

# ACH580-01 UL Type 4X (IP66) drives, NEC types

## Quick installation and start-up guide

This guide is applicable to the North American product types. There is a separate guide for the global (IEC) product types.

Documentation in other languages	Ecodesign information (EU 2019/1781 and SI 2021 No. 745)	About this document
		3AXD50001020132 Rev B EN 2024-05-24 © 2024 ABB. All rights reserved. Original instructions.
		 3AXD50001020132B

## Safety instructions

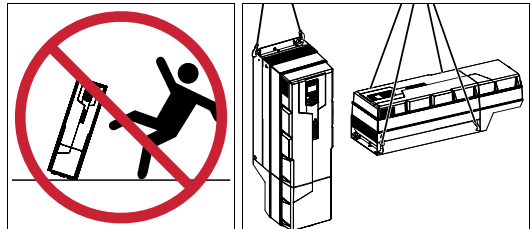


**WARNING!** Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do electrical installation or maintenance work.



**WARNING!** Before you activate the automatic fault reset or automatic restart functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault or supply break. If these functions are activated, the installation must be clearly marked as defined in IEC/EN/UL 61800-5-1, subclause 6.5.3, for example, "THIS MACHINE STARTS AUTOMATICALLY".

- Do not do work on the drive, motor cable, motor, or control cables when the drive is connected to the input power. Before you start the work, isolate the drive from all dangerous voltage sources and make sure that it is safe to start the work. Always wait for 5 minutes after disconnecting the input power to let the intermediate circuit capacitors discharge.
- Do not do work on the drive when a rotating permanent magnet motor is connected to it. A rotating permanent magnet motor energizes the drive, including its input and output terminals.
- Do not tilt the drive. The drive is heavy and has a high center of gravity. It can topple accidentally.
- All frames have lifting eyes to assist with lifting.
- Frames R3: Lifting the drive with a lifting device is recommended since weight exceeds 50 lb (23 kg)



## 1. Unpack the drive

Keep the drive in its package until you are ready to install it. Make sure that these items are included:

- drive
- mounting template
- control panel (factory-installed inside the cover)
- quick installation and start-up guide
- multilingual residual voltage warning stickers
- hardware and firmware manuals, if ordered
- options in separate packages, if ordered.

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

## 2. Reform the capacitors

If the drive has not been powered up for a year or more, you must reform the DC link capacitors. See [Related documents](#) or contact ABB technical support.

## 3. Select the cables and fuses

**Input power cable:** Use symmetrical shielded cable (VFD cable) for the best EMC performance. NEC installations: Conduit with continuous conductivity (Type EMT, RMC or LFMC) is also allowed and must be grounded on both ends. Non-metallic conduit (Type LFNC) will not suppress EMC noise. If noise issues are occurring, changing to continuously conductive conduit or shielded cable will be beneficial in most situations. Do not run input power wiring and motor wiring in the same conduit.

**Motor cable:** ABB recommends symmetrically shielded VFD motor cable to reduce bearing current and wear and stress on motor insulation and to provide the best EMC performance. Although not recommended, conductors inside conduit are allowed in NEC installations. Continuously conductive (metallic) conduit (Type EMT, RMC or LFMC) should be grounded on both ends. Non-metallic conduit (Type LFNC) will not suppress EMC noise. If noise issues are occurring, changing to continuously conductive conduit or shielded cable will be beneficial in most situations. Use separate conduit run for each motor. Do not run input power wiring and motor wiring in the same conduit.

**Wet locations and underground cable:** Use liquid-tight conduit in wet, dirty, dusty, corrosive or similar locations when using conduit. Usage of Non-metallic conduit underground and in wet locations is allowed. However, these installations

inherently have an increased chance for nuisance problems due to the potential for water/moisture in the conduit. Water/moisture in the conduit increases the likelihood of VFD faults or warnings. Proper installation is required to make sure there is no intrusion of water/moisture.

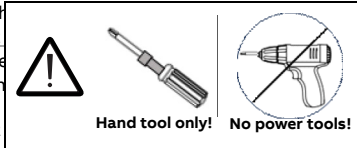
For more information: see Hardware Manual, section Electrical Installation – North America

- **Power cable types:** Use only copper conductors.
- **Current rating:** max. load current.
- **Voltage rating (minimum):** 600 V AC cable is accepted for up to 500 V AC, 750 VAC cable is accepted for up to 600 V AC, 1000 V AC cable is accepted for up to 690 V AC.
- **Temperature rating:** Use 75 °C conductors minimum, except for drives with a voltage rating of 575 Vac (-6) with ambient temperature above 40 °C, use 90 °C conductors. Insulation temperature can be higher as long as the ampacity is based on 75 °C conductors.
- **Size:** Refer to [Ratings, fuses and typical power cable sizes](#) for the typical cable sizes and to [Input power cables with disconnect switch option \(F254\)](#) for the maximum cable sizes.
- Select the control cables. Use double-shielded twisted-pair cable for analog signals. Use double-shielded or single-shielded cable for the digital, relay and I/O signals. Do not run 24 V and 115/230 V signals in the same cable.
- Protect the drive and input power cable with the correct fuses. Refer to [Ratings, fuses and typical power cable sizes](#).

#### 4. Examine the installation site

Examine the site where you will install the drive. Make sure that:

- Site is dry and clean during the installation. Drive is not watertight until installation is complete.
- The installation site is sufficiently ventilated or cooled to remove heat from the drive.
- The ambient conditions meet the requirements. Refer to [Ambient temperature and humidity requirements](#).
- Outdoor installations: protect the drive from direct sunlight to prevent overheating.
- The installation surface is as close to vertical as possible and strong enough to support the drive. Refer to [Weights and free space requirements](#).
- The installation surface, floor and materials near the drive are not flammable.
- There is sufficient free space around the drive for cooling, maintenance and operation. For the minimum free space requirements, refer to [Weights and free space requirements](#).
- There are no sources of strong magnetic fields such as high-current single-core conductors or contactor coils near the drive. A strong magnetic field can cause interference or inaccuracy in the operation of the drive.

