

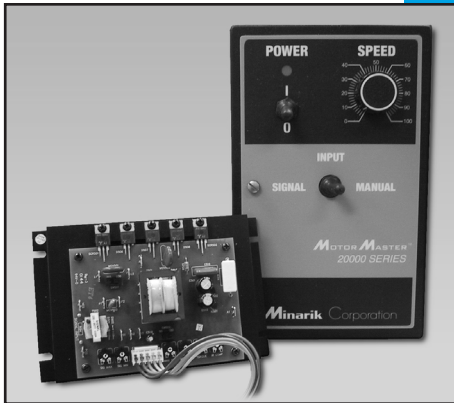
# PCM23000 SERIES

Models:

PCM23001A

PCM23401A

PCM23411A



# User's Manual

Signal-Following Speed Controls

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Printed in the United States of America.

# Safety Warnings



SHOCK  
HAZARD




AVOID  
HEAT



KEEP  
DRY



AVOID  
VIBRATION

**Note:** This symbol  denotes an important safety message. Please read these sections very carefully before performing any calibration, repair, or other procedure contained in this manual.

- Have a qualified electrical maintenance 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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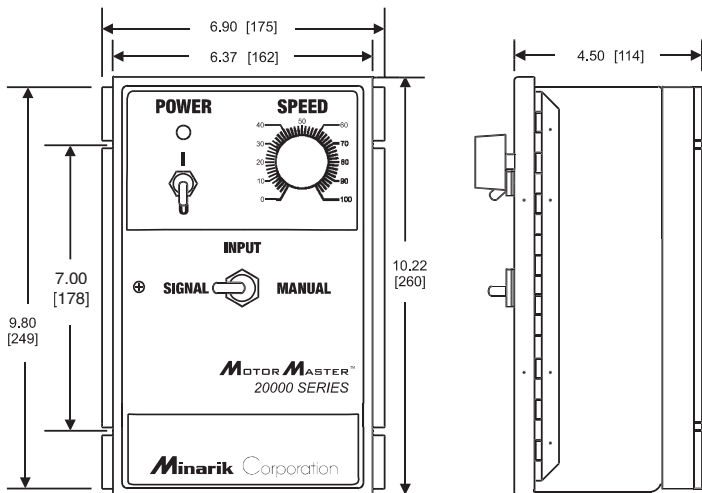
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# Specifications

Model	AC Line Voltage	Max. Armature Current (Amps DC)	Armature Voltage Range	Horsepower Range
PCM23001A	115	10	0 – 90	1/8 – 1
	230	10	0 – 180	1/4 – 2
PCM23401A	115	10	0 – 90	1/8 – 1
	230	10	0 – 180	1/4 – 2
PCM23411A	115	1.5	0 – 90	1/20 – 1/8
	230	1.5	0 – 180	1/10 – 1/4
<b>Form Factor</b>	1.37 at base speed			
<b>Acceleration Time</b>	1 second			
<b>Deceleration Time</b>	1 second			
<b>Load Regulation (at base speed)</b>	2%			
<b>Input voltage signal range (input circuit is isolated; S1 to S2)</b>	0-10 VDC			
<b>Field Voltage</b>				
115 VAC Input	50/100VDC			
230 VAC Input	100/200 VDC			
<b>Field Current, Maximum</b>	1.0 ADC			
<b>Vibration</b>	0.5g max (0 – 50 Hz)			
	0.1g max (above 50 Hz)			
<b>Ambient Temp. Range (PCM23401/PCM23411)</b>	10°C – 40°C			
<b>Ambient Temp. Range (PCM23001)</b>	10°C – 55°C			



# PCM23401A/PCM23411A



FOUR MOUNTING SLOTS 0.19 x 3.4 [5 x 9]  
ALL DIMENSIONS IN INCHES [MM]

**Figure 2. PCM23401A/PCM23411A Dimensions**

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# Installation

## Mounting



### 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.

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.

- 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. Four 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.

## 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.

This drive is isolated from earth ground. 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 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 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.

## 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 PCM20000 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. Fuse blocks are included on cased drives only.

