

**Minarik** Automation  
& Control

# PCM20000 SERIES

Models:

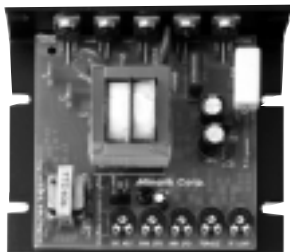
**PCM21000A**

**PCM21000C**

**PCM21010A**

**PCM22000A**

**PCM22000C**



**USER'S MANUAL**


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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.

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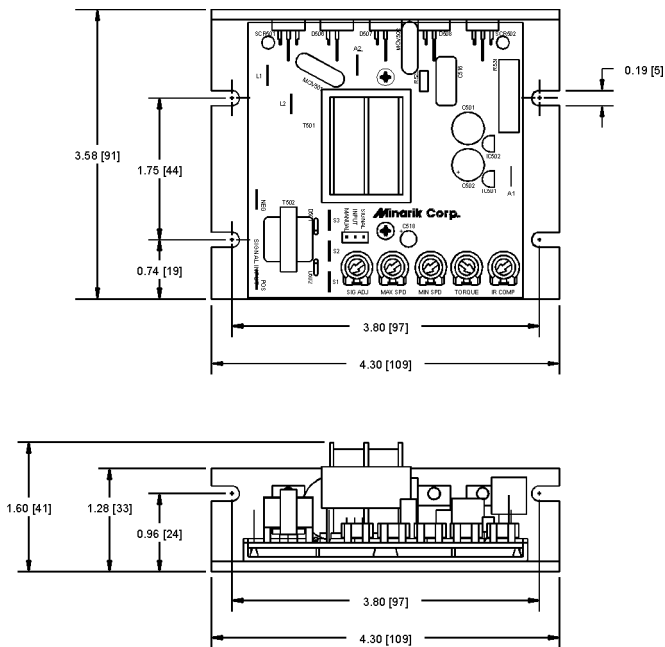
# Specifications

Model	PCM21000	PCM21010	PCM22000
Line voltage†	115 VAC	115 VAC	230 VAC
Line current, max	7A AC	3A AC	7A AC
Line current, max††	14A AC	n/a	14A AC
Armature voltage range	0 – 90 VDC	0 – 90 VDC	0 – 180 VDC
Horsepower range	1/4 – 1/2 hp	1/20 – 1/8 hp	1/2 – 1 hp
Horsepower range††	1/4 – 1 hp	n/a	1/2 – 2 hp
Armature current, max	5 ADC	2 ADC	5 ADC
Armature current, max††	10 ADC	n/a	10 ADC
Input signal range (input circuit is isolated)			
Voltage			0 – 10 VDC
Current (PCM2x000C series only)			4 – 20 mADC
Ambient temperature range			10°C – 55°C

† Line voltage is  $\pm 10\%$ , 50/60 Hz, single phase

†† When mounted on 223-0159 heat sink kit

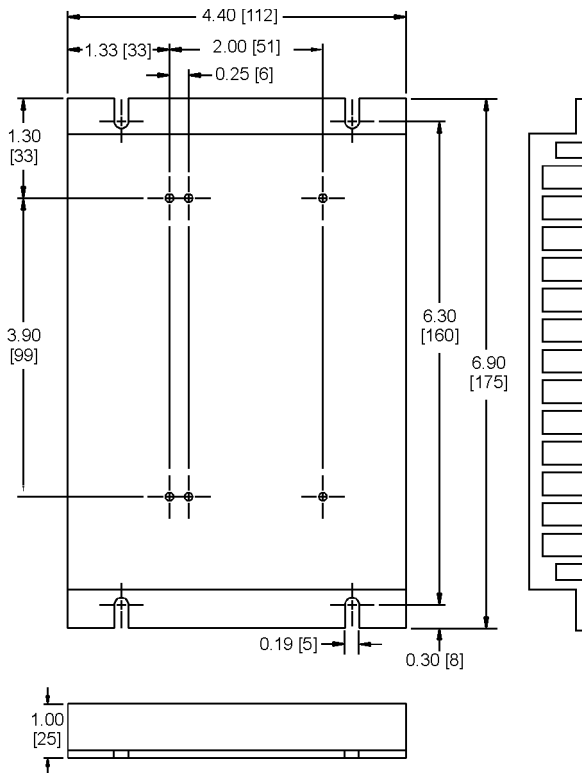
# Dimensions



ALL DIMENSIONS IN INCHES [MILLIMETERS]

**Figure 1. PCM2x000A and PCM2x000C Dimensions**





ALL DIMENSIONS IN INCHES [MILLIMETERS]

**Figure 2. Heat Sink Kit Dimensions**

# Installation



## Warning

**Do not install, rewire, or remove this control with input power applied.** Doing so may cause fire or serious injury. Make sure you have read and understood the Safety Warnings before attempting 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 to reach bare metal.

## Wiring



### Warning



Do not install, remove, or rewire this equipment with power applied. Failure to heed this warning may result in fire, explosion, or serious injury.

Circuit potentials are at 115 or 230 VAC above ground. To prevent the risk of injury or fatality, avoid direct contact with the printed circuit board or with circuit elements.

