to use shielded cables with 2, 3 or 4 conductors. ABB recommends to use shielded cables with 4 conductors.

Refer to the table below for the cables and possible configurations.

Cable type	Positive	Negative	PE (ground)
2-conductor shielded cable	1 conductor	1 conductor	Shield[1)]
3-conductor shielded cable	1 conductor	1 conductor	1 conductor + shield
4-conductor shielded cable	2 conductors	2 conductors	Shield[1)]

1) The shield must meet the requirements of IEC 61439-1. If the shield does not meet the requirements, an additional PE conductor or cable is required.

ABB does not recommend to use single core cables. If it necessary to use single core cables, obey these guidelines:

- Use shielded cables. Ground the cable shields only at one end.
- Put the cables in groups of 2 or 4.
- Attach the cables according to the requirements to withstand the apparent short circuit forces.

Typical cable sizes

See the technical data.

Minimizing electromagnetic interference

The customer (or the system integrator) must obey these rules in order to minimize the electromagnetic interference caused by rapid current changes in the energy storage cables:

- Shield the energy storage cabling completely, either by using shielded cable or a metallic enclosure. Unshielded single-core cable can only be used if it is routed inside a cabinet that efficiently suppresses radiated emissions.
- Install the cables away from other cable routes.
- Avoid long parallel runs with other cables. The minimum recommended separation distance for parallel cabling is 0.3 m (1 ft).
- Cross other cables at right angles.

Keep the cable as short as possible in order to minimize the radiated emissions and stress on converter IGBT semiconductors. The longer the cable, the higher the radiated emissions, inductive load and voltage peaks over the IGBTs of the DC/DC converter.

Maximum cable length

Refer to the technical data.

EMC compliance of the complete installation

ABB has not verified that the EMC requirements are fulfilled with external energy storage and its cabling. The EMC compliance of the complete installation must be considered by the customer (or the system integrator).

Parallel connection

It is possible to connect multiple DC/DC converter units in parallel. In the parallel connection, both the inputs and the outputs of the units must be connected together. The inputs are connected through the common DC bus of the drive as standard. The outputs (ES+ to ES+, ES- to ES-) must be connected together at the energy storage end by the customer (or the system integrator).

The customer (or the system integrator) must make sure that the load sharing is even between the parallel units. Depending on the case, this may require additional parameter tuning in DC/DC converter control programs of both units:

- If the operating mode selection (parameter 197.13) is Power or Add: The load between the units is inherently shared according to the power or current references. No additional settings are required.
- If the operating mode selection (parameter 197.13) is DC voltage: Tune the load sharing using the droop control function.
- Master/follower operation of the parallel units: The control program does not support the master/follower link between several units. However, it is possible to implement the Master/follower operation with an external PLC. In that case, one DC/DC converter unit, the master unit, operates in the DC voltage control mode and the other unit(s) in power control mode. The external PLC reads the output current reference of the master unit, and uses it as the current reference of the follower units.

The load sharing during an overvoltage or undervoltage control of the DC/DC converter can require tuning of the DC voltage offset value between the parallel units. See the firmware manual for details.

The customer (or the system integrator) must pay special attention to the protection concept in case of parallel units. The protection must operate reliably in all possible fault cases.

5

Electrical installation

Contents of this chapter

This chapter contains instructions on wiring the converter units.

Note: The instructions do not cover all possible cabinet constructions and energy storage media.

Safety

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

Electrical safety precautions

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

This procedure gives information on how to de-energize the drive and make it safe to do work on it. The procedure does not include all possible drive configurations. Each drive is made to order. Always refer to the circuit diagrams of the drive delivery.

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

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

Do these steps before you begin any installation or maintenance work.

1. Prepare for the work.
   - Make sure that you have a work order.
   - Do an on-site risk assessment or job hazard analysis.
   - Make sure that you have the correct tools available.
   - Make sure that the workers are qualified.
   - Select the correct personal protective equipment (PPE).
   - Stop the motor(s).
2. Clearly identify the work location and equipment.
3. Disconnect all possible voltage sources. Make sure that re-connection is not possible. Lock out and tag out.
   - Open the disconnecting device of the energy storage connected to the DC/DC converter unit. The disconnecting device is outside the drive cabinet. Then open the DC switch-disconnector ([Q11], option +F286 or +F290) of the unit.
   - Open the main disconnecting device of the drive.
   - Open the charging switch if present.
   - Open the disconnector 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.)
   - 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 switch-disconnector 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.
   - Open the main isolating device of the drive.
   - Disconnect all 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 other energized parts in the work location against contact and take special precautions when close to bare conductors.
5. Measure that the installation is de-energized. Use a quality voltage tester. 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).
   - Before and after you measure the installation, verify the operation of the voltage tester on a known voltage source.
   - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is zero.
   - Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is zero.

     Important! Repeat the measurement also with the DC voltage setting of the tester. Measure between each phase and ground. There is a risk of dangerous

DC voltage charging due to leakage capacitances of the motor circuit. This voltage can remain charged for a long time after the drive power-off. The measurement discharges the voltage.

- Make sure that the voltage between the drive DC busbars and the grounding (PE) busbar is zero.
- Make sure that the voltage between the energy storage terminals of the DC/DC converter unit (ES+ and ES-) and the grounding (PE) busbar is zero.

WARNING!
The busbars inside the cabinet of liquid-cooled drives 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.

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

Measuring the insulation resistance of the DC cabling

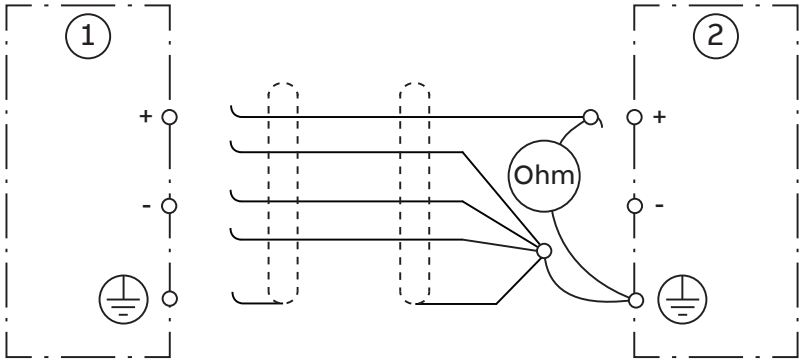
WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

WARNING!
Before you measure the insulation resistance of the DC cabling, open the DC switch/disconnector [Q11] of the converter unit. Also make sure that the charging switch [Q10] is open.

WARNING!
Do not do voltage withstand or insulation resistance tests on the drive. The tests can cause damage to the drive. Every drive is tested for insulation between the main circuit and the chassis at the factory. Also, there are voltage-limiting circuits inside the drive which cut down the testing voltage automatically.

Measure the insulation resistance of the DC cabling as follows:

1. Make sure that the cable is disconnected at the drive end and at the other end. All conductors and the cable shield must be disconnected.
2. At the drive end, connect all conductors and shield of the cable together and to the grounding busbar (PE).
3. Disconnect one conductor and measure the insulation resistance between the conductor and the grounding busbar (PE). Use a measuring voltage of 1 kV DC. The insulation resistance must be higher than 1 Mohm.
4. Disconnect another conductor and measure its insulation resistance. Do this for all remaining conductors (including the cable shield).



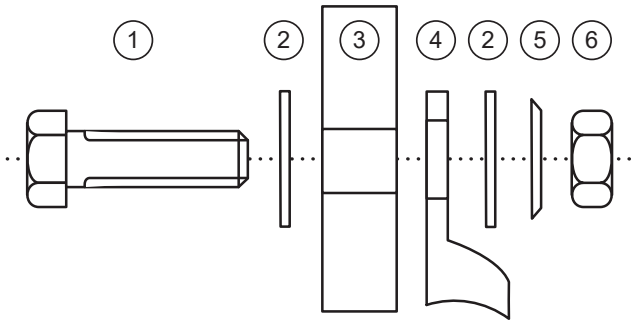
1	Energy storage
2	Converter unit

Connecting the energy storage cable and load disconnected indicator cable

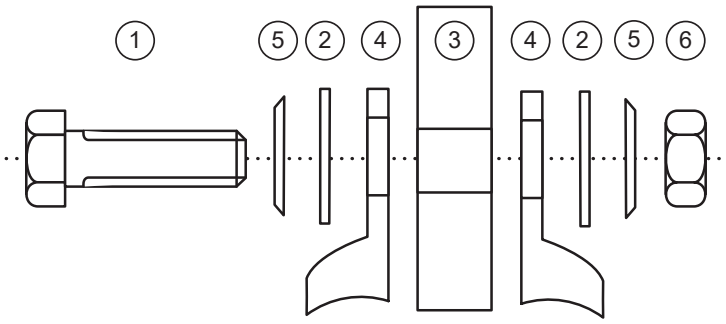
Use of fasteners in cable lug connections

Use the bolts, nuts and washers delivered with the drive. Install all the fasteners in the correct order. See the figure below. Tighten the cable lug to the torque specified for the connection.

Cable lug on one side of the busbar



Cable lugs on both sides of the busbar

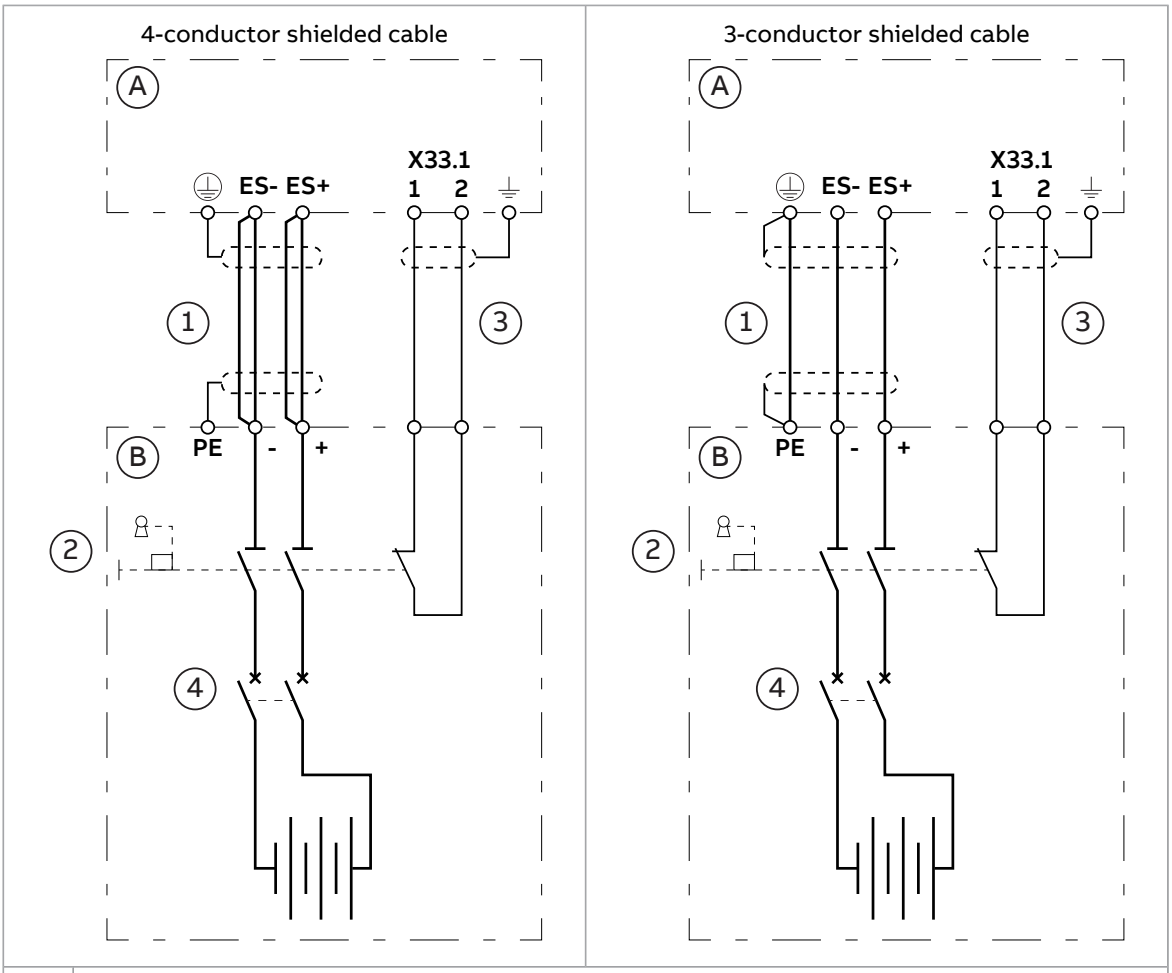


1	Bolt	4	Cable lug
2	Plain washer	5	Spring washer
3	Busbar	6	Nut

Connection diagram

If the converter unit has parallel modules, each module must have its own output cables. The cables must also be identical (cable type, cross-sectional area, and length must be the same).

This diagram shows the connections between the DC/DC converter unit and an energy storage.



A	DC/DC converter unit
B	Energy storage
1	Shielded 3-conductor or 4-conductor cable and 360° grounding of the cable shield at the cable entry. If you use parallel cables, make sure they are identical (type, cross-sectional area, length are the same). If you use a 4-conductor cable, a separate PE conductor or cable is required if the shield conductivity does not meet the requirements of IEC 61439-1.
2	Disconnecting device
3	Connection to load disconnected indicator [P13.x] on the cabinet door
4	Protective circuit breaker

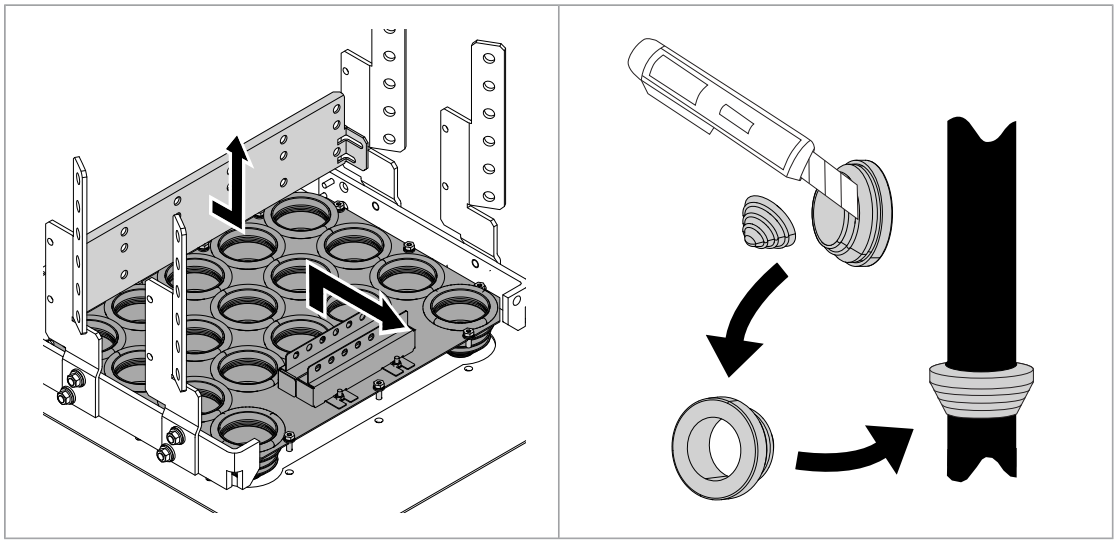
Connection procedure of the energy storage cables

This section describes the power cable connecting procedure for a bottom cable entry with the standard cable entry plate. The standard cable entry plate has conductive sleeves for 360° grounding of the cable shields. If the drive or unit has another type of cable entry plate, such as a Roxtec cable entry plate (option +H394), or cable gland

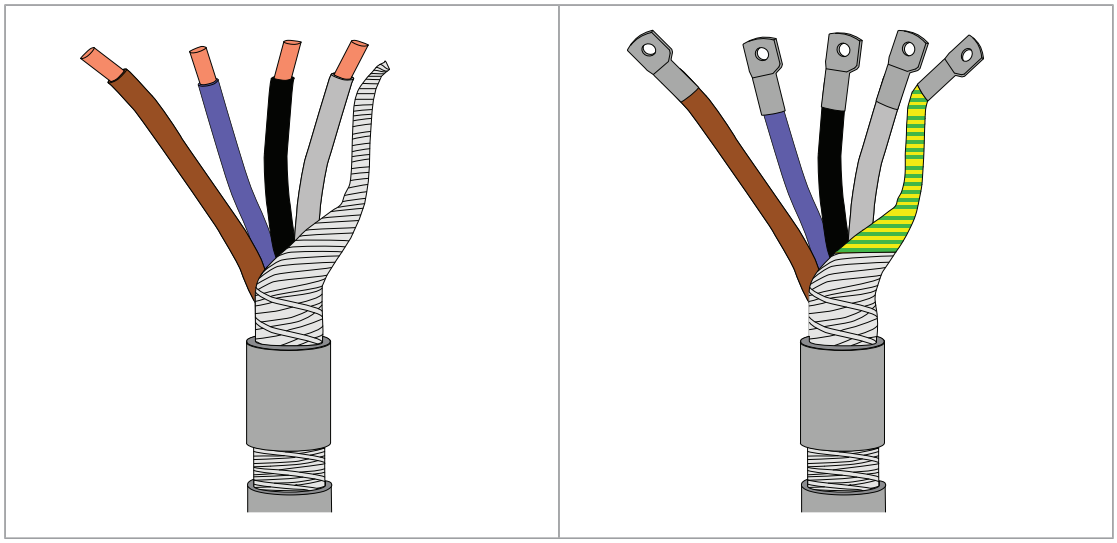
plate (option +H358), refer also to the instruction of the related non-ABB installation accessories. For example, the Roxtec instructions or the instructions by the cable gland manufacturer.

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Open the door of the DC/DC converter cubicle and remove the shrouding (if any).
3. IP54 cabinet: Remove the rear horizontal cable support and the cable entry plate.
   IP54 cabinet: Remove a sealing grommet from the cable entry plate for each cable. Cut hole into the rubber grommet and slide it onto the cable.

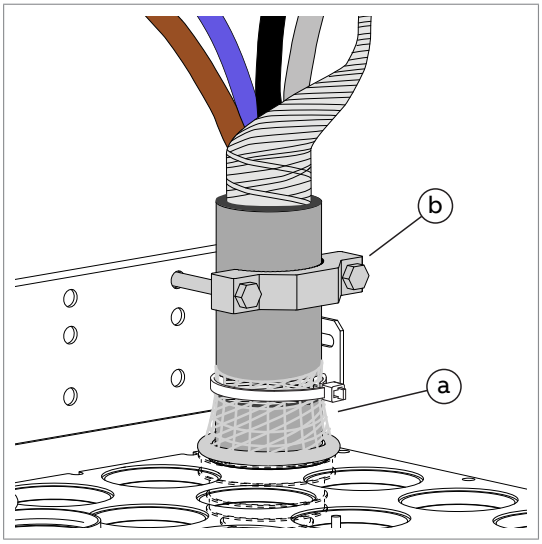


4. Lead the cables inside the cabinet through the cable entry plate. If there are several cables, use the rear 3 holes first.
   IP54 cabinet: Attach the the sealing grommets to the cable entry plate. Attach also the cable entry plate, and the cable support.
5. For each cable, strip off 3…5 cm (1.2 … 2 inches) of the outer insulation above the cable entry plate. Strip also the end of the cable, and the end of the conductors. Twist the shield to form a PE conductor, and mark it with yellow-green tape or heat-shrink tubing.
6. For each cable, attach cable lugs at the end of the PE conductor (twisted shield) and other conductors.



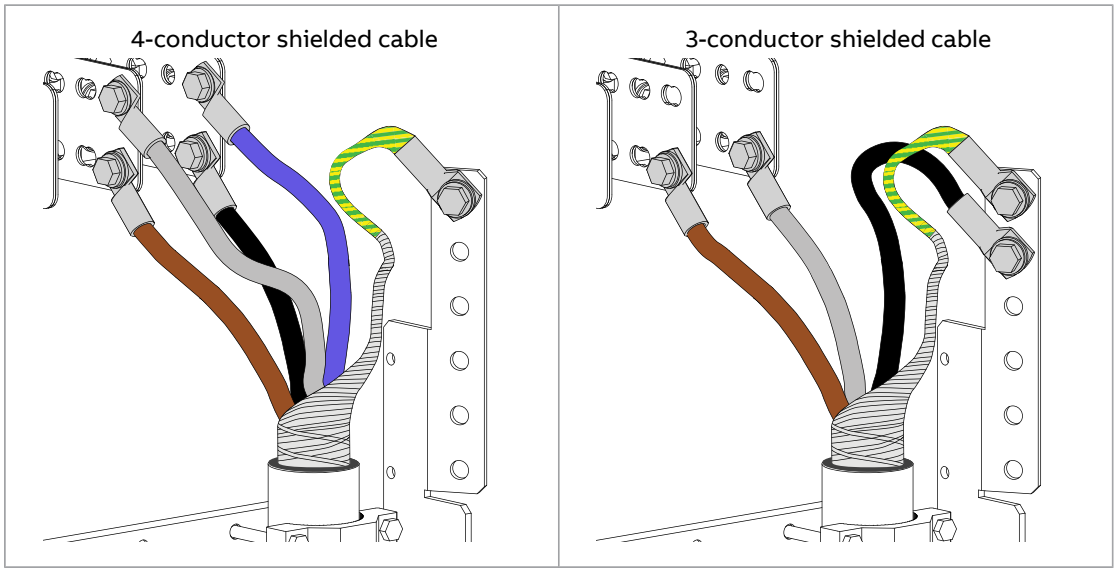
WARNING!
Apply grease to stripped aluminum conductors before you attach them to non-coated aluminum cable lugs. Obey the grease manufacturer's instructions. Aluminum-aluminum contact can cause oxidation in the contact surfaces.

7. For each cable, attach the conductive sleeve (a) to the bare cable shield with a cable tie. Attach the cable to the support bracket with a clamp (b).



8. For each cable, connect the positive conductor(s) to terminal ES+, and the negative conductor(s) to terminal ES-. Connect the cable shield to the PE busbar. If you use a 3-conductor cable, connect one conductor to the PE busbar. Use the bolts, nuts, and washers included in the delivery, and the connection method specified in Use

of fasteners in cable lug connections (page 52). Tighten the fasteners to the torque given in the technical data.



9. If there are more than 3 cables, attach additional cable support brackets for them.
10. Lead the load disconnected indicator cable inside the cubicle and connect it to the applicable terminals. For more information, refer to the control cable connection instructions.
11. Install the shrouding removed earlier and close the cubicle doors.
12. At the energy storage, connect the cables according to the instructions of the energy storage manufacturer.

Connecting the control cables

See the control unit chapter for the default I/O connections. Note that the default I/O connections can be affected by some options. See the circuit diagrams delivered with the drive for the actual wiring.

Control cable connection procedure

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

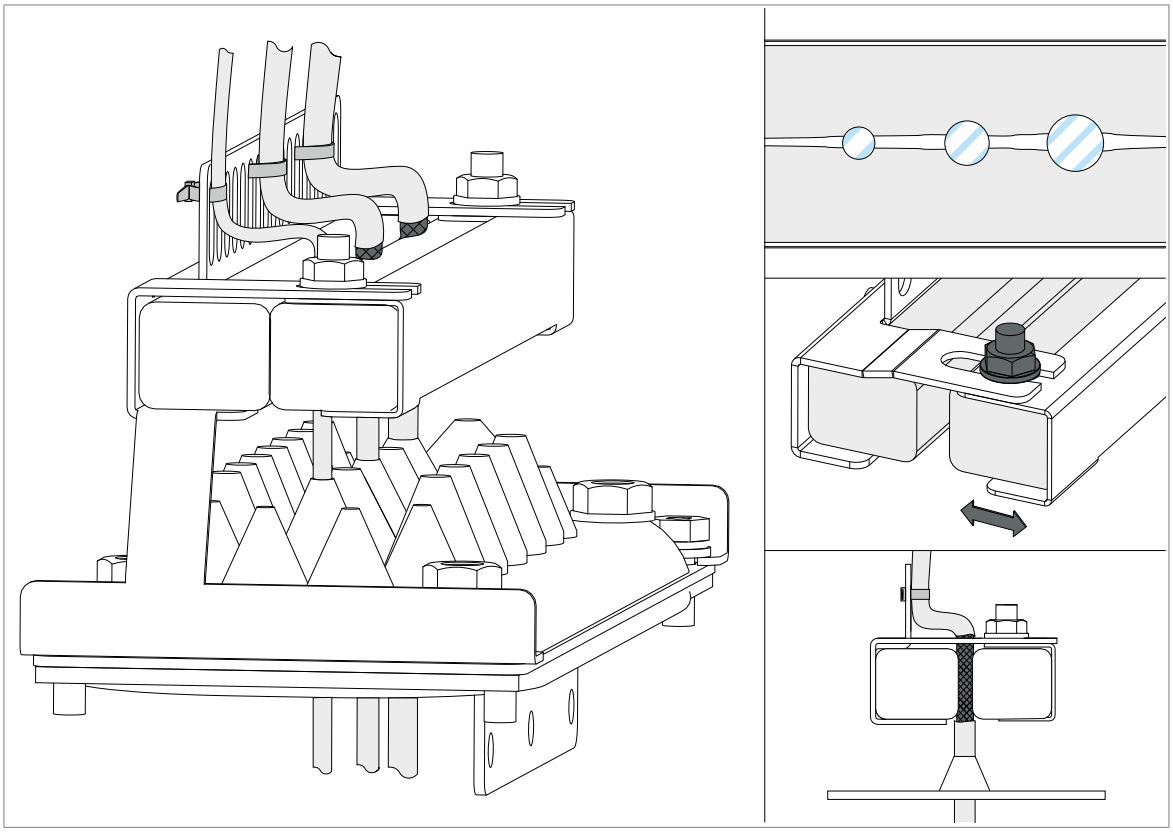
1. Stop the drive (if running) and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Put the control cables into the cabinet as described in section Grounding the outer shields of the control cables 360° at the cabinet entry (page 57).

3. Route the control cables as described in section Routing the control cables inside the cabinet (page 59).
4. Connect the control cables as described in section Connecting control cabling (page 59).

Grounding the outer shields of the control cables 360° at the cabinet entry

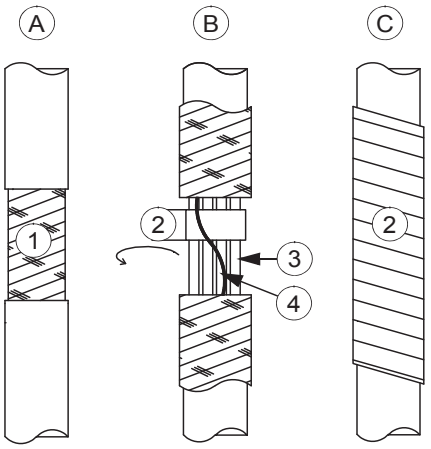
Ground the outer shields of all control cables 360° with the EMI conductive cushions at the cabinet entry. The grounding principle is the same for top and bottom entry cables. The figures show the bottom entry. The actual design details can vary.

1. If necessary, temporarily remove the shrouding in front of the cable entry.
2. Put the cables in sequence from the smallest to the largest. This will help to achieve a good contact with the cushions.
3. Loosen the tightening bolts of the EMI conductive cushions and pull them apart.
4. Cut holes in the grommets and put the cables through the grommets.
5. Peel the insulation from the part of the cable that will be in contact with the EMI conductive cushion.
6. Put the cables between the cushions and attach them with cable ties for strain relief.
7. Move the cushions back together.
8. Tighten the bolts to make sure that the EMI conductive cushions press tightly around the peeled part of the cables.



If the outer surface of the shield is non-conductive:

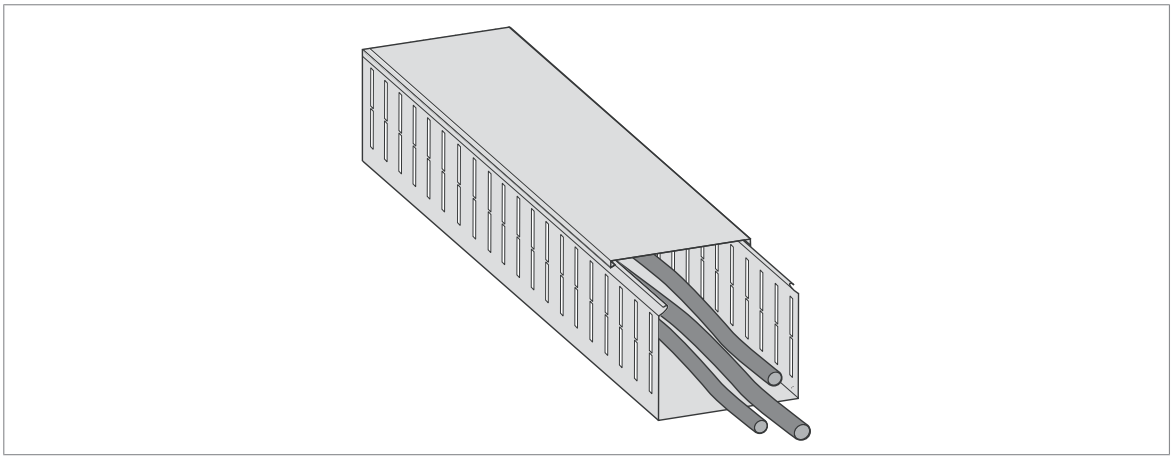
- Cut the shield at the midpoint of the peeled part. Be careful not to cut the conductors or the grounding wire.
- Turn the conductive side of the shield inside out over the insulation.
- Cover the exposed shield and the peeled cable with copper foil to keep the shielding continuous.



