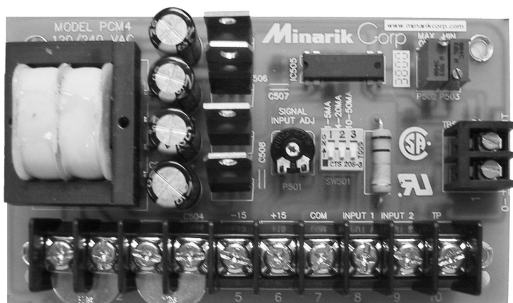


USER'S MANUAL



PROCESS CONTROL MODULE PCM4


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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.



Circuit potentials are at 120 VAC or 240 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

Power Requirements

Line input	120/240 VAC, 50/60 Hz, single phase
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Input Signal Ranges (input circuit is isolated)

Voltage signal

Narrow range	-25 to +25 VDC
--------------	----------------

Wide range	-250 to +250 VDC
------------	------------------

Current signal	1-5 mADC, 4-20 mADC, 10-50 mADC
----------------	---------------------------------

Input Impedance

Voltage signal	>25K ohms
----------------	-----------

Current signal

1-5 mADC	1K ohm
----------	--------

4-20 mADC	235 ohms
-----------	----------

10-50 mADC	100 ohms
------------	----------

Output

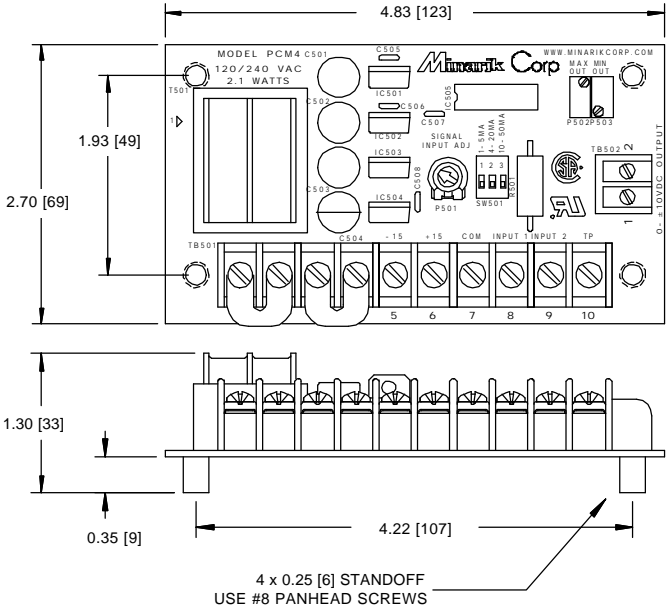
Impedance	800 ohms
-----------	----------

Voltage range, max	-10 to +10 VDC
--------------------	----------------

Linearity	0.01%
-----------	-------

Operating Temperature Range	0 - 50 °C
-----------------------------	-----------

Dimensions



ALL DIMENSIONS IN INCHES [MILLIMETERS]

Figure 1. Process Control Module (PCM4) Dimensions

Introduction

Model PCM4 accepts a grounded or floating, bipolar, DC signal input and generates a proportional floating output voltage. The output of the PCM4 follows the variations of its input: it increases as the signal increases and decreases as the signal decreases.

This output can be supplied to the speed setting circuit of a motor drive to rotate the motor at a speed proportional to the signal input. Because the PCM4 can follow bipolar input voltage signals, it can drive a regenerative variable speed drive through the complete range of motor speeds in both forward and reverse directions.

This manual contains specifications, installation procedures, connections, and calibration procedures for the process control module, model PCM4. Refer to your variable speed drive user's manual for additional installation, operation, and troubleshooting procedures.

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

- PCM4 components are sensitive to electrostatic fields. Avoid contact with the circuit board directly.
- Protect the PCM4 from dirt, moisture, and accidental contact. Provide sufficient room for access to the terminal block.
- Mount the PCM4 away from other heat sources. Operate within the specified ambient operating temperature range. The operating temperature range for the PCM4 is 0°C through 50°C.
- Prevent loose connections by avoiding excessive vibration of the process control module board.
- Mount the PCM4 in either a horizontal or vertical plane.
- The PCM4 is mounted using 4 – 0.25 inch [6mm] standoffs. See Figure 1, page 2 for the physical locations of these standoffs. Use #8 panhead screws to fasten the standoffs to the mounting surface.

