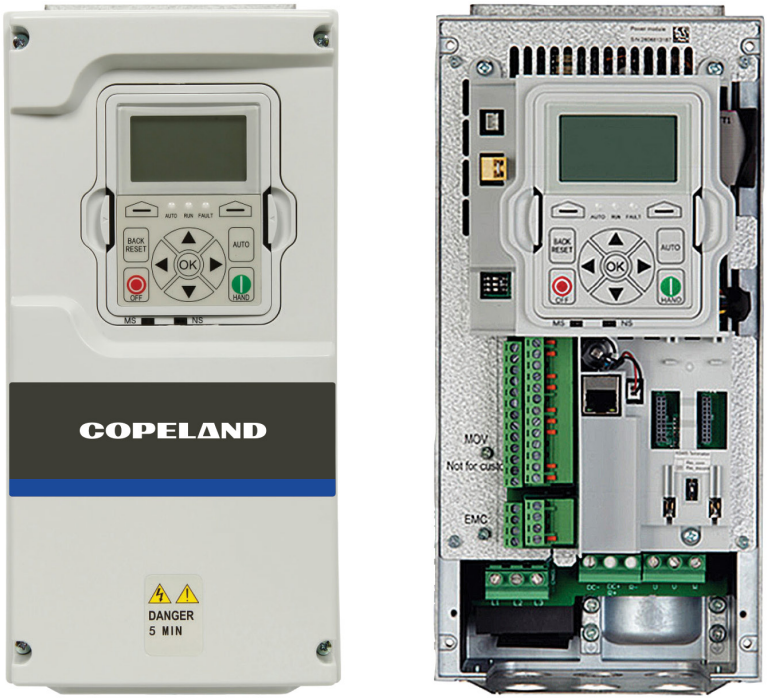
Copeland commercial HVACR variable frequency drive – EVH series



COPELAND

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Safety precautions

⚠WARNING	ELECTRICAL SHOCK HAZARD Disconnect and lock out power before servicing. Discharge all capacitors before servicing. Use compressor with grounded system only. Molded electrical plug must be used when required. Refer to original equipment wiring diagrams. Electrical connections must be made by qualified electrical personnel. Failure to follow these warnings could result in serious personal injury.

Before performing the installation

- Disconnect the power supply of the device
- Ensure that devices cannot be accidentally restarted
- Verify isolation from the supply
- Earth and short circuit the device
- Cover or enclose any adjacent live components
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system
- Before installation and before touching the device, ensure that you are free of electrostatic charge
- The functional earth (FE, PES) must be connected to the protective earth (PE) or the potential equalization. The system installer is responsible for implementing this connection
- Connecting cables and signal lines should be installed so that inductive or capacitive interference does not impair the automation functions
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation
- Suitable safety hardware and software measures should be implemented for the I/O interface so that an open circuit on the signal side does not result in undefined states in the automation devices
- Ensure a reliable electrical isolation of the extra-low voltage of the 24 V supply. Only use power supply units complying with IEC 60364-4-41 (VDE 0100 Part 410) or HD384.4.41 S2
- Deviations of the input voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise, this may cause malfunction and dangerous operation
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause a restart
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented
- Wherever faults in the automation system may cause injury or material damage, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks, and so on)
- Depending on their degree of protection, adjustable frequency drives may contain live bright metal parts, moving or rotating components, or hot surfaces during and immediately after operation
- Removal of the required covers, improper installation, or incorrect operation of motor or adjustable frequency drive may cause the failure of the device and may lead to serious injury or damage
- The electrical installation must be carried out in accordance with the relevant regulations (for example, with regard to cable cross sections, fuses, PE)
- Installations containing adjustable frequency drives must be provided with additional monitoring and protective devices in accordance with the applicable safety regulations. Modifications to the adjustable frequency drives using the operating software are permitted
- All covers and doors must be kept closed during operation
  - Never touch live parts or cable connections of the adjustable frequency drive after it has been disconnected from the power supply. Due to the charge in the capacitors, these parts may still be live after disconnection. Fit appropriate warning signs

Step 1—Copeland EVH overview

This chapter describes the purpose and contents of this manual, the receiving inspection recommendations and the Copeland EVH series open drive catalog numbering system.

How to use this manual

The purpose of this manual is to provide you with information necessary to install, start up, and setup the Copeland EVH series variable speed drive (VSD). To provide for safe installation and operation of the equipment, read the safety guidelines at the beginning of this manual and follow the procedures outlined in the following chapters before connecting power to the Copeland series VSD. Keep this operating manual handy and distribute to all users, technicians and maintenance personnel for reference.

Receiving and inspection

The Copeland EVH series VSD has met a stringent series of factory quality requirements before shipment. It is possible that packaging or equipment damage may have occurred during shipment. After receiving your Copeland series VSD, please check for the following:

Check to make sure that the package includes the install manual, quick start guide, and accessory packet. The accessory packet includes:

- Rubber grommets
- Control cable grounding clamps
- Additional grounding screw

Inspect the unit to ensure it was not damaged during shipment.

Make sure that the part number indicated on the nameplate corresponds with the catalog number on your order.

If shipping damage has occurred, please contact and file a claim with the carrier involved immediately.

If the delivery does not correspond to your order, please contact your Copeland electrical representative.

Note: Do not destroy the packing. The template printed on the protective cardboard can be used for marking the mounting points of the Copeland VSD on the wall or in a cabinet.

Real time clock battery activation

To activate the real time clock (RTC) functionality in the EVH VSD, the RTC battery (already mounted in the drive) must be connected to the control board.

Simply remove the primary drive cover, locate the RTC battery directly below the keypad, and connect the white 2-wire connector to the receptacle on the control board.

Figure 1. RTC battery connection

Table 1. Common abbreviations

Abbreviation	Definition
CT	Constant torque with high overload rating (150%)
VT	Variable torque with low overload rating (110%)
I_H	High overload (150%)
I_L	Low overload (110%)
VFD	Variable frequency drive

Rating label/carton label

COPELAND

Cat. No.: EVH-3443D3-R21BEN			
Style No.:3-5330-001A			
Copland™ EVH VSD		Factory ID: Plant 11	
VT		Input	Output
1.1KW	U (V~)	380-440 3Ø	0~Vin 3Ø
	F (Hz)	50/60 Hz	0-400 Hz
	I (A)	3.1	3.3
1.5HP	U (V~)	440-500 3Ø	0~Vin 3Ø
	F (Hz)	50/60 Hz	0-400 Hz
	I (A)	2.8	3
Enclosure Rating		TYPE 1 / IP 21	

User installation manual : 2020ECT-37

Serial No.: XX20J0001

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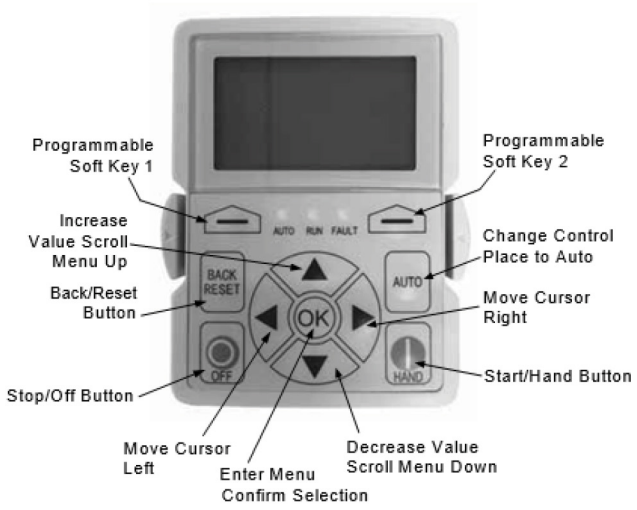
TÜVRheinland CERTIFIED

