ABB DRIVES FOR WATER

ACQ580-01 drives

Quick installation and start-up guide for global IEC product types

3AXD50001324131 Rev B MUL
EFFECTIVE: 2025-06-24

EN – Quick installation instructions

This guide is applicable to the global product types. There is a separate guide for the North American product types. For frame R9e installation instructions, refer to ACS580-01, ACH580-01 and ACQ580-01 drives frame size R9e installation instructions (3AXD50001240653 [English]).

Safety instructions

⚠WARNING Obey the safety instructions of the drive. 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, commissioning or maintenance work.

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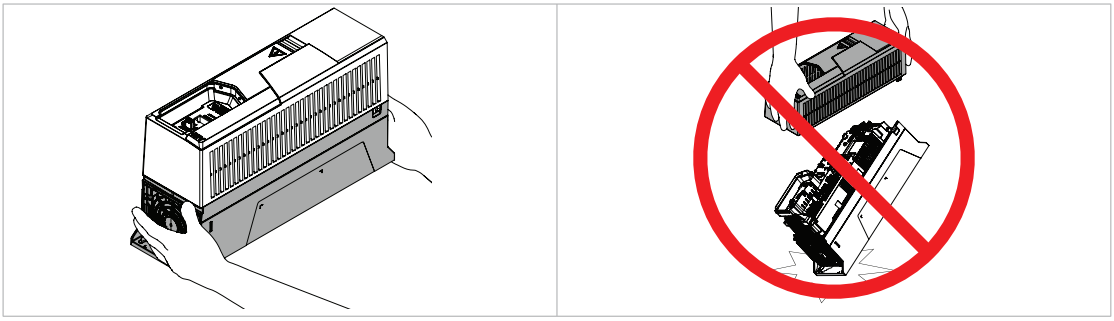
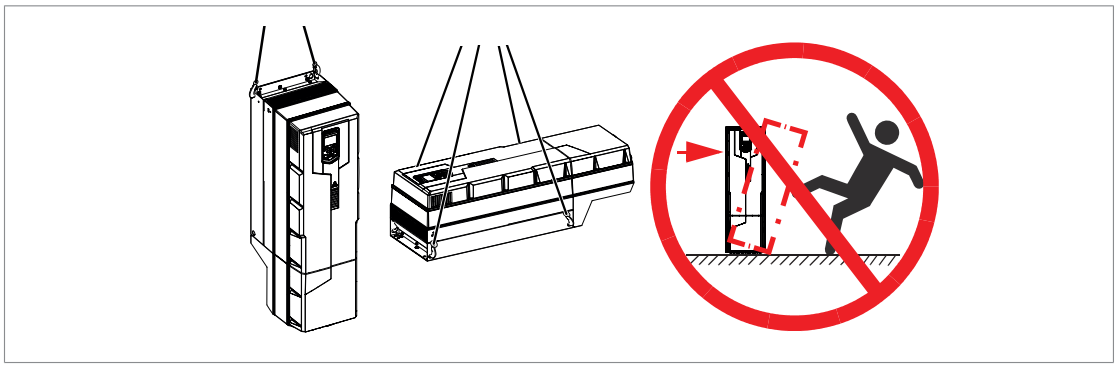
- Do not do work on the drive, motor cable, motor, or control cables when the drive is connected to the input power. Before you start the work, isolate the drive from all dangerous voltage sources and make sure that it is safe to start the work. Always wait for 5 minutes after disconnecting the input 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.
- Frames R1 and R2, IP21 (UL Type 1): Do not lift the drive by holding it from the cover. The cover can come loose and cause the drive to fall.



- Frames R5…R9: Lift the drive with a lifting device. Use the lifting eyes of the drive. Do not tilt the drive. The drive is heavy and its center of gravity is high. An overturning drive can cause physical injury.



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:

- cable box (frames R1…R2 and R5…R9, IP21 [UL Type 1])
- drive
- mounting template
- control panel
- quick installation and start-up guide
- multilingual residual voltage warning stickers
- hardware and firmware manuals if ordered
- options in separate packages if ordered.

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

Reform the capacitors

The capacitors must be reformed if the drive has not been powered (either in storage or unused) for a year or more. The manufacturing date is on the type designation label. For information on reforming the capacitors, refer to Capacitor reforming instructions (3BFE64059629 [English]).

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). Aluminum cables can only be used for input power cabling in 230 V drives with frame size R5…R8. In UL installations, use only copper conductors.
  - **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 and for drives with option +B056 (IP55, UL Type 12), select a cable rated for at least 75 °C (167 °F).
  - **Size:** Refer to Ratings, 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 Ratings and Fuses and typical power cable sizes.

Examine the installation site

Examine the installation site. Make sure that:

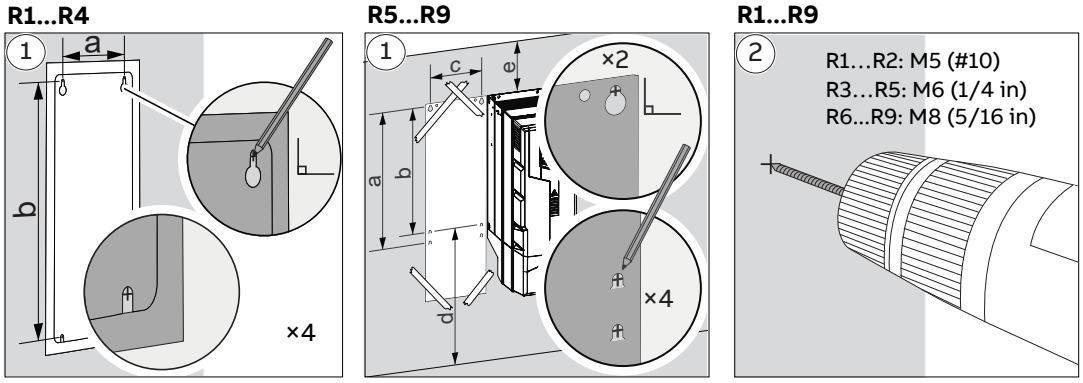
- The installation site is sufficiently ventilated or cooled to remove heat from the drive. Refer to the technical data.
- The ambient conditions of the drive meet the specifications. Refer to the technical data.
- The material behind, above, and below the drive is non-flammable.
- The installation surface is as close to vertical as possible and strong enough to hold the drive.
- There is sufficient free space around the drive for cooling, maintenance work, and operation. Refer to the free space specifications for the drive.
- 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.