A	Stripped cable
B	Conductive surface of the shield exposed
C	Stripped part covered with copper foil
1	Cable shield
2	Copper foil
3	Shielded twisted pair
4	Grounding wire

Routing the control cables inside the cabinet

Use the existing trunking in the cabinet where possible. Use sleeving if cables are laid against sharp edges. When running cables to or from a swing-out frame, leave enough slack at the hinge to allow the frame to open fully.



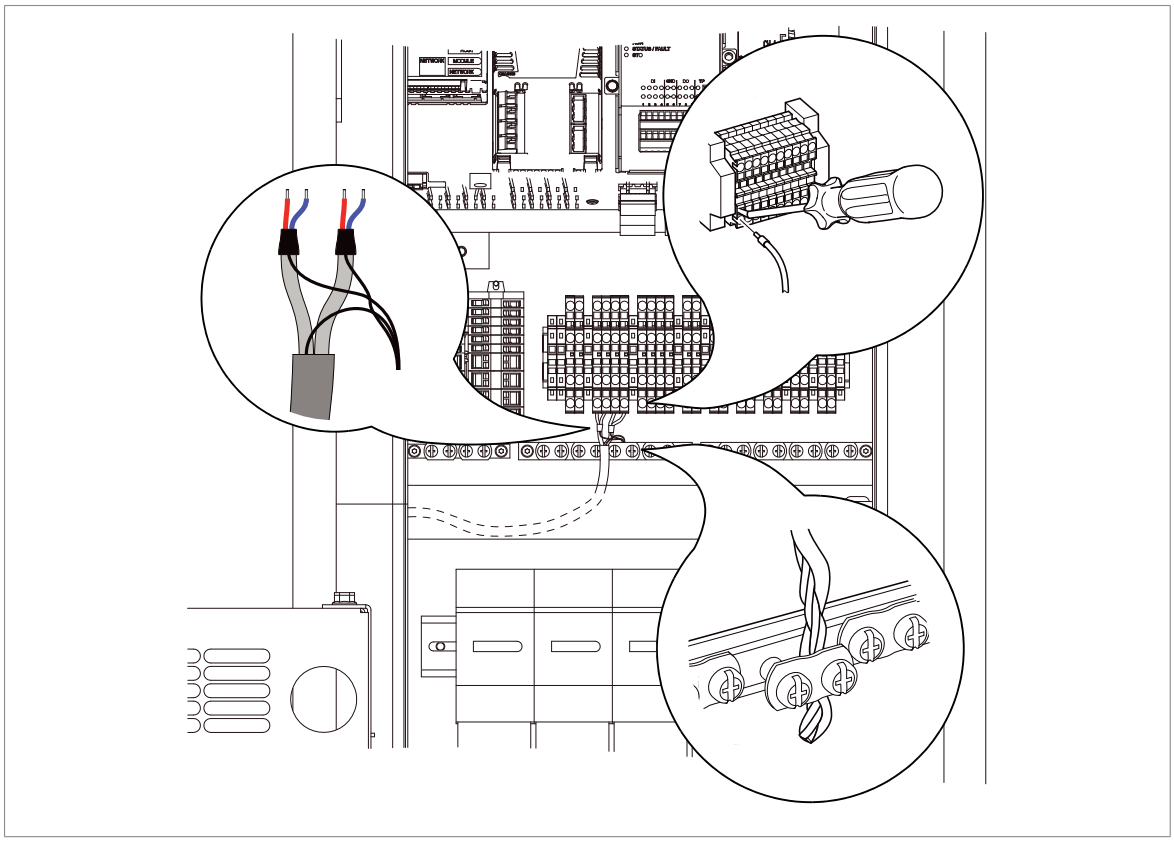
Connecting control cabling

Connect the conductors to the appropriate terminals. Refer to the wiring diagrams delivered with the drive.

Obey these instructions:

- Connect the inner twisted pair shields and all separate grounding wires to the grounding clamps near the terminals.
- Ground the outer shield of the cable at the cable entry, not at the grounding clamps near the terminals.
- Keep any signal wire pairs twisted as close to the terminals as possible. Twisting the wire with its return wire reduces disturbances caused by inductive coupling.
- At the other end of the cable, leave the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, eg. 3.3 nF / 630 V. The shield can also be grounded directly at both ends if they are in the same ground line with no significant voltage drop between the end points.

The drawing below represents the grounding of the control cabling when connecting to a terminal block inside the cabinet. The grounding is done in the same way when connecting directly to a component such as the control unit.



Installing option modules

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

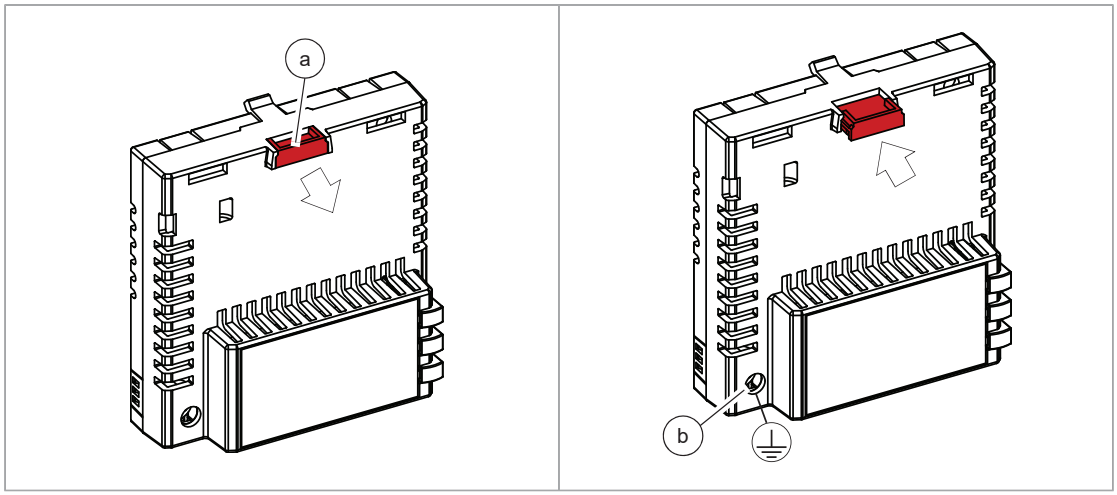
Pay attention to the free space required by the cabling or terminals coming to the option modules.

1. Do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Pull out the lock (a) with a screw driver.

   Note: The location of the lock depends on the module type.
3. Install the module to a free option module slot on the control unit.
4. Push in the lock (a).
5. Tighten the grounding screw (b) to a torque of 0.8 N·m (7 lbf·in).

Note: The screw tightens the connections and grounds the module. It is essential for fulfilling the EMC requirements and for proper operation of the module.

WARNING!
Do not use excessive force, or leave the screw too loose. Over-tightening can cause damage to the screw or module. A loose screw can cause an operation failure.



6. Connect the wiring to the module. Obey the instructions given in the documentation of the module.

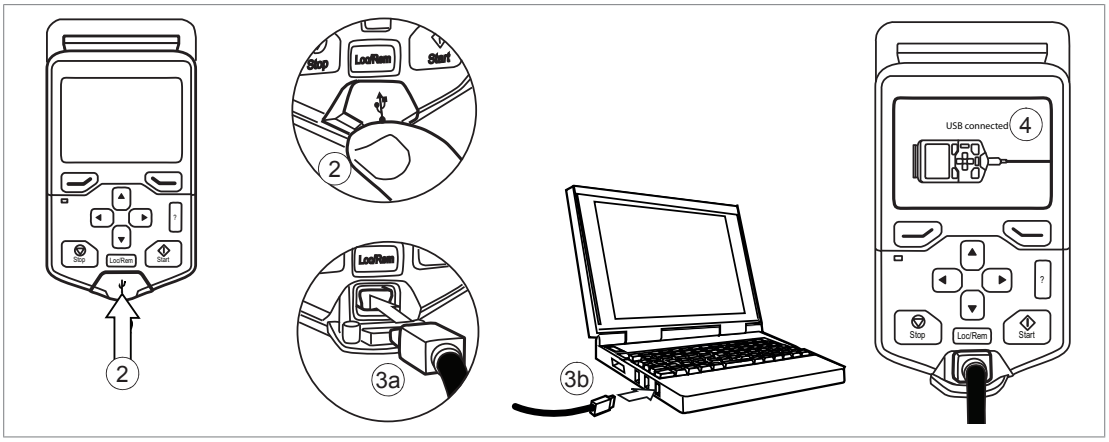
If you need to remove the option module after it has been installed into the drive, use a suitable tool (e.g. small pliers) to carefully pull out the lock.

Connecting a PC

WARNING!
Do not connect the PC directly to the control panel connector of the control unit. It can cause damage.

A PC (with, for example, the Drive Composer PC tool) can be connected as follows:

1. To connect a control panel to the unit, either
   - insert the control panel into the panel holder or platform, or
   - use an Ethernet (eg, Cat 5e) networking cable.
2. Remove the USB connector cover on the front of the control panel.
3. Connect an USB cable (Type A to Type Mini-B) between the USB connector on the control panel (3a) and a free USB port on the PC (3b).
4. The panel will display an indication whenever the connection is active.
5. See the documentation of the PC tool for setup instructions.


Stop
Loc/Rem
Start
2
2
3a
3b
USB connected
4
Stop
Loc/Rem
Start

6

The control unit

Contents of this chapter

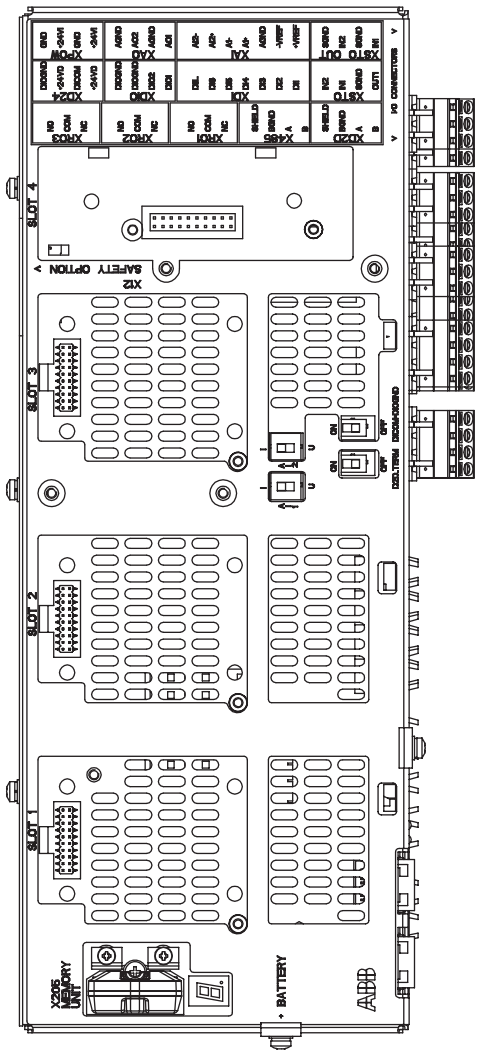
This chapter

- describes the connections of the control unit
- contains the specifications of the inputs and outputs of the control unit.

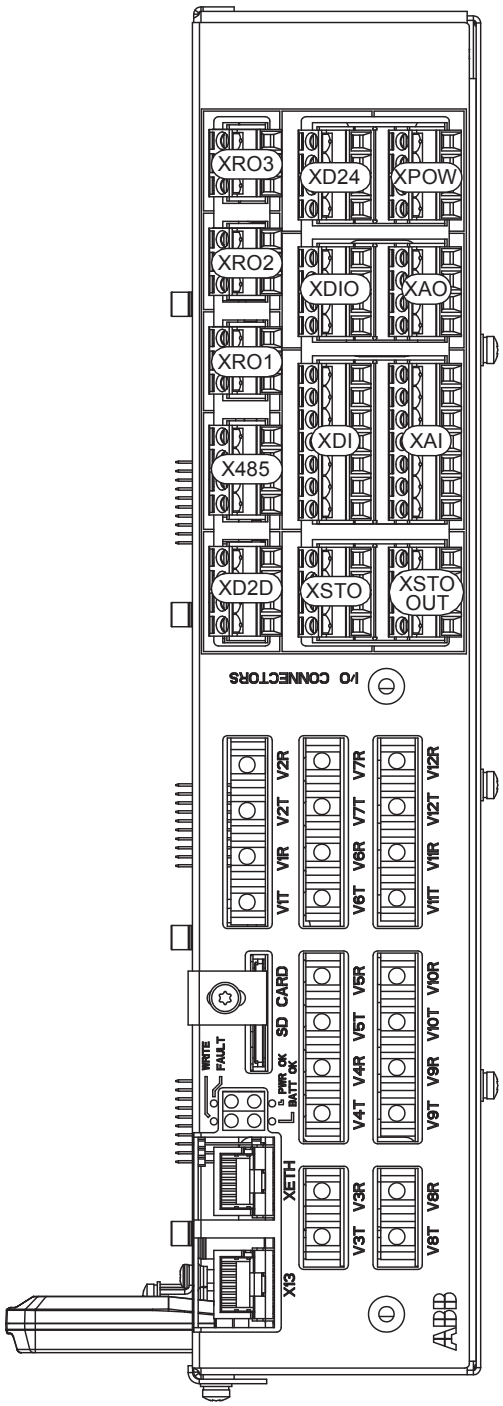
General

A BCU or UCU control unit controls the converter unit. The control unit is connected to the converter module(s) through fiber optic cables.

BCU layout

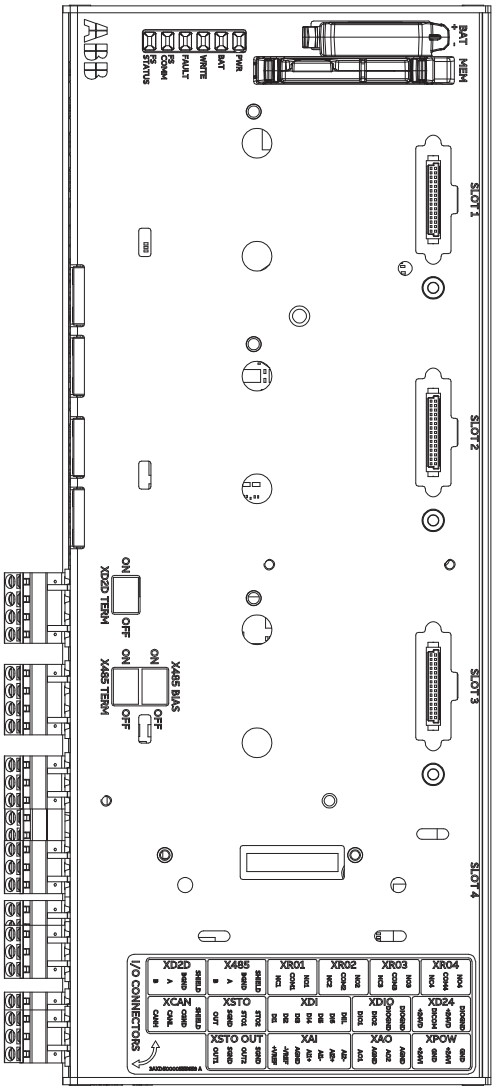


	Description
I/O	I/O terminals (see following diagram)
SLOT 1	I/O extension, encoder interface or fieldbus adapter module connection. (This is the sole location for an FDPI-02 diagnostics and panel interface.)
SLOT 2	I/O extension, encoder interface or fieldbus adapter module connection
SLOT 3	I/O extension, encoder interface, field-bus adapter or FSO safety functions module connection
SLOT 4	RDCO-0x DDCS communication option module connection
X205	Memory unit connection
BATTERY	Holder for real-time clock battery (BR2032)
AI1	Mode selector for analog input AI1 (I = current, U = voltage)
AI2	Mode selector for analog input AI2 (I = current, U = voltage)
D2D TERM	Termination switch for drive-to-drive link (D2D)
DICOM= DIOGND	Ground selection. Determines whether DICOM is separated from DIOGND (ie. the common reference for the digital inputs floats). See the ground isolation diagram.
7-segment display Multicharacter indications are displayed as repeated sequences of characters	
	(“U” is indicated briefly before “o”.) Control program running
	Control program startup in progress
	(Flashing) Firmware cannot be started. Memory unit missing or corrupted
	Firmware download from PC to control unit in progress
	At power-up, the display may show short indications of eg. “1”, “2”, “b” or “U”. These are normal indications immediately after power-up. If the display ends up showing any other value than those described, it indicates a hardware failure.



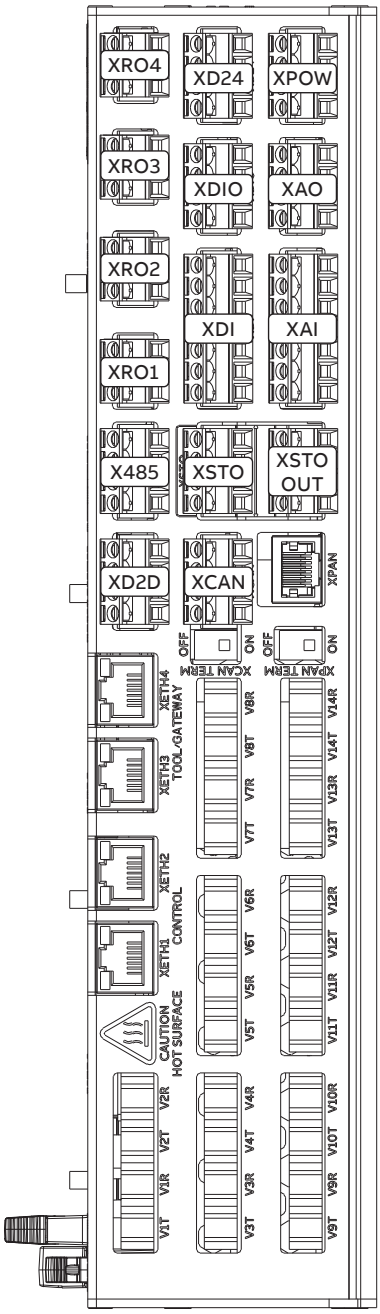
	Description
XAI	Analog inputs
XAO	Analog outputs
XDI	Digital inputs, Digital input interlock (DIIL)
XDIO	Digital input/outputs
XD2D	Drive-to-drive link
XD24	+24 V output (for digital inputs)
XETH	Ethernet port – Not in use
XPOW	External power input
XRO1	Relay output RO1
XRO2	Relay output RO2
XRO3	Relay output RO3
XSTO	Safe torque off connection (input signals)
XSTO OUT	Safe torque off connection (to inverter modules)
X12	(On the opposite side) Not in use
X13	Control panel / PC connection
X485	Connection to CIO-01
V1T/V1R, V2T/V2R	Fiber optic connection to modules 1 and 2 (VxT = transmitter, VxR = receiver)
V3T/V3R … V7T/V7R	Fiber optic connection to modules 3…7 (BCU-12/22 only) (VxT = transmitter, VxR = receiver)
V8T/V8R … V12T/V12R	Fiber optic connection to modules 8…12 (BCU-22 only) (VxT = transmitter, VxR = receiver)
SD CARD	Data logger memory card for inverter module communication
BATT OK	Real-time clock battery voltage is higher than 2.8 V. If the LED is off when the control unit is powered, replace the battery.
FAULT	The control program has generated a fault. See the firmware manual of the supply/inverter unit.
PWR OK	Internal voltage supply is OK
WRITE	Writing to memory card in progress. Do not remove the memory card.

UCU-22...24 layout

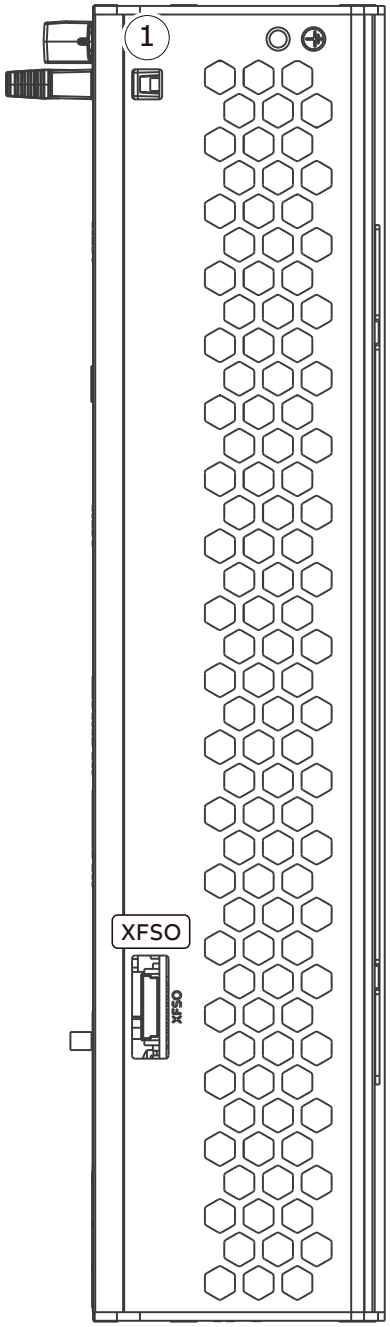


	Description
I/O	I/O terminals
SLOT 1	I/O extension, encoder interface or fieldbus adapter module connection. For F-type modules with USCA-02 adapter.
SLOT 2	I/O extension, encoder interface or fieldbus adapter module connection. For F-type modules with USCA-02 adapter.
SLOT 3	I/O extension, encoder interface or fieldbus adapter module connection. For F-type modules with USCA-02 adapter.
SLOT 4	RDCO-0x DDCS communication option module connection
MEM	UMU-01 memory unit connection. Data logger microSDHC memory card for inverter module communication is inside the memory unit.
BAT	Holder for real-time clock battery (BR2032)
XD2D TERM	Termination switches for drive-to-drive link (XD2D)
X485 TERM	RS-485 link termination switch
X485 BIAS	RS-485 link bias switch.
DICOM= DIOGND	Ground selection. Determines whether DICOM is separated from DIOGND (ie. the common reference for the digital inputs floats). Refer to the ground isolation diagram.

LED	Description
PWR	When the PWR LED is on, the voltage supply is sufficient.
BAT	When the BAT LED is on, the real-time clock battery voltage is higher than 2.5 V. If the LED is off, replace the battery.
WRITE	When the WRITE LED is on, writing to microSDHC memory card is in progress. Do not remove the microSDHC memory card.
FAULT	The control program has generated a fault. Refer to the firmware manual.
FS COMM	Reserved.
FS STATUS	Reserved.



	Description
XAI	Analog input
XAO	Analog output
XCAN	Not in use
XCAN TERM	CAN bus termination switch
XDI	Digital input
XDIO	Digital input/output
XD2D	Drive-to-drive link
XD24	+24 V output (for digital input)
XETH1	Ethernet ports for fieldbus, internal switch
XETH2	
XETH3	Ethernet ports for tool communication, internal switch
XETH4	
XPAN	Control panel connection
XPAN TERM	Panel bus termination switch
XPOW	External power input
XRO1	Relay output RO1
XRO2	Relay output RO2
XRO3	Relay output RO3
XRO4	Relay output RO4, reserved.
XSTO	Safe torque off connection (input signals)
XSTO OUT	Safe torque off connection (to inverter modules)
X485	RS-485 link
V1T/V1R … V14T/V14R	Fiber optic connections to converter modules (VxT = transmitter, VxR = receiver)



	Description
XFSO	Not in use
Environmental sensors (1)	Humidity and temperature measurements

Default I/O diagram of the converter control unit (BCU)

The diagram below shows the default I/O connections of the BCU control unit of the converter, and describes the use of the signals/connections. Under normal circumstances, the factory-made wiring should not be changed.

The wire size accepted by all screw terminals (for both stranded and solid wire) is 0.5 … 2.5 mm² (22 … 12 AWG). The tightening torque is 0.45 N·m (4 lbf·in).

Terminal			Description	
XD2D			Drive-to-drive link	
1	1	B	Not in use by default	
2	2	A		
3	3	BGND		
4	4	Shield		
ON OFF	D2D.TERM		Drive-to-drive link termination switch [1]	
X485			RS485 connection	
5	5	B	CIO-01 module connection (optional)	
6	6	A		
7	7	BGND		
8	8	Shield		
XRO1, XRO2, XRO3			Relay outputs	
11	11	NC	Norm. closed	XRO1: Not in use 250 V AC / 30 V DC, 2 A
12	12	COM	Common	
13	13	NO	Norm. open	
21	21	NC	Norm. closed	XRO2: **Fault (-1)** [2] (Energized = no fault) 250 V AC / 30 V DC, 2 A
22	22	COM	Common	
23	23	NO	Norm. open	
31	31	NC	Norm. closed	XRO3: **Fan control** (DC/DC converter running, fan control on) 250 V AC / 30 V DC, 2 A
32	32	COM	Common	
33	33	NO	Norm. open	
XSTO, XSTO OUT			Safe torque off	
1	1	OUT	XSTO: Factory connection. Both circuits (power module, control unit) must be closed for the unit to start (IN1 and IN2 must be connected to OUT). [3]	
2	2	SGND		
3	3	IN1		
4	4	IN2		
5	5	IN1	XSTO OUT: Not in use	
6	6	SGND		
7	7	IN2		
8	8	SGND		

Terminal			Description
XDI			Digital inputs
1 2 3 4 5 6 7	1	DI1	Temp fault[2] (0 = overtemperature)
	2	DI2	Not in use by default
	3	DI3	Not in use by default
	4	DI4	Not in use by default
	5	DI5	Not in use by default
	6	DI6	Not in use by default
	7	DIIL	Not in use by default
XDIO			Digital input/outputs
1 2 3 4	1	DIO1	Not in use by default
	2	DIO2	Not in use by default
	3	DIOGND	Digital input/output ground
	4	DIOGND	Digital input/output ground
XD24			Auxiliary voltage output
5 6 7 8	1	+24VD	+24 V DC 200 mA[4]
	2	DICOM	Digital input ground
	3	+24VD	+24 V DC 200 mA[4]
	4	DIOGND	Digital input/output ground
ON OFF	DICOM=DIOGND		Ground selection switch[5]
XAI			Analog inputs, reference voltage output
1 2 3 4 5 6 7	1	+VREF	10 V DC, R_L 1…10 kohm
	2	-VREF	-10 V DC, R_L 1…10 kohm
	3	AGND	Ground
	4	AI1+	Not in use by default. 0(2)…10 V, R_{in} > 200 kohm[6]
	5	AI1-	
	6	AI2+	Not in use by default. 0(4)…20 mA, R_{in} = 100 ohm[7]
	7	AI2-	
– U	AI1		AI1 current/voltage selection switch
– U	AI2		AI2 current/voltage selection switch
XAO			Analog outputs
1 2 3 4	1	AO1	**Zero**[2] 0…20 mA, R_L < 500 ohm (not in use by default)
	2	AGND	
	3	AO2	**Zero**[2] 0…20 mA, R_L < 500 ohm (not in use by default)
	4	AGND	
XPOW			External power input
1 2 3 4	1	+24VI	24 V DC, 2.05 A
	2	GND	
	3	+24VI	
	4	GND	
X12			Safety functions module connection (not in use in DC/DC converter units)
X13			Control panel connection

Terminal	Description
X205	Memory unit connection

1) Must be set to ON when the unit is the first or last unit on the drive-to-drive (D2D) link. On intermediate units, set termination to OFF.
2) Default use of the signal in the control program. The use can be changed by a parameter. See also the delivery-specific circuit diagrams.
3) This input only acts as a true Safe torque off input in inverter units. In other applications (eg, supply, DC/DC converter, or brake unit), de-energizing the IN1 and/or IN2 terminal will stop the unit but not constitute a true safety function.
4) Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.
5) Determines whether DICOM is separated from DIOGND (ie, common reference for digital inputs floats). ON: DICOM connected to DIOGND. OFF: DICOM and DIOGND separate.
6) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by switch AI1. Change of setting requires reboot of control unit.
7) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by switch AI2. Change of setting requires reboot of control unit.

Default I/O diagram of the converter control unit (UCU-22…24)

The diagram below shows the default I/O connections of the UCU control unit of the converter, and describes the use of the connections. Under normal circumstances, the factory-made wiring should not be changed.

The wire size accepted by all screw terminals (for both stranded and solid wire) is 0.5 … 2.5 mm^2 (22…12 AWG). The tightening torque is 0.45 N·m (4 lbf·in).

