ABB DRIVES FOR HVAC

ACH180 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.

- 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.

1. Unpack the delivery

Keep the drive in its package until you install it. After unpacking, protect the drive from dust, debris and moisture.
Make sure that all of the items are present and that there are no signs of damage:
- drive
- installation accessories (mounting template, cable clamps, screws, etc.)
- safety instructions
- multilingual warning sticker sheet (residual voltage warning)
- user interface guide (under the drive front cover)
- quick installation and start-up guide.

2. Reform the capacitors

If the drive has not been powered up for a year or more, you must reform the DC link capacitors. The manufacturing date is on the type designation label. Refer to Capacitor reforming instructions (3BFE64059629 [English]).

3. Select the cables and fuses

- Select the power cables. Obey the local regulations.
  - **Input power cable:** ABB recommends to use symmetrical shielded cable (VFD cable) for the best EMC performance.
  - **Motor cable:** Use symmetrical shielded cable (VFD cable) for the best EMC performance. Symmetrical shielded cable also reduces bearing currents, wear, and stress on motor insulation.
  - **Power cable types:** For IEC installations, use copper or aluminum cables (if permitted). In North America, use only copper cables.
  - **Current rating:** max. load current.
  - **Voltage rating:** min. 600 V AC.
  - **Temperature rating:** For IEC installations, select a cable rated for at least 70 °C (158 °F) maximum permissible temperature of conductor in continuous use. For North America, select a cable rated for at least 75 °C (167 °F).
  - **Size:** Refer to Fuses and typical power cable sizes for the typical cable sizes and to Terminal data for the power cables 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 Fuses and typical power cable sizes.

4. Examine the installation site

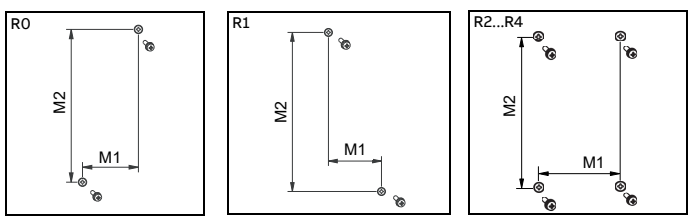
The drive is intended for cabinet installation and has a degree of protection of IP20 / UL open type as standard.

Examine the site where you will install the drive. Make sure that:
- The installation site is sufficiently ventilated and hot air does not recirculate.
- There is sufficient free space around the drive for cooling, maintenance, and operation. Refer to Free space requirements.
- The ambient conditions meet the specifications. Refer to Ambient conditions.
- The installation surface is as close to vertical as possible and strong enough to support the weight of the drive. Refer to Dimensions and weights.
- The materials behind, above and below the drive are not 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 or inaccuracy in the operation of the drive.

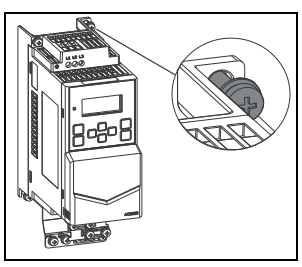
5. Install the drive

You can install the drive with screws, or to a DIN rail (top hat type, width × height = 35 mm × 7.5 mm [1.4 in × 0.3 in]).
- Install frame R0 drives vertically. R0 drives do not have a cooling fan.
- You can install drives with frame sizes R1…R4 tilted by up to 90 degrees, from vertical to fully horizontal orientation.
- Do not install the drive upside down.
- You can install several drives side by side.

To install the drive with screws



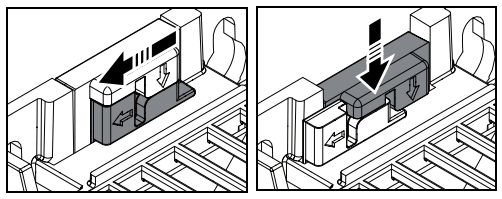
1. Make marks onto the surface for the mounting holes. Use the mounting template that was delivered with the drive.
2. Drill the holes for the mounting screws. If necessary, install suitable plugs or anchors into the holes.
3. Install the mounting screws into the holes. Refer to Dimensions and weights for the maximum screw diameter. Leave a gap between the screw head and installation surface.
4. Put the drive onto the mounting screws.
5. Tighten the mounting screws.



To install the drive to a DIN installation rail

DIN rail mounting kit is available for frames R0…R1 and R2. Refer to BDRK-01 Installation guide (3AXD50000940615 [multilingual]) for R0…R1 and BDRK-02 Installation guide (3AXD50000940714 [multilingual]) for R2.
Use the integrated lock to install frames R3 and R4 to a DIN installation rail:
1. Move the locking part to the left. If necessary, use a slotted screwdriver.
2. Push and hold the locking button down.
3. Put the top tabs of the drive onto the top edge of the DIN rail.
4. Put the drive against the bottom edge of the DIN rail.
5. Release the locking button.
6. Move the locking part to the right.
7. Make sure that the drive is correctly installed.

To move the drive, use a slotted screwdriver to open the locking part.



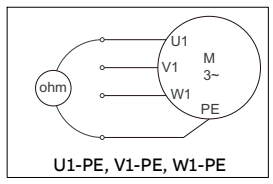
Note: For UL/CSA installations: Warning label 3AXD50001058098 (included in the delivery) must be adhered near the drive and clearly visible.

6. Measure the insulation resistance

Drive: Do not do voltage tolerance or insulation resistance tests on the drive as testing can damage the drive.

Input power cable: Before you connect the input power cable to the drive, measure its insulation resistance according to local regulations.

Motor and motor cable:
1. 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.
2. 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 instructions.
   Note: Moisture inside the motor reduces the insulation resistance. If you think that there is moisture in the motor, dry the motor and do the measurement again.