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 120 or 240 VAC above ground. To prevent the risk of injury or fatality, avoid direct contact with the printed circuit board or with circuit elements.

- Use 18-24 AWG wire for signal wiring. Use 16-18 AWG wire for AC line (L1, L2) wiring.

Shielding guidelines



Warning

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

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. 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 the PCM4.

Screw terminal block

Connections to Minarik's PCM4 are made to a screw terminal block. Using a screwdriver, turn the terminal block screw counter-clockwise to open the wire clamp. Insert stripped wire into the wire clamp. Turn the terminal block screw clockwise to clamp the wire. See Figure 2.

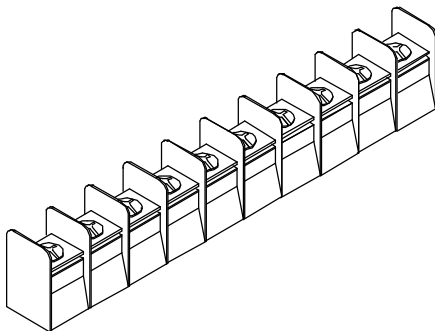


Figure 2. Screw Terminal Block

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. The switch contacts should be rated at 2 amps AC and 250 volts.

AC line connections

When operating on 120 VAC, leave the jumper bars installed between terminals 1 and 2 and between 3 and 4 (see Figure 3). This is how the unit is shipped from the factory. When operating on 230VAC, remove both jumper bars and place one jumper bar between terminals 2 and 3 (see Figure 4).

Connect the AC power leads to terminals 1 and 4.

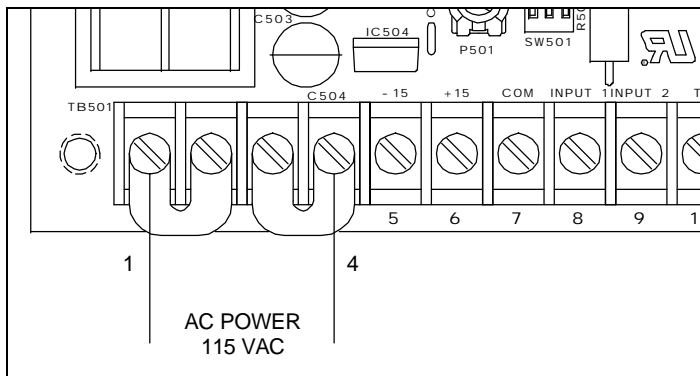


Figure 3. 115 VAC Power Connection

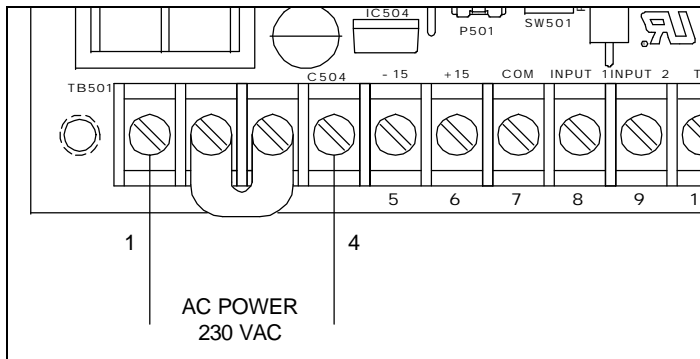


Figure 4. 230 VAC Power Connection

Input signal connections

Connect the incoming voltage or current signal leads to INPUT 1 (terminal 8) and to COM (terminal 7). If the maximum input voltage will exceed 25V, connect the signal leads to INPUT 2 (terminal 9) and to COM (terminal 7). See Figure 5 below. Use insulated shielded wire or twisted pair for PCM4 input and output signal leads longer than 18 inches. Connect the shielding to earth ground at the end away from the PCM4 and trim the exposed shielding at the PCM4 to preclude accidental grounding of the PCM4.

Bundle the signal-carrying leads separately from the motor leads or AC power leads.