Terminal			Description
XD2D			Drive-to-drive link
1 2 3 4	1 2 3 4	D2D_B D2D_A BGND SHIELD	Not in use by default
ON 1	XD2D TERM		Drive-to-drive link termination switch. 1)
X485			RS485 connection
5 6 7 8	5 6 7 8	B A BGND SHIELD	CIO-01 module connection (optional)
ON 1	X485 BIAS		X485 bias selection switch
ON 1	X485 TERM		X485 termination switch
XCAN			CAN bus
9 10 11 12	9 10 11 12	CAN_H CAN_L CAN_CGND CAN_SHLD	Not supported Not supported Not supported Control cable shield

Terminal			Description	
	XCAN TERM		CANopen termination switch	
XRO1			Relay output 1	
11 12 13	11 12 13	NC1 COM1 NO1	Norm. closed Common Norm. open	XRO1: Not in use 250 V AC / 30 V DC, 2 A
XRO2			Relay output 2	
21 22 23	21 22 23	NC2 COM2 NO2	Norm. closed Common Norm. open	XRO2: **Fault (-1)** [2] (Energized = no fault) 250 V AC / 30 V DC, 2 A
XRO3			Relay output 3	
31 32 33	31 32 33	NC3 COM3 NO3	Norm. closed Common Norm. open	XRO3: **Fan control** (DC/DC converter in operation, fan control on) 250 V AC / 30 V DC, 2 A
XRO4			Relay output 4	
41 42 43	41 42 43	NC4 COM4 NO4	Norm. closed Common Norm. open	XRO4: Not supported 250 V AC / 30 V DC, 2 A
XSTO			Safe torque off [3]	
1 2 3 4	1 2 3 4	OUT SGND STO1 STO2	XSTO: Factory connection. Both circuits must be closed for the supply to start (STO1 and STO2 must be connected to OUT).	
XSTO OUT			Safe torque off connection (to inverter modules)	
5 6 7 8	5 6 7 8	OUT1 SGND OUT2 SGND	XSTO OUT: Not in use.	
XDI			Digital inputs	
1 2 3 4 5 6 7	1 2 3 4 5 6 7	DI1 DI2 DI3 DI4 DI5 DI6 DIIL	**Temp fault** [2] (0 = overtemperature) Not in use by default Not in use by default Not in use by default Not in use by default Not in use by default Not in use by default	
XDIO			Digital input/outputs	
1 2 3 4	1 2 3 4	DIO1 DIO2 DIOGND DIOGND	Not in use by default Not in use by default Digital input/output ground Digital input/output ground	
XD24			Auxiliary voltage output	

Terminal			Description
5 6 7 8	5	+24VD	+24 V DC 200 mA [4]
	6	DICOM	Digital input ground
	7	+24VD	+24 V DC 200 mA [4]
	8	DIGND	Digital input/output ground
ON 1	DICOM=DIOGND		Ground selection switch. Determines whether DICOM is separated from DIOGND (ie, common reference for digital inputs floats). ON: DICOM connected to DIOGND. OFF: DICOM and DIOGND separate.
XAI			Analog inputs, reference voltage output
1 2 3 4 5 6 7	1	+VREF	10 V DC, R_L 1…10 kohm
	2	-VREF	-10 V DC, R_L 1…10 kohm
	3	AGND	Ground
	4	AI1+	Not in use by default. 0(2)…10 V, R_{in} > 200 kohm [5]
	5	AI1-	
	6	AI2+	Not in use by default. 0(4)…20 mA, R_{in} = 100 ohm [6]
	7	AI2-	
XAO			Analog outputs
1 2 3 4	1	AO1	**Zero** (no signal indicated)[2] 0…20 mA, R_L < 500 ohm (not in use by default)
	2	AGND	
	3	AO2	**Zero** (not signal indicated)[2] 0…20 mA, R_L < 500 ohm (not in use by default)
	4	AGND	
XPOW			External power input
1 2 3 4	1	+24V	24 V DC, 2.05 A
	2	GND	
	3	+24V	
	4	GND	
XFSO			Safety functions module connection. Not used in DC/DC converter units.
XETH1			Ethernet ports for fieldbus. Not in use by default.
XETH2			
XETH3			Ethernet ports for tool communication. Not in use by default.
XETH4			
XPAN			Control panel connection
ON 1	XPAN TERM		Control panel connection termination switch
MEM			Memory unit connection

1) Must be set to ON when the unit is the first or last unit on a drive-to-drive (D2D) link. On intermediate units, set termination to OFF (1).
2) Default use of the signal in the control program. The use can be changed by a parameter. See also the delivery-specific circuit diagrams.
3) This input only acts as a true Safe torque off input in inverter units. In other applications (such as DC/DC converter unit), de-energizing the STO1 and/or STO2 terminal will stop the unit but not constitute a SIL/PL classified safety function.
4) Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.
5) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm]. Change of setting requires reboot of control unit.
6) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm]. Change of setting requires reboot of control unit.

Additional information on the connections

Power supply for the control unit (XPOW)

The control unit is powered from a 24 V DC, 2 A supply (ZCU, BCU) or a 24 V DC, 2.9 A supply (UCU) through terminal block XPOW. With a type BCU/UCU control unit, a second supply can be connected to the same terminal block for redundancy.

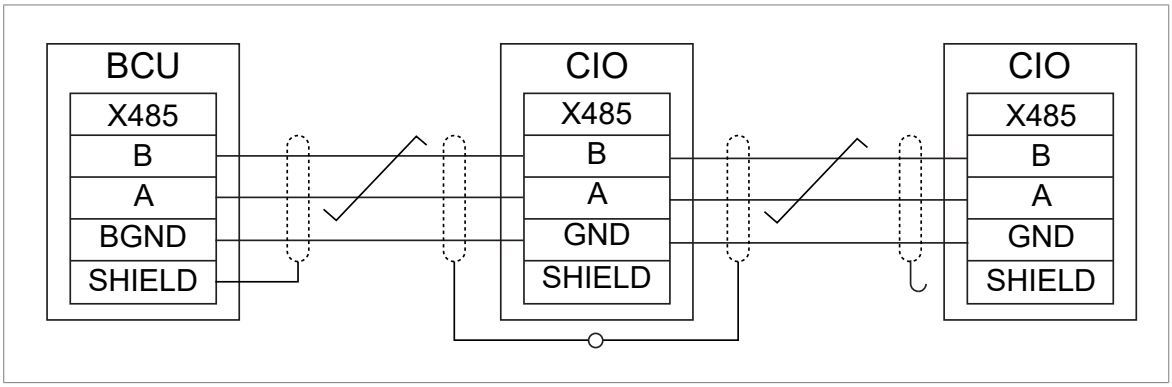
Using a second supply is recommended, if:

- the control unit needs to be kept operational during input power breaks, for example, because of continuous fieldbus communication
- immediate restart is needed after a power break (that is, no control unit power-up delay is allowed).

The X485 connector (BCU)

The X485 connector provides a connection for the optional CIO-01 I/O module. Refer to CIO-01 I/O module for distributed I/O bus control user's manual (3AXD50000126880 [English]) for more information.

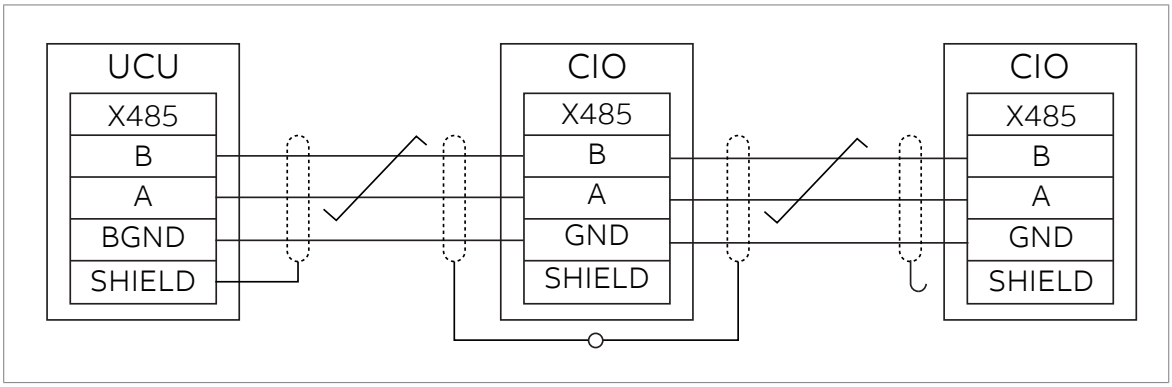
This diagram shows the wiring for the module.



The X485 connector (UCU)

The X485 connector provides a connection for the optional CIO-01 I/O module. Refer to CIO-01 I/O module for distributed I/O bus control user's manual (3AXD50000126880 [English]) for more information.

This diagram shows the wiring for the module.



Terminate the I/O bus at its physical ends:

1. Set the termination resistor switch of the CIO-01 module on the end of the I/O bus to ON position.
2. Set the X485 termination switch (X485 TERM) of the UCU control unit to ON position to terminate the other end of the I/O bus.
3. Set the termination resistors of all other CIO-01 modules to OFF position.

Make sure that two devices in the I/O bus have the biasing on:

1. Set the X485 bias switch (X485 BIAS) of the UCU control unit to ON position.
2. Make sure that the termination resistor switch in one of the CIO-01 modules is set to ON position. This automatically starts the biasing.

Safe torque off (XSTO, XSTO OUT)

Note: The XSTO input only acts as a true Safe torque off input on the inverter control unit. De-energizing the STO input terminals of other units (supply, DC/DC converter, or brake unit) will stop the unit but not constitute a SIL/PL classified safety function.

FSO safety functions module connection (X12, with BCU only)

Refer to the applicable FSO module user's manual. Note that the FSO safety functions module is not used in supply, DC/DC converter or brake units.

Note: Control units that have a sticker with the text “No FSO support” are not compatible with the FSO safety functions module.

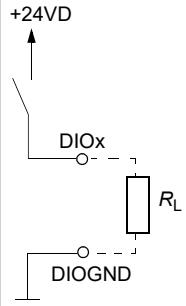
SDHC memory card slot

The BCU control unit has an on-board data logger that collects real-time data from the power modules to help fault tracing and analysis. The data is stored onto the SDHC memory card inserted into the SD CARD slot and can be analyzed by ABB service personnel.

MicroSDHC memory card slot

The UCU-22…24 has an on-board data logger that collects real-time data from the power modules to help fault tracing and analysis. The data is stored onto the microSDHC memory card inserted into the UMU memory unit and can be analyzed by ABB service personnel.

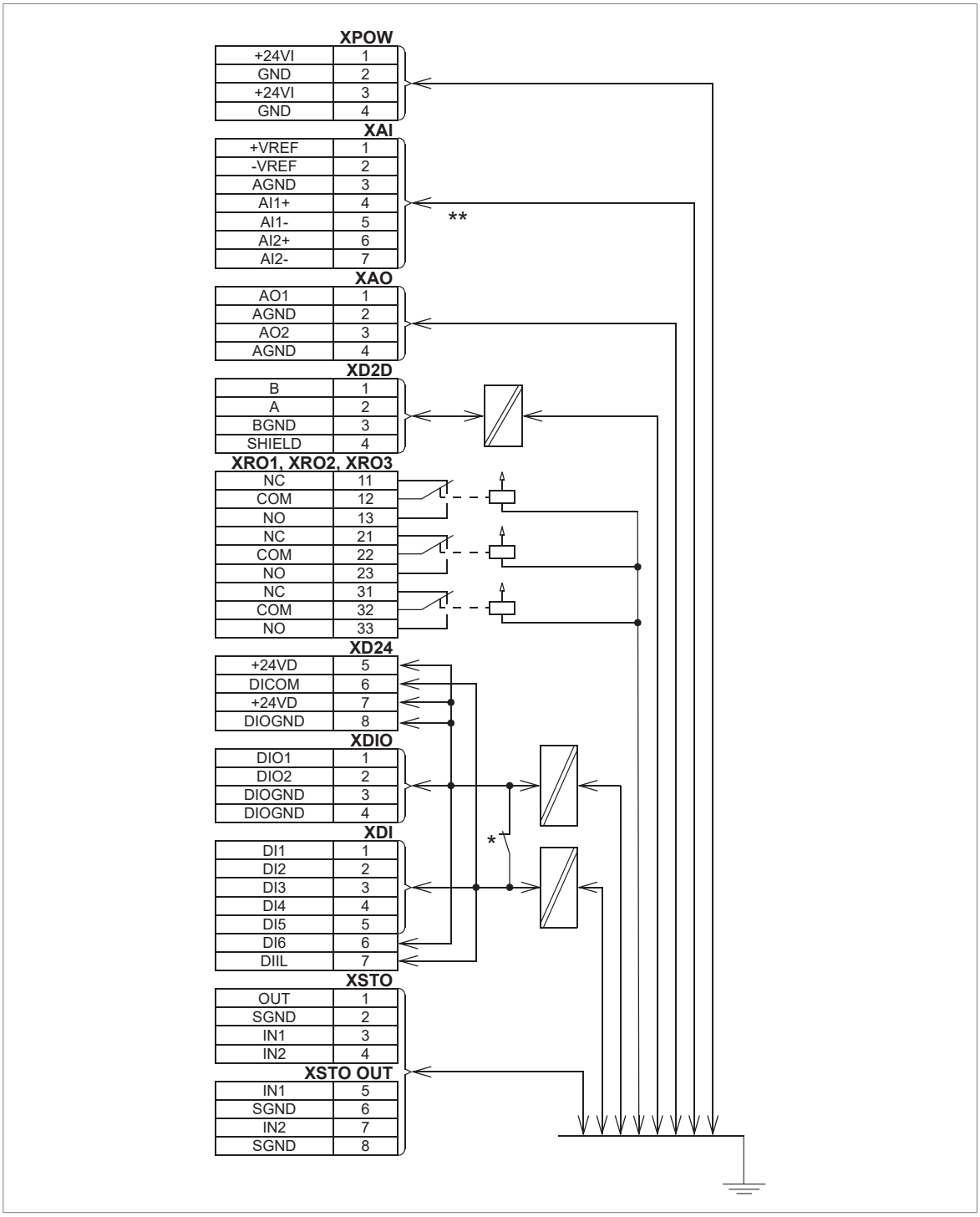
Connector data

Power supply (XPOW)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) 24 V (±10%) DC, 2 A (BCU) 19…32 V DC, 2.9 A (UCU-22…24) External power input. Two supplies can be connected to the BCU and UCU-22…24 control units for redundancy.
Relay outputs RO1…RO3 (XRO1…XRO3 [BCU]) Relay outputs RO1…RO4 (XRO1…XRO4 [UCU-22…24])	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) 250 V AC / 30 V DC, 2 A Protected by varistors
+24 V output (XD24:2 and XD24:4)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) Total load capacity of these outputs is 4.8 W (200 mA / 24 V) minus the power taken by DIO1 and DIO2.
Digital inputs DI1…DI6 (XDI:1…XDI:6)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) 24 V logic levels: “0” < 5 V, “1” > 15 V R_{in}: 2.0 kohm Input type: NPN/PNP (DI1…DI5), PNP (DI6) Hardware filtering: 0.04 ms, digital filtering up to 8 ms (BCU) I_{max}: 15 mA (DI1…DI5), 5 mA (DI6)
Start interlock input DIIL (XDI:7)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) 24 V logic levels: "0" < 5 V, "1" > 15 V R_{in}: 2.0 kohm Input type: NPN/PNP Hardware filtering: 0.04 ms, digital filtering up to 8 ms
Digital inputs/outputs DIO1 and DIO2 (XDIO:1 and XDIO:2) Input/output mode selection by parameters. DIO1 can be configured as a frequency input (0…16 kHz with hardware filtering of 4 microseconds) for 24 V level square wave signal (sinusoidal or other wave form cannot be used). (BCU) DIO1 can be configured as a frequency input (0…100 kHz with hardware filtering of 4 microseconds) for 24 V level square wave signal (sinusoidal or other wave form cannot be used). (UCU-22…24) In some control programs, DIO2 can be configured as a 24 V level square wave frequency output. Refer to the firmware manual, parameter group 11.	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) As inputs: 24 V logic levels: "0" < 5 V, "1" > 15 V. R_{in}: 2.0 kohm. Filtering: 1 ms. As outputs: Total output current from +24VD is limited to 200 mA 

Reference voltage for analog inputs +VREF and -VREF (XAI:1 and XAI:2)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) 10 V ±1% and -10 V ±1%, R_{load} 1…10 kohm Maximum output current: 10 mA
Analog inputs AI1 and AI2 (XAI:4 … XAI:7). Current/voltage input mode selection by switches (BCU) Current/voltage input mode selection by parameters 12.15 AI1 unit selection and 12.25 AI2 unit selection (UCU)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) Current input: -20…20 mA, R_{in} = 100 ohm Voltage input: -10…10 V, R_{in} > 200 kohm Differential inputs, common mode range ±30 V Sampling interval per channel: 0.25 ms Hardware filtering: 0.25 ms Resolution: 11 bit + sign bit Inaccuracy: 1% of full scale range
Analog outputs AO1 and AO2 (XAO)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) 0…20 mA, R_{load} < 500 ohm Frequency range: 0…500 Hz Resolution: 11 bit + sign bit Inaccuracy: 2% of full scale range
XD2D connector	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) Physical layer: RS-485 Transmission rate: 8 Mbit/s Cable type: Shielded twisted-pair cable with a twisted pair for data and a wire or another pair for signal ground (nominal impedance 100 … 165 ohm, for example Belden 9842) Maximum length of link: 50 m (164 ft) Termination by switch
RS-485 connection (X485)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) Physical layer: RS-485 Cable type: Shielded twisted-pair cable with a twisted pair for data and a wire or another pair for signal ground (nominal impedance 100 … 165 ohm, for example Belden 9842) Maximum length of link: 50 m (164 ft) Termination and bias by switch (X485 TERM and X485 BIAS) (UCU-22…24)
CAN connection (XCAN [UCU-22…24])	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) Termination by switch (XCAN TERM) This connection is not supported by the firmware.

Safe torque off connection (XSTO)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) Input voltage range: -3…30 V DC Logic levels: "0" < 5 V, "1" > 17 V. **Note:** For the unit to start, both connections must be “1”. This applies to all control units (including drive, inverter, supply, brake, DC/DC converter etc. control units), but SIL/PL classified Safe torque off functionality is only achieved through the XSTO connector of the drive/inverter control unit. Current consumption: 10 mA (continuous) per STO channel (UCU-22…24). The number of parallel drive/inverter modules does not have an effect on the current consumption. Current consumption: 66 mA (continuous) per STO channel per drive/inverter module (BCU) EMC (immunity) according to IEC 61326-3-1 and IEC 61800-5-2
Safe torque off output (XSTO OUT)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in) To STO connector of inverter module.
Control panel connection (X13 [BCU]) Control panel connection (XPAN [UCU-22…24])	Connector: RJ-45 Cable length < 100 m (328 ft) (BCU) Cable length < 50 m (164 ft) (UCU-22…24) Termination by switch (XPAN TERM) (UCU-22…24)
Ethernet connection (XETH [BCU]) Fieldbus Ethernet connection with internal switch (XETH1 and XETH2 [UCU-22…24]) Tool Ethernet connection with internal switch (XETH3 and XETH4 [UCU-22…24])	Connector: RJ-45 This connection is not supported by the firmware (BCU) Cable type: minimum requirement CAT5e (UCU-22…24)
SDHC memory card slot (SD CARD [BCU])	Memory card type: SDHC Maximum memory size: 4 GB
microSDHC memory card slot (microSDHC CARD [UCU-22…24])	Memory card type: microSDHC (minimum of class 4 speed grade) Supported memory size: 4 GB…32 GB
Battery	Real-time clock battery type: BR2032
The terminals of the control unit fulfill the Protective Extra Low Voltage (PELV) requirements. The PELV requirements of a relay output are not fulfilled if a voltage higher than 48 V is connected to the relay output.	

BCU ground isolation diagram

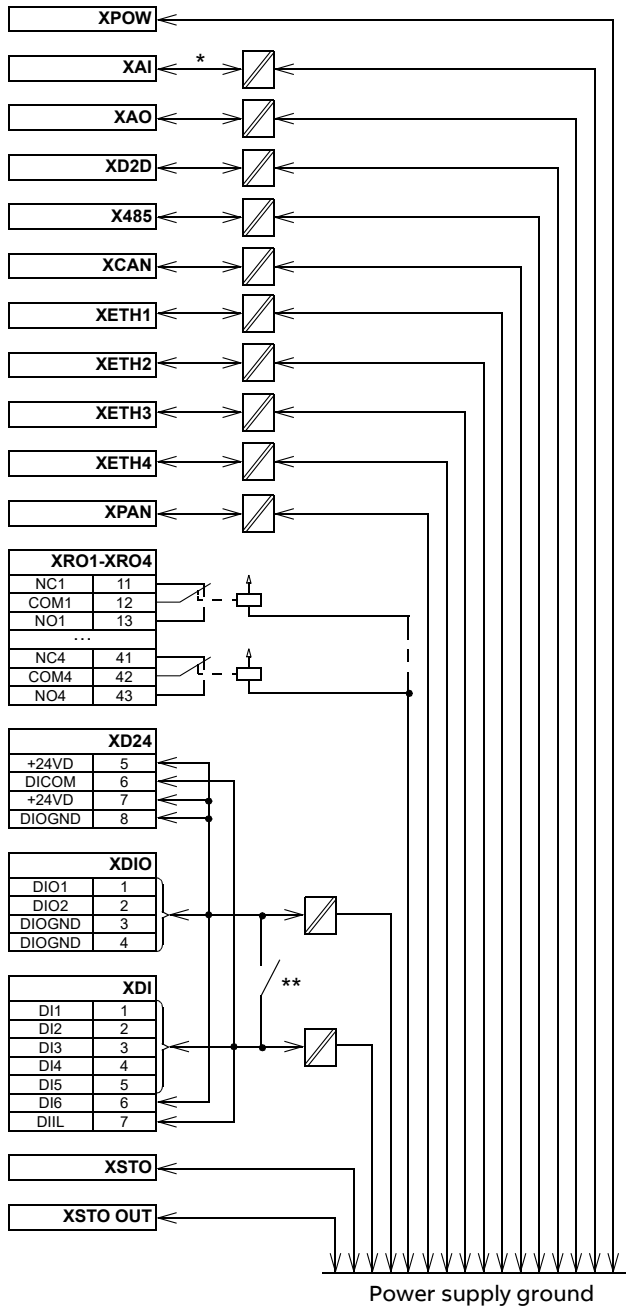


*Ground selector (DICOM=DIOGND) settings

DICOM=DIOGND: ON All digital inputs share a common ground (DICOM connected to DIOGND). This is the default setting.
DICOM=DIOGND: OFF Ground of digital inputs DI1…DI5 and DIIL (DICOM) is isolated from DIO signal ground (DIOGND). Isolation voltage 50 V.

**The maximum common mode voltage between each AI input and AGND is +30 V

UCU-22…24 ground isolation diagram



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DICOM=DIOGND: ON All digital inputs share a common ground (DICOM connected to DIOGND). This is the default setting.
DICOM=DIOGND: OFF Ground of digital inputs DI1…DI5 and DIIL (DICOM) is isolated from DIO signal ground (DIOGND). Isolation voltage 50 V.

7

Installation checklist

Contents of this chapter

This chapter contains a checklist for the mechanical and electrical installation of the drive.

Checklist

Examine the mechanical and electrical installation of the drive before start-up. Go through the checklist together with another person.

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

WARNING!
Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.

Make sure that ...	☑
The ambient operating conditions meet the drive ambient conditions specification and enclosure rating (IP code).	☐
The supply voltage matches the nominal input voltage of the drive. See the type designation label.	☐
The insulation resistance of the input power cable, motor cable and motor is measured according to local regulations and the manuals of the drive.	☐
The drive cabinet is attached to the floor, and if necessary due to vibration etc, also by its top to the wall or roof.	☐

Make sure that ...	☑
If the drive is connected to a network other than a symmetrically grounded TN-S system: You have done all the required modifications (for example, you may need to disconnect the EMC filter or ground-to-phase varistor) See the electrical installation instructions in the supply unit manual.	☐
There is an adequately sized protective earth (ground) conductor(s) between the drive and the switchboard, the conductor is connected to correct terminal, and the terminal is tightened to the correct torque. Grounding has also been measured according to the regulations.	☐
There is an adequately sized protective earth (ground) conductor between the energy storage and the DC/DC converter, the conductor is connected to the correct terminal, and the terminal is tightened to the correct torque. Proper grounding has also been measured according to the regulations.	☐
The energy storage cable is connected to the correct terminals of the DC/DC converter and energy storage, and the terminals are tightened to the correct torque.	☐
The energy storage is equipped with fuses for protecting the energy storage cable in a cable short-circuit situation.	☐
The energy storage is equipped with a disconnecting device.	☐
The input power cable is connected to the correct terminals, the phase order is correct, and the terminals are tightened to the correct torque.	☐
There is an adequately sized protective earth (ground) conductor between the motor and the drive. The conductor is connected to the correct terminal, and the terminal is tightened to the correct torque. Grounding has also been measured according to the regulations.	☐
The motor cable is connected to the correct terminals, the phase order is correct, and the terminals are tightened to the correct torque.	☐
The motor cable is routed away from other cables.	☐
No power factor compensation capacitors are connected to the motor cable.	☐
If an external brake resistor is connected to the drive: There is an adequately sized protective earth (ground) conductor between the brake resistor and the drive, and the conductor is connected to the correct terminal, and the terminals are tightened to the correct torque. Grounding has also been measured according to the regulations.	☐
If an external brake resistor is connected to the drive: The brake resistor cable is connected to the correct terminals, and the terminals are tightened to the correct torque.	☐
If an external brake resistor is connected to the drive: The brake resistor cable is routed away from other cables.	☐
The control cables are connected to the correct terminals, and the terminals are tightened to the correct torque.	☐
The voltage setting of the auxiliary voltage transformers (if any) is correct. See the electrical installation instructions.	☐
If a drive bypass connection will be used: The direct-on-line contactor of the motor and the drive output contactor are either mechanically and/or electrically interlocked, that is, they cannot be closed at the same time. A thermal overload device must be used for protection when bypassing the drive. Refer to local codes and regulations.	☐
There are no tools, foreign objects or dust from drilling inside the drive.	☐
The terminal box cover of the motor is in place. Cabinet shrouds are in place and doors are closed.	☐
The motor and the driven equipment are ready for power-up.	☐
The coolant connections between cubicles (if any) and to the cooling circuit are tight.	☐
If the drive is equipped with a cooling unit: Make sure that the mechanical and electrical installation of the cooling unit is completed. Refer to the cooling unit documentation.	☐

8

Start-up

Contents of this chapter

This chapter describes the start-up procedure of the converter unit. The information is valid for cabinet-installed ACS880-1607LC DC/DC converter units.

The default device designations are given in square brackets, for example, [Q11]. The same device designations are also used in the delivery-specific circuit diagrams.

Refer to the delivery-specific circuit diagrams when you do the start-up tasks.

WARNING!
Only a qualified electrical professional can do the work described in this chapter. The persons who does the work must know the energy storage system, the DC/DC converter control program and the operation principle of the DC/DC converter.

Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. The safety instructions are given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]).

Before you start, connect a control panel to the DC/DC converter unit. ABB recommends that you also have a PC with a drive commissioning tool (Drive Composer) connected. For information on the use of the control panel, refer to ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual (3AUA0000085685 [English]). For information on the use of the Drive Composer PC tool, refer to Drive Composer start-up and maintenance PC tool user's manual (3AUA0000094606 [English]).

Start-up procedure

Tasks	☑
Safety	
 **WARNING!** Obey the safety instructions during the start-up procedure. See ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation or maintenance work.	☐
Checks/Settings with no voltage connected	
Make sure that it is safe to start the work. Do the steps in section Electrical safety precautions (page 49).	☐
Make sure that the disconnector of the supply transformer is locked into the open position and that voltage cannot be connected to the drive accidentally.	☐
Make sure that all external auxiliary circuits are de-energized and disconnected. See the start-up instructions in the supply unit hardware manual.	☐
Make sure that the supply unit is de-energized, and the drive system is isolated from the supply network.	☐
DC/DC converter with the DC switch-disconnector [Q11] (option +F286): Make sure that the DC switch-disconnector [Q11] and the DC/DC converter charging switch [Q10] are open and locked.	☐
Make sure that the energy storage disconnecting device (customer or system integrator-installed device) is locked into the open position.	☐
Make sure that the mechanical and electrical installation of the converter unit is completed and inspected. Refer to the installation checklist.	☐
Make sure that the drive is ready for the converter unit power up: • The supply and inverter units have been installed according to the instructions given in their hardware manuals. • The supply unit has been started up according to the instructions given in the applicable supply unit manual. • The inverter units have been started up according to the instructions given in the hardware manual and applicable firmware manual.	☐
If the converter unit was stored for more than one year: Reform the electrolytic DC capacitors in the DC bus of the drive. Refer to Capacitor reforming instructions (3BFE64059629 [English]).	☐
Close the auxiliary voltage circuit breakers of the converter unit [F21, F22]. Close also other circuit breakers of the converter auxiliary circuits: cabinet fans [F115] and BAMU voltage/current measurement [F7] if present and the auxiliary voltage switch of the drive supply unit. Refer to the circuit diagrams delivered with the converter unit.	☐
Starting and checking the cooling system	
Fill up and bleed the internal cooling circuit. Start the cooling unit up. See Filling up and bleeding the internal cooling circuit (page 118).	☐
Check the cooling system for leaks. Make sure that cooling circuit joints at the shipping split joining cubicles are tight and that all drain valves have been closed.	☐
Make sure that the coolant can flow freely in all cubicles.	☐
Close the cabinet doors.	☐
Connecting voltage to the drive and converter control unit	
Connect main AC voltage to the input terminals of the drive supply unit: Close the disconnector of the supply transformer.	☐

Tasks	☑
WARNING! When you connect voltage to the supply unit, the DC busbars and the converters connected to the DC bus will become energized. **WARNING!** Converter units with a DC switch-disconnector: Some types of converter modules can be energized through a charging circuit even if the DC switch-disconnector is open or the DC fuses are removed. Converter units without a DC switch-disconnector: If the converter unit only has DC fuses without a switch fuse, all the converter units with the DC fuses in position will be energized when the main breaker/contactor closes. To prevent this, remove the fuses from the converter units which are to remain de-energized before you connect the voltage. **Do not install or remove DC fuses when the main breaker/contactor of the supply unit is closed (DC busbars are energized).** If the drive is equipped with a main switch-disconnector (option +F253): Close the main disconnecting device of the drive system.	☐
Close the auxiliary voltage switch [Q21] of the drive supply unit. The converter control unit will be powered. **Do not** close the main circuit breaker [Q1] (option +F255) or the main contactor [Q2] (option +F250) of the drive supply unit! You must not energize the drive DC bus at this time.	☐
Setting the parameters	
Set the DC/DC converter parameters. Refer to chapter **Start-up** in DC/DC converter control program firmware manual (3AXD50000024671 [English]).	☐
Charging the DC/DC converter and connecting voltage to the converter	
Make sure that the energy storage disconnecting device is open. **WARNING!** Always keep the energy storage disconnected from DC/DC converter until the DC/DC converter is charged.	☐
Start the supply unit and close the main contactor [Q2] (option +F250) or the main circuit breaker [Q1] (option +F255) of the drive supply unit.	☐
Power up and charge the DC/DC converter: DC/DC converter with the DC switch-disconnector [Q11] (option +F286): 1. Close the DC/DC converter charging switch [Q10.x]. The DC/DC converter disconnected indicator light [P12.x] goes off. 2. After the Charging OK indicator light [P11.x] comes on, close the DC switch-disconnector [Q11]. 3. Open the DC/DC converter charging switch [Q10.x]. **Note:** The charging switch must be open before you can start the DC/DC converter. DC/DC converter without DC switch-disconnector (without option +F286): 1. Start the supply unit and close the main contactor [Q2] (option +F250) or the main breaker [Q1] (option +F255) of the drive supply unit. The DC/DC converter is energized and gets charged.	☐
Connecting the energy storage to the DC/DC converter	
Set parameter 120.12 Run enable 1 to Off. This makes sure that the DC/DC converter does not start automatically or unexpectedly after you connect the energy storage.	☐
Set the control panel to local control mode with the **Loc/Rem** key.	☐
Make sure that the energy storage voltage is less than the drive DC link voltage.	☐
WARNING! Do not close the energy storage disconnecting device if the DC/DC converter is not connected to the drive DC link or not ready to use. Close the energy storage disconnecting device. The load disconnected indicator [P13.x] goes off.	☐

Tasks	☑
Close the energy storage protective circuit breaker (customer or system integrator-installed device).	☐
Testing the DC/DC converter operation	
Set parameter 120.12 Run enable 1 to On.	☐
Set parameter 122.01 User Power ref to 0 A.	☐
Set current limits to low values, for example, • 130.119 Minimum current to -50 A. • 130.120 Maximum current to 50 A.	☐
Push the **Start** key on the control panel to start the converter. After start, increase slowly the value of parameter 122.01 User Power ref.	☐
Check the following signals: • 102.01 DC voltage • 102.02 ES voltage used • 102.08 Total current • 102.11 Modulation index % • 130.101 DDC limit word 1.	☐
Press the **Stop** key on the control panel to stop the converter.	☐

9

Maintenance

Contents of this chapter

This chapter instructs how to maintain the DC/DC converter unit. The information is valid for cabinet-installed ACS880-1607LC DC/DC converter units.

