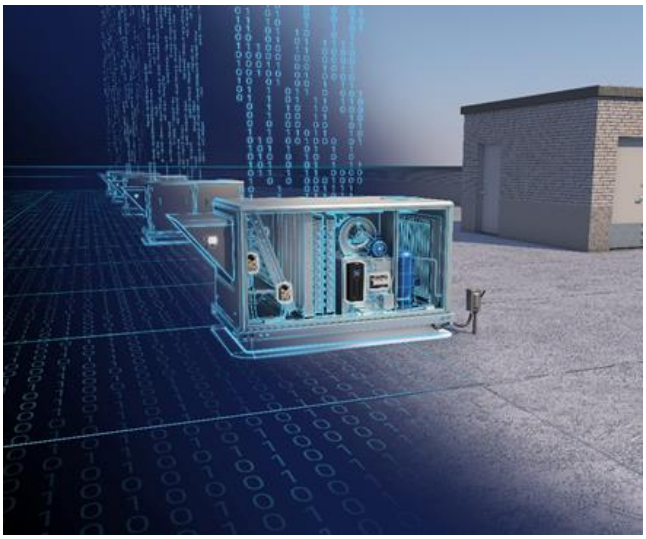
SIEMENS



Climatix VFD

Installation Instructions

A6V12282655

2021-03-02

Smart Infrastructure

Table of Contents

Legal notes

Legal note concept

This guide includes notes that must be followed to prevent damage to property.

Notes dealing only with damage to property use the signal word **NOTICE** and an exclamation point. They are depicted as follows:

!	***NOTICE***
	Type and source of hazard Consequences in the event the hazard occurs Measures/prohibitions to prevent the hazard

Qualified personnel

Only qualified personnel may commission the device/system. In this regard, qualified personnel have the training and experience necessary to recognize and avoid risks when working with this device/system.

Proper use

The device/system described here may only be used on building technical plants and for the described applications only.

The trouble-free and safe operation of the device/system described here requires proper transportation, correct warehousing, mounting, installation, commissioning, operation, and maintenance.

You must comply with permissible ambient conditions. You must comply with the information provided in the *Technical Requirements* Section and any notes in the associated documentation.

Fuses, switches, wiring and grounding must comply with local safety regulations for electrical installations. Observe all local and currently valid laws and regulations.

Exemption from liability

The content of this document was reviewed to ensure it matches the hardware and firmware described herein. Deviations cannot be precluded, however, so that we cannot guarantee that the document matches in full the actual device/system. The information provided in this document is reviewed on a regular basis and any required corrections are added to the next edition.

PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.

DANGER

- ☑ Disconnect AC input power before connecting any wiring to the AC motor drive.
- ☑ There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. Take anti-static measures before touching these components or the circuit boards. These components are especially sensitive to static electricity. Please do not touch these components or the circuit boards before taking anti-static measures.
- ☑ Never modify the internal components or wiring.
- ☑ Ground the AC motor drive by using the ground terminal. The grounding method must comply with the laws of the country where the AC motor drive is to be installed.
- ☑ DO NOT install the AC motor drive in a place subjected to high temperature, direct sunlight and inflammables.

CAUTION

- ☑ Never connect the AC motor drive output terminals U/T1, V/T2 and W/T3 directly to the AC mains circuit power supply.
- ☑ After finishing the wiring of the AC motor drive, check if U/T1, V/T2 and W/T3 are short-circuited to ground with a multimeter. Do NOT power the drive if short circuits occur. Eliminate the short circuits before the drive is powered.
- ☑ Rated voltage of power system to install motor drives is as below, make sure that the installation voltage is within the ranges mentioned below while installing the motor drives:
  For 115V models, the range is between 85–132 V.
  For 230V models, the range is between 170–264 V.
  For 460V models, the range is between 323–528 V.
  For 575V models, the range is between 425V–660V.
- ☑ Refer to the table below for short circuit rating:

Model (Power)	Short circuit rating
115V	5 kA
230V	5 kA
460V	5 kA
575V	5 kA

- ☑ Only qualified persons are allowed to install, wire and maintain the AC motor drives.
- ☑ Even if the three-phase AC motor is stopped, a charge with hazardous voltages may still remain in the main circuit terminals of the AC motor drive.
- ☑ The performance of electrolytic capacitor will degrade if it is not charged for a long time. It is recommended to charge the drive which is stored in no charge condition every 2 years for 3–4 hours to restore the performance of electrolytic capacitor in the motor drive.
  Note: When power up the motor drive, use adjustable AC power source (ex. AC autotransformer) to charge the drive at 70%–80% of rated voltage for 30 minutes (do not run the motor drive). Then charge the drive at 100% of rated voltage for an hour (do not run the motor drive). By doing these, restore the performance of electrolytic

- The figures in this instruction are only for reference and may be slightly different depending on your model, but it will not affect your customer rights.

Overview

This document is intended for Installers and Technicians using the Climatix VFD.

The instructions in this document will cover how to install and connect the Climatix VFD. See *Climatix VFD User Guide* (A6V12384673) for additional information.

Before you start

Upon receipt of your Climatix VFD please take the following precautions:

1. Inspect your VFD to ensure it was not damaged during shipment. Verify the part number printed on the package matches the part indicated on the nameplate.
2. Ensure the mains voltage is within the range indicated on the nameplate. Install the AC motor drive according to the instructions in this manual.
3. Before applying power, ensure that all devices, including mains power, motor, control board and digital keypad, are correctly connected.

Tools Required

To install the Climatix VFD you will need the following:

- Flat-blade screwdrivers
- Wire Strippers
- Tape Measure
- Drill
- Mounting hardware: Screws, or nuts and bolts (four each)

Climatix VFD

The Climatix VFD is designed for use in rooftop applications (up to 20 tons) and provides basic functionality and features with simplified commissioning and monitoring when used in conjunction with the Climatix RTU Solution.

Topology

The Climatix VFD is designed for use with the Climatix RTU Solution. To leverage the full benefits of the VFD design connect the VFD to the controller as shown below. In the RTU solution external I/O devices should be connected to the Climatix controller to take advantage of the remote monitoring functionality available in Climatix IC.

After installing and connecting the VFD, users utilizing the Climatix RTU Solution should download the Climatix Mobile App to proceed with commissioning. If using the VFD as a standalone drive or when connecting to a third party controller, see the *Climatix VFD User Guide* for commissioning assistance.

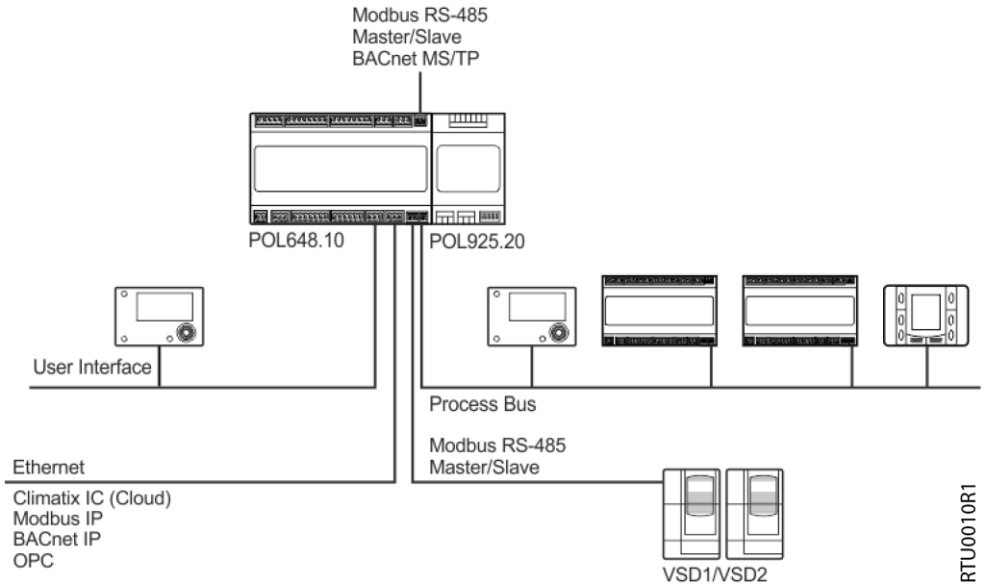


Fig. 1: Climatix RTU Solution Topology.