U1-PE, V1-PE, W1-PE

7. Make sure that the drive is compatible with the grounding system

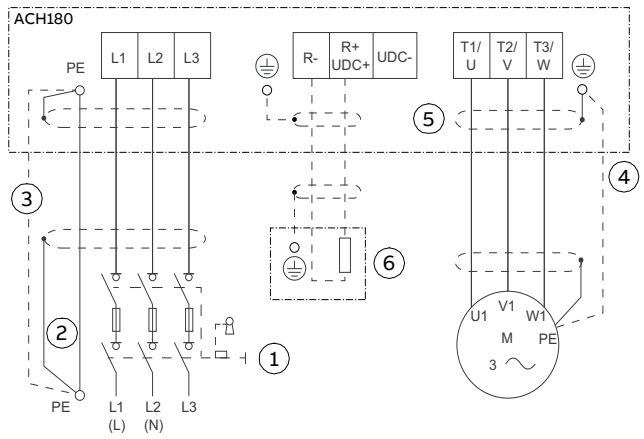
You can install all drive types to a symmetrically grounded TN-S system (center-grounded wye). The drive is delivered with the EMC and VAR screws installed. The material of the screws (plastic or metal) depends on the product variant. The table shows when to remove the metal EMC screw (disconnect the internal EMC filter) or metal VAR screw (disconnect the varistor circuit).

Screw label	Factory default screw material	Grounding systems		
		Symmetrically grounded TN-S systems (center-grounded wye)	Corner-grounded delta, midpoint-grounded delta and TT systems	IT systems (ungrounded or high-resistance grounded)
EMC	Metal	Do not remove	Remove	Remove
	Plastic	Do not remove [1]	Do not remove	Do not remove
VAR	Metal	Do not remove	Do not remove	Remove
	Plastic	Do not remove	Do not remove	Do not remove

1) Can install the metal screw (included in the drive delivery) to connect the internal EMC filter.

8. Connect the power cables

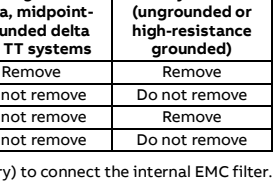
Connection diagram (shielded cables)



1. Disconnecting device.
2. Two protective earth (ground) conductors. Drive safety standard IEC/EN61800-5-1 requires two PE conductors, if the cross-sectional area of the PE conductor is less than 10 mm² Cu or 16 mm² Al. For example, you can use the cable shield in addition to the fourth conductor.
3. Use a separate grounding cable or a cable with a separate PE conductor for the line side, if the conductivity of the fourth conductor or shield does not meet the requirements for the PE conductor.
4. Use a separate grounding cable if the conductivity of the shield is not sufficient, or if there is no symmetrically constructed PE conductor in the cable.
5. 360° grounding of the cable shield is required for the motor cable and brake resistor cable (if used). It is also recommended for the input power cable.
6. Brake resistor and resistor cable (optional, for frames R2...R4 only).

Connection procedure (shielded cables)

For the tightening torques, refer to Terminal data for the power cables.



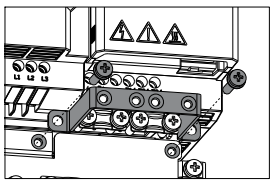
1. Attach the residual voltage warning sticker in the local language to the drive.
2. Install the grounding plate.
3. Strip the motor cable.
4. Ground the motor cable shield under the grounding clamp for 360° grounding.
5. Twist the motor cable shield into a bundle and mark it with yellow-green insulation tape. Install a cable lug and connect the shield to the grounding terminal.
6. Connect the phase conductors of the motor cable to terminals T1/U, T2/V and T3/W.
7. Frames R2…R4: If you use a brake resistor, connect the resistor cable to terminals R- and UDC+. Use a shielded cable and ground the shield under the grounding clamp for 360° grounding.
8. Frames R2…R4: Make sure that the R- and UDC+ terminal screws are tightened. Do this step also if you do not connect cables to the terminals.
9. Strip the input power cable.
10. If the input power cable has a shield, twist the shield into a bundle, mark it and connect it to the grounding terminal.
11. Connect the PE conductor of the input power cable to the grounding terminal. If necessary, use a second PE conductor.
12. 3-phase drives: Connect the phase conductors of the input power cable to terminals L1, L2 and L3.
    1-phase drives: Connect the phase and neutral conductors to terminals L and N.
13. Mechanically attach the cables on the outside of the drive.

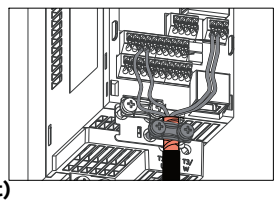
9. Connect the control cables

Connection procedure

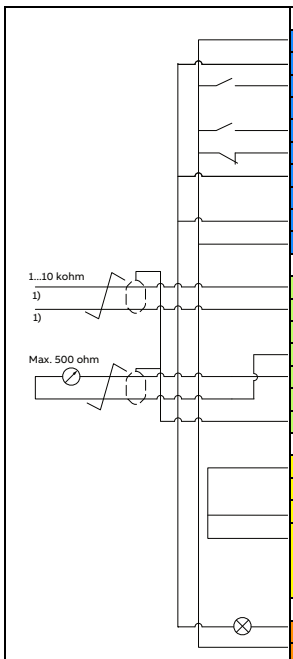
Do the connections according to the default control connections of the HVAC default macro. Keep the signal wire pairs twisted as near to the terminals as possible to prevent inductive coupling. The tightening torque for the terminal connections is 0.5 …0.6 N·m (4.4 …5.3 lbf·in).

