



MDVF05-D230-PCM

Chassis, Microprocessor-based
Variable Frequency Drive with Isolation
for Single and Three Phase AC Motors

Specifications

Model	Line Voltage (VAC)	Motor Voltage Range (VDC)	Continuous Motor Current (Amps)	Horsepower Range
MDVF03-D230-PCM	115 or 230	0 - 115 0 - 230	5.0*	1/16 - 3/4 1/8 - 1 1/2

* When mounted to allow upwards airflow through the heat sink fins.
De-rate to 4.0 amps when mounted in any other configuration.

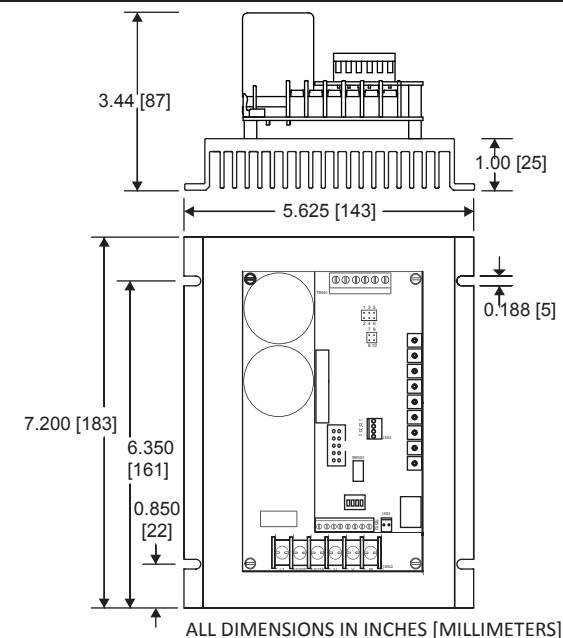
AC Line Voltage.....	115/230 VAC ± 10%, 50/60 Hz, single phase
Output Frequency Range.....	0 - 120 Hz
Form Factor.....	1.05
Acceleration Time Range (0 - 60 Hz).....	0.5 - 12 seconds
Deceleration Time Range (60 - 0 Hz).....	0.5 - 12 seconds
Adjustable DC Injection Voltage.....	0 - 27 VDC
Adjustable DC Injection Voltage Time.....	0 - 5 seconds
Analog Input Voltage Range (S1 to S2).....	0 - 5; 0 to ± 10 VDC
Current Range (S1 to S2).....	4 - 20 mA
Input Impedance (S1 to S2).....	>50K ohms
Load Regulation.....	1% base speed or better
Speed Range.....	100:1
Vibration (0 - 50 Hz).....	0.5G maximum
(>50 Hz).....	0.1G maximum
Ambient Temperature Range.....	0°C - 40°C
Weight.....	2.5 lbs

Safety Warnings

READ ALL SAFETY WARNINGS BEFORE INSTALLING THIS EQUIPMENT

- **DO NOT INSTALL, REMOVE, OR REWIRE THIS EQUIPMENT WITH POWER APPLIED.** Have a qualified electrical technician install, adjust and service this equipment. Follow the National Electrical Code and all other applicable electrical and safety codes, including the provisions of the Occupational Safety and Health Act (OSHA), when installing equipment.
- **Circuit potentials are at 115 or 230 VAC above earth ground.** Avoid direct contact with the printed circuit board or with circuit elements to prevent the risk of serious injury or fatality. Use a non-metallic screwdriver for adjusting the calibration trim pots. Use approved personal protection equipment and insulated tools if working on this drive with power applied.
- Reduce the chance of an electrical fire, shock, or explosion by using proper grounding techniques, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.
- **Minarik Drives strongly recommends the installation of a master power switch in the line voltage input.** The switch contacts should be rated for 250 VAC and 200% of motor nameplate current.
- **Removing AC line power is the only acceptable method for emergency stopping.** Do not use DC injection braking, decelerating to minimum speed, or coasting to a stop for emergency stopping. They may not stop a drive that is malfunctioning. Removing AC line power is the only acceptable method for emergency stopping.
- Line starting and stopping (applying and removing AC line voltage) is recommended for infrequent starting and stopping of a drive only. DC injection braking, decelerating to minimum speed, or coasting to a stop is recommended for frequent starts and stops. Frequent starting and stopping can produce high torque. This may cause damage to motors.
- **Do not disconnect any of the motor leads from the drive** unless power is removed or the drive is disabled. Opening any one lead while the drive is running may destroy the drive.
- Under no circumstances should power and logic level wires be bundled together.
- Be sure potentiometer tabs do not make contact with the potentiometer's body. Grounding the input will cause damage to the drive.
- **Only connect to terminal L2-DBL if using a 115 VAC line with a motor rated higher than 115 VAC.**
- Caution should be taken when operating fan-cooled motors at low speeds because their fans may not move sufficient air to properly cool the motor. ACE recommends "inverter-duty" motors when the speed range is beyond 10:1.
- Drive is designed to work with permanent split capacitor, shaded pole, and standard three phase induction motors. In general, the drive can work with capacitor-start motors, but it is conditional on the current pull when the capacitor is in effect and how long the application calls for a speed that the capacitor will stay in the auxiliary winding.