Install the drive on the wall

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

Prepare the installation site

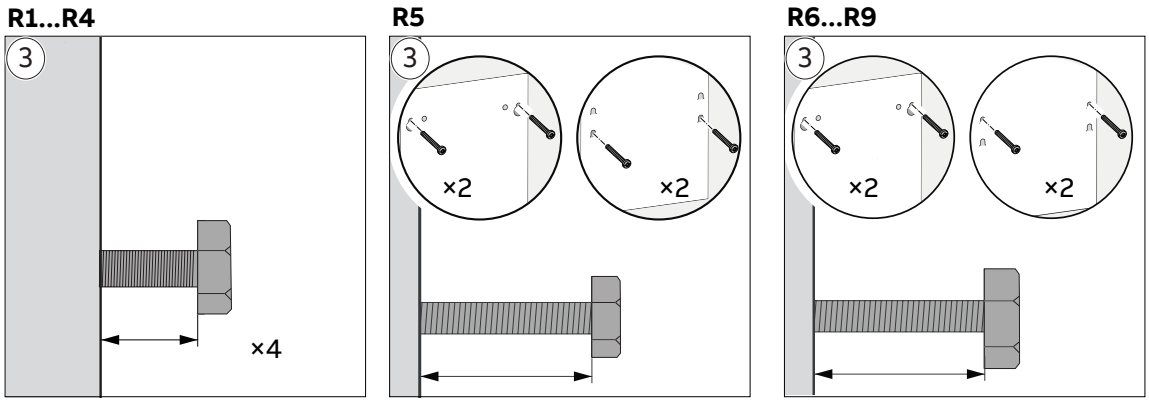
1. Make marks with the help of the mounting template. Remove the mounting template before you install the drive on the wall.
2. Drill the holes and put anchors or plugs into the holes.



	R1		R2		R3		R4		R5		R6		R7		R8		R9	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
a	98	3.86	98	3.86	160	6.30	160	6.30	612*	24.09*	571	22.5	623	24.5	701	27.6	718	28.3
b	317	12.48	417	16.42	473	18.62	619	24.37	581	22.87	531	20.9	583	23.0	658	25.9	658	25.9
c	-	-	-	-	-	-	-	-	160	6.30	213	8.4	245	9.7	263	10.3	345	13.6
d	-	-	-	-	-	-	-	-	200	7.87	300	11.8	300	11.8	300	11.8	300	11.8
e	-	-	-	-	-	-	-	-	100	3.94	155	6.1	155	6.1	155	6.1	200	7.9

*Not valid for R5 v2

3. Install the screws. Leave a gap between the screw head and mounting surface.



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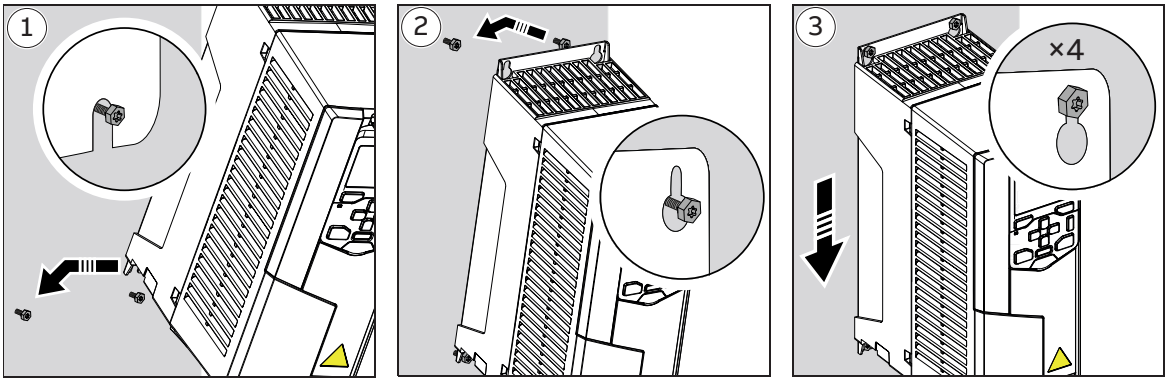
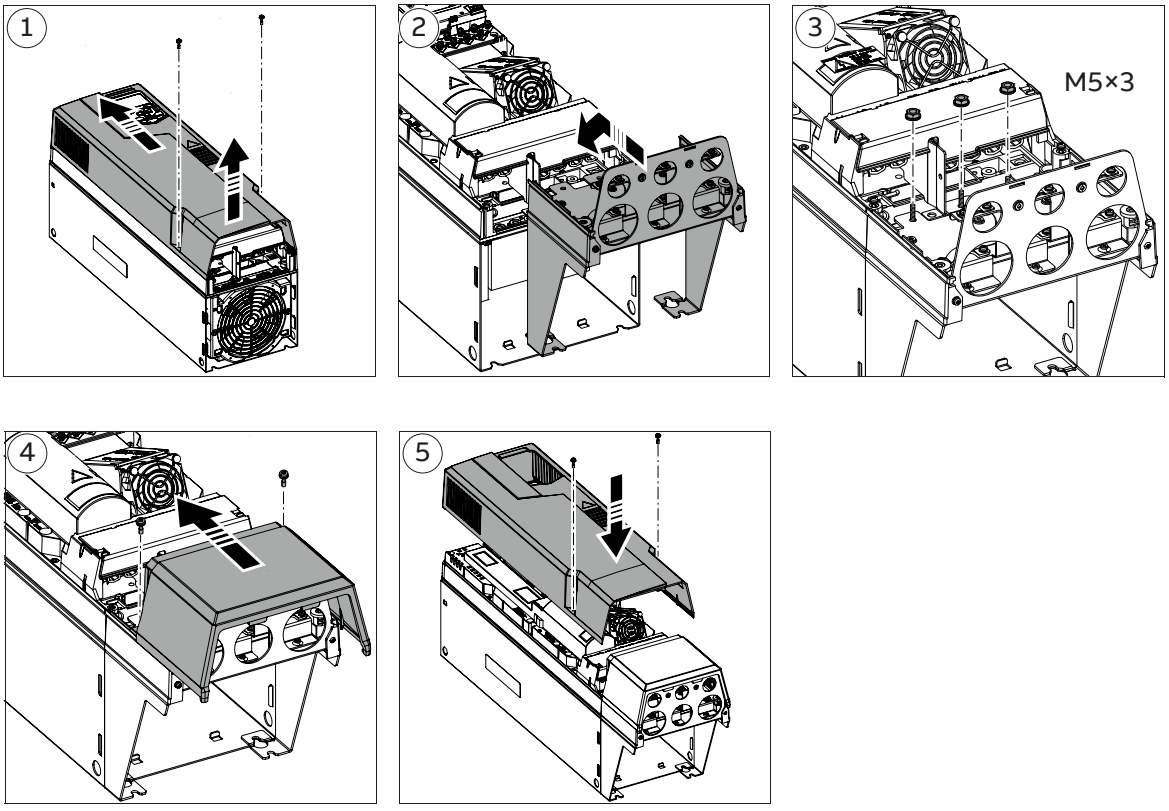
Frames R1...R4, R5 v2: Put the drive on the wall and tighten the screws

