ABB INDUSTRIAL DRIVES

ACS880-1607 DC/DC-converter units

Hardware manual

ACS880-1607 DC/DC-converter units

Hardware manual

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EN
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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 ACS880-1607 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 multidrives cabinets and modules safety instructions (3AUA0000102301 [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
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
Supply unit	Supply module(s) under control of one control unit, and related components.

Term	Description
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.

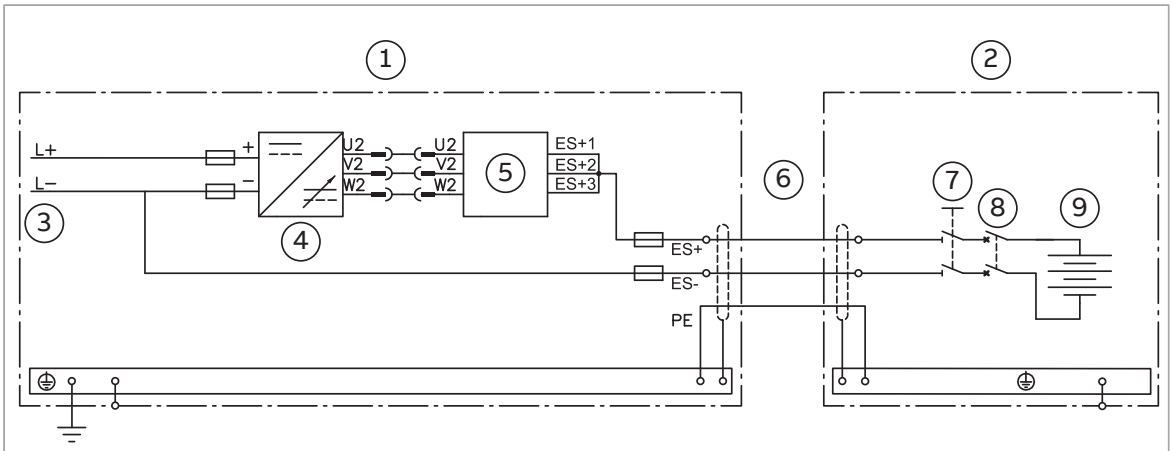
The DC/DC-converter unit has a single converter module or parallel converter modules under the command of one control unit. Parallel DC/DC-converter modules must have a common energy storage. Each parallel module must have the output cabling of its own. ABB also recommends that you use identical cablings (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

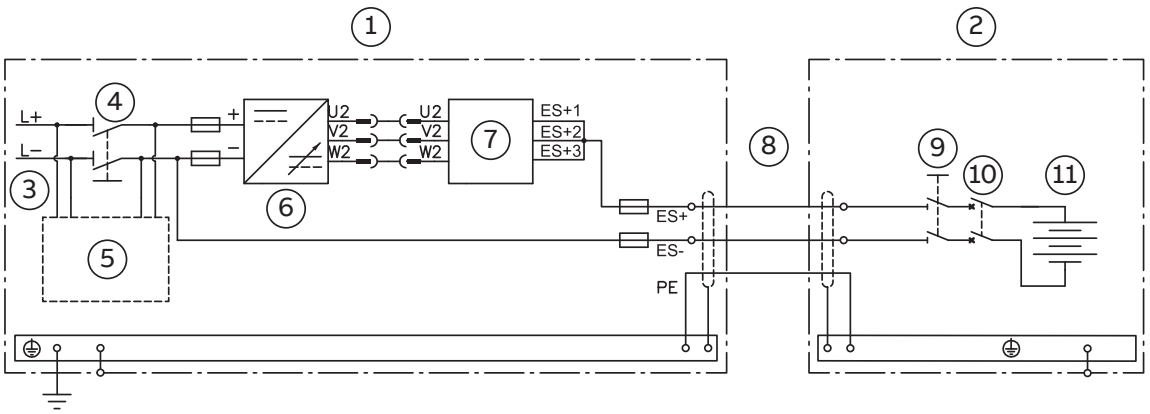
The DC/DC-converter has output DC fuses and DC fuses on the drive DC bus side. A DC switch-disconnector is available as option +F286.

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



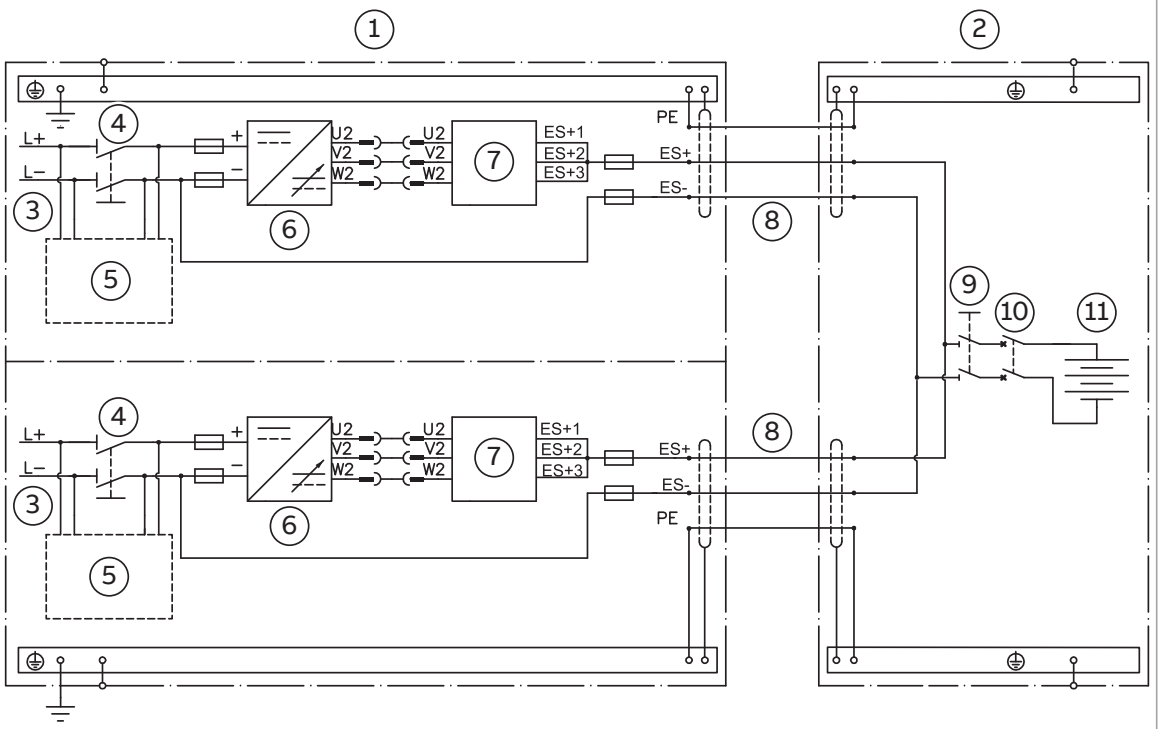
1	DC/DC-converter cubicle
2	Energy storage cabinet
3	Drive DC bus
4	DC/DC-converter module
5	Filter module
6	Cabling between DC/DC-converter unit and energy storage
7	Energy storage disconnecting device
8	Energy storage protective circuit breaker
9	Energy storage

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

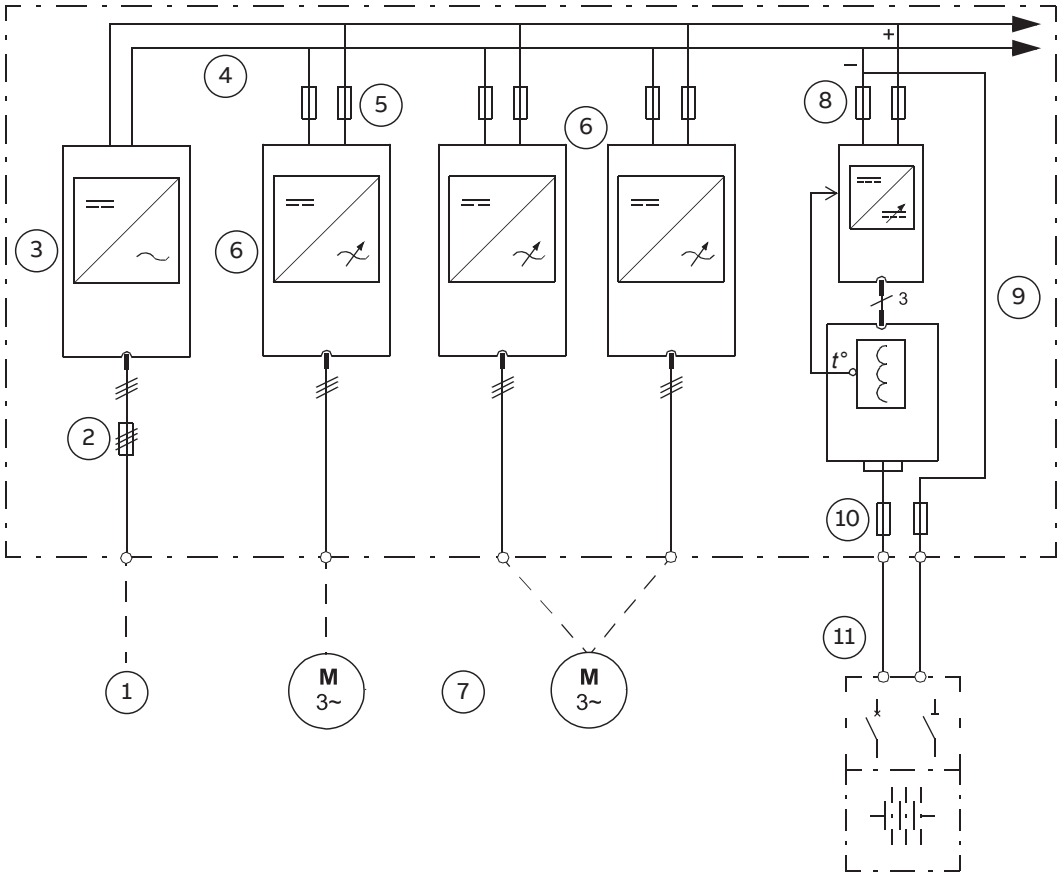
This figure shows a simplified main circuit diagram of parallel-connected DC/DC-converter modules with the DC switch-disconnector (option +F286) and charging circuit. Also the energy storage and related cabling and equipment are visible.



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

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

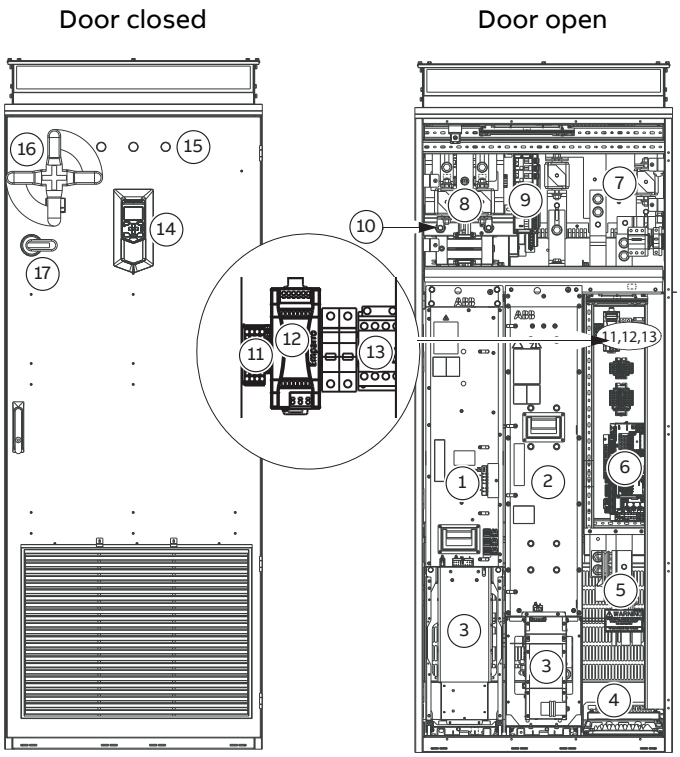
Converter unit hardware

Cabinet layout

The DC/DC-converter cubicle includes a converter module, a BDCL filter module and a BCU or UCU control unit. Each converter is equipped with dedicated DC fuses. A DC switch-disconnector is optional (option +F286) but commonly used. A converter unit with a DC switch-disconnector also has a precharge circuit including a charging switch on the door.

The figure show the components of the converter unit cubicle with the door closed, and with the door open and shrouds removed. In this figure, the DC/DC-converter unit cubicle has the DC switch-disconnector and charging circuit.

With DC switch-disconnector and charging

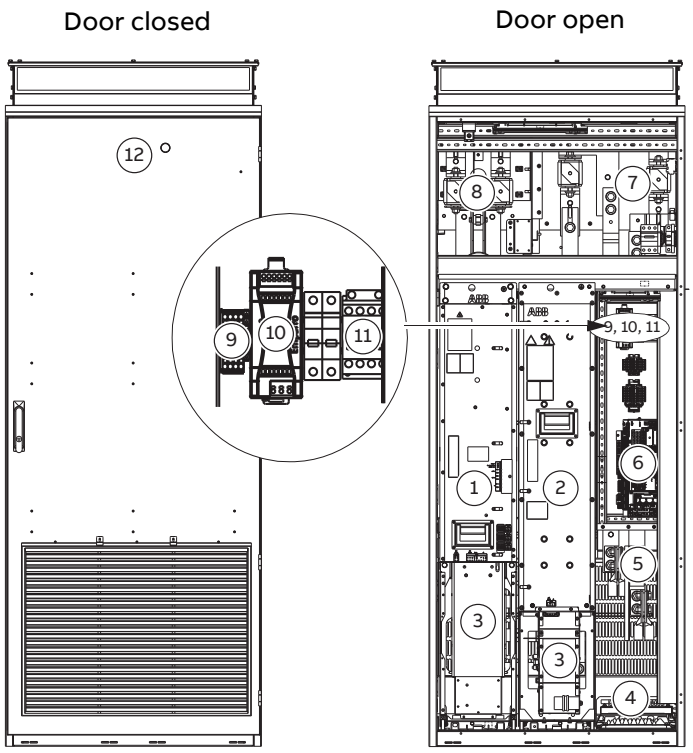


1	T11.1	R8i DC/DC-converter module
2	R13.1	Filter module
3	-	Module cooling fans
4	-	Cable entries for energy storage cables
5	ES+, ES-	Energy storage connection
6	A41	Control unit
7	F13.xx	Output DC fuses
8	F11.xx	DC fuses (DC bus side)
9	A11.1	Charging controller; charging resistors ([R1.x]…[R4.x]) are behind the charging controller

10	-	Charging switch [Q10.1] shaft
11	X33.1	Connection from the energy storage disconnecting device to the load disconnected indicator [P13.x]
12	T22.1	24 V DC power supply
13	Q26.1	Contactor for filter fan control
14		Control panel
15	P11.1…P13.1	Door lights: Charging OK ([P11.x], green), DC/DC-converter disconnected ([P12.x], white), Load disconnected ([P13.x], white)
16	Q11.1	DC switch-disconnector (option +F286) handle
17	-	Charging switch handle

This figure shows a converter unit cubicle without the DC switch-disconnector (option +F286) and charging circuit.

Without DC switch-disconnector and charging



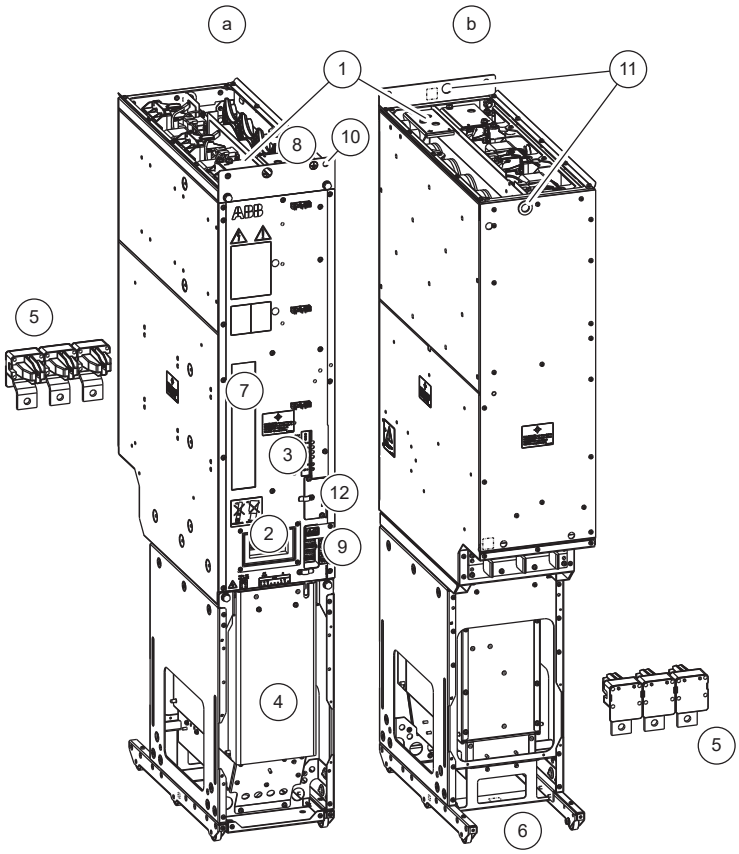
1	T11.1	R8i DC/DC-converter module
2	R13.1	Filter module
3	-	Module cooling fans
4	-	Cable entries for energy storage cables
5	ES+, ES-	Energy storage connection
6	A41	Control unit
7	F13.xx	Output DC fuses

8	F11.xx	DC fuses (DC bus side)
9	X33.1	Connection from the energy storage disconnecting device to the load disconnected indicator [P13.x]
10	T22.1	24 V DC power supply
11	Q26.1	Contactor for filter fan control
12	P13.1	Door light: Load disconnected ([P13.x], white)

Converter module hardware

Frame R8i layout

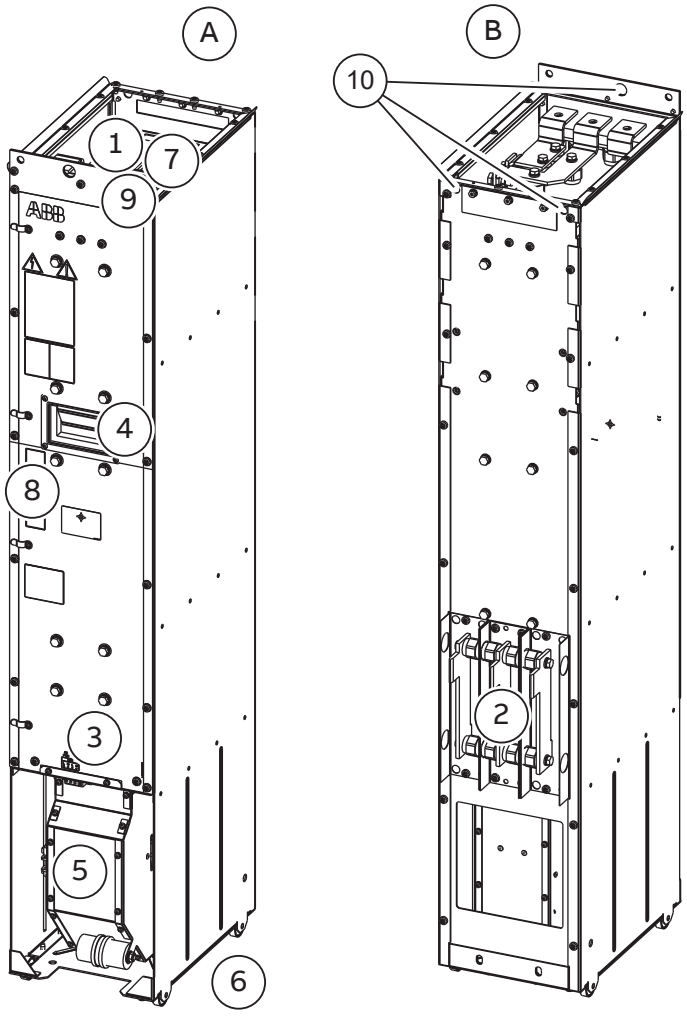
This figure shows the layout of the R8i module.



A	R8i module, front
B	R8i module, back
1	DC busbars
2	Handle
3	LEDs and fiber optic connectors
4	Fan (standard speed-controlled fan shown; a direct-on-line fan is available as option +C188)
5	Quick connector (three phases). The counterpart is fastened to the cabinet behind the module.
6	Wheels

7	Type designation label
8	Terminal block [X50] (power supply for internal boards and module heating element, option +C183; DOL fan supply, option +C188)
9	Connectors [X51], [X52], [X53]
10	The unpainted grounding point (PE) between module frame and cabinet frame.
11	Lifting eyes
12	Circuit board compartment fan

BDCL filter module



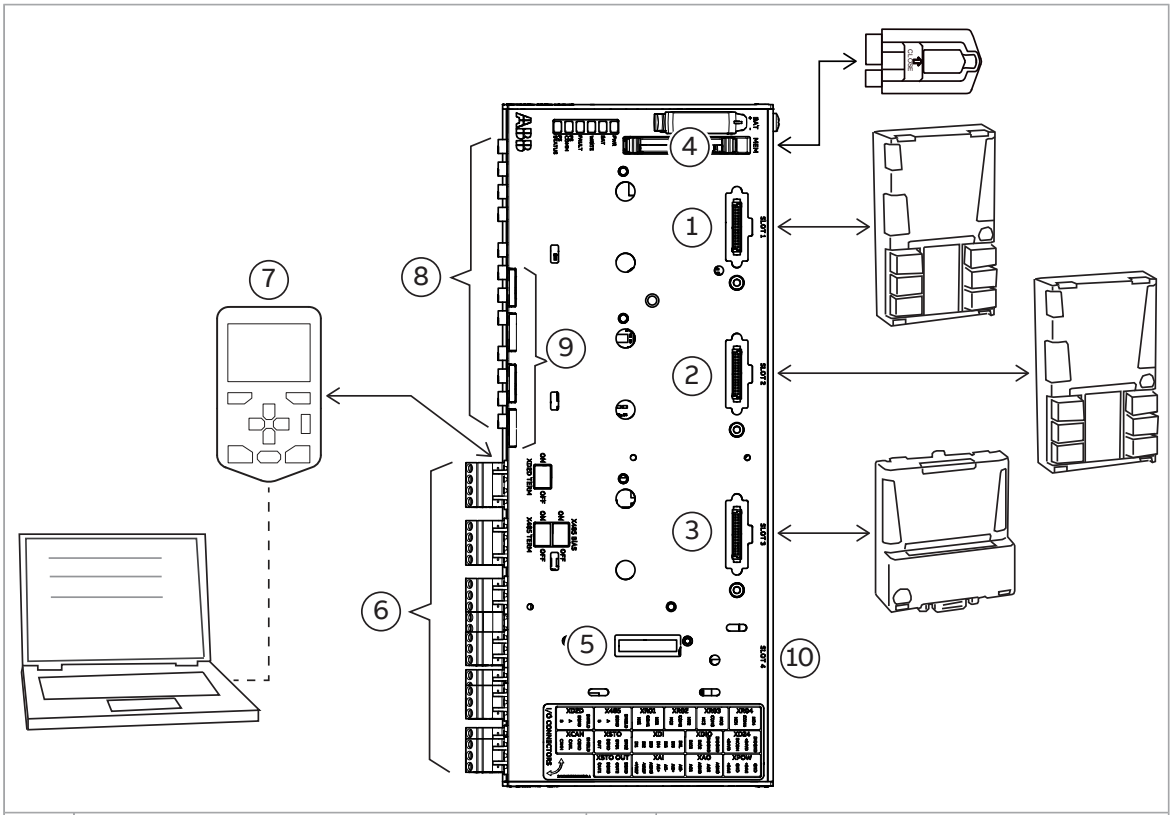
A	Filter module, front
B	Filter module, back
1	Energy storage connection
2	Converter module connection
3	Terminal block [X55] (DOL fan supply, option +C188) (ready-connected)
4	Handle
5	Fan
6	Wheels

