ABB MICRO DRIVES

ACS150 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 are ready to install it. After unpacking, protect the drive from dust, debris and moisture. Make sure that these items are included:

- clamping plates, clamps and screws
- mounting template, integrated into the package
- quick installation and start-up guide.

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. The manufacturing date is on the type designation label. Refer to *Guide for capacitor reforming* (3AFE68735190 [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:** In IEC installations, use copper or aluminum cables (if permitted). In UL installations, use only copper cables.
  - **Current rating:** max. load current.
  - **Voltage rating:** min. 600 V AC.
  - **Temperature rating:** In IEC installations, select a cable rated for at least 70 °C (158 °F) maximum permissible temperature of conductor in continuous use. In UL installations, 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. For the minimum free space requirements, refer to *Free space requirements*.
- The ambient conditions meet the requirements. 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 installation surface, floor and materials near 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.

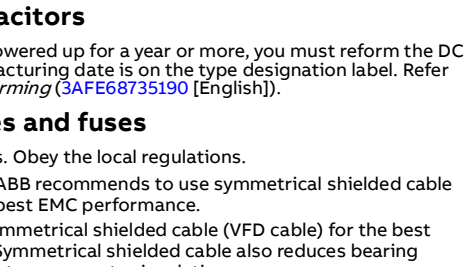
5. Install the drive

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]).

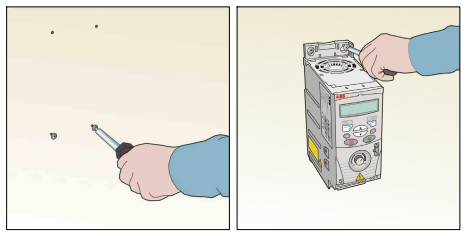
Do not install the drive upside down. Make sure that the cooling air exhaust is above the cooling air inlet.

To install the drive with screws

1. Cut out the mounting template from the package and use it to mark the locations for the mounting holes.
2. Make the holes for the mounting screws and install suitable plugs or anchors.

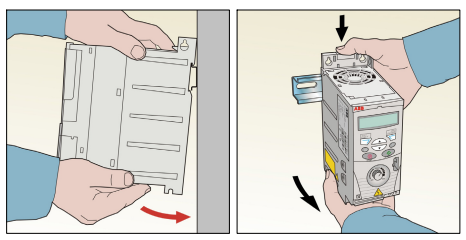


3. Install the mounting screws. Leave a gap between the screw head and mounting surface.
4. Place the drive onto the mounting screws.
5. Tighten the mounting screws.



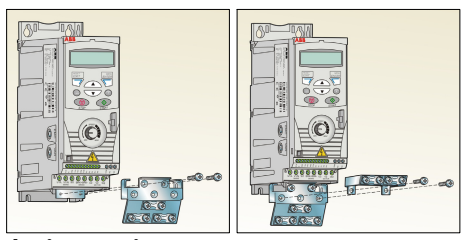
To install the drive to a DIN rail

1. Put the top of the drive onto the DIN installation rail at an angle as shown in the figure.
2. Put the drive against the wall.
3. Make sure that the drive is correctly installed.
4. To remove the drive, press the release lever on top of the drive.



6. Attach the clamping plates

1. Attach the clamping plate to the plate at the bottom of the drive with the provided screws.
2. Attach the I/O clamping plate to the clamping plate with the provided screws.



7. Measure the insulation resistance

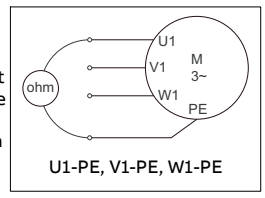
Measuring the insulation is typically not required in North America.

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

Input power cable: Measure the insulation of the input power cable before you connect it to the drive. 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 U2, V2 and W2.
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.



U1-PE, V1-PE, W1-PE

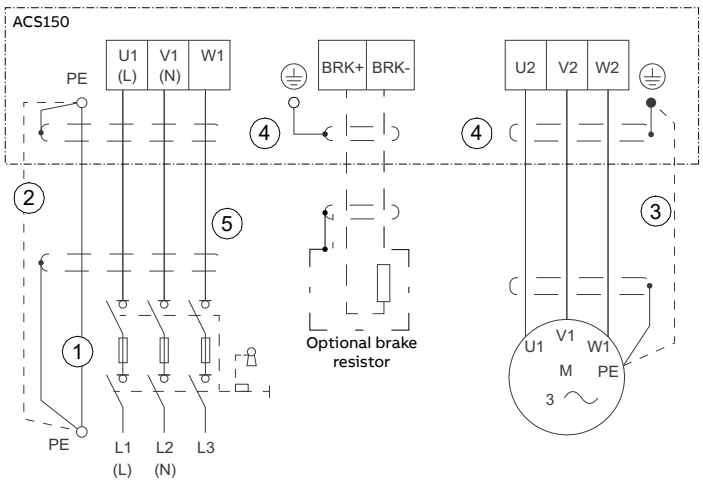
8. Make sure that the drive is compatible with the grounding system

You can connect all drive types to a symmetrically grounded TN-S system (center-grounded wye).

