

# ACH480 drives

## Quick installation and start-up guide



### 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.

- Keep the drive in its package until you install it. After unpacking, protect the drive from dust, debris and moisture.
- Use the required personal protective equipment: safety shoes with metal toe cap, safety glasses, protective gloves and long sleeves, etc.
- When the drive or connected equipment is energized, do not do work on the drive, motor cable, motor, control cables or control circuits.
- 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 power terminals.

#### Electrical safety precautions

- Clearly identify the work location and equipment.
- Disconnect all possible voltage sources. Make sure that re-connection is not possible. Lock out and tag out.
  - Open the main disconnecting device of the drive.
  - If you have a permanent magnet motor connected to the drive, disconnect the motor from the drive.
  - Disconnect any dangerous external voltages from the control circuits.
  - After you disconnect power from the drive, always wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.
- Protect any other energized parts in the work location against contact.
- Take special precautions when close to bare conductors.
- Measure that the installation is de-energized.
  - Use a multimeter with a minimum impedance of 1 Mohm.
  - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the ground (PE) is close to 0 V.
  - Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the ground (PE) is close to 0 V.
  - Make sure that the voltage between the drive DC terminals (R+/UDC+ and UDC-) and the ground (PE) is close to 0 V.
- Install temporary grounding as required by the local regulations.
- Ask the person in control of the electrical installation work for a permit to work.

See the drive hardware manual for the full safety instructions.

### 1. Examine the installation area

The drive is intended for cabinet installation and has a degree of protection of IP20 / UL open type.

Make sure that in the installation area:

- There is sufficient space above and below the drive for cooling, and hot air does not recirculate. Refer to [Free space requirements](#).
- The ambient conditions are suitable. Refer to [Ambient conditions](#).
- The mounting surface is non-flammable and can hold the weight of the drive. Refer to [Dimensions and weights](#).
- Materials near the drive are non-flammable.
- 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 in the operation of the drive.

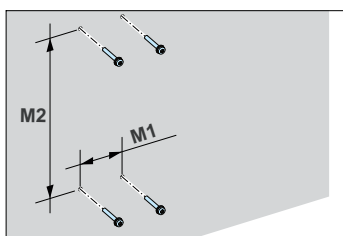
### 2. Install the drive

You can install the drive with screws, or to a DIN rail (IEC/EN 60715 top hat type, width × height = 35 mm × 7.5 mm [1.4 in × 0.3 in]).

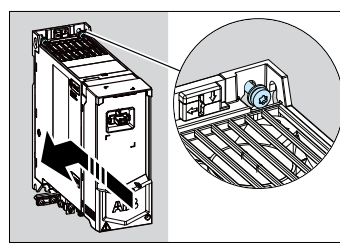
- Make sure that there is a minimum of 75 mm (3 in) of free space at the top and bottom of the drive for cooling air.
- You can install the R1, R2, R3 and R4 drives tilted by up to 90 degrees, from vertical to fully horizontal orientation.
- You can install several drives side by side.
- Do not install the drive upside down. Make sure that the cooling air exhaust is above or level with the cooling air inlet.

#### To install the drive with screws

- Make marks onto the surface for the mounting holes. Refer to [Dimensions and weights](#). Use the included mounting template for frames R3 and R4.
- Drill the holes for the mounting screws. If necessary, install suitable plugs or anchors into the holes.
- Install the mounting screws into the holes. Leave a clearance between the screw head and installation surface.

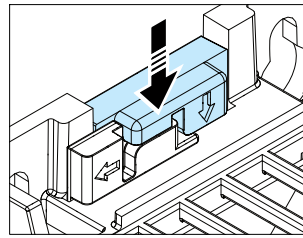
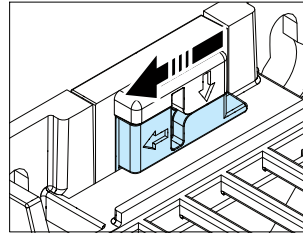


- Put the drive onto the mounting screws.
- Tighten the mounting screws.