Installation

When mounting the Climatix VFD, follow these precautions:

- Prevent fiber particles, scraps of paper, shredded wood, sawdust, metal particles, and so on from adhering to the heat sink.
- Install the drive in a metal cabinet. When installing one drive below another, use a metal separator between drives to prevent mutual heating and to prevent the risk of fire.
- Install the VFD in a Pollution Degree 2 environment with clean, circulating air. A clean, circulating environment means air without pollution substances and dust.
- Mount the drive in an IP54 cabinet to maintain the Pollution Degree 2 rating or in a pollution-controlled environment.
- When installing the VFD in a Pollution Degree 2 (IEC/EN 60664-1) environment, only nonconductive pollution occurs for the electrical equipment in the cabinet and thermostatic chamber and temporary conductivity caused by condensation is expected.

The minimum clearances are shown below. Failure to follow the minimum mounting clearances may cause the fan to malfunction and cause heat dissipation problems.

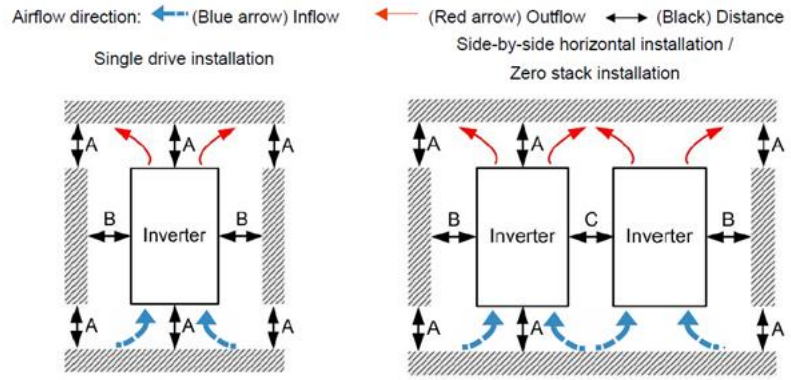


Fig. 2: Required Mounting Clearances.

Installation method	A [mm]	B [mm]	C [mm]	Ambient temperature (°C)	
				Max. (Without derating)	Max. (derating)
Single drive installation	50	30	-	50	60
Side-by-side horizontal installation	50	30	30	50	60
Zero stack installation	50	30	0	40	50

Wiring

Follow these precautions prior to wiring the VFD:

DANGER	**Turn off the AC motor drive power** before doing any wiring. A charge with hazardous voltages may remain in the DC bus capacitors even after the power has been turned off for a short time. Measure the remaining voltage with a DC voltmeter on +1/DC+ and DC- before doing any wiring. For your safety, do not start wiring before the voltage drops to a safe level (less than 25 Vdc). Installing wiring with a residual voltage may cause personal injury, sparks and a short circuit. Only qualified personnel familiar with AC motor drives are allowed to perform installation, wiring and commissioning. Ensure the power is turned off before wiring to prevent electric shock. Ensure that power is only applied to the R/L1, S/L2, and T/L3 terminals. Failure to comply may result in damage to the equipment. The voltage and current must be in the range indicated on the nameplate (see the Climatix VFD User Guide, *Nameplate Information* for details). All units must be grounded directly to a common ground terminal to prevent damage from a lightning strike or electric shock and reduce noise interference. Tighten the screws of the main circuit terminals to prevent sparks caused by screws loosened due to vibration.
CAUTION	For your safety, choose wires that comply with local regulations when wiring. Check the following items after finishing the wiring: Are all connections correct? Are there any loose wires? Are there any short circuits between the terminals or to ground?

Removing the front cover

Press the clip on both sides, and then remove the cover by rotating it upwards.

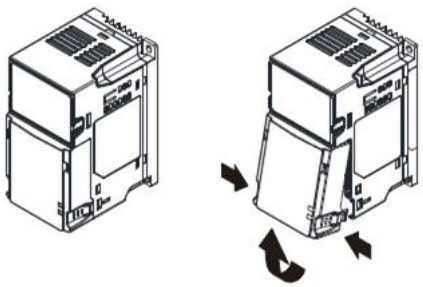


Fig. 3: Removing the Front Cover.

Climatix VFD Wiring Overview

When using the Climatix RTU Solution, connect I/O such as sensors and other devices directly to the Climatix controller to enable remote monitoring in the Climatix IC. To connect I/O directly to the VFD or to utilize optional VFD accessories, see the *Climatix VFD User Guide* (A6V12384673) for additional instructions. For an overview of Climatix VFD wiring, see Figure 4: RTU Wiring Diagram. For a detailed drawing see Figure 5: VFD Main Circuit and Control Wiring Diagram.

Connect the VFD to the Climatix RTU Solution as follows:

1. Connect the VFD to Supply power [R/L1, S/L2, T/L3] using the recommended protected circuit.
2. Connect the motor to the VFD [U, V, W].
3. Connect to the controller using Modbus RS-485 [SGND, SG+, SG-] to your Climatix Controller.
4. To enable Safe Torque Off (STO) functionality, remove the STO Jumper [+24V, S1, S2] and install the STO equipment. See the *Climatix VFD User Guide* (A6V12384673) for additional information.

RTU Wiring Diagram

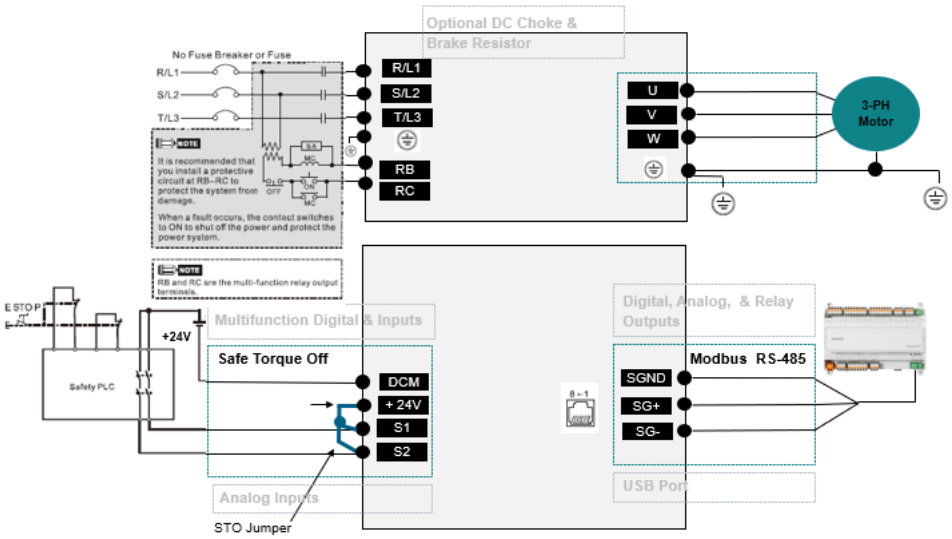


Fig. 4: RTU Wiring Diagram.