Dimensions



Installation

Mounting

- Drive components are sensitive to electrostatic discharge. Avoid direct contact with the circuit board. Hold the drive by the plate only.
- Protect the drive from dirt, moisture, and accidental contact.
- Provide sufficient room for access to the terminals and calibration trim pots.
- Mount the drive away from heat sources. Operate the drive within the specified ambient operating temperature range.
- Prevent loose connections by avoiding excessive vibration of the drive.
- Mount the drive with its board in either a horizontal or vertical plane. Six 0.17" (4 mm) holes in the plate accept #8 pan head screws. If mounted horizontally, the drive must be de-rated to 2.5 amps.
- The plate should be earth grounded.

Wiring

Use 18 - 24 AWG wire for logic wiring. Use 14 - 16 AWG wire for AC line and motor wiring.

Shielding Guidelines

As a general rule, Minarik Drives recommends shielding of all conductors. If it is not practical to shield power conductors, Minarik Drives recommends shielding all logic-level leads. If shielding of logic-level leads is not practical, the user should twist all logic leads with themselves to minimize induced noise. It may be necessary to earth ground the shielded cable. If noise is produced by devices other than the drive, ground the shield at the drive end. If noise is generated by the drive, ground the shield at the end away from the drive. Do not ground both ends of the shield.

Fusing

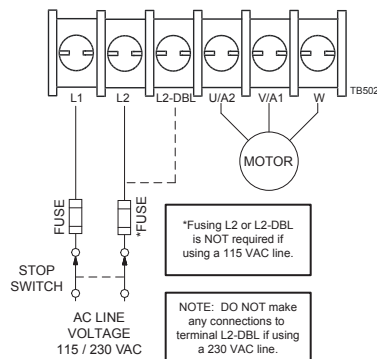
Minarik Drives drives require an external line fuse for protection. Use fast acting fuses rated for 250 VAC or higher and 150% of the maximum armature current. Fuse the HOT leg of the AC line when using 115 VAC and both lines when using 230 VAC.

Line Input

If using a 115 VAC line with a 115 VAC motor or a 230 VAC line with a 115 or 230 VAC motor, connect to terminals L1 and L2. If using a 115 VAC line with a 230 VAC motor, connect to terminals L1 and L2-DBL. Minarik Drives recommends the use of a double-pole, single-throw master power switch. The switch should be rated at a minimum of 250 VAC and 200% of motor current.

Motor

Connect the motor leads to terminals U/A2, V/A1, and W.



POWER (BOTTOM BOARD)

Connections

LOGIC (TOP BOARD)

Speed Potentiometer

Use a 10K ohm, 1/4 W potentiometer for speed control. Connect the counter-clockwise end of the potentiometer to S1, wiper to S2, and the clockwise end to S3. If the potentiometer works inversely of desired functionality, (i.e. to increase motor speed, you must turn the potentiometer counterclockwise), power off the drive and swap the S1 and S3 connections.

Analog Input Signal Range

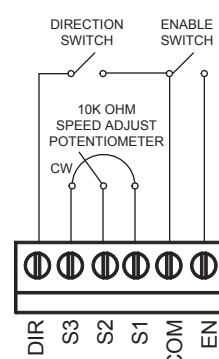
Instead of using a speed adjust potentiometer, MDVF-PCM series drives may be wired to follow an analog input signal. This input signal can be in the form of voltage (0-5, 0 to ±10 VDC) or current (4-20 mA). Because these drives have built in isolation, the input signal can be grounded or ungrounded (floating). Connect the signal common (-) to S1 and the signal reference (+) to S2. See the Operations section for jumper settings.

Enable

Short terminals EN and COM to accelerate the motor to set speed. Open the ENABLE terminals to coast the motor to zero speed. If no ENABLE switch is desired, wire a jumper between terminals COM and EN. **Do not use the enable for emergency stopping.**

Direction

Short terminals DIR and COM to change the direction of the motor. If no direction switch is desired, leave this connection open.



Startup

SELECT SWITCHES

Select Switch (SW501)

Dip Switch 1: ON - 115 VAC Out - Sets a 115 VAC output with 115 or 230 VAC in.
 OFF - 230VAC Out - Sets a 230 VAC output with 115 or 230 VAC in.

