

ABB INDUSTRIAL DRIVES

BCU-02/12/22 control units

Hardware manual



List of related manuals

Drive hardware manuals and guides

	Code (English)
ACS880 multidrive cabinets and modules safety instructions	3AUA0000102301
ACS880 multidrive cabinets and modules electrical planning instructions	3AUA0000102324
Drive modules cabinet design and construction instructions	3AUA0000107668
BCU-02/12/22 control units hardware manual	3AUA0000113605

Supply module manuals

ACS880-204 IGBT supply modules hardware manual	3AUA0000131525
ACS880-204LC IGBT supply modules hardware manual	3AXD50000284436
ACS880 IGBT supply control program firmware manual	3AUA0000131562
ACS880-304 +A018 diode supply modules hardware manual	3AXD50000010104
ACS880 diode supply control program firmware manual	3AUA0000103295
ACS880-904 regenerative rectifier modules hardware manual	3AXD50000020457
ACS880 regenerative rectifier control program firmware manual	3AXD50000020827

Inverter module manuals

ACS880-104 inverter modules hardware manual	3AUA0000104271
ACS880-104LC inverter modules hardware manual	3AXD50000045610
ACS880 primary control program firmware manual	3AUA0000085967
ACS880 primary control program quick start-up guide	3AUA0000098062

Brake module and DC/DC converter module manuals

ACS880-604 3-phase brake chopper modules hardware manual	3AXD50000022033
ACS880 brake control program firmware manual (3-phase brake)	3AXD50000020967
ACS880-1604 DC/DC converter modules hardware manual	3AXD50000023642
ACS880-1604LC DC/DC converter modules hardware manual	3AXD50000371631
ACS880 DC/DC converter control program firmware manual	3AXD50000024671

Module package hardware manuals

ACS880-04 single drive module packages hardware manual	3AUA0000138495
ACS880-04XT drive modules (500 to 1200 kW) hardware manual	3AXD50000025169
ACS880-14 and -34 single drive module packages hardware manual	3AXD50000022021

Option manuals

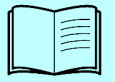
FSO-12 safety functions module user's manual	3AXD50000015612
FSO-21 safety functions module user's manual	3AXD50000015614
FDPI-02 diagnostics and panel interface user's manual	3AUA0000113618

You can find manuals and other product documents in PDF format on the Internet. See section [Document library on the Internet](#) on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.

BCU-02/12/22 control units

Hardware manual

Table of contents



3. Installation



Table of contents

1. Introduction to the manual

Contents of this chapter	7
Contents of the manual	7
Safety	7
Terms and abbreviations	8

2. Hardware description

Contents of this chapter	9
Hardware description	9
Fiber optic connections	10
Layout	11
The 7-segment display	14
LEDs	14

3. Installation

Contents of this chapter	15
Examining the delivery	15
Identifying different control unit types	15
Mechanical installation	16
Installing the control unit	17
Vertical DIN rail mounting	17
Horizontal DIN rail mounting	18
Installing the FSO-xx safety functions module	19
Electrical installation	20
Related documents	20

4. Maintenance

Contents of this chapter	21
Replacing the real-time clock battery	21
Replacing the memory unit	22
Replacing the SD/SDHC memory card	22
Replacing the control unit	22
Replacement illustration	23

5. Technical data

Contents of this chapter	25
Connector data	25
Ground isolation diagram	28
Other information	29
Battery	29
Protection classes	29
Ambient conditions	29
Materials	29
Applicable standards	29



Markings 29
Cybersecurity disclaimer 29

6. Dimension drawings

Contents of this chapter 31
Dimension drawing of the control unit 32

Further information

Product and service inquiries 33
Product training 33
Providing feedback on ABB Drives manuals 33
Document library on the Internet 33



1

Introduction to the manual

Contents of this chapter

This chapter gives basic information about the manual and the terms used in the manual.

Contents of the manual

This manual contains a description of the use and structure of the control unit and its technical data. It also describes how to install and maintain the control unit.

Safety



WARNING! Obey the safety instructions given in *ACS880 multidrive cabinets and modules safety instructions* (3AUA0000102301 [English]), or *ACS880 liquid-cooled multidrive cabinets and modules safety instructions* (3AXD50000048633 [English]), or *ACS880-04XT drive modules (500 to 1200 kW) hardware manual* (3AXD50000025169 [English]). If you ignore the safety instructions, injury or death can occur. If you are not a qualified electrician, do not do electrical work.

Terms and abbreviations

Term	Description
BCU	Type of control unit
Drive	Frequency converter for controlling AC motors
FSO-xx	FSO-12 or FSO-21 safety functions module
Inverter	Converts direct current and voltage to alternating current and voltage
LED	Light-emitting diode
RDCO	DDCS communication module
SD card	Secure digital memory card
SDHC card	Secure digital high capacity memory card
STO	Safe torque off (IEC/EN 61800-5-2)

Later in this manual, the term *converter* replaces terms drive, converter, and inverter.

2

Hardware description

Contents of this chapter

This chapter gives information about the hardware of the control units.

Hardware description

The BCU-02, BCU-12 and BCU-22 are control units used for controlling converters via fiber optic links. They contain integrated branching unit functionality for collecting and storing real-time data from the converter modules to help fault tracing and analysis. The data is stored on the SDHC memory card inserted into the SD CARD slot and can be analyzed by ABB service personnel.

The control unit types have a different number of fiber optic connections:

BCU type	No. of fiber optic connections	Can be replaced with
BCU-02	2	BCU-02, BCU-12, BCU-22
BCU-12	7	BCU-12, BCU-22
BCU-22	12	BCU-22

The control unit requires an external 24 V DC power source. It has three option slots for I/O extensions, encoders and fieldbus adapters, and a removable memory unit. For example, if you need to replace the control unit, you can keep the parameter settings by moving the memory unit from the defective control unit to the new one.

The drive-to-drive link (XD2D) is a daisy-chained RS-485 transmission line that allows basic master/follower communication with one master and multiple followers. The control unit also has one option slot for connecting a RDCO DDCS communication option board. For more information, see the *RDCO-0x DDCS communication option modules user's manual* (3AFE64492209 [English]).