VFD Main Circuit and Control Wiring Diagram

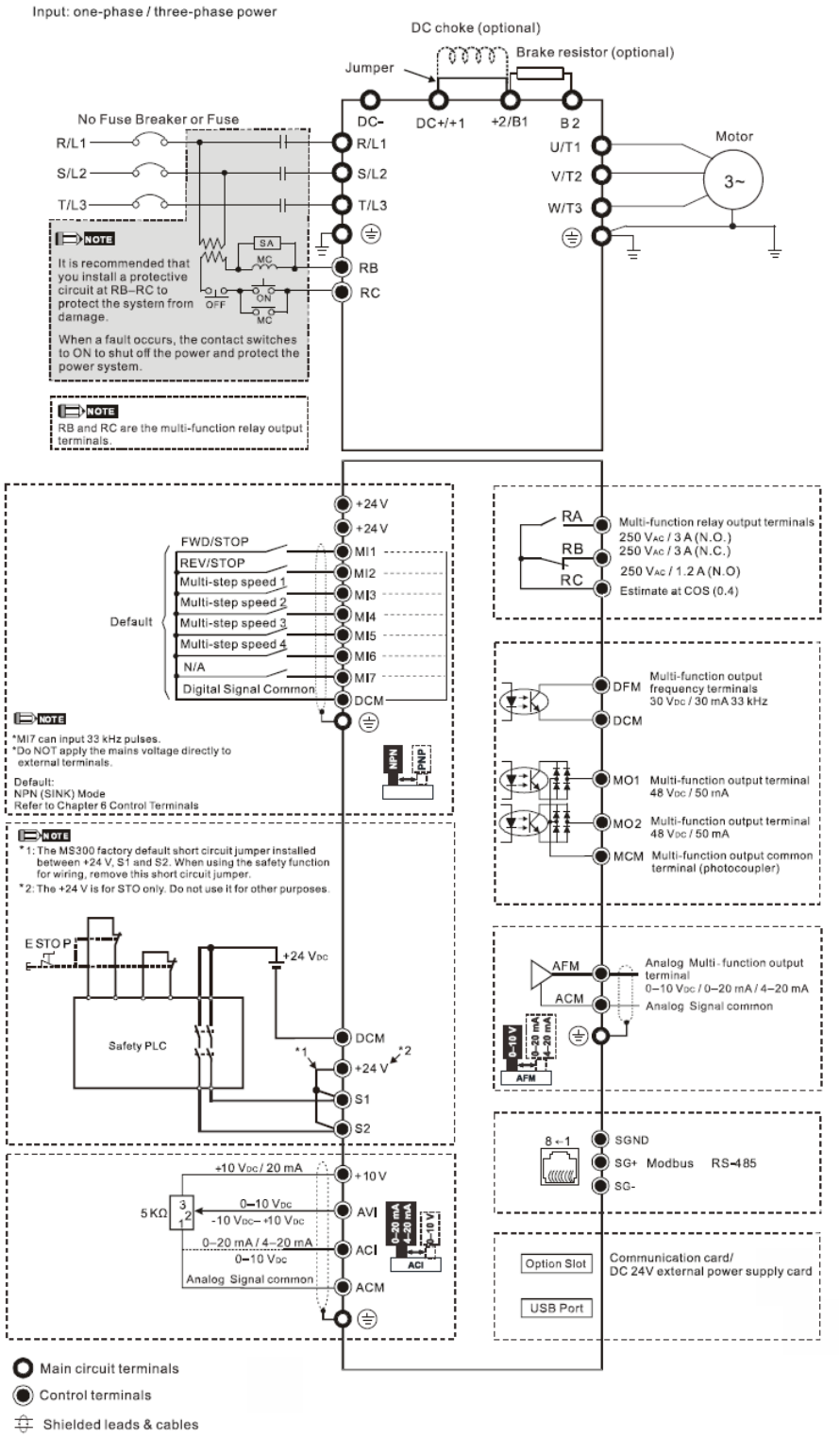


Fig. 5: VFD Main Circuit and Control Wiring Diagram.

Main Circuit Diagram

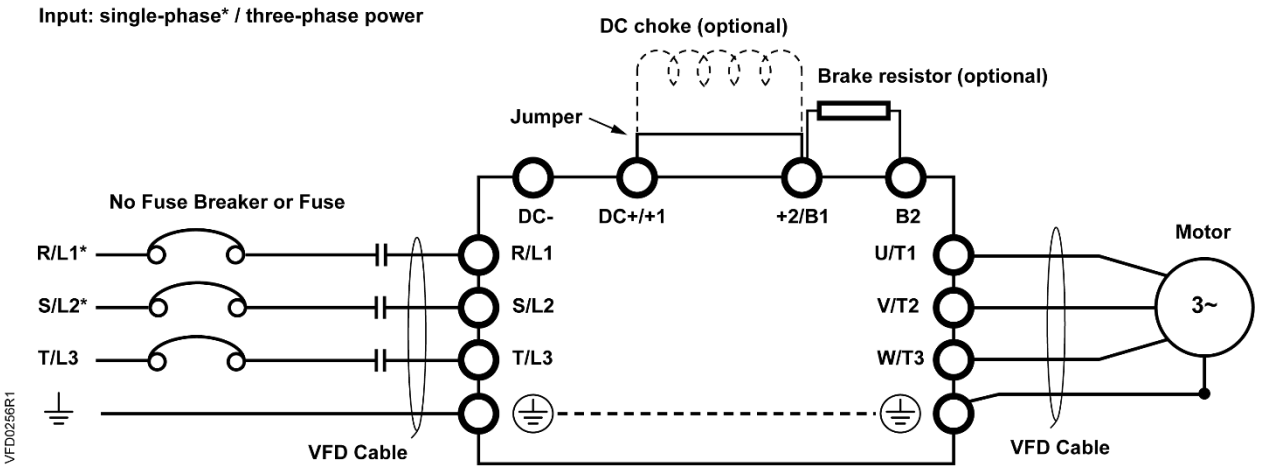


Fig. 6: Main Circuit Diagram.

Terminals	Descriptions
R/L1, S/L2	Mains input terminals (single-phase)
R/L1, S/L2, T/L3	Mains input terminals (three-phase)
U/T1, V/T2, W/T3	AC motor drive output terminals for connecting three-phase IM and PM motors.
+1, +2	Connections for DC reactor to improve the power factor. Remove the jumper before installing a DC reactor.
DC+, DC-	Connections for brake unit (VFDB series) Common DC bus
B1, B2	Connections for brake resistor (optional).
⏚	Ground connection; comply with local regulations.

Main Circuit Terminal Specifications

DANGER	Tighten the screws in the main circuit terminal to prevent sparks caused by screws loosened due to vibration. If necessary, use an inductive filter only at the motor output terminals U/T1, V/T2, W/T3 of the AC motor drive. DO NOT use phase-compensation capacitors or L-C (Inductance-Capacitance) or R-C (Resistance-Capacitance), unless approved by Delta. DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives. DO NOT connect brake resistors directly to +1/DC+ to DC-, +2/B1 to DC- to prevent damage to the drive or to the brake resistors. Ensure proper insulation of the main circuit wiring in accordance with the relevant safety regulations.

CAUTION

Main input power terminals

R/L1, S/L2 and T/L3 have no phase-sequence requirement; they can be connected in any sequence.

Add a magnetic contactor (MC) to the power input wiring to cut off power quickly and reduce malfunctions when the AC motor drive protection function activates. Both ends of the MC should have an R-C surge absorber.

Use voltage and current within the specifications. See *the Climatix VFD User Guide* (P/N A6V12384674) for details.

Although the leakage current of one single MS300 drive is less than 10 DC mA, electric shock may still occur due to the leakage current from other equipment such as motors and leads. Therefore, it is recommended that you install one of the followings to prevent danger caused by electric shock.

Use a copper wire with a cross-section of 10 mm^2 or above or an aluminum wire of 16 mm^2 as the connection between the casing and the ground.

Install an Earth Leakage Circuit Breaker (ELCB).

Due to the high frequency current of the leakage current of the AC motor drive, select a Type B ELCB specifically for the drive when using an ELCB. For tripping or malfunctions on the usage of ELCB, refer to Section 7-8 Capacitive Filter for details. The power system of the AC motor drive affects the power factor, so select a MCCB with larger capacity.

Use shielded wire or conduit for the power wiring and ground the two ends of the shielding or conduit.

DO NOT run and stop the AC motor drives by turning the power ON and OFF. Run and stop the AC motor drives by sending the RUN and STOP commands through the control terminals or the keypad. If you still need to run and stop the AC motor drives by turning the power ON and OFF, do so no more often than ONCE per hour.

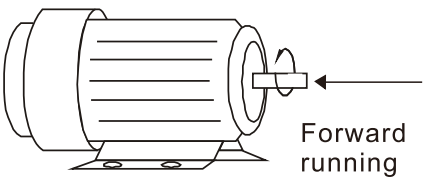
To comply with UL standards, connect the drive to a three-phase three-wire or three-phase four-wire Wye system type of mains power system.

Output terminals of the main circuit

Use well-insulated motors to prevent any electric leakage from motors.

When the AC drive output terminals U/T1, V/T2, and W/T3 are connected to the motor terminals U/T1, V/T2, and W/T3 respectively, the FWD LED indicator on the digital keypad is ON. This means the AC motor drive executes running forward, and the motor rotates counterclockwise (viewed from the shaft end of the motor, as shown in the figure below).

On the contrary, when the REV LED indicator lights, the AC motor drive executes running in reverse, and the motor rotates in an opposite direction to the figure below. If the AC motor drive executes running forward but the motor rotates in a reverse direction, exchange any two of the U/T1, V/T2 and W/T3 motor leads.