Maintenance intervals

The tables below show the maintenance tasks which can be done by the end user. For ABB Service offering, refer to www.abb.com/drivesservices or consult your local ABB Service representative (www.abb.com/searchchannels).

Description of symbols

Action	Description
I	Inspection (visual inspection and maintenance action if needed)
P	Performance of on/off-site work (commissioning, tests, measurements or other work)
R	Replacement

Recommended maintenance intervals after start-up

Recommended annual actions by the user	
Connections and environment	
Quality of supply voltage	P
Spare parts	
Spare parts	I
DC circuit capacitors reforming, spare modules and spare capacitors	P

Inspections by user	
Tightness of terminals	I
Dustiness, corrosion and temperature	I
Cooling liquid pipe connections	I
Coolant antifreeze concentration	P
Other	
ABB-SACE Air circuit breaker maintenance	I
ABB Contactors maintenance	I

Recommended every 2nd year actions by the user	
Inspection of coolant quality	P
Inspection of expansion tank air pressure	P
External circuit of main heat exchanger (temperature/flow/pressure)	I

Item	**Years from start-up**						
	3	**6**	**9**	**12**	**15**	**18**	**21**
Coolant							
Coolant draining and refill		R		R		R	
Liquid cooling circuit							
ABB cooling unit	Refer to ACS880-1007LC liquid cooling unit user's manual (3AXD50000129607 [English])						
Cabinet fans							
Cooling fans 230 VAC 50/60 Hz and 24 VDC			R			R	
CIO module for fan control (230 VAC and 24 VDC)			R			R	
Cooling fans 115 VAC 50/60 Hz		R		R		R	
CIO module for fan control (115 VAC) [1]		I/R		R		I/R	
Internal cooling fan for circuit boards							
R7i module internal cooling fan			R			R	
Aging							
BCU/UCU control unit battery (Real-time clock)		R		R		R	
Control panel battery (Real-time clock)			R			R	
Cabinet auxiliary power supplies [2]				R			
Buffer module 24 VDC +F276 Ride through function [2]		R		R		R	

1) Replace CIO module or reset fan counters. Refer to CIO-01 I/O module for distributed I/O bus control user's manual (3AXD50000126880 [English]).
2) Check amount of auxiliary power supplies and buffer modules from cabinet or manufactured bill of materials.

Note:

- Maintenance and component replacement intervals are based on the assumption that the equipment is operated within the specified ratings and ambient conditions. ABB recommends annual drive inspections to ensure the highest reliability and optimum performance.
- Long term operation near the specified maximum ratings or ambient conditions may require shorter maintenance intervals for certain components. Consult your local ABB Service representative for additional maintenance recommendations.

Maintenance timers and counters

The control program has maintenance timers and counters that can be configured to generate a warning when a pre-defined limit is reached. Each timer/counter can be set to monitor any parameter. This feature is especially useful as a service reminder. For more information, see the firmware manual.

Disconnecting the DC/DC converter

Disconnecting the DC/DC converter from the energy storage

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

This procedure tells you how to disconnect the DC/DC converter from the energy storage.

1. Set the control panel to local mode with the **Loc/Rem** key.
2. Push the **Stop** key on the control panel.
3. Set parameter 120.19 Enable start signal to value Off. This prevents an accidental start of the unit.
4. Open the energy storage protective circuit breaker.
5. Open the energy storage disconnecting device. Lock out and tag out.

   Note: The load disconnected indicator light [P13.x] is on when the energy storage disconnecting device is open.
6. If it is necessary to disconnect the DC/DC converter from the drive system, and the converter has a DC switch-disconnector [Q11], continue with step 2 of the procedure in section Disconnecting the DC/DC converter from the drive system with the DC switch-disconnector (page 90).

Disconnecting the DC/DC converter from the drive system with the DC switch-disconnector

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

This procedure tells you how to disconnect the DC/DC converter from the energy storage and the drive system with the optional DC switch-disconnector (option +F286).

1. Do the steps in section Disconnecting the DC/DC converter from the energy storage (page 89).
2. Drives with DC switch-disconnector [Q11]: Open the DC switch-disconnector [Q11] (option +F286). Lock out and tag out.

   Note: The DC/DC converter disconnected indicator light [P12.x] is on when the DC switch-disconnector [Q11] is open.
3. If it is necessary to do work inside the DC/DC converter unit, stop the drive system and isolate it from the main and auxiliary power supplies. Do the steps in section Electrical safety precautions (page 49).

Connecting the DC/DC converter

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

This procedure tells you how to connect the DC/DC converter to the energy storage and the drive system.

1. Make sure that the work is completed and there are no tools inside the drive.
2. Close the cabinet doors.
3. Connect the DC/DC converter and energy storage. Refer to these instructions in chapter Start-up:
   - Connecting voltage to the drive and converter control unit (page 84)
   - Charging the DC/DC converter and connecting voltage to the converter (page 85)
   - Connecting the energy storage to the DC/DC converter (page 85).
4. Set the control panel to local mode with the **Loc/Rem** key.
5. Set parameter 120.19 Enable start signal to value On.
6. Push the **Start** key on the control panel.

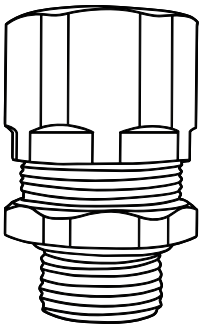
Liquid pipe connector installation instructions

These instructions are applicable to the liquid pipe connectors that are used in ABB drives. There are two types of connectors: type A and type B. Refer to the illustrations

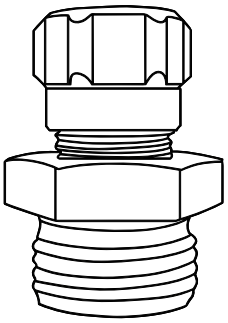
below. When you install a connector, identify the connector type first. Obey the type-specific instructions carefully.

Reserve these materials and tools at hand:

- LOCTITE 2700 threadlocker
- Torque wrench (size depends on the connector size)
- For the type B connector: adjustable pliers



Type A



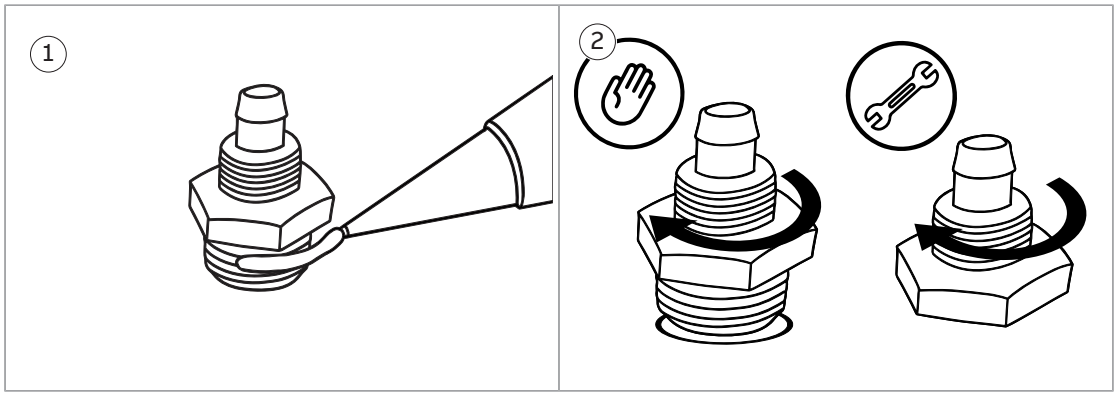
Type B

WARNING!
Do the electrical safety precautions steps before you do work on the drive. Refer to the drive safety instructions. If you are not a qualified electrical professional, do not do work on the drive. If you ignore safety instructions, injury or death, or damage to the equipment can occur.

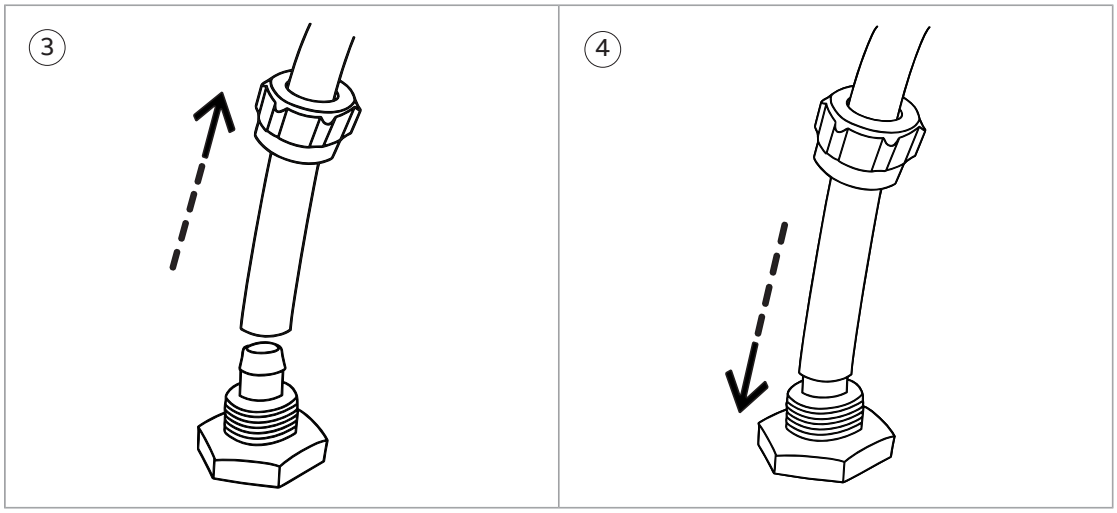
Installation procedure:

1. If the union nut has no sealing ring (o-ring), apply the threadlocker to the threads of the union nut. Always add the threadlocker onto the outer thread. This prevents the threadlocker from entering the circuit.
2. Put the union nut carefully onto the threads and start to screw it in by hand. Tighten it to the torque specified in the table below with a torque wrench. Wipe out extra threadlocker.

Torque for type A connector	Torque for type B connector
30 N·m	20 N·m

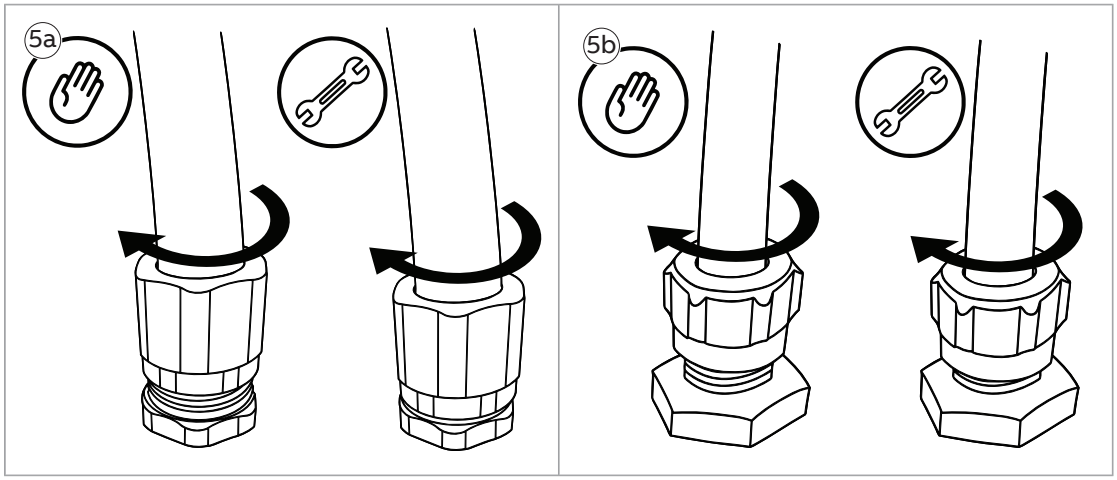


3. Push the screwing plug over the pipe, and place the pipe on the union nut.
4. Pull down the screwing plug.



5. a) Type A connector: Start to screw the plug in by hand. Tighten the plug with a torque wrench to 20 N·m.
   b) Type B connector: Start to screw the plug in by hand. Tighten the plug with adjustable pliers. Leave 2…3 mm thread visible.

WARNING!
Do not tighten the plug of the type B connector too much. It can break the connector or pipe.



Fuses

Checking and replacing the fuses – frame R7i

Replacing a converter fuse

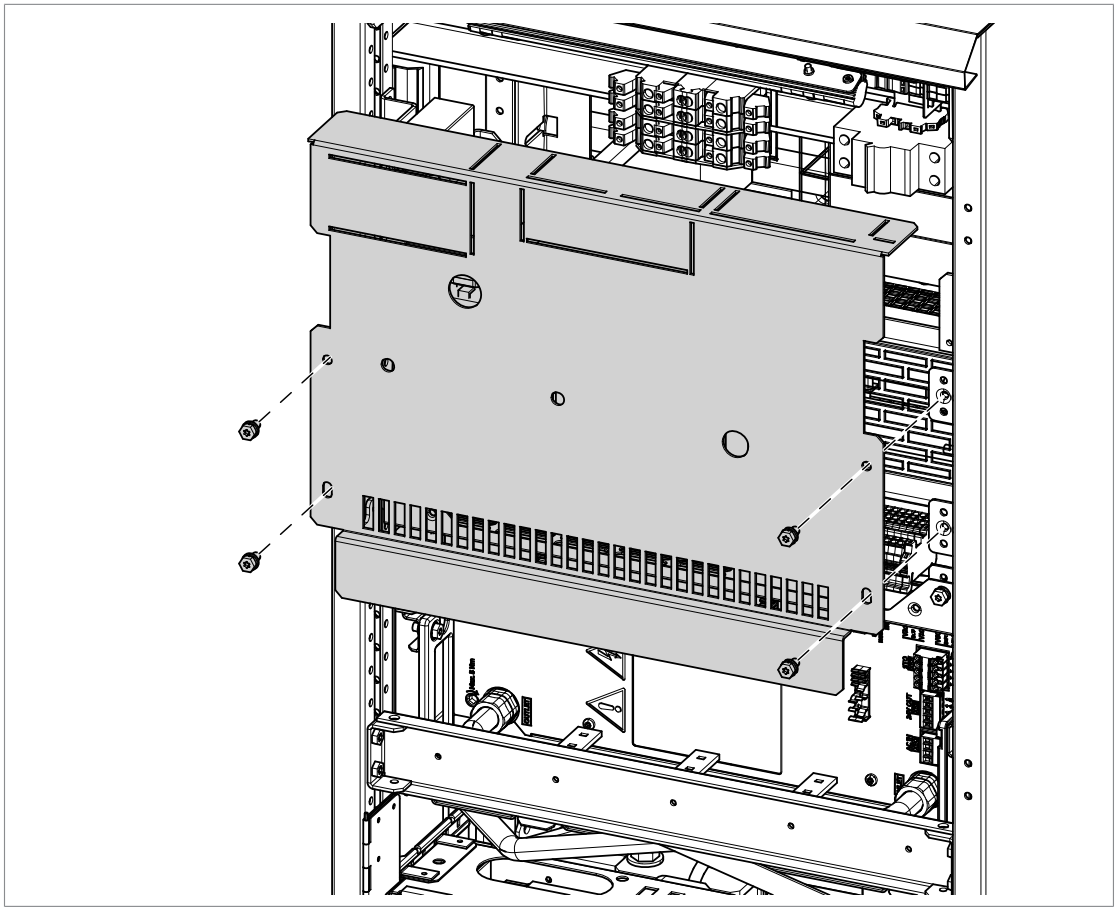
WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

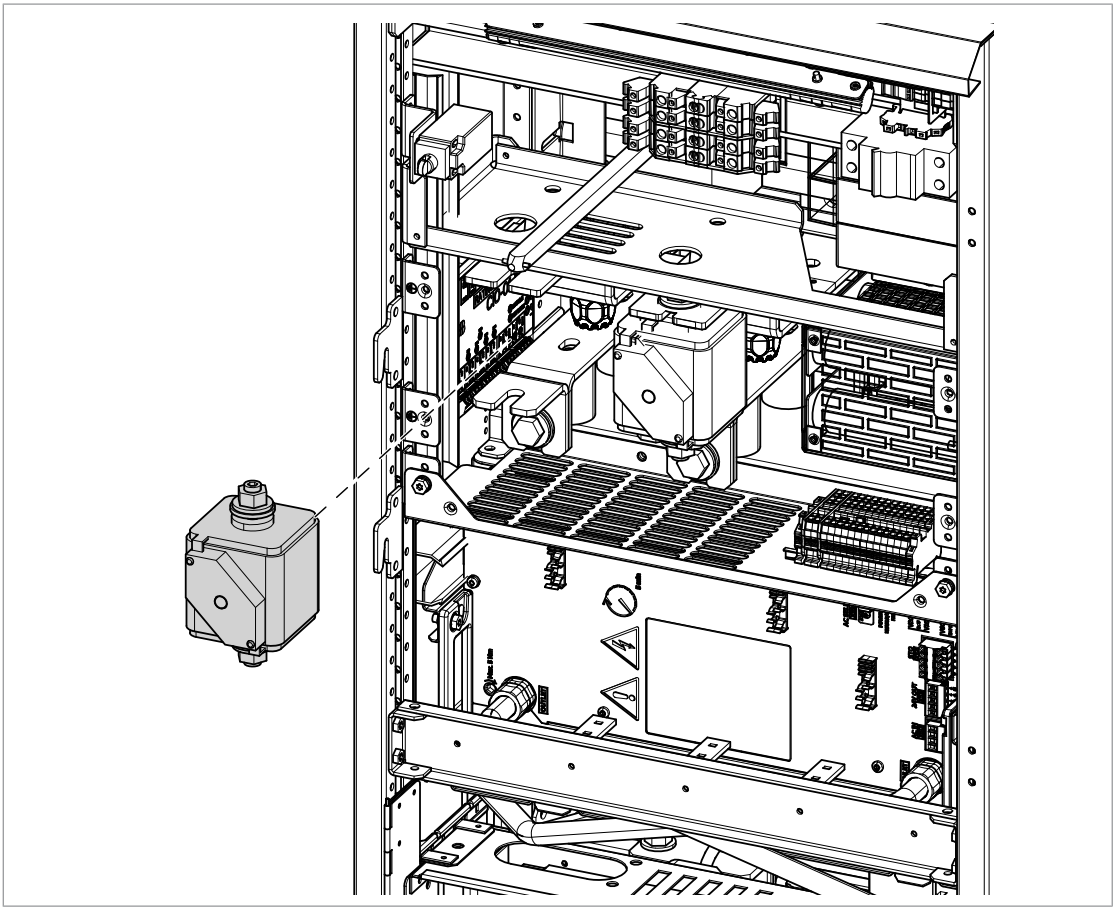
WARNING!
Do not remove or install a fuse when the drive DC bus is energized. If you do, serious injury or death, or damage to the equipment can occur.

Replace a blown fuse with a new one of the same type as follows. For tables of recommended fuses, see the technical data.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Open the cubicle door.
3. Remove the converter fuse cover.



4. Loosen the two nuts on the studs attached to the fuse. Slide the fuse block out.



5. Remove the studs, nuts and washers from the fuse and install them to the new fuse. Make sure that you install the washers in the original order.
6. Torque the nuts as follows:
   - Bussmann fuses: 50 N·m (37 lbf·ft)
   - Other: Refer to the fuse manufacturer's instructions.
7. Install the converter fuse cover.

Replacing an output fuse

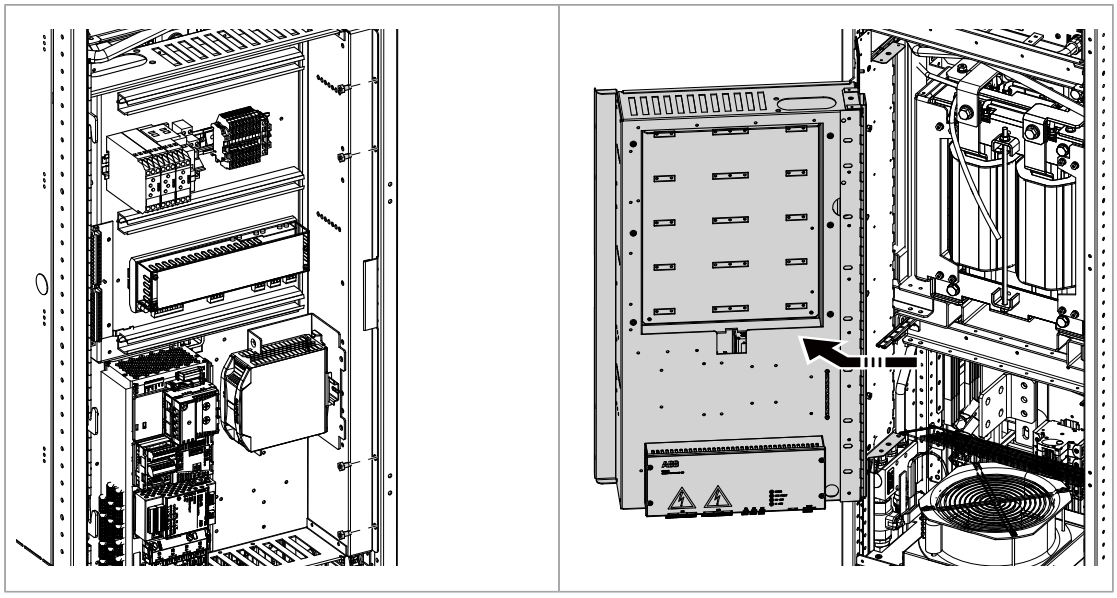
WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

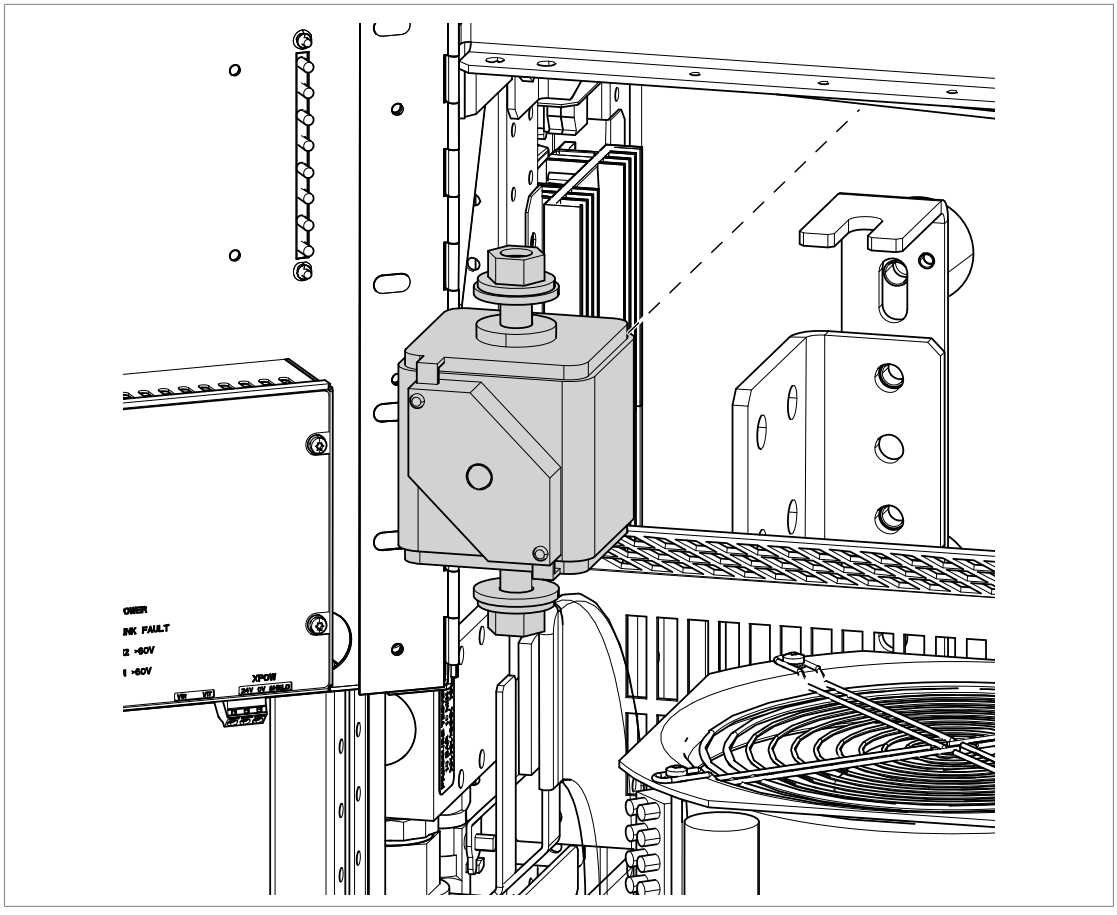
WARNING!
Do not remove or install a fuse when the drive DC bus is energized. If you do, serious injury or death, or damage to the equipment can occur.

Replace a blown fuse with a new one of the same type as follows. For tables of recommended fuses, see the technical data.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Open the cubicle door.
3. Remove the screws that hold the swing-out frame closed. Then open the frame.



4. Loosen the two nuts on the studs attached to the fuse. Slide the fuse block out.



5. Remove the studs, nuts and washers from the fuse and install them to the new fuse. Make sure that you install the washers in the original order.

6. Torque the nuts as follows:
   - Bussmann fuses: 50 N·m (37 lbf·ft)
   - Other: Refer to the fuse manufacturer's instructions.
7. Close the swing-out frame and install the screws.

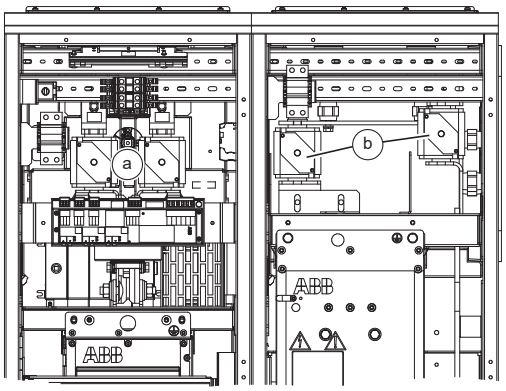
Checking and replacing the fuses – frame R8i

The DC/DC converter unit has two sets of fuses: output fuses on the energy storage side and fuses on the DC bus side.

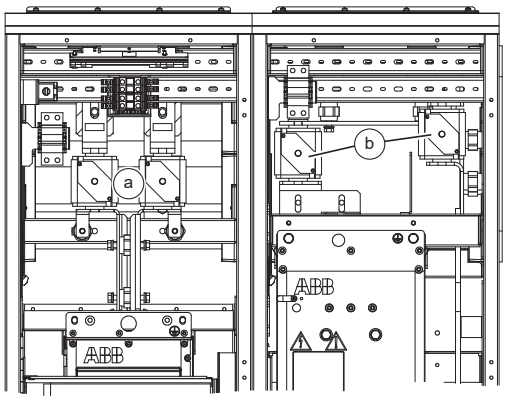
For the location of the fuses, see the figures:

- The converter fuses [F11.x] on the drive DC bus side are marked with **a** in the figure.
- The output fuses [F13.x] on the energy storage side are marked with **b** in the figure.