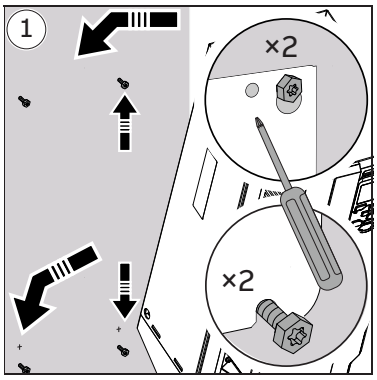


Frame R5, IP21 (UL Type 1): Install the cable box

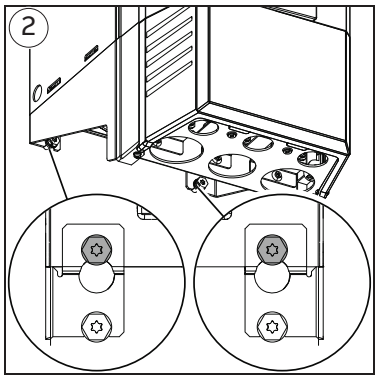


- **Frames R5...R9: Put the drive on the wall and tighten the screws**

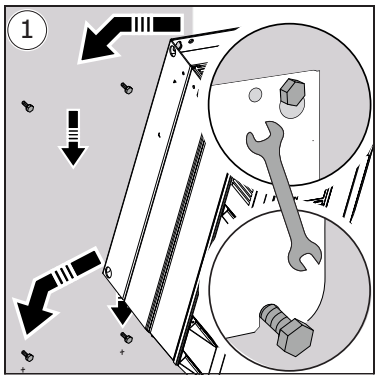
R5



R5

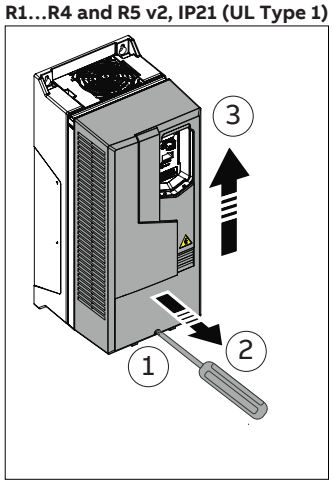


R6...R9

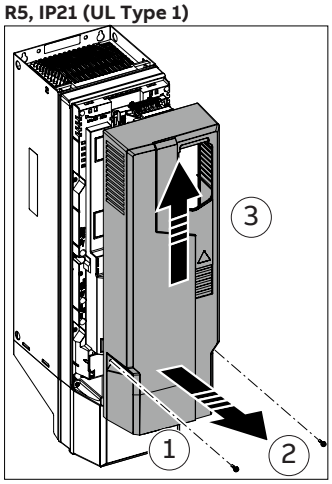


Remove the cover(s)

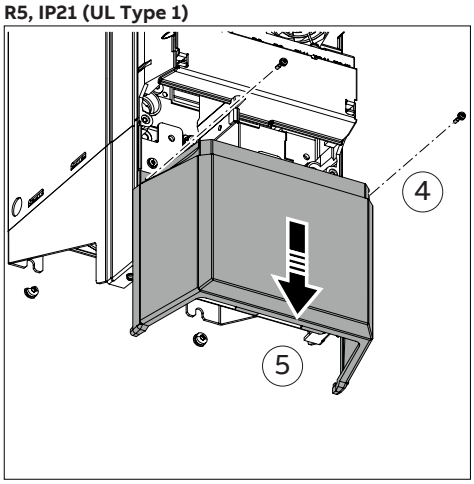
R1...R4 and R5 v2, IP21 (UL Type 1)



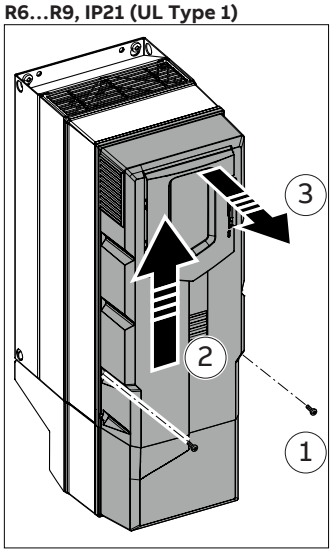
R5, IP21 (UL Type 1)



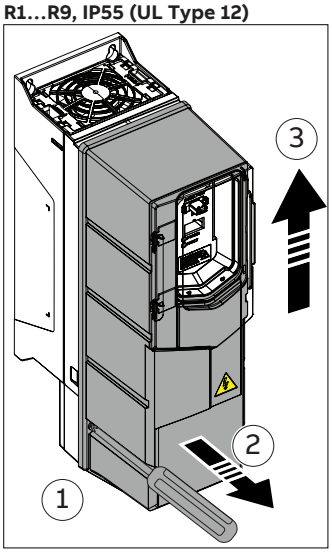
R5, IP21 (UL Type 1)



R6...R9, IP21 (UL Type 1)

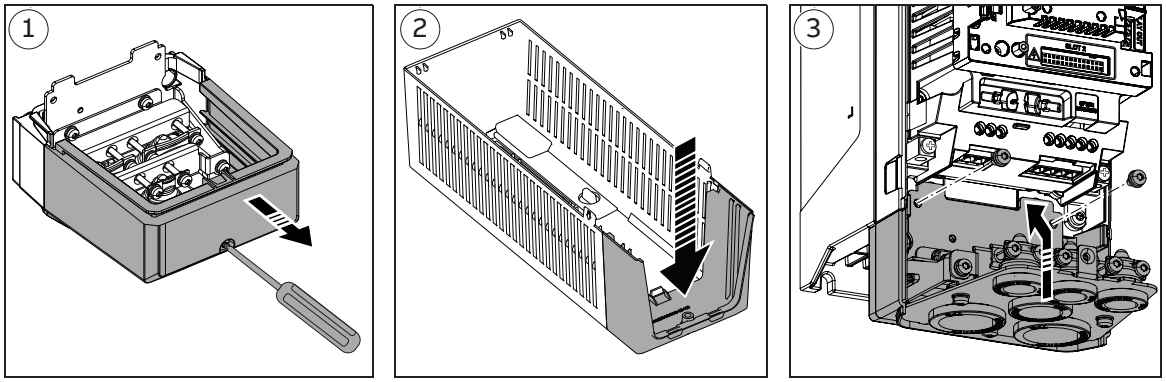


R1...R9, IP55 (UL Type 12)

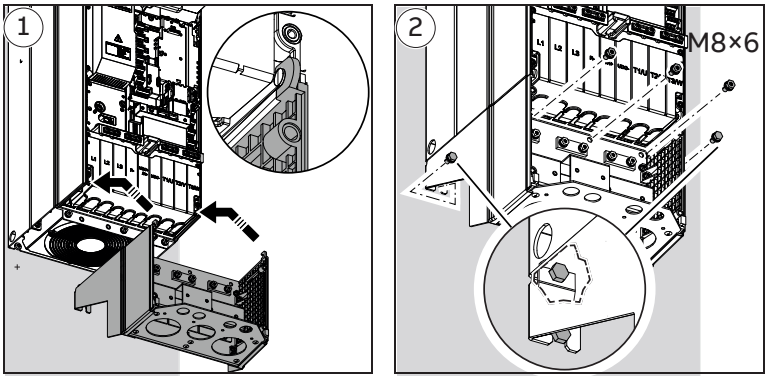


Frames R1...R2 and R6...R9, IP21 (UL Type 1): Install the cable box

R1...R2



R6...R9



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

Frames R1…R4: to the control panel mounting platform, Frames R5…R9: next to the control unit.

Make sure that the drive is compatible with the grounding system

You can connect all drives to a symmetrically grounded TN-S system (center-grounded wye). If you install the drive to a different system, you must disconnect the EMC screws (disconnect the EMC filter) and/or disconnect the VAR screw (disconnect the varistor circuit).

Frame size	Symmetrically grounded TN-S systems (center-grounded wye)	Corner-grounded delta and midpoint-grounded delta systems	IT systems (ungrounded or high-resistance grounded)	TT systems [1) 2)]
R1...R3 **R4 v2** **R5 v2**	Do not disconnect EMC or VAR screw.	Disconnect EMC screw. Do not disconnect VAR screw.	Disconnect EMC and VAR screws.	Disconnect EMC and VAR screws.