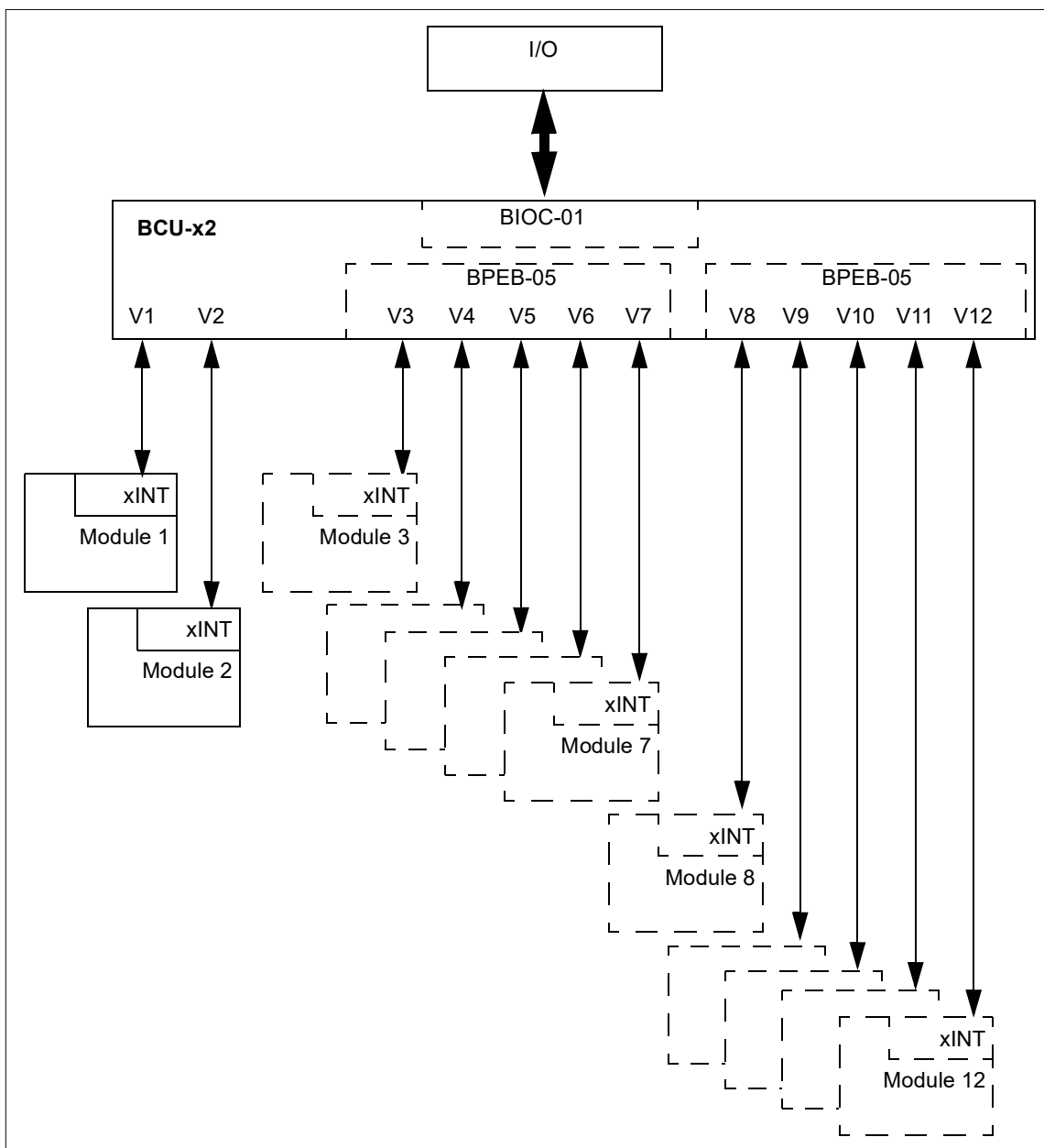
Fiber optic connections

The BCU-02 control unit has two fiber optic connections V1 and V2 for connecting to converter modules. The BCU-12 control unit has one BPEB-05 board, and the BCU-22 control unit has two BPEB-05 boards. Each BPEB-05 board adds five fiber optic connections. Thus, the BCU-12 has seven connections (V1...V7), and the BCU-22 has twelve connections (V1...V12).

The maximum lengths of the cables are:

- 1 mm plastic optical fiber cables, 35 m (115 ft)
- 200 μ m hard-clad silica fiber cables, 100 m (328 ft).

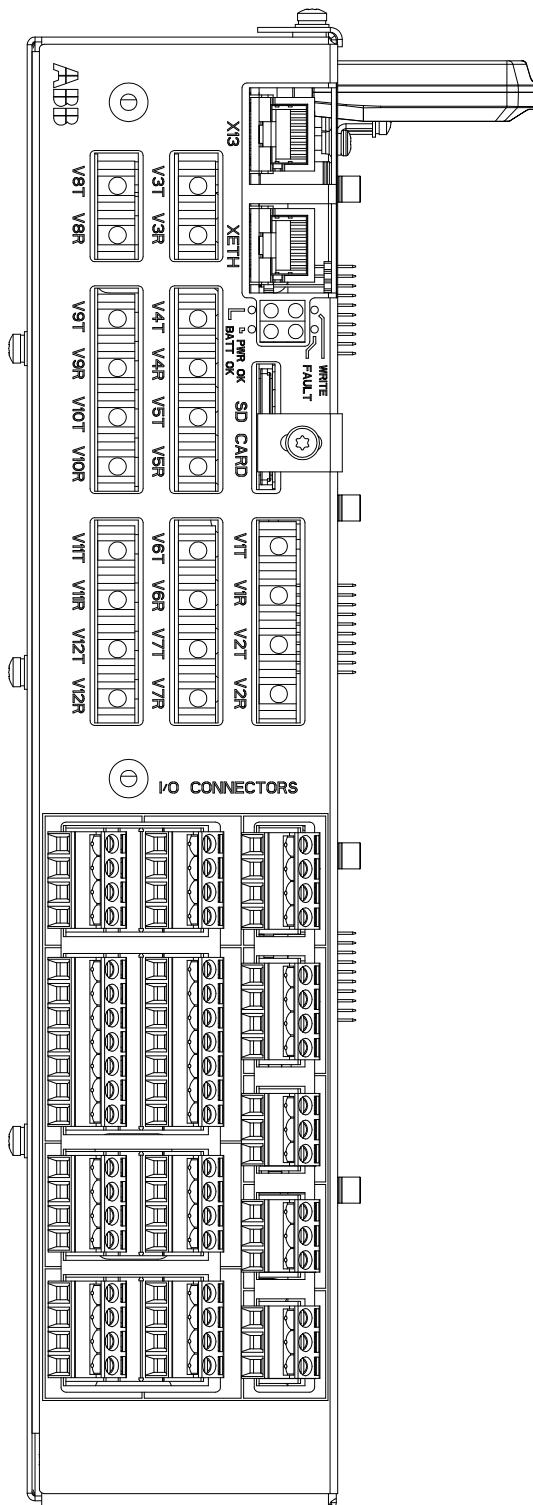
Fiber optic pairs connected to one control unit must have the same length. With long distances, cables of different length cause different delays, which can have an unwanted effect on the operation.



