ABB INDUSTRIAL DRIVES

ACS880-107 inverter units

Hardware manual

ACS880-107 inverter units

Hardware manual

3AUA0000102519 Rev G
EN
Original instructions
EFFECTIVE: 2023-12-28

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Further information

1

Introduction to the manual

Contents of this chapter

This chapter gives basic information on the manual.

Applicability

This manual is applicable to air-cooled ACS880-107 inverter units.

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, option code and item designation

Some descriptions, instructions, technical data and dimensional drawings which concern only a certain group of units may be marked with the symbol of the frame size (such as “R2i”, “4×R8i”, etc.). The marking derives from the quantity and basic construction of the inverter modules that form the inverter unit. For example, the frame size “2×R8i” indicates that the inverter unit consists of two frame size R8i inverter modules connected in parallel.

The frame size is marked on the type designation labels. The frame size of each inverter module is also shown in the rating tables. See the technical data.

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
BCU	Type of control unit
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 link	DC circuit between rectifier and inverter
Drive	Frequency converter for controlling AC motors
FAIO-01	Analog I/O extension module
FCAN	Optional CANopen® adapter module
FCNA	Optional ControlNet™ adapter module
FDCO	Optical DDCS communication module
FDIO-01	Optional digital I/O extension module
FDNA	Optional DeviceNet™ adapter module
FDPI	Diagnostics and panel interface board
FECA	Optional EtherCAT® adapter module
FEIP	Optional Ethernet adapter module
FEN-01	Optional TTL incremental encoder interface module
FEN-11	Optional absolute encoder interface module
FEN-21	Optional resolver interface module
FEN-31	Optional HTL incremental encoder interface module
FENA	Optional Ethernet adapter module
FEPL	Optional Ethernet POWERLINK adapter module
FIO-01	Optional digital I/O extension module
FIO-11	Optional analog I/O extension module
FMBT	Optional Ethernet adapter module for Modbus TCP protocol
FPBA	Optional PROFIBUS DP adapter module
FPNO	Optional PROFINET IO adapter module
FPTC-01	Optional thermistor protection module

Term	Description
FPTC-02	Optional ATEX-certified thermistor protection module for potentially explosive atmospheres
Frame, frame size	Physical size of the drive or power module
FSCA	Optional Modbus RTU adapter module
FSE-31	Optional pulse encoder interface module for safety encoder
FSO-12, FSO-21	Optional functional safety modules
IGBT	Insulated gate bipolar transistor
Intermediate circuit	DC circuit between rectifier and inverter
INU	Inverter unit
Inverter	Converts direct current and voltage to alternating current and voltage.
Inverter module	Inverter bridge, related components and drive DC link capacitors enclosed in a metal frame or enclosure. Intended for cabinet installation.
Inverter unit	Inverter module(s) under control of one control 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
POUS	Prevention of unexpected start-up
RDCO	Optical DDCS communication module
RFI	Radio-frequency interference
SIL	Safety integrity level (1…3) (IEC 61508, IEC 62061, IEC 61800-5-2)
STO	Safe torque off (IEC/EN 61800-5-2)
Supply unit	Supply module(s) under control of one control unit, and related components.
UPS	Uninterruptible power supply
ZCU	Type of 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

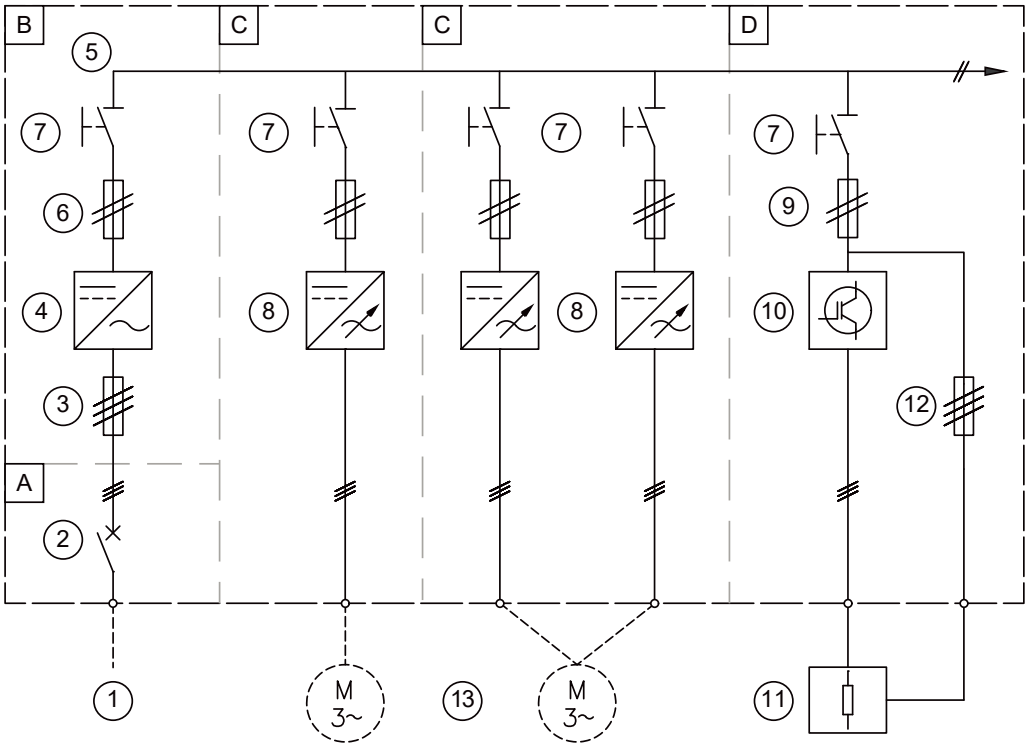
Operation principle and hardware description

Contents of this chapter

This chapter describes a typical drive system and the hardware of the inverter unit. The information is valid for all ACS880-107 inverter units.

Overview diagram of the drive system

The diagram that follows shows an example of a multidrive. The supply unit connects the drive to the AC supply network. It converts the AC voltage into DC. The DC voltage is distributed through the DC bus to all inverter units and optional brake units. The inverter unit converts the DC back to AC that rotates the motor. The brake unit (optional) conveys energy to brake resistors whenever needed.



A	Incoming unit
B	Supply unit
C	Inverter unit
D	Brake unit (optional)
1	AC supply
2	Main breaker, or main contactor and main switch-disconnector
3	Input (AC) fuses
4	Supply module
5	DC bus
6	Supply and inverter module DC fuses
7	DC switch/disconnector (optional)
8	Inverter modules
9	Brake chopper fuses
10	3-phase brake chopper module (optional)
11	Brake resistors (optional or acquired by the customer)
12	Fuses for the brake resistors
13	Motor(s) (acquired by the customer)

Inverter unit hardware

General

An inverter unit contains the components required to control one motor. These include one or more inverter modules connected in parallel, together with the necessary auxiliary equipment such as control electronics, fusing, cabling and switchgear.

ACS880-107 inverter units range from 1.5 to 5600 kW in power. ACS880-107 inverter units employ inverter modules from frame size R1i to R8i. Up to approximately 500 kW, inverter units consist of one module only; higher powers are achieved by connecting multiple R8i modules in parallel.

All inverter modules have coated circuit boards as standard.

Cabinet system

An inverter unit is built into one or more adjoining cubicles and contains the components that are required to control one motor. At smaller inverter sizes, a single cubicle can contain several inverter units, each controlling a different motor. Large inverter units consist of parallel-connected modules and can occupy several cubicles.

Examples of the cabinet configurations are included below as well as in the dimensions and weights chapter. The motor cabling direction is optionally up or down – see below under each module frame size for specific information.

Cooling

Each inverter module has its own cooling fan(s). Control cubicles can have additional cooling fans.

The inverter cubicles have the air intake at the lower part of the door. The intake can optionally be through the floor, adding 130 mm (5.12”) to the standard depth of 600 mm (23.62”) of the cabinet.

The cooling air outlets are on the roof of each cubicle. Some configurations have exhaust fans fitted inside the top compartment of the cubicle. A channeled air outlet is optional.

Inverter module frame sizes R1i...R4i

General

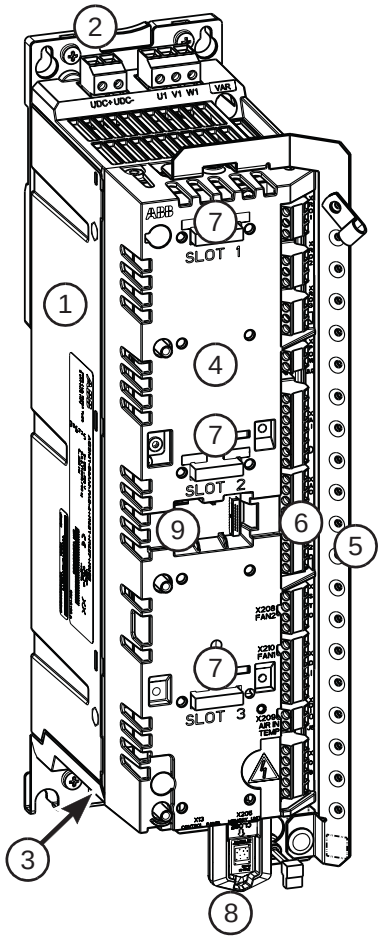
The motor (output) cables are connected to either detachable or non-detachable screw terminal blocks at the bottom of the cubicle. The modules have a built-in ZCU drive control unit, which contains the basic I/Os and slots for optional I/O modules.

The modules have an internal capacitor precharge circuit.

External optional equipment is primarily installed on mounting plates in the same cubicle.

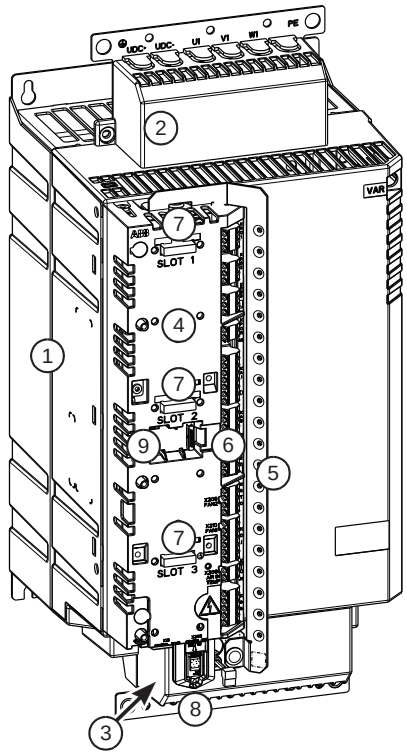
Module layout examples

Frame R1i (Frame R2i has a similar layout)



Item	Explanation
1	Power unit
2	DC (input) connections
3	Motor (output) connection (obscured). This has been wired to a separate terminal block in the lower part of the cubicle.
4	ZCU-14 control unit mounted on top of the power unit
5	Grounding/strain relief rail for control cables
6	I/O terminal blocks
7	3 slots for optional modules
8	Memory unit
9	Connection for FSO safety functions module

Frame R4i (Frame R3i has a similar layout)



Item	Explanation
1	Power unit
2	DC (input) connections (under connector cover)
3	Motor (output) connection (under connector cover). This has been wired to a separate terminal block in the lower part of the cubicle.
4	ZCU-14 control unit mounted on top of the power unit
5	Grounding/strain relief rail for control cables
6	I/O terminal blocks
7	3 slots for optional modules
8	Memory unit
9	Connection for FSO safety functions module

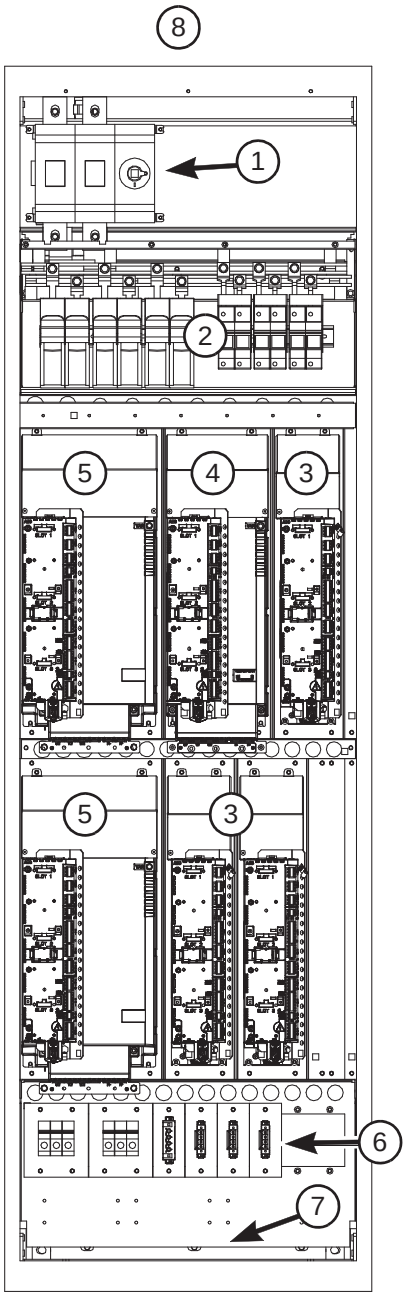
Standard cabinet layout

Several inverter modules of frame sizes R1i…R4i can be installed in one cubicle. The standard cubicle width is 400, 600, 800 or 1000 mm depending on the size and number of inverter modules installed.

Each module has dedicated DC fuse disconnectors. The motor (output) connections are located at the lower part of the cubicle; depending on the power of the inverter module, these are either detachable or non-detachable terminal blocks.

The cubicle is equipped with cable entries for the motor cables in the floor.

This illustration shows an example of a 600 mm wide cubicle with three R1i, one R3i and two R4i modules.



Item	Explanation
1	Main DC switch fuse for all units in the cubicle (optional) or main DC fuses
2	DC fuse disconnectors for each individual module
3	Three frame R1i inverter modules
4	Frame R3i inverter module
5	Two frame R4i inverter modules
6	Output connections
7	Cable entries
8	Air outlet compartment with cabinet cooling fan (not shown)

Layout of cubicle with frame R1i...R4i modules in their own compartments (option +C204)

If option +C204 is selected, each inverter module is installed into its own compartment behind a door. Up to three inverter modules of frame sizes R1i…R4i can be installed in one 400 mm wide cubicle.

At the top of the cubicle, there is another compartment which contains the common DC switch-disconnector and fuses for all the modules in the cubicle.

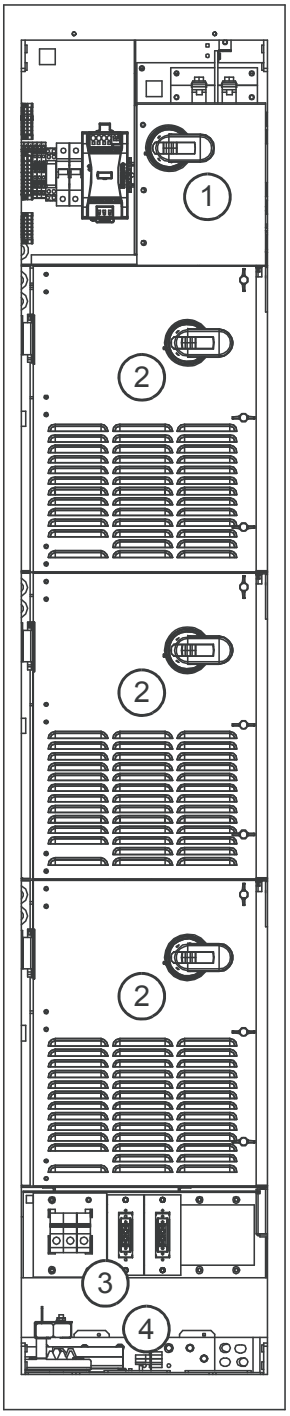
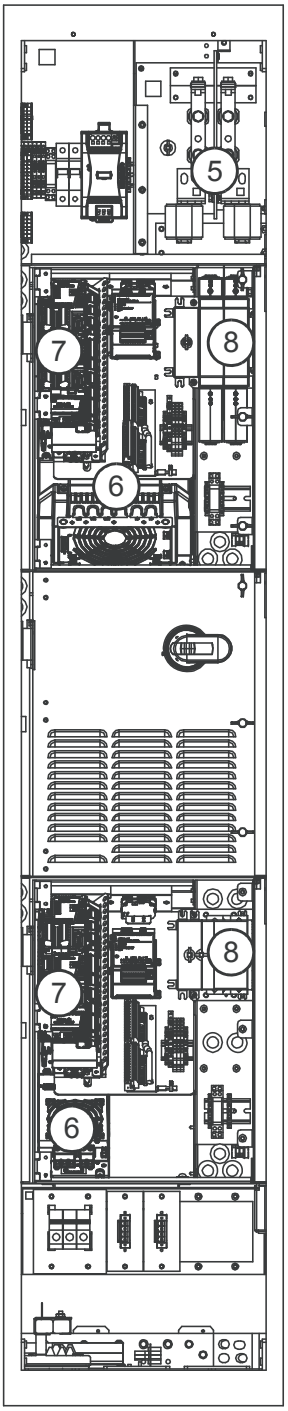
The inverter modules are installed in an inclined position so that the cooling air flows from the cool area at the front of the cubicle through the modules into the hot area at the back. The hot air is exhausted through the roof of the cubicle.

Each module has a dedicated DC switch-disconnector. When the switch-disconnector is open, the door to that particular compartment can be opened. It is also allowable to replace the module, its cooling fan, or its DC fuses.

The motor (output) connections for each module are located at the lower part of the cubicle; depending on the power of the inverter module, these are either detachable or non-detachable terminal blocks.

The cubicle is equipped with cable entries for the motor cables in the floor.

This illustration shows an example of a 400 mm wide cubicle with three R1i…R4i modules.

Compartment (doors closed)	Compartment (doors open)	Item	Explanation
		1	Main DC switch-disconnector handle for all units in the cubicle
		2	Compartments for inverter modules (with DC switch-disconnector handle)
		3	Output connections
		4	Cable entries
		5	Common DC fuses for all units in the cubicle
		6	Inverter module
		7	Inverter control unit
		8	Module-specific DC switch-disconnector with fuses

Inverter module frame size R5i

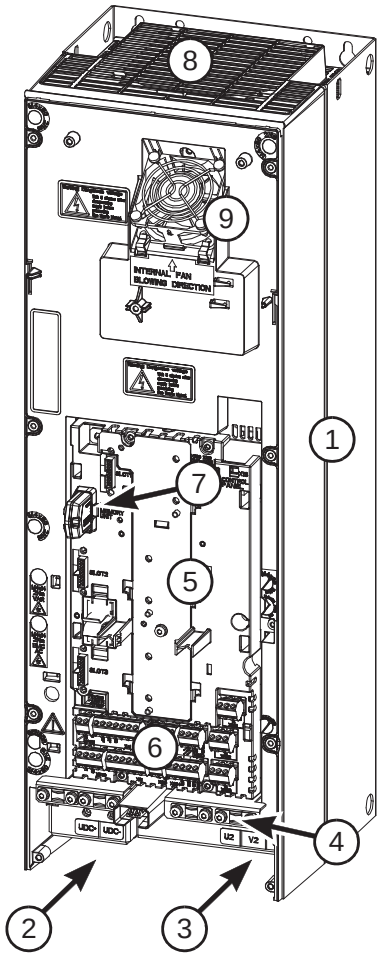
General

The motor (output) cables are connected to either detachable or non-detachable screw terminal blocks at the bottom of the cubicle. The modules have a built-in ZCU drive control unit, which contains the basic I/Os and slots for optional I/O modules.

The modules have an internal capacitor precharge circuit.

External optional equipment is primarily installed on mounting plates in the same cubicle.

Module layout



Item	Explanation
1	Power unit
2	DC (input) connection
3	Motor (output) connection. This has been wired to a separate terminal block in the lower part of the cubicle.
4	Control cable clamps
5	ZCU-12 control unit. The control unit has three slots for optional modules.
6	I/O terminal blocks
7	Memory unit
8	Main cooling fan
9	Auxiliary cooling fan

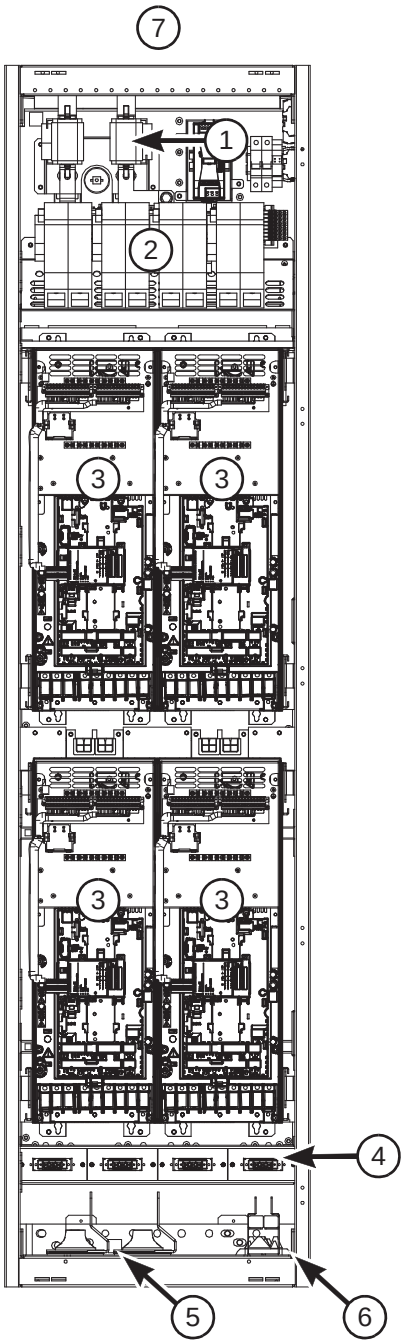
Standard cabinet layout

Several inverter modules of frame size R5i can be installed in one cubicle. The standard cubicle widths are 300 and 500 mm. The number of modules that can be fitted into the cubicle also depends on the optional equipment selected.

Each module has dedicated DC fuse disconnectors. The motor (output) connections are detachable plug connectors located at the lower part of the cubicle.

The cubicle is equipped with cable entries at the floor.

This illustration shows an example of a 500 mm wide cubicle with four R5i modules.



Item	Explanation
1	Main DC switch for all units in the cubicle (optional) and main DC fuses
2	DC fuse disconnectors for each individual module
3	R5i inverter modules (with ZCU-12 control units)
4	Output connections
5	Output cable entries
6	Control cable entry
7	Air outlet compartment with cabinet cooling fan (not shown)

Layout of cubicle with frame R5i modules in their own compartments (option +C204)

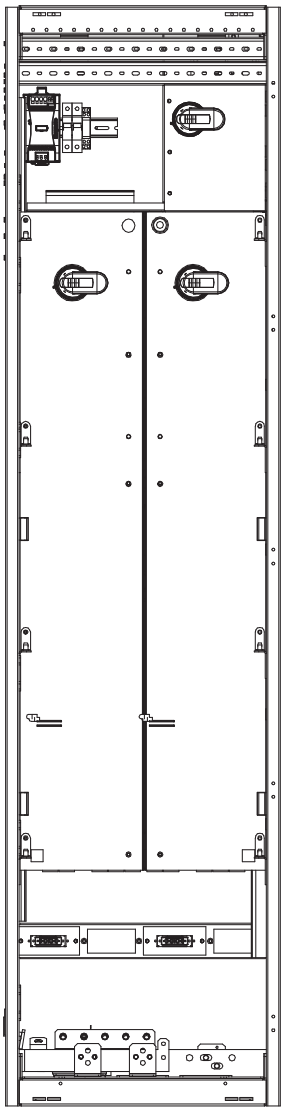
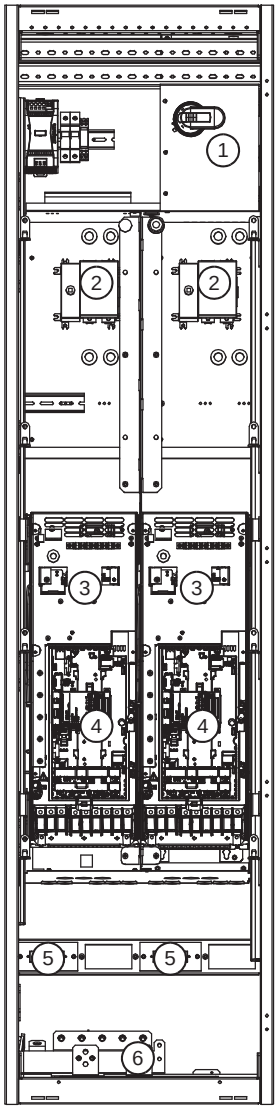
If option +C204 is selected, two frame R5i inverter modules are installed into their own compartments in a 500 mm wide cubicle. At the top of the cubicle, there is another compartment which contains the common DC switch-disconnector and fuses for all the modules in the cubicle.

The inverter modules are installed in an upright position. The cooling air is guided from the cool area at the front of the cubicle through the modules into the hot area at the back. The hot air is exhausted through the roof of the cubicle.

Each module has a dedicated DC switch-disconnector. When the switch-disconnector is open, the door to that particular compartment can be opened. It is also allowable to replace the module, its cooling fan, or its DC fuses.

The motor (output) connections for each module are located at the lower part of the cubicle. The cubicle is equipped with cable entries at the floor.

This illustration shows an example of the layout with two R5i modules.

Compartment (doors closed)	Compartment (doors open)	Item	Explanation
		1	Main DC switch-disconnector handle for both modules in the cubicle Compartment for DC fuses
		2	DC switch-disconnectors (with fuses) for each individual module
		3	Inverter modules
		4	Inverter control units
		5	Output connections
		6	Cable entries

Inverter module frame sizes R6i and R7i

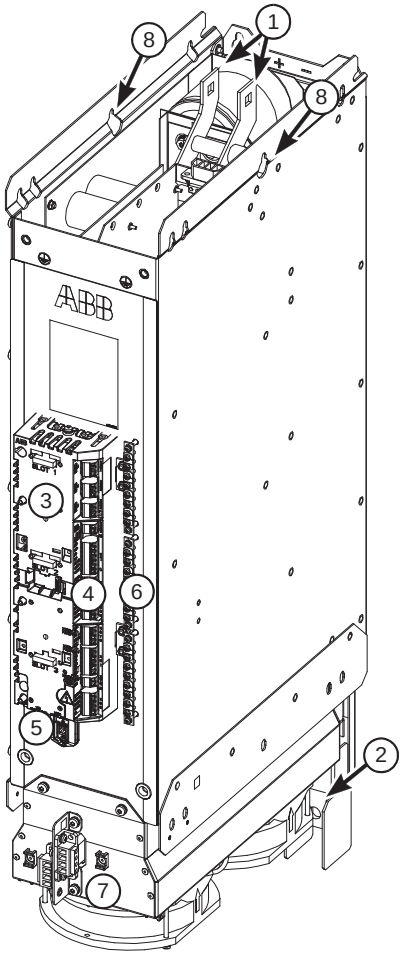
The inverter cubicle is equipped with cable entries for the motor cables in the floor of the cubicle. As standard, the output busbars are extended to the lower part of the cubicle for easy access.

The drive control unit (type ZCU-14) is mounted onto the module. The control unit has inputs, outputs, and slots for option modules. Other optional equipment is primarily installed on separate mounting plates.

The cooling fan(s) is supplied from the module and can be easily replaced.

Frame R6i or R7i module with option +V992 is a hardware version that is added to offering during 2023. Hardware version +V992 is mechanically and electrically backward-compatible with modules without option +V992. However, ACS880 primary control program v3.40 and later versions only support option +V992.

Module layout

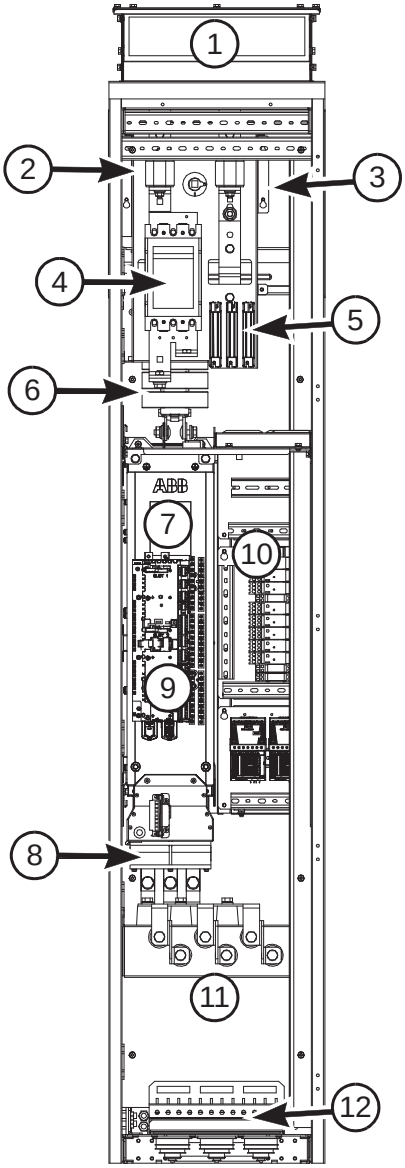


Item	Explanation
1	DC (input) connection
2	Motor (output) connection
3	ZCU-14 control unit (with slots for optional I/O modules)
4	I/O terminal blocks
5	Control panel connector, memory unit
6	Grounding/clamping plates for control cables
7	Cooling fan holder with one (R6i) or two (R7i) fans
8	Lifting eyes

Cabinet layout

Each inverter module of frame sizes R6i or R7i is installed in a 400 mm wide cubicle. The modules have a dedicated DC fuses or switch fuse. The modules have an internal capacitor pre-charge circuit apart from largest R7i types which have an external charging contactor and resistors.

This illustration shows an example of a cubicle with an R6i/R7i inverter module.



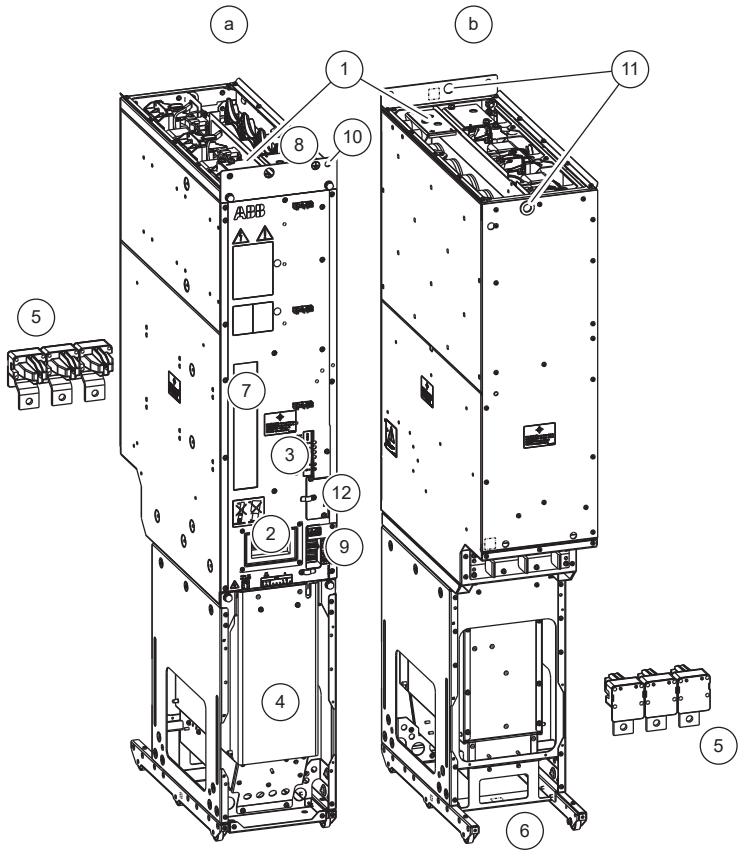
Item	Explanation
1	Air outlet
2	DC fuses
3	DC switch-disconnector (behind DC fuses and mounting plate) (optional)
4	Charging contactor (R7i only) (optional)
5	Charging resistors (R7i only) (optional)
6	Common mode filters
7	Inverter module
8	Inverter module cooling fan(s)
9	Control unit
10	Control voltage circuit components, installation space for other equipment such as relays
11	Output busbars
12	Cable entries

Motor cabling

The motor cables are connected to the output busbars at the bottom of the cubicle. For top exit, the depth of the cabinet is increased by 130 mm.

Inverter module frame size R8i and multiples

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

Cooling fans

The cooling fan unit at the base of the inverter module contains two DC fans. The fans are PWM-controlled according to an internal temperature measurement. The fan carriage can be easily removed for fan replacement, or to allow access to the output cable connections at the back of the cubicle.

The inverter module also has a small fan ventilating the circuit board compartment inside the module. The fan can be serviced without removing the inverter module from the cabinet.

Control electronics

Inverter units that have one or more R8i modules use a BCU control unit. The control unit has inputs, outputs, and slots for option modules. A fiber optic link connects the control unit to each inverter module. Safety circuits that use the built-in Safe torque off (STO) functionality are connected to the control unit.

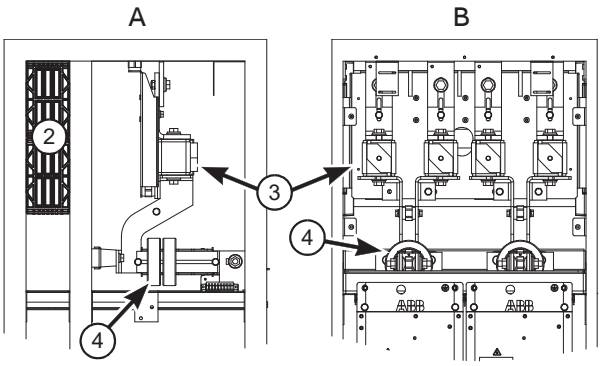
The control electronics are typically located in a 300 mm wide control cubicle (DCU), which can also contain components of the auxiliary voltage circuit and optional features such as relays and circuit breakers. The cubicle can also contain the control equipment of another inverter unit. A 400 mm wide cubicle is optionally available.

Cabinet layout

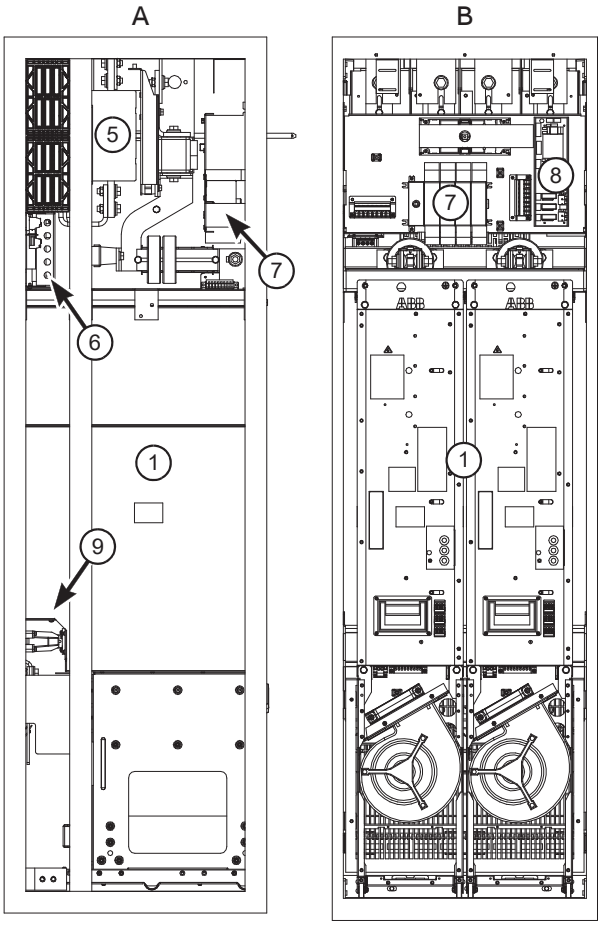
1…3 inverter modules can be installed in one cubicle. The width of the cubicle is 400, 600 or 800 mm respectively. Each module has dedicated DC fuses. A DC switch-disconnector is optional. An inverter unit with a switch-disconnector also has a precharge circuit including a charging switch on the door. When connecting the inverter unit to the DC bus, the charging switch is closed first. After the precharging completes, the DC switch-disconnector can be closed and the charging switch opened.

This illustration shows a cubicle with two R8i inverter modules with shrouding removed. The top compartment of the cubicle is shown with and without optional DC switch-disconnector and charging components.

Without DC switch-disconnector

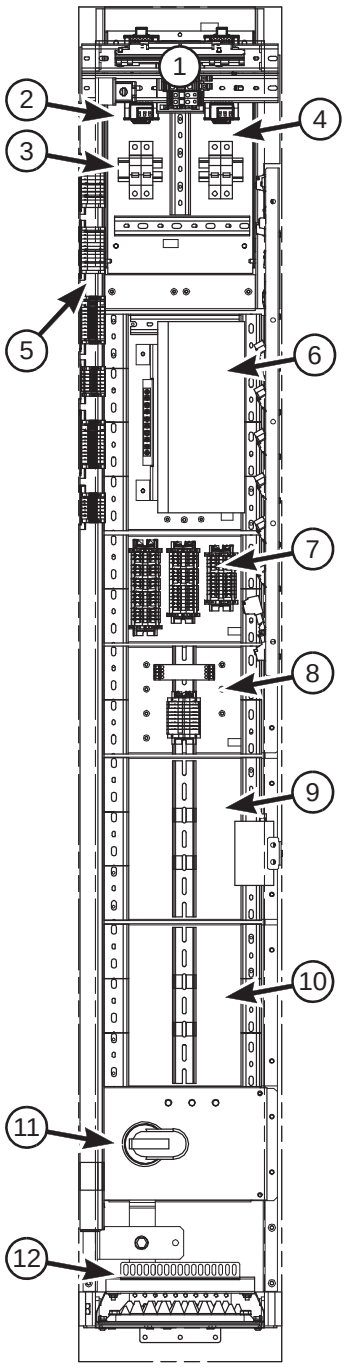


With DC switch-disconnector and charging circuit



Item	Explanation
A	Side view
B	Front view
1	Inverter modules
2	DC bus
3	DC fuses
4	Common mode filters
5	DC switch-disconnector [Q2]
6	Charging resistors
7	Charging switch [Q10]
8	Charging controller
9	AC quick connector

The illustration that follows shows an example of a 300 mm wide control equipment cubicle.

Front view	Item	Explanation
	1	Terminal block for auxiliary voltage distribution
	2	24 V DC power supply for control circuits
	3	Circuit breakers for control voltages
	4	Space for installation of items 2 and 3 for a second inverter unit
	5	(On the left-hand side wall) Terminal blocks for control circuits and auxiliary voltage distribution
	6	Control unit
	7	Terminal blocks for control unit I/O (option +L504)
	8 … 10	Mounting space for additional or optional circuitry
	11	Grounding switch of inverter unit output (optional)
	12	Control cable entry (optionally on the roof of the cubicle)

Motor cabling

The motor cabling connects to the module via a quick connector at the back of the module. By default, each inverter module is cabled individually to the motor. With an optional common motor terminal cubicle, the outputs of the parallel-connected inverter modules are connected to a separate cubicle containing a single set of output busbars.

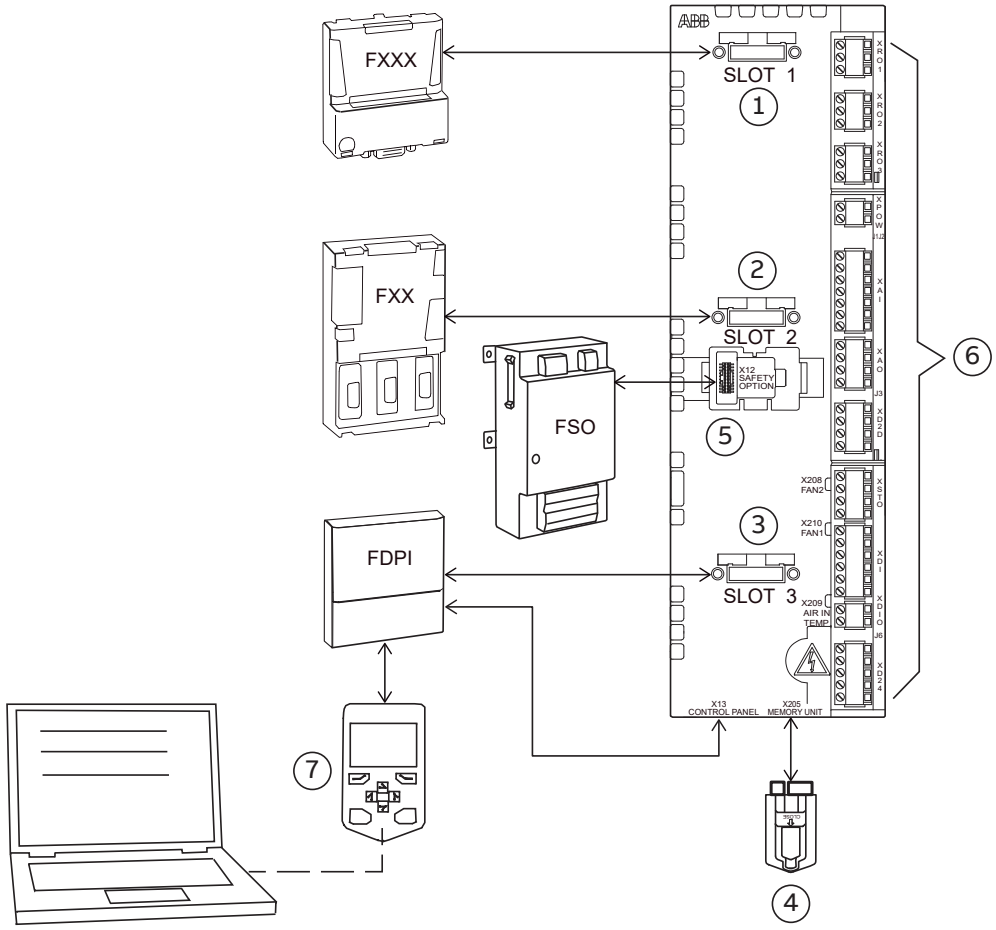
The cubicle is available in bottom-exit and top-exit variants. The standard cabling direction is down; top exit adds 200 mm to the depth of the cubicle.

Control interfaces

Overview of control connections of the ZCU control unit

The diagram shows the control connections and interfaces of the ZCU-14 control unit.

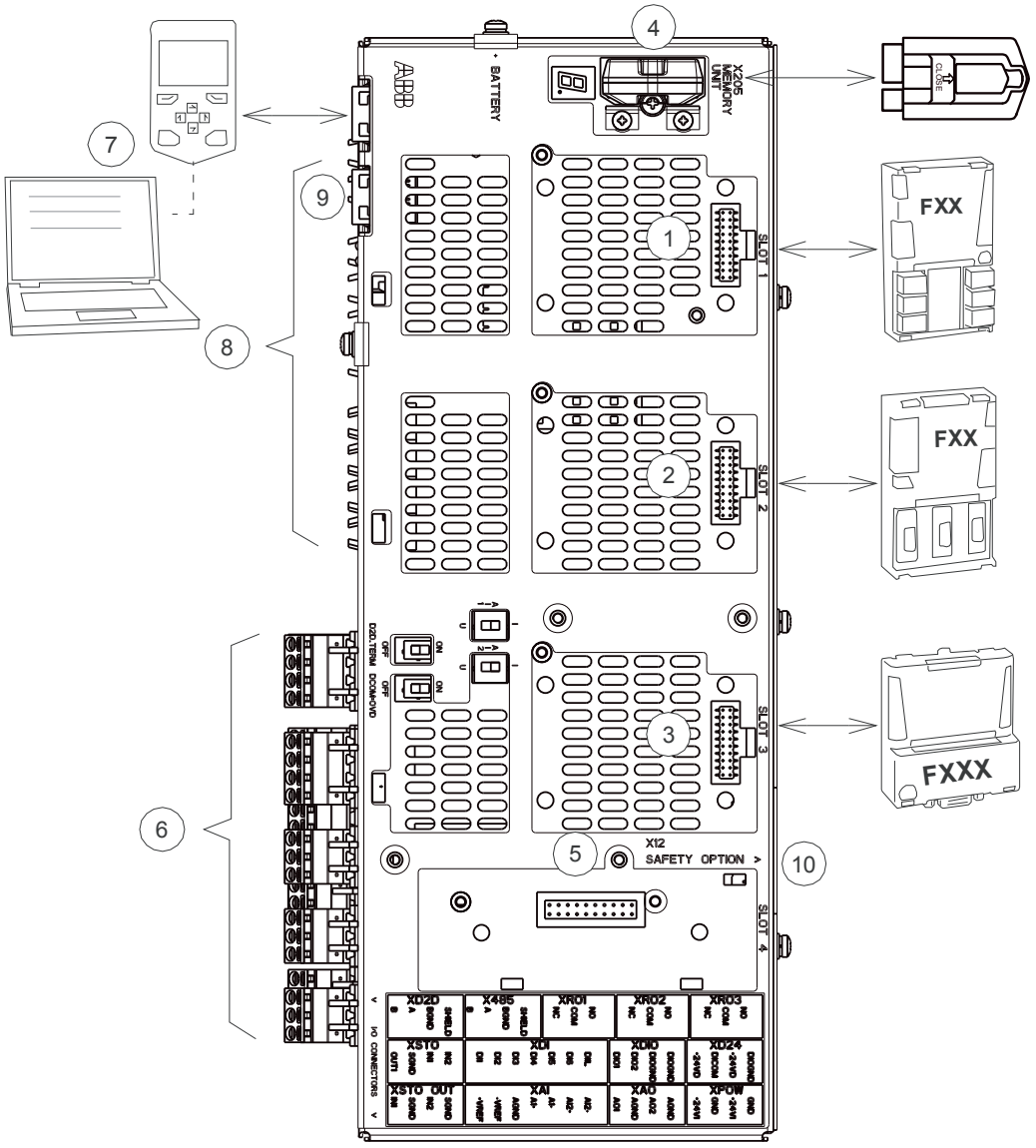
It is used with module frame sizes R1i…R7i. Frame R5i modules use a type ZCU-12 unit which has a different layout but the same connectivity as the ZCU-14.



1 2 3	Option modules can be inserted into slots 1, 2 and 3 as follows: **Modules** — **Slots** Analog and digital I/O extension modules [1] — 1, 2, 3 Feedback interface modules — 1, 2, 3 Fieldbus communication modules — 1, 2, 3 FSO safety functions module — 2 (X12) 1) When installed into slot 3 of a ZCU-14 control unit, the module will extend over the edge. ABB recommends that you use slot 1 or 2 instead whenever possible.
4	Memory unit
5	Connector for FSO safety functions module (X12). The module reserves slot 2 when connected.
6	I/O terminal blocks

7	Control panel

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.

The ACS-AP-W control panel

The ACS-AP-W is the user interface of the inverter unit, providing the essential controls such as Start/Stop/Direction/Reset/Reference, and the parameter settings for the control program.

The control panel can be mounted on a platform on the inverter cubicle door. The maximum number of platforms on one door is four, but one control panel can be used to control several units through a panel link.

For details on the control panel, see ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual (3AUA0000085685 [English]).

Control by PC tools

There is a USB connector on the front of the panel that can be used to connect a PC to the drive.

Fieldbus control

The inverter unit can be controlled through a fieldbus interface if the unit is equipped with an optional fieldbus adapter, and when the control program has been configured for fieldbus control by parameters. For information on the parameters, see the appropriate firmware manual of the inverter unit.

Other control devices

DC switch-disconnector (option +F286)

The inverter unit can optionally be equipped with a DC switch-disconnector [Q2] which allows the isolation of the unit from the DC link. Before the unit is reconnected to the DC link, the capacitors of the inverter module(s) must be charged through a charging circuit.

With frame R1i…R5i inverter units, the DC switch-disconnector controls all of the inverter modules within that particular cubicle. Each module is additionally fitted with DC fuse disconnectors or a switch-disconnector. If R1i…R5i units are ordered in their own compartments (option +C204), the cubicle is equipped with a common DC switch-disconnector and the modules with dedicated DC switch-disconnectors as standard.

The status of the DC switch-disconnector (as well as module-specific disconnectors of R1i…R5i modules) is connected to the inverter(s). By default, the inverter is disabled when the DC switch-disconnector (or a DC fuse disconnector) is open.

WARNING!
Do not operate the DC switch-disconnectors under load.

WARNING!
Do not operate the DC fuse disconnectors under load or under voltage.

WARNING!
With frame n×R8i inverter units, both the DC switch-disconnector [Q2] and the charging switch [Q10] must be opened to disconnect the inverter unit from the DC link.

Charging switch (frame R8i and multiples only)

Frame n×R8i inverter units equipped with a DC switch-disconnector (option +F286) have a charging circuit including an BSFC-02 charging control unit and a charging switch [Q10] on the cubicle door. Before closing the DC switch-disconnector, the user

closes the charging switch. After the precharging completes, a green light [H1] on the cabinet door illuminates. The DC switch-disconnector can now be closed, and the charging switch opened.

Note: The charging switch must be opened before the inverter unit can be started.

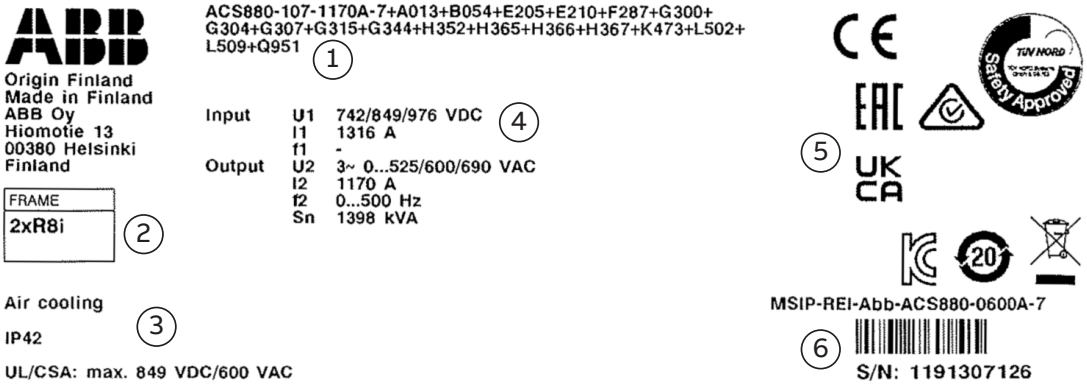
Type designation labels

Inverter unit type designation label

Each inverter unit has a type designation label attached onto the inside of the cubicle door. Note that multiple small inverter units can be installed within one cubicle, and that an inverter unit can consist of several cubicles and inverter modules.

Quote the complete type designation and serial number when contacting technical support on the subject of an inverter unit.

An example label is shown below.

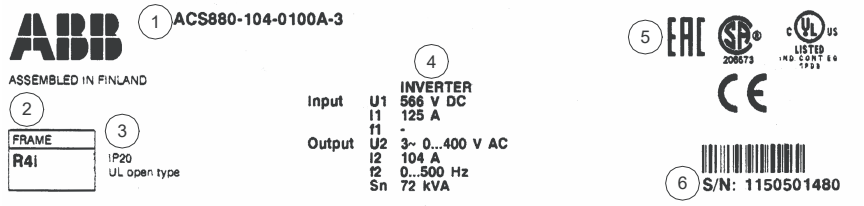


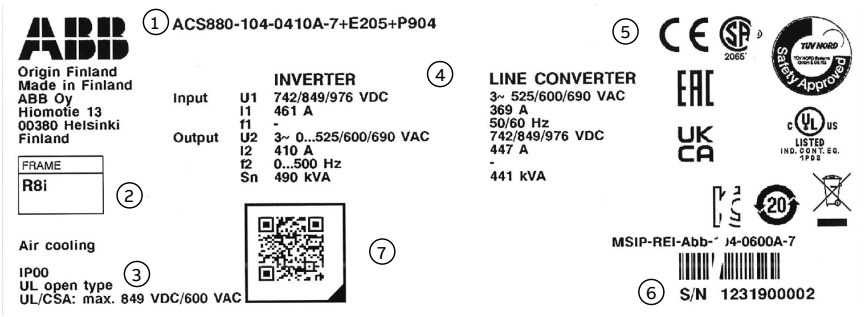
1	Type designation
2	Frame size
3	Cooling data, degree of protection, UL/CSA specifications
4	Ratings
5	Valid markings
6	Serial number. The first digit of the serial number refers to the manufacturing plant. The next four digits refer to the unit's manufacturing year and week, respectively. The remaining digits complete the serial number so that there are no two units with the same number.

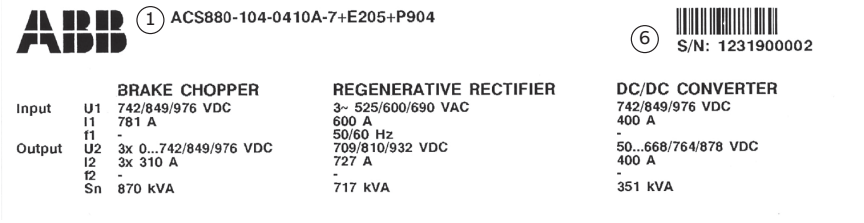
Inverter module type designation label

Each module has a type designation label attached to it. The label contains information on the specifications and configuration of the module. The first digits express the basic construction, for example “ACS880-104-0100A-3”. Any optional selections are given thereafter, separated by plus signs. There is an additional label for frame R8i multiples.

Examples of the labels are shown below.







1	Type designation.
2	Frame size.
3	Degree of protection; additional UL/CSA specifications.
4	Ratings. The labels show ratings for inverter module (INVERTER), IGBT supply module (LINE CONVERTER), brake chopper module (BRAKE CHOPPER), regenerative rectifier module (REGENERATIVE RECTIFIER) and DC/DC converter module (DC/DC CONVERTER).
5	Valid markings.
6	Serial number. The first digit refers to the manufacturing plant. The next four digits indicate manufacturing year and week respectively (yyww). The remaining digits complete the serial number so that there are no two units with the same number.
7	Product information

Type designation key

Type designation key of the inverter unit

The type designation contains information on the specifications and configuration of the drive. The first digits from left express the basic drive type. The optional selections are given thereafter, separated by plus signs, eg, +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
ACS880-107	Default configuration: Inverter unit, IEC industrial cabinet construction, plinth height 50 mm, IP22 (UL type 1), 50 Hz supply frequency, control (auxiliary) voltage 230 V AC, bottom entry and exit of cables, European-style motor cable entries, aluminum DC busbars (up to 3200 A), tin-plated copper DC busbars (from 3200 A up), speed-controlled module cooling fans, DC fuses, DC fuse/disconnectors (frames R1i…R5i only), standard wire markings, ACS880 primary control program, Safe torque off function, coated circuit boards, USB memory stick containing complete documentation in English.
Size	
xxxxx	Refer to the rating tables
Voltage range	
3	513…566 V DC. This is indicated in the type designation label as typical input voltage level (566 V DC).
5	513…707 V DC. This is indicated in the type designation label as typical input voltage levels (566/679/707 V DC).
7	709…976 V DC. This is indicated in the type designation label as typical input voltage levels (742/849/976 V DC).