Do not disconnect any of the motor leads from the drive unless power is removed or the drive is disabled. Opening any one motor lead may destroy the drive.

- Use 18-24 AWG wire for speed adjust potentiometer wiring. Use 14–16 AWG wire for AC line (L1, L2) and motor (A1 and A2) wiring.

## Shielding guidelines



### Warning

Under no circumstances should power and logic leads be bundled together. Induced voltage can cause unpredictable behavior any electronic device, including motor controls.

As a general rule, Minarik recommends shielding of all conductors.

If it is not practical to shield power conductors, Minarik recommends shielding all logic-level leads. If shielding logic 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 a device on the drive, ground the shield at the end away from the drive. Do not ground both ends of the shield.

If the drive continues to pick up noise after grounding the shield, it may be necessary to add AC line filtering devices, or to mount the drive in a less noisy environment.

Logic wires from other input devices, such as motion controllers and PLL velocity controllers, must be separated from power lines in the same manner as the logic I/O on this drive.

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## Heat sinking

PCM2x000-series drives require an additional heat sink when the continuous armature current is above 5 ADC. Use Minarik® part number 223–0159. All other chassis drives have sufficient heat sinking in their basic configurations.

Apply a thermally conductive heat sink compound (such as Dow Corning® 340 Heat Sink Compound) between the drive chassis and heat sink surface for optimum heat transfer.

## Line fusing

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. Fuse blocks are included on cased drives only.

Table 1 (page 8) lists the recommended replacement line fuse sizes.

**Table 1. Line Fusing Chart**

<b>90 VDC Motor Horsepower</b>	<b>180 VDC Horsepower</b>	<b>Max. DC Armature Current (amps)</b>	<b>AC Line Fuse Size (amps)</b>
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	2.5	5
1/3	3/4	3.5	8
1/2	1	5.0	10
3/4	1 1/2	7.5	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).

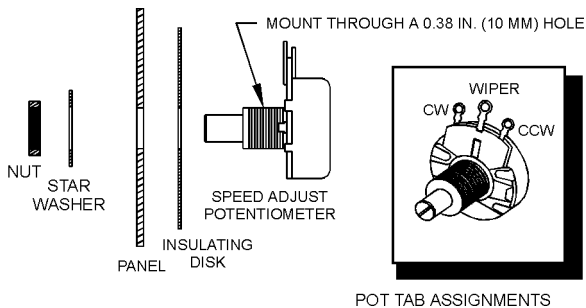
## Speed adjust potentiometer



### Warning

Be sure that the potentiometer tabs do not make contact with the potentiometer enclosure. Grounding the input will cause damage to the drive.

Mount the speed adjust potentiometer through a 0.38 in. (10 mm) hole with the hardware provided (Figure 3). Install the circular insulating disk between the panel and the 10K ohm speed adjust potentiometer. Twist the speed adjust potentiometer wire to avoid picking up unwanted electrical noise. If speed adjust potentiometer wires are longer than 18 in. (457 mm), use shielded cable. Keep speed adjust potentiometer wires separate from power leads (L1, L2, A1, A2).



**Figure 3. Speed Adjust Potentiometer Installation**

## Connections



### Warning

**Do not connect this equipment with power applied.**

Failure to heed this directive may result in fire or serious injury.

**Minarik strongly recommends the installation of a master power switch in the voltage input line, as shown in Figure 4 (page 13) or Figure 5 (page 14).** The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

## Power, fuse and motor connections

If you use a PCM2x000A-series drive, connect the power input leads, an external line fuse and a DC motor to the drive's printed circuit board (PCB) as shown in Figure 4, page 13.

If you use a PCM2x000C-series drive, refer to Figure 5 (page 14).

### Motor

Connect a DC motor to PCB terminals A1 and A2 as shown in Figure 4. **Ensure that the motor voltage rating is consistent with the drive's output voltage.**



Minarik drives supply motor voltage from A1 and A2 terminals. It is assumed throughout this manual that, when A1 is positive with respect to A2, the motor will rotate clockwise (CW) while looking at the output shaft protruding from the front of the motor. If this is opposite of the desired rotation, simply reverse the wiring of A1 and A2 with each other.

## Power input



### Warning

**Minarik strongly recommends the installation of a master power switch in the voltage input line, as shown in Figure 4.** The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

Connect the AC line power leads to terminals L1 and L2, or to a double-throw, single-pole master power switch (recommended).

## Line fuse

Wire an external line fuse between the stop switch (if installed) and the L1 terminal on terminal board TB501. An additional line fuse should be installed on L2 if the input voltage is 230 VAC. The line fuse(s) should be rated at 250 volts and 150 - 200% of maximum motor nameplate current. Refer to the line fuse chart on page 8 for fuse ratings.