Before you connect the drive to a corner-grounded delta system or IT system (ungrounded or high-resistance grounded), remove the metal EMC filter grounding screw. If the drive has a plastic EMC screw (drives with type code ACS150-03U-...), it is not necessary to remove the screw.

9. Connect the power cables

Connection diagram (shielded cables)

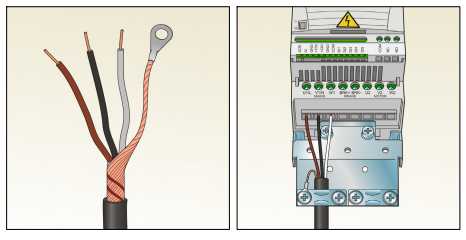


1. Two protective earth (ground) conductors. Drive safety standard IEC/EN/UL 61800-5-1 requires two PE conductors, if the cross-sectional area of the PE conductor is less than 10 mm^2 Cu or 16 mm^2 Al. For example, you can use the cable shield in addition to the fourth conductor.
2. Use a separate grounding 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.
3. Use a separate grounding cable for the motor side, if the conductivity of the shield is not sufficient, or if there is no symmetrically constructed PE conductor in the cable.
4. 360-degree 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.
5. 1-phase drives: Connect phase to U1 and neutral to V1. Keep W1 disconnected.

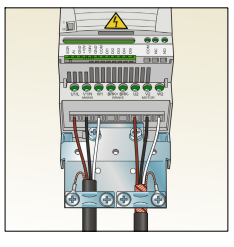
Connection procedure (shielded cables)

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

1. Strip the input power cable. Ground the cable shield (if any) under the grounding clamp. Twist the cable shield into a bundle, mark it accordingly and connect it to the grounding terminal. Connect other grounding conductors (PE) to the grounding terminal. Connect the phase conductors to the U1, V1 and W1 terminals.



2. Strip the motor cable. Ground the 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 to the U2, V2 and W2 terminals.
3. If you use a brake resistor, connect the brake resistor cable to terminals BRK+ and BRK- . Use a shielded cable and ground the shield under the grounding clamp.
4. Make sure that the BRK+ and BRK- terminal screws are tightened. Do this step also if you do not connect cables to the terminals.
5. Mechanically attach the cables on the outside of the drive.

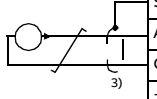


10. Connect the control cables

Do the connections according to the default control connections of the application macro that you select.

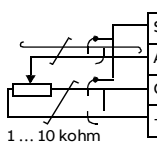
Default I/O connections (ABB standard macro)

The diagram shows the I/O connections when parameter *9902* is set to 1 (ABB STANDARD).



I/O connection [4]	
SCR	Signal cable shield (screen)
AI	Frequency reference: 0 ... 20 mA
GND	Analog input circuit common
+10V	Reference voltage: +10 V DC, max. 10 mA
+24V	Auxiliary voltage output: +24 V DC, max. 200 mA
GND	Auxiliary voltage output common
COM	Digital input common
DI1	Stop (0) / Start (1)
DI2	Forward (0) / Reverse (1)
DI3	Constant speed selection [1]
DI4	Constant speed selection [1]
DI5	Acceleration and deceleration selection [2]
Relay connection [5]	
COM	Relay output No fault [Fault (-1)]
NC	
NO	

Alternative connection for AI(1):



SCR	If you use a voltage signal instead of current, switch the IU selector to U (0 ... 10 V voltage signal), and use this connection instead the one shown above.
AI	
GND	
+10V	

1) See parameter group 12 CONSTANT SPEEDS:

DI3	DI4	Operation (parameter)
0	0	Set speed through integrated potentiometer
1	0	Speed 1 (*1202*)
0	1	Speed 2 (*1203*)
1	1	Speed 3 (*1204*)

2) 0 = ramp times according to parameters *2202* and *2203*. 1 = ramp times according to parameters *2205* and *2206*.

3) 360 degree grounding under a clamp.