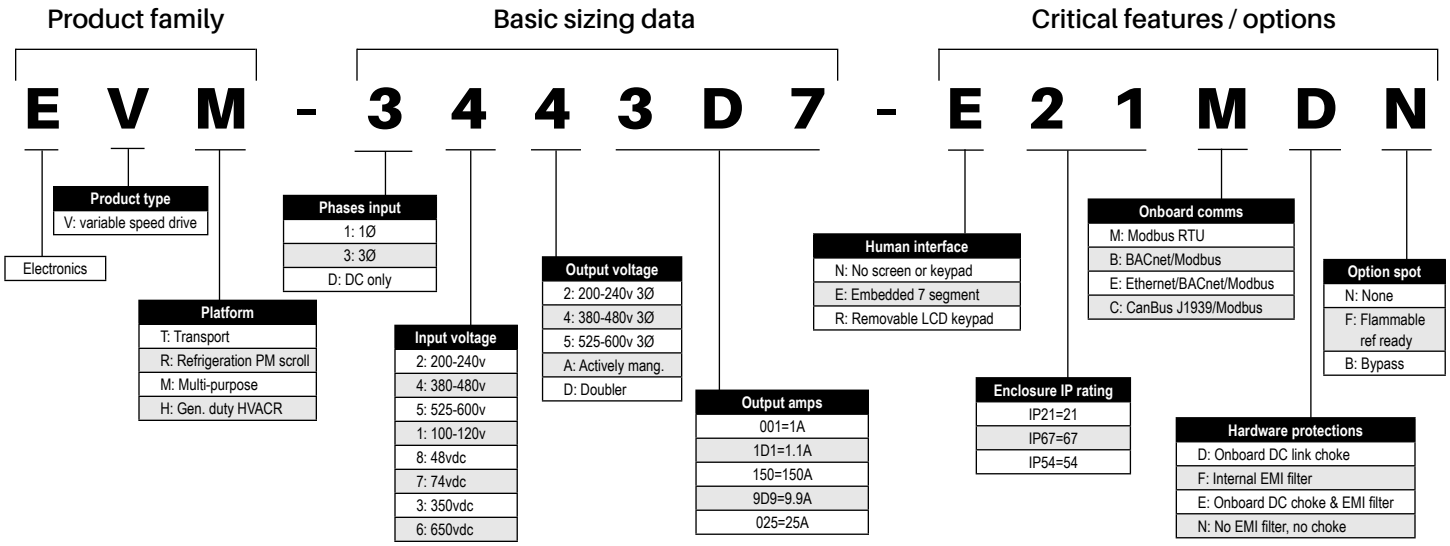
N.W.: XX.XX KG G.W.: XX.XX KG

20201015 Assembled in Dominican Republic

Keypad button overview

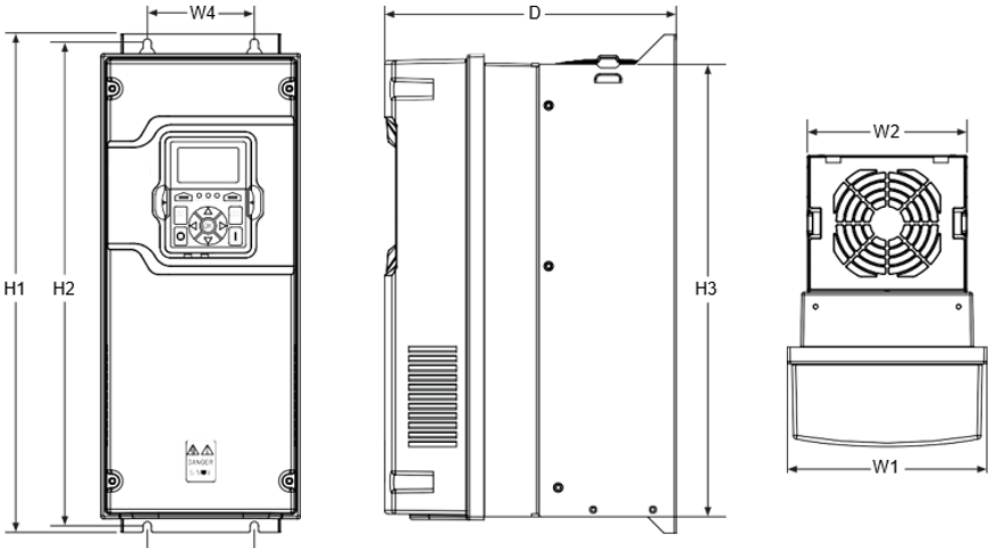


Nomenclature



Step 2—Copeland EVM drive installation

Dimensions and weights



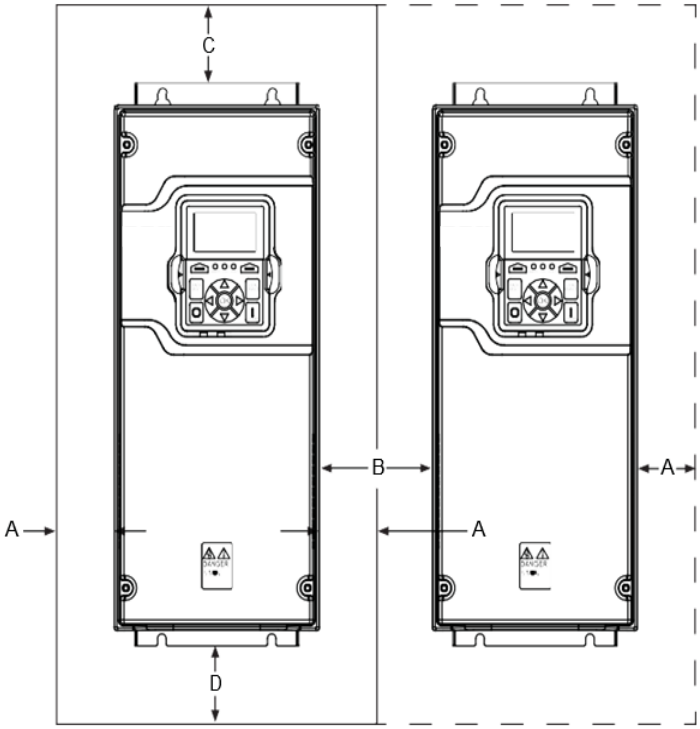
Approximate dimensions in inches (mm)

Frame size	D	H1	H2	H3	W1	W2	W3	W4	Ø	Weight lb (kg)
FR0	6.83 (173.5)	10.58 (268.7)	10.16 (258.0)	9.54 (242.3)	5 (127.0)	4.97 (126.3)	4.26 (108.3)	4.26 (108.3)	0.28 (7.0)	4.41 (2.0)
FR1	7.91 (200.9)	12.87 (327.0)	12.28 (312.0)	11.50 (292.0)	6.02 (153)	4.80 (122.0)	3.94 (100.0)	3.94 (100.0)	0.28 (7.0)	14.33 (6.5)
FR2	9.63 (244.7)	16.50 (419.0)	15.98 (406.0)	14.96 (380)	6.61 (167.8)	5.28 (134.0)	3.54 (90.0)	3.54 (90.0)	0.28 (7.0)	23.37 (10.6)
FR3	10.44 (265.1)	21.97 (558.0)	21.46 (545.0)	20.41 (518.5)	8.06 (204.6)	7.24 (184.0)	4.92 (125.0)	4.92 (125.0)	0.35 (9.0)	49.82 (22.6)
FR4	11.57 (294.0)	24.80 (630)	24.31 (617.5)	23.26 (590.7)	9.36 (237.7)	9.13 (232.0)	8.07 (205.0)	8.07 (205.0)	0.35 (9.0)	77.60 (35.2)
FR5	13.41 (340.7)	34.98 (888.5)	29.65 (753.0)	27.83 (707.0)	11.34 (288.0)	11.10 (282.0)	8.66 (220.0)	8.66 (220.0)	0.35 (9.0)	154.32 (70.0)
FR6	14.61 (371)	40.75 (1035)	33.27 (845)	31.38 (797)	19.13 (486)	18.90 (480)	15.75 (400)	15.75 (400)	0.35 (9)	246.91 (112)

Mounting

For mounting space guidelines, please follow the below diagram and table. Then,find the correct frame size mounting instructions.

- Minimum clearances A and B for drives with type 12 (IP54) enclosure is 0mm (in) for FR1, FR2, FR3, FR4.
- The below guidelines apply unless testing has been completed to validate a design outside of these recommendations. This work must be done in collaboration with Copeland application engineering.

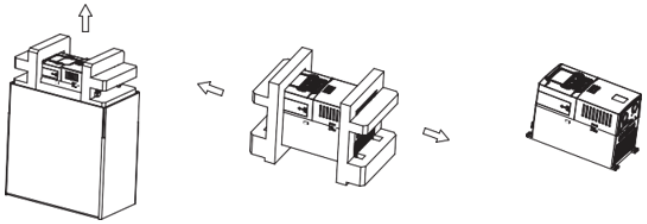


Frame size	A [@] in (mm)	B [@] in (mm)	C in (mm)	D in (mm)	Cooling air required CFM (m^3/h) [@]
FR0 [@]	0	0	3.94 (100)	1.97 (50)	16.5 (28)
FR1	0.79 (20)	1.58 (40)	3.94 (100)	1.97 (50)	14 (24)
FR2	1.18 (30)	2.36 (60)	6.30 (160)	2.36 (60)	55 (94)
FR3	0	0	7.87 (200)	3.15 (80)	85 (144)
FR4	0	0	11.81 (300)	3.94 (100)	153 (260)
FR5	3.15 (80)	6.30 (160)	11.81 (300)	7.87 (200)	232 (395)
FR6	3.15 (80)	6.30 (160)	15.75 (400)	12.99 (330)	230V: 435 (739) 480V/600V: 400 (679)

FR0 mounting instructions

Step 1:

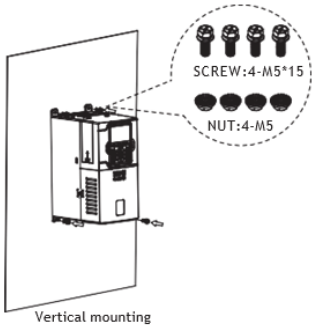
Lift the drive out from the carton, remove the packaging

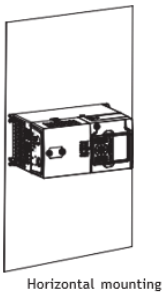


Step 2:

Attach the drive to the mounting plate with four M5X15 screws and four M5 nuts. The opening dimension on the mounting plate should follow required dimension (refer to the drive mounting template printed on the outside carton)

The drive can be mounted vertically or horizontally according to customer's need.



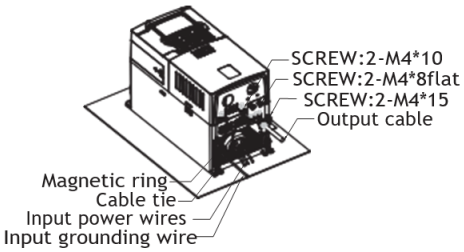


Step 3: (EMI version only)

1. EN version FR0 or US version FR0 with EMC kit
1)Input wiring: Run the L1,L2, L3 wires through a magnetic ring and wind one lap, fix the L1,L2, L3 wires and magnetic ring with a cable tie, then connect the L1,L2, L3 wires to input terminals. Connect the input grounding wire to the bottom metal plate with a M4*10 screw.)