Converter unit with a DC switch/disconnector



Converter unit without a DC switch/disconnector



WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

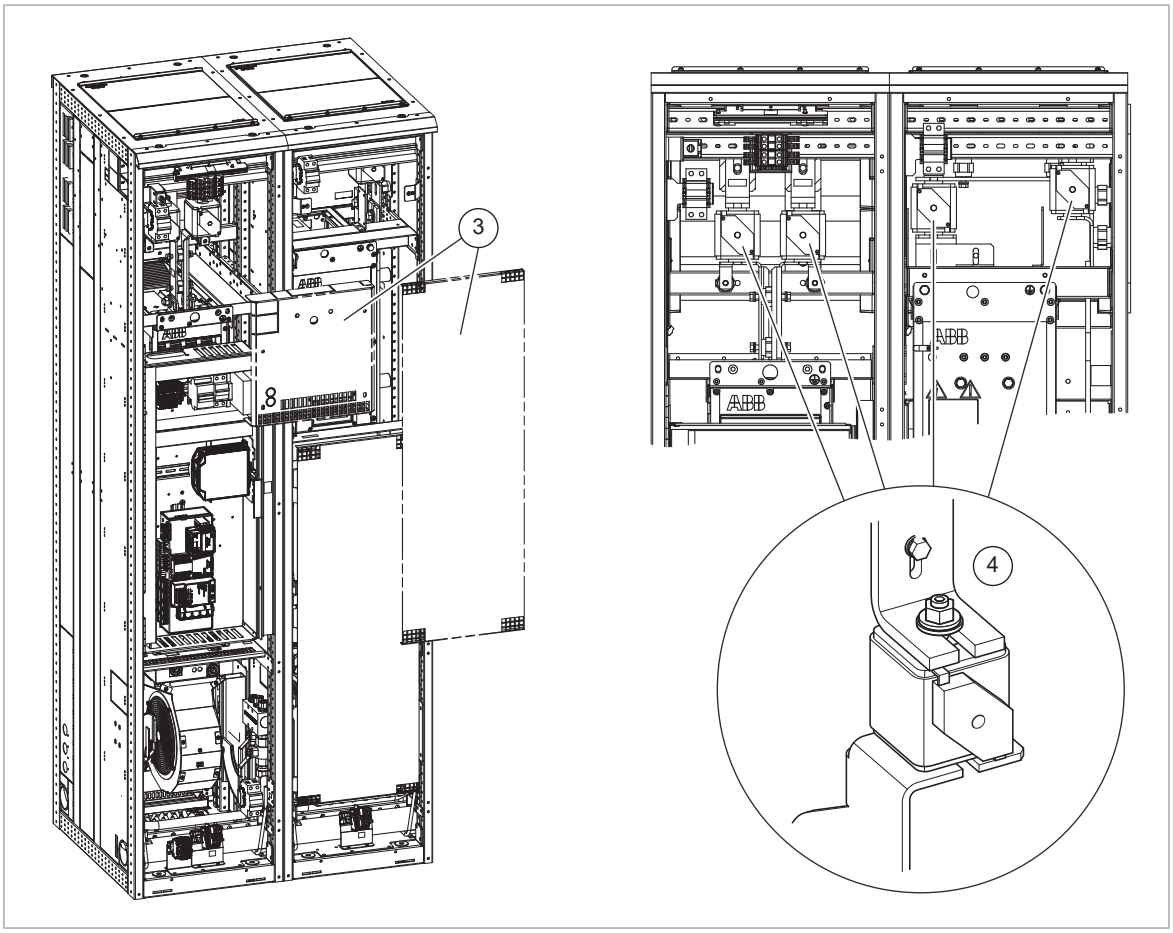
If you are not a qualified electrical professional, do not do installation or maintenance work.

WARNING!
Do not remove or install a fuse when the drive DC bus is energized. If you do, serious injury or death, or damage to the equipment can occur.

Replace a blown fuse with a new one of the same type as follows. For tables of recommended fuses, see the technical data.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Open the cubicle door.
3. Remove the screws of the shroud in the upper part of the cubicle. Remove the shrouds.

4. Loosen the nuts of the headless screws of the fuses so that you can slide out the fuse blocks. Make note of the order of the washers on the screws.
5. Remove the screws, nuts and washers from the old fuses and attach them to the new fuses. Make sure to keep the washers in the original order.
6. Insert the new fuses into their slots in the cubicle.
7. Tighten the nuts to torque as follows:
   - Bussmann fuses: 50 N·m (37 lbf·ft)
   - Other: Refer to the fuse manufacturer's instructions.
8. Install the shrouds.



Fans

The lifespan of the cooling fans of the drive depends on running time, ambient temperature and dust concentration. See the firmware manual for the actual signal which indicates the running time of the cooling fan. Reset the running time signal after fan replacement. See also CIO-01 I/O module for distributed I/O bus control user's manual (3AXD50000126880 [English]).

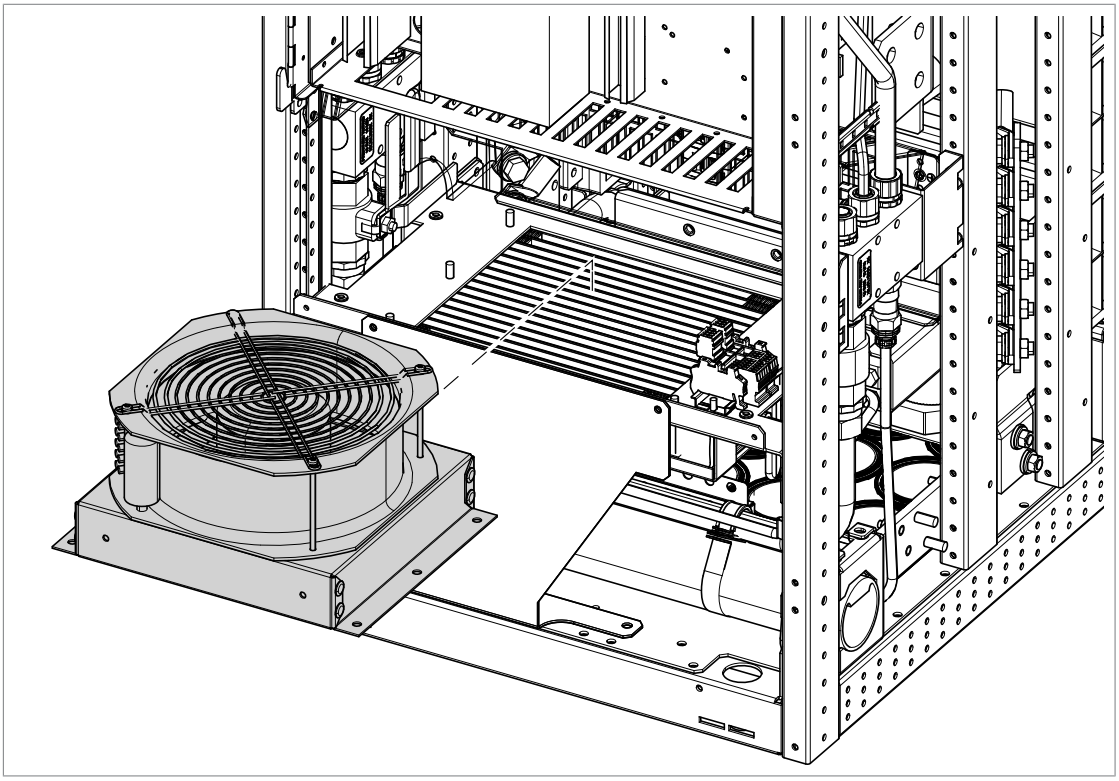
Replacement fans are available from ABB. Do not use other than ABB-specified spare parts.

Frame R7i cabinet fan replacement

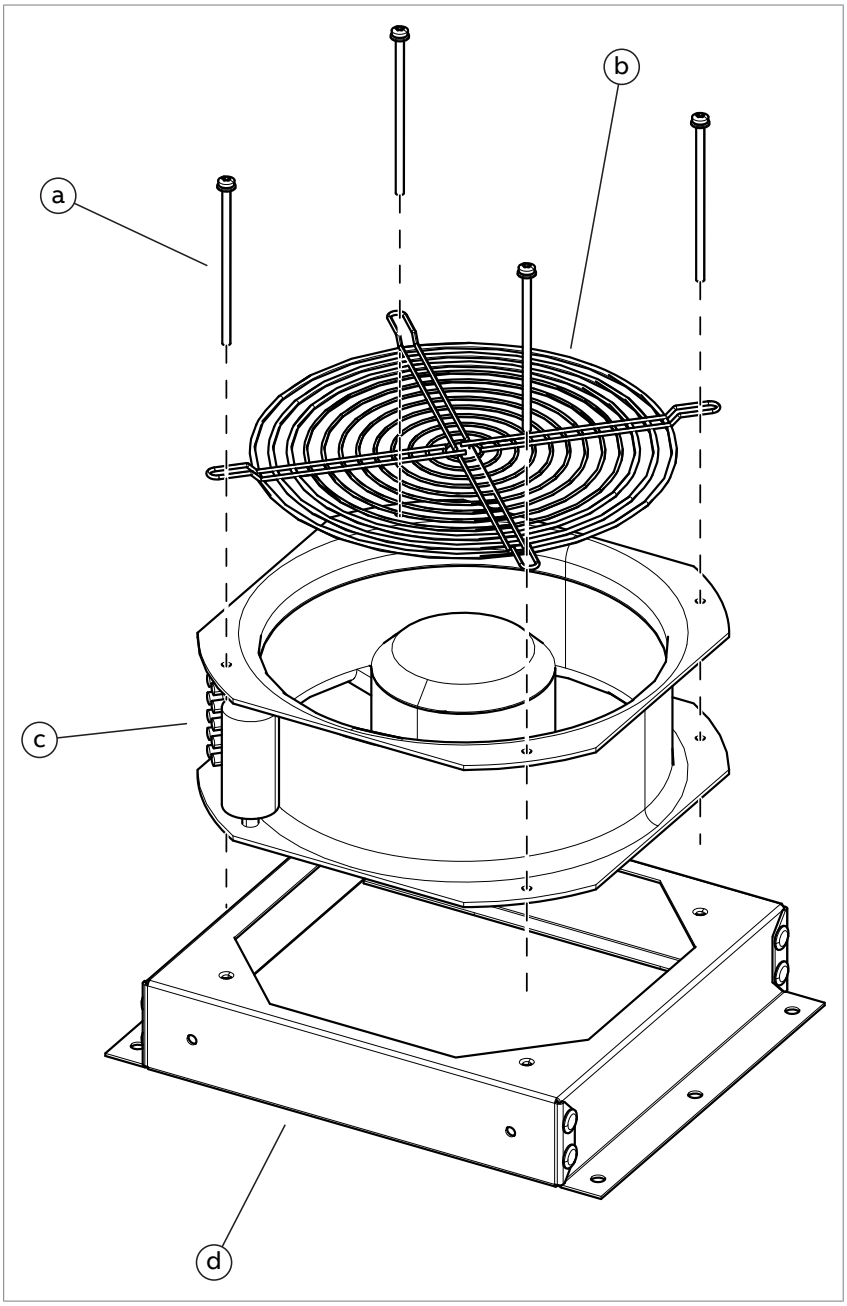
WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Open the cubicle door.
3. Disconnect the fan wiring.
4. Remove the six screws that attach the fan assembly to the heat exchanger. Then remove the fan assembly from the cabinet.



5. Remove the screws (a) that hold the finger guard (b) and fan (c) to the fan mounting plate (d).



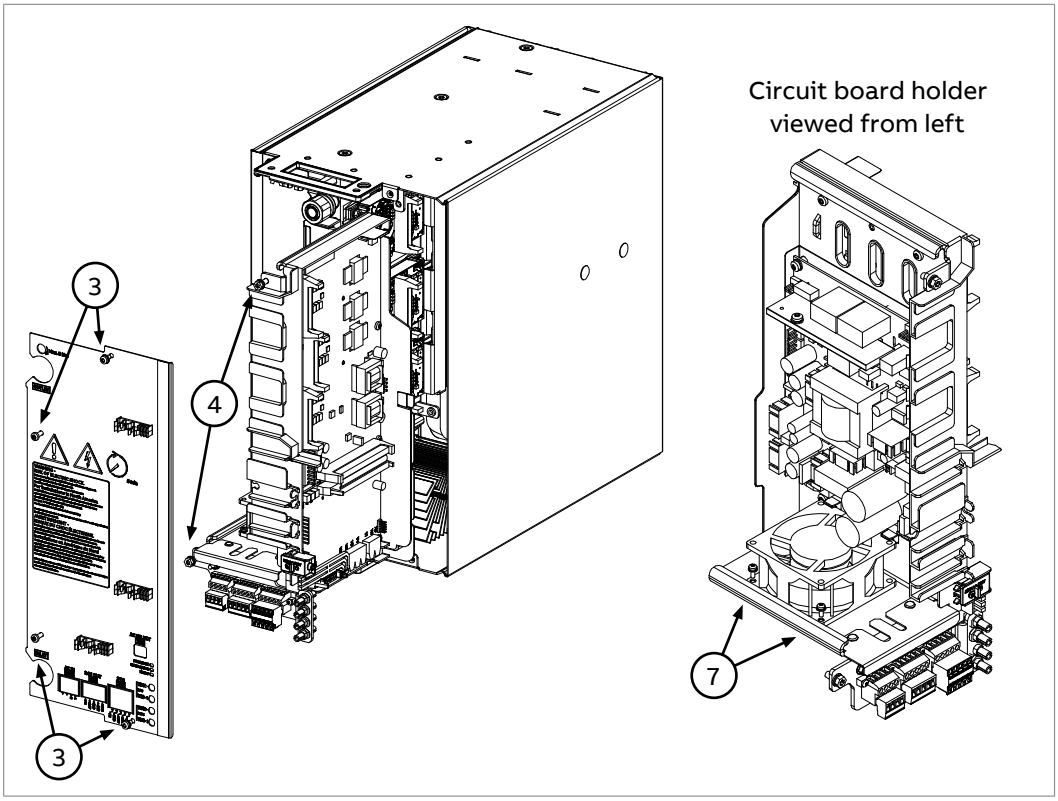
6. Assemble the fan assembly with a new fan. The airflow direction of the fan must be up.
7. Install the fan assembly into the cubicle
8. Connect the fan wiring.

Frame R7i – internal module fan replacement

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Detach and move aside the wiring in front of the module.
3. Remove the four screws that hold the faceplate of the module. Remove the faceplate.
4. Remove the two screws that attach the circuit board holder to the module frame.
5. Carefully pull the circuit board holder outward until you have access to the cooling fan at the bottom of the holder. Detach the wiring coming to the circuit boards if necessary.
6. Disconnect the wiring of the fan.
7. Remove the two screws that hold the fan. Remove the fan.
8. Install a new fan in reverse order to the above. Note that the direction of airflow is up.

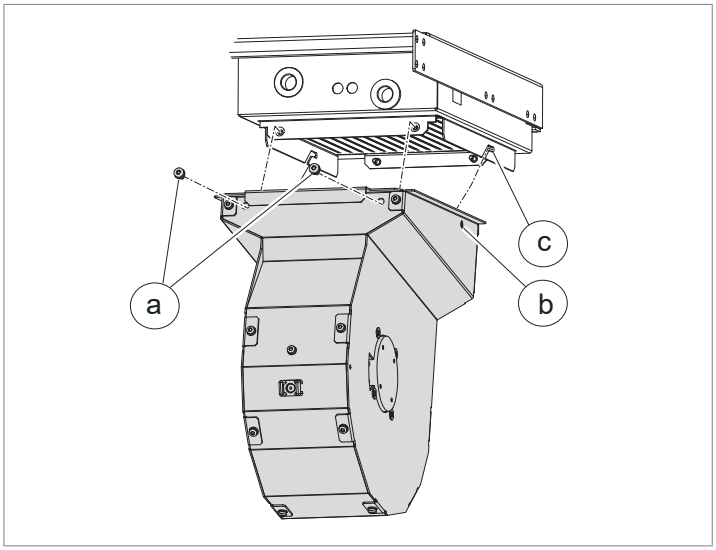


Frame R8i fan replacement

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Remove any shrouding in front of the cooling fan in case of marine construction (option +C121).
3. Disconnect the fan wiring. Remove the CIO module.
4. Remove the two retaining screws (a).
5. Pull the fan outwards to separate it from the heat exchanger housing.
6. Install new fan in reverse order. Align the guide pins (b) at the rear of the fan cowling with the slots (c) in the module bottom guide, then install the retaining screws (a).



R7i converter module

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

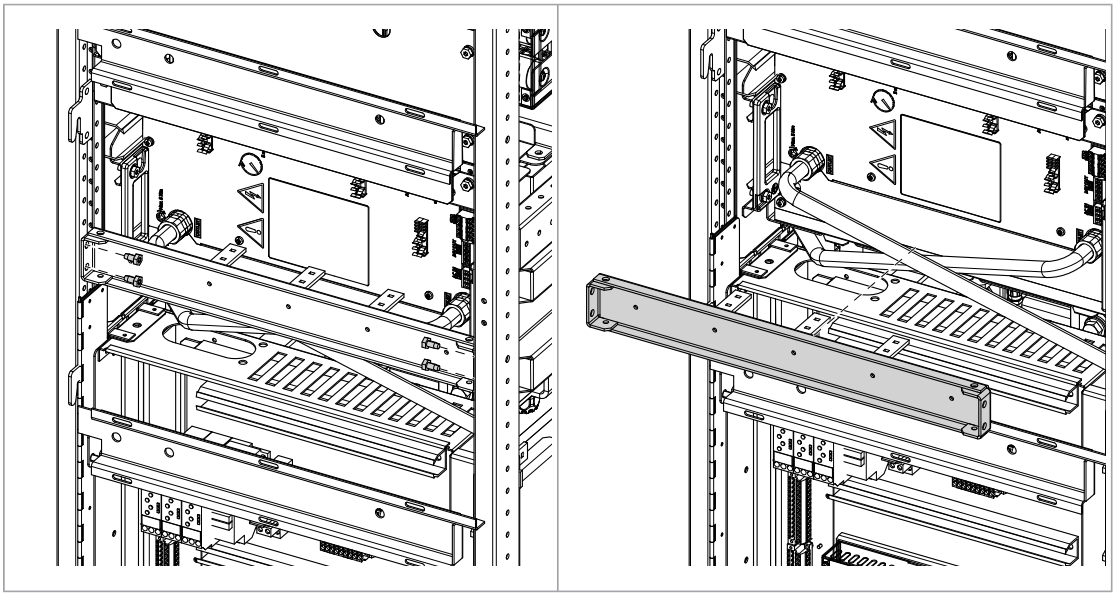
WARNING!
Make sure that the replacement module has exactly the same type code as the old module.

WARNING!
Stop the pumps and drain the coolant before you do work on the liquid cooling system. There is high-pressure hot coolant (6 bar, max. 50 °C) in the cooling circuit when it is in operation.

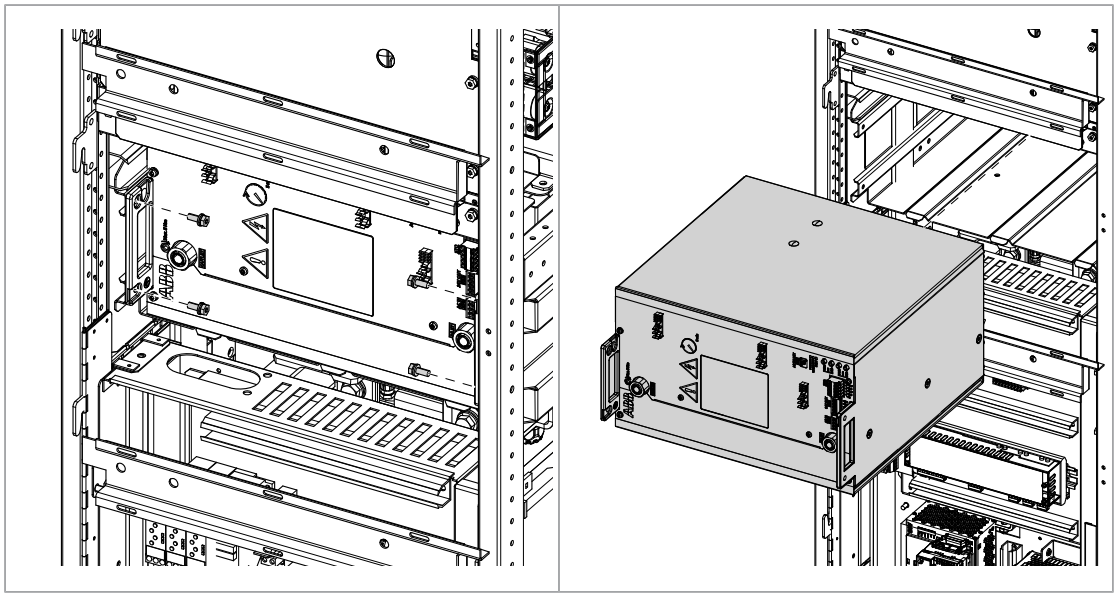
WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

Removing the module

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Open the cubicle door.
3. Remove the support beam in front of the module.



4. Disconnect the power and control cables from the module.
5. Close the inlet and outlet valves of the cubicle.
6. Put the drain hoses into a container. Open the drain valves. This will drain all the equipment in the cubicle.
7. After the coolant is drained, disconnect the coolant pipes from the module.
8. Assemble and install the service platform included in the delivery. Instructions are included in the platform kit.
9. Remove the screws that attach the module to the cabinet frame. Pull out the module onto the service platform.



Installing the module

Install the module as follows:

1. Push the module carefully into its bay.
2. Install the module retaining screws and torque them to 5 N·m (3.6 lbf·ft).
3. Connect the coolant pipes to the module. Tighten to 20 N·m (14.75 lbf·ft).
4. Connect the power and control cables to the module.
5. Fill up the cooling system. For instructions, see section Filling up and bleeding the internal cooling circuit (page 118).
6. Install the support beam in front of the module.

R8i converter module

Replacing an R8i converter module

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

WARNING!
Make sure that the replacement module has exactly the same type code as the old module.

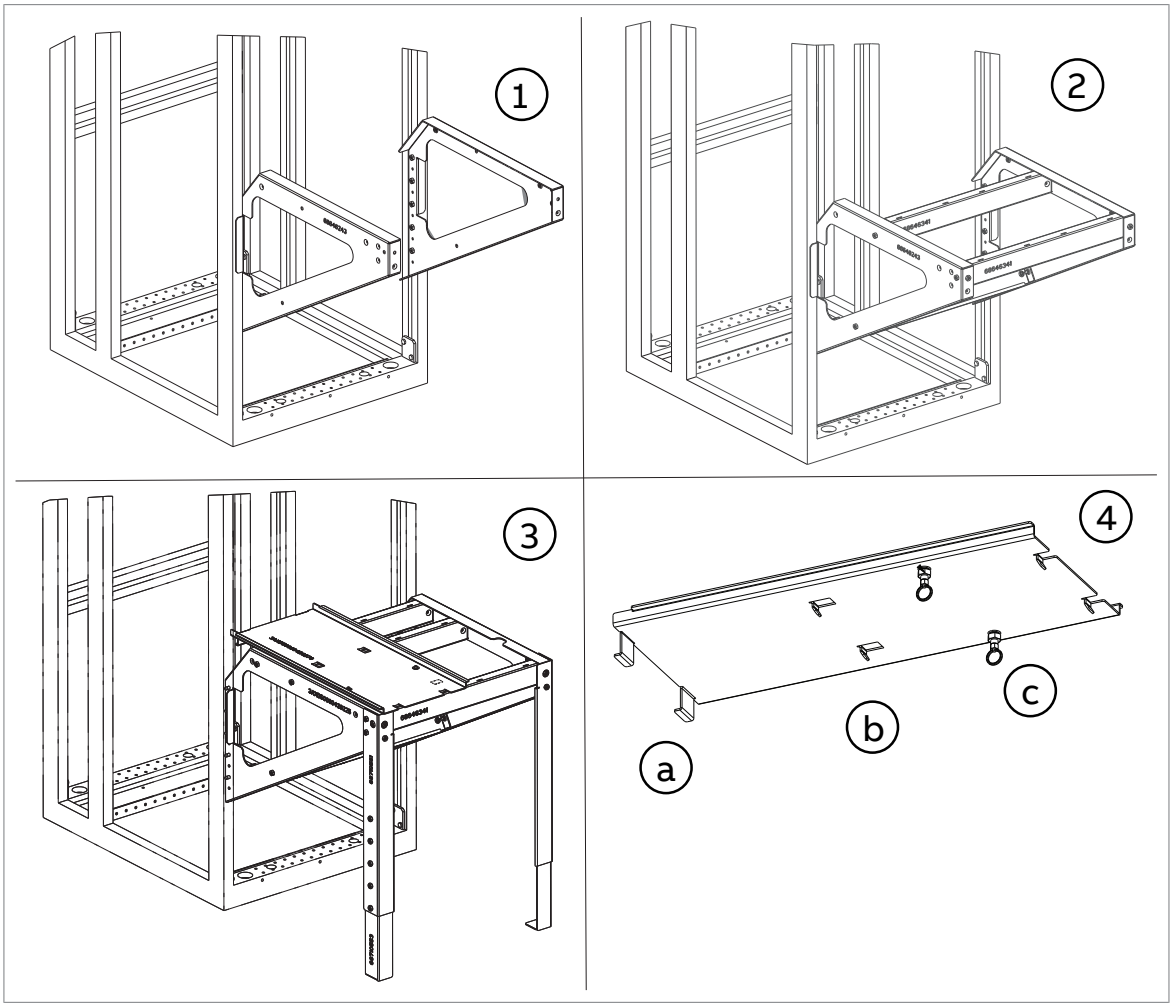
WARNING!
Stop the pumps and drain the coolant before you do work on the liquid cooling system. There is high-pressure hot coolant (6 bar, max. 50 °C) in the cooling circuit when it is in operation.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

Assembling the service platform

The service platform is included in the cabinet delivery. It can be used when installing or servicing liquid-cooled R8i modules.

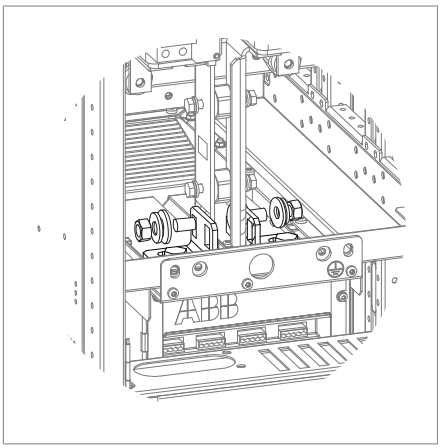
1. Fasten the triangular supports to the cabinet frame (5 × M6 screws for each support). Make sure that the guide pins are properly inserted in the holes of the frame. Tighten the screws to torque (max 5.5 N·m / 4 lb·ft).
2. Select the braces (4 pcs) according to the width of the cubicle and attach them to the supports.
3. Attach the support feet to the platform and adjust them to the correct height.
4. Attach the slide plate. Put the hooks (a) at the back of the slide plate through the holes in the cabinet frame. Align the slots (b) in the slide plate with the braces.
5. Fix the slide plate into place with the index screws (c) at the bottom of the slide plate.



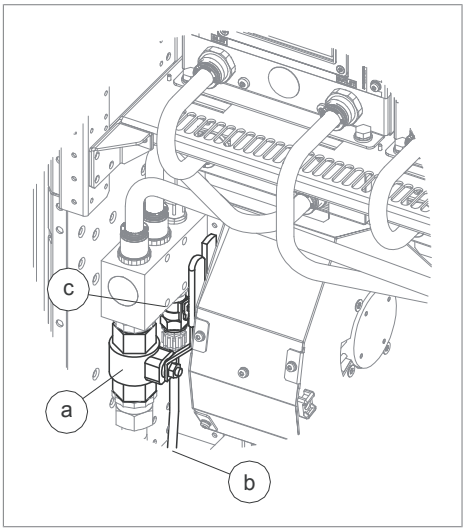
Removing the module

1. Do the steps in section Electrical safety precautions (page 49).
2. Assemble the service platform delivered with the drive. Refer to section Assembling the service platform (page 104).
3. Remove the shrouding in front of the module.
4. Remove the locking screws of the swing-out frame (if present) and open it.
5. Disconnect the wiring from the module and move it aside. Use cable ties to keep the wiring out of the way.

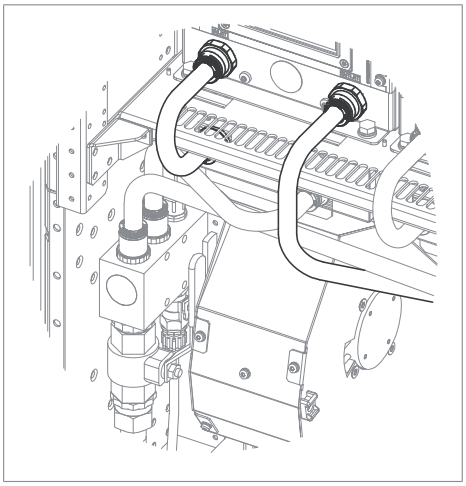
6. Remove the L-shaped DC busbars at the top of the module. Make note of the orientation of the screws as well as the order of the washers.