Table 1 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

## Speed adjust potentiometer (Model PCM23001A only)

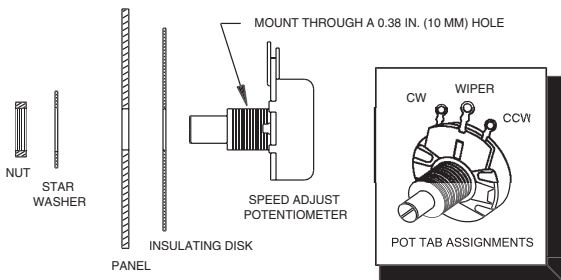


### Warning

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**

## 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 12.** The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

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

## PCM23001A connections

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 12.

### Power input connections

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

## Line fuse connections

Wire an external line fuse between the stop switch (if installed) and the L1 terminal on the PC board. An additional line fuse should be installed on L2 if the input voltage is 230VAC. 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 7 for fuse ratings.

## Motor connections

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.

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.**

## Field output connections



### Warning

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

**Table 2. PCM23001A Field Output Connections**

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

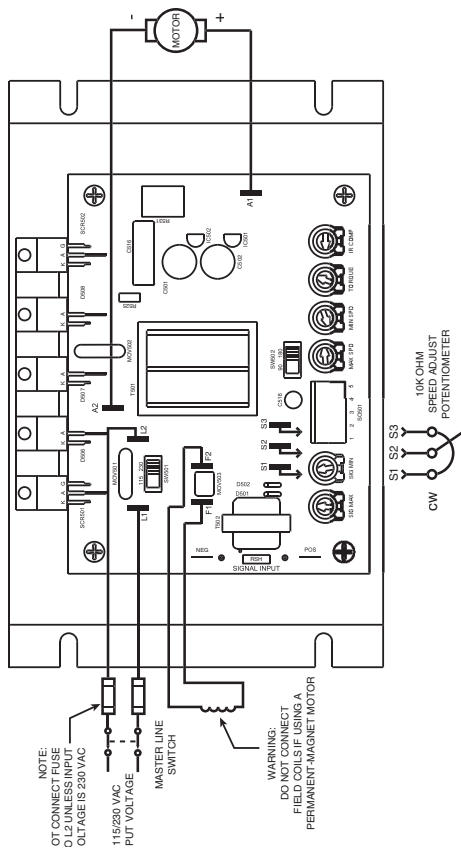
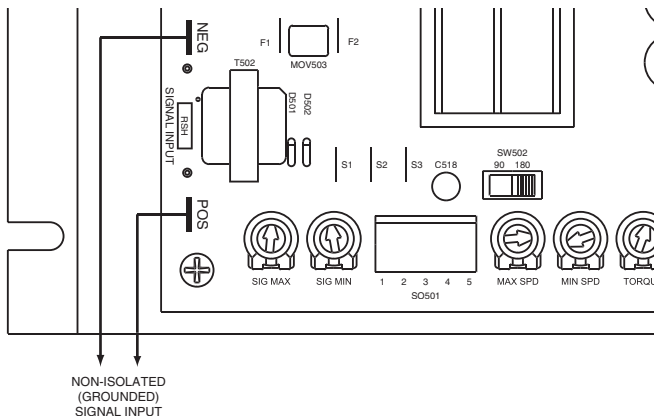


Figure 4. PCM23001A Connections

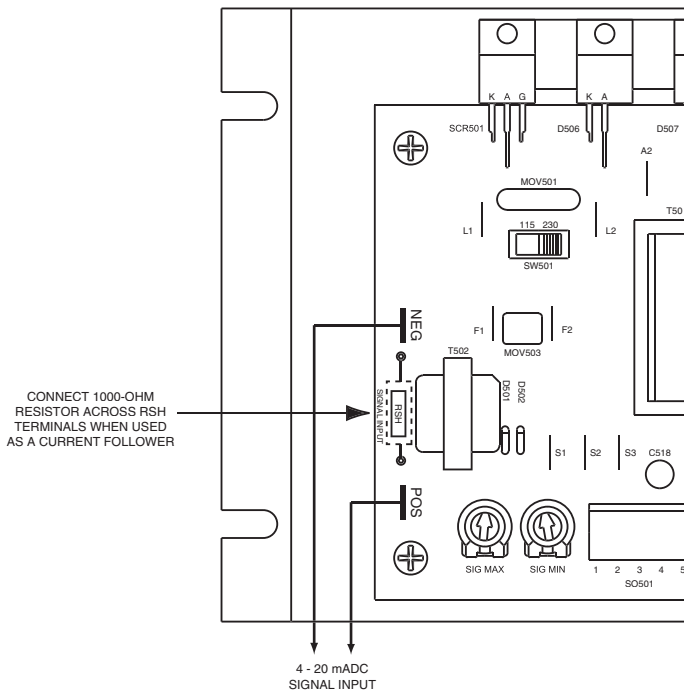
## Current and voltage follower

The PCM23001A series drives can be configured to follow a grounded (non-isolated) voltage or current signal. To configure the drive to follow a voltage signal, connect the signal leads to the SIGNAL INPUT POS and SIGNAL INPUT NEG terminals, observing proper polarity (see Figure 5).

