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# *KLC* Services, Inc.

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## **FLEX-MATE K500 SERVICE MANUAL WARRANTY**

### **TABLE OF CONTEXT**

<b>Section</b>	<b>Title</b>	<b>Page</b>
	<b>Serviceability Limitations</b>	<b>2</b>
	<b>Warranty Information</b>	<b>3</b>
<b>1.0</b>	<b>Routine Maintenance Schedule</b>	<b>3</b>
<b>2.0</b>	<b>Basic Troubleshooting During Warranty Period</b>	<b>4</b>
<b>3.0</b>	<b>Basic Troubleshooting Out of Warranty Period</b>	<b>4</b>
<b>4.0</b>	<b>The Flex-Mate K500 Motor PCB</b>	<b>5</b>
<b>5.0</b>	<b>Cable Connections</b>	<b>5</b>
<b>6.0</b>	<b>Test Points and Variable Resistors</b>	<b>6</b>
<b>7.0</b>	<b>Calibration Processes For the Flex-Mate K500 Knee CPM</b>	<b>6</b>
<b>7.1</b>	<b>Range Limit Calibration</b>	
<b>7.2</b>	<b>Limits of Reversing Load</b>	
7.2.1	<i>Calibration of older model PCBs</i>	8
7.2.2	<i>Calibration of current model PCBs</i>	8
<b>8.0</b>	<b>Servicing and Repair Instructions</b>	<b>8</b>
8.0.1	<i>Available Kitted Parts List</i>	8
<b>8.1</b>	<b>Pulley Replacement Instructions</b>	
8.1.1	<i>Pulley / Belt Removal</i>	9
8.1.2	<i>Pulley / Belt Installation</i>	9
<b>8.2</b>	<b>Bearing Replacement Instructions</b>	
8.2.1	<i>Bearing Removal</i>	10
8.2.2	<i>Cotter Pin Removal</i>	10
8.2.3	<i>Nylon Lock Nut Removal</i>	10
8.2.4	<i>Flange Bearing / Pulley Installation</i>	11
8.2.5	<i>Flange Bearing / Thrust Bearing Installation</i>	11
8.2.6	<i>Cotter Pin Installation</i>	11
8.2.7	<i>Nylon Lock Nut Installation</i>	11
<b>8.3</b>	<b>Potentiometer Replacement Instructions</b>	
8.3.1	<i>Potentiometer Removal</i>	11
8.3.2	<i>Potentiometer Installation</i>	12
8.3.3	<i>Potentiometer Calibration</i>	13
<b>8.4</b>	<b>Lead screw Replacement Instructions</b>	
8.4.1	<i>Leadscrew Removal</i>	14
8.4.2	<i>Leadscrew Installation</i>	14
<b>8.5</b>	<b>Nut Housing Replacement Instructions</b>	
8.5.1	<i>Nut Housing Removal</i>	15
8.5.2	<i>Nut Housing Installation</i>	16
8.5.3	<i>Reinstalling the Leadscrew</i>	17
<b>8.6</b>	<b>Membrane Switch Replacement Instructions</b>	
8.6.1	<i>Membrane Switch Removal</i>	17
8.6.2	<i>Membrane Switch Installation</i>	17
<b>8.7</b>	<b>Rod End / Ball Joint Replacement Instruction</b>	
8.7.1	<i>Rod End Removal</i>	18
8.7.2	<i>Rod End Installation</i>	18
<b>8.8</b>	<b>Brush / Rod Replacement Instructions</b>	
8.8.1	<i>Weather Stripping Removal</i>	18

8.8.2	<i>Brush Removal</i>	19
8.8.3	<i>Brush Installation</i>	19
<b>8.9</b>	<b>Handle Replacement Instructions</b>	
8.9.1	<i>Handle Removal</i>	19
8.9.2	<i>Handle Installation</i>	19
<b>8.10</b>	<b>Optical Sensor Replacement Instructions</b>	
8.10.1	<i>Sensor Removal</i>	19
8.10.2	<i>Sensor Installation</i>	20
<b>8.11</b>	<b>Motor Replacement Instructions</b>	
8.11.1	<i>Motor Removal</i>	21
8.11.2	<i>Motor Installation</i>	21
<b>8.12</b>	<b>Transformer Replacement Instructions</b>	
8.12.1	<i>Transformer Removal</i>	22
8.12.2	<i>Transformer Installation</i>	22
<b>8.13</b>	<b>Housing Replacement Instructions</b>	
8.13.1	<i>Housing Removal</i>	23
8.13.2	<i>Housing Installation</i>	24
<b>8.14</b>	<b>Electronics Upgrade / Replacement Instructions</b>	
8.14.1	<i>Electronics Removal</i>	25
8.14.2	<i>Electronics Upgrade Installation</i>	25
<b>8.15</b>	<b>Miscellaneous Parts List</b>	<b>26</b>
<b>8.15.1</b>	<b>Electronic Replacement Parts List</b>	<b>27</b>

## SERVICEABILITY LIMITATIONS

06500 Flexmate K500 (domestic)

Primary (input): 120VAC 60Hz 25W

The FLEX-MATE K500 is a CLASS 1 device based on its type of protection against electric shock. It is a TYPE B APPLIED PART device based on the degree of protection against electric shock. The degree of protection against ingress of water is ordinary. Its primary mode of use is continuous.

FLEX-MATE K500 can be transported and stored in an environment of – 40°F to 158°F (–40°C to 70°C), with a relative humidity between 10% and 100% non-condensing. The FLEX-MATE K500 can operate between 50°F to 95°F (10°C to 35°C) under the same humidity levels, and 700 hPa to 1060 hPa atmospheric pressure.

Any service requirements beyond the scope of this service manual are to be performed by the factory or an authorized service/repair representative.

Units returned to the factory for repair are not to be modified. Such modifications include, but are not limited to, (a) modifications that restrict the accessibility to critical components, (b) modifications that bypass any safety features originally designed into the Flex-Mate K500 Knee CPM unit, (c) or modifications that may cause further damage to the Flex-Mate K500 Knee CPM unit or the end user.

Replacement of any modified components will be made at the customer's expense.

## FLEX-MATE K500 WARRANTY

KLC Services, Inc. warrants the Flex-Mate K500 to be free from defects in materials and workmanship under normal and proper use under the direct supervision of a licensed health care practitioner during the warranty period of one year, commencing from the date of purchase. Date of Purchase will be the date your payment is processed by our Bank and funds are received by KLC Services, Inc. This warranty extends only to the original purchaser and is not transferable to anyone who subsequently purchases, leases or otherwise obtains the K500 from the original purchaser. This Warranty is void if within the warranty period, the K500 has been serviced, parts removed, tampered with or replaced or any other actions taken beyond the scope of Routine Maintenance and Basic Troubleshooting as specified in the service manual by any party other than KLC Services, Inc.

In the event the K500 exhibits a defect in material or workmanship during the warranty period, KLC Services, Inc. will at no additional charge repair or replace defective parts or the entire unit at KLC Service's option.

Except for the warranties and conditions set forth herein, KLC Services, Inc. disclaims all other warranties, express or implied, or statutory, including but not limited to the implied warranties of merchantability or fitness for a particular purpose. Any implied warranties that may be imposed by applicable law are limited to the terms of this limited warranty. No other warranties, express or implied, are given and no affirmation of or by KLC Services, Inc., by words or action, will constitute a warranty. In no event shall KLC Services, Inc. be liable for any incidental, special or consequential damages, including but not limited to loss of business, revenue, profits, data or use, whether in an action in contract or tort or based on a warranty arising out of or in connection with the use or performance of the K500 or any software supplied by KLC Services, Inc. that accompanies the K500, even if KLC Services, Inc. has been advised of the possibility of such damages. Purchaser understands, acknowledges and agrees that repair or replacement, as applicable, under the warranty services described herein are your sole and exclusive remedies with respect to any breach of the warranty set forth herein.

### **SECTION 1**

#### **ROUTINE MAINTENANCE SCHEDULE**

**NOTE:** The bearings that are located at each end of the leadscrew are sealed and do not require oiling

	<b>Before each use –</b> <i>To be performed by user or service personnel</i>	<b>Every Month –</b> <i>To be performed by user or service personnel</i>	<b>Every 3 Months –</b> <i>To be performed by authorized service personnel</i>
Inspections	General condition	General condition	Frayed power cord Housing integrity Check belt wear
Grease Lubrication			Grease <sup>1</sup> the outside edges of Thrust Bearing at lower end of Drive Screw. Use a white lithium based grease
Oil Lubrication <b>NOTE:</b> Never lubricate any belts or pulleys with oil.	Apply 3 drops of oil <sup>2</sup> to the oiling felt located in the nut housing.	Apply 3 drops of oil <sup>2</sup> to the oiling felt located in the nut housing.	The oiling felt of the nut housing is to be inspected and replaced if necessary. Using oil <sup>2</sup> add a drop to the Knee Joints, Rod Ends, 'S' Brackets and Clevis connections.
Cleaning	Clean housing & leg carriage with a mild soap solution and dry thoroughly.	Wipe the belt(s) & both pulleys with alcohol and allowed to dry thoroughly before installing belts.	Wipe pulleys with alcohol and replace belt if required.

