

ABB DRIVES FOR WATER

ACQ80-04 drives

Quick installation and start-up guide



Safety instructions

Read the safety instructions in the *ACQ80-04 drives (0.75 to 22 kW) Hardware manual* (3AXD50000170661[EN]).

**WARNING!** Obey these safety instructions to prevent physical injury or death, or damage to the equipment. If you are not a qualified electrician, 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, etc.
- Disconnect all possible voltage sources. Lock and tag.
- When the drive or connected equipment is energized, do not do work on the drive, motor cable, motor, control cables or control circuits.
- After you disconnect the input AC and DC (PV) power, wait for five minutes to let the DC bus capacitors discharge. Measure and make sure that the,
  - voltage between the DC bus terminals (UDC+, UDC-) is 0 V.
  - DC voltage between the DC bus terminals (UDC+, UDC-) and ground (PE) is 0 V.
- Make sure that the equipment is not energized. Use a multimeter with an impedance of at least 1 Mohm. Make sure that the,
  - voltage between the drive input power terminals (L1, L2, L3) and the ground (PE) is 0 V.
  - phase to phase voltage between the drive input power terminals (L1, L2, L3) is 0 V.
  - voltage between the drive output terminals (T1/U, T2/V, T3/W) and the ground (PE) is 0 V.
  - phase to phase voltage between drive output terminals (T1/U, T2/V, T3/W) is 0 V AC.
- If you use a permanent magnet synchronous motor, do not do work on the drive when the motor rotates. A permanent magnet motor that rotates energizes the drive and the output power terminals.

WARNING! The installation, start-up and operation of this equipment requires detailed instructions. Refer to the detailed instructions in the *ACQ80 Hardware manual* (3AXD50000170661 [EN]) and *ACQ80 Firmware manual* (3AXD50000170654 [EN]). You can download these manuals from the ABB website.

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 cooling and hot air does not recirculate back to air inlet of the drive.
- There is sufficient space above and below the drive for cooling. 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.

2. Install the drive

You can install the drive with screws or to a DIN rail [Top Hat, W x H = 35 x 7.5 mm (1.4 x 0.3 in)].

Installation requirements:

- Make sure that there is a minimum of 75 mm (2.9 in) of free space at the top and bottom of the drive for cooling air.
- You can install several drives side by side. Side-mounted options require approximately 20 mm (0.8 in) of space on the right side of the drive.

WARNING! Do not install the drive upside down. Make sure that the cooling air exhaust (at the top) is always above the cooling air inlet (at the bottom).

To install the drive with screws

1. Make marks onto the surface for the mounting holes. Refer to [Dimensions and weights](#). The R2 and R3 drives come with a mounting template.

M2

M1

2. Make the holes for the mounting screws and install suitable plugs or anchors if required.

3. Start to tighten the screws into the mounting holes.

4. Install the drive onto the mounting screws.

5. Tighten the mounting screws.

To install the drive on a DIN rail

1. Move the locking part to the left.

2. Push and hold the locking button down.

3. Put the top tabs of the drive onto the top edge of the DIN installation rail.

4. Put the drive against the bottom edge of the DIN installation rail.

5. Release the locking button.

6. Move the locking part to the right.

7. Make sure that the drive is correctly installed.

8. To remove the drive, use a flat-head screwdriver to open the locking part.

3. Measure the insulation resistance

**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:**

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 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

See the drive hardware manual for the cable selection instructions.

**Note:**

**Input power cable:** IEC/EN 61800-5-1 requires two protective earth (ground) conductors.

**Motor cable:** ABB recommends to use symmetrical shielded cable (VFD cable) for the best EMC performance.

**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.

Connection diagram (shielded cables)

CAUTION! ABB recommends to use a lightning pole to avoid lightning strike to the drive. Make sure that the lightening pole ground is not common for PV cell, drive, and motor.

If you do wiring in conduits, see the drive hardware manual for more information.