To configure the drive to follow a current signal, install a 1 Kohm, 1/2W resistor across the RSH terminal posts. Connect the signal leads as you would for a voltage follower application (see Figure 6, page 14).



**Figure 5. Voltage Signal Follower Configuration**



**Figure 6. Current Signal Follower Configuration**

## PCM23401A/PCM23411A 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 7 (page 18).** The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

Connect the power input leads, field coil leads and a DC motor to the drive's terminal block as shown in Figure 7 (page 18).

## Power input connections

### 115 VAC input

Connect power to terminals 1 and 2 of the terminal board as shown.

### 230 VAC input

Connect power to terminals 1 and 3 of the terminal board as shown.

## Motor connections

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.

Connect a DC motor to terminals 4 and 5 as shown in Figure 7 (page 18). Connect the motor's negative (-) lead to terminal 4. Connect the motor's positive (+) lead to terminal 5. **Ensure that the motor voltage rating is consistent with the drive's output voltage.**

## Field output connections



### Warning

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

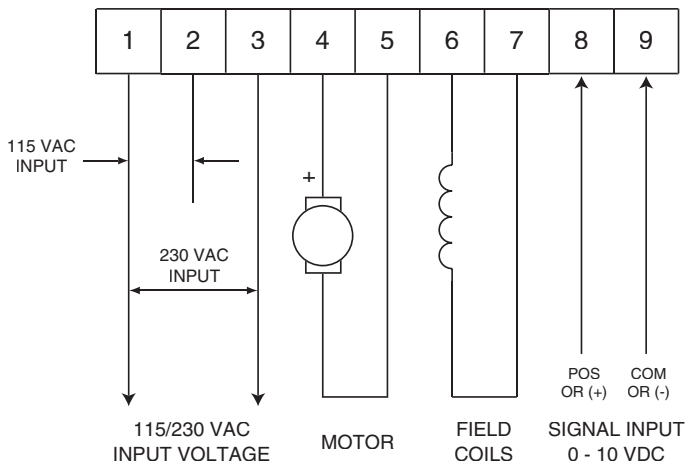
Use 18 AWG wire to connect the field output to a shunt wound motor. Table 3 (page 17) lists the field output connections. These connections are on the terminal block located at the bottom of the case.

**Table 3. PCM23401A/PCM23411A Field Output Connections**

<b>Line Voltage (VAC)</b>	<b>Approximate Field Voltage (VDC)</b>	<b>Connect Motor Field To Terminals</b>
115	50	6 (+) and 1 (-)
115	100	6 (+) and 7 (-)
230	100	6 (+) and 1 (-)
230	200	6 (+) and 7 (-)

### **Voltage follower connections**

The PCM23401A/PCM23411A series drives can be configured to follow a grounded (non-isolated) or non-grounded (isolated) voltage signal. To configure the drive to follow a voltage signal, connect the signal leads to terminals 8 (positive or +) and 9 (common or -) on the terminal block (Figure 7, page 18).



NOTE:  
THE TERMINAL BLOCK IS LOCATED  
AT THE BOTTOM ON CASSED DRIVES.

**Figure 7. PCM23401A/PCM23411A Connections**

---

# Operation



## Warning

Dangerous voltages exist on the drive when it is powered. BE ALERT. High voltages can cause serious or fatal injury.

## Before applying power

1. Verify that no conductive material is present on the printed circuit board.
2. Verify that the AC supply is properly balanced.
3. Verify that voltage select switches SW1 and SW2 are set to the proper voltage for your application

# Operating Modes

## PCM23001A operating modes

The PCM23001A can operate in one of three modes, determined by shorting selected pins on mode-select header block SO501. An 18-inch harness and mating plug assembly (Minarik p/n 201-0038) is shipped as part of the PCM23001 control. Refer to Figure 8 (page 21) for operating mode connections.

### Manual Mode

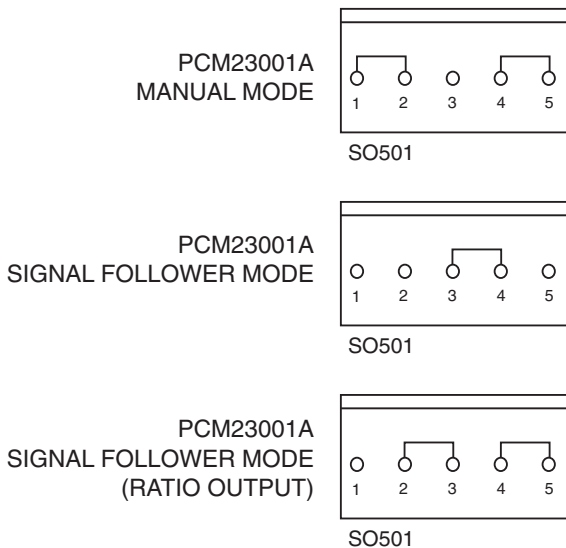
In this mode, the control will ignore any signal input and will respond only to the speed adjust potentiometer setting. See Figure 8 (page 21). To operate in manual mode, short pin 1 to pin 2, and short pin 4 to pin 5.

### Signal Follower Mode

The control will ignore the speed adjust potentiometer setting and follows an external signal only. To operate in signal follower mode, short pin 3 to pin 4.

### Signal with Ratio Output

The control follows the external signal, but its output is also proportional to the setting of the speed adjust potentiometer. This feature is useful in multiple motor applications, where it may be necessary to adjust the speed ratio between two or more motors. To operate in this mode, short pin 2 to pin 3, and pin 4 to pin 5.



**Figure 8. Operating Modes**

## **PCM23401A/PCM23411A Operating Modes**

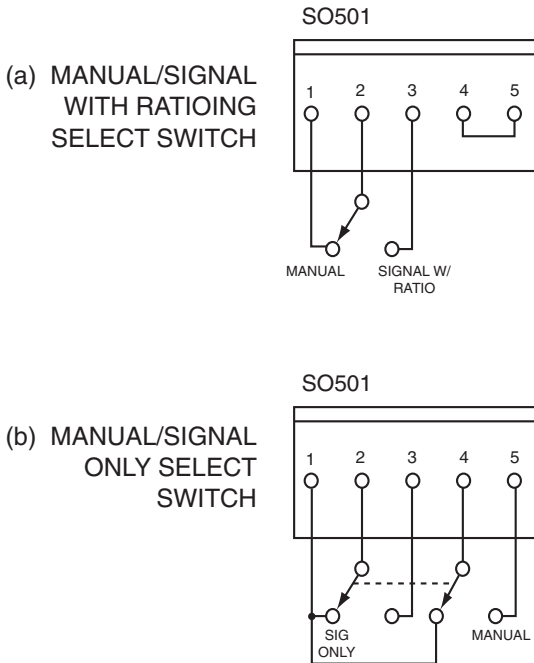
The mode selector switch on the PCM23401A drive, mounted on its cover, provides the option of operating in either MANUAL or SIGNAL mode (see Figure 2, page 3). SIGNAL mode includes the ratio feature described on page 20.

### **Manual/Signal With Ratio Output Mode Selector**

Connect a switch or relay as shown in Figure 9a (page 23) to select manual or signal with ratio output modes.

### **Manual/Signal Only Mode Select**

To remove the ratio feature, rewire the switching device per Figure 9b (page 23). This will change the mode options to MANUAL or SIGNAL only.



**Figure 9. Manual/Signal With Ratio Output Mode Select**

## Operating Mode Selector Switch

To enable the selection of an operating mode from either of two possibilities, connect the harness leads to a switch or a relay in accordance with figures 10a, 10b, or 10c (page 25) as your application requires.

### **Manual/Signal Only Mode Selector**

To enable either manual only or signal input only modes, connect a switch or relay as shown in Figure 10a (page 25).

### **Manual/Signal With Ratio Output Mode Selector**

To enable either manual only or signal with ratio output modes, connect a switch or relay as shown in Figure 10b (page 25).

### **Signal Only/Signal With Ratio Output Mode Selector**

To enable either signal only or signal with ratio output modes, connect a switch or relay as shown in Figure 10c (page 25).