#### To install the drive to a DIN rail

- Move the locking part to the left. If necessary, use a flat-head screwdriver.
- Push and hold the locking button down.
- Put the top tabs of the drive onto the top edge of the DIN installation rail.
- Put the drive against the bottom edge of the DIN installation rail.
- Release the locking button.
- Move the locking part to the right.
- Make sure that the drive is correctly installed.
- To remove the drive, open the locking part.



### 3. Measure the insulation resistance

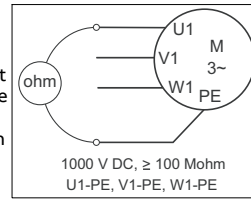
Measuring the insulation is typically not required in North America.

**Drive:** Do not do voltage tolerance or insulation resistance tests on the drive, because this can cause damage to the drive.

**Input power cable:** Before you connect the input power cable, measure the insulation of the input power cable. Obey the local regulations.

**Motor and motor cable:**

- Make sure that the motor cable is connected to the motor and disconnected from the drive output terminals T1/U, T2/V and T3/W.
- Use a voltage of 1000 V DC to measure the insulation resistance between each phase conductor and the protective earth conductor. The insulation resistance of an ABB motor must be more than 100 Mohm (at 25 °C / 77 °F). For the insulation resistance of other motors, refer to the manufacturer's documentation. Moisture in the motor decreases the insulation resistance. If you think that there is moisture in the motor, dry the motor and do the measurement again.



### 4. Select the cables

**Input power cable:** Use symmetrical shielded cable (VFD cable) for the best EMC performance.

**Motor cable:** Use symmetrical shielded cable (VFD cable) for the best EMC performance, and to comply with the drive EMC standard EN/IEC 61800-3. Symmetrical shielded cable also reduces bearing currents, wear, and stress on motor insulation.

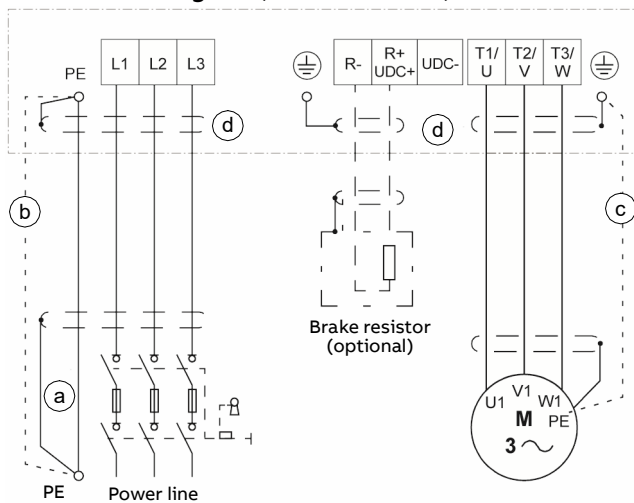
**Control cable:** Use a double-shielded twisted-pair cable for the analog signals. Use a double- or single-shielded cable for the digital, relay and I/O signals. Do not mix 24 V and 115/230 V signals in the same cable.

For more information, see the drive hardware manual.

### 5. Connect the power cables

For instructions about wiring in conduits, see the drive hardware manual.

#### Connection diagram (shielded cables)



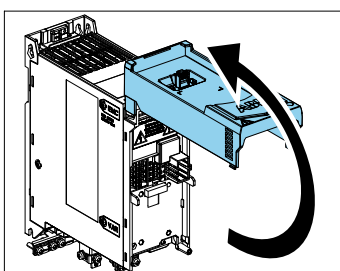
- Two protective earth (ground) conductors. Drive safety standard IEC/EN 61800-5-1 requires two PE conductors, if the cross-sectional area of the PE conductor is less than 10 mm<sup>2</sup> Cu or 16 mm<sup>2</sup> Al. For example, you can use the cable shield in addition to the fourth conductor.
- Separate grounding cable (line side). Use it if the conductivity of the fourth conductor or shield is not sufficient for the protective grounding.
- Separate grounding cable (motor side). Use it if the conductivity of the shield is not sufficient for the protective grounding, or there is no symmetrically constructed grounding conductor in the cable.
- 360-degree grounding of the cable shield. This is required for the motor cable and brake resistor cable, and recommended for the input power cable.

#### Connection procedure (shielded cables)

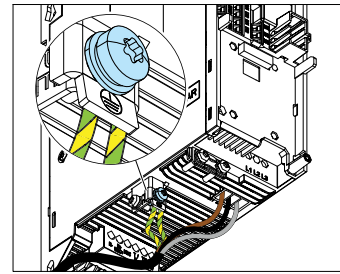
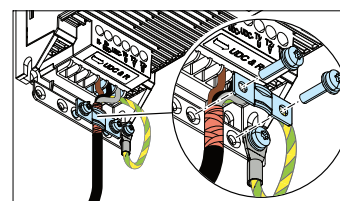
**WARNING!** Obey the safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.

**WARNING!** Make sure that the drive is compatible with the earthing system. You can connect all drive types to a symmetrically grounded TN-S system. You can also connect the UL (NEC) drive types to a corner-grounded system. For other systems, see the drive hardware manual.

- Loosen the locking screw of the front cover. Then lift the front cover up.
- Attach the residual voltage warning sticker in the local language to the drive.
- Strip the motor cable.
- Ground the motor cable shield under the grounding clamp.
- Twist the motor cable shield into a bundle, mark it accordingly and connect it to the grounding terminal.



- Connect the phase conductors of the motor cable to the T1/U, T2/V and T3/W motor terminals.
- If used, connect the brake resistor cable to the R- and UDC+ terminals. Use a shielded cable and ground the shield under the grounding clamp.
- Strip the input power cable.
- If the input power cable has a shield, ground the shield under the grounding clamp. Then twist the shield into a bundle, mark it and connect it to the grounding terminal.
- Connect the PE conductor of the input power cable to the grounding terminal. If necessary, use a second PE conductor.
- Connect the phase conductors of the input power cable to the L1, L2 and L3 input terminals.
- Mechanically attach the cables on the outside of the drive.

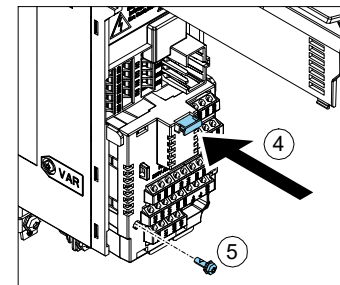
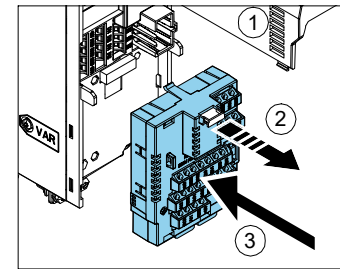


Frame size	Tightening torques for the terminal connections	
	L1, L2, L3, T1/U, T2/V, T3/W R-, R+/UDC+, UDC-	PE
R1...R2	0.5 ... 0.6 N·m (5 lbf·in)	1.2 N·m (10.6 lbf·in)
R3	1.2 ... 1.5 N·m (11 ... 13 lbf·in)	1.2 N·m (10.6 lbf·in)
R4	2.5 ... 3.7 N·m (22 ... 32 lbf·in)	2.9 N·m (25.7 lbf·in)

### 6. Install the communication module

To install the communication module (I/O module or fieldbus module):

- Loosen the locking screw of the front cover. Then lift the front cover up.
- Pull out the locking tab of the communication module.
- Align the communication module contacts with the contacts on the drive. Carefully push the module into position.
- Push in the locking tab of the communication module.
- Tighten the locking screw to fully attach and electrically ground the communication module.

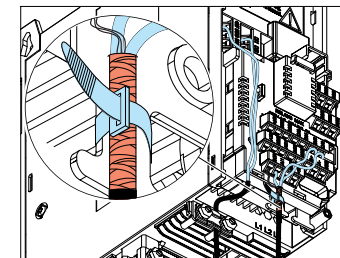


### 7. Connect the control cables

#### Connection procedure

Keep the signal wire pairs twisted as near to the terminals as possible to prevent inductive coupling.

- Strip a part of the outer shield of the control cable for grounding.
- Use a cable tie to ground the outer shield to the grounding tab.
- Strip the control cable conductors.
- Connect the conductors to the correct control terminals. Tightening torque: 0.5 ... 0.6 N·m (4.4 ... 5.3 lbf·in).
- Connect the shields of the twisted pairs and grounding wires to the SCR terminal. Tightening torque: 0.5 ... 0.6 N·m (4.4 ... 5.3 lbf·in).
- Mechanically attach the control cables on the outside of the drive.
- Close the front cover and tighten the locking screw.