For instructions on how to connect the control unit to the converter module(s), see the applicable converter hardware manual.

Layout

The figures show the layout of the BCU-22 control unit. For the default I/O connection diagrams and more information on the connections, see the applicable converter hardware manual.







	Description
I/O connector	
XAI	Analog input
XAO	Analog output
XDI	Digital input and digital start interlock
XDIO	Digital input/output
XD2D	Drive-to-drive link
XD24	+24 V output for digital input
XPOW	External power input
XRO1	Relay output 1
XRO2	Relay output 2
XRO3	Relay output 3
XSTO	Safe torque off connection (input signal). Note: This input only acts as a true Safe torque off input in control units controlling a motor. In other applications (such as a supply or brake unit), de-energizing the IN1 and/or IN2 terminal will stop the unit but does not constitute a true safety function. For more information on Safe torque off, see the applicable converter hardware manual.
XSTO OUT	Safe torque off connection (output for powering XSTO input of inverter modules).
X485	Not in use
Switch	
A11	Analog input 1 current/voltage selection
A12	Analog input 2 current/voltage selection
D2D TERM	Drive-to-drive link termination
DICOM = DIOGND	Determines whether DICOM is separated from DIOGND (ie, common reference for digital inputs floats).
Fiber optic connector	
V1T...V12T, V1R...V12R	Fiber optic connector to converter module: T = Transmitter, R = Receiver
Connector for optional module	
SLOT 1	F-type adapter, interface and I/O extension modules If FDP1-02 diagnostics and panel interface is used, it has to be installed in slot 1 with two screws.
SLOT 2	F-type adapter, interface and I/O extension modules
SLOT 3	F-type adapter, interface and I/O extension modules, FSO-xx safety functions module
SLOT 4	RDCO-0x DDCS communication option modules
Safety option connector	
X12	Cable connector for the FSO-xx safety functions module. Note: The FSO-xx safety functions module can be used only with ACS880 inverters. For more information on the FSO-xx safety functions module, see the applicable FSO-xx safety functions module user's manual.
Control panel and Ethernet connector	
XETH	Ethernet port, not in use
X13	Control panel
Memory unit and card connector	
X205 MEMORY UNIT	Converter memory unit connector
SD CARD	Secure digital card holder (Data logger memory for the fiber optic links)

	Description
Miscellaneous	
+ Battery	Real-time clock battery

The 7-segment display

The following table gives the indications of the 7-segment display on the control unit. Multi-character indications are displayed as repeated sequences of characters.

	"U" is indicated shortly before "o". The control program has been launched and is running.
	Flashing character. The firmware cannot be started: The memory unit is missing or corrupted.
	The firmware download from a PC to the control unit is in progress.
	At the converter power-up, the 7-segment display can show short indications of, for example, "1", "2", "b" or "U". These are normal indications immediately after powering up the converter. If the 7-segment display ends up showing other values than described above after the power-up, it indicates a hardware failure.

LEDs

The following table gives the indications of the LEDs on the control unit.

LED	
BATT OK	When on, the battery voltage of the real time clock is sufficient (higher than 2.8 V). When off, <ul style="list-style-type: none"> • battery voltage is below 2.8 V, • battery is missing, or • control unit is not powered.
PWR OK	When on, internal voltage is sufficient.
FAULT	When on, the control program indicates that the equipment is faulty. See the applicable firmware manual.
WRITE	When on, writing to the SD card is in progress.

3

Installation



Contents of this chapter

This chapter gives information about the installation procedures and the contents of the delivery.

Examining the delivery

Make sure that these items are included:

- control unit with the I/O connectors
- memory unit
- SD/SDHC flash memory card (inserted in its slot)
- real-time clock battery.

Make sure that there are no signs of damage to any of the items.

■ Identifying different control unit types

Before you install the control unit, make sure that it has the correct control program for the converter hardware in question. The control program is shown on the label attached to the memory unit.

Make sure also that the control unit is correct for your equipment configuration.

Mechanical installation



WARNING! Do not install the control unit adjacent to electromagnetic disturbance sources, such as relays, contactors, brake choppers, power and motor cabling. The minimum recommended distance from such components is 200 mm (7.9 in).

ABB recommends to install metallic screening between the control unit and the source of disturbance. This can reduce the required distance.



WARNING! Install the control unit so that air can pass freely through the ventilation holes in the housing. Do not install the control unit directly above heat-generating equipment.

You can install the control unit on a vertical or horizontal standard 35 × 7.5/15 mm DIN rail. In vertical direction, you can install the unit either top side or bottom side up. If you install the unit horizontally, the connectors must be downwards and the connector texts the right way up.

Leave enough space for cabling, and also for replacing the memory unit and real-time clock battery. See chapter [Maintenance \(page 21\)](#).