Frame size	Symmetrically grounded TN-S systems (center-grounded wye)	Corner-grounded delta and midpoint-grounded delta systems	IT systems (ungrounded or high-resistance grounded)	TT systems [1) 2)]
R4...R5	Do not disconnect EMC or VAR screw.	**Note:** The drive is not evaluated for use on these systems by IEC standards.	Disconnect EMC screws (2 pieces) and VAR screw.	Disconnect EMC screws (2 pieces) and VAR screw.
R6...R9	Do not disconnect EMC or VAR screw.	Do not disconnect EMC AC or VAR screws. Disconnect EMC DC screw.	Disconnect EMC screws (2 pieces) and VAR screw.	Disconnect EMC screws (2 pieces) and VAR screw.

1) A residual current device must be installed in the supply system.
2) ABB does not guarantee the EMC category or the operation of the ground leakage detector built inside the drive.

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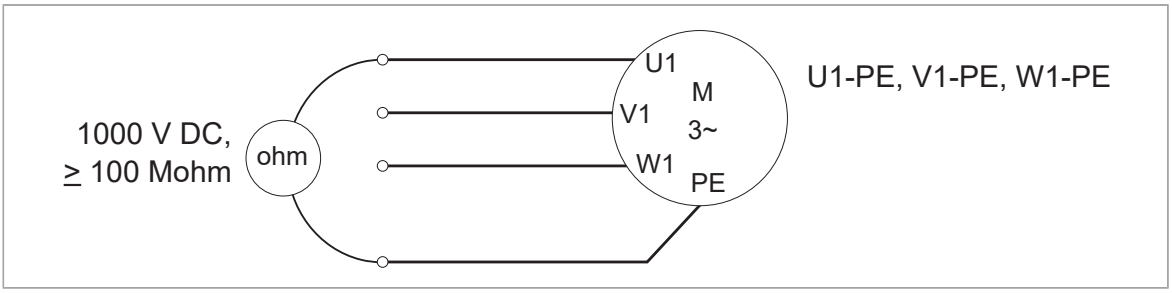
Measure the insulation resistance of the input and motor cables and the motor

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

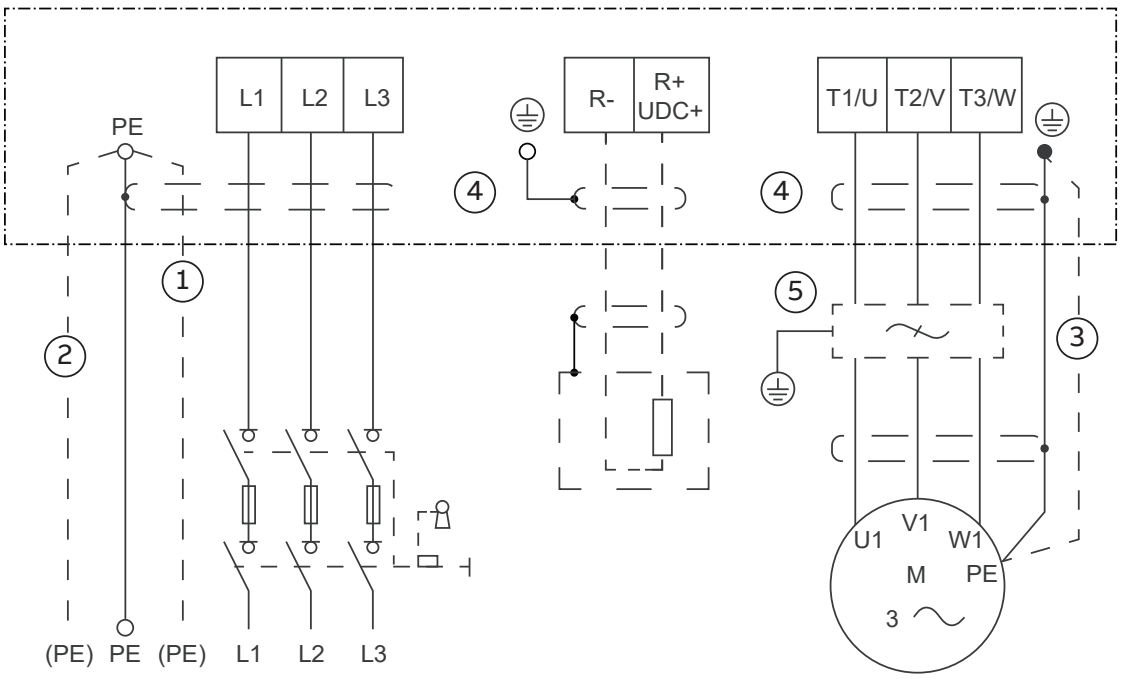
Measure the insulation resistance of the motor and motor cable when the motor cable is disconnected from the drive. Measure the insulation resistance between each phase conductor and the Protective Earth conductor using a measuring voltage of 1000 V DC. The insulation resistance of an ABB motor must be greater than 100 Mohm (reference value at 25 °C or 77 °F). For the insulation resistance of other motors, consult the manufacturer's instructions.

Note: Moisture inside the motor casing will reduce the insulation resistance. If you suspect moisture, dry the motor and repeat the measurement.



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° 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	If necessary, install an external filter (d*u*/d*t*, common mode, or sine filter). Filters are available from ABB.

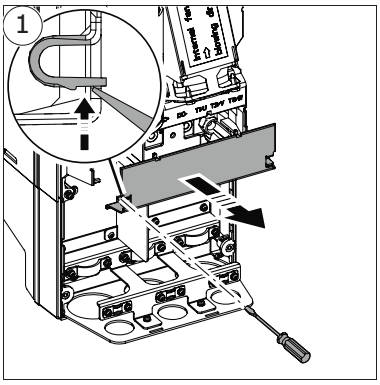
Note: Frames R1…R3 have a built-in brake chopper. If necessary, you can connect a brake resistor to terminals R- and UDC+/R+. The brake resistor is not included in the drive delivery.

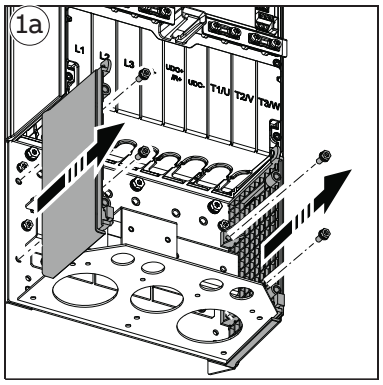
In frames R4…R9, you can connect an external brake chopper to terminals UDC+ and UDC-. The brake chopper is not included in the drive delivery.

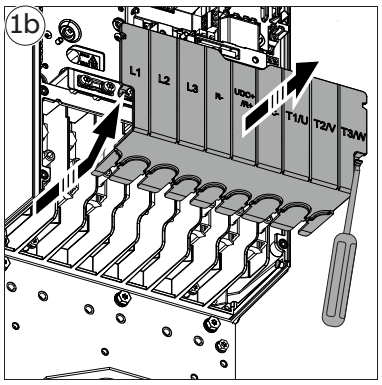
Connection procedure

1. Frames R5…R9: Remove the shroud(s) on the power cable terminals (not in R5 v2).

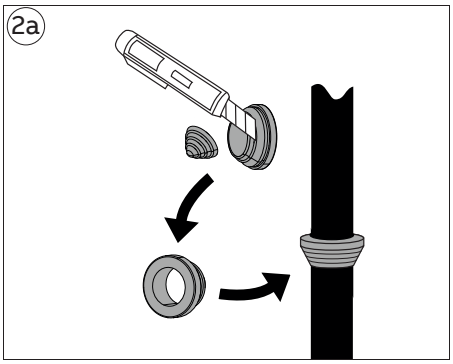
   Frames R6…R9: Remove the side plates (a). Remove the shroud (b), then make the necessary holes for the cables. In frames R8…R9, if you install parallel cables, also make the necessary holes in the lower shroud.