7	Terminal block [X30] (module DOL fan supply, option +C188)
8	Type designation label of the module
9	The unpainted grounding point
10	Lifting eyes

Control unit

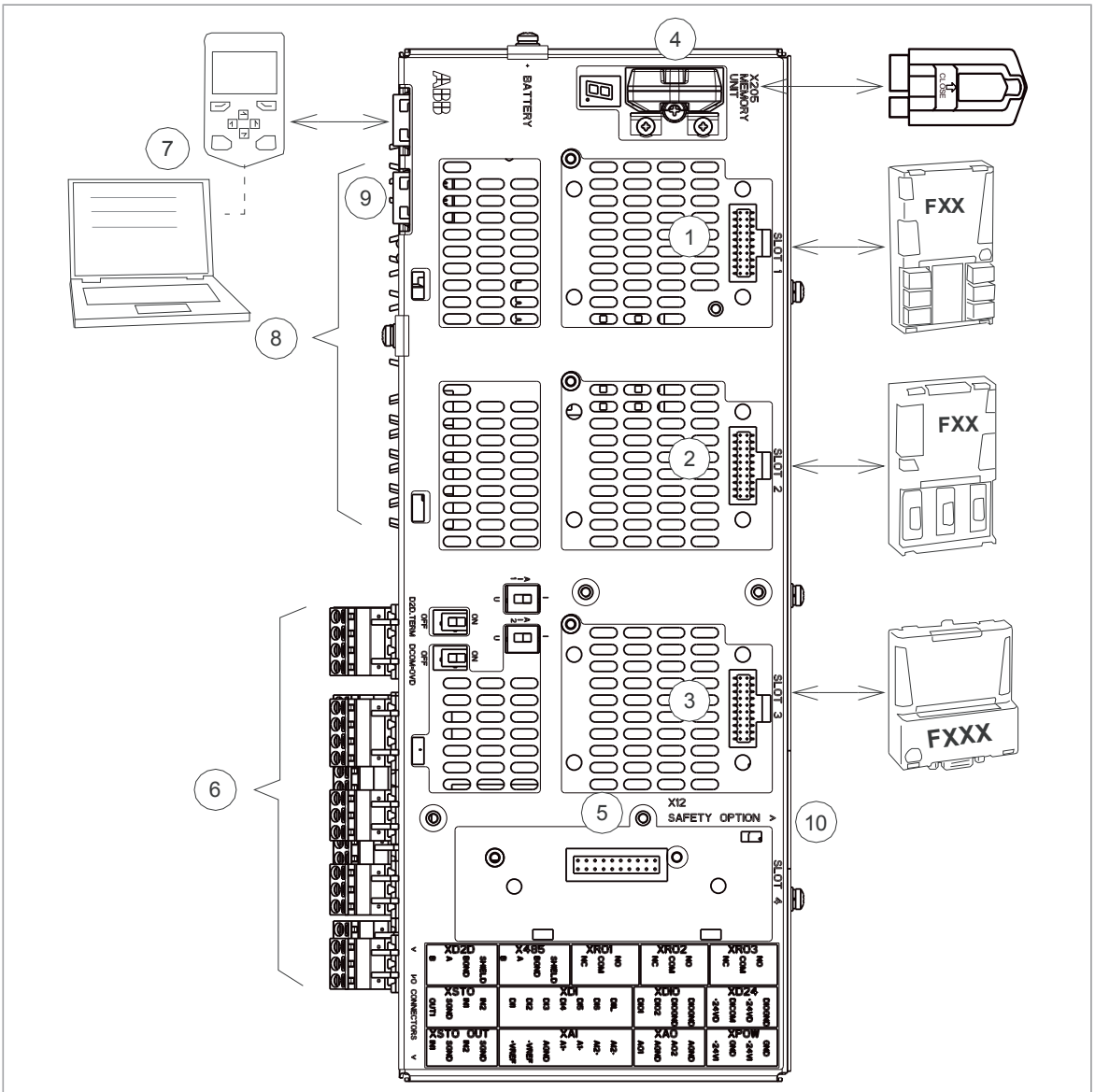
DC/DC-converter units use a UCU or BCU control unit. The control unit has inputs, outputs, and slots for option modules. A fiber optic link connects the control unit to each converter module.

Overview of the control connections 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. For F-type modules with USCA-02 adapter.	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.

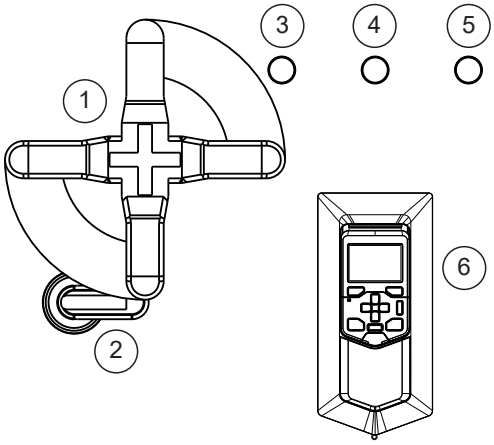
Overview of the control connections of the BCU control unit



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 module	9	Ethernet port. Not in use.
6	Terminal blocks.	10	Safety option interface. Only in use for the inverter units.

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 [A49]

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.

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

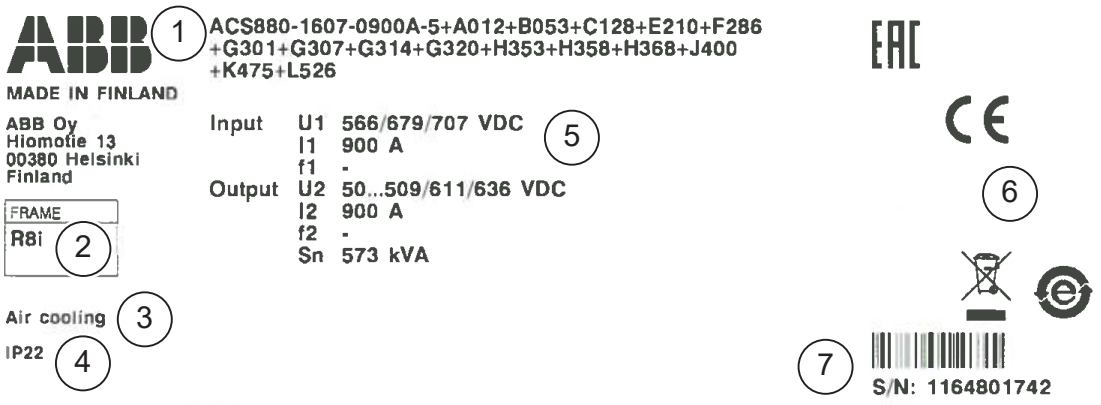
You can control the converter unit through a fieldbus interface if the unit is equipped with an optional fieldbus adapter, and when you have configured the control program for the fieldbus control with parameters. For more information on parameters, see ACS880 DC/DC converter control program firmware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

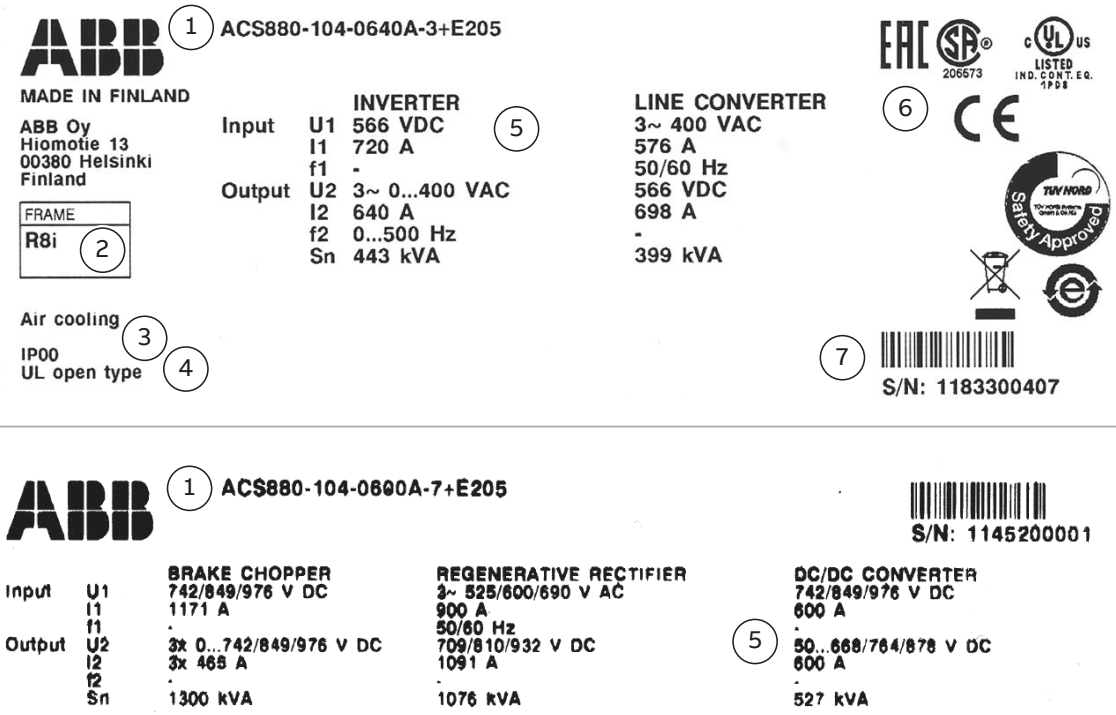


1	Type designation
2	Frame size
3	Cooling system and other additional data
4	Degree of protection
5	Ratings
6	Valid markings. Refer to ACS880 multidrives cabinets and modules electrical planning instructions (3AUA0000102324 [English]).
7	Serial number. The first digit of the serial number refers to the 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 module.

Example labels are shown below.

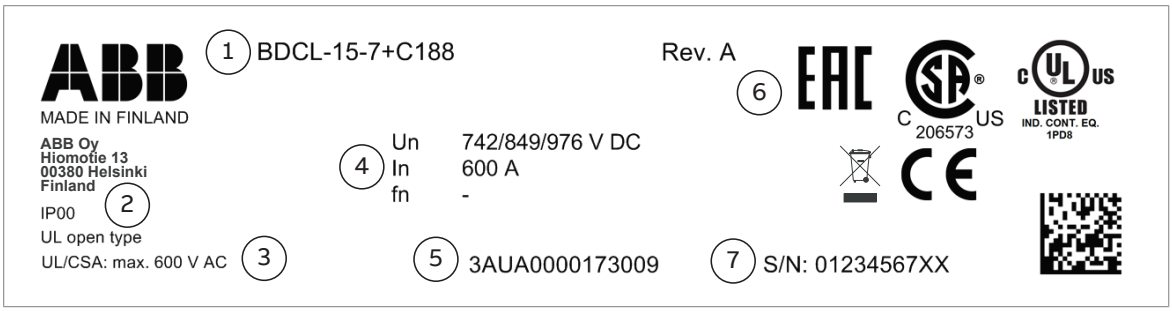


1	Type designation
2	Frame size
3	Degree of protection
4	UL/CSA data
5	Ratings
6	Valid markings. Refer to ACS880 multidrives cabinets and modules electrical planning instructions (3AUA0000102324 [English]).
7	Serial number. The first digit of the serial number refers to the manufacturing plant. The next 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.

An example label is shown below.



No.	Description
1	Type designation
2	Degree of protection
3	UL/CSA data
4	Ratings
5	Code of the filter
6	Valid markings. See ACS880 multidrives cabinets and modules electrical planning instructions (3AUA0000102324 [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 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
1607	Construction: cabinet-installed DC/DC-converter unit. When no options are selected: Supply frequency 50 Hz, control voltage 230 V AC, IP22 (UL type 1), EN/IEC industrial cabinet construction, power and control cabling through the bottom of the cabinet, DC busbar material aluminum, cable supply conductors, standard wiring material, speed-controlled fan, 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.

Code	Description
Voltage range	
3	DC voltage corresponding AC input voltages 3 ~ 380…415 V. This is indicated in the type designation label as typical input voltage level 566 V DC.
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 (849 V DC for UL/CSA).

Option codes

Code	Description
B053	IP22 (UL Type 1)
B054	IP42 (UL Type 1 Filtered)
B055	IP54 (UL Type 12)
C121	Marine construction
C128	Air inlet through bottom of cabinet
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
C176	Door hinges on left
C180	Seismic design
C188	Direct-on-line module cooling fans
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
E210	EMC/RFI filter for 2nd environment TN (grounded) or IT (ungrounded) system, category C3
F286	DC switch-disconnector
G300	Cabinet and module heating elements (external supply)
G301	Cabinet lighting
G304	Control (auxiliary) voltage 115 V AC
G307	Terminals for connecting external control voltage (230 V AC or 115 V AC, eg. UPS)
G314	Aluminum busbars
G315	Tin-plated copper DC busbars
G330	Halogen-free wiring and materials
G442	BAMU auxiliary measurement unit
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)

Code	Description
H367	Control cabling through floor of cabinet
H368	Control cabling through roof of cabinet
J400	ACS-AP-W control panel (with Bluetooth)
J410	Control panel mounting platform
J425	ACS-AP-I control panel (without Bluetooth)
K450	Panel bus (control of several units from one control panel)
K451	FDNA-01 DeviceNet™ adapter module
K454	FPBA-01 PROFIBUS DP® adapter module
K457	FCAN-01 CANopen® adapter module
K458	FSCA-01 RS-485 (Modbus/RTU) adapter module
K462	FCNA-01 ControlNet™ adapter module
K469	FECA-01 EtherCAT® adapter module
K470	FEPL-02 Ethernet POWERLINK adapter module
K475	FENA-21 Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols, 2-port
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
L500	FIO-11 analog I/O extension module
L501	FIO-01 digital I/O extension module
L504	Additional I/O terminal block
L509	RDCO-04 optical DDCS communication module (4×Transmitter/Receiver)
L525	FAIO-01 analog I/O extension module
L526	FDIO-01 digital I/O extension module
P904	Extended warranty (30 months from delivery or 24 months from commissioning)
P909	Extended warranty (42 months from delivery or 36 months from commissioning)
P911	Extended warranty (66 months from delivery or 60 months from commissioning)
P912	Seaworthy packaging
P913	Special color (RAL Classic)
P947	Safety data calculation and validation for tailored safety functions
P948	Customized extended warranty
P966	Special color (other than RAL Classic)
V112	Module auxiliary and fan power supply connector change
V998	UCU-22…24 control unit

Type designation key of the converter module

Type designation describes the composition of the module in short. The complete designation code is divided in subcodes:

- The first digits form the basic code. It describes the basic construction of the module. The fields in the basic code are separated by hyphens.
- The plus codes follow the basic code. Each plus code starts with an identifying letter (common for the whole product series), followed by descriptive digits. The plus codes are separated by plus signs.

The subcodes are described below.

Code	Description
Basic codes	
ACS880	Product series
104	Construction: Inverter, supply, converter or brake module.
Size	
xxxxx	Refer to the ratings table in the technical data.
Voltage range	
3	DC voltage corresponding AC input voltages 3 ~ 380…415 V. This is indicated in the type designation label as typical input voltage level 566 V DC.
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 (849 V DC for UL/CSA).
Option codes (plus codes)	
C129	UL Listed (evaluated to both U.S. and Canadian safety requirements)
C132	Marine type approval
C134	CSA approved
C188	Direct-on-line (DOL) cooling fan
C209	Marine product certification issued by Bureau Veritas
E205	Internal d*u*/d*t* filtering
G304	115 V auxiliary voltage supply
P904	Extended warranty (30 months from delivery or 24 months from commissioning)
P909	Extended warranty (42 months from delivery or 36 months from commissioning)
P911	Extended warranty (66 months from delivery or 60 months from commissioning)
V112	Module auxiliary and fan power supply connector change

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. The optional selections are given thereafter, separated by plus signs.

Code	Description
Basic code	
BDCL-14	BDCL-14 filter
BDCL-15	BDCL-15 filter
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	
C188	Direct-on-line (DOL) cooling fan (included in the delivery as standard)
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 multidrives cabinets mechanical installation instructions (3AUA0000101764 [English]).

Energy storage

Obey the instructions of the energy storage manufacturer.

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 multidrives cabinets and modules electrical planning instructions (3AUA0000102324 [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 multidrives cabinets and modules safety instructions (3AUA0000102301 [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 persons 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 drive and motor(s).
2. Clearly identify the work location and equipment.
3. Disconnect all possible voltage sources. Make sure that 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 it is 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 it is present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
   - If a permanent magnet motor connects 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, 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 electrical work. This includes, but is 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 (U, V, W) and the grounding (PE) busbar is zero.

     Important! Repeat the measurement with the DC voltage setting of the voltage 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.

6. Install temporary grounding as required by the local regulations.
7. Ask for a permit to work from the person that is responsible for the electrical installation work.

Measuring the insulation resistance of the DC cabling

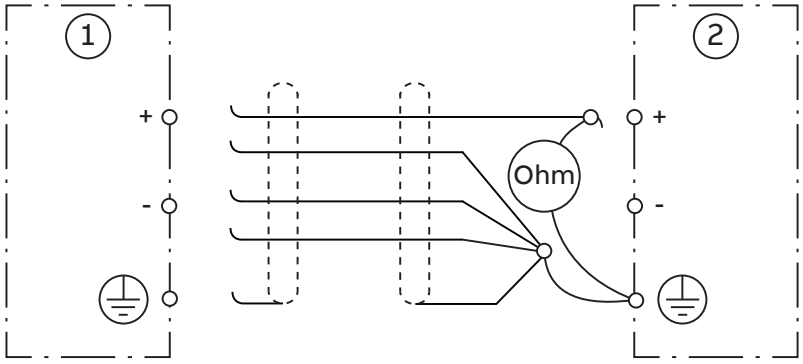
WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

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).



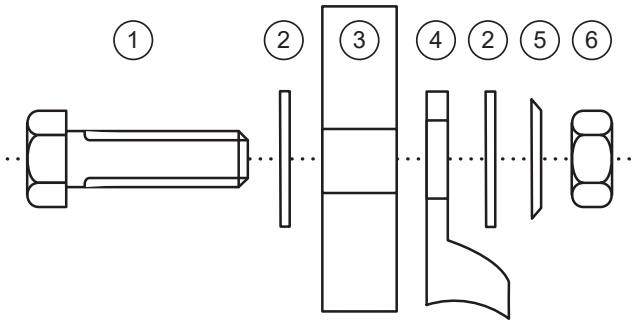
1	Energy storage
2	Converter unit

Connecting the energy storage cable and load disconnected indicator cable

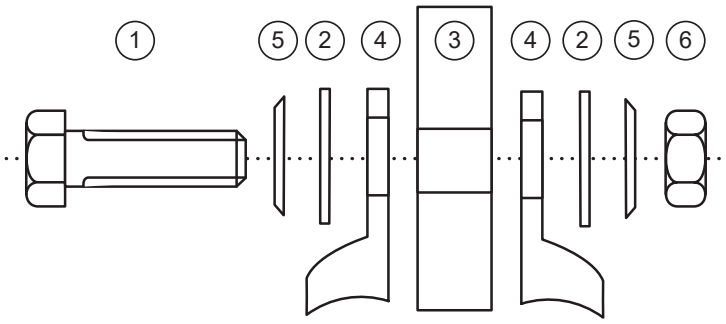
Use of fasteners in cable lug connections

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

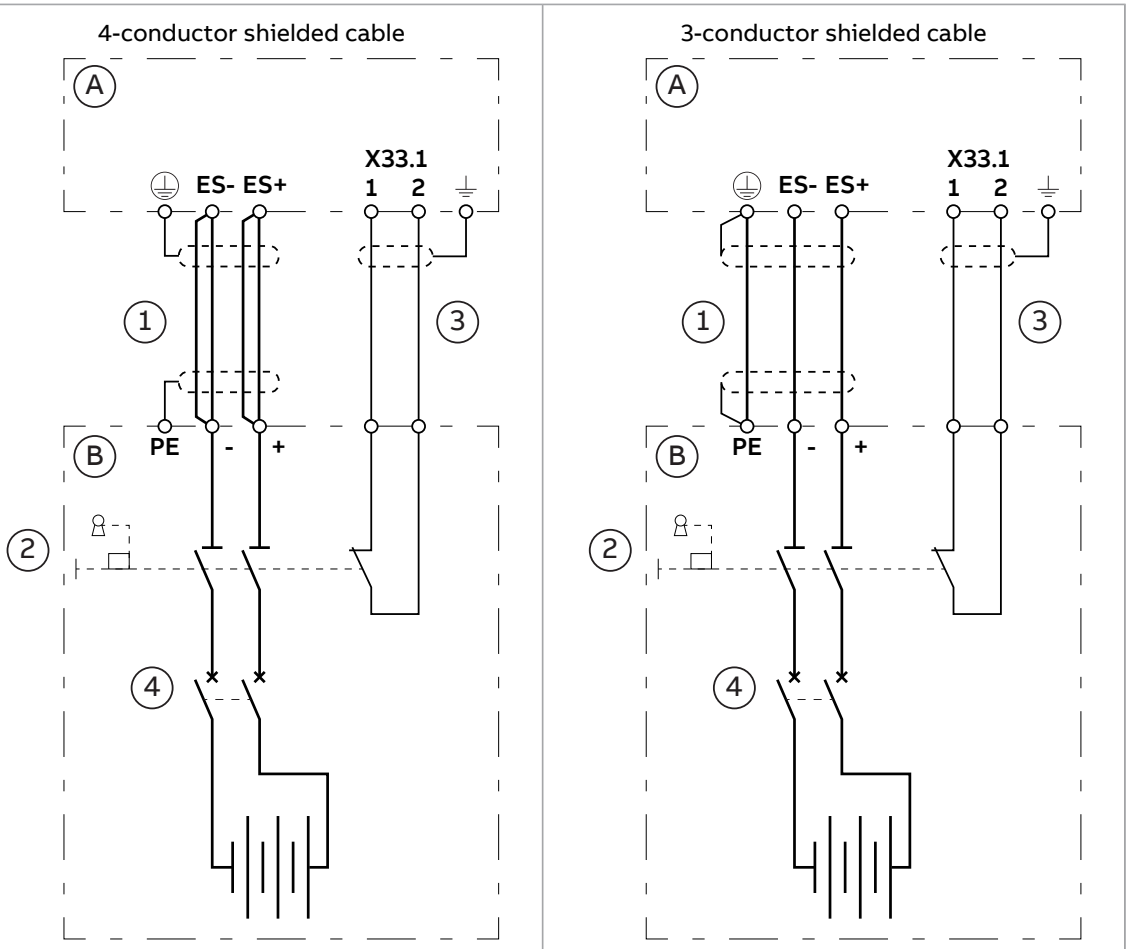


1	Bolt	4	Cable lug
2	Plain washer	5	Spring washer
3	Busbar	6	Nut

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

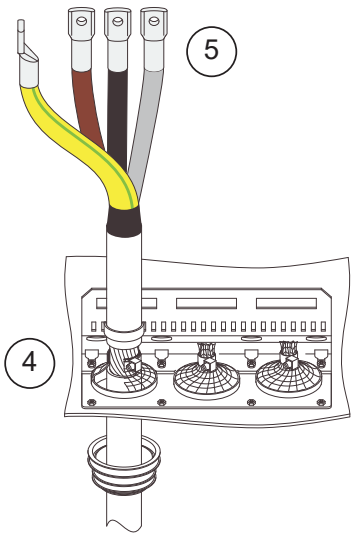
Connection procedure of the energy storage cables

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!
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.

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.