1. Christo-Lube grease from Lubrication Technology, Inc., 310 Morton Street, Jackson, Ohio 45640, (740) 286-2644.
2. 3-in-1 Oil or equivalent sewing machine oil.

## SECTION 2

### BASIC TROUBLESHOOTING DURING WARRANTY PERIOD

No pendant display.	Check that the wall outlet has power. Check power switch-on.
Pendant displays "Err".	Turn power off, wait 5 seconds, and turn power back on.
Pendant adjustments inoperative, but display is on.	Check all connections at the P.C. Board.
Unit will not start, or it starts then stops.	Check pendant settings. Check belts.
Cannot change pendant settings.	Refer to User's Manual regarding locking feature.
<b>NOTE: If the above solutions do not work or for other problems not listed, call KLC Services, Inc. Any actions taken other than those listed above will void the Warranty.</b>	

## SECTION 3

### TROUBLESHOOTING OUT OF WARRANTY PERIOD

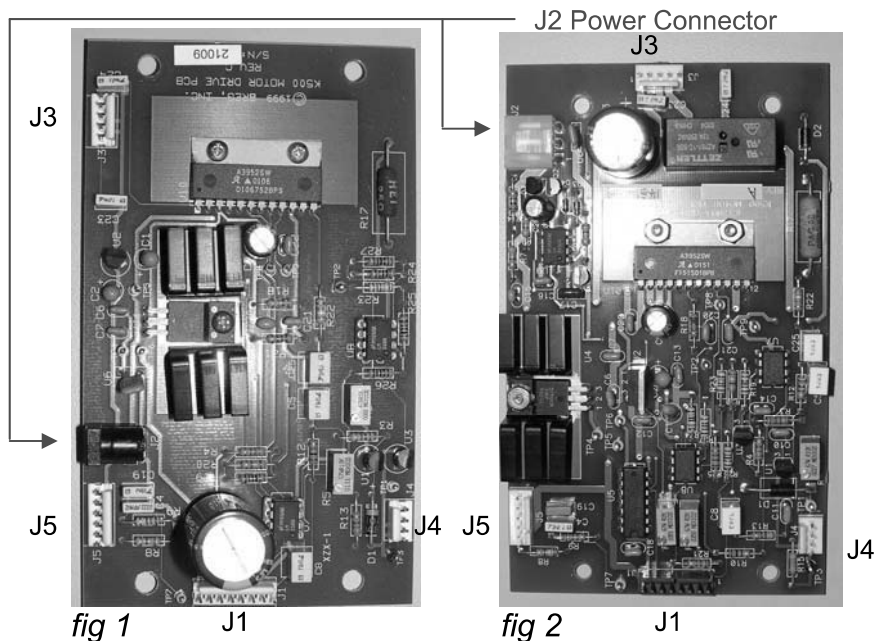
No pendant display.	Check that the wall outlet has power. Check power switch-on. Use a multi-meter to check voltage before and after switch: <ul style="list-style-type: none"> <li>- If no voltage before switch, replace transformer. (See voltage chart Pg27)</li> <li>- If voltage before but not after switch, replace switch.</li> <li>- If voltage after switch, check all P.C. Board and pendant connections.</li> <li>- If still no display, replace pendant.</li> <li>- If still no display, replace P.C. Board. (Note: If this solves the problem, test the original pendant; it may be okay.)</li> </ul>
Pendant adjustments inoperative, but display is on.	Check to see if the settings are locked. <ul style="list-style-type: none"> <li>- If locked, a dot will appear in the lower right hand corner of the display. To remove lock, press both the 'UP' and 'DOWN' arrows at the same time.</li> </ul> Check all connections at the P.C. Board. Replace pendant. <ul style="list-style-type: none"> <li>- If still no display, replace P.C. Board. (Note: If this solves the problem, test the original pendant; it may be okay.)</li> </ul>
Unit will not start, or it starts then stops.	Check pendant settings. Ensure settings are greater than 10° apart. Check belts. Ensure that no oil has gotten onto the belts. <ul style="list-style-type: none"> <li>- If oil is present, remove all belts and wipe the clean both the belts and pulleys with alcohol to remove oil. Allow the components to dry thoroughly before installing belts.</li> </ul> Remove the belts and turn each of the pulleys by hand. <ul style="list-style-type: none"> <li>- If any of the pulleys do not turn freely, this could be the cause of the issue.</li> <li>- If the Large Pulley does not turn freely, inspect the thigh adjustment knobs for alignment, the condition of the leadscrew and nut, and the amount of slack/play in the driveline. Also inspect the tightness of the screw at the knee joint.</li> <li>- If the Dual Pulley/Transfer Pulley does not turn freely, replace pulley.</li> <li>- If the motor pulley does not turn freely, replace motor.</li> </ul> Remove the Motor Connector from J3 on the Motor PCB. Using a knife blade carefully push the red and black wires deeper into the connector. Reattach connector and turn on power. Use a multi-meter to test voltage at motor after pressing the Start/Stop button. (See voltage chart Pg27) <ul style="list-style-type: none"> <li>- If there is voltage to the motor, but the motor is not running, replace motor.</li> <li>- If there is no voltage to the motor, replace P.C. Board.</li> <li>- If still no voltage to the motor, replace the pendant. (Note: If this solves the problem, test the original P.C. Board, it may be okay.)</li> </ul>
Cannot change pendant settings.	Check to see if settings are locked. If locked, a dot will appear in the lower right hand corner of the display. To remove lock, press both the 'UP' and 'DOWN' arrows at the same time. <ul style="list-style-type: none"> <li>- If unlocking does not work, replace pendant.</li> <li>- If this still does not work, replace the P.C. Board (Note: If this solves the problem, test the original pendant; it may be okay.)</li> </ul>
Angle does not appear to read correctly on pendant.	Start unit. Set extension limit to 0°. Stop unit when 0° is displayed on the pendant. Visually check to see that the Leg Carriage is perfectly straight. <ul style="list-style-type: none"> <li>- If the carriage is not aligned properly, calibrate the range of motion as dictated in Section 7.1 of this manual.</li> </ul>
Loud grinding screeching sounds present when in	Inspect the position of the encoder wheel within the optical sensor. <ul style="list-style-type: none"> <li>- If it is contacting the sensor, reposition the encoder wheel.</li> </ul> Inspect the area just below the rear of the motor for debris.

motion / with or without load	<ul style="list-style-type: none"> <li>- If a black powder is evident, replace motor.</li> </ul> <p>Inspect the inside of the extrusion/rail for contact between the wheel screw and sidewall.</p> <ul style="list-style-type: none"> <li>- If contact has been made. Remove upper carriage assembly as dictated in Section 8.5 - Nut Housing Replacement Instructions and ensure the proper assembly.</li> </ul> <p>Inspect the condition of the leadscrew.</p> <ul style="list-style-type: none"> <li>- If the operational portion of the leadscrew appears dry, apply oil to the oiler felt and leadscrew.</li> <li>- If the operational surface of the leadscrew appears to be dry but shiny, the Teflon coating has been worn off. It is recommended that the leadscrew is replaced at this time.</li> </ul>
Powdery substance developing under unit	<p>Determine area of development.</p> <ul style="list-style-type: none"> <li>- If under the foot end of the unit and the color is whitish, inspect the motor, pulleys, and belts for excessive wear. Replace if necessary.</li> <li>- If under user end and the color is reddish brown or black, inspect the rod ends. Replace if necessary.</li> </ul>
All other problems.	Call KLC Services, Inc. for assistance.

## Section 4 The Flex-mate K500 Motor PCB

Due to modifications in both the electronic hardware and software for the K500 Knee CPM, there are 2 different calibration processes. Determination of the Motor PCB will be required to employ the correct calibration process. The earlier model boards (fig 3) calibration process requires adjustment to R5 for Range Limit and R6 for Load Limit. The load limit on the earlier is bi-directional which means one setting of both flexion and extension. Calibration adjustments for the current model board (fig 4) includes R5 for the Range limit, as with the earlier model, but splits the Load Limit settings for the Flexion (R1) and the Extension (R6). It is recommended that if either an earlier model Motor PCB (fig3) is being replaced in the CPM unit, the controller board/chip be replaced at the same time.

## Section 5 Cable Connections



## **Section 6**

### **Test Points and Variable Resistors**

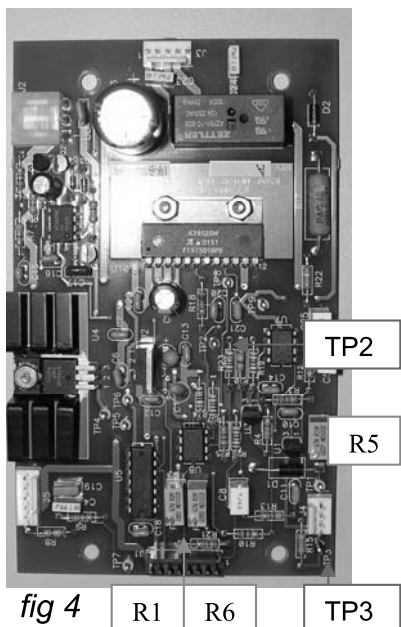
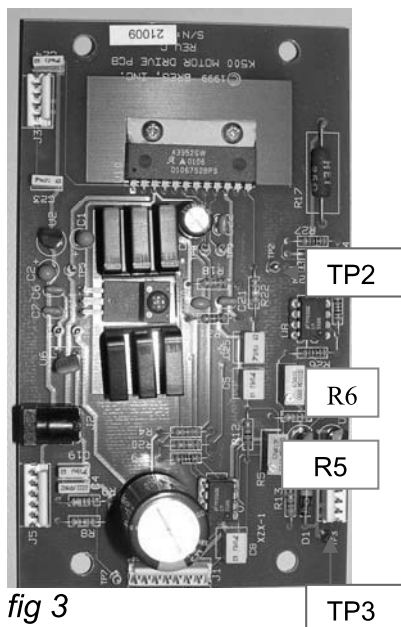


Figure 1 - Motor PCB is the earlier model PCB for the Flex-mate K500. Most CPM units with a serial number that begins with '1' will have this board installed, unless it is a demo unit, or has been updated.