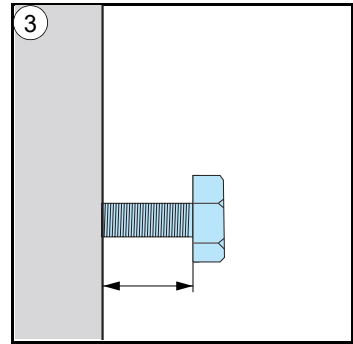
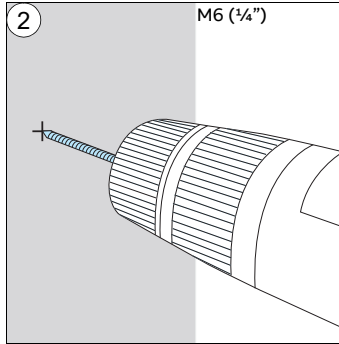
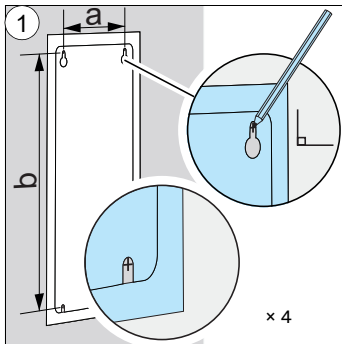


#### 5. Install the drive on the wall

Select fasteners that comply with local requirements applicable to wall surface materials, drive weight and application.

##### ■ Prepare the installation site

1. Make marks with the help of the mounting template. Remove the mounting template before you install the drive on the wall.
2. Drill the holes and put anchors or plugs into the holes.
3. Install the screws. Leave a gap between the screw head and mounting surface.

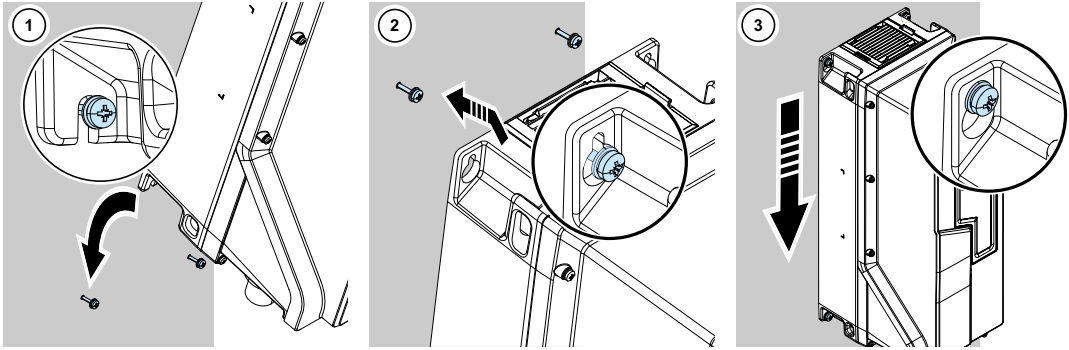


##### ■ Distance between mounting holes

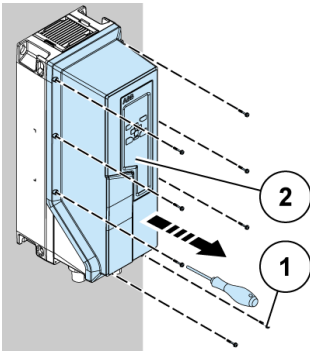
Frame size	Width (a)		Height (b)	
	mm	in	mm	in
R1	175	6.89	497	19.57
R2	175	6.89	581	22.87
R3	244	9.61	622	24.50

Your drive's frame size is shown on the drive nameplate.

**Put the drive on the wall and tighten the screws**



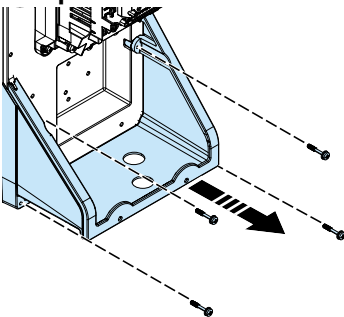
**6. Remove the cover(s)**



8 screws (Pozidriv #2)  
Tighten to 1.8 lbf-ft (2.5 Nm)



**7. Optional - remove and replace the cable/conduit box (to modify holes) - 4 screws**

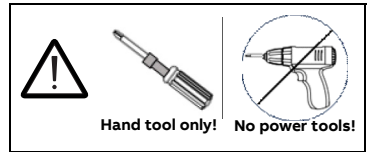


8 screws (Pozidriv #2)  
Tighten to 2.5 Nm(1.8 lbf-ft)



**WARNING!** Cable box screws must be correctly torqued to ensure a water-tight seal.

**Use:** Hand tool with Pozidriv #2 bit  
**Torque:** 2.5 Nm(1.8 lbf-ft)  
**DO NOT OVER-TORQUE!**



Hand tool only!

No power tools!

**8. Attach a residual voltage warning sticker to the drive in the local language**

To the control panel mounting platform.

**9. Make sure that the drive is compatible with the grounding system**

You can connect all drives to a symmetrically grounded TN-S system (center-grounded wye) without any modifications to the built-in EMC filter or varistors. If you install the drive to a different system, reconfigure the EMC and VAR screws as shown in the table below. The table also shows the optional modifications available.

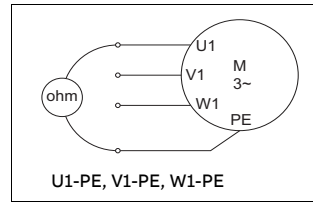
Frame size	Connection	TN System NEC (B066) Default <sup>3)</sup>	TN System IEC (B063) Default <sup>4)</sup>	Corner-grounded delta and Midpoint-grounded delta system	IT system	TT system
R1...R3	EMC (DC)	None or plastic	Metal <sup>2)</sup>	None or plastic <sup>1)</sup>	None or plastic <sup>1)</sup>	None or plastic <sup>1)</sup>
	VAR	Metal	Metal	None or plastic	None or plastic <sup>1)</sup>	None or plastic <sup>1)</sup>

<sup>1)</sup> Metal screw must not be used.  
<sup>2)</sup> Optional, for better noise filtering.  
<sup>3)</sup> NEC (UL) drives (+B066) have these screws installed by default.  
<sup>4)</sup> IEC drives (+B063) have these screws installed by default.

## 10. Measure the insulation resistance of the power cables and the motor

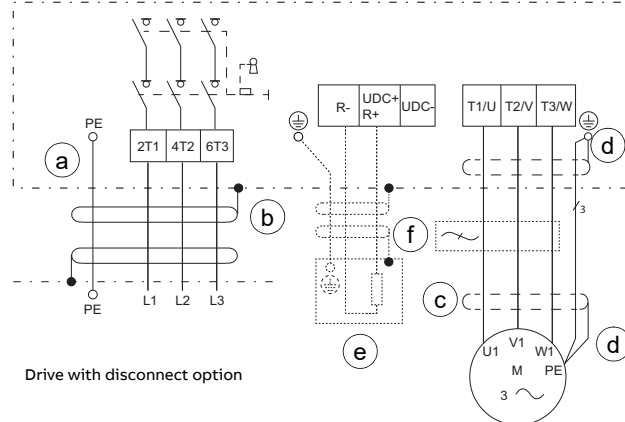
Measure the insulation resistance of the input cable before you connect it to the drive. Obey local regulations.