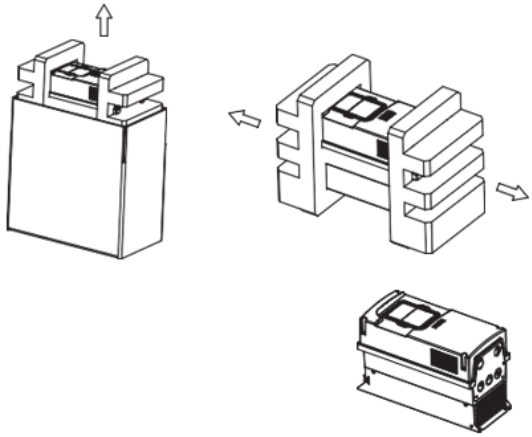
Output wiring: attach a L shape EMC grounding plate to the bottom of drive with two M4*8 flat screws. Connect the output U, V, W wires to output terminals. Connect the output grounding wire to the bottom metal plate with a M4*10 screw. Clamp the output cable shield to the L shape EMC grounding plate with a small rectangular EMC grounding plate and two M4*15 screws.

2. US version FR0 without EMC kit, there are no magnetic ring and EMC grounding plates, but it is necessary to connect the output cable shield to the bottom metal surface with a M4*10 screw

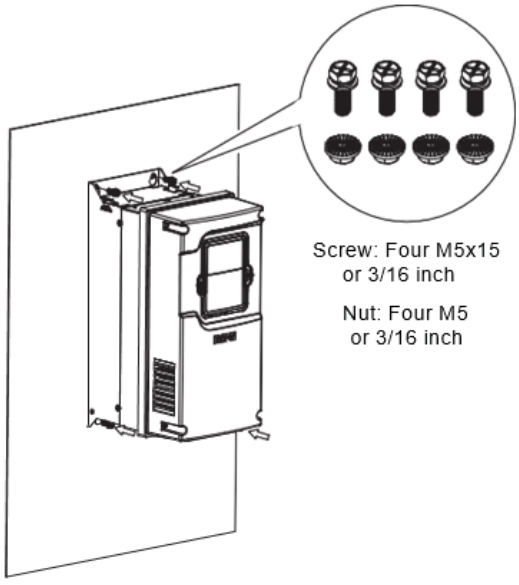


FR1 mounting instructions

Step 1:

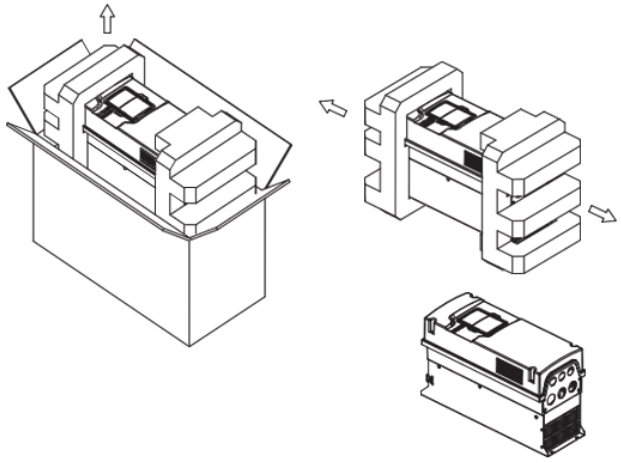


Step 2:

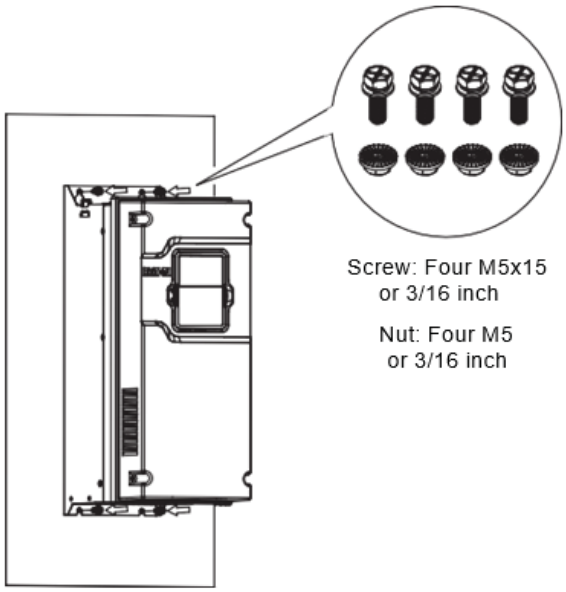


FR2 mounting instructions

Step 1:

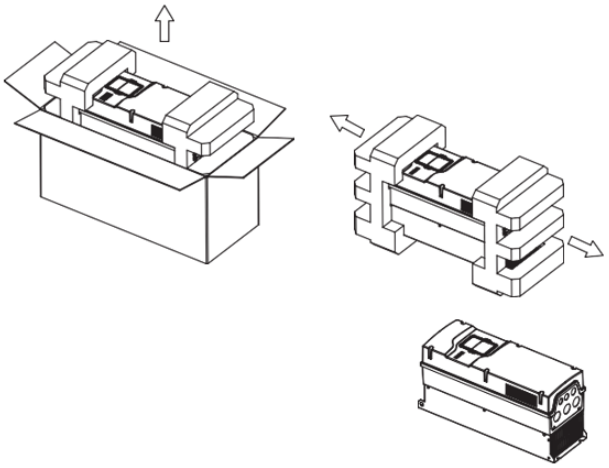


Step 2:

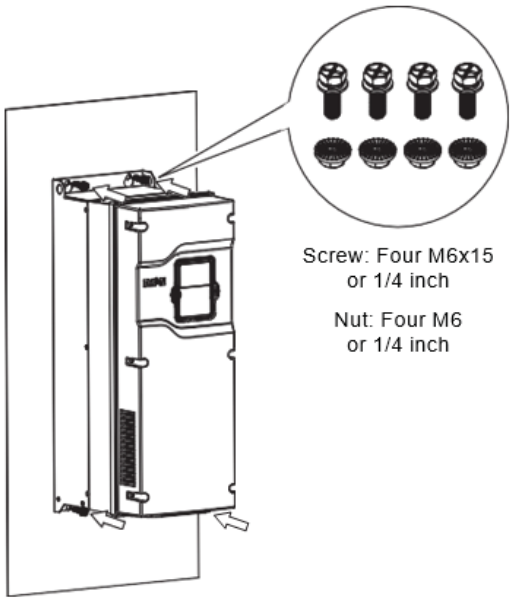


FR3 mounting instructions

Step 1:

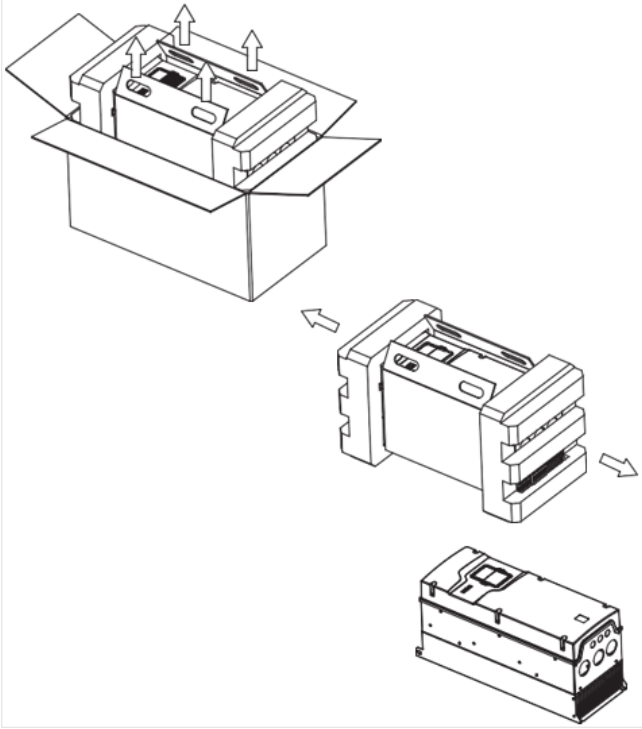


Step 2:

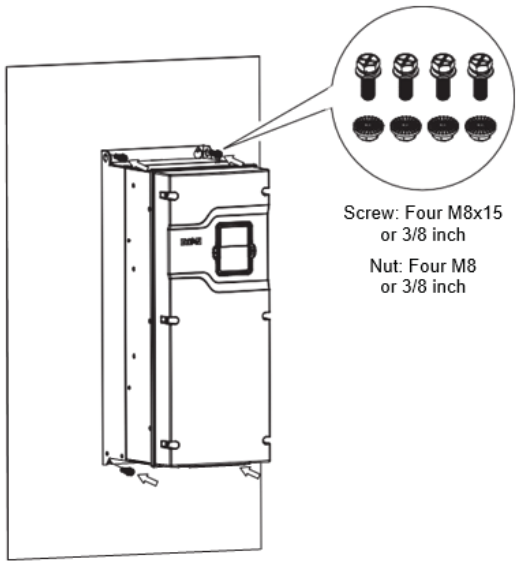


FR4 mounting instructions

Step 1:

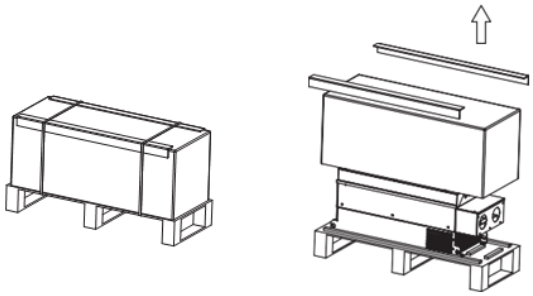


Step 2:

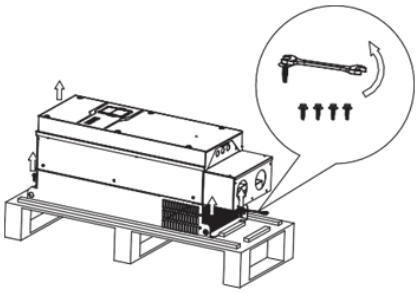


FR5 mounting instructions

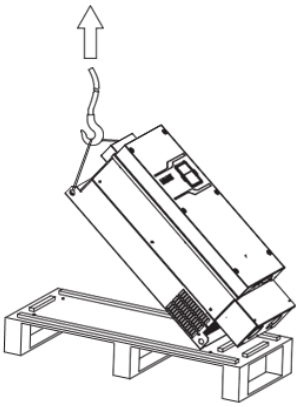
Step 1:



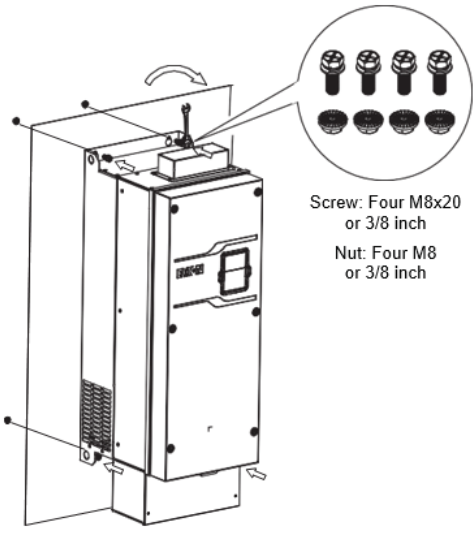
Step 2:



Step 3:



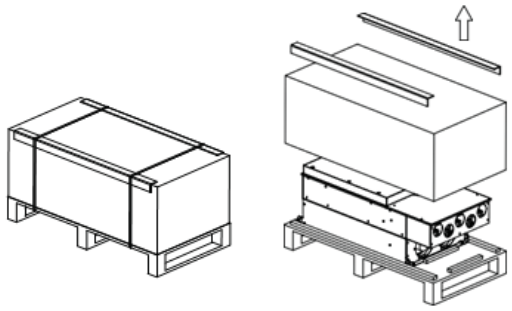
Step 4:



FR6 mounting instructions

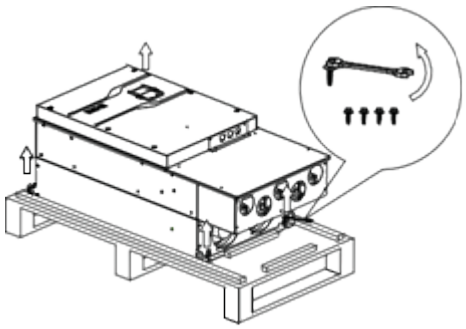
Step 1:

Remove the carton from the drive



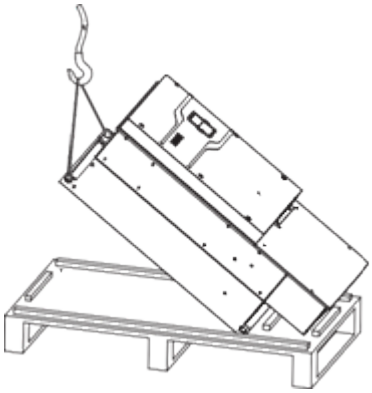
Step 2:

Remove the four screws (used to fix the drive to the pallet) with an M8 or 3/8-inch wrench.



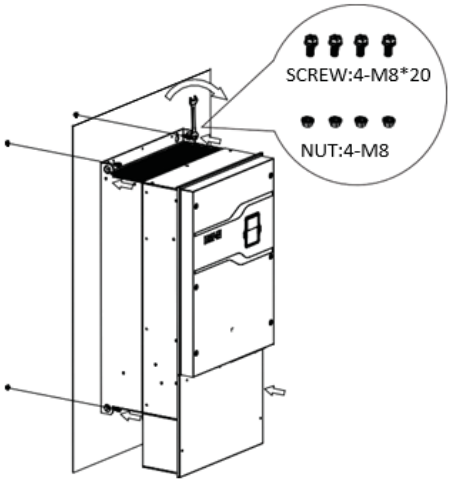
Step 3:

Use a hook to lift the drive.



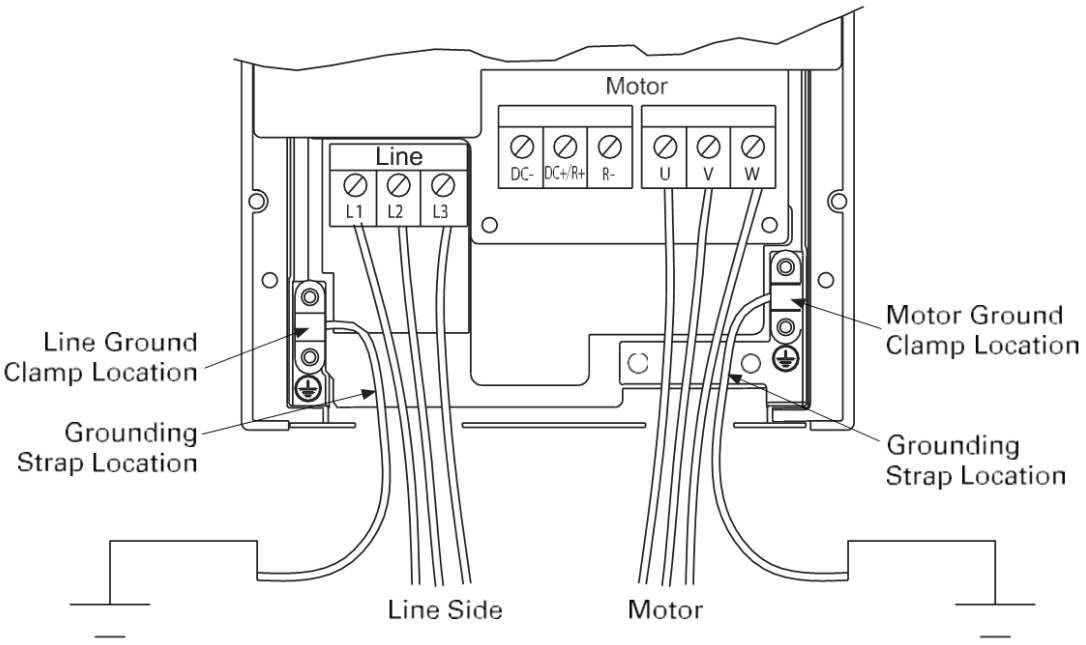
Step 4:

Attach the drive to the mounting plate with four M8x20 or 3/8-inch screws and four M8 or 3/8-inch nuts with an M8 or 2/8-inch wrench. The opening dimensions on the mounting plate should follow required dimensions (refer to the drive mounting template printed on the outside carton).



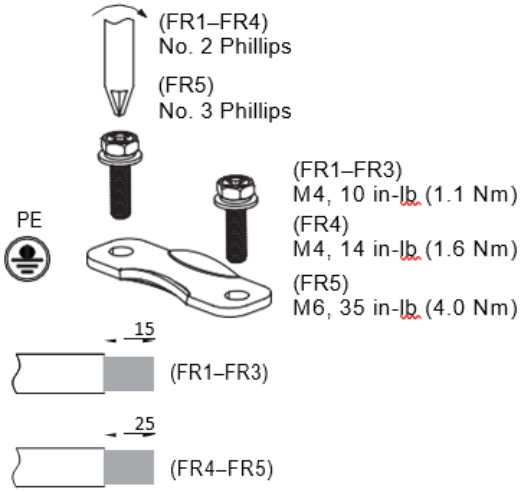
Ground wiring

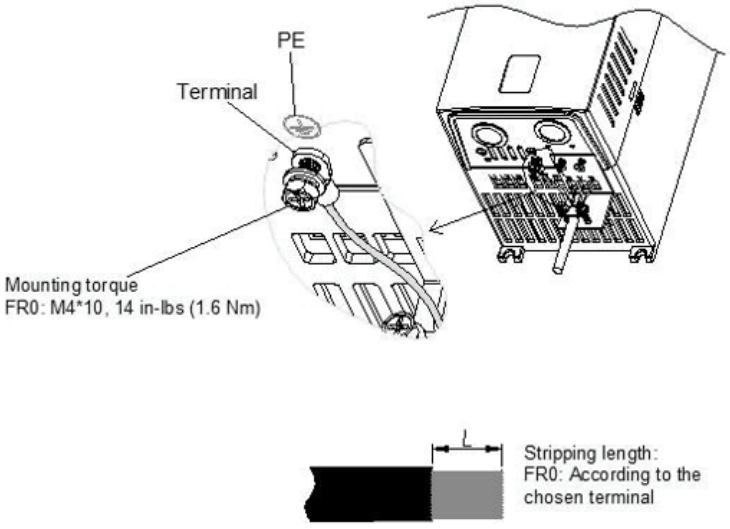
Warning! Connect only in voltage-free state!