Figure 2 – Motor PCB is the 'newer' UL60601 approved board. This board will be in use with all K500 CPM units that have a serial number beginning with '2', unless it is a demo unit, or has been updated during routine maintenance.

Identification of the boards may be achieved in a number of ways. Easiest means is to identify the (J2) 'power connector' (see fig 1 and fig 2). The earlier motor board will have a 'black' DC plug (fig 1), while the UL60601 version will have a white connector (fig 2). The second means of identification is to scan the board for the number of variable resistors mounted to the board. On the Fig 3 PCB, there are 2 variable resistors (R5, R6). On the Fig 4, UL PCB, there are 3 (R1, R6, R5).

## **Section 7**

### **CALIBRATION PROCESSES FOR THE FLEX-MATE K500 KNEE CPM**

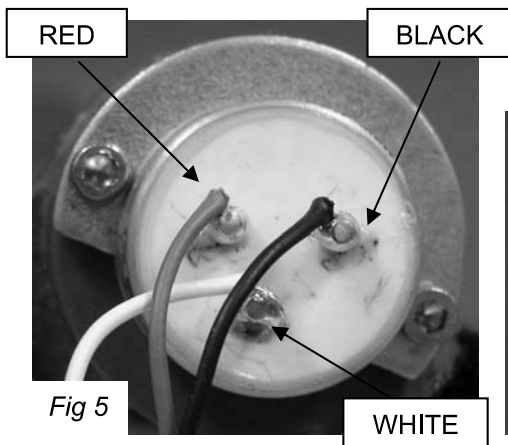
#### **Sec 7.1**      **RANGE LIMIT CALIBRATION**

*For the calibration Range Limit, the CPM unit is to be plugged in and turned on. The thigh support of the carriage must also be set at its lowest setting (below 35 on the scale). This process is for either the older or current model boards.*

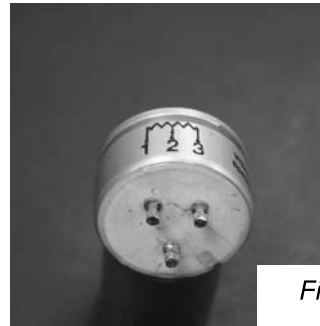
**During the process of repairing and reinstallation of a potentiometer, calibration will be required. If, in the case of a broken wire to the potentiometer, the display will give a false reading to what the physical angle of the carriage actually is. This reading will normally be evident with a display reading of less than –10. To repair and recalibrate the potentiometer, follow this process.**

Remove the 3 Goniometer cover screws and cover.

Check the rear of the Goniometer for any broken wires. If there are multiple wire disconnected from the potentiometer, re-solder the wire to the posts indicated in the Fig 5



**NOTE:** Should the wires of the potentiometer break and require to be soldered onto the post, assure that the wires are attached to the proper post of the potentiometer. See figures 5 and 6



#### **WIRING DIAGRAM DEFINITION**

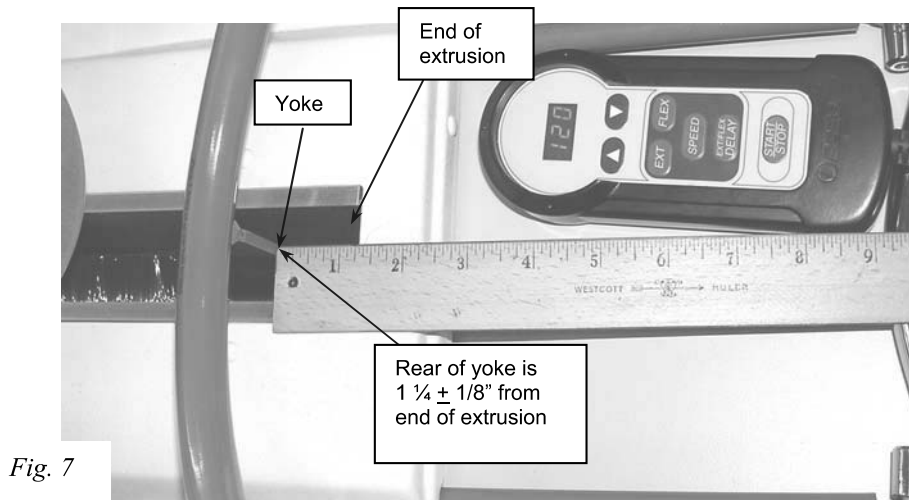
On the side of the Potentiometer is a wiring diagram. When viewing the components as indicated in the Fig 6 photo, the numbers of the diagram will be aligned with the proper post. The number/wire combinations are;  
Post 1 – White  
Post 2 – Black  
Post 3 – Red

On the joint coupling, remove the first setscrew and tighten the second one, then replace the first setscrew. This will insure the coupling is tight to the shaft.

Using the control pendant, move the leg carriage until the thigh and calf support bars on either side of the hinges align in a straight line. This can be checked visually or with a straight edge.

Loosen the 2 screws, using a 3/32" Allen wrench that hold the Goniometer in position. Rotate the Goniometer until the control pendant displays reads 0°. Tighten the 2 screws.

Start the CPM in flexion and stop it when the rear of the calf support nut yoke is 1-1/4"  $\pm$  1/8" from the rear end of the extrusion (figure 7).



Check the control pendant display, if it does not read 120° then adjust R5 on the Motor PCB with a small screwdriver until it does. **Important:** Be sure to turn the power "OFF" and then back "ON" (at the base of the unit) after making your final adjustment to "Lock" the new settings into the software memory.

Make sure all screws and set screws are tight and replace the Goniometer cover.

Check -10° again, if it does not read -10° change the Motor PCB.

#### **Sec 7.2 LIMITS OF REVERSING LOAD**

*In order to properly calibrate the Reversing Load Limits of the Flex-mate K500 Knee CPM, and digital multi-meter should be used. It is also recommended that probe clips be utilized to ensure proper connectivity and allow easier adjusting of the calibration settings. Below are 2 examples of the clips that can be used.*



### Sec 7.2.1 Calibration of older model Motor PCBs (fig 3)

- A. To set the reversing load limit bring the CPM to the  $-10^\circ$  position, then find TP2, TP3 and R6 on the Motor PCB.
- B. Using a voltmeter attach the positive lead to TP2, the negative lead to TP3 and set the voltmeter for volts.
- C. With CPM power ON, the meter should read about .450 volts (450 mV).
- D. The CPM should be able to lift about 40 pounds before the load reverse limit is activated. If it fails to lift the weight, adjust R6 counter-clockwise to increase the voltage and the weight is not activating the load reverse limit.

#### **WARNING!!!!**

**Under no circumstances should the R6 voltage setting exceed the maximum of .450 volts at the  $-10^\circ$  position. Exceeding the .450v rating may damage the motor and motor driver over time.**

### Sec 7.2.2 Calibration of Current model Motor PCBs (fig 4)

- A. Set the Extension Limit at  $-10^\circ$  position and Flexion Limit at  $120^\circ$  positions on the controller.
- B. Locate TP2, TP3, R1, and R6 on the Motor PCB.
- C. Attach the positive lead of a Voltmeter to TP2 and the negative lead to TP3.
- D. Press the Start/Stop key on the keypad to start the motor.
- E. Stop the unit by pressing the Start/Stop key when the unit is extending and  $-8^\circ$  has been reached. Adjust R6 so that the voltage on the Voltmeter reads  $0.125 \pm 0.002$  Volt. Turn the trim pot counter-clockwise to increase the voltage, clockwise to decrease the voltage.
- F. Press Start/Stop button again to turn on the motor. The unit will start flexing. Stop the motor and start again. The unit will start extending and when it reaches  $-10^\circ$  it will reverse and begin flexing. When the unit is flexing and  $-8^\circ$  appears on the keypad, stop the motor. Adjust R1 so that the Voltmeter shows a reading of  $0.425 \pm 0.002$  Volt. As with the R1 adjustment, turn the trim pot counter-clockwise to increase the voltage, clockwise to decrease the voltage.
- G. With these adjustments, CPM must cycle without reversal when loaded with a 40 pound weight.
- H. Do not re-adjust these limits if reversal occurs. Be sure the unit is properly aligned since misalignment would cause excessive surge currents during start-ups and result in motor reversal. Also, make sure the track is properly oiled. Excessive friction may also cause motor reversal.