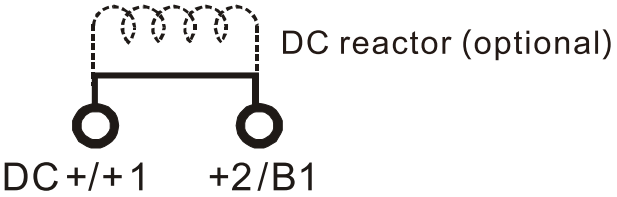


Terminals for connecting DC reactor, external brake resistor and DC circuit

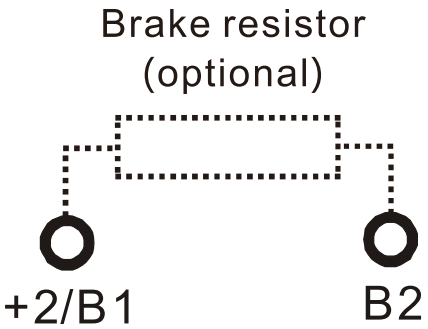
Use the terminals, as shown in the figure below, to connect a DC reactor to improve the power factor and reduce harmonics. A jumper is connected to these terminals at the factory. Remove that jumper before connecting to a DC reactor.

Tighten the jumper if a DC reactor is not connected and DC+/+1 and +2/B1 terminals are used for common DC bus or brake resistors in order to prevent the AC motor drive from losing power and damage to the terminals. If the jumper is missing due to wiring, see the recommended main

circuit terminal wire gauge mentioned in this section to short-circuit the DC+/+1 and +2/B1 terminals.



Install an external brake resistor for applications in frequent deceleration to stop, short deceleration time (such as high frequency operation and heavy load operation), too low braking torque, or increased braking torque.



Connect the external brake resistor to +2/B1, B2 terminals of the AC motor drives.

DO NOT connect two ends of the brake resistor directly to DC+/+1 and DC-, +2/B1 to DC- to prevent damage to the drive and to the brake resistor.

When connecting DC+/+1 and DC- in common DC bus applications, see this section for the wiring terminal specification and the wire gauge information.

⚠ WARNING

Select the correct cable and insulation.

Selecting the wrong cable with the wrong insulation can cause problems that range from high charging currents wasting energy due to heat dissipation, to complete cable failure.

NOTE: Electrical conductors and equipment supplied by power conversion equipment as part of adjustable speed drive systems and servo drive systems shall be listed flexible motor supply cable marked RHH, RHW, RHW-2, XHH, XHHW, or XHHW-2.

Source: NFPA.ORG NFPA79 2018 Paragraph 4.4.2.8 archived revision information.

To determine the correct wiring to use to connect your VFD, see the following tables for wire size specifications for VFDs in each frame size.

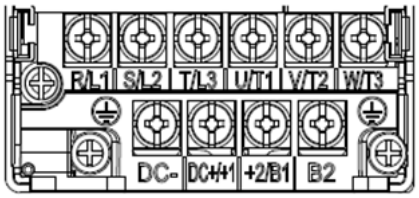
Main Circuit Wire Gauge Notes:

- If you install at Ta 122°F (50°C) above environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 194°F (90°C) or above.
- If you install at Ta 122°F (50°C) environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 167°F (75°C) or 194°F (90°C).
- To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on a temperature resistance of 167°F (75°C), in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.

Frame A Main Circuit Terminals

Additional Note for Frame Size A:

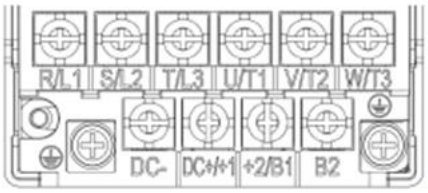
When installing RT0005-11N at Ta 104°F (40°C) above environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 194°F (90°C) or above.



Models	Main Circuit Terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3 DC-, DC+/+1, +2/B1, B2			Grounding Terminals (+)		
	Max. Wire Gauge	Min. Wire Gauge	Screw Size and Torque (10%)	Max. Wire Gauge	Min. Wire Gauge	Screw Size and Torque (10%)
RT0002-11N	2.5 mm^2 (14 AWG)	2.5 mm^2 (14 AWG)	M3.5 9 kg-cm (7.8 lb-in) (0.88Nm)	2.5 mm^2 (14 AWG)	2.5 mm^2 (14 AWG)	M3.5 9 kg-cm (7.8 lb-in) (0.88Nm)
RT0005-11N						
RT0002-21N		1.5 mm^2 (16 AWG)				
RT0005-21N		2.5 mm^2 (14 AWG)				
RT0002-23N		0.75 mm^2 (18 AWG)				
RT0005-23N						
RT001X-23N		1.5 mm^2 (16 AWG)				
RT0005-43N		0.75 mm^2 (18 AWG)				
RT001X-43N						
RT001X-53N						

Table 1: Frame A Wire Gauge Details

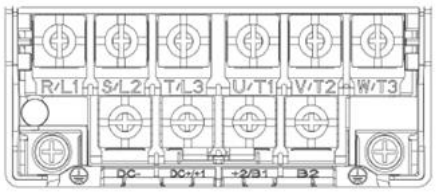
Frame B Main Circuit Terminals



Models	Main Circuit Terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3 DC-, DC+/+1, +2/B1, B2			Grounding Terminals (+)		
	Max. Wire Gauge	Min. Wire Gauge	Screw Size and Torque (10%)	Max. Wire Gauge	Min. Wire Gauge	Screw Size and Torque (10%)
RT0002-21F	4 mm^2 (12 AWG)	1.5 mm^2 (16 AWG)	M4 15 kg-cm (13.0 lb-in) (1.47 Nm)	2.5 mm^2 (14 AWG)	2.5 mm^2 (14 AWG)	M4 15 kg-cm (13.0 lb-in) (1.47 Nm)
RT0005-21F		2.5 mm^2 (14 AWG)				
RT001X-21F RT001X-21N		4 mm^2 (12 AWG)		4 mm^2 (12 AWG)	4 mm^2 (12 AWG)	
RT002X-23N						
RT0005-43F		0.75 mm^2 (18 AWG)		2.5 mm^2 (14 AWG)	2.5 mm^2 (14 AWG)	
RT001X-43F						
RT002X-43N RT002X-43F		2.5 mm^2 (14 AWG)				
RT002X-53N		0.75 mm^2 (18 AWG)				

Table 2: Frame B Wire Gauge Details

Frame C Main Circuit Terminals



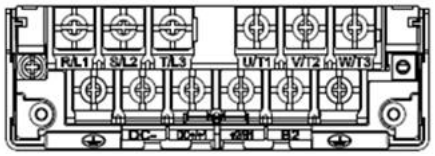
Models	Main Circuit Terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3 DC-, DC+/+1, +2/B1, B2			Grounding Terminals (+)		
	Max. Wire Gauge	**Min. Wire Gauge**	**Screw Size and Torque (10%)**	**Max. Wire Gauge**	**Min. Wire Gauge**	**Screw Size and Torque (10%)**
RT001X-11N	10 mm^2 (8 AWG)	10 mm^2 (8 AWG)	M4 20 kg-cm (17.4 lb-in) (1.96 Nm)	10 mm^2 (8 AWG)	10 mm^2 (8 AWG)	M4 20 kg-cm (17.4 lb-in) (1.96 Nm)
RT002X-21N RT002X-21F						
RT003X-21N RT003X-21F						
RT003X-23N		6 mm^2 (10 AWG)		6 mm^2 (10 AWG)	6 mm^2 (10 AWG)	
RT005X-23N		10 mm^2 (8 AWG)		10 mm^2 (8 AWG)	10 mm^2 (8 AWG)	
RT003X-43N RT003X-43F		2.5 mm^2 (14 AWG)		2.5 mm^2 (14 AWG)	2.5 mm^2 (14 AWG)	
RT005X-43N RT005X-43F		4 mm^2 (12 AWG)		4 mm^2 (12 AWG)	4 mm^2 (12 AWG)	
RT003X-53N		2.5 mm^2 (14 AWG)		2.5 mm^2 (14 AWG)	2.5 mm^2 (14 AWG)	
RT005X-53N		4 mm^2 (12 AWG)		4 mm^2 (12 AWG)	4 mm^2 (12 AWG)	

Table 3: Frame C Wire Gauge Details

Frame D Main Circuit Terminals

Additional Note for Frame Size D:

When installing RT010X-43N at Ta 113°F (45°C) above environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 194°F (90°C) or above.