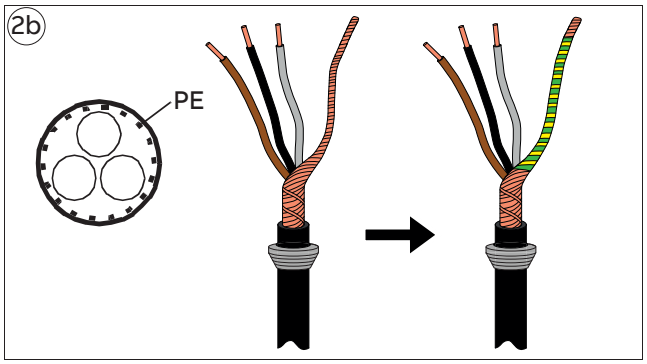






2. Prepare the power cables:
   - Remove the rubber grommets from the cable entry.
   - Cut a sufficient hole in the rubber grommet. Slide the grommet onto the cable (a).
   - Prepare the ends of the input power cable and motor cable as illustrated in the figure (b).
   - Slide the cables through the holes in the cable entry and attach the grommets to the holes.
   - If you use aluminum cables, apply grease to the stripped conductors before you connect them to the drive.





3. Connect the power cables. For the tightening torques, refer to Terminal data for the power cables.
   - Connect the phase conductors of the motor cable to terminals T1/U, T2/V and T3/W. Connect the twisted shield of the cable to the grounding terminal. (a)
   - Connect the input power cable to terminals L1, L2 and L3. Connect the twisted shield of the cable and the additional PE conductor to the grounding terminal. (b)
   - Frames R8…R9: If you use only one conductor, ABB recommends that you put it under the upper pressure plate. If you use parallel power cables, put the first conductor under the lower pressure plate and the second under the upper pressure plate.
   - Frames R8…R9: If you use parallel power cables, install the second grounding shelf for the parallel power cables.
   - Tighten the clamps of the power cable grounding shelf onto the stripped part of the cables (c). Torque the clamps to 1.2 N·m (10.6 lbf·in).

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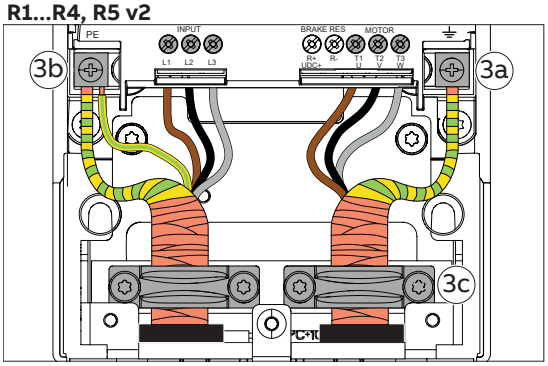
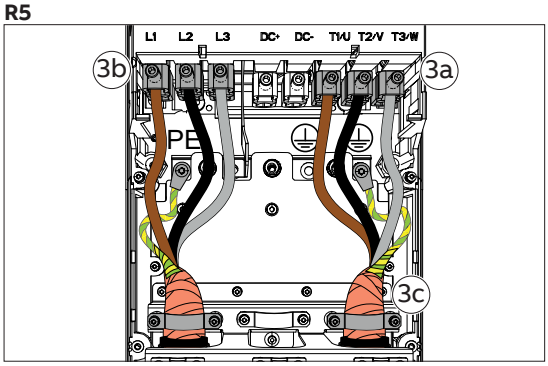
- If used, connect the brake resistor or brake chopper cables. In frames R1…R2, you must install the grounding shelf before you can connect the brake cables (refer to the next step).
- Frames R6…R9: After you connect the power cables, install the shroud on the terminals (d).

R1...R4, R5 v2

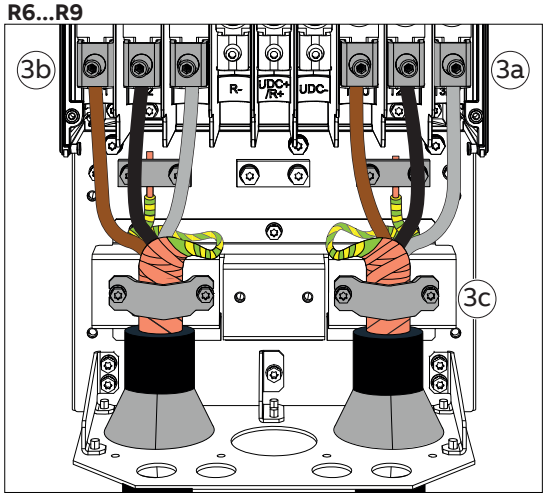


R5

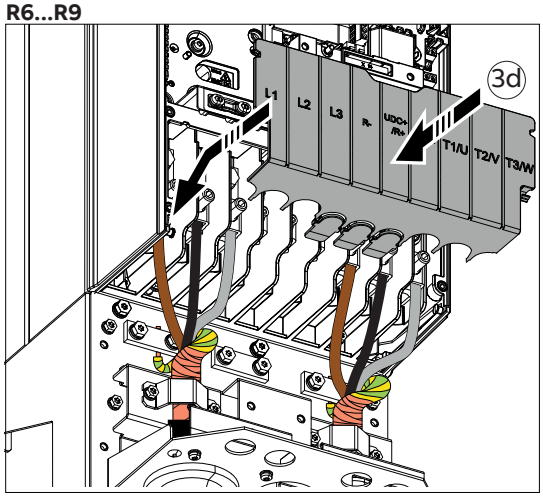


Note: The illustration above shows frames R1…R2. Frames R3…R4 are similar.

R6...R9

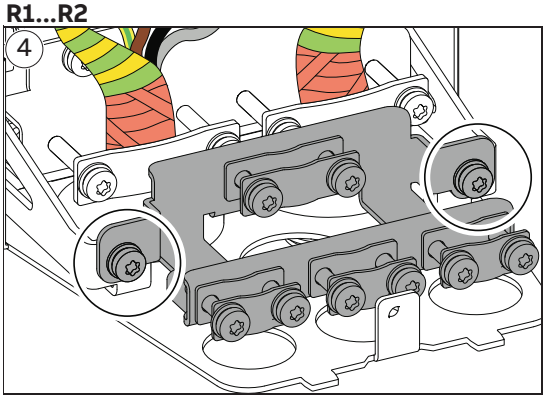


R6...R9

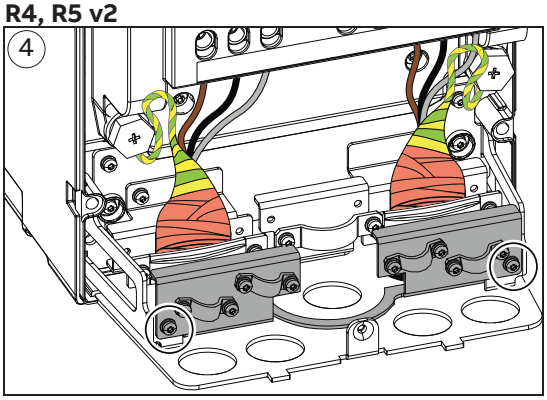


4. Frames R1, R2, R4, R5 v2, R6…R9: Install the grounding shelf. In frames R6…R9, this is the grounding shelf for the control cables.