Clamp install: For screw torques and wire stripping by frame please see picture

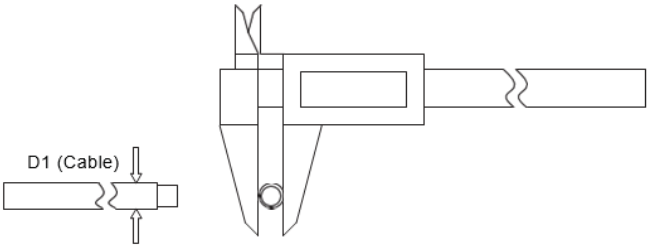
***For FRO only**





Rubber grommet installation instructions

Step 1:



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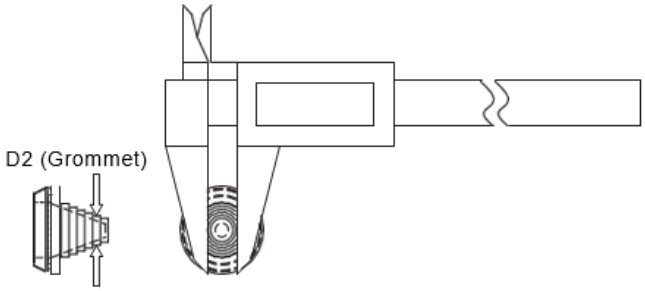
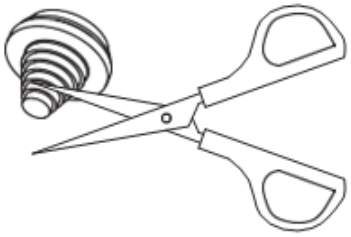
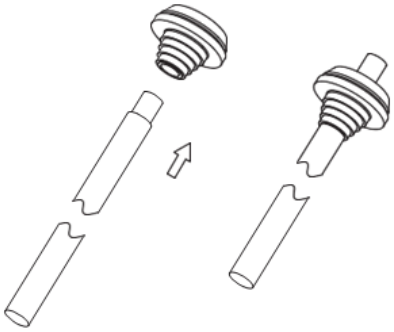


Step 3:

D1 ≤ D2 ≤ D1 + 2 mm



Step 4:



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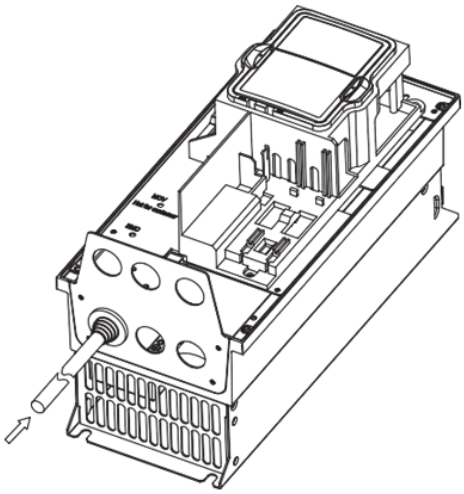

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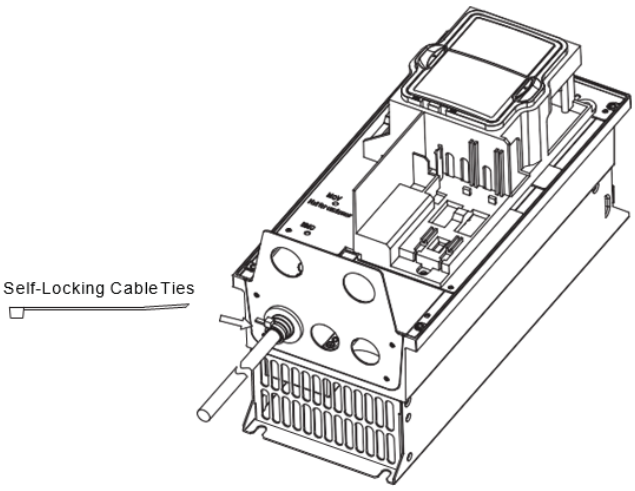
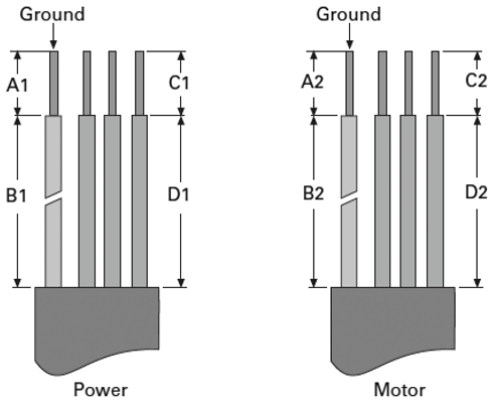


Input power and motor cable stripping lengths



Frame size	Power wiring in inches (mm)				Motor wiring in inches (mm)			
	A1	B1	C1	D1	A2	B2	C2	D2
FR0 @	0.39 (10)	5.12 (130)	0.39 (10)	5.12 (130)	0.39 (10)	3.15 (80)	0.39 (10)	1.97 (50)
FR1	0.39 (10)	1.77 (45)	0.39 (10)	1.38 (35)	0.39 (10)	1.77 (45)	0.39 (10)	1.38 (35)
FR2	0.59 (15)	1.77 (45)	0.59 (15)	1.77 (45)	0.59 (15)	1.57 (40)	0.59 (15)	1.57 (40)
FR3	0.59 (15)	1.57 (40)	0.59 (15)	1.97 (50)	0.59 (15)	1.57 (40)	0.59 (15)	1.97 (50)
FR4	0.98 (25)	2.56 (65)	0.98 (25)	4.72 (120)	0.98 (25)	2.56 (65)	0.98 (25)	4.72 (120)
FR5	1.10 (28)	6.10 (155)	1.10 (28)	9.45 (240)	1.10 (28)	6.10 (155)	1.10 (28)	9.45 (240)
FR6	0.98 (25)	4.72 (120)	0.98 (25)	7.87 (200)	0.98 (25)	4.72 (120)	0.98 (25)	7.87 (200)

Power connection tightening torque

Frame size	Power wire in-lb (Nm)	Ground wire in-lb (Nm)	Control wire in-lb (Nm) @
FR0@	5.3 (0.6)	14 (1.6)	4.5 (0.5)
FR1	5.3 (0.6)	10 (1.1)	4.5 (0.5)
FR2	15.6 (1.8)	10 (1.1)	4.5 (0.5)
FR3	40 (4.5)	10 (1.1)	4.5 (0.5)
FR4	95 (10.7)	14 (1.6)	4.5 (0.5)
FR5	354 (40.0)	35 (4.0)	4.5 (0.5)
FR6	480 (54.2)	35 (4.0)	4.5 (0.5)

Notes:

- Strip the motor and power cables as shown above.
- Both UL and IEC tools may be used
- Applies to strained wire, solid wire, or ferrule installations

Circuit breaker sizing

The circuit breaker selected must be in accordance with the National Electric Code (NEC) requirements. The NEC determines that circuit breakers should handle 80% of their rated capacity for continuous loads and 100% for intermittent loads. NEC Articles 210.20, 215.3, and 430 address the NEC requirements in more detail. For safety reasons, it is recommended to assume all loads are continuous.

To explain the process for finding the minimum breaker size necessary, you do the following:

1. Find your total current load of the circuit (ex: 13.7)
2. Multiply your current load by 1.25 to find your minimum breaker size (ex: 13.7*1.25=17.125)
3. Find the correct breaker to match the size you found in #2. If it is not a standard size, per the NEC, you would select the next standard size up. For our example, we would select a 20A breaker.

Cable and fuse guidelines

North America cable fuse sizes

208 vac to 240 vac ratings

						NEC wire size (AWG)		Terminal connection size (AWG)	
Frame size	208V input current (VT/I_L)	NEC motor amp rating at 230 V	NEC motor amp rating at 208 V	Current (VT/I_L) at 40 °C	Recommended fuse rating [@]	Line and motor	Ground	Line and motor	Ground
FR0 [@]	5.6	4.2	4.6	4.8	10	14	14	26–10	18–10
	7.6	6	6.6	6.6	10	14	14	26–10	18–10
	9	6.8	7.5	7.8	15	14	14	26–10	18–10
FR1	4.4	4.2	4.6	4.8	10	14	14	24–10	18–10
	6.1	6	6.6	6.6	10	14	14	24–10	18–10
	7.2	6.8	7.5	7.8	10	14	14	24–10	18–10
	10.2	9.6	10.6	11	15	14	14	24–10	18–10
	11.6	—	—	12.5	15	12	12	24–10	18–10
FR2	16.3	15.2	16.7	17.5	20	10	10	20–6	12–6
	23.2	22	24.2	25	30	8	10	20–6	12–6
	29	28	30.8	31	35	8	10	20–6	12–6
FR3	44.2	42	46.2	48	60	6	6	6–2	14–4
	56	54	59.4	61	80	4	6	6–2	14–4
FR4	64.6	68	74.8	75	100	3	4	6–1/0	10–1/0
	78	80	88	88	110	2	4	6–1/0	10–1/0
	94.3	104	114	114	125	1/0	3	6–1/0	10–1/0
FR5	129	130	143	143	175	3/0	3	1/0–350 kcmil	8–250 kcmil
	157	154	169	170	200	4/0	3	1/0–350 kcmil	8–250 kcmil
	189	192	211	211	250	300	3	1/0–350 kcmil	8–250 kcmil
FR6	242.8	248	273	261	400	2*2/0	3	2*(1/0–300 kcmil)	3–300 kcmil
	290.3	312	343	312	400	2*4/0	3	2*(1/0–300 kcmil)	3–300 kcmil

Notes:

- Line and motor cable size is selected according to UL 508C table 40.3 for copper conductor rated 75°C. Use only with copper wire rated 75°C here. Size requirements for other different wire types are defined in the National Electrical Code, ANSI/NFPA 70.
- Earthing conductor size is determined by the maximum overcurrent device rating used ahead of the drive according to UL 508C Table 6.4.
- If power cubes or bypass are used, a UL listed class RK5, J, T or equivalent fuse is recommended.