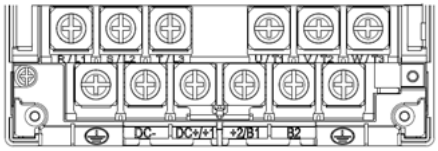
Models	**Main Circuit Terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3 DC-, DC+/+1, +2/B1, B2**			**Grounding Terminals (+)**		
	Max. Wire Gauge	**Min. Wire Gauge**	**Screw Size and Torque (10%)**	**Max. Wire Gauge**	**Min. Wire Gauge**	**Screw Size and Torque (10%)**
RT0075-23N	10 mm^2 (8 AWG)	10 mm^2 (8 AWG)	M4 20 kg-cm (17.4 lb-in) (1.96 Nm)	10 mm^2 (8 AWG)	10 mm^2 (8 AWG)	M4 20 kg-cm (17.4 lb-in) (1.96 Nm)
RT0075-43N RT0075-43F		6 mm^2 (10 AWG)		6 mm^2 (10 AWG)	6 mm^2 (10 AWG)	
RT010X-43N RT010X-43F		10 mm^2 (8 AWG)		10 mm^2 (8 AWG)	10 mm^2 (8 AWG)	
RT0075-53N		6 mm^2 (10 AWG)		6 mm^2 (10 AWG)	6 mm^2 (10 AWG)	
RT010X-53N						

Table 4: Frame D Wire Gauge Details

Frame E Main Circuit Terminals

Additional Notes for Frame Size E:

- When installing RT010X-23N at Ta 104°F (40°C) above environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 194°F (90°C) or above.
- When installing RT015X-23N at Ta 95°F (35°C) above environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 194°F (90°C) or above.
- When installing RT020-43N or RT020-43F at Ta 95°F (35°C) above environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 194°F (90°C) or above.
- See *Lug Specifications* for dimensions and specifications.



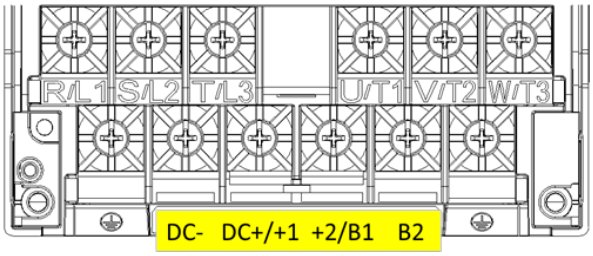
Models	Main Circuit Terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3 DC-, DC+/+1, +2/B1, B2			Grounding Terminals (+)		
	Max. Wire Gauge	Min. Wire Gauge	Screw Size and Torque (10%)	Max. Wire Gauge	Min. Wire Gauge	Screw Size and Torque (10%)
RT010X-23N	16 mm^2 (6 AWG)	16 mm^2 (6 AWG)	M5 25 kg-cm (21.7 lb-in) (2.45 Nm)	16 mm^2 (6 AWG)	16 mm^2 (6 AWG)	M5 25 kg-cm (21.7 lb-in) (2.45 Nm)
RT015X-23N	25 mm^2 (4 AWG)	25 mm^2 (4 AWG)		25 mm^2 (4 AWG)		
RT015X-43N RT015X043F	16 mm^2 (6 AWG)	16 mm^2 (6 AWG)		16 mm^2 (6 AWG)		
RT020X-43N RT020X-43F						

Table 5: Frame E Wire Gauge Details

Frame F Main Circuit Terminals

Additional notes for Frame Size F:

- If you install at Ta 122°F (50°C) environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 167°F (75°C) or 194°F (90°C) or above.
- If you install at Ta 122°F (50°C) above environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 194°F (90°C) or above.
- For RT020X-23N, if you install at 95°F (35°C) above environment, use copper wires that have a voltage rating of 600V and are temperature resistant to 194°F (90°C) or above.
- To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on a temperature resistance of 167°F (75°C) in accordance with UP requirements and recommendations. Do not reduce the wire gauge when using high- temperature resistant wires.



Models	Main Circuit Terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3 DC-, DC+/+1, +2/B1, B2			Grounding Terminals (+)		
	Max. Wire Gauge	Min. Wire Gauge	Screw Size and Torque (10%)	Max. Wire Gauge	Min. Wire Gauge	Screw Size and Torque (10%)
RT020X-23N	35 mm^2 (2 AWG)	35 mm^2 (2 AWG)	M6 40 kg-cm (34.7 lb-in.) (3.92 Nm)	35 mm^2 (2 AWG)	16 mm^2 (6 AWG)	M6 40 kg-cm (34.7 lb-in.) (3.92 Nm)
RT025X-43N RT025X-43F		25 mm^2 (4 AWG)		25 mm^2 (4 AWG)		
RT030X-43N RT030X-43F		35 mm^2 (2 AWG)		35 mm^2 (2 AWG)		

Table 6: Frame F Wire Gauge Details

Lug Specifications

Siemens does not provide ring lugs used for wiring. This section provides the recommended ring lug specifications. Part numbers shown in the chart below are for ring lugs produced by K.S Terminals, Inc. and are for reference only. Customers may purchase ring lugs from other suppliers to match the specifications provided.

- After crimping the wire to the ring lug (must be UL and CSA approved R/C [YDPU2]), install heat shrink tubing rated at a minimum of 600 Vac insulation over the live part.
- Main circuit terminals: R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, DC-, DC+/+1, +2/B1, B2

Single-phase models do not have a T/L3 terminal.

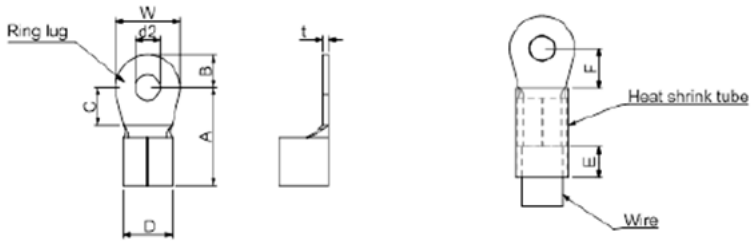


Fig. 7: Ring Lug Specifications

Unit: mm

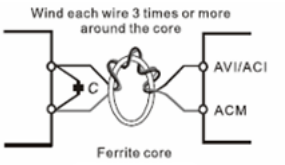
Frame	*AWG	Kit P/N	A (MAX)	B (MAX)	C (MIN)	D (MAX)	d2 (MIN)	E (MIN)	F (MIN)	W (MAX)	t (MAX)
A	18	RNBS 1-3.7	9.8	3.2	4.8	4.1	3.7	13.0	4.2	6.6	0.8
	16	RNBS 2-3.7									
	14	RNBS 2-3.7									
B	18	RNBS1-4	12.1	3.6	6.1	5.6	4.3	13.0	4.5	7.2	1
	16	RNBS1-4									
	14	RNBS2-4									
	12	RNBS5-4									
C	14	RNBS2-4	17.8	5.0	6.1	7.2	4.3	13.0	5.5	10.5	1.2
	12	RNBS5-4									
	10	RNBS5-4									
	8	RNBS8-4									
D	10	RNBS5-4	17.8	5.0	6.1	7.2	4.3	13.0	5.5	10.5	1.2
	8	RNBS8-4									
E	6	RNB14-5	27.1	6.1	10.5	11.5	5.3	13.0	6.5	12.6	1.7
	4	RNBS22-5									
F	6	RNBS14-6	35.0	9.0	13.3	14.0	6.2	13.0	10.0	19.5	1.8
	4	RNBS22-6									
	2	RNBS38-6									

- AWG: See Main Circuit Terminal Specification [→ 11] for the correct wire gauge for your VFD.

Control Terminal Specifications

CAUTION

Analog input terminals (AVI, ACI, ACM)



- Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible (less than 20 m) with proper grounding. If the noise is inductive, connecting the shield to the ACM terminal can reduce interference.
- Use twisted-pair wire for weak analog signals.
- If the analog input signals are affected by noise from the AC motor drive, connect a capacitor and a ferrite core as shown in the figure above.