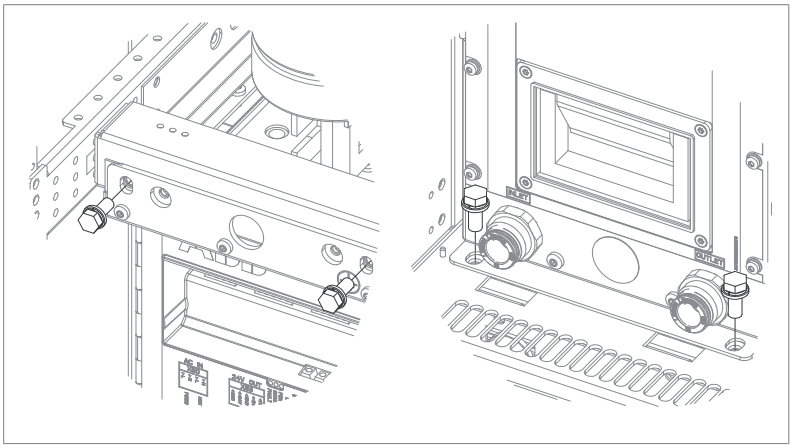
7. Close the inlet valve (a) and outlet valve (located on the right-hand side of the cubicle). Lead the drain hoses (b, on both sides of the cubicle) into a suitable container. Open the drain valves (c, on both sides of the cubicle). This will drain all modules in the cubicle.



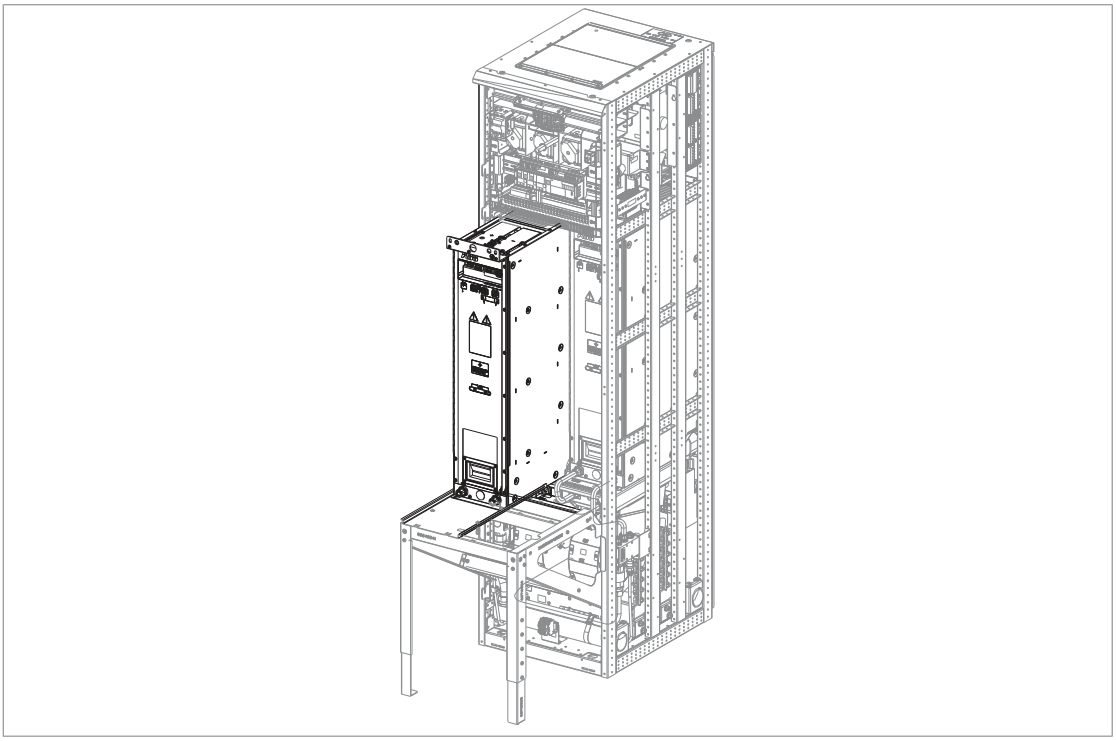
8. After the module has drained, disconnect the piping from the module.



9. Remove the module retaining screws at the top and the bottom of the module.



10. Pull the module carefully out onto the service platform. Keep the module secured to a hoist or equivalent to prevent the module from falling. For information on using the lifting device, see Converter module lifting device for drive cabinets hardware manual (3AXD50000210268 [English]).



Reinstalling the module

1. Push the module carefully into its bay.
2. Fasten the retaining screws at the top and the bottom of the module.
3. Reinstall the DC busbars at the top of the module.
4. Reconnect the coolant pipes to the module. Tighten to specified torque. R8i module coolant connections: 15 N·m (11.1 lbf·ft). Other connections: 20 N·m (14.75 lbf·ft).
5. Reconnect the control wiring to the module.
6. Fill up the cooling system. For instructions, see section Filling up and bleeding the internal cooling circuit.
7. Close the swing-out frame (if present). Reinstall all shrouds removed earlier.

Capacitors

The intermediate DC circuit of the drive contains several electrolytic capacitors. Operating time, load, and surrounding air temperature have an effect on the life of the capacitors. Capacitor life can be extended by decreasing the surrounding air temperature.

Capacitor failure is usually followed by damage to the unit and an input cable fuse failure, or a fault trip. If you think that any capacitors in the drive have failed, contact ABB.

Reforming the capacitors

The capacitors must be reformed if the drive has not been powered (either in storage or unused) for a year or more. The manufacturing date is on the type designation label. For information on reforming the capacitors, refer to Capacitor reforming instructions (3BFE64059629 [English]).

Control panel

Refer to ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual (3AUA0000085685 [English]).

Control unit

BCU control unit types

There are three variants of the BCU control unit used in ACS880: BCU-02, BCU-12 and BCU-22. These have a different number of converter module connections (2, 7 and 12 respectively) but are otherwise identical. The three BCU types are interchangeable as long as the number of connections is sufficient. For example, the BCU-22 can be used as a direct replacement for both BCU-02 and BCU-12.

UCU control unit types

Different variants of the UCU control units are used in ACS880 drives: UCU-22…24. These have a different number of converter module connections but are otherwise identical. The UCU types are interchangeable as long as the number of connections is sufficient. For example, the UCU-24 can be used as a direct replacement for both UCU-22 and UCU-23.

Replacing the memory unit (BCU)

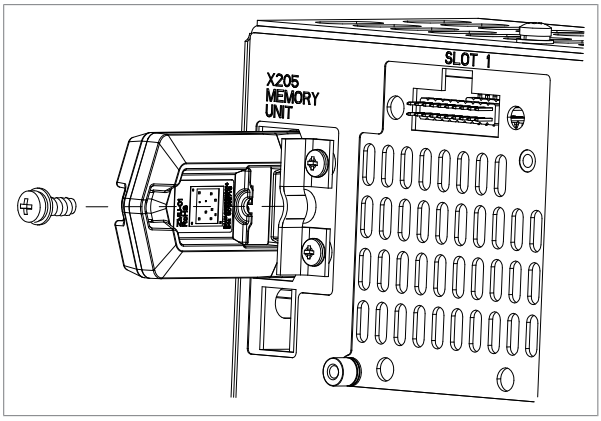
After replacing a control unit, you can keep the existing parameter settings by transferring the memory unit from the defective control unit to the new control unit.

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

WARNING!
Do not remove or insert the memory unit when the control unit is powered.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Make sure that the control unit is not powered.
3. Remove the fastening screw and pull the memory unit out.
4. Install a memory unit in reverse order.



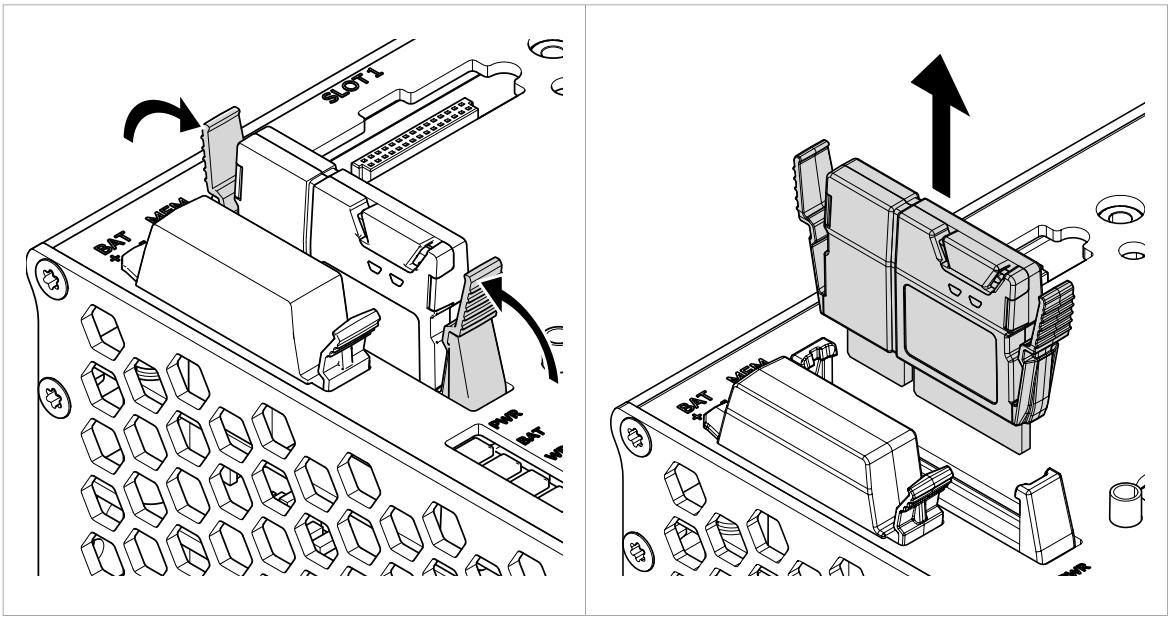
Replacing the memory unit (UCU-22...24)

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

After replacing a control unit, you can keep the existing parameter settings by transferring the memory unit from the defective control unit to the new control unit.

WARNING!
Do not remove or install the memory unit when the control unit is powered.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Make sure that the control unit is not powered.
3. Push and hold in the clips on the memory unit. Pull the memory unit out.
4. Push the new memory unit in.



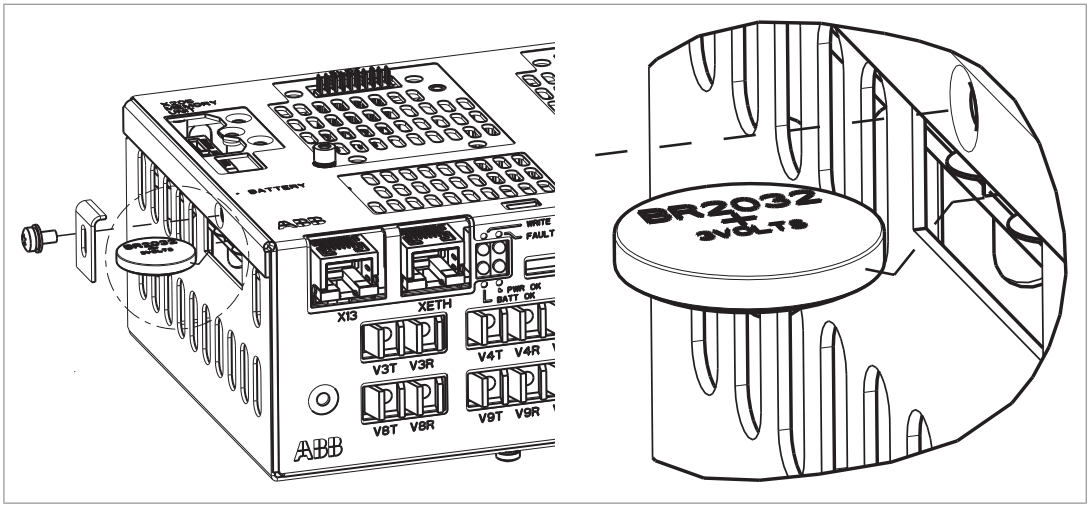
Replacing the BCU control unit battery

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrives cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

Replace the real-time clock battery if the BATT OK LED is not illuminated when the control unit is powered.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Undo the fastening screw and remove the battery.
3. Replace the battery with a new BR2032 battery.
4. Dispose of the old battery according to local disposal rules or applicable laws.
5. Set the real-time clock.



Replacing the real-time clock battery (UCU-22...24)

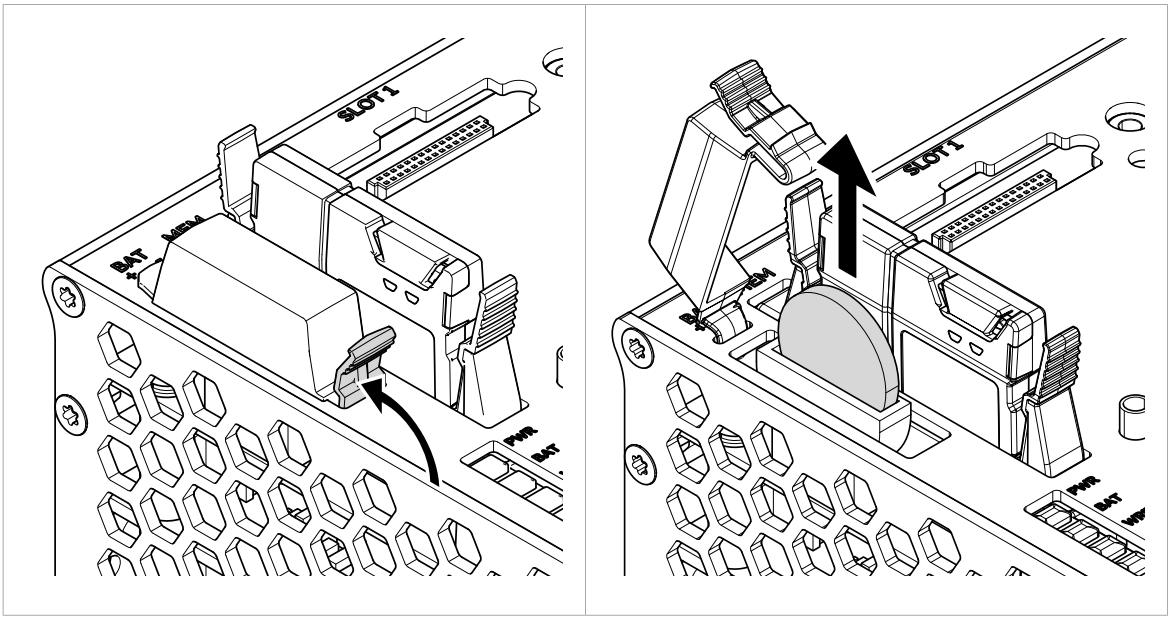
WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

Replace the real-time clock battery if the BAT LED is off when the control unit is powered.

1. Stop the drive and do the steps in section Electrical safety precautions (page 49) before you start the work.
2. Open the battery cover.
3. Replace the battery with a new BR2032 battery.

Note: The real-time clock stays set for 2 minutes without battery.

4. Close the battery cover.
5. Set the real-time clock if necessary.
6. Dispose of the old battery according to local disposal rules or applicable laws.

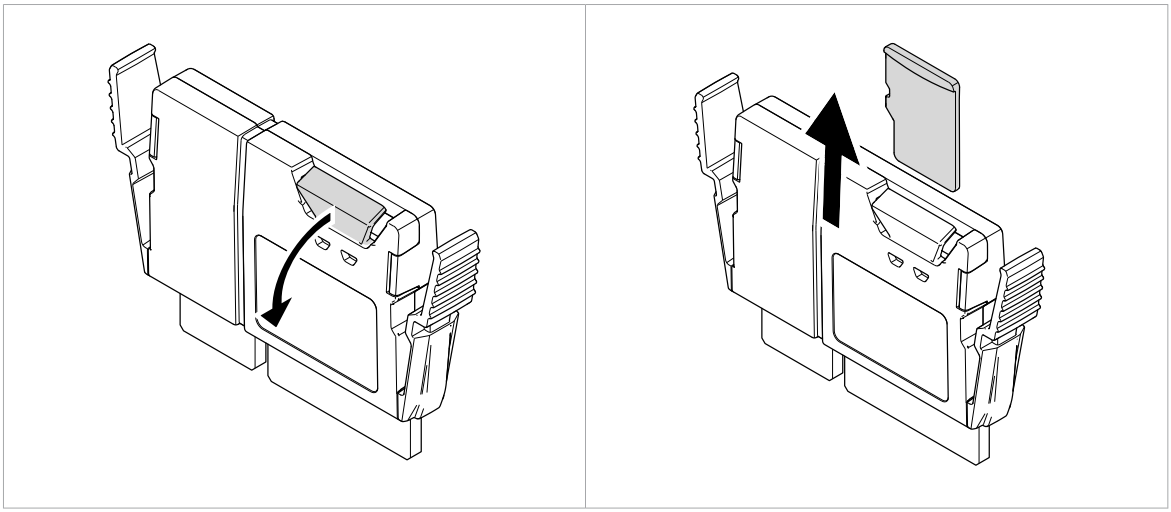


Replacing the microSDHC memory card (UCU-22…24)

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

For the replacement card type, refer to the technical data.

1. Remove the UMU-01 memory unit from the control unit.
2. Move away from the cabinet before you remove the microSDHC card from the memory unit. The card is small and can fall into the cabinet.
3. Open the memory card cover in the memory unit.
4. Push the card to remove it.
5. Install a new card in reverse order.



LEDs and other status indicators

This section gives information on how to read the status indications of the DC/DC converter.

The control panel on the cabinet door shows the warnings and faults given by the control program. You can also use the Drive Composer PC tool to view the warnings and faults. For more information, refer to the firmware manual and the Drive Composer PC tool manual.

Control panel and panel platform/holder LEDs

The ACS-AP-… control panel has a status LED. The control panel mounting platform or holder has two status LEDs. For their indications, see the following table.

Location	LED	Indication
Control panel	Continuous green	The unit is functioning normally.
	Flickering green	Data is transferred between the PC and the unit through the USB connection of the control panel.
	Flashing green	There is an active warning in the unit.
	Continuous red	There is an active fault in the unit.
	Flashing red	There is a fault that requires the stopping and restarting of the drive/converter/inverter.
	Flashing blue (ACS-AP-W only)	The Bluetooth interface is enabled, in discoverable mode, and ready for pairing.
	Flickering blue (ACS-AP-W only)	Data is being transferred through the Bluetooth interface of the control panel.
Control panel mounting platform or holder (with the control panel removed)	Red	There is an active fault in the unit.
	Green	Power supply for the control unit is OK.

Converter module LEDs

The converter module LEDs are given in section Converter module hardware (page 24)

Converter unit LEDs

The converter unit cabinet has 1…3 door lamps. The indications are given in this table.

LED	Color	Indication (When the LED is on)
Charging OK indicator	Green	The DC bus of the converter modules is charged. The unit is ready for connection to the common DC bus.
DC/DC converter disconnected	White	The DC/DC converter unit is disconnected from the main DC bus. **Note:** Auxiliary voltages must be disconnected separately.
Load disconnected indicator (white)	White	The disconnector of the energy storage is open.

Note: When the white lamps are on, DC/DC converter is disconnected from the DC bus and the energy storage.

10

Internal cooling circuit

Contents of this chapter

The cooling system of a liquid-cooled drive consists of two circuits: the internal cooling circuit and the external cooling circuit. The internal cooling circuit covers the heat-generating electrical components of the drive and transfers the heat to the cooling unit. In the cooling unit, the heat is transferred to the external cooling circuit which is usually part of a larger external cooling system. This chapter deals with the internal cooling circuit.

Applicability

The information in this chapter is applicable to cabinet-built ACS880 liquid-cooled drives. Except where otherwise indicated, the information is also applicable to drives built out of ACS880 liquid-cooled multidrives modules.

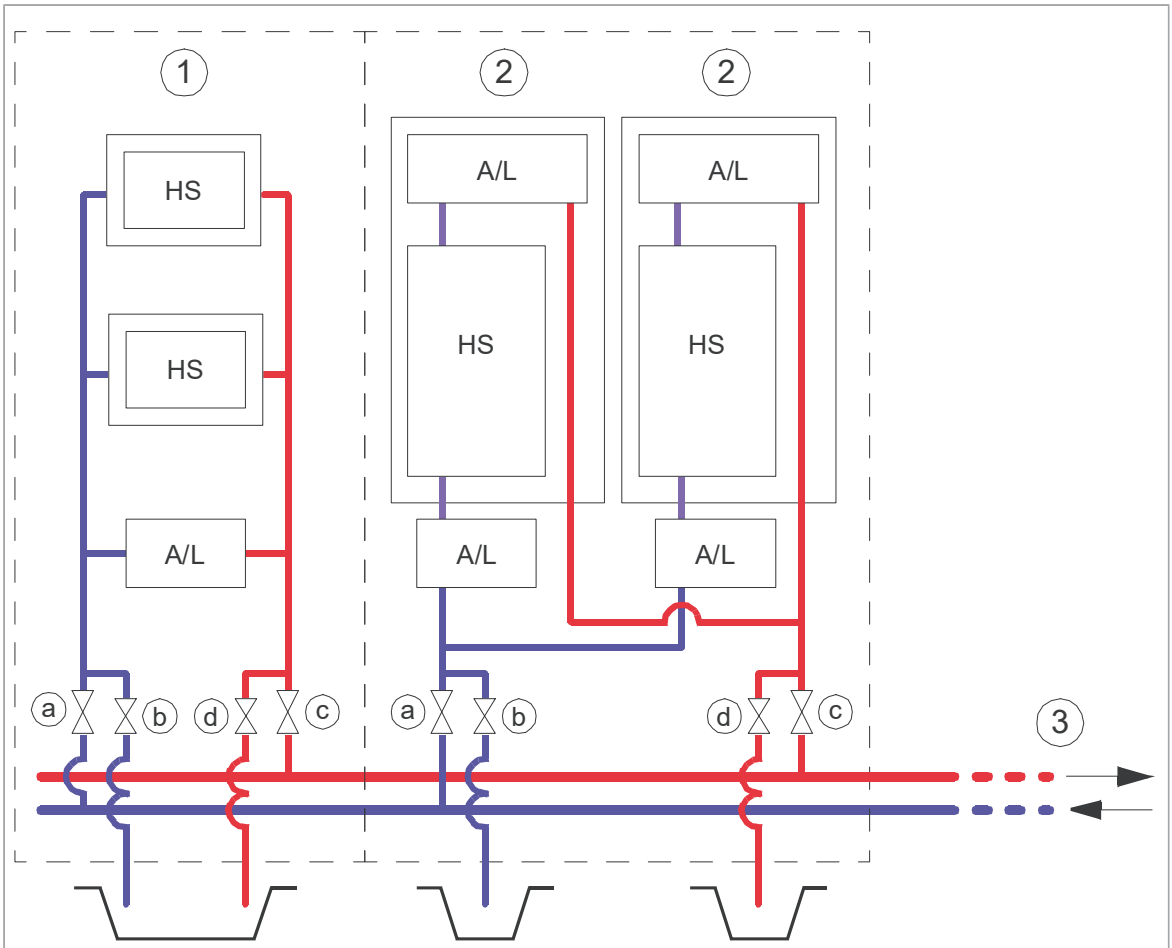
Internal cooling system

Each cubicle has an inlet and an outlet manifold, fitted with a stop valve and a drain valve. The stop valves can be closed to isolate all modules in the cubicle from the main cooling circuit.

In cabinet line-ups built by ABB, valves are color-coded:

- Blue – Open during operation
- Red – Closed during operation

The following diagram shows the coolant pipe connections in a drive system consisting of a supply unit and an inverter unit. Other units, such as brake units, DC/DC converter units have similar cooling arrangements. Other cubicles containing components that require cooling may also contain heat exchangers.



1	Supply modules. The drawing shows the configuration of a diode supply unit with two modules, ie. there is a common air-to-liquid exchanger in the cubicle. With an IGBT supply unit, each module has a dedicated air-to-liquid exchanger as shown for item 2.
2	Inverter modules
3	To/From cooling unit
A/L	Air-to-liquid heat exchanger
HS	Heat sink
a	Inlet valve
b	Inlet-side drain valve
c	Outlet valve
d	Outlet-side drain valve

The coolant used with ACS880 liquid-cooled drive systems is Antifrogen® L 25% or 50% mixture. See Coolant specification (page 120).

Connection to a cooling unit

Connection to an ACS880-1007LC cooling unit

Refer to ACS880-1007LC cooling unit user's manual (3AXD50000129607 [English]).

Connection to a custom cooling unit

General requirements

Equip the system with an expansion vessel to damp pressure rise due to volume changes when the temperature varies. Equip the system with a pump that provides a nominal flow and pressure. Keep the pressure within the limits specified in Technical data (page 120). Install a pressure regulator to make sure that the maximum permissible operating pressure is not exceeded.

Install a bleed valve at the highest point of the cooling circuit, and a drain valve at the lowest point.

The materials that can be used are listed in Cooling circuit materials (page 122).

Coolant temperature control

The temperature of the coolant in the internal cooling circuit must be kept within the limits specified in Technical data (page 120). Note that the minimum temperature is dependent on ambient temperature and relative humidity.

Filling up and bleeding the internal cooling circuit

Both the drive and coolant must be at room temperature before filling up the cooling circuit.

WARNING!
Make sure that the maximum permissible operating pressure is not exceeded. When necessary regulate the pressure to appropriate level by draining excess coolant out of the system.

WARNING!
Bleeding of the cooling circuit is very important and has to be done with great care. Air bubbles in the cooling circuit may reduce or completely block coolant flow and lead to overheating. Let the air out of the cooling system while filling in coolant and, eg. after any power module replacements.

Drive line-ups with an ACS880-1007LC cooling unit

Obey the filling up and bleeding instructions in ACS880-1007LC cooling unit user's manual (3AXD50000129607 [English]).

Drive line-ups with a custom cooling unit

Note:

- In filling up the system, the drain valves in the line-up are used only to vent the air from the circuit so that it can be displaced by the coolant. The actual bleeding of the circuit must be done via an external bleed valve installed at the highest point of the cooling circuit. The most practical location for the valve is usually near or at the cooling unit.
- Observe the instructions given by the manufacturer of the cooling unit. Pay special attention to filling up and bleeding the pumps properly as they may be damaged if operated when dry.
- Draining coolant into the sewer system is not allowed.

1. Open the bleed valve at the cooling unit.
2. Open the inlet valve and the outlet-side drain valve of one cubicle. Keep the outlet valve and the inlet-side drain valve closed.
3. Attach a hose to the outlet-side drain valve and lead it into a suitable container.
4. Fill the circuit with coolant. For the coolant specification, refer to section Coolant specification (page 120).
   To minimize foaming, do not exceed the filling flow rate of 5 l/min (1.3 US gallon/min).
5. As the piping and modules in the cubicle fills up, coolant starts to flow from the hose. Let some coolant flow out, then close the drain valve.
6. Close the inlet valve.
7. Repeat steps 2…6 for all cubicles in the line-up.
8. Open the inlet and outlet valves in all cubicles. Let any air remaining in the system out through the bleed valve at the cooling unit.

9. Close the bleed valve at the cooling unit.
10. Continue to fill in coolant until a base pressure of approximately 250 kPa is achieved.
11. Open the bleed valve of the pump to let out any air.
12. Re-check the pressure and add coolant if necessary.
13. Start the coolant pump. Let any air remaining in the system out through the bleed valve at the cooling unit.
14. After one to two minutes, stop the pump or block the coolant flow with a valve.
15. Re-check the pressure and add coolant if necessary.
16. Repeat steps 13…15 a few times until all air is let out of the cooling circuit. Listen for a humming sound and/or feel the piping for vibration to find out if there is still air left in the circuit.

Draining the internal cooling circuit

The modules in each cubicle can be drained through the drain valves without draining the whole internal cooling circuit.

WARNING!
Hot, pressurized coolant can be present in the cooling circuit. Do not work on the cooling circuit before the pressure is released by stopping the pumps and draining coolant.

1. Attach hoses to each drain valve in the cubicle to be drained. Lead the hoses into a suitable container. Make sure the ends of the hoses are not immersed in coolant at any point so that air can displace the coolant in the system.
2. Open the drain valves. Wait until all coolant has drained.

   Note: Draining coolant into the sewer system is not allowed.
3. If required, dry the piping with compressed oil-free air of less than 6 bar.
4. If the drive is to be stored in temperatures below 0 °C (32 °F),
   - dry the cooling circuit with air,
   - fill the cooling circuit with coolant specified under Coolant specification (page 120).
   - drain the cooling circuit again.

Maintenance intervals

As a general rule, the quality of the coolant should be checked at intervals of two years. This can be done by distributors of Antifrogen® L (see www.clariant.com) if a 250 milliliter sample is provided.

Technical data

Coolant specification

Coolant type

Antifrogen® L (by Clariant International Ltd, www.clariant.com) 25% or 50% mixture, available from Clariant distributors and ABB Service representatives.

Do not dilute the coolant. It is ready to use.

Antifrogen® L 25% mixture is usable in storage temperatures down to -16 °C (3.2 °F). Antifrogen® L 50% mixture is usable in storage temperatures down to -40 °C (-40 °F).

Note that operation below 0 °C (32 °F) is not permitted regardless of the freezing point of the coolant.

WARNING!
The warranty does not cover damage that occurs from the use of incorrect coolant.

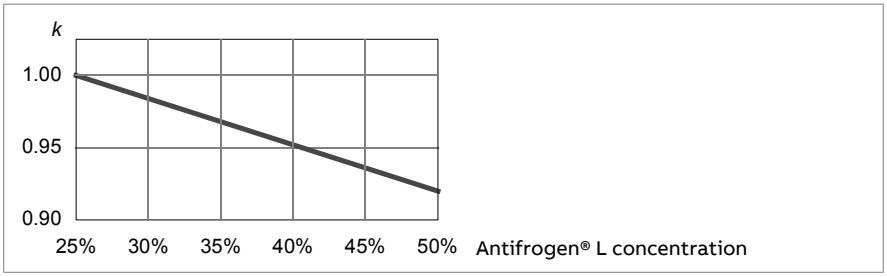
Temperature limits

Ambient temperature: See the technical data of the drive/unit.

Freeze protection: The freezing point of the coolant is determined by the concentration of heat transfer fluid in the mixture.