Option codes

Code	Description
A012	50 Hz supply frequency
A013	60 Hz supply frequency
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)
C130	Channeled air outlet
C132	Marine type approval. Refer to ACS880…+C132 marine type-approved cabinet-built drives supplement (3AXD50000039629 [English]).
C134	CSA approved
C164	Plinth height 100 mm
C176	Door hinges on left
C179	Plinth height 200 mm

Code	Description
C180	Seismic design
C188	Direct-on-line module cooling fans
C204	Modules in their own compartments
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
E206	Sine output filter
E208	Common mode filtering
E210	EMC/RFI filter for 2nd environment TN (grounded) or IT (ungrounded) system, category C3
E230	High speed filter unit (40 µH, 1500 A) in a 500 mm wide cubicle
E231	High speed filter unit (20 µH, 2100 A) in a 500 mm wide cubicle
2E231	High speed filter unit (20 + 20 µH, 2100 A) in a 700 mm wide cubicle
F267	Service switch at inverter output
F269	Output contactors
F270	Output grounding switch
F271	Output grounding terminals
F286	DC switch-disconnector
F287	DC fuses
F288	DC fuse-disconnector(s)
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)
G313	Output for motor space heater (external supply)
G314	Aluminum busbars
G315	Tin-plated copper DC busbars
G320	Control (auxiliary) voltage 230 V AC
G330	Halogen-free wiring and materials
G338	Wire marking class A1
G339	Wire marking class A2
G340	Wire marking class A3
G341	Wire marking class B1
G342	Wire marking class C1
G343	Corrosion indicator
G344	Auxiliary voltage transformer
G412	Light-duty aluminum DC busbars
G453	Common mode filter temperature monitoring
H350	Power cabling entry from bottom

Code	Description
H351	Power cabling entry from top
H352	Power cabling exit from bottom
H353	Power cabling exit from top
H358	Cable gland plates (3 mm steel, undrilled)
H359	Common motor terminal cubicle
H364	Cable gland plates (3 mm aluminum, undrilled)
H365	Cable gland plates (6 mm brass, undrilled)
H366	Common output terminals (for inverter modules mounted in the same cubicle)
H367	Control cabling through floor of cabinet
H368	Control cabling through roof of cabinet
H371	Cable size 2 terminals for aluminum cables (frame R4i)
J400	ACS-AP-W control panel (with Bluetooth)
J410	Control panel mounting platform
J412	Common control panel
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
K473	FENA-11 Ethernet adapter module for EtherNet/IP™, Modbus TCP® and PROFINET IO® protocols
K475	FENA-21 Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols, 2-port
K480	Ethernet switch for PC tool or control network (for max. 6 inverter units)
K483	Ethernet switch with optical link for PC tool or control network (for max. 6 inverter units)
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
K493	Ethernet switch for PROFINET
K494	Ethernet switch with optical link for PROFINET
K500	Wired remote monitoring
K501	Wireless remote monitoring with 4G
K502	Wireless remote monitoring with Bluetooth
K503	Wireless remote monitoring with 4G and Bluetooth
L500	FIO-11 analog I/O extension module
L501	FIO-01 digital I/O extension module
L502	FEN-31 HTL incremental encoder interface module
L503	FDCO-01 optical DDCS communication adapter module
L504	Additional I/O terminal block

Code	Description
L505	Thermal protection with PTC relays (1 or 2 pcs)
L506	Thermal protection with Pt100 relays (3, 5 or 8 pcs)
L508	FDCO-02 optical DDCS communication adapter module
L509	RDCO-04 optical DDCS communication module (4×Transmitter/Receiver)
L513	ATEX-certified thermal protection with PTC relays (1 or 2 pcs)
L514	ATEX-certified thermal protection with Pt100 relays (3, 5 or 8 pcs)
L516	FEN-21 resolver interface module
L517	FEN-01 TTL incremental encoder interface module
L518	FEN-11 TTL absolute encoder interface module
L521	FSE-31 pulse encoder interface module
L525	FAIO-01 analog I/O extension module
L526	FDIO-01 digital I/O extension module
L536	FPTC-01 thermistor protection module
L537	FPTC-02 ATEX-certified thermistor protection module
L539	Isolation relay for motor temperature switch
M600	Starter for auxiliary motor fan, trip limit 1 … 1.6 A
M601	Starter for auxiliary motor fan, trip limit 1.6 … 2.5 A
M602	Starter for auxiliary motor fan, trip limit 2.5 … 4 A
M603	Starter for auxiliary motor fan, trip limit 4 … 6.3 A
M604	Starter for auxiliary motor fan, trip limit 6.3 … 10 A
M605	Starter for auxiliary motor fan, trip limit 10…16 A
M606	Starter for auxiliary motor fan, trip limit 16…20 A
M610	Starter for auxiliary motor fan, trip limit 20…25 A
M660	Starter for electromagnetic motor brake: 24 V DC, 0.40 … 0.63 A
M661	Starter for electromagnetic motor brake: 115 V AC, 0.40 … 0.63 A
M662	Starter for electromagnetic motor brake: 230 V AC, 0.40 … 0.63 A
M663	Starter for electromagnetic motor brake: 400 V AC, 3-phase, 0.40 … 0.63 A
N5000	Winder control program
N5050	Crane control program
N5100	Winch control program
N5200	PCP (Progressive Cavity Pump) control program
N5300	Test bench control program
N5600	ESP (Electrical Submersible Pump) control program
N5700	Position control program
N7502	Control program for synchronous reluctance motors (SynRM)
N8010	IEC 61131-3 application programmability
N8200	High speed (> 598 Hz) license
P904	Extended warranty (30 months from delivery or 24 months from commissioning)
P909	Extended warranty (42 months from delivery or 36 months from commissioning)
P912	Seaworthy packaging
P913	Special color (RAL Classic)
P947	Safety data calculation and validation for tailored safety functions

Code	Description
P948	Customized extended warranty
P966	Special color (other than RAL Classic)
P967	High-speed variant
Q950	Prevention of unexpected start-up with FSO safety functions module, by activating the Safe torque off function
Q951	Emergency stop (category 0) with safety relays, by opening the main breaker/contactor
Q952	Emergency stop (category 1) with safety relays, by opening the main breaker/contactor
Q957	Prevention of unexpected start-up with safety relays, by activating the Safe torque off function
Q963	Emergency stop (category 0) with safety relays, by activating the Safe torque off function
Q964	Emergency stop (category 1) with safety relays, by activating the Safe torque off function
Q965	Safely-limited speed with FSO-21 and encoder
Q966	Safely-limited speed without encoder
Q971	ATEX-certified safe disconnection function
Q972	FSO-21 safety functions module
Q973	FSO-12 safety functions module
Q979	Emergency stop (configurable for category 0 or 1) with FSO safety functions module, by activating the Safe torque off function
Q982	PROFIsafe with FSO safety functions module and FPNO-21 Ethernet adapter module
Q986	FSPS-21 PROFIsafe safety functions module
R700	Printed documents in English
R701	Printed documents in German [1)]
R702	Printed documents in Italian[1)]
R705	Printed documents in Swedish[1)]
R706	Printed documents in Finnish[1)]
R707	Printed documents in French[1)]
R708	Printed documents in Spanish[1)]
R711	Printed documents in Russian[1)]
R712	Printed documents in Chinese[1)]
V112	Module auxiliary and fan power supply connector change

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

Type designation key of the inverter 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	513…566 V DC. This is indicated in the type designation label as typical input voltage level (566 V DC).
5	513…707 V DC. This is indicated in the type designation label as typical input voltage levels (566/679/707 V DC).
7	709…976 V DC. This is indicated in the type designation label as typical input voltage levels (742/849/976 V DC).
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
N5000	Winder control program
N5050	Crane control program
N5100	Winch control program
N5200	PCP/ESP control program
N5300	Test bench control program
N5600	ESP control program
N5700	Position control program
N7502	SynRM control firmware
N8010	Drive application programming
N8200	High speed version
P904	Extended warranty (30 months from delivery or 24 months from commissioning)
P909	Extended warranty (42 months from delivery or 36 months from commissioning)
P967	Module variant with capability for increased switching frequency
Q971	ATEX-certified Safe Disconnection Function, Ex II (2) GD
V112	Module auxiliary and fan power supply connector change
V992	Frames R6i and R7i: Hardware version added to product offering during 2023.

3

Electrical installation

Contents of this chapter

This chapter describes the electrical installation of the inverter units.

The circuit diagrams in this chapter are simplified presentations. Refer to the diagrams delivered with the drive system for details.

For more information on cable selection, protections, etc., see ACS880 multidrive cabinets and modules electrical planning instructions (3AUA0000102324 [English]).

The tightening torques for the electrical connections are listed in the technical data.

Warnings

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 personnel who do work on the drive, motor cable or motor.

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

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

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

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

1. Prepare for the work.
   - Make sure that you have a work order.
   - Do an on-site risk assessment or job hazard analysis.
   - Make sure that you have the correct tools available.
   - Make sure that the workers are qualified.
   - Select the correct personal protective equipment (PPE).
   - Stop the motor(s).
2. Clearly identify the work location and equipment.
3. Disconnect all possible voltage sources. Make sure that re-connection is not possible. Lock out and tag out.
   - If the drive is equipped with a DC/DC converter unit or a DC feeder unit: Open the disconnecting device of the energy storage connected to the unit. The disconnecting device is outside the drive cabinet. Then open the DC switch-disconnector ([Q11], option +F286 or +F290) of the unit.
   - Open the main disconnecting device of the drive.
   - Open the charging switch if present.
   - Open the disconnector of the supply transformer. (The main disconnecting device in the drive cabinet does not disconnect the voltage from the AC input power busbars of the drive cabinet.)
   - Open the auxiliary voltage switch-disconnector (if present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
   - If you have a permanent magnet motor connected to the drive, disconnect the motor from the drive with a safety switch or by other means.
   - Open the main isolating device of the drive.
   - Disconnect all dangerous external voltages from the control circuits.
   - After you disconnect power from the drive, always wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.
4. Protect other energized parts in the work location against contact and take special precautions when close to bare conductors.
5. Measure that the installation is de-energized. Use a quality voltage tester. If the measurement requires removal or disassembly of shrouding or other cabinet

structures, obey the local laws and regulations applicable to live working (including – but not limited to – electric shock and arc protection).
- Before and after you measure the installation, verify the operation of the voltage tester on a known voltage source.
- Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is zero.
- Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is zero.
  Important! Repeat the measurement also with the DC voltage setting of the tester. Measure between each phase and ground. There is a risk of dangerous DC voltage charging due to leakage capacitances of the motor circuit. This voltage can remain charged for a long time after the drive power-off. The measurement discharges the voltage.
- Make sure that the voltage between the drive DC busbars and the grounding (PE) busbar is zero.
- If the drive is equipped with a DC/DC converter unit or a DC feeder unit: Make sure that the voltage between the energy storage terminals of the 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 in control of the electrical installation work.

General notes

Printed circuit boards

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

Handling fiber optic cables

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

- Handle the fiber optic cables with care.
- When you disconnect the fiber optic cables, always hold the connector, not the cable.
- Do not touch the ends of the fibers. They are sensitive to dirt.
- Do not bend the fiber optic cables too tightly. The minimum allowed bend radius is 35 mm (1.4 in).

Measuring the insulation

Measuring the insulation resistance of the drive

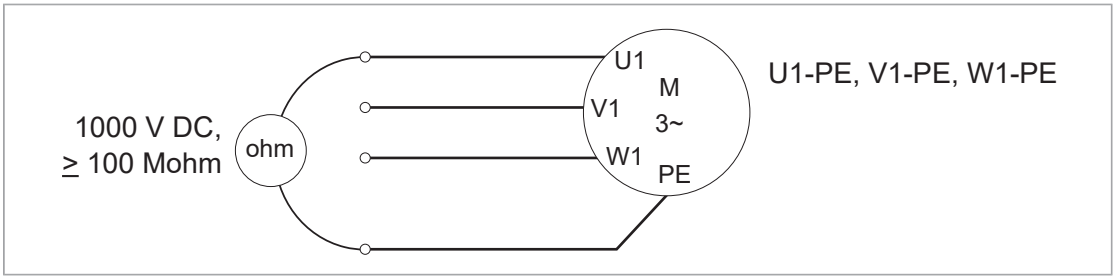
WARNING!
Do not do voltage withstand or insulation resistance tests on the drive. The tests can cause damage to the drive. Every drive is tested for insulation between the main circuit and the chassis at the factory. Also, there are voltage-limiting circuits inside the drive which cut down the testing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

Measuring the insulation resistance of the motor and motor cable

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.

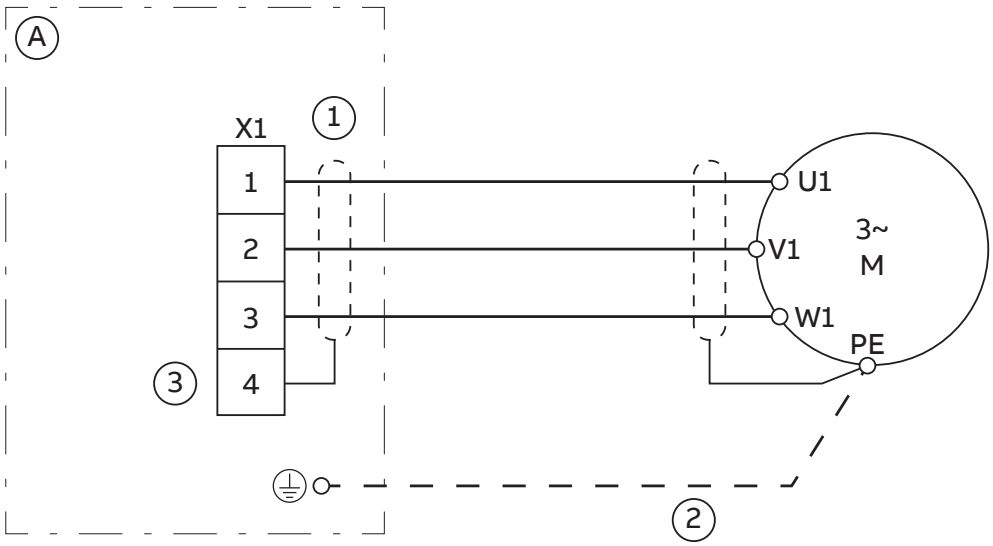
1. Do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Make sure that the motor cable is disconnected from the drive output terminals.
3. Measure the insulation resistance between each phase conductor and the protective earth conductor. Use a measuring voltage of 1000 V DC. The insulation resistance of an ABB motor must be more than 100 Mohm (reference value at 25 °C [77 °F]). For the insulation resistance of other motors, refer to the manufacturer's instructions.

   Note: Moisture inside the motor reduces the insulation resistance. If you think that there is moisture in the motor, dry the motor and do the measurement again.



Connecting the motor cable – Frame sizes R1i...R5i

Connection diagram



A	Inverter unit
1	360° grounding at cable entry
2	Use a separate grounding cable if the conductivity of the cable shield is less than 50% of the conductivity of the phase conductor in a cable with no symmetrically constructed grounding conductor. See ACS880 multidrive cabinets and modules electrical planning instructions (3AUA0000102324 [English]).
3	If the inverter unit does not have terminal X1:4, connect the cable shield directly to the PE busbar.

If there is a symmetrically constructed grounding conductor in the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the drive and motor ends.

Do not use an asymmetrically constructed motor cable. Connecting its fourth conductor at the motor end increases bearing currents and causes extra wear.

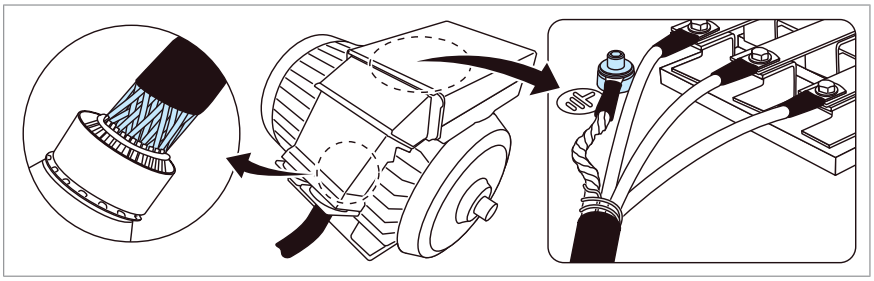
Motor cable connection procedure

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.

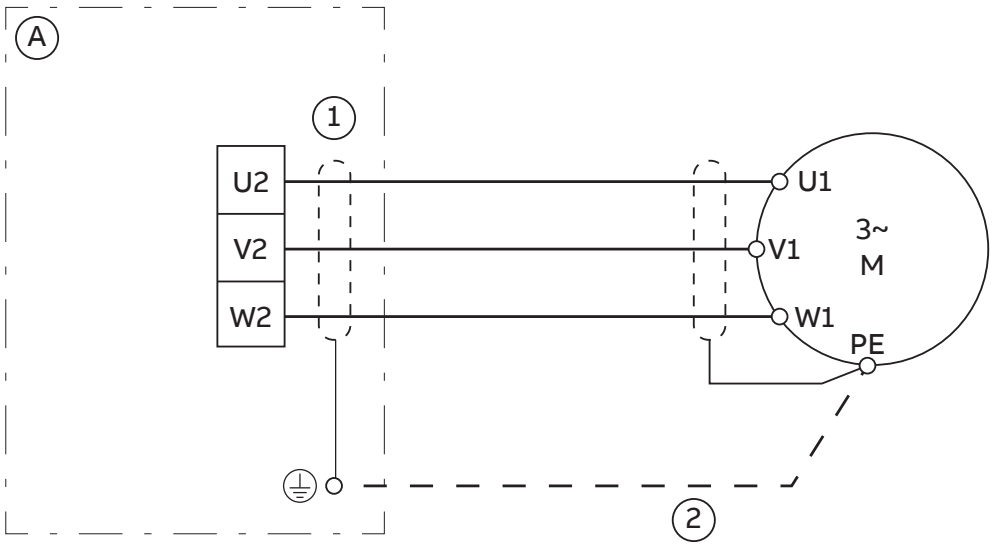
1. Do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Run the cable into the cubicle through one of the cable glands provided. Remove the outer jacket of the cable wherever it passes through the cable gland.

3. Cut the cable to suitable length and strip the ends of the individual conductors.
4. Twist the shield strands of the cable together to form a separate conductor and crimp a ferrule onto it. (With frame R4i, connect the cable shield to the PE busbar using a crimp ring terminal.)
5. Connect the conductors to terminal block/connector X1. (If X1:4 is not present, connect the cable shield directly to the PE busbar.) See Drives cabinets_Connecting cable lug to a busbar.xml.
6. Secure the cable inside the cabinet mechanically.
7. Tighten the cable gland.
8. At the motor, connect the cables according to instructions from the motor manufacturer. Pay special attention to the phase order. For minimum radio-frequency interference, ground the cable shield 360° at the cable entry of the motor terminal box.



Connecting the motor cable – Frame sizes R6i and R7i

Connection diagram



A	Inverter unit
1	360° grounding at cable entry
2	Use a separate grounding cable if the conductivity of the cable shield is less than 50% of the conductivity of the phase conductor in a cable with no symmetrically constructed grounding conductor. See ACS880 multidrive cabinets and modules electrical planning instructions (3AUA0000102324 [English]).

If there is a symmetrically constructed grounding conductor in the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the drive and motor ends.

Do not use an asymmetrically constructed motor cable. Connecting its fourth conductor at the motor end increases bearing currents and causes extra wear.

Motor cable connection procedure

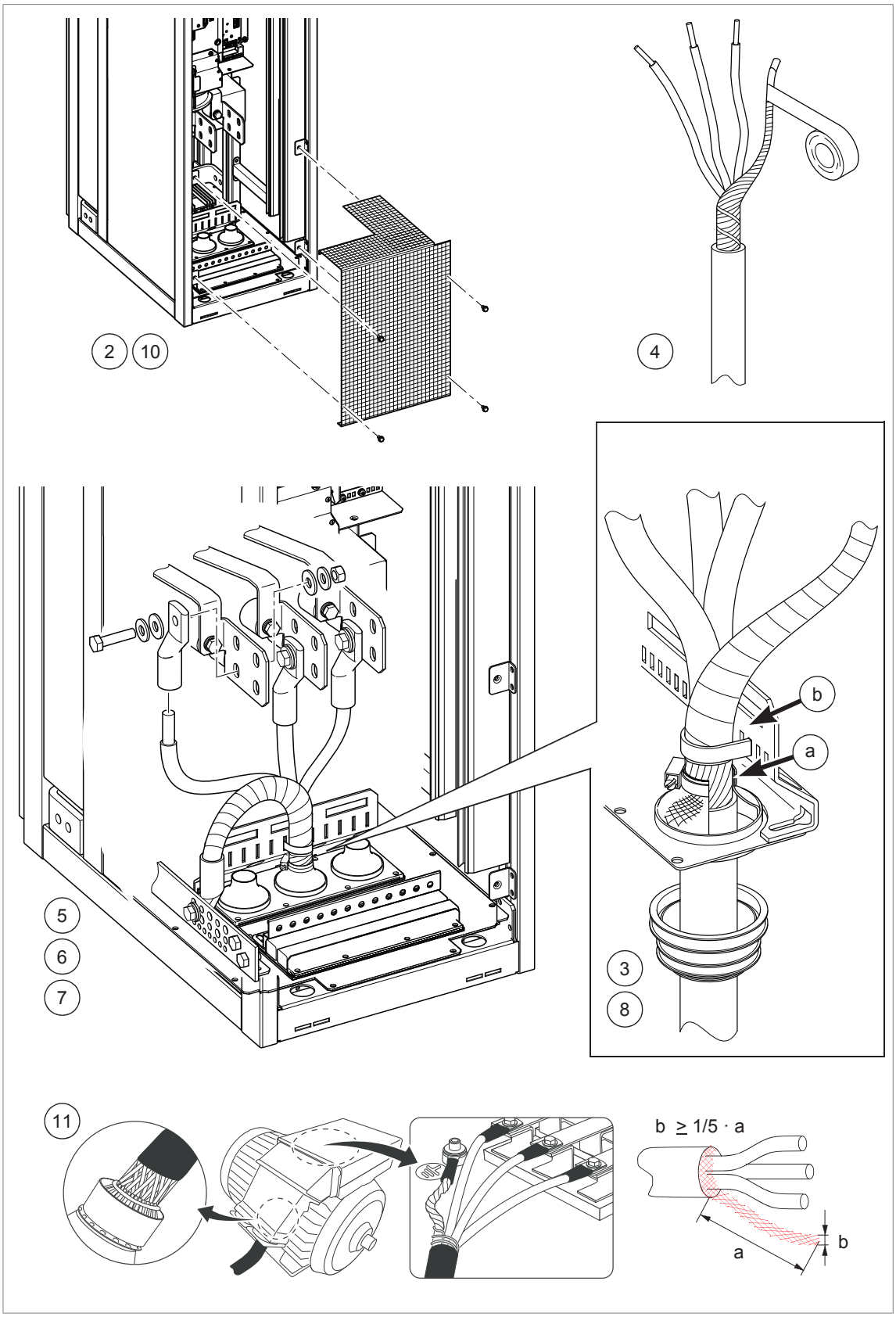
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

Refer to the illustrations below.

1. Do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Remove the shroud covering the lower part of the cubicle.

3. Run the cable into the cubicle through the cable cable entries provided. In case a grounding cable gland is available, remove the outer jacket of the cable where it passes through the cable gland (a).
4. Cut the cable to suitable length and strip the ends of the individual conductors. Twist the shield strands together to form a separate conductor and wrap it with tape.
5. Crimp suitable lug terminals onto the phase conductors and the ground conductor. The dimensions of the output busbars are shown in the technical data.
6. Connect the shield (and any grounding conductors) of the cable to the PE busbar close to the cable entries.
7. Connect the phase conductors of the motor cable to the U2, V2 and W2 terminals.
8. Secure the cable mechanically. It is recommended to arrange for 360° grounding of the shield at the cable entry; an example is shown in the detail drawing (b).
9. Connect the control cables as described in section Connecting the control cables (page 66).
10. Install the shroud.
11. At the motor, connect the cables according to instructions from the motor manufacturer. Pay special attention to the phase order. For minimum radio-frequency interference, ground the cable shield 360° at the cable entry of the motor terminal box, or ground the cable by twisting the shield so that the flattened shield is wider than 1/5 of its length.


2
10
4
b
a
5
6
7
3
8
11
b ≥ 1/5 · a
a
b

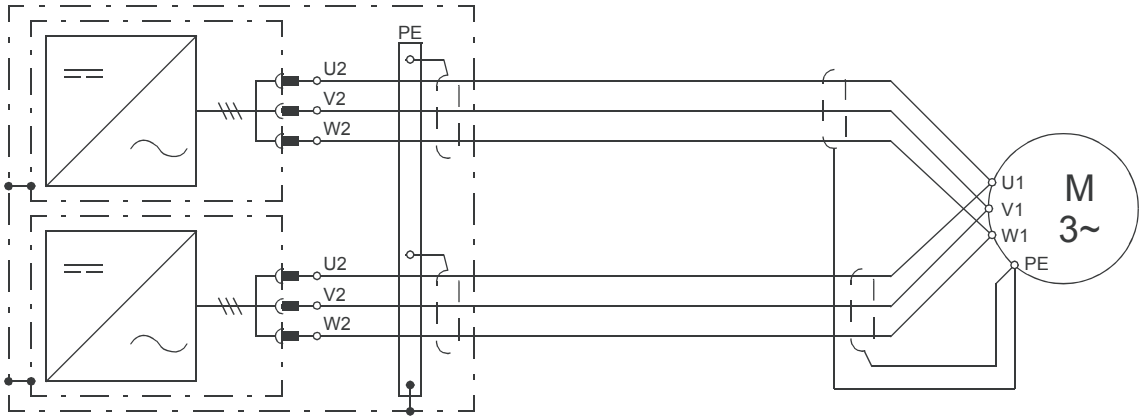
Connecting the motor cables – Frame size R8i and multiples without common motor terminal cubicle or sine output filter

On units without a common motor terminal cubicle or a sine output filter, the motor cables connect to busbars located behind the inverter module(s). The location and dimensions of the busbars are shown in the dimension drawings delivered with the drive and in the example drawings in this manual.

Motor connection diagram (without option +H366)

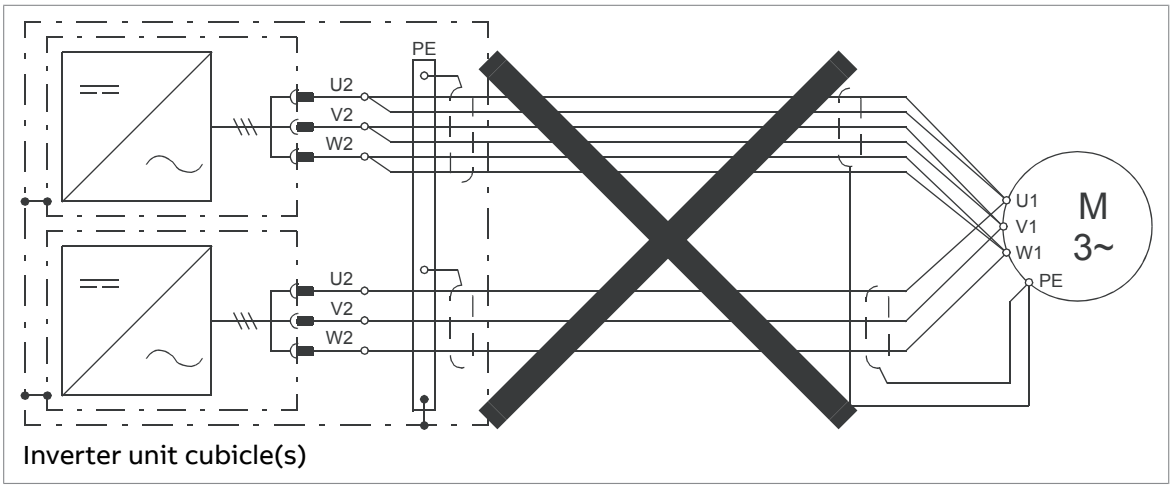
All parallel-connected inverter modules are to be cabled separately to the motor.

360° grounding must be used at the cable entries.



The recommended cable types are given in the technical data.

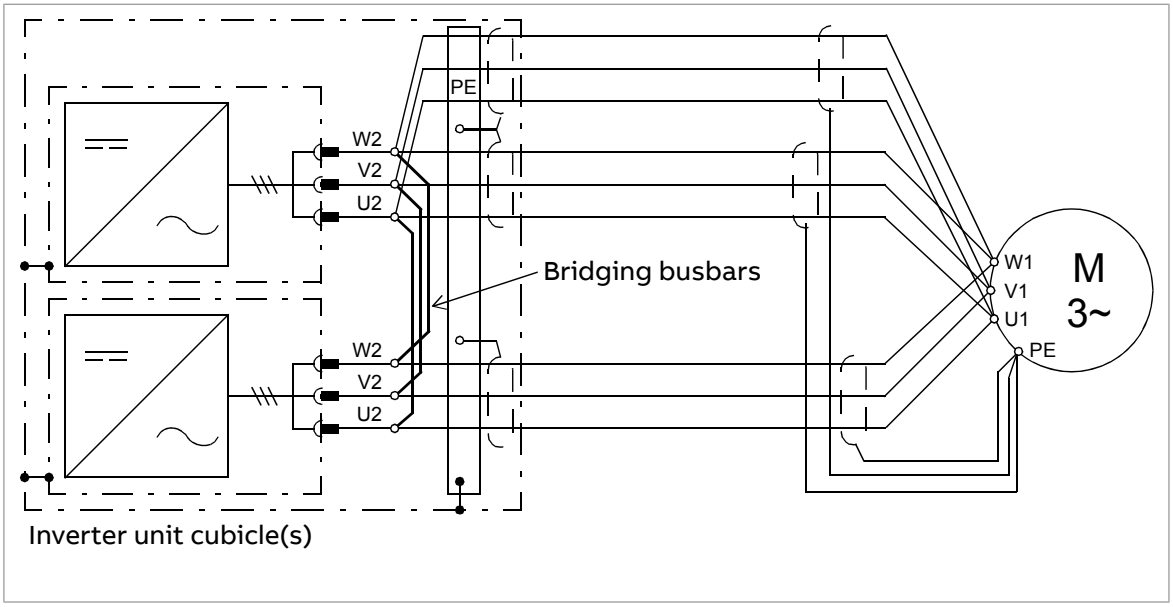
WARNING!
The cabling from all inverter modules to the motor must be physically identical considering cable type, cross-sectional area, and length.



Motor connection diagram (with option +H366)

With option +H366, the output busbars of the inverter modules within the same cubicle are connected by bridging busbars. The bridging balances the motor current between

the modules, which allows more cabling options. For example, it is possible to use a number of cables that could not otherwise be evenly distributed between the inverter modules.



The recommended cable types are given in the technical data.

WARNING!
The bridging can carry the nominal output of one inverter module. In case of three parallel modules, make sure that the load capacity of the bridging is not exceeded. For example, if the cabling connects to the output busbars at one module only, use the module in the middle.

The +H366 option only interconnects the outputs of inverter modules within the same cubicle, not modules installed in different cubicles. Therefore, when the drive has more than three inverter modules, make sure that the load is distributed evenly between the modules:

- In case of two inverter cubicles of two modules, connect the same number of cables to each cubicle.
- In case of one inverter cubicle with three modules and another with two, each cubicle requires a number of cables proportional to the number of modules within. For example, connect three out of five (or six out of ten, etc.) cables to the cubicle with three modules, the remaining two out of five (four out of ten) cables to the cubicle with two modules.

Procedure

To get more space for cabling work, you can remove the inverter modules or the fan carriages of each module. Especially in the case of multiple inverter modules in the same cubicle, you can consider only removing the fan carriages. This is faster than removing the entire module, but gives less free space for the work than removing the module.

Removing an inverter module

Refer to section Removing an inverter module (page 126).

Removing the fan carriage of an inverter module

Refer to the drawings below.

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.

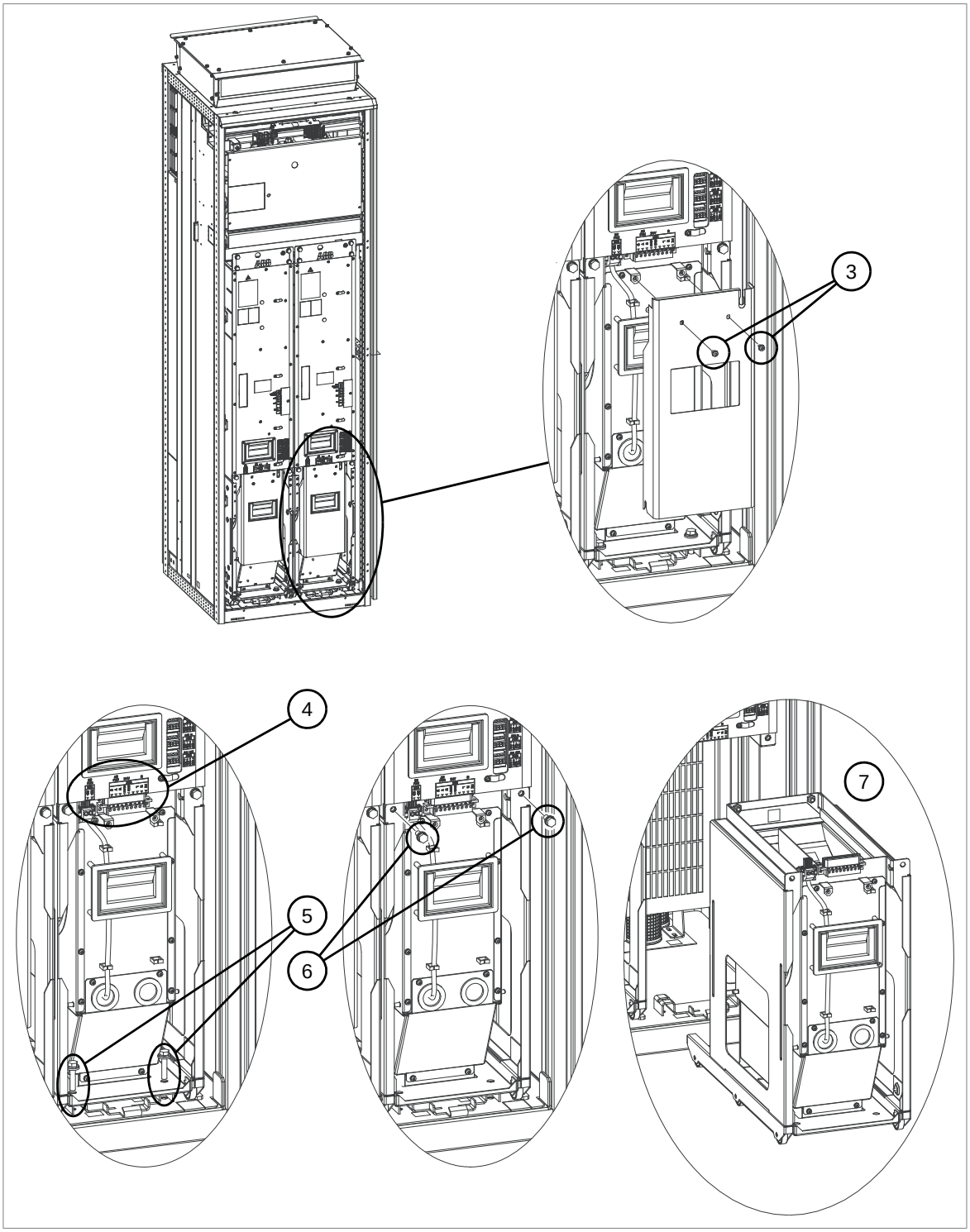
If you are not a qualified electrical professional, do not do installation or maintenance work.

1. Do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Open the inverter module cubicle door.
3. Remove the screws holding the front cover plate. Lift the cover plate somewhat to release it.
4. Disconnect the wiring at the top of the fan carriage.
5. Remove the two screws at the bottom of the fan carriage.

   WARNING!
   Before you proceed, make sure that the two screws holding the top of the inverter module are in place.

6. Remove the two screws at the top of the fan carriage. (During reassembly, tighten these screws to 22 N·m [16 lbf·ft].)

   Note: Units with marine or seismic design have an additional transverse bracket that is attached to the module with these screws. At this point, loosen the retaining screws of the bracket at the left and the right ends and remove it. (During reassembly, tighten the bracket retaining screws to 9 N·m [6.6 lbf·ft].)
7. Pull the fan carriage out.
8. Repeat the procedure for other fan carriages in the same cubicle.


3
4
5
6
7

Connecting the motor cables

Refer to the drawings below.

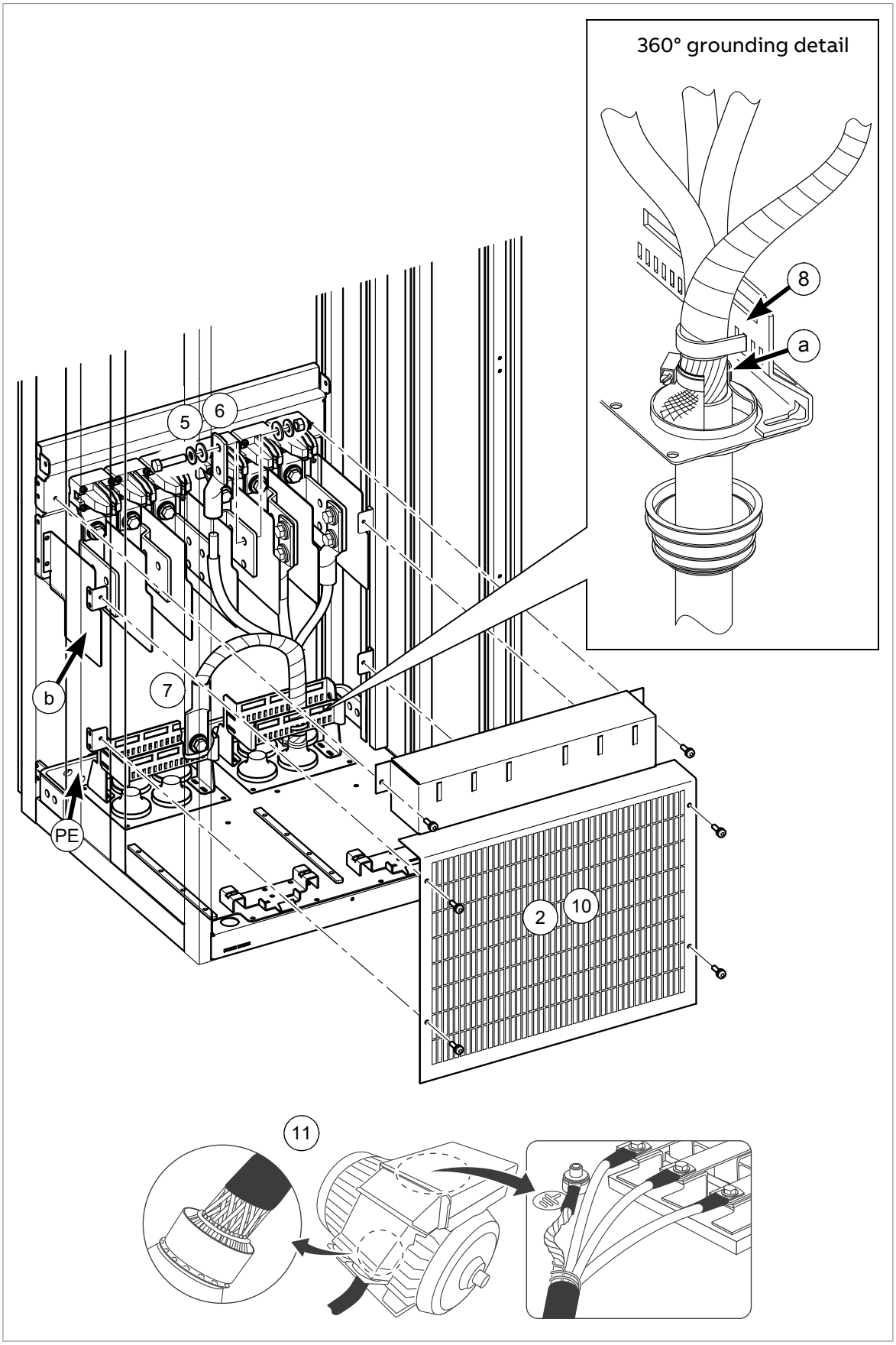
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

1. Do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Remove the shroud in front of the output busbars.
3. For 360° grounding of the shield at the cable entry, remove the outer jacket of each cable where they pass through the cable entry (a).
4. Cut the cable to suitable length and strip the ends of the individual conductors. Twist the shield strands together to form a separate conductor and wrap it with tape.
5. Crimp suitable lug terminals onto the phase conductors and the ground conductor. The dimensions of the output busbars are shown in chapter Technical data.
6. Connect the phase conductors of the motor cable to the U2, V2 and W2 terminals. Refer to section Use of fasteners in cable lug connections (page 61). You can temporarily remove the plastic insulators (b) between the busbars to make the installation work easier.

   WARNING!
   The plastic insulators (b) between the busbars must be in place when the inverter is powered.

7. Connect the shield (and any grounding conductors) of the cable to the PE busbar close to the cable entries.
8. Secure the cable mechanically.
9. Repeat the procedure for other modules (if any).
10. Install the shroud removed earlier.
11. At the motor, connect the cables according to instructions from the motor manufacturer. Pay special attention to the phase order. For minimum radio-frequency interference, ground the cable shield 360° at the cable entry of the motor terminal box, or ground the cable by twisting the shield so that the flattened shield is wider than 1/5 of its length.


360° grounding detail
8
a
5
6
7
b
PE
2
10
11

Installing the fan carriage of an inverter module

If the inverter module was removed completely instead of only the fan carriage, proceed to section Installing an inverter module (page 131).

The installation of the fan carriage is the removal procedure in reverse. See section Removing the fan carriage of an inverter module (page 54).

Installing an inverter module

Refer to section Installing an inverter module (page 131).

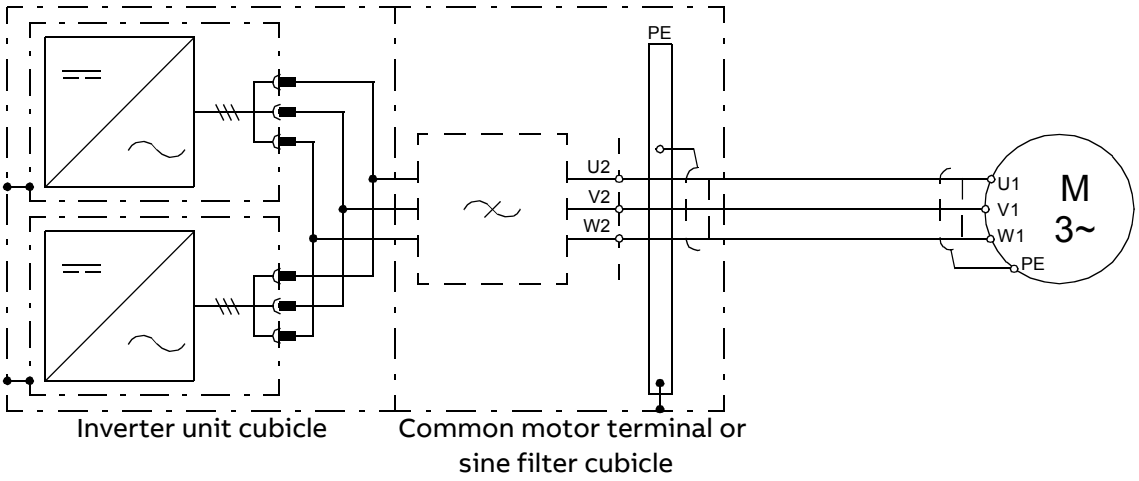
Connecting the motor cables – Frame size R8i and multiples with common motor terminal cubicle

Output busbars

If the drive is equipped with option +H359, the motor cables connect to a common motor terminal cubicle. Similarly, if the drive is equipped with option +E206 (sine output filter), the motor cables connect to the output busbars in the sine filter cubicle.

The location and dimensions of the busbars are visible in the dimensional drawings delivered with the drive.

Connection diagram



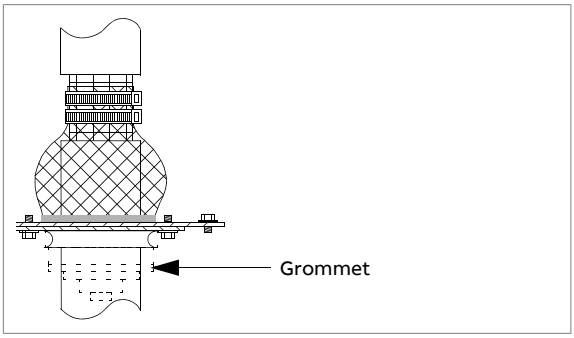
The recommended cable types are given in the technical data.

Procedure

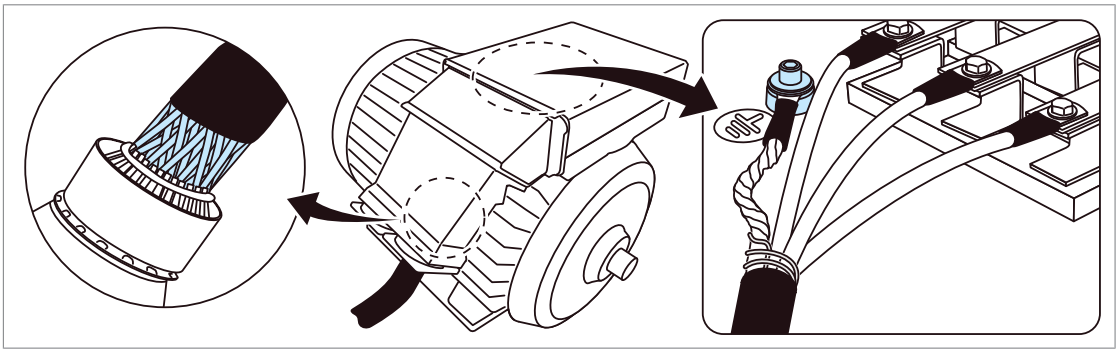
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

1. Do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Open the door of the cubicle and remove the shrouding.
3. Lead the cables into the cubicle. Make the 360° grounding arrangement at the cable entry as shown.



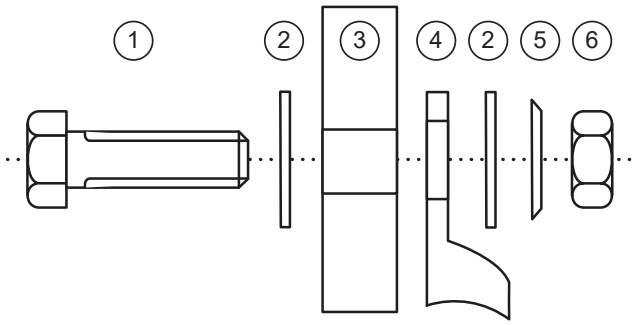
4. Cut the cables to suitable length. Strip the cables and conductors.
5. Twist the cable screens into bundles and connect the bundles to the PE busbar in the cubicle.
6. Connect any separate ground conductors/cables to the PE busbar in the cubicle. Refer to section Use of fasteners in cable lug connections (page 61).
7. Connect the phase conductors to the output terminals. Use the tightening torques specified in section Tightening torques (page 163).
8. Install the shrouding that was removed earlier and close the cubicle doors.
9. At the motor, connect the cables according to instructions from the motor manufacturer. Pay special attention to the phase order. For minimum radio-frequency interference, ground the cable shield 360° at the cable entry of the motor terminal box, or ground the cable by twisting the shield so that the flattened shield is wider than 1/5 of its length.



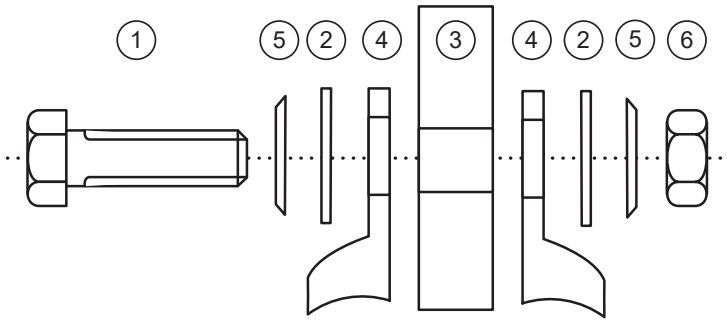
Use of fasteners in cable lug connections

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

Installing optional modules on the control unit

Installing an FSO safety functions module (frame sizes R1i...R7i)

If you need to install multiple optional modules on the control unit, install the FSO module first.

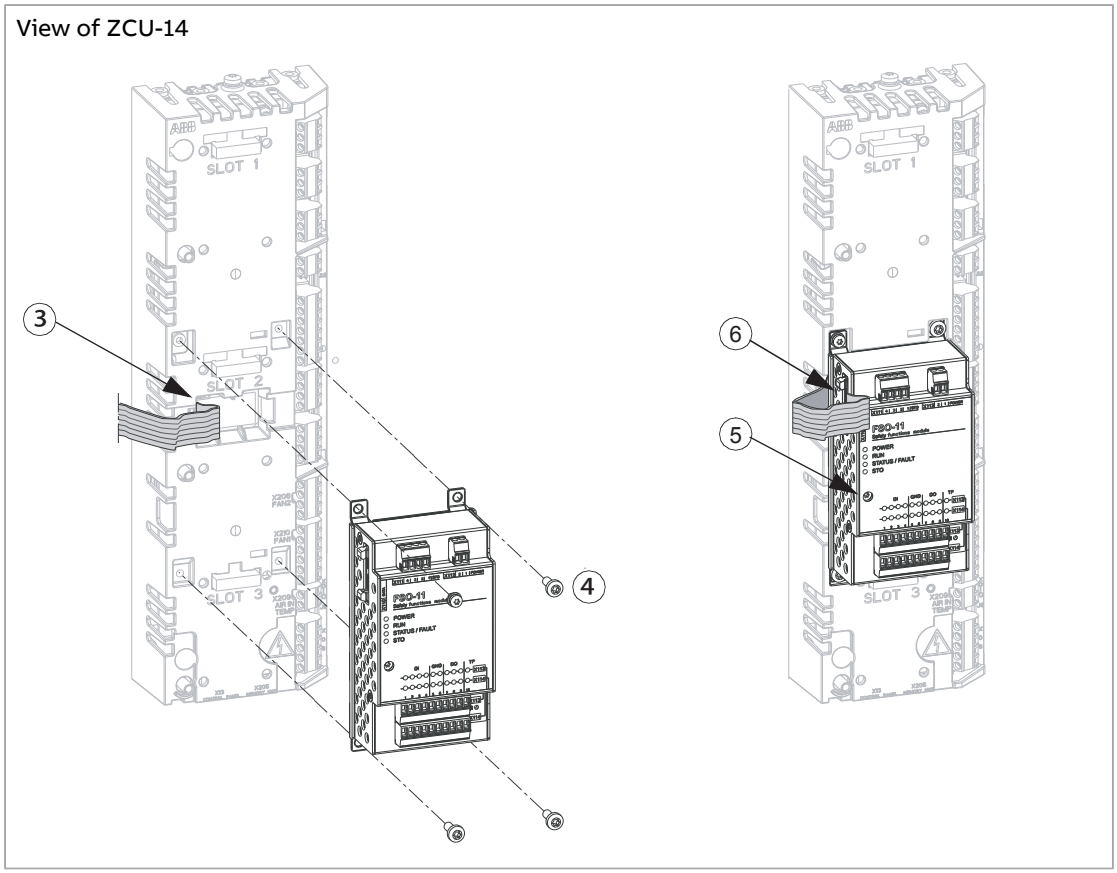
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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 44) before you start the work.
2. The FSO module comes with alternative bottom plates for mounting on different control units. Replace the bottom plate of the FSO module if necessary.
3. Connect the data cable to connector X12 on the control unit.
4. Put the FSO module into its position on SLOT 2 of the control unit. Attach the module by the bottom plate with four screws.
5. Torque the FSO module electronics grounding screw to 0.8 N·m (7.1 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.
6. Connect the other end of the data cable to connector X110 on the FSO module.
7. To complete the installation, refer to the instructions in the user's manual delivered with the FSO module.

View of ZCU-14



Installing an FSO safety functions module (frame sizes R8i and multiples)

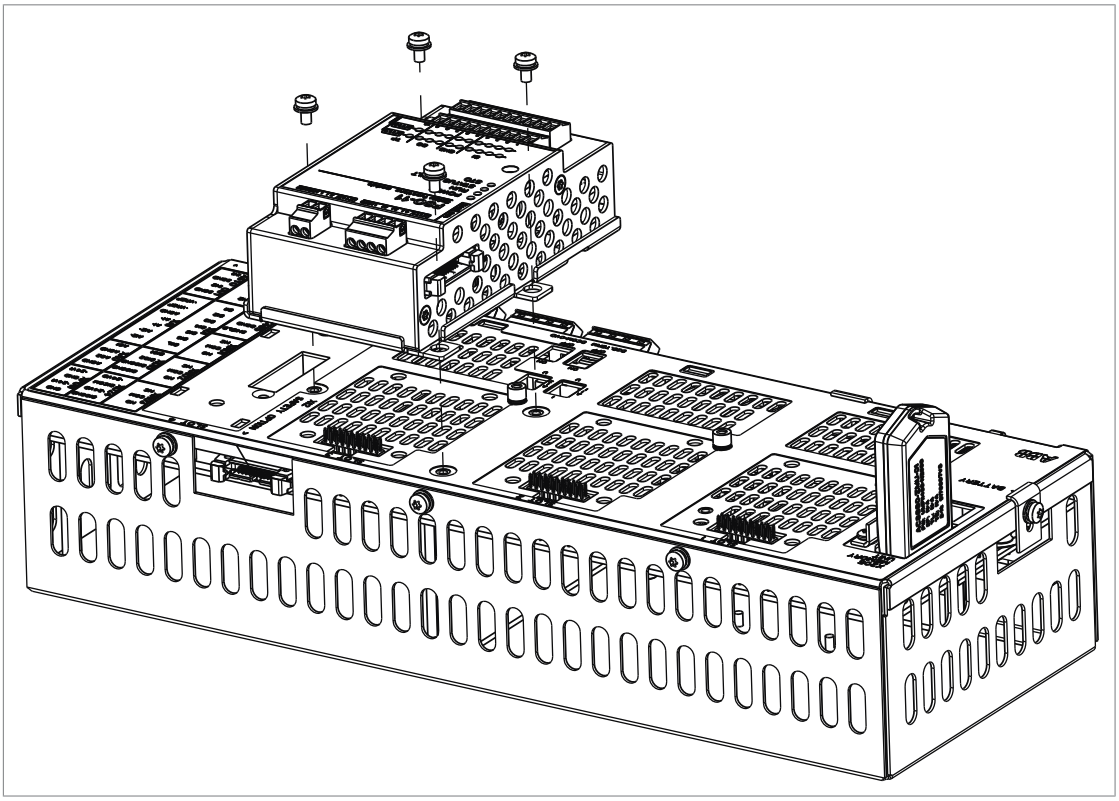
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

This procedure describes the installation of an FSO safety functions module onto the BCU control unit. As an alternative, the FSO module can be installed adjacent to the control unit, which is the standard method for factory-installed FSO modules. For instructions, refer to the applicable FSO module user's manual.

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) before you start the work.
2. The FSO module comes with alternative bottom plates for installation onto different control units. For installation onto a BCU control unit, the mounting points should be located at the long edges of the module as shown in the illustration below. If necessary, replace the bottom plate of the FSO module.