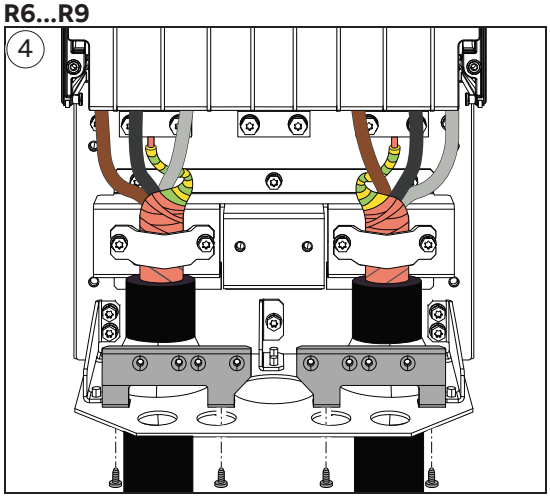
R1...R2



R4, R5 v2

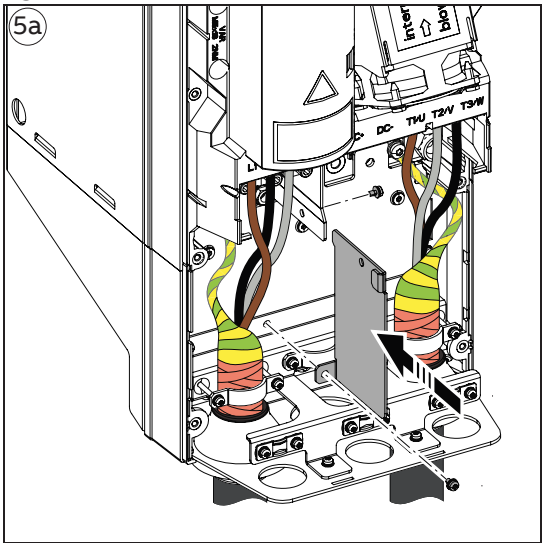


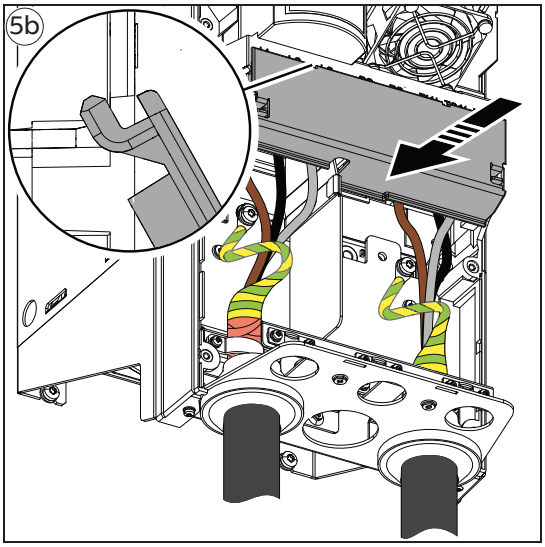
R6...R9



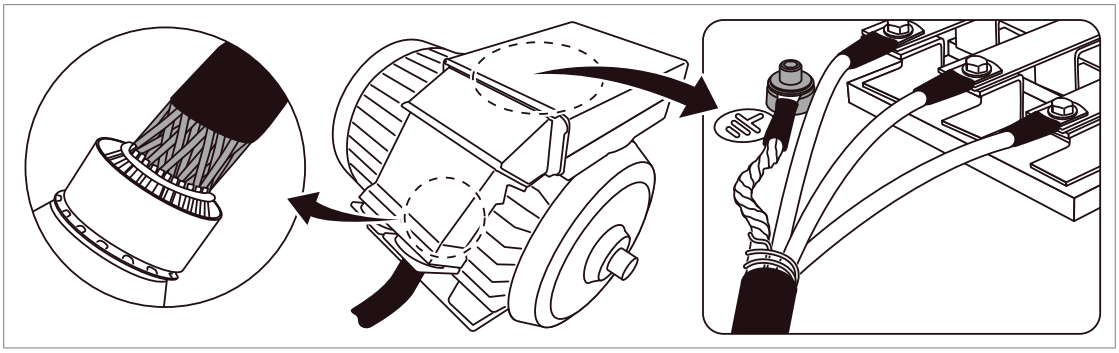
5. Frame R5: Install the cable box plate (a) and shroud (b).

R5





6. Attach the cables outside the drive mechanically.
7. Ground the motor cable shield at the motor end. For minimum radio frequency interference, ground the motor cable shield 360° at the cable entry of the motor terminal box.



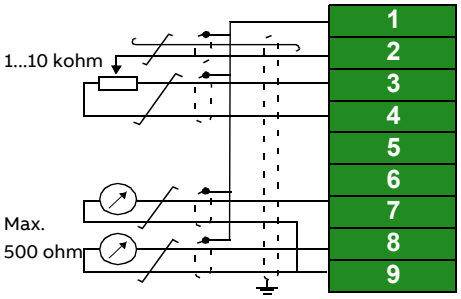
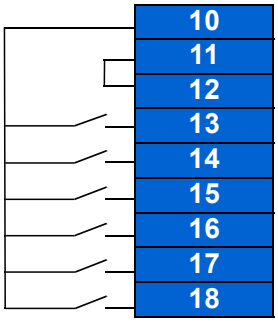
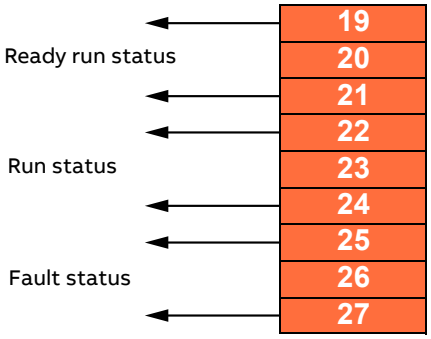
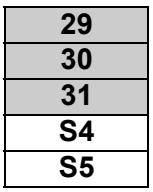
Connect the control cables

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

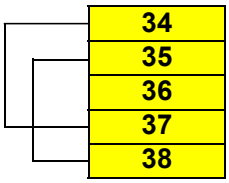
1. Cut a hole into the rubber grommet and slide the grommet onto the cable.
2. Ground the outer shield of the cable 360° under the grounding clamp. Keep the cable unstripped as close to the terminals of the control unit as possible. Ground also the pair-cable shields and grounding wire at the SCR terminal.
3. Tie all control cables to the provided cable tie mounts.

Default control connections

The default control connections for the Water default are shown below.