## Section 8.0                      SERVICING AND REPAIR INSTRUCTIONS

This section includes the instructions that are contained in the repair kits.

### Section 8.0.1                      AVAILABLE KITTED PARTS LISTS

Kit Description	Kit Part Number		*** indicates kit is universal in use
	Serial Number 1XXXX	Serial Number 2XXXX	
Softgoods Pad Set K500	06490		***
Pulley Replacement Kit	71160		***
Bearing Replacement Kit	71170		***
Potentiometer Replacement Kit	71190	76524	
Lead Screw Replacement Kit	71200		***
Nut Housing Replacement Kit	71205		***
Membrane Switch Replacement	71220		***
Rod End Replacement Kit	71230		***
Brush / Rod Replacement Kit	71240		***
Handle Replacement Kit	71250		***
Optical Sensor Replacement Kit	71270		***
Motor Assembly Replacement Kit	71280		***
Transformer Replacement Kit	71290	76520	
Controller Replacement Kit	71300	76522	
Power Switch Replacement Kit	71310		***
Footplate Assembly Replacement Kit	71330		***
Housing Replacement Kit	71480	76521	
Electronics Upgrade Package	73616		not required

### **SECTION 8.1    PULLEY REPLACEMENT INSTRUCTIONS**

(FOR USE WITH KIT NUMBER 71160)

#### **Tools required:**

Small Flathead Screwdriver

Retaining Ring Pliers

3/32" Allen Wrench

#### **Sec 8.1.1                      To remove the pulleys and belts:**

1. Switch unit to off and unplug the transformer from the wall.
2. Remove the push rivets from the lower end of the unit ( portion with labeling near power cord) by lifting head of rivet with a small screwdriver and remove cover. Be sure to place rivets where they will not be lost.
3. Remove belts from the large pulley and discard.
4. To remove the large pulley, loosen the set screw(s) with a 3/32" Allen Wrench and remove pulley from lead screw shaft, Discard pulley and setscrew(s).
5. Remove spring washer and discard.
6. Remove the 3 belts from the Dual Pulley and discard.
7. To remove dual pulley, first remove the retaining ring from the pulley shaft with retaining ring pliers. Discard pulley.
8. Remove nylon washer and wave washers (2) and discard
9. Wipe away any excess residue that may have accumulated on both shafts.

#### **Sec 8.1.2                      To install the new pulleys and belts:**

1. Place small spring washer onto pulley shaft.

2. Place dual pulley onto pulley shaft. The larger portion of the pulley is to be next to the motor plate. Using the retaining ring pliers, install the retaining ring onto the shaft, assuring the ring is seated into the groove on the shaft.
3. Install the three smaller diameter belts to the motor pulley and the larger portion of the dual pulley.
4. Place nylon washer and wave washers (2) onto lead screw shaft.
5. Install the large pulley onto the lead screw shaft. When installing, assure that the set screw is aligned with the 1/8" diameter hole on the shaft. The pulley should be flush with the end of the shaft.
6. Install the Full-dog setscrew into the pulley and tighten, assure that the 'Full-dog point' is properly seated into the hole on the shaft. Install the 1/4" setscrew into the pulley and tighten.
7. Install the three larger diameter belts to the large pulley and the smaller portion of the dual pulley.
8. Replace housing onto unit and secure with push rivets.

**Note:** This pulley/belt system is to be used with units that have a 'grooved' pulley on the motor assembly. If the system being repaired has a non-grooved pulley, then an upgraded motor assembly kit (BREG P/N – 71280) will need to be installed.

## **Section 8.2 BEARING REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71170)*

### **Tools required:**

**Rubber Mallet**  
**Diagonal Cutters**  
**Small Flathead Screwdriver**

**Slip Lock Pliers**  
**Retaining Ring Pliers**  
**7/16" Open End Wrench**

**1/4" Drive Pin Punch**  
**3/32" Allen Wrench**

**Note:** Due to upgrades in the system that allow for better adjustment of the leadscrew, there are two (2) leadscrew configurations. To determine which configuration is installed into the unit being repaired, examine the fastening system for the thrust bearing. This is the end of the leadscrew opposite the pulley and belts. Configuration One will have a collar and cotter pin attachment\* and Configuration Two will incorporate a 1/4-28 nylon lock nut. The removal and installation instructions for both are detailed below.  
 (\* obsolete component no longer offered in repair kits)

### **Sec 8.2.1 To remove the bearings:**

1. Switch unit to off and unplug the transformer from the wall.
2. Remove the push rivets from the upper housing of the unit by lifting head of rivet with a small screwdriver, remove smaller cover and set aside. Be sure to place rivets where they will not be lost.
3. Remove belts from the large pulley and set aside.
4. Remove the large pulley loosening the set screw with a 3/32" Allen Wrench, also remove spring washer and set them aside. (Perform steps 4 & 5 at this time, only if the Configuration One attachment (cotter pin/collar) is in use. Otherwise, leave this pulley/flange bearing on the leadscrew to assist in the removal of the nylon lock nut defined in Step 9.
5. Separate extrusion weather stripping / brushes with fingers and place drive punch against flanged bushing. Gently tap with rubber mallet until bearing is free from the motor plate. Remove old bearing from lead screw and discard.
6. To remove the thrust bearing, move the upper housing to reduce interference while working.

### **Sec 8.2.2 Configuration One (Cotter Pin / Collar Removal)**

7. To remove the cotter pin from the leadscrew, rotate lead screw shaft to expose the tail ends of cotter pin and bend ends with the pliers until straightened. Rotate shaft to expose the opposite end of the pin and pull it out of the collar. Set aside for later installation.
8. Remove the collar and set it aside for later installation. Remove the thrust bearing, and thrust bushing and discard.

### **Sec 8.2.3 Configuration Two (Nylon Lock Nut)**

9. To remove the nylon lock nut from the leadscrew, place the 7/16 open-end wrench onto the nut. Grasp the large pulley to secure the leadscrew in place and remove the nut. Place the nut aside and discard the spring washer, if any are installed.
10. Perform Step 4 & 5 at this time to remove the large pulley and flange bearing from the pulley end of the lead screw.
11. To remove flanged bushing, separate extrusion weather stripping / brushes with fingers and place drive punch against flanged bushing. Gently tap with rubber mallet until bearing is free from the thrust bearing plate. Remove old bearing from lead screw and discard.

### **Sec 8.2.4 To install the new bearings:**

#### **FLANGE BEARING/PULLEY INSTALLATION:**

**NOTE:** As with the Thrust Bearing Removal/Installation configurations, there are 2 different pulley configurations and 3 different mounting hardware configurations for the large pulley. If you are using the previous pulley/leadscrew that were installed before the replacement of the bearings, determine which configuration it is and follow the stated installation process for that configuration. If you are installing either the pulley kit (Kit No. 71160) or the leadscrew kit (Kit No. 71200) separately, there may be alignment and attachment issues. It is recommended that if either of these kits are being replaced that the associated kit also be installed.

The pulley configurations are as follow:

- (1) Black toothed pulley w/ flat, toothed belt\*
- (2) Grey grooved pulley w/ round belts

The mounting configurations and the associated pulley descriptions are as follow:

Pulley Configuration	Fastener Type	Leadscrew Mount
(1) Black pulley/toothed belt*	6-32 x .1925L set screw*	Flat slot*
(2) Grey grooved pulley	10-24 x .625L set screw	Chamfered Hole
	10-24 x .50L full dog set screw	1/8" hole

(\* obsolete component no longer offered in repair kits)

1. Place a flange bearing onto lead screw shaft as so the flanged portion of the bearing is away from unit. Press bearing into the thrust bearing plate until the flange is flush with the plate. Gently tap bearing into place with rubber mallet if necessary.
2. Reinstall the large pulley and spring washers assuring the set screw is aligned with the flattened key way / hole on the lead screw shaft.
3. Install 2<sup>nd</sup> setscrew, if applicable, and tighten securely.
4. Install belt(s) between the dual pulley and the large pulley.

### **Sec 8.2.5 FLANGE BEARING/THRUST BEARING INSTALLATION:**

5. Place a flange bearing onto lead screw shaft as so the flanged portion of the bearing is away from unit. Press bearing into the thrust bearing plate until the flange is flush with the plate. Gently tap bearing into place with rubber mallet if necessary.
6. Remove pre-greased thrust bearing from plastic bag and slide onto lead screw shaft. Assure that the thrust bushing is properly installed into the thrust bearing.

### **Sec 8.2.6 Installation of Configuration One (Collar / Cotter Pin)**

7. Once the thrust bearing is installed onto the leadscrew, place collar onto shaft and align the thru-hole with the hole in the lead screw shaft and insert cotter pin.
8. Using slip lock pliers, bend the ends of the cotter pin until it is flush with the collar.

### **Sec 8.2.7 Installation of Configuration Two (Nylon Lock Nut)**

9. Once the thrust bearing is installed onto the leadscrew, place the two spring washers onto the shaft and hand thread the nut onto the leadscrew.

10. Grasp the large pulley with one hand and tighten the nylon nut with the 7/16" wrench.

To assure that the unit will not bind during operation, allow for approximately 1/16" play.