3. Attach the FSO module onto slot 3 of the BCU control unit [A41] with four screws.

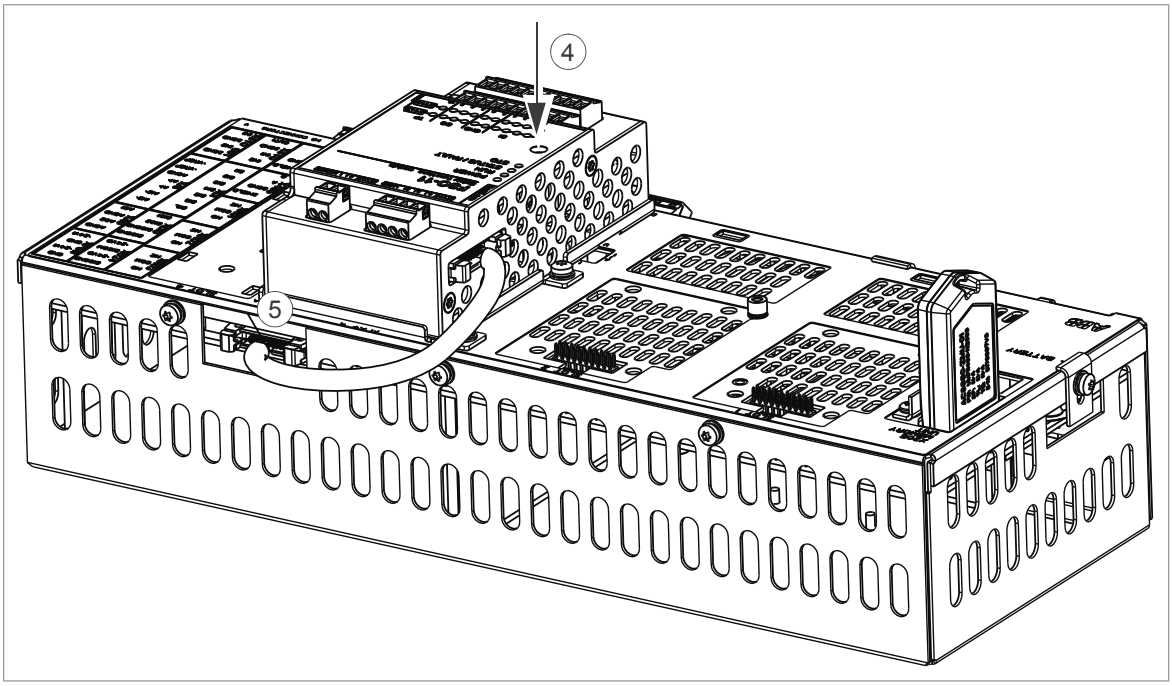


4. Torque the FSO module electronics grounding screw to 0.8 N·m (7.1 lbf·in).

   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.

5. Connect the FSO module data cable between FSO connector X110 and BCU connector X12.

6. To complete the installation, refer to the instructions in the applicable FSO module user's manual.



Installation of I/O extension, fieldbus adapter and pulse encoder interface modules

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

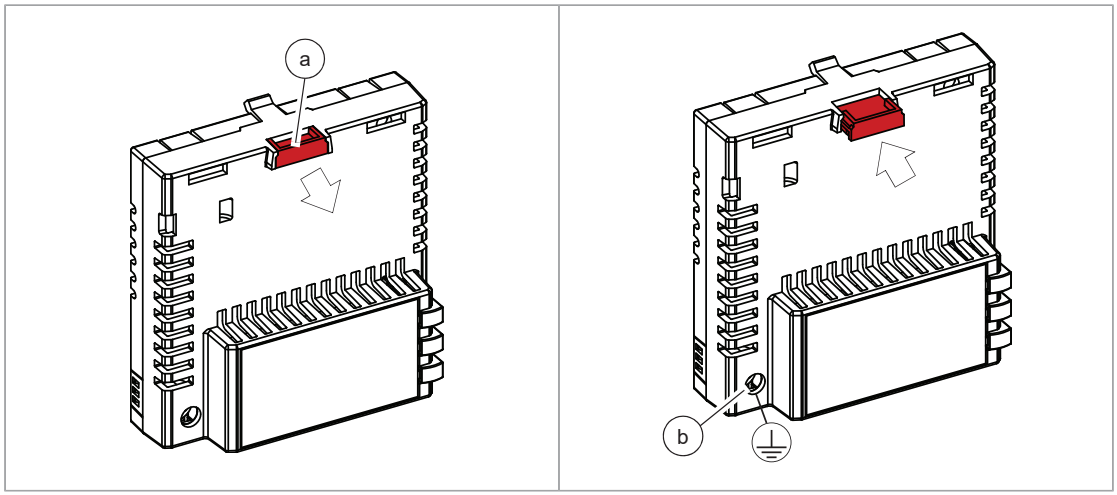
Pay attention to the free space required by the cabling or terminals coming to the option modules.

1. Repeat the steps described in Electrical safety precautions (page 44).
2. Pull out the lock (a) with a screw driver.

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

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

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



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

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

Connecting the control cables

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

Control cable connection procedure

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

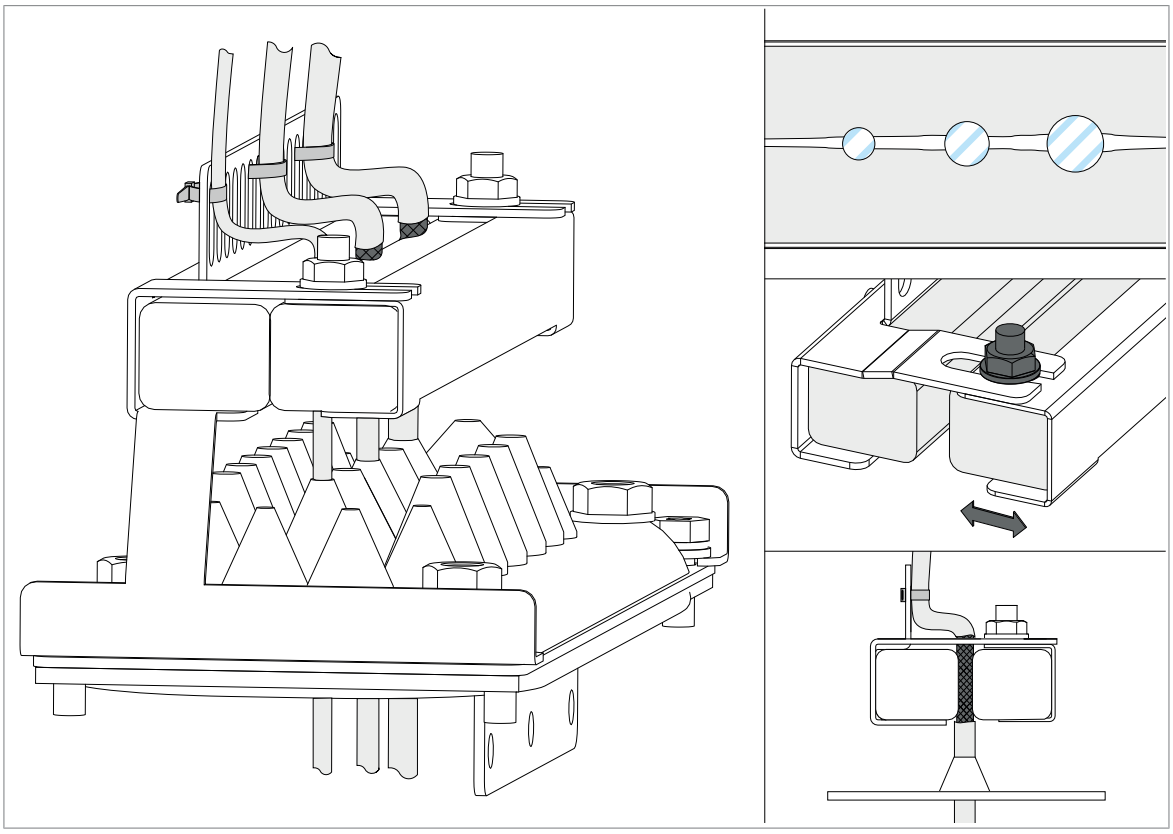
If you are not a qualified electrical professional, do not do installation or maintenance work.

1. Stop the drive (if running) and do the steps in section Electrical safety precautions (page 44) 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 66).
3. Route the control cables as described in section Routing the control cables inside the cabinet (page 68).
4. Connect the control cables as described in section Connecting control cabling (page 68).

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

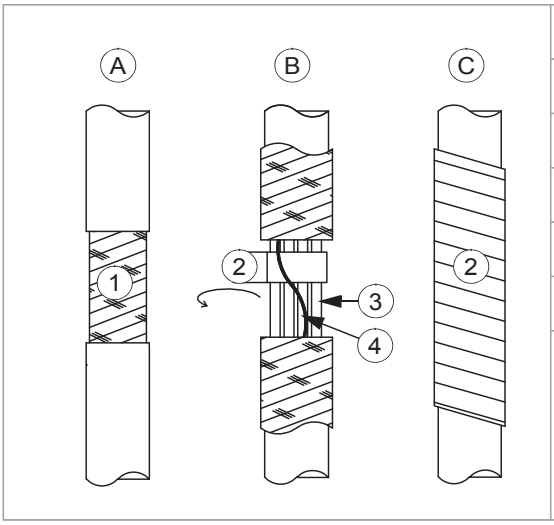
Ground the outer shields of all control cables 360° with the EMI conductive cushions at the cabinet entry. The grounding principle is the same for top and bottom entry cables. The figures show the bottom entry. The actual design details can vary.

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:

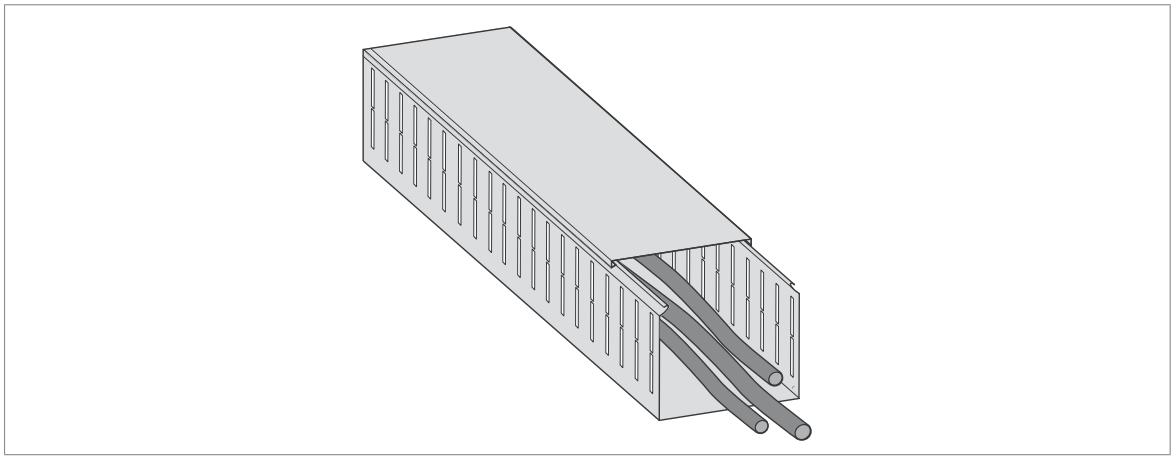
- Cut the shield at the midpoint of the peeled part. Be careful not to cut the conductors or the grounding wire.
- Turn the conductive side of the shield inside out over the insulation.
- Cover the exposed shield and the peeled cable with copper foil to keep the shielding continuous.



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

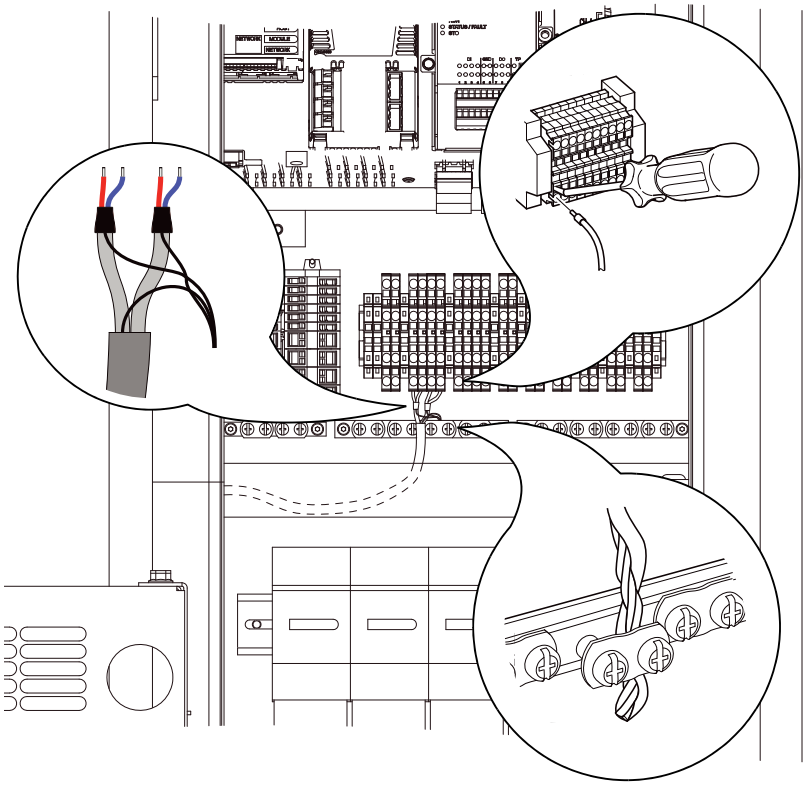
Connect the conductors to the appropriate terminals. Refer to the wiring diagrams delivered with the drive.

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

Obey these instructions:

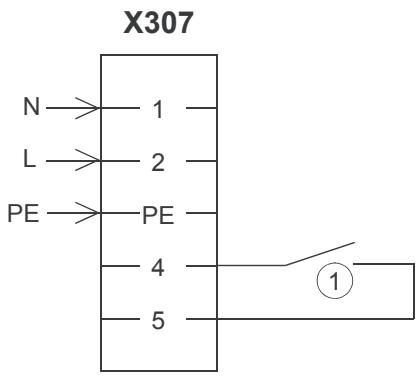
- Connect the inner twisted pair shields and all separate grounding wires to the grounding clamps near the terminals.
- Ground the outer shield of the cable at the cable entry, not at the grounding clamps near the terminals.
- Keep any signal wire pairs twisted as close to the terminals as possible. 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.



Connecting a 230/115 V AC auxiliary voltage supply (UPS, option +G307)

Wire the external control voltage to terminal block X307 as shown below.



1 Internal wiring of UPS supervision: circuit breaker or fuse off/fault = contact open.

Connecting the emergency stop push buttons (options +Q951, +Q952, +Q963, +Q964, +Q978,+Q979)

Connect external emergency stop push buttons according to the circuit diagrams delivered with the drive.

Connecting the emergency stop push buttons (option +Q951)

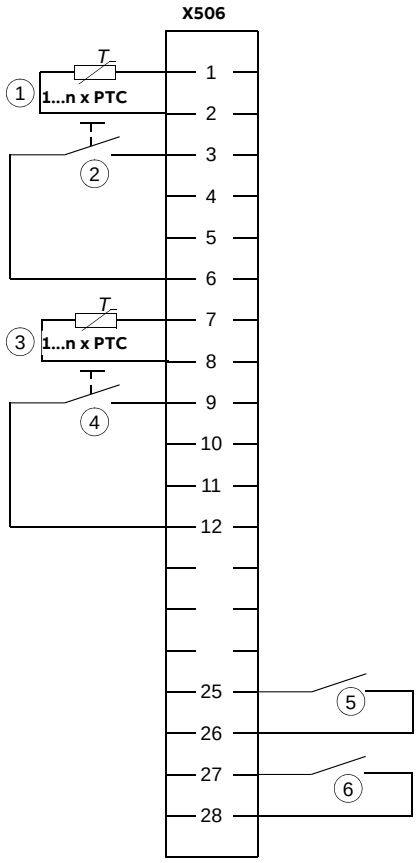
Connect external emergency stop push buttons (if any) according to the circuit diagrams delivered with the drive.

Wiring the starter for auxiliary motor fan (options +M6xx)

Connect the power supply wires for the auxiliary motor fan to terminal blocks X601…X605 according to the circuit diagrams delivered with the drive.

Wiring the PTC thermistor relay(s) (options +L505, +2L505, +L513 and +2L513)

The external wiring of option +2L505 and +2L513 (two thermistor relays) is shown below. For example, one relay can be used to monitor the motor windings, the other to monitor the bearings. The maximum contact load capacity is 250 V AC 10 A. For the actual wiring, see the circuit diagram delivered with the drive. For instructions on commissioning options +L513 and +2L513, see ATEX-certified motor thermal protection functions for cabinet-built ACS880 drives (options +L513+Q971 and +L514+Q971) user's manual (3AXD50000014979 [English]).



1 PTC sensors monitored by relay K74.
$R_G = R_1 + R_2 + R_N < 1.5$ kohm.

2 External reset for relay K74.

Note: With +L505 and +2L505, the terminals can be bridged for automatic reset. However, this is not allowed by ATEX regulations.

3 PTC sensors monitored by relay K75.
$R_G = R_1 + R_2 + R_N < 1.5$ kohm.

4 External reset for relay K75.

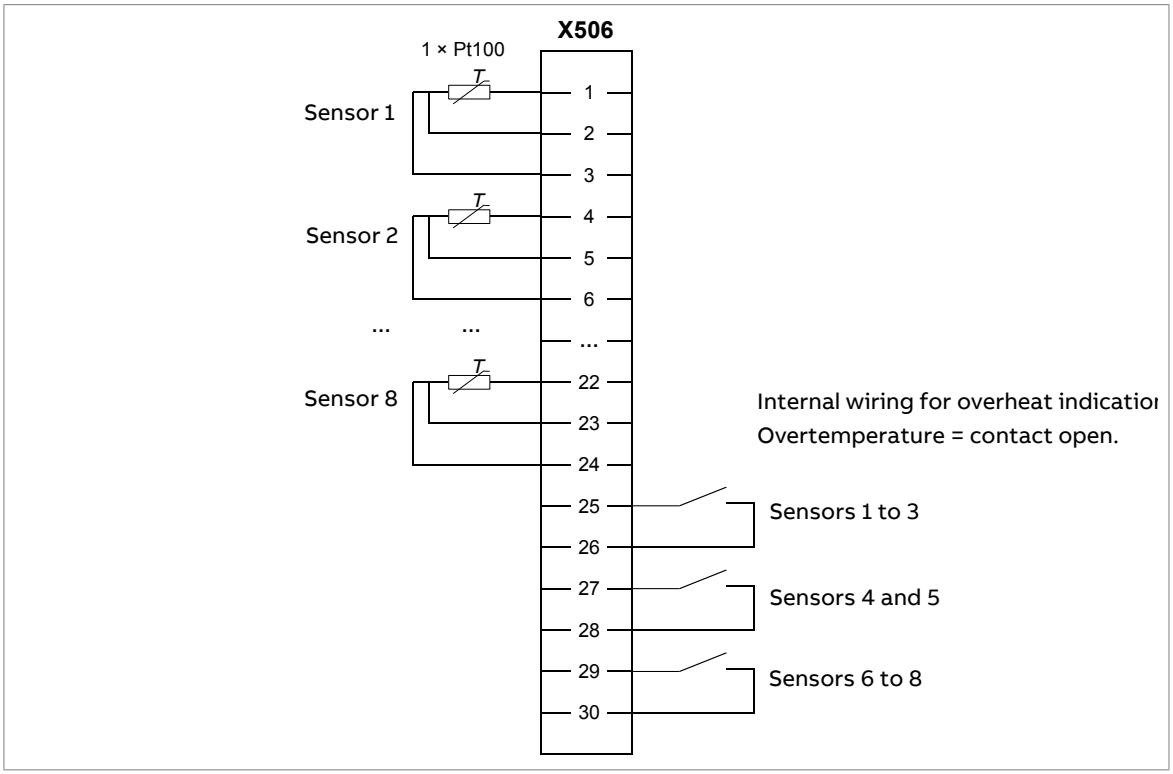
Note: With +L505 and +2L505, the terminals can be bridged for automatic reset. However, this is not allowed by ATEX regulations.

5 Overheat indication from relay K74: overtemperature = contact open.

6 Overheat indication from relay K75: overtemperature = contact open.

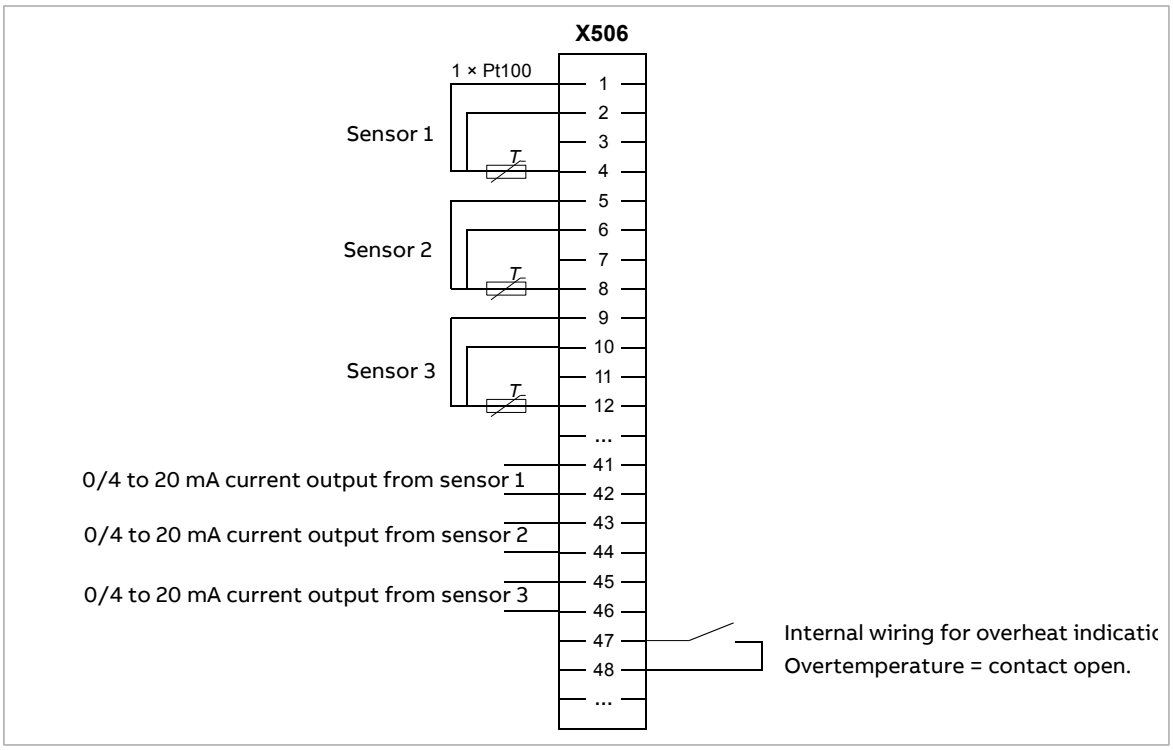
Wiring the Pt100 relays (option +nL506)

External wiring of eight Pt100 sensor modules is shown below. Contact load capacity 250 V AC 10 A. For the actual wiring, see the circuit diagram delivered with the drive.



Wiring the Pt100 relays (option +nL514)

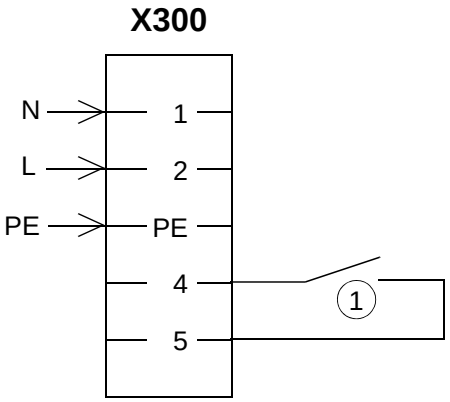
External wiring of three Pt100 sensor modules is shown below. Contact load capacity 250 V AC 10 A. For the actual wiring, see the circuit diagram delivered with the drive. For instructions on commissioning option +nL514, see ATEX-certified motor thermal protection functions for cabinet-built ACS880 drives (options +L513+Q971 and +L514+Q971) user's manual (3AXD50000014979 [English]).



Powering the heating and lighting equipment (options +G300, +G301 and +G313)

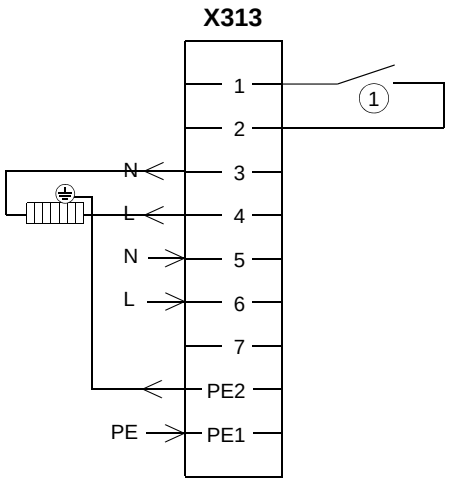
See the circuit diagrams delivered with drive.

Connect the external power supply wires for the cabinet heater and lighting to terminal block X300 at the back of the mounting plate.



1 Internal wiring of the cabinet heater: heater off/fault = contact open.

Connect the motor heater wiring to terminal block X313 as shown below. Maximum external power supply 16 A.



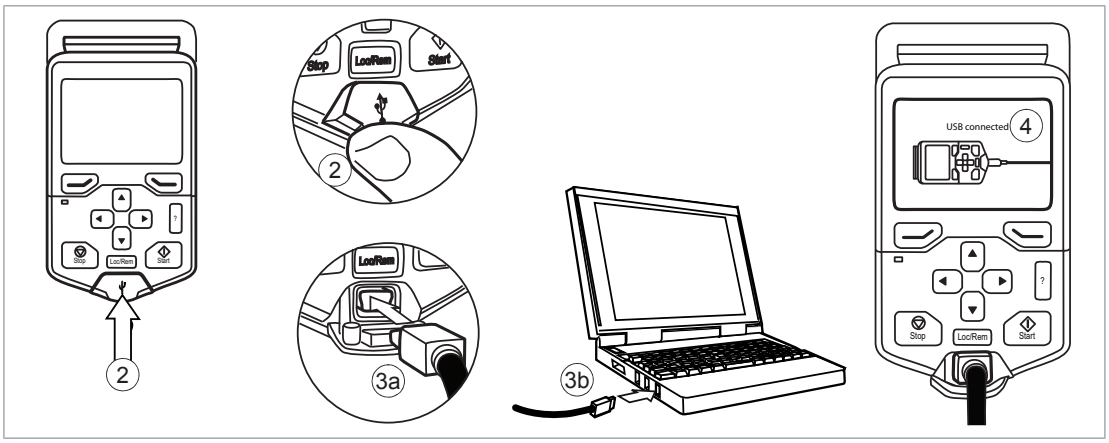
1 Internal wiring of the motor space heater supervision: heater off/fault = contact open.

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.



Panel bus (control of several units from one control panel)

One control panel (or PC) can be used to control several drives (or inverter units, supply units etc.) by constructing a panel bus. This is done by daisy-chaining the panel connections of the drives. Some drives have the necessary (twin) panel connectors in the control panel holder; those that do not require the installation of an FDPI-02 module (available separately). For further information, see the hardware description and FDPI-02 diagnostics and panel interface user's manual (3AUA0000113618 [English]).

The maximum allowed length of the cable chain is 100 m (328 ft).

1. Connect the panel to one drive using an Ethernet (for example Cat 5e) cable.
   - Use Menu - Settings - Edit texts - Drive to give a descriptive name to the drive
   - Use parameter 49.01* to assign the drive with a unique node ID number
   - Set other parameters in group 49* if necessary
   - Use parameter 49.06* to validate any changes.

   *The parameter group is 149 with supply (line-side), brake or DC/DC converter units.

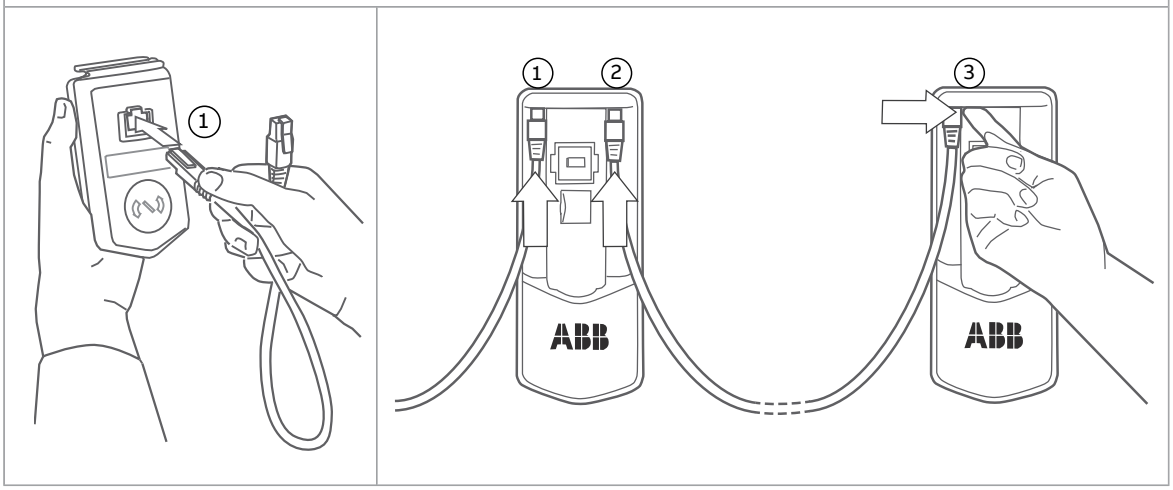
   Repeat the above for each drive.
2. With the panel connected to one unit, link the units using Ethernet cables.
3. Switch on the bus termination on the drive that is farthest from the control panel in the chain.
   - With drives that have the panel mounted on the front cover, move the terminating switch into the outer position.
   - With the FDPI-02 module: move termination switch S1 on the FDPI-02 module into the TERMINATED position.

Make sure that bus termination is off on all other drives.

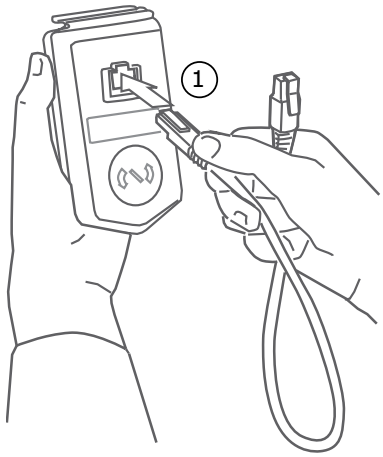
4. On the control panel, switch on the panel bus functionality (Options - Select drive - Panel bus). The drive to be controlled can now be selected from the list under Options - Select drive.

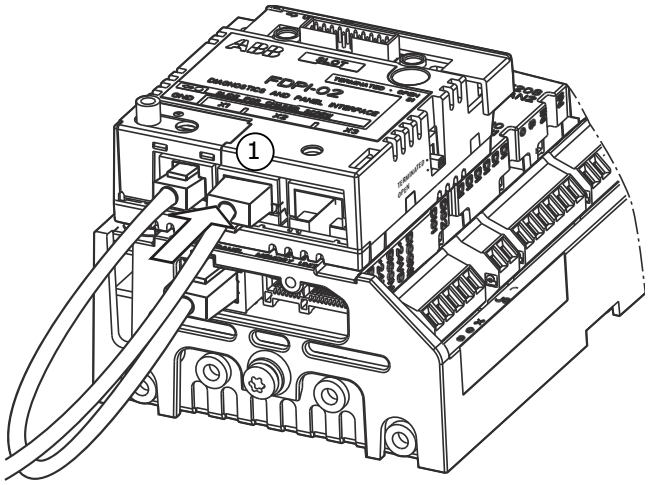
If a PC is connected to the control panel, the drives on the panel bus are automatically displayed in the Drive Composer PC tool.

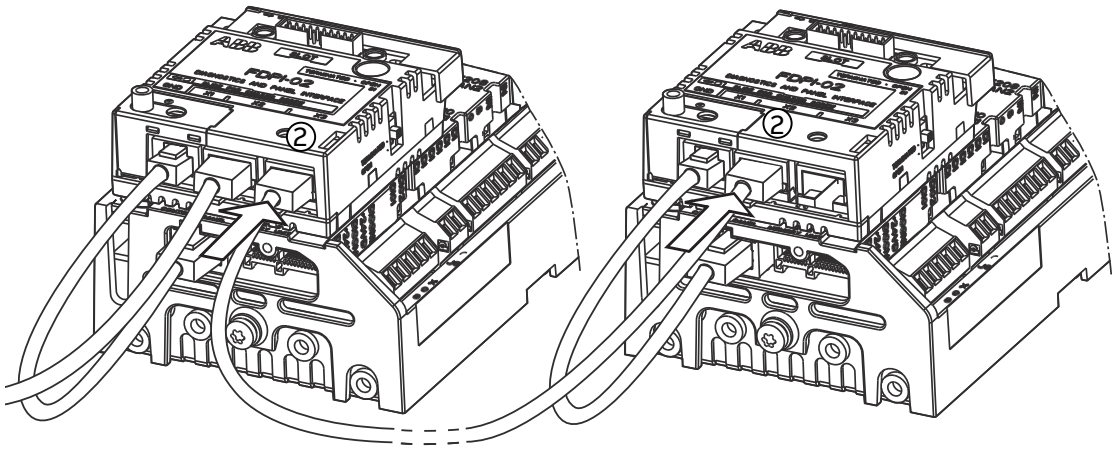
With twin connectors in the control panel holder:

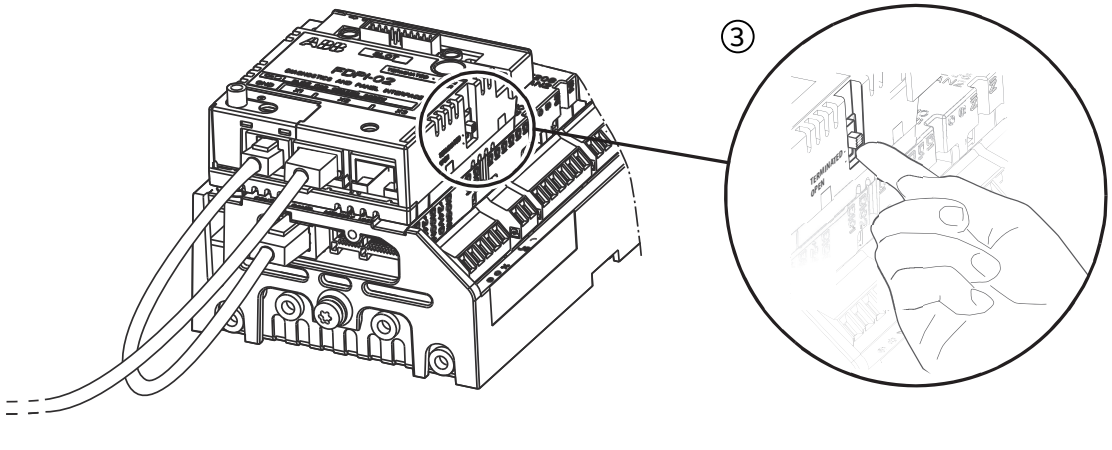


With FDPI-02 modules:









4

Control units of the drive

Contents of this chapter

This chapter

- describes the connections of the control unit(s) used in the drive,
- contains the specifications of the inputs and outputs of the control unit(s).

General

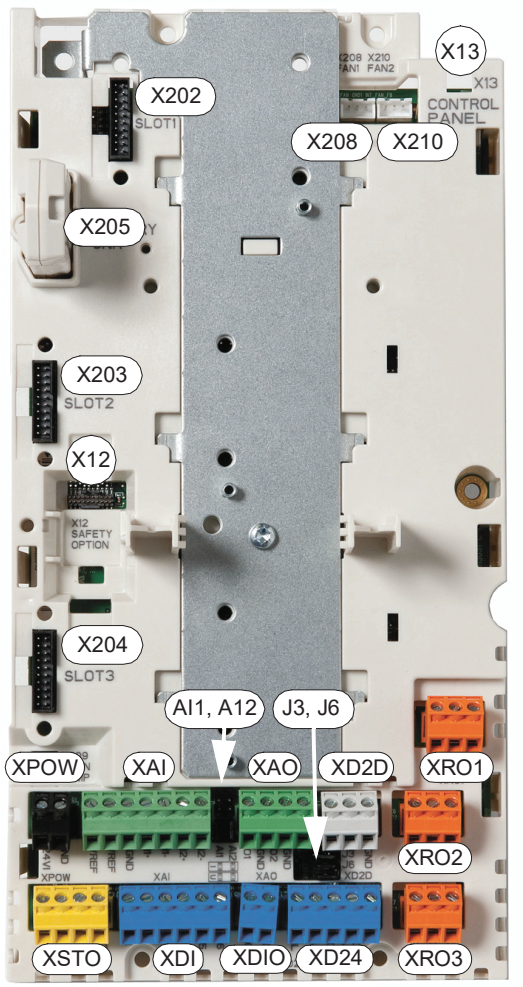
The inverter unit uses one of these control units:

- frame sizes R1i…R4i, R6i and R7i: ZCU-14 control unit
- frame size R5i: ZCU-12 control unit
- frame size R8i: BCU-02/12/22 control unit.

The control unit is connected to the inverter module(s) through fiber optic cables.

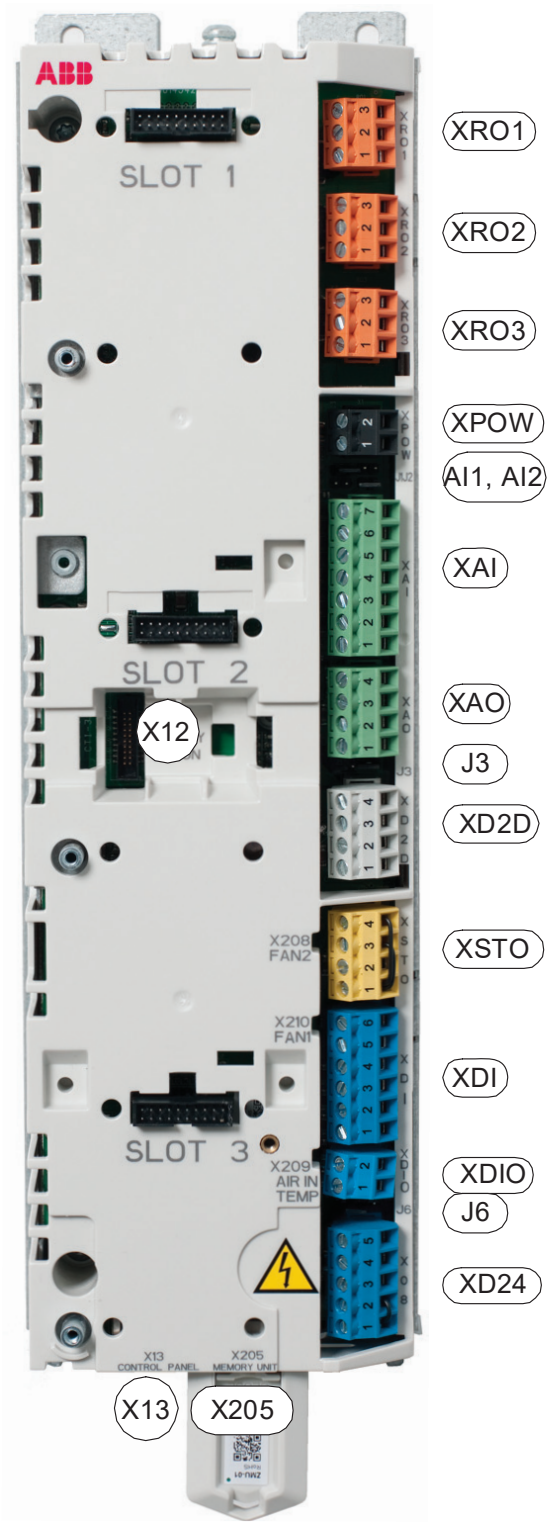
Different types of BCU control units have a different number of fiber optic connection ports. For more information, refer to the control unit hardware manual.

ZCU-12 layout



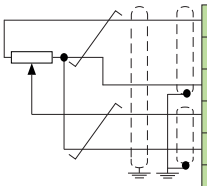
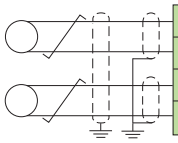
	Description
XAI	Analog inputs
XAO	Analog outputs
XDI	Digital inputs
XDIO	Digital input/outputs
XD24	Digital input interlock (DIIL) and +24 V output
XD2D	Drive-to-drive link
XPOW	External power input
XRO1	Relay output RO1
XRO2	Relay output RO2
XRO3	Relay output RO3
XSTO	Safe torque off connection
X12	Connection for FSO safety functions module
X13	Control panel connection
X202	Option slot 1
X203	Option slot 2
X204	Option slot 3
X205	Memory unit connection (memory unit inserted in the picture)
X208	Cooling fan 1 connection
X210	Cooling fan 2 connection
AI1, AI2	Current/Voltage selection jumpers (J1, J2) for analog inputs
J3	Drive-to-drive link termination switch (J3)
J6	Common digital input ground selection switch (J6)

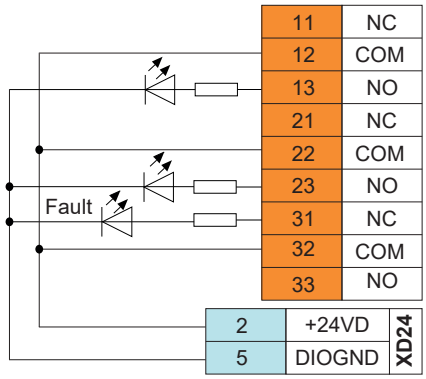
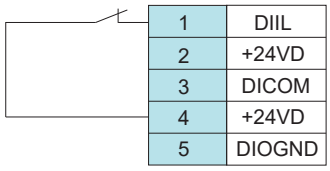
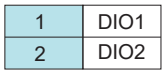
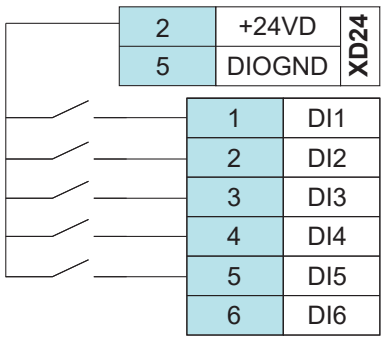
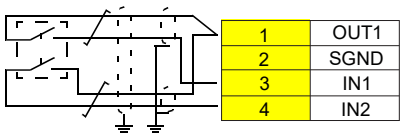
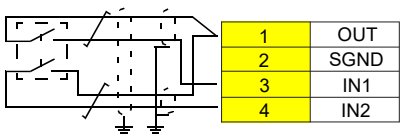
ZCU-14 layout



	Description
XPOW	External power input
XAI	Analog inputs
XAO	Analog outputs
XD2D	Drive-to-drive link
XRO1	Relay output RO1
XRO2	Relay output RO2
XRO3	Relay output RO3
XD24	Digital input interlock (DIIL) and +24 V output
XDIO	Digital input/outputs
XDI	Digital inputs
XSTO	Safe torque off connection (inverter unit only). **Note:** This connection only acts as a true Safe torque off input when the ZCU is controlling an inverter unit. When the ZCU is controlling a supply unit, de-energizing the inputs will stop the unit but will not constitute a true safety function.
X12	Connection for FSO safety functions module (inverter unit only).
X13	Control panel connection
X202	Option slot 1
X203	Option slot 2
X204	Option slot 3
X205	Memory unit connection (memory unit inserted in the drawing)
AI1, AI2	Voltage/Current selection jumpers (AI1, AI2) for analog inputs
J3	Drive-to-drive link termination switch (J3)
J6	Common digital input ground selection jumper (J6).

Default I/O diagram of the inverter control unit (ZCU)

Connection	Term	Description
XPOW External power input		
1 +24VI 2 GND	+24VI GND	24 V DC, 2 A min. (without optional modules)
XAI Reference voltage and analog inputs		
 1 +VREF 2 -VREF 3 AGND 4 AI1+ 5 AI1- 6 AI2+ 7 AI2- AI2:I AI1:I AI2:U AI1:U	+VREF	10 V DC, R_L 1…10 kohm
	-VREF	-10 V DC, R_L 1…10 kohm
	AGND	Ground
	AI1+ AI1-	**Speed reference** 0(2)…10 V, R_{in} > 200 kohm [1]
	AI2+ AI2-	By default not in use. 0(4)…20 mA, R_{in} = 100 ohm [1]
	AI1 (ZCU-12) J1 (ZCU-14)	Current (I) / voltage (U) selection jumper for AI1
	AI2 (ZCU-12) J2 (ZCU-14)	Current (I) / voltage (U) selection jumper for AI2
XAO Analog outputs		
 1 AO1 2 AGND 3 AO2 4 AGND	AO1 AGND	**Motor speed rpm** 0…20 mA, R_L < 500 ohm
	AO2 AGND	**Motor current** 0…20 mA, R_L < 500 ohm
XD2D Drive-to-drive link		
ZCU-12: 1 B 2 A 3 BGND ZCU-14: 1 B 2 A 3 BGND 4 Shield	B A BGND Shield (ZCU-14 only)	Master/follower, drive-to-drive or embedded fieldbus connection [2]
	J3	Drive-to-drive link termination [2]

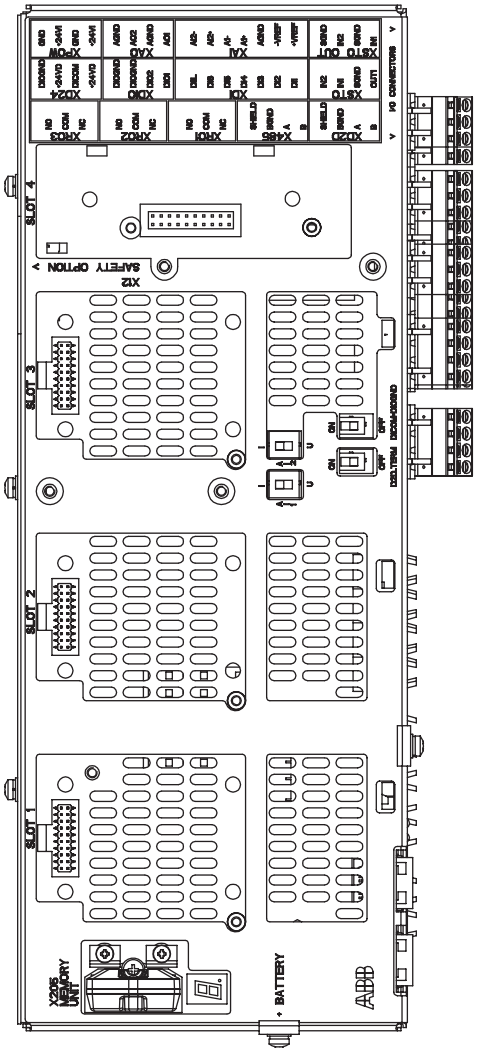
Connection	Term	Description
XRO1, XRO2, XRO3 Relay outputs		
	NC COM NO	**Ready run** 250 V AC / 30 V DC 2 A
	NC COM NO	**Running** 250 V AC / 30 V DC 2 A
	NC COM NO	**Fault (-1)** 250 V AC / 30 V DC 2 A
XD24 Auxiliary voltage output, digital interlock [3]		
	DIIL	Run enable [3]
	+24VD	+24 V DC 200 mA [4]
	DICOM	Digital input ground
	+24VD	+24 V DC 200 mA [4]
	DIOGND	Digital input/output ground
XDIO Digital input/outputs		
	DIO1	Output: Ready run
	DIO2	Output: Running
	J6	Ground selection [5]
XDI Digital inputs		
	DI1	Stop (0) / Start (1)
	DI2	Forward (0) / Reverse (1)
	DI3	Reset
	DI4	Acc/Dec time select [6]
	DI5	Constant speed 1 (1 = On) [7]
	DI6	By default, not in use.
 (ZCU-12)  (ZCU-14)	OUT1 (ZCU-12) OUT (ZCU-14)	Safe torque off circuits must be closed for the drive to start. [8]
	SGND	
	IN1	
	IN2	
X12	Safety options connection	
X13	Control panel connection	

Connection	Term	Description
X205	Memory unit connection	

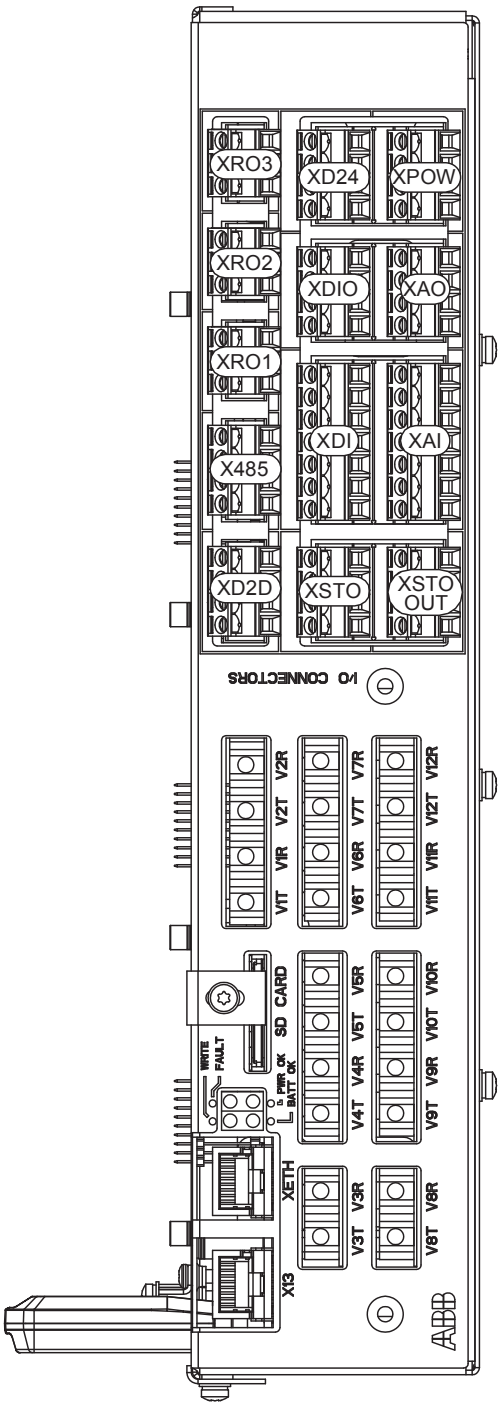
1) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by jumper. Change of setting requires reboot of control unit.
2) See section The XD2D connector (page 89)
3) See section DIIL input (page 89).
4) Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.
5) Determines whether DICOM is separated from DIOGND (ie. common reference for digital inputs floats; in practice, selects whether the digital inputs are used in current sinking or sourcing mode). See also ZCU ground isolation diagram (page 96). DICOM=DIOGND ON: DICOM connected to DIOGND. OFF: DICOM and DIOGND separate.
6) 0 = Acceleration/deceleration ramps defined by parameters *23.12*/*23.13* in use. 1 = Acceleration/deceleration ramps defined by parameters *23.14*/*23.15* in use.
7) Constant speed 1 is defined by parameter *22.26*.
8) See chapter The Safe torque off function (page 191).

The wire size accepted by all screw connectors (for both stranded and solid wire) is 0.5 … 2.5 mm^2 (24…12 AWG). The torque is 0.5 N·m (5 lbf·in).

BCU layout



	Description
I/O	I/O terminals (see following diagram)
SLOT 1	I/O extension, encoder interface or fieldbus adapter module connection. (This is the sole location for an FDPI-02 diagnostics and panel interface.)
SLOT 2	I/O extension, encoder interface or fieldbus adapter module connection
SLOT 3	I/O extension, encoder interface, field-bus adapter or FSO safety functions module connection
SLOT 4	RDCO-0x DDCS communication option module connection
X205	Memory unit connection
BATTERY	Holder for real-time clock battery (BR2032)
AI1	Mode selector for analog input AI1 (I = current, U = voltage)
AI2	Mode selector for analog input AI2 (I = current, U = voltage)
D2D TERM	Termination switch for drive-to-drive link (D2D)
DICOM= DIOGND	Ground selection. Determines whether DICOM is separated from DIOGND (ie. the common reference for the digital inputs floats). See the ground isolation diagram.
7-segment display Multicharacter indications are displayed as repeated sequences of characters	
o	(“U” is indicated briefly before “o”.) Control program running
U	Control program startup in progress
F	(Flashing) Firmware cannot be started. Memory unit missing or corrupted
1	Firmware download from PC to control unit in progress
2	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
X485	Not in use
V1T/V1R, V2T/V2R	Fiber optic connection to modules 1 and 2 (VxT = transmitter, VxR = receiver)
V3T/V3R … V7T/V7R	Fiber optic connection to modules 3…7 (BCU-12/22 only) (VxT = transmitter, VxR = receiver)
V8T/V8R … V12T/V12R	Fiber optic connection to modules 8…12 (BCU-22 only) (VxT = transmitter, VxR = receiver)
SD CARD	Data logger memory card for inverter module communication
BATT OK	Real-time clock battery voltage is higher than 2.8 V. If the LED is off when the control unit is powered, replace the battery.
FAULT	The control program has generated a fault. See the firmware manual of the supply/inverter unit.
PWR OK	Internal voltage supply is OK
WRITE	Writing to memory card in progress. Do not remove the memory card.

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

The table below describes the use of the connections in the inverter unit. Under normal circumstances, the factory-made wiring should not be changed.

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

Terminal			Description	
XD2D			Drive-to-drive link	
1 2 3 4	1	B	Drive-to-drive link. Refer to section The XD2D connector (page 89).	
	2	A		
	3	BGND		
	4	Shield		
ON OFF	D2D.TERM		Drive-to-drive link termination switch. Must be set to ON when the inverter unit is the first or last unit in the drive-to-drive (D2D) link. On intermediate units, set termination to OFF.	
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: **Ready** (Energized = Ready) 250 V AC / 30 V DC, 2 A
	12	COM	Common	
	13	NO	Norm. open	
	21	NC	Norm. closed	XRO2: **Running** (Energized = Running) 250 V AC / 30 V DC, 2 A
	22	COM	Common	
	23	NO	Norm. open	
	31	NC	Norm. closed	XRO3: **Fault (-1)** (Energized = No fault) 250 V AC / 30 V DC, 2 A
	32	COM	Common	
	33	NO	Norm. open	
XSTO, XSTO OUT			Safe torque off	
1 2 3 4 5 6 7 8	1	OUT	XSTO: Factory connection. Both circuits must be closed for the drive to start (IN1 and IN2 must be connected to OUT). Refer to chapter The Safe torque off function.	
	2	SGND		
	3	IN1		
	4	IN2		
	5	IN1	XSTO OUT: Safe torque off output to inverter modules.	
	6	SGND		
	7	IN2		
	8	SGND		
XDI			Digital inputs	

Terminal			Description
1 2 3 4 5 6 7	1	DI1	Stop (0) / Start (1)
	2	DI2	Forward (0) / Reverse (1)
	3	DI3	Reset
	4	DI4	Acceleration & deceleration select [1]
	5	DI5	Constant speed 1 select (1 = on) [2]
	6	DI6	Not in use by default.
	7	DIIL	Run enable [3]
XDIO			Digital input/outputs
1 2 3 4	1	DIO1	Output: Ready
	2	DIO2	Output: Running
	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 [4]
	6	DICOM	Digital input ground
	7	+24VD	+24 V DC 200 mA [4]
	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+	Speed reference. 0(2)…10 V, R_{in} > 200 kohm [5]
	5	AI1-	
	6	AI2+	Not in use by default. 0(4)…20 mA, R_{in} = 100 ohm [6]
	7	AI2-	
– ⊃	AI1		AI1 current/voltage selection switch
– ⊃	AI2		AI2 current/voltage selection switch
XAO			Analog outputs
1 2 3 4	1	AO1	**Motor speed rpm** 0 … 20 mA, R_L < 500 ohm
	2	AGND	
	3	AO2	**Motor current** 0 … 20 mA, R_L < 500 ohm
	4	AGND	
XPOW			External power input
1 2 3 4	1	+24VI	24 V DC, 2.05 A Two supplies can be connected for redundancy.
	2	GND	
	3	+24VI	
	4	GND	
X12			Safety functions module connection
X13			Control panel connection

Terminal	Description
X205	Memory unit connection

1) 0 = Acceleration/deceleration ramps defined by parameters 23.12/23.13 in use.
1 = Acceleration/deceleration ramps defined by parameters 23.14/23.15 in use.