Connection	Term	Description
X1 Reference voltage and analog inputs and outputs		
	1	SCR	Signal cable shield (screen)
	2	AI1	Output frequency/speed reference: 0…10 V
	3	AGND	Analog input circuit common
	4	+10V	Reference voltage 10 V DC
	5	AI2	Actual feedback: 0…10 V
	6	AGND	Analog input circuit common
	7	AO1	Output frequency: 0…10 V
	8	AO2	Output current: 0…20 mA
	9	AGND	Analog output circuit common
X2 & X3 Aux. voltage output and programmable digital inputs		
	10	+24V	Aux. voltage output +24 V DC, max. 250 mA
	11	DGND	Aux. voltage output common
	12	DCOM	Digital input common for all
	13	DI1	Stop (0) / Start (1)
	14	DI2	Not configured
	15	DI3	Constant frequency/speed selection
	16	DI4	Not configured
	17	DI5	Not configured
	18	DI6	Not configured
X6, X7, X8 Relay outputs		
	19	RO1C	Ready run 250 V AC / 30 V DC 2 A
	20	RO1A	
	21	RO1B	
	22	RO2C	Running 250 V AC / 30 V DC 2 A
	23	RO2A	
	24	RO2B	
	25	RO3C	Fault (-1) 250 V AC / 30 V DC 2 A
	26	RO3A	
	27	RO3B	
X5 Embedded fieldbus		
	29	B+	Embedded fieldbus, EFB (EIA-485)
	30	A-	
	31	DGND	
	S4	TERM	Termination switch
	S5	BIAS	Bias resistors switch
X4 Safe Torque Off		

EN

Connection		Term	Description
	34	OUT1	Safe torque off. Factory connection. Both circuits must be closed for the drive to start. Refer to Safe torque off (STO).
	35	OUT2	
	36	SGND	
	37	IN1	
	38	IN2	
X10 24 V AC/DC			
	40	24 V AC/DC+ in	R6...R9 only: External 24 V AC/DC input to power up the control unit when the main supply is disconnected.
	41	24 V AC/DC- in	

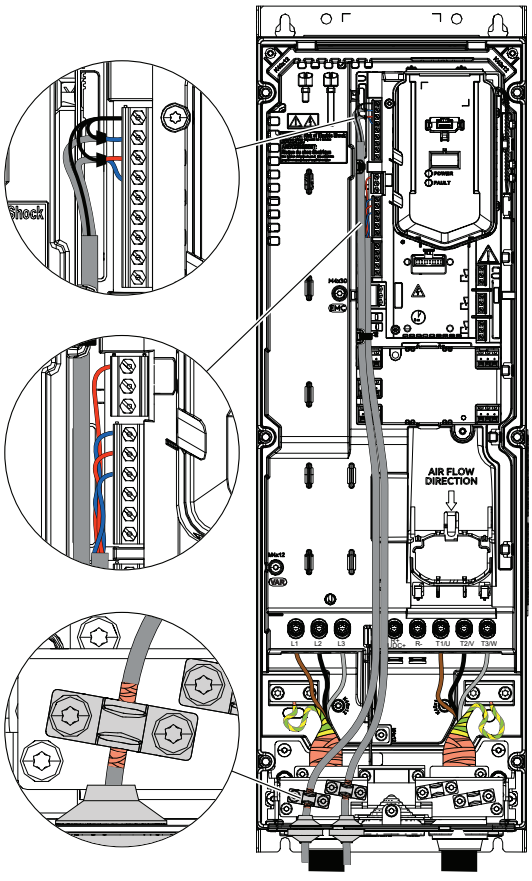
EN

Total load capacity of the auxiliary voltage output +24 V (X2:10) is 6.0 W (250 mA / 24 V DC). Tightening torques 0.5…0.6 N·m (4.4…5.3 lbf·in). Wire strip length 7…8 mm (0.3 in). All terminal sizes 0.14…2.5 mm^2 (26…14 AWG). Digital inputs DI1…DI5 also support 10…24 V AC.

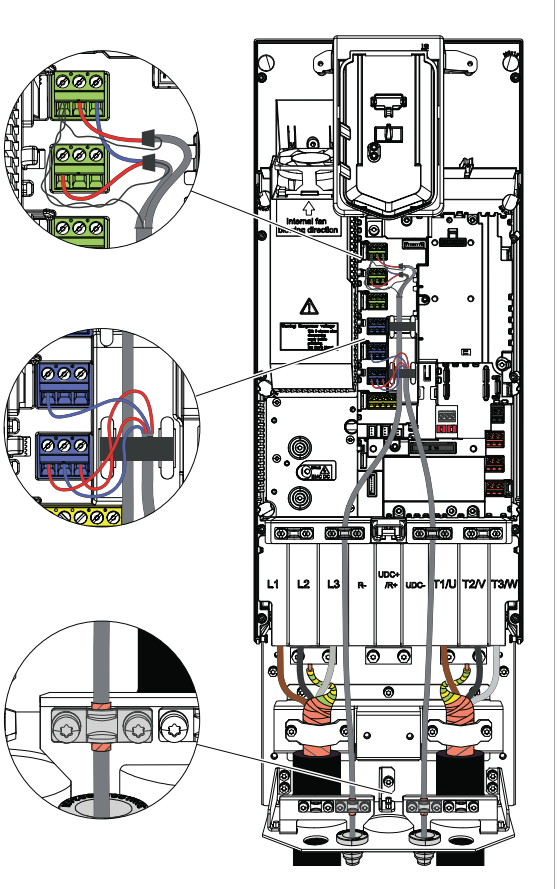
Control cable installation examples

These images show examples for routing the control cables in frames R4 and R6…R9. Frames R1…R3 and R5 are similar to frame R4.

R4, R4 v2, R5 v2



R6…R9



Embedded fieldbus connection

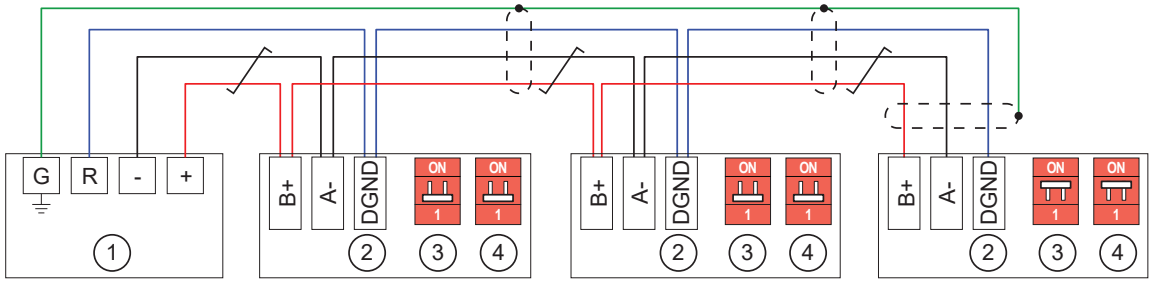
The EIA-485 network uses shielded, twisted-pair cable with a characteristic impedance of 100…130 ohm for data signaling. The distributed capacitance between conductors is less than 100 pF per meter (30 pF per foot). Distributed capacitance between conductors and shield is less than 200 pF per meter (60 pF per foot). Foil or braided shields are acceptable.