The higher the concentration of heat transfer fluid, the higher the viscosity of the coolant. This results in a higher pressure loss in the system. See Pressure limits (page 122).

The nominal current ratings of drive system modules apply to an Antifrogen® L / water solution of 25/75% (volume). With the Antifrogen® L concentration between 25% and 50%, the drive output current must be derated by 1/3 percentage point per 1 p.p. increase in Antifrogen® L concentration. The drawing below shows the derating factor *(k)* in relation to Antifrogen® L concentration.



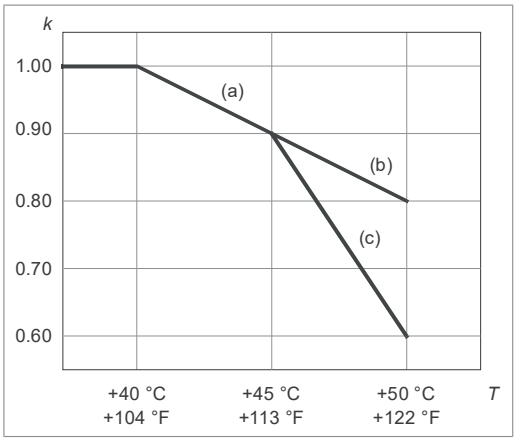
Incoming coolant temperature:

- 0…40 °C (32…104 °F): no drive output current derating required
- 40…45 °C (104…113 °F): drive output current must be derated by 2 percentage points per 1 °C (1.8 °F) temperature increase, as shown by curve (a).
- 45…50 °C (113…122 °F):
  - If components with a maximum operating temperature of 55 °C (131 °F) are installed in the same space as the drive modules, drive output current must

be derated by 6 percentage points per 1 °C (1.8 °F) temperature increase, as shown by curve (c).

- If there are no components with a maximum operating temperature of 55 °C (131 °F) installed in the same space as the drive modules, drive output current must be derated by 2 percentage points per 1 °C (1.8 °F) temperature increase, as shown by curve (b).

The drawing below shows the derating factor *(k)* in relation to coolant temperature.



Condensation is not permitted. The minimum coolant temperature to avoid condensation (at an atmospheric pressure of 1 bar) is shown below as a function of relative humidity (RH) and ambient temperature (T_{air}).

T_{air} (°C)	Min. $T_{coolant}$ (°C)				
	RH = 95%	RH = 80%	RH = 65%	RH = 50%	RH = 40%
5	4.3	1.9	-0.9	-4.5	-7.4
10	9.2	6.7	3.7	-0.1	-3.0
15	14.2	11.5	8.4	4.6	1.5
20	19.2	16.5	13.2	9.4	6.0
25	24.1	21.4	17.9	13.8	10.5
30	29.1	26.2	22.7	18.4	15.0
35	34.1	31.1	27.4	23.0	19.4
40	39.0	35.9	32.2	27.6	23.8
45	44.0	40.8	36.8	32.1	28.2
50	49.0	45.6	41.6	36.7	32.8
55	53.9	50.4	46.3	42.2	37.1

	= Not permitted as standard but the coolant temperature must be 0 °C (32 °F) or more.
Example:	At an air temperature of 45 °C and relative humidity of 65% the coolant temperature must not be less than +36.8 °C

Maximum temperature rise: Depends on heat losses and mass flow. Typically 10 °C (18 °F) with nominal losses and flow.

Pressure limits

Base pressure: 250 kPa (recommended); 300 kPa (maximum). “Base pressure” denotes the pressure of the system compared with the atmospheric pressure when the cooling circuit is filled with coolant.

Air counterpressure in expansion vessel (with ACS880-1007LC cooling unit): 80 kPa

Design pressure (PS): 600 kPa

Nominal pressure difference: 120 kPa with Antifrogen® L 25% coolant solution, 140 kPa with Antifrogen® L 50% coolant solution. This has to be taken into account when dimensioning the liquid cooling circuit.

Maximum pressure difference: 160 kPa

Coolant flow rate limits

The maximum coolant flow rate for all drive equipment is 1.3 × nominal. See the technical data chapter for nominal values.

Cooling circuit materials

Materials used in the internal cooling circuit are listed below.

- stainless steel AISI 316L (UNS 31603)
- heavy gauge aluminum
- plastic materials such as PA, PEX and PTFE

  Note: PVC hoses are not suitable for use with antifreeze.
- rubber gasketing NBR (nitrile rubber).

WARNING!
If you connect external piping to the internal cooling circuit, use only materials that are specified above. Other materials can cause galvanic corrosion. If the external piping contains other materials, use a cooling unit with a heat exchanger (for example, ACS880-1007LC) to keep the external piping separate from the internal cooling circuit.

11

Technical data

Contents of this chapter

This chapter contains the technical data for the DC/DC converter units.

Ratings

ACS880-1607LC-...	Frame	No-overload use							
		$I_{DC\ input}$	$I_{rms\ output}$	$P_{contmax}$	$P_{contmax}$	$I_{max\ output}$	S_n	I_{p2p}	$f_{SW\ out}$
		A (DC)	A (DC)	kW	hp	A (DC)	kVA	A	Hz
U_n = 500 V									
0150A-5	R7i	147	150	95	128	188	95	9	12000
0250A-5	R7i	244	250	159	213	313	159	9	12000
0350A-5	R7i	341	350	223	299	438	223	9	12000
0450A-5	R7i	439	450	286	384	563	286	9	12000
0550A-5	R7i	536	550	350	469	688	350	9	12000
0700A-5	2×R7i	682	700	446	597	875	446	5	24000
0900A-5	2×R7i	876	900	572	768	1125	572	5	24000
1100A-5	2×R7i	1071	1100	700	939	1375	700	5	24000
U_n = 690 V									
0150A-7	R7i	147	150	132	177	188	132	13	12000
0200A-7	R7i	196	200	176	236	250	176	13	12000
0300A-7	R7i	293	300	263	353	375	263	13	12000
0399A-7	R7i	390	400	351	471	500	351	13	12000
0599A-7	2×R7i	585	600	527	707	750	527	6	24000
0799A-7	2×R7i	780	800	703	942	1000	703	6	24000

ACS880-1607LC-...	Frame	No-overload use							
		$I_{DC\ input}$	$I_{rms\ output}$	$P_{contmax}$	$P_{contmax}$	$I_{max\ output}$	S_n	I_{p2p}	$f_{SW\ out}$
		A (DC)	A (DC)	kW	hp	A (DC)	kVA	A	Hz
0400A-7	R8i	391	400	351	471	500	351	38	12000
0500A-7	R8i	490	500	439	589	625	439	38	12000
0600A-7	R8i	590	600	527	707	750	527	56	12000
0700A-7	R8i	690	700	615	824	875	615	56	12000
0800A-7	R8i	790	800	703	942	1000	703	56	12000
0900A-7	R8i	880	900	790	1060	1125	790	56	12000
1000A-7	2×R8i	980	1000	878	1178	1250	878	19	24000
1200A-7	2×R8i	1180	1200	1054	1413	1500	1054	28	24000
1400A-7	2×R8i	1370	1400	1230	1649	1750	1230	28	24000
1600A-7	2×R8i	1570	1600	1405	1884	2000	1405	28	24000
1800A-7	2×R8i	1760	1800	1581	2120	2250	1581	28	24000

ACS880-1607LC-...	Frame	Short time overload use		Heavy overload use	
		$I_{short\ time}$	$P_{short\ time}$	I_{Hd}	P_{Hd}
		A	kW	A	kW
U_n = 500 V					
0150A-5	R7i	94	60	113	72
0250A-5	R7i	156	99	189	120
0350A-5	R7i	219	139	265	168
0450A-5	R7i	281	179	340	216
0550A-5	R7i	344	219	416	265
0700A-5	2×R7i	437	278	529	337
0900A-5	2×R7i	562	358	680	433
1100A-5	2×R7i	687	437	831	529
U_n = 690 V					
0150A-7	R7i	94	82	113	100
0200A-7	R7i	125	110	151	133
0300A-7	R7i	187	165	227	199
0399A-7	R7i	250	219	302	266
0599A-7	2×R7i	375	329	453	398
0799A-7	2×R7i	500	439	605	531
0400A-7	R8i	250	219	302	266
0500A-7	R8i	312	274	378	332
0600A-7	R8i	375	329	453	398
0700A-7	R8i	437	384	529	465
0800A-7	R8i	500	439	605	531
0900A-7	R8i	562	494	680	597
1000A-7	2×R8i	625	549	756	664
1200A-7	2×R8i	750	658	907	797

ACS880-1607LC-...	Frame	Short time overload use		Heavy overload use	
		$I_{short\ time}$	$P_{short\ time}$	I_{Hd}	P_{Hd}
		A	kW	A	kW
1400A-7	2×R8i	874	768	1058	929
1600A-7	2×R8i	999	878	1209	1062
1800A-7	2×R8i	1124	987	1360	1195

U_n Nominal supply voltage of the drive

$I_{DC\ input}$ Maximum continuous DC input current from DC bus

$I_{rms\ output}$ Maximum continuous output current to/from energy storage

$P_{contmax}$ Maximum continuous output power to/from energy storage

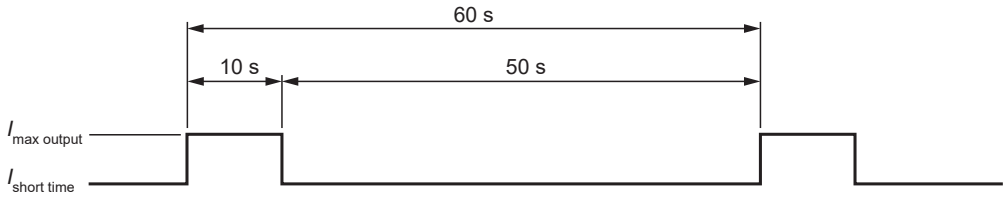
$I_{max\ output}$ Maximum output current to/from energy storage. Available for 10 seconds at start, otherwise as long as permitted by drive temperature.

S_n Nominal apparent power

I_{p2p} Peak-to-peak value of output current ripple measured after the filter

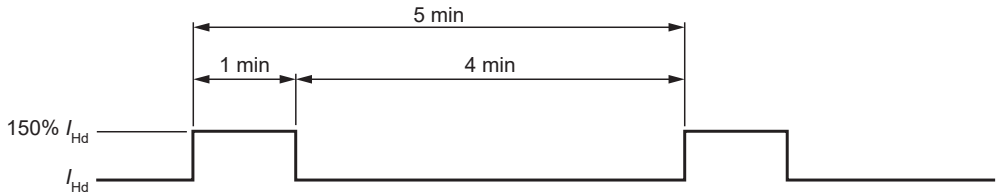
$f_{sw\ out}$ Switching frequency at output terminals (energy storage connection) measured after the filter

$I_{short\ time}$ Continuous output current allowing 10 s of $I_{max\ output}$ every 60 s



$P_{short\ time}$ Continuous output power allowing 10 s of $I_{max\ output}$ every 60 s

I_{Hd} Continuous output current allowing 150% I_{Hd} for 1 min every 5 min

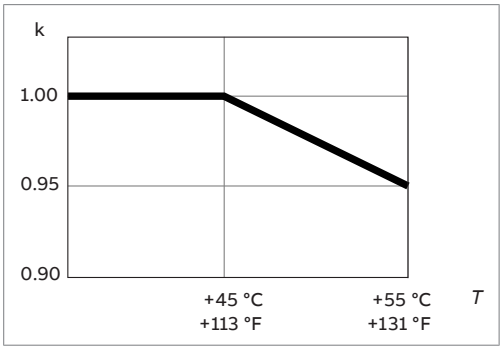


P_{Hd} Continuous output power allowing 150% I_{Hd} for 1 min every 5 min

Derating

Surrounding air temperature derating

In the temperature range +45…55 °C (+113…131 °F), the rated output current is derated by 0.5 percentage points for every added 1 °C (1.8 °F). The output current can be calculated by multiplying the current given in the rating table by the derating factor *(k)*:



Altitude derating

At altitudes more than 1000 m (3281 ft) above sea level, the output current derating is 1 percentage point for every added 100 m (328 ft). For example, the derating factor for 1500 m (4921 ft) is 0.95. The maximum permitted installation altitude is given in the technical data.

For a more accurate derating, use the DriveSize PC tool.

For coolant derating, refer to section Temperature limits (page 120).

Type equivalence table

Converter unit type	Basic module type			BDCL filter	
ACS880-1607LC-...	**ACS880-104LC-...**	**Frame size**	**Qty**	**Type**	**Qty**
U_n = 500 V					
0150A-5	0120A-5	R7i	1	BDCL-13LC-7	1
0250A-5	0140A-5	R7i	1	BDCL-13LC-7	1
0350A-5	0200A-5	R7i	1	BDCL-13LC-7	1
0450A-5	0240A-5	R7i	1	BDCL-13LC-7	1
0550A-5	0460A-5	R7i	1	BDCL-13LC-7	1
0700A-5	0200A-5	R7i	2	BDCL-13LC-7	2
0900A-5	0240A-5	R7i	2	BDCL-13LC-7	2
1100A-5	0460A-5	R7i	2	BDCL-13LC-7	2
U_n = 690 V					
0150A-7	0100A-7	R7i	1	BDCL-13LC-7	1
0200A-7	0140A-7	R7i	1	BDCL-13LC-7	1
0300A-7	0220A-7	R7i	1	BDCL-13LC-7	1
0399A-7	0389A-7	R7i	1	BDCL-13LC-7	1
0599A-7	0220A-7	R7i	2	BDCL-13LC-7	2
0799A-7	0389A-7	R7i	2	BDCL-13LC-7	2
0400A-7	0480A-7	R8i	1	BDCL-14LC-7	1
0500A-7	0530A-7	R8i	1	BDCL-14LC-7	1
0600A-7	0600A-7	R8i	1	BDCL-15LC-7	1
0700A-7	0670A-7	R8i	1	BDCL-15LC-7	1
0800A-7	0750A-7	R8i	1	BDCL-15LC-7	1
0900A-7	0850A-7	R8i	1	BDCL-15LC-7	1
1000A-7	0530A-7	R8i	2	BDCL-14LC-7	2

Converter unit type	Basic module type			BDCL filter	
ACS880-1607LC-...	ACS880-104LC-...	Frame size	Qty	Type	Qty
1200A-7	0600A-7	R8i	2	BDCL-15LC-7	2
1400A-7	0670A-7	R8i	2	BDCL-15LC-7	2
1600A-7	0750A-7	R8i	2	BDCL-15LC-7	2
1800A-7	0850A-7	R8i	2	BDCL-15LC-7	2

Fuses

DC fuses

These fuses are used on the DC bus side and on the energy storage side.

ACS880-1607LC-...	Rating	Size	Type	Ordering code	Qty
	A		Bussmann		
U_n = 500 V					
0150A-5	250	1	170M4390	3AUA0000114933	2
0250A-5	400	1	170M4393	3AUA0000076327	2
0350A-5	550	3	170M6543	3AXD50000698752	2
0450A-5	700	3	170M6545	68735980	2
0550A-5	900	3	170M6547	63919381	2
0700A-5	550	3	170M6543	3AXD50000698752	2
0900A-5	700	3	170M6545	68735980	2
1100A-5	900	3	170M6547	63919381	2
U_n = 690 V					
0150A-7	250	1	170M4390	3AUA0000114933	2
0200A-7	315	1	170M4391	3AXD50000010196	2
0300A-7	500	3	170M6542	3AXD50000021111	2
0399A-7	630	3	170M6544	63903167	2
0599A-7	500	3	170M6542	3AXD50000021111	2
0799A-7	630	3	170M6544	63903167	2
0400A-7	630	3	170M6544	63903167	2
0500A-7	800	3	170M6546	63919128	2
0600A-7	1000	3	170M6548	63916749	2
0700A-7	1100	3	170M6549	68736021	2
0800A-7	1250	3	170M6500	63919462	2
0900A-7	1400	3	170M6501	3AUA0000086673	2
1000A-7	800	3	170M6546	63919128	4
1200A-7	1000	3	170M6548	63916749	4
1400A-7	1100	3	170M6549	68736021	4
1600A-7	1250	3	170M6500	63919462	4
1800A-7	1400	3	170M6501	3AUA0000086673	4

Note: All listed fuses are UL Recognized.

BAMU unit fuses

The BAMU voltage/current measurement unit (option +G442) typically has one of these protection devices:

- a miniature circuit breaker of type S804S-UCB10 (IEC), or
- two fuses of type 1021 CP URB 27X60/32 (UL)

For the actual type of protection, refer to the documentation delivered with the drive.

Filter module data

Filter module type	Nominal inductance / phase	DC resistance / phase
	µH	ohm
BDCL-13LC	1610	8
BDCL-14LC	540	7
BDCL-15LC	360	7

Dimensions and weights

ACS880-1607LC-...	Frame	Height [1)]	Width	Depth	Weight
		mm	mm	mm	kg
U_n = 500 V					
0150A-5	R7i	2010	500	644	400
0250A-5	R7i	2010	500	644	400
0350A-5	R7i	2010	500	644	400
0450A-5	R7i	2010	500	644	400
0550A-5	R7i	2010	500	644	400
0700A-5	2×R7i	2010	1000	644	800
0900A-5	2×R7i	2010	1000	644	800
1100A-5	2×R7i	2010	1000	644	800
U_n = 690 V					
0150A-7	R7i	2010	500	644	400
0200A-7	R7i	2010	500	644	400
0300A-7	R7i	2010	500	644	400
0399A-7	R7i	2010	500	644	400
0599A-7	2×R7i	2010	1000	644	800
0799A-7	2×R7i	2010	1000	644	800
0400A-7	R8i	2010	800	644	680
0500A-7	R8i	2010	800	644	680
0600A-7	R8i	2010	800	644	710
0700A-7	R8i	2010	800	644	710
0800A-7	R8i	2010	800	644	710
0900A-7	R8i	2010	800	644	710
1000A-7	2×R8i	2010	1600	644	1425
1200A-7	2×R8i	2010	1600	644	1425

ACS880-1607LC-...	Frame	Height [1]	Width	Depth	Weight
		mm	mm	mm	kg
1400A-7	2×R8i	2010	1600	644	1425
1600A-7	2×R8i	2010	1600	644	1425
1800A-7	2×R8i	2010	1600	644	1425

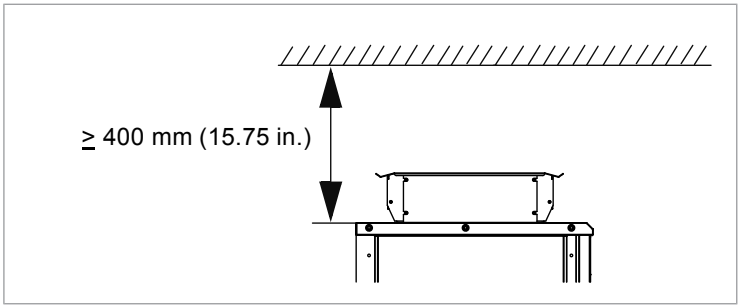
[1] The top power cable entry (option +H351) increases height (+50 mm) and width (+300 mm)

Free space requirements

Free space requirements

The values are as required by cooling, maintenance and/or operation of the pressure relief (if present). Also obey the general mechanical installation instructions.

Front		Sides		Above	
mm	in.	mm	in.	mm	in.
1000	39	0	0	250	9.85



Losses, cooling data and noise

ACS880-1607LC-...	Frame	Losses [1]			Noise		Efficiency [2]
		P_{loss} (converter)	P_{loss} (filter)	P_{loss} total	L_{WA} [3]	L_{PA} [4]	
		kW	kW	kW	dBA	dBA	%
U_n = 500 V							
0150A-5	R7i	0.6	0.5	1.1	*	*	99.1
0250A-5	R7i	1.0	0.6	1.6	*	*	99.1
0350A-5	R7i	1.3	0.8	2.1	*	*	99.1
0450A-5	R7i	1.7	1.1	2.8	*	*	99.0
0550A-5	R7i	2.0	1.5	3.5	*	*	99.0
0700A-5	2×R7i	2.5	1.6	4.1	*	*	99.1
0900A-5	2×R7i	3.2	2.2	5.4	*	*	99.0
1100A-5	2×R7i	3.8	2.9	6.7	*	*	99.0
U_n = 690 V							
0150A-7	R7i	1.2	0.7	1.8	*	*	98.9
0200A-7	R7i	1.5	0.8	2.3	*	*	98.9
0300A-7	R7i	2.0	1.0	3.0	*	*	98.9

ACS880-1607LC-...	Frame	Losses[1]			Noise		Efficiency[2]
		P_{loss} (converter)	P_{loss} (filter)	P_{loss} total	L_{WA}[3]	L_{PA}[4]	
		kW	kW	kW	dBA	dBA	%
0399A-7	R7i	2.7	1.2	3.9	*	*	98.9
0599A-7	2xR7i	3.9	1.9	5.7	*	*	99.0
0799A-7	2xR7i	5.3	2.4	7.6	*	*	98.9
0400A-7	R8i	3.3	0.9	4.2	82	64	98.8
0500A-7	R8i	4.1	1.2	5.3	82	64	98.8
0600A-7	R8i	4.7	1.5	6.2	82	64	98.8
0700A-7	R8i	5.5	1.8	7.3	82	64	98.8
0800A-7	R8i	6.4	2.1	8.5	82	64	98.8
0900A-7	R8i	7.2	2.5	9.7	82	64	98.8
1000A-7	2×R8i	8.9	2.3	11.2	84	66	98.7
1200A-7	2×R8i	10.6	3.0	13.6	84	66	98.7
1400A-7	2×R8i	12.7	3.6	16.3	84	66	98.7
1600A-7	2×R8i	14.8	4.2	19.0	84	66	98.6
1800A-7	2×R8i	17.1	4.9	22.0	84	66	98.6

1) These losses are not calculated according to the ecodesign standard IEC 61800-9-2.
2) Efficiency at nominal current and nominal power (U_{DC} typical and U_{ES} at 90% of U_{DC}). The efficiency is not calculated according to the ecodesign standard IEC 61800-9-2.
3) Measured in a hemi-anechoic room in accordance with ISO 9614-2 standard.
4) Estimated sound pressure level at 1 m (3.3 ft) distance from the cabinet.

* Data was not available at the time of publication of this manual.

ACS880-1607LC-...	Frame	Coolant volume				Coolant flow rate			Pressure loss
		Power module(s)	Filter	Cabinet	Total	Power module(s)	Filter(s)	Total	kPa
		l	l	l	l	l/min	l/min	l/min	
U_n = 500 V									
0150A-5	R7i	0.2	0.8	2.2	3.2	13	2	15	120
0250A-5	R7i	0.2	0.8	2.2	3.2	13	2	15	120
0350A-5	R7i	0.2	0.8	2.2	3.2	13	2	15	120
0450A-5	R7i	0.2	0.8	2.2	3.2	13	2	15	120
0550A-5	R7i	0.2	0.8	2.2	3.2	13	2	15	120
0700A-5	2×R7i	0.4	1.6	4.4	6.4	26	4	30	120
0900A-5	2×R7i	0.4	1.6	4.4	6.4	26	4	30	120
1100A-5	2×R7i	0.4	1.6	4.4	6.4	26	4	30	120
U_n = 690 V									
0150A-7	R7i	0.2	0.8	2.2	3.2	13	2	15	120
0200A-7	R7i	0.2	0.8	2.2	3.2	13	2	15	120
0300A-7	R7i	0.2	0.8	2.2	3.2	13	2	15	120
0399A-7	R7i	0.2	0.8	2.2	3.2	13	2	15	120

ACS880-1607LC-...	Frame	Coolant volume				Coolant flow rate			Pressure loss
		Power module(s)	Filter	Cabinet	Total	Power module(s)	Filter(s)	Total	kPa
		l	l	l	l	l/min	l/min	l/min	
0599A-7	2×R7i	0.4	1.6	4.4	6.4	26	4	30	120
0799A-7	2×R7i	0.4	1.6	4.4	6.4	26	4	30	120

ACS880-1607LC-...	Frame	Coolant volume				Coolant flow rate			Pressure loss
		Power module(s)	Power module cabinet	Filter cabinet	Total	Power module(s)	Filter(s)	Total	kPa
		l	l	l	l	l/min	l/min	l/min	
U_n = 690 V									
0400A-7	R8i	1.9	2.6	2.6	7.1	16	20	36	120
0500A-7	R8i	1.9	2.6	2.6	7.1	16	20	36	120
0600A-7	R8i	1.9	2.6	2.6	7.1	16	20	36	120
0700A-7	R8i	1.9	2.6	2.6	7.1	16	20	36	120
0800A-7	R8i	1.9	2.6	2.6	7.1	16	20	36	120
0900A-7	R8i	1.9	2.6	2.6	7.1	16	20	36	120
1000A-7	2×R8i	3.8	5.2	5.2	14.2	32	40	72	120
1200A-7	2×R8i	3.8	5.2	5.2	14.2	32	40	72	120
1400A-7	2×R8i	3.8	5.2	5.2	14.2	32	40	72	120
1600A-7	2×R8i	3.8	5.2	5.2	14.2	32	40	72	120
1800A-7	2×R8i	3.8	5.2	5.2	14.2	32	40	72	120

Tightening torques

Unless a tightening torque is specified in the text, the following torques can be used.

Electrical connections

Size	Torque	Strength class
M3	0.5 N·m (4.4 lbf·in)	4.6...8.8
M4	1 N·m (9 lbf·in)	4.6...8.8
M5	4 N·m (35 lbf·in)	8.8
M6	9 N·m (6.6 lbf·ft)	8.8
M8	22 N·m (16 lbf·ft)	8.8
M10	42 N·m (31 lbf·ft)	8.8
M12	70 N·m (52 lbf·ft)	8.8
M16	120 N·m (90 lbf·ft)	8.8

Mechanical connections

Size	Max. torque	Strength class
M5	6 N·m (53 lbf·in)	8.8
M6	10 N·m (7.4 lbf·ft)	8.8
M8	24 N·m (17.7 lbf·ft)	8.8

Insulation supports

Size	Max. torque	Strength class
M6	5 N·m (44 lbf·in)	8.8
M8	9 N·m (6.6 lbf·ft)	8.8
M10	18 N·m (13.3 lbf·ft)	8.8
M12	31 N·m (23 lbf·ft)	8.8

Cable lugs

Size	Max. torque	Strength class
M8	15 N·m (11 lbf·ft)	8.8 (A2-70 or A4-70)
M10	32 N·m (23.5 lbf·ft)	8.8
M12	50 N·m (37 lbf·ft)	8.8

Input power (DC bus) connection

Voltage (U_1)	ACS880-1607LC-xxxxx-5 = 566…707 V DC. This is indicated in the type designation label as typical input voltage levels 566 / 679 / 707 V DC. ACS880-1607LC-xxxxx-7 = 742…976 V DC. This is indicated in the type designation label as typical input voltage levels 742 / 849 / 976 V DC (849 V DC for UL/CSA).
Input terminals, converter module	Frame R7i: Quick connector. Frame R8i: M12. Torque: 70 N·m (52 lbf·ft). Maximum intrusion into module 20 mm (0.8 in).
Input terminals, filter module	BDCL-13LC: M12. Torque: 70 N·m (52 lbf·ft). BDCL-14LC and BDCL-15LC: M10. Torque: 42 N·m (31 lbf·ft). Maximum intrusion into module 20 mm (0.8 in).

Output power (energy storage) connection

Voltage (U_2)	ACS880-1607LC-xxxxx-5 = Maximum output voltage 50 V…95% of U_{DC} (Drive DC voltage in the DC bus). This is indicated in the type designation label as typical output voltage range 50…509 / 611 / 636 V DC. ACS880-1607LC-xxxxx-7 = Maximum output voltage 50 V…95% of U_{DC} (Drive DC voltage in the DC bus). This is indicated in the type designation label as typical output voltage range 50…668 / 764 / 878 V DC (764 V DC for UL/CSA). Recommended output voltage 150 V…80% of U_{DC}.
Current	See the ratings data.
Output terminals, converter module	Quick connector.

Output terminals, cabinet	See the dimension drawings.
Maximum energy storage cable length	100 m (328 ft)

Typical power cable sizes

The tables below give the current carrying capacity (I_{Lmax}) and typical size for copper and aluminum cables with PVC or XLPE insulation. A correction factor K = 0.70 is used. Time const. is the temperature time constant of the cable.

The cable sizing is based on a maximum of 9 cables installed side by side on a ladder type cable tray, with three trays on top of each other (with 30 cm of space between the trays), and an ambient temperature of 30 °C (IEC 60364-5-52).