International cable and fuse sizes

208 vac to 240 vac ratings

Frame size	Amp suffix	208 V input current (VT/I_L)	Current (VT/I_L) at 40°C	Fuse rating (gG/gL)[2]	Mains and motor cable Cu (mm^2)	Terminal cable size	
						Main terminal Cu (mm^2)	Earth terminal Cu (mm^2)
FR0[1]	4D8	5.6	4.8	10	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
	6D6	7.6	6.6	10	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
	7D8	9	7.8	16	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
FR1	4D8	4.4	4.8	6	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
	6D6	6.1	6.6	10	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
	7D8	7.2	7.8	16	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
	011	10.2	11	16	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
	012	11.6	12.5	16	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
FR2	017	16.3	17.5	20	3*4+4	0.5–16	4–16
	025	23.2	25	32	3*4+4	0.5–16	4–16
	031	29	31	32	3*6+6	0.5–16	4–16
FR3	048	44.2	48	50	3*16+16	16–35	2.5–25
	061	56	61	63	3*16+16	16–35	2.5–25
FR4	075	64.6	75	80	3*25+16	16–50	6–50
	088	78	88	100	3*35+16	16–50	6–50
	114	94.3	114	125	3*50+25	16–50	6–50
FR5	143	129	143	160	3*70+35	50–185	10–120
	170	157	170	200	3*95+50	50–185	10–120
	211	189	211	250	3*150+95	50–185	10–120
FR6	261	242.8	261	400	2*(3*70+35)	2*(50–150)	35–150
	312	290.3	312	400	2*(3*95+50)	2*(50–150)	35–150

Notes:

- Line and motor cable size is selected according to IEC 60364-5-52:2009 Table B.52.4 for copper conductor with PVC insulation with a wiring condition of ambient temperature 30 °C in air and an installation method of "B2" (cables in conduit and cable trunking systems). For other wiring conditions, please refer to the standard of IEC 60364-5-52:2009 for suitable cable sizes.
- Earthing conductor size is determined by the cross-sectional area of phase conductors according to IEC/EN 61800-5-1:2007 Table 5. So, if phase conductor size is changed, earthing conductor size should also be changed accordingly.
- If power cubes or bypass are used, a Class gG/gL fuse is recommended.

North America cable and fuse sizes

440 vac to 500 vac ratings

Frame size	Amp suffix	Input current (VT/I_L)	NEC motor amp rating at 460 V	Current (VT/I_L) at 40 °C	Recommended fuse rating [@]	Line and motor	Ground	Line and motor	Ground
FR0 [@]	3D3	3.8	3	3	10	14	14	26–10	18–10
	4D3	4.3	3.4	3.4	10	14	14	26–10	18–10
	5D6	6	4.8	4.8	10	14	14	26–10	18–10
	7D6	9.6	7.6	7.6	15	14	14	26–10	18–10
FR1	3D3	2.8	3	3	10	14	14	26–10	18–10
	4D3	3.2	3.4	3.4	10	14	14	26–10	18–10
	5D6	4.5	4.8	4.8	10	14	14	26–10	18–10
	7D6	7.1	7.6	7.6	10	14	14	26–10	18–10
	9D0	8.4	—	7.6	15	14	14	26–10	18–10
	012	10.2	11	11	15	14	14	26-10	18–10
FR2	016	13	14	14	20	12	12	20–6	12–6
	023	19.6	21	21	30	10	10	20–6	12–6
	031	25.2	27	27	35	8	8	20–6	12–6
FR3	038	31.7	34	34	50	6	8	6–2	14–4
	046	37	40	40	60	6	8	6–2	14–4
	061	48.1	52	52	80	4	6	6–2	14–4
FR4	072	59.3	65	65	100	4	4	6–1/0	10–1/0
	087	70.3	77	77	110	3	4	6–1/0	10–1/0
	105	87.6	96	96	125	1	3	6–1/0	10–1/0
FR5	140	114.4	124	124	175	2/0	3	1/0–350 kcmil	8–250 kcm
	170	144	156	156	200	3/0	3	1/0–350 kcmil	8–250 kcm
	205	166.1	180	180	250	250 kcmil	3	1/0–350 kcmil	8–250 kcm
FR6	261	226.4	240	240	400	2*2/0	3	2*(1/0–300 kcmil)	3–300 kcm
	310	284.9	302	302	400	2*4/0	3	2*(1/0–300 kcmil)	3–300 kcm

Notes:

- Line and motor cable size is selected according to UL 508C Table 40.3 for copper conductor rated 75 °C. Use only with copper wire rated 75 °C here. Size requirements for other different wire types are defined in the National Electrical Code, ANSI/N F PA 70.
- Earthing conductor size is determined by the maximum overcurrent device rating used ahead of the drive according to UL 508C Table 6.4.
- If power cubes or bypass are used, a UL listed Class RK5, J, T or equivalent fuse is recommended.

International cable and fuse sizes

380 vac to 440 vac ratings

Frame size	Amp suffix	400 V input current (VT/I_L)	Current (VT/I_L) at 40 °C	Fuse rating (gG/gL) [@]	Terminal cable size		
					Mains and motor cable Cu (mm^2)	Main terminal Cu (mm^2)	Earth terminal Cu (mm^2)
FR0 [@]	3D3	4.3	3.3	6	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
	4D3	5.5	4.3	10	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
	5D6	7.1	5.6	10	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
	7D6	9.6	7.6	16	3*1.5+1.5	0.2–6 solid or 0.2–4 stranded	0.75–6
FR1	3D3	3.1	3.3	6	3*1.5+1.5	0.2–6 solid or 0.2- 4 standard	0.75–6
	4D3	4	4.3	6	3*1.5+1.5		0.75–6
	5D6	5.2	5.6	10	3*1.5+1.5		0.75–6
	7D6	7.1	7.6	16	3*1.5+1.5		0.75–6
	9D0	8.4	9	16	3*1.5+1.5		0.75–6
	012	11.2	12	16	3*1.5+1.5		0.75–6
FR2	016	15	16	20	3*4+4	0.5–16	4–16
	023	21.5	23	25	3*4+4	0.5–16	4–16
	031	29	31	32	3*6+6	0.5–16	4–16
FR3	038	35.2	38	40	3*16+16	16–35	2.5–25
	046	42.6	46	50	3*16+16	16–35	2.5–25
	061	55.7	61	63	3*16+16	16–35	2.5–25
FR4	072	65.7	72	80	3*25+16	16–50	6–50
	087	79.4	87	100	3*35+16	16–50	6–50
	105	97	105	125	3*50+25	16–50	6–50
FR5	140	129	140	160	3*70+35	50–185	10–120
	170	157	170	200	3*95+50	50–185	10–120
	205	189	205	250	3*120+70	50–185	10–120
FR6	261	246.2	261	400	2*(3*70+35)	2*(50–150)	35–150
	310	292.4	310	400	2*(3*95+50)	2*(50–150)	35–150

Notes:

- Line and motor cable size is selected according to IEC 60364-5-52:2009 Table B.52.4 for copper conductor with PVC insulation with a wiring condition of ambient temperature 30 °C in air and an installation method of "B2" (cables in conduit and cable trunking systems). For other wiring conditions, please refer to the standard of IEC 60364-5-52:2009 for suitable cable sizes.
- Earthing conductor size is determined by the cross-sectional area of phase conductors according to IEC/EN 61800-5-1:2007 Table 5. So, if phase conductor size is changed, earthing conductor size should also be changed accordingly.
- If power cubes or bypass are used, a Class gG/gL fuse is recommended.

