## List of related manuals

### Drive hardware manuals and guides
- ACS880 multidrive cabinets and modules safety instructions
- ACS880 multidrive cabinets and modules electrical planning instructions
- Drive modules cabinet design and construction instructions
- BCU-02/12/22 control units hardware manual

### Supply module manuals
- ACS880 multidrive cabinets and modules safety instructions
- ACS880 multidrive cabinets and modules electrical planning instructions
- Drive modules cabinet design and construction instructions
- BCU-02/12/22 control units hardware manual

### Supply module manuals
- ACS880-204 IGBT supply modules hardware manual
- ACS880-204LC IGBT supply modules hardware manual
- ACS880 IGBT supply control program firmware manual
- ACS880 diode supply control program firmware manual
- ACS880-904 regenerative rectifier modules hardware manual
- ACS880 regenerative rectifier control program firmware manual

### Inverter module manuals
- ACS880-104 inverter modules hardware manual
- ACS880-104LC inverter modules hardware manual
- ACS880 primary control program firmware manual
- ACS880 primary control program quick start-up guide

### Brake module and DC/DC converter module manuals
- ACS880-604 3-phase brake chopper modules hardware manual
- ACS880 brake control program firmware manual (3-phase brake)
- ACS880-1604 DC/DC converter modules hardware manual
- ACS880-1604LC DC/DC converter modules hardware manual
- ACS880 DC/DC converter control program firmware manual

### Module package hardware manuals
- ACS880-04 single drive module packages hardware manual
- ACS880-04XT drive modules (500 to 1200 kW) hardware manual
- ACS880-14 and -34 single drive module packages hardware manual

### Option manuals
- FSO-12 safety functions module user’s manual
- FSO-21 safety functions module user’s manual
- FDPI-02 diagnostics and panel interface user’s manual

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

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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

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

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

<table>
<thead>
<tr>
<th>BCU type</th>
<th>No. of fiber optic connections</th>
<th>Can be replaced with</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCU-02</td>
<td>2</td>
<td>BCU-02, BCU-12, BCU-22</td>
</tr>
<tr>
<td>BCU-12</td>
<td>7</td>
<td>BCU-12, BCU-22</td>
</tr>
<tr>
<td>BCU-22</td>
<td>12</td>
<td>BCU-22</td>
</tr>
</tbody>
</table>

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 μm 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.
The label describes the location of the I/O connectors and has the same colors as the connectors.
<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I/O connector</strong></td>
</tr>
<tr>
<td>XAI</td>
</tr>
<tr>
<td>XAO</td>
</tr>
<tr>
<td>XDI</td>
</tr>
<tr>
<td>XDIO</td>
</tr>
<tr>
<td>XD2D</td>
</tr>
<tr>
<td>XD24</td>
</tr>
<tr>
<td>XPOW</td>
</tr>
<tr>
<td>XRO1</td>
</tr>
<tr>
<td>XRO2</td>
</tr>
<tr>
<td>XRO3</td>
</tr>
<tr>
<td>XSTO</td>
</tr>
<tr>
<td>XSTO OUT</td>
</tr>
<tr>
<td>X485</td>
</tr>
<tr>
<td><strong>Switch</strong></td>
</tr>
<tr>
<td>AI1</td>
</tr>
<tr>
<td>AI2</td>
</tr>
<tr>
<td>D2D TERM</td>
</tr>
<tr>
<td>DICOM = DIOGND</td>
</tr>
<tr>
<td><strong>Fiber optic connector</strong></td>
</tr>
<tr>
<td>V1T...V12T, V1R...V12R</td>
</tr>
<tr>
<td><strong>Connector for optional module</strong></td>
</tr>
<tr>
<td>SLOT 1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SLOT 2</td>
</tr>
<tr>
<td>SLOT 3</td>
</tr>
<tr>
<td>SLOT 4</td>
</tr>
<tr>
<td><strong>Safety option connector</strong></td>
</tr>
<tr>
<td>X12</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Control panel and Ethernet connector</strong></td>
</tr>
<tr>
<td>XETH</td>
</tr>
<tr>
<td>X13</td>
</tr>
<tr>
<td><strong>Memory unit and card connector</strong></td>
</tr>
<tr>
<td>X205 MEMORY UNIT</td>
</tr>
<tr>
<td>SD CARD</td>
</tr>
</tbody>
</table>

*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.
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.