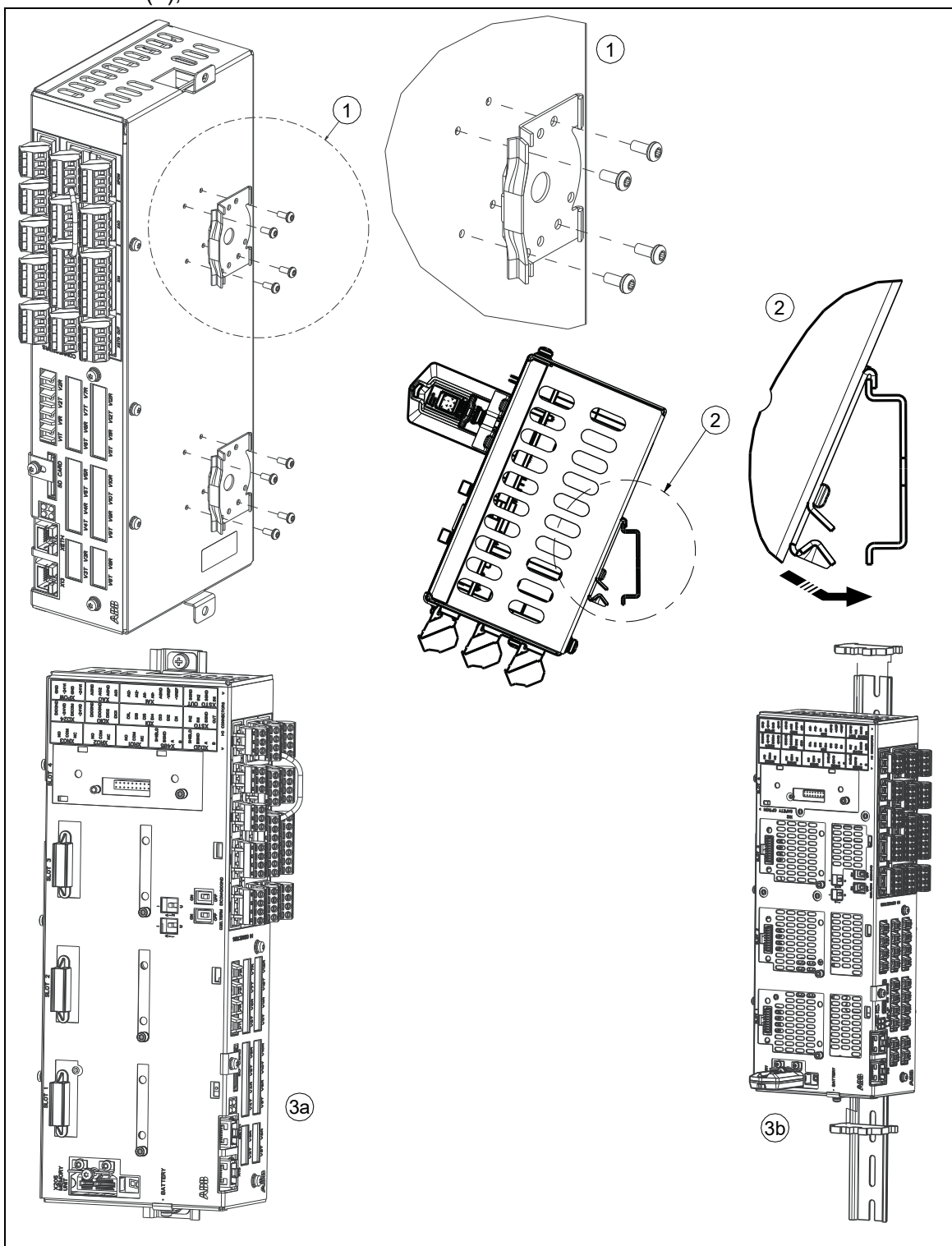


■ Installing the control unit

The control unit is grounded through the DIN rail.

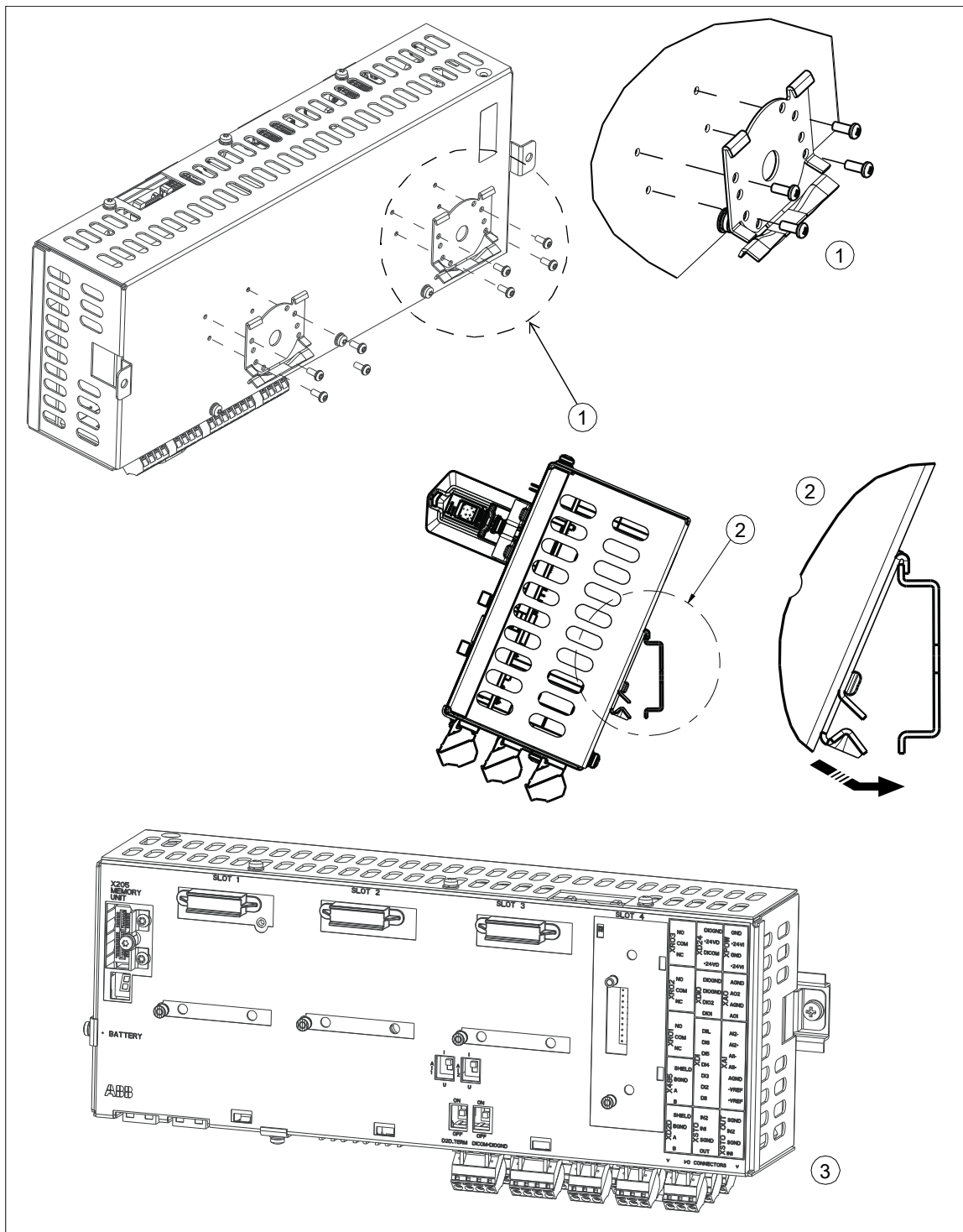
Vertical DIN rail mounting

1. Attach the latches to the back of the control unit with four screws for each latch.
2. Push the control unit to the rail as shown below. It makes a click.
3. To prevent movement of the control unit, attach it to the rail with screws (a), or end brackets (b), or both.