1. Remove the front cover.
2. Install the grounding plate.
3. Strip a part of the outer shield of the control cable for grounding the shield.
4. Use a 360° grounding clamp to connect the outer shield to the grounding plate.
5. Strip the control cable conductors. For stranded (multi-wire) conductors, install ferrules at the bare conductor ends.
6. Connect the conductors to the correct control terminals. Insert the conductor into a push-in terminal. To release, push the open/close button all the way down firmly with a flathead screwdriver.
7. Connect the shields of the twisted pairs and grounding wires to the SCREEN terminal.
8. Mechanically attach the control cables on the outside of the drive.





Default I/O connections (HVAC default)



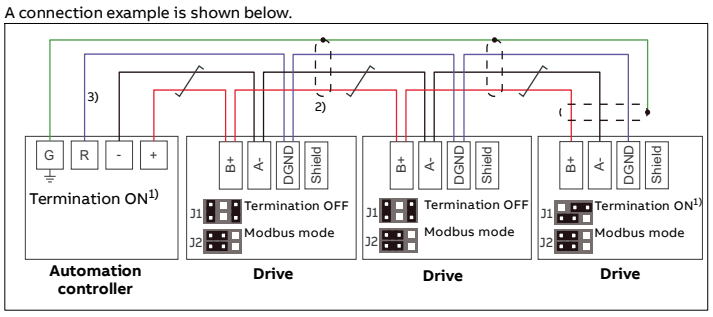
Digital I/O		
21	24 V	Aux. +24 V DC, max 200 mA
22	DGND	Aux. voltage output common
8	DI1	Stop (0) / Start (1)
9	DI2	Not configured
10	DI3	Constant speed selection
11	DI4	Start interlock 1 (1 = allow start)
12	DCOM	Digital input common
18	DO	Running
19	DO COM	Digital output common
20	DO SRC	Digital output auxiliary voltage
Analog I/O		
14	AI1/DI5	Speed reference (0…10V)
13	AGND	Analog input circuit common
15	AI2	Not used
16	AGND	Analog output circuit common
17	AO	Output frequency (0...20mA)
23	10V	Ref. voltage +10 V DC
24	SCREEN	Signal cable shield (screen)
Safe torque off (STO) (only on ACH180-04S)		
1	S+	Safe torque off (STO). Both circuits must be closed for the drive to start. The drawing shows the simplified connection of a safety circuit through safety contacts. If STO is not used, leave the factory-installed jumpers in place. See also section Safe torque off (STO).
2	SGND	
3	S1	
4	S2	
Relay output		
5	NC	Damper control
6	COM	
7	NO	
EIA-485 Modbus RTU		
25	B+	Embedded Modbus RTU (EIA-485)
26	A-	
27	DGND	
28	SHIELD	
Jumper		
J1	Termination	Modbus termination selection

1) Reference signal (0...10 V)

Embedded fieldbus connection

Connect the fieldbus to the EIA-485 Modbus RTU terminal which is on the front of the drive.
To configure Modbus RTU communication with the embedded fieldbus:
1. Connect the fieldbus cables and the necessary I/O signals.
2. Use the jumpers to set the termination and bias settings.
3. Power up the drive and set the necessary parameters.

A connection example is shown below.



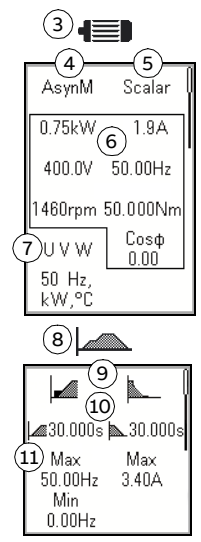
1) The devices at the ends of the fieldbus must have termination set to ON. All other devices must have termination set to OFF.
2) Attach the cable shields together at each drive, but do not connect them to the drive. Connect the shields only to the grounding terminal in the automation controller.
3) Connect the DGND conductor to the signal ground reference terminal in the automation controller.

10. 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.

For information on the user interface, refer to the ACH180 User interface guide (3AXD50000955909 [English]).

1. Power up the drive.
2. Set the unit (international or US).
3. Go to **Motor data** view.
4. Set the motor type:
   • **AsynM:** Asynchronous motor
   • **PMSM:** Permanent magnet synchronous motor
   • **EC Ti:** Ferrite assisted synchronous reluctance motor.
5. Set the motor control mode:
   Scalar: Frequency reference. Do not use this mode for permanent magnet synchronous motors.
   Use this mode when:
   • The number of motors can change.
   • The nominal motor current is less than 20% of the nominal drive current.
   Vector: Speed reference. This is suitable for most cases. The drive does an automatic standstill ID run when the drive is started for the first time.
6. Set the nominal motor values.
7. Press the **Auto/Hand** key to start the motor and check the direction of rotation. If the direction is incorrect, you can:
   • change the **Motor phase order** setting, or
   • change the phase order of the motor cable.
8. Go to **Motor control** view.
9. Set the start and stop mode.
10. Set the acceleration and deceleration times.
11. Set the maximum and minimum frequencies (or speeds).
12. Tune the drive parameters to the application. You can also use the Assistant control panel (ACH-AP-...) or the Drive Composer PC tool.



Warnings and faults

WARNING! If 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 61800-5-1, subclause 6.5.3, for example, "THIS MACHINE STARTS AUTOMATICALLY".

Code	Description
2310	Overcurrent. The output current is more than the internal limit. This can be caused by an earth fault or phase loss.
2330	Earth leakage. A load unbalance that is typically caused by an earth fault in the motor or the motor cable.
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	Wiring or earth fault. The input and motor cable connections are incorrect.
3210	DC link overvoltage. There is an overvoltage in the intermediate DC circuit.
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.
5091	Safe torque off. The Safe torque off (STO) function is on.
6681	EFB communication loss. Break in embedded fieldbus communication.
AFF6	Identification run. The motor ID run occurs at the next start.
FA81	Safe torque off 1: Safe torque off circuit 1 is broken.
FA82	Safe torque off 2: Safe torque off circuit 2 is broken.