Measure the insulation resistance of the motor cable and motor when the cable is disconnected from the drive. Measure the insulation resistance between each phase conductor and the PE 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 or 77 °F). For the insulation resistance of other motors, see the manufacturer's instructions. Moisture inside the motor decreases the insulation resistance. If you think that there is moisture, dry the motor and do the measurement again.

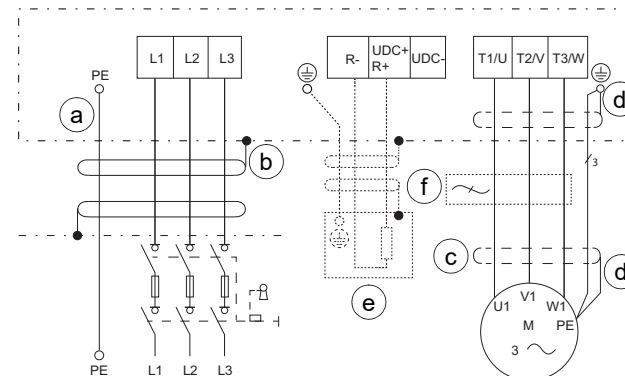


## 11. Connect the power cables

### UL (NEC) connection diagram with symmetrically shielded cable or conduit



Drive with disconnect option



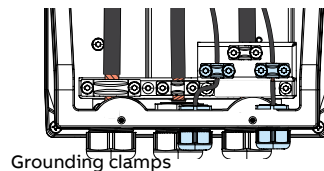
Drive without disconnect option

**Note:** UL (NEC) installation can include separate insulated conductors inside a conduit, shielded VFD cable in conduit, or shielded VFD cable without conduit. The normal dashed symbol (c) in this diagram represents the shield of shielded VFD cable. The same solid symbol (b) represents conduit.



**WARNING:** If installing drive indoors or outdoors in a wet, dirty, dusty, corrosive or similar environment, all cable, conduit and fittings must be approved for use in this type of environment. Fittings must be properly tightened to the drive such that no leakage occurs. Failure to follow these instructions can lead to injury or death, or damage to the equipment.

- Insulated ground conductor in a conduit:** Ground to drive's PE terminal and to the distribution panel ground bus. For a VFD cable installation see d.
- Conduit ground:** Bond the conduit to the drive's conduit box and to the distribution panel enclosure. For a VFD cable installation see c.
- Shield of a VFD shielded cable:** Ground the shield 360° under drive's grounding clamp, then twist with the ground conductors and connect under the drive's ground terminal. Ground the shield also 360° at the motor end, then twist and connect under the motor's ground terminal. For a conduit installation see b.
- Symmetrically constructed grounding conductors inside a VFD shielded cable:** Twist together, combine with the shield and connect under the drive's ground terminal and under the motor's ground terminal. For a conduit installation see a.
- External brake resistor connection (if used):** For a conduit installation see a and b. For a VFD cable installation see c and d. In addition, cut the third phase conductor which is not needed for the brake resistor connection.
- If necessary, install an external filter (du/dt, common mode, or sine filter). Filters are available from ABB.

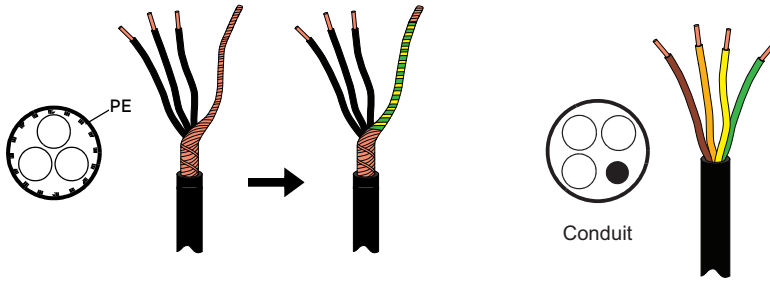


### Connection procedure

- Prepare the power cables (shielded cable).
  - Prepare the ends of the input power cable and motor cable as illustrated in the applicable figure (b).
  - Install the conduit fitting or cord grip (not supplied).
  - Slide the cables through the fitting or grip. After wires are terminated, complete installation of conduit and/or tighten the cord grip to achieve a water-tight seal.

## 2. Prepare the power cables (conduit):

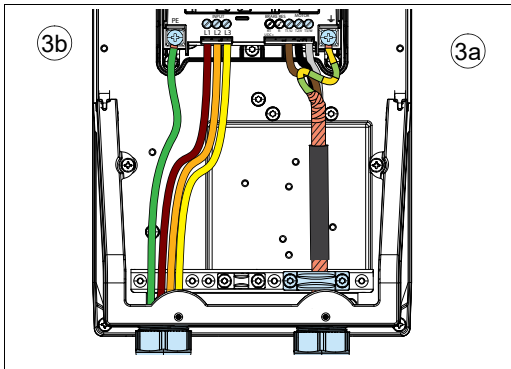
- Attach the cable conduit fittings for the motor and input cabling to the cable entry holes



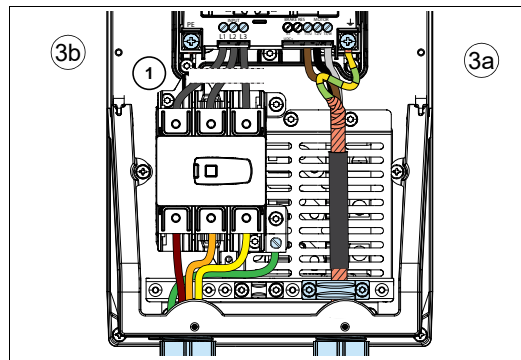
## 3. Connect the power cables. For the tightening torques, refer to [Terminal data for power connections](#).

- Slide the conductors through the conduit.
  - Connect the conductors:
    - Connect the phase conductors of the motor cable to terminals T1/U, T2/V and T3/W. Connect the twisted shield of the cable to the grounding terminal. (3a)
    - Connect the grounding conductor to the grounding terminal. Connect the phase conductors of the input power cable as was done for the motor cabling. Use terminals L1, L2 and L3 if no disconnect option is present. When an optional disconnect is present, connect the input power cable conductors to the disconnect switch at terminals 2T1, 4T2 and 6T3. (3b)
    - If used, connect the brake resistor cables.
4. Secure the conduits outside the unit mechanically. In wet, dirty, dusty, corrosive or similar locations, all fittings must be properly tight and secured such that no leakage can occur.