AC grid or generator

AC MCB/ MCB

MOV

EMI filter

DC+ ACQ80-04 V drive

PE

Earth pit 1

Earth pit 1

Earth pit 1

Pump motor

PV input terminal

DC/ MCB/ Fuse

1

3

2

L1 L2 L3

U

W

DC-

1. Reverse polarity diodes.

2. EMI filter is optional but is mandatory for IEC/EN62920 standard compliance which is required in Europe.

3. Ground connection should be common for MOV, drive, and pump.

Note:

ACQ80 is intended to be used for speed control of 3ph AC pump motors and is powered from either AC Grid or DC photo-voltaic array. ABB recommends not to use it as an island grid forming inverter or to supply generic 1ph or 3ph loads, other than 3ph AC pump motors.

Connection procedure (shielded cables)

If you do wiring in conduits, see the drive hardware manual for more information.

WARNING! Obey the safety instructions in the *ACQ80 Hardware manual* (3AXD50000170661 [EN]). If you ignore them, injury or death, or damage to the equipment can occur.

WARNING! Make sure that the drive is compatible with the power supply 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 power supply systems, you may need to disconnect the EMC filter or the ground-to-phase varistor. For more information, see the drive hardware manual.

1. Open the front cover. To open the front cover, loosen the locking screw and lift the front cover up.

2. Strip the motor cable.

3. Ground the motor cable shield under the grounding clamp.

4. Twist the motor cable shield into a bundle, mark it accordingly and connect it to the grounding terminal.

5. Connect the phase conductors of the motor cable to the T1/U, T2/V and T3/W motor terminals. Tighten the terminals to 0.8 N·m (7 lbf·in) torque.

6. Strip the input AC power cable.

7. Connect the DC cables as per the connection diagram.

8. If the input AC power cable has a shield, twist it into a bundle, mark it and connect it to the grounding terminal.

9. Connect the PE conductor of the input AC power cable to the grounding terminal. If it is necessary, use a second PE conductor.

10. Connect the phase conductors of the input AC power cable to the L1, L2 and L3 input terminals. Tighten the terminals to 0.8 N·m (7 lbf·in) torque.

11. Mechanically attach the cables on the outside of the drive.

Note!

If you power up the drive before you install the I/O or fieldbus module, the drive gives a warning.

6. Install the communication module

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

1. Open the front cover.

2. Align the communication module contacts with the contacts on the drive.

3. Carefully push the communication module into position.

4. Push the locking tab in.

5. Use a Torx TX10 screwdriver and tighten the locking screw (torque 0.8 N·m) to fully attach and electrically ground the communication module.

7. Connect the control cables

Connection procedure

Do the connections according to the default control connections of the application macro that you select. For the connections of the factory default macro (ABB standard macro), refer to [Default I/O connections \(ABB standard macro\)](#). For the other macros, refer to the *ACQ80 Firmware manual* (3AXD50000170654 [EN]).

**Note:**

- This is an IEC compliant connection procedure.

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

1. Strip a part of the outer shield of the control cable for grounding.

2. Use the metal cable tie provided to ground the outer shield to the grounding tab.

3. Strip the control cable conductors.

4. Connect the conductors to the correct control terminals. Tighten the terminals to 0.5 N·m (4 lbf·in) torque.

5. Connect the shields of the twisted pairs and grounding wires to the SCR terminal. Tighten the terminals to 0.5 N·m (4 lbf·in) torque.

6. Mechanically attach the control cables on the outside of the drive.

7. Close the front cover and tighten the locking screw.

Default I/O connections (ABB standard macro)

Terminal

Description

Base unit

Reference voltage and analog I/O

SCR

AI1

AGND

+10 V

AI2

AGND

AO1

AO2

AGND

Signal cable shield (screen)

Not configured

Analog input circuit common

Reference voltage 10 V DC

Not configured

Analog input circuit common

Output frequency: 0...20 mA

Motor current

Analog output circuit common

Aux. voltage output and programmable digital inputs

+24 V

DGND

DCOM

DI1

DI2

DI3

DI4

DI5

DI6

Aux. voltage output +24 V DC, max. 250 mA

Aux. voltage output common

Digital input common for all

Stop (0)/Start (1)

Not configured

Not configured

Not configured

Not configured

Not configured

Relay outputs

RO1C

RO1A

RO1B

RO2C

RO2A

RO2B

RO3C

RO3B

RO3A

Ready run

250 V AC/30 V DC

2 A

Running

250 V AC/30 V DC

2 A

Fault (-1)

250 V AC/30 V DC

2 A

EIA-485 Modbus RTU

B+

A-

DGND

TERM&BIAS

Embedded Modbus RTU (EIA-485)

Serial data link termination switch

Safe torque off

SGND

IN1

IN2

OUT1

Safe torque off. Factory connection. Both circuits must be closed for the drive to start.