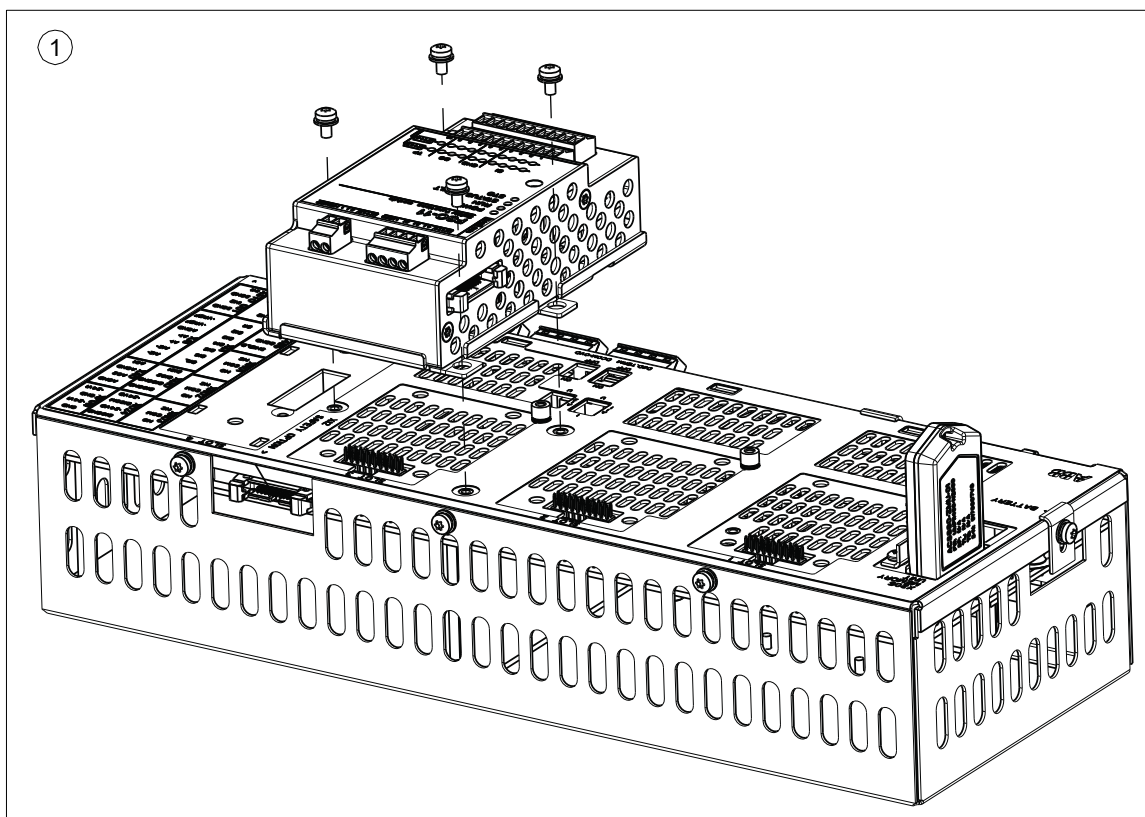
Horizontal DIN rail mounting

1. Attach the latches to the back of the control unit with four screws for each latch.
2. Push the control unit to the rail as shown below. It makes a click.
3. (Optional) To prevent movement of the control unit, attach it to the rail with screws or end brackets.

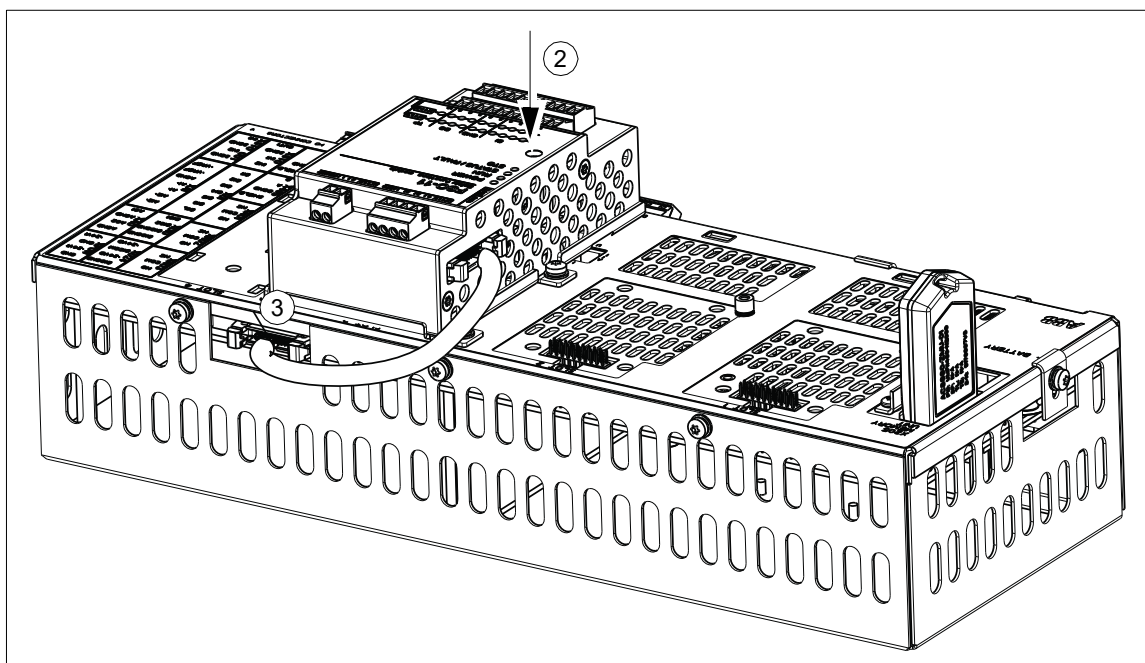


■ Installing the FSO-xx safety functions module

1. Install the FSO-xx safety functions module onto slot 3 with four screws.



2. Tighten the FSO-xx electronics grounding screw. Tightening torque 0.8 N·m (7.1 lbf·in).
3. Connect the FSO-xx data cable to FSO-xx connector X110 and to BCU connector X12.