11. Replace upper housings and push rivets.

### **Section 8.3 POTENTIOMETER REPLACEMENT/CALIBRATION INSTRUCTIONS**

(For use with kit number 71190 or 76524)

**NOTE:** Kit number 71190 incorporates a 'Heyco' strain relief to secure the cord to the housing and is used on CPMs with serial numbers beginning with '1'. CPM units with serial numbers beginning with '2' use kit number 76524 and incorporate a molded strain relief to secure the cord into the housing. These kits are not interchangeable.

#### **Tools required:**

**Phillips Screwdriver**

**3/32" Allen Wrench**

**Pliers or strain relief pliers**

**Flat Head Screwdriver**

**Needle Nose Pliers**

**Straight Edge**

**5/64" Allen Wrench**

**6" Ruler or Tape Measure**

**NOTE:** When replacing the potentiometer, there are three phases. Removal, Installation, Calibration.

#### **Sec 8.3.1 To remove the existing goniometer assembly:**

1. If unit is operational, Turn unit on and start into flexion position until all screws on goniometer housing can be reached.
2. Switch unit to off and unplug the transformer from the wall.
3. Remove the push rivets from the upper housing of the unit by lifting head of rivet with a small screwdriver, remove smaller cover and set aside. Be sure to place rivets where they will not be lost.
4. Remove Potentiometer Housing using a Phillips head screwdriver, discard screws.
5. Remove the 2 socket head screws from the goniometer bracket using a 3/32" Allen Wrench. Discard screws and bracket.
6. Remove set screws from the upper part of the calf support using a 5/64" Allen wrench and remove press fit bushing from unit and discard.
7. Disconnect the potentiometer connector from the header marked J4 on the Motor PCB.
8. To remove the Heyco strain relief from housing (for serial numbers beginning with '1'), use either a regular pair of slip-lock pliers or strain relief pliers, compress the strain relief to remove the strain relief from the housing, then pull cord out and discard the old potentiometer assembly. To remove the potentiometer cables from CPMs that have a serial numbers that start with the number '2', grasp the molded strain relief near the base with either the slip lock or strain relief pliers and turn counter-clockwise 90°. Then pull the cord out and discard.

#### **Sec 8.3.2 To install a new potentiometer assembly:**

**NOTE:** Before the installation of the potentiometer, verification of the -10° through the 120° range must be performed. To achieve this, connect the potentiometer cable to the J4 connector on the motor drive board. Plug the CPM transformer in and turn on the CPM unit at the power switch. The display on the hand held controller should be lit. Grasp the potentiometer in one hand and slowly turn the bushing counter-clockwise until -10° is displayed. Slowly turn the bushing clockwise until the display reaches 120°. Once the 120° position has been reached, slowly turn the bushing counter-clockwise until the display reaches 0°.

1. Hand rotate the CPM carriage to a near 0° angle.
2. Oil the press fit bushing on the potentiometer with a light-weight oil and insert it into the hinged area (knuckle). Align hole in bushing to the set screw hole and install the 1/2" long set screw, followed by the second set screw, making sure to tighten both snugly.

3. Thread the cable through the opening for the potentiometer. For CPM units with a serial number beginning with the number '1', compress the Heyco strain relief and insert it into the opening to secure the potentiometer cable. For CPM units with a serial number that begin with the number '2', insert the molded strain relief into the key-hole and turn it 90° counter-clockwise to engage the locking mechanism.
  4. Connect the potentiometer connector to the header on the Motor PCB labeled J4.
  5. Turn the CPM on at the power switch to allow viewing of the angle on the controller. Turn the potentiometer by hand to 0°. Slowly turn the potentiometer clockwise, while viewing the display, to assure that the component is reading the correct -10° - 120° range. Turn the potentiometer in the opposite direction to return it to the 0° position.
  6. Place potentiometer bracket into the slot on the potentiometer and install the socket head cap screws using the 3/32" Allen wrench. Do not tighten screws until 0 degree mark has been set in Steps 8 and 9.
  7. Plug transformer into wall and start the unit into extension mode until the bars of both the thigh and calf supports are in alignment. This step can also be done by hand. Use a straight edge to verify.
  8. Once alignment has been confirmed, carefully turn potentiometer until readout on the controller reads 0 degrees.
  9. Tighten the screws with a 3/32" Allen Wrench by alternating half turns until the potentiometer is secured.
  10. Attach the potentiometer housing with the #4-40 flat head screws provided and tighten snugly with a Phillips screwdriver. The strain relief pigtail from the potentiometer assembly should slide into the slot in the housing.
- NOTE:** Once the screws for the bracket have been tightened, perform the 120° calibration process defined below.
11. Replace housing and reinstall push rivets.

### **Sec 8.3.3 Calibration of the 120° position:**

**NOTE:** The calibration process described below is to be performed with the Thigh Support Adjustment set at its lowest position. Failure to properly position the thigh support will make the distance adjustment of 1-1/4" difficult and may possibly damage the CPM unit.

1. With the power on, start the CPM into full (120°) flexion. Stop the carriage.
2. Position the ruler onto the unit to measure the distance between the yoke and the end of the extrusion (aluminum rail).
3. Move the yoke by turning the pulley until the yoke is 1-1.4" from the back of the extrusion. If the display reads 120° and the display is not flashing, then the calibration process is complete.
4. If the display does not read 120°, or if it is flashing between angles, the flexion limit will need to be set.
5. Locate the 'R5' variable resistor. With a small flat screwdriver, turn the adjustment screw until the display on the pendant reads a steady 120°. **Important:** Be sure to turn the power "OFF" and then back "ON" (at the base of the unit) after making your final adjustment to "**Lock**" the new settings into the software memory.
6. Once the 120° position has been set, start the CPM and allow it to run down to the 0° position. Verify the 0° position.

7. If the 0° position is verified, complete the installation process above. If 0° position cannot be verified, repeat the calibration process.

## **Section 8.4 LEAD SCREW REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71200)*

### **Tools required:**

<b>Rubber Mallet</b>	<b>Slip Lock Pliers</b>	<b>Diagonal Cutters</b>	<b>Retaining Ring Pliers</b>
<b>1/64" Allen Wrench</b>	<b>3/32" Allen Wrench</b>	<b>1/8" Allen Wrench</b>	<b>5/32" Allen Wrench</b>
<b>Small Flathead Screwdriver</b>		<b>2 Foot Of Light Weight Rope or String</b>	
<b>#0 Phillips Screwdriver</b>		<b>7/16" Open-End Wrench</b>	

### **Sec 8.4.1 To remove the existing lead screw:**

1. Turn unit on and start into complete flexion (120°). Using the lightweight rope or string, secure calf support to thigh support.
2. Switch unit to off and unplug the transformer from the wall.
3. Remove the push rivets from both halves of the upper housing of the unit by lifting head of rivet with a small screwdriver, remove smaller cover and set aside. Be sure to place rivets where they will not be lost.
4. There are 2 different configurations for the manner in which the Thrust Bearing is secured to the lead screw, Collar and cotter pin, or a ¼" – 28 Nylon Locking Nut. To determine this, examine the attachment at the opposing end of the leadscrew from the pulley/belt assembly
  - For units with the collar/cotter pin attachment method. – Remove the thrust bearing and collar assembly by rotating lead screw to expose the tail ends of the cotter pins and cut ends off with diagonal cutters. Rotate lead screw and remove remainder of cotter pin by pulling with the slip lock pliers. Discard the thrust bearing, collar, and cotter pin.
  - For units with the ¼" – 28 Nylon Locking Nut. – Remove the thrust bearing assembly by placing a 7/16" open-end wrench onto the nut. Hold the large pulley firmly and remove the nut from the leadscrew. Discard the used Nylon Locking Nut.
5. Remove the belts from the large pulley and set aside. To remove the large pulley, Remove the retaining set screw (if present) and then loosen the set screw with a 3/32" Allen wrench and pull the pulley and spring washers from the lead screw and set aside.

**NOTE:** When removing the pulley, please note that if the pulley is black and has teeth (such as a gear) and the belt being removed also has teeth, this pulley is of the original configuration and cannot be used with the new leadscrew. If this is the case then you must replace this pulley with kit number 71160. Be aware, this new pulley system incorporates the use of 3 round belts that will run from the dual pulley to the large drive pulley. It also uses 3 thinner round belts that run between the dual pulley and the motor pulley. If the belt of the 2<sup>nd</sup> set, between the motor and the dual pulley is flat, then the motor assembly (kit number 71280) must be changed also.

6. To remove leadscrew from the CPM unit, the flanged bushing on the pulley end will need to be removed. First, remove the extrusion weather stripping or nylon brushes fingers and discard. Place the open-end of the 7/16" wrench over the leadscrew against the bushing and gently tap the wrench with rubber mallet until bushing is free of the motor plate. Take care not to damage bearings inner race. Set bearing aside until reinstallation.
7. Untie the calf support from the thigh support and slide the lead screw out of the motor plate. Turn the lead screw until it is free of the unit. Discard lead screw.
8. Turn the nut housing to allow the removal of the orange ACME nut that is inside of the nut housing. Discard the ACME nut. If the CPM unit has a built in oiling felt, remove it and discard also.

