AMERICAN CONTROL ELECTRONICS

14300 De La Tour Drive • South Beloit, IL 61080
Phone: (815) 624-2745 • Fax: (815) 624-6334
www.minarikdrives.com

PMB703-7

4Q PWM Chassis Adjustable Speed Drive with Isolation for PMDC Brush Motors

Specifications

Model	Line Voltage (VAC)	Armature Voltage Range (VDC)	Continuous Armature Current (Amps)	Horsepower Range
PMB703-7	115 or 230	0 - 90	7.0*	1/15 - 1/2
		0 - 130		1/15 - 3/4
		0 - 180		1/8 - 1
		0 - 240		1/8 - 1 1/2

* When mounted vertically. De-rate to 5.5 amps when mounted horizontally.

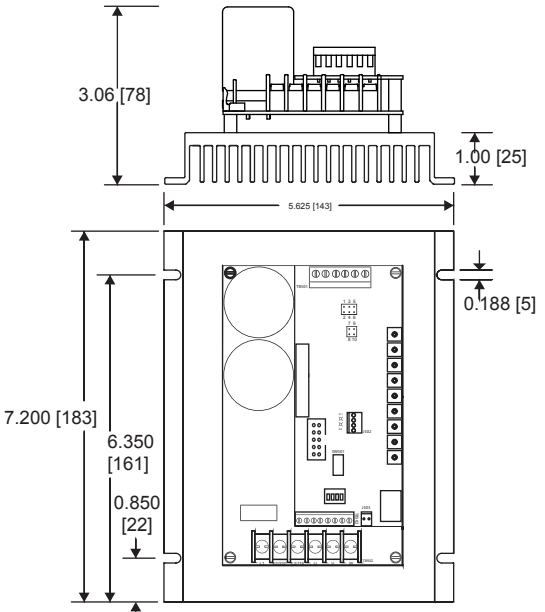
AC Line Voltage.....115/230 VAC ± 10%, 50/60 Hz, single phase
Form Factor.....1.05
Acceleration Time Range *for 90 / 130 VDC armature voltage*.....0.5 - 11 seconds
for 180 / 240 VDC armature voltage.....0.5 - 20 seconds
Deceleration Time Range *for 90 / 130 VDC armature voltage*.....0.5 - 11 seconds
for 180 / 240 VDC armature voltage.....0.5 - 20 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.
- **ACE 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 regenerative 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. Regenerative 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 no 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 130 VDC.**

Dimensions



ALL DIMENSIONS IN INCHES [MILLIMETERS]

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. Four 0.17" (4 mm) holes in the heat sink accept #8 pan head screws. If mounted horizontally, the drive must be de-rated to 5.5 amps.
- The heat sink 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, ACE recommends shielding of all conductors. If it is not practical to shield power conductors, ACE 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

ACE 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.

Connections

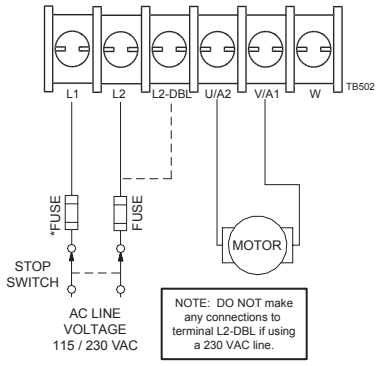
POWER (BOTTOM BOARD)

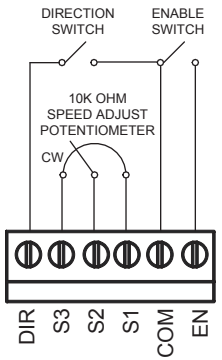
Line Input

If using a 115 VAC line with a 90/130 VDC motor or a 230 VAC line with a 90/130/180/240 VDC motor, connect to terminals L1 and L2. If using a 115 VAC line with a 180/240 VDC motor, connect to terminals L1 and L2-DBL. ACE recommends the use of a double-pole, single-throw master power switch. The switch should rated at a minimum of 250 VAC and 200% of motor current.

Motor

Connect the DC armature leads to terminals U/A2 and V/A1. If the motor does not spin in the desired direction, power down the drive and reverse these 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, MDPM-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 - Torque Mode - The drive will control the torque (current) of the motor. This is used in tensioning applications.

OFF - Speed Mode - The drive will control the speed (voltage) or the motor. This is used in variable speed applications.

Dip Switch 2: ON - WigWag Mode - The potentiometer or analog signal determines both motor speed and direction. The direction switch will still come into effect.

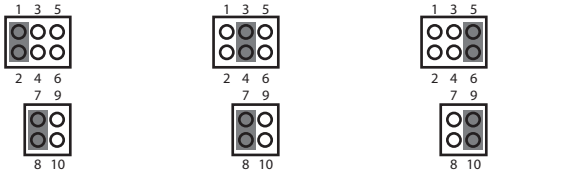
	Full Speed Reverse	Zero Speed	Full Speed Forward
Potentiometer	Full CCW	12 o'clock	Full CW
0 - 5 VDC	0 VDC	2.5 VDC	5 VDC
0 - 10 VDC	0 VDC	5 VDC	10 VDC
4 - 20 mA	4 mA	12 mA	20 mA

OFF - Pot/Switch Mode - The potentiometer or analog signal (0 - 5 VDC, 0 - 10 VDC, 4-20 mA) determines the motor speed while the direction switch determines the direction. If using a bidirectional analog signal (0 to ± 10 VDC), the polarity of the signal determines the direction (ie -10 VDC is full speed reverse, 0 VDC is zero speed, 10 VDC is full speed forward). The direction switch will still come into effect even with a bidirectional signal.

Dip Switch 3: ON - Brake Mode - Opening the ENABLE switch will regeneratively brake the motor to zero speed without applying the decel ramp. At zero speed, the drive will apply holding torque.

OFF - Enable Mode - Opening the ENABLE switch will coast the motor to a stop. The drive cannot provide holding torque at zero speed because it's disabled.

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

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:

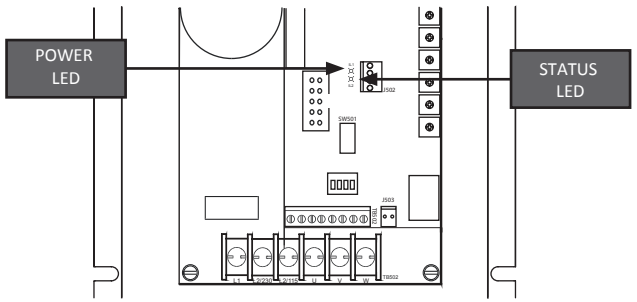
2 Flashes: Undervoltage - Internal DC BUS voltage dropped too low.

3 Flashes: Overvoltage - Internal DC BUS voltage rose too high.

4 Flashes: Current Limit or Short Circuit - The drive is in current limit or has detected a short across the motor.

5 Flashes: Overtemperature Shut Down - Drive's temperature has reached critical temperature.

6 Flashes: Overtemperature Warning - Drive's temperature is approaching critical temperature. Maximum motor current is being reduced gradually as the drive's temperature rises.



STARTUP

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

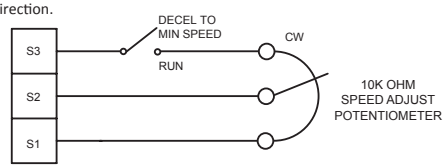
1. Turn the speed adjust potentiometer full counterclockwise (CCW) or set the analog input voltage or current signal to minimum.
2. Apply AC line voltage.
3. Close the enable switch and verify that the green Power LED (IL1) if flashing.
4. Slowly advance the speed adjust potentiometer clockwise (CW) 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.

Operation

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 when travling in the forward direction. By opening the switch, the motor accelerates to set speed at a rate determined by the ACCEL TIME trim pot setting if accelerating in the forward direction.



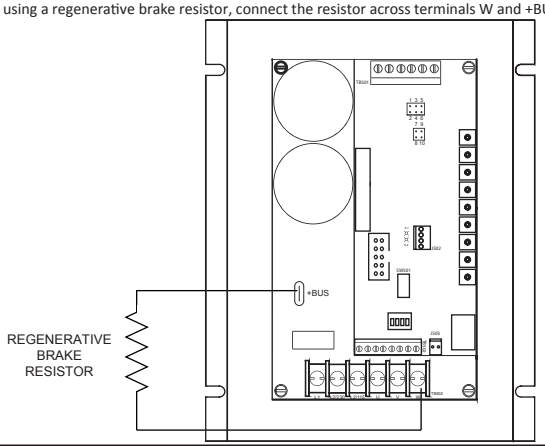
REGENERATIVE BRAKE RESIDTOR

PWM drives are limited in their regnerative capability. The regenerative energy is returned into the drive's bus capacitor. When this capacitor is full, the drive can no longer regen until the capacitor begins to empty. During these periods, the motor actually coasts. While the regen/coast periods are frequent enough that the user may not see the transitions, it does result in a longer deceleration time.

The solution is a brake resistor. When the capacitor is full, the drive will divert the regen energy through through the resistor. For the regenerative brake resistor, use a 40 watt minimum, high power, wire-wound resistor. Sizing the regenerative brake resistor depends on load inertia, motor voltage, and braking time. Use a lower-value, higher-wattage dynamic brake resistor to stop a motor more rapidly. Brake resistor values must not be less than 40 ohms.

Please note that applications with light regenerative loads may not require the use of a regenerative brake resistor.

If using a regenerative brake resistor, connect the resistor across terminals W and +BUS.



Calibration

CALIBRATION INSTRUCTIONS ARE ASSUMING THAT THE DRIVE IS SET UP FOR SPEED MODE AND POT/SWITCH MODE. IF USING TORQUE MODE OR WIGWAG MODE, PLEASE REFER TO THE USER'S MANUAL.

Zero Adjust (P1 / ZERO ADJ): The ZERO ADJ setting adjusts out any non-linearities in the logic circuit that might arise from component tolerances. This factory calibrated and should not need any adjustment.

Minimum Speed (P2 / 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 Forward Speed (P3 / MAX FWD SPEED): The MAX FWD SPEED setting determines the maximum motor speed in the forward direction 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 FWD SPEED:

1. Set the MAX FWD 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 FWD SPEED trim pot until the desired maximum forward speed is reached.

Maximum Reverse Speed (P4 / MAX REV SPEED): The MAX REV SPEED setting determines the maximum motor speed in the reverse direction 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 REV SPEED:

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

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

Acceleration (P5 / ACCEL TIME): The ACCEL TIME setting determines the time the motor takes to ramp to a higher speed regardless of direction. To calibrate the ACCEL TIME, turn the ACCEL TIME trim pot CW to increase the forward acceleration time and CCW to decrease the forward acceleration time.

Deceleration (P6 / DECEL TIME): The DECEL TIME setting determines the time the motor takes to ramp to a lower speed regardless of direction. To calibrate the DECEL TIME, turn the DECEL TIME trim pot CW to increase the forward deceleration time and CCW to decrease the forward deceleration time.

Forward Torque (P7 / MOTOR CUR LIM): The MOTOR CUR LIM setting determines the maximum torque for accelerating and driving the motor in the forward or reverse directions. To calibrate the MOTOR CUR LIM:

1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the MOTOR CUR LIM trim pot to minimum (full CCW).
3. Set the speed adjust potentiometer (full CW) or input voltage or current signal to maximum forward speed (full CW).
4. Carefully lock the motor armature. Be sure that the motor is firmly mounted.
5. Apply power source. The motor should be stopped.
6. Slowly adjust the MOTOR CUR LIM trim pot CW until the armature current is 150% of motor rated armature current.
7. Turn the speed adjust potentiometer to minimum speed (full CCW).
8. Remove power source.
9. Remove the stall from the motor.
10. Remove the ammeter in series with the motor armature if it is no longer needed.

Reverse Torque (P8 / REGEN CUR LIM): The REGEN CUR LIM setting determines the maximum torque for decelerating the motor and resisting an overhauling load in the forward and reverse directions. Turn the REGEN CUR LIM trim pot CW to increase the regen current limit and CCW to decrease the regen current limit.

IR Compensation (P9 / IR COMP): The IR COMP setting determines the degree to which motor speed is held constant as the motor load changes. It is factory set for optimum motor regulation. To calibrate the IR COMP:

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