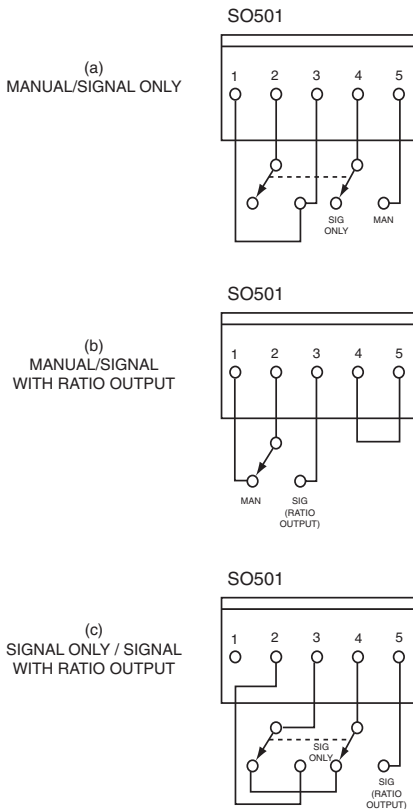


Figure 10. Operating Mode Selector Switch Connections

## Voltage Select Switches



### Warning

Change switch settings only when the drive is disconnected from the AC line voltage. Make sure all switches are set to their correct position before applying power.

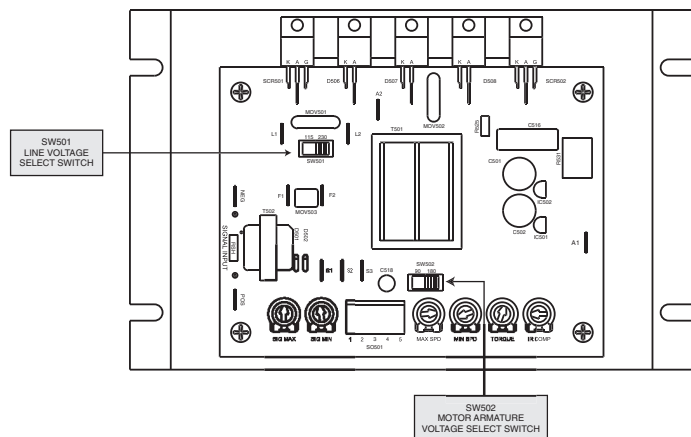


Figure 11. Voltage Select Switch Locations

## Line Voltage (SW501)

Prior to applying AC power, ensure that voltage select switches SW501 is set to 115 for 115 VAC line voltage, and 230 for 230 VAC line voltage.

## Motor Armature Voltage (SW502)

Set motor armature voltage switch SW502 to 90 for 90 VDC motor armatures, and 180 for 180 VDC motor armatures.

## Starting the drive

1. Select MANUAL mode and turn the speed adjust potentiometer full CCW.
2. Apply power and slowly rotate the speed adjust potentiometer knob clockwise until the desired speed is reached.
3. To shut down the drive, rotate the speed adjust potentiometer full CCW and remove power.

## Line starting and line stopping

When AC line voltage is applied to the drive, the motor accelerates to the set speed. When AC line voltage is removed, the motor coasts to a stop. Line starting and line stopping (applying and removing AC line voltage) is recommended for starting and stopping in emergency situations only. It is not recommended for frequent starting and stopping.

# Calibration

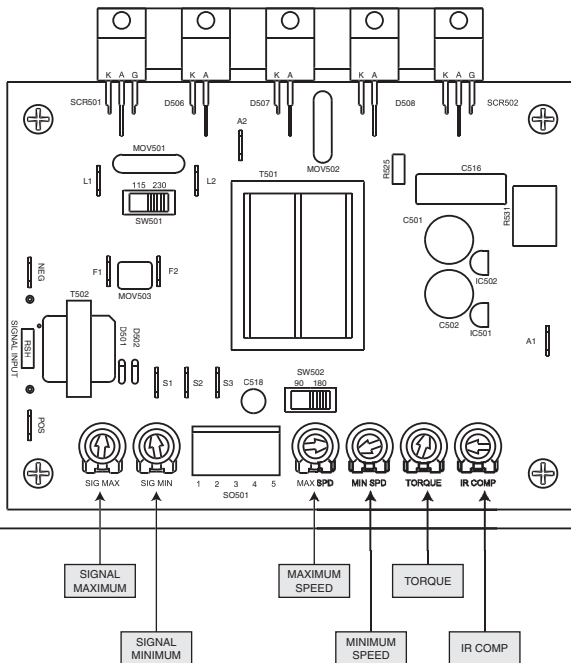


## Warning

Dangerous 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.