Electrical installation



WARNING! Obey the safety instructions given in *ACS880 multidrive cabinets and modules safety instructions* (3AUA0000102301 [English]), or *ACS880 liquid-cooled multidrive cabinets and modules safety instructions* (3AXD50000048633 [English]), or *ACS880-04XT drive modules (500 to 1200 kW) hardware manual* (3AXD50000025169 [English]). If you ignore the safety instructions, injury or death can occur. If you are not a qualified electrician, do not do electrical work.

Connect the +24 V external power supply to the control unit connector XPOW. You can connect a second power supply for redundancy.

Connect the fiber optic cables from the converter module to the control unit. Refer to the instructions given in the converter module hardware manual.

■ Related documents

For general electrical installation instructions, see *ACS880 multidrive cabinets and modules electrical planning instructions* (3AUA0000102324 [English]), or *ACS880 liquid-cooled multidrive cabinets and modules electrical planning* (3AXD50000048634 [English]) and the applicable converter hardware manual, or *ACS880-04XT drive modules (500 to 1200 kW) hardware manual* (3AXD50000025169 [English]).

For information on the electrical installation of the FSO-xx safety functions module, see the applicable FSO-xx safety functions module user's manual.

For the default I/O connection diagrams and more information on the connections, see the applicable converter hardware manual.





Maintenance

Contents of this chapter

This chapter gives instructions on how to do maintenance on the control unit.

Replacing the real-time clock battery

Replace the real-time clock battery if the *BATT OK* LED is off when the control unit is powered. For information on the LED, see section [LEDs \(page 14\)](#). For the replacement battery type, see [Battery \(page 29\)](#).

See **A** in figure [Replacement illustration \(page 23\)](#).

1. Remove the screw and the clip covering the battery.
 2. Remove the battery.
 3. Insert a new battery. Refer to the illustration.
 4. Install the screw and the clip.
 5. Set the real-time clock.
 6. Discard the old battery. Obey local disposal rules and applicable laws.
-

Replacing the memory unit



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

See **B** in figure [Replacement illustration \(page 23\)](#).

1. Remove the screw.
2. Pull out the old memory unit.
3. Insert the new memory unit.
4. Install the screw.

Replacing the SD/SDHC memory card

Do not remove the SD card while the yellow *WRITE* LED is on. Writing to the SD card is in progress. For the replacement card type, see the technical data.

See **C** in figure [Replacement illustration \(page 23\)](#).

1. Remove the screw and the clip covering the memory card.
2. Push the card to remove it.
3. Install the new card in reverse order.

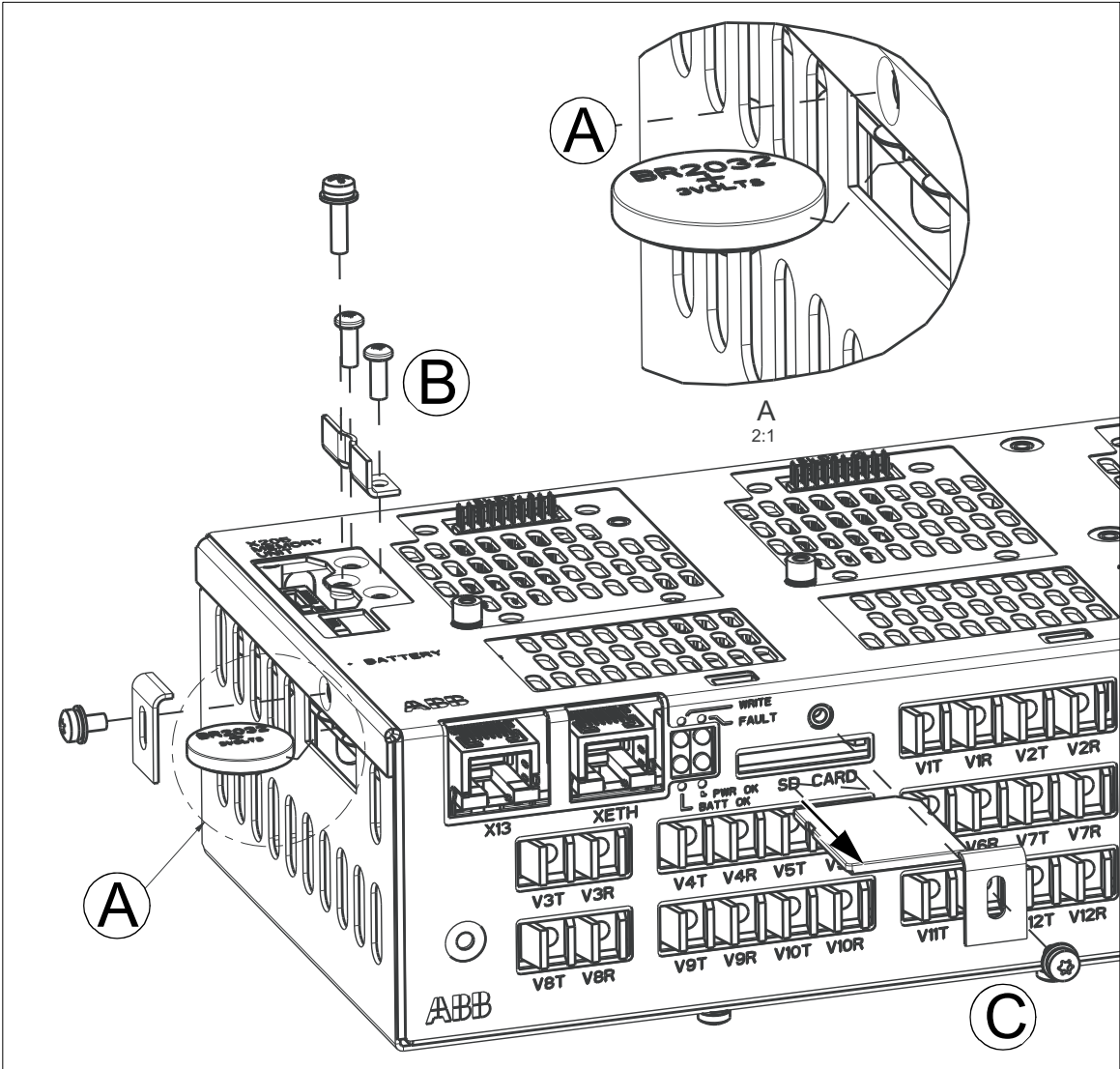
Replacing the control unit

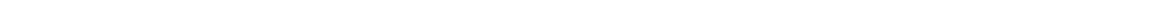
See section [Installing the control unit \(page 17\)](#).