List of most commonly used parameters

Most commonly used parameters and selections are shown in the table. Refer to the drive firmware manual for the complete lists.

Par. No.	Par. Name	Settings/Range (default value in bold)
Group 99 Motor data		
99.03	Motor type	**[0]Asynchronous motor**, [1]Permanent magnet motor, [3]PMaSynRM
99.04	Motor control mode	[0]Vector, **[1]Scalar**
99.06	Motor nominal current	depends on rating
99.07	Motor nominal voltage	depends on rating
99.08	Motor nominal frequency	depends on rating
99.09	Motor nominal speed	depends on rating
99.10	Motor nominal power	depends on rating
99.11	Motor nominal cosφ	0.00 … 1.00
99.12	Motor nominal torque	depends on rating
99.16	Motor phase order	**[0]UVW**, [1]UWV
Group 01 Actual values (read-only)		
1.01	Motor speed used	-30000.00 … 30000.00 rpm
1.06	Output frequency	-500.00 … 500.00 Hz
1.07	Motor current	0.00 … 30000.00 A
1.10	Motor torque	-1600.00% … 1600.00%
1.11	DC voltage	0.00 … 2000.00 V
1.13	Output voltage	0 … 2000 V
1.14	Output power	-32768.00 … 32767.00 kW
Group 5 Diagnostics (read-only)		
5.02	Run-time counter	0 … 65535 days
5.11	Inverter temperature	-40.0 … 160.0%
Group 10 Standard DI, RO		
10.24	RO1 source	[2]Ready run, [7]Running, [14]Fault, [16]Fault/Warning **[54]Damper control**
Group 11 Standard DI, RO		
11.06	DO1 output source	**[0]Not energized**, [2]Ready run, [7]Running, [14]Fault, [16]Fault/Warning, [54]Damper control
11.21	DI5/AI1 configuration	[0]Digital input 5, **[1]Analog input 1**
Group 12 Standard AI		
12.15	AI1 unit selection	**[2]V**, [10]mA
12.17	AI1 min	0.000 … 11.000 V or 0.000 … 22.000 mA, **0.000 V** or **0.000 mA**
12.18	AI1 max	0.000 … 11.000 V or 0.000 … 22.000 mA, **10.000 V** or **20.000 mA**
12.19	AI1 scaled at AI1 min	-32768.000 … 32767.000, **0.000**
12.20	AI1 scaled at AI1 max	-32768.000 … 32767.000, **50.000**
12.25	AI2 unit selection	[2]V, **[10]mA**
12.27	AI2 min	0.000 … 11.000 V or 0.000 … 22.000 mA, **0 V** or **4 mA**
12.28	AI2 max	0 … 11.000 V or 0 … 22.000 mA, **10 V** or **20 mA**
12.29	AI2 scaled at AI2 min	-32768.000 … 32767.000, **0.000**
12.30	AI2 scaled at AI2 max	-32768.000 … 32767.000, **50.000**
Group 13 Standard AO		
13.12	AO1 source	**[3]Output frequency**, [4]Motor current
13.15	AO1 unit selection	**[2]V**, [10]mA
13.17	AO1 source min	-32768.0 … 32767.0, **0.0**
13.18	AO1 source max	-32768.0 … 32767.0, **50.0**
13.19	AO1 out at AO1 src min	0.000 … 11.000 V or 0.000 … 22.000 mA, **0.000mA** or **0.000 V**
13.20	AO1 out at AO1 src max	0.000 … 11.000 V or 0.000 … 22.000 mA, **20.000 mA** or **10.000 V**
Group 19 Operation mode		
19.11	Ext1/Ext2 selection	**[0]EXT1**, [1]EXT2, [3]DI1, [4]DI2, [5]DI3, [6]DI4, [7]DI5
Group 20 Start/stop/direction		
20.01	Ext1 commands	[0]Not selected, **[1]In1 Start**, [2]In1 Start;In2 Dir, [3]In1 Start fwd;In2 Start rev, [4]In1P Start;In2 Stop,[5]In1P Start;In2 Stop;In3 Dir, [6]In1P Start fwd;In2P Start rev;In3 Stop, [11]Control panel, [14]Embedded fieldbus
20.03	Ext1 in1 source	[0]Always off, **[2]DI1**, [3]DI2, [4]DI3, [5]DI4, [6]DI5
20.04	Ext1 in2 source	**[0]Always off**,[2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
20.05	Ext1 in3 source	**[0]Always off**, [2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
20.06	Ext2 commands	**[0]Not selected**, [1]In1 Start, [2]In1 Start;In2 Dir, [3]In1 Start fwd;In2 Start rev, [4]In1P Start;In2 Stop,[5]In1P Start;In2 Stop;In3 Dir, [6]In1P Start fwd;In2P Start rev;In3 Stop, [11]Control panel, [14]Embedded fieldbus
20.08	Ext2 in1 source	**[0]Always off**, [2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
20.09	Ext2 in2 source	**[0]Always off**, [2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