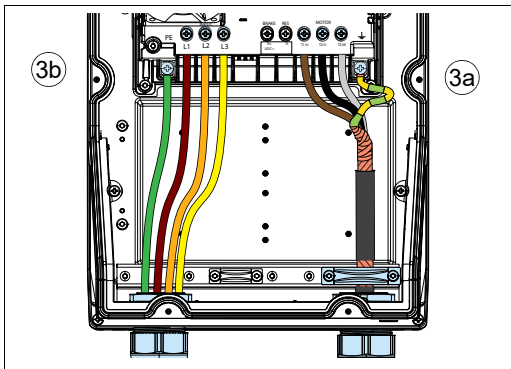
### R1...R2 without disconnect



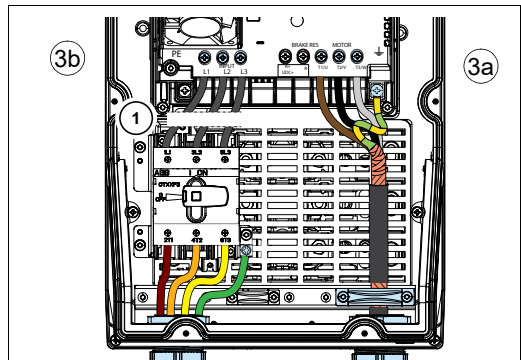
### R1...R2 with disconnect



### R3 without disconnect



### R3 with disconnect



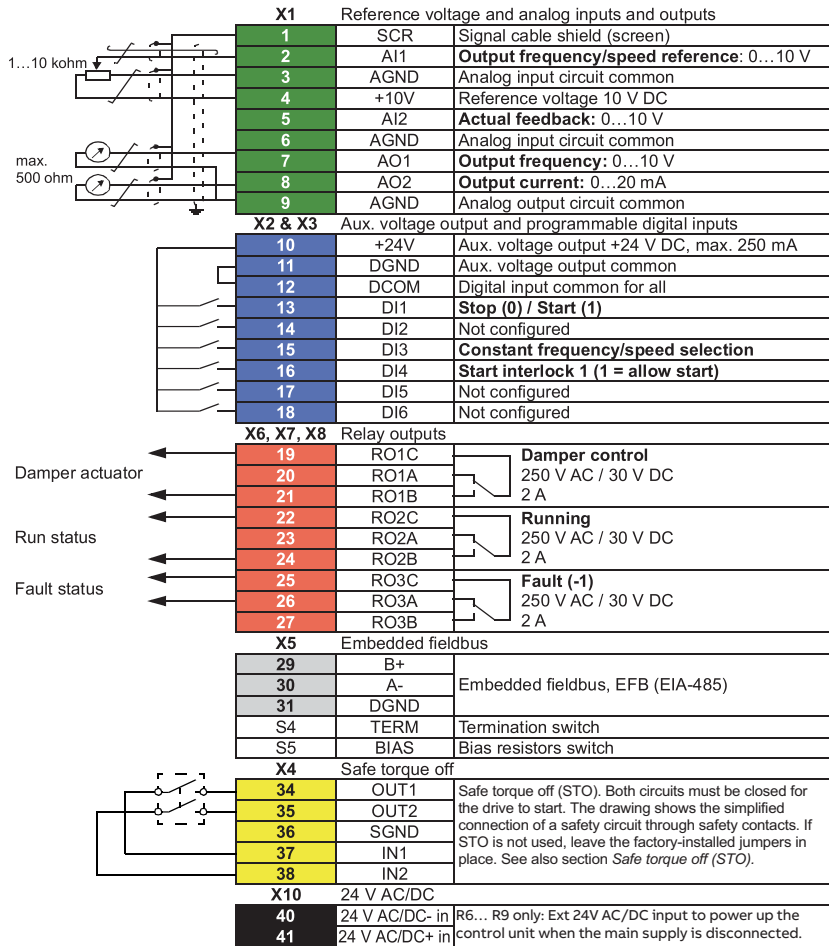
Note 1: Internal fuse block is wired between the disconnect and the drive

## 12. Connect the control cables

Make the connections according to the application. Keep the signal wire pairs twisted as near to the terminals as possible.

1. Attach cable fitting/grip to the small cable entry hole. Slide the control cables through the cable fitting/grip.
2. Ground the shield at one end of the cable only. If you ground the shield at the source of the signal, do not ground it at the SCR terminal.
3. Tie all control cables to the provided cable tie mounts.
4. Secure the conduit outside the unit mechanically. In wet, dirty, dusty, corrosive or similar locations, all fittings must be properly tightened and secured such that no leakage can occur.

## Default I/O connections (HVAC default configuration)

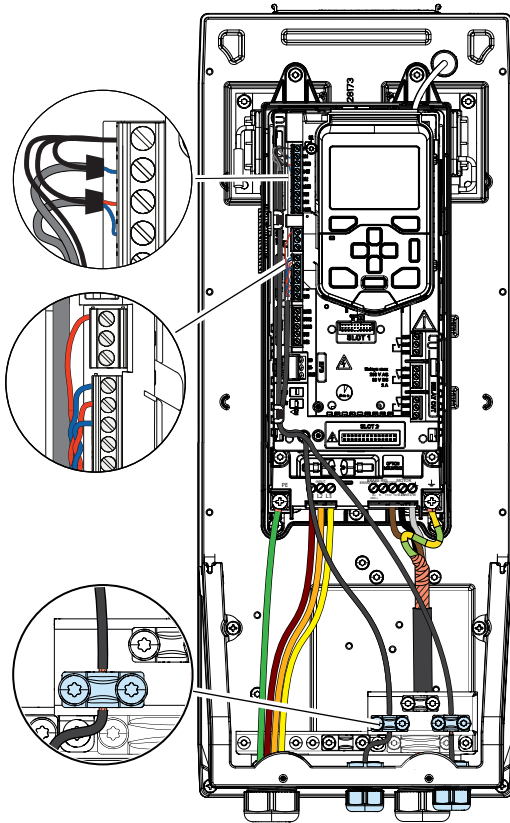


Total load capacity of the auxiliary voltage output +24V (X2:10) is 6.0 W (250 mA / 24 V DC).

Terminals	Wire size	Tightening torque
+24V, DGND, DCOM, B+, A-, DGND, Ext. 24V	0.2 ... 2.5 mm <sup>2</sup> (24 ... 14 AWG)	0.5 ... 0.6 N·m (5 lbf·in)
DI, AI, AO, AGND, RO, OUT, IN, SGND	0.14 ... 1.5 mm <sup>2</sup> (26 ... 16 AWG)	

## Control cable installation examples

This section shows examples for routing the control cables. Utilize the retaining clips along the edge of the controller.