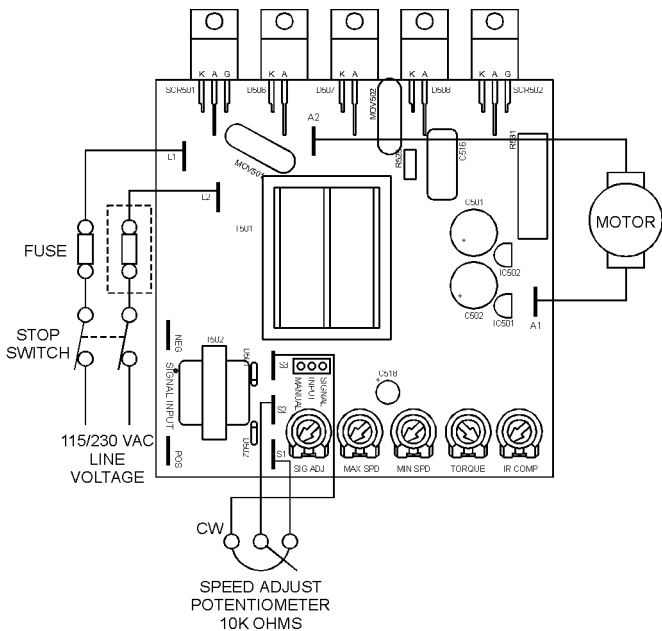


Figure 4. PCM2x000A Drive Connections

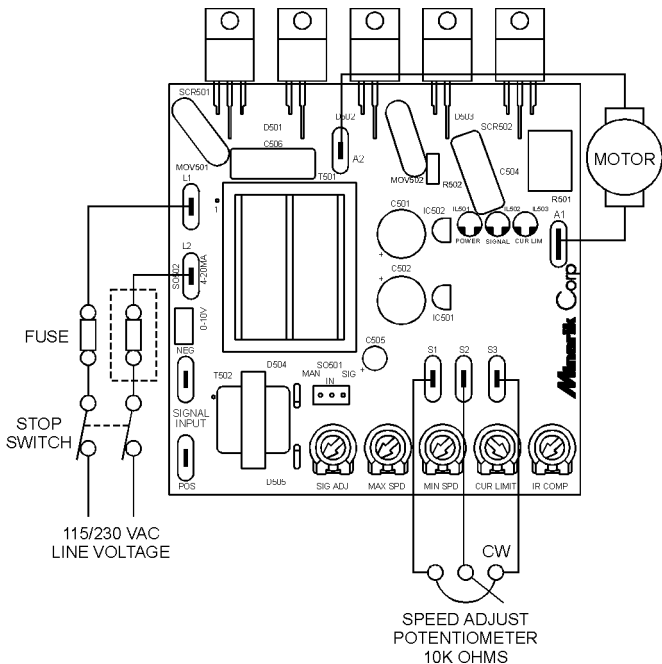


Figure 5. PCM2x000C Drive Connections

## Voltage signal follower (PCM2x000A)



### Warning

Before applying power, ensure that SO501 is set to SIGNAL as shown in Figure 6.

Instead of using a speed adjust potentiometer, the drive may be wired to follow a 0–10 VDC grounded or ungrounded voltage signal. Connect the signal input (+) to POS. Connect the signal common (–) to NEG. A potentiometer can be used to scale the analog input voltage.

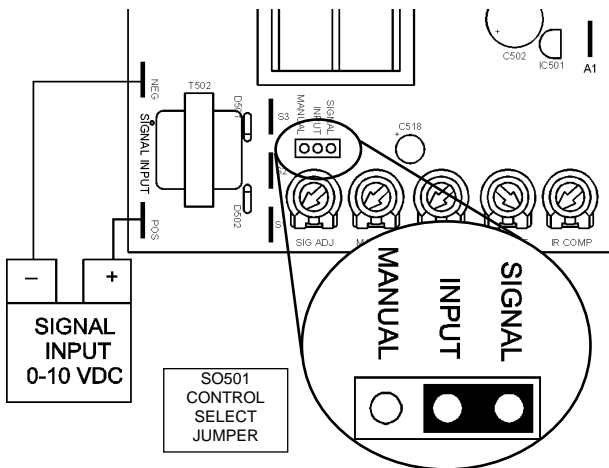


Figure 6. PCM2x000A Voltage Follower Connections

## Voltage signal follower (PCM2x000C)



### Warning

Before applying power, ensure that SO501 is set to SIGNAL and SO502 is set to 0-10 V as shown in Figure 7.

Instead of using a speed adjust potentiometer, the drive may be wired to follow a 0–10 VDC voltage signal. Connect the signal input (+) to POS. Connect the signal common (–) to NEG. A potentiometer can be used to scale the analog input voltage.

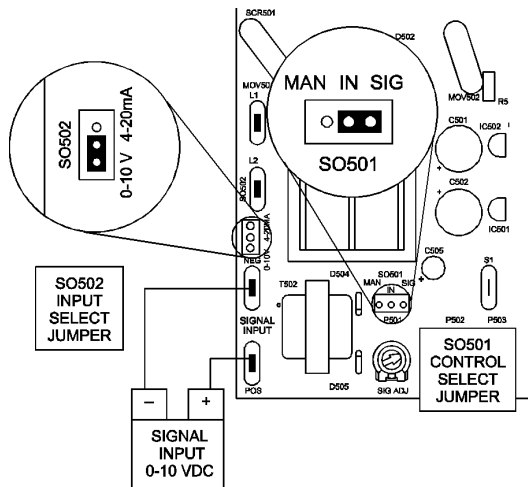


Figure 7. PCM2x000C Voltage Follower Connections

## Current signal follower (PCM2x000C only)



### Warning

Before applying power, ensure that SO501 is set to SIGNAL and SO502 is set to 4-20 mA as shown in Figure 8.