*(see note below)*

**NOTE:** There are 2 configurations for the nut housing. The difference between them is the 2<sup>nd</sup> 'newer' configuration incorporates a 'felt' oiling pad inside the housing and is distinguishable by an increased length and a small hole on the top of the housing for applying the oil to the pad. It is suggested that, if the original, non-oiling housing is evident, that this assembly be replaced with kit number 71205; Nut Housing Assembly.

9. Wipe down nut housing, yoke area, and inside of the aluminum extrusion/rail with clean towel to remove all debris from the yoke of the calf support.

#### **Sec 8.4.2 Installation of the Leadscrew:**

**NOTE:** Note that if the pulley is black and has teeth (such as a gear) and the belt being removed also has teeth, this pulley is of the original configuration and cannot be used with the new leadscrew. If this is the case than you must replace this pulley with kit number 71160.

Be aware, this new pulley system incorporates the use of 3 round belts that will run from the dual pulley to the large drive pulley. It also uses 3 thinner round belts that run between the dual pulley and the motor pulley. If the belt of the 2<sup>nd</sup> set, between the motor and the dual pulley is flat, then the motor assembly (kit number 71280) must be changed also.

1. Insert the orange ACME nut into the nut housing. If the nut housing has a built in oiling felt, assure that the felt does not get folded. Apply lightweight machine oil to the felt to thoroughly saturate the felt.
2. Insert new lead screw into the ACME nut through the motor plate and thread in approximately 4". Pull the calf and thigh supports back to into flexion position and secure with the lightweight rope. Continue threading the lead screw in until it is extended through the flanged bushing in the thrust plate.
3. Reinstall the thrust bearing, thrust bushing, 2 spring washers and the ¼" – 28 Nylon Locking Nut onto the lead screw and tighten the nut up to the nylon insert. For leadscrews that incorporate the use of the collar / cotter pin, slide the collar onto the shaft and align the small hole to the hole on the leadscrew. Insert the cotter pin. Rotate the leadscrew to expose ends of the cotter pin. Spread the ends of the cotter pins and wrap them back around the leadscrew. Assure that the legs of the cotter pin are flat against the shaft. If clicking is heard when it is turned on, or if the unit freezes in place, inspect the legs of the pin to assure that they are not interfering with the housing or frame of the CPM unit.
4. Place the flange bearing onto the lead screw and press in flush to the motor plate. Gently tap the outer race of the bearing in with the rubber mallet if necessary. Take care not to damage the inner race.
5. Reinstall the large pulley by realigning the Full-dog setscrew to the 1/8" hole in the leadscrew. The pulley should be flush with the end of the lead screw. Install the #10 – 24 x ¼" retaining setscrew into the large pulley and tighten firmly.
6. Place the open-end 7/16" wrench onto the Nylon Locking Nut. Grip the large pulley firmly and tighten the nut. It is recommended that approximately 1/16" of gap (play) be left in the driveline to reduce binding of the leadscrew.
7. Reinstall the belts between the dual and large pulleys.
8. Remove lightweight rope from unit.
9. Plug transformer into wall and start the unit to assure proper tracking of the upper assembly. If the leg supports are tracking properly, tighten rod end screws.
10. If the assembly is not tracking properly, remove screw on opposite side of the direction of the tracking and turn the rod end out by 1/2 turn and reinstall screw. Allow unit to run 2-3 cycles and verify if the unit is tracking properly. If correct, tighten rod end screws. If not repeat this step until proper tracking is achieved.
11. Install brushes and rods by sliding a brush into each of the grooves on the upper lip of the aluminum extrusion.
12. Slide the rods in behind the brushes to secure the brushes in place.
13. Replace both sections of the upper housing and reinstall the push rivets

#### **SECTION 8.5 NUT HOUSING REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71205)*

##### **Tools required:**

Rubber Mallet  
1/64" Allen Wrench  
Small Flathead Screwdriver

Slip Lock Pliers  
3/32" Allen Wrench

Diagonal Cutters  
1/8" Allen Wrench  
2 Foot Of Light Weight Rope or String

Retaining Ring Pliers  
5/32" Allen Wrench

**Sec 8.5.1 To remove the existing nut housing:**

1. Turn unit on and start into complete flexion (120°). Using the lightweight rope or string, secure calf support to thigh support.
2. Switch unit to off and unplug the transformer from the wall.
3. Remove the push rivets from both halves of the upper housing of the unit by lifting head of rivet with a small screwdriver, remove smaller cover and set aside. Be sure to place rivets where they will not be lost.
4. There are 2 different configurations for the manner in which the Thrust Bearing is secured to the lead screw, Collar and cotter pin, or a ¼" – 28 Nylon Locking Nut. To determine this, examine the attachment at the opposing end of the leadscrew from the pulley/belt assembly
  - For units with the collar/cotter pin attachment method. – Remove the thrust bearing and collar assembly by rotating lead screw to expose the tail ends of the cotter pins and straighten the ends with pliers. Rotate lead screw and remove the cotter pin by pulling with the slip lock pliers. Set thrust bearing, collar, and cotter pin aside for later installation.
  - For units with the ¼" – 28 Nylon Locking Nut. – Remove the thrust bearing assembly by placing a 7/16" open-end wrench onto the nut. Hold the large pulley firmly and remove the nut from the leadscrew. Set the Nylon Locking Nut aside for later installation.
5. Remove the belts from the large pulley and set aside. To remove the large pulley, Remove the retaining set screw (if present) and then loosen the set screw with a 3/32" Allen wrench and pull the pulley and spring washers from the lead screw and set aside.
6. To remove leadscrew from the CPM unit, the flanged bushing on the pulley end will need to be removed. First, remove the extrusion weather stripping or nylon brushes and discard. Place the open-end of the 7/16" wrench over the leadscrew against the bushing and gently tap the wrench with rubber mallet until bushing is free of the motor plate. Take care not to damage bearings inner race. Set bearing aside until reinstallation.
7. Untie the calf support from the thigh support and slide the lead screw out of the motor plate. Turn the lead screw until it is free of the unit. Set the leadscrew aside until reinstallation
8. Remove the two screws securing the rod end ball joints to disconnect the thigh/calf supports from the unit. Take care not to turn the rod ends as it cause the unit to track improperly when it is re-assembled.
10. Rotate the calf support 90 degrees and remove it from the unit.
11. Place the ¼" drive punch into threaded hole to secure nut housing for removal of the screws holding the bushings and rollers. Using a 1/8" Allen Wrench, remove the screws, bushings, rollers, and housing and discard. Wipe off old grease and oil and set aside for later installation. If the nut housing is of the newer configuration, which has a 'felt' oiling pad installed, discard used oiling pad (see note below).
12. Wipe down yoke area and inside of the aluminum extrusion/rail with clean towel to remove all debris from the yoke of the calf support.

**Sec 8.5.2 To install a new nut housing:**

1. Place oiler felt into a small cup and saturate with the supplied oil. Gently squeeze felt to remove excess oil.
2. Insert the oiler felt into the recess inside the nut housing. Install the orange ACME nut into housing taking care not to 'roll' the oiler felt during this process.
3. Install the housing into the calf support yoke, assuring that the oiler hole is to the top front of the support.
4. Slide a washer, bushing and a roller onto each of the two #10-32 x 5/8" button head screws.



5. Place a small drop of serviceable lock tight onto the ends of each screw.
6. Insert the assemblies through the holes in the yoke and secure tightly to the nut housing.

**NOTE:** Assure that the ACME nut is not locked in place by the screws. If the nut cannot move in a reasonably free motion, it may cause binding of the leadscrew or premature failure of the coating on the leadscrew.

7. Reinstall thigh/calf support into unit.
8. Reinstall the screws that connect the thigh/calf support to the unit. Do not tighten screws completely at this time.

### **Sec 8.5.3 Installation of the Leadscrew:**

1. Insert lead screw into the ACME nut through the motor plate and thread in approximately 4". Pull the calf and thigh supports back to into flexion position and secure with the lightweight rope. Continue threading the lead screw in until it is extended through the flanged bushing in the thrust plate.
2. Reinstall the thrust bearing, thrust bushing, 2 spring washers and the ¼" – 28 Nylon Locking Nut onto the lead screw and tighten the nut up to the nylon insert.
3. Place the flange bearing onto the lead screw and press in flush to the motor plate. Gently tap the outer race of the bearing in with the rubber mallet if necessary. Take care not to damage the inner race.
4. Reinstall the large pulley by realigning the setscrew to the hole/notch in the leadscrew. The pulley should be flush with the end of the lead screw. If the pulley being installed if the gray grooved pulley, be sure to install the retaining setscrew into the large pulley and tighten firmly.
5. Place the open-end 7/16" wrench onto the Nylon Locking Nut. Grip the large pulley firmly and tighten the nut. It is recommended that approximately 1/16" of gap (play) be left in the driveline to reduce binding of the leadscrew.
6. Reinstall the belts between the dual and large pulleys.
7. Remove lightweight rope from unit.
8. Plug transformer into wall and start the unit to assure proper tracking of the upper assembly. If the leg supports are tracking properly, tighten rod end screws.
9. If the assembly is not tracking properly, remove screw on opposite side of the direction of the tracking and turn the rod end out by 1/2 turn and reinstall screw. Allow unit to run 2-3 cycles and verify if the unit is tracking properly. If correct, tighten rod end screws. If not repeat this step until proper tracking is achieved.
10. Install brushes and rods by sliding a brush into each of the grooves on the upper lip of the aluminum extrusion.
11. Slide the rods in behind the brushes to secure the brushes in place.
12. Replace both sections of the upper housing and reinstall the push rivets

## **SECTION 8.6 MEMBRANE SWITCH REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71220)*

### **Tools required:**

**#1 Phillips Screwdriver**

**Small Flathead Screwdriver**

### **Sec 8.6.1 To remove the existing membrane switch:**

1. Pull label off of the back of the controller pendant and discard.
2. Remove screws using a #1 Phillip screwdriver, keep screws for re-assembly of pendent.