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Open the door of the DC/DC-converter cubicle and remove the shrouding (if any).
3. Lead the cables into the cubicle through the cable entry plate.
4. Ground the cable shield 360° at the cable entry.
5. Cut the cables to suitable length. Strip the cables and conductors, and install the cable lugs at the end of the conductors.
6. Connect the conductors to the applicable terminals. Refer to the delivery-specific connection diagram of the cabinet-installed unit. For the tightening torques, refer to the technical data.
7. Twist the cable shields into bundles and connect them to the protective grounding busbar (PE) of the cabinet.
8. Install the shrouding removed earlier and close the cubicle doors.
9. At the energy storage, connect the cables according to the instructions of the energy storage manufacturer.

	A cable entry with 360° grounding of the cable shield.

Connection procedure of the load disconnected indicator cable

WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [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 and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Open the door of the DC/DC-converter cubicle and remove the shrouding.
3. Run the load disconnected indicator cable inside the cubicle and connect to the applicable terminal. Obey the general control cable connection instructions. Refer to section Connecting the control cables (page 49).

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

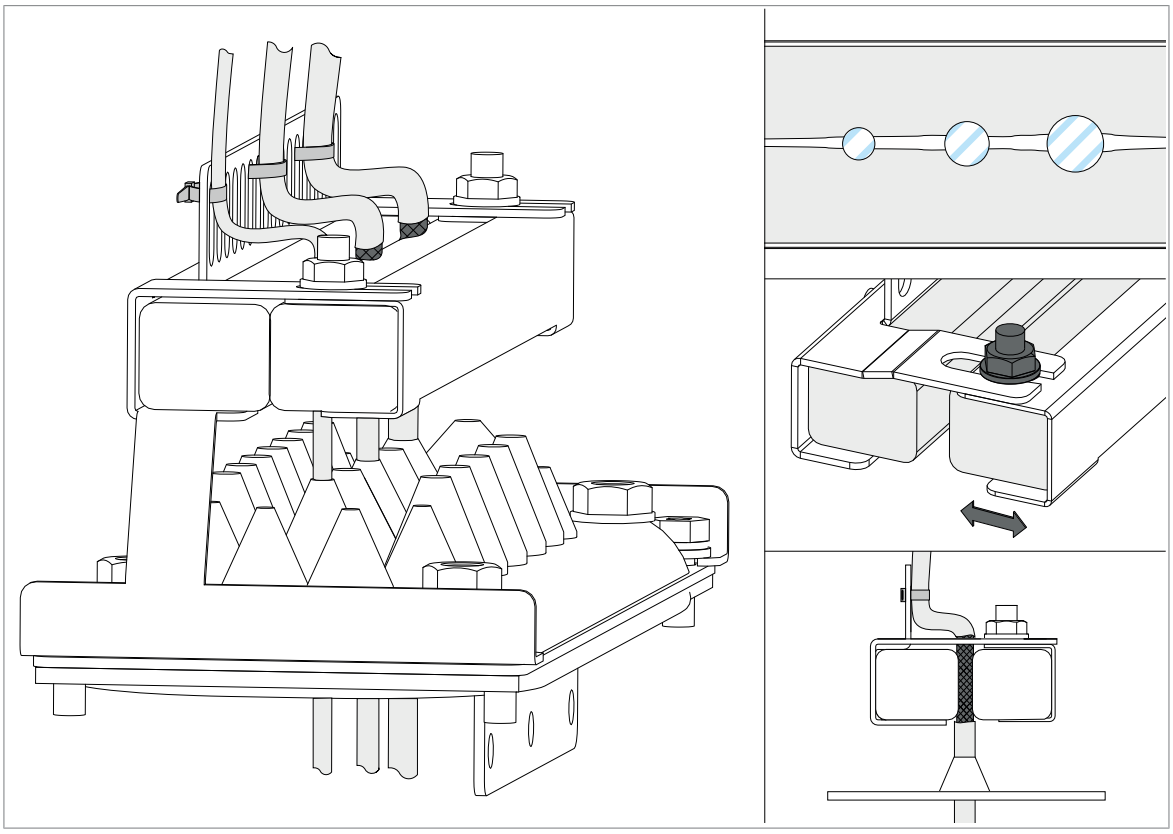
WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

1. Stop the drive (if running) and do the steps in section Electrical safety precautions (page 43) 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 50).
3. Route the control cables as described in section Routing the control cables inside the cabinet (page 52).
4. Connect the control cables as described in section Connecting control cabling (page 52).

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

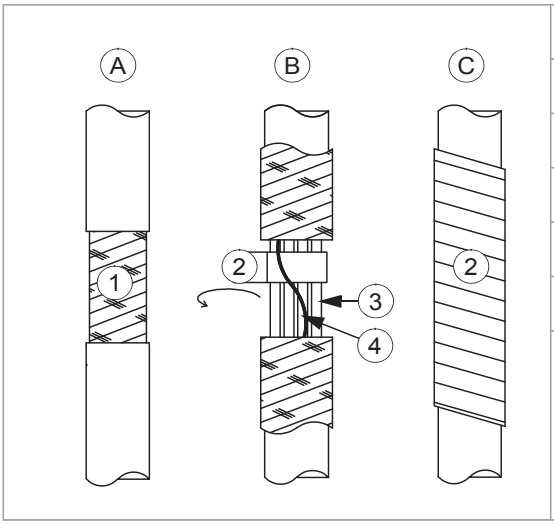
Ground the outer shields of all control cables 360° with the EMI conductive cushions at the cabinet entry. The grounding principle is the same for top and bottom entry cables. The figures show the bottom entry. The actual design details can vary.

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:

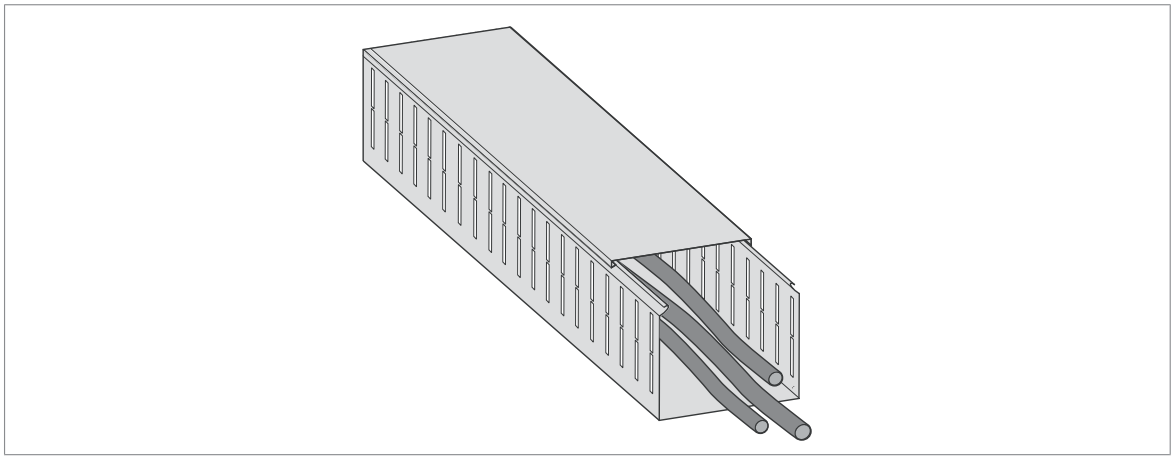
- Cut the shield at the midpoint of the peeled part. Be careful not to cut the conductors or the grounding wire.
- Turn the conductive side of the shield inside out over the insulation.
- Cover the exposed shield and the peeled cable with copper foil to keep the shielding continuous.



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

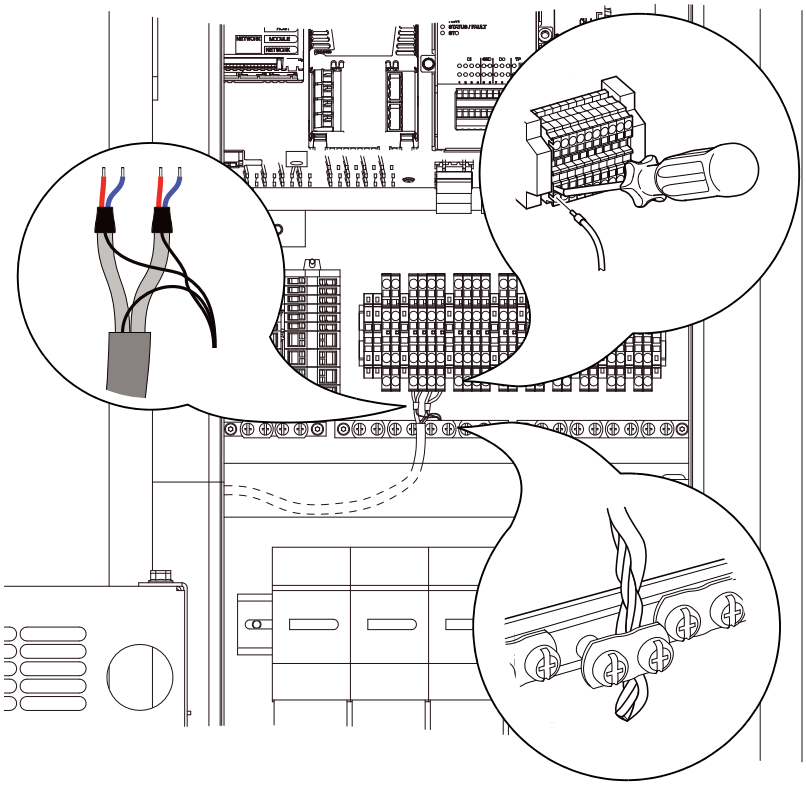
Connect the conductors to the appropriate terminals. Refer to the wiring diagrams delivered with the drive.

With option +L504, the terminals of the inverter control unit are available on terminal block X504.

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

WARNING!
Use ESD wristband when you handle printed circuit boards. Do not touch the boards unnecessarily. The boards are sensitive to electrostatic discharge.

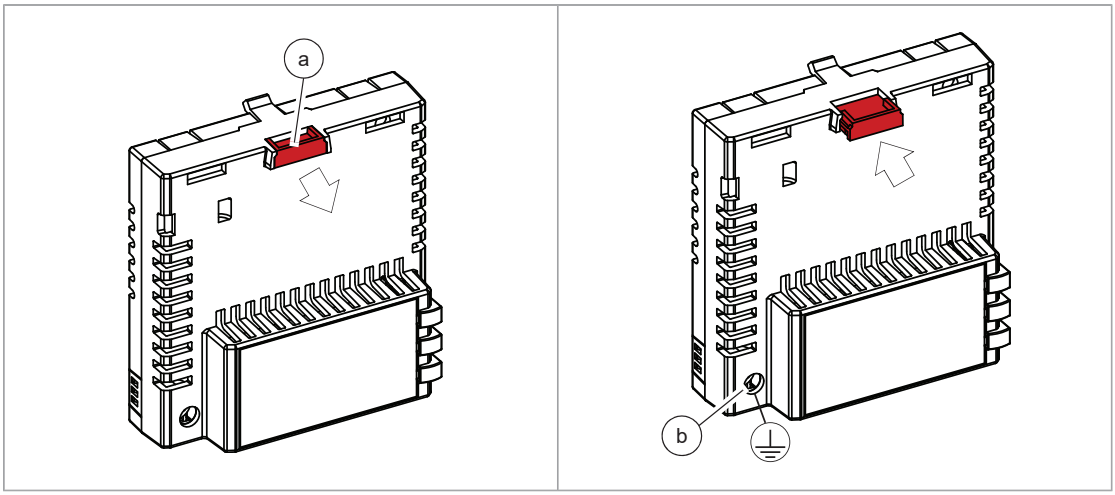
Pay attention to the free space required by the cabling or terminals coming to the option modules.

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) 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.

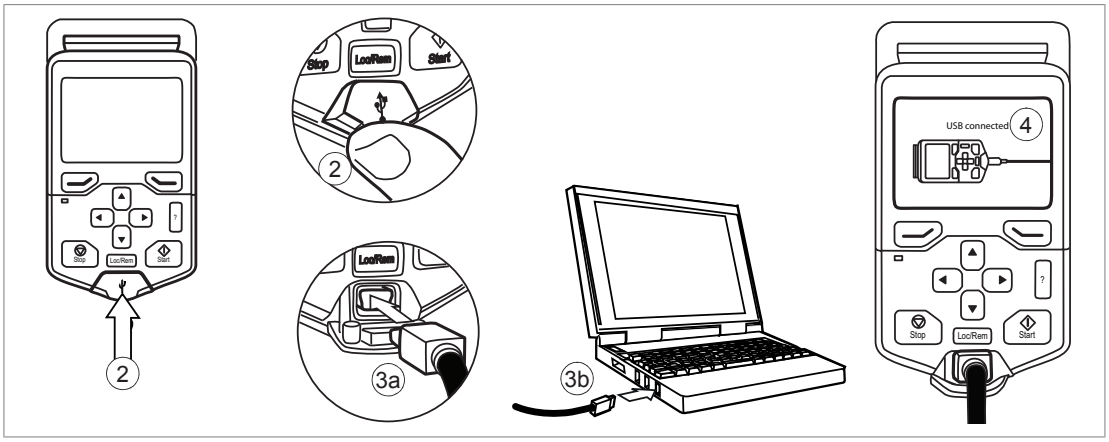
If you must remove the option module after it is installed into the drive, use a suitable tool (for example, small pliers) to carefully pull out the lock.

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

Control unit (UCU)

Contents of this chapter

This chapter:

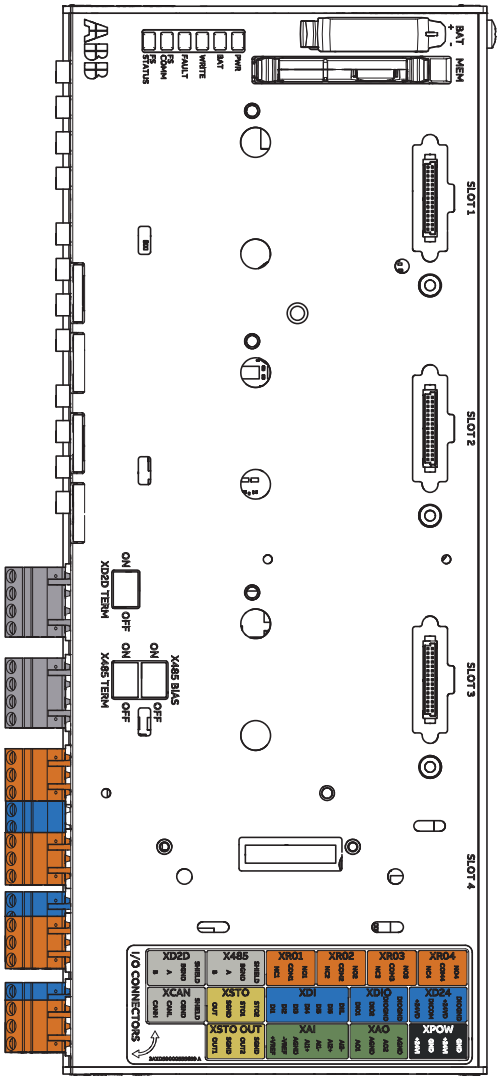
- gives information on the connections of the control unit, and
- contains the specifications of the inputs and outputs of the control unit.

General

The UCU control units are used for controlling power modules (drive, inverter, supply, converter, etc) via fiber optic links. UCU-22 has two, UCU-23 has eight and UCU-24 has 14 power module connections. The UCU control units have integrated branching unit functionality for collecting and storing real-time data from the power modules to help fault tracing and analysis. The data is stored on a memory card which can be analyzed by ABB service personnel.

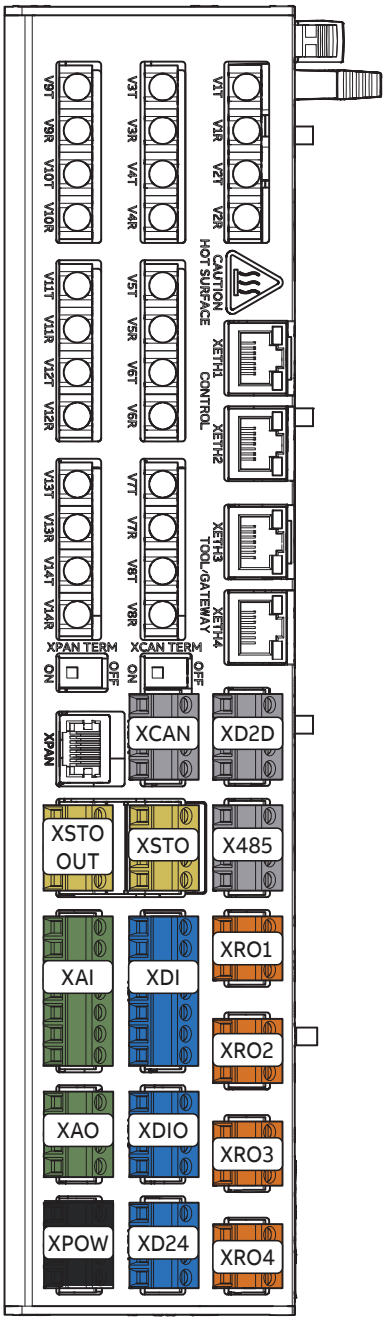
Layout

The figures below show an example UCU-24 control unit.

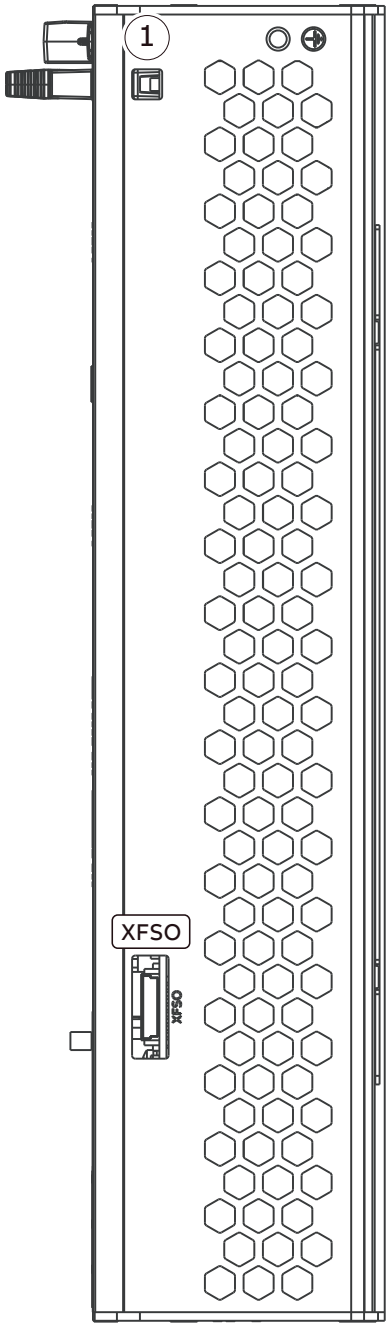


	Description
I/O	I/O terminals
SLOT 1	I/O extension, encoder interface or fieldbus adapter module connection. For F-type modules with USCA-02 adapter.
SLOT 2	
SLOT 3	
SLOT 4	RDCO-0x DDCS communication option module connection
MEM	UMU-01 memory unit connection. Data logger microSDHC memory card for inverter 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
1	Humidity and temperature measurements

Default I/O diagram of the converter control unit

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

Terminal			Description	
XD2D			Drive-to-drive link	
1 2 3 4	1 2 3 4	B A BGND SHIELD	Not supported in DC/DC converter units	
	XD2D TERM		Drive-to-drive link termination switch	
X485			RS485 connection	
5 6 7 8	5 6 7 8	B A BGND SHIELD	Not in use by default	
	X485 BIAS		X485 bias selection switch	
	X485 TERM		X485 termination switch	
XCAN			CAN bus	
9 10 11 12	9 10 11 12	CANH CANL CGND SHIELD	Not supported Control cable shield	
	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) [1] (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

Terminal			Description	
XRO4			Relay output 4	
41	41	NC4	Norm. closed	XRO4: Not supported 250 V AC / 30 V DC, 2 A
42	42	COM4	Common	
43	43	NO4	Norm. open	
XSTO			Safe torque off input connection	
1	1	OUT	XSTO: STO1 and STO2 are connected to OUT at the factory. To enable start and operation, STO1 and STO2 must be connected to OUT.	
2	2	SGND		
3	3	STO1		
4	4	STO2		
XSTO OUT			Safe torque off output connection (to inverter modules)	
5	5	OUT1	XSTO OUT: Not in use.	
6	6	SGND		
7	7	OUT2		
8	8	SGND		
XDI			Digital inputs	
1	1	DI1	Temp fault[1] (0 = overtemperature)	
2	2	DI2	Not in use by default	
3	3	DI3	Not in use by default	
4	4	DI4	Not in use by default	
5	5	DI5	Not in use by default	
6	6	DI6	Not in use by default	
7	7	DIIL	Not in use by default. DIIL is connected to XD24:5 at the factory.	
XDIO			Digital input/outputs	
1	1	DIO1	Not in use by default	
2	2	DIO2	Not in use by default	
3	3	DIOGND	Digital input/output ground	
4	4	DIOGND	Digital input/output ground	
XD24			Auxiliary voltage output	
5	5	+24VD	+24 V DC 200 mA[2]	
6	6	DICOM	Digital input ground	
7	7	+24VD	+24 V DC 200 mA[2]	
8	8	DIOGND	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.	

Terminal			Description
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 [3]
	5	AI1-	
	6	AI2+	Not in use by default. 0(4)…20 mA, R_{in} = 100 ohm [4]
	7	AI2-	
XAO			Analog outputs
1 2 3 4	1	AO1	Zero (no signal indicated)[1] 0…20 mA, R_L < 500 ohm (not in use by default)
	2	AGND	
	3	AO2	Zero (no signal indicated)[1] 0…20 mA, R_L < 500 ohm (not in use by default)
	4	AGND	
XPOW			External power input
1 2 3 4	1	+24VI	19…32 V DC, 1.5 … 2.9 A (depends on the load and supply voltage) External power input. Two supplies can be connected to the control unit for redundancy.
	2	GND	
	3	+24VI	
	4	GND	
XFSO			Safety functions module connection. Not supported in DC/DC converter units.
XETH1			Ethernet ports for fieldbus. Support depends on the firmware. Refer to the firmware manual.
XETH2			
XETH3			Ethernet ports for tool communication. Support depends on the firmware. Refer to the firmware manual.
XETH4			
XPAN			Control panel connection
	XPAN TERM		Control panel connection termination switch. Used for panel bus configuration.
MEM			Memory unit connection

1) Default use of the signal in the control program. The use can be changed by a parameter. See also the delivery-specific circuit diagrams.
2) Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.
3) 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.
4) 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)

Power to the control unit is supplied internally through terminal block XPOW.

Refer to the control unit connector data for the current and voltage ratings of the power supply.

Connect an additional external power supply to the free +24 V and GND terminals of the XPOW terminal block if:

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

Digital interlock (DIIL)

Digital interlock input (DIIL) terminal is originally intended for interlock signals that stop the drive/unit when necessary. In the ACS880 primary control program, DIIL terminal is the source for the run enable signal by default. The inverter unit or drive cannot start, or it stops when there is no DIIL signal. In other control programs (and units), the default use of the DIIL terminal varies. Refer to firmware manual for more information.

Note: This input is **not** SIL or PL classified.

Control panel connection (XPAN)

The XPAN connector can be used to connect an assistant control panel or FDPI-02 diagnostics and panel interface unit to the control unit. With FDPI-02, it is possible to connect one control panel to two or more control units in a chain topology, also known as a panel bus. For more information, refer to FDPI-02 diagnostics and panel interface user's manual (3AUA0000113618 [English]).

The XPAN TERM switch sets the termination for the panel bus. Must be set to ON if there is no panel bus, or if the control unit is the last one in a panel bus. On intermediate units in a panel bus, set termination to OFF (1).