+24V

DGND

DCOM

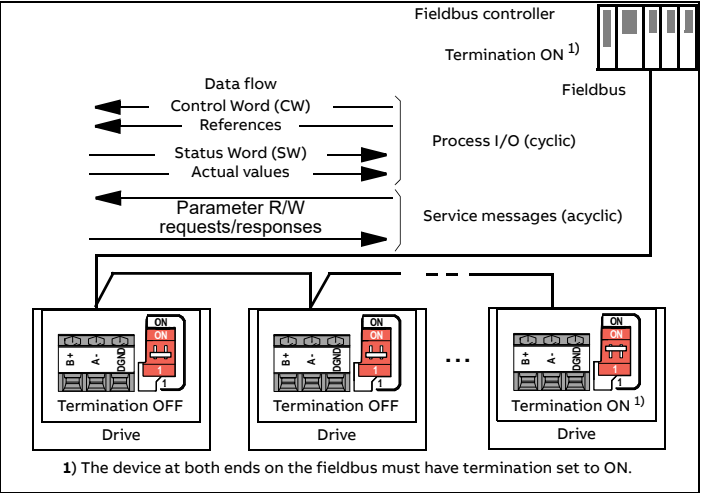
Auxiliary voltage output. The alternative terminals have the same supply as the base unit.

Note:

× refers to terminals in the base unit. Other terminals are in the RIIO-01 I/O extension module (installed in the standard drive variant as default).

Connecting EIA-485 Modbus RTU terminal to the drive

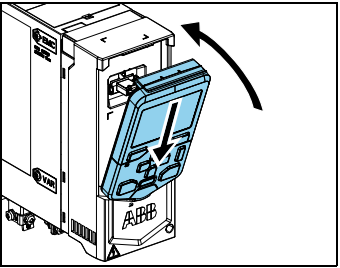
Connect the fieldbus to the EIA-485 Modbus RTU terminal on the RIIO-01 module which is attached to the control unit of the drive. The connection diagram is shown below.



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 *ACQ80 Firmware manual* (3AXD50000170654 [EN]).

**WARNING!** Before you start up the drive, make sure that the installation is complete. Make sure that the cover of the drive and the cable box, if included, are in place. Make sure 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.

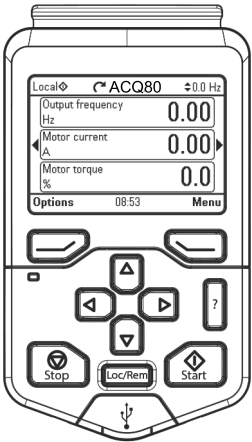
For information on the user interface, refer to the *ACS-AP-x Assistant control panel user's manual* (3AUA0000085685 [EN]).

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).

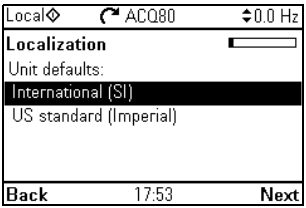


3. Select *Start set-up* and push the right softkey (Next).



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.



To set up fieldbus communications for a fieldbus adapter, refer to the applicable fieldbus adapter manual and to the *ACQ80 Firmware manual* (3AXD50000170654 [EN]).

6. Navigate to parameters and configure below parameters for a basic start up.

Parameter	Value
99.03 Motor type	Asynchronous /Permanent magnet motor
99.04 Motor control mode	Scalar for Asynchronous motor and Vector for Permanent magnet motor
Motor data parameters 99.06... 99.10	As per motor name plate
79.10 Operating mode	Manual IN1 Start; stop
79.11 Manual input source 1	Start signal source - DI1
79.41 Start DC voltage	ABB recommends to keep this value higher than the value in parameter 79.42.
79.42 PV cell min voltage/79.43 PV cell max voltage	As per PV cell rating
79.51 Pump minimum speed	ABB recommends to keep this value 20% of motor nominal rpm or more.
79.52 Pump maximum speed	Pump maximum speed in RPM

For information on program features, refer to the *ACQ80 Firmware manual* (3AXD50000170654 [EN]).