3. Disconnect the existing membrane switch from the controller circuit board.
4. Peel membrane switch from front controller housing and discard. If necessary, use a small flathead screwdriver to lift the edge of the switch.

#### **Sec 8.6.2 To replace the membrane switch:**

1. Peel backing from new membrane switch and position onto front controller housing. Be sure to thread connector through slot in housing before applying switch.
2. Connect switch to circuit board.
3. Replace circuit board back into front housing, assuring that the strain relief is inside case and the wires are not interfering with alignment of the housing bosses through the circuit board.
4. Place back controller housing and secure with screws (3).
5. Peel backing off of controller back label and position onto the back of the controller housing.
6. Peel backing off of the supplied Velcro loop and attach to the back of the controller label.

### **Section 8.7 ROD END / BALL JOINT REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71230)*

#### **Tools required:**

**5/32" Allen Wrench**

**Slip Lock Pliers**

#### **Sec 8.7.1 To remove the existing Rod End Ball Joints:**

1. Remove screw connecting the lower extension to the frame.
2. Remove rod end from frame.

**NOTE:** If the rod ends will not turn due to rust, corrosion, or damage, Use the slip lock pliers to carefully turn the rod ends until they turn freely. A small amount of WD-40 can be sprayed on threads to help loosen the cause of the binding.

#### **Sec 8.7.2 To replace the Rod End Ball Joints:**

1. Insert rod end into frame.
2. Install screw connection the lower extension to the frame.
3. Plug transformer into wall and start the unit to assure proper tracking of the upper assembly. If the leg supports are tracking properly, tighten rod end screws.
4. If the assembly is not tracking properly, remove screw on opposite side of the direction of the tracking and turn the rod end out by ¼ turn and reinstall screw. Allow unit to run 2-3 cycles and verify if the unit is tracking properly. If correct, tighten rod end screws. If not repeat this step until proper tracking is achieved.

### **SECTION 8.8 BRUSH / ROD REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71240)*

#### **Tools required:**

**3/32" Allen Wrench**

**Slip Lock Pliers**

**Flat Screwdriver**

#### **Sec 8.8.1 To remove the existing Weather Stripping:**

1. Switch unit to off and unplug the transformer from the wall.

2. Remove the push rivets from the front half of the upper housing of the unit by lifting head of rivet with a small screwdriver, remove smaller cover and set aside. Be sure to place rivets where they will not be lost.
3. Remove the belts from the large pulley and set aside. To remove the large pulley, loosen the set screw with a 3/32" Allen wrench and pull the pulley and spring washers from the lead screw and set aside.
4. Grasp end of weather stripping and pull perpendicular from unit to remove.

**Sec 8.8.2 To remove the existing brushes/rods:**

1. Switch unit to off and unplug the transformer from the wall.
2. Remove the push rivets from the front half of the upper housing of the unit by lifting head of rivet with a small screwdriver, remove smaller cover and set aside. Be sure to place rivets where they will not be lost.
3. Remove the belts from the large pulley and set aside. To remove the large pulley, loosen the set screw with a 3/32" Allen wrench and pull the pulley and spring washers from the lead screw and set aside.
4. With a flat screwdriver, pry open the very ends of the extrusion if they have been crimped close.
5. Grasp end of brush with slip lock pliers and extract from end of unit.
6. Slide rod out of unit from end.

**Sec 8.8.3 To replace the Brush / Rod Assembly:**

1. Insert the brush into the extrusion from the end nearest the pulley system.
2. Insert the metal rod into the extrusion behind the brush to push the brush forward towards the center of the unit.
3. Crimp the ends of the extrusion to secure the brushes.
4. Replace housing onto unit and secure with push rivets.

**SECTION 8.9 HANDLE REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71250)*

**Tools required:**

**#2 Phillips Screwdriver**

**Flathead Screwdriver**

**Sec 8.9.1 To remove the existing Handle:**

1. Switch unit to off and unplug the transformer from the wall.
  2. Remove caps at the end of the handle by prying with a flathead screwdriver.
- NOTE:** These caps may not be present on some units due to a change in the handle.
3. Remove screws with a #2 Phillips screwdriver.
  4. Remove handle from CPM unit.

**Sec 8.9.2 To replace the Handle:**

1. Place handle between mounting points on unit.
2. Place mounting hardware over ends of handle as so the tabs on hardware are set into offset hole on the units cover.
3. Secure the mounting hardware with a #2 Phillips screwdriver.

## SECTION 8.10 OPTICAL SENSOR REPLACEMENT INSTRUCTIONS

(For use with kit number 71270)

### Tools required:

#1 Phillips Screwdriver

Small Flathead Screwdriver

#### Sec 8.10.1 To remove the existing Optical Sensor:

1. Switch unit to off and unplug the transformer from the wall.
2. Remove the push rivets from the lower end of the unit (portion with labeling near power cord) by lifting head of rivet with a small screwdriver and remove cover. Be sure to place rivets where they will not be lost.
3. Unplug connector for the optical sensor from the header on the PCB marked J5.
4. Using a #1 Phillips screwdriver, remove the screw that secures the optical sensor to the motor assembly.
5. Using a small flathead screwdriver, open the wire clip securing the wire.
6. Discard old optical sensor and wire.

#### Sec 8.10.2 To replace the Optical Sensor Assembly:

7. Secure the optical sensor to the motor assembly with the provided screw. Verify that the chamfer is positioned towards the motor PCB and the encoder wheel is centered between the two posts of the optical sensor, as indicated in fig 8.

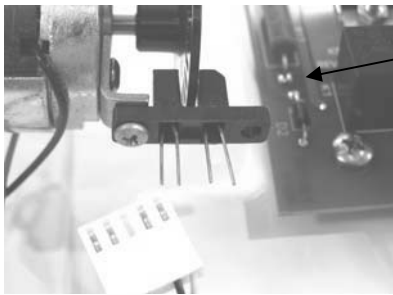


fig 8

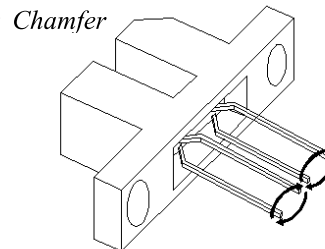


fig 9

8. If the optical sensor wire was not connected to the optical sensor, verify that the leads are twisted in the proper direction, as indicated in fig 9.
9. Attach the 5-pin connector shown in fig 10 and 11 to the optical sensor. Use a nylon cable tie to secure the cable tie to the optical sensor as shown in fig 11.

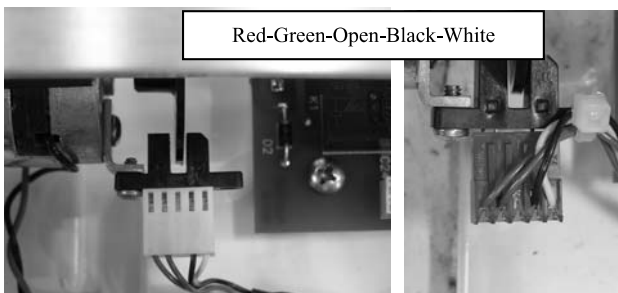


fig 10



fig 11



fig 12

10. Plug the optical sensor connector into the header marked J5 as indicated in fig 12.
11. Secure the optical sensor wire to the optical sensor by threading a small wire tie through the hole of the optical sensor, wrapping the tie around the wire and pulling it tight. Cut off the excess wire tie.

12. Replace the cover and secure with push rivets

## **SECTION 8.11 MOTOR REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71280)*

### **Tools required:**

**#0 Phillips Screwdriver**

**#1 Phillips Screwdriver**

**Small Flathead Screwdriver**

**7/64" Allen Wrench**

**NOTE:** Before the replacement of the motor assembly, view the pulleys installed into the unit. These pulleys should incorporate the use of 3 round belts connecting the pulleys. These pulleys are easily distinguishable by the grooves and gray color. The small pulley of the motor should also have grooves. If any of the pulleys installed require flat belts, it will be necessary to replace the following components also. The pulley assembly (kit number 71160), and the leadscrew (kit number 71200).