PCM23001A Series drives have six user adjustable trimpots: SIG MAX, SIG MIN, MAX SPD, MIN SPD, IR COMP and TORQUE.

Recalibrate the trimpots if a lower current motor is used (lower than the rated maximum of the drive). All trimpot settings increase with clockwise (CW) rotation, and decrease with counterclockwise (CCW) rotation. Use a non-metallic screwdriver for calibration. Each trimpot is identified on the printed circuit board.



**Figure 12. Calibration Trimpot Layout**

## MIN SPD (Minimum Speed)

**NOTE:** Check the MIN and MAX trimpot setting after recalibrating to verify that the motor runs at the desired minimum speed.

The MIN trimpot setting determines the motor speed when the speed adjust potentiometer is turned full CCW. It is operational only in MANUAL mode and is factory set to zero speed.

To calibrate MIN trimpot setting:

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

## MAX SPD (Maximum Speed)

**NOTE:** Check the MIN and MAX trimpot setting after recalibrating to verify that the motor runs at the desired maximum speed.

The MAX SPD trimpot setting determines the motor speed when the speed adjust potentiometer is turned full CW. It is operational only when the control is in MANUAL mode.

To calibrate MAX SPD trimpot setting:

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

## SIG MIN (Signal Minimum)

**NOTE:** SIG MIN is operative only when the control is in SIGNAL or SIGNAL WITH RATIO OUTPUT mode.

The SIG MIN trimpot establishes the motor speed obtained in response to the minimum input signal.

To calibrate the SIG MIN pot, apply the minimum signal. Adjust the SIG MIN trimpot until the motor runs at the desired speed or is just at the threshold of rotation. If the operation is in SIGNAL WITH RATIO OUTPUT mode, the speed adjust potentiometer must be turned fully CW while this calibration is being made.

## SIG MAX (Signal Maximum)

**NOTE:** SIG MAX is operative only when the control is in SIGNAL or SIGNAL WITH RATIO OUTPUT mode.

The SIG MAX trimpot establishes the motor speed obtained in response to the maximum input signal.

To calibrate the SIG MAX pot, apply the maximum signal. Adjust the SIG MAX trimpot until the motor runs at the desired speed. If the operation is in SIGNAL WITH RATIO OUTPUT mode, the speed adjust potentiometer must be turned fully CW while this calibration is being made.

## TORQUE



### Warning

Although TORQUE 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 trimpot setting determines the maximum torque for accelerating and driving the motor. Use the following procedure to calibrate the TORQUE setting:

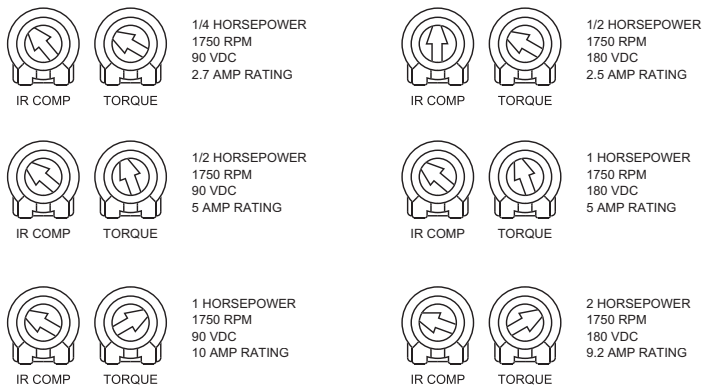
1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the TORQUE trimpot to minimum (full CCW).
3. Set the speed adjust potentiometer to maximum speed (full CW).
4. Carefully lock the motor armature. Be sure that the motor is firmly mounted.
5. Apply line power. The motor should be stopped.
6. Slowly adjust the TORQUE trimpot CW until the armature current is 120% of motor rated armature current.
7. Turn the speed adjust potentiometer CCW.
8. Remove line power.
9. Remove the stall from the motor.
10. Remove the ammeter in series with the motor armature if it is no longer needed.

## IR COMP (IR Compensation)

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



**Figure 13. PCM23001A IR Comp and Torque Trimpot Settings**

---

# Troubleshooting



## Warning

Dangerous 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

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 drive's rated armature outputs are consistent with the motor ratings.