North America cable and fuse sizes

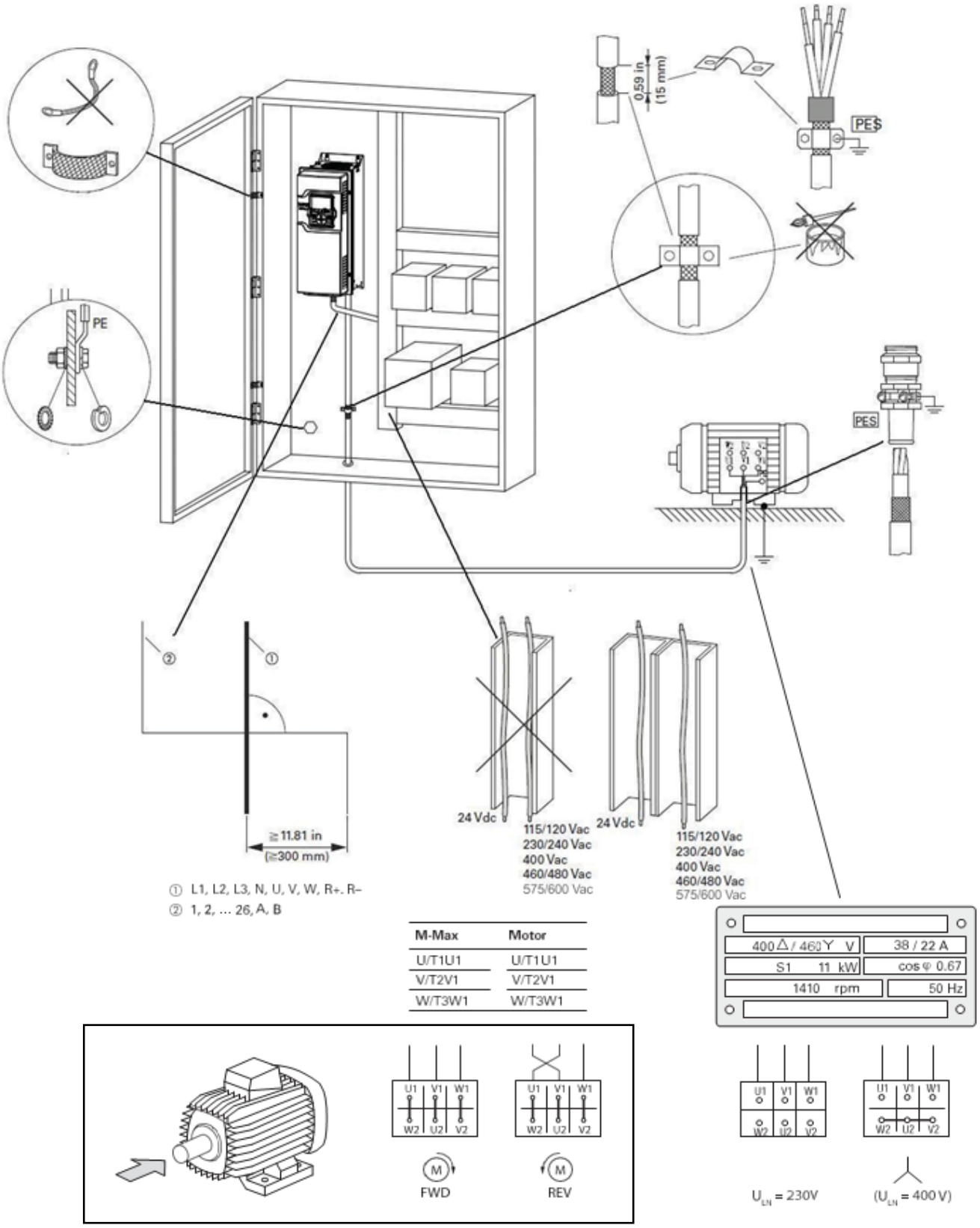
525 vac to 600 vac ratings

Frame size	Amp suffix	575 V input current (VT/I_L)	NEC motor amp rating at 575 V	Current (VT/I_L) at 40 °C	Recommended fuse rating ®	NEC wire Size (AWG)		Terminal connection size (AWG)	
						Line and motor	Ground	Line and motor	Ground
FR1	4D5	4.2	3.9	4.5	10	14	14	26–10	18–10
	7D5	7	6.1	7.5	10	14	12	26–10	18–10
	010	9.3	9	10	15	14	10	26–10	18–10
FR2	013	12.5	11	13.5	20	12	10	20–6	12–6
	018	16.7	17	18	30	10	10	20–6	12–6
	022	20.4	22	22	35	10	8	20–6	12–6
FR3	027	25.2	27	27	40	6	8	6–2	14–4
	034	31.7	32	34	45	6	8	6–2	14–4
	041	38.2	41	41	50	6	6	6–2	14–4
FR4	052	48.1	52	52	70	4	6	6–1/0	10–1/0
	062	57.4	62	62	80	4	6	6–1/0	10–1/0
	080	73	77	80	125	2	4	6–1/0	10–1/0
FR5	100	91.3	99	100	150	1/0	4	1/0–350 kcmil	8–250 kcmil
	125	114.1	125	125	175	2/0	4	1/0–350 kcmil	8–250 kcmil
	144	132.9	144	144	200	3/0	4	1/0–350 kcmil	8–250 kcmil
FR6	208	202.8	192	208	400	2*1/0	3	2*(1/0–300 kcmil)	3–300 kcmil
	250	243.8	242	250	400	2*2/0	3	2*(1/0–300 kcmil)	3–300 kcmil

Notes:

- Line and motor cable size is selected according to UL 508C Table 40.3 for copper conductor rated 75 °C. Use only with copper wire rated 75 °C here. Size requirements for other different wire types are defined in the National Electrical Code, ANSI/NFPA 70.
- Earthing conductor size is determined by the maximum overcurrent device rating used ahead of the drive according to UL 508C Table 6.4.
- If power cubes or bypass are used, a UL listed Class RK5, J, T or equivalent fuse is recommended.

Drive to motor connection panel mount

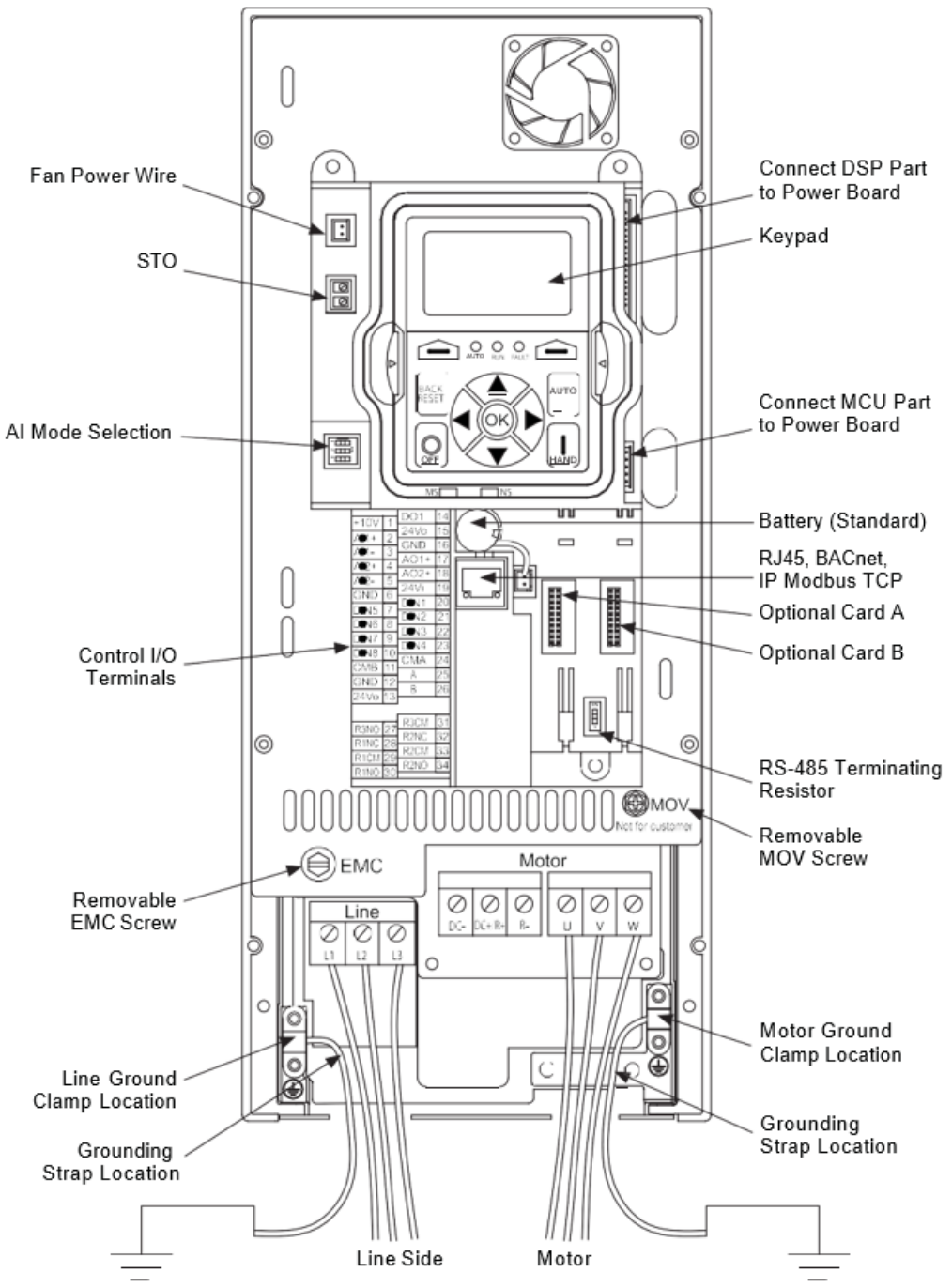


Verifying rotation

When starting the compressor up for the first time, verify it is running in the correct direction. For pumps or compressors, verify your discharge pressure starts to increase and your suction decreases. For fans, make sure it is blowing air in the correct direction. If it is running in reverse, please see the box in the above diagram.

Step 3—Control board layout

+10V	1	DO1	14
AI1+	2	24Vo	15
AI1•	3	GND	16
AI2+	4	AO1+	17
AI2•	5	AO2+	18
GND	6	24Vi	19
DIN5	7	DIN1	20
DIN6	8	DIN2	21
DIN7	9	DIN3	22
DIN8	10	DIN4	23
CMB	11	CMA	24
GND	12	A	25
24Vo	13	B	26
R3NO	27	R3CM	31
R1NC	28	R2NC	32
R1CM	29	R2CM	33
R1NO	30	R2NO	34



Default

	OFF	ON
AI1: 0 to 10 V	1	
AI2	2	
AI2	3	

AI1: 0 to 20 mA

OFF	ON
2	
3	

AI2: 0 to 20 mA

OFF	ON
2	
3	

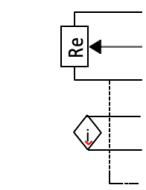
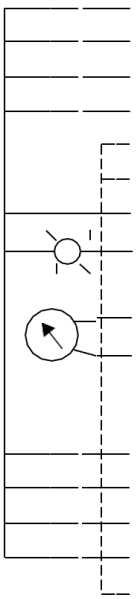
AI2: 0 to 10 V