20.10	Ext2 in3 source	**[0]Always off**, [2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
20.21	Direction	[0]Request, **[1]Forward**, [2]Reverse
Group 21 Start/stop mode		
21.01	Start mode	[0]Fast, [1]Const time, **[2]Automatic**
21.02	Magnetization time	0 … 10000 ms, **500 ms**
21.03	Stop mode	**[0]Coast**, [1]Ramp, [2]Torque limit
21.19	Scalar start mode	[0]Normal, [1]Const time, **[2]Automatic**, [3]Torque Boost, [4]Automatic+boost [5]Flying start [6]Flying start+boost
Group 22 Speed reference selection		
22.11	Ext1 speed ref1	**[1]AI1 scaled**, [2]AI2 scaled, [8]EFB ref1, [9]EFB ref2, [16]PID
22.18	Ext2 speed ref1	**[0]Zero**, [1]AI1 scaled, [2]AI2 scaled, [8]EFB ref1, [9]EFB ref2, [16]PID
22.22	Constant speed sel1	[0]Always off, [2]DI1, [3]DI2, **[4]DI3**, [5]DI4, [6]DI5
22.23	Constant speed sel2	**[0]Always off**, [2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
22.26	Constant speed 1	-30000.00 … 30000.00 rpm, **300.00 rpm**
22.27	Constant speed 2	-30000.00 … 30000.00 rpm, **600.00 rpm**
22.28	Constant speed 3	-30000.00 … 30000.00 rpm, **900.00 rpm**
22.71	Motor potentiometer function	**[0]Disabled**, [1]Enabled (init at stop/power-up), [2]Enabled (resume always), [3]Enabled (init to actual) [4]Enabled (resume/init to actual)
22.72	Motor potentiometer initial value	-32768.00… 32767.00, **0.00**
22.73	Motor potentiometer up source	**[0]Not used**, [2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
22.74	Motor potentiometer down source	**[0]Not used**, [2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
22.75	Motor potentiometer ramp time	0.0…3600.0 s, **40.0 s**
22.76	Motor potentiometer min value	-32768.00… 32767.00, **-50.00**
22.77	Motor potentiometer max value	-32768.00… 32767.00, **50.00**
Group 23 Speed reference ramp		
23.12	Acceleration time 1	0.000 … 1800.000 s, **20.000 s**
23.13	Deceleration time 1	0.000 … 1800.000 s, **20.000 s**
Group 28 Frequency reference chain		
28.11	Ext1 frequency ref1	**[1]AI1 scaled**, [2]AI2 scaled, [8]EFB ref1, [9]EFB ref2, [16]PID
28.15	Ext2 frequency ref1	**[0]Zero**, [1]AI1 scaled, [2]AI2 scaled, [8]EFB ref1, [9]EFB ref2, [16]PID
28.22	Constant frequency sel1	[0]Always off, [2]DI1, [3]DI2, **[4]DI3**, [5]DI4, [6]DI5
28.23	Constant frequency sel2	**[0]Always off**, [2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
28.26	Constant frequency 1	-500.00 … 500.00 Hz, **5.00 Hz**
28.27	Constant frequency 2	-500.00 … 500.00 Hz, **10.00 Hz**
28.28	Constant frequency 3	-500.00 … 500.00 Hz, **15.00 Hz**
28.72	Freq acceleration time 1	0.000 … 1800.000 s, **30.000 s**
28.73	Freq deceleration time 1	0.000 … 1800.000 s, **30.000 s**
Group 30 Limits		
30.11	Minimum speed	-30000.00 … 30000.00 rpm, **0.00 rpm**
30.12	Maximum speed	-30000.00 … 30000.00 rpm, **1500.00 rpm**
30.13	Minimum frequency	-500.00 … 500.00 Hz, **0.00 Hz**
30.14	Maximum frequency	-500.00 … 500.00 Hz, **50.00 Hz**
30.17	Maximum current	depends on rating
Group 31 Fault functions		
31.11	Fault reset selection	**[0]not used,** [2]DI1, [3]DI2, [4]DI3, [5]DI4, [6]DI5
Group 40 Process PID set 1		
40.07	Process PID operation mode	**[0]Off**, [1]On, [2]On when drive running
40.08	Set 1 feedback 1 source	[8]AI1 percent, **[9]AI2 percent**
40.16	Set 1 setpoint 1 source	**[2]Internal setpoint**, [11]AI1 percent, [12]AI2 percent
40.24	Set 1 internal setpoint 0	-200000.00 … 200000.00, **0.00**
40.31	Set 1 deviation inversion	**[0]Not inverted (Ref - Fbk)**, [1]Inverted (Fbk - Ref)
40.32	Set 1 gain	0.01 … 100.00, **1.00**
40.33	Set 1 integration time	0.0 … 9999.0 s, **10.0 s**
Group 45 Energy efficiency		
45.11	Energy optimizer	**[0]Disable**, [1]Enable
Group 58 Embedded fieldbus		
58.01	Protocol enable	**[0]None**, [1]ModbusRTU, [2]BACnet MSTP, [5]N2, [7]GP1