Safe torque off (XSTO, XSTO OUT)

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 control units (supply, DC/DC converter, or brake unit) stops the unit but does not constitute a SIL/PL classified safety function.

MicroSDHC memory card slot

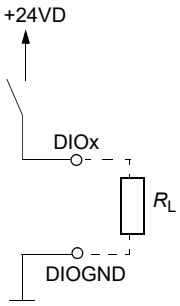
The control unit has an on-board data logger that collects real-time data from the power modules to help fault tracing and analysis. The data is stored onto the microSDHC memory card inserted into the UMU-01 memory unit and can be analyzed by ABB service personnel.

Connector data

The wire size accepted by all screw terminals (for both stranded and solid wire) is 0.5 … 2.5 mm^2 (22…12 AWG). Connector pitch is 5 mm.

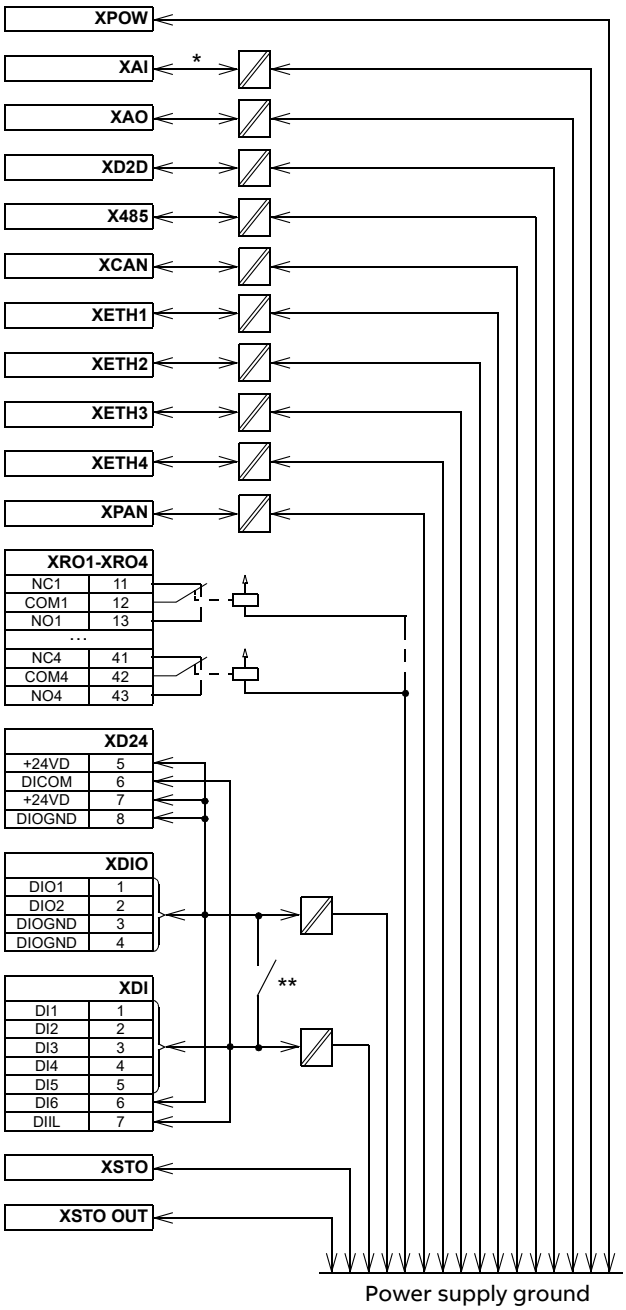
Maximum tightening torque of the screw terminals is 0.45 N·m (4 lbf·in).

Power supply (XPOW)	19…32 V DC, 1.5 … 2.9 A (depends on the load and supply voltage) External power input. Two supplies can be connected to the control unit for redundancy.
Relay outputs XRO1…XRO4	250 V AC / 30 V DC, 2 A Protected by varistors

+24 V output (XD24:2 and XD24:4)	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)	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 I_{max}: 15 mA (DI1…DI5), 5 mA (DI6)
Start interlock input DIIL (XDI:7)	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…100 kHz with hardware filtering of 4 microseconds) for 24 V level square wave signal (sinusoidal or other wave form cannot be used). 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.	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)	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 parameters 12.15 AI1 unit selection and 12.25 AI2 unit selection	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)	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	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)	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)

CAN connection (XCAN)	Termination by switch (XCAN TERM) This connection is not supported by the ACS880 control programs.
Safe torque off connection (XSTO)	Input voltage range: -3…30 V DC Logic levels: "0" < 5 V, "1" > 17 V. **Note:** Both circuits must be closed to enable start and operation (STO1 and STO2 must be connected to OUT). 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 (continuous) per STO channel: 10 mA. The number of parallel inverter modules does not have an effect on the current consumption. EMC (immunity) according to IEC 61326-3-1 and IEC 61800-5-2
Safe torque off output (XSTO OUT)	To STO connector of inverter module.
Control panel connection (XPAN)	Connector: RJ-45 Cable length < 50 m (164 ft) Termination by switch (XPAN TERM)
Fieldbus Ethernet connection with internal switch (XETH1 and XETH2)	Connector: RJ-45 Cable type: minimum requirement CAT5e
microSDHC memory card slot (microSDHC CARD)	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.	

Ground isolation diagram



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

****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.

7

Control unit (BCU)

Contents of this chapter

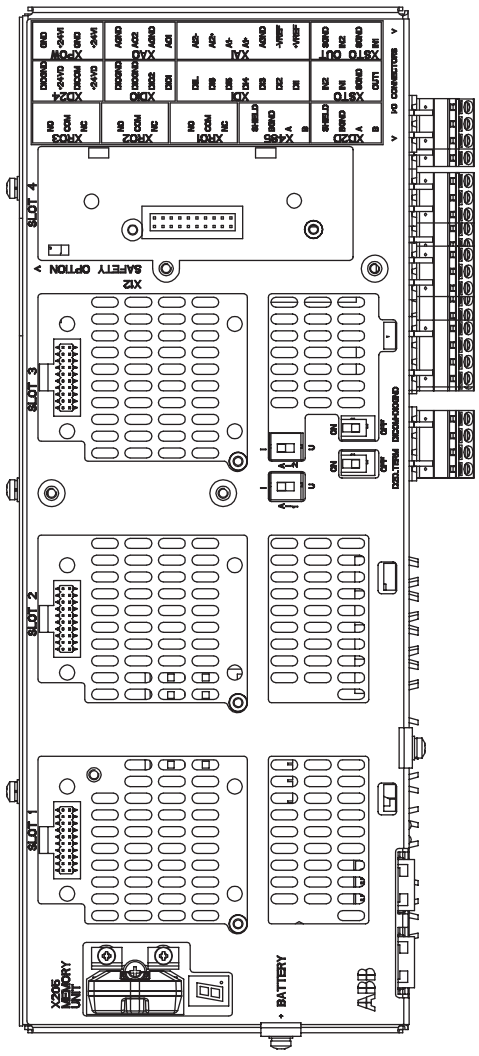
This chapter:

- gives information on the connections of the control unit, and
- contains the specifications of the inputs and outputs of the control unit.

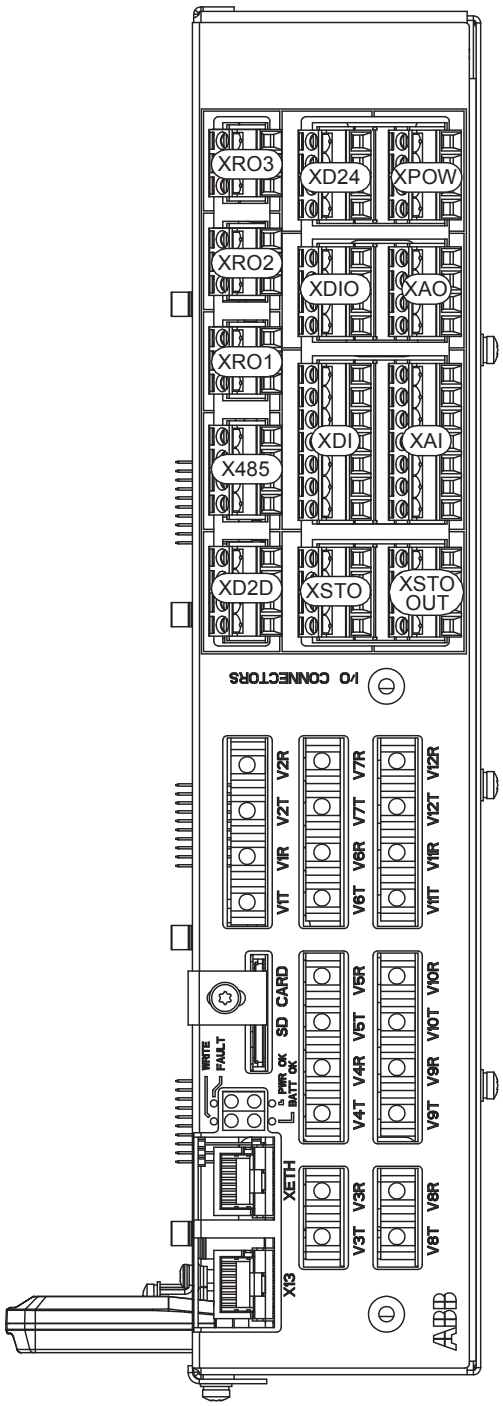
General

The BCU control units are used for controlling power modules (drive, inverter, supply, converter, etc) via fiber optic links. BCU-02 has two, BCU-12 has seven, and BCU-22 has 12 power module connections. The BCU control units have integrated branching unit functionality for collecting and storing real-time data from the power modules to help fault tracing and analysis. The data is stored on a memory card which can be analyzed by ABB service personnel.

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 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) Connection for FSO safety functions module (optional)
X13	Control panel, PC connection through the control panel
X485	Not in use by default
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 and BCU-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 is sufficient
WRITE	Writing to memory card in progress. Do not remove the memory card.

Default I/O diagram of the converter control unit

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

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

Terminal			Description
XDI			Digital inputs
1 2 3 4 5 6 7	1	DI1	Temp fault[1] (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. DIIL is connected to XD24:5 at the factory.
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	5	+24VD	+24 V DC 200 mA[2]
	6	DICOM	Digital input ground
	7	+24VD	+24 V DC 200 mA[2]
	8	DIOGND	Digital input/output ground
ON OFF	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[3]
	5	AI1-	
	6	AI2+	Not in use by default. 0(4)…20 mA, R_{in} = 100 ohm[4]
	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[1] 0…20 mA, R_L < 500 ohm (not in use by default)
	2	AGND	
	3	AO2	Zero[1] 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 (±10%), 2 A External power input. Two supplies can be connected to the control unit for redundancy.
	2	GND	
	3	+24VI	
	4	GND	

Terminal	Description
X12	Safety functions module connection. Not supported in DC/DC converter units.
X13	Control panel connection
X205	Memory unit connection

1) Default use of the signal in the control program. The use can be changed by a parameter. See also the delivery-specific circuit diagrams.
2) Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.
3) 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.
4) 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.

Additional information on the connections

Power supply for the control unit (XPOW)

Power to the control unit is supplied internally through terminal block XPOW.

Refer to the control unit connector data for the current and voltage ratings of the power supply.

Connect an additional external power supply to the free +24 V and GND terminals of the XPOW terminal block if:

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

Digital interlock (DIIL)

Digital interlock input (DIIL) terminal is originally intended for interlock signals that stop the drive/unit when necessary. In the ACS880 primary control program, DIIL terminal is the source for the run enable signal by default. The inverter unit or drive cannot start, or it stops when there is no DIIL signal. In other control programs (and units), the default use of the DIIL terminal varies. Refer to firmware manual for more information.

Note: This input is **not** SIL or PL classified.

Safe torque off (XSTO, XSTO OUT)

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 control units (supply, DC/DC converter, or brake unit) stops the unit but does not constitute a SIL/PL classified safety function.

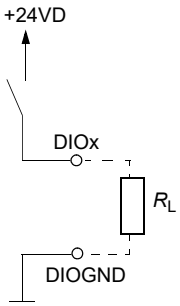
SDHC memory card slot

The 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.

Connector data

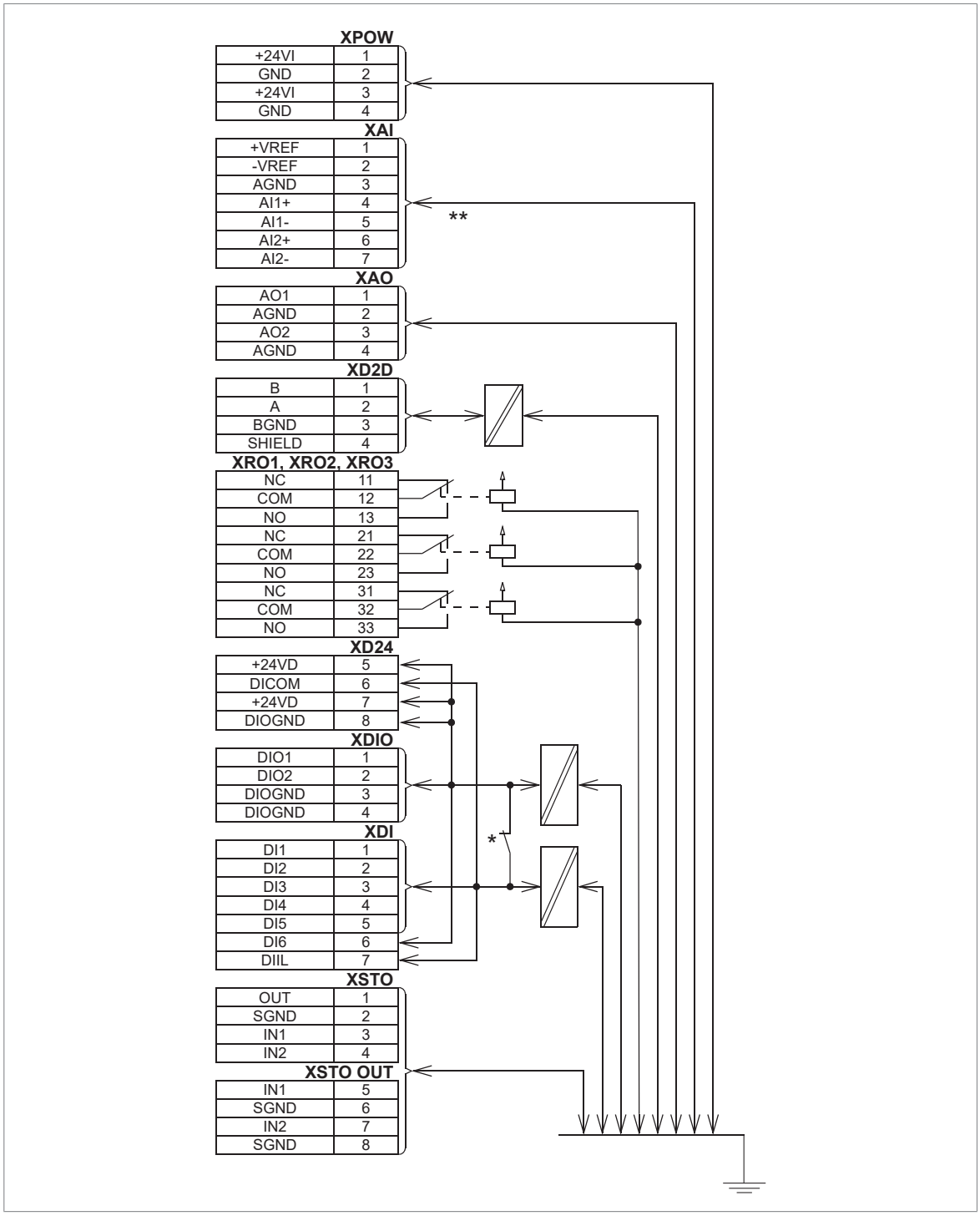
The wire size accepted by all screw terminals (for both stranded and solid wire) is 0.5 … 2.5 mm^2 (22…12 AWG). Connector pitch is 5 mm.

The maximum tightening torque for screw terminals is 0.45 N·m (4 lbf·in).

Power supply (XPOW)	24 V DC (±10%), 2 A External power input. Two supplies can be connected to the BCU control unit for redundancy.
Relay outputs RO1…RO3 (XRO1…XRO3)	250 V AC / 30 V DC, 2 A Protected by varistors
+24 V output (XD24:5 and XD24:7)	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)	24 V logic levels: “0” < 5 V, “1” > 15 V R_{in}: 2.0 kohm (DI1…DI5) Input type: NPN/PNP (DI1…DI5), PNP (DI6) Hardware filtering: 0.04 ms, digital filtering up to 8 ms I_{max}: 15 mA (DI1…DI5), 5 mA (DI6)
Start interlock input DIIL (XDI:7)	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). 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.	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)	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	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)	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	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)	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)
Safe torque off connection (XSTO)	Input voltage range: -3…30 V DC Logic levels: "0" < 5 V, "1" > 17 V. **Note:** Both circuits must be closed to enable start and operation (IN1 and IN2 must be connected to OUT). 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: 66 mA (continuous) per STO channel per drive/inverter module EMC (immunity) according to IEC 61326-3-1 and IEC 61800-5-2
Safe torque off output (XSTO OUT)	To STO connector of inverter module.
Control panel connection (X13)	Connector: RJ-45 Cable length < 100 m (328 ft)
Ethernet connection (XETH)	Connector: RJ-45 This connection is not supported by the firmware
SDHC memory card slot (SD CARD)	Memory card type: SDHC Maximum memory size: 4 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

8

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!
Do the steps in section Electrical safety precautions (page 43) 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.	☐
The cooling air can flow freely in and out of the drive.	☐

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 area in front of the drive is clean: the drive cooling fan cannot draw any dust or dirt inside.	☐
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.	☐

9

Start-up

Contents of this chapter

This chapter describes the start-up procedure of the converter unit. The persons who do the start-up procedure must know the energy storage system, the DC/DC-converter control program and the operation principle of the DC/DC-converter.

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 procedure.

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 multidrives cabinets and modules safety instructions (3AUA0000102301 [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 43).	☐
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 [F21.1, F26.1]. Close also other circuit breakers in between the converter control unit [A41] and the auxiliary voltage switch [Q21] of the drive supply unit. Refer to the circuit diagrams delivered with the converter unit.	☐
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.	☐
Make sure that the DC/DC-converter module and filter module cooling fan turns freely in the correct direction. A paper sheet set on the intake (door) gratings stays. The fans operate without unusual noises.	☐
Press the **Stop** key on the control panel to stop the converter.	☐

10

Maintenance

Contents of this chapter

This chapter instructs how to maintain the DC/DC-converter modules and how to interpret their fault indications. The information is valid for ACS880-1604 DC/DC-converter modules and example cabinet installations of the modules.

Note: The instructions do not cover all possible cabinet constructions.

WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [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.

Maintenance intervals

The tables show the maintenance tasks that can be done by the end user. For the ABB Service offering, contact your local ABB Service representative (new.abb.com/contact-centers).

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	
Cabinet door filters IP54	R
Quality of supply voltage	P
Spare parts	
Spare parts	I
DC circuit capacitors reforming, spare modules and spare capacitors	P
Inspections by user	
IP22 and IP42 air inlet and outlet meshes	I
Tightness of terminals	I
Dustiness, corrosion and temperature	I
Heatsink cleaning	I
Other	
ABB-SACE Air circuit breaker maintenance	I
ABB Contactors maintenance	I

Item	Years from start-up						
	3	6	9	12	15	18	21
Main cooling fan							
R8i direct online 50/60 Hz			R			R	
R8i speed controlled			R			R	
Internal cooling fan for circuit boards							
R8i			R			R	
Cabinet cooling fan							
Internal LONG-LIFE 50 Hz			R			R	
Internal LONG-LIFE 60 Hz		R		R		R	
Door LONG-LIFE 50 Hz			R			R	
Door LONG-LIFE 60 Hz		R		R		R	
IP54 50 Hz			R			R	
IP54 60 Hz		R		R		R	
Aging							
Control unit battery		R		R		R	
Control panel battery			R			R	
Cabinet auxiliary power supplies				R			

Note:

- The maintenance and component replacement intervals are based on the assumption that the equipment operates 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. Contact 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 88).

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 87).
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 43).

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 82)
   - Charging the DC/DC-converter and connecting voltage to the converter (page 83)
   - Connecting the energy storage to the DC/DC-converter (page 83).
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.

Cabinet

Cleaning the interior of the cabinet

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.

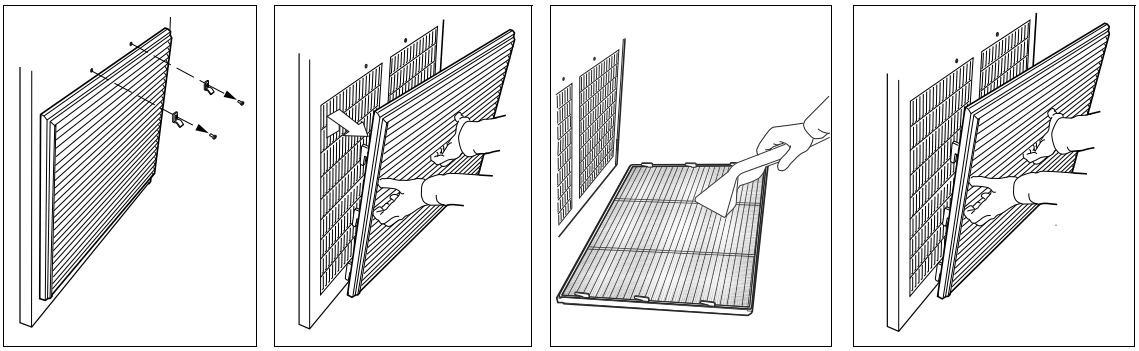
WARNING!
Use a vacuum cleaner with antistatic hose and nozzle, and wear a grounding wristband. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Open the cabinet door.
3. Clean the interior of the cabinet. Use a vacuum cleaner and a soft brush.
4. Clean the air inlets of the fans and air outlets of the modules (top).
5. Clean the air inlet gratings (if any) on the door.
6. Close the door.