Dip Switch 2: ON - 50 Hz - Sets a base frequency of 50 Hz on the output.
 OFF - 60 HZ - Sets a base frequency of 60 Hz on the output.

Dip Switch 3: ON - Brake Mode - Opening the ENABLE switch will regeneratively brake the motor to zero speed without applying the decel ramp.
 OFF - Enable Mode - Opening the ENABLE switch will coast the motor to a stop.

Dip Switch 4: ON - Carrier frequency of 1.6 kHz (audible, but prevents GFI tripping).
 OFF - Carrier frequency of 16 kHz (not audible, but may cause GFI tripping).

JUMPERS



0-5 VDC or Potentiometer
 Jumper Pins 1&2 and 7&8



0 to ± 10 VDC
 Jumper Pins 3&5 and 7&8



4-20 mA
 Jumper Pins 5&6 and 9&10

STARTUP

- Verify that no foreign conductive material is present on the printed circuit board.
 - Ensure that all switches and jumpers are properly set.

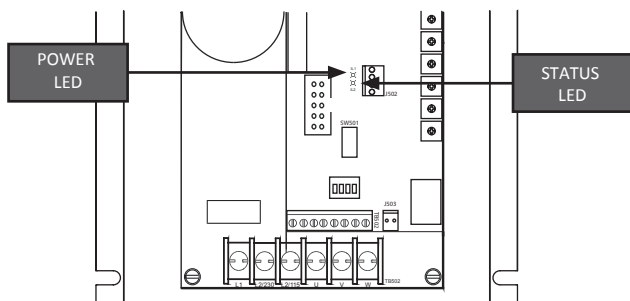
1. Turn the speed adjust potentiometer full counterclockwise (CCW) or set the analog input voltage or current signal to minimum.
2. Apply AC line voltage.
3. Close the enable switch and verify that the green Power LED (IL1) if flashing.
4. Slowly advance the speed adjust potentiometer clockwise (CW) or increase the analog input voltage or current signal. The motor slowly accelerates as the potentiometer is turned CW or as the analog input voltage or current signal is increased. Continue until the desired speed is reached.
5. Remove AC line voltage from the drive to coast the motor to a stop.

LEDs

Power (IL1): Green LED is solid when AC line voltage is applied to the drive, but the drive is disabled. It flashes whenever AC line voltage is applied to the drive and the drive is enabled.

Status (IL2): Red LED is solid when in current limit or flashes following fault code:

- 2 Flashes: Undervoltage - Internal DC BUS voltage dropped below 91 VDC. Will automatically clear when the DC BUS voltage rises to at least 99.5 VDC.
- 3 Flashes: Overvoltage - Internal DC BUS voltage rose above 430 VDC. Will automatically clear when the DC BUS voltage drops to at least 409 VDC.
- 4 Flashes: Current Limit or Short Circuit - The drive is in current limit or has detected a short across at least two phases.
- 5 Flashes: Overtemperature Shut Down - Drive's temperature has reached critical temperature.
- 6 Flashes: Overtemperature Warning - Drive's temperature is approaching critical temperature.



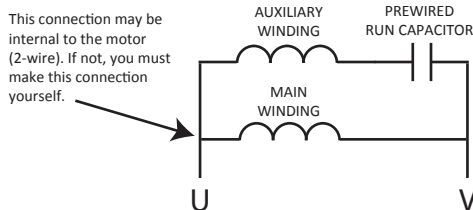
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Operation

MOTOR CONNECTIONS

Single Phase Operation - Non-reversing

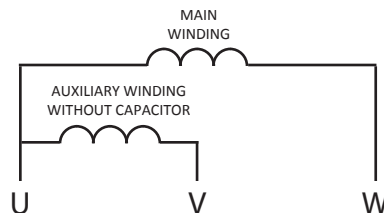
For single phase operation, connect the motor as show in the figure below. Ensure that the prewired capacitor and its associated motor coil are connected to terminals U and V as shown. This connection may be internal if using a 2-wire motor. If the motor has three leads, you must make this connection yourself.



This connection may be internal to the motor (2-wire). If not, you must make this connection yourself.

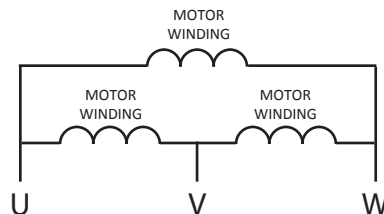
Single Phase Operation - Reversing

Remove the capacitor and connect the motor as show in the figure below. While allowing for solid-state reversing, this wiring scheme may result in sub-optimal motor operation. Depending on the motor construction and application requirements, the motor may need to be derated.