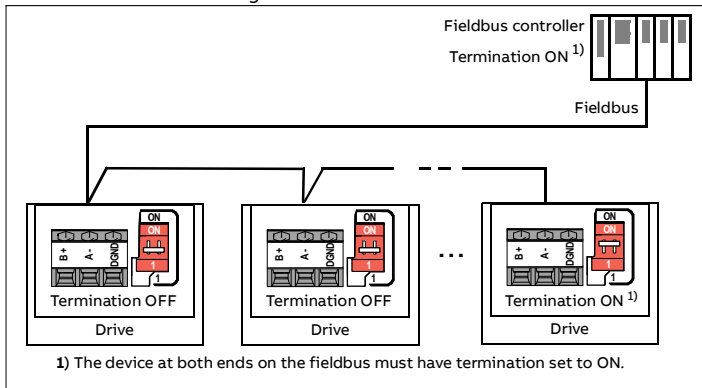
#### Default I/O connections (HVAC default)

Terminal	Description	Base unit
SCR	Signal cable shield (screen)	
AI1	Output freq./speed ref. 0 ... 10 V	
AGND	Analog input circuit common	
+10 V	Reference voltage 10 V DC	
AI2	Actual feedback: 0 ... 20 mA	
AGND	Analog input circuit common	
AO1	Output frequency: 0 ... 20 mA	
AO2	Output current: 0 ... 20 mA	
AGND	Analog output circuit common	
<b>Aux. voltage output and programmable digital inputs</b>		
+24 V	Aux. voltage output +24 V DC, max. 250 mA	×
DGND	Aux. voltage output common	×
DCOM	Digital input common for all	×
DI1	Stop (0)/Start (1)	×
DI2	Not configured	×
DI3	Constant frequency/speed selection	
DI4	Start interlock 1 (I = allow start)	
DI5	Not configured	
DI6	Not configured	
<b>Relay outputs</b>		
RO1C	Damper control	×
RO1A	250 V AC/30 V DC	×
RO1B	2 A	×
RO2C	Running	
RO2A	250 V AC/30 V DC	
RO2B	2 A	
RO3C	Fault (-1)	
RO3A	250 V AC/30 V DC	
RO3B	2 A	
<b>Embedded fieldbus</b>		
B+	Embedded fieldbus (EIA-485)	
A-		
DGND		
TERM&BIAS	Serial data link termination switch	
<b>Safe torque off</b>		
SGND	Safe torque off. Factory connection. Both circuits must be closed for the drive to start.	×
IN1		×
IN2		×
OUT1		×
<b>Auxiliary voltage output. The alternative terminals have the same supply as the base unit.</b>		
+24V		
DGND		
DCOM		

**Note:** × refers to terminals in the base unit. Other terminals are in the RIO-01 I/O & EIA-485 module (delivered with the standard drive variant as default).

## Connecting EIA-485 embedded fieldbus to the drive

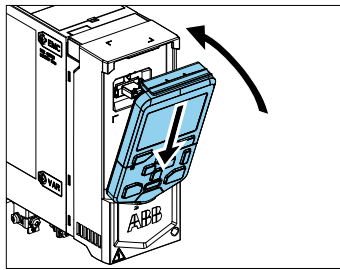
Connect the fieldbus to the EIA-485 embedded fieldbus terminal on the RII0-01 module. The connection diagram is shown below.



## 8. Install the control panel

To install the control panel:

1. Close the front cover and tighten the locking screw.
2. Put the bottom edge of the control panel into position.
3. Push the top of the control panel until it locks into position.



## 9. Start up the drive

For information on the start-up and drive parameters, refer to the drive firmware manual.

**WARNING!** Before you start up the drive, make sure that the installation is complete. Make sure that the cover of the drive is in place. Make sure also that the motor does not cause danger when it starts. Disconnect the motor from other machinery, if there is a risk of damage or injury.

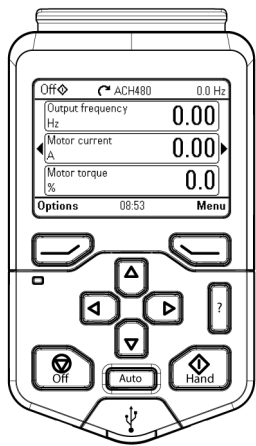
For information on the user interface, refer to the *ACx-AP-x Assistant control panel user's manual* (3AUA0000085685 [English]).

The control panel has softkeys below the display to access the corresponding commands, and arrow keys to navigate the menu and change parameter values. Push the "?" button to open the help function.

First start-up:

Make sure that you have the motor data (from the name plate) available.

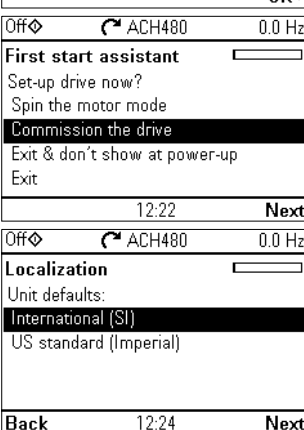
1. Set the main power to on.



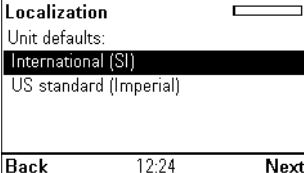
2. Select the user interface language with the arrow keys and set it with the right softkey (OK).



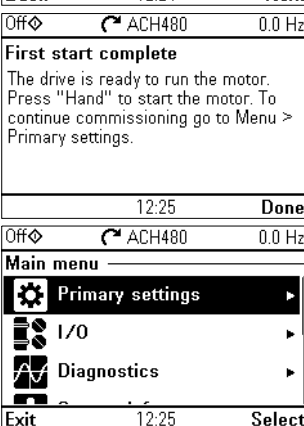
3. Select Commission the drive and push the right softkey (Next).



4. Select the localization and push the right softkey (Next).



5. To complete the start-up procedure, enter the settings and values when you are prompted by the set-up assistant.



You can also use *Primary settings* in the Main menu to configure the unit.

## Fieldbus communication

You can connect the drive to a serial communication link with a fieldbus adapter module or the embedded fieldbus interface. The embedded fieldbus interface is included in the RII0-01 I/O module, and it supports Modbus RTU, BACnet MS/TP and N2 protocols.

To configure BACnet MS/TP communication with the embedded fieldbus:

1. Connect the fieldbus cable and the required I/O signals. Refer to *Default I/O connections (HVAC default)* and *Connecting EIA-485 embedded fieldbus to the drive*.
2. If the drive is at the end of the fieldbus, set the termination switch to ON.
3. Power up the drive.
4. Configure fieldbus communication from the parameter list.

The minimum set of parameters for BACnet MS/TP configuration:

Parameters	Setting
20.01 Ext1 commands	Embedded fieldbus
22.11 Ext1 speed ref 1 (vector)	EFB ref1
28.11 Ext1 frequency ref1 (scalar)	EFB ref1
31.11 Fault reset selection	DI1 <sup>1)</sup>
58.01 Protocol enable	BACnet MSTP
58.03 Node address	1 (default)
58.04 Baud rate	Autodetect (default)
58.40 Device object ID	User-defined (valid range 0...4194302)

1) If you select DI1, you must connect the reset signal to digital input DI1.

## Warnings and faults

Warning	Fault	Description
A2A1	2281	Warning: Current calibration is done at the next start. Fault: Output phase current measurement fault.
A2B1	2310	Overcurrent. The output current is more than the internal limit. This can be caused by an earth fault or phase loss.
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.
-	3181	Cross connection. The input and motor cable connections are incorrect.
A3A1	3210	DC link overvoltage. There is an overvoltage in the intermediate DC circuit.
A3A2	3220	DC link undervoltage. There is an undervoltage in the intermediate DC circuit.
-	3381	Output phase loss. All three phases are not connected to the motor.
A5A0	5091	Safe torque off. The Safe torque off (STO) function is on.
-	6681	EFB communication loss. Break in embedded fieldbus communication.
-	7510	FBA A communication. Communication lost between drive and fieldbus adapter.
A7AB	-	Extension I/O configuration failure. The I/O module is not connected to the drive, or there is a parameterization conflict.
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