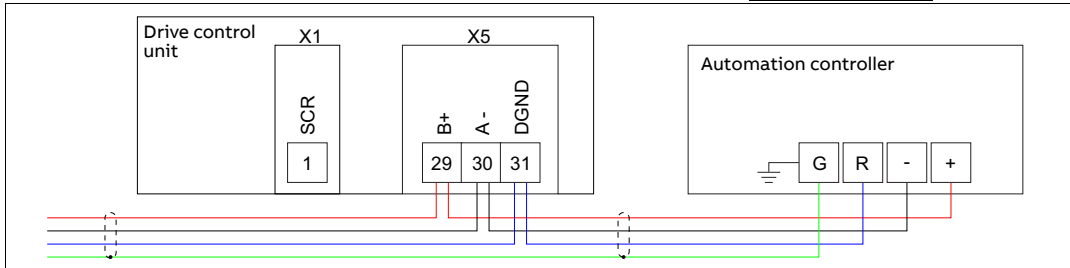
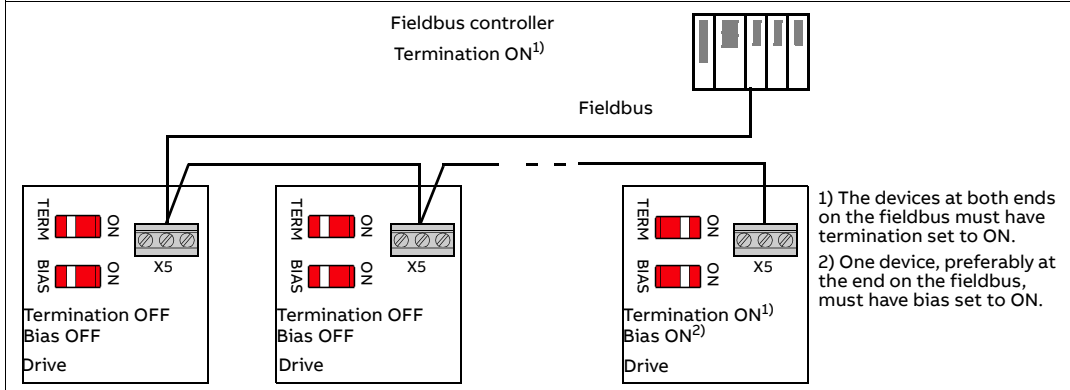
### ■ EIA-485 embedded fieldbus connection

You can connect the drive to a serial communication link with a fieldbus adapter module or the embedded fieldbus interface. The embedded fieldbus interface supports BACnet.

To configure BACnet communication with the embedded fieldbus:

1. Connect the fieldbus cable and the required I/O signals. Use Belden 9842 or equivalent. Belden 9842 is a dual twisted, shielded pair cable with a wave impedance of 120 Ohms.
2. If the drive is at the end of the fieldbus, set the termination switch to ON.
3. Power up the drive and set the required parameters. Refer to [Motor overload protection](#).

Overview and connection diagrams for connecting the drive to the fieldbus are shown below.



- Connect the cable shields together at each drive, but do not connect them to the drive.
- Connect the shield only to terminal “G” (ground) in the automation controller.
- Connect the DGND conductor to terminal “R” (reference) in the automation controller.

### 13. Install optional modules, if included in the delivery

### 14. Before installing the cover, for outdoor installations in conditions when dew or frost is possible: take extra precautions to help prevent the formation of condensation within the drive. This includes:

1. Seal the conduit openings: Cold damp air can enter the drive through the conduit under the right conditions causing frost to form in the cable box. Use a sealant around the wires to prevent air infiltration through the conduit.
2. Enclose the drive with dry air: Very little air is allowed into the drive cavity once the cover is secured. Closing the cover when the ambient air is dry will help prevent condensation from forming. Close the drive when the ambient air is cold (below freezing) or when it is warm but with low RH (relative humidity): 70 °F (21 °C) with RH < 40%; 80 °F (27 °C) with RH < 30%.
3. Maintain power to the drive at all times: Whenever the drive is powered up, even when the motor is not being controlled, the drive will generate heat and the internal fan will run. This will help prevent condensation.

### 15. Install the cover(s)

The cover installation procedure is the opposite of the removal procedure. Tighten the eight screws until the cover is flush with the heat sink applying 1.8 ft-lb (2.5 Nm) of torque using a Pozidriv #2 bit. Use hand tool only. Do not use power tools. Refer to [Remove the cover\(s\)](#). Notice: Some bowing of the cover between screws is normal.



**WARNING!** Cover screws must be correctly torqued to ensure a water-tight seal.

**Use:** Hand tool with Pozidriv #2 bit

**Torque:** 1.8 lbf-ft (2.5 Nm)

**DO NOT OVER-TORQUE!**

### 16. Start up the drive















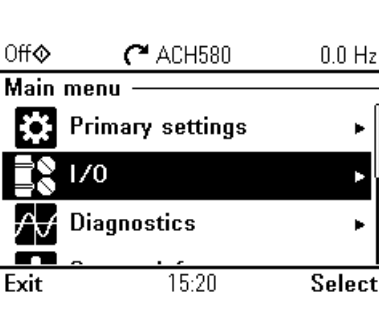






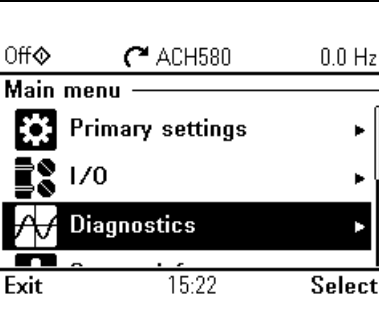




**WARNING!** Before you start up the drive, make sure that the installation is completed. Make sure also that it is safe to start the motor. Disconnect the motor from other machinery if there is a risk of damage or injury.

Use the control panel to do the start-up procedure. The two commands at the bottom of the display show the functions of the two softkeys and located below the display. The commands assigned to the softkeys are different depending on the context. Use the arrow keys , , and to move the cursor or change values depending on the active view. Key shows a context-sensitive help page.