Connect the cable to the EIA-485 terminal on the control unit. Obey these wiring instructions:

- Attach the cable shields together at each drive, but do not connect them to the drive.
- Connect the cable shields only to the grounding terminal in the automation controller.
- Connect the signal ground (DGND) conductor to the signal ground reference terminal in the automation controller. If the automation controller does not have a signal ground reference terminal, connect the signal ground conductor to the cable shield through a 100 ohm resistor, preferably near the automation controller.

Connection example is shown below.

With signal ground reference terminal



1	Automation controller
2	Drive
3	Termination switch. The devices at the ends of the fieldbus must have termination on. All other devices must have termination off.
4	Biasing switch. One (and only one) device, preferably at the end on the bus must have the bias on.

Install optional modules, if included in the delivery

For instructions, refer to the option module manual.

Install the cover(s)

The cover installation procedure is the opposite of the removal procedure. Refer to Remove the cover(s) (page 7). In frames R6…R9, install the side plates shown in Connection procedure (page 10) before you install the cover.

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.

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

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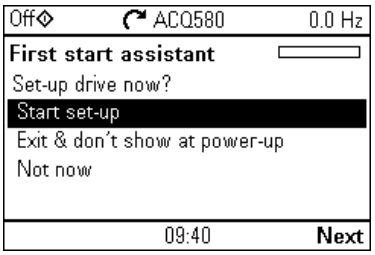
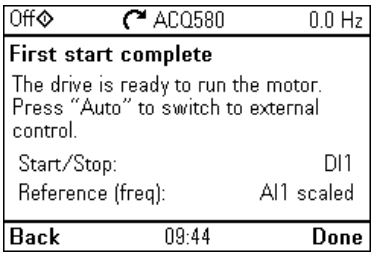
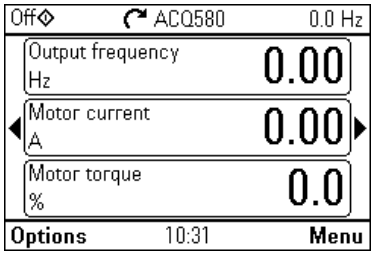
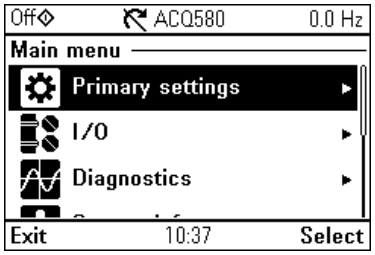
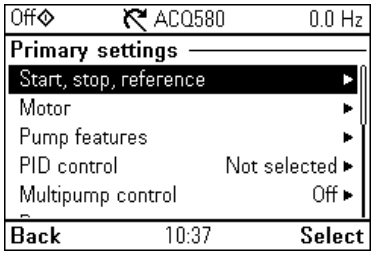
Use the control panel to do the start-up procedure. The two commands at the bottom of the display (**Options** and **Menu**) show the functions of the two softkeys and located below the display. The commands assigned to the softkeys are different depending on the context. Use the arrow keys, and to move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

1. Power up the drive. Make sure that you have the motor nameplate data available.	
2. The First start assistant guides you through the first start-up. The assistant begins automatically. Wait until the control panel shows the language selection screen. Select the language you want to use and press (**OK**). **Note:** After you select the language, it takes a few minutes for the control panel to wake up.	
3. Select **Start set-up** and press (**Next**).	
4. To complete the First start assistant, select the values and settings when prompted by the assistant. Continue until the panel shows that the first start is complete. When the panel shows that the first start is complete, the drive is ready for use. Press (**Done**) to enter the Home view.	

5. The Home view monitors the values of selected signals.	
6. Make additional adjustments, for example pump protections, starting from the Main menu. Press (**Menu**) in the Home view to enter the Main menu. Select Primary settings and press (**Select**) (or ▶). To get more information on the Primary settings menu items, press ? to open the help page.	 

Fieldbus communication

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

Parameter	Setting	Description
20.01 Ext1 commands	Embedded fieldbus	Selects fieldbus as the source for the start and stop commands when EXT1 is selected as the active control location.
22.11 Ext1 speed ref1	EFB ref1	Selects a reference received through the embedded fieldbus interface as speed reference 1. Use this parameter for speed control.
28.11 Ext1 frequency ref1	EFB ref1	Selects a reference received through the embedded fieldbus interface as frequency reference 1. Use this parameter for frequency control.
58.01 Protocol enable	Modbus RTU	Initializes embedded fieldbus communication.
58.03 Node address	1 (default)	Node address. Do not use the same node address for different nodes online at the same time.
58.04 Baud rate	19.2 kbps (default)	Defines the communication speed of the link. Use the same setting as in the master station.
58.05 Parity	8 EVEN 1 (default)	Selects the parity and stop bit setting. Use the same setting as in the master station.
58.06 Communication control	Refresh settings	Validates any changed EFB configuration settings. Use this after changing any parameters in group 58.

Other parameters related to the fieldbus configuration:

58.14 Communication loss action	58.17 Transmit delay	58.28 EFB act1 type	58.34 Word order

58.15 Communication loss mode	58.25 Control profile	58.31 EFB act1 transparent source	58.101 Data I/O 1 … 58.114 Data I/O 14 time
58.16 Communication loss time	58.26 EFB ref1 type	58.33 Addressing mode	

Warnings and faults

Warning	Fault	Aux. code	Description
A2A1	2281	Current calibration	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 also 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 due to missing input power line phase.
-	3181	Wiring or earth fault	Incorrect input and motor cable connection.
A3A1	3210	DC link overvoltage	Intermediate DC circuit voltage is too high.
A3A2	3220	DC link undervoltage	Intermediate DC circuit voltage is too low.
-	3381	Output phase loss	All three phases are not connected to the motor.
-	5090	STO hardware failure	STO hardware diagnostics has detected hardware failure. Contact ABB.
A5A0	5091	Safe torque off	The Safe torque off (STO) function is active.
A7CE	6681	EFB comm loss	Break in embedded fieldbus communication.
A7C1	7510	FBA A communication	Communication lost between drive (or PLC) and fieldbus adapter.
A7AB	-	Extension I/O configuration failure	The installed C-type module is not the same as configured, or there is an error in the communication between the drive and module.
AFF6	-	Identification run	The motor ID run occurs at the next start.
-	FA81	Safe torque off 1 loss	The Safe torque off circuit 1 is broken.
-	FA82	Safe torque off 2 loss	The Safe torque off circuit 2 is broken.

Safe torque off (STO)

The drive has a Safe torque off (STO) function 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 STO is activated, it coasts to a stop. Closing the activation switch deactivates 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 Safe torque off function does not disconnect the voltage of the main and auxiliary circuits from the drive. Isolate the drive from all power supplies before you do maintenance work on the electrical parts of the drive or the motor.

Note:

- If stopping by coasting is not acceptable, stop the drive and machinery using the appropriate stop mode before activating 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

- The voltage at the STO input terminals of the drive must be at least 13 V DC to be interpreted as “1”
- STO reaction time (shortest detectable break): 1 ms
- STO response time: 2 ms (typical), 5 ms (maximum)
- Fault detection time: Channels in different states for longer than 200 ms
- Fault reaction time: Fault detection time + 10 ms.
- STO fault indication (parameter 31.22) delay: < 500 ms
- STO warning indication (parameter 31.22) delay: < 1000 ms.
- Safety integrity level (SIL, EN 62061): 3
- Performance level (PL, EN ISO 13849-1): e

The 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.