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

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

<b>Problem</b>	<b>Possible Causes</b>	<b>Suggested Solutions</b>
Line fuse blows	<ol style="list-style-type: none"><li data-bbox="366 240 586 290">1. Line fuses are the wrong size.</li><li data-bbox="366 323 629 400">2. Motor cable or armature is shorted to ground.</li><li data-bbox="366 432 594 596">3. Nuisance tripping caused by a combination of ambient conditions and high-current spikes.</li><li data-bbox="366 826 607 850">4. Field circuit is open.</li></ol>	<ol style="list-style-type: none"><li data-bbox="670 240 923 290">1. Check that line fuses are the correct size.</li><li data-bbox="670 323 899 400">2. Check motor cable and armature for shorts.</li><li data-bbox="670 432 940 793">3. Add a blower to cool the drive components; decrease TORQUE settings, or resize motor and drive for actual load demand, or check for incorrectly aligned mechanical components or “jams”. See page 32 for information on adjusting the TORQUE trimpot.</li><li data-bbox="670 826 868 902">4. Send in drive to Minarik repair department.</li></ol>

<b>Problem</b>	<b>Possible Causes</b>	<b>Suggested Solutions</b>
Line fuse does not blow, but the motor does not run	<ol style="list-style-type: none"><li>1. Speed adjust pot or signal input is set to zero speed.</li><li>2. Speed adjust pot or signal input connections are open.</li><li>3. Drive is overloaded.</li><li>4. Drive is not receiving AC line voltage.</li><li>5. Motor is not connected.</li></ol>	<ol style="list-style-type: none"><li>1. Increase speed adjust pot or signal input setting.</li><li>2. Check that the speed adjust pot or signal input connections are not open.</li><li>3. Verify that the motor is not jammed. Increase CURR. LIMIT setting.</li><li>4. Apply AC line voltage to L1 and L2.</li><li>5. Connect motor to A1 and A2.</li></ol>
Motor runs too fast at maximum speed setting	<ol style="list-style-type: none"><li>1. MIN SPD and MAX SPD settings are too high.</li><li>2. Field connections are loose (shunt-wound motors only)</li></ol>	<ol style="list-style-type: none"><li>1. Recalibrate MIN SPD and MAX SPD.</li><li>2. Check field connections</li></ol>

<b>Problem</b>	<b>Possible Causes</b>	<b>Suggested Solutions</b>
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. Control is in current limit mode.	1. Adjust the IR COMP setting slightly CCW until the motor speed stabilizes. 2. Check that motor is of sufficient horsepower and amperage.

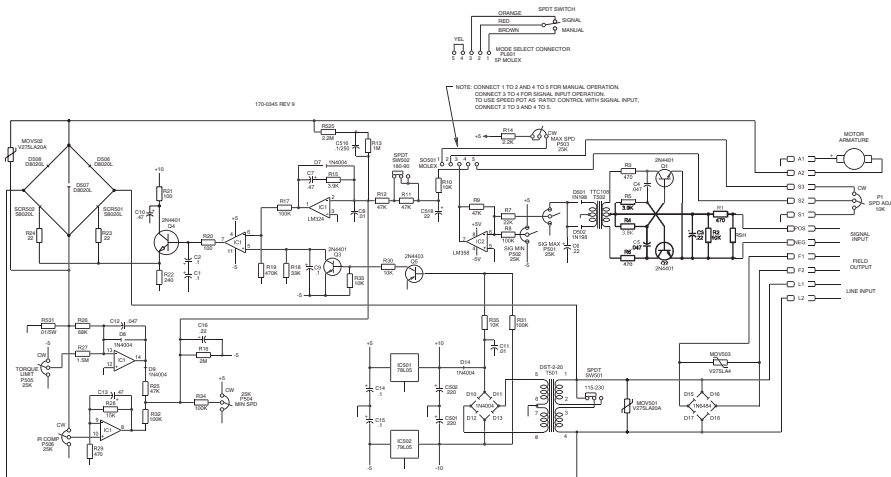


Figure 14. PCM23001A Schematic



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## 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
PCM23001A		Header Block Harness	201-0038
		Fuse Kit (1 - 5A)	050-0066
		Fuse Kit (5 - 15A)	050-0071
	T501	Transformer, 115/230 VAC	230-0083
PCM23401A	Same as PCM23001A		
PCM23411A	Same as PCM23001A		

# 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.

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 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, Minarik's 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	CE4MM
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 (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).

## NOTES

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## NOTES

## NOTES

# 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 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.



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