2) Constant speed 1 is defined by parameter 22.26.

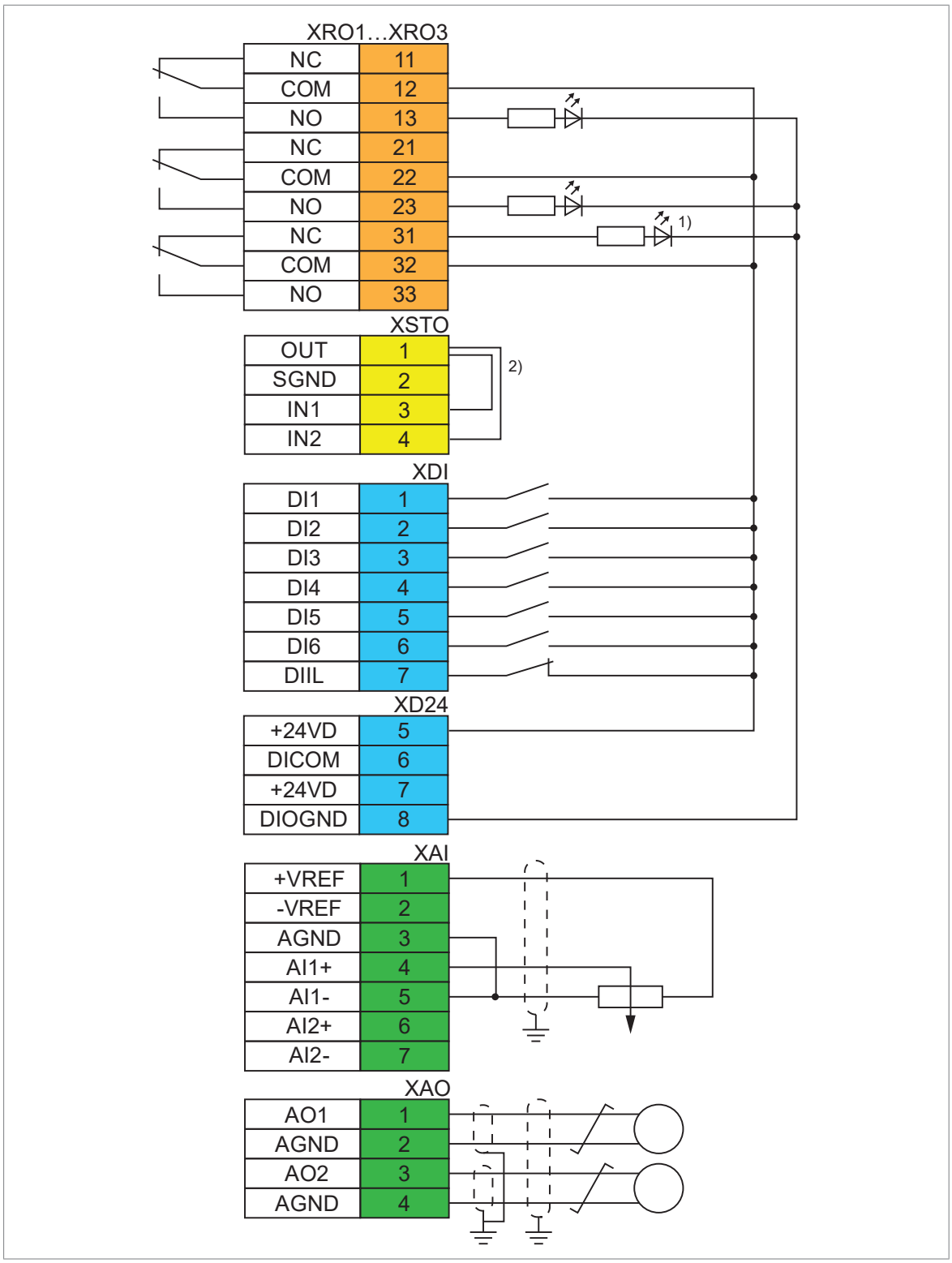
3) The DIIL input is configured to stop the unit when the input signal is removed. This input does not have a SIL or PL classification.

4) Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.

5) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by switch AI1. Change of setting requires reboot of control unit.

6) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by switch AI2. Change of setting requires reboot of control unit.

The diagram below shows the default I/O connections on the inverter control unit (A41).



1) Fault

2) If necessary, you can connect a safety device (for example, a safety relay) to the XSTO terminal. Refer to chapter The Safe torque off function.

Additional information on the connections

Power supply for the control unit (XPOW)

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

Using a second supply is recommended, if:

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

DIIL input

The DIIL input is used for the connection of safety circuits. The input is parametrized to stop the unit when the input signal is lost.

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

The XD2D connector

The XD2D connector provides an RS-485 connection that can be used for

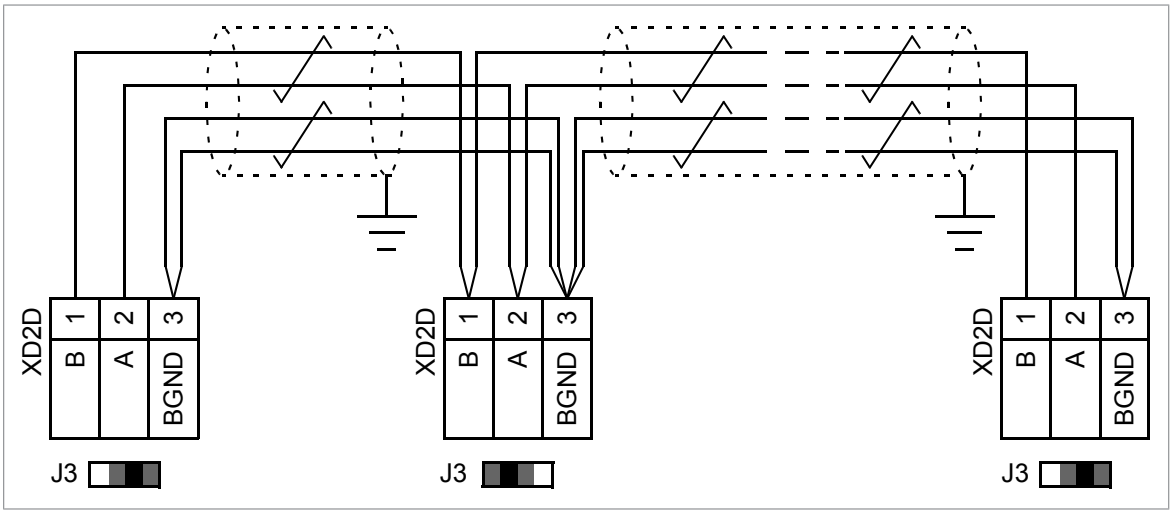
- basic master/follower communication with one master drive and multiple followers,
- fieldbus control through the embedded fieldbus interface (EFB), or
- drive-to-drive (D2D) communication implemented by application programming.

See the firmware manual of the drive for the related parameter settings.

Terminate the bus on the units at the ends of the drive-to-drive link. Disable bus termination on the intermediate units.

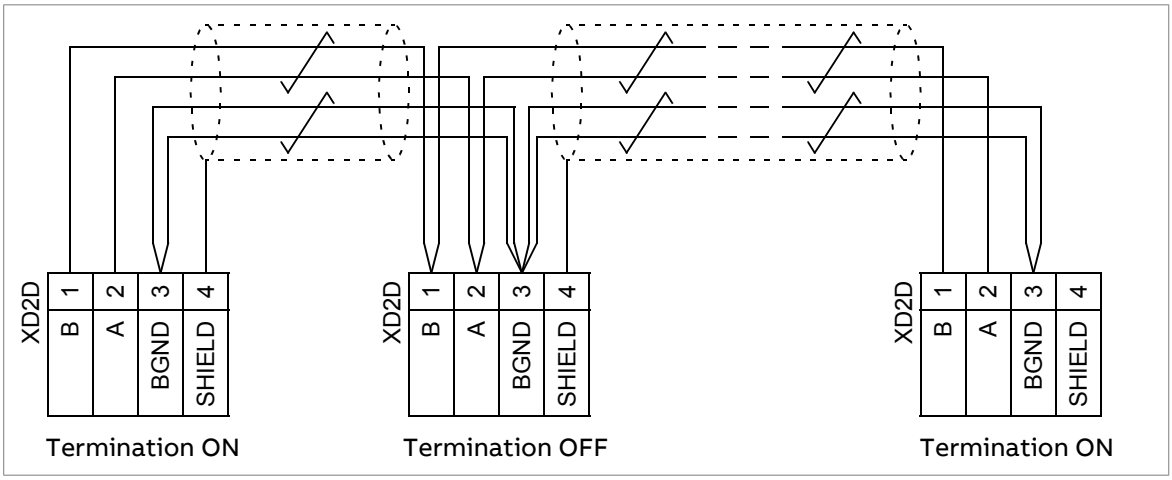
Use a shielded twisted-pair cable for data, and another pair or a wire for signal ground (nominal impedance 100…165 ohm, for example Belden 9842). For the best immunity, ABB recommends high quality cable. Keep the cable as short as possible. Avoid unnecessary loops and parallel runs near power cables such as motor cables.

The diagram that follows shows the wiring of the drive-to-drive link. The diagram is applicable to ZCU-12 control units.



The diagram that follows shows the wiring of the drive-to-drive link. The diagram is applicable to these control units:

- BCU-02/12/22
- ZCU-14



Safe torque off (XSTO, XSTO OUT)

See chapter The Safe torque off function (page 191).

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

FSO safety functions module connection (X12)

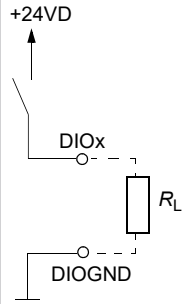
Refer to the applicable FSO module user's manual. Note that the FSO safety functions module is not used in supply, DC/DC converter or brake units.

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

SDHC memory card slot

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

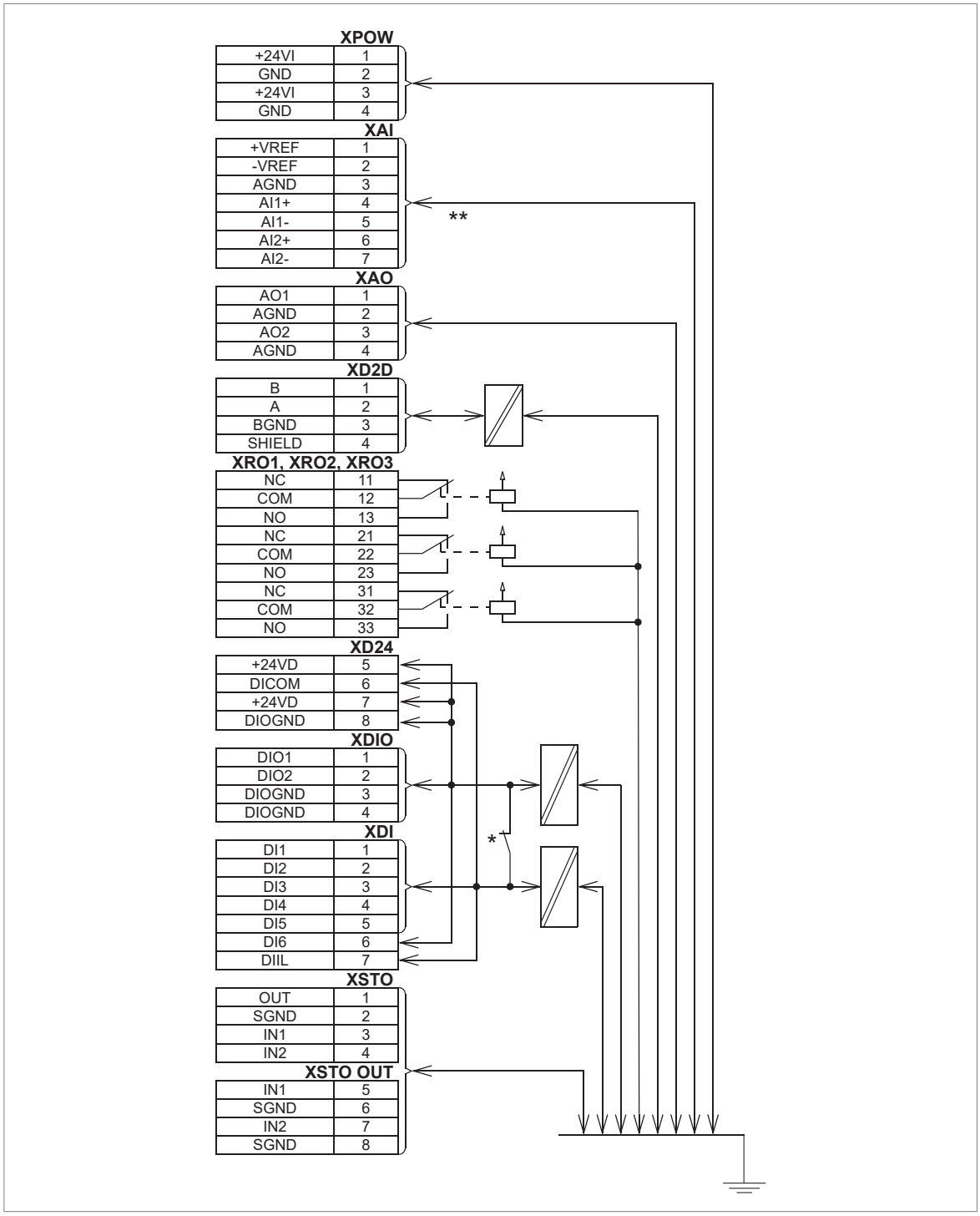
Connector data

Power supply (XPOW)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) 24 V (±10%) DC, 2 A (BCU) 24 V (±10%) DC, 2 A (ZCU) External power input. Two supplies can be connected to the BCU control unit for redundancy.
Relay outputs RO1…RO3 (XRO1…XRO3)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) 250 V AC / 30 V DC, 2 A Protected by varistors
+24 V output (XD24:2 and XD24:4)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) Total load capacity of these outputs is 4.8 W (200 mA / 24 V) minus the power taken by DIO1 and DIO2.
Digital inputs DI1…DI6 (XDI:1…XDI:6)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) 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 (XD24:1 [ZCU], XDI:7 [BCU])	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) 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.	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) As inputs: 24 V logic levels: "0" < 5 V, "1" > 15 V. R_{in}: 2.0 kohm. Filtering: 1 ms. As outputs: Total output current from +24VD is limited to 200 mA 
Reference voltage for analog inputs +VREF and -VREF (XAI:1 and XAI:2)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) 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 jumpers (ZCU) or switches (BCU)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) Current input: -20…20 mA, R_{in} = 100 ohm Voltage input: -10…10 V, R_{in} > 200 kohm Differential inputs, common mode range ±30 V Sampling interval per channel: 0.25 ms Hardware filtering: 0.25 ms Resolution: 11 bit + sign bit Inaccuracy: 1% of full scale range
Analog outputs AO1 and AO2 (XAO)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) 0…20 mA, R_{load} < 500 ohm Frequency range: 0…300 Hz (ZCU), 0…500 Hz (BCU) Resolution: 11 bit + sign bit Inaccuracy: 2% of full scale range
XD2D connector	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) 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 jumper (ZCU) or switch (BCU)
RS-485 connection (X485 [BCU])	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) 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)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) Input voltage range: -3…30 V DC Logic levels: "0" < 5 V, "1" > 17 V. **Note:** For the unit to start, both connections must be “1”. This applies to all control units (including drive, inverter, supply, brake, DC/DC converter etc. control units), but SIL/PL classified Safe torque off functionality is only achieved through the XSTO connector of the drive/inverter control unit. Current consumption (continuous) per STO channel: • Frames R1i…R4i: 56 mA • Frame R5i: 21 mA • Frames R6i…R7i: 41.5 mA • Frames R6i…R7i with option +V992: 25 mA • Frame R8i with BCU control unit: 66 mA per parallel inverter module EMC (immunity) according to IEC 61326-3-1 and IEC 61800-5-2 See also chapter The Safe torque off function (page 191).
Safe torque off output (XSTO OUT) (BCU control units only)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Maximum tightening torque 0.45 N·m (4 lbf·in[BCU]) To STO connector of inverter module.

Control panel connection (X13)	Connector: RJ-45 Cable length < 100 m (328 ft)
Ethernet connection (XETH [BCU])	Connector: RJ-45 This connection is not supported by the firmware
SDHC memory card slot (SD CARD [BCU])	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

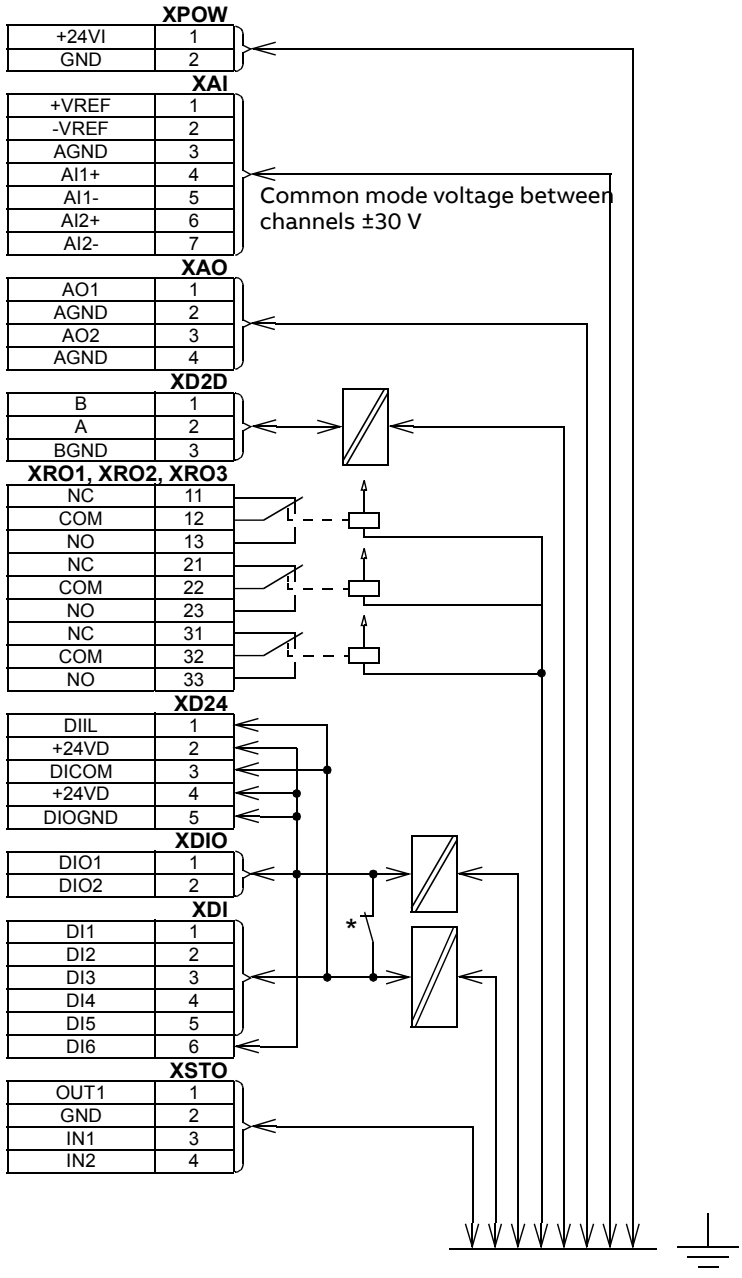


*Ground selector (DICOM=DIOGND) settings

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

ZCU ground isolation diagram



* Ground selector (J6) settings

 (ZCU-12)

 • (ZCU-14)

All digital inputs share a common ground (DICOM connected to DIOGND). This is the default setting.

 (ZCU-12)

•  (ZCU-14)

Ground of digital inputs DI1…DI5 and DIIL (DICOM) is isolated from DIO signal ground (DIOGND). Isolation voltage 50 V.

5

Installation checklist

Contents of this chapter

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

Checklist

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

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

WARNING!
Stop the drive and do the steps in section Electrical safety precautions (page 44) 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.	☐
If the drive is equipped with a DC/DC converter unit: 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.	☐
If the drive is equipped with a DC/DC converter unit: 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.	☐
If the drive is equipped with a DC/DC converter unit: The energy storage is equipped with fuses for protecting the energy storage cable in a cable short-circuit situation.	☐
If the drive is equipped with a DC/DC converter unit: 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.	☐

6

Start-up

Contents of this chapter

This chapter describes the hardware commissioning of the inverter unit. For information on setting up the control program, refer to the appropriate firmware manual. For information on commissioning the supply unit, refer to its hardware manual.

Start-up procedure

The tasks which are needed in certain cases only are marked with underlining, and option codes are given in brackets. Default device designations (if any) are given in brackets after the name, for example “main switch-disconnector (Q1)”. The same device designations are also used in the circuit diagrams.

These instructions cannot and do not cover all possible start-up tasks of a customized drive. Always refer to the delivery-specific circuit diagrams when proceeding with the start-up.

Note: For some options (such as safety options +L513, +L514, +L536, +L537, +Q950, +Q951, +Q952, +Q957, +Q963, +Q964, +Q965, +Q966, +Q978, +Q979), additional start-up instructions are given in their separate manuals.

Action	☑
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.	☐
Prerequisites	
The mechanical and electrical installation of the drive has been inspected and approved. See Installation checklist (page 97).	☐
The insulation resistance of the assembly has been checked according to instructions. See Electrical installation (page 43).	☐
The supply unit of the drive system has been started up according to the instructions in its hardware manual.	☐
Checks/Settings with no voltage connected	
Do the steps listed in Electrical safety precautions (page 44). Refer to the hardware manual of the supply unit for more information.	☐
Check the settings of breakers/switches in the auxiliary circuits. See the circuit diagrams delivered with the drive.	☐
Disconnect any unfinished or uninspected auxiliary voltage (115/230 V AC) cables that lead from the terminal blocks to the outside of the equipment.	☐
Make sure that both channels of the Safe torque off circuit connected to the STO input of the inverter control unit (A41) are closed. Refer to the wiring diagrams delivered with the drive. With parallel-connected frame R8i inverter modules, make sure that the STO OUT output on the inverter control unit (A41) is chained to the STO inputs of all inverter modules. If the Safe torque off functionality is not used, make sure that the STO input on all inverter modules is correctly wired to +24 V and ground.	☐
Drives with Pt100 relays (option +(n)L506): • Check the connections against the circuit diagrams of the delivery. • Set the alarm and trip levels of the Pt100 relays. Set the alarm and trip levels of the Pt100 relay as low as possible based on the operating temperature and test results of the machine. The trip level can be set, for example, 10 °C higher than what the temperature of the machine is at maximal load in the maximum environmental temperature. ABB recommends to set the operating temperatures of the relay, typically for example, as follows: • 120…140 °C when only tripping is in use • alarm 120…140 °C and trip 130…150 °C when both alarm and tripping are used.	☐
Powering up the auxiliary circuit of the drive	
Make sure that it is safe to connect voltage. Make sure that: • nobody is working on the drive or circuits that have been wired from outside into the drive cabinet • the cover of the motor terminal box is in place.	☐
Close the circuit breakers and/or fuse disconnectors supplying the auxiliary voltage circuits.	☐
Close the cabinet doors.	☐
Close the main breaker of the supply transformer.	☐
Switch on the auxiliary voltage.	☐
Setting up the inverter unit parameters, and performing the first start	
Set up the inverter control program. See the appropriate start-up guide and/or firmware manual. There is a separate start-up guide only for some control programs.	☐

Action	☑
With inverter units consisting of frame R8i modules, check the setting of parameter 95.09 Switch fuse controller.	☐
Drives with a sine output filter (option +E206): Make sure that bit 1 of parameter 95.15 Special HW settings is activated.	☐
Drives with an fieldbus adapter module (optional): Set the fieldbus parameters. Activate the appropriate assistant (if present) in the control program, or see the user's manual of the fieldbus adapter module, and the drive firmware manual. Check that the communication works between the drive and the PLC.	☐
Drives with an encoder interface module (optional): Set the encoder parameters. Activate the appropriate assistant (if present) in the control program, or see the user's manual of the encoder interface module, and the drive firmware manual.	☐
Powering up the main circuit of the drive	
Start the supply unit according to the instructions in its hardware manual.	☐
On-load checks	
Start the motor to perform the ID run.	☐
Make sure that the cooling fans rotate freely in the right direction, and the air flows upwards.	☐
Make sure that the motor starts, stops and follows the speed reference in the correct direction when controlled with the control panel.	☐
Make sure that the motor starts, stops and follows the speed reference in the correct direction when controlled through the customer-specific I/O or fieldbus.	☐
Drives in which the Safe torque off control circuit is in use: Test and validate the operation of the Safe torque off function. See section Validation test procedure (page 200).	☐
Drives with an emergency stop function (option +Q951, +Q952, +Q963, +Q964, +Q978, or +Q979): Test and validate the operation of the emergency stop function. Refer to the delivery-specific circuit diagrams and the applicable safety option user's manual.	☐
Drives with a Prevention of unexpected start-up function (option +Q950 or +Q957): Test and validate the operation of the POUS function. Refer to the delivery-specific circuit diagrams and the applicable safety option user's manual.	☐
Drives with a Safely-limited speed function (option +Q965 or +Q966): Test and validate the operation of the SLS function. Refer to the delivery-specific circuit diagrams and the applicable safety option user's manual.	☐
Drives with a motor thermal protection function (option +L513, +L514, +L536, or +L537): Test and validate the operation of the motor thermal protection function. Refer to the delivery-specific circuit diagrams and the applicable safety option user's manual.	☐

7

Maintenance

Contents of this chapter

This chapter contains preventive maintenance instructions.

Maintenance intervals

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

Description of symbols

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

Recommended maintenance intervals after start-up

Recommended annual actions by the user	
Connections and environment	
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

Recommended annual actions by the user	
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
Cooling							
Inverter module main cooling fan			R			R	
Frame R5i auxiliary cooling fan			R			R	
Circuit board cooling fan			R			R	
Cabinet cooling fan, internal (50 Hz)			R			R	
Cabinet cooling fan, internal (60 Hz)		R		R		R	
Cabinet cooling fan, door (50 Hz)			R			R	
Cabinet cooling fan, door (60 Hz)			R			R	
NSIN filter cooling fan			R			R	
Aging							
ZCU/BCU control unit battery (Real-time clock)		R		R		R	
Control panel battery (Real-time clock)			R			R	
Cabinet auxiliary power supplies				R			
Functional safety							
Safety function test	I Refer to the maintenance information of the safety function.						
Safety component expiry (Mission time T_M)	20 years						

Note:

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

Maintenance timers and counters

The control program has maintenance timers and counters that can be configured to generate a warning when a pre-defined limit is reached. Each timer/counter can be

set to monitor any parameter. This feature is especially useful as a service reminder. For more information, see the firmware manual.

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 44) 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 exterior of the drive

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.

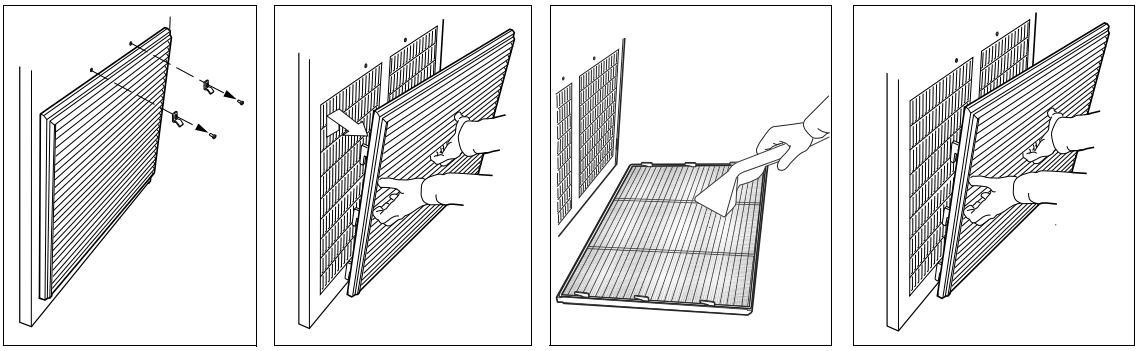
1. Stop the drive and do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Clean the exterior of the drive. Use:
   - vacuum cleaner with an antistatic hose and nozzle
   - soft brush
   - dry or damp (not wet) cleaning cloth. Moisten with clean water, or mild detergent (pH 5…9 for metal, pH 5…7 for plastic).

WARNING!
Prevent water from entering the drive. Never use excessive amount of water, a hose, steam, etc.

Cleaning the door air inlets (IP22 and IP42)

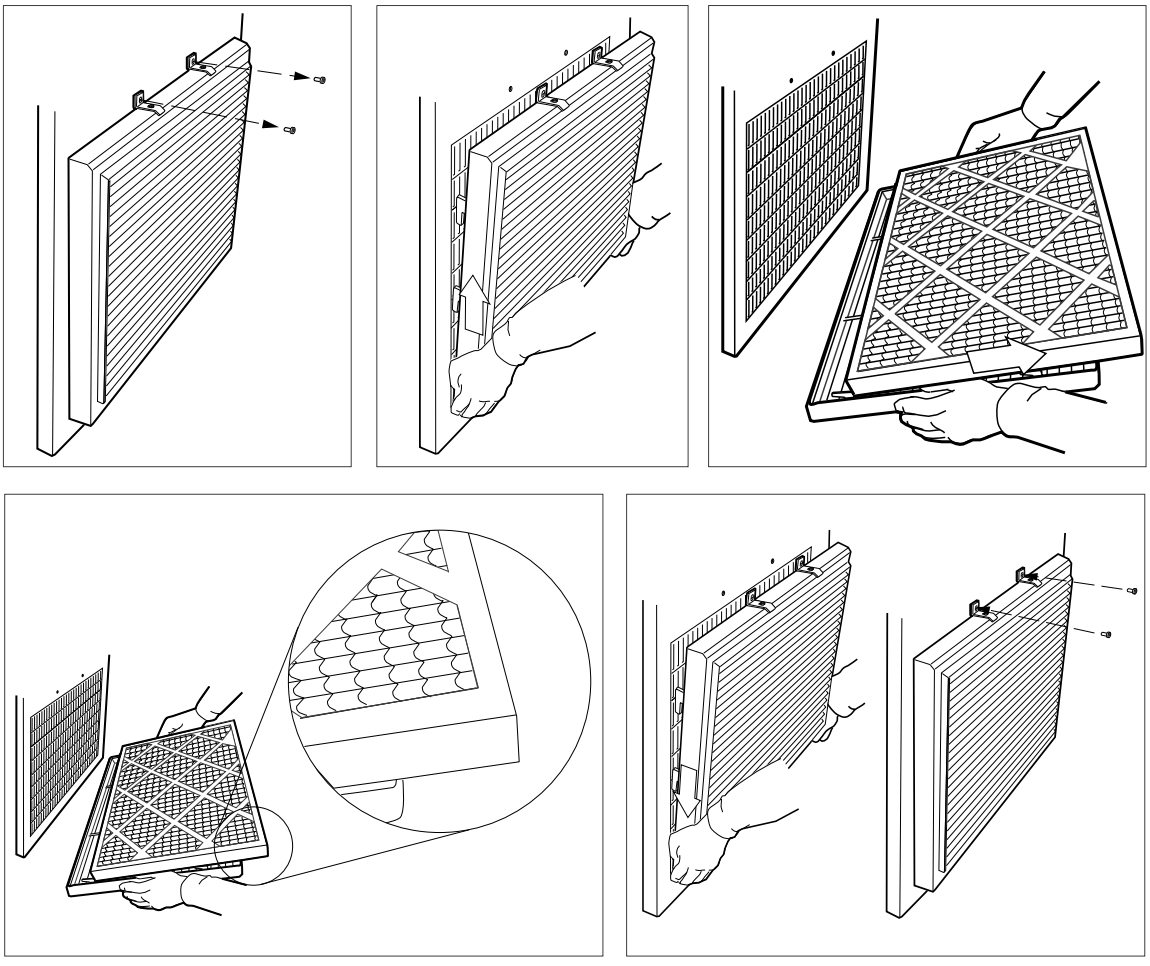
Check the dustiness of the air inlet meshes. If the dust cannot be removed by vacuum cleaning from outside through the grating holes with a small nozzle, proceed as follows:

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) 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 44) 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.



Replacing the roof outlet filters (IP54)

1. Remove the front and back gratings of the fan cubicle by lifting them upwards.
2. Remove the air filter mat.
3. Place the new filter mat in the grating.
4. Reinstall the gratings in reverse order.

Cleaning the heatsink

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 44) 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. 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. If there is a risk of dust entering adjoining equipment, do the cleaning in another room.
5. Reinstall the cooling fan.

Cooling 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.

Module cooling fans

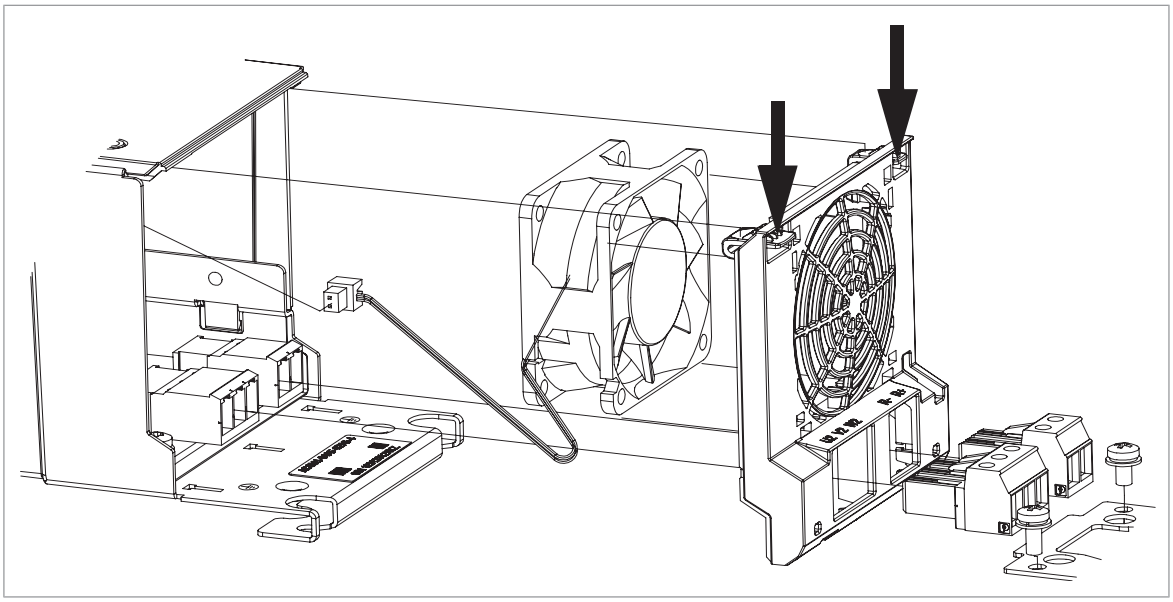
Replacing the R1i and R2i module cooling fan

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 44) before you start the work.
2. Detach the power cable clamp plate and terminal blocks.
3. Release the retaining clips (arrowed) carefully using a screwdriver.
4. Pull the fan holder out.
5. Disconnect the fan cable.
6. Carefully bend the clips on the fan holder to free the fan.
7. Install new fan in reverse order.

Note: The airflow direction is bottom-to-top. Install the fan so that the arrow on it points up.



In the drawing, the direction of airflow is from right to left.

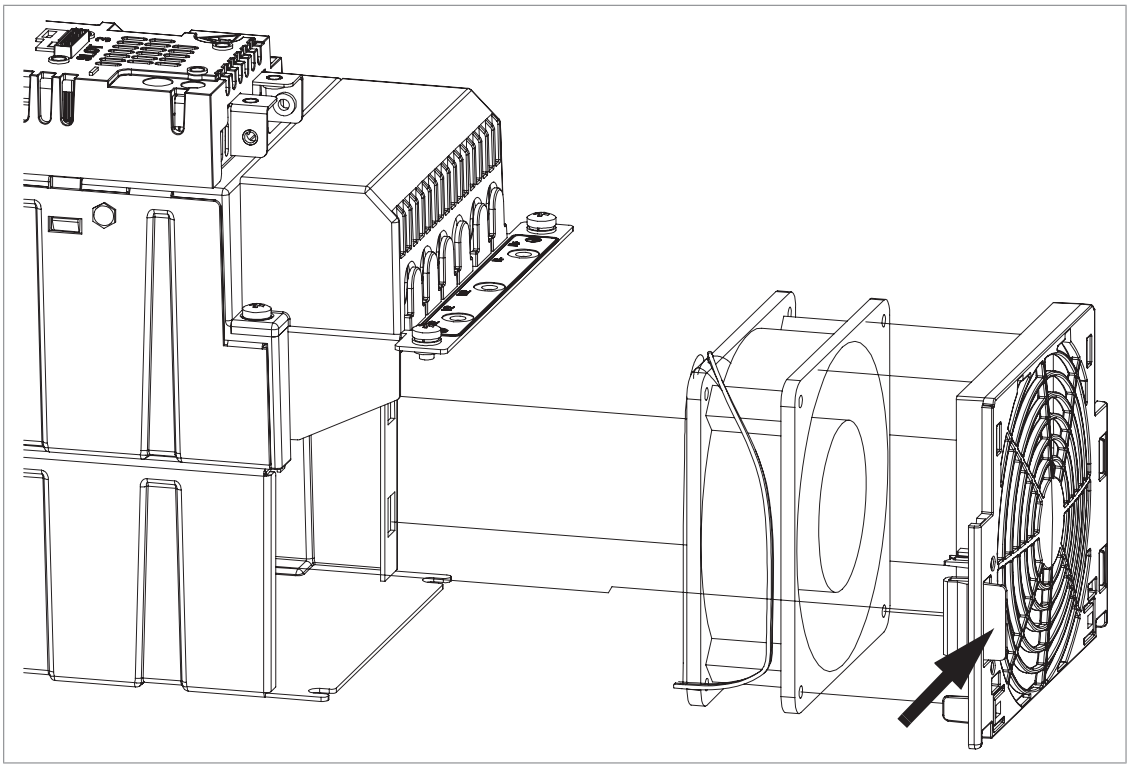
Replacing the R3i and R4i module cooling fan

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 44) before you start the work.
2. To remove the fan, release the retaining clip (arrowed) carefully using a screwdriver.
3. Pull the fan holder out.
4. Disconnect the fan cable.
5. Carefully bend the clips on the fan holder to free the fan.
6. Install new fan in reverse order.

Note: The airflow direction is bottom-to-top. Install the fan so that the airflow arrow points up.



In the picture diretion of airflow is from right to left.

Replacing the R5i module main cooling fan (without option +C204)

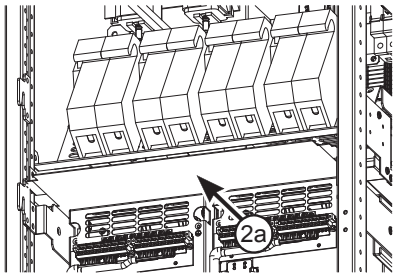
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

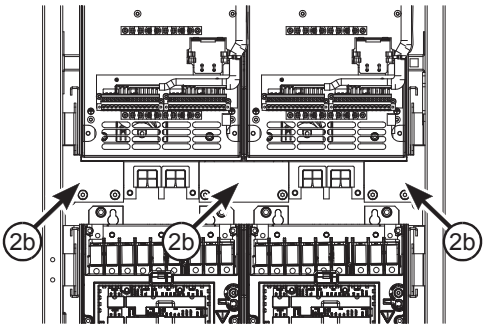
If you are not a qualified electrical professional, do not do installation or maintenance work.

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

The main cooling fan is located at the top of the module. The replacement of the main cooling fan requires that the module is pulled outwards far enough to create room above the module.

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Remove the air baffles shown:
   - Upper-row module: (2a) above the module
   - Lower-row module: (2b) above the module.





3. Disconnect all cabling from the module. Move the cables aside.
4. Remove the four mounting nuts and screws of the module (two at the top edge, two at the bottom edge).
5. Pull the module carefully outwards along its rails until the fan at the top is accessible.

   WARNING!
   Do not pull the module out any further than what is required to change the fan (unless you intend to remove the module completely). The rails have no stops to prevent the module from sliding all the way out.

6. Lift the fan mounting plate by the front edge.
7. Disconnect the power supply wires.
8. Lift out the fan assembly.

Install the new fan assembly and insert the module in reverse order to the above. Make sure that the fan blows upwards.

Replacing the R5i module main cooling fan (with option +C204)

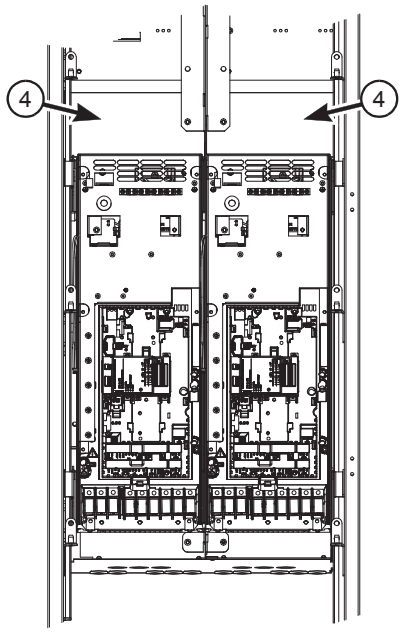
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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.

The main cooling fan is located at the top of the module.

1. Stop the inverter.
2. Switch off the DC switch-disconnector of the compartment and open the door. You can completely remove the door for easier access.
3. Remove the fuses from the DC switch-disconnector of the compartment.
4. Remove the air baffle above the module.



5. Lift the fan mounting plate by the front edge.
6. Disconnect the power supply wires.
7. Lift out the fan assembly.

Install the new fan assembly and insert the module in reverse order to the above. Make sure that the fan blows upwards.

Replacing the R5i module auxiliary cooling fan

Frame R5i modules have an auxiliary fan located at the top front of the 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.

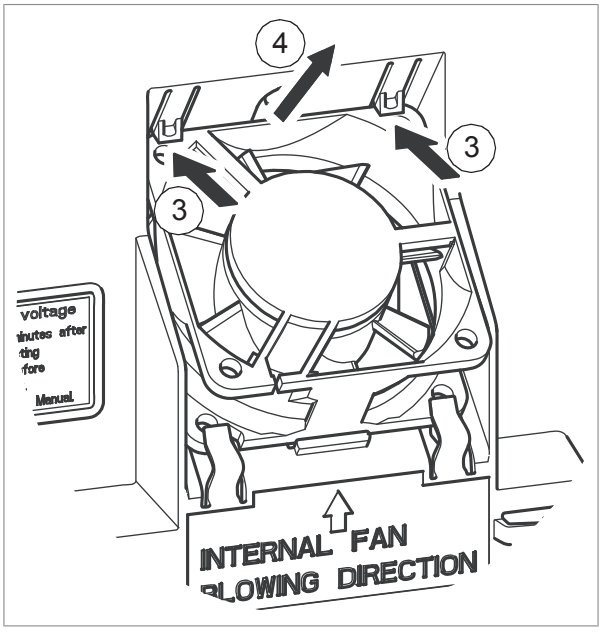
If you are not a qualified electrical professional, do not do installation or maintenance work.

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) before you start the work.

   Note: If the module is installed in its own compartment (option +C204), you can do this procedure after:

   - the module-specific DC switch-disconnector is opened, and
   - the module-specific DC fuses are removed.

   All other safety actions mentioned apply.
2. Disconnect the fan from the control unit. Make note of the connector the plug is connected to.
3. Push the two locking tabs gently inwards to release the fan.
4. Remove the fan.
5. Install new fan in reverse order. Make sure that the fan blows up (the arrows on the fan frame and the fan holder point in the same direction).



Replacing the R6i and R7i module cooling fan

Frame R6i module has one fan, R7i module has two.

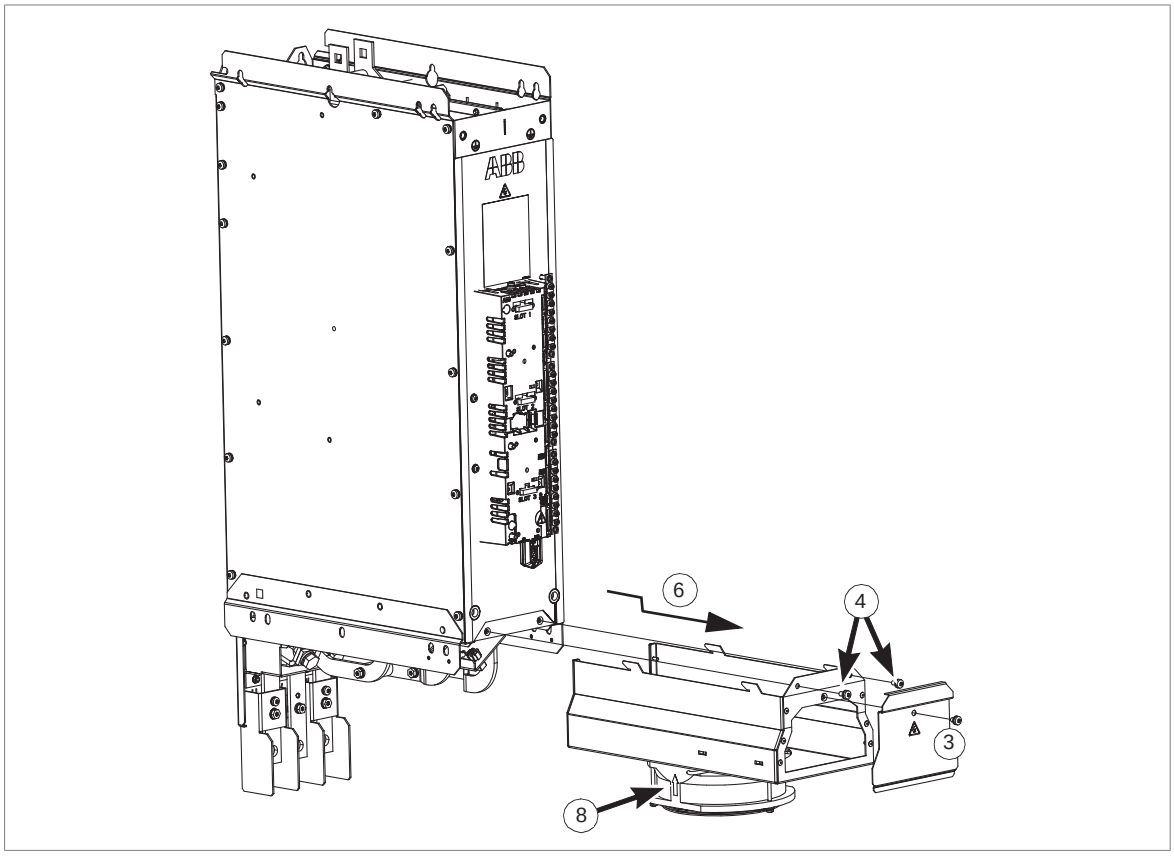
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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 do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Open the door. Remove any shrouding in front of the fan unit.
3. Remove the front plate.
4. Remove the two screws that lock the fan unit.
5. Disconnect the power supply wire(s) of the fan(s).
6. To free the fan holder, pull it slightly outwards (about 5 mm), then downwards.
7. Remove the fan(s) from the fan holder.
8. Install new fan(s) in reverse order to the above.

Note: The airflow direction is bottom-to-top. Make sure that the airflow direction arrow on the fan points up.



Replacing R8i module cooling fan (speed-controlled version)

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

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.

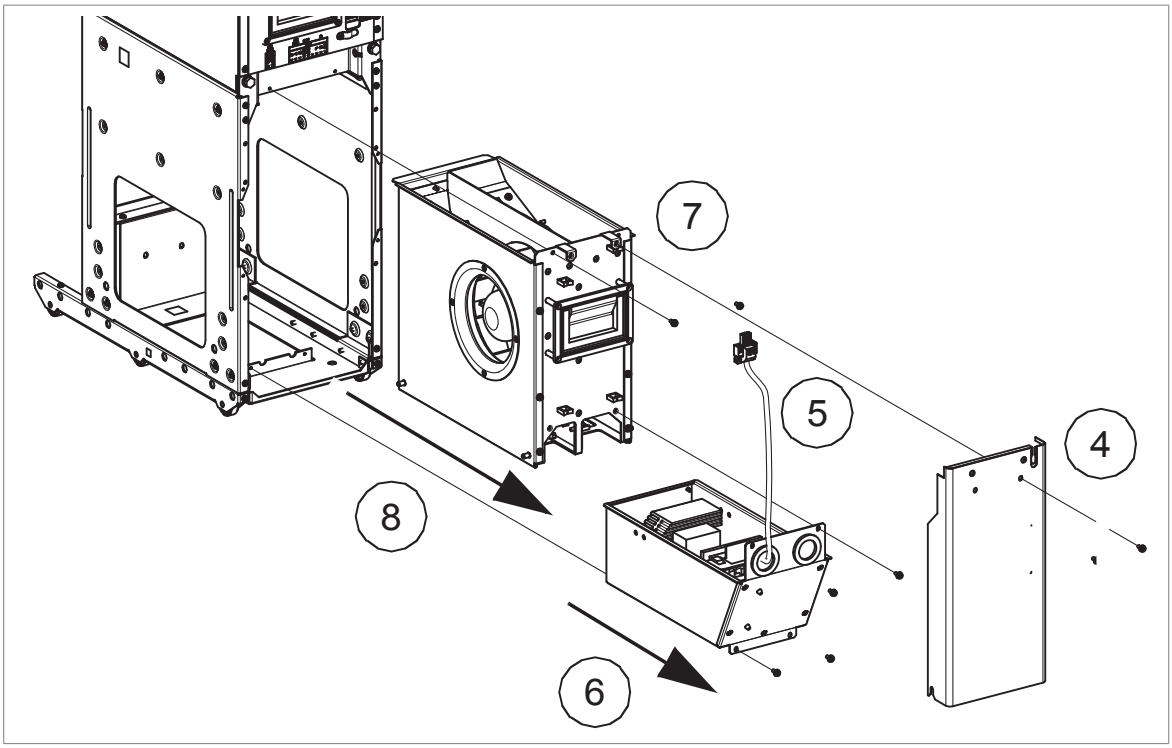
If you are not a qualified electrical professional, do not do installation or maintenance work.

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

Before you 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 44) 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 R8i module cooling fan (direct-on-line version)

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.

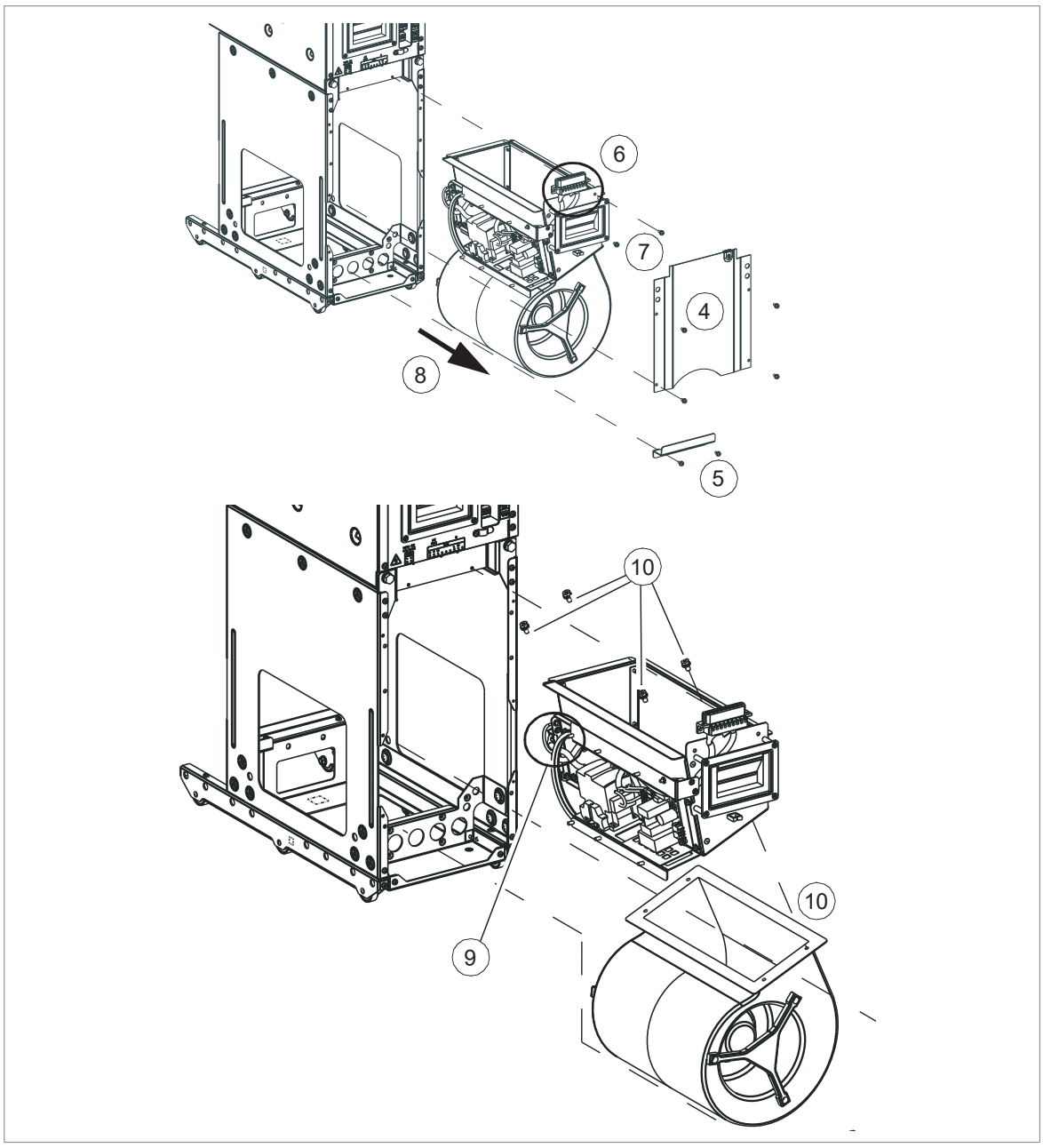
If you are not a qualified electrical professional, do not do installation or maintenance work.