Instead of using a speed adjust potentiometer, the drive may be wired to follow a 4-20 mADC signal (Figure 8). Connect the signal input (+) to POS. Connect the signal common (-) to NEG.

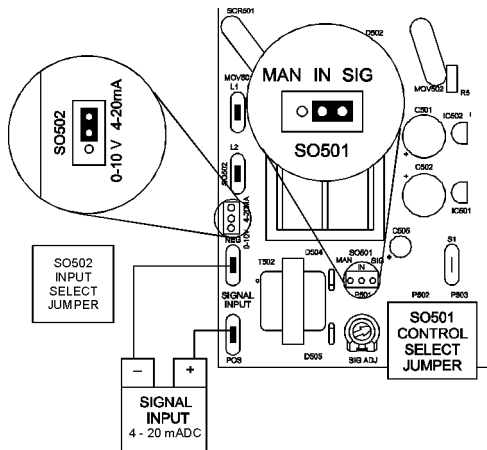


Figure 8. Current Follower Connections (PCM2x000C only)

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# Operation



## Warning

Floating voltages exist on the drive when it is powered. BE ALERT. High voltages can cause serious or fatal injury. For your safety, use personal protective equipment (PPE) when operating this drive.

Do not change jumper settings with power applied. Failure to follow these instructions may result in damage to the motor or drive, or serious injury to personnel.

## Before applying power

- Ensure that all jumpers are properly set prior to applying power. See Figure 9 (page 18) for PCM2x000A jumper location and settings. See Figure 10 (page 19) for PCM2x000C jumper locations and settings.
- Verify that no conductive material is present on the printed circuit board.

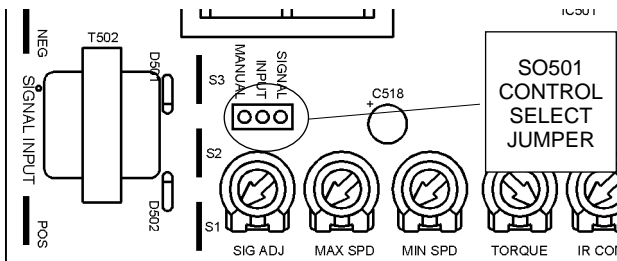
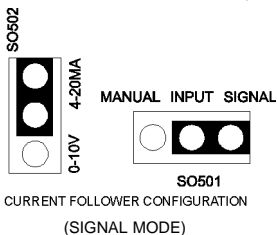
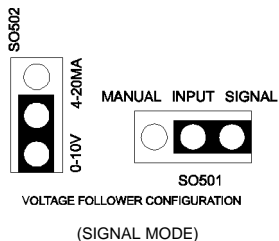
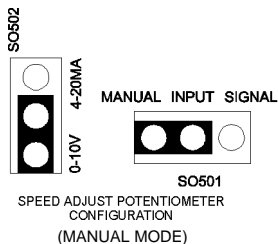
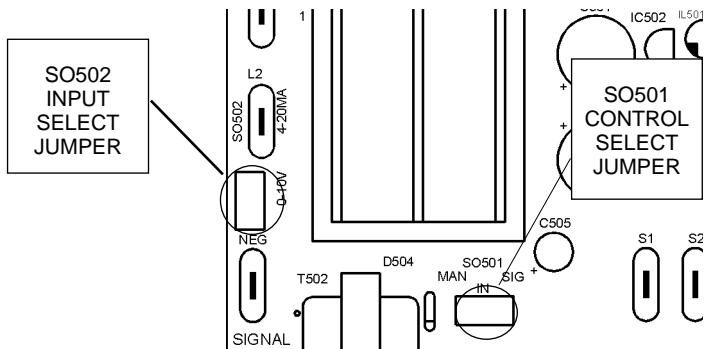


Figure 9. PCM2x000A Jumper Locations and Settings





**Figure 10. PCM2x00C Jumper Locations and Settings**

## Startup

To start the drive:

1. Turn the speed adjust potentiometer full counterclockwise (CCW). If the drive is following a voltage or current signal, set the signal to zero.
2. Apply AC line voltage.
3. Slowly advance the speed adjust potentiometer clockwise (CW), or slowly increase the reference signal. The motor slowly accelerates as the potentiometer is turned CW, or the signal is increased. Continue until the desired speed is reached.
4. Set the speed adjust potentiometer to zero, remove AC line voltage, or set the input signal to zero. The drive will coast to a stop.

If the motor or drive does not perform as described, disconnect the AC line voltage immediately. Refer to the Troubleshooting section for further assistance.

## Starting and stopping methods



### Warning

Decelerating to minimum speed, dynamic braking, or coasting to a stop is recommended for frequent starts and stops. Do not use any of these methods for emergency stopping. 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.

For this reason, **Minarik strongly recommends installing an emergency stop switch on both the L1 and L2 inputs** (see *Connections* on pages 13 and 14).

## Line starting and line stopping

Line starting and line stopping (applying and removing AC line voltage) is recommended for infrequent starting and stopping of a drive only. 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.

Minarik strongly recommends installing an emergency stop switch on both the L1 and L2 inputs (see *Connections* on pages 12 and 13).

## Decelerate to a stop

The RUN/STOP switch shown in Figure 11 may be used to decelerate a motor to a stop. Closing the switch between S2 and S1 decelerates the motor from set speed to a stop. Opening the switch will cause the motor to accelerate to set speed.

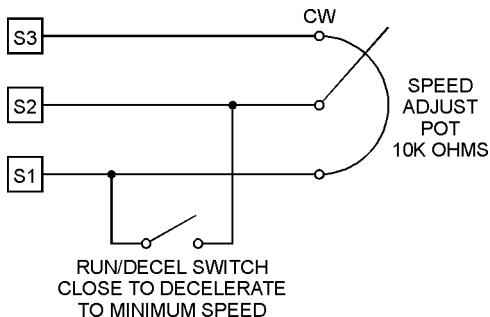


Figure 11. Run/Decelerate to Zero Speed Switch

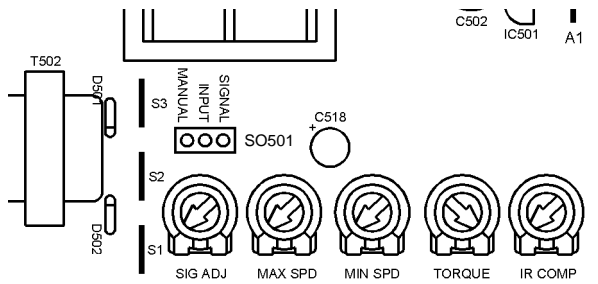
# Calibration



## Warning

Floating voltages exist on the drive when it is powered. When possible, disconnect the voltage input from the drive before adjusting the trimpots. If the trimpots must be adjusted with power applied, use insulated tools and the appropriate personal protection equipment. BE ALERT. High voltages can cause serious or fatal injury.

Each drive is factory calibrated to its maximum current rating. Readjust the calibration trimpot settings to accommodate lower horsepower motors. All adjustments increase with CW rotation, and decrease with CCW rotation.



**Figure 12. Calibration Trimpot Layout**

## Calibration procedure

### Before applying power

1. Verify that no conductive material is present on the printed circuit board.
2. Ensure that all jumpers are properly set.
3. Set all trimpots except TORQUE (CURR LIMIT on PCM20000C series drives) to full counterclockwise (CCW).
4. Set the TORQUE (CURR LIMIT on PCM20000C series drives) trimpot full clockwise (CW).
5. Set the speed adjust potentiometer or reference input signal to zero.
6. Apply line power to the drive.
7. Calibrate the trimpots in the following order:
  - SIGNAL ADJUST (SIG ADJ)
  - MINIMUM SPEED (MIN SPD)
  - MAXIMUM SPEED (MAX SPD)
  - TORQUE (CURR LIMIT on PCM20000C series drives)
  - REGULATION (IR COMP)

## SIGNAL ADJUST (SIG ADJ)



**NOTE:** This adjustment is not functional when operating in MANUAL mode.

### Calibration for PCM21000x drives:

The SIG ADJ setting determines the speed that the motor will achieve when the input voltage or current signal is at its maximum level. It is factory-set to deliver a 90 VDC armature output with a 10 VDC input signal. PCM22000x-series drives are calibrated to deliver a 180 VDC armature output with a 10 VDC input signal.

To calibrate SIG ADJ:

1. Ensure that no power is applied to the drive.
2. Set jumper SO501 to SIGNAL mode.
3. If using a PCM2x000C-series drive, set SO502 to 0-10V.
4. Apply line voltage.
5. Apply the maximum voltage or current signal
6. Rotate SIG ADJ until the desired motor speed is reached. If the drive is operated as a voltage follower, the signal required for rated output voltage must be at least 5 VDC, but no greater than 20 VDC.
7. Set the voltage signal to zero.

## MINIMUM SPEED (MIN SPD)

The MIN SPD setting determines the minimum speed when the speed adjust potentiometer is turned full CCW, or when the signal input is set to its minimum value. It is factory set to zero speed.

To calibrate MIN SPD:

1. Set the speed adjust potentiometer full CCW, or set the signal input to its minimum value.
2. Adjust the MIN SPD trimpot until the motor turns at the desired minimum speed.

## MAXIMUM SPEED (MAX SPD)



**NOTE:** This adjustment is not functional when operating in SIGNAL mode.

The MAX SPD setting determines the maximum motor speed when the speed adjust potentiometer is turned full CW. It is factory set to its maximum setting.

To calibrate MAX SPD:

1. Ensure that no power is applied to the drive.
2. Set jumper SO501 to MANUAL mode.
3. Apply line voltage.
4. Set the MAX trimpot full CCW.
5. Turn the speed adjust potentiometer full CW.
6. Adjust the MAX SPD trimpot until the desired maximum motor speed is reached.



## TORQUE (CURR LIMIT on PCM2000C series drives)



### Warning

Although TORQUE/CURR LIMIT is set to 120% of motor nameplate current rating, continuous operation beyond that rating may damage the motor. If you intend to operate beyond the rating, contact your Minarik representative for assistance.

The TORQUE (CURR LIMIT on PCM2000C series) setting determines the maximum armature current output of the drive. It is factory set at 120% of maximum drive current.

TORQUE/CURR LIMIT must be recalibrated if you use a lower horsepower motor.

To calibrate TORQUE/CURR LIMIT, use the following procedure:

1. With no power applied to the drive, connect a DC ammeter in series with the motor armature.
2. Set the TORQUE/CURR LIMIT trimpot to full CCW.
3. Carefully lock the motor armature. Ensure that the motor is firmly mounted.
4. Apply line power. The motor should be stopped.
5. Set the speed potentiometer or reference signal to maximum speed. The motor should remain stopped.
6. Slowly rotate the TORQUE/CURR LIMIT trimpot clockwise (CW) until the ammeter reads 120% of maximum motor armature current.

7. Set the speed adjust potentiometer or reference signal to zero speed.
8. Remove power from the drive.
9. Remove the lock from the motor shaft.
10. Remove the ammeter in series with the motor armature.

## **REGULATION (IR COMP)**

The 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. To calibrate IR COMP (exact calibration):

1. Turn the IR COMP trimpot full CCW.
2. 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.

## PCM20010 SERIES



TORQUE



IR COMP

1 HP  
90 VDC  
1750 RPM  
10 AMPS



TORQUE



IR COMP

2 HP  
180 VDC  
1750 RPM  
10 AMPS



TORQUE



IR COMP

3/4 HP  
90 VDC  
1750 RPM  
7.5 AMPS



TORQUE



IR COMP

1 1/2 HP  
180 VDC  
1750 RPM  
7.5 AMPS

## ALL OTHER PCM20000 SERIES DRIVES



TORQUE



IR COMP

1 HP  
90 VDC  
1750 RPM  
10 AMPS



TORQUE



IR COMP

2 HP  
180 VDC  
1750 RPM  
10 AMPS



TORQUE



IR COMP

3/4 HP  
90 VDC  
1750 RPM  
7.5 AMPS



TORQUE



IR COMP

1 1/2 HP  
180 VDC  
1750 RPM  
7.5 AMPS



TORQUE



IR COMP

1/2 HP  
90 VDC  
1750 RPM  
5 AMPS



TORQUE



IR COMP

1 HP  
180 VDC  
1750 RPM  
5 AMPS



TORQUE



IR COMP

1/3 HP  
90 VDC  
1750 RPM  
3.5 AMPS



TORQUE



IR COMP

3/4 HP  
180 VDC  
1750 RPM  
3.5 AMPS



TORQUE



IR COMP

1/4 HP  
90 VDC  
1750 RPM  
2.5 AMPS



TORQUE



IR COMP

1/2 HP  
180 VDC  
1750 RPM  
2.5 AMPS

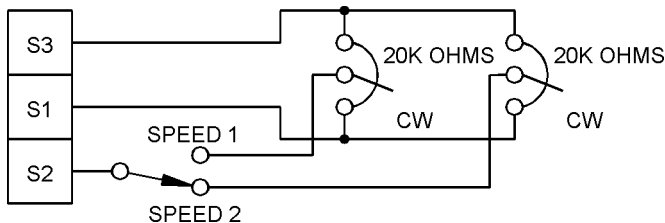
**NOTE:** TORQUE settings may be substituted for CURRENT LIMIT on PCM2x000C series controls

**Figure 13. Typical TORQUE and IR COMP settings  
(actual settings may vary with each application)**

# Application Notes

## Independent Adjustable Speeds

Connect two speed adjust potentiometers with a single-pole two-position switch to select between two independent speeds shown in the forward direction (Figure 14). The speed adjust potentiometers can be mounted at two separate operating stations.



**Figure 14. Independent Adjustable Speeds  
(Forward Direction)**

## Multiple fixed speeds

Replace the speed adjust potentiometer with series resistors with a total series resistance of 10K ohms (Figure 15). Add a single pole, multi-position switch with the correct number of positions for the desired number of fixed speeds.

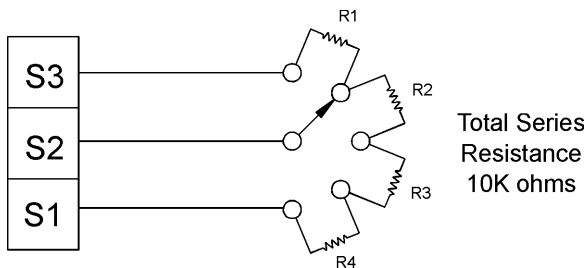
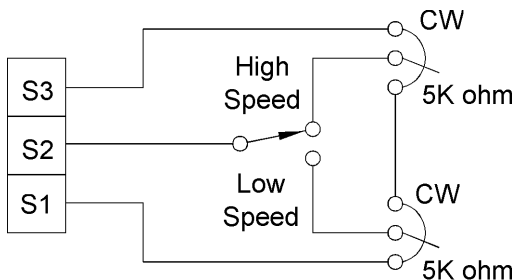


Figure 15. Multiple Fixed Speeds

## Adjustable speeds using potentiometers in series

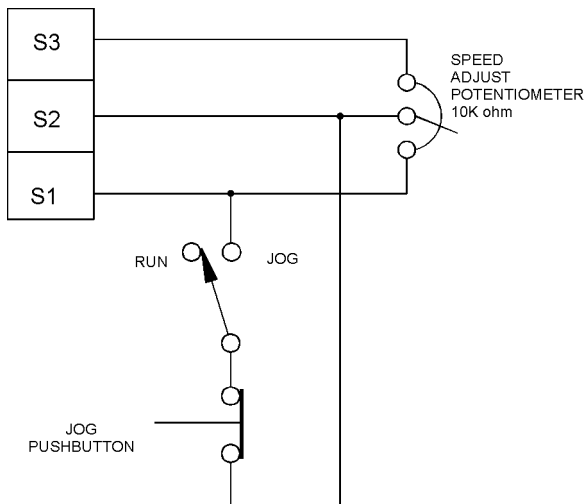
Replace the speed adjust potentiometer with a single pole, multi-position switch, and two or more potentiometers in series, with a total series resistance of 10K ohms. Figure 16 shows a connection for fixed high and low speed adjust potentiometers



**Figure 16. Adjustable Fixed Speeds Using Potentiometers in Series**

## RUN/JOG switch

Connect a RUN/JOG switch and the JOG pushbutton as shown in Figure 17. 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 17. RUN/JOG Switch Connection to Speed Adjust Potentiometer**

# Troubleshooting



## Warning

Floating voltages exist on the drive when it is powered.  
When possible, disconnect the drive while troubleshooting.  
High voltages can cause serious or fatal injury.

## Before troubleshooting

Check the following steps before proceeding:

- The AC line voltage must be balanced, and match the voltage on the drive nameplate.
- The motor must be rated for the drive's rated armature outputs.
- Terminal block connections should be consistent with the connections shown in this manual.

For additional assistance, contact your local Minarik® distributor, or the factory direct at:

(800) MINARIK (646-2745) (phone) or (800) 394-6334 (fax).



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## **Diagnostic LEDs (PCM2000C series only)**

PCM2x000C series drives are equipped with three diagnostic LEDs to aid in system evaluation and troubleshooting. See Figure 18 (page 40) for LED location.

### **POWER (GREEN)**

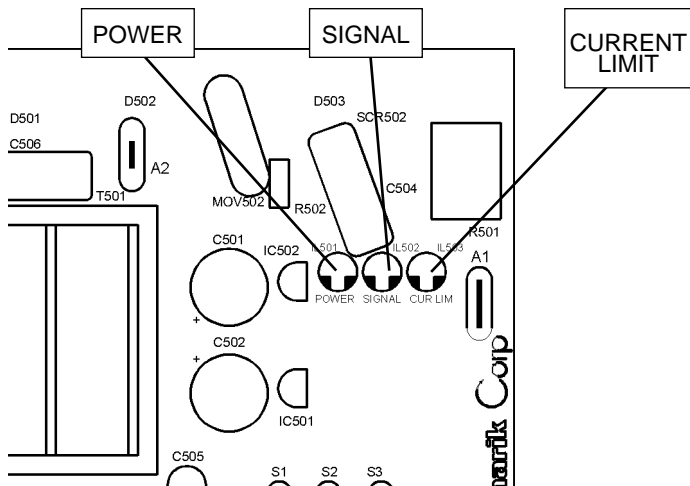
The green POWER LED lights when AC line voltage is applied to the drive. The POWER LED is extinguished when power is disconnected.

### **SIGNAL (YELLOW)**

The yellow SIGNAL LED lights when power is applied, and a voltage, current, or manual signal is sent to the drive. The SIGNAL LED is extinguished when no signal is applied.

### **CURR LIM (RED)**

The red CURR LIM LED lights when the current required to drive the motor is greater than is allowed by the CURR LIMIT trimpot. If the CURR LIM LED lights, shut down the drive and remove or reduce the load on the motor. Restart the drive and check the TORQUE trimpot setting.



**Figure 18. Diagnostic LED Location (PCM 2000C Series Only)**

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## Motor does not run

1. Check that the motor is receiving AC power. Check fuses and circuit breakers. Verify that the main power switch is on. Check whether the speed adjust pot is turned fully CCW (MANUAL mode) or the input signal is at zero.
2. The speed adjust pot may be open or the signal input leads may be open.
3. Check whether the motor or its load is mechanically jammed. Remove the cause of the jam. NOTE: If an application requires more torque than is allowed by the TORQUE trimpot setting, the control will go to current limit under maximum loading conditions. Assuming that the motor is properly sized, it then will be necessary to reset TORQUE slightly CW until the stalled condition is removed.

## Fuses or circuit breakers blow

1. Check all wiring for shorts, grounds, and misconnections to the control and motor.
2. Check that the motor ratings are within the ratings of the control.

## **Motor will not stop at zero speed setting**

The MIN SPEED adjustment is set too high.

## **Motor runs in reverse**

Disconnect AC power. Reverse the armature connections. Restore power to the control.

## **Motor slows under increased load**

The IR COMP adjustment may be set too low. Increase the setting until the speed remains acceptably constant over the load range.

## **Motor speed is unstable under load**

The IR COMP adjustment may be set too high. Decrease it until the symptom disappears.

The motor may be “bouncing” in and out of current limit. Verify that the TORQUE setting (CURR LIMIT on PCM2x000C series drives) is sufficient for your application. Increase the setting if it is too low.

## **Motor runs at full speed at all times**

If in the MANUAL mode, the speed adjust pot, or leads from the pot to the control, may be open.

## Replacement Parts

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

**Table 2. Replacement Parts**

Model No.	Symbol	Description	Minarik® P/N
<b>PCM21000A</b>	C501-502	220 uF, 35 VDC Capacitor	011-0027
	D501-502	Schottky Diode	071-0017
	SCR501-502	S8020L High-power SCR	072-0043
	T501	ST-3-3109 115VAC Transformer	230-0083
	T502	Transformer	230-0077
		Chassis	222-0079
		10K Ohm Pot Kit	202-0031
		1-5A Fuse Kit	050-0066
		5-15A Fuse Kit	050-0071
<b>PCM21000C</b>	<b>Same as PCM21000A, except:</b>		
	C501-502	100 uF, 25 VDC Capacitor	011-0079
	D504-505	Schottky Diode	071-0017
	MOV501-502	2725V RMS, 4500A MOV	075-0011
	R501	0.01 Ohm 5W Standup Resistor	032-0129
<b>PCM21010A</b>	<b>Same as PCM21000A</b>		
<b>PCM22000A</b>	<b>Same as PCM21000A</b>		
<b>PCM22000C</b>	<b>Same as PCM21000C</b>		

**1-5A Fuse Kit Contains**

1 Amp 3AG Fast-blo Fuse	050-0042
1.5 Amp 3AG Fast-blo Fuse	050-0026
3 Amp 3AG Fast-blo Fuse	050-0021
5 Amp 3AG Fast-blo Fuse	050-0022

**5-15A Fuse Kit Contains**

5 Amp 3AG Fast-blo Fuse	050-0022
8 Amp 3AG Fast-blo Fuse	050-0059
10 Amp 3AG Normal-blo Fuse	050-0024
15 Amp 3AG Normal-blo Fuse	050-0018

**Potentiometer Kit Contains**

10K Ohm $\pm$ 5%, 1/4W Potentiometer	120-0009
3/8-32 X 1/2 Nut	151-0007
3/8 Int Tooth Lockwasher	152-0007
9 ea Non-insulated Female Tabs	163-0028

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# Certificate of Compliance

Minarik Corporation hereby certifies that its PCM20000 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 PCM20000 series has been tested to the following test specifications:

**EN55011:1991 (emissions), and  
EN50082-1:1992 (immunity)**

Compliance allows Minarik’s PCM20000 series to bear the CE mark.

## End User Responsibilities

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 PCM20000 series’ design, external filtering is required.

Minarik requires the Corcom® filters listed in Table 3. If the exact filter is not available, use a filter matching the following specifications:

L = (1.73 + 0.03) milliHenries.

C = (0.27 + 0.54) microFarads (X); 0.0055 microFarads (Y).

R = 330Kohms.

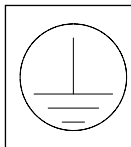
Rated current: 1.4 times maximum DC motor current.

Filter type: Balanced 2-section.

**Table 3. 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 3 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 3 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, Minarik p/n CEXXMM, on the output must be deployed. 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:

$L \text{ \& } L1 = 2 * (0.8) \text{ milliHenries.}$

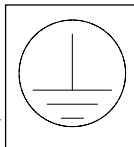
$C \text{ \& } C1 = 2 * (0.1) \text{ microFarads @ 400W VDC.}$

$R_{in} = 0.1 \text{ ohm; } R_{out} = 1.2 \text{ ohm.}$

**Table 4. Minarik® Filters**

<b>Nameplate Current of Motor Wired to the Drive</b>	<b>Minarik® Filter Part Number</b>
0 to 4 amps	CE4MM
4.1 to 13 amps	CE20MM

The filters in Table 4 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 (like 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 from date of shipment thereof. Within this warranty period, the Corporation will repair or replace such products that are returned to Minarik Corporation, 901 East Thompson Avenue, Glendale, CA 91201-2011 USA.

This warranty shall not apply to any product that has been repaired by unauthorized persons. 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 breach of any of the Corporation's obligations, whether express or implied, and particularly of any other claim or breach 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.



901 E Thompson Avenue  
Glendale, CA 91201-2011

Tel.: 1-800-MINARIK (646-2745)

Fax: 1-800-394-6334

[www.minarikcorp.com](http://www.minarikcorp.com)

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