CAUTION

Contact input terminals (MI1-MI7, DCM, +24 Vdc)

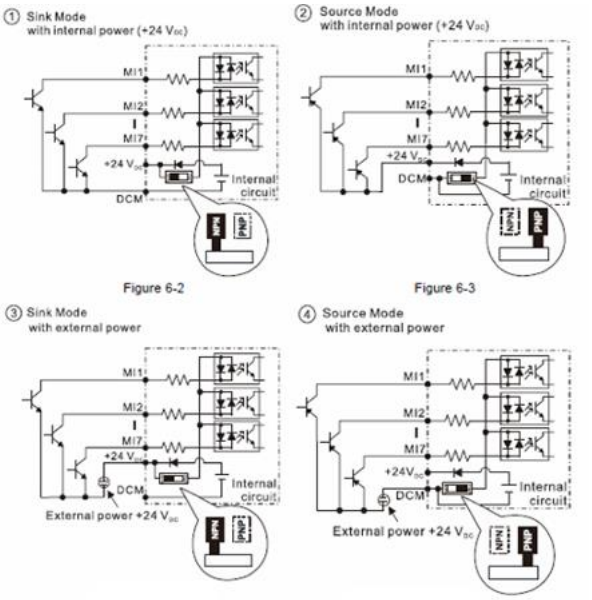


Figure 6-2

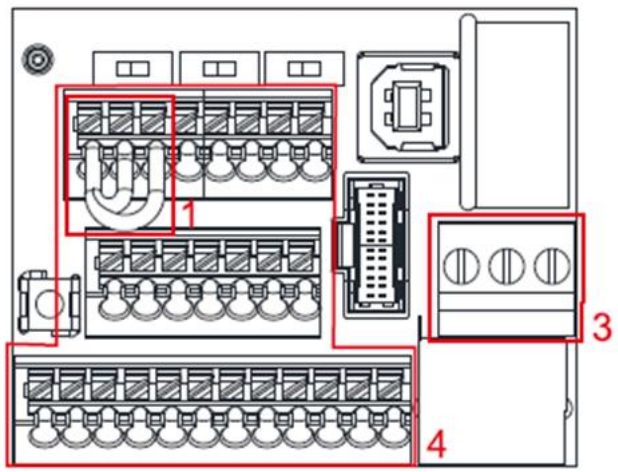
Figure 6-3

When the photo coupler uses the internal power supply, the switch connection for Sink and Source modes displays as shown in the figures.

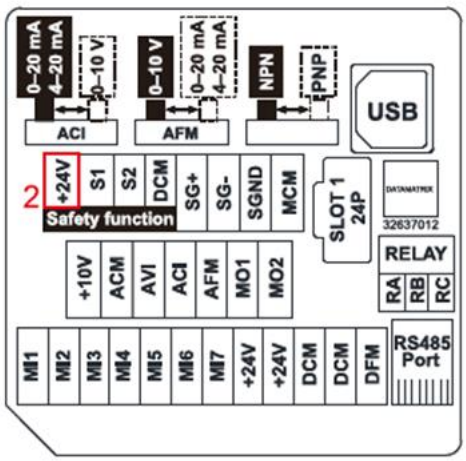
CAUTION

Transistor output terminals (MO1, MO2, MCM)

- Connect the digital outputs to the correct polarity.
- When connecting a relay to the digital outputs, connect a surge absorber across the coil and check the polarity.



Control Terminal Diagram



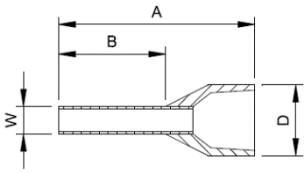
Control Terminal Location Diagram

Wiring Precautions

1. The factory default is +24 Vdc/S1/S2 short-circuited by jumper, as shown in Area 1 in Figure 25: Control Terminal Diagram [→ 20]. See Figure 10: Climatix VFD Detailed Wiring Diagram [→ 9] for details.
2. Use the +24 Vdc power supply of the safety function for STO only. Do NOT use it for other purposes
3. The RELAY terminal uses the PCB terminal block as shown in Area 3 Figure 25: Control Terminal Diagram. [→ 20]
4. Tighten the wiring with a 3.5 mm width and 0.6 mm thickness slotted screwdriver.
5. The ideal length of stripped wire at the connection side is 6 to 7 mm.
6. When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.
7. The Control terminal uses the push-in spring terminal block as shown in Area 4 Figure 25: Control Terminal Diagram [→ 20]:
8. Tighten the wiring with a 2.5 mm width and 0.4 mm thickness slotted screwdriver.
9. The ideal length of stripped wire at the connection side is 9 mm.
10. When wiring bare wires, ensure that they are perfectly arranged to go through the wiring holes.

Control Terminal Wiring Specifications

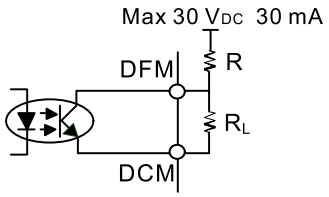
Terminal Name	Wiring Specifications of Control Terminals	Stripping Length (mm)	Maximum Wire Gauge	Minimum Wire Gauge	Tightening Torque (±10%)
RELAY Terminals	Solid	6–7	1.5 mm^2 [16 AWG]	0.2 mm^2 [24 AWG]	5 Kg-cm [4.3 lb-in.] [0.49 Nm]
	Strand				
Control Terminals	Solid	9	0.75 mm^2 [18 AWG]	0.2 mm^2 [24 AWG]	
	Strand				
	Stranded with ferrules with plastic sleeve	9	0.5 mm^2 [20 AWG]		

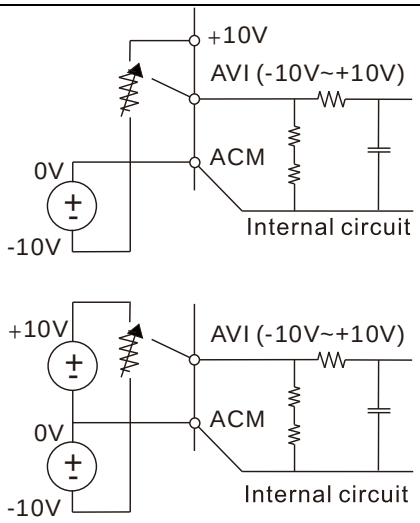
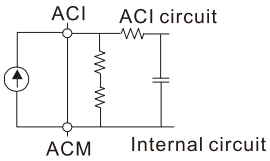
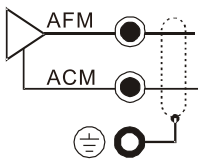


Wire Gauge	Manufacturer	Model Name	A (Max)	B (Max)	D (Max)	W (Max)
0.2 mm^2 (24 AWG)	PHOENIX CONTACT	AI 0,25- 8 YE	12.5	8	2.6	1.1
0.34 mm^2 (22 AWG)	PHOENIX CONTACT	AI 0,34- 8 TQ	12.5	8	3.3	1.3
0.5 mm^2 (20 AWG)	PHOENIX CONTACT	AI 0,5 – 8 WH	14	8	3.5	1.4
Recommended specifications and models for crimping tool: CRIMPFOX 10S – 121045, Manufacturer: PHOENIX CONTACT DNT13-0101, Manufacturer: DINKLE						

Table 7: Crimping Terminal Recommendations

The following describes the functionality of Climatix VFD terminals. For additional information on parameters referenced below see the *Climatix VFD User Guide*.