Cleaning the door air inlets (IP22 and IP42)

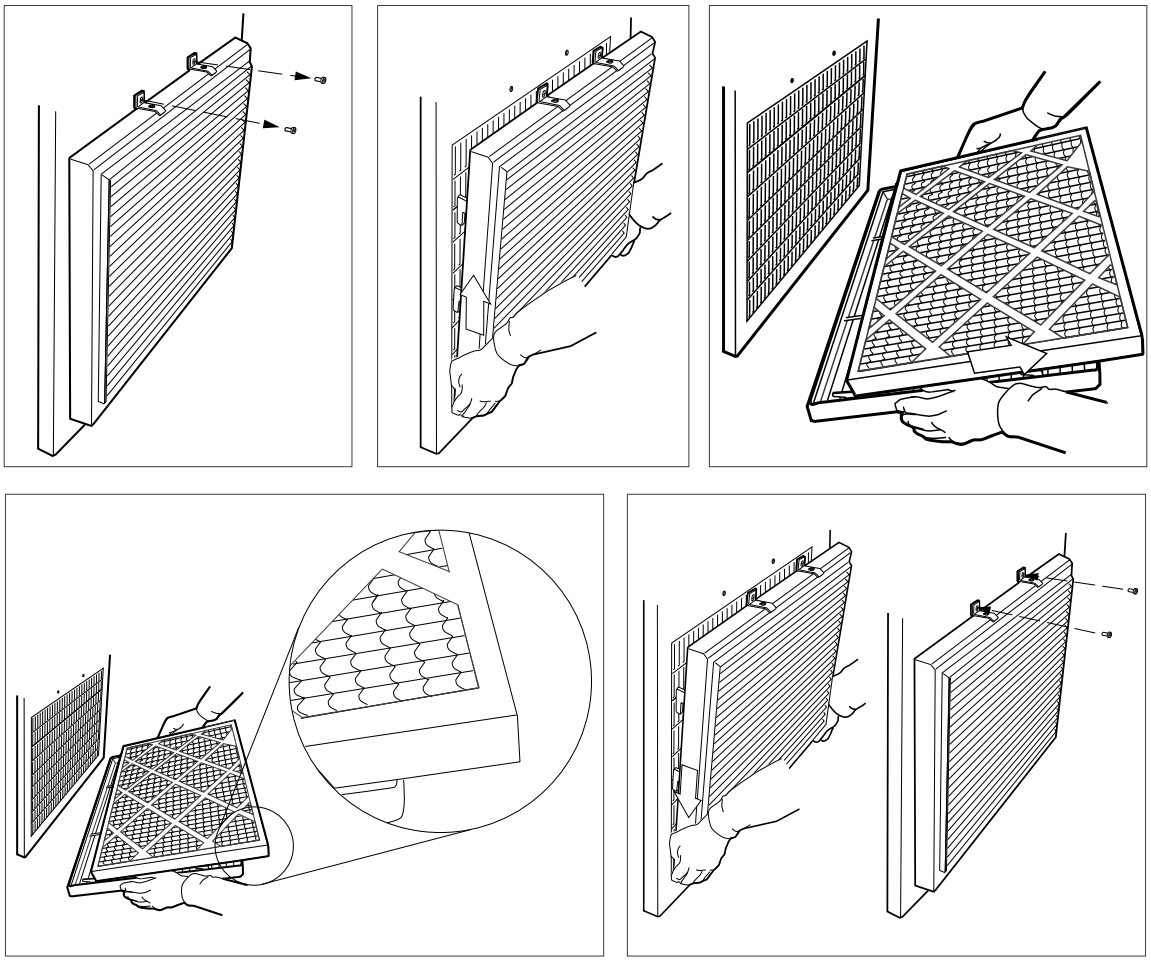
Check the dustiness of the air inlet meshes. If the dust cannot be removed by vacuum cleaning from outside through the grating holes with a small nozzle, proceed as follows:

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Remove the fasteners at the top of the grating.
3. Lift the grating and pull it away from the door.
4. Vacuum clean or wash the grating on both sides.
5. Reinstall the grating in reverse order.



Replacing the inlet door filters (IP54)

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Remove the fasteners at the top of the grating.
3. Lift the grating and pull it away from the door.
4. Remove the air filter mat.
5. Place the new filter mat in the grating the metal wire side facing the door.
6. Reinstall the grating in reverse order.



Cleaning the roof outlet filters (IP54)

The outlet filters on the roof of IP54 units can be accessed by pulling the gratings upwards.

Fuses

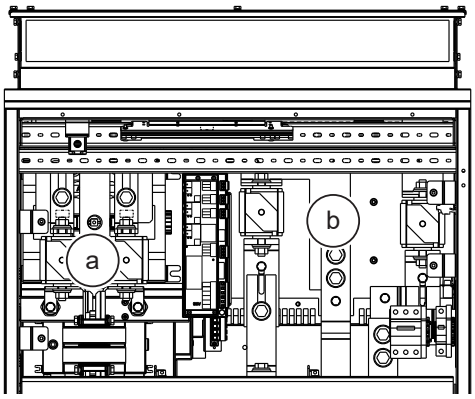
Checking and replacing the fuses – frame R8i

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

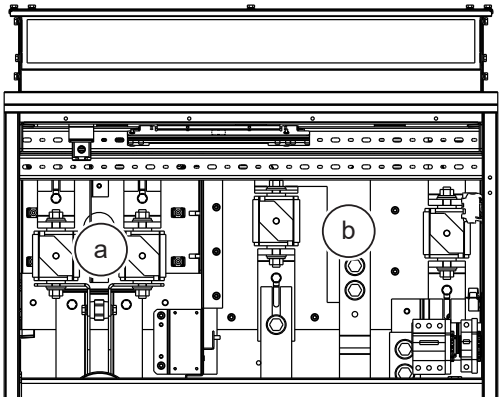
For the location of the fuses, see the figures:

- 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-disconnect



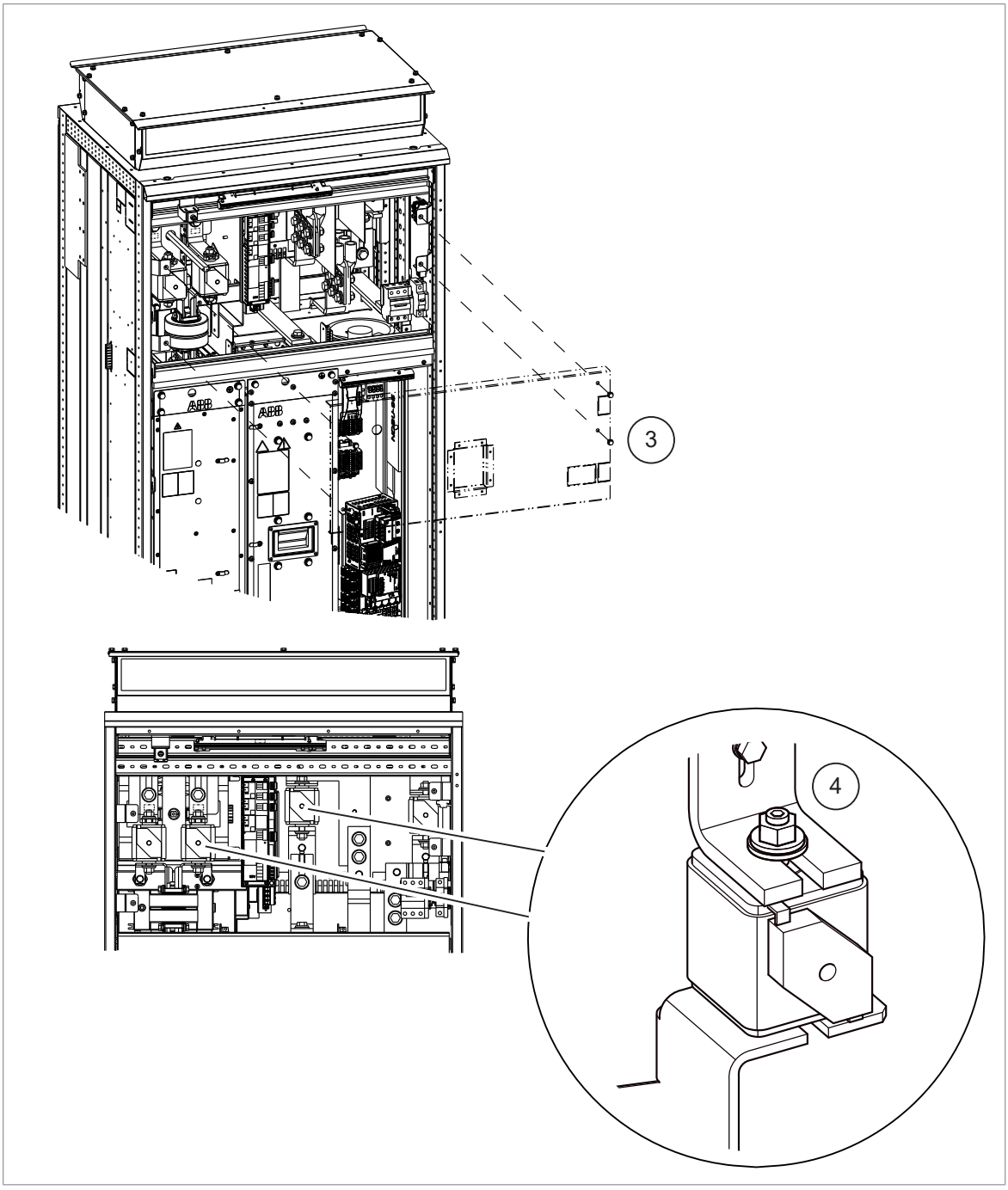
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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 43) 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

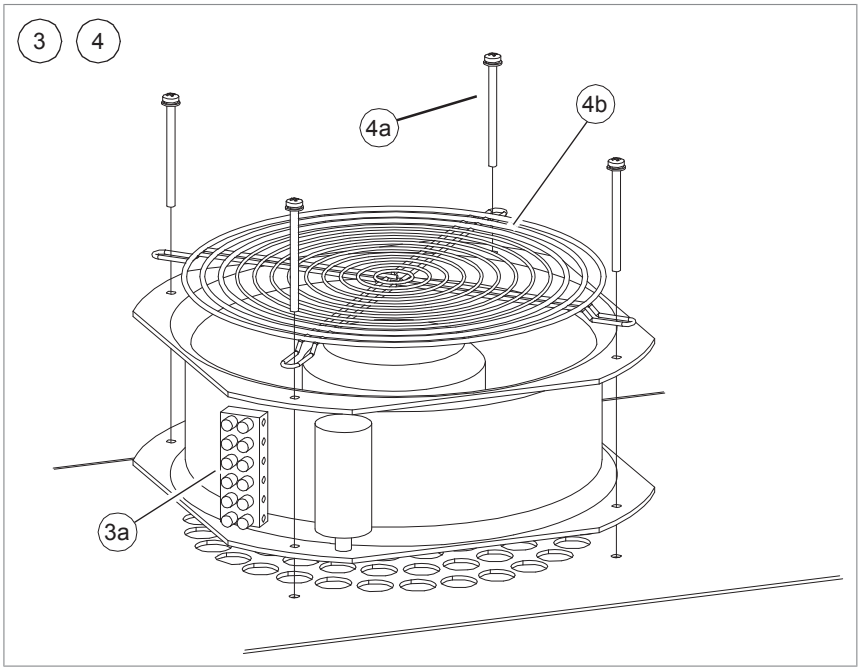
The lifespan of the cooling fans of the drive depends on running time, ambient temperature and dust concentration. See the firmware manual for the actual signal which indicates the running time of the cooling fan. Reset the running time signal after fan replacement.

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

Replacing the cabinet cooling fan

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 43) before you start the work.
2. Remove the shrouding (if any) in front of the fan.
3. Disconnect the fan wiring (a).
4. Remove the fastening screws (a) and finger guard (b) of the fan.
5. Install the new fan in reverse order. Make sure that the arrow indicating the air flow direction points up.



Replacing the speed-controlled cooling fan of the DC/DC-converter module

The module is equipped with a fan unit that contains two cooling fans.

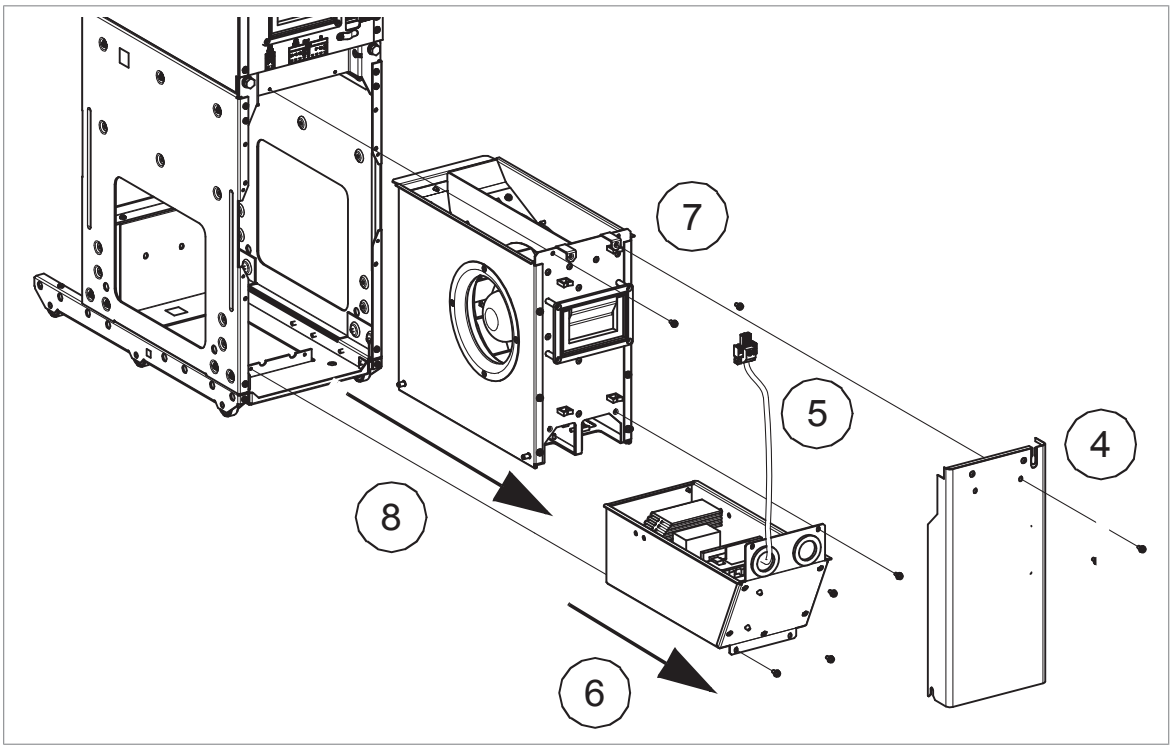
WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

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

Before you start replacing the fan kit of the converter module, make sure that the connector at the end of the fan kit cable is compatible with the counterpart in the

module. Black connector is compatible only with the black counterpart, and gray connector only with the gray counterpart. If the connectors are not compatible, replace the connector at the end of the fan kit cable. Use the connector in the old fan kit, or order a suitable connector from ABB.

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Open the cubicle door.
3. Remove the shroud in front of the fan (if any).
4. Remove the screws holding the front cover plate. Lift the cover plate somewhat to release it.
5. Disconnect the fan wiring.
6. Remove the unit below the fan.
7. Remove the screws of the fan unit.
8. Pull out the fan unit.
9. Install a new fan in reverse order.



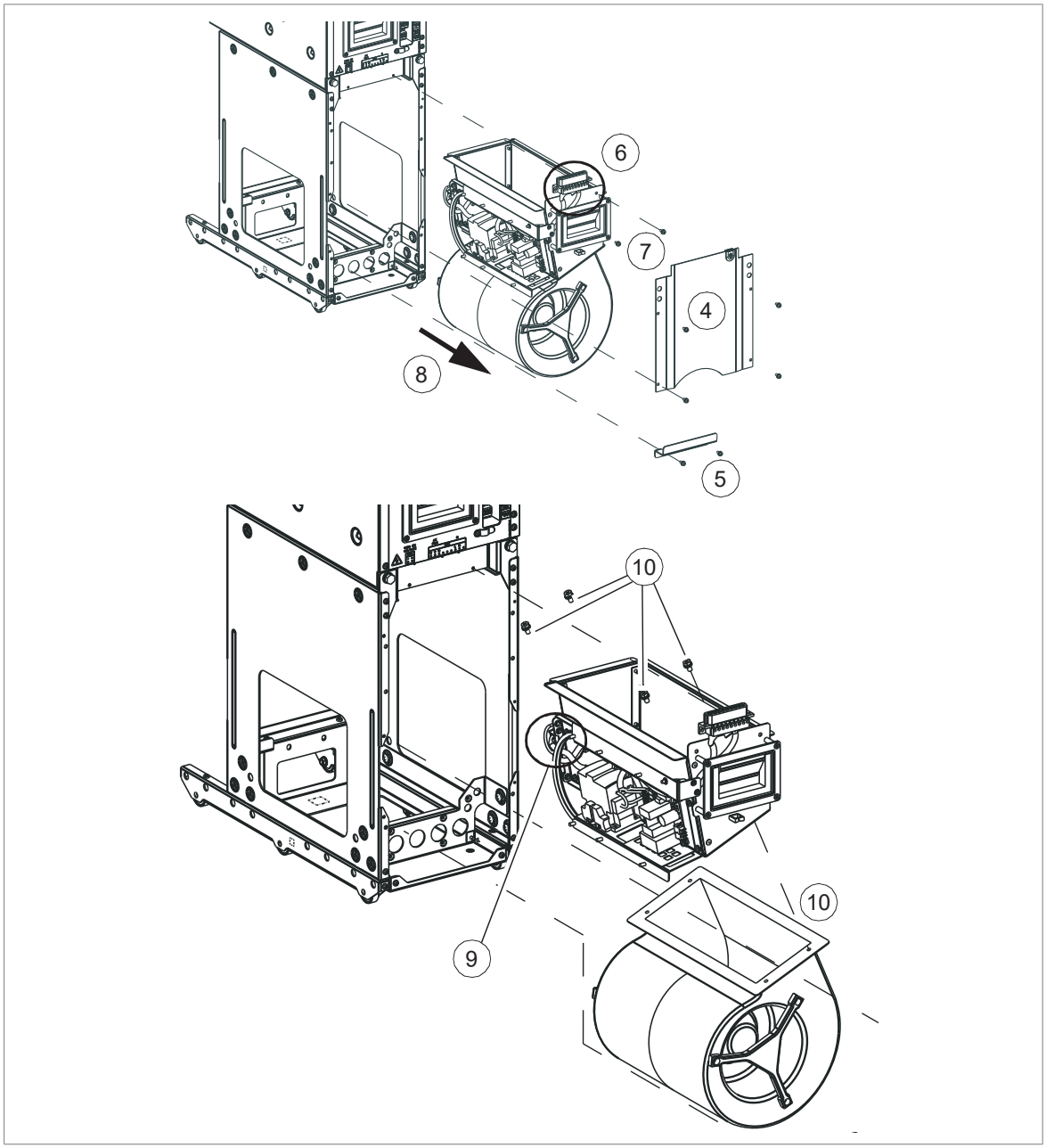
Replacing the direct-on-line fan (option +C188) of the DC/DC-converter module

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.

Before you start replacing the fan kit of the converter module, make sure that the connector at the end of the fan kit cable is compatible with the counterpart in the module. Black connector is compatible only with the black counterpart, and gray connector only with the gray counterpart. If the connectors are not compatible, replace the connector at the end of the fan kit cable. Use the connector in the old fan kit, or order a suitable connector from ABB. Refer to Connector replacement guide for ACS880-x04 R8i/D8T, BLCL-2X, BL-2X and BLHF DOL fan (3AXD50001059903 [English]).

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Open the door.
3. Remove the shroud in front of the fan (if any).
4. Remove the screws holding the front cover plate. Lift the cover plate somewhat to release it.
5. Remove the bracket.
6. Disconnect the wiring of the fan unit.
7. Remove the screws of the fan unit.
8. Pull out the fan unit.
9. Disconnect the fan wire from the fan unit.
10. Remove the screws of the fan.
11. Install a new fan in reverse order.



Replacing the circuit board compartment fan

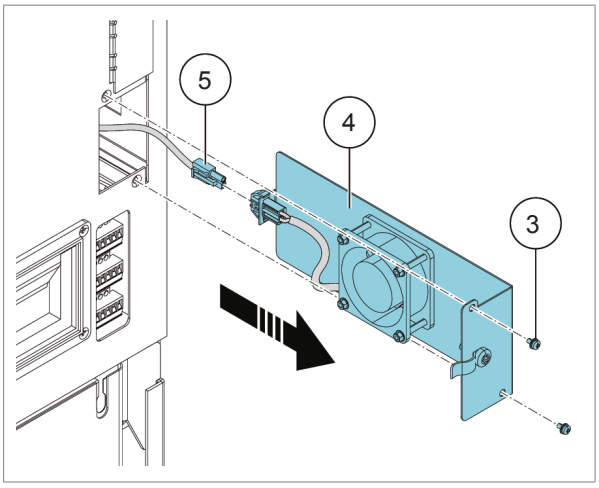
Frame R8i modules are equipped with a fan blowing air through the circuit board compartment.

The fan is accessible from the front of the module.

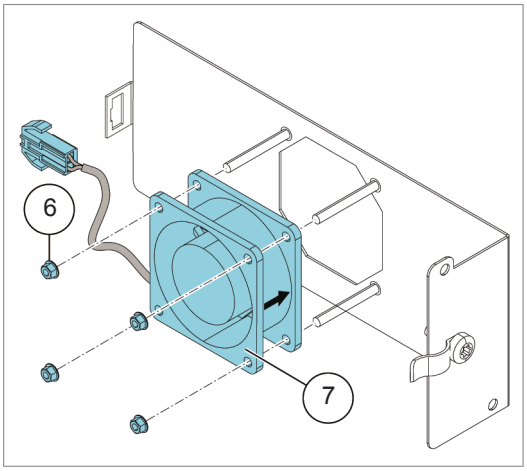
WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Open the door of the module cubicle.
3. Remove the two M4×12 (T20) screws which lock the fan holder.

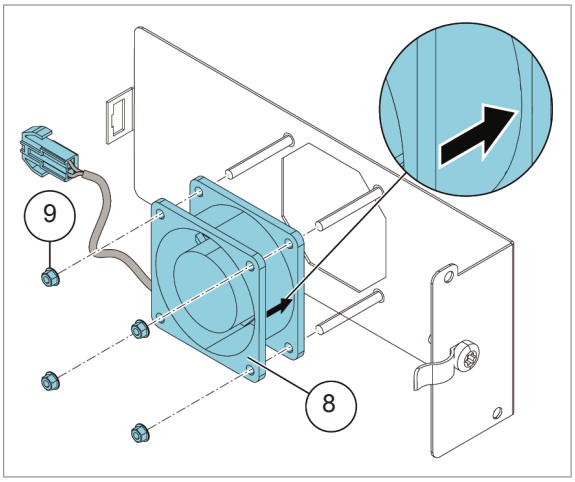
4. Pull the fan holder out of the module.
5. Disconnect the fan cable.



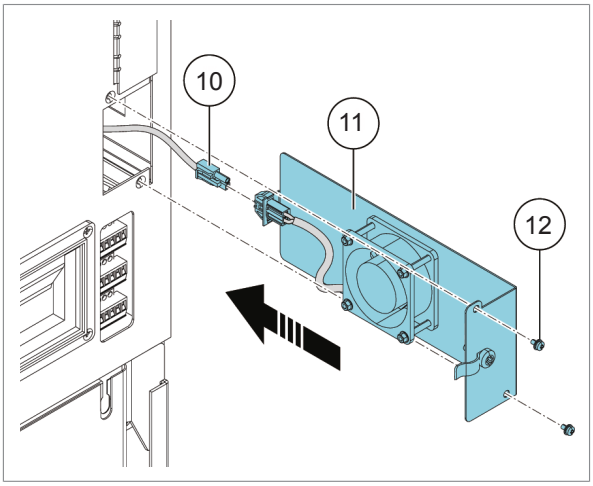
6. Remove the four M3 (5.5 mm) nuts which hold the fan.
7. Remove the fan from the fan holder.



8. Put the fan onto the threaded studs on the fan holder with the airflow direction arrow pointing towards the fan holder.
9. Install and tighten the four nuts removed earlier.



10. Connect the fan cable.
11. Align and push the fan holder into the module.
12. Install and tighten the two M4×12 (T20) screws.



Replacing the fan of the BDCL filter

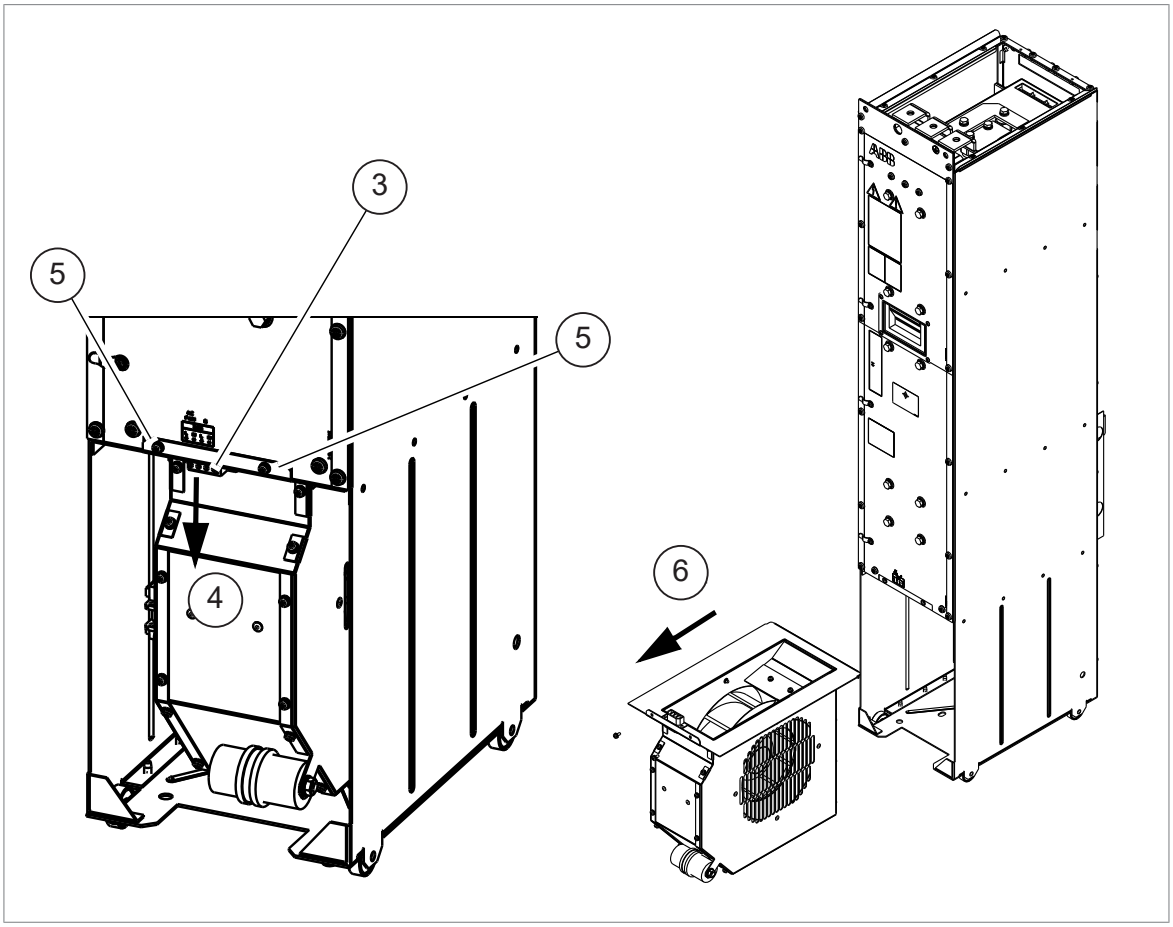
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

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

Before you replace the fan kit of the filter module, make sure that the connector at the end of the fan kit cable is compatible with the counterpart in the module. Black connector is compatible only with the black counterpart, and gray connector only with the gray counterpart. Refer to Connector replacement guide, fan kit cable for BDCL-1… BLCL-0…, or ACS880-304 D7T with +C188 (3AXD50001065126 [English]).

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Open the door.
3. Remove the two locking screws of fan supply plug connector.
4. Pull the plug connector downwards to unplug the fan wiring.
5. Remove the two locking screws in front of the fan unit.
6. Pull the fan unit out.
7. Install a new fan in reverse order.



Replacing the roof fan for IP54 cabinet

Cabinets with ABB air outlet kits

WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [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!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and disconnect the DC/DC-converter unit from the energy storage. Refer to section Disconnecting the DC/DC-converter from the energy storage (page 87). Then disconnect the drive from the input power supply and do the steps in section Electrical safety precautions (page 43)
2. The instruction mentioned for each air outlet kit in the ordering information contains an exploded view of the outlet. Remove all gratings and filters, and finally remove the plate on top of the outlet. Unscrew all necessary screws securing the fan and remove it.
3. Install new fan in reverse order.

Cabinets with other fan types

WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [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!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and disconnect the DC/DC-converter unit from the energy storage. Refer to section Disconnecting the DC/DC-converter from the energy storage (page 87). Then disconnect the drive from the input power supply and do the steps in section Electrical safety precautions (page 43)
2. Obey the instructions of the manufacturer of the air outlet or enclosure system.

DC/DC-converter module

Cleaning the module

The drive module heatsink fins pick up dust from the cooling air. The drive runs into overtemperature warnings and faults if the heatsink is not clean. When necessary, clean the heatsink as follows.

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

WARNING!
Use a vacuum cleaner with antistatic hose and nozzle, and wear a grounding wristband. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

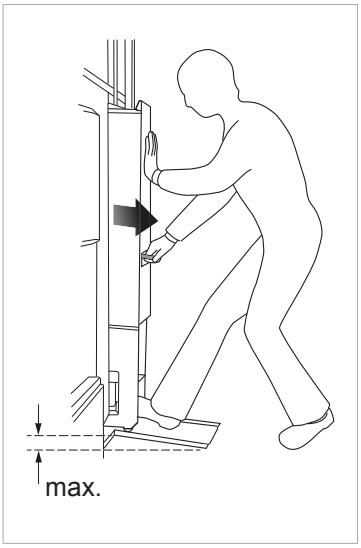
1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Remove the drive module from the cabinet.
3. Remove the module cooling fan(s). See the separate instructions.
4. Protect the adjacent equipment from dust.
5. Blow dry, clean and oil-free compressed air from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust.
6. Reinstall the cooling fan.

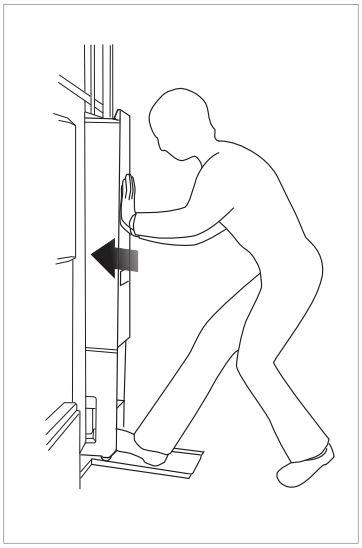
Replacing the R8i DC/DC-converter module

WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [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.

- Do not use the module extraction/installation ramp when the height of the drive cabinet plinth is more than the maximum permitted height.
- Secure the module extraction/installation ramp carefully.
- Push the module into the cabinet and pull it from the cabinet carefully preferably with help from another person. Keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back. Keep your fingers away from the edges of the front flange of the module.





- Do not move the module on its wheels for long distances. It can cause damage to the wheels. Also, there is a risk of the module falling over.
- Be careful when handling a tall module. The module overturns easily because it is heavy and has a high center of gravity. Whenever possible, secure the module with chains. Do not leave an unsupported module unattended especially on a sloping floor.

- Wear protective gloves and long sleeves! Some parts have sharp edges.

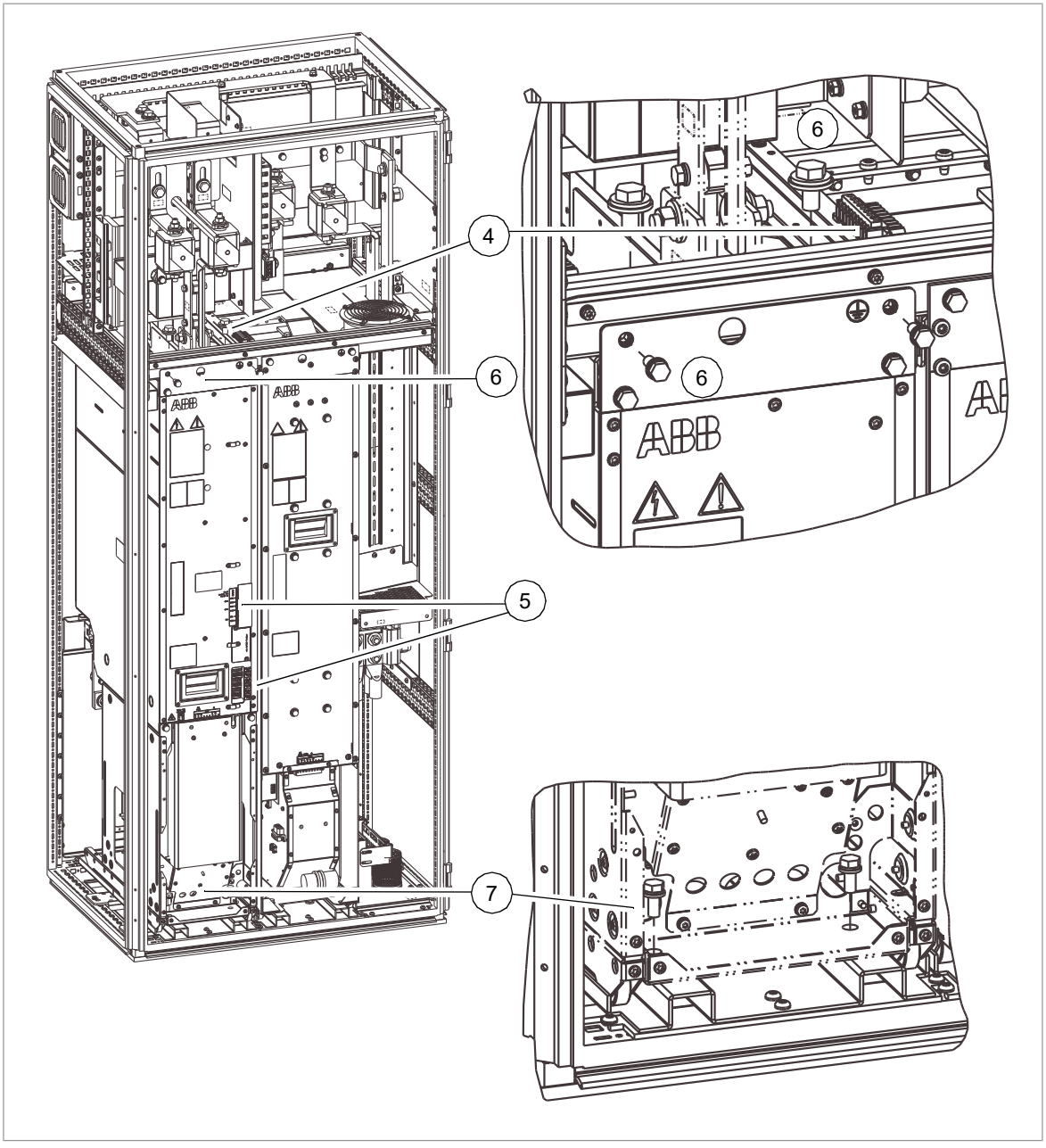
Note: There is a module lifter available from ABB Service. See Lifter for air-cooled drive modules user's guide (3AXD50000332588 [English]).

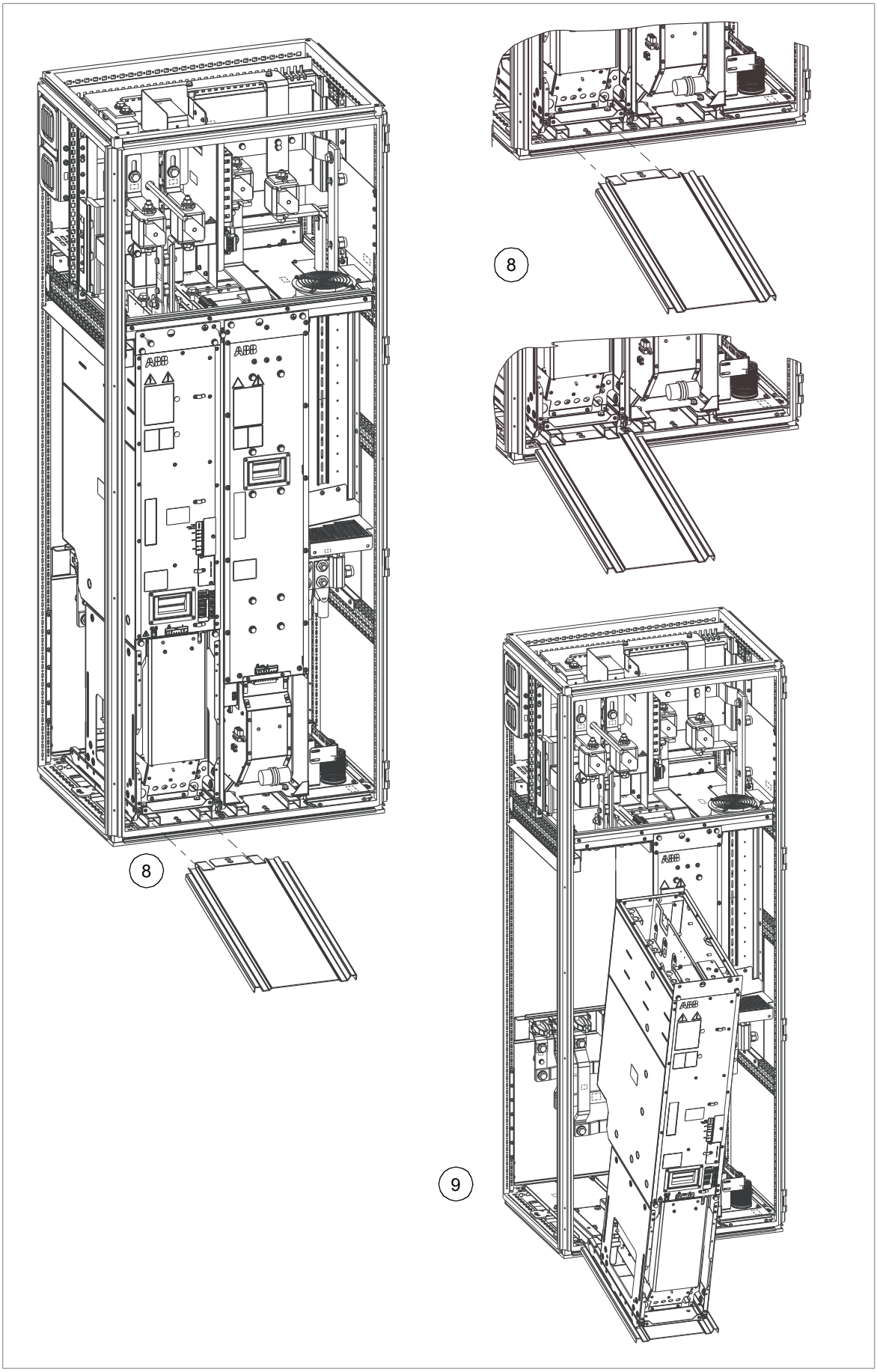
Before you replace a converter module with a new one, make sure that the connector of the auxiliary power supply cable in the cabinet is compatible with the counterpart in the module (X50). Black connector is compatible only with the black counterpart, and gray connector only with the gray counterpart. If the connectors are not compatible, replace the connector in the new module. Use the connector from the old module, or order suitable connector from ABB. Refer to Connector replacement guide, auxiliary power supply for ACS880-104 R8i, ACS880-304 D8T and D7T (3AXD50001060015 [English]) or Connector replacement guide, auxiliary power supply for ACS880-104 R8i with +C183, ACS880-304 D8T with +C183 (3AXD50001060022 [English]).

Replace the converter module as follows:

1. Stop the drive and disconnect the DC/DC-converter unit from the energy storage. Refer to section Disconnecting the DC/DC-converter from the energy storage (page 87). Then disconnect the drive from the input power supply and do the steps in section Electrical safety precautions (page 43)
2. Open the cubicle door.
3. Remove the shrouds (if any).
4. Disconnect the terminal block [X50] cable (if any) on top of the module.
5. Disconnect the optic cables and connector [X53].
6. Remove the two fastening screws in front of the module. Remove the two M12 fastening bolts in the module DC connection, loosen the carriage screws on the DC flanges and lift the flanges up.
7. Remove the two fastening screws in the lower part of the module.
8. Use a module pull out ramp or other lifting device to remove the module from the cabinet. If the ramp is used, install it by placing the hooks of the ramp between the bottom plate and Rittal frame.
9. Pull the module carefully out of the cabinet along the ramp, or use another lifting device to remove the module.
10. Replace the module:

- Push the module back in and fasten. Be careful not to break the fastening screws: tighten the fastening screws of the module to 22 N·m (16.2 lbf·ft) and fastening bolts of the DC output busbars to 70 N·m (51.6 lbf·ft).
- Connect the module signal wire set to the module terminal block [X50].
- Reconnect the fiber optic cables and connector [X53].
- Remove the module pull-out ramp, attach the shrouds (if any) and close the cabinet doors.

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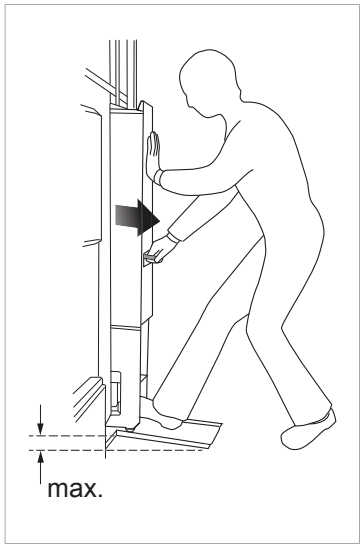
BDCL filter module

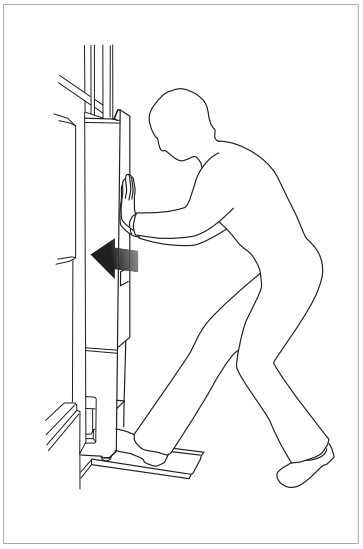
Replacing the BDCL filter

WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [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.

- Do not use the module extraction/installation ramp when the height of the drive cabinet plinth is more than the maximum permitted height.
- Secure the module extraction/installation ramp carefully.
- Push the module into the cabinet and pull it from the cabinet carefully preferably with help from another person. Keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back. Keep your fingers away from the edges of the front flange of the module.





- Do not move the module on its wheels for long distances. It can cause damage to the wheels. Also, there is a risk of the module falling over.
- Be careful when handling a tall module. The module overturns easily because it is heavy and has a high center of gravity. Whenever possible, secure the module with chains. Do not leave an unsupported module unattended especially on a sloping floor.

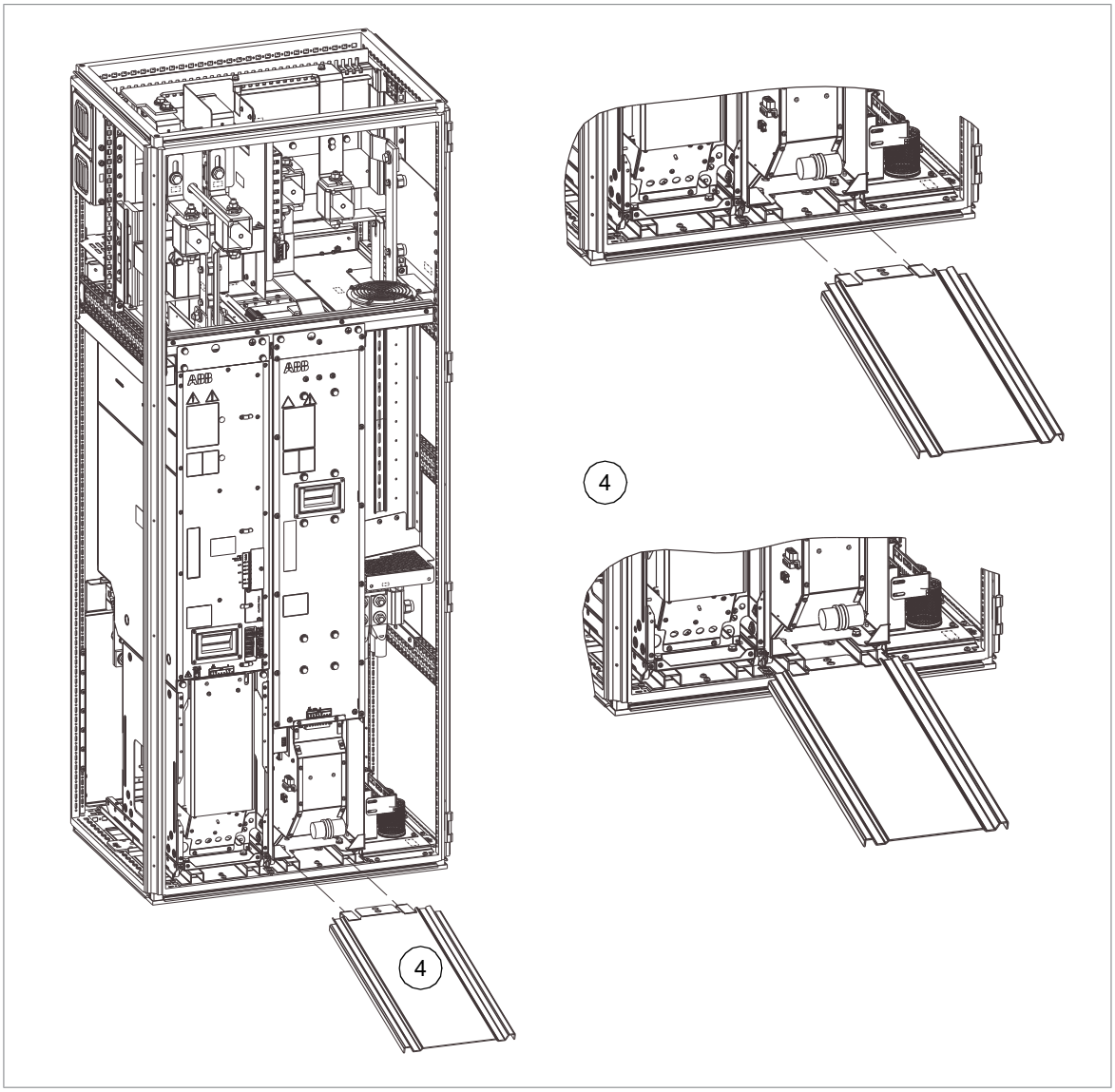
- Wear protective gloves and long sleeves! Some parts have sharp edges.

Note: There is a module lifter available from ABB Service. See Lifter for air-cooled drive modules user's guide (3AXD50000332588 [English]).