1. If the control unit is attached to the rail with screws or end brackets, remove them.
2. Remove the control unit from the rail.
3. Remove the latches from the back of the control unit.
4. Pull out the detachable terminal blocks that have control cables connected.
5. Install the new control unit in reverse order.

If there is a safety circuit connected to the STO terminals (XSTO) of the control unit, do the acceptance test of the safety function after replacing the control unit. See the drive or inverter module hardware manual, safety option user's manual, and/or the related FSO safety functions module user's manual.

Replacement illustration





5

Technical data

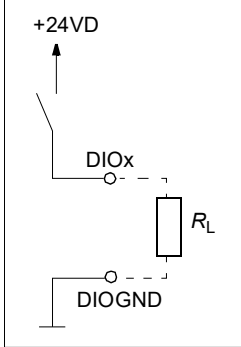
Contents of this chapter

This chapter contains the technical data for the control units.

Connector data

Terminal

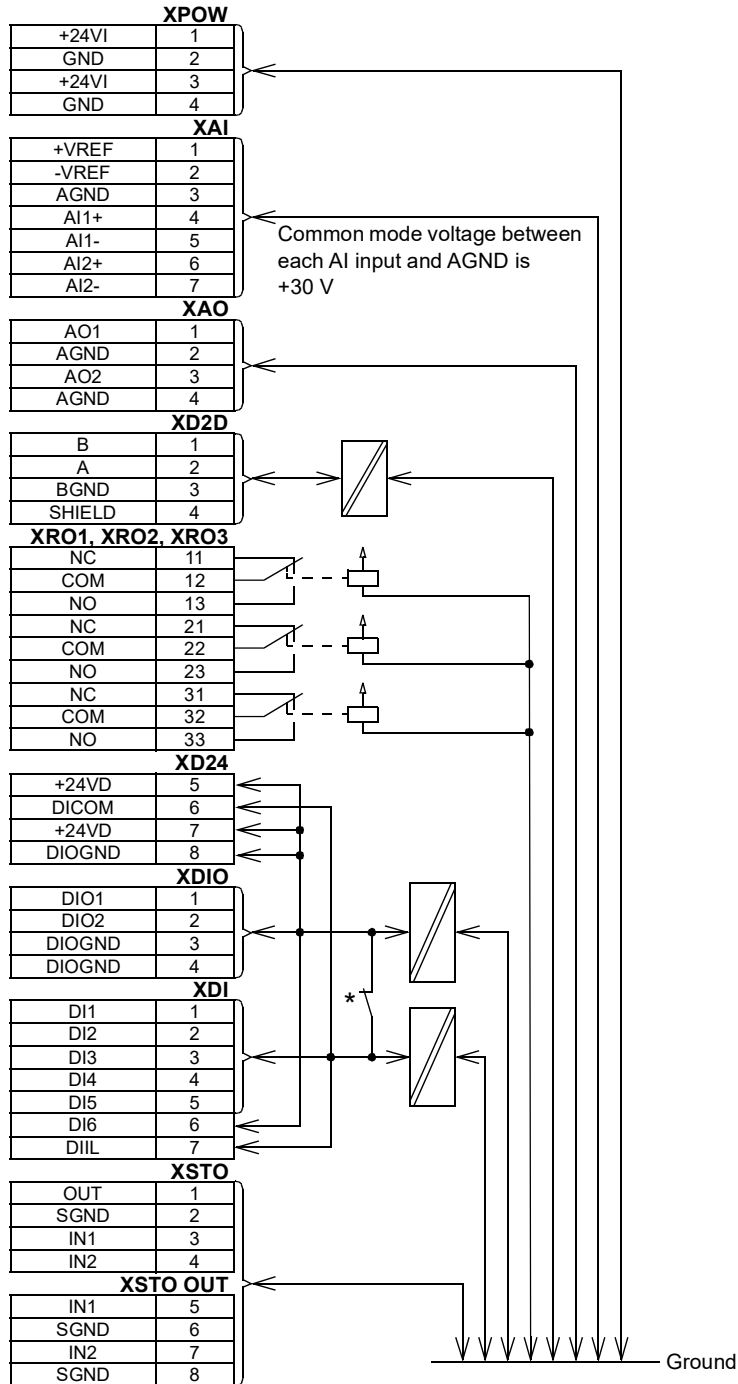
Power supply (XPOW)	Connector pitch 5 mm, wire size 2.5 mm ² 24 V (±10%) DC, 2 A External power input. Two supplies can be connected for redundancy.
Relay outputs RO1...RO3 (XRO1...XRO3)	Connector pitch 5 mm, wire size 2.5 mm ² 250 V AC / 30 V DC, 2 A Protected by varistors
+24 V output (XD24:2 and XD24:4)	Connector pitch 5 mm, wire size 2.5 mm ² 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 2.5 mm ² 24 V logic levels: "0" < 5 V, "1" > 15 V R_{in} : 2.0 kohm Input type: NPN/PNP (DI1...DI5), NPN (DI6) Hardware filtering: 0.04 ms, digital filtering up to 8 ms DI6 (XDI:6) can alternatively be used as an input for a PTC thermistor. "0" > 4 kohm, "1" < 1.5 kohm I_{max} : 15 mA (DI1...DI5), 5 mA (DI6)

Start interlock input DIIL (XDI:7)	Connector pitch 5 mm, wire size 2.5 mm ² 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...XDIO:4)	Connector pitch 5 mm, wire size 2.5 mm ² 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 +24 VD is limited to 200 mA
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). DIO2 can be configured as a 24 V level square wave frequency output. See the firmware manual.	
Reference voltage for analog inputs +VREF and -VREF (XAI:1 and XAI:2)	Connector pitch 5 mm, wire size 2.5 mm ² 10 V ±1% and -10 V ±1%, R_{load} 1 ... 10 kohm Maximum output current: 10 mA
Analog inputs AI1 and AI2 (XAI:4 ... XAI:7).	Connector pitch 5 mm, wire size 2.5 mm ² 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, adjustable digital filtering up to 8 ms Resolution: 11 bit + sign bit Inaccuracy: 1% of full scale range Inaccuracy with Pt100 sensors: 10 °C (18 °F)
Analog outputs AO1 and AO2 (XAO)	Connector pitch 5 mm, wire size 2.5 mm ² 0...20 mA, R_{load} < 500 ohm Frequency range: 0 ... 500 Hz Resolution: 11 bit + sign bit Inaccuracy: 2% of full scale range
Drive-to-drive link (XD2D)	Connector pitch 5 mm, wire size 2.5 mm ² Physical layer: RS-485 Termination by switch
RS-485 connection (X485)	Connector pitch 5 mm, wire size 2.5 mm ² Physical layer: RS-485
Safe torque off connection (XSTO)	Connector pitch 5 mm, wire size 2.5 mm ² Input voltage range: -3...30 V DC Logic levels: "0" < 5 V, "1" > 17 V For the unit to start, both connections must be "1" Current consumption: 66 mA (continuous) per STO channel per inverter module EMC (immunity) according to IEC 61326-3-1