<table>
<thead>
<tr>
<th>LEDs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATT OK</td>
<td>When on, the battery voltage of the real time clock is sufficient (higher than 2.8 V). When off,</td>
</tr>
<tr>
<td></td>
<td>• battery voltage is below 2.8 V,</td>
</tr>
<tr>
<td></td>
<td>• battery is missing, or</td>
</tr>
<tr>
<td></td>
<td>• control unit is not powered.</td>
</tr>
<tr>
<td>PWR OK</td>
<td>When on, internal voltage is sufficient.</td>
</tr>
<tr>
<td>FAULT</td>
<td>When on, the control program indicates that the equipment is faulty. See the applicable firmware manual.</td>
</tr>
<tr>
<td>WRITE</td>
<td>When on, writing to the SD card is in progress.</td>
</tr>
</tbody>
</table>

Miscellaneous

| + Battery | Real-time clock battery |

“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.
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.
Re 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
# Technical data

## Contents of this chapter

This chapter contains the technical data for the control units.

## Connector data

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply (XPOW)</strong></td>
<td>Connector pitch 5 mm, wire size 2.5 mm²&lt;br&gt;24 V (±10%) DC, 2 A&lt;br&gt;External power input. Two supplies can be connected for redundancy.</td>
</tr>
<tr>
<td><strong>Relay outputs RO1…RO3  (XRO1…XRO3)</strong></td>
<td>Connector pitch 5 mm, wire size 2.5 mm²&lt;br&gt;250 V AC / 30 V DC, 2 A&lt;br&gt;Protected by varistors</td>
</tr>
<tr>
<td><strong>+24 V output (XD24:2 and XD24:4)</strong></td>
<td>Connector pitch 5 mm, wire size 2.5 mm²&lt;br&gt;Total load capacity of these outputs is 4.8 W (200 mA / 24 V) minus the power taken by DIO1 and DIO2.</td>
</tr>
<tr>
<td><strong>Digital inputs DI1…DI6 (XDI:1…XDI:6)</strong></td>
<td>Connector pitch 5 mm, wire size 2.5 mm²&lt;br&gt;24 V logic levels: &quot;0&quot; &lt; 5 V, &quot;1&quot; &gt; 15 V&lt;br&gt;$R_{in}$: 2.0 kohm&lt;br&gt;Input type: NPN/PNP (DI1…DI5), NPN (DI6)&lt;br&gt;Hardware filtering: 0.04 ms, digital filtering up to 8 ms&lt;br&gt;DI6 (XDI:6) can alternatively be used as an input for a PTC thermistor.&lt;br&gt;&quot;0&quot; &gt; 4 kohm, &quot;1&quot; &lt; 1.5 kohm&lt;br&gt;$I_{max}$: 15 mA (DI1…DI5), 5 mA (DI6)</td>
</tr>
</tbody>
</table>
Start interlock input DIIL (XDI:7)
Connector pitch 5 mm, wire size 2.5 mm²
24 V logic levels: “0” < 5 V, “1” > 15 V
$R_{\text{in}}$: 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)
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 mm²
10 V ±1% and –10 V ±1%, $R_{\text{load}}$ 1…10 kohm
Maximum output current: 10 mA

Analog inputs AI1 and AI2 (XAI:4 … XAI:7)
Current/voltage input mode selection by switches
Connector pitch 5 mm, wire size 2.5 mm²
Current input: –20…20 mA, $R_{\text{in}}$: 100 ohm
Voltage input: –10…10 V, $R_{\text{in}}$ > 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 mm²
0…20 mA, $R_{\text{load}}$ < 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 mm²
Physical layer: RS-485
Termination by switch

RS-485 connection (X485)
Connector pitch 5 mm, wire size 2.5 mm²
Physical layer: RS-485

Safe torque off connection (XSTO)
Connector pitch 5 mm, wire size 2.5 mm²
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
<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe torque off output (XSTO OUT)</td>
<td>Connector pitch 5 mm, wire size 2.5 mm²</td>
</tr>
<tr>
<td></td>
<td>To STO connector of inverter module</td>
</tr>
<tr>
<td>Control panel connection (X13)</td>
<td>Connector: RJ-45</td>
</tr>
<tr>
<td></td>
<td>Cable length &lt; 3 m (10 ft)</td>
</tr>
<tr>
<td>Ethernet connection (XETH)</td>
<td>Connector: RJ-45</td>
</tr>
<tr>
<td></td>
<td>This connection is not supported by the firmware.</td>
</tr>
<tr>
<td>SDHC memory card slot (SD CARD)</td>
<td>Memory card type: SDHC</td>
</tr>
<tr>
<td></td>
<td>Maximum memory size: 8 GB</td>
</tr>
</tbody>
</table>

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

Common mode voltage between each AI input and AGND is +30 V

*Ground selector (DICOM=DIOGND) settings

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

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

Battery
Real-time clock battery  BR2032

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)

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

Applicable standards
EN 61800-5-1:2007  Adjustable speed electrical power drive systems. Part 5-1: Safety requirements – electrical, thermal and energy
EN 61800-3:2004  Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
IEC/EN 62109-1:2010  Safety of power converters for use in photovoltaic power systems Part 1: General requirements

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

Markings
cULus  The control unit is cULus Listed.

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

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