Related documents

ACH180 manual list

Ecodesign information (EU 2019/1781)

3AXD50000955886 Rev B EN 2024-02-21
Original instructions.

3AXD50000955886B

Ratings

Type ACH180-04S-…	Input current		Output ratings									
	No choke	With choke	Max. current	Nominal use			Light-duty use			Heavy-duty use		
	I_1	I_1	I_{max}	I_n	P_n		I_{Ld}	P_{Ld}		I_{Hd}	P_{Hd}	
	A	A	A	A	kW	hp	A	kW	hp	A	kW	hp
1-phase U_n = 200 … 240 V												
02A4-1	5.0	3.3	3.2	2.4	0.37	0.5	2.4	0.37	0.5	1.8	0.25	0.33
03A7-1	6.9	4.8	4.3	3.7	0.55	0.75	3.5	0.55	0.75	2.4	0.37	0.5
04A8-1	9.0	6.2	6.7	4.8	0.75	1.0	4.6	0.75	1.0	3.5	0.55	0.75
06A9-1	12.6	9.2	8.1	6.9	1.1	1.5	6.6	1.1	1.5	4.5	0.75	1.0
07A8-1	17.3	12.0	11.9	7.8	1.5	2.0	7.5	1.5	2.0	6.6	1.1	1.5
09A8-1	21.8	17.0	13.5	9.8	2.2	3.0	9.3	2.2	3.0	7.5	1.5	2.0
12A2-1	23.9	21.1	17.6	12.2	3.0	3.0	11.6	3.0	3.0	9.3	2.2	3.0
3-phase U_n = 200 … 240 V												
02A4-2	3.4	2.4	3.2	2.4	0.37	0.5	2.3	0.37	0.5	1.8	0.25	0.33
03A7-2	4.5	3.7	4.3	3.7	0.55	0.75	3.5	0.55	0.75	2.3	0.37	0.5
04A8-2	5.7	4.8	6.7	4.8	0.75	1.0	4.6	0.75	1.0	3.2	0.55	0.75
06A9-2	7.1	6.9	8.3	6.9	1.1	1.5	6.6	1.1	1.5	4.6	0.75	1.0
07A8-2	8.9	7.8	11.9	7.8	1.5	2.0	7.4	1.5	2.0	6.6	1.1	1.5
09A8-2	12.9	9.8	13.3	9.8	2.2	2.0+	9.3	2.2	2.0+	7.4	1.5	2.0
15A6-2	19.1	15.6	19.3	15.6	3.0	4.0	14.6	3.0	4.0	9.3	2.2	3.0
17A5-2	21.2	17.5	26.3	17.5	4.0	5.0	16.7	4.0	5.0	14.6	3.0	4.0
25A0-2	27.2	25.0	30.1	25.0	5.5	7.5	24.2	5.5	7.5	16.7	4.0	5.0
033A-2	35.0	32.0	43.6	32.0	7.5	10.0	30.8	7.5	10.0	24.2	5.5	7.5
048A-2	48.0	48.0	55.4	48.0	11.0	15.0	46.2	11.0	15.0	30.8	7.5	10.0
055A-2	48.0	48.0	55.4	55.0	11.0	20.0	50.2	11.0	20.0	44.0	11.0	15.0
3-phase U_n = 380 … 415 V												
01A8-4	2.8	1.5	2.2	1.8	0.55	-	1.7	0.55	-	1.2	0.37	-
02A6-4	3.6	1.9	3.2	2.6	0.75	-	2.5	0.75	-	1.8	0.55	-
03A3-4	4.6	2.5	4.3	3.3	1.1	-	3.1	1.1	-	2.4	0.75	-
04A0-4	6.3	3.3	5.9	4.0	1.5	-	3.5	1.5	-	3.3	1.1	-
05A6-4	9.0	4.6	7.2	5.6	2.2	-	5.3	2.2	-	4.0	1.5	-
07A2-4	12.0	6.0	10.0	7.2	3.0	-	6.8	3.0	-	5.6	2.2	-
09A4-4	13.0	8.0	13.0	9.4	4.0	-	8.9	4.0	-	7.2	3.0	-
12A6-4	17.4	12.6	16.9	12.6	5.5	-	12.0	5.5	-	9.4	4.0	-
17A0-4	25.2	17.0	22.7	17.0	7.5	-	16.2	7.5	-	12.6	5.5	-
25A0-4	31.8	25.0	30.6	25.0	11.0	-	23.8	11.0	-	17.0	7.5	-
033A-4	40.9	32.0	45.0	32.0	15.0	-	30.5	15.0	-	25.0	11.0	-
038A-4	49.0	38.0	57.6	38.0	18.5	-	36.0	18.5	-	32.0	15.0	-
045A-4	55.7	45.0	68.4	45.0	22.0	-	42.0	22.0	-	38.0	18.5	-
050A-4	55.7	50.0	81.0	50.0	22.0	-	48.0	22.0	-	45.0	22.0	-
3-phase U_n = 440 … 480 V												
01A8-4	1.9	1.3	2.2	1.6	-	0.75	1.6	-	0.75	1.1	-	0.5
02A6-4	2.4	1.6	3.3	2.1	-	1.0	2.1	-	1.0	1.6	-	0.75
03A3-4	3.5	2.1	4.3	3.0	-	1.5	3.0	-	1.5	2.1	-	1.0
04A0-4	4.6	2.8	5.9	3.5	-	2.0	3.5	-	2.0	3.0	-	1.5
05A6-4	6.9	3.8	7.2	4.8	-	3.0	4.8	-	3.0	3.5	-	2.0
07A2-4	9.2	5.0	10.0	6.0	-	3.0	6.0	-	3.0	4.8	-	3.0
09A4-4	10.3	6.7	13.0	7.6	-	5.0	7.6	-	5.0	6.3	-	3.0
12A6-4	14.8	11.0	16.9	11.0	-	7.5	11.0	-	7.5	7.6	-	5.0
17A0-4	20.3	14.0	22.7	14.0	-	10.0	14.0	-	10.0	11.0	-	7.5
25A0-4	26.6	21.0	30.6	21.0	-	15.0	21.0	-	15.0	14.0	-	10.0
033A-4	33.9	27.0	45.0	27.0	-	20.0	27.0	-	20.0	21.0	-	15.0
038A-4	41.3	34.0	57.6	34.0	-	25.0	34.0	-	25.0	27.0	-	20.0
045A-4	46.9	40.0	68.4	40.0	-	30.0	40.0	-	30.0	34.0	-	25.0
050A-4	46.9	42.0	81.0	42.0	-	30.0	42.0	-	30.0	42.0	-	30.0

I_1 Input current for 230 V and 400 V with motor power P_N (kW), and for 480 V with motor power P_{Ld} (hp).
I_{max} Maximum output current. Available for 2 seconds every 10 minutes when the output frequency is less than 9 Hz.
I_n Nominal output current. Maximum continuous rms output current (no overload).
I_{Ld} Continuous rms output current. Allows 10% overload for 1 minute every 10 minutes.
I_{Hd} Continuous rms output current. Allows 50% overload for 1 minute every 10 minutes.
P_n Typical motor power in nominal use (no overload)
P_{Ld} Typical motor power in light-duty use (10% overload)
P_{Hd} Typical motor power heavy-duty use (50% overload)
The kilowatt ratings are applicable to most IEC 4-pole motors. The horsepower ratings are applicable to most NEMA 4-pole motors.