### **8.11.1 To remove the existing Motor Assembly:**

1. Switch unit to off and unplug the transformer from the wall.
2. Remove the push rivets from the lower end of the unit (portion with labeling near power cord) by lifting head of rivet with a small screwdriver and remove cover. Be sure to place rivets where they will not be lost.
3. Remove belts from the large, set aside.
4. Remove the 3 belts from the Dual Pulley. Set belts aside.
5. With a #0 Phillips screwdriver, remove the optical sensor from the bracket on the motor. Set the sensor out of the way but do not disconnect it from the board. Set the screw aside to where it will not be lost. If there is a cable tie securing the connector to the optical
6. Unplug connector for the motor from the header on the PCB marked J3.
7. Using a #1 Phillips screwdriver, remove the screw that secures the motor to the motor plate of the frame. Discard old motor assembly, screws, and washers.
8. Remove the rubber grommets from the motor plate and discard.
9. Wipe off any built up debris from the motor plate with clean, dry cloth.

### **8.11.2 To replace the Motor Assembly:**

10. Insert the four rubber grommets from kit into the motor plate.
11. Install the new motor assembly into the unit through the motor plate. Secure the motor with the provided washers and screws. Do not tighten motor.
12. Install the 1"x1" pad enclosed under the aluminum rail such that one edge matches the edge of the rail and the other edge is flush with the end of the motor. Tighten the motor screws using 7/64" Allen Wrench.
13. Reattach the optical sensor to the bracket of the motor. Assure that the encoder wheel is centered between the posts of the optical sensor.
14. Plug the 5-pin connector from the motor into the header marked J5 optical sensor. The connector wires are Red-Green-Black-White when viewed from left to right.
15. Reinstall the belts between the dual pulley and the motor pulley.
16. Reinstall the belts between the dual pulley and the large pulley.
17. Replace housing and secure with push rivets.

## **SECTION 8.12 TRANSFORMER REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71290 and kit number 76520)*

### **Tools required:**

**Slip-lock Pliers**

**Small Flathead Screwdriver**

**Small Diagonal Cutters**

**Adjustable Wrench**

**NOTE:** Due to modifications of the CPM housings, there are different processes for the removal and reinstallation of the transformer into the housing. The first determining factor is the type of strain relief that is installed into the unit being worked on.

The simplest means is to review the serial number of the CPM unit. For all serial numbers beginning with the number '1', kit number 71290 would be used. This kit incorporates a 'HEYCO' 90° strain relief that is installed into an elongated hole.

For CPM serial numbers beginning with '2', kit number 76520 would be used. This kit incorporates a 'molded' 90° strain relief that is fitted into a slot on the lower housing.

There are also two (2) motor PCBs in use. The first that will be in use on most units with a serial number starting with '1', unless the motor PCB has been changed, is a DC power plug that is cylindrical in shape. The second motor PCB will have a white, flat power connector with a locking clip to secure it to the PCB. This 2<sup>nd</sup> PCB may be found in some units with a serial number beginning with '1', if the unit has had its PCB replaced.

For these units that have had the board changed, kit number 71290 also includes a jumper to connect the DC plug to the PCB.

### **8.12.1 To Remove the existing Transformer:**

1. Switch unit to off and unplug the transformer from the wall.
2. Remove the push rivets from the lower end of the unit (portion with labeling near power cord) by lifting head of rivet with a small screwdriver and remove cover. Be sure to place rivets where they will not be lost.
3. Disconnect the flag connectors from the power switch.
4. \*For units with serial numbers beginning with '1'
5. Clip cable tie securing the DC plug to the motor PCB and unplug.
6. \*For units with serial numbers beginning with '2' and S/N 1XXXXX units with a newer motor PCB
7. Unplug the power connector from the PCB.
8. Using the adjustable wrench, unscrew the ring terminal on the green ground wire from the frame. Retain screw for reinstallation.

**NOTE:** It may be necessary to remove the large pulley from the CPM in order to remove the ring terminal. If this is required, remove the belts from the pulley and set aside. Using a 3/32" Allen wrench, remove the 1<sup>st</sup> setscrew from the pulley. Back the 2<sup>nd</sup> setscrew out approximately 1/4" to release the pulley from the leadscrew. Set the pulley aside for reinstallation.

9. Open wire clip to release wires.
10. \*For units with serial numbers beginning with '1'
11. Remove strain relief bushing from the housing and pull cord through. Discard old transformer.
12. \*For units with serial numbers beginning with '2'
13. Lift the molded strain relief out of its slot in the housing and discard the transformer.

### **8.12.2 To Replace the Transformer:**

*\*For units with serial numbers beginning with '1'*

14. Insert the wire through the housing and secure with the strain relief bushing. The bushing should be located approximately 1 – 2 inches back from the stripped portion of the wire. Direct the transformer cable away from the switch.
15. Connect the two flag connectors to the power switch.

16. Connect DC plug to the PCB and secure it with the 4" cable tie.

**NOTE:** For connecting to a newer PCB, plug the DC plug onto the jumper that was included in kit number 71290. Plug the other end of the jumper into the PCB.

*\*For units with serial numbers beginning with '2'*

17. Slip the molded strain relief into its slot on the lower housing. Be sure to direct the transformer cable away from the switch as to not interfere with it's accessibility or operation.

18. Secure the ring terminal on the green ground wire to the frame, using the screw saved in Part 1.

**NOTE:** If it was necessary to remove the large pulley to remove the screw, replace it at this time. Assure that the setscrew is aligned properly with the mounting hole on the leadscrew. Replace the belts accordingly.

19. Secure wires into the wire clip.

20. Secure wires to the PBC power to the frame of the CPM.

21. Replace housing and secure with push rivets.

### **SECTION 8.13 HOUSING REPLACEMENT INSTRUCTIONS**

*(For use with kit number 71480 or kit number 76521)*

#### **Tools required:**

**#0 Phillips Screwdriver**  
**Diagonal Cutters**

**Pliers or strain relief pliers**

**Small Flathead Screwdriver**

**NOTE:** There are two (2) different configurations of the CPM housings for the Flexmate K500. The difference between the configurations is due to the manner of securing the cables for the transformer, controller, and potentiometer. The first configuration (kit number 71480), is used for units with a serial number beginning with '1', uses the 'HEYCO' strain relief to secure the cables passing through the housing.

The second configuration (kit number 76521) is for units with a serial number beginning with the number '2' and incorporates a molded strain on each cable that lock onto special keyways of these housings.

#### **8.13.1 To remove the existing housing:**

1. Switch unit to off and unplug the transformer from the wall.
2. Remove the push rivets from both halves of the upper housing of the unit by lifting head of rivet with a small screwdriver, remove and discard rivets.
3. Open wire clips with the small flat-head screwdriver and remove wires from clips.
4. Disconnect the connectors from the headers on the motor PCB:

1. Controller – J1
2. Transformer – J2
3. Motor – J3
4. Potentiometer – J4
5. Optical Sensor – J5

Note: Cut cable tie securing the DC plug on the transformer

5. Remove the strain relief bushings or molded strain relief from the housing sections with strain relief pliers and discard the bushings. To remove the molded controller and potentiometer relief, grasp the relief near the base with the strain relief pliers and twist counter-clockwise 90° and pull relief from housing. Carefully remove the wires that are threaded through the openings. To remove the strain relief for the transformer, slide the relief from its slot.
6. Discard both sections of the upper housing.
7. Unscrew the ground wire on the transformer from the frame, and retain screw for reinstallation.

8. Remove the Motor PC Board from its mountings. Set screws aside for reinstallation of board.
9. Using the small diagonal cutters, clip the wire tie that is securing the switch into the housing.
10. Disconnect the flag connectors from the power switch. With the diagonal cutters, cut the cable tie that is securing the switch to the housing and remove the switch from the housing. Set aside the switch for later installation.
11. Remove handle by removing the flat head screws with the Phillips screwdriver. And set aside for later installation.
12. Turn the Flex-Mate unit upside-down and remove the 4 screws that secure the housing to the frame. Discard lower housing.

#### **8.13.2 To install a new housing:**

1. Place new lower housing onto up-turned unit and align the holes to the frame. Install the 4-#8-32 x .318" screws to secure the lower housing.
2. Turn the unit right-side up and install the power switch into the unit as so the 'on' position will be next to the power cord. Secure the power switch into the housing with a 4" cable tie.
3. Position the PC board into the unit as so the main power connection is opposite the motor. Reinstall the screws and secure snugly.
4. Install the power cord into the lower housing and secure with the right angle strain relief. For the molded strain relief, position the relief to face away from the power switch as to not interfere with its operation and plug the power connector to the board. Plug the DC power plug into its port and secure with the 4" cable tie. Reconnect the flag connectors to the power switch, and the ground wire to the frame.
5. Thread the potentiometer and controller wires through the appropriate holes and secure them to the housing. For the controller and potentiometer cables with the molded relief, insert the relief into its keyway and twist it 90° to lock it into place.
6. Reconnect the wires to their appropriate connections on the PC Board:
  1. Controller – J1
  2. Transformer – J2
  3. Motor – J3
  4. Potentiometer – J4
  5. Optical Sensor – J5
7. Reattach the upper housing portions to the lower housings with the plastic push rivets.
8. Reinstall the handle onto the side of the unit with the #8-32 x 7/8" flat head screws and press the handle caps into position.

### **Section 8.14 Electronics Upgrade / Replacement Instructions**

*(For use with kit number 73616. Also for kit number 76523, in part.)*

**NOTE:** As stated in Section 4 of this manual, there have been modifications made to the Flexmate K500 Motor PCB. Due to these changes, