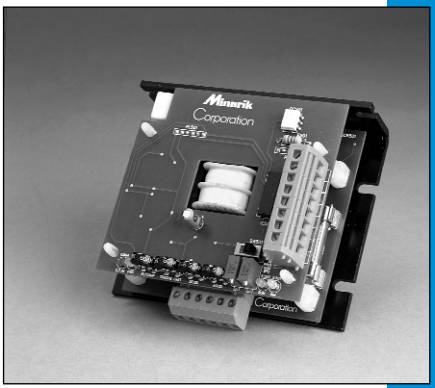
Minarik Automation & Control

MM03-PCM
MM10-PCM



SCR, Adjustable Speed Drives for DC Brush Motors

User's Manual

Printed in the United States of America.

Safety Warnings

- This symbol ⚠ denotes an important safety tip or warning. Please read these instructions carefully before performing any of the procedures contained in this manual.
- 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.
- Reduce the chance of an electrical fire, shock, or explosion by proper grounding, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.

⚠ **It is possible for a drive to run at full speed as a result of a component failure.** Minarik strongly recommends the installation of a master switch in the main power input to stop the drive in an emergency.

Circuit potentials are at 115 VAC 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 trimpots. Use approved personal protective equipment and insulated tools if working on this drive with power applied.

Contents

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Specifications

Model	AC Line Voltage	Maximum Armature Current (Amps DC)	Armature Voltage Range	Horsepower Range
MM03-115AC-PCM	115	3.0	0 – 90	1/50 – 1/8
MM03-230AC-PCM	230	3.0	0 – 180	1/15 – 1/4
MM10-115AC-PCM*	115	10.0	0 – 90	1/8 – 1
MM10-230AC-PCM*	230	10.0	0 – 180	1/4 – 2

**MM10 Series drives require heat sink kit p/n 223-0159 above 5 amps*

Form Factor	1.37 at base speed
Acceleration Time	0.1 – 10 sec
Deceleration Time	0.1 – 10 sec
Load Regulation (at base speed)	2%
Ambient Temp. Range	10°C–40°C
Vibration	0.5g max (0 – 50 Hz) 0.1g max (above 50 Hz)

Dimensions

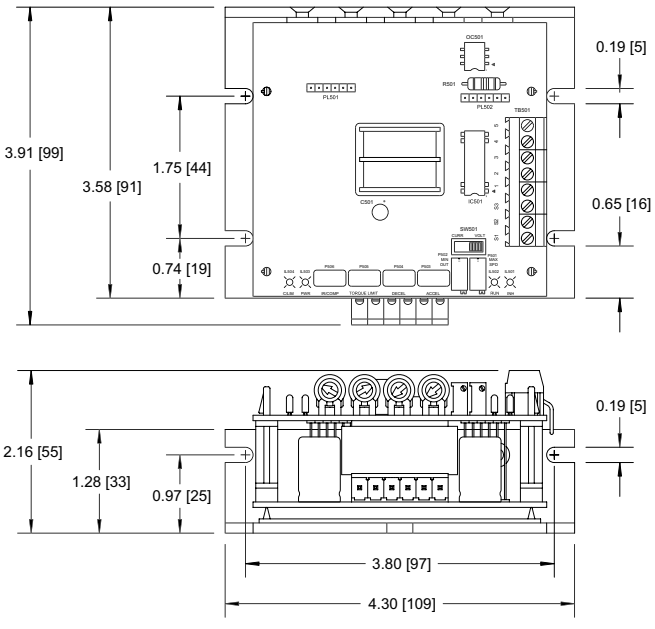


Figure 1. MM03/MM10-PCM Series Dimensions

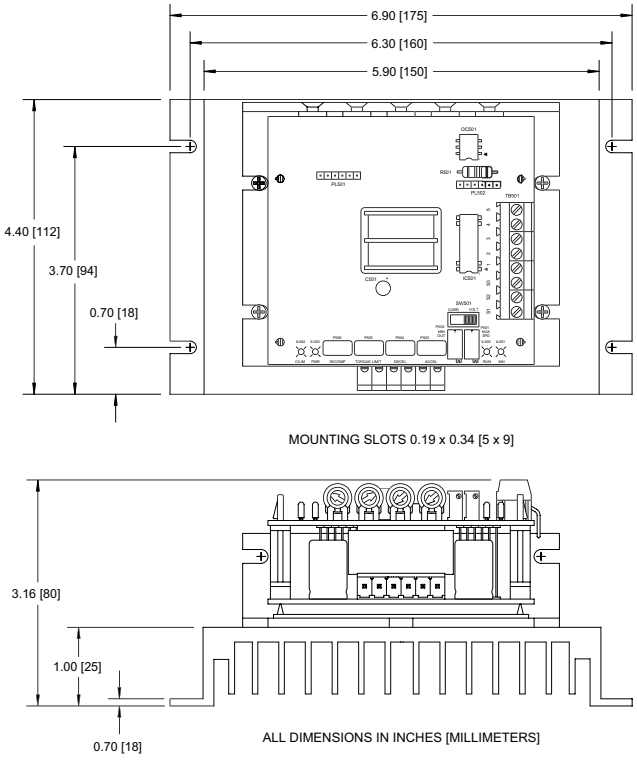


Figure 1A. MM10-PCM Series Dimensions with 223-0159 Heat Sink Added

Installation

Mounting

- Drive components are sensitive to electrostatic fields. Avoid direct contact with the circuit board. Hold drive by the chassis only.
- Protect the drive from dirt, moisture and accidental contact.
- Provide sufficient room for access to the terminal block and calibration trimpots.
- 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 drive with its board in either a horizontal or vertical plane. Six 0.19 in. (5 mm) wide slots in the chassis accept #8 pan head screws. Fasten either the large base or the narrow flange of the chassis to the subplate.
- The chassis must be earth grounded. Use a star washer beneath the head of at least one of the mounting screws to penetrate the anodized chassis surface and reach bare metal.

Wiring

- Use 18 AWG wire for speed adjust potentiometer wiring. Use 16 AWG wire for motor field (F1 and F2) wiring and 12 AWG wire for motor and AC line voltage wiring.
- Twist logic wires (for speed adjust potentiometer and inhibit) to avoid picking up unwanted electrical noise. Use shielded cable if wires are longer than 18 in. (46 cm).
- Keep logic wires away from power carrying lines or sources of electrical noise that can cause erratic operation. Never run speed adjust potentiometer or inhibit wires in the same conduit as the motor and AC line voltage wires.
- 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 a device on the drive, ground the shield at the end away from the drive. Do not ground both ends of the shield.

Line fuses

Protect all Minarik drives with AC line fuses. Use fast acting fuses rated for 250 volts and approximately 150%–200% of the maximum armature current.

Line Fusing for MM Series Drives

Minarik drives require an external fuse for protection. Use fast acting fuses rated for 250 VAC or higher, and approximately 150% of the maximum armature current. Fuse both L1 and L2 when the line voltage is 230 VAC. The fuse chart below lists the recommended line fuse sizes.

Table 1. Fuse Chart

90 VDC Motor Horsepower	180 VDC Horsepower	Max. DC Armature Current (amps)	AC Line Fuse Size (amps)
1/20	1/10	0.5	1
1/15	1/8	0.8	1.5
1/8	1/4	1.5	3
1/6	1/3	1.7	3
1/4	1/2	2.6	5
1/3	3/4	3.5	8
1/2	1	5.0	10
3/4	1 1/2	7.6	15
1	2	10	15

Minarik Corporation offers two fuse kits: part number 050–0066 (1–5A Fuse Kit) and 050–0071 (5–15A Fuse Kit).

Quick-disconnect terminal block

The quick-disconnect terminal block is composed of a 6-pin header block, located on the power circuit board, and a 6-screw terminal plug (see Figure 2). To use the quick-disconnect terminal block:

1. Carefully pull terminal plug from header block.
2. With a small flat-head screwdriver, turn terminal plug screw counterclockwise to open wire clamp.
3. Insert stripped wire into the large opening in front of the plug.
4. Turn the terminal plug screw clockwise to clamp the wire.
5. Repeat steps 2–4 for each terminal until all connections are made. Make no connections to F1 and F2 if using a permanent magnet motor.
6. Insert plug into header until securely fastened.

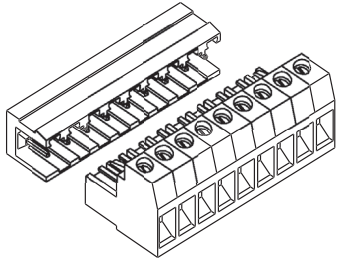
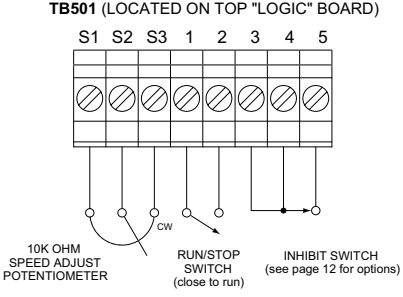
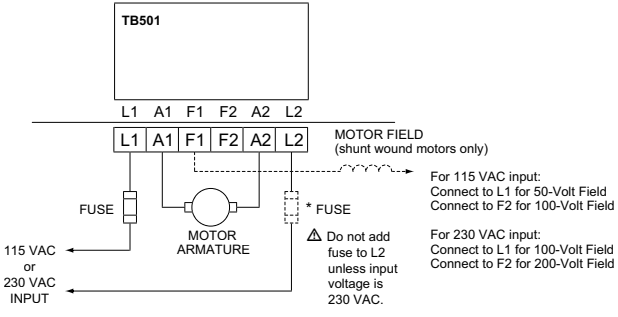


Figure 2. Quick-disconnect terminal block (typical)

Connections



SIGNAL CONNECTIONS ON BOTTOM "LOGIC" BOARD



MOTOR AND POWER CONNECTIONS ON BOTTOM "POWER CIRCUIT" BOARD

Figure 3. MM03/MM10-PCM Series Drive Connections

Field output

The field output is for shunt wound motors only. Do not make any connections to F1 and F2 when using a permanent magnet motor.

Use 16 AWG wire to connect the field output to a shunt wound motor. Table 2 lists the field output connections.

Table 2. Field Output Connections

Line Voltage (VAC)	Approximate Field Voltage (VDC)	Connect Motor Field To
115	50	F1 and L1
115	100	F1 and F2
230	100	F1 and L1
230	200	F1 and F2

Current and voltage follower

The drive can be configured to follow an isolated (floating) or non-isolated (grounded) signal input instead of a speed adjust potentiometer. (See Figure 4 below.)

Note: Ensure that SW501, CURR/VOLT SELECT, is in the proper position for your application prior to applying power. The factory setting for this switch is the VOLT position.

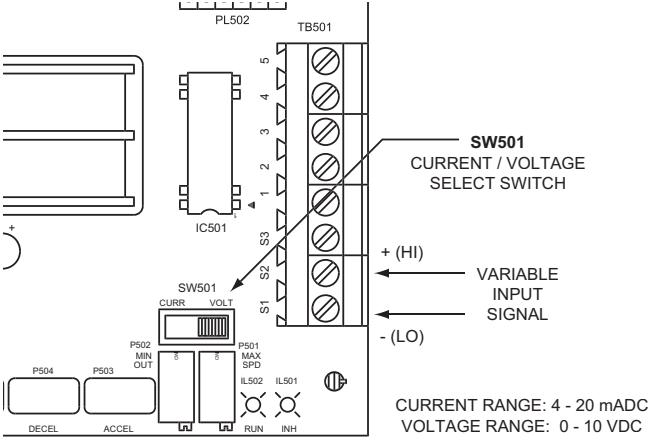


Figure 4. Current/Voltage Follower Configuration

Operation

Before applying power

- Verify that no conductive material is present on the printed circuit board.
- Verify that the AC supply is properly balanced.

Startup

To start the drive:

1. Apply AC power to the drive. The POWER ON (green) LED lights when power is applied.
2. Rotate the speed adjust potentiometer knob clockwise until the desired speed is reached.

Line starting and stopping

Line starting and stopping (applying and removing AC line voltage) is recommended only for infrequent starting and stopping of a drive. When AC line voltage is applied to the drive, the motor accelerates to the speed set by the speed adjust potentiometer. When AC line voltage is removed, the motor coasts to a stop.

Inhibit circuit

Connect an inhibit switch as shown in Figure 5 or 5a. Engaging the inhibit circuit causes the motor to decelerate to a stop at a rate controlled by the DECEL trimpot. Disengaging the inhibit circuit accelerates the motor to set speed at a rate controlled by the ACCEL trimpot.

Twist the wires to the inhibit terminals and separate them from power-carrying wires or sources of electrical noise. Use shielded cable if the inhibit wires are longer than 18 inches (46 cm). If shielded cable is used, ground only one end of the shield to earth ground. Do not ground both ends of the shield.

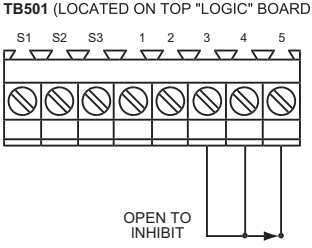


Figure 5.
Inhibit Terminals (Option 1)

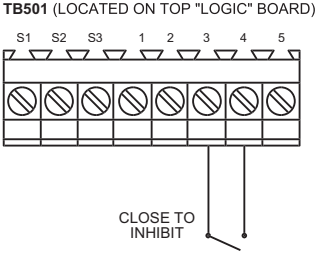


Figure 5a.
Inhibit Terminals (Option 2)

Decelerating to minimum speed

The switch shown in Figure 6 may be used to decelerate a motor to a minimum speed. Closing the switch between S1 and S2 decelerates the motor from set speed to a minimum speed determined by the MIN OUT trimpot setting. If the MIN OUT trimpot is set full CCW, the motor decelerates to zero speed when the switch between S1 and S2 is closed. The DECEL trimpot setting determines the rate at which the drive decelerates. By opening the switch, the motor accelerates to set speed at a rate determined by the ACCEL trimpot setting.

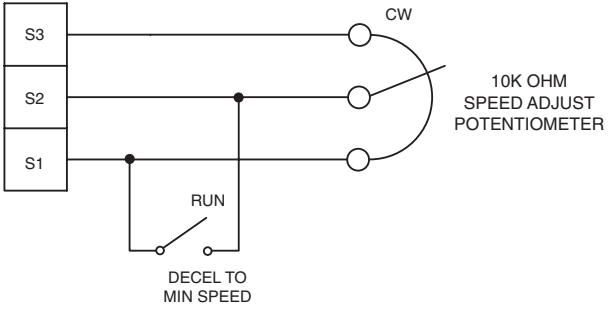


Figure 6. Run/Decelerate to Minimum Speed Switch

Dynamic braking

Dynamic braking may be used to rapidly stop a motor (Figure 7). For the RUN/BRAKE switch, use a two-pole, two position switch rated for at least 250 VDC, 12 amps. For the dynamic brake resistor, use a high-power wirewound resistor rated at a minimum of 40 watts.

Sizing the dynamic 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. See Table 3 for recommended dynamic brake resistor sizes.

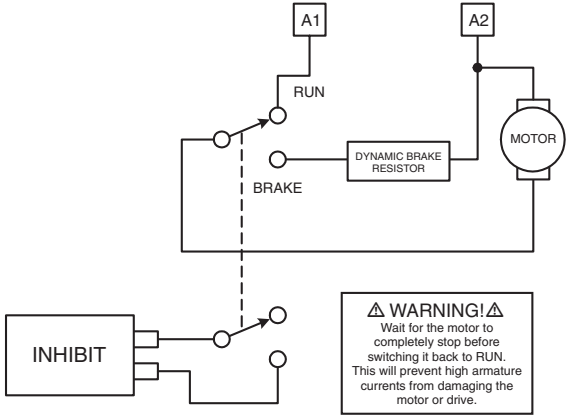


Figure 7. Dynamic Brake Connection

Table 3. Recommended Dynamic Brake Resistor Sizes

Motor Armature Current Rating	Minimum Dynamic Brake Resistor Value	Minimum Dynamic Brake Resistor Wattage
Less than 2 ADC	1 ohm	1W
2–3 ADC	5 ohm	5W
3–5 ADC	10 ohm	10W
5–10 ADC	20 ohm	20W
10–17 ADC	40 ohm	50W

WARNING!

For frequent starts and stops, short the inhibit terminals, decelerate to a minimum speed, or apply a dynamic brake to the motor. Do not use any of these methods for emergency stopping because they may not stop a drive that is malfunctioning. **Removing AC line power (both L1 and L2) is the only acceptable method for emergency stopping.**

Frequent starting and stopping can produce high torque. This may cause damage to motors, especially gearmotors that are not properly sized for the application.

Diagnostic LEDs

MM03/MM10-PCM series drives are equipped with four diagnostic LEDs:

Power (PWR): Green LED lights whenever AC line voltage is applied to the drive.

Current Limit (CURR LIMIT or CL): Red LED lights whenever the drive reaches current limit.

Run (RUN): Green LED lights whenever the drive is applying a signal to the motor.

Inhibit (INH): Amber LED lights whenever the inhibit circuit is engaged.

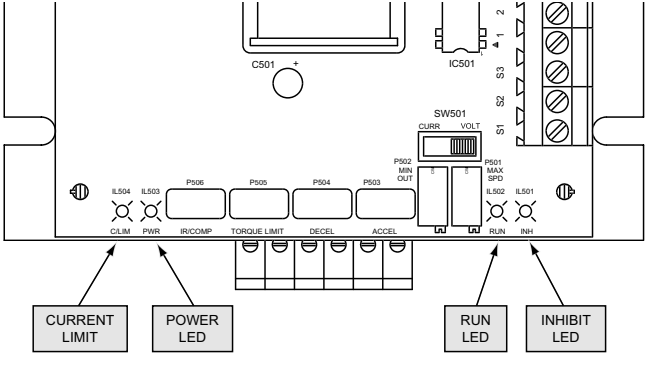


Figure 8. Diagnostic LED locations

Calibration

MM03/MM10-PCM series drives have six user-adjustable trimpots: acceleration (ACCEL), deceleration (DECEL), TORQUE LIMIT, regulation (IR COMP), minimum speed (MIN OUT) and maximum speed (MAX SPD).

Recalibrate the trimpots if a different horsepower motor is used. Four (4) trimpot settings increase with clockwise (CW) rotation and decrease with counterclockwise (CCW) rotation: ACCEL, DECEL, TORQUE LIMIT, and IR COMP. The MIN OUT and MAX SPD trimpots increase with counterclockwise (CCW) rotation and decrease with clockwise (CW) rotation. Use a non-metallic screwdriver for calibration. Each trimpot is identified on the printed circuit board.

ACCELERATION (ACCEL)

The ACCELERATION **(ACCEL)** setting determines the time the motor takes to ramp to a higher speed. The ACCEL setting is factory set to its minimum value (full CCW).

To calibrate ACCEL trimpot setting:

1. Set the ACCEL trimpot full CCW.
2. Turn the speed adjust potentiometer full CW.
3. Adjust the ACCEL trimpot until the desired time is reached for maximum motor speed.

DECELERATION (DECEL)

The deceleration (**DECEL)** trimpot setting adjusts the time required for the motor to ramp to a lower speed. The shortest DECEL time is the time that the motor takes to coast to a stop. It is factory set to the minimum value (full CCW).

To calibrate DECEL trimpot setting:

1. Turn the speed adjust potentiometer full CCW.
2. Adjust the DECEL trimpot until the motor has stopped, or is running at the desired minimum speed.

Note: Check the DECEL and ACCEL trimpot settings after recalibrating to verify that the motor runs at the desired minimum and maximum speed.

TORQUE LIMIT (TQ LIM)

The torque limit **(TQ LIM)** trimpot setting determines the maximum armature current output of the drive. It is factory calibrated to 3.6 amps DC for MM03-PCM drives and 12A DC for MM10-PCM drives. See Figure 9 on page 20 for approximate TQ LIM settings.

To calibrate TORQUE LIMIT:

1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the TORQUE LIMIT trimpot to minimum (full CCW).
3. Lock the motor shaft. Be sure that the motor is firmly mounted. Connect, but do not apply, power to the drive.

4. Set the speed adjust potentiometer to minimum (full CCW) and apply power to the drive.
5. Set the speed adjust potentiometer to maximum (full CW).
6. Adjust the TORQUE LIMIT trimpot CW slowly until the armature current is 120% of motor rated armature current.
7. Set the speed adjust potentiometer to minimum and remove the lock from the motor shaft.

REGULATION (IR COMP)

The regulation (**IR COMP)** trimpot setting determines the degree to which motor speed is held constant as the motor load changes. It is factory set for optimum motor regulation. See Figure 9 on page 20 for approximate IR COMP settings.

To calibrate IR COMP (exact calibration):

1. Ensure that power is not applied and turn the IR COMP trimpot full CCW.
2. Apply power and set the speed adjust potentiometer until the motor runs at midspeed without load (for example, 900 RPM for an 1800 RPM motor) A hand held 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 trimpot until the motor runs at the speed measured in step 2.

Approximate calibration:

If the motor does not maintain set speed as the load changes, gradually rotate the IR COMP trimpot CW. If the motor oscillates (overcompensation), the IR COMP trimpot may be set too high (CW). Turn the IR COMP trimpot CCW to stabilize the motor speed.

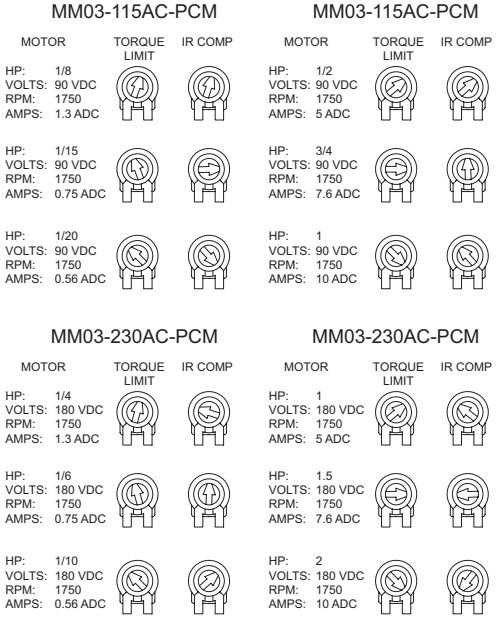


Figure 9. Approximate CURR. LIMIT and IR COMP Settings

MINIMUM OUTPUT (MIN OUT)

The minimum output (**MIN OUT)** setting determines the motor speed when the speed adjust potentiometer is turned full CCW. It is factory set to zero speed.

To calibrate, turn the speed adjust potentiometer full CCW. Adjust the MIN SPD trimpot until the motor has stopped or is running at the desired minimum speed. NOTE: The MIN OUT trimpot increases with counterclockwise (CCW) rotation and decreases with clockwise (CW) rotation.

MAXIMUM SPEED (MAX SPD)

The maximum speed (**MAX SPD)** setting determines the motor speed when the speed adjust potentiometer is turned full CW. It is factory set for maximum rated motor speed.

To calibrate, set the MAX SPD trimpot full CCW. Turn the speed adjust potentiometer full CW. Adjust the MAX SPD trimpot until the desired maximum motor speed is reached. NOTE: The MAX SPD trimpot increases with counterclockwise (CCW) rotation and decreases with clockwise (CW) rotation.

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

Application Notes

Multiple fixed speeds

Replace the speed adjust potentiometer with series resistors with a total series resistance of 10K ohms (Figure 10). Add a single pole, multi-position switch with the correct number of positions for the desired number of fixed speeds.

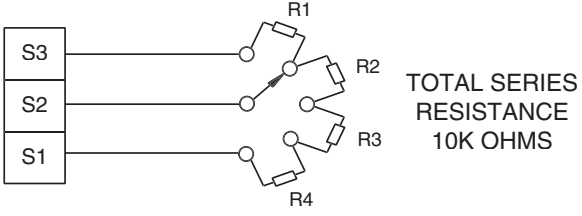


Figure 10. Multiple Fixed Speeds

Adjustable speeds using potentiometers in series

Replace the speed adjust potentiometer with a single-pole, multi-position switch, and two or more potentiometers in series, with a total series resistance of 10K ohms. Figure 11 shows a connection for fixed high and low speed adjust potentiometers.

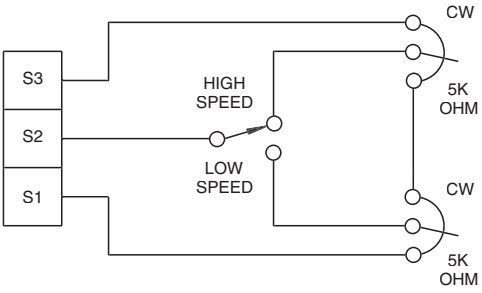


Figure 11. Adjustable Fixed Speeds Using Potentiometers in Series

Independent adjustable speeds

Replace the speed adjust potentiometer with a single-pole, multi-position switch, and two or more potentiometers in parallel, with a total parallel resistance of 10K ohms. Figure 12 shows the connection of two independent speed adjust potentiometers that can be mounted at two separate operating stations.

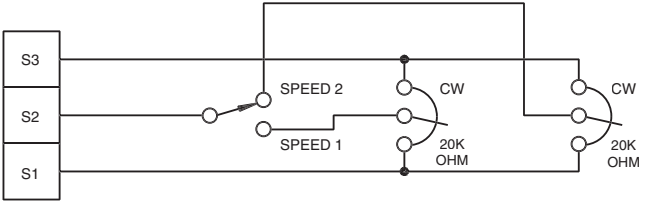


Figure 12. Independent Adjustable Speeds

RUN/JOG switch connection to speed adjust potentiometer

In this wiring option, connect the RUN/JOG switch and the JOG pushbutton as shown in Figure 13. When the RUN/JOG switch is set to JOG, the motor decelerates to minimum speed (minimum speed is determined by the MIN SPD trimpot setting). Press the JOG pushbutton to jog the motor. Return the RUN/JOG switch to RUN for normal operation.

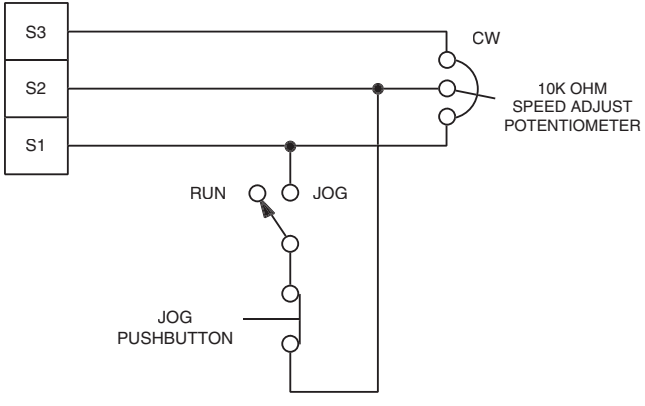


Figure 13. RUN/JOG Switch Connection to Speed Adjust Potentiometer

Leader-follower application

In this application, use a PCM4 to monitor the speed of the leader motor (see Figure 14). The PCM4 isolates the leader motor from the follower drive, and outputs a voltage proportional to the leader motor armature voltage. The follower drive uses this voltage reference to set the speed of the follower motor. An optional ratio potentiometer may be used to scale the PCM4 output voltage.

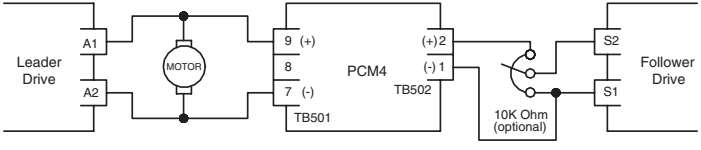


Figure 14. Leader-Follower Application

Reversing

A dynamic brake may be used when reversing the motor direction (see Figure 15). Use a three-pole, three-position switch rated for at least 10A at 250 VDC. The dynamic braking resistor should be ceramic encased,a minimum of 20Ω and rated at 40 watts. The motor stops less rapidly with higher brake resistor values. Wait for the motor to stop completely before switching it to either the forward or reverse direction.

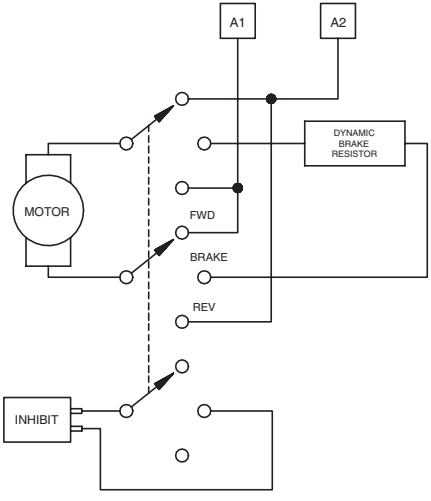


Figure 15. Reversing Circuit Connection

Reversing with a DIGI-LOK Controller

A DIGI-LOK controller, model DLC600, can be used in a reversing application. The DIGI-LOK must be inhibited while braking. Without the inhibit feature, the controller will continue to regulate. This will cause overshoot when the DIGI-LOK is switched back to the drive.

Figure 16 shows the connection of the reversing circuit between an MM03/MM10-PCM series drive and a DLC600. Note: Only one DLC option (Optical Encoder or Magnetic Pickup) may be used simultaneously.

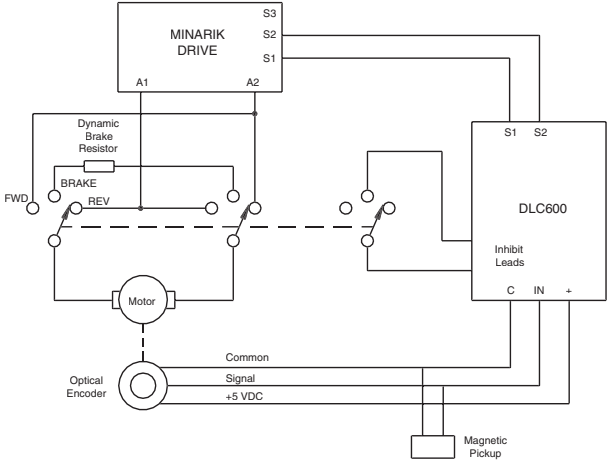


Figure 16. Reversing with a DLC600

Troubleshooting

> ⚠ **WARNING!**
> Dangerous voltages exist on the drive when it is powered. When possible, disconnect the AC line voltage from the drive while troubleshooting. Be alert. High voltages can cause serious or fatal injury.

Before troubleshooting

Perform the following steps before starting any procedure in this section:

1. Disconnect AC line voltage from the drive.
2. Check the drive closely for damaged components.
3. Check that no conductive or other foreign material has become lodged on the printed circuit board.
4. Verify that every connection is correct and in good condition.
5. Verify that there are no short circuits or grounded connections.
6. Check that the voltage selection switch settings match the AC line and output voltages.
7. Check that the drive's rated armature and field outputs are consistent with the motor ratings.

Problem	Possible Causes	Suggested Solutions
Line fuse blows	1. Line fuses are the wrong size. 2. Motor cable or armature is shorted to ground. 3. Nuisance tripping caused by a combination of ambient conditions and high-current spikes. 4. Field circuit is open.	1. Check that line fuses are the appropriate size. 2. Check motor cable and armature for shorts. 3. Increase CURR. LIMIT setting. 4. Send drive to Minarik repair department.
Line fuse does not blow, but the motor does not run	1. Speed adjust pot or speed input signal is set to zero. 2. Speed adjust pot or speed input signal connections are open. 3. Current limit circuit is engaged or set too low. 4. Drive is not receiving AC line voltage. 5. Motor is not connected.	1. Increase speed adjust pot or speed input signal setting. 2. Check that the speed adjust pot or speed input signal connections are not open. 3. Verify that the motor is not jammed. Increase CURR. LIMIT setting. 4. Apply AC line voltage to L1 and L2. 5. Connect motor to A1 and A2.

Problem	Possible Causes	Suggested Solutions
Motor runs too fast at maximum speed setting	1. MIN SPD and MAX SPD settings are too high.	1. Recalibrate MIN SPD and MAX SPD.
Motor runs too slow or too fast	1. MIN SPD and MAX SPD are not calibrated.	1. Calibrate MIN SPD and MAX SPD.
Motor will not reach the desired speed.	1. MAX SPD setting is too low. 2. IR COMP setting is too low. 3. Motor is overloaded.	1. Increase MAX SPD setting. 2. Increase IR COMP setting. 3. Check motor load. Resize the motor and drive if necessary.
Motor pulsates or surges under load	1. IR COMP is set too high. 2. Motor “bouncing” in and out of current limit.	1. Adjust the IR COMP setting slightly CCW until the motor speed stabilizes. 2. Make sure motor is not undersized for load; adjust CURR. LIMIT setting.

For additional assistance, contact your local Minarik Distributor, or the factory direct:

TEL: 1-800-MINARIK (646-2745) or FAX: 1-800-394-6334

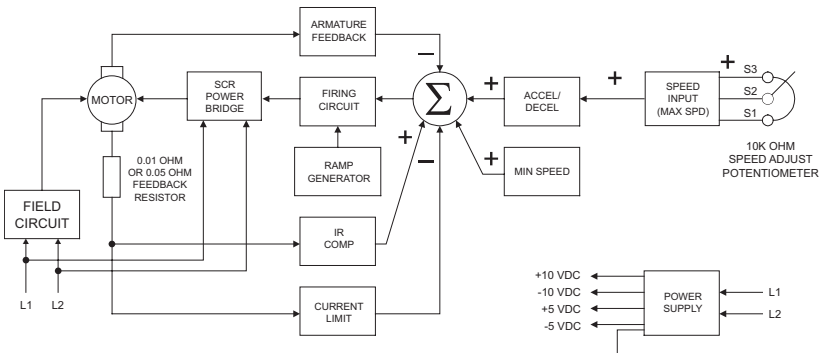


FIgure 17. MM03/MM10-PCM Series Block Diagram

Replacement Parts

Replacement parts are available from Minarik Corporation and its distributors for this drive series.

Table 4. Replacement Parts

Model No.	Symbol	Description	Minarik P/N
MM03-115AC-PCM	D501– 503	600V, 8A Diode	071-0007
	FU502	5A, 3AG Fast-Blow Fuse	050-0022
	N/A	Chassis	222-0079
	N/A	Circuit Board Support Rivet	153-0078
	N/A	Circuit Board Support Rivet	153-0074
	N/A	10K Ohm Pot Kit	202-0079
	R502	.05 Ohm, 5W Resistor	032-0089
	SCR501, -502	600V, 8A SCR	072-0024
	T501	115VAC Prim, 36VCT Transformer	230-0103
	TB501	6-pin, 90-deg. header block	164-0276
MM03-230AC-PCM		Same parts as above, except:	
	T501	230VAC Prim, DST-336 Transformer	230-0104
MM10-115AC-PCM	D501–503	800V, 20A Diode	071-0039
	FU502	20A, 3AB Fast-Blow Fuse	050-0019
	N/A	Chassis	222-0079
	N/A	Circuit Board Support Rivet	153-0078
	N/A	Circuit Board Support Rivet	153-0074
	N/A	10K Ohm Pot Kit	202-0079
	R502	.01 Ohm, 5W Resistor	032-0129
	SCR501, -502	800V, 20A SCR	072-0043
	T501	115VAC Prim, 36VCT Transformer	230-0103
	TB501	6-pin, 90-deg. header block	164-0276
MM10-230AC-PCM		Same parts as above, except:	
	T501	230VAC Prim, DST-336 Transformer	230-0104

Certificate of Compliance

Minarik Corporation hereby certifies that its MM-PCM series drives have been approved to bear the “CE” mark provided the conditions of approval (listed in Exhibit “A”) have been met by the end user.

The MM-PCM series has been tested to test specifications EN55011:1991 (emissions), and EN50082-1:1992 (immunity).

Compliance allows Minarik’s MM-PCM series to bear the CE mark. The end user, as described herein, falls into one of two categories:

1. The Consumer will deploy a stand-alone unit as an integral, yet external, portion of the machine he/she is operating.

2. The Original Equipment Manufacturer (OEM) will implement the product as a component of the machine being manufactured.

Exhibit “A”

In addition to EMI/RFI safeguards inherent in the MM-PCM series’ design, external filtering is required. Minarik requires the Corcom® filters listed in Table 5. If the exact filter is not available, the specifications are as follows:

L = (1.73 + 0.03) milliHenries.
C = (0.27 + 0.54) microFarads (X); 0.0055 microFarads (Y).
R = 330Kohms.
Rated current: 1.4 times maximum DC motor current.
Filter type: Balanced 2-section.

Table 5. Corcom® Filters

Nameplate Current of Motor Wired to the Drive	Corcom® Filter Part Number
0 to 4 amps	6VV1
4.1 to 13 amps	20VV1

The filters in Table 5 should be wired to the AC line within 0.25 meters of the drive. The ground connection from the filter must be wired to solid earth ground (resistance less than 500 ohms), not machine ground. This is very important!

If the end-user is using a CE-approved motor, the correct filter from Table 5 is all that is necessary to meet the EMC directives listed herein.

If the end-user is not using a CE-approved motor, a second filter on the output, p/n CEXXMM, must be used. XX = rated current of the filter.

The CE20MM is a Real-Pole Balanced-Pi 3-pole filter. If the exact filter is not available, the specifications are as follows:

L & L1 = 2 * (0.8) milliHenries.
C & C1 = 2 * (0.1) microFarads @ 400W VDC.
R_{in} = 0.1 ohm; R_{out} = 1.2 ohm.

Table 6. Minarik Filters

Nameplate Current of Motor Wired to the Drive	Minarik Filter Part Number
0 to 4 amps	CE04MM
4.1 to 13 amps	CE20MM

The filters in Table 6 must be wired to the DC output of the drive, as close to the drive as possible. The ground connection from the filter must be wired to solid earth ground (resistance less than 500 ohms); not machine ground. This is very important!

The end user must use the filtration listed in Exhibit A to comply with CE. The OEM may choose to provide alternative filtering that encompasses the Minarik drive and other electronics within the same panel.

The OEM has this liberty because CE is a machinery directive. Whether or not every component in the OEM's machinery meets CE, the OEM must still submit his machine for CE approval.

Thus, no component must necessarily meet CE within the machine, as long as the OEM takes the necessary steps to guarantee the machine does meet CE. By the same token, even if every component in the OEM's machine does meet CE, the machine will not necessarily meet CE as a machine.

Using CE-approved wiring practices, such as proper shielding, and the filters listed in Exhibit A guarantee the drive will meet EN55011 (1991 emissions standard) and EN50082-1 (1992 immunity standard).

Unconditional Warranty

A. Warranty - Minarik Corporation (referred to as "the Corporation") warrants that its products will be free from defects in workmanship and material for twelve (12) months or 3,000 hours, whichever comes first, from date of manufacture thereof. Within this warranty period, the Corporation will repair or replace, at its sole discretion, such products that are returned to Minarik Corporation, 901 East Thompson Avenue, Glendale, CA 91201-2011 USA.

This warranty applies only to standard catalog products, and does not apply to specials. Any returns for special controls will be evaluated on a case-by-case basis. The Corporation is not responsible for removal, installation, or any other incidental expenses incurred in shipping the product to and from the repair point.

B. Disclaimer - The provisions of Paragraph A are the Corporation's sole obligation and exclude all other warranties of merchantability for use, express or implied. The Corporation further disclaims any responsibility whatsoever to the customer or to any other person for injury to the person or damage or loss of property of value caused by any product that has been subject to misuse, negligence, or accident, or misapplied or modified by unauthorized persons or improperly installed.

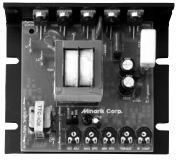
C. Limitations of Liability - In the event of any claim for breech of any of the Corporation's obligations, whether express or implied, and particularly of any other claim or breech of warranty contained in Paragraph A, or of any other warranties, express or implied, or claim of liability that might, despite Paragraph B, be decided against the Corporation by lawful authority, the Corporation shall under no circumstances be liable for any consequential damages, losses, or expense arising in connection with the use of, or inability to use, the Corporation's product for any purpose whatsoever.

An adjustment made under warranty does not void the warranty, nor does it imply an extension of the original 12-month warranty period. Products serviced and/or parts replaced on a no-charge basis during the warranty period carry the unexpired portion of the original warranty only.

If for any reason any of the foregoing provisions shall be ineffective, the Corporation's liability for damages arising out of its manufacture or sale of equipment, or use thereof, whether such liability is based on warranty, contract, negligence, strict liability in tort, or otherwise, shall not in any event exceed the full purchase price of such equipment.

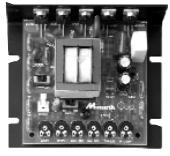
Any action against the Corporation based upon any liability or obligation arising hereunder or under any law applicable to the sale of equipment or the use thereof, must be commenced within one year after the cause of such action arises.

Other drives from Minarik Corporation:

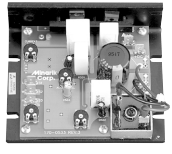


PCM20000 Series

DLC600



MM23000 Series



XP Series
(AC or DC Input)

Minarik Automation & Control

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