Fuses and typical power cable sizes

Type ACH180-04x-…	Fuses			Cable conductor sizes (Cu)		Frame size
	gG	gR	UL class T 1) 2) 3) 4)			
	Bussmann type	Bussmann type	Bussmann/ Edison type	mm^2	AWG	
1-phase U_n = 230 V (range 200 … 240 V)						
02A4-1	C10G10	FWP-32G14F	JJN-6	1.5	16	R0
03A7-1	C10G16	FWP-32G14F	JJN-10	1.5	16	R0
04A8-1	C10G16	FWP-40G14F	JJN-15	1.5	16	R0
06A9-1	C10G20	FWP-50G14F	JJS-70	3×1.5 + 1.5	16	R1
07A8-1	C10G25	FWP-50G14F	JJN-25	3×2.5 + 2.5	14	R1
09A8-1	C14G40	FWP-50G14F	JJN-35	3×2.5 + 2.5	14	R1
12A2-1	C14G40	FWP-63G22F	JJN-35	3×2.5 + 2.5	14	R2
3-phase U_n = 230 V (range 200 … 240 V)						
02A4-2	C10G6	FWP-25G14F	JJN-6	1.5	16	R0
03A7-2	C10G8	FWP-32G14F	JJN-10	1.5	16	R0
04A8-2	C10G16	FWP-32G14F	JJN-10	1.5	16	R0
06A9-2	C10G16	FWP-50G14F	JJN-15	3×1.5 + 1.5	16	R1
07A8-2	C10G20	FWP-50G14F	JJN-20	3×2.5 + 2.5	14	R1
09A8-2	C10G25	FWP-50G14F	JJN-20	3×2.5 + 2.5	14	R1
15A6-2	C10G32	FWP-50G14F	JJN-30	3×6 + 6	10	R2
17A5-2	C10G32	FWP-50G14F	JJN-35	3×6 + 6	10	R2
25A0-2	C22G50	FWP-80G22F	JJN-40	3×6 + 6	10	R3
033A-2	C22G63	FWP-100G22F	JJN-50	3×10 + 10	8	R3
048A-2	C22G100	FWP-150A	JJN-100	3×25 + 16	4	R4
055A-2	C22G100	FWP-150A	JJN-100	3×25 + 16	4	R4
3-phase U_n = 400 V (range 380 … 415 V) or 460 V (range 440 … 480 V)						
01A8-4	C10G4	FWP-20G14F	JJS-6	1.5	16	R0
02A6-4	C10G6	FWP-20G14F	JJS-6	1.5	16	R0
03A3-4	C10G10	FWP-20G14F	JJS-10	1.5	16	R0
04A0-4	C10G10	FWP-25G14F	JJS-10	3×1.5 + 1.5	16	R1
05A6-4	C10G16	FWP-25G14F	JJS-20	3×1.5 + 1.5	16	R1
07A2-4	C10G20	FWP-32G14F	JJS-20	3×2.5 + 2.5	14	R1
09A4-4	C10G25	FWP-32G14F	JJS-25	3×2.5 + 2.5	14	R1
12A6-4	C14G32	FWP-50G14F	JJS-30	3×2.5 + 2.5	14	R2
17A0-4	C14G40	FWP-50G14F	JJS-35	3×6 + 6	10	R2
25A0-4	C22G50	FWP-80G22F	JJS-40	3×6 + 6	10	R3
033A-4	C22G63	FWP-100G22F	JJS-60	3×10 + 10	8	R3
038A-4	C22G80	FWP-125A	JJS-70	3×10 + 10	8	R4
045A-4	C22G100	FWP-150A	JJS-70	3×16 + 16	6	R4
050A-4	C22G100	FWP-150A	JJS-70	3×25 + 16	4	R4

1) The recommended branch protection fuses must be used to maintain the IEC/EN/UL 61800-5-1 listing.
2) The drive is suitable for use on a circuit capable of delivering not more than 100000 symmetrical amperes (rms) at 480 V (480 V drives) or 240 V (240 V drives) maximum when protected by the fuses given in this table.
3) As an alternative to Class T fuses, you can use Class J or Class CF fuses of the same voltage and current rating for branch circuit protection of 3-phase drives.
4) 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.

Terminal data for the power cables

Frame size	L1, L2, L3, T1/U, T2/V, T3/W, R-, R+/UDC+, UDC-						PE			
	Min. wire size (solid/ stranded)		Max. wire size (solid/ stranded)		Tightening torque		Max. wire size (solid/ stranded)		Tightening torque	
	mm^2	AWG	mm^2	AWG	N·m	lbf·in	mm^2	AWG	N·m	lbf·in
R0	0.2/0.2	18	6/4	10	0.5…0.6	5	6/4	10	1.2	10.6
R1 … R2	0.2/0.2	18	6/6	10	0.5…0.6	5	6/4	10	1.2	10.6
R3	0.5/0.5	20	10/6	8/10	1.2…1.5	11…13	16/16	6	1.2	10.6
R4	0.5/0.5	20	25/16	4/6	2.5…3.7	22…32	16/16	6	1.2	10.6

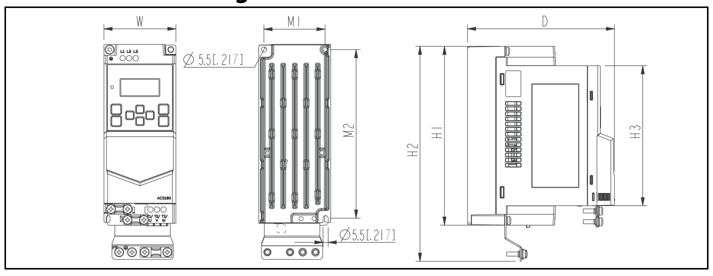
Notes:
- The minimum specified wire size does not necessarily have sufficient current carrying capacity at maximum load.
- The terminals do not accept a conductor that is one size larger than the maximum specified wire size.
- The maximum number of conductors per terminal is 1.

Free space requirements

Frame size	Above		Below		Sides		Front	
	mm	in	mm	in	mm	in	mm	in
R0	75	3	75	3	50	2	0	0
R1 … R4	75	3	75	3	0	0	0	0

Note: Frame size R0 requires 50mm free space on the sides. If the ambient temperature is <40°C, R0 frames can be installed side-by-side.

Dimensions and weights



Frame size	Dimensions														Weights	
	H1		H2		H3		W		D		M1		M2			
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
R0	174	6.85	209	8.23	136	5.35	70	2.76	143	5.63	60	2.36	164	6.46	0.92	2.03
R1	190	7.48	220	8.66	152	5.98	70	2.76	143	5.63	60	2.36	180	7.09	1.24	2.73
R2	202	7.95	230	9.06	165	6.48	120	4.72	143	5.63	106	4.17	191	7.52	1.92	4.23
R3	205	8.07	241	9.49	165	6.48	170	6.69	174	6.85	148	5.83	191	7.52	3.30	7.28
R4	205	8.07	240	9.45	165	6.48	260	10.24	179	7.03	234	9.21	191	7.52	5.30	11.69

Ambient conditions

Requirement	During operation (installed for stationary use)
Installation site altitude	0 … 2000 m (0 … 6562 ft) **Derating:** The output current must be derated 1% for each 100 m (330 ft) above 1000 m (3281 ft).
Surrounding air temperature	-10 … +60 °C (14 … 140 °F). No frost permitted. See derating in hardware manual (3AXD50000955862 [English]).
Relative humidity	<95% (IEC 60068-2-78) without condensation
Contamination levels	No conductive dust permitted.
Shock or free fall	Not permitted

Markings

The applicable markings are shown on the type label of the product.

CE UL RCM UKCA EIP BTL WEEE TÜV Nord

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 of 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

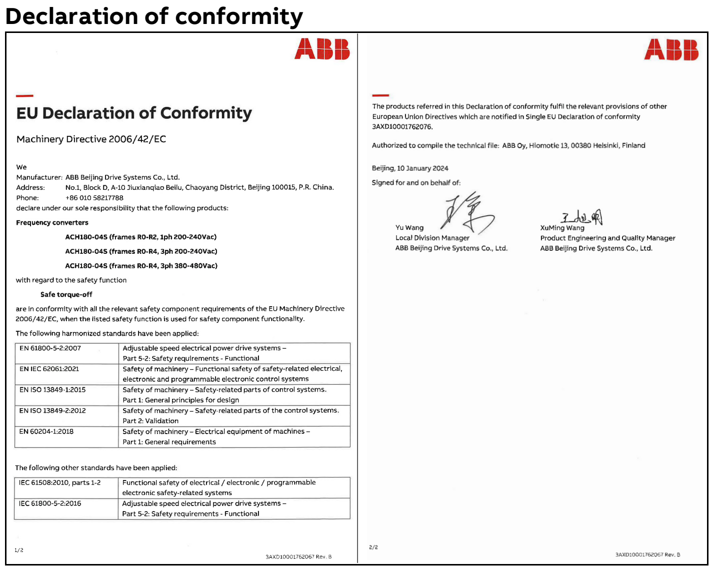
To ensure the safe operation of a safety function, a validation test is required. The test must be carried out by a competent person with adequate expertise and knowledge of the safety function. The test procedures and report must be documented and signed by this person. Validation instructions of the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

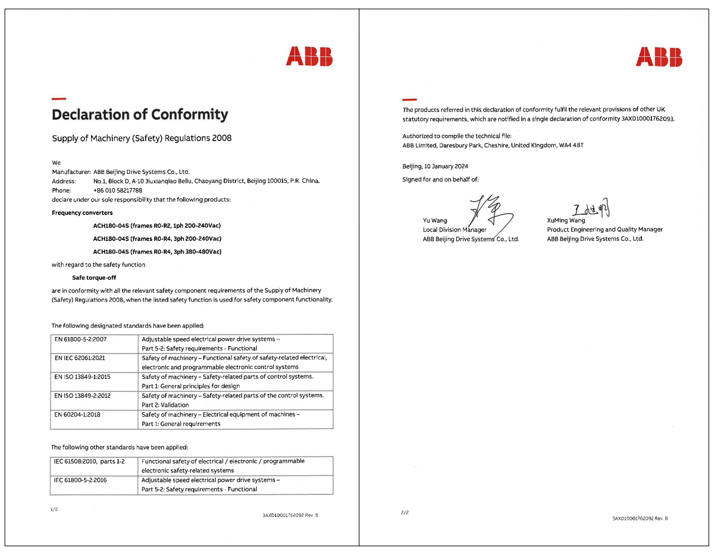
Technical data

- Minimum voltage at S1 and S2 to be interpreted as “1”: 13 V DC
- STO reaction time (shortest detectable break): 1 ms
- STO response time: 5 ms (typical), 10 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.

Declaration of conformity


EU Declaration of Conformity
Machinery Directive 2006/42/EC
The products referred in this Declaration of conformity fulfil the relevant provisions of other European Union Directives which are notified in Single EU Declaration of conformity 3AXD10001762076.
Authorized to compile the technical file: ABB Oy, Hiomotie 13, 00380 Helsinki, Finland


Declaration of Conformity
Supply of Machinery (Safety) Regulations 2008