OFF	ON
2	
3	

AI2: –10 V to +10 V

Factory-set control terminal functions

I/O Connection

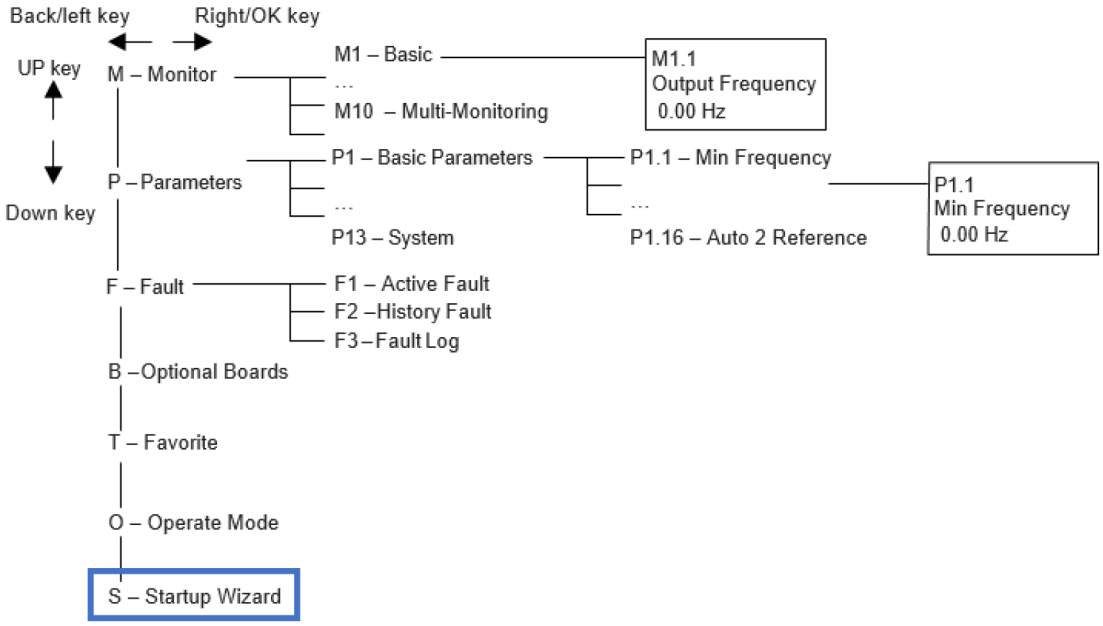
External wiring	Pin	Signal name	Signal	Default setting	Description
	1	+10 V	Ref. Output Voltage	—	10 Vdc Supply Source
	2	AI1+[G)]	Analog Input 1	0–10 V	Voltage Speed Reference (Programmable to 4 mA to 20 mA)
	3	AI1–	Analog Input 1 Ground	—	Analog Input 1 Common (Ground)
	4	AI2+[G)]	Analog Input 2	4 mA to 20 mA	Current Speed Reference (Programmable to 0–10 V)
	5	AI2–	Analog Input 2 Ground	—	Analog Input 2 Common (Ground)
	6	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
	7	DIN5	Digital Input 5	Preset Speed B0	Sets frequency output to Preset Speed 1
	8	DIN6	Digital Input 6	Preset Speed B1	Sets frequency output to Preset Speed 2
	9	DIN7	Digital Input 7	Emergency Stop (TI–)	Input forces VFD output to shut off
	10	DIN8	Digital Input 8	Force Remote (TI+)	Input takes VFD from Local to Remote
	11	CMB	DI5 to DI8 Common	Grounded	Allows source input
	12	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
	13	24 V	+24 Vdc Output	—	Control voltage output (100 mA max.)
	14	DO1	Digital Output 1	Ready	Shows the drive is ready to run
	15	24 Vo	+24 Vdc Output	—	Control voltage output (100 mA max.)
	16	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
	17	AO1+	Analog Output 1	Output Frequency	Shows Output frequency to motor 0–60 Hz (4 mA to 20 mA)
	18	AO2+	Analog Output 2	Motor Current	Shows Motor current of motor 0–FLA (4 mA to 20 mA)
	19	24 Vi	+24 Vdc Input	—	External control voltage input
	20	DIN1	Digital Input 1	Run Forward	Input starts drive in forward direction (start enable)
	21	DIN2	Digital Input 2	Run Reverse	Input starts drive in reverse direction (start enable)
	22	DIN3	Digital Input 3	External Fault	Input causes drive to fault
	23	DIN4	Digital Input 4	Fault Reset	Input resets active faults
	24	CMA	DI1 to DI4 Common	Grounded	Allows source input
	25	A/+	RS-485 Signal A	—	Fieldbus Communication (Modbus, BACnet)
	26	B/-	RS-485 Signal B	—	Fieldbus Communication (Modbus, BACnet)
	27	R3NO	Relay 3 Normally Open	At Speed	Relay output 3 shows VFD is at Ref. Frequency
	28	R1NC	Relay 1 Normally Closed	Run	Relay output 1 shows VFD is in a run state
	29	R1CM	Relay 1 Common		
	30	R1NO	Relay 1 Normally Open		
	31	R3CM	Relay 3 Common	at Speed	Relay output 3 shows VFD is at Ref. Frequency
	32	R2NC	Relay 2 Normally Closed	Fault	Relay output 2 shows VFD is in a fault state
	33	R2CM	Relay 2 Common		
	34	R2NO	Relay 2 Normally Open		

Notes:

- The above wiring demonstrates a SINK configuration. It is important that CMA and CMB are wired to ground (as shown by dashed line). If a SOURCE configuration is desired, wire 24 V to CMA and CMB and close the inputs to ground. When using the +10 V for AI1, it is important to wire AI1—to ground (as shown by dashed line). If using +10 V for AI1 or AI2, terminals 3, 5, and 6 need to be jumpered together.
- AI1+ and AI2+ block that it can support 10K potentiometer.

Step 4 —startup and setup of drive

Main menu navigation for startup



Startup Wizard

In the Startup Wizard, you will be prompted for essential information needed by the drive so that it can start controlling your process. In the wizard, you will need the following keypad buttons:

Up/Down buttons
Use these to change value

OK button
Confirm selection and enter into next question

Back/Reset button
If this was pressed at the first question, the Startup Wizard will be cancelled.

Once you have connected power to your Copeland EVM frequency converter, and the Startup Wizard is enabled. Follow these instructions to easily set up your device.

Startup Wizard instructions

For any further explanations of the below items please see Copeland AE bulletin AE-1466. Information for Items 6-13 can be found in Copeland mobile or OPI for the specific compressor model. For general motors, on the nameplate.

Item	Description	
1	Startup Wizard	Press OK?
2	Application	0=Basic 1 = PID 2 = Advanced
3	Language	0 = English 1 = 2 = Deutsch
4	Real Time Clock	yy.mm.dd hh:mm:ss
5	Daylight Saving	0 = Off 1 = EU 2 = US
6	Min Frequency	Min: 0.00Hz Max: Max Frequency
7	Max Frequency	Min: Min Frequency Max: 400.00Hz
8	Motor Nom Current	Min: 0.1A Max: 500.0A
9	Current Limit	Min: Ih*1/10 Max: Ih*2
10	Motor Nom Speed	Min: Ih*1/10 Max: Ih*2
11	Motor PF	Min: 0.30 Max: 1.0
12	Motor Nom Voltage	Min: 180V Max: 690V
13	Motor Nom Frequency	Min: 30.00 Hz Max: 400.00 Hz
14	Accel Time 1	Min: 0.1 sec Max:3000.0 sec
15	Decel Time 1	Min: 0.1 sec Max:3000.0 sec
16	Hand Control Place	0=Keypad 1 = I/O Terminal Start 1 2 = I/O Terminal Start 2 3 = Fieldbus
17	Hand Reference	0 = AI1 1 = AI2 2 = Slot A: AI1 3 = Slot B: AI1 4 = AI1 Joystick 5 = AI2 Joystick 6 = Keypad 7 = Fieldbus 9 = Max Frequency 10 = AI1 + AI2 11 = AI1 –AI2 12 = AI2 –AI1 13 = AI1 * AI2 14 = AI1 or AI2 15 = Min(AI1,AI2) 16 = Max(AI1,AI2) 17 = PID1 Control Output 18 = PID2 Control Output
18	Auto 1 Control Place	0 = I/O Terminal Start 1 1 = Fieldbus 2 = I/O Terminal Start 2 3 = Keypad
19	Auto 1 Control Reference	0 = AI1 1 = AI2 2 = Slot A: AI1 3 = Slot B: AI1 4 = AI1 Joystick 5 = AI2 Joystick 6 = Keypad 7 = Fieldbus 9 = Max Frequency 10 = AI1 + AI2 11 = AI1 –AI2 12 = AI2 –AI1 13 = AI1 * AI2 14 = AI1 or AI2 15 = Min(AI1,AI2) 16 = Max(AI1,AI2) 17 = PID1 Control Output 18 = PID2 Control Output
20	Bypass Enabled	0 = Disabled 1 = Enabled
21	Application Mini-Wizard	Press OK?

Now the Startup Wizard is done. It wont show again on the next power up. If you want to reset it, please set the startup Wizard (P13.1.17) or select it from the main menu screen to enable and cycle the power to the drive.

About Copeland

Copeland is a global leader in sustainable heating, cooling, refrigeration and industrial solutions. We help commercial, industrial, refrigeration and residential customers reduce their carbon emissions and improve energy efficiency. We address issues like climate change, growing populations, electricity demands and complex global supply chains with innovations that advance the energy transition, accelerate the adoption of climate friendly low GWP (Global Warming Potential) and natural refrigerants, and safeguard the world's most critical goods through an efficient and sustainable cold chain. We have over 18,000 employees, with feet on the ground in 50 countries - a global presence that makes it possible to serve customers wherever they are in the world and meet challenges with scale and speed. Our industry-leading brands and diversified portfolio deliver innovation and technology proven in over 200 million installations worldwide. Together, we create sustainable solutions that improve lives and protect the planet today and for future generations. For more information, visit copeland.com.

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