- |    |  |
|----|--|
| 1. | Power up the drive. Make sure that you have the motor name plate data available. |
|----|--|




2.	<p>The First start assistant guides you through the first start-up. The assistant begins automatically. Wait until the control panel shows the language selection screen.</p> <p>Select the language you want to use and press  (<b>OK</b>).</p> <p><b>Note:</b> After you select the language, it takes a few minutes for the control panel to wake up.</p>	
3.	<p>Select <b>Commission the drive</b> and press  (<b>Next</b>).</p>	<p>Off  ACH580 0.0 Hz</p> <hr/> <p><b>First start assistant</b> </p> <p>Set-up drive now? Spin the motor mode <b>Commission the drive</b> Exit &amp; don't show at power-up Exit</p> <hr/> <p>15:16 <b>Next</b></p>
4.	<p>Select the localization you want to use and press  (<b>Next</b>).</p>	<p>Off  ACH580 0.0 Hz</p> <hr/> <p><b>Localization</b> </p> <p>Unit defaults: <b>International (SI)</b> US standard (Imperial)</p> <hr/> <p><b>Back</b> 15:16 <b>Next</b></p>
5.	<p>To complete the first start assistant, select the values and settings when prompted by the assistant. Continue until the panel shows that the first start is complete.</p> <p>When the panel shows that the first start is complete, the drive is ready for use. Press  (<b>Done</b>) to enter the Home view.</p>	<p>Off  ACH580 0.0 Hz</p> <hr/> <p><b>First start complete</b></p> <p>The drive is ready to run the motor. Press "Hand" to start the motor. To continue commissioning go to Menu &gt; Primary settings.</p> <hr/> <p>15:19 <b>Done</b></p>
6.	<p>The Home view shows the values of the selected signals.</p>	<p>Off  ACH580 0.0 Hz</p> <hr/> <p>Output frequency <b>0.00</b> Hz</p> <hr/> <p>Motor current <b>0.00</b> A</p> <hr/> <p>All actual value <b>0.000</b> V</p> <hr/> <p><b>Options</b> 15:19 <b>Menu</b></p>

7.	After the additional adjustments, make sure that the actual I/O wiring matches the I/O use in the control program. In the <b>Main</b> menu, select <b>I/O</b> and press  ( <b>Select</b> ).	 <p>Off  ACH580 0.0 Hz</p> <p><b>Main menu</b></p> <ul style="list-style-type: none"> <li> Primary settings ▶</li> <li> <b>I/O</b> ▶</li> <li> Diagnostics ▶</li> </ul> <p>Exit 15:20 <b>Select</b></p>
8.	After making the additional adjustments and checking the I/O connections, use the Diagnostics menu to make sure that the setup is functioning correctly. In the Main menu, select <b>Diagnostics</b> and press  ( <b>Select</b> ) (or  ).	 <p>Off  ACH580 0.0 Hz</p> <p><b>Main menu</b></p> <ul style="list-style-type: none"> <li> Primary settings ▶</li> <li> I/O ▶</li> <li> <b>Diagnostics</b> ▶</li> </ul> <p>Exit 15:22 <b>Select</b></p>

### Motor overload protection

The motor thermal overload protection is set to motor current and motor class curves as default. Motor thermal overload protection can also be measured using motor temperature devices or can be estimated using a motor model defined by parameters. To enable protection using motor model parameters or measurement devices set parameter 35.11 and subsequent parameters through 35.55. To adjust motor class curves (default is class 20), change parameters 35.56 and 35.57.

Use the information key () on the drive control panel for more information on setting group 35 parameters. You must set the drive overload parameters correctly, or motor damage could occur.

### Fieldbus communication

To configure the embedded fieldbus communication for BACnet MSTP, you must set at least these parameters:

Parameter	Setting	Description
20.01 Ext1 commands	Embedded fieldbus	Selects fieldbus as the source for the start and stop commands when EXT1 is selected as the active control location.
22.11 Ext1 speed ref1	EFB ref1	Selects a reference received through the embedded fieldbus interface as speed reference 1. Use this parameter with the vector motor control mode.
28.11 Ext1 frequency ref1	EFB ref1	Selects a reference received through the embedded fieldbus interface as frequency reference 1. Use this parameter with the frequency motor control mode.
58.01 Protocol enable	BACnet MSTP	Initializes embedded fieldbus communication.
58.03 Node address	1 (default)	Node address. There must be no two nodes with the same node address online.
58.04 Baud rate	19.2 kbps (default)	Defines the communication speed of the link. Use the same setting as in the master station.
58.05 Parity	8 EVEN 1 (default)	Selects the parity and stop bit setting. Use the same setting as in the master station.
58.06 Communication control	Refresh settings	Validates any changed EFB configuration settings. Use this after changing any parameters in group 58.

Other parameters related to the fieldbus configuration:

58.14 Communication loss action	
58.15 Communication loss mode	58.101 Data I/O 1 ...
58.16 Communication loss time	58.114 Data I/O 14

### Warnings and faults

Warning	Fault	Aux. code	Description
A2A1	2281	Current calibration	<u>Warning:</u> Current calibration is done at the next start. <u>Fault:</u> Output phase current measurement fault.
A2B1	2310	Overcurrent	The output current is more than the internal limit. This can also be caused by an earth fault or phase loss.

Warning	Fault	Aux. code	Description
A2B3	2330	Earth leakage	A load unbalance that is typically caused by an earth fault in the motor or the motor cable.
A2B4	2340	Short circuit	There is a short-circuit in the motor or the motor cable.
-	3130	Input phase loss	The intermediate DC circuit voltage oscillates due to missing input power line phase.
-	3181	Wiring or earth fault	Incorrect input and motor cable connection.
A3A1	3210	DC link overvoltage	Intermediate DC circuit voltage is too high.
A3A2	3220	DC link undervoltage	Intermediate DC circuit voltage is too low.
-	3381	Output phase loss	All three phases are not connected to the motor.
-	5090	STO hardware failure	STO hardware diagnostics has detected hardware failure. Contact ABB.
A5A0	5091	Safe torque off	The Safe torque off (STO) function is active.
A7CE	6681	EFB comm loss	Break in embedded fieldbus communication.
A7C1	7510	FBA A communication	Communication lost between drive (or PLC) and fieldbus adapter.
A7AB	-	Extension I/O configuration failure	The installed C-type module is not the same as configured, or there is an error in the communication between the drive and module.
AFF6	-	Identification run	The motor ID run occurs at the next start.
-	FA81	Safe torque off 1	The Safe torque off circuit 1 is broken.
-	FA82	Safe torque off 2	The Safe torque off circuit 2 is broken.