Before you replace a filter module with a new one, make sure that the connector of the auxiliary power supply cable in the cabinet is compatible with the counterpart in the new module. Black connector is compatible only with the black counterpart, and gray connector only with the gray counterpart. If the connectors are not compatible, replace the connector in the new module. Use the connector from the old module, or order suitable connector from ABB. Refer to Auxiliary power supply for BLCL-1..., BLCL-0..., BL-1..., or BDCL-1... Connector replacement guide (3AXD50001065171 [English])

Replace the filter module as follows:

1. Stop the drive and disconnect the DC/DC-converter unit from the energy storage. Refer to section Disconnecting the DC/DC-converter from the energy storage (page 87). Then disconnect the drive from the input power supply and do the steps in section Electrical safety precautions (page 43)
2. Open the cubicle door.
3. Remove the shrouds (if any).
4. If you use a module pull out ramp to remove the module from the cabinet, install it by placing the hooks of the ramp between the bottom plate and Rittal frame.
5. Disconnect the auxiliary power supply cable from terminal block [X30] on top of the filter module.
6. Remove the two fastening screws in front of the filter module. Unscrew and remove the bolts on the DC connection.
7. Remove the four fastening screws in the lower part of the filter module.
8. Pull the module carefully out of the cabinet along the ramp, or use another lifting device to remove the module.
9. Replace the module:
   - Push the module back in and fasten. Be careful not to break the fastening screws: tighten the fastening screws of the module to 22 N·m (16.2 lbf·ft) and fastening bolts to 70 N·m (51.6 lbf·ft).
   - Connect the module signal wire set to the module terminal block [X30].
   - Remove the module pull-out ramp, attach the shrouds (if any) and close the cabinet doors.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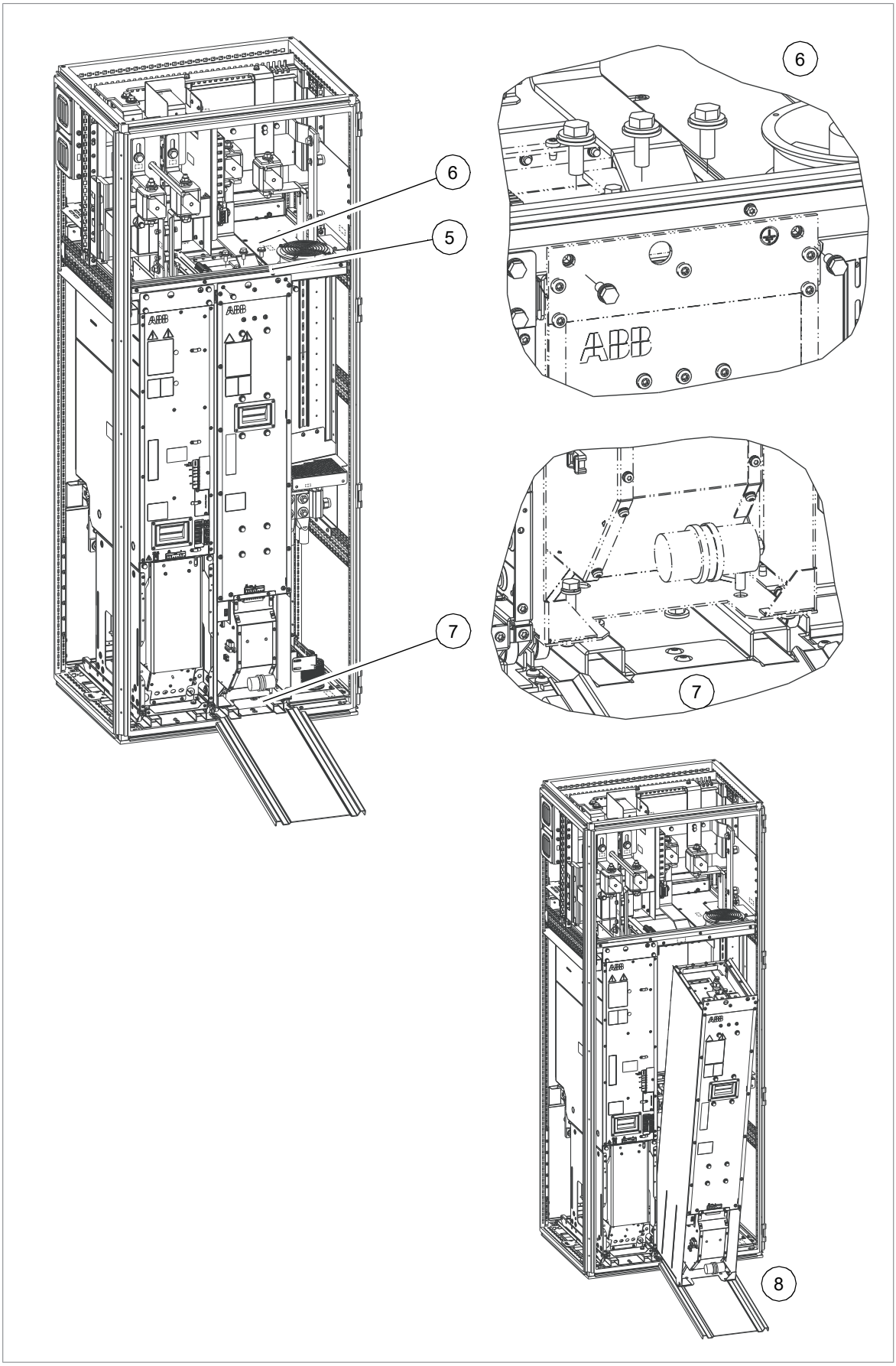
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Capacitors

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 Assistant control panels user's manual (3AUA0000085685 [English]).

UCU control unit

UCU control unit types

There are three variants of the UCU control unit used in ACS880: UCU-22, UCU-23 and UCU-24. These have a different number of converter module connections but are otherwise identical. The UCU types are interchangeable if the number of connections is sufficient and the control program is the same. For example, UCU-24 can be used as a direct replacement for both UCU-22 and UCU-23.

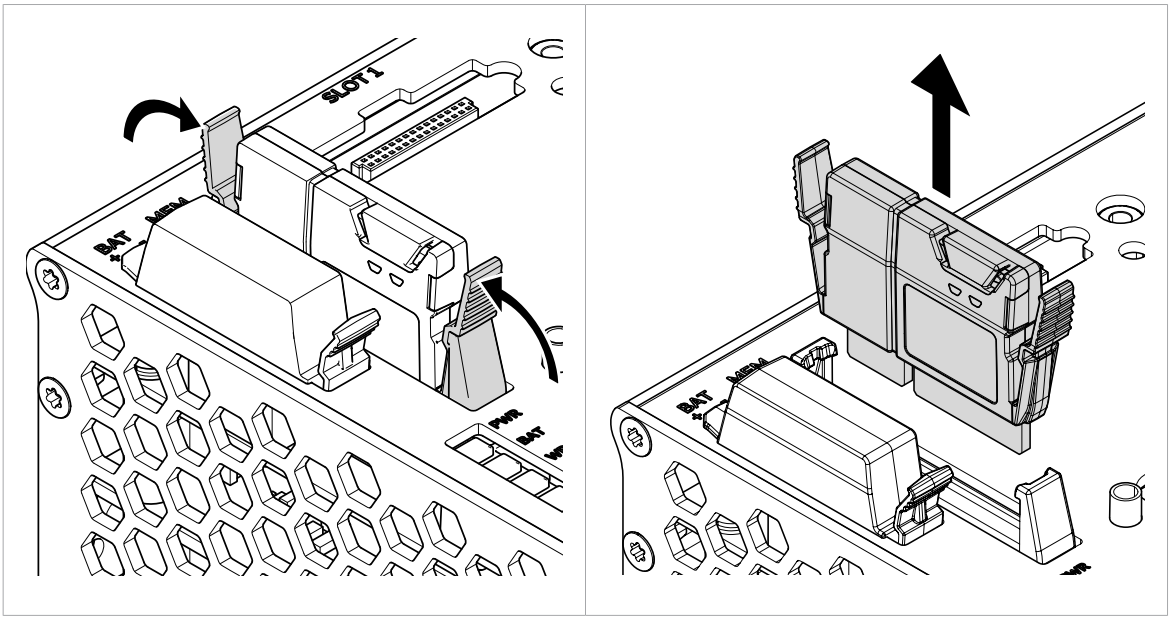
Replacing the memory unit (UCU)

If you replace the control unit, move the memory unit from the old control unit to the new control unit to keep the existing parameter settings.

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!
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 43) 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.



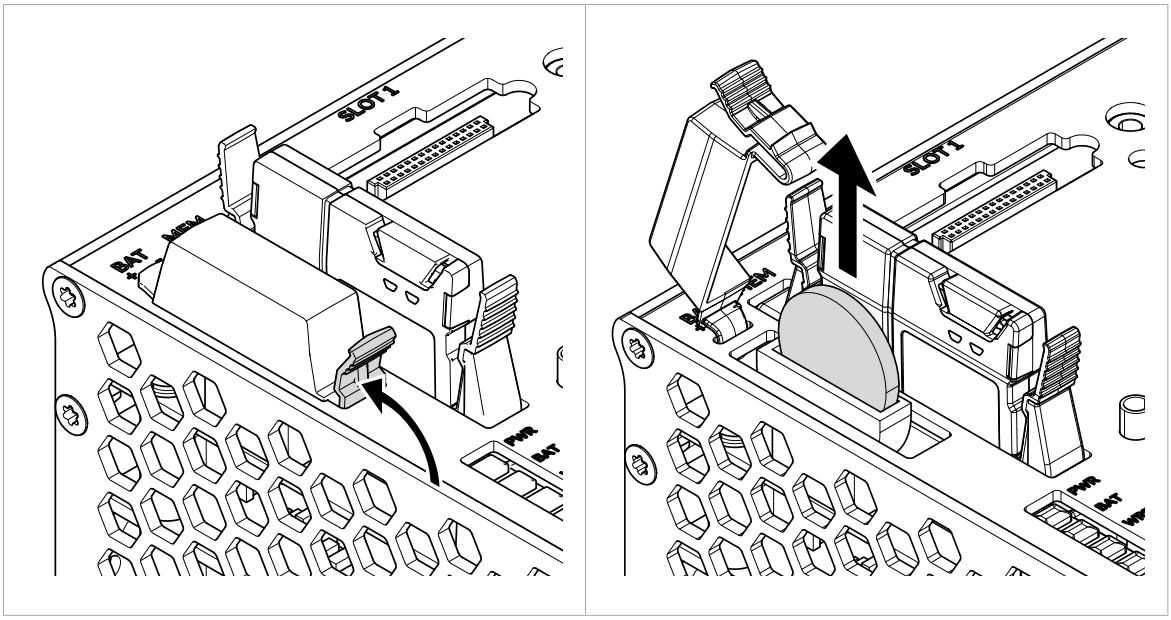
Replacing the real-time clock battery (UCU)

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 43) 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. If necessary, set the real-time clock.
6. Dispose of the old battery according to local disposal rules or applicable laws.

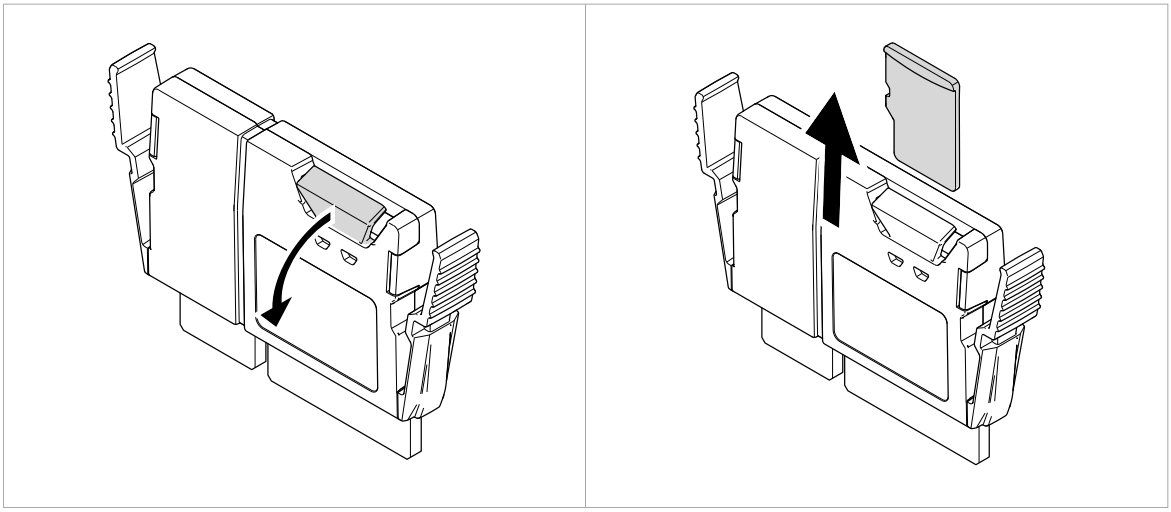


Replacing the microSDHC memory card (UCU)

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. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Remove the UMU-01 memory unit from the control unit.
3. Take the memory unit out from the cabinet before you remove the microSDHC card from it. The card is small and can fall into the cabinet.
4. Open the memory card cover in the memory unit.
5. Push the card to remove it.
6. Install a new card in reverse order.



BCU 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 but are otherwise identical. The BCU types are interchangeable if the number of connections is sufficient and the control program is the same. For example, BCU-22 can be used as a direct replacement for both BCU-02 and BCU-12.

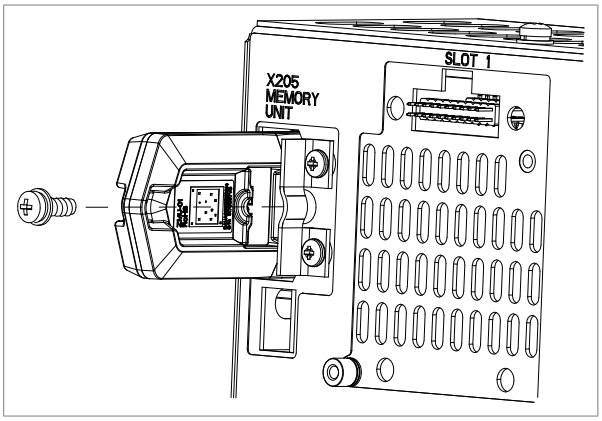
Replacing the memory unit (BCU)

If you replace the control unit, move the memory unit from the old control unit to the new control unit to keep the existing parameter settings.

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!
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 43) 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.

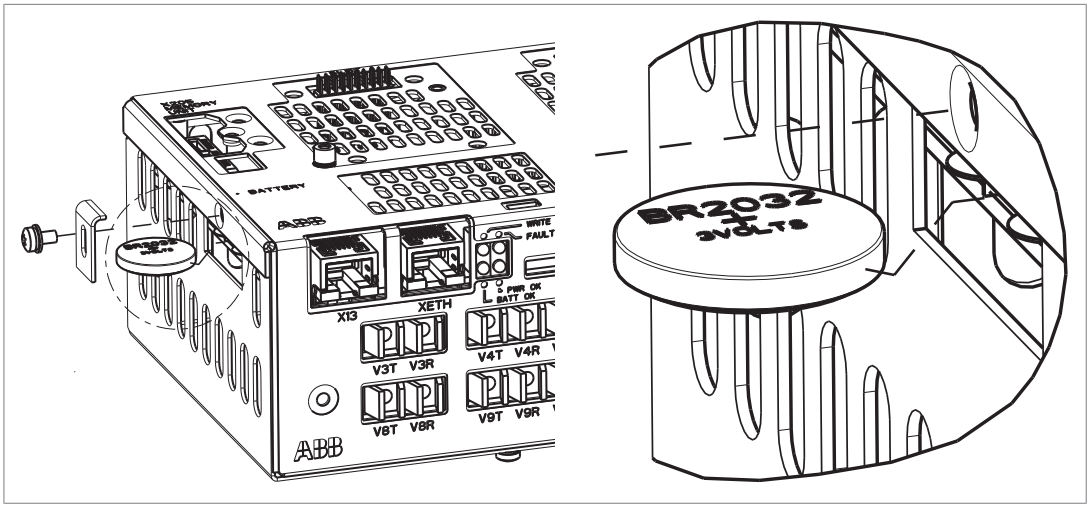


Replacing the battery (BCU)

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 BATT OK LED is off when the control unit is powered.

1. Stop the drive and do the steps in section Electrical safety precautions (page 43) before you start the work.
2. Remove the fastening screw.
3. Replace the battery with a new BR2032 battery.
4. If necessary, set the real-time clock.
5. Discard the old battery according to local disposal rules or applicable laws.



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.

R8i module 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 sufficient (> 21 V).

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.

11

Technical data

Contents of this chapter

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

Ratings

ACS880-1607-...	Frame	No-overload use							
		I_1 (input)	I_2 (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 = 400 V									
0600A-3	R8i	600	600	305	410	900	305	22	12000
0900A-3	R8i	900	900	458	614	1350	458	33	12000
1200A-3	2×R8i	1200	1200	611	819	1800	611	11	24000
1800A-3	2×R8i	1800	1800	916	1229	2700	916	16	24000
U_n = 500 V									
0600A-5	R8i	600	600	382	512	900	382	27	12000
0900A-5	R8i	900	900	573	768	1350	573	41	12000
1200A-5	2×R8i	1200	1200	764	1024	1800	764	14	24000
1800A-5	2×R8i	1800	1800	1146	1536	2700	1146	20	24000
U_n = 690 V									
0400A-7	R8i	400	400	351	471	600	351	38	12000
0600A-7	R8i	600	600	527	707	900	527	56	12000
0800A-7	2×R8i	800	800	703	942	1200	703	19	24000
1200A-7	2×R8i	1200	1200	1054	1413	1800	1054	28	24000

ACS880-1607-...	Frame	Short time overload use		Heavy overload use	
		$I_{short\ time}$	$P_{short\ time}$	I_{Hd}	P_{Hd}
		A	kW	A	kW
U_n = 400 V					
0600A-3	R8i	450	229	510	260
0900A-3	R8i	675	343	765	389
1200A-3	2×R8i	899	458	1020	519
1800A-3	2×R8i	1349	687	1529	779
U_n = 500 V					
0600A-5	R8i	450	286	510	324
0900A-5	R8i	675	429	765	487
1200A-5	2×R8i	899	572	1020	649
1800A-5	2×R8i	1349	859	1529	973
U_n = 690 V					
0400A-7	R8i	300	263	340	298
0600A-7	R8i	450	395	510	448
0800A-7	2×R8i	600	527	680	597
1200A-7	2×R8i	899	790	1020	895

U_n Nominal supply voltage of the drive

I_1 Maximum continuous DC input current from DC bus

I_2 Maximum continuous output current to/from energy storage

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

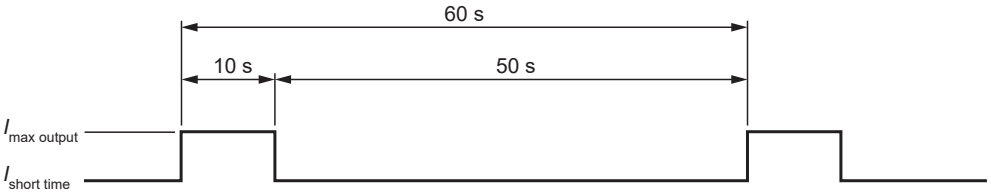
$I_{max\ output}$ Maximum output current to/from energy storage. Available for 10 seconds at start, otherwise as long as permitted by drive temperature.

S_n Nominal apparent power

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

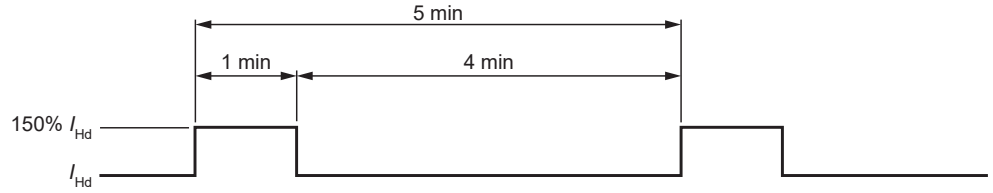
$f_{sw\ out}$ Switching frequency at output terminals (energy storage connection) measured after the filter

$I_{short\ time}$ 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

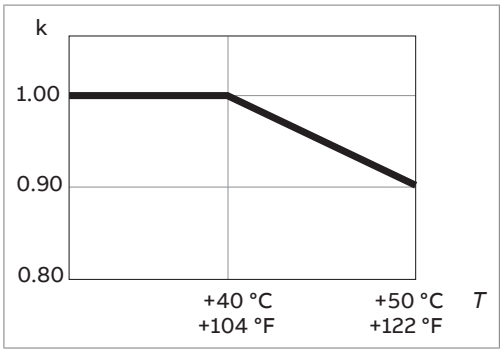


P_{Hd} Continuous output power allowing 150% I_{Hd} for 1 min every 5 min

Derating

Surrounding air temperature derating

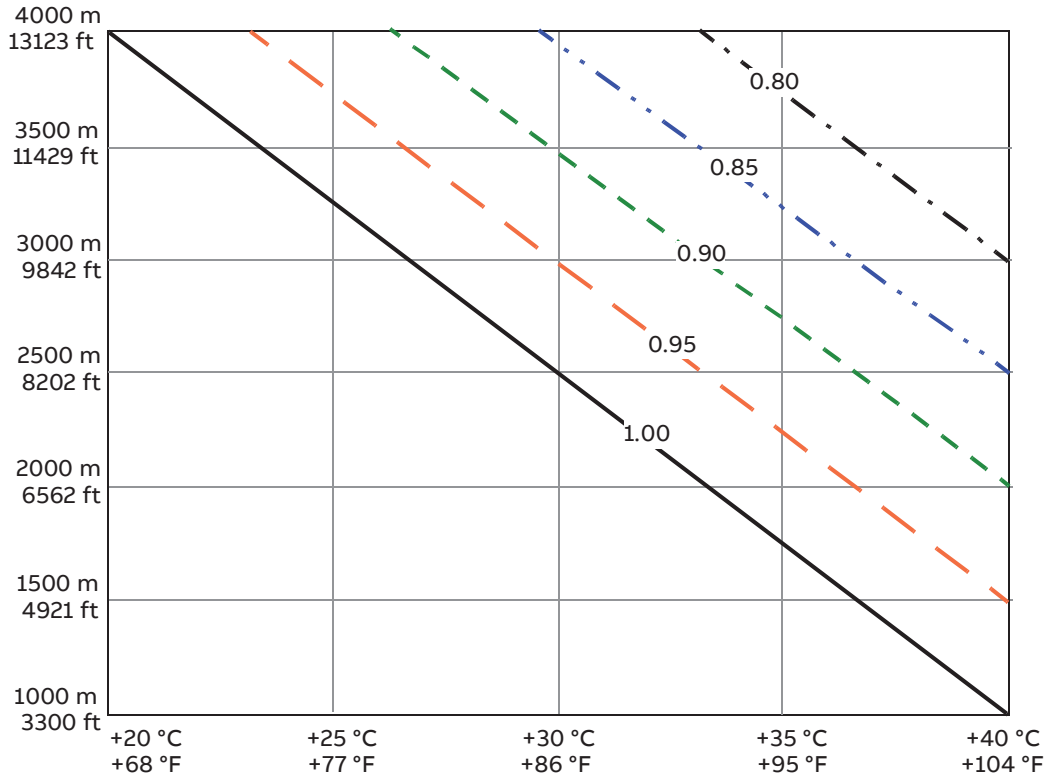
In the temperature range +40…50 °C (+104…122 °F), the rated output current is derated by 1 percentage point for every added 1 °C (1.8 °F). The output current can be calculated by multiplying the current given in the rating table by the derating factor *(k)*:



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.

If the surrounding air temperature is less than +40 °C (104 °F), the derating can be reduced by 1.5 percentage points for every 1 °C (1.8 °F) reduction in temperature. A few altitude derating curves are shown below.