Conductor cross-section (copper)		**PVC insulation Conductor temperature 70°**		**XLPE insulation Conductor temperature 90°**		**Typical dimensions of copper cable**	
mm²	**AWG / kcmil**	**I_{Lmax} (A)**	**Time const. (s)**	**I_{Lmax} (A)**	**Time const. (s)**	**Size**	**ø [mm]**
1.5	16	13	85	16	67	3 × 1.5 + 1.5	13
2.5	12	18	121	23	88	3 × 2.5 + 2.5	14
4	12	24	175	30	133	3 × 4 + 4	16
6	10	30	251	38	186	3 × 6 + 6	18
10	8	42	359	53	268	3 × 10 + 10	21
16	6	56	514	70	391	3 × 16 + 16	23
25	4	71	791	89	598	3 × 25 + 16	24
35	1	88	1000	110	760	3 × 35 + 16	26
50	1/0	107	1308	134	990	3 × 50 + 25	29
70	2/0	137	1613	171	1230	3 × 70 + 35	32
95	4/0	167	2046	209	1551	3 × 95 + 50	38
120	250	193	2441	241	1859	3 × 120 + 70	41
150	300	223	2820	279	2139	3 × 150 + 70	44
185	400	255	3329	319	2525	3 × 185 + 95	50
240	500	301	4073	376	3099	3 × 240 + 120	55
300	600	348	4779	435	3636	3 × 300 + 150	58

Conductor cross-section (aluminum)		**PVC insulation Conductor temperature 70°**		**XLPE insulation Conductor temperature 90°**		**Typical dimensions of aluminum cable**	
mm²	**AWG / kcmil**	**I_{Lmax} (A)**	**Time const. (s)**	**I_{Lmax} (A)**	**Time const. (s)**	**Size**	**ø [mm]**
35	1	67	736	84	669	3 × 35 + 10 Cu	26
50	1/0	82	959	102	874	3 × 50 + 15 Cu	29
70	2/0	105	1182	131	1079	3 × 70 + 21 Cu	32
95	4/0	128	1492	159	1376	3 × 95 + 29 Cu	38
120	250	148	1776	184	1637	3 × 120 + 41 Cu	41

Conductor cross-section (aluminum)		PVC insulation Conductor temperature 70°		XLPE insulation Conductor temperature 90°		Typical dimensions of aluminum cable	
mm²	AWG / kcmil	I_{Lmax} (A)	Time const. (s)	I_{Lmax} (A)	Time const. (s)	Size	ø [mm]
150	300	171	2042	213	1881	3 × 150 + 41 Cu	44
185	400	196	2422	243	2237	3 × 185 + 57 Cu	49
240	500	231	2967	286	2740	3 × 240 + 72 Cu	54
300	600	267	3478	330	3229	3 × 300 + 88 Cu	58

Control accuracy – Current and voltage control performance data

Current control dynamic response	Step response time < 10 ms for a reference step 0…50% of the drive nominal current
Current control accuracy (static)	Current error < 1% of the drive nominal current rating For the DC current ripple, refer to the ratings data.
Energy storage voltage control accuracy (static)	Voltage error < 1% of the drive nominal voltage (converter with the optional BAMU voltage/current measurement unit, option +G442) **Note:** If the converter does not include the BAMU voltage/current measurement unit, the voltage measurement accuracy depends on the customer's measurement device.

Coolant connections

Tube fitting, quick coupler for 16/13 mm polyamide (PA) pipe.

Protection classes

Degrees of protection (IEC/EN 60529)	IP42 (standard), IP54 (option +B055)
Enclosure types (UL50)	UL Type 1 (standard), UL Type 12 (option +B055). For indoor use only.
Arcing class (IEC TR 61641)	B – ASSEMBLY providing personnel and ASSEMBLY protection under arcing conditions. Tested at the following voltage with an arcing current of 65 kA for 300 milliseconds: • 400 V units (indicated by "-3" in drive type): 420 V • 500 V units (indicated by "-5" in drive type): 550 V • 690 V units (indicated by "-7" in drive type): 760 V
Overvoltage category (IEC/EN 60664-1)	III, except for auxiliary power connections (fan, control, heating, lighting, cooling unit pump etc) which are category II.
Protective class (IEC/EN 61800-5-1)	I

Energy efficiency data (ecodesign)

Energy efficiency data is not provided for the drive/unit. Multidrives and multidrive modules are not in the scope of the EU ecodesign requirements (Regulation EU/2019/1781) or the UK ecodesign requirements (Regulation SI 2021 No. 745).

Ambient conditions

This section gives the environmental requirements for the converter module. The converter module must be used in a heated indoor controlled environment.

	Operation installed for stationary use	**Storage in protective package**	**Transportation in protective package**
Altitude above sea level	0…4000 m (13123 ft)* Output derated above 1000 m (3281 ft). See section Altitude derating. *Neutral-grounded TN and TT network systems, non-corner-grounded IT network systems. Corner-grounded TN, TT and IT network systems up to 600 V.	-	-
Air temperature	0 … +45 °C (+32 … +113 °F), no condensation allowed. Output derated in the range +45 … +55 °C (+113 … +131 °F).	-40 … +70 °C (-40 … +158 °F)	-40 … +70 °C (-40 … +158 °F)
Relative humidity	Maximum 95%, no condensation allowed	Maximum 95%, no condensation allowed	Maximum 95%, no condensation allowed
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination	IEC/EN 60721-3-3:2002: Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use of weather protected locations	IEC 60721-3-1:1997	IEC 60721-3-2:1997
Chemical gases	Class 3C2	Class 1C2	Class 2C2
Solid particles	Class 3S1	Class 1S3 (packing must support this, otherwise 1S2)	Class 2S2
	No conductive dust allowed.		

	Operation installed for stationary use	Storage in protective package	Transportation in protective package
Vibration	IEC 61800-5-1 IEC 60068-2-6:2007, EN 60068-2-6:2008 Environmental testing Part 2: Tests -Test Fc: Vibration (sinusoidal) 10 … 57 Hz, max. 0.075 mm amplitude 57 … 150 Hz 1 *g* Tested in a typical cabinet assembly according to: Max. 1 mm (0.04 in.) (peak value, 5 … 13.2 Hz), max. 0.7 *g* (13.2 … 100 Hz) sinusoidal	IEC/EN 60721-3-1:1997	IEC/EN 60721-3-1:1997
Shock IEC 60068-2-27:2008, EN 60068-2-27:2009 Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	Not allowed	With packing max. 100 m/s^2 (330 ft./s^2) 11 ms	With packing max. 100 m/s^2 (330 ft./s^2) 11 ms

Colors

RAL 7035, RAL 9017.

Materials

Drive

Refer to ACS880 cabinet-installed drives Recycling instructions and environmental information (3AXD50000153909 [English]).

Packaging of drive

- Plywood[1)]
- Wood
- PET (strapping)
- PE (VCI film)
- Metal (fixing clamps, screws)
- VCI emitter capsules
- Clay desiccant.

1) Seaworthy package only

Packaging of options

- Cardboard
- Kraft paper
- PP (straps)

- PE (film, bubble wrap)
- Plywood, wood (only for heavy components).

Materials vary according to the item type, size and shape. Typical package consists of a cardboard box with paper filling or bubble wrap. ESD-safe packing materials are used for printed circuit boards and similar items.

Manuals

Printed product manuals are made of recyclable paper. Product manuals are available on the Internet.

Disposal

The main parts of the drive can be recycled to preserve natural resources and energy. Product parts and materials should be dismantled and separated.

Generally all metals, such as steel, aluminum, copper and its alloys, and precious metals can be recycled as material. Plastics, rubber, cardboard and other packaging material can be used in energy recovery.

Printed circuit boards and DC capacitors need selective treatment according to IEC 62635 guidelines.

To aid recycling, most plastic parts are marked with an appropriate identification code. In addition, components containing substances of very high concern (SVHCs) are listed in European Chemicals Agency's SCIP database. SCIP is the database for information on Substances of Concern In articles as such or in complex objects (Products) established under the Waste Framework Directive (2008/98/EC). For further information, contact your local ABB distributor or consult European Chemicals Agency's SCIP database to find out which SVHCs are used in the drive, and to find out where those components are located.

Contact your local ABB distributor for further information on environmental aspects. End of life treatment must follow international and national regulations.

For more information on ABB end of life services, refer to new.abb.com/service/end-of-lifeservices.

Applicable standards

Refer to ACS880 liquid-cooled multidrives modules electrical planning (3AXD50000048634 [English]).

Markings

Refer to ACS880 liquid-cooled multidrives modules electrical planning (3AXD50000048634 [English]).

Disclaimers

Generic disclaimer

The manufacturer shall have no obligation with respect to any product which (i) has been improperly repaired or altered; (ii) has been subjected to misuse, negligence or accident; (iii) has been used in a manner contrary to the manufacturer’s instructions; or (iv) has failed as a result of ordinary wear and tear.

Cyber security disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

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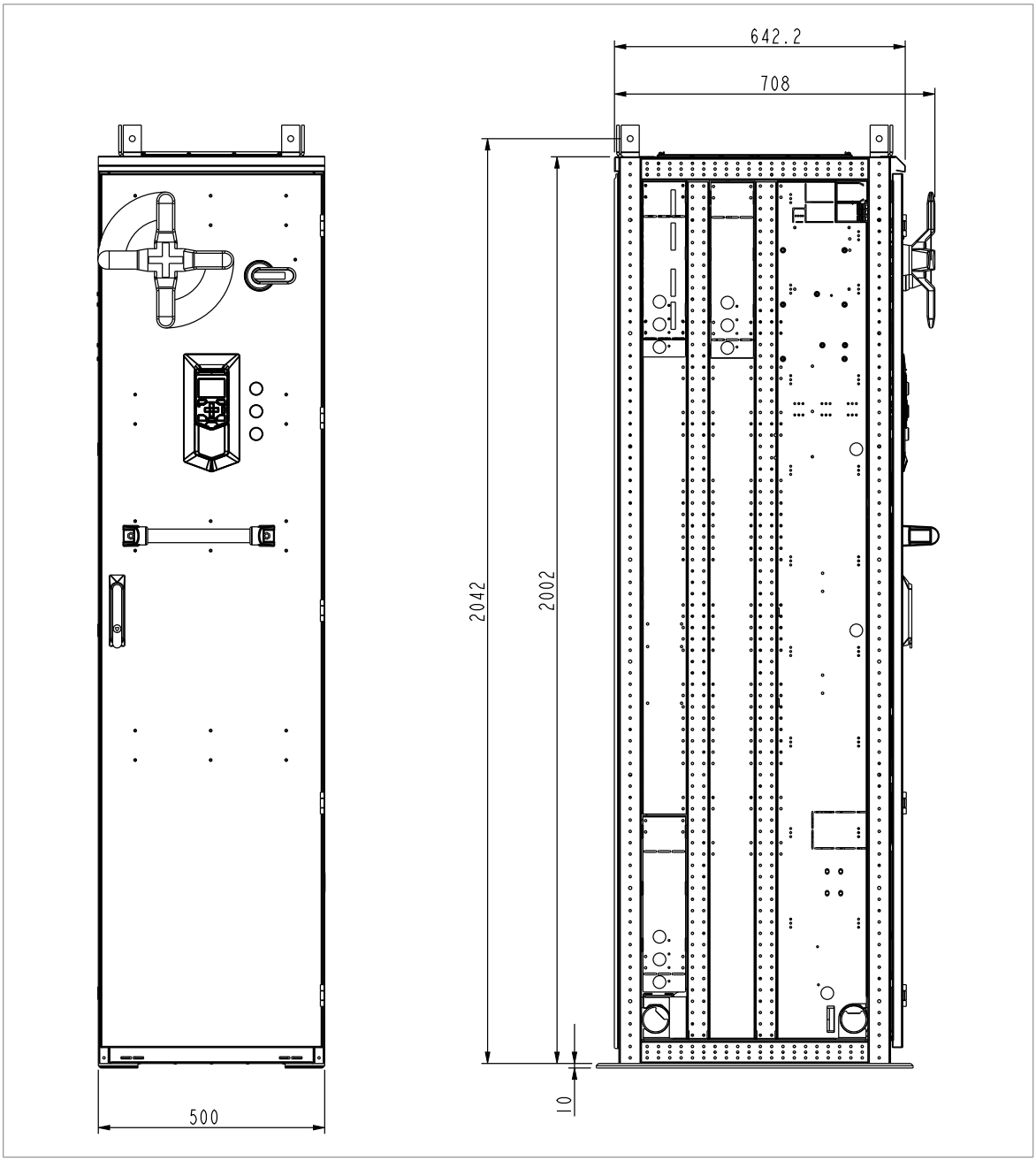
Dimension drawings

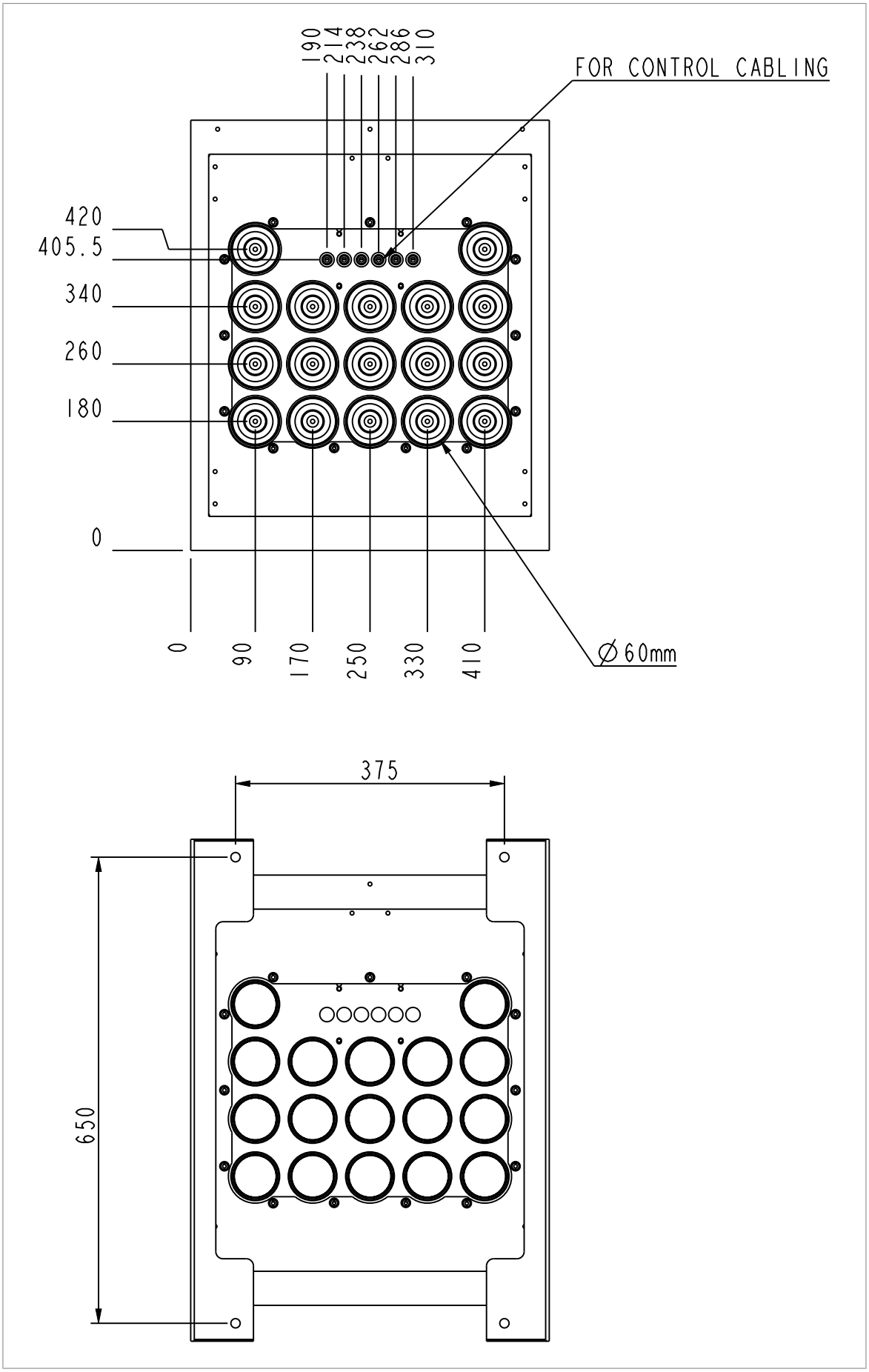
Contents of this chapter

This chapter contains the following dimension data:

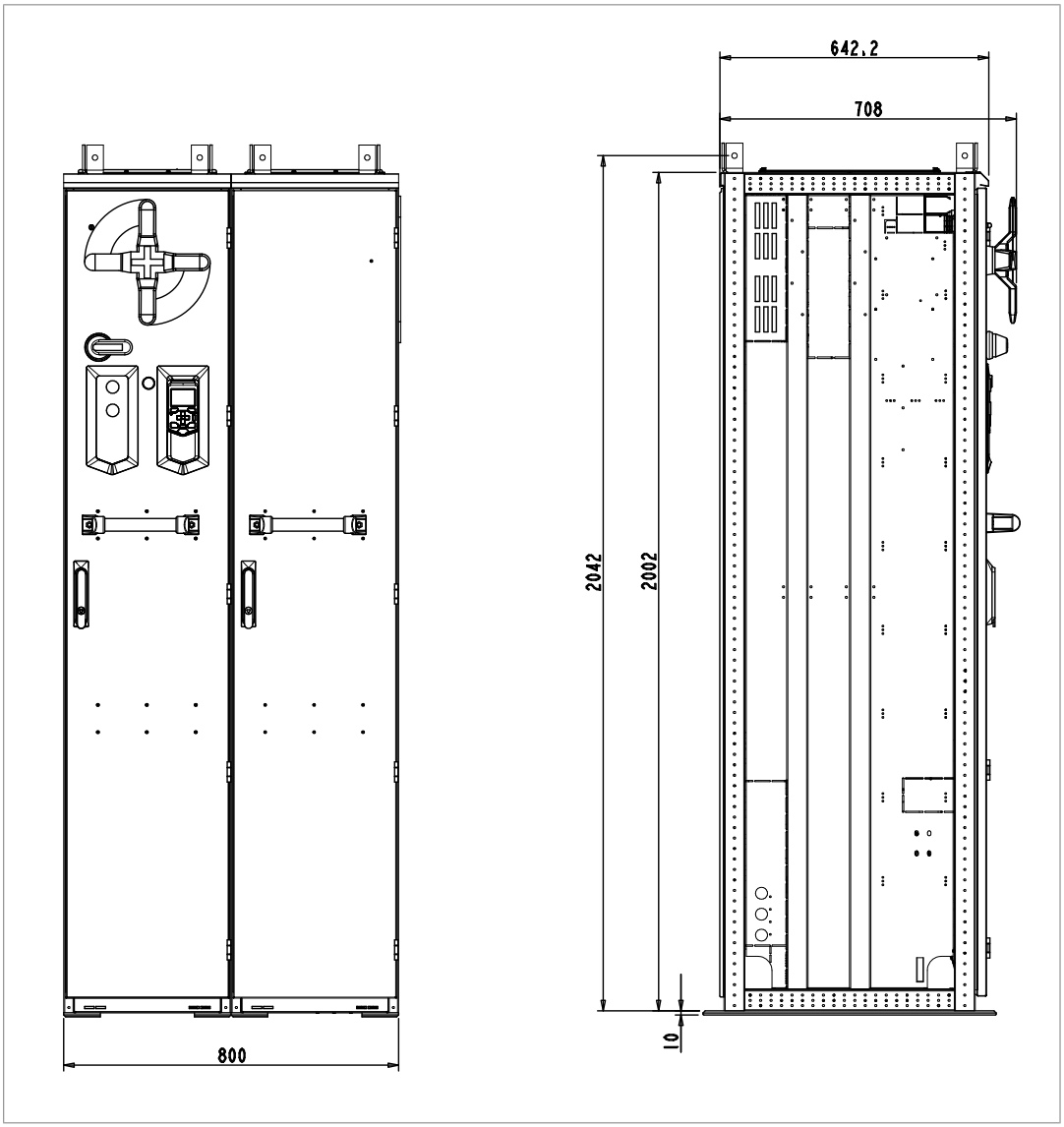
- Dimension drawings of DC/DC converter unit
- Location and size of output terminals for energy storage cables

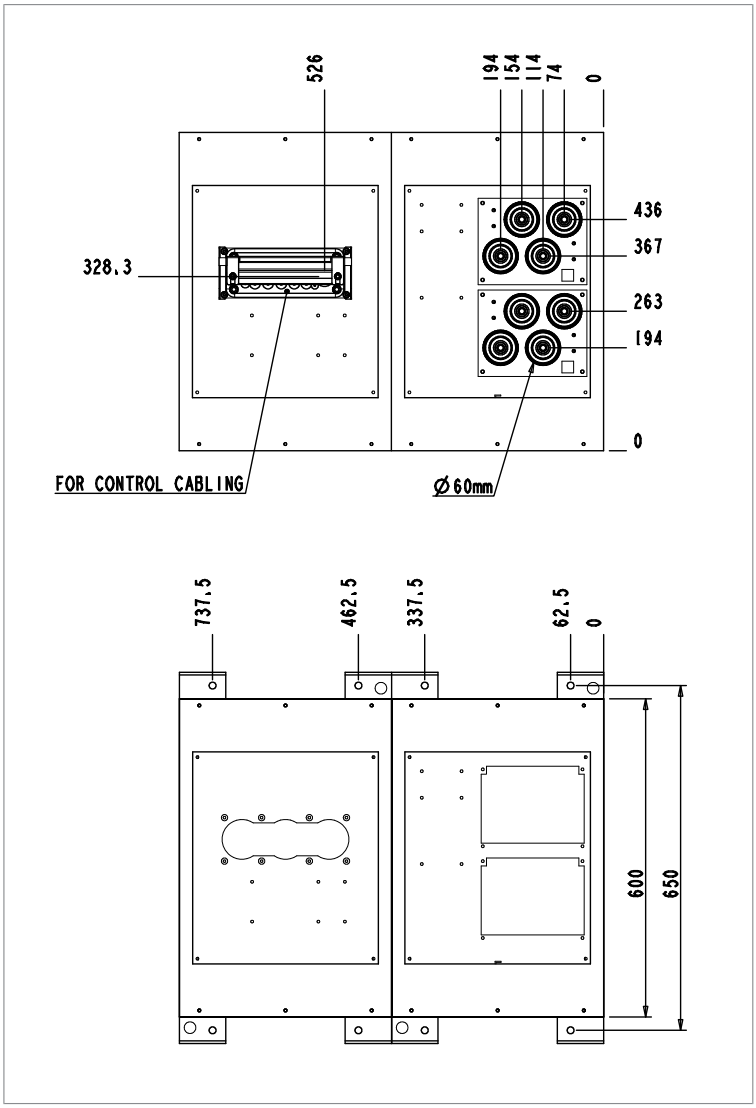
DC/DC converter unit with 1×R7i converter module



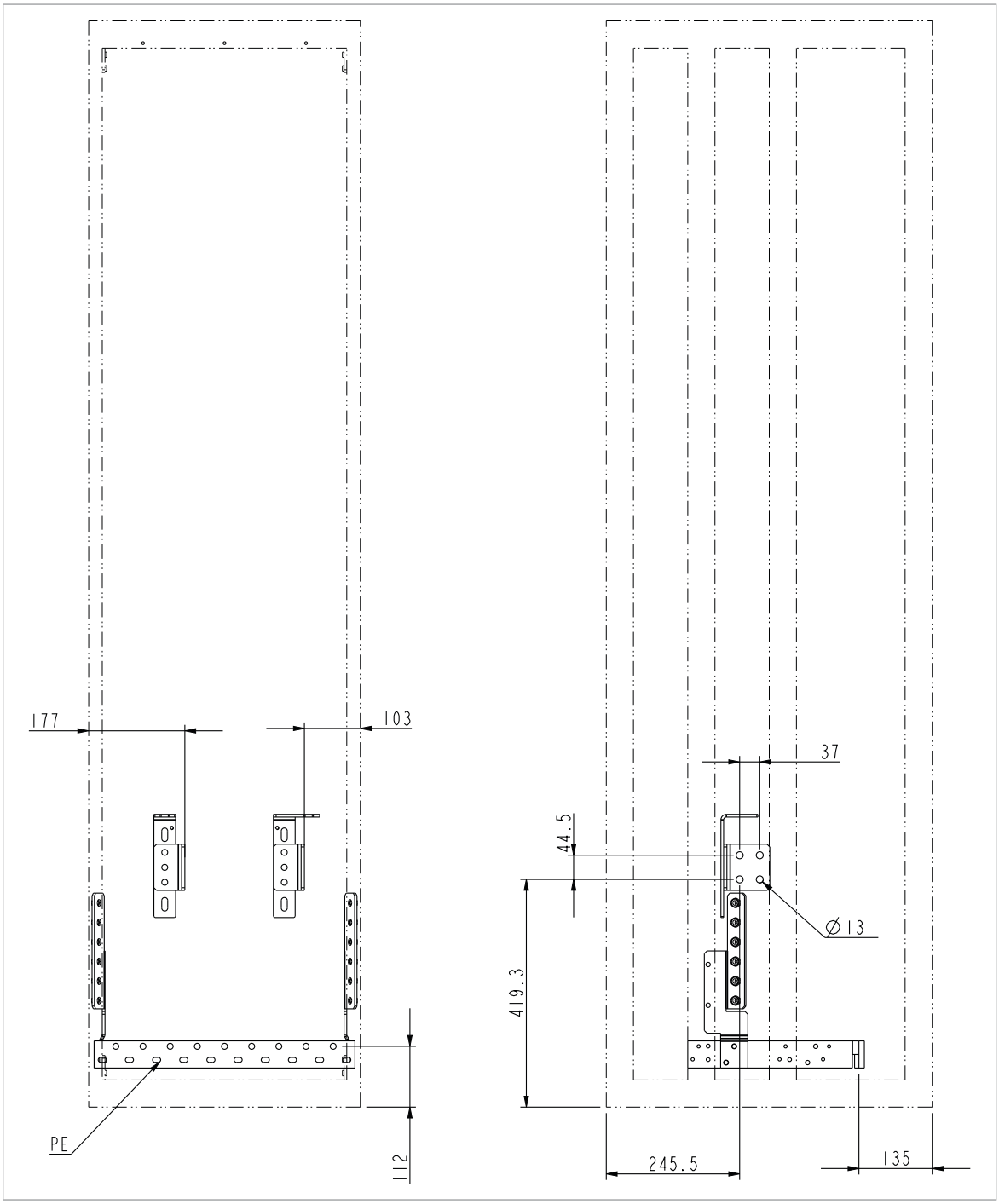

190
214
238
262
286
310
FOR CONTROL CABLING
420
405.5
340
260
180
0
0
90
170
250
330
410
Ø60mm
375
650

DC/DC converter unit with 1×R8i converter module

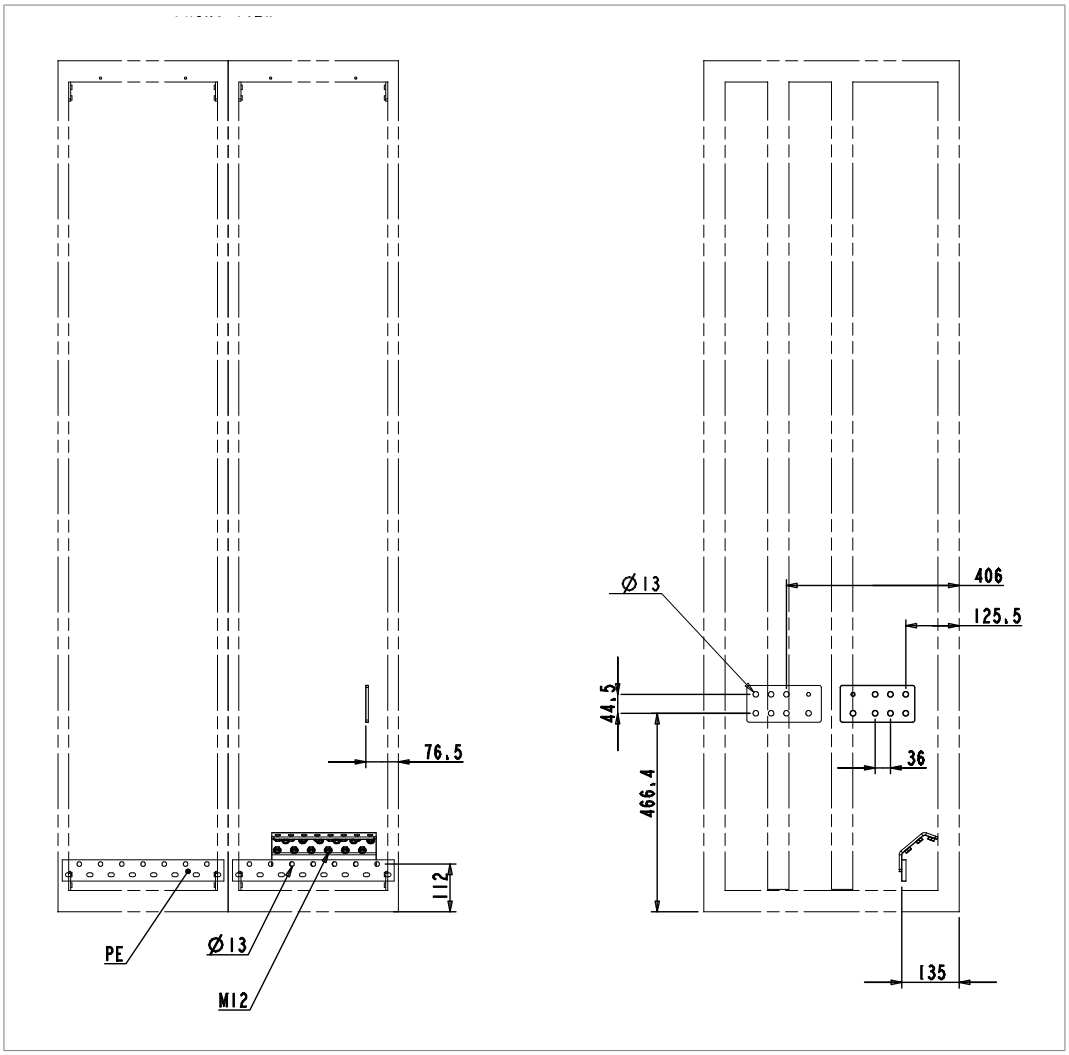



526
194
154
114
74
0
436
367
263
194
0
328.3
FOR CONTROL CABLING
Ø60mm
737.5
462.5
337.5
62.5
0
600
650

Location and size of energy storage connection terminals – Frame R7i



Location and size of energy storage connection terminals – Frame R8i



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/contact-centers.

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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