## Ratings, fuses and typical power cable sizes

ACH580-01-...	Nominal ratings				Fuses <sup>4)</sup>			Typical power cable sizes, Cu		Frame size
	Input current	Output current <sup>1)</sup> light duty	Motor power <sup>2)</sup>		gG fuse (IEC 60269)	uR/aR fuse <sup>3)5)</sup> (DIN 43620)	UL class T <sup>6)7)8)</sup>	mm <sup>2</sup> 9)10)	AWG 11)	
	I <sub>L</sub> A	I <sub>LD</sub> A	P <sub>n</sub> kW	P <sub>LD</sub> hp	ABB type	Busmann type				
U <sub>1</sub> = 200...240 V, P <sub>n</sub> at U <sub>n</sub> = 3-phase 208/230 V, 60 Hz										
04A6-2	4.6	4.6	0.75	1.0	OFAF000H25	170M1563	JJS-15	3×6.0 + 6.0	14	R1
06A6-2	6.6	6.6	1.1	1.5	OFAF000H25	170M1563	JJS-15	3×6.0 + 6.0	14	R1
07A5-2	7.5	7.5	1.5	2.0	OFAF000H25	170M1563	JJS-15	3×6.0 + 6.0	14	R1
10A6-2	10.6	10.6	3.0	3.0	OFAF000H25	170M1563	JJS-15	3×6.0 + 6.0	14	R1
017A-2	16.7	16.7	4.0	5.0	OFAF000H25	170M1563	JJS-30	3×6.0 + 6.0	10	R1
024A-2	24.2	24.2	5.5	7.5	OFAF000H40	170M1565	JJS-40	3×6.0 + 6.0	8	R2
031A-2	30.8	30.8	7.5	10.0	OFAF000H40	170M1565	JJS-40	3×6.0 + 6.0	8	R2
046A-2	46.2	46.2	11.0	15.0	OFAF000H63	170M1566	JJS-80	3×10 + 10	6	R3
059A-2	59.4	59.4	15	20	OFAF000H63	170M1566	JJS-80	3×16 + 16	4	R3
U <sub>1</sub> = 440...480 V, P <sub>n</sub> at U <sub>n</sub> = 3-phase 460 V, 60 Hz										
02A1-4	2.1	2.1	0.75	1.0	OFAF000H4	170M1561	JJS-15	3×6.0 + 6.0	14	R1
03A0-4	3.0	3.0	1.1	1.5	OFAF000H6	170M1561	JJS-15	3×6.0 + 6.0	14	R1
03A5-4	3.5	3.5	1.5	2.0	OFAF000H6	170M1561	JJS-15	3×6.0 + 6.0	14	R1
04A8-4	4.8	4.8	2.2	3.0	OFAF000H10	170M1561	JJS-15	3×6.0 + 6.0	14	R1
06A0-4	6.0	6.0	3.0	3.0	OFAF000H10	170M1561	JJS-15	3×6.0 + 6.0	14	R1
07A6-4	7.6	7.6	4.0	5.0	OFAF000H16	170M1561	JJS-15	3×6.0 + 6.0	14	R1
012A-4	12.0	12.0	5.5	7.5	OFAF000H16	170M1561	JJS-15	3×6.0 + 6.0	14	R1
014A-4	14.0	14.0	7.5	10.0	OFAF000H25	170M1563	JJS-30	3×6.0 + 6.0	12	R2
023A-4	23.0	23.0	11.0	15.0	OFAF000H32	170M1563	JJS-30	3×6.0 + 6.0	10	R2
027A-4	27.0	27.0	15.0	20.0	OFAF000H40	170M1565	JJS-40	3×10 + 10	8	R3
034A-4	34.0	34.0	18.5	25.0	OFAF000H50	170M1565	JJS-60	3×10 + 10	8	R3
044A-4	44.0	44.0	22.0	30.0	OFAF000H63	170M1566	JJS-60	3×10 + 10	6	R3
U <sub>1</sub> = 500...600 V, P <sub>n</sub> at U <sub>n</sub> = 3-phase 575 V, 60 Hz										
02A7-6	2.7	2.7	1.5	2.0	-	-	JJS-15	-	14	R2
03A9-6	3.9	3.9	2.2	3.0	-	-	JJS-15	-	14	R2
06A1-6	6.1	6.1	4.0	5.0	-	-	JJS-15	-	14	R2
09A0-6	9.0	9.0	5.5	7.5	-	-	JJS-15	-	14	R2
011A-6	11.0	11.0	7.5	10.0	-	-	JJS-15	-	14	R2
017A-6	17.0	17.0	11.0	15.0	-	-	JJS-30	-	10	R2
022A-6	22	22	15.0	20.0	-	-	JJS-40	-	10	R3
027A-6	27	27	18.5	25.0	-	-	JJS-40	-	8	R3
032A-6	32	32	22.0	30.0	-	-	JJS-40	-	8	R3

1) I<sub>L</sub> = Nominal current with 10% overload allowed for one minute every ten minutes.

2) P<sub>n</sub> = Typical motor power with no overload capacity. P<sub>LD</sub> = Typical motor power in light duty use (10% overload). The kilowatt ratings apply to most IEC 4-pole motors. The horsepower ratings apply to most NEMA 4-pole motors.

3) For IEC installations, ABB recommends aR fuses. See hardware manual for guidelines in selecting between aR and gG fuses, and for additional fuse alternatives.

4) When option +F254 is included (UL98 input disconnect switch with handle and fuses), the type JJS fuses as listed are included inside the drive. Otherwise, the recommended branch protection fuses must be used externally to maintain the IEC/EN/UL 61800-5-1 and CSA C22.2 No. 274 certifications.

5) IEC 61439-1: The drive is suitable for use on a circuit capable of delivering not more than 65 kA when protected by the fuses given in this table.

6) UL 61800-5-1, CSA C22.2 No. 274: The drive is suitable for use on a circuit capable of delivering not more than 100,000 symmetrical Amperes (rms) at 600 V maximum when protected by the ABB recommended fuses, internally or externally. Option +F254 (UL98 input disconnect switch with handle and internal fuses) provides branch circuit protection at this 100,000 A rating without the need for external upstream fuses.

7) Refer to [Alternate Fuses, MMPs and Circuit Breakers for ABB Drives \(3AXD50000645015 \[English\]\)](#) for additional UL fuses and circuit breakers that can be used as branch circuit protection.

8) Class J, CC, and CF fuses are also allowed at the same nominal current and voltage ratings as external fuses.

9) Where 6 mm<sup>2</sup> is typical, minimum 2.5 mm<sup>2</sup> (4.0 mm<sup>2</sup> for 024A-2) is allowed when permitted according to note 6. (Does not apply to 31A-2 or 023A-4)

10) **NEC Installations:** The cable sizing is based on NEC Table 310-15 for copper wires, 75 °C (167 °F) wire insulation at 40 °C (104 °F) ambient temperature. Not more than three current-carrying conductors in raceway or cable or earth (directly buried). For other conditions, size the cables according to local safety regulations, appropriate input voltage and the load current of the drive.