Terminals	Terminal Function	Description
+24 Vdc	Digital control signal common (Source)	+24 Vdc ± 10 % 100 mA
MI1 – MI7	Multi-function input 1–7	See Pr.02-01–02-07 to program the multi-function inputs MI1–MI7. Source Mode ON: activation current 3.3 mA ≥ 11 Vdc OFF: cut-off voltage ≤ 5 Vdc Sink Mode ON: activation current 3.3 mA ≤ 13 Vdc OFF: cut-off voltage ≥ 19 Vdc When Pr.02-00=0, MI1 and MI2 can be programmed. When Pr.02-00≠0, the functions of MI1 and MI2 act according to Pr.02-00 setting. When Pr.02-07=0, MI7 is pulse input terminal. MI7 uses pulse input, and the maximum input frequency=33 kHz. You can use it as frequency command source or connect it to the encoder for motor closed-loop control. MI7 motor closed-loop control only supports VFPG control mode.
DFM	Digital frequency signal output 	DFM uses pulse voltage as an output monitoring signal; Duty-cycle: 50 % Min. load impedance R_L: 1 kΩ / 100 pF Max. current endurance: 30 mA Max. voltage: 30 Vdc ± 1 % (when 30 Vdc/30 mA/RL=100 pF) Max. output frequency: 33 kHz Current-limiting resistor R: ≥ 1 KΩ Output load impedance R_L Capacitive load ≤ 100 pF Resistive load ≥ 1 kΩ, resistance determines the output voltage value. DFM-DCM voltage = external voltage * (R_L/ (R_L+R))
DCM	Digital control/ Frequency signal common (Sink)	
MO1	Multi-function Output 1 (photo coupler)	The AC motor drive outputs various monitoring signals, such as drive in operation, frequency reached, and overload indication through a transistor (open collector). Max. 48 Vdc 50 mA
MO2	Multi-function Output 2 (photo coupler)	
MCM	Multi-function Output Common (photo coupler)	
RA	Multi-function relay output 1 (N.O.) a	Resistive Load 3A (N.O.)/3A (N.C.) 250 Vac A (N.O.)/3A (N.C.) 30 Vdc Inductive Load (COS 0.4) 1.2A (N.O.)/1.2A (N.C.) 250 Vac 2.0A (N.O.)/1.2A (N.C.) 30 Vdc To output different kinds of monitoring signals such as motor drive in operation, frequency reached, and overload indication.
RB	Multi-function relay output 1 (N.C.) b	
RC	Multi-function relay common	
+10 V	Potentiometer power supply	Power supply for analog frequency setting: +10.5 ± 0.5 Vdc/ 20 mA
AVI	Analog voltage frequency command	Impedance: 20 kΩ Range: 0–10V / -10–10V = 0–Maximum Operation Frequency (Pr.01-00)

		Mode switching by setting Pr.03-00, Pr.03-28 AVI resolution=10 bits
ACI	Analog current frequency command 	Impedance: Current mode=250 Ω, Voltage mode=20 kΩ Range: 0–20 mA/4–20 mA/0–10V = 0–Maximum Operation Frequency (Pr.01-00) Mode switching by setting Pr.03-01, Pr. 03-29 ACI resolution = 12 bits
AFM	Multi-function analog voltage output 	Switch: The AFM default is 0–10V (voltage mode). To switch to the current mode, follow the instructions indicated on the inner side of the front cover or refer to page 6-2 in the user manual to switch AFM to the current mode position (0–20 mA/4–20 mA) and set Pr.03.31. Voltage mode Range: 0–10V (Pr.03-31=0) corresponds to the maximum operating range of the control target Max. output current: 2 mA Max. Load: 5 kΩ Current mode Range: 0–20 mA (Pr.03-31=1)/4–20 mA (Pr.03-31=2) corresponds to the maximum operating range of the control target, maximum load 500 Ω AFM resolution=10 bits
ACM	Analog Signal Common	Analog signal common terminal
S1, S2	Default: S1/S2 short-circuited to +24 Vdc	
DCM	Rated voltage: 24 Vdc ± 10%; maximum voltage: 30 Vdc ±10 % Rated current: 6.67 mA ± 10% STO activation mode Input voltage level: 0 Vdc < S1-DCM or S2-DCM < 5 Vdc STO response time ≤ 20 ms (S1/S2 operates until the AC motor drive stops outputting current) STO cut-off mode Input voltage level: 11 Vdc < S1-DCM and S2-DCM < 30 Vdc Power removal safety function per EN 954-1 and IEC / EN 61508 **NOTE:** See *Safe Torque Off Function* for details.	
SG+	Modbus RS-485	

SG-			
SGND			
RJ45	PIN 1, 2, 6: Reserved	PIN 3, 7: SGND	PIN 4: SG-
	PIN 5: SG+	PIN 8: +10 VS (provides KPC-CC01(optional) power supply)	

Grounding Considerations

Floating ground systems

A floating ground system is also called an IT system, an ungrounded system, or a high impedance/ resistance (greater than 30 Ω) grounded system.

- Remove the RFI jumper to disconnect the ground cable from the internal filter capacitor and surge absorber.
- Do not install an external RFI/EMC filter. The external EMC filter passes through a filter capacitor and connects power input to the ground. This is very dangerous and damages the motor drive.
- In situations where EMC is required, use an EMC filter specifically for IT system if necessary. Disconnecting the ground cable from the filter prevents damage to the motor drive but voids the guarantee of EMC compliance.
- If EMC is required, check for excess electromagnetic radiation affecting nearby low-voltage circuits. In some situations, the adapter and cable naturally provide enough suppression. If in doubt, install an extra electrostatic shielded cable on the power supply side between the main circuit and the control terminals to increase shielding.

Isolating main power from the ground

When the power distribution system for the drive is a floating ground system (IT Systems) or an asymmetric ground system (Corner Grounded TN Systems), you must remove the RFI jumper. Removing the RFI jumper disconnects the internal capacitors from the ground to avoid damaging the internal circuits and to reduce the ground leakage current.

Important points regarding ground connection

To ensure the safety of personnel, proper operation, and to reduce electromagnetic radiation, you must properly ground the motor and drive during installation.

- The diameter of the grounding cables must comply with the local safety regulations.
- You must connect the shielded cable to the motor drive's ground to meet safety regulations.
- Only use the shielded cable as the Ground for equipment after meeting aforementioned points.
- When installing multiple drives, do not connect the Grounds of the drives in series; connect each drive to the Ground. See below for approved Ground connections:

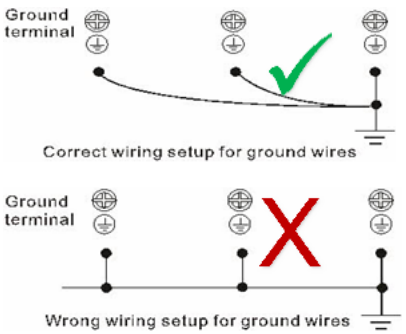


Fig. 8: Climatix VFD Grounding

Safe Torque Off

The Climatix RT provides a Safe Torque Off (STO) function. It uses dual-channel S1 and S2 signal inputs to turn off IGBT switching, further preventing the generation of motor torque to achieve a safe stop. The Safe Torque Off function meets the following international standards:

- ISO 13849-1: 2015 Category 3 PL d
- IEC 61508 SIL2
- EN 62061 SIL CL 2
- EN 60204-1 Category 0

The diagram below shows the internal circuit diagram of the safe control loop. The drive is shipped with the terminals of the safe control loop + 24V-S1-S2 are short-circuited together.

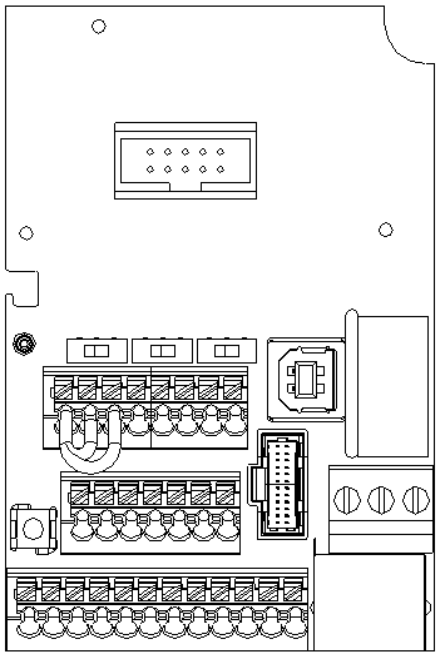


Fig. 9: Climatix VFD Safe Torque Off Jumper

Safe Torque Off Wiring:

To enable safe torque off functionality, remove the jumper wire shorting +24V-S1-S2.

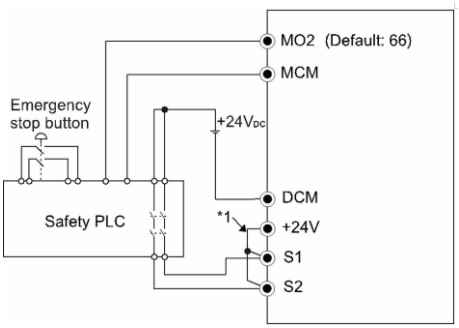


Fig. 10: Safe Torque Off Wiring

RFI Jumper

The drive contains Varistors/MOVs that are connected from phase-to-phase and from phase-to-ground to prevent the drive from unexpected stop or damage caused by mains surges or voltage spikes. Because the Varistor/MOVs from phase-to-ground are connected to ground with the RFI jumper, removing the RFI jumper disables the protection.