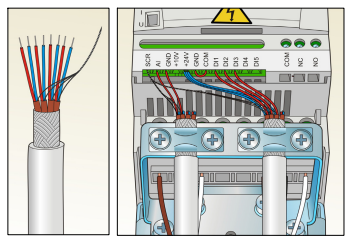
4) Tightening torque: 0.22 N·m (2 lbf·in)

5) Tightening torque: 0.5 N·m (4.4 lbf·in)

Connection procedure

To prevent inductive coupling, keep the signal wire pairs twisted all the way up to the terminals.

1. Strip the outer insulation of the cable and ground the bare shield 360 degrees under the clamp.
2. Connect the conductors to the correct control terminals.
3. For double-shielded cables, twist also the grounding conductors of each pair in the cable together and connect the bundle to terminal SCR (1).
4. Mechanically attach the control cables on the outside of the drive.



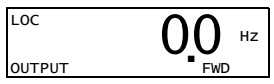
11. Start up the drive

WARNING! Make sure that it is safe to start the motor. Disconnect the motor from other machinery, if there is a risk of damage or injury.

Before you start up the drive, make sure that the installation is completed and that you have the motor nameplate data available.

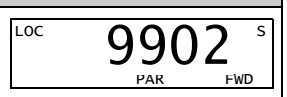
Power-up

☐ Apply input power. The panel powers up into the Output mode.



Entry of start-up data

☐ Select the application macro (parameter *9902*) according to how the control cables are connected. The default value 1 (ABB STANDARD) is suitable in most cases.

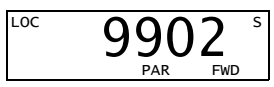


The general parameter setting procedure in the Short parameter mode is described below.

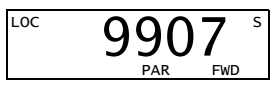
1. To go to the Main menu, press ⌐ if the bottom line shows OUTPUT. Otherwise press ⌐ repeatedly until you see MENU at the bottom.

2. Press keys ▲ / ▼ until you see "PAr S" on the display.

3. Press ⌐. The display shows a parameter of the Short parameter mode.



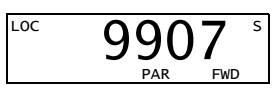
4. Find the appropriate parameter with keys ▲ / ▼.



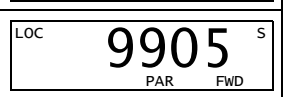
5. Press and hold ⌐ for approximately two seconds until the parameter value is shown with SET under the value.

6. Change the value with keys ▲ / ▼. The value changes faster while you keep the key pressed down.

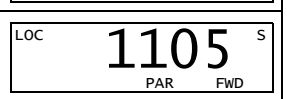
7. Save the parameter value by pressing ⌐.



☐ Enter the motor data from the motor nameplate.
- motor nominal voltage (*9905*)
- motor nominal current (*9906*)
- motor nominal frequency (*9907*).

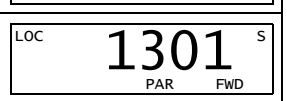


☐ Set the maximum value for external reference REF1 (*1105*).



☐ Set constant speeds 1, 2 and 3 (*1202, 1203, 1204*).

☐ Set the minimum value (%) corresponding to the minimum signal for AI(1) (*1301*). Typical settings:
0% for 0 ... 20 mA (or 0 ... 10 V) signal.
20% for 4 ... 20 mA (or 2 ... 10 V) signal.



☐ Set the maximum limit for the drive output frequency (*2008*). This is equal to power line frequency, typically (50 or 60 Hz).

☐ Select the motor stop function (*2102*).
1 = Stop by coasting.
2 = Stop along a ramp defined by parameters.

LOC 2102 S
PAR FWD

Direction of motor rotation

☐ Check the direction of the motor rotation:
1. Turn the potentiometer fully counterclockwise.
2. If the drive is in remote control (REM shown on the display), press LOC/REM to switch to local control.
3. Press ◇ to start the motor.
4. Turn the potentiometer slightly clockwise until the motor rotates.
5. Make sure that the direction of the motor is the same as shown on the display (FWD means forward and REV reverse).
6. Press ▽ to stop the motor.

LOC 1202 S
PAR FWD


forward


reverse

If necessary, change the direction of the motor rotation as follows:
1. De-energize the installation:
   - Disconnect the input power and all dangerous external voltages from the drive. Wait 5 minutes for the intermediate circuit capacitors to discharge.
   - Make sure that reconnection is not possible. Lock out and tag out.
   - Use a voltage tester to measure that the installation is de-energized. Before and after measuring, verify the operation of the voltage tester on a known voltage source.
   - Make sure that the voltage between each input terminal (U1, V1, W1) and ground (PE) is zero.
   - Make sure that the voltage between each output terminal (U2, V2, W2) and ground (PE) is zero.
   - Make sure that the voltage between each DC terminal (BRK+, BRK-) and ground (PE) is zero.
   - Install temporary grounding as required by the local regulations.
2. Interchange two motor cable phase conductors at the drive output terminals or at the motor connection box.
3. Power on the drive and check the direction of the motor rotation again as described above.