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

Before you 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 44) 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

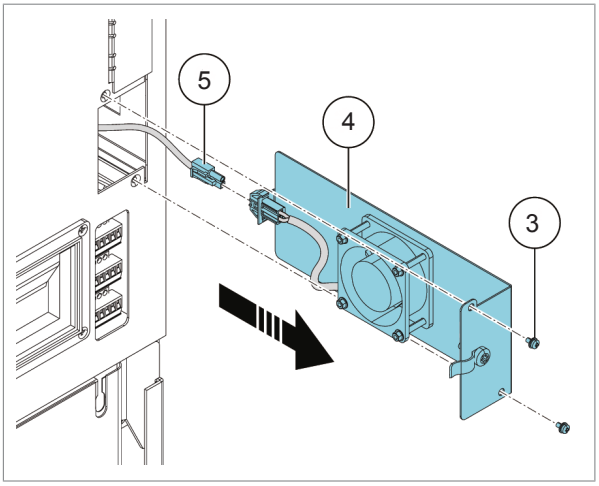
Frame R8i modules are equipped with a fan blowing air through the circuit board compartment.

The fan is accessible from the front of the module.

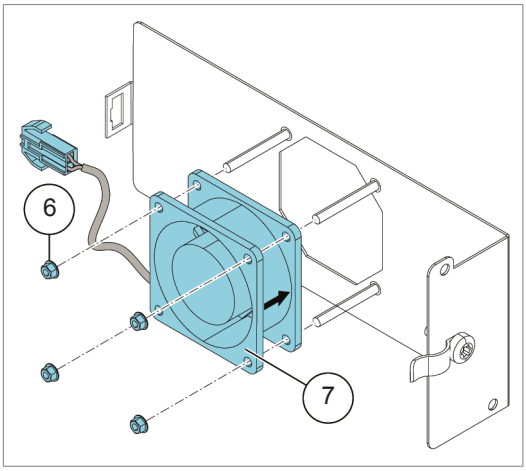
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

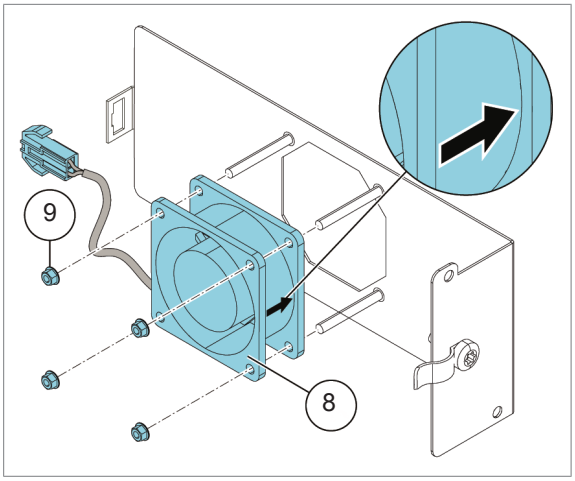
1. Stop the drive and do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Open the door of the module cubicle.
3. Remove the two M4×12 (T20) screws which lock the fan holder.
4. Pull the fan holder out of the module.
5. Disconnect the fan cable.



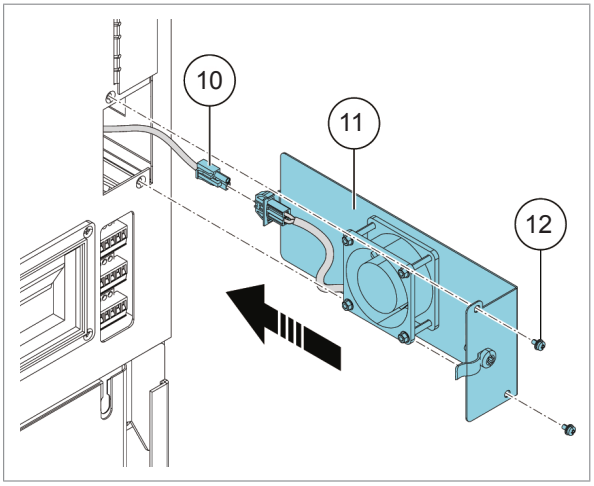
6. Remove the four M3 (5.5 mm) nuts which hold the fan.
7. Remove the fan from the fan holder.



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.



Cabinet cooling fans

Replacing R1i...R5i cabinet fans

300…600 mm wide cubicles containing frame R1i…R5i inverter modules have one exhaust fan in the top compartment of the cubicle. 800 mm and 1000 mm wide cabinets have two fans.

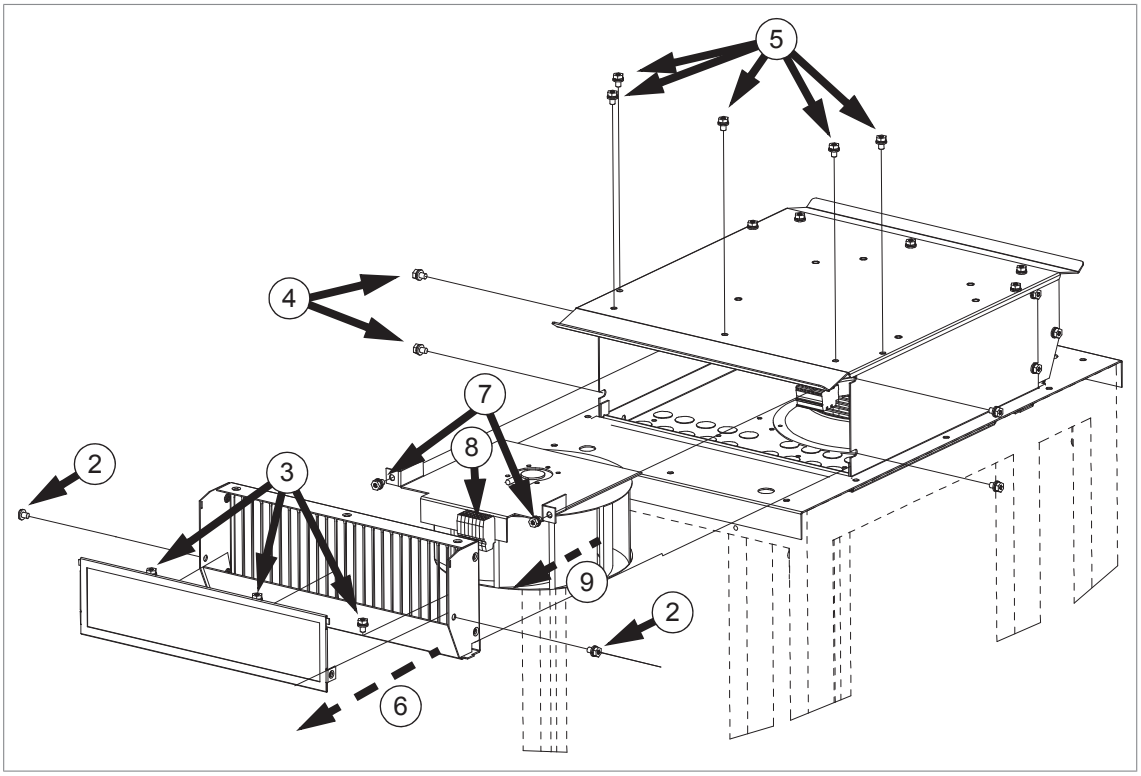
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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 do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Remove the front mesh (1 screw at either side).
3. Remove the 3 screws holding the lower edge of the front grating.
4. Loosen the four screws connecting the fan compartment to the grating (2 on both sides).
5. Remove the five screws closest to the front edge of the top plate.
6. Pull the front grating out. You may need to bend the top plate slightly upwards out of the way.
7. Remove the two screws holding the fan assembly.
8. Disconnect the fan cable.
9. Pull out the fan assembly. Detach the fan.

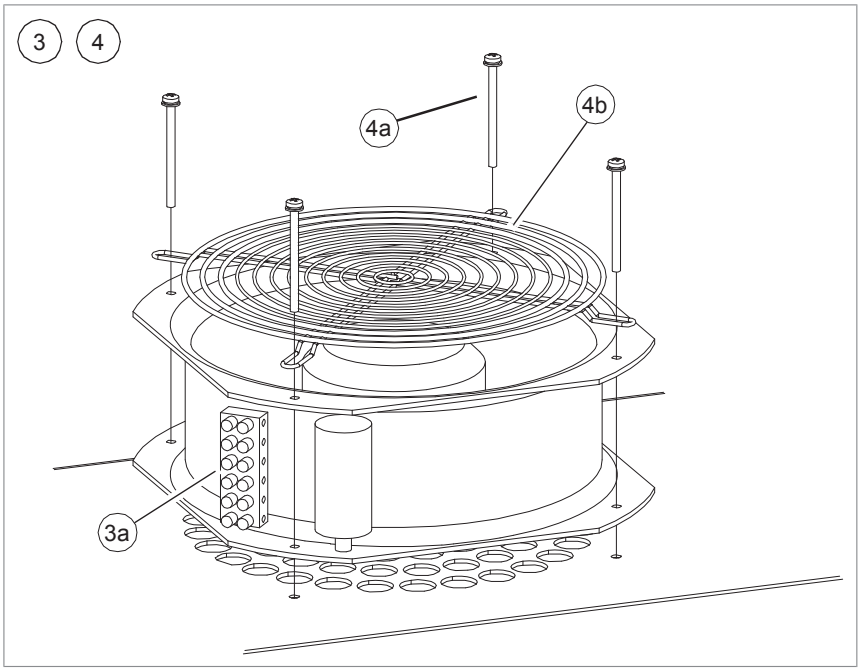
Install the new fan in reverse order.



Replacing the control cubicle fan (Frame R8i and multiples)

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

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) 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 upwards (floor fan) or inward (door fan).



Inverter modules

Replacing R1i...R4i inverter module (with option +C204, modules in their own compartments)

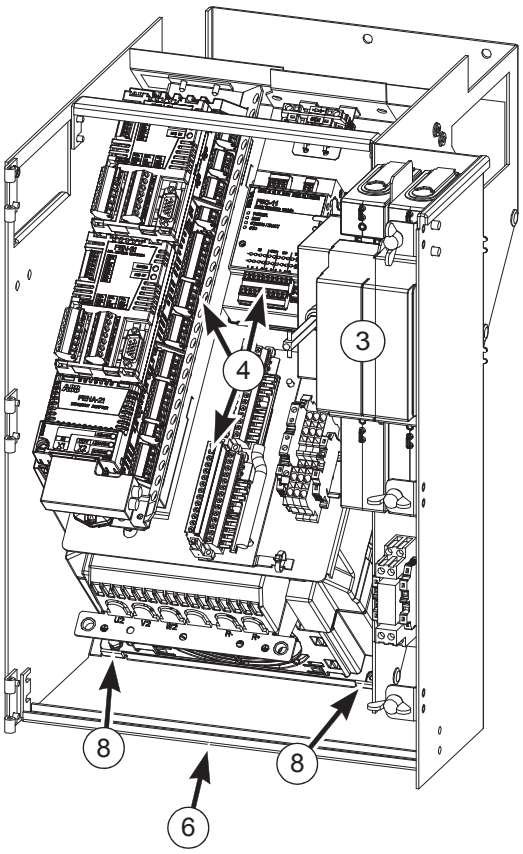
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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 do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Switch off the DC switch-disconnector of the compartment and open the door. You can remove the door entirely for better access.
3. Remove the fuses from the DC switch-disconnector of the compartment.
4. Disconnect the control wiring from the inverter control unit and other equipment mounted onto the module.
5. If present, remove the FSO module together with its mounting plate.
6. Remove the transverse brace in front of the base of the inverter module.
7. Disconnect the output cabling at the base of the inverter module.
8. Secure a good grip on the module to prevent it from falling out, and remove the two screws holding the base of the inverter module.
9. Carefully slide the module down and towards the front until you can access the DC plug connector at the top. Detach the connector.
10. Lift the inverter module out of its compartment.
11. (Frames R3i and R4i only) In case the module is replaced, transfer the DC connector extension from the old module to the new module.

Install the module in reverse order.



Replacing R5i inverter module (without option +C204)

See Replacing the R5i module main cooling fan (without option +C204) (page 111)

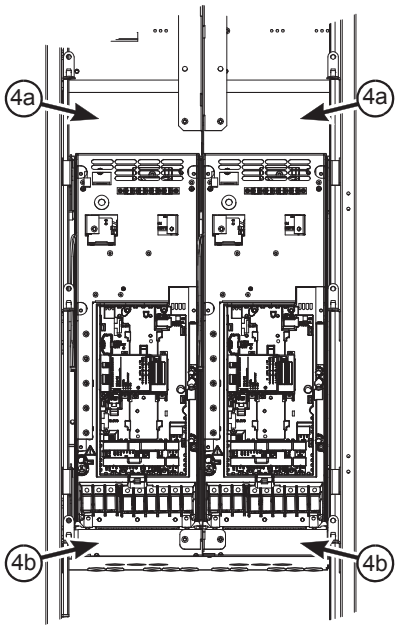
Replacing R5i inverter module (with option +C204, modules in their own compartments)

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 do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Switch off the DC switch-disconnector of the compartment and open the door. You can remove the door entirely for easier access.
3. Remove the fuses from the DC switch-disconnector of the compartment.
4. Remove the air baffles above (4a) and below (4b) the module.



5. Disconnect all cabling from the module. Move the cables aside.
6. Secure a good grip on the module to prevent it from falling out, and remove the four mounting nuts and screws of the module (two at the top edge, two at the bottom edge).
7. Pull the module out along its rails.

Install the module in reverse order.

Replacing R6i and R7i inverter modules

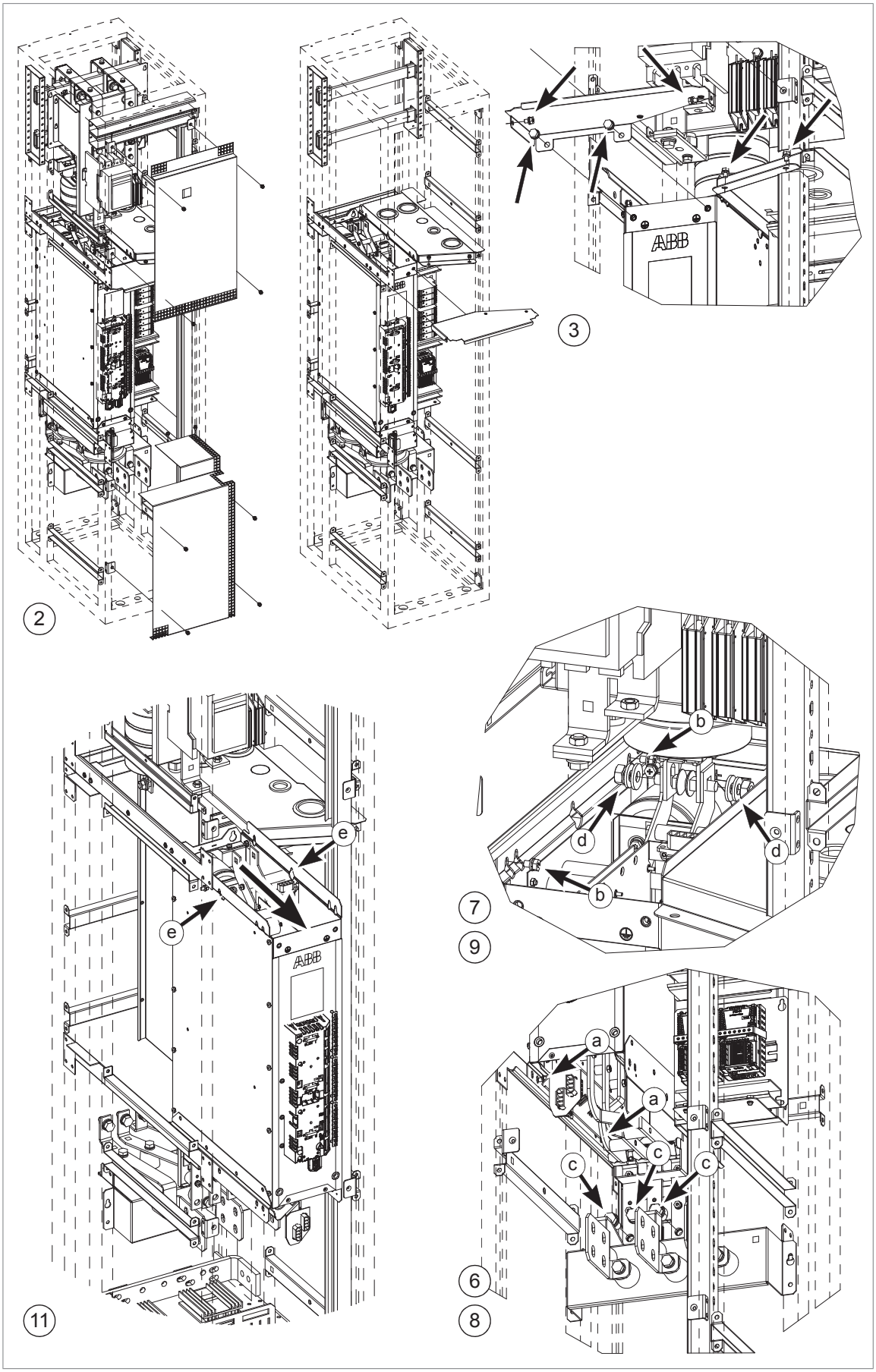
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

Note: A lifting device is available from ABB. See Converter module lifting device for drive cabinets hardware manual (3AXD50000210268 [English]).

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Remove the shrouds.
3. Remove the air baffle at the top of the module (6 screws, arrowed).
4. Disconnect the wiring from the inverter control unit.
5. Remove the fan(s) as advised under Replacement of module fan(s) (frames R6i and R7i).
6. Remove the two screws holding the module at the bottom (a).
7. Remove the two screws holding the module at the top (b).
8. Disconnect the AC busbars by removing the three screws (c).
9. Disconnect the DC busbars by removing the two screws (d).
10. (Frame R7i only) Disconnect the charging resistors (if present).
11. Pull the module outwards until the lifting eyes (e) at each side of the module are accessible.
12. Attach a hoist to the lifting eyes and pull the module out.

Install the module in reverse order.


2
3
b
d
d
b
7
9
e
e
11
a
a
c
c
c
6
8

Replacing R8i inverter modules

Removing an inverter module

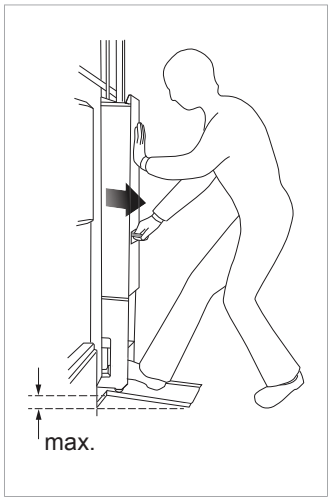
Note: As an alternative to using the extraction/installation ramp, a lifter is available from ABB Service. See Lifter for air-cooled drive modules user's guide (3AXD50000332588 [English]).

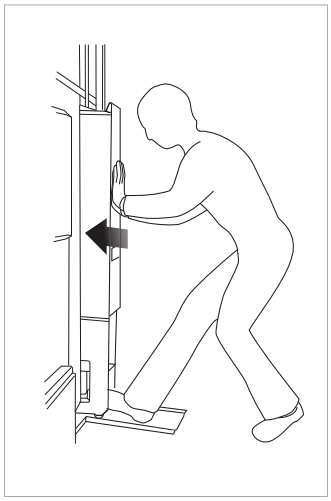
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

WARNING!
Use extreme caution when maneuvering the inverter module. It is heavy and has a high center of gravity. Ignoring the following instructions can cause physical injury, or damage to the equipment.

- Use the required personal protection equipment: safety shoes with metal toe cap, protective gloves, etc.
- Do not use the module extraction/installation ramp with plinth heights that exceed the maximum allowed height.
- 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.






- 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.

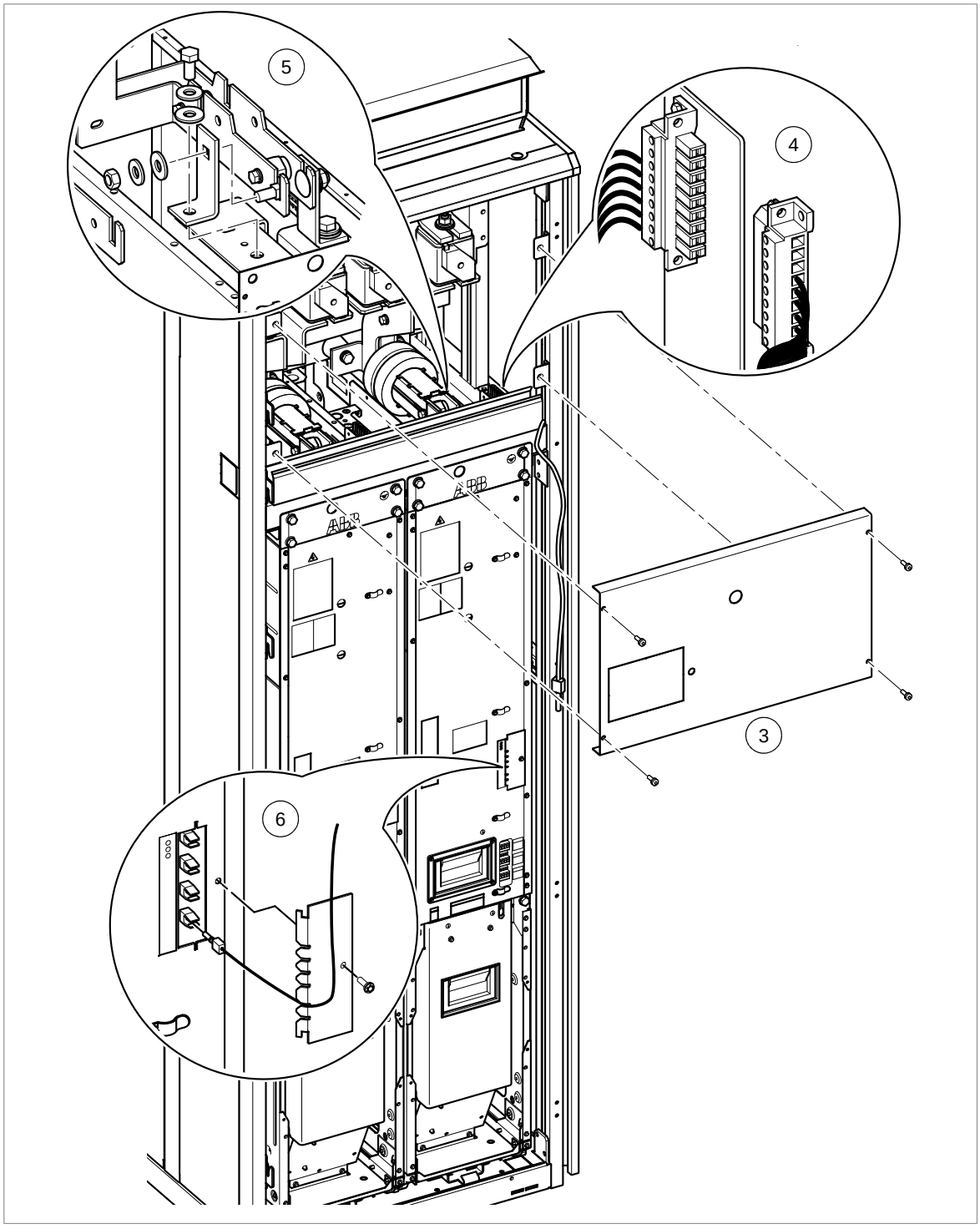

Note: The illustrations represent a frame 2×R8i inverter cubicle with option +F286 (DC switch-disconnector). On units without +F286, the DC busbars are oriented differently, but the procedure is otherwise the same.

1. Do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Open the inverter module cubicle door.
3. Remove the shroud at the top of the cubicle.
4. Detach the terminal block [X50] at the top of the module.
5. Detach the DC busbars from the module. Make note of the order and position of the screws and washers.
6. Detach the wiring connected to the terminals on the front of the module (including fiber optic cabling). Move the disconnected wiring aside.
7. Drives with option +C121 (Marine construction) or +C180 (Seismic design):
   a. Loosen the bolts holding the transverse retaining bracket both on the left and the right. (During reassembly, tighten these screws to 9 N·m [6.6 lbf·ft].)
   b. Remove the bolts holding the retaining bracket to the module.
   c. Remove the retaining bracket.
   d. Reinstall the bolts to the module. Tighten to 22 N·m (16 lbf·ft).

   WARNING! Do not proceed before the bolts are securely in place. Otherwise, the parts of the module can become separated and cause injury or damage.
8. Attach the module extraction/installation ramp (included) to the base of the cabinet so that the tabs on the mounting bracket enter the slots on the ramp.

   WARNING!
   Make sure that the markings on the ramp agree with the plinth height. An incorrect ramp can cause the module to fall over when removing it from the cabinet.
9. Remove the two retaining screws at the bottom front of the module.

   WARNING!
   Before you proceed, make sure the cabinet is level, or chock the wheels of the module.
10. Remove the two retaining screws at the top front of the module.
11. Pull the module carefully out along the ramp. While pulling on the handle with your right hand, keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back.
12. Move the module into a safe location outside the immediate work area and make sure it cannot topple over. Chock the wheels of the module if the floor is not completely level.
13. Repeat the procedure for the other inverter modules.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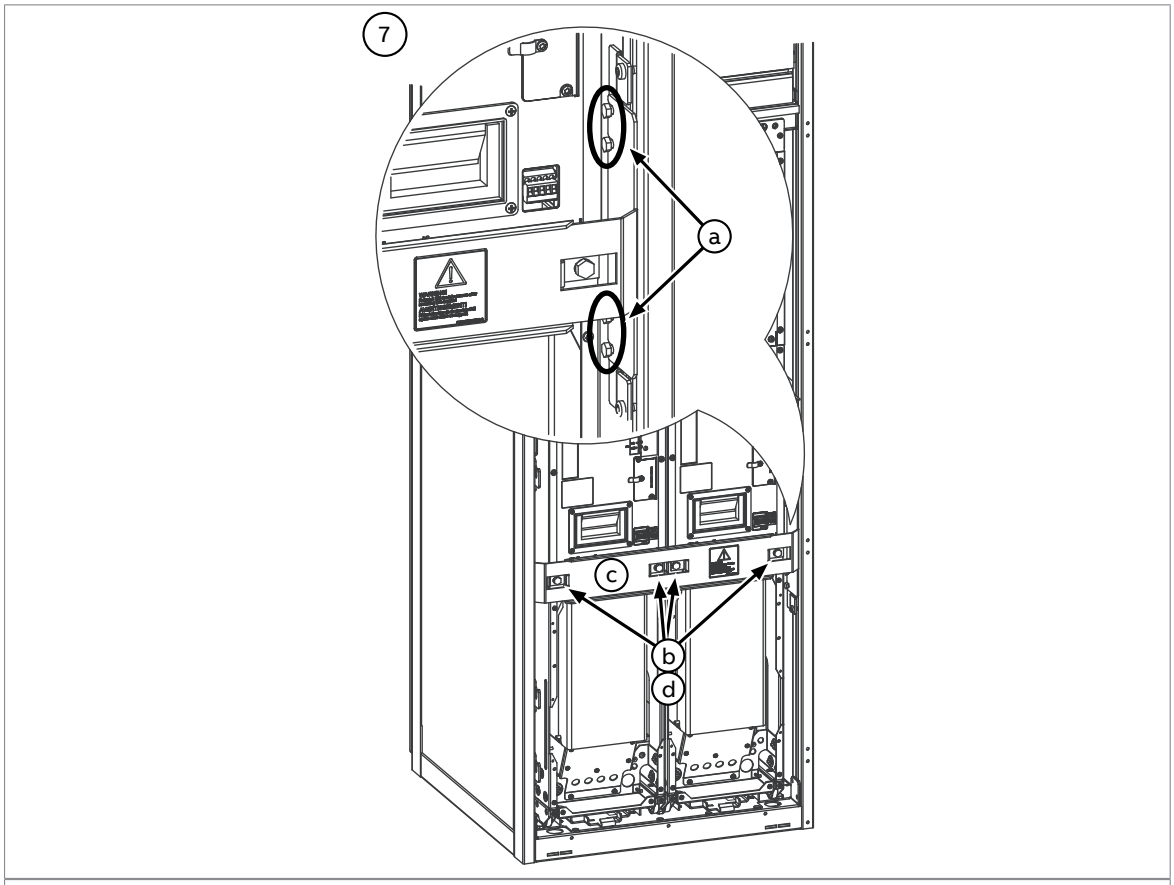
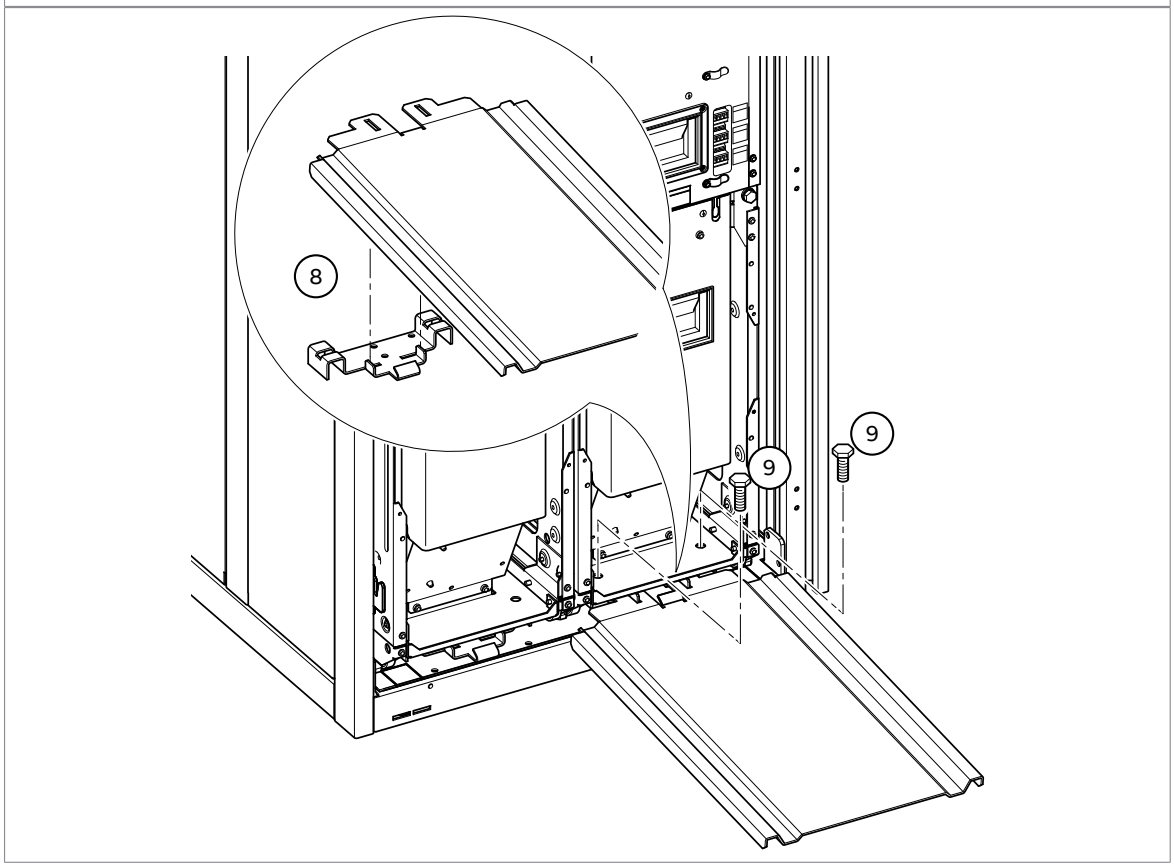
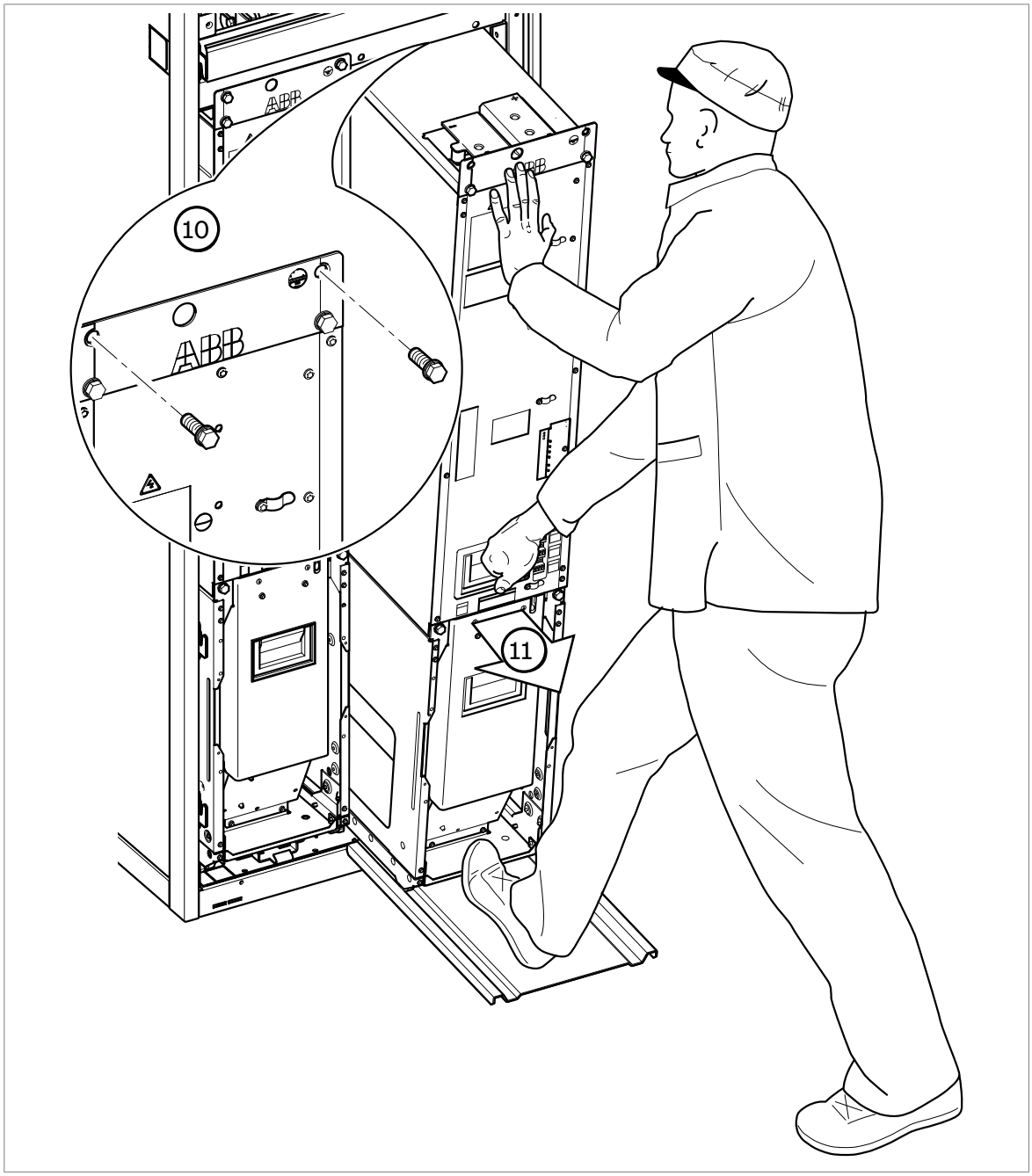

7
a
c
b
d


8
9
9



Installing an inverter 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.

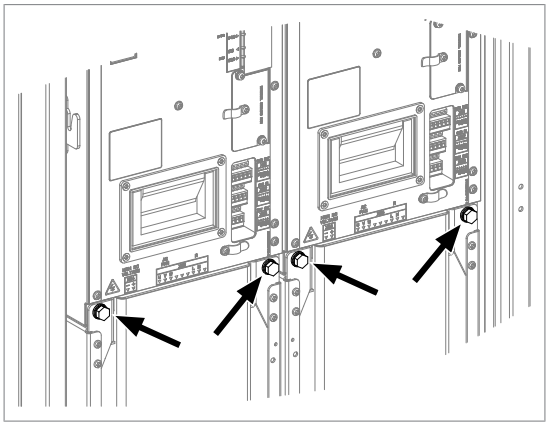
Before you replace an inverter module with a new one, make sure that the connector of the auxiliary power supply cable in the cabinet is compatible with the counterpart in the module (X50). Black connector is compatible only with the black counterpart, and gray connector only with the gray counterpart. 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]).

If you replace a module with a new one, make sure that the new module has the same type code as the old one.

1. Make sure there are no tools, debris or any other foreign objects in the cubicle.
2. If not already in place, attach the module extraction/installation ramp (included) to the base of the cabinet so that the tabs on the mounting bracket enter the slots on the ramp.
3. Push the module up the ramp and back into the cubicle.
   - **Keep your fingers away from the edge of the module front plate to avoid pinching.**
   - **Keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back.**
4. Attach the top front of the module with two screws. Tighten to 22 N·m (16 lbf·ft).
5. Attach the bottom front of the module with two screws. Tighten to 22 N·m (16 lbf·ft).
6. Remove the ramp.
7. Drives with option +C121 (Marine construction) or +C180 (Seismic design):
   a. Remove the bolts holding the fan carriage (two bolts per module).

   WARNING! The module retaining screws (two at top, two at bottom per module) must be in place before removing these screws. Otherwise, the parts of the module can become separated and cause injury or damage.

   b. Install the transverse retaining bracket. At the ends of the bracket, tighten the screws to 9 N·m [6.6 lbf·ft]. Install the fan carriage bolts removed at previous step, and tighten to 22 N·m (16 lbf·ft).
8. Attach the DC busbars to the module. Tighten to 70 N·m (52 lbf·ft). See Use of fasteners in cable lug connections (page 61).
9. Connect terminal block [X50] at the top of the module.

10. Connect the wiring and fiber optic cables to the terminals on the front of the module.
11. Repeat the procedure for the other inverter modules.
12. Reinstall the shroud near the top of the cubicle.

Activating the reduced run function of the inverter unit

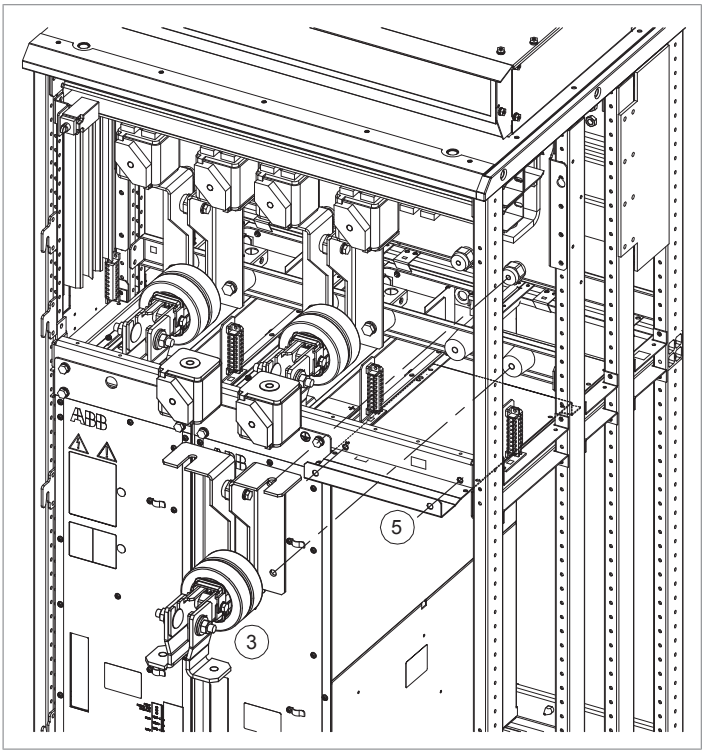
A “reduced run” function is available for inverter units consisting of parallel-connected inverter modules. The function makes it possible to continue operation with limited current even if one (or more) module is out of service, for example, because of maintenance work. In principle, reduced run is possible with only one module, but the physical requirements of operating the motor still apply; for example, the modules remaining in use must be able to provide the motor with enough magnetizing current.

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

Refer to the drawing below.

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Remove the shrouding above the module bay (in front of the DC fuses).
3. Remove the DC fuses and the busbar assembly connecting the fuses to the inverter module. Store these parts – they are to be reinstalled only with the inverter module. Make note of the order of washers.
4. Remove the faulty module from its bay. See the module replacement instructions.
5. Install the air baffle (included) to the underside of the top module guide:

- Fasten the front edge of the baffle to the module mounting holes using the module mounting screws (2 × M8). Tighten to 9 N·m (6.6 lbf·ft).
- Fasten the left/right sides of the baffle using M4 screws wherever possible. (This depends on the location of the module in the cubicle.) Tighten to 1…2 N·m (0.7 … 1.5 lbf·ft).



6. If the inverter control unit (A41) is powered from the faulty module, connect the power supply wiring to another module using the extension wire set included.
7. If the Safe torque off (STO) function is in use, install the jumper wire set included in the STO wiring in place of the missing module. (This is not needed if the module was the last on the STO wire chain.)
8. Reinstall all shrouding removed earlier.

   Note: Do not reinstall the DC fuses or busbars but store them elsewhere until the module can be reinstalled.
9. Switch on the power to the drive.
10. Enter the number of inverter modules present into parameter 95.13 Reduced run mode.
11. Reset all faults and start the drive.
12. If the Safe torque off (STO) function is in use, perform a validation test. See the STO instructions.

The maximum current is now automatically limited according to the new inverter configuration. A mismatch between the number of detected modules and the value set in parameter 95.13 will generate a fault.

Returning the module

1. Install the module in reverse order. Use the following tightening torques:

- DC busbar assembly to upper insulators (2 × M8): 9 N·m (6.6 lbf·ft)
- DC busbar assembly to lower insulators (2 × M10): 18 N·m (13.3 lbf·ft)
- Fuses to DC busbars: 50 N·m (37 lbf·ft) (Bussmann), 46 N·m (34 lbf·ft) (Mersen/Ferraz-Shawmut)
- Module to cabinet frame (4 × M8): 22 N·m (16 lbf·ft)
- DC busbar assembly to module DC input (2 × M12): 70 N·m (52 lbf·ft)

2. Restore the original wiring (STO and control unit power supply whenever needed).
3. Set parameter 95.13 to 0 to disable the reduced run function.
4. If the Safe torque off (STO) function is in use, perform a validation test. See the STO instructions.

Replacing DC fuses (frame R8i and multiples)

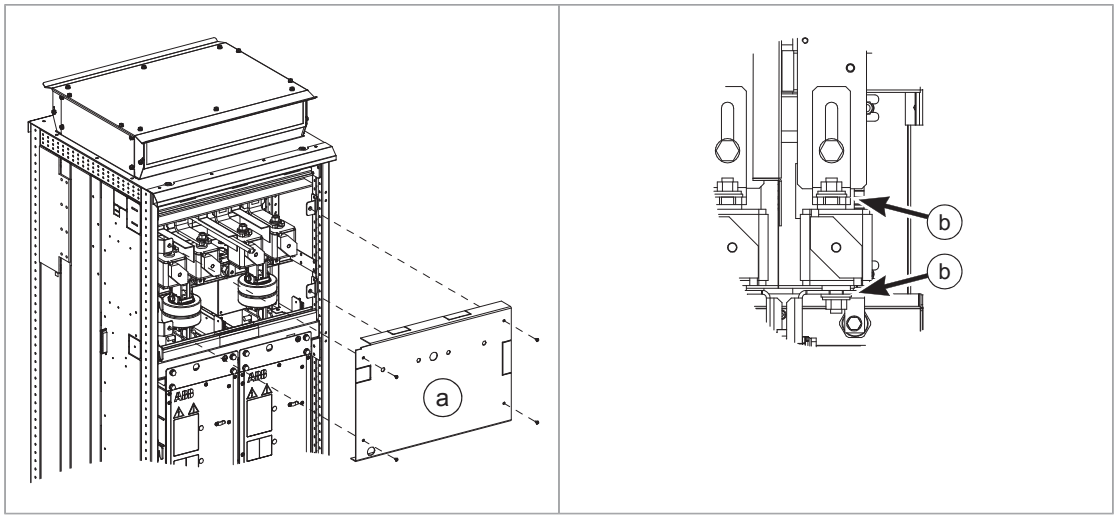
WARNING!
Obey the safety instructions given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

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

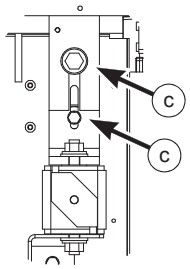
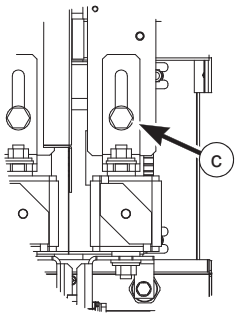
WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

Note: The illustrations represent a frame 2×R8i inverter cubicle with option +F286 (DC switch-disconnector). On units without +F286, the DC busbars are oriented differently, but the procedure is otherwise the same unless noted.

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Remove the shroud (a) in front of the fuses.
3. Loosen the nuts (b) of the blown fuse.

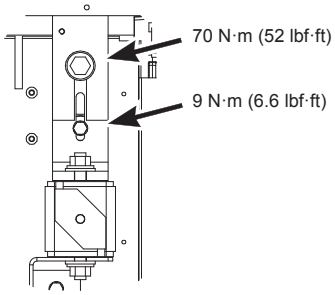
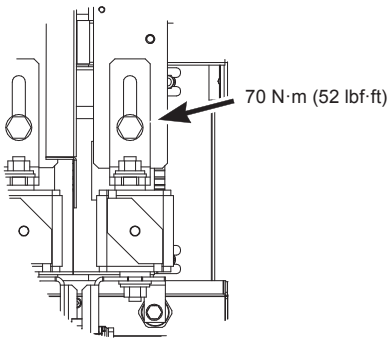


4. Loosen the mounting screws of the top busbar (c) so that you can adjust the gap for the fuse block.

Without DC switch	With DC switch (+F286)
	

5. Slide out the fuse block.
6. Move the screws, nuts and washers from the blown fuse to the new fuse. Make sure to keep the washers in the original order.

   Note: See the technical data for a table of recommended fuses.
7. Insert the new fuse block into its slot. Tighten both nuts of the fuse only until there is no play between the fuse and the busbars.
8. Tighten the mounting screws of the top busbars to the tightening torque shown in the figures below.

Without DC switch	With DC switch (+F286)
	

9. Tighten the fuse block nuts to the correct tightening torque:
   - Cooper-Bussmann fuses: 50 N·m (37 lbf·ft)
   - Mersen (Ferraz Shawmut) fuses: 46 N·m (34 lbf·ft)
   - Other: Refer to the fuse manufacturer's instructions.
10. Install the shroud removed earlier. Tighten the screws to 6 N·m (4.4 lbf·ft).

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]).

Functional safety components

The mission time of functional safety components is 20 years which equals the time during which failure rates of electronic components remain constant. This applies to the components of the standard Safe torque off circuit as well as any modules, relays and, typically, any other components that are part of functional safety circuits.

The expiry of mission time terminates the certification and SIL/PL classification of the safety function. The following options exist:

- Renewal of the whole drive and all optional functional safety module(s) and components.
- Renewal of the components in the safety function circuit. In practice, this is economical only with larger drives that have replaceable circuit boards and other components such as relays.

Note that some of the components may already have been renewed earlier, restarting their mission time. The remaining mission time of the whole circuit is however determined by its oldest component.

Contact your local ABB service representative for more information.

Control units

Replacing the memory unit (ZCU or BCU control unit)

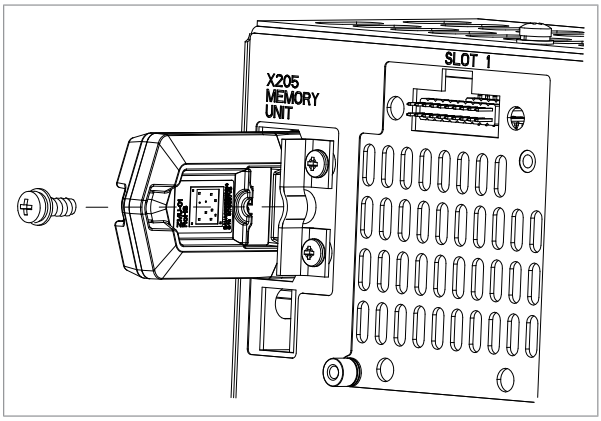
After replacing a control unit, you can keep the existing parameter settings by transferring the memory unit from the defective control unit to the new control unit.

WARNING!
Obey the safety instructions given in ACS880 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 insert the memory unit when the control unit is powered.

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) 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.

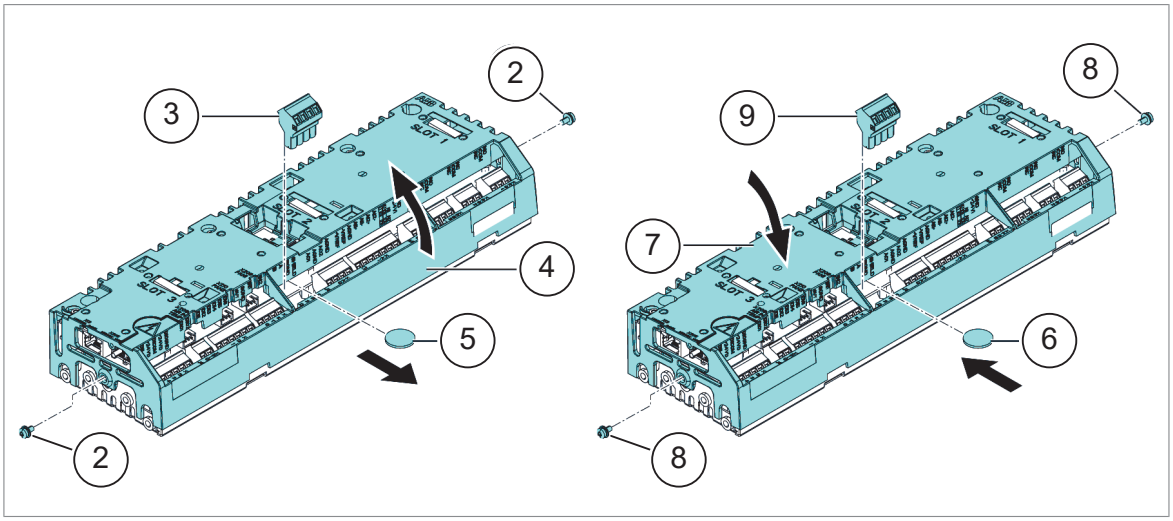


Replacing the ZCU-14 control unit battery

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 44) before you start the work.
2. Remove the M4×8 (T20) screws at the ends of the control unit.
3. To see the battery, remove the XD2D terminal block.
4. Carefully lift the edge of the control unit cover on the side with the I/O terminal blocks.
5. Pull the battery out of the battery holder.
6. Put a new CR2032 battery into the battery holder.
7. Close the control unit cover.
8. Tighten the M4×8 (T20) screws.
9. Install the XD2D terminal block.



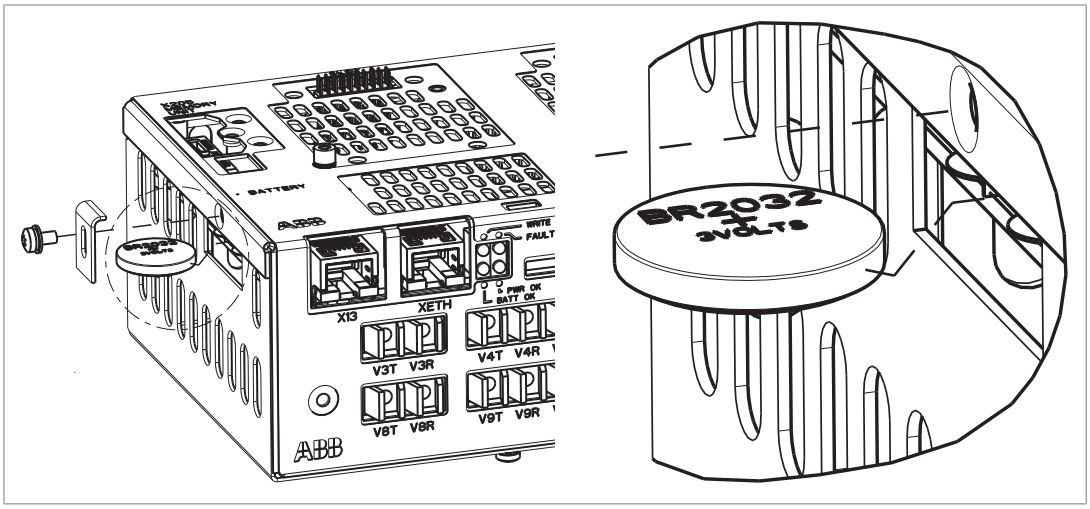
Replacing the BCU control unit battery

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.

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

1. Stop the drive and do the steps in section Electrical safety precautions (page 44) before you start the work.
2. Undo the fastening screw and remove the battery.
3. Replace the battery with a new BR2032 battery.
4. Dispose of the old battery according to local disposal rules or applicable laws.
5. Set the real-time clock.



Control panel

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

8

Technical data

Contents of this chapter

This chapter contains the technical specifications of the inverter unit, for example, the ratings, technical specifications and requirements, and provisions for fulfilling the requirements for CE and other markings.