	Derating factor 1.00
	Derating factor 0.95
	Derating factor 0.90
	Derating factor 0.85
	Derating factor 0.80

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

Type equivalence table

Converter unit type	Basic module type			BDCL filter	
ACS880-1607-...	ACS880-104-...	Frame size	Qty	Type	Qty
U_n = 400 V					
0600A-3	0640A-3	R8i	1	BDCL-14-5	1
0900A-3	0900A-3	R8i	1	BDCL-15-5	1
1200A-3	0640A-3	R8i	2	BDCL-14-5	2
1800A-3	0900A-3	R8i	2	BDCL-15-5	2
U_n = 500 V					
0600A-5	0590A-5	R8i	1	BDCL-14-5	1
0900A-5	0810A-5	R8i	1	BDCL-15-5	1
1200A-5	0590A-5	R8i	2	BDCL-14-5	2
1800A-5	0810A-5	R8i	2	BDCL-15-5	2
U_n = 690 V					
0400A-7	0410A-7	R8i	1	BDCL-14-7	1
0600A-7	0600A-7	R8i	1	BDCL-15-7	1

Converter unit type	Basic module type			BDCL filter	
ACS880-1607-...	ACS880-104-...	Frame size	Qty	Type	Qty
0800A-7	0410A-7	R8i	2	BDCL-14-7	2
1200A-7	0600A-7	R8i	2	BDCL-15-7	2

Fuses

DC fuses (DC bus side)

Unit type ACS880-1607-...	Rating	Type	Example (Bussmann)	Qty
U_n = 400 V				
0600A-3	1100 A, 690 V, size 3	Flush end type	170M6415	2
0900A-3	1600 A, 690 V, size 3	Flush end type	170M6419	2
1200A-3	1100 A, 690 V, size 3	Flush end type	170M6415	4
1800A-3	1600 A, 690 V, size 3	Flush end type	170M6419	4
U_n = 500 V				
0600A-5	1100 A, 690 V, size 3	Flush end type	170M6415	2
0900A-5	1600 A, 690 V, size 3	Flush end type	170M6419	2
1200A-5	1100 A, 690 V, size 3	Flush end type	170M6415	4
1800A-5	1600 A, 690 V, size 3	Flush end type	170M6419	4
U_n = 690 V				
0400A-7	700 A, 1250 V, size 3	Flush end type	170M6545	2
0600A-7	1100 A, 1000 V, size 3	Flush end type	170M6549	2
0800A-7	700 A, 1250 V, size 3	Flush end type	170M6545	4
1200A-7	1100 A, 1000 V, size 3	Flush end type	170M6549	4

Output DC fuses (energy storage side)

Unit type ACS880-1607-...	Rating	Type	Example (Bussmann)	Qty
U_n = 400 V				
0600A-3	1100 A, 690 V, size 3	Flush end type	170M6415	2
0900A-3	1600 A, 690 V, size 3	Flush end type	170M6419	2
1200A-3	1100 A, 690 V, size 3	Flush end type	170M6415	4
1800A-3	1600 A, 690 V, size 3	Flush end type	170M6419	4
U_n = 500 V				
0600A-5	1100 A, 690 V, size 3	Flush end type	170M6415	2
0900A-5	1600 A, 690 V, size 3	Flush end type	170M6419	2
1200A-5	1100 A, 690 V, size 3	Flush end type	170M6415	4
1800A-5	1600 A, 690 V, size 3	Flush end type	170M6419	4
U_n = 690 V				
0400A-7	700 A, 1250 V, size 3	Flush end type	170M6545	2
0600A-7	1100 A, 1000 V, size 3	Flush end type	170M6549	2

Unit type ACS880-1607-...	Rating	Type	Example (Bussmann)	Qty
0800A-7	700 A, 1250 V, size 3	Flush end type	170M6545	4
1200A-7	1100 A, 1000 V, size 3	Flush end type	170M6549	4

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	mohm
BDCL-14	540	7
BDCL-15	360	7

Dimensions and weights

Unit type ACS880-1607-...	Height 1		Height 2		Width		Depth 1		Depth 2		Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lbs
U_n = 400 V												
0600A-3	2145	84.4	2315	91.1	800	31.5	636	25	756	29.8	650	1433
0900A-3	2145	84.4	2315	91.1	800	31.5	636	25	756	29.8	680	1499
1200A-3	2145	84.4	2315	91.1	1600	63.0	636	25	756	29.8	1300	2866
1800A-3	2145	84.4	2315	91.1	1600	63.0	636	25	756	29.8	1360	2998
U_n = 500 V												
0600A-5	2145	84.4	2315	91.1	800	31.5	636	25	756	29.8	650	1433
0900A-5	2145	84.4	2315	91.1	800	31.5	636	25	756	29.8	680	1499
1200A-5	2145	84.4	2315	91.1	1600	63.0	636	25	756	29.8	1300	2866
1800A-5	2145	84.4	2315	91.1	1600	63.0	636	25	756	29.8	1360	2998
U_n = 690 V												
0400A-7	2145	84.4	2315	91.1	800	31.5	636	25	756	29.8	650	1433
0600A-7	2145	84.4	2315	91.1	800	31.5	636	25	756	29.8	680	1499
0800A-7	2145	84.4	2315	91.1	1600	63.0	636	25	756	29.8	1300	2866
1200A-7	2145	84.4	2315	91.1	1600	63.0	636	25	756	29.8	1360	2998

Definitions

Height 1 Normal height (IP22, IP42)

Height 2 Height with IP54 roof

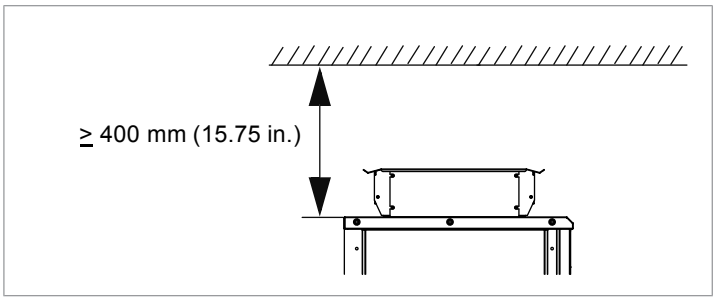
Depth 1 Normal height (without option +C128)

Definitions

Depth 2 Depth with option +C128 (extra air inlet channel at the bottom)

Free space requirements

Leave a minimum of 400 mm (15.75 in) of free space above the basic roof level.



For the rest of the free space requirements, see ACS880 multidrive cabinets mechanical installation instructions (3AUA0000101764 [English]).

Losses, cooling data and noise

Type ACS880-1607-...	Frame	P_{loss}	Air flow		Noise	Efficiency[1)]
		kW	m³/h	ft³/min	dB	%
U_n = 400 V						
0600A-3	R8i	5.2	2200	1295	74	98.3
0900A-3	R8i	8.0	2200	1295	74	98.3
1200A-3	2×R8i	10.5	4400	2590	76	98.3
1800A-3	2×R8i	16.5	4400	2590	76	98.2
U_n = 500 V						
0600A-5	R8i	6.0	2200	1295	74	98.5
0900A-5	R8i	9.1	2200	1295	74	98.4
1200A-5	2×R8i	12.1	4400	2590	76	98.4
1800A-5	2×R8i	18.8	4400	2590	76	98.4
U_n = 690 V						
0400A-7	R8i	6.4	2200	1295	74	98.2
0600A-7	R8i	10.6	2200	1295	74	98.0
0800A-7	2×R8i	12.8	4400	2590	76	98.2
1200A-7	2×R8i	21.5	4400	2590	76	98.0

1) The efficiency is not calculated according to the ecodesign standard IEC 61800-9-2.

Definitions

P_{loss} Heat dissipation. Maximum total losses of the DC/DC-converter and BDCL filter with full output power.

Noise Noise (DC/DC-converter and BDCL filter)

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)	ACS880-1607-xxxxx-3 = 566 V DC. This is indicated in the type designation label as typical input voltage levels 566 V DC. ACS880-1607-xxxxx-5 = 566…707 V DC. This is indicated in the type designation label as typical input voltage levels 566 / 679 / 707 V DC. ACS880-1607-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-14 and BDCL-15: 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)	ACS880-1607-xxxxx-3 = 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 V DC. ACS880-1607-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. ACS880-1607-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

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]
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
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

Terminal and cable entry data for the power cables

Refer to the dimension drawings.

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.

Protection classes

Degrees of protection (IEC/EN 60529)	IP22 (standard), IP42 (option +B054), IP54 (option +B055)
Enclosure types (UL50)	UL Type 1 (standard), UL Type 1 (option +B054), UL Type 12 (Standard). 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 "-4" 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 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

Environmental limits for the drive are given below. The drive is to be used in a heated, indoor, controlled environment.

	Operation installed for stationary use	**Storage in the protective package**	**Transportation in the protective package**
Installation site altitude	0…4000 m (0…13123 ft)* Output derated above 1000 m (3281 ft). *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 … +40 °C (+32 … +104 °F). No condensation allowed. Output derated in the range +40 … +50 °C (+104 … +122 °F). For UL and CSA compliant installations, the maximum surrounding air temperature is 40 °C (104 °F).	-40 … +70 °C (-40 … +158 °F)	-40 … +70 °C (-40 … +158 °F)

	Operation installed for stationary use	Storage in the protective package	Transportation in the protective package
Relative humidity	Max. 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination	IEC/EN 60721-3-3:2002 Chemical gases: Class 3C2 Solid particles: Class 3S2 (3S1 with IP20). No conductive dust allowed.	IEC 60721-3-1:1997 Chemical gases: Class 1C2 Solid particles: Class 1S3 (packing must support this, otherwise 1S2)	IEC 60721-3-2:1997 Chemical gases: Class 2C2 Solid particles: Class 2S2
Pollution degree IEC/EN 60664-1	2		
Vibration IEC/EN 61800-5-1 IEC 60068-2-6:2007, EN 60068-2-6:2008	IEC/EN 60721-3-3:2002 10…57 Hz: max. 0.075 mm amplitude 57…150 Hz: 1 *g* Units with marine construction (option +C121): Max. 1 mm (0.04 in) (5 … 13.2 Hz), max. 0.7 *g* (13.2 … 100 Hz) sinusoidal	IEC/EN 60721-3-1:1997 10…57 Hz: max. 0.075 mm amplitude 57…150 Hz: 1 *g*	IEC/EN 60721-3-2:1997 2…9 Hz: max. 3.5 mm amplitude 9…200 Hz: 10 m/s² (32.8 ft/s²)
Shock IEC 60068-2-27:2008, EN 60068-2-27:2009	Not allowed	With packing max. 100 m/s² (328 ft/s²) 11 ms	With packing max. 100 m/s² (328 ft/s²) 11 ms

Colors

RAL 7035, RAL 9017.

Materials

Drive

Refer to Recycling instructions and environmental information for ACS880 cabinet-installed drives and multidrive modules (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-life-services.

Applicable standards

Refer to ACS880 multidrives cabinets and modules electrical planning instructions (3AUA0000102324 [English]).

Markings

Refer to ACS880 multidrives cabinets and modules electrical planning instructions (3AUA0000102324 [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.

12

Dimension drawings

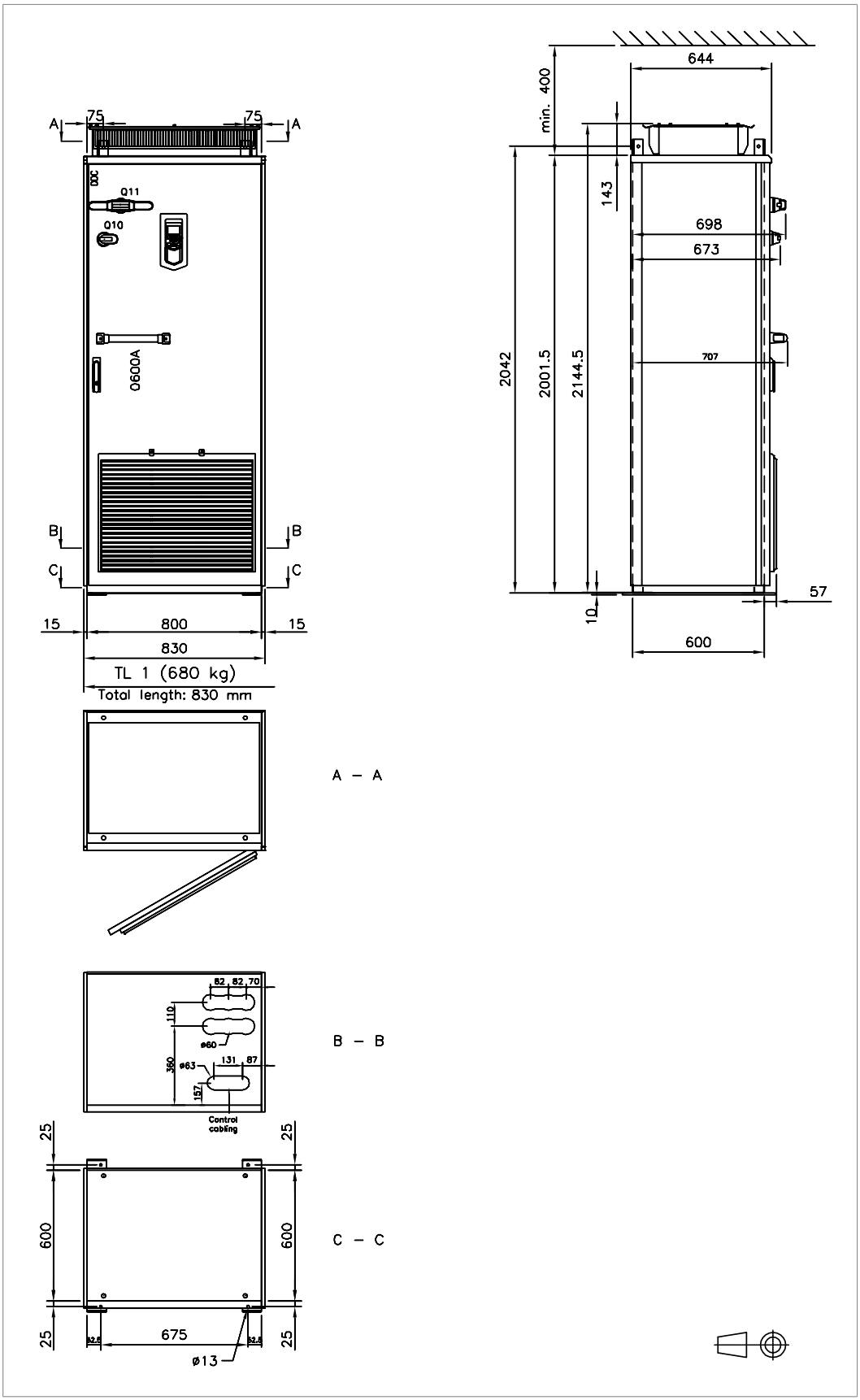
Contents of this chapter

This chapter contains the following dimension data:

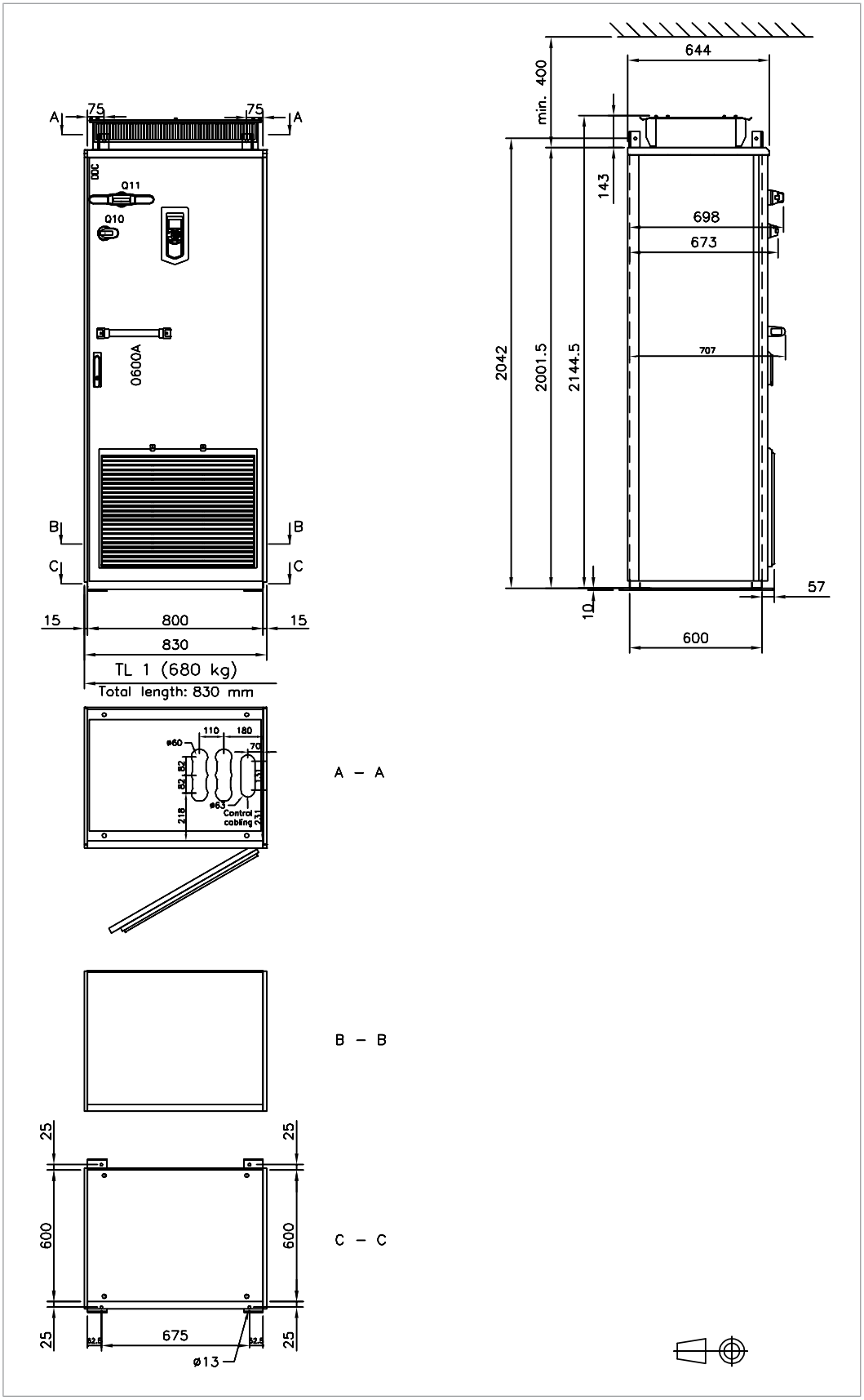
- Dimension drawings of DC/DC converter unit
- Location and size of output terminals for energy storage cables.

Dimension drawings

Frame 1×R8i, bottom cable entry

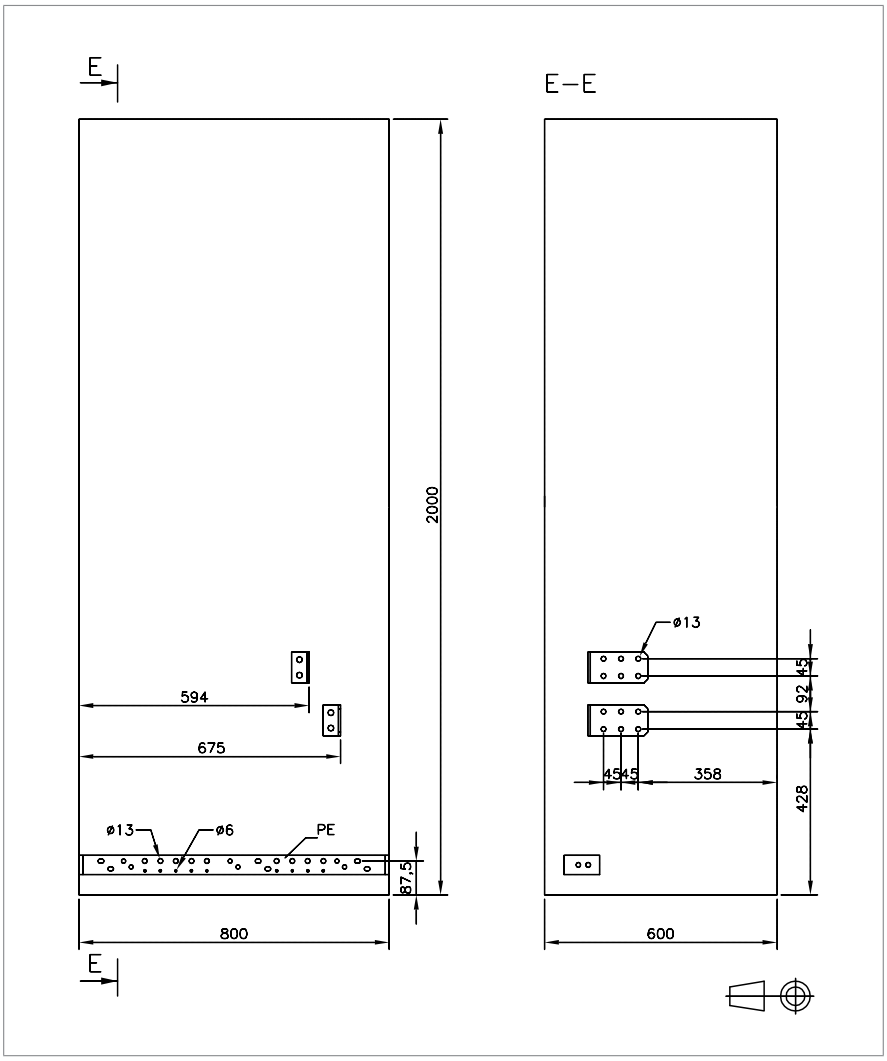


Frame 1×R8i, top cable entry

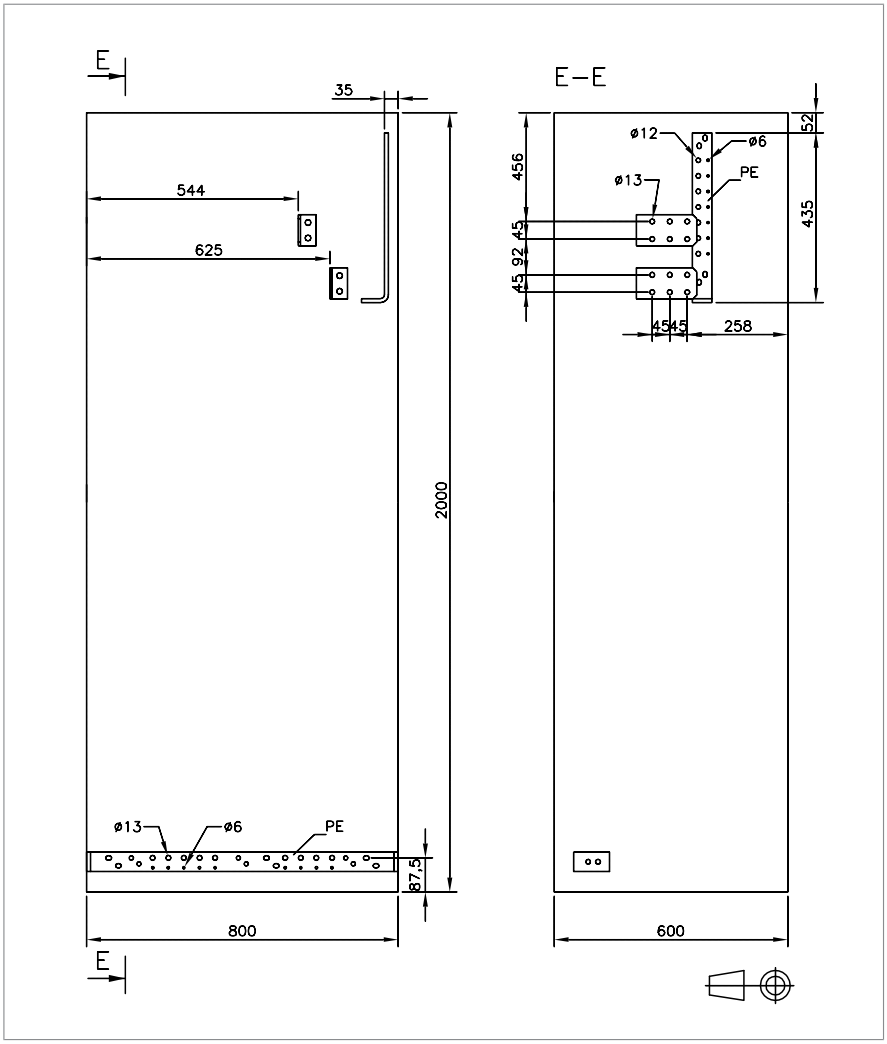


Location and size of input terminals

Frame 1×R8i, bottom cable entry



Frame 1×R8i, top cable entry



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 forms.abb.com/form-26567.

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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