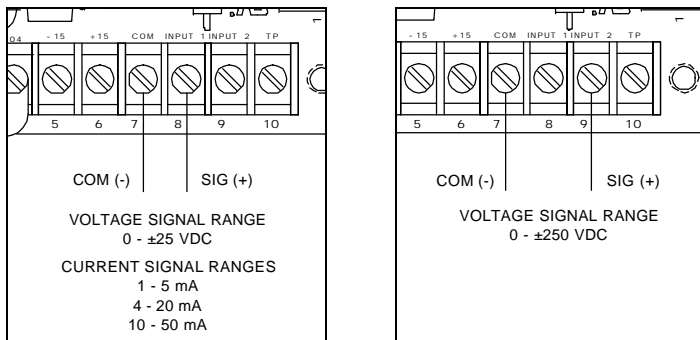


Figure 5. Connection – Following an External Signal

Master signal generator



Warning

Bidirectional output mode should never be used with standard SCR (single quadrant) variable speed drives. These drives only respond to one polarity in their speed setting circuits.

The PCM4 can be used as a master controller to:

- (1) provide a floating DC master voltage input to other PCM4 modules interfacing with standard variable speed drives or
- (2) to drive several variable speed drives directly, provided that their circuit design permits wiring of their speed circuits in common.

Unidirectional applications require a positive PCM4 output. Connect a 10K ohm potentiometer (not provided with the PCM4) as the master control pot using the +15 VDC supply on the PCM4.

The normal wiring of an external master control potentiometer is the CW side of the potentiometer to +15 V supply (terminal 6), and the CCW side to COM (terminal 7). The potentiometer wiper is connected to INPUT 1 (terminal 8). See Figure 6 (page 13). The potentiometer is rotated clockwise to increase the voltage at INPUT 1 and, therefore, increasing the PCM4 output voltage.

Bipolar input is necessary to control motor reversals when the motor is being driven by a four quadrant, regenerative variable speed drive.

To wire the external master control potentiometer to provide a bipolar, adjustable voltage input signal, wire the potentiometer across the -15 and $+15$ V supply terminals, with the CW end at $+15$ V. Connect the pot wiper to the INPUT 1 (terminal 8). See Figure 7 (page 13).

The center position of the wiper produces zero input voltage. Potentiometer rotation CW from center produces increasing positive voltage; CCW rotation from center produces increasing negative voltage.

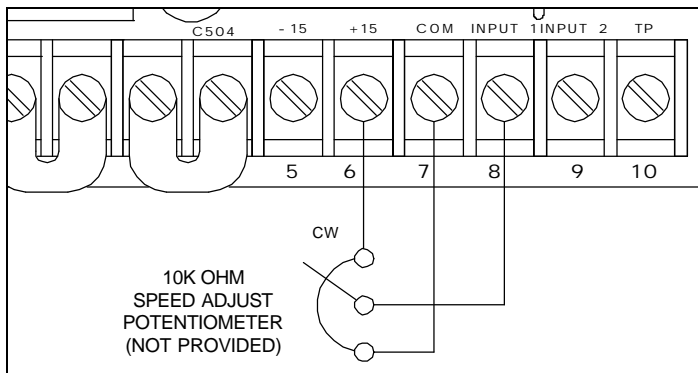


Figure 6. Unidirectional Manual Master Signal Source Connection

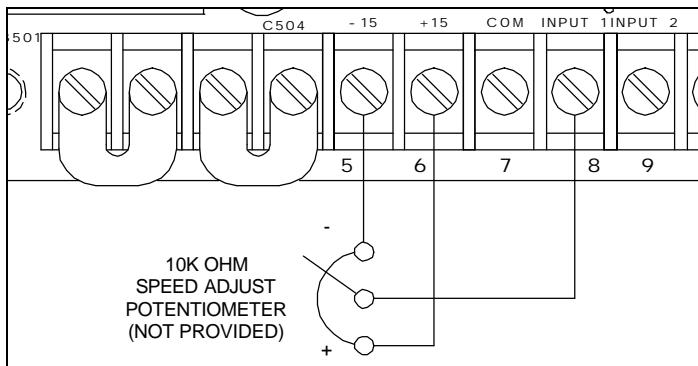


Figure 7. Bidirectional Manual Master Signal Source Connection

Output voltage connections



Warning

Always check the instruction manual supplied with the variable speed drive that will be interfaced with the PCM4 module. The scheme shown for wiring to an external voltage source, as well as the specifications on that input, must be well understood before proceeding.

Output connections are made to the small terminal block on the board (TB502). Connect the output leads to terminal 1 and 2 (Figure 8, page 16). When the input signal at INPUT1 is positive with respect to COM terminal 2 will be positive.

The exception to this polarity rule occurs when the PCM4 has been calibrated to bias its output as a voltage follower. An input of zero volts can be calibrated to produce a finite positive or negative output voltage.

The PCM4 output is a floating DC voltage. It is brought into the speed setting circuit of a variable speed drive to replace the main speed adjust potentiometer.

Most Minarik SCR-type, non-regenerative drives are designed with the speed setting voltage positive with respect to board common. The positive external signal is brought to the “speed pot wiper” terminal, usually designated S2, and the common signal lead to the “speed pot CCW” terminal usually S1.

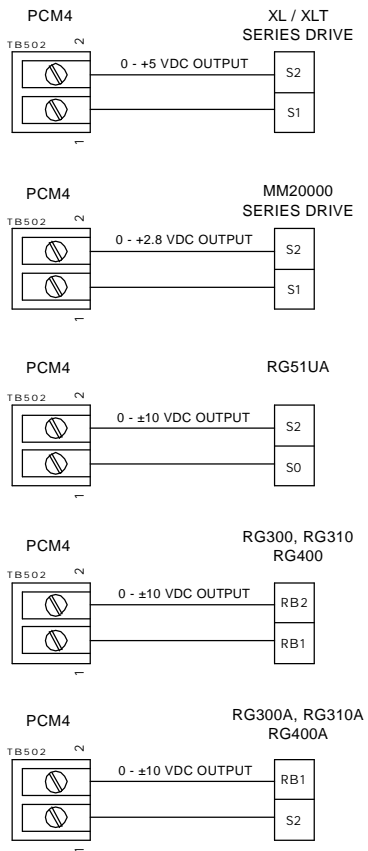


Figure 8. Connection – Output Voltage

Multiple follower requirements



Warning

Most Minarik variable speed drives cannot be wired with their speed-setting circuits in common with each other. They require a dedicated PCM4 for each variable speed drive.

Included are all Minarik models in the MM20000 series, XL series, and all regenerative drives (RG series). A multiple follower system using any of these drives must consist of a master PCM4 driving follower PCM4 modules. See pages 18 and 19 of this manual.

MM30000 series

Minarik's MM30000A series drives can be operated with their boards sharing one common. This series of drives is the only Minarik series that permits more than one drive to follow a single PCM4 module. See Figure 9.

The number of MM30000-type drives that can be driven by one PCM4 is limited by the output impedance of the PCM4. Potentiometers may be wired in parallel with the PCM4 output for final speed adjustments and ratioing. The net resistance of these paralleled ratioing pots must be at least 800 ohms.

When using ratioing potentiometers, connect each MM30000 series drive to the master PCM4 as detailed in Figure 9. The input to the master PCM4 can be any of the standard single quadrant inputs discussed in this manual.

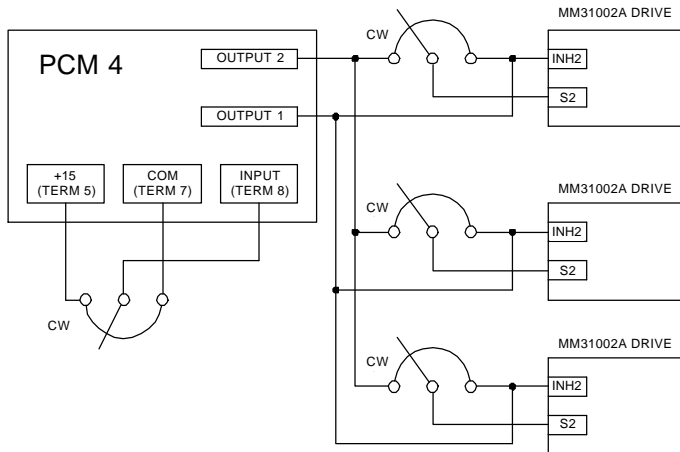


Figure 9. Connection – Multiple Follower System

Multiple drives following a single signal input

When more than one Minarik drive must follow one voltage signal, each must be wired individually to dedicated PCM4 modules. Each PCM4 module then receives the “master” input signal. The MM30000 series discussed in the preceding paragraphs is the only exception.

Each of the PCM4 units must first be modified.

1. Check that all 3 DIP switches (SW501) , located near the center of the board, are in their OFF position.
2. Cut the left hand (CCW) pin of P501, the SIGNAL INPUT ADJ, off each PCM4. The figure below shows this trimmer potentiometer.

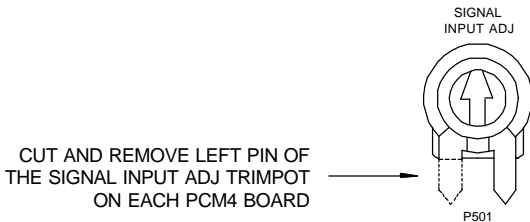


Figure 10. Signal Input Adjust

Connect one 50K ohm ratioing potentiometer across the master input voltage signal for each dedicated PCM4 module. Wire each ratioing pot to the input signal source potentiometer as shown in Figure 11 below.

Master PCM4 with multiple drives following

If a PCM4 is to provide the master input voltage signal as detailed on pages 14 - 15, dedicated PCM4s are again necessary. Each of the PCM4s must be modified as detailed on page 19. Ratioing potentiometers may then be wired with their CW sides to terminal 2 of the master PCM4 and their CCW sides to terminal 1 of the master PCM4.

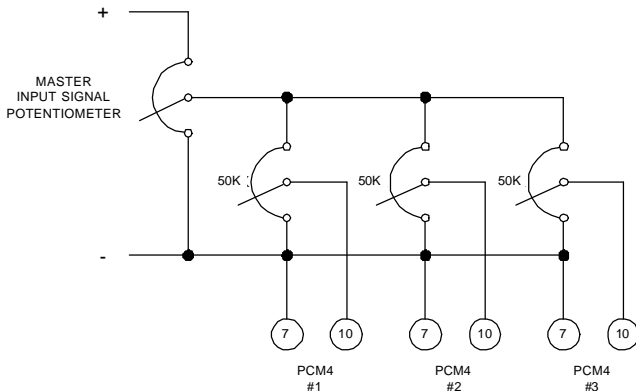


Figure 11. Connection – Ratio Potentiometers Multiple Follower System

Calibration



Warning

Dangerous voltages exist on the PCM4 when it is powered. 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.

Signal Input Adjust

The SIGNAL INPUT ADJ potentiometer is used to set the maximum Test Point voltage to approximately 5 VDC, as measured between terminals TP and COM. The importance of this step is to scale the input signal voltage to keep it well within the range of the PCM4's comparator chip. This calibration is only approximate. A tolerance of 0.2 Volts is acceptable.

The SIGNAL INPUT ADJ is calibrated only when the PCM4 is following a voltage signal. When the PCM4 is following a current signal set the SIGNAL INPUT ADJ fully CW. See Figure 12 for approximate calibration of SIGNAL INPUT ADJ.

To calibrate the SIGNAL INPUT ADJ:

1. Apply the true maximum voltage input.
2. Check voltage at TP vs. COM to verify that it is approximately 5V. Adjust SIGNAL INPUT ADJ if needed.

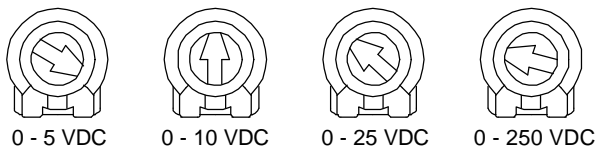


Figure 12. SIGNAL INPUT ADJ - Calibration Positions

DIP switches



Warning

Only one DIP switch should be ON at a time and only when the PCM4 is set up to follow a current signal. All three DIP switches must be OFF when following a voltage signal.

Each DIP switch selects the range for input current following. DIP switch 1 is for 1 – 5 mA input, DIP switch 2 is for 4 – 20 mA input, and DIP switch 3 is for 10 – 50 mA input.