### IEC ratings

IEC type ACH480-04-...	Input rating	Input with choke	Output ratings				Frame size	
			Max. current	Nominal use	Light-duty use			
	$I_N$	$I_N$	$I_{max}$	$I_N$	$P_N$	$I_d$	$P_d$	
	A	A	A	A	kW	A	kW	
3-phase $U_N = 400$ V								
02A7-4	4.2	2.6	3.2	2.6	0.75	2.5	0.75	R1
03A4-4	5.3	3.3	4.7	3.3	1.1	3.1	1.1	R1
04A1-4	6.4	4.0	5.9	4.0	1.5	3.8	1.5	R1
05A7-4	9.0	5.6	7.2	5.6	2.2	5.3	2.2	R1
07A3-4	11.5	7.2	10.1	7.2	3.0	6.8	3.0	R1
09A5-4	15.0	9.4	13.0	9.4	4.0	8.9	4.0	R1
12A7-4	20.2	12.6	16.9	12.6	5.5	12.0	5.5	R2
018A-4	27.2	17.0	22.7	17.0	7.5	16.2	7.5	R3
026A-4	40.0	25.0	30.6	25.0	11.0	23.8	11.0	R3
033A-4	45.0	32.0	45.0	32.0	15.0	30.5	15.0	R4
039A-4	50.0	38.0	57.6	38.0	18.5	36.0	18.5	R4
046A-4	56.0	45.0	68.4	45.0	22.0	42.8	22.0	R4
050A-4	60.0	50.0	81.0	50.0	22.0	48.0	22.0	R4

### UL (NEC) ratings

UL (NEC) type ACH480-04-...	Input rating	Input with choke	Output ratings				Frame size	
			Max. current	Nominal use	Light-duty use			
	$I_N$	$I_N$	$I_{max}$	$I_N$	$P_N$	$I_d$	$P_d$	
	A	A	A	A	hp	A	hp	
3-phase $U_N = 480$ V								
02A1-4	3.4	2.1	3.6	2.1	1.0	2.1	1.0	R1
03A0-4	4.8	3.0	5.2	3.0	1.5	3.0	1.5	R1
03A5-4	5.4	3.4	6.6	3.5	2.0	3.4	2.0	R1
04AB-4	7.7	4.8	8.0	4.8	3.0	4.8	2.0	R1
06A0-4	9.6	6.0	11.2	6.0	3.0	6.0	3.0	R1
07A6-4	12.2	7.6	14.4	7.6	5.0	7.6	5.0	R1
011A-4	17.6	11.0	18.8	11.0	7.5	11.0	7.5	R2
014A-4	22.4	14.0	25.2	14.0	10.0	14.0	10.0	R3
021A-4	33.6	21.0	34.0	21.0	15.0	21.0	15.0	R3
027A-4	37.9	27.0	50.0	27.0	20.0	27.0	20.0	R4
034A-4	44.7	34.0	64.0	34.0	25.0	34.0	25.0	R4
042A-4	50.4	42.0	90.0	42.0	30.0	42.0	30.0	R4

### Fuses

For information on fuses, circuit breakers and manual motor protectors, refer to the drive hardware manual.

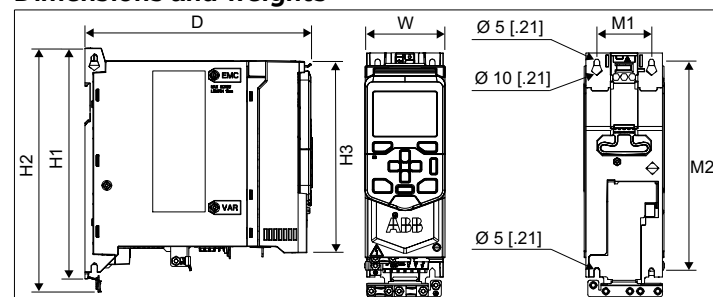
### Ambient conditions

Requirement	During operation (installed for stationary use)
Installation altitude	400/480 V units: 0 ... 4000 m (0 ... 13123 ft) above sea level (with output derating above 1000 m [3281 ft]) <sup>1)</sup>
Surrounding air temperature	-10 ... +60 °C (14 ... 140 °F). If the temperature is more than 50 °C (122 °F), output derating is necessary. Frost is not permitted.
Relative humidity	5 ... 95% without condensation
Contamination levels (IEC 60721-3-3: 2002)	Conductive dust is not permitted
Shock (IEC 60068-2-27, IATA 1A)	Not permitted
Free fall	Not permitted