Safe torque off output (XSTO OUT)	Connector pitch 5 mm, wire size 2.5 mm ² To STO connector of inverter module
Control panel connection (X13)	Connector: RJ-45 Cable length < 3 m (10 ft)
Ethernet connection (XETH)	Connector: RJ-45 This connection is not supported by the firmware.
SDHC memory card slot (SD CARD)	Memory card type: SDHC Maximum memory size: 8 GB

The terminals on the board fulfill the Protective Extra Low Voltage (PELV) requirements. The PELV requirements of a relay output are not fulfilled if a voltage higher than 48 V is connected to the relay output.

Ground isolation diagram



***Ground selector (DICOM=DIOGND) settings**

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

Other information

Battery

Real-time clock battery	BR2032
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Protection classes

Degree of protection (IEC/EN 60529)	IP10
Enclosure type (UL 508C)	UL Open Type
Overvoltage category (IEC 60664-1)	II
Protective class (IEC/EN 61800-5-1)	I
Protective class (IEC 62109-1)	II

Ambient conditions

Air temperature in operation	0...70 °C (32...158 °F)
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Materials

Housing	Hot-dip zinc coated steel, cover painted
Label	Polycarbonate
Package	Cardboard

Applicable standards

EN 61800-5-1:2007	<i>Adjustable speed electrical power drive systems. Part 5-1: Safety requirements – electrical, thermal and energy</i>
EN 61800-3:2004	<i>Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods</i>
IEC/EN 62109-1:2010	<i>Safety of power converters for use in photovoltaic power systems Part 1: General requirements</i>
UL508C:2002	<i>UL Standard for Safety, Power Conversion Equipment, third edition</i>

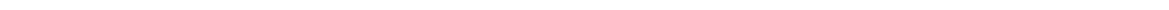
Note: For other standards, see the applicable hardware and functional safety manuals.

Markings

cULus	The control unit is cULus Listed.
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Cybersecurity 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.





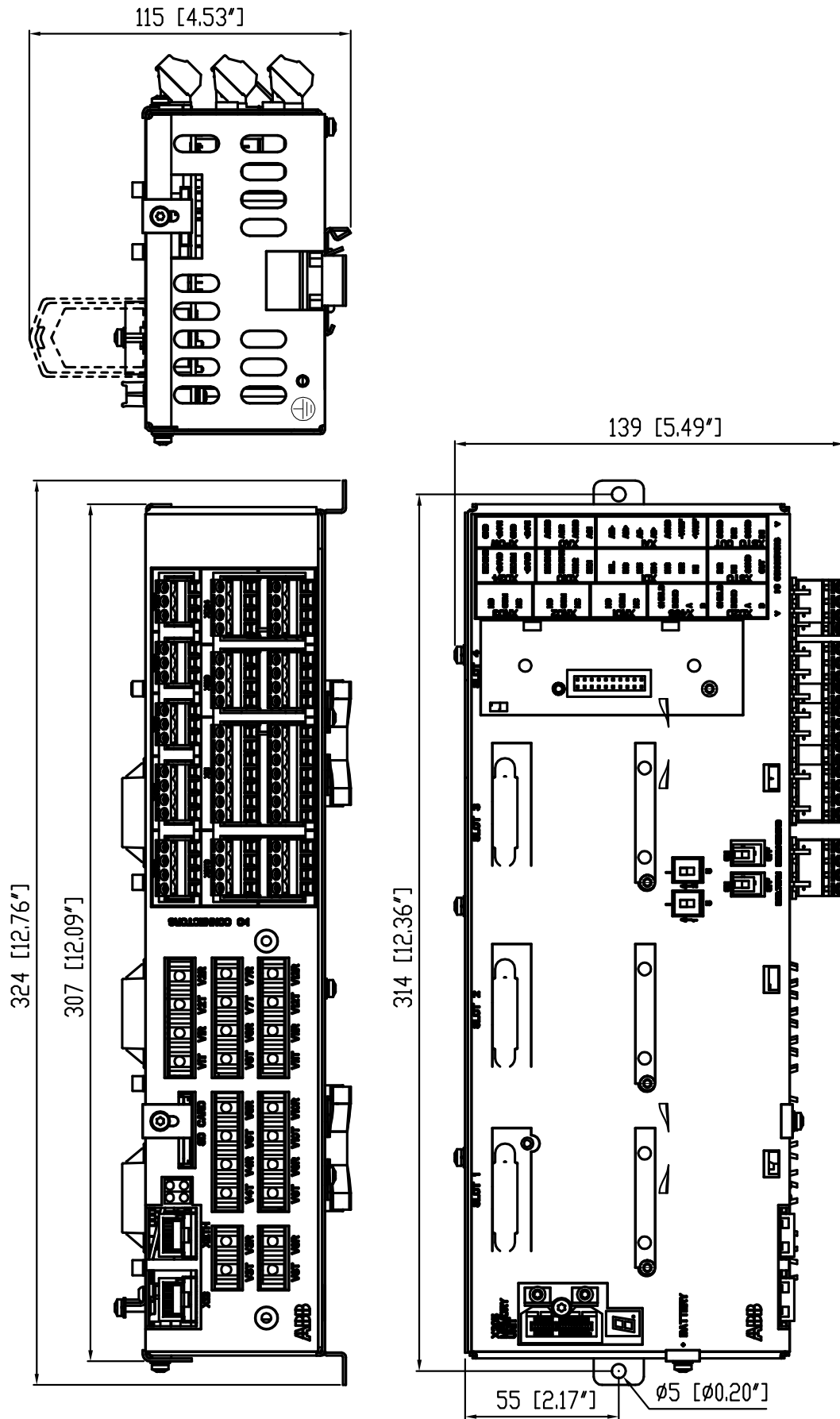
6

Dimension drawings

Contents of this chapter

This chapter shows the dimensions of the control unit.

Dimension drawing of the control unit



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 abb.com/searchchannels.

Product training

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

Providing feedback on ABB Drives manuals

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