Ratings

Inverter unit type ACS880-107- ...	Frame size	Input ratings	Output ratings							
				No-overload use			Light-overload use		Heavy-duty use	
		I_1	I_{max}	I_2	P_N	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	A	kW	kVA	A	kW	A	kW
U_n = 400 V										
004A8-3	R1i	5.8	7.0	4.8	1.5	3.3	4.5	1.5	4.0	1.5
006A0-3	R1i	7.2	8.8	6.0	2.2	4.2	5.5	2.2	5.0	1.5
008A0-3	R1i	9.6	10.5	8.0	3.0	5.5	7.6	3.0	6.0	2.2
0011A-3	R2i	12.6	13.5	10.5	4.0	7.3	9.7	4.0	9.0	3.0
0014A-3	R2i	16.8	16.5	14.0	5.5	9.7	13.0	5.5	11.0	4.0
0018A-3	R2i	21.6	21	18.0	7.5	12.5	16.8	7.5	14.0	5.5
0025A-3	R3i	30	33	25	11.0	17.3	23	11.0	19.0	7.5
0035A-3	R3i	42	44	35	15.0	24.2	32	15.0	29	11.0
0044A-3	R3i	53	53	44	18.5	30.5	41	18.5	35	15.0
0050A-3	R3i	60	66	50	22	35	46	22	44	22
0061A-3	R4i	73	78	61	30	42	57	30	52	22
0078A-3	R4i	94	100	78	37	54	74	37	69	30

Inverter unit type ACS880-107- ...	Frame size	Input ratings	Output ratings							
				No-overload use			Light-overload use		Heavy-duty use	
		I_1	I_{max}	I_2	P_N	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	A	kW	kVA	A	kW	A	kW
0094A-3	R4i	113	124	94	45	65	90	45	75	37
0100A-3	R4i	125	125	104	55	72	100	55	78	37
0140A-3	R6i	169	183	141	75	98	135	75	105	55
0170A-3	R6i	203	220	169	90	117	162	90	126	55
0210A-3	R6i	247	268	206	110	143	198	110	154	75
0250A-3	R6i	295	320	246	132	170	236	132	184	90
0300A-3	R7i	360	390	300	160	208	288	160	224	110
0350A-3	R7i	420	455	350	200	42	336	160	262	132
0470A-3	R8i	529	620	470	250	326	451	250	352	160
0640A-3	R8i	720	840	640	355	443	614	315	479	250
0760A-3	R8i	855	990	760	400	527	730	400	568	315
0900A-3	R8i	1013	1080	900	500	624	864	450	673	355
1250A-3	2×R8i	1406	1630	1250	630	866	1200	630	935	500
1480A-3	2×R8i	1665	1930	1480	800	1025	1420	800	1107	630
1760A-3	2×R8i	1980	2120	1760	1000	1219	1690	900	1316	710
2210A-3	3×R8i	2486	2880	2210	1200	1531	2122	1200	1653	900
2610A-3	3×R8i	2936	3140	2610	1400	1808	2506	1400	1952	1000
3450A-3	4×R8i	3881	4140	3450	1800	2390	3312	1800	2581	1400
4290A-3	5×R8i	4826	5150	4290	2400	2972	4118	2000	3209	1800
5130A-3	6×R8i	5771	6160	5130	2800	3554	4925	2400	3837	2000
U_n = 500 V										
003A6-5	R1i	4.3	5.3	3.6	1.5	3.1	3.4	1.5	3.0	1.5
004A8-5	R1i	5.8	7.0	4.8	2.2	4.2	4.5	2.2	4.0	1.5
006A0-5	R1i	7.2	8.8	6.0	3.0	5.2	5.5	3.0	5.0	2.2
008A0-5	R1i	9.6	10.5	8.0	4.0	6.9	7.6	4.0	6.0	3.0
0011A-5	R2i	12.6	13.5	10.5	5.5	9.1	9.7	5.5	9.0	4.0
0014A-5	R2i	16.8	16.5	14.0	7.5	12.1	13.0	7.5	11.0	5.5
0018A-5	R2i	21.6	21	18.0	11.0	15.6	16.8	11.0	14.0	7.5
0025A-5	R3i	30	33	25	15.0	21.7	23	15.0	19.0	11.0
0030A-5	R3i	36	36	30	18.5	26.0	28	18.5	24	15.0
0035A-5	R3i	42	44	35	22	30	32	22	29	18.5
0050A-5	R3i	60	66	50	30	43	46	30	44	22
0061A-5	R4i	73	78	61	37	53	57	37	52	30
0078A-5	R4i	94	100	78	45	68	74	45	69	45
0094A-5	R4i	113	124	94	55	81	90	55	75	45
0110A-5	R6i	136	147	113	75	98	108	75	85	55
0140A-5	R6i	163	177	136	90	118	131	90	102	55
0170A-5	R6i	198	215	165	110	143	158	110	123	75

Inverter unit type ACS880-107- ...	Frame size	Input ratings	Output ratings							
				No-overload use			Light-overload use		Heavy-duty use	
		I_1	I_{max}	I_2	P_N	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	A	kW	kVA	A	kW	A	kW
0200A-5	R6i	236	256	197	132	171	189	132	147	90
0240A-5	R6i	288	312	240	160	208	230	160	180	110
0300A-5	R7i	362	393	302	200	262	290	200	226	132
0340A-5	R7i	408	442	340	250	294	326	200	254	160
0440A-5	R8i	495	580	440	250	381	422	250	329	200
0590A-5	R8i	664	770	590	400	511	566	355	441	250
0740A-5	R8i	833	970	740	500	641	710	450	554	355
0810A-5	R8i	911	1060	810	560	701	778	500	606	400
1150A-5	2×R8i	1294	1500	1150	800	996	1104	710	860	560
1450A-5	2×R8i	1631	1890	1450	1000	1256	1392	900	1085	710
1580A-5	2×R8i	1778	2060	1580	1100	1368	1517	1000	1182	800
2150A-5	3×R8i	2419	2800	2150	1500	1862	2064	1400	1608	1100
2350A-5	3×R8i	2644	3060	2350	1600	2035	2256	1500	1758	1200
3110A-5	4×R8i	3499	4050	3110	2000	2693	2986	2000	2326	1600
3860A-5	5×R8i	4343	5020	3860	2400	3343	3706	2400	2887	2000
4610A-5	6×R8i	5186	6000	4610	3200	3992	4426	2800	3448	2400
U_n = 690 V										
007A3-7	R5i	8.2	9.5	7.3	5.5	8.7	7.0	5.5	5.5	4.0
009A8-7	R5i	11.0	12.7	9.8	7.5	11.7	9.4	7.5	7.3	5.5
014A2-7	R5i	16.0	18.5	14.2	11.0	17.0	13.6	11.0	10.6	7.5
0018A-7	R5i	20	23	18.0	15.0	21.5	17.3	15.0	13.5	11.0
0022A-7	R5i	25	29	22	18.5	26.3	21	18.5	16.5	15.0
0027A-7	R5i	30	35	27	22	32	26	22	20	18.5
0035A-7	R5i	39	46	35	30	42	34	30	26	22
0042A-7	R5i	47	55	42	37	50	40	37	31	30
0052A-7	R5i	59	68	52	45	62	50	45	39	37
0062A-7	R6i	74	81	62	55	74	60	55	46	45
0082A-7	R6i	98	107	82	75	98	79	75	61	55
0100A-7	R6i	119	129	99	90	118	95	90	74	75
0130A-7	R6i	150	163	125	110	149	120	110	94	75
0140A-7	R6i	173	187	144	132	172	138	132	108	90
0190A-7	R6i	230	250	192	160	229	184	160	144	132
0220A-7	R7i	260	282	217	200	259	208	200	162	160
0270A-7	R7i	324	351	270	250	323	259	250	202	200
0340A-7	R8i	383	510	340	315	406	326	250	254	200
0410A-7	R8i	461	620	410	400	490	394	355	307	250
0530A-7	R8i	596	800	530	500	633	509	450	396	355
0600A-7	R8i	675	900	600	560	717	576	560	449	400

Inverter unit type ACS880-107- ...	Frame size	Input ratings	Output ratings							
				No-overload use			Light-overload use		Heavy-duty use	
		I_1	I_{max}	I_2	P_N	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	A	kW	kVA	A	kW	A	kW
0800A-7	2×R8i	900	1200	800	800	956	768	710	598	560
1030A-7	2×R8i	1159	1550	1030	1000	1231	989	900	770	710
1170A-7	2×R8i	1316	1760	1170	1100	1398	1123	1000	875	800
1540A-7	3×R8i	1733	2310	1540	1400	1840	1478	1400	1152	1100
1740A-7	3×R8i	1958	2610	1740	1600	2080	1670	1600	1302	1200
2300A-7	4×R8i	2588	3450	2300	2000	2749	2208	2000	1720	1600
2860A-7	5×R8i	3218	4290	2860	2800	3418	2746	2400	2139	2000
3420A-7	6×R8i	3848	5130	3420	3200	4087	3283	3200	558	2400
3990A-7	7×R8i	4489	5990	3990	3600	4769	3830	3600	2985	2800
4560A-7	8×R8i	5130	6840	4560	4400	5450	4378	4000	3411	3200
5130A-7	9×R8i	5771	7700	5130	4800	6131	4925	4800	3837	3600
5700A-7	10×R8i	6413	8550	5700	5600	6812	5472	5200	4264	4000

Definitions

U_n	Nominal AC supply voltage of drive system
I_1	Nominal rms input current
I_2	Nominal output current (available continuously with no over-loading)
P_n	Typical motor power in no-overload use The horsepower ratings are typical NEMA motor sizes at 460 V (ACS880-107-xxxxA-5) and 575 V (ACS880-107-xxxxA-7) respectively.
S_n	Apparent power in no-overload use
I_{Ld}	Continuous rms output current allowing 10% overload for 1 minute every 5 minutes
P_{Ld}	Typical motor power in light-overload use
I_{max}	Maximum output current. Available for 10 seconds at start; otherwise as long as allowed by drive temperature.
I_{Hd}	Continuous rms output current allowing 50% overload for 1 minute every 5 minutes
P_{Hd}	Typical motor power in heavy-duty use

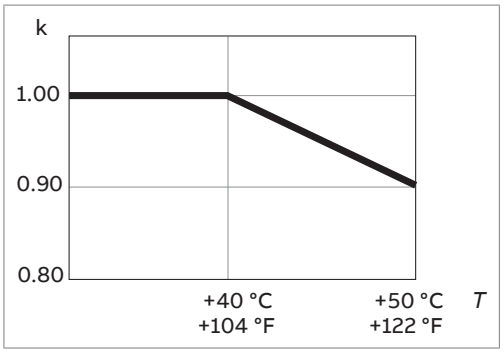
Note:

- The ratings apply at an ambient temperature of 40 °C (104 °F).
- To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current.
- The DriveSize dimensioning tool available from ABB is recommended for selecting the drive, motor and gear combination.

Derating

Surrounding air temperature derating

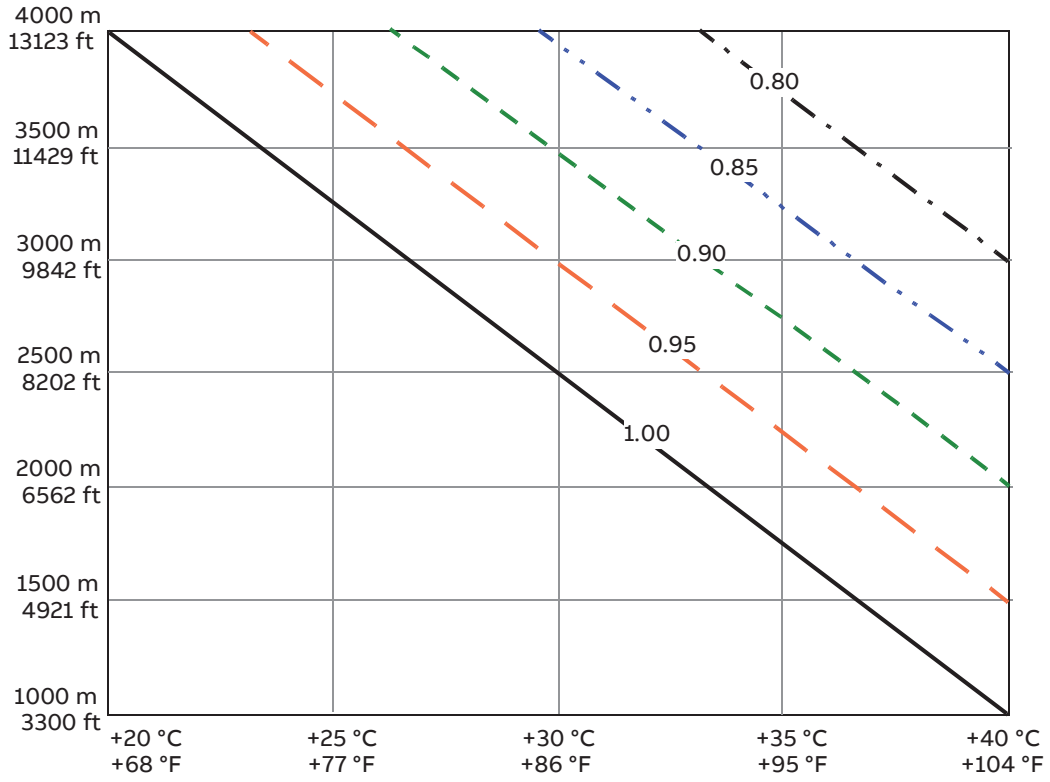
In the temperature range +40…50 °C (+104…122 °F), the rated output current is derated by 1 percentage point for every added 1 °C (1.8 °F). The output current can be calculated by multiplying the current given in the rating table by the derating factor *(k)*:



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.

Inverter modules used, DC fuses, and DC capacitances

Unit type	Module type and quantity		Module DC fuse type and quantity		DC capacitance
ACS880-107-...	ACS880-104-...	Qty	Type	Qty	µF
U_n = 400 V					
004A8-3	004A8-3	1	Eaton Bussmann FWP-10A14F [1)]	2	280
006A0-3	006A0-3	1	Eaton Bussmann FWP-15A14F [1)]	2	280
008A0-3	008A0-3	1	Eaton Bussmann FWP-15A14F [1)]	2	280
0011A-3	0011A-3	1	Eaton Bussmann FWP-20A14F [1)]	2	435
0014A-3	0014A-3	1	Eaton Bussmann FWP-25A14F [1)]	2	865
0018A-3	0018A-3	1	Eaton Bussmann FWP-32A14F [1)]	2	865
0025A-3	0025A-3	1	Mersen 6.921 CP URQ 27x60/50 [1)]	2	785
0035A-3	0035A-3	1	Mersen 6.921 CP URQ 27x60/63 [1)]	2	785
0044A-3	0044A-3	1	Mersen 6.921 CP URQ 27x60/80 [1)]	2	1178
0050A-3	0050A-3	1	Mersen 6.921 CP URQ 27x60/100 [1)]	2	1178

Unit type	Module type and quantity		Module DC fuse type and quantity		DC capacitance
ACS880-107-...	ACS880-104-...	Qty	Type	Qty	µF
0061A-3	0061A-3	1	Mersen 6.921 CP URQ 27x60/125 1)	2	1570
0078A-3	0078A-3	1	Mersen 6.921 CP URQ 27x60/160 1)	2	2355
0094A-3	0094A-3	1	Mersen 6.921 CP URQ 27x60/200 1)	2	2355
0100A-3	0100A-3	1	Mersen 6.921 CP URQ 27x60/200 1)	2	2355
0140A-3	0140A-3	1	Eaton Bussmann 170M4410	2	4500
0170A-3	0170A-3	1	Eaton Bussmann 170M4412	2	4500
0210A-3	0210A-3	1	Eaton Bussmann 170M4413	2	4500
0250A-3	0250A-3	1	Eaton Bussmann 170M4414	2	6750
0300A-3	0300A-3	1	Eaton Bussmann 170M4416	2	9000
0350A-3	0350A-3	1	Eaton Bussmann 170M4417	2	9000
0470A-3	0470A-3	1	Eaton Bussmann 170M6413	2	11250
0640A-3	0640A-3	1	Eaton Bussmann 170M6416	2	13500
0760A-3	0760A-3	1	Eaton Bussmann 170M6417	2	18000
0900A-3	0900A-3	1	Eaton Bussmann 170M6419	2	18000
1250A-3	0640A-3	2	Eaton Bussmann 170M6416	4	27000
1480A-3	0760A-3	2	Eaton Bussmann 170M6417	4	36000
1760A-3	0900A-3	2	Eaton Bussmann 170M6419	4	36000
2210A-3	0760A-3	3	Eaton Bussmann 170M6417	6	54000
2610A-3	0900A-3	3	Eaton Bussmann 170M6419	6	54000
3450A-3	0900A-3	4	Eaton Bussmann 170M6419	8	72000
4290A-3	0900A-3	5	Eaton Bussmann 170M6419	10	90000
5130A-3	0900A-3	6	Eaton Bussmann 170M6419	12	108000
U_n = 500 V					
003A6-5	003A6-5	1	Eaton Bussmann FWP-10A14F 1)	2	280
004A8-5	004A8-5	1	Eaton Bussmann FWP-10A14F 1)	2	280
006A0-5	006A0-5	1	Eaton Bussmann FWP-15A14F 1)	2	280
008A0-5	008A0-5	1	Eaton Bussmann FWP-15A14F 1)	2	280
0011A-5	0011A-5	1	Eaton Bussmann FWP-20A14F 1)	2	435
0014A-5	0014A-5	1	Eaton Bussmann FWP-25A14F 1)	2	865
0018A-5	0018A-5	1	Eaton Bussmann FWP-32A14F 1)	2	865
0025A-5	0025A-5	1	Mersen 6.921 CP URQ 27x60/50 1)	2	785
0030A-5	0030A-5	1	Mersen 6.921 CP URQ 27x60/63 1)	2	785
0035A-5	0035A-5	1	Mersen 6.921 CP URQ 27x60/63 1)	2	785
0050A-5	0050A-5	1	Mersen 6.921 CP URQ 27x60/100 1)	2	1178
0061A-5	0061A-5	1	Mersen 6.921 CP URQ 27x60/125 1)	2	1570
0078A-5	0078A-5	1	Mersen 6.921 CP URQ 27x60/160 1)	2	2355
0094A-5	0094A-5	1	Mersen 6.921 CP URQ 27x60/200 1)	2	2355

Unit type	Module type and quantity		Module DC fuse type and quantity		DC capacitance
ACS880-107-...	ACS880-104-...	Qty	Type	Qty	µF
0110A-5	0110A-5	1	Eaton Bussmann 170M4409	2	4500
	0110A-5 +C129+V992	1	Eaton Bussmann 170M4389	2	4500
	0110A-5 +C134+V992	1	Eaton Bussmann 170M4389	2	4500
0140A-5	0140A-5	1	Eaton Bussmann 170M4410	2	4500
	0140A-5 +C129+V992	1	Eaton Bussmann 170M4390	2	4500
	0140A-5 +C134+V992	1	Eaton Bussmann 170M4390	2	4500
0170A-5	0170A-5	1	Eaton Bussmann 170M4412	2	4500
	0170A-5 +C129+V992	1	Eaton Bussmann 170M4391	2	4500
	0170A-5 +C134+V992	1	Eaton Bussmann 170M4391	2	4500
0200A-5	0200A-5	1	Eaton Bussmann 170M4412	2	4500
	0200A-5 +C129+V992	1	Eaton Bussmann 170M4393	2	4500
	0200A-5 +C134+V992	1	Eaton Bussmann 170M4393	2	4500
0240A-5	0240A-5	1	Eaton Bussmann 170M4414	2	6750
	0240A-5 +C129+V992	1	Eaton Bussmann 170M6541	2	6750
	0240A-5 +C134+V992	1	Eaton Bussmann 170M6541	2	6750
0300A-5	0300A-5	1	Eaton Bussmann 170M4416	2	9000
	0300A-5 +C129+V992	1	Eaton Bussmann 170M6543	2	9000
	0300A-5 +C134+V992	1	Eaton Bussmann 170M6543	2	9000
0340A-5	0340A-5	1	Eaton Bussmann 170M4417	2	9000
	0340A-5 +C129+V992	1	Eaton Bussmann 170M6545	2	9000
	0340A-5 +C134+V992	1	Eaton Bussmann 170M6545	2	9000
0440A-5	0440A-5	1	Eaton Bussmann 170M6413	2	11250
0590A-5	0590A-5	1	Eaton Bussmann 170M6415	2	13500
0740A-5	0740A-5	1	Eaton Bussmann 170M6417	2	18000
0810A-5	0810A-5	1	Eaton Bussmann 170M6417	2	18000
1150A-5	0590A-5	2	Eaton Bussmann 170M6415	4	27000
1450A-5	0740A-5	2	Eaton Bussmann 170M6417	4	36000
1580A-5	0810A-5	2	Eaton Bussmann 170M6417	4	36000
2150A-5	0740A-5	3	Eaton Bussmann 170M6417	6	54000
2350A-5	0810A-5	3	Eaton Bussmann 170M6417	6	54000

Unit type	Module type and quantity		Module DC fuse type and quantity		DC capacitance
ACS880-107-...	ACS880-104-...	Qty	Type	Qty	µF
3110A-5	0810A-5	4	Eaton Bussmann 170M6417	8	72000
3860A-5	0810A-5	5	Eaton Bussmann 170M6417	10	90000
4610A-5	0810A-5	6	Eaton Bussmann 170M6417	12	108000
U_n = 690 V					
007A3-7	007A3-7	1	Mersen 1021 CP URB 27x60/32 [1)]	2	343
009A8-7	009A8-7	1	Mersen 1021 CP URB 27x60/32 [1)]	2	343
014A2-7	014A2-7	1	Mersen 1021 CP URB 27x60/32 [1)]	2	343
0018A-7	0018A-7	1	Mersen 1021 CP URB 27x60/40 [1)]	2	343
0022A-7	0022A-7	1	Mersen 1021 CP URB 27x60/40 [1)]	2	687
0027A-7	0027A-7	1	Mersen 1021 CP URB 27x60/50 [1)]	2	687
0035A-7	0035A-7	1	Mersen 1021 CP URB 27x60/63 [1)]	2	687
0042A-7	0042A-7	1	Mersen 1021 CP URB 27x60/80 [1)]	2	687
0052A-7	0052A-7	1	Mersen 1021 CP URB 27x60/100 [1)]	2	687
0062A-7	0062A-7	1	Eaton Bussmann 170M3392	2	1500
0082A-7	0082A-7	1	Eaton Bussmann 170M4388	2	1500
0100A-7	0100A-7	1	Eaton Bussmann 170M4389	2	1500
0130A-7	0130A-7	1	Eaton Bussmann 170M4390	2	3000
0140A-7	0140A-7	1	Eaton Bussmann 170M4391	2	3000
0190A-7	0190A-7	1	Eaton Bussmann 170M4392	2	3000
0220A-7	0220A-7	1	Eaton Bussmann 170M4393	2	4500
0270A-7	0270A-7	1	Eaton Bussmann 170M4395	2	4500
	0270A-7 +C129+V992	1	Eaton Bussmann 170M6543	2	4500
	0270A-7 +C134+V992	1	Eaton Bussmann 170M6543	2	4500
0340A-7	0340A-7	1	Eaton Bussmann 170M6544	2	6000
0410A-7	0410A-7	1	Eaton Bussmann 170M6546	2	6000
0530A-7	0530A-7	1	Eaton Bussmann 170M6548	2	9000
0600A-7	0600A-7	1	Eaton Bussmann 170M6549	2	9000
0800A-7	0410A-7	2	Eaton Bussmann 170M6546	4	12000
1030A-7	0530A-7	2	Eaton Bussmann 170M6548	4	18000
1170A-7	0600A-7	2	Eaton Bussmann 170M6549	4	18000
1540A-7	0530A-7	3	Eaton Bussmann 170M6548	6	27000
1740A-7	0600A-7	3	Eaton Bussmann 170M6549	6	27000
2300A-7	0600A-7	4	Eaton Bussmann 170M6549	8	36000
2860A-7	0600A-7	5	Eaton Bussmann 170M6549	10	45000
3420A-7	0600A-7	6	Eaton Bussmann 170M6549	12	54000
3990A-7	0600A-7	7	Eaton Bussmann 170M6549	14	63000
4560A-7	0600A-7	8	Eaton Bussmann 170M6549	16	72000
5130A-7	0600A-7	9	Eaton Bussmann 170M6549	18	81000

Unit type	Module type and quantity		Module DC fuse type and quantity		DC capacitance
ACS880-107-...	ACS880-104-...	Qty	Type	Qty	µF
5700A-7	0600A-7	10	Eaton Bussmann 170M6549	20	90000

1) These DC fuses are used for the protection of individual modules. The cubicle also contains larger main DC fuses that are common to all modules. The size of the main DC fuses depends on the number and size of the inverter modules. Blown fuses must be replaced with equivalent fuses.

Noise and cooling characteristics

Inverter unit type ACS880-107-...	Noise level	Heat dissipation 1)			Air flow		
		Inverter unit	Sine filter (option +E206)	Total	Inverter unit	Sine filter (option +E206)	Total
	dB(A)	kW	kW	kW	m³/h (cfm)	m³/h (cfm)	m³/h (cfm)
U_n = 400 V							
004A8-3	47	0.07	*	–	24 (14)	*	–
006A0-3	47	0.08	*	–	24 (14)	*	–
008A0-3	47	0.09	*	–	24 (14)	*	–
0011A-3	39	0.11	*	–	48 (28)	*	–
0014A-3	39	0.14	*	–	48 (28)	*	–
0018A-3	39	0.17	*	–	48 (28)	*	–
0025A-3	63	0.20	*	–	142 (84)	*	–
0035A-3	63	0.30	*	–	142 (84)	*	–
0044A-3	71	0.35	*	–	200 (118)	*	–
0050A-3	71	0.41	*	–	200 (118)	*	–
0061A-3	70	0.50	*	–	290 (171)	*	–
0078A-3	70	0.60	*	–	290 (171)	*	–
0094A-3	70	0.74	*	–	290 (171)	*	–
0100A-3	70	0.75	*	–	290 (171)	*	–
0140A-3	71	1.1	*	–	650 (383)	*	–
0170A-3	71	1.4	*	–	650 (383)	*	–
0210A-3	71	1.8	*	–	650 (383)	*	–
0250A-3	71	2.0	*	–	650 (383)	*	–
0300A-3	72	2.5	*	–	940 (553)	*	–
0350A-3	72	3.1	*	–	940 (553)	*	–
0470A-3	**72	4.8	5.0	9.8	**1300 (765)	2000 (1180)	3300 (1940)
0640A-3	**72	6.7	5.0	11.7	**1300 (765)	2000 (1180)	3300 (1940)
0760A-3	**72	8.0	5.0	13.0	**1300 (765)	2000 (1180)	3300 (1940)
0900A-3	**72	10	7	17	**1300 (765)	2000 (1180)	3300 (1940)
1250A-3	**74	13	10	23	**2600 (1530)	4000 (2350)	6600 (3880)
1480A-3	**74	16	10	26	**2600 (1530)	4000 (2350)	6600 (3880)
1760A-3	**74	20	14	34	**2600 (1530)	4000 (2350)	6600 (3880)

Inverter unit type ACS880-107-...	Noise level	Heat dissipation [1]			Air flow		
		Inverter unit	Sine filter (option +E206)	Total	Inverter unit	Sine filter (option +E206)	Total
	dB(A)	kW	kW	kW	m³/h (cfm)	m³/h (cfm)	m³/h (cfm)
2210A-3	**76	23	14	37	**3900 (2295)	4000 (2350)	7900 (4650)
2610A-3	**76	30	21	51	**3900 (2295)	6000 (3530)	9900 (5830)
3450A-3	**76	40	21	61	**5200 (3060)	6000 (3530)	11200 (6590)
4290A-3	**77	50	28	78	**6500 (3825)	8000 (4710)	14500 (8535)
5130A-3	**78	60	35	95	**7800 (4590)	10000 (5890)	17800 (10480)
U_n = 500 V							
003A6-5	47	0.06	*	–	24 (14)	*	–
004A8-5	47	0.07	*	–	24 (14)	*	–
006A0-5	47	0.08	*	–	24 (14)	*	–
008A0-5	47	0.09	*	–	24 (14)	*	–
0011A-5	39	0.13	*	–	48 (28)	*	–
0014A-5	39	0.15	*	–	48 (28)	*	–
0018A-5	39	0.18	*	–	48 (28)	*	–
0025A-5	63	0.23	*	–	142 (84)	*	–
0030A-5	63	0.28	*	–	142 (84)	*	–
0035A-5	63	0.32	*	–	142 (84)	*	–
0050A-5	71	0.48	*	–	200 (118)	*	–
0061A-5	70	0.55	*	–	290 (171)	*	–
0078A-5	70	0.65	*	–	290 (171)	*	–
0094A-5	70	0.80	*	–	290 (171)	*	–
0110A-5	71	1.0	*	–	650 (383)	*	–
0140A-5	71	1.2	*	–	650 (383)	*	–
0170A-5	71	1.5	*	–	650 (383)	*	–
0200A-5	71	1.8	*	–	650 (383)	*	–
0240A-5	71	2.0	*	–	650 (383)	*	–
0300A-5	72	2.7	*	–	940 (553)	*	–
0340A-5	72	3.2	*	–	940 (553)	*	–
0440A-5	**72	4.7	2.5	7.2	**1300 (765)	700 (410)	2000 (1180)
0590A-5	**72	6.3	6.0	12.3	**1300 (765)	2000 (1180)	3300 (1940)
0740A-5	**72	8.1	6.0	14.1	**1300 (765)	2000 (1180)	3300 (1940)
0810A-5	**72	9.3	8.0	17.3	**1300 (765)	2000 (1180)	3300 (1940)
1150A-5	**74	12	8	20	**2600 (1530)	2000 (1180)	4600 (2710)
1450A-5	**74	16	12	28	**2600 (1530)	4000 (2350)	6600 (3880)
1580A-5	**74	18	16	34	**2600 (1530)	4000 (2350)	6600 (3880)
2150A-5	**76	24	16	40	**3900 (2295)	4000 (2350)	7900 (4650)
2350A-5	**76	27	24	51	**3900 (2295)	6000 (3530)	9900 (5830)
3110A-5	**76	36	24	60	**5200 (3060)	6000 (3530)	11200 (6590)

Inverter unit type ACS880-107-...	Noise level	Heat dissipation[1]			Air flow		
		Inverter unit	Sine filter (option +E206)	Total	Inverter unit	Sine filter (option +E206)	Total
	dB(A)	kW	kW	kW	m³/h (cfm)	m³/h (cfm)	m³/h (cfm)
3860A-5	**77	44	32	76	**6500 (3825)	8000 (4710)	14500 (8535)
4610A-5	**78	53	40	93	**7800 (4590)	10000 (5890)	17800 (10480)
U_n = 690 V							
007A3-7	62	0.22	*	–	280 (165)	*	–
009A8-7	62	0.28	*	–	280 (165)	*	–
014A2-7	62	0.40	*	–	280 (165)	*	–
0018A-7	62	0.49	*	–	280 (165)	*	–
0022A-7	62	0.58	*	–	280 (165)	*	–
0027A-7	62	0.66	*	–	280 (165)	*	–
0035A-7	62	0.86	*	–	280 (165)	*	–
0042A-7	62	1.00	*	–	280 (165)	*	–
0052A-7	62	1.12	*	–	280 (165)	*	–
0062A-7	71	0.80	*	–	650 (383)	*	–
0082A-7	71	1.1	*	–	650 (383)	*	–
0100A-7	71	1.3	*	–	650 (383)	*	–
0130A-7	71	1.5	*	–	650 (383)	*	–
0140A-7	71	1.8	*	–	650 (383)	*	–
0190A-7	71	2.5	*	–	650 (383)	*	–
0220A-7	72	2.8	*	–	940 (553)	*	–
0270A-7	72	3.3	*	–	940 (553)	*	–
0340A-7	**72	5.2	3.0	8.2	**1300 (765)	700 (410)	2000 (1180)
0410A-7	**72	6.1	3.0	9.1	**1300 (765)	700 (410)	2000 (1180)
0530A-7	**72	7.9	7.0	14.9	**1300 (765)	2000 (1180)	3300 (1940)
0600A-7	**72	9.0	7.0	16.0	**1300 (765)	2000 (1180)	3300 (1940)
0800A-7	**74	12	7	19	**2600 (1530)	2000 (1180)	4600 (2710)
1030A-7	**74	15	9	24	**2600 (1530)	2000 (1180)	4600 (2710)
1170A-7	**74	18	9	27	**2600 (1530)	2000 (1180)	4600 (2710)
1540A-7	**76	23	18	41	**3900 (2295)	4000 (2350)	7900 (4650)
1740A-7	**76	26	18	44	**3900 (2295)	4000 (2350)	7900 (4650)
2300A-7	**76	35	18	53	**5200 (3060)	4000 (2350)	9200 (5410)
2860A-7	**77	43	27	70	**6500 (3825)	6000 (3530)	12500 (7360)
3420A-7	**78	52	27	79	**7800 (4590)	6000 (3530)	13800 (8120)
3990A-7	**78	60	36	96	**9100 (5360)	8000 (4710)	17100 (10060)
4560A-7	**79	69	36	105	**10400 (6120)	8000 (4710)	18400 (10830)
5130A-7	**79	78	45	123	**11700 (6890)	10000 (5890)	21700 (12770)
5700A-7	**79	86	54	140	**13000 (7650)	12000 (7060)	25000 (14710)

[1] These losses are not calculated according to the ecodesign standard IEC 61800-9-2.

*Contact your local ABB representative for availability and technical data of sine filters.

**Maximum value with direct-on-line cooling fan.

Sine output filter data

Sine output filters are available as option +E206. The table below shows the types and technical data of the filters and filter cubicles used. The standard filters listed require no current derating.

For availability of sine output filters for other inverter unit types, contact your local ABB representative.

Inverter unit type ACS880-107...	Sine filter(s) used		Nominal current	Dimensions		Cooling data	
	Qty	Type		Width	weight	Heat dissipation	Air flow
			A	mm	kg (lbs)	kW	m³/h (cfm)
U_n = 400 V							
0470A-3	1	NSIN-0900-6	783	1000	840 (1850)	See Noise and cooling characteristics (page 150)	
0640A-3	1	NSIN-0900-6	783	1000	840 (1850)		
0760A-3	1	NSIN-0900-6	783	1000	840 (1850)		
0900A-3	1	NSIN-1380-6	1201	1000	960 (2120)		
1250A-3	2	NSIN-0900-6	1488	2000	1680 (3700)		
1480A-3	2	NSIN-0900-6	1488	2000	1680 (3700)		
1760A-3	2	NSIN-1380-6	2282	2000	1920 (4230)		
2210A-3	2	NSIN-1380-6	2282	2000	1920 (4230)		
2610A-3	3	NSIN-1380-6	3387	3000	2880 (6350)		
3450A-3	3	NSIN-1380-6	3387	3000	2880 (6350)		
4290A-3	4	NSIN-1380-6	4468	4000	3840 (8470)		
5130A-3	5	NSIN-1380-6	5525	5000	4800 (10580)		
U_n = 500 V							
0440A-5	1	NSIN-0485-6	447	400	340 (750)	See Noise and cooling characteristics (page 150)	
0590A-5	1	NSIN-0900-6	783	1000	840 (1850)		
0740A-5	1	NSIN-0900-6	783	1000	840 (1850		
0810A-5	1	NSIN-1380-6	1201	1000	960 (2120)		
1150A-5	1	NSIN-1380-6	1201	1000	960 (2120)		
1450A-5	2	NSIN-0900-6	1488	2000	1680 (3700)		
1580A-5	2	NSIN-1380-6	2282	2000	1920 (4230)		
2150A-5	2	NSIN-1380-6	2282	2000	1920 (4230)		
2350A-5	3	NSIN-1380-6	3387	3000	2880 (6350)		
3110A-5	3	NSIN-1380-6	3387	3000	2880 (6350)		
3860A-5	4	NSIN-1380-6	4468	4000	3840 (8470)		
4610A-5	5	NSIN-1380-6	5525	5000	4800 (10580)		

Inverter unit type ACS880-107...	Sine filter(s) used		Nominal current	Dimensions		Cooling data	
	Qty	Type		Width	weight	Heat dissipation	Air flow
			A	mm	kg (lbs)	kW	m³/h (cfm)
U_n = 690 V							
0340A-7	1	NSIN-0485-6	447	400	340 (750)	See Noise and cooling characteristics (page 150)	
0410A-7	1	NSIN-0485-6	447	400	340 (750)		
0530A-7	1	NSIN-0900-6	783	1000	840 (1850)		
0600A-7	1	NSIN-0900-6	783	1000	840 (1850)		
0800A-7	1	NSIN-0900-6	783	1000	840 (1850)		
1030A-7	1	NSIN-1380-6	1201	1000	960 (2120)		
1170A-7	1	NSIN-1380-6	1201	1000	960 (2120)		
1540A-7	2	NSIN-1380-6	2282	2000	1920 (4230)		
1740A-7	2	NSIN-1380-6	2282	2000	1920 (4230)		
2300A-7	2	NSIN-1380-6	2282	2000	1920 (4230)		
2860A-7	3	NSIN-1380-6	3387	3000	2880 (6350)		
3420A-7	3	NSIN-1380-6	3387	3000	2880 (6350)		
3990A-7	4	NSIN-1380-6	4468	4000	3840 (8470)		
4560A-7	4	NSIN-1380-6	4468	4000	3840 (8470)		
5130A-7	5	NSIN-1380-6	5525	5000	4800 (10580)		
5700A-7	6	NSIN-1380-6	6557	6000	5760 (12700)		

Input power (DC) connection

Voltage (U1)	ACS880-107-xxxxx-3: 513…566 V DC. This is indicated in the type designation label as typical input voltage level (566 V DC). ACS880-107-xxxxx-5: 513…707 V DC. This is indicated in the type designation label as typical input voltage levels (566/679/707 V DC). ACS880-107-xxxxx-7: 709…976 V DC. This is indicated in the type designation label as typical input voltage levels (742/849/976 V DC).
Drive AC supply network type	TN (grounded) and IT (ungrounded) systems up to 690 V AC. Frames R5i…R8i: Corner-grounded systems up to 600 V AC.

Motor connection data

Motor types	Asynchronous AC induction motors, permanent magnet synchronous motors, AC induction servomotors and ABB synchronous reluctance (SynRM) motors
Voltage (U2)	3-phase symmetrical, Umax at field weakening point ACS880-107-xxxxx-3: 0…400 V AC. The maximum value (400 V) is a typical drive input voltage level shown on the type designation label of the supply unit corresponding to 380…415 V AC. ACS880-107-xxxxx-5: 0…400/480/500 V AC. The maximum values (400/480/500 V) are typical drive input voltage levels shown on the type designation label of the supply unit corresponding to 380…500 V AC. ACS880-107-xxxxx-7: 0…525/600/690 V AC. The maximum values (525/600/690 V) are typical drive input voltage levels shown on the type designation label of the supply unit corresponding to 525…690 V AC.

Frequency (f2)	0…500 Hz 0…120 Hz with sine output filters (option +E206) 0…120 Hz for frames R1i…R5i with du/dt filters (option +E205) 0…200 Hz for frames R6i and R7i with du/dt filters (option +E205) • For higher operational output frequencies, contact your local ABB representative. • Operation at frequencies higher than 150 Hz can require derating. For more information, contact your local ABB representative.
Current	Refer to the technical data.
Switching frequency	Frames R1i…R4i: 4.5 kHz (typical) Frames R5i…R8i: 3 kHz (typical) The switching frequency can vary per frame and voltage. For exact values, contact your local ABB representative.
Maximum recommended motor cable length	Frames R1i…R2i: 150 m (492 ft)[1)] Frames R3i…R7i: 300 m (984 ft)[1)] Frame R8i and multiples: 500 m (1640 ft) **Note:** Longer cables cause a motor voltage decrease which limits the available motor power. The decrease depends on the motor cable length and characteristics. Contact ABB for more information. A sine filter (optional) at the drive output also causes a voltage decrease.
Output terminals	Refer to section Terminal and cable entry data for the power cables (page 156).

1) Tested with 100 m (328 ft) for EMC Category C3. See standards and markings information in ACS880 multidrive cabinets and modules electrical planning instructions (3AUA0000102324 [English]).

Typical power cable sizes

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

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

Conductor cross-section (copper)		**PVC insulation Conductor temperature 70°**		**XLPE insulation Conductor temperature 90°**		**Typical dimensions of copper cable**	
mm²	**AWG / kcmil**	**I_{Lmax} (A)**	**Time const. (s)**	**I_{Lmax} (A)**	**Time const. (s)**	**Size**	**ø [mm]**
1.5	16	13	85	16	67	3 × 1.5 + 1.5	13
2.5	12	18	121	23	88	3 × 2.5 + 2.5	14
4	12	24	175	30	133	3 × 4 + 4	16
6	10	30	251	38	186	3 × 6 + 6	18
10	8	42	359	53	268	3 × 10 + 10	21
16	6	56	514	70	391	3 × 16 + 16	23
25	4	71	791	89	598	3 × 25 + 16	24
35	1	88	1000	110	760	3 × 35 + 16	26
50	1/0	107	1308	134	990	3 × 50 + 25	29
70	2/0	137	1613	171	1230	3 × 70 + 35	32

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]
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

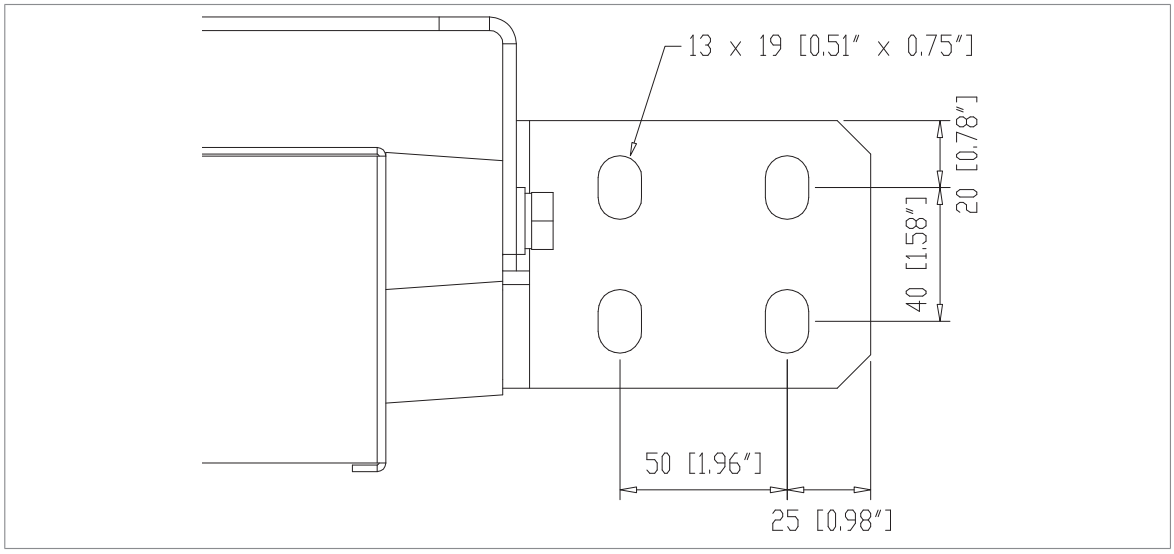
Conductor cross-section (aluminum)		PVC insulation Conductor temperature 70°		XLPE insulation Conductor temperature 90°		Typical dimensions of aluminum cable	
mm²	AWG / kcmil	I_{Lmax} (A)	Time const. (s)	I_{Lmax} (A)	Time const. (s)	Size	ø [mm]
35	1	67	736	84	669	3 × 35 + 10 Cu	26
50	1/0	82	959	102	874	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

Output terminals (frames R1i…R5i)

Frame size	U2, V2, W2, PE (terminal block X1)				Type
	Maximum conductor size		Tightening torque		
	mm²	AWG	N·m	lbf·in	
R1i, R2i	6 (stranded)	10	0.7 … 0.8	6.2 … 7.1	Detachable screw terminal block
	10 (solid)				
R3i, R5i	16	6	1.7 … 1.8	15…16	
R4i	50 (copper cable)	1/0	6…8	53…71	Screw terminal block
	70 (aluminum cable) (option +H371)	2/0	15	133	

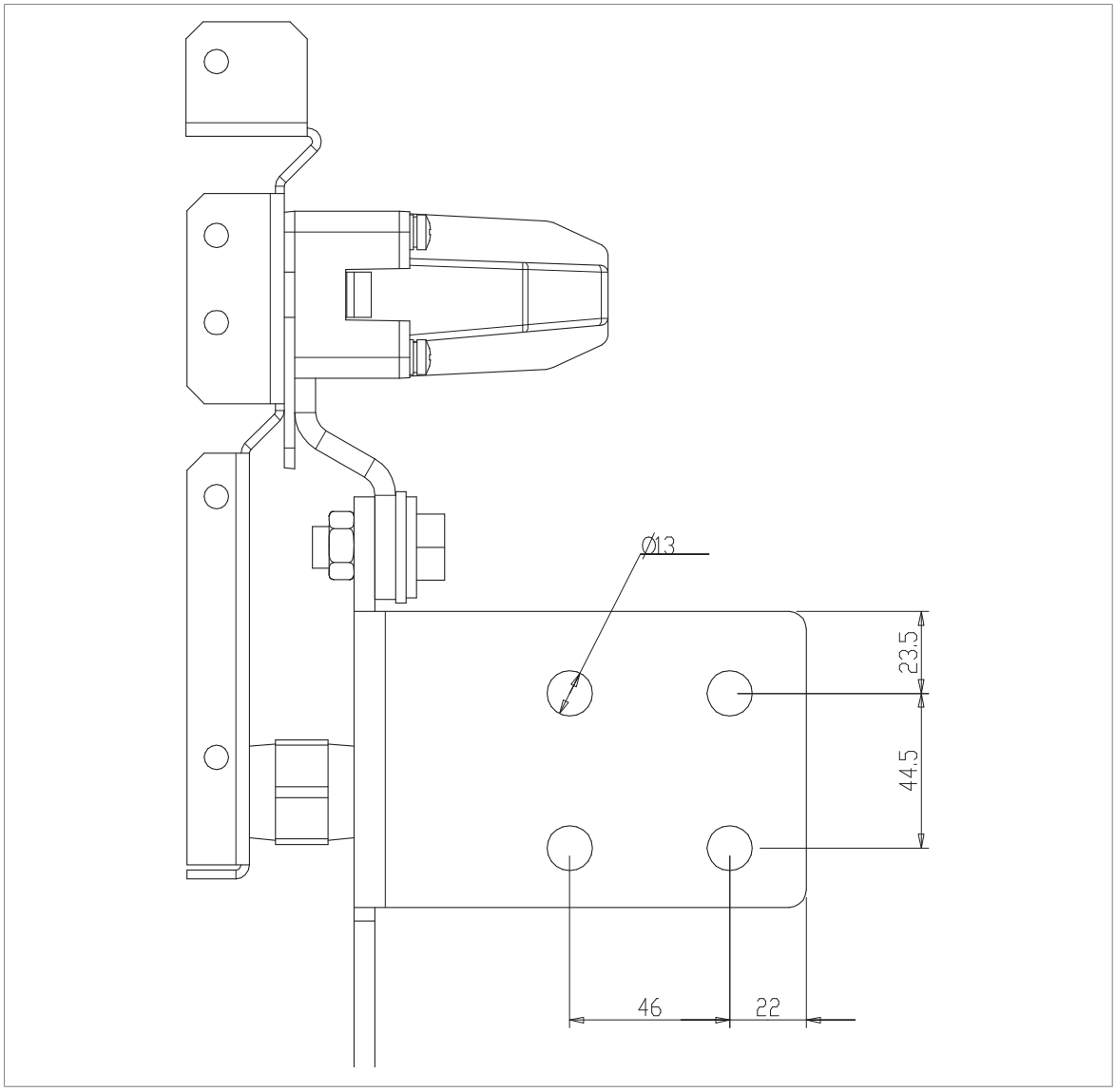
Output terminals (frames R6i...R7i)



Screw size: M12 or ½". Tightening torque: 70 N·m (52 lbf·ft)

Busbar material: Tin-plated copper

Output terminals (frame R8i)

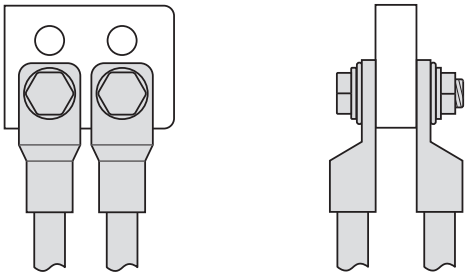


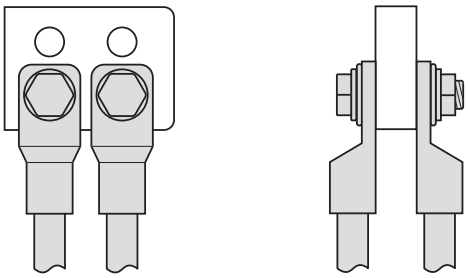
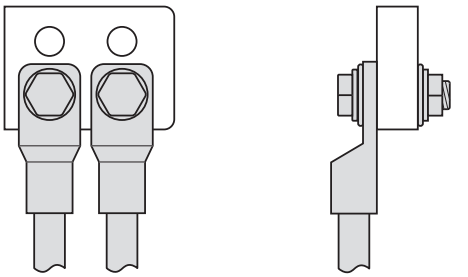
Screw size: M12 or ½". Tightening torque: 70 N·m (52 lbf·ft)

Busbar material: Tin-plated copper

Connection capability (frame R8i)

The maximum number of motor cables depends on the cable size, cable material, number of inverter modules and on the inverter unit cubicle width. Before you select motor cable sizes, check the inverter unit construction from the project-specific dimension drawings and use the tables below to determine the connection capability.

Maximum number of 3-phase motor cables (copper) for each inverter module, n×R8i with cable exit from bottom		
Cable cross section (mm^2)	**Copper compression cable lugs (DIN 46235)**	**Connection method**
50	6*	
70	6*	
95	6*	
120	6*	
150	4	
185	4	
240	4	
300	-	-
* Requires additional engineering. Standard cable entry plate not suitable.		

Maximum number of 3-phase motor cables (aluminum) for each inverter module, n×R8i with cable exit from bottom		
Cable cross section (mm^2)	**Aluminum compression cable lugs (DIN 46329)**	**Connection method**
50	6*	
70	6*	
95	6*	
120	6*	
150	4	
185	4	
240	4	
300	2	
* Requires additional engineering. Standard cable entry plate not suitable.		

Control connections

See chapter Control units of the drive (page 77).

Efficiency

Approximately 98% at nominal power level. The efficiency is not calculated according to the ecodesign standard IEC 61800-9-2.

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).

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

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…2000 m (0…6562 ft) above sea level. For altitudes over 2000 m, contact ABB. Output derated above 1000 m (3281 ft).	-	-
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)
Relative humidity	Max. 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		

	Operation installed for stationary use	Storage in the protective package	Transportation in the protective package
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

Cooling

Method	Fans built in inverter modules, exhaust fans in frame R1i…R5i cubicles, and IP54 cubicles of other frame sizes. Fan in cooling air inlet of control cubicles (frame R8i and multiples).
Filter material (IP54)	Inlet (door): Camfil/airComp 300-50 Outlet (roof): Camfil/airTex G150
Air flow	See Noise and cooling characteristics (page 150)

Colors

RAL 7035, RAL 9017.

Materials

Drive

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

Packaging of drive

- Plywood[1)]
- Wood
- PET (strapping)
- PE (VCI film)

- Metal (fixing clamps, screws)
- VCI emitter capsules
- Clay desiccant.

1) Seaworthy package only

Packaging of options

- Cardboard
- Kraft paper
- PP (straps)
- PE (film, bubble wrap)
- Plywood, wood (only for heavy components).

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

Manuals

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

Disposal

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

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

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

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

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

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

Applicable standards

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

Markings

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

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

Disclaimers

Generic disclaimer

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

Cyber security disclaimer

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

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

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Dimensions and weights

Contents of this chapter

This chapter contains information on the dimensions and weights of ACS880-107 inverter cubicles.

Frames R1i...R7i

Frames R1i...R5i

Because of the modularity of the design, the width of the cubicle varies between 400…1000 mm according to the number and size of the modules.

The following drawing displays a 400 mm wide cubicle, but the main dimensions apart from width are also applicable to wider cubicles. For details, refer to the dimension drawings delivered with the unit.

Option +C128 (cooling air intake through floor of cabinet) extends the cabinet depth by 130 mm.

Weights

The table shows the estimated maximum weights of R1i…R5i cubicles.

Frame size	Cubicle width	Estimated max. weight	
	mm	kg	lbs
R1i…R4i	400	240	530
	600	310	685
	800	400	880
	1000	485	1070
R5i	300	200	440
	500	320	705

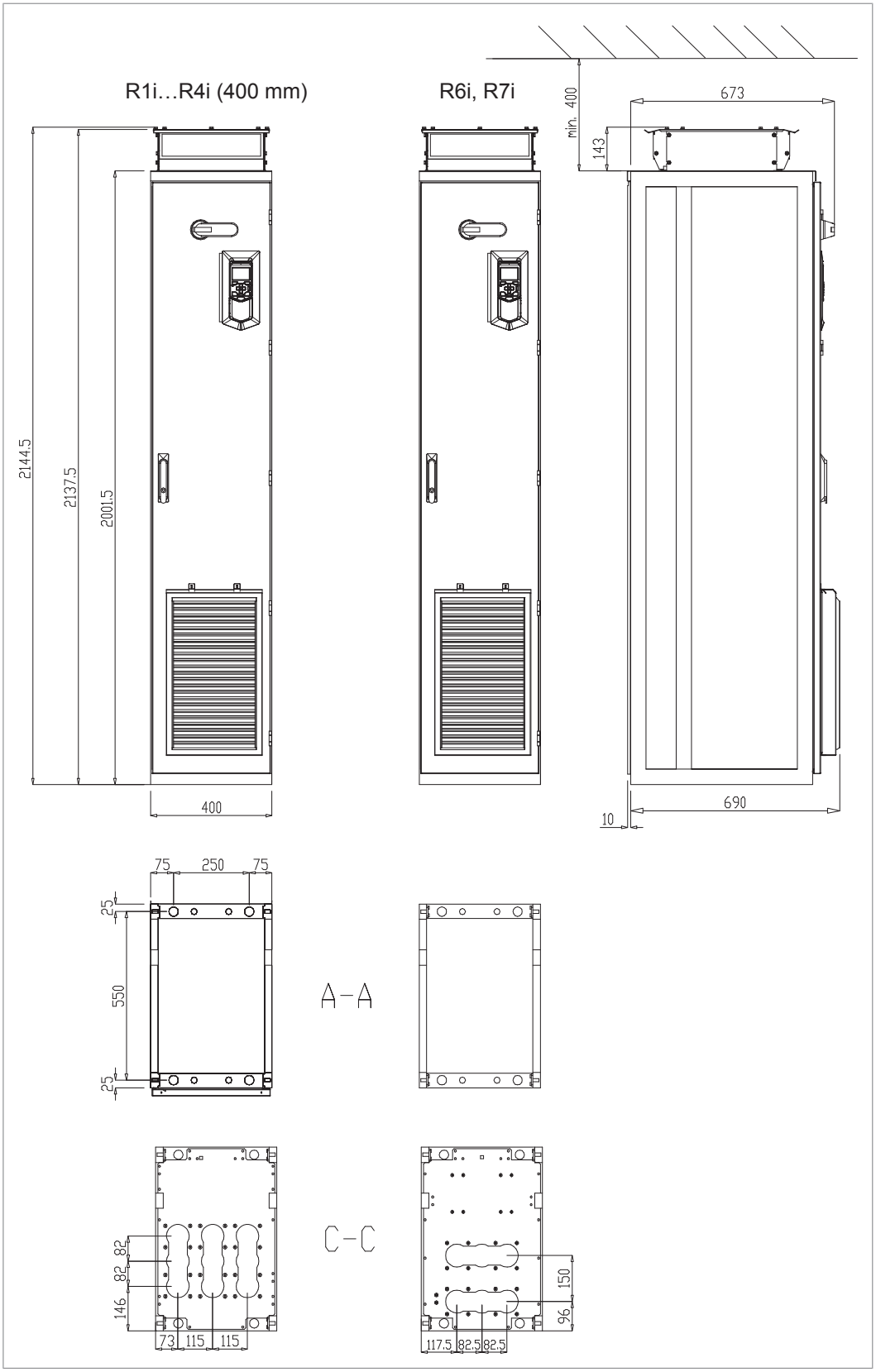
Frame size	Cubicle width	Estimated max. weight	
	mm	kg	lbs
R5 with option +C204	500	280	615

Frames R6i and R7i

Each frame R6i and R7i inverter unit is housed in a 400 mm wide cubicle such as the one pictured below. The approximate weight of the cubicle is 250 kg (550 lbs). For details, refer to the dimension drawings delivered with the unit.

Options +H353 (motor cabling through roof of cabinet) and +C128 (cooling air intake through floor of cabinet) extend the cabinet depth by 130 mm.