Acceleration/deceleration times

☐ Set the acceleration time 1 (*2202*) and deceleration time 1 (*2203*).

LOC 2202 S
PAR FWD

Final check

☐ The start-up is now completed. If you want to save your setting as a user macro, set parameter *9902* to value -1 (USER S1 SAVE).

LOC 9902 S
PAR FWD

☐ Make sure that there are no faults or alarms shown on the display.

Fault codes

Fault	Description
F0001	OVERCURRENT - The output current is higher than the trip limit.
F0002	DC OVERVOLT - The intermediate circuit DC voltage is too high.
F0003	DEV OVERTEMP - Drive IGBT temperature is too high.
F0004	SHORT CIRC - There is a short-circuit in the motor cable(s) or motor.
F0006	DC UNDERVOLT - The intermediate circuit DC voltage is too low.
F0009	MOT OVERTEMP - The motor temperature is too high or the start-up data is incorrect.
F0016	EARTH FAULT - There is an earth (ground) fault in the motor or motor cable.
F0022	INPUT PHASE LOSS - The intermediate circuit DC voltage oscillates because of a missing input power line phase or a blown fuse.

Ratings

ACS150	Input		Input with choke		Output					Frame size
	I_{1N}	I_{1N} (480 V)	I_{1N}	I_{1N} (480 V)	I_{2N}	$I_{2,1/10}$	I_{2max}	P_N		
x = E/U	A	A	A	A	A	A	A	kW	hp	
1-phase U_N = 230 V										
01x-02A4-2	6.1	-	4.5	-	2.4	3.6	4.2	0.37	0.5	R0
01x-04A7-2	11	-	8.1	-	4.7	7.1	8.2	0.75	1	R1
01x-06A7-2	16	-	11	-	6.7	10.1	11.7	1.1	1.5	R1
01x-07A5-2	17	-	12	-	7.5	11.3	13.1	1.5	2	R2
01x-09A8-2	21	-	15	-	9.8	14.7	17.2	2.2	3	R2
3-phase U_N = 230 V										
03x-02A4-2	4.3	-	2.2	-	2.4	3.6	4.2	0.37	0.5	R0
03x-03A5-2	6.1	-	3.5	-	3.5	5.3	6.1	0.55	0.75	R0
03x-04A7-2	7.6	-	4.2	-	4.7	7.1	8.2	0.75	1	R1
03x-06A7-2	12	-	6.1	-	6.7	10.1	11.7	1.1	1.5	R1
03x-07A5-2	12	-	6.9	-	7.5	11.3	13.1	1.5	2	R1
03x-09A8-2	14	-	9.2	-	9.8	14.7	17.2	2.2	3	R2
3-phase U_N = 400/480 V										
03x-01A2-4	2.2	1.8	1.1	0.9	1.2	1.8	2.1	0.37	0.5	R0
03x-01A9-4	3.6	3.0	1.8	1.5	1.9	2.9	3.3	0.55	0.75	R0
03x-02A4-4	4.1	3.4	2.3	1.9	2.4	3.6	4.2	0.75	1	R1
03x-03A3-4	6.0	5.0	3.1	2.6	3.3	5.0	5.8	1.1	1.5	R1
03x-04A1-4	6.9	5.8	3.5	2.9	4.1	6.2	7.2	1.5	2	R1
03x-05A6-4	9.6	8.0	4.8	4.0	5.6	8.4	9.8	2.2	3	R1
03x-07A3-4	12	9.7	6.1	5.1	7.3	11.0	12.8	3	3	R1
03x-08A8-4	14	11	7.7	6.4	8.8	13.2	15.4	4	5	R1

I_{1N} continuous rms input current (for dimensioning cables and fuses)
I_{1N} (480 V) continuous rms input current (for dimensioning cables and fuses) for drives with 480 V input voltage
I_{2N} continuous rms current. 50% overload is permitted for one minute every ten minutes.
$I_{2,1/10}$ maximum (50% overload) current permitted for one minute every ten minutes
I_{2max} maximum output current. Available for two seconds at start.
P_N typical motor power (nominal use). The kilowatt ratings apply to most IEC 4-pole motors. The horsepower ratings apply to most NEMA 4-pole motors.