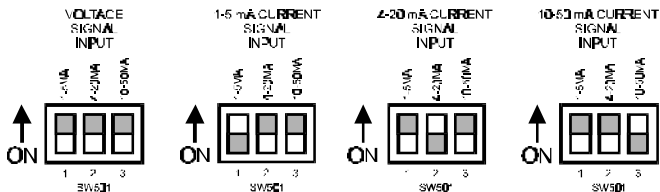


Figure 13. DIP Switch Settings

Input signal calibration

Calibration of the MIN OUT and MAX OUT 15–turn trimpots is required to establish the relationship between the input voltage signal range and the output range.

The true maximum and minimum input signal values are not required. Because the PCM4 response is linear, any two calibration points define the output vs. input relationship. Select points as close to the range extremes as possible to minimize extrapolation error.

The absolute maximum output from the PCM4 is 10 VDC. The minimum input voltage to the PCM4 that can produce 10 VDC output is 5 VDC.

Input voltage calibration

To calibrate when using a voltage input signal:

1. Verify that all DIP switches are OFF.
2. Set the SIGNAL INPUT ADJ to the input range position, as indicated on Figure 12, page 22.
3. Apply the lower voltage input.
4. Set MIN OUT adjustment to obtain the desired lower voltage output.

5. Apply the higher voltage input.
6. Set MAX out adjustment to obtain the desired higher voltage output.
7. Apply the true maximum input voltage.
8. Check voltage at TP vs. COM to ensure that it is approximately 5VDC at the maximum input voltage. Adjust SIGNAL INPUT ADJ if necessary.
9. Repeat steps 3 – 6 until no further recalibration is needed.

Input current calibration

To calibrate when using a current input signal:

1. Verify that the correct DIP switch is ON and that the others are in the OFF position.
2. Set the SIGNAL INPUT ADJ fully CW.
3. Apply the lower current input.
4. Set MIN OUT adjustment to obtain the desired lower voltage output.
5. Apply the higher current input.
6. Set MAX OUT adjustment to obtain the desired higher voltage output.
7. Repeat steps 3 – 6 until no further recalibration is necessary.

Troubleshooting



Warning

Dangerous voltages exist on the PCM4 when it is powered. 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 PCM4 and variable speed drive.
2. Check the PCM4 and 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 input voltage jumpers are installed properly for the input voltage being used (see page 6).
7. Check that the drive's rated armature and field outputs are consistent with the motor ratings.

Problem	Possible Causes	Suggested Solutions
<p>Motor attached to the drive does not run.</p>	<ol style="list-style-type: none"> 1. No output voltage from PCM4 (TB502). 2. Loose connections between PCM4 and motor drive. 3. PCM4 is not receiving AC line voltage. 4. Input signal is not connected. 5. SIGNAL INPUT ADJ potentiometer is not calibrated. 6. Motor drive not calibrated properly. 	<ol style="list-style-type: none"> 1. Recalibrate the PCM4. If there is still no output send PCM4 to Minarik for repair. 2. Check connections between TB502 and the input of motor drive. 3. Apply AC line voltage to terminals 1 and 4. 4. Check that the PCM4 is receiving voltage (or current) input signal. 5. Calibrate SIGNAL INPUT ADJ (page 26). 6. Re-calibrate motor drive according to manufacturer's instructions.

Problem	Possible Causes	Suggested Solutions
Motor is not running at full speed.	<ol style="list-style-type: none"><li data-bbox="365 251 626 343">1. Voltage out (TB502) is not changing as input changes<li data-bbox="365 536 619 629">2. Loose connections between PCM4 and motor drive.	<ol style="list-style-type: none"><li data-bbox="668 251 934 501">1. Check that the voltage out (TB502) is changing as input changes. Recalibrate the PCM4. If voltage is still not changing send the drive to Minarik repair.<li data-bbox="668 536 924 659">2. Check connections between TB502 and the input of motor drive.
Motor runs too slow, or too fast.	<ol style="list-style-type: none"><li data-bbox="365 698 629 790">1. DIP switches are not set properly for current input.<li data-bbox="365 826 614 883">2. Motor drive not calibrated properly.	<ol style="list-style-type: none"><li data-bbox="668 698 902 790">1. Check DIP switch positions if using current input.<li data-bbox="668 826 907 948">2. Re-calibrate motor drive according to manufacturer's instructions.

Notes

Notes

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.

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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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