Dimension drawing – 400 mm wide cubicle



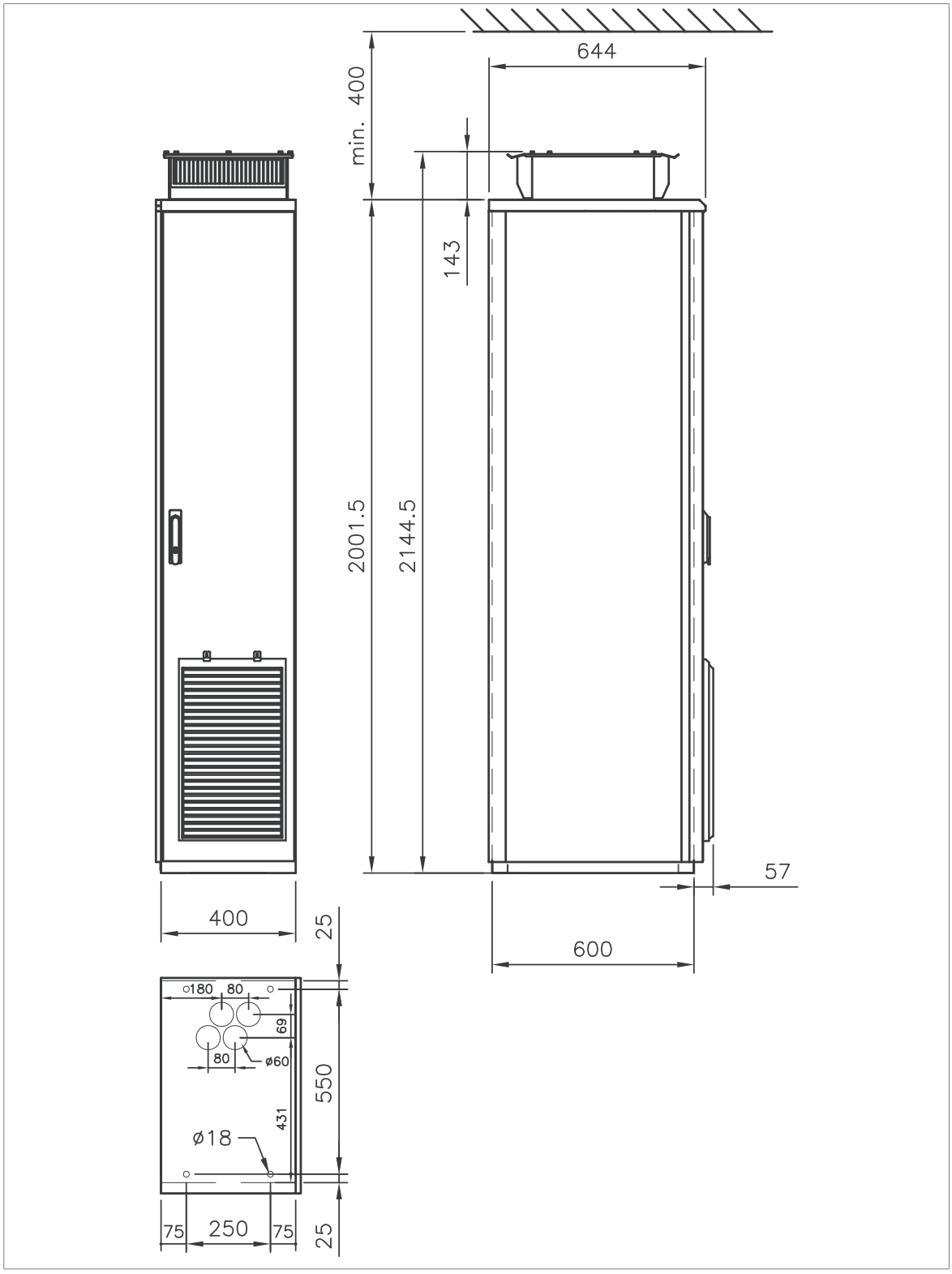
Frame R8i and multiples

The standard cubicle widths are 400 mm (frame R8i), 600 mm (2×R8i) and 800 mm (3×R8i). The approximate weights of the cubicles are 320, 510 and 660 kg (705, 1125 and 1455 lbs) respectively. Larger inverter units are combinations of these cubicles.

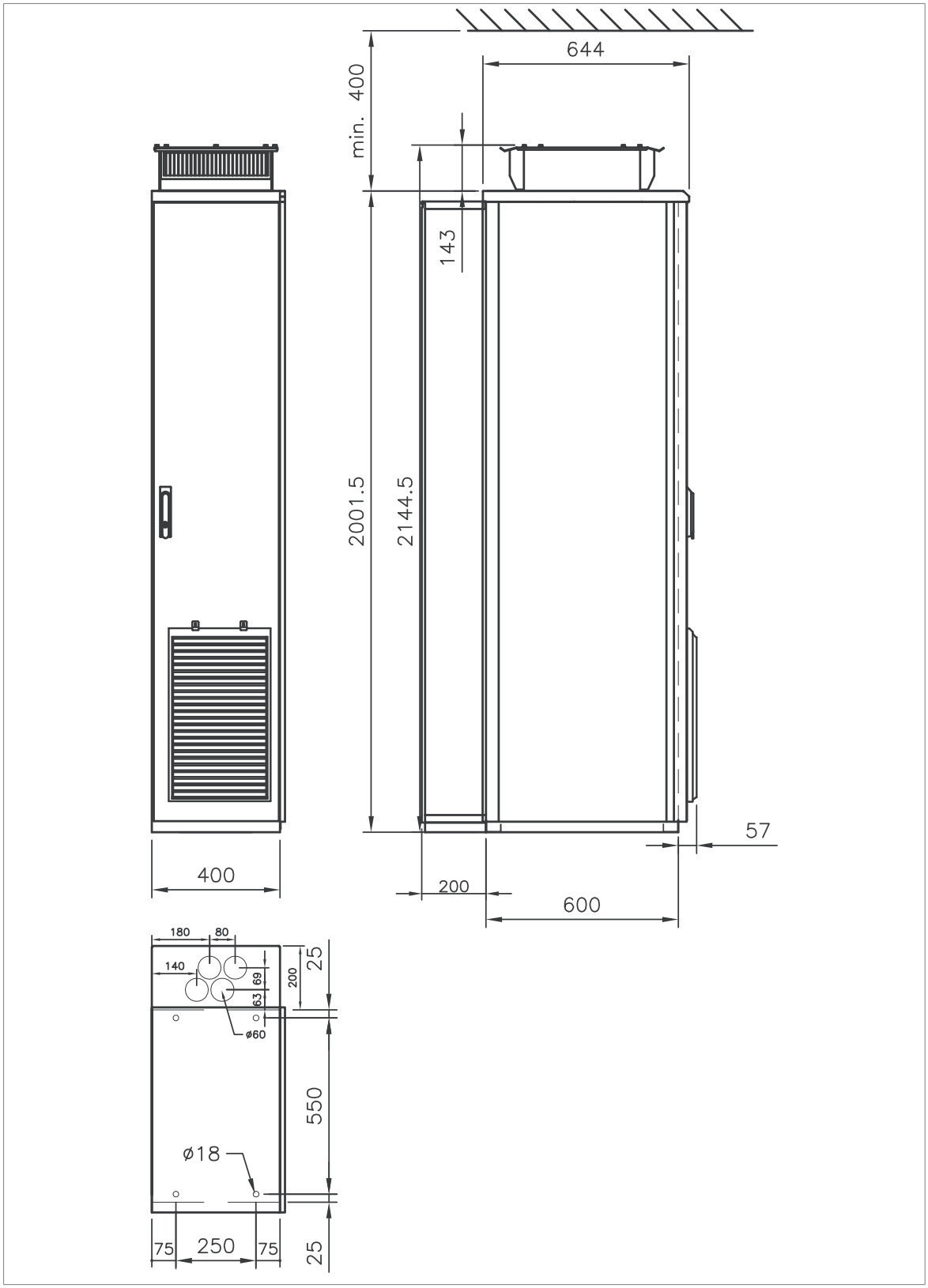
As standard, the control equipment is located in a separate 300 mm wide cubicle (DCU). A 400 mm wide cubicle is optionally available.

Option +C128 (cooling air intake through floor of cabinet) extends the cabinet depth by 130 mm. Option +H353 (motor cabling through roof of cabinet) extends the cabinet depth by 200 mm.

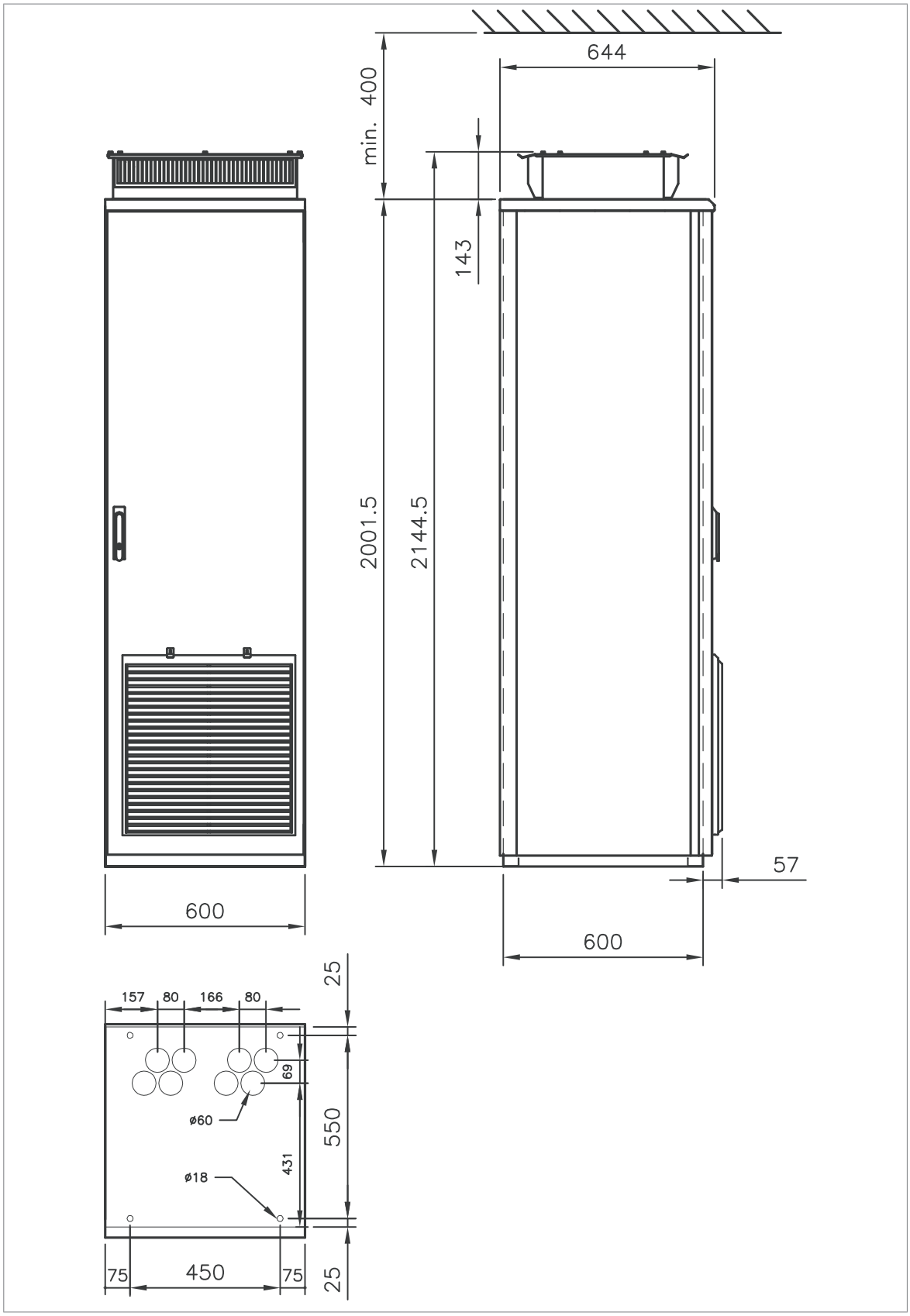
Dimension drawing – R8i (without +C128 or +H353), bottom cable exit



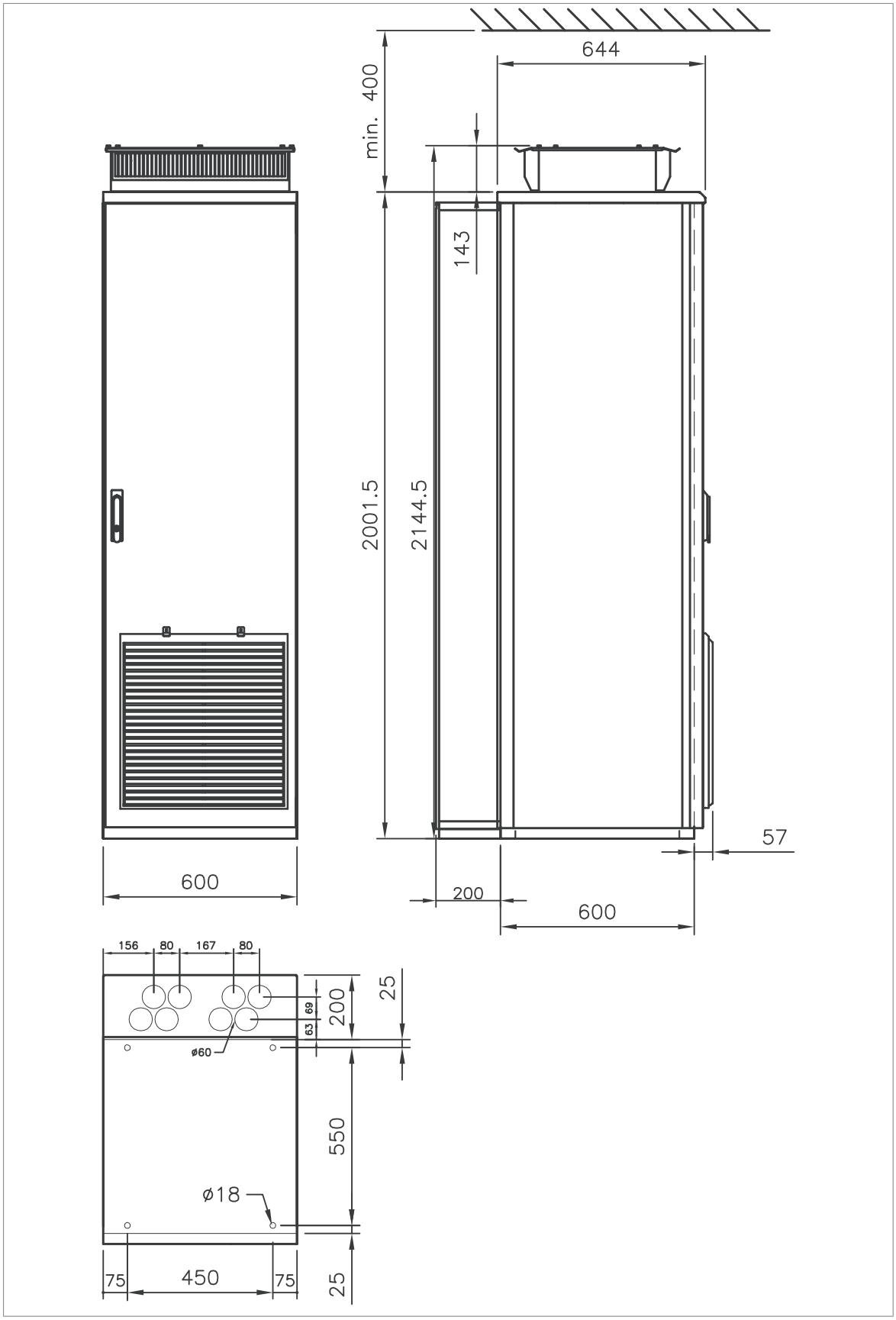
Dimension drawing – R8i (without +C128 or +H353), top cable exit



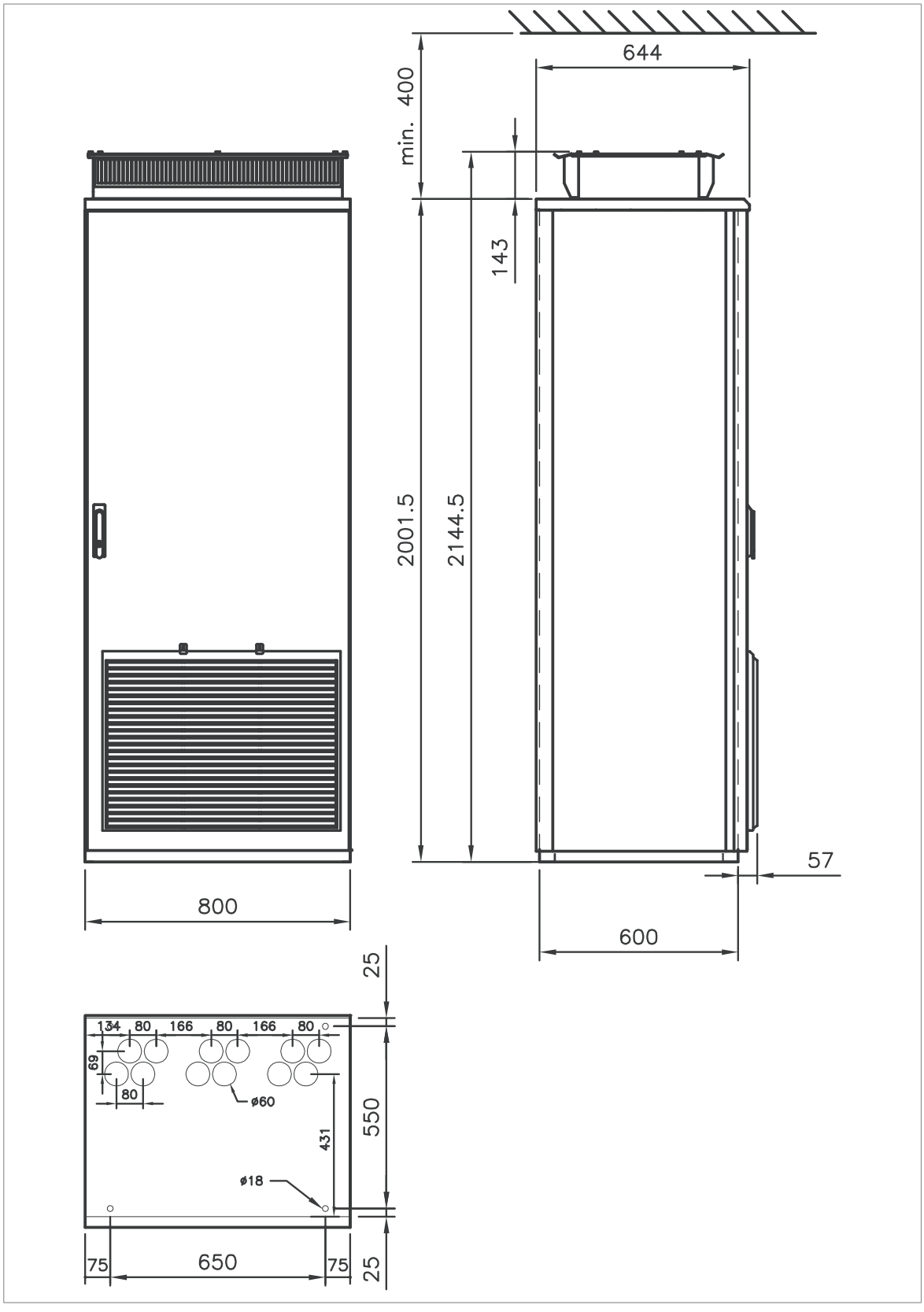
Dimension drawing – 2×R8i (without +C128 or +H353), bottom cable exit



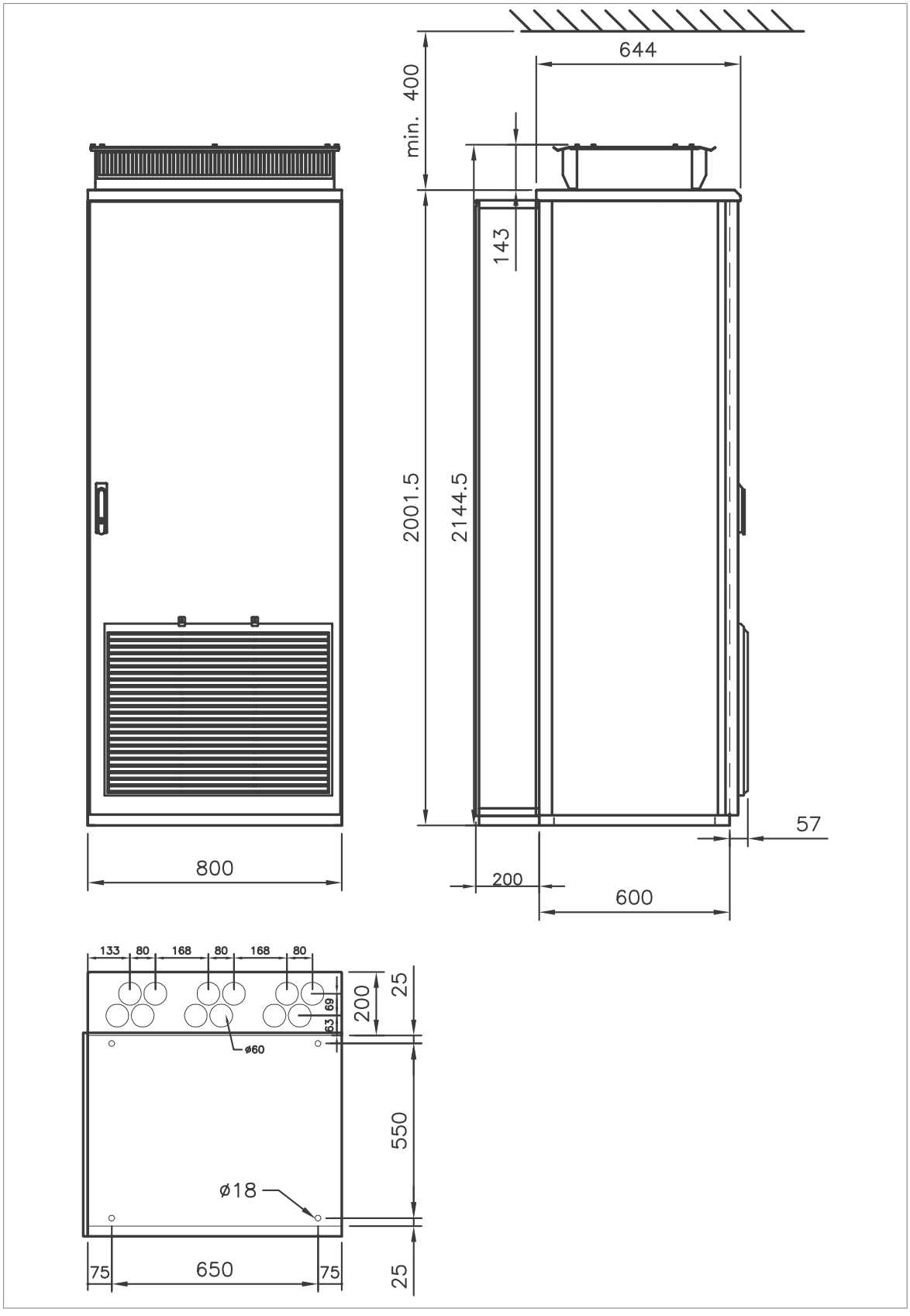
Dimension drawing – 2×R8i (without +C128 or +H353), top cable exit



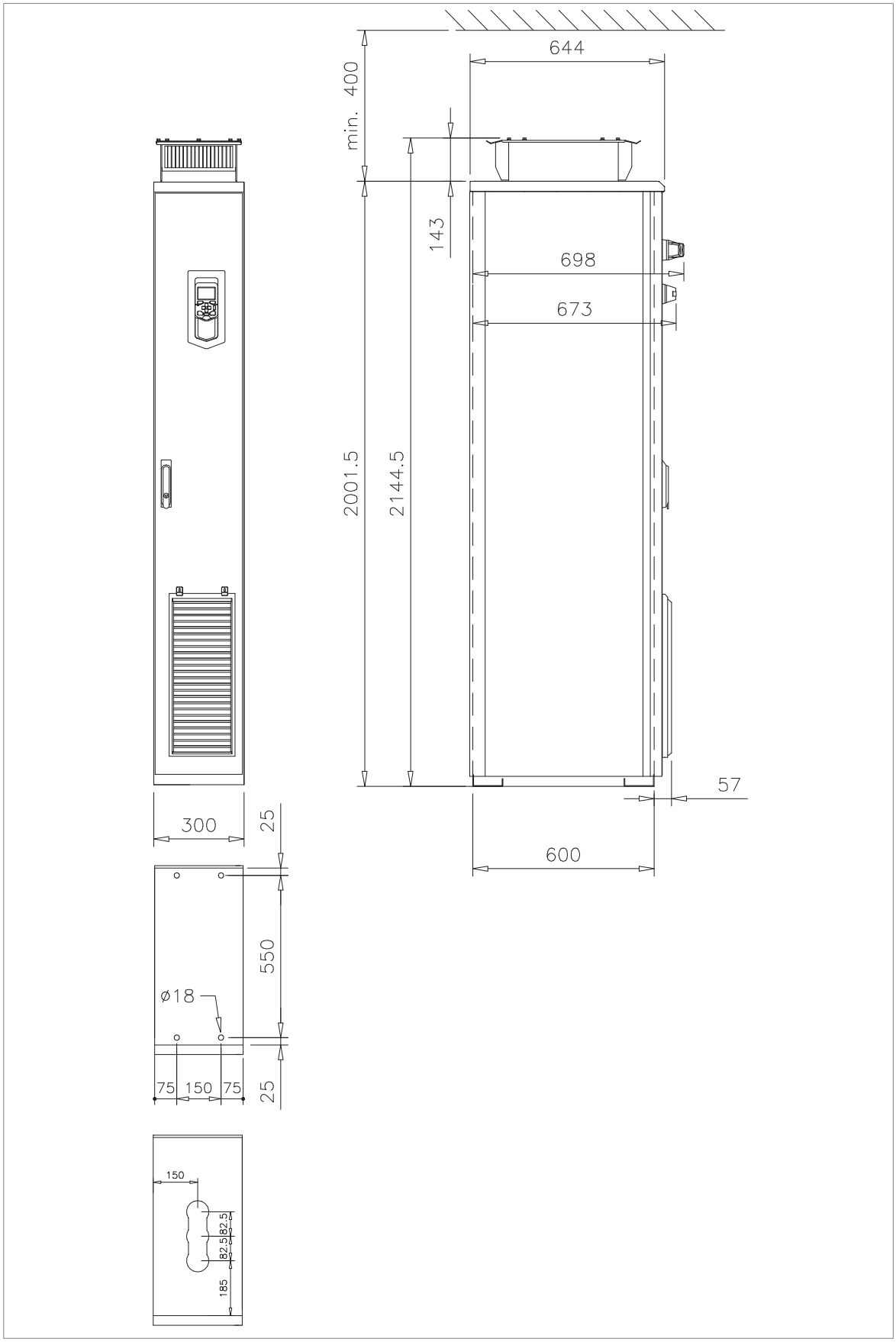
Dimension drawing – 3×R8i (without +C128 or +H353), bottom cable exit



Dimension drawing – 3×R8i (without +C128 or +H353), top cable exit



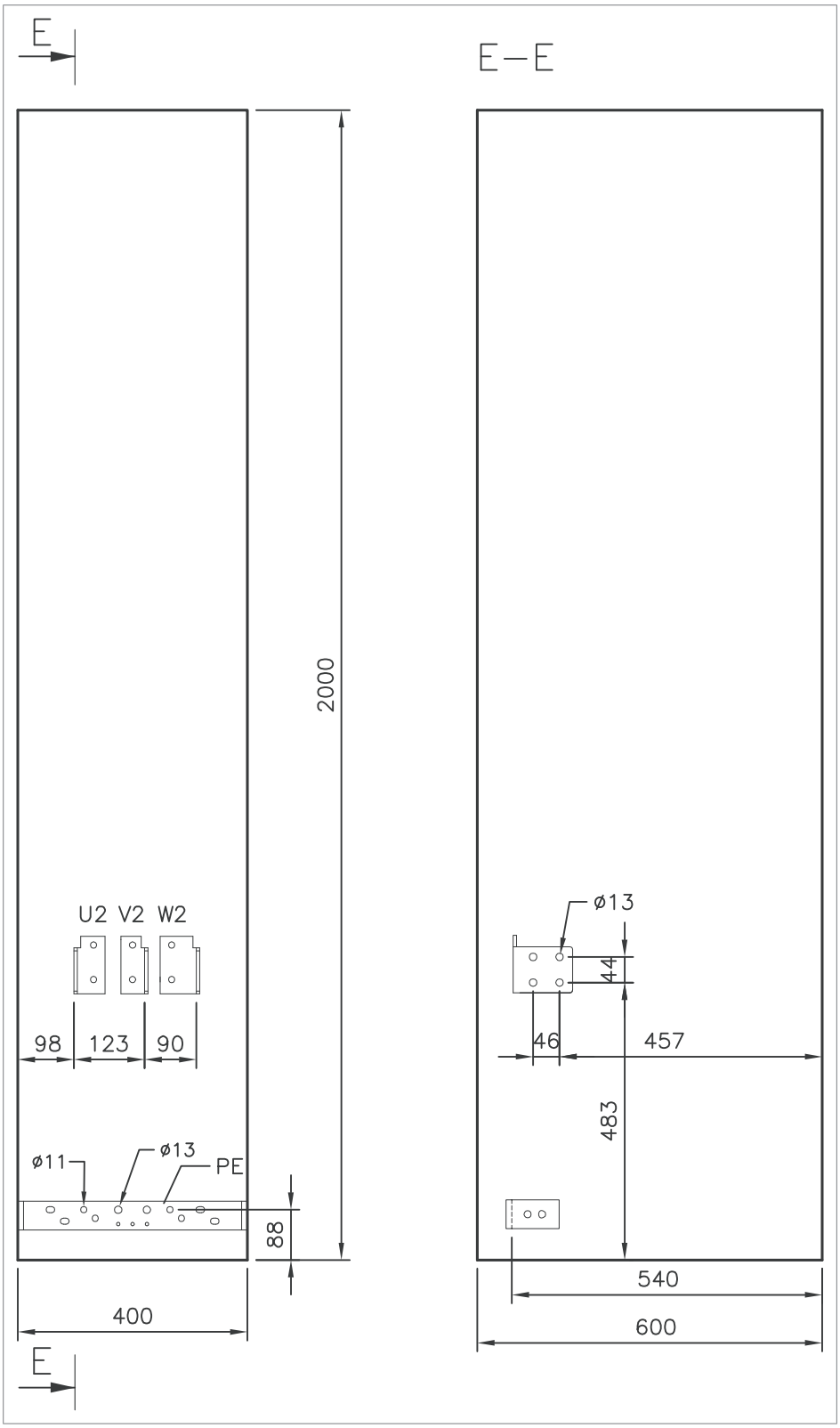
Dimension drawing – drive control unit (DCU) (300 mm)



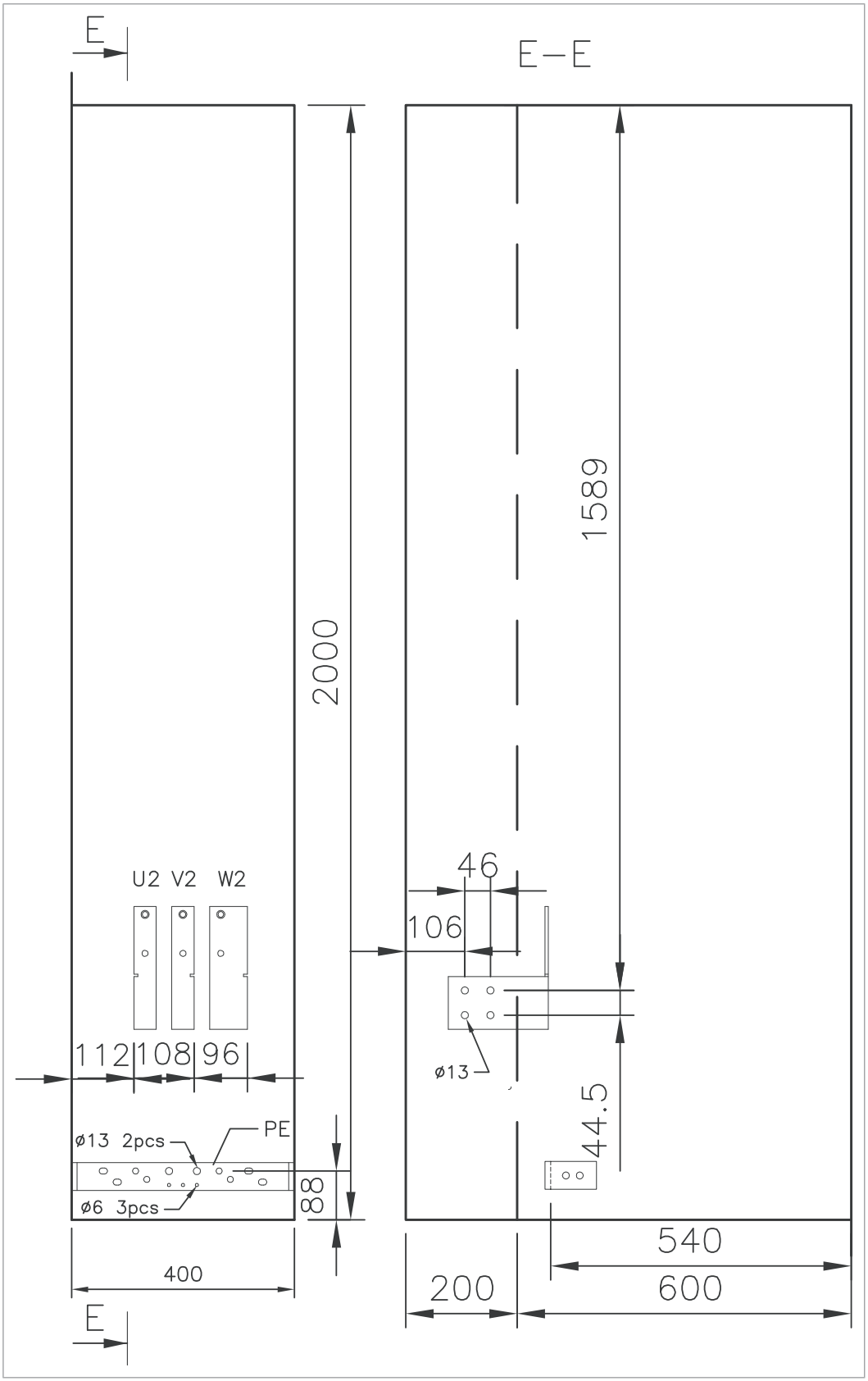
Location and size of output terminals

Units without common motor terminal cubicle

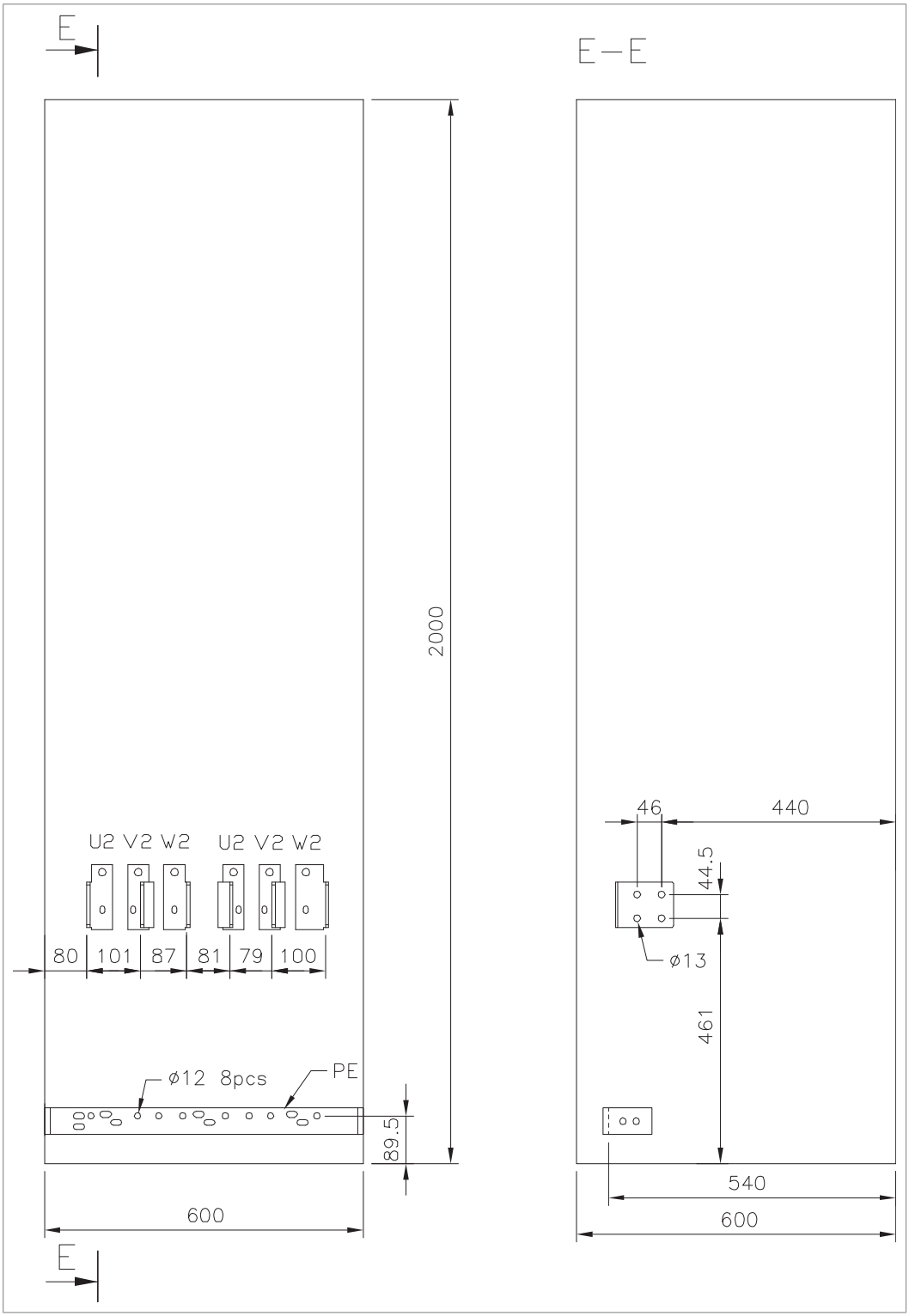
Inverter module cubicle with one R8i module, bottom cable exit



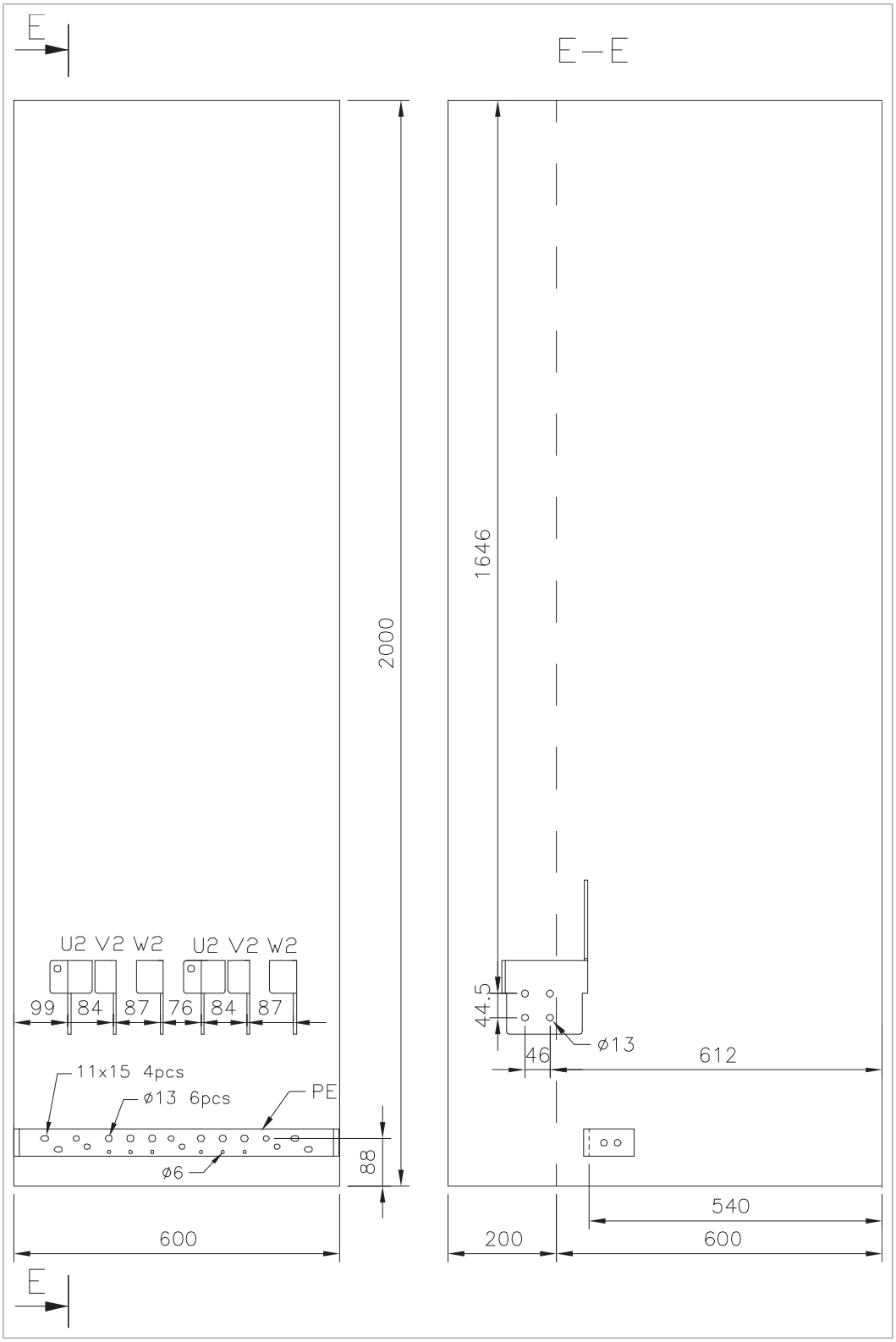
Inverter module cubicle with one R8i module, top cable exit



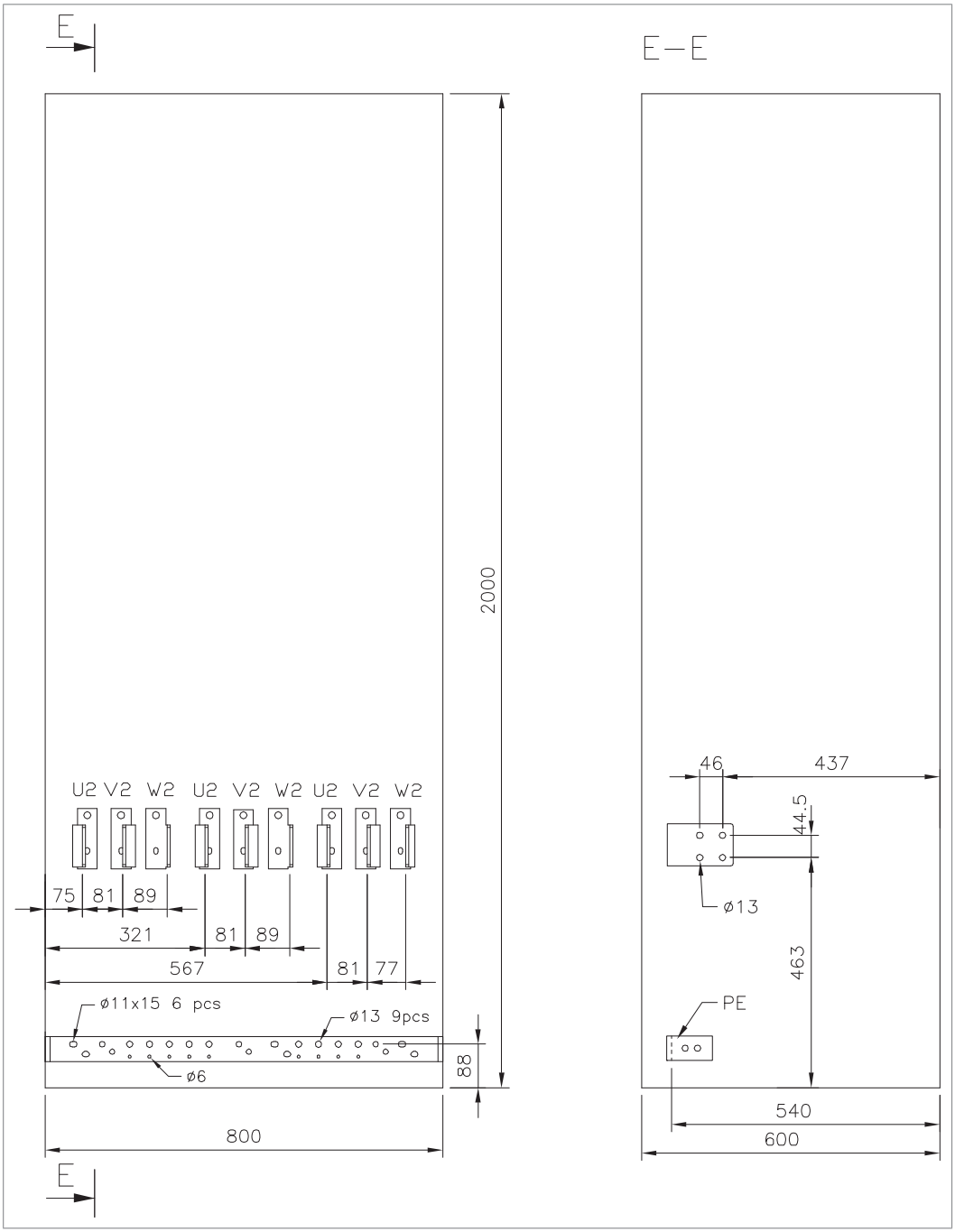
Inverter module cubicle with two R8i modules, bottom cable exit



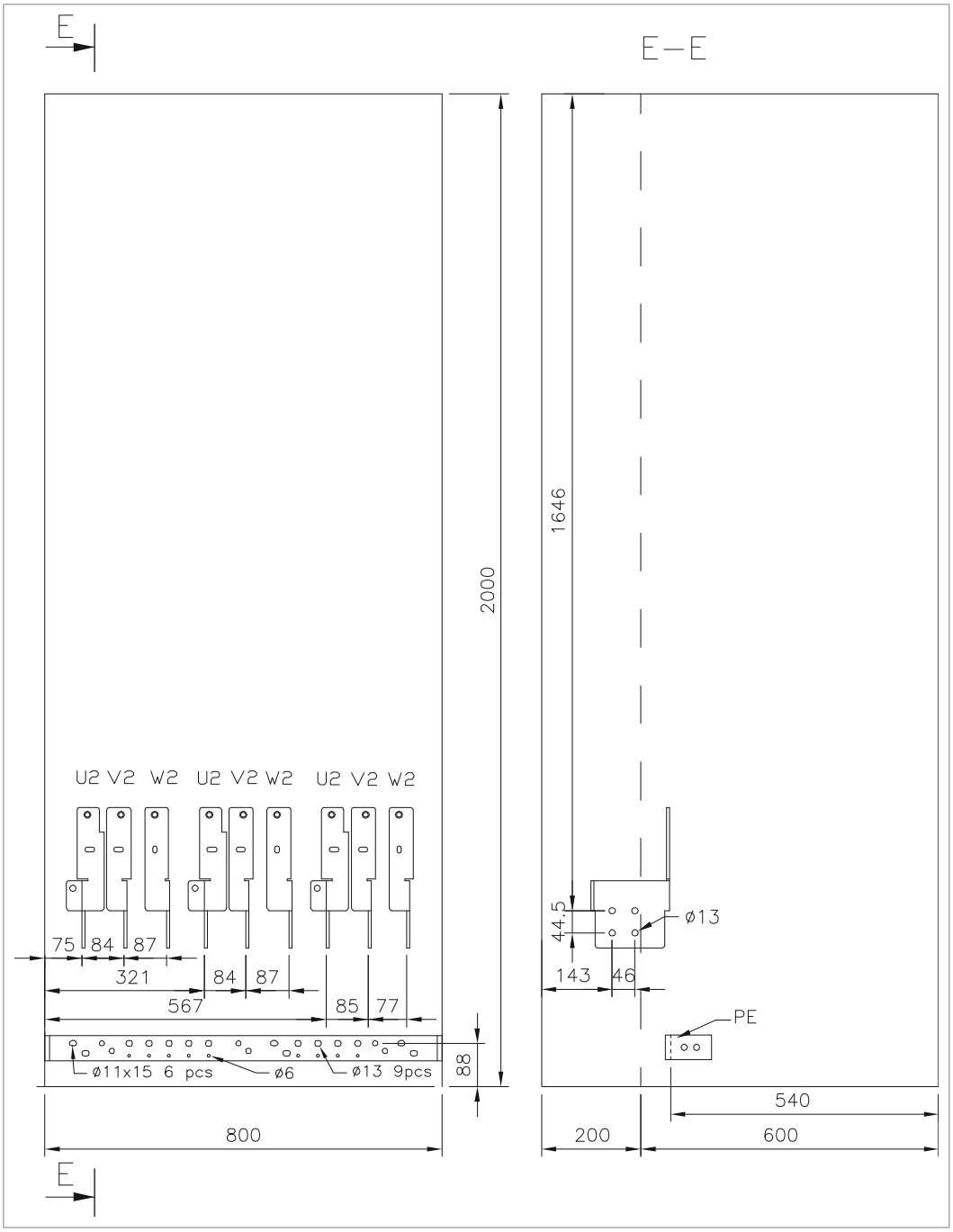
Inverter module cubicle with two R8i modules, top cable exit



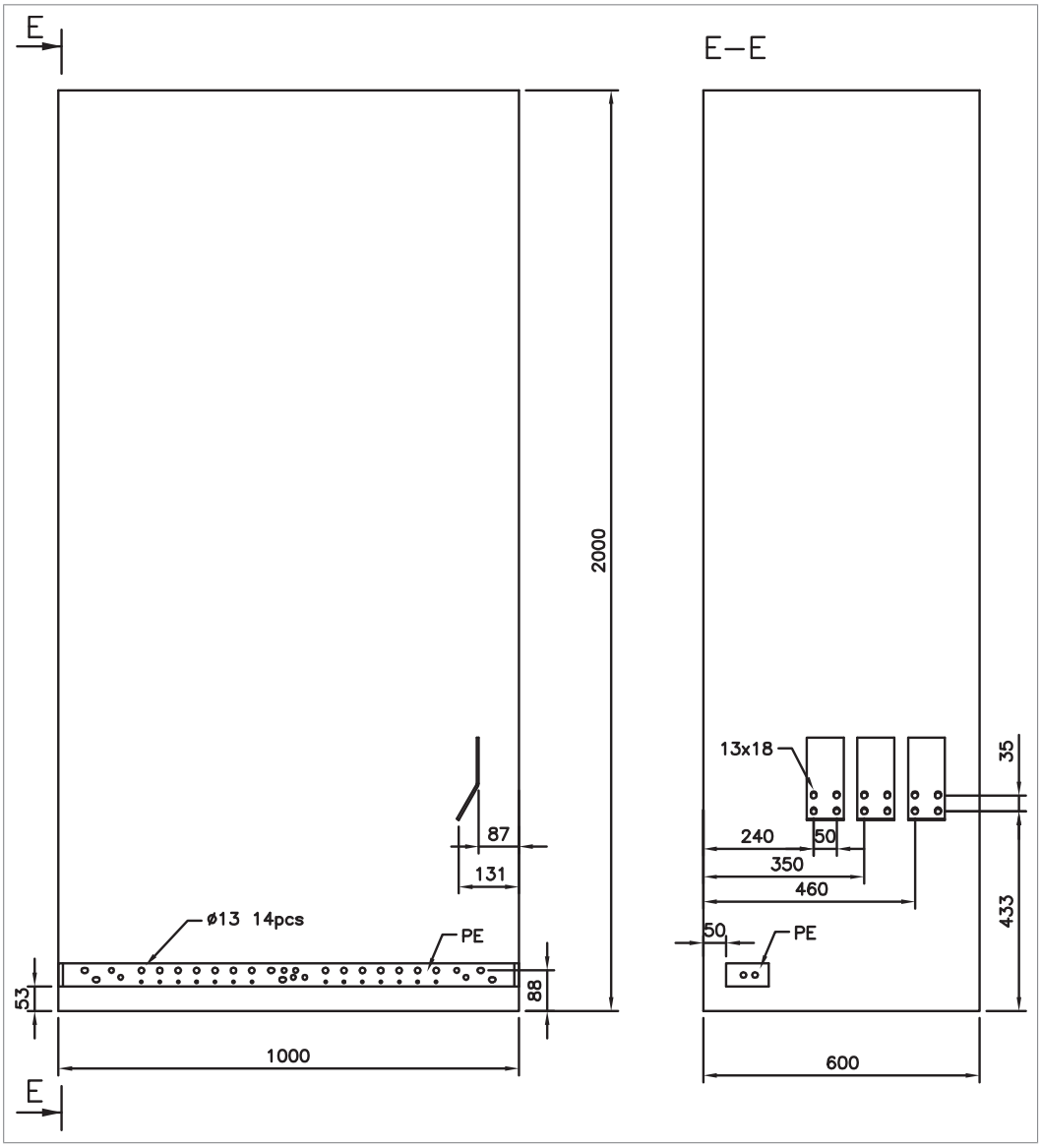
Inverter module cubicle with three R8i modules, bottom cable exit