Ecodesign  
(EU 2019/1781) and SI 2021 No. 745)

ACQ80 manual list



3AXD50000701247 Rev B EN 2022-02-16  
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3AXD50000701247B

Warnings and faults generated by the drive

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. This can be caused by missing AC supply phase or other reasons.
	3181	Cross connecion. 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.
AFF6	-	Identification run. The motor ID run occurs at the next start.
D506	-	Pump cleaning not possible: Pump cleaning not started as the drive is not in remote control.
D5B0	-	Pump min speed: MPPT logic is unable to increase motor speed above 79.51 Pump minimum speed. This is caused by less solar power. As a result, drive stops and resets after default reset time set in the parameter 79.61 Fault reset time.
-	D4B0	Running dry: Dry run protection is activated.
-	D4B1	PV max volt: The DC bus voltage in the inverter is above the voltage set in 79.43 PV cell max voltage.
D5B1	-	Start delay active: This alarm occurs if more than three start occurs within one minute. Warning resets automatically after five minutes and if start command is present, drive starts automatically.

For the complete list of warnings and faults, refer to the *ACQ80-04 standard control program firmware manual* ([3AXD50000170654EN]).

Ratings

For detailed technical information, refer to the *ACQ80-04 Hardware manual* (3AXD50000170661 [EN]).

■ IEC ratings,  $U_N = 400\text{ V}$

IEC type ACQ80-04-...	Input	Output ratings				Frame size	
		Max. current	Nominal use				
		$I_N$	$I_{max}$	$I_N$	$P_N$		$P_N$
		A	A	A	kW		hp
0kW75-4	2.6	3.2	2.6	0.75	1.0	R0	
01kW1-4	3.3	4.7	3.3	1.1	1.5	R0	
01kW5-4	4.0	5.9	4.0	1.5	2.0	R0	
02kW2-4	5.6	7.2	5.6	2.2	3.0	R0	
03kW0-4	7.2	10.1	7.2	3.0	4.0	R0	
04kW0-4	9.4	13.0	9.4	4.0	5.0	R0	
05kW5-4	12.6	16.9	12.6	5.5	7.5	R1	
07kW5-4	17.0	22.7	17.0	7.5	10.0	R2	
011kW-4	25.0	30.6	25.0	11.0	15.0	R2	
015kW-4	33.0	45.0	32.0	15.0	20.0	R3	
18kW5-4	39.0	57.6	38.0	18.5	25.0	R3	
022kW-4	50.0	81.0	50.0	22.0	30.0	R3	

■ Fuses

For more information on fuses, circuit breakers and manual motor protectors, refer to the *ACQ80-04 Hardware manual* (3AXD50000170661 [EN]).

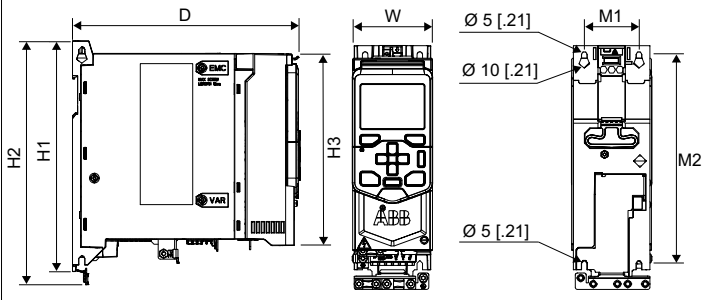
Ambient conditions

Requirement	During operation (installed for stationary use)
Installation altitude	400 V units: 0...4000 m (0...13123 ft) above sea level (with derating above 1000 m [3281 ft]) <sup>1)</sup>
Air temperature	-10...+60 °C (14...140 °F). Above 50 °C (122 °F) derating is required. No frost allowed.
Relative humidity	5... 95% without condensation
Contamination levels (IEC 60721-3-x)	No conductive dust allowed IEC 60721-3-3: 2002 Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use of weather protected locations
Shock (IEC 60068-2-27, ISTA 1A)	Not allowed
Free fall	Not allowed

1) Altitude derating: Up to 4000 m (13123 ft) is possible for 400 V units, if the maximum switching voltage for the integrated Relay Output 1 is 30 V at 4000 m (13123 ft) (e.g. do not connect 250 V to Relay Output 1). Up to 250 V is permitted up to 2000 m (6562 ft).