1) A maximum altitude of 4000 m (13123 ft) is permitted for 400/480 V units, if the switching voltage for the integrated relay output RO1 is not more than 30 V. Below 2000 m (6562 ft), the maximum switching voltage is 250 V.

For a 3-phase 400/480 V drive at an altitude between 2000 ... 4000 m (6562 ... 13123 ft), only the following earthing systems are permitted: TN-S, TT.

## Dimensions and weights



Frame size	H1		H2		H3		W		D		M1		M2		Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
R1	205	8.1	223	8.8	176	6.9	73	2.8	207	8.2	50	2.0	191	7.5	1.77	3.90
R2	205	8.1	223	8.8	176	6.9	97	3.8	207	8.2	75	2.9	191	7.5	2.35	5.19
R3	205	8.1	220	8.7	176	6.9	172	6.8	207	8.2	148	5.8	191	7.5	3.52	7.76
R4	205	8.1	240	9.5	176	6.9	260	10.2	212	8.4	238	9.4	191	7.5	6.02	13.3

## Free space requirements

Frame size	Above		Below		Sides <sup>1)</sup>	
	mm	in	mm	in	mm	in
R1...R4	75	3	75	3	0	0

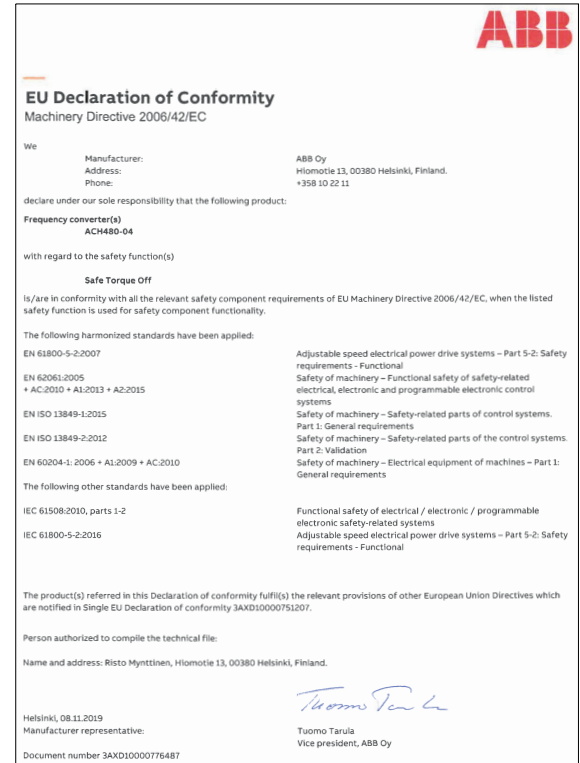
1) A side-mounted option module requires 20 mm (0.8 in) of free space on the right side of the drive.

## Markings

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



## Declaration of conformity



## Related documents

Document	Code (English)
ACH480 drives hardware manual	3AXD50000245949
ACH480 HVAC control program firmware manual	3AXD50000247134
ACH480 quick installation and start-up guide	3AXD50000247141
ACx-AP-x assistant control panels user's manual	3AUA0000085685
FBIP-21 BACnet/IP adapter module quick guide	3AXD50000158171
FDNA-01 DeviceNet adapter module quick guide	3AXD50000158515
FENA-01/-11/-21 Ethernet adapter module user's manual	3AUA0000093568
FMBT-21 Modbus/TCP adapter module quick guide	3AXD50000158560
FPBA-01 PROFIBUS DP adapter module user's manual	3AFE68573271
FPNO-21 PROFINET adapter module quick guide	3AXD50000158577

Online manuals applicable to this product:



List of ACH480 manuals