Fuses and typical power cable sizes

ACS150...	Fuses		Size of conductor (Cu)							
	gG	UL Class T or CC (600 V) 1) 2)	Input (U1, V1, W1)		Motor (U2, V2, W2)		PE		Brake (BRK+, BRK-)	
x = E/U	A	A	mm^2	AWG	mm^2	AWG	mm^2	AWG	mm^2	AWG
1-phase U_N = 230 V										
01x-02A4-2	10	10	2.5	14	0.75	18	2.5	14	2.5	14
01x-04A7-2	16	20	2.5	14	0.75	18	2.5	14	2.5	14
01x-06A7-2	16/20 3)	25	2.5	10	1.5	14	2.5	10	2.5	12
01x-07A5-2	20/25 3)	30	2.5	10	1.5	14	2.5	10	2.5	12
01x-09A8-2	25/35 3)	35	6	10	2.5	12	6	10	6	12
3-phase U_N = 230 V										
03x-02A4-2	10	10	2.5	14	0.75	18	2.5	14	2.5	14
03x-03A5-2	10	10	2.5	14	0.75	18	2.5	14	2.5	14
03x-04A7-2	10	15	2.5	14	0.75	18	2.5	14	2.5	14
03x-06A7-2	16	15	2.5	12	1.5	14	2.5	12	2.5	12
03x-07A5-2	16	15	2.5	12	1.5	14	2.5	12	2.5	12
03x-09A8-2	16	20	2.5	12	2.5	12	2.5	12	2.5	12
3-phase U_N = 400/480 V										
03x-01A2-4	10	10	2.5	14	0.75	18	2.5	14	2.5	14
03x-01A9-4	10	10	2.5	14	0.75	18	2.5	14	2.5	14
03x-02A4-4	10	10	2.5	14	0.75	18	2.5	14	2.5	14
03x-03A3-4	10	10	2.5	12	0.75	18	2.5	12	2.5	12
03x-04A1-4	16	15	2.5	12	0.75	18	2.5	12	2.5	12
03x-05A6-4	16	15	2.5	12	1.5	14	2.5	12	2.5	12
03x-07A3-4	16	20	2.5	12	1.5	14	2.5	12	2.5	12
03x-08A8-4	20	25	2.5	12	2.5	12	2.5	12	2.5	12

1) Use the specified fuses 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 maximum when protected by the fuses given in this table.
3) For 50% overload capacity, use the larger fuse alternative.

Terminal data for the power cables

Frame size	U1, V1, W1, U2, V2, W2, BRK+, BRK-						PE			
	Min. wire size (solid/stranded)		Max. wire size (solid/stranded)		Tightening torque		Max. wire size (solid or stranded)		Tightening torque	
	mm^2	AWG	mm^2	AWG	N·m	lbf·in	mm^2	AWG	N·m	lbf·in
R0…R2	0.25/0.2	24	6.0/4.0	10	0.8	7	25	3	1.2	11

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.

Ambient conditions

Requirement	During operation (installed for stationary use)
Installation altitude	0 … 2000 m (0 … 6562 ft) above sea level. The rated output current must be derated by 1% for each 100 m (328 ft) above 1000 m (3281 ft).
Surrounding air temperature	-10 … +50 °C (14 … 122 °F). No frost permitted. The rated output current must be derated by 1% for each 1 °C (1.8 °F) above 40 °C (104 °F).
Relative humidity	0 … 95%. No condensation permitted. Maximum permitted relative humidity is 60% in the presence of corrosive gases.
Contamination levels	No conductive dust permitted
Shock (IEC 60068-2-27, ISTA 1A)	Not permitted
Free fall	Not permitted

Dimensions and weights

Frame size	IP20 / UL open type											
	H1		H2		H3		W		D		Weight	
	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
R0	169	6.65	202	7.95	239	9.41	70	2.76	142	5.59	1.1	2.4
R1	169	6.65	202	7.95	239	9.41	70	2.76	142	5.59	1.3/1.2 1)	2.9/2.6 1)
R2	169	6.65	202	7.95	239	9.41	105	4.13	142	5.59	1.5	3.3

1) 230 V drives / 400 V drives

H1 height without fastenings or clamping plate
H2 height with fastening and without clamping plate
H3 height with fastenings and clamping plate
W width
D depth

Free space requirements

Frame size	Above		Below		Sides	
	mm	in	mm	in	mm	in
All	75	3	75	3	0	0

Markings

The applicable markings are shown on the type designation label.

CE UL RCM EAC WEEE EIP UKCA

Related documents

ACS150 user's manual

ACS150 manual list

Ecodesign information (EU 2019/1781)

3AXD50000625970 Rev C EN 2021-12-01
Original instructions.

3AXD50000625970C