For a 3-phase 400 V drive at 4000 m (13123 ft) altitude, only the following power systems are permitted: TN-S, TN-c, TN-CS, TT (not corner grounded).

Dimensions and weights



Frame size	Dimensions and weights													
	H1		H2		H3		W		D		M1		M2	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
R0	205	8.1	223	8.8	176	6.9	73	2.8	207	8.2	50	2.0	191	7.5
R1	205	8.1	223	8.8	176	6.9	97	3.8	207	8.2	75	2.9	191	7.5
R2	205	8.1	220	8.7	176	6.9	172	6.8	207	8.2	148	5.8	191	7.5
R3	205	8.1	240	9.5	176	6.9	260	10.2	212	8.4	238	9.4	191	7.5

Free space requirements


Frame size	Free space required					
	Above		Below		On the sides	
	mm	in	mm	in	mm	in
R0...R3	75	2.9	75	2.9	0	0

Certifications

The applicable certifications are shown on the product's type label.



Declaration of conformity



### EU Declaration of Conformity

Machinery Directive 2006/42/EC

We  
Manufacturer: ABB INDIA LIMITED,  
Address: Plot No 5 & 6,2nd Phase, Peenya Industrial Area, Bangalore, 560058, India.  
Phone: +91 80 22949359

Declare under our sole responsibility that the following product:

Frequency converter  
**ACQ80-04** (frames R0 – R3)

with regard to the safety function  
**Safe torque-off**


Is in conformity with all the relevant safety component requirements of the EU Machinery Directive 2006/42/EC, when the listed safety function is used for safety component functionality.

The following harmonized standards have been applied:

EN 61800-5-2:2007	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional
EN 62061:2005 + AC:2010 + A1:2013 + A2:2015	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
EN ISO 13849-1:2015	Safety of machinery – Safety-related parts of control systems. Part 1: General principles for design.
EN ISO 13849-2:2012	Safety of machinery – Safety-related parts of the control systems. Part 2: Validation
EN 60204-1:2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements

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R05 template code: 3AF010105, Rev. C



The following other standard have been applied:

IEC 61508:2010, parts 1-2	Functional safety of electrical / electronic / programmable electronic safety-related systems
IEC 61800-5-2:2016	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional

The product referred in this declaration of conformity fulfils the relevant provisions of other European Union directives which are notified in a single EU declaration of conformity 3AXD10000715392.

Person authorized to compile the technical file:  
Name and address: Jussi Vesti, Hiomotie 13, 00380 Helsinki, Finland.

Bangalore, 15 Dec 2021  
Signed for and on behalf of:

A R Madhusudan  
Vice President – Drive Products, ABB India

Laxmikantha Shenoy  
PE Manager, ABB India

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3AXD50000715412 Rev. C  
R05 template code: 3AF010105, Rev. C

Related documents

Document	Code (English)
ACQ80-04 (0.75 to 160 kW, 1.0 to 215 hp) hardware manual	<a href="#">3AXD50000170661</a>
ACQ80-04 standard control program firmware manual	<a href="#">3AXD50000170654</a>
FECA-01 EtherCAT adapter module user's manual	<a href="#">3AUA0000068940</a>
FCAN-01 CANopen Adapter Module User's Manual	<a href="#">3AFE68615500</a>
FPBA-01 PROFIBUS DP adapter module user's manual	<a href="#">3AFE68573271</a>
FEIP-21 EtherNet/IP fieldbus adapter module User's manual	<a href="#">3AXD50000158621</a>
FMBT-21 Modbus/TCP Adapter Module User's Manual	<a href="#">3AXD50000158607</a>
FSCA-01 RS-485 adapter module user's manual	<a href="#">3AUA0000109533</a>