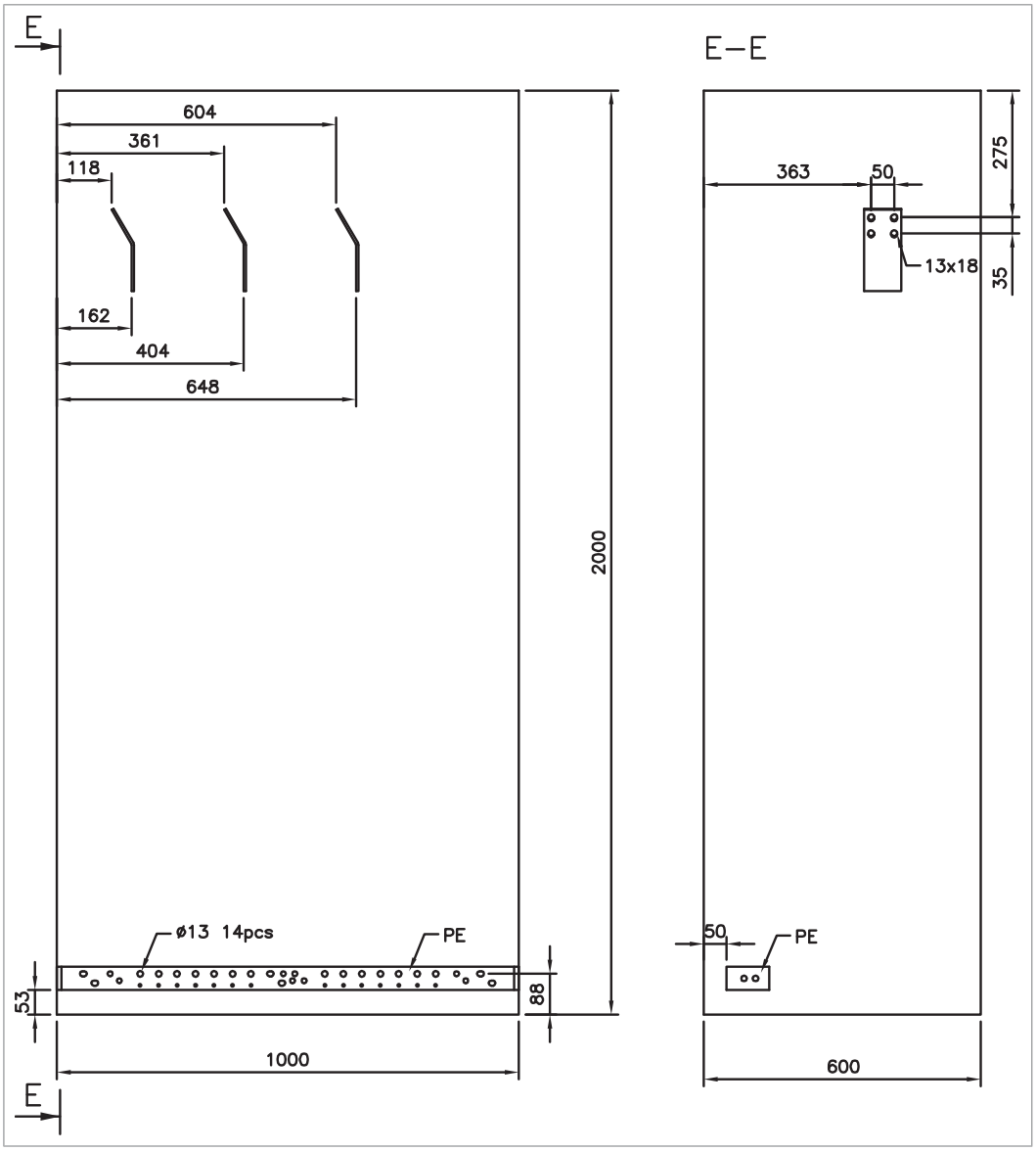
Inverter module cubicle with three R8i modules, top cable exit



Sine filter cubicle, 1000 mm, bottom cable exit

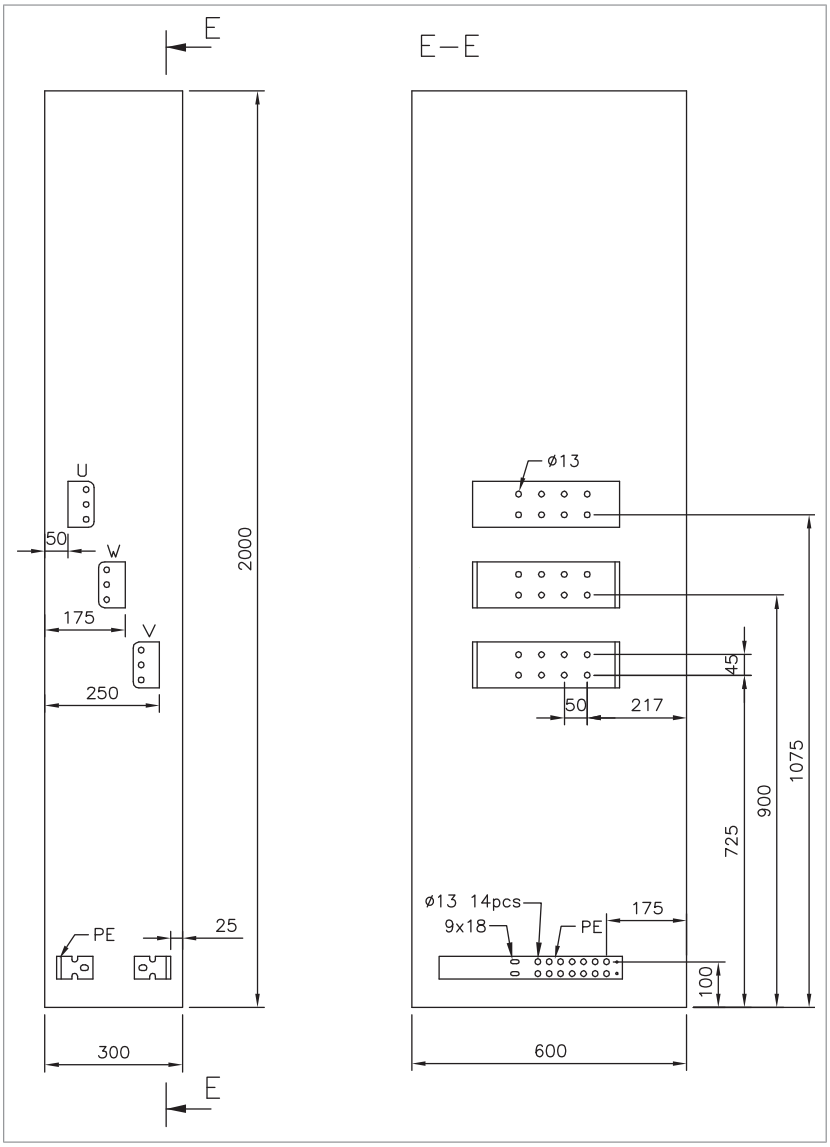


Sine filter cubicle, 1000 mm, top cable exit

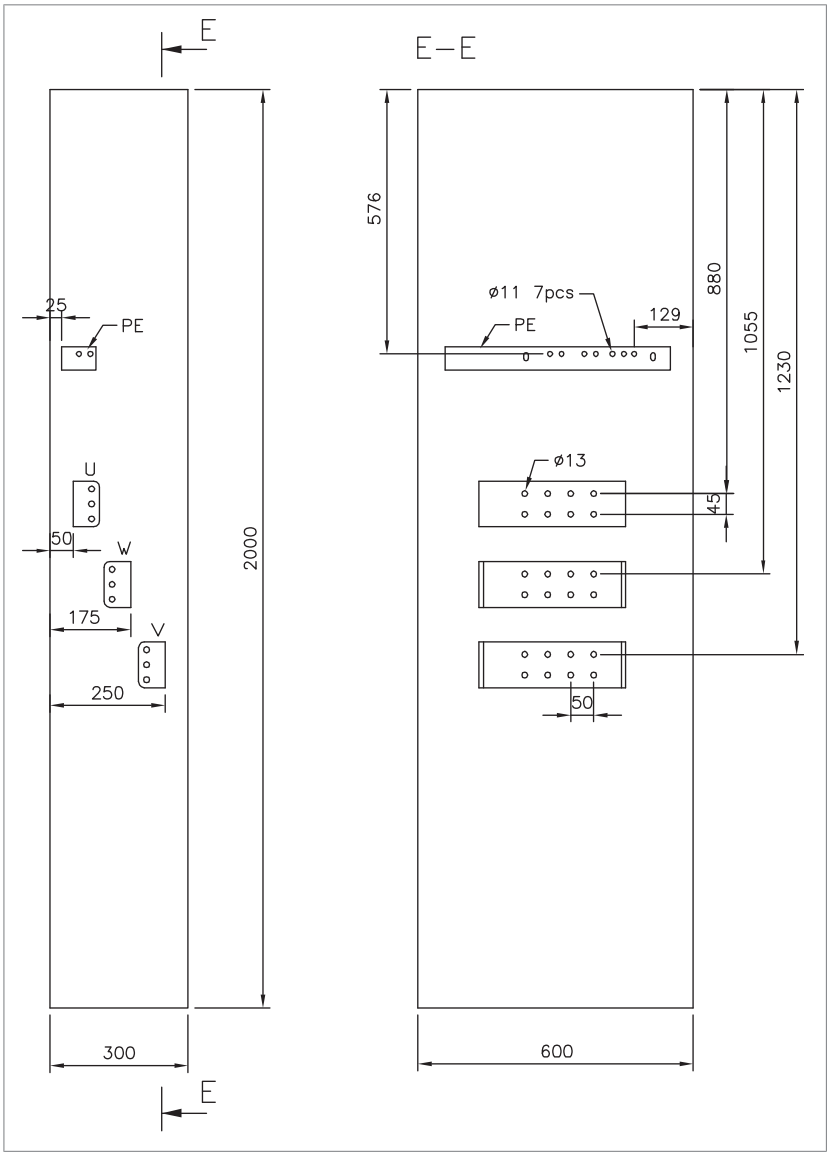


Units with common motor terminal cubicle (+H359)

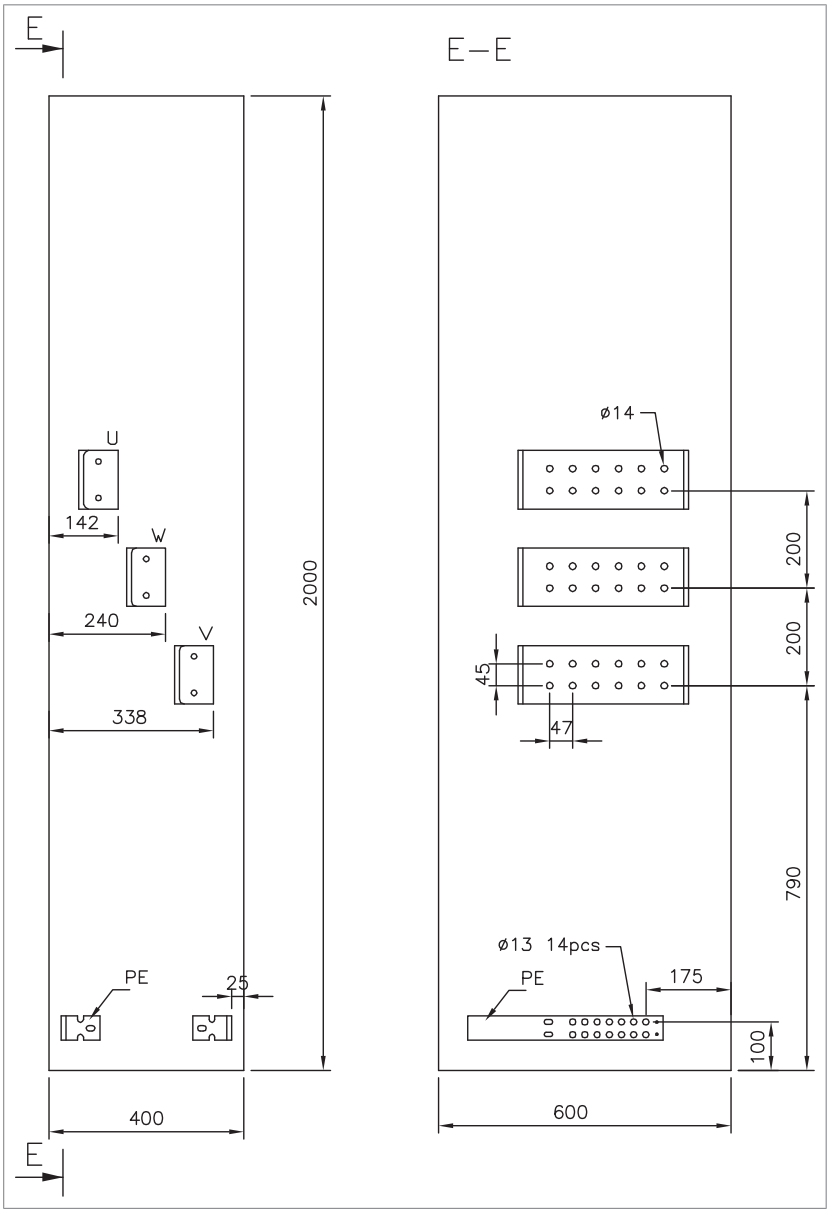
Cubicle width 300 mm, bottom cable exit



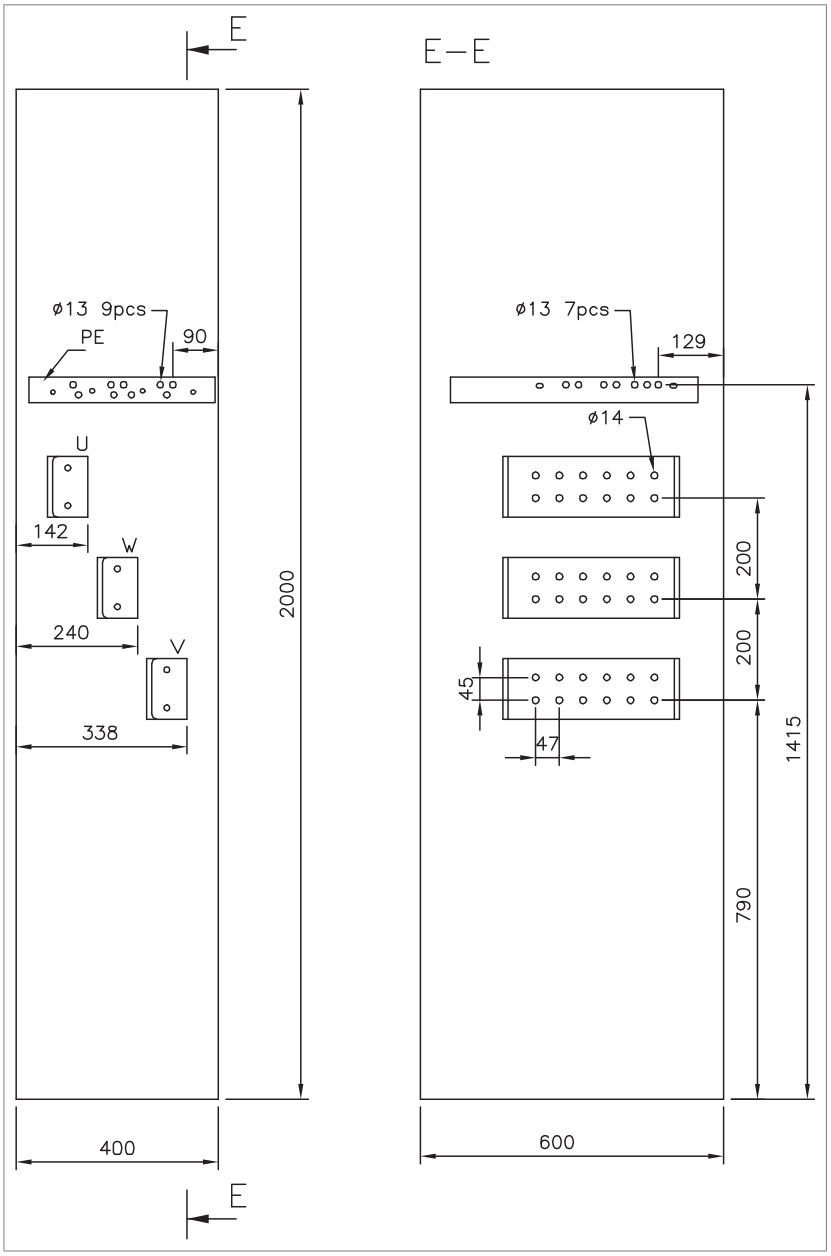
Cubicle width 300 mm, top cable exit



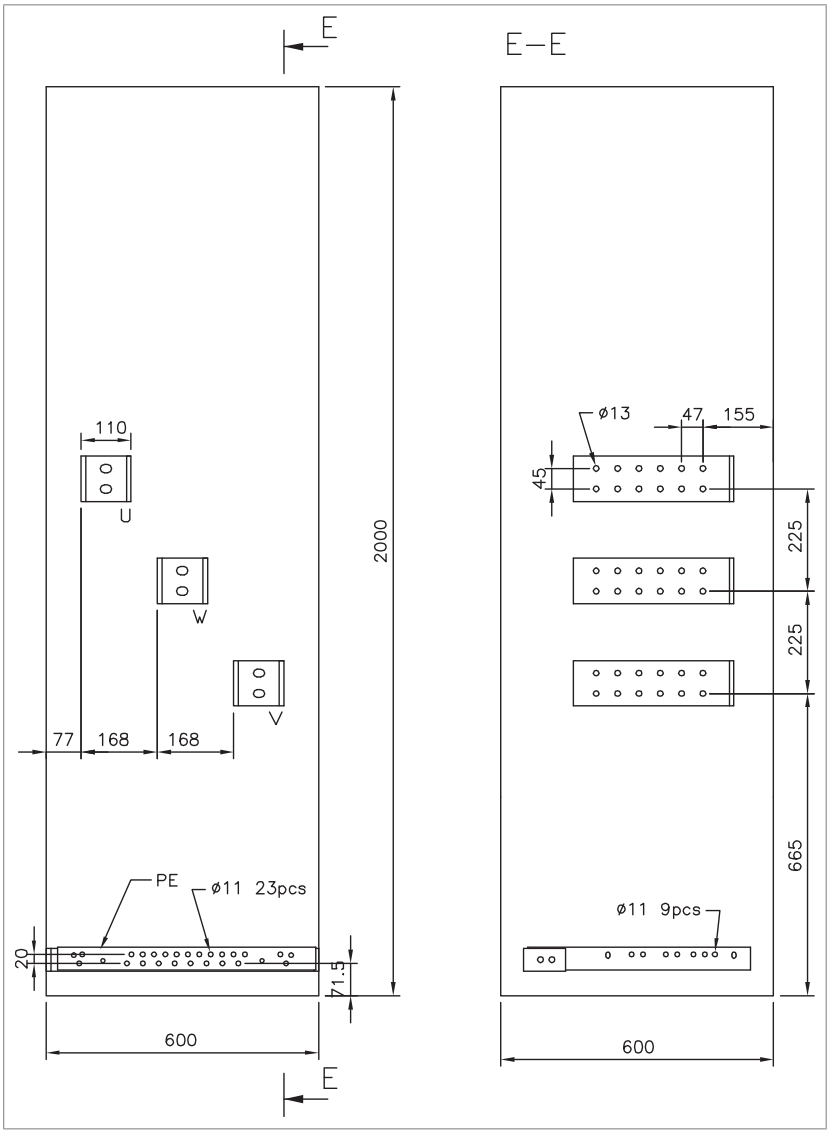
Cubicle width 400 mm, bottom cable exit



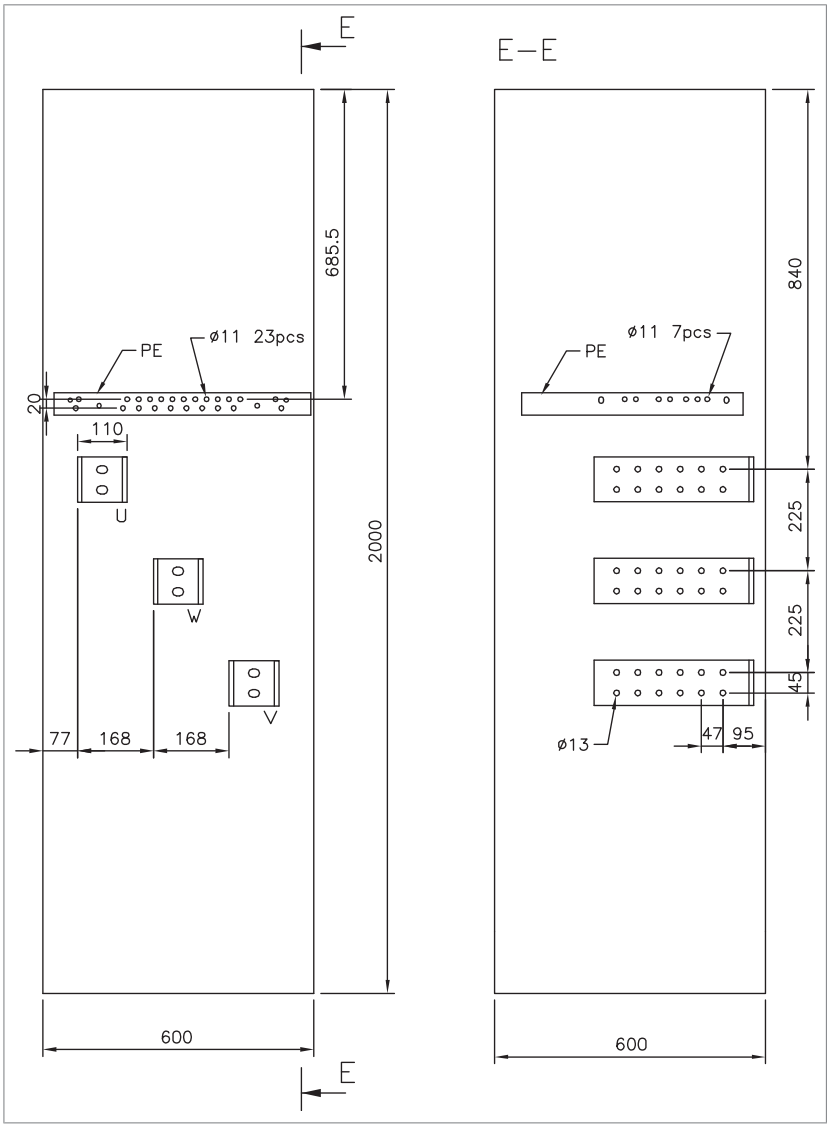
Cubicle width 400 mm, top cable exit



Cubicle width 600 mm, bottom cable exit



Cubicle width 600 mm, top cable exit



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The Safe torque off function

Contents of this chapter

This chapter describes the Safe torque off (STO) function of the drive and gives instructions for its use.

Note: In this chapter, the term 'drive' refers to one inverter unit of the drive system.

Description

WARNING!
In case of parallel-connected drives or dual-winding motors, the STO must be activated on each drive to remove the torque from the motor.

The Safe torque off function can be used, for example, as the final actuator device of safety circuits (such as an emergency stop circuit) that stop the drive in case of danger. Another typical application is a prevention of unexpected start-up function that enables short-time maintenance operations like cleaning or work on non-electrical parts of the machinery without switching off the power supply to the drive.

When activated, the Safe torque off function disables the control voltage for the power semiconductors of the drive output stage, thus preventing the drive from generating the torque required to rotate the motor. If the motor is running when Safe torque off is activated, it coasts to a stop.

The Safe torque off function has a redundant architecture, that is, both channels must be used in the safety function implementation. The safety data given in this manual is calculated for redundant use, and does not apply if both channels are not used.

The Safe torque off function complies with these standards:

Standard	Name
IEC 60204-1:2021 EN 60204-1:2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
IEC 61000-6-7:2014	Electromagnetic compatibility (EMC) – Part 6-7: Generic standards – Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations
IEC 61326-3-1:2017	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
IEC 61511-1:2017	Functional safety – Safety instrumented systems for the process industry sector
IEC 61800-5-2:2016 EN 61800-5-2:2007	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional
EN IEC 62061:2021	Safety of machinery – Functional safety of safety-related control systems
EN ISO 13849-1:2015	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
EN ISO 13849-2:2012	Safety of machinery – Safety-related parts of control systems – Part 2: Validation

The function also corresponds to Prevention of unexpected start-up as specified by EN ISO 14118:2018 (ISO 14118:2017), and Uncontrolled stop (stop category 0) as specified in EN/IEC 60204-1.

Compliance with the European Machinery Directive and the UK Supply of Machinery (Safety) Regulations

See ACS880 multidrive cabinets and modules electrical planning instructions (3AUA0000102324 [English]).

Wiring

For the electrical specifications of the STO connection, see the technical data of the control unit.

Activation switch

In the wiring diagrams, the activation switch has the designation [K]. This represents a component such as a manually operated switch, an emergency stop push button switch, or the contacts of a safety relay or safety PLC.

- In case a manually operated activation switch is used, the switch must be of a type that can be locked out to the open position.
- The contacts of the switch or relay must open/close within 200 ms of each other.
- An FSO safety functions module, an FSPS safety functions module or an FPTC thermistor protection module can also be used. For more information, see the module documentation.

Cable types and lengths

- ABB recommends double-shielded twisted-pair cable.
- Maximum cable lengths:
  - 300 m (1000 ft) between activation switch [K] and drive control unit
  - 60 m (200 ft) between multiple drives
  - 60 m (200 ft) between external power supply and first control unit
  - 30 m (100 ft) between control unit and last inverter module in the chain.

Note: A short-circuit in the wiring between the switch and an STO terminal causes a dangerous fault. Therefore, it is recommended to use a safety relay (including wiring diagnostics) or a wiring method (shield grounding, channel separation) which reduces or eliminates the risk caused by the short-circuit.

Note: The voltage at the STO input terminals of the control unit (or frame R8i inverter module) must be at least 17 V DC to be interpreted as “1”.

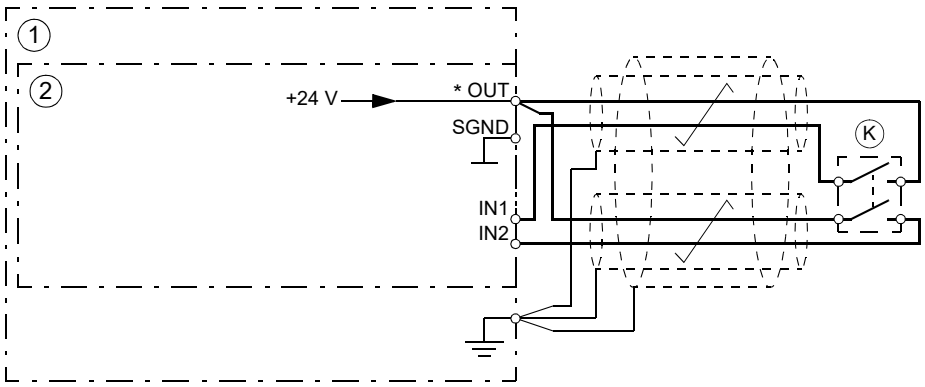
The pulse tolerance of the input channels is 1 ms.

Grounding of protective shields

- Ground the shield in the cabling between the activation switch and the control unit at the control unit only.
- Ground the shield in the cabling between two control units at one control unit only.
- Do not ground the shield in the cabling between control unit and inverter module, or between inverter modules.

Dual-channel connection with internal power supply

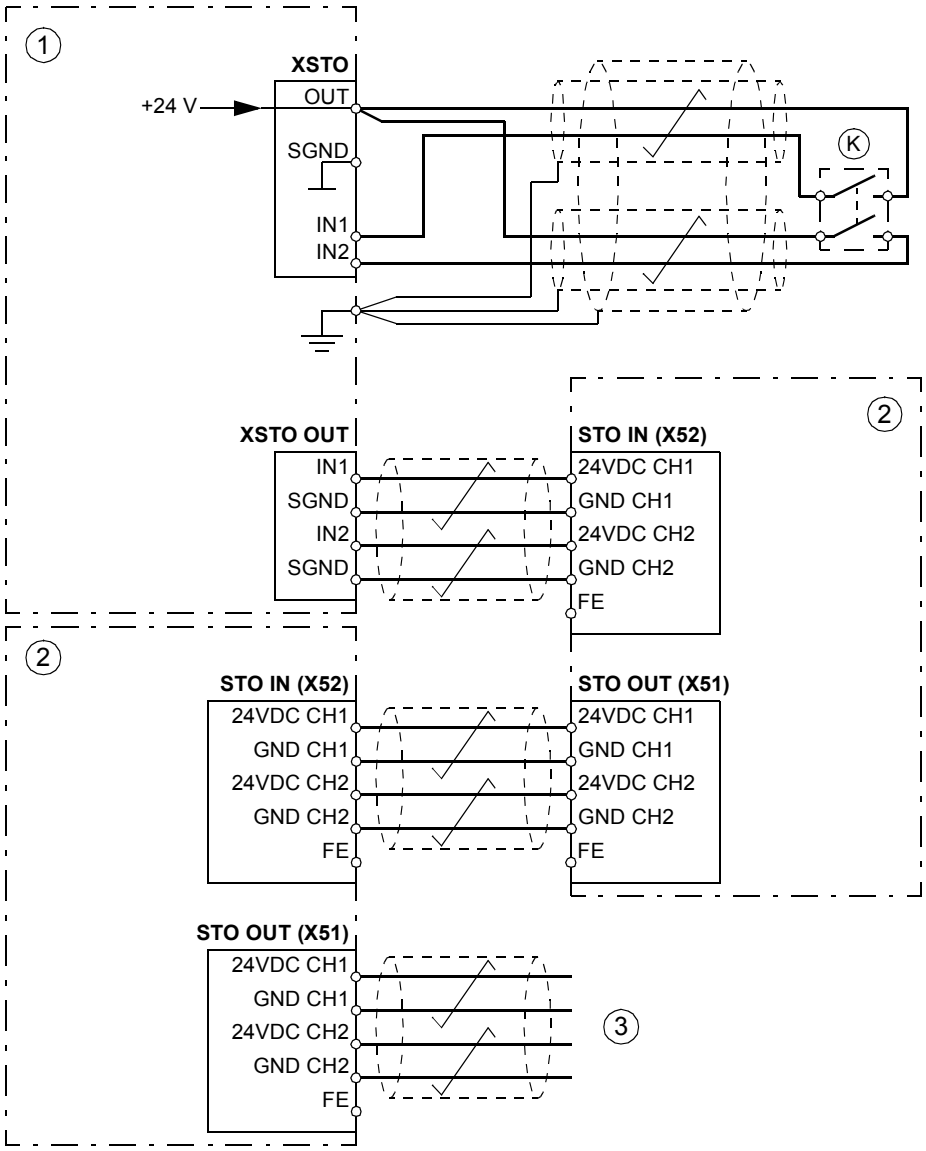
Frames R1i...R7i



1	Inverter unit
2	Control unit
K	Activation switch

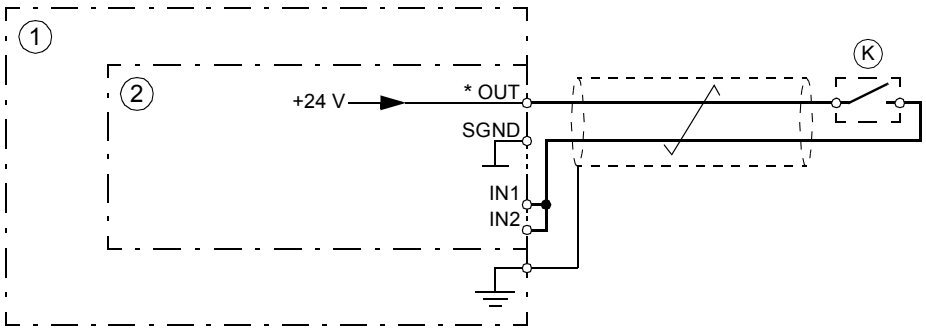
* OUT1 in frame R5i

Frame R8i and multiples



1	Inverter control unit
2	Inverter module(s)
3	To remaining inverter modules
K	Activation switch

Single-channel connection of activation switch



Note:

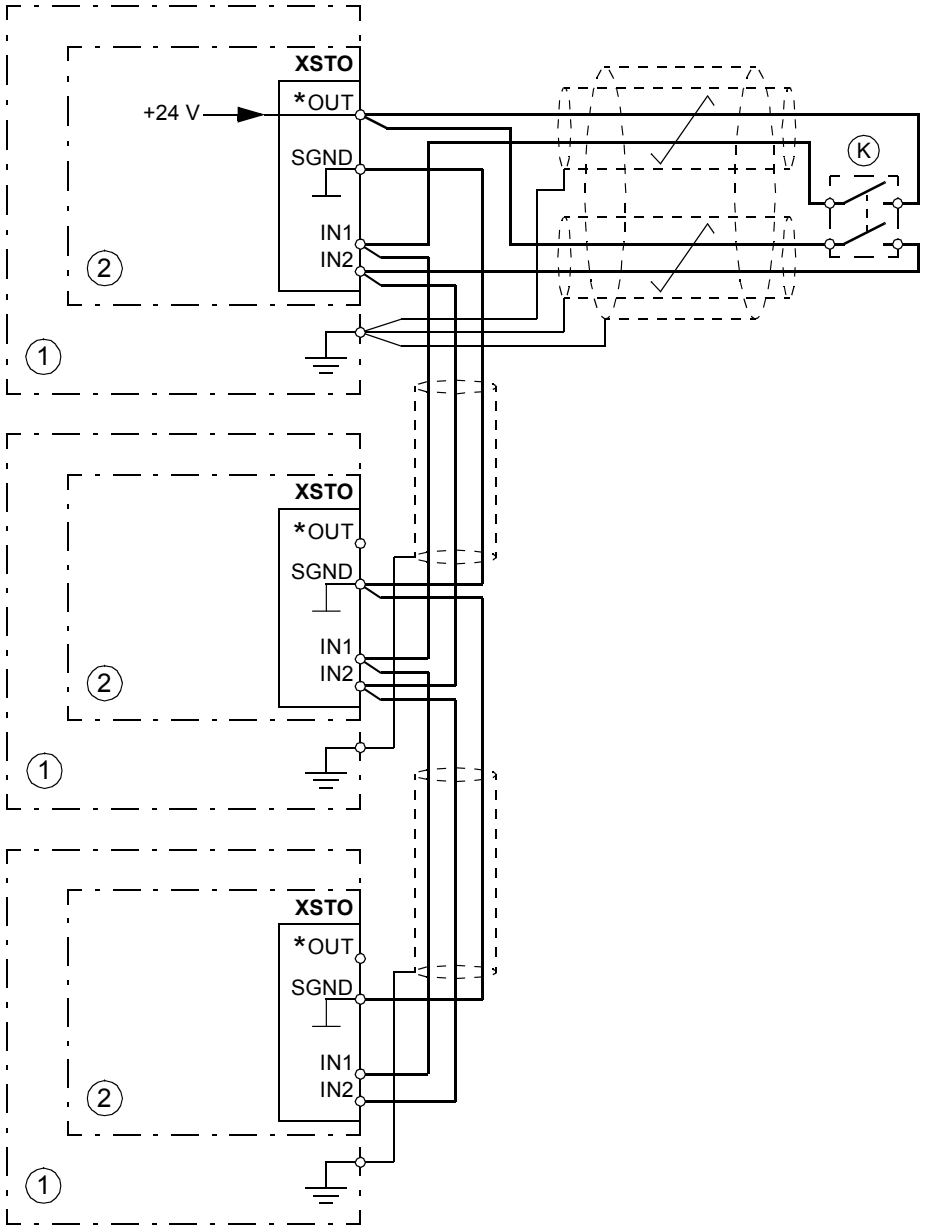
- Both STO inputs (IN1, IN2) must be connected to the activation switch. Otherwise, no SIL/PL classification is given.
- Pay special attention to avoiding any potential failure modes for the wiring. For example, use shielded cable. For measures for fault exclusion of wiring, see eg. EN ISO 13849-2:2012, table D.4.

1	Inverter unit
2	Control unit
K	Activation switch **Note:** A single-channel activation switch can limit the SIL/PL capability of the safety function to a lower level than the SIL/PL capability of the STO function of the drive.

* "OUT1" with frame R5i

Multiple inverter units

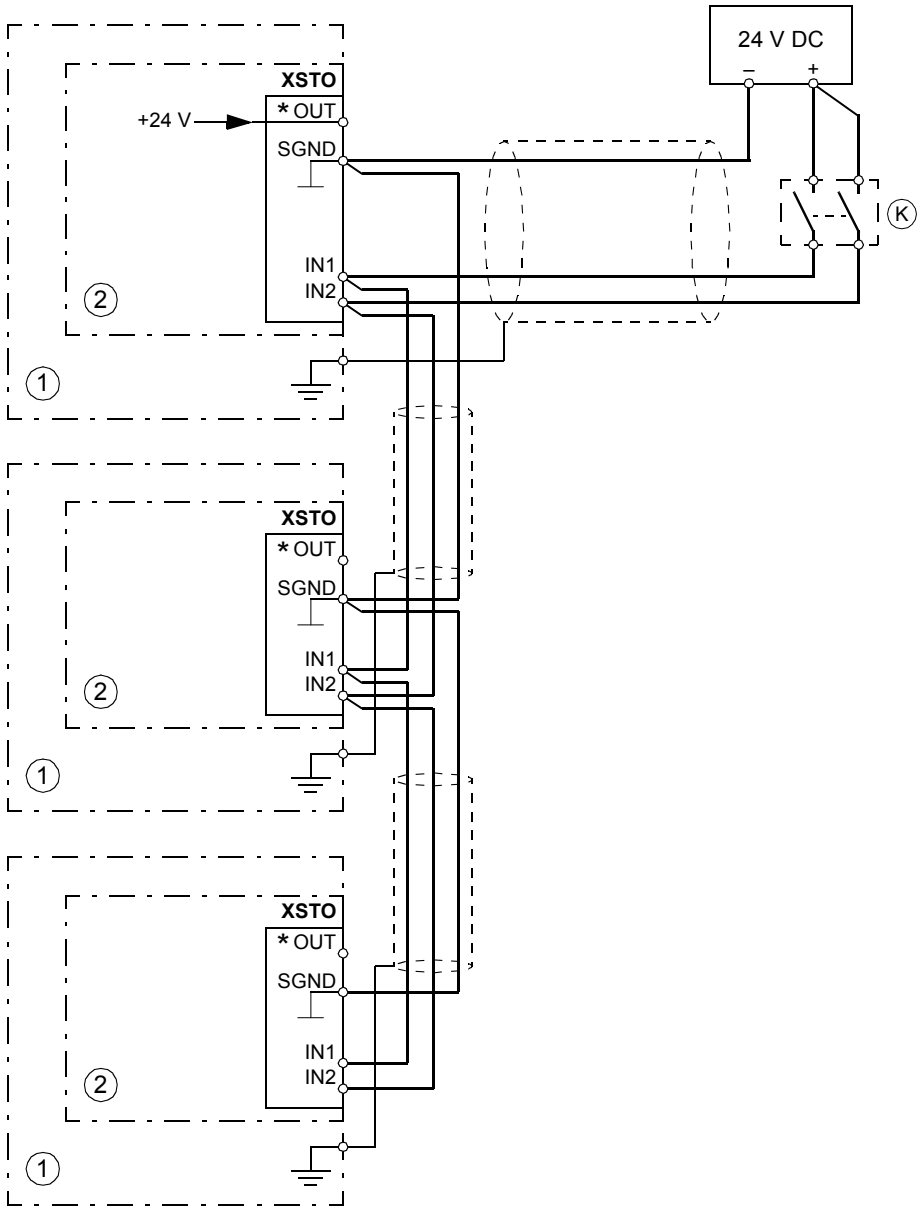
Internal power supply



1	Inverter unit
2	Control unit
K	Activation switch

* OUT1 in inverters with ZCU-12 control units.

External power supply



1	Inverter unit
2	Control unit
K	Activation switch

* OUT1 in inverters with ZCU-12 control units.

Operation principle

1. The Safe torque off activates (the activation switch is opened, or safety relay contacts open).
2. The STO inputs of the drive control unit de-energize.
3. The control unit cuts off the control voltage from the output IGBTs.
4. The control program generates an indication as defined by parameter 31.22 (see the firmware manual of the drive).
   The parameter selects which indications are given when one or both STO signals are switched off or lost. The indications also depend on whether the drive is running or stopped when this occurs.

   Note: This parameter does not affect the operation of the STO function itself. The STO function will operate regardless of the setting of this parameter: a running drive will stop upon removal of one or both STO signals, and will not start until both STO signals are restored and all faults reset.

   Note: The loss of only one STO signal always generates a fault as it is interpreted as a malfunction of STO hardware or wiring.
5. The motor coasts to a stop (if running). The drive cannot restart while the activation switch or safety relay contacts are open. After the contacts close, a reset may be needed (depending on the setting of parameter 31.22). A new start command is required to start the drive.

Start-up including validation test

To ensure the safe operation of a safety function, validation is required. The final assembler of the machine must validate the function by performing a validation test. The test must be performed

1. at initial start-up of the safety function
2. after any changes related to the safety function (circuit boards, wiring, components, settings, replacement of inverter module, etc.)
3. after any maintenance work related to the safety function
4. after a drive firmware update
5. at the proof test of the safety function.

Competence

The validation test of the safety function must be carried out by a competent person with adequate expertise and knowledge of the safety function as well as functional safety, as required by IEC 61508-1 clause 6. The test procedures and report must be documented and signed by this person.

Validation test reports

Signed validation test reports must be stored in the logbook of the machine. The report shall include documentation of start-up activities and test results, references to failure reports and resolution of failures. Any new validation tests performed due to changes or maintenance shall be logged into the logbook.

Validation test procedure

After wiring the Safe torque off function, validate its operation as follows.

Note: If the drive is equipped with safety option +L513, +L514, +L536, +L537, +Q950, +Q951, +Q952, +Q957, +Q963, +Q964, +Q965, +Q966, +Q978 or +Q979, also do the procedure shown in the documentation of the option.

If an FSO or FSPS module is installed, refer to its documentation.

Note: All inverter modules of the drive must be powered and connected to the STO circuit during the validation test.

Action	☑
WARNING! Obey the safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.	☐
Make sure that the motor can be run and stopped freely during start-up.	☐
Stop the drive (if running), switch the input power off and isolate the drive from the power line using a disconnector.	☐
Check the STO circuit connections against the wiring diagram.	☐
Close the disconnector and switch the power on.	☐
In case the drive consists of parallel-connected modules, check that the number of modules detected (parameter 95.14) matches the actual number of modules, and that the drive type is correctly set in parameter 95.31.	☐

Action	☑
Test the operation of the STO function when the motor is stopped. • Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. Make sure that the drive operates as follows: • Open the STO circuit. The drive generates an indication if one is defined for the 'stopped' state in parameter 31.22 (see the firmware manual). • Give a start command to verify that the STO function blocks the drive's operation. The motor should not start. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Test the operation of the STO function when the motor is running. • Start the drive and make sure the motor is running. • Open the STO circuit. The motor should stop. The drive generates an indication if one is defined for the 'running' state in parameter 31.22 (see the firmware manual). • Reset any active faults and try to start the drive. • Make sure that the motor stays at a standstill and the drive operates as described above in testing the operation when the motor is stopped. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Test the operation of the failure detection of the drive. The motor can be stopped or running. • Open the 1st input channel of the STO circuit. If the motor was running, it should coast to a stop. The drive generates an FA81 fault indication (see the firmware manual). • Give a start command to verify that the STO function blocks the drive's operation. The motor should not start. • Open the STO circuit (both channels). • Give a reset command. • Close the STO circuit (both channels). • Reset any active faults. Restart the drive and check that the motor runs normally. • Open the 2nd input channel of the STO circuit. If the motor was running, it should coast to a stop. The drive generates an FA82 fault indication (see the firmware manual). • Give a start command to verify that the STO function blocks the drive's operation. The motor should not start. • Open the STO circuit (both channels). • Give a reset command. • Close the STO circuit (both channels). • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Document and sign the validation test report which verifies that the safety function is safe and accepted for operation.	☐

Use

1. Open the activation switch, or activate the safety functionality that is wired to the STO connection.
2. The STO inputs on the drive control unit de-energize, and the control unit cuts off the control voltage from the output IGBTs.
3. The control program generates an indication as defined by parameter 31.22 (see the firmware manual of the drive).
4. The motor coasts to a stop (if running). The drive will not restart while the activation switch or safety relay contacts are open.
5. Deactivate the STO by closing the activation switch, or resetting the safety functionality that is wired to the STO connection.
6. Reset any faults before restarting.

WARNING!
The Safe torque off function does not disconnect the voltage of the main and auxiliary circuits from the drive. Therefore maintenance work on electrical parts of the drive or the motor can only be carried out after isolating the drive from the supply and all other voltage sources.

WARNING!
The Safe torque off functionality is only achieved through the XSTO connector of the inverter control unit (A41). True Safe torque off functionality is not achieved through the XSTO connectors of other control units (such as the supply control unit or the brake control unit).

The Safe torque off function is supported by any ACS880 inverter or drive control program. It is not supported by supply, DC/DC converter or brake firmware.

WARNING!
The drive cannot detect or memorize any changes in the STO circuitry when the drive control unit is not powered or when the main power to the drive is off. If both STO circuits are closed and a level-type start signal is active when the power is restored, it is possible that the drive starts without a fresh start command. Take this into account in the risk assessment of the system.

WARNING!
Permanent magnet or synchronous reluctance [SynRM] motors only:

In case of a multiple IGBT power semiconductor failure, the drive can produce an alignment torque which maximally rotates the motor shaft by $180/p$ degrees (with permanent magnet motors) or $180/2p$ degrees (with synchronous reluctance [SynRM] motors) regardless of the activation of the Safe torque off function. p denotes the number of pole pairs.

Notes:

- If a running drive is stopped by using the Safe torque off function, the drive will cut off the motor supply voltage and the motor will coast to a stop. If this causes

danger or is not otherwise acceptable, stop the drive and machinery using the appropriate stop mode before activating the Safe torque off function.

- The Safe torque off function overrides all other functions of the drive.
- The Safe torque off function is ineffective against deliberate sabotage or misuse.
- The Safe torque off function has been designed to reduce the recognized hazardous conditions. In spite of this, it is not always possible to eliminate all potential hazards. The assembler of the machine must inform the final user about the residual risks.

Maintenance

After the operation of the circuit is validated at start-up, the STO function shall be maintained by periodic proof testing. In high demand mode of operation, the maximum proof test interval is 20 years. In low demand mode of operation, the maximum proof test interval is 10 years; see section Safety data (page 207).

There are two alternative procedures for proof testing:

1. Perfect proof testing. It is assumed that all dangerous failures of the STO circuit are detected during the test. PFD_{avg} values for STO with the perfect proof testing procedure are given in the safety data section.
2. Simplified proof testing. This procedure is faster and simpler than perfect proof testing. Not all dangerous failures of the STO circuit are detected during the test. The PFD_{avg} value for STO with the simplified proof testing procedure is given in the safety data section.

Note: The proof testing procedures are only valid for proof testing (periodic test, item 5 under section Start-up including validation test) but not for re-validation after changes made in the circuit. Re-validation (items 1…4 under Start-up including validation test) must be done according to the initial validation procedure.

Note: See also the Recommendation of Use CNB/M/11.050 (published by the European co-ordination of Notified Bodies) concerning dual-channel safety-related systems with electromechanical outputs:

- When the safety integrity requirement for the safety function is SIL 3 or PL e (cat. 3 or 4), the proof test for the function must be performed at least every month.
- When the safety integrity requirement for the safety function is SIL 2 (HFT = 1) or PL d (cat. 3), the proof test for the function must be performed at least every 12 months.

The STO function of the drive does not contain any electromechanical components.

In addition to proof testing, it is a good practice to check the operation of the function when other maintenance procedures are carried out on the machinery.

Include the Safe torque off operation test described above in the routine maintenance program of the machinery that the drive runs.

If any wiring or component change is needed after start-up, or the parameters are restored, do the test given in section Validation test procedure (page 200).

Use only spare parts approved by ABB.

Record all maintenance and proof test activities in the machine logbook.

Competence

The maintenance and proof test activities of the safety function must be carried out by a competent person with adequate expertise and knowledge of the safety function as well as functional safety, as required by IEC 61508-1 clause 6.

Perfect proof test procedure

Action	☑
WARNING! Obey the safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.	☐
Test the operation of the STO function. If the motor is running, it will stop during the test. • Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. Make sure that the drive operates as follows: • Open the STO circuit. The drive generates an indication if one is defined for the 'stopped' state in parameter 31.22 (see the firmware manual). • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Test the operation of the failure detection of the drive. The motor can be stopped or running. • Open the 1st input channel of the STO circuit. If the motor was running, it should coast to a stop. The drive generates an FA81 fault indication (see the firmware manual). • Open the STO circuit (both channels). • Give a reset command. • Close the STO circuit (both channels). • Reset any active faults. • Open the 2nd input channel of the STO circuit. If the motor was running, it should coast to a stop. The drive generates an FA82 fault indication (see the firmware manual). • Open the STO circuit (both channels). • Give a reset command. • Close the STO circuit (both channels). • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Document and sign the test report to verify that the safety function has been tested according to the procedure.	☐

Simplified proof test procedure

Action	☑
WARNING! Obey the safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.	☐
Test the operation of the STO function. If the motor is running, it will stop during the test. • Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. Make sure that the drive operates as follows: • Open the STO circuit. The drive generates an indication if one is defined for the 'stopped' state in parameter 31.22 (see the firmware manual). • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Document and sign the test report to verify that the safety function has been tested according to the procedure.	☐

Fault tracing

The indications given during the normal operation of the Safe torque off function are selected by drive control program parameter 31.22.

The diagnostics of the Safe torque off function cross-compare the status of the two STO channels. In case the channels are not in the same state, a fault reaction function is performed and the drive trips on an FA81 or FA82 fault. An attempt to use the STO in a non-redundant manner, for example activating only one channel, will trigger the same reaction.

See the firmware manual of the drive control program for the indications generated by the drive, and for details on directing fault and warning indications to an output on the control unit for external diagnostics.

Any failures of the Safe torque off function must be reported to ABB.

Safety data

The safety data for the Safe torque off function is given below.

Note: The safety data is calculated for redundant use, and applies only if both STO channels are used.

Frame size	SIL	SC	PL	PFH (T_1 = 20 a) (1/h)	PFD_{avg}			$MTTF_D$ (a)	DC (%)	SFF (%)	Cat.	HFT	CCF	T_M (a)	PFH_{diag} (1/h)	λ_{Diag_s} (1/h)	λ_{Diag_d} (1/h)
					Perfect proof test		Simplified proof test										
					T_1 = 5 a	T_1 = 10 a	T_1 = 5 or 10 a										
R1i R2i R3i R4i	3	3	e	3.23E-09	7.08E-05	1.91E-05	3.82E-05	24293	≥90	>99	3	1	80	20	1.20E-11	8.25E-08	1.20E-09
R5i	3	3	e	3.36E-09	6.27E-05	5.41E-07	9.58E-07	16946	≥90	>99	3	1	80	20	1.00E-11	1.31E-07	1.20E-09
R6i R7i	3	3	e	3.87E-09	8.47E-05	8.97E-06	1.75E-05	6538	≥90	>99	3	1	80	20	1.54E-09	2.14E-07	1.54E-07
R8i	3	3	e	1.30E-10	2.86E-06	5.71E-06	1.14E-05	23970	≥90	>99	3	1	80	20	2.13E-09	1.84E-07	2.14E-07
2×R8i	3	3	e	1.39E-10	3.06E-06	6.11E-06	1.22E-05	16330	≥90	>99	3	1	80	20	2.92E-09	3.02E-07	2.92E-07
3×R8i	3	3	e	1.48E-10	3.26E-06	6.51E-06	1.30E-05	12390	≥90	>99	3	1	80	20	3.71E-09	4.19E-07	3.71E-07
4×R8i	3	3	e	1.57E-10	3.46E-06	6.91E-06	1.38E-05	9980	≥90	>99	3	1	80	20	4.50E-09	5.36E-07	4.50E-07
5×R8i	3	3	e	1.66E-10	3.66E-06	7.31E-06	1.46E-05	8360	≥90	>99	3	1	80	20	5.28E-09	6.54E-07	5.29E-07
6×R8i	3	3	e	1.76E-10	3.86E-06	7.71E-06	1.54E-05	7190	≥90	>99	3	1	80	20	6.07E-09	7.71E-07	6.07E-07
7×R8i	3	3	e	1.85E-10	4.07E-06	8.10E-06	1.62E-05	6310	≥90	>99	3	1	80	20	6.86E-09	8.88E-07	6.86E-07
8×R8i	3	3	e	1.94E-10	4.27E-06	8.50E-06	1.70E-05	5620	≥90	>99	3	1	80	20	7.65E-09	1.01E-06	7.65E-07
9×R8i	3	3	e	2.03E-10	4.47E-06	8.90E-06	1.78E-05	5060	≥90	>99	3	1	80	20	8.43E-09	1.12E-06	8.44E-07
10×R8i	3	3	e	2.12E-10	4.67E-06	9.30E-06	1.86E-05	4610	≥90	>99	3	1	80	20	9.22E-09	1.24E-06	9.22E-07
3AXD10000041323 K, 3AXD10000078136 K																	

- The STO is a type A (frames R1i…R7i) or type B (frame R8i and multiples) safety component as defined in IEC 61508-2.
- Relevant failure modes:
  - The STO trips spuriously (safe failure)
  - The STO does not activate when requested
  - A fault exclusion on the failure mode “short circuit on printed circuit board” has been made (EN 13849-2, table D.5). The analysis is based on an assumption that one failure occurs at one time. No accumulated failures have been analyzed.
- STO response times:
  - STO reaction time (shortest detectable break): 1 ms
  - STO response time:
    - Frames R1i…R7i: 7 ms (typical), 10 ms (maximum)
    - Frame R8i and multiples: 2 ms (typical), 25 ms (maximum)
  - Fault detection time: Channels in different states for longer than 200 ms
  - Fault reaction time: Fault detection time + 10 ms.
- Indication delays:
  - STO fault indication (parameter 31.22) delay: < 500 ms
  - STO warning indication (parameter 31.22) delay: < 1000 ms.

Terms and abbreviations

Term or abbreviation	Reference	Description
Cat.	EN ISO 13849-1	Classification of the safety-related parts of a control system in respect of their resistance to faults and their subsequent behavior in the fault condition, and which is achieved by the structural arrangement of the parts, fault detection and/or by their reliability. The categories are: B, 1, 2, 3 and 4.
CCF	EN ISO 13849-1	Common cause failure (%)
DC	EN ISO 13849-1	Diagnostic coverage (%)
HFT	IEC 61508	Hardware fault tolerance
$MTTF_D$	EN ISO 13849-1	Mean time to dangerous failure: (Total number of life units) / (Number of dangerous, undetected failures) during a particular measurement interval under stated conditions
PFD_{avg}	IEC 61508	Average probability of dangerous failure on demand, that is, mean unavailability of a safety-related system to perform the specified safety function when a demand occurs
PFH	IEC 61508	Average frequency of dangerous failures per hour, that is, average frequency of a dangerous failure of a safety related system to perform the specified safety function over a given period of time
PFH_{diag}	IEC/EN 62061	Average frequency of dangerous failures per hour for the diagnostic function of STO
PL	EN ISO 13849-1	Performance level. Levels a…e correspond to SIL
Proof test	IEC 61508, IEC 62061	Periodic test performed to detect failures in a safety-related system so that, if necessary, a repair can restore the system to an "as new" condition or as close as practical to this condition
SC	IEC 61508	Systematic capability (1…3)
SFF	IEC 61508	Safe failure fraction (%)
SIL	IEC 61508	Safety integrity level (1…3)
STO	IEC/EN 61800-5-2	Safe torque off

Term or abbreviation	Reference	Description
T_1	IEC 61508-6	Proof test interval. T_1 is a parameter used to define the probabilistic failure rate (PFH or PFD) for the safety function or subsystem. Performing a proof test at a maximum interval of T_1 is required to keep the SIL capability valid. The same interval must be followed to keep the PL capability (EN ISO 13849) valid. See also section Maintenance.
T_M	EN ISO 13849-1	Mission time: the period of time covering the intended use of the safety function/device. After the mission time elapses, the safety device must be replaced. Note that any T_M values given cannot be regarded as a guarantee or warranty.
λ_{Diag_d}	IEC 61508-6	Dangerous failure rate (per hour) of the diagnostics function of STO
λ_{Diag_s}	IEC 61508-6	Safe failure rate (per hour) of the diagnostics function of STO

TÜV certificate

The TÜV certificate is available on the Internet at www.abb.com/drives/documents.

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.

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