Although a single drive complies with the international standards for leakage current, an installation with several drives with built-in EMC filters can trigger the RCD. Removing the RFI jumper helps, but voids the guaranteed EMC performance of each drive.

Frames A through F

Screw Torque: 4 to 6 kg-cm/[3.5 to 5.2 lb-in.]/[0.39 to 0.59 Nm]

1. Loosen the screw and remove the RFI jumper. (See below.)
2. Retighten the screw after the RFI jumper is removed.

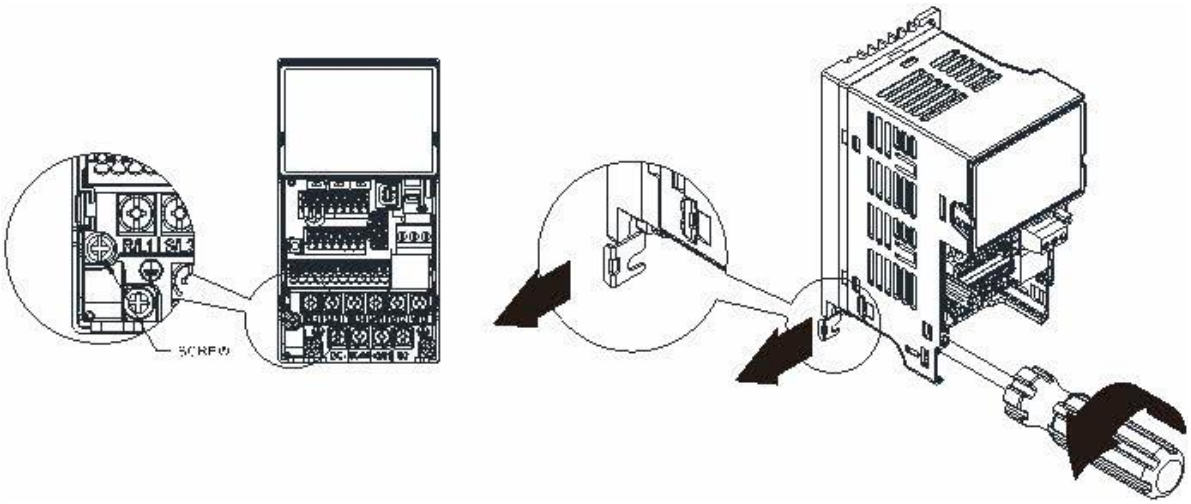
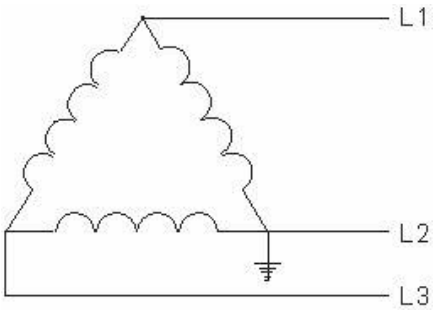
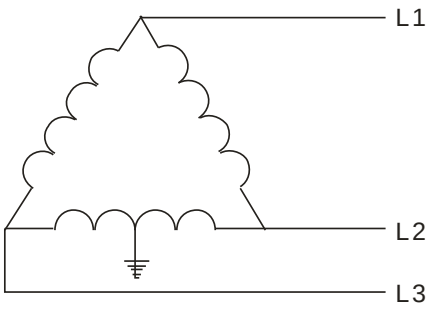
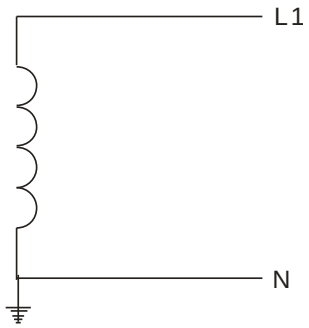
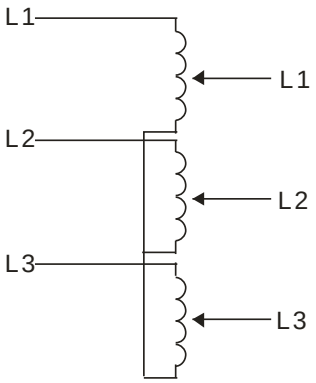


Fig. 11: Figure RFI Jumper Removal

	**⚠ CAUTION**
	Do not remove the RFI jumper while the power is on. Removing the RFI jumper also cuts the capacitor conductivity of the surge absorber to Ground and the built-in EMC filter capacitors. This voids compliance with the EMC specifications. To maintain the efficiency of the EMC circuit, do not remove the RFI jumper if the main power is a symmetrically grounded power system. Remove the RFI jumper when conducting high voltage tests. When conducting a high voltage test for the entire facility, disconnect the main power and the motor if the leakage current is too high. Do not remove the RFI jumper while power to the input terminal of the drive is on.

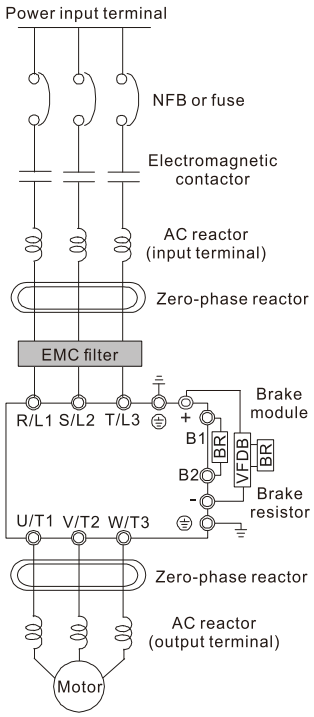
Asymmetric Ground System (Corner Grounded TN Systems)

	⚠ WARNING
	In the following four situations, you must remove the RFI jumper. This prevents the system from grounding through the RFI and filter capacitors and damaging the drive.

Grounding at a corner a triangle configuration	Grounding at a midpoint in a polygonal configuration
	
Grounding at one end in a single-phase configuration	**No stable neutral grounding in a 3-phase auto transformer configuration**
	

System Wiring Diagram

	Accessories may be needed to comply with IEEE-519 standard for harmonic distortion limits.



Call-out	**Description**
Power input terminal	Supply power according to the rated power specifications
NFB or fuse	There may be a large inrush current during power on. See Section 7-2 NFB to select a suitable NFB or Section 7-3 Fuse Specification Chart.
Electromagnetic contactor	Switching the power ON/OFF on the primary side of the electromagnetic contactor can turn the drive ON/OFF, but frequent switching can cause machine failure. Do not switch ON/OFF more than once an hour. Do not use the electromagnetic contactor as the power switch for the drive; doing so shortens the life of the drive. See Section 7-2 Magnetic Contactor / Air Circuit Breaker to select the electromagnetic contactor that meets your requirement.
AC reactor (input terminal)	When the main power supply capacity is greater than 500 kVA, or when it switches into the phase capacitor, the instantaneous peak voltage and current generated may destroy the internal circuit of the drive. It is recommended that you install an input side AC reactor in the drive. This also improves the power factor and reduces power harmonics. The wiring distance should be within 10 m. See Section 7-4 AC/DC Reactor for details

Zero phase reactor	Used to reduce radiated interference, especially in environments with audio devices, and reduce input and output side interference. The effective range is AM band to 10 MHz. See Section 7-5 Zero Phase Reactors for details.
EMC filter	Can be used to reduce electromagnetic interference. See Section 7-6 EMC Filter for details.
Brake module and Brake resistor (BR)	Used to shorten the deceleration time of the motor. See Section 7-1 Brake Resistors and Brake Units Used in AC Motor Drives for details.
AC reactor (output terminal)	The motor cable length affects the size of the reflected wave on the motor end. It is recommended that you install an AC output reactor when the motor wiring length exceeds the value listed in Section 7-4.

Support

Extranet registration

Register for the OEM extranet and access exclusive information and resources:
http://www.siemens.com/buildingtechnologies-oem.

Support on technical problems

Follow this sequence for support issues:

1. Contact the supplier of the device or plant.
2. If unknown, Siemens provides the following tools:

- Visit the Download Center for more information: http://www.downloads.siemens.com.
- Receive assistance by using the Service and Support Portal https://support.industry.siemens.com.
- Submit a technical support request: http://www.siemens.com/automation/support-request.

Other documentation

- Climatix VFD Submittal Sheet (Part Number A6V12110259)
- Climatix VFD User Guide (Part Number A6V12384673)
- Scan QR code to access all documentation.

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