Three Phase Operation

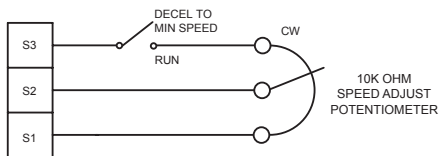
For three phase operation, connect the motor as show in the figure below. Connect to terminals U, V, and W as shown.



DECELERATING & STOPPING

Decelerate to Minimum or Zero Speed

The switch shown below may be used to decelerate a motor to a minimum speed. Opening the switch between S3 and the potentiometer decelerates the motor from set speed to a minimum speed determined by the MIN SPEED trim pot setting. If the MIN SPEED trim pot is set full CCW, the motor decelerates to zero speed when the switch is opened. The DECEL TIME trim pot setting determines the rate at which the drive decelerates. By closing the switch, the motor accelerates to set speed at a rate determined by the ACCEL TIME trim pot.



Calibration

Minimum Speed (P1 / MIN SPEED): The MIN SPEED setting determines the minimum motor speed when the speed adjust potentiometer is set for minimum speed. It is factory set for zero speed. To calibrate the MIN SPEED:

1. Set the MIN SPEED trim pot full CCW.
2. Set the speed adjust potentiometer or input voltage or current signal for minimum speed.
3. Adjust the MIN SPEED trim pot until the desired minimum speed is reached or is just at the threshold of rotation.

Maximum Speed (P2 / MAX SPEED): The MAX SPEED setting determines the maximum motor speed when the speed adjust potentiometer or input voltage or current signal is set for maximum speed. It is factory set for maximum motor rated speed. To calibrate the MAX SPEED:

1. Set the MAX SPEED trim pot full CCW.
2. Set the speed adjust potentiometer or input voltage or current signal for maximum forward speed.
3. Adjust the MAX SPEED trim pot until the desired maximum forward speed is reached.

Check the MIN SPEED and MAX SPEED adjustments after recalibrating to verify that the motor runs at the desired minimum and maximum speeds.

Acceleration (P3 / ACCEL TIME): The ACCEL TIME setting determines the time the motor takes to ramp to a higher speed. To calibrate the ACCEL TIME, turn the ACCEL TIME trim pot CW to increase the acceleration time.

Deceleration (P4 / DECEL TIME): The DECEL TIME setting determines the time the motor takes to ramp to a lower speed. To calibrate the DECEL TIME, turn the DECEL TIME trim pot CW to increase the deceleration time.

Slip Compensation (P5 / SLIP COMP): The SLIP COMP setting determines the degree to which motor speed is held constant as the motor load changes. To calibrate the SLIP COMP:

1. Set the SLIP COMP trim pot full CCW.
2. Increase the speed adjust potentiometer until the motor runs at midspeed without load. A handheld tachometer may be used to measure motor speed.
3. Load the motor to its full load current rating. The motor should slow down.
4. While keeping the load on the motor, rotate the SLIP COMP trim pot until the motor runs at the speed measured in step 2. If the motor oscillates (overcompensation), the SLIP COMP trim pot may be set too high (CW). Turn the SLIP COMP trim pot CCW to stabilize the motor.
5. Unload the motor.

Voltage Boost (P6 / VOLTAGE BOOST): The VOLTAGE BOOST setting increases the motor torque at low speeds. The minimum setting is sufficient for most applications and does not need to be adjusted. If the motor stalls or runs erratically at very low speeds (below 10 Hz), the boost trim pot may need adjustment. To calibrate the VOLTAGE BOOST:

1. Run the motor at the lowest continuous speed/frequency required.
2. Increase the VOLTAGE BOOST trim pot until the motor runs smoothly. **Continuous operation beyond the motor's current rating may damage the motor.**

Torque (P7 / TQ LIMIT): The TQ LIMIT setting determines the maximum torque for accelerating and driving the motor. To calibrate the TQ LIMIT:

1. With power disconnected from the drive, connect a RMS ammeter in series with one of the motor leads.
2. Turn the TQ LIMIT trim pot to full CW. Apply power and adjust the motor speed to full rated speed.
3. Load the motor so that it draws the RMS current previously determined.
4. Slowly turn the TQ LIMIT trim pot CCW until the red LED starts flickering. Then turn the trim pot slightly more so that it just starts to reduce the motor amps on the RMS ammeter.

Brake Voltage (P8 / BRAKE VOLTAGE): The brake voltage determines the voltage level at which the drive will apply current for DC Injection Braking. The higher the voltage, the more current will be motor. DC Injection Braking will only occur in Braking Mode (Dip Switch 3 = ON).

Brake Time-Out (P9 / BRAKE TIME-OUT): The BRAKE TIME-OUT determines how long the DC Injection Braking current will be applied when braking. DC Injection Braking will only occur in Braking Mode (Dip Switch 3 = ON).