## Terminal data for power connections

### Input power cables with disconnect switch option (F254)

Frame size	2T1, 4T2, 6T3						PE (same ground lug for all three frames)			
	Min. wire size (solid/stranded)		Max. wire size (solid/stranded)		Tightening torque		Max. wire size (solid/stranded)		Tightening torque	
	mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG	N-m	lbf-ft	mm <sup>2</sup>	AWG	N-m	lbf-ft
R1	2.5	14	25	4	6.2	4.6	2.5/2.5	14	4.0	2.9
R2	2.5	14	25	4	6.2	4.6	10/10	8	4.5	3.3
R3	2.5	14	25	4	6.2	4.6	35/35	2	5.1	3.8

### Input power cables without disconnect switch option

Frame size	L1, L2, L3						PE			
	Min. wire size (solid/stranded)		Max. wire size (solid/stranded)		Tightening torque		Max. wire size (solid/stranded)		Tightening torque	
	mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG	N-m	lbf-ft	mm <sup>2</sup>	AWG	N-m	lbf-ft
R1	0.2/0.2	24	6/4	10	1.0	0.7	16/16	6	1.5	1.1
R2	0.5/0.5	20	16/16	6	1.5	1.1	16/16	6	1.5	1.1
R3	0.5/0.5	20	35/25	2	3.5	2.6	35/35	2	1.5	1.1

### Output power cables

Frame size	T1/U, T2/V, T3/W, R-, R+/UDC+						PE			
	Min. wire size (solid/stranded)		Max. wire size (solid/stranded)		Tightening torque		Max. wire size (solid/stranded)		Tightening torque	
	mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG	N-m	lbf-ft	mm <sup>2</sup>	AWG	N-m	lbf-ft
R1	0.2/0.2	24	6/4	10	1.0	0.7	16/16	6	1.5	1.1
R2	0.5/0.5	20	16/16	6	1.5	1.1	16/16	6	1.5	1.1
R3	0.5/0.5	20	35/25	2	3.5	2.6	35/35	2	1.5	1.1

#### Notes:

- The minimum specified wire size does not necessarily have sufficient current carrying capacity at maximum load.
- The maximum number of conductors per terminal is 1 except where indicated.

## Weights and free space requirements

Frame size	Weights		Weights with Sunshield		Free space requirements for vertical installation									
					Stand alone				Side by side <sup>1)</sup>					
					Above		Below		Above		Below			
	kg	lb	kg	lb	mm	in	mm	in	mm	in	mm	in		
R1	12.7	28	16	35	65	2.6	50	2.0	150	5.9	200	7.9	200	7.9
R2	15.5	34	18.8	41	65	2.6	50	2.0	150	5.9	200	7.9	200	7.9
R3	25.5	56	29.4	65	65	2.6	50	2.0	150	5.9	200	7.9	200	7.9

1) Without free space on the sides.

Frame size	Free space requirements for horizontal installation							
	Fan side		Cable box side		Above		Below	
	mm	in	mm	in	mm	in	mm	in
R1	150	5.9	50	2.0	30	1.2	200	7.9
R2	150	5.9	50	2.0	30	1.2	200	7.9
R3	200	7.9	50	2.0	30	1.2	200	7.9

## Ambient conditions

This table shows the requirements for the ambient conditions when the drive is in operation (installed for stationary use).

Installation altitude	0 ... 4000 m (0 ... 13123 ft) above sea level. The output current must be derated at altitudes above 1000 m (3281 ft). The derating is 1% for each added 100 m (328 ft) above 1000 m (3281 ft). Above 2000 m (6562 ft), these grounding systems are permitted: TN-S (center-grounded wye), TT, and IT (ungrounded or high-resistance symmetrically grounded). For the installation requirements for corner-grounded systems at this altitude, contact your local ABB representative.
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Surrounding air temperature	<b>Operation:</b> -25 ... +50 °C (-13 ... 122 °F). No frost permitted. At temperatures over 40 °C (104 °F), the rated output current must be derated by 1% for each added 1 °C (1.8 °F). <b>Storage (in the package):</b> -40 to +70 °C (-40 to +158 °F).
Relative humidity	5 ... 95%. No condensation permitted. Maximum permitted relative humidity is 60% in the presence of corrosive gases.
Contamination levels (IEC 60721-3-3: 2002)	Chemical gases: Class 3C3/C4. Solid particles: Class 3S2. No conductive dust permitted.
Vibration	Per IEC-60068-2-6

## Safe Torque Off (STO)

The drive has a Safe torque off function (STO) in accordance with IEC/EN 61800-5-2. It can be used, for example, as the final actuator device of safety circuits that stop the drive in case of danger (such as an emergency stop circuit).

When activated, the STO 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. The control program generates an indication as defined by parameter 31.22. If the motor is running when Safe torque off is activated, it coasts to a stop. Closing the activation switch deactivates the STO. Any faults generated must be reset before restarting.

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



**WARNING!** The STO function does not disconnect the voltage from the main and auxiliary circuits of the drive.

### Notes:

- If stopping by coasting is not acceptable, stop the drive and machinery using the appropriate stop mode before activating the STO.
- The STO function overrides all other functions of the drive.

### Wiring

The safety contacts must open/close within 200 ms of each other.

Double-shielded twisted-pair cable is recommended for the connection. The maximum length of the cabling between the switch and the drive control unit is 300 m (1000 ft). Ground the shield of the cable at the control unit only.

### Validation

To ensure the safe operation of a safety function, a validation test is required. The test must be carried out by a competent person with adequate expertise and knowledge of the safety function. The test procedures and report must be documented and signed by this person. Validation instructions of the STO function can be found in the drive hardware manual.

### Technical data

- Minimum voltage at IN1 and IN2 to be interpreted as "1": 13 V DC
- STO reaction time (shortest detectable break): 1 ms
- STO response time: 2 ms (typical), 5 ms (maximum)
- Fault detection time: Channels in different states for longer than 200 ms
- Fault reaction time: Fault detection time + 10 ms
- STO fault indication (parameter 31.22) delay: < 500 ms
- STO warning indication (parameter 31.22) delay: < 1000 ms
- Safety integrity level (EN 62061): SIL 3
- Performance level (EN ISO 13849-1): PL e

The drive STO is a type A safety component as defined in IEC 61508-2.

For the full safety data, exact failure rates and failure modes of the STO function, refer to the drive hardware manual.

## Markings

The applicable markings are shown on the type designation label of the drive.



CE

UL

RCM

NSF

WEEE

TUV Nord

UKCA

## Related documents

Document	Code (English)
ACH580-01 (0.75 to 250 kW, 1.0 to 350 hp) hardware manual	<a href="#">3AXD50000044839</a>
ACH580 HVAC control program firmware manual	<a href="#">3AXD50000027537</a>
ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual	<a href="#">3AUA0000085685</a>
Drive composer PC tool user's manual	<a href="#">3AUA0000094606</a>
Converter module capacitor reforming instructions	<a href="#">3BFE64059629</a>
Declaration of China RoHS II Conformity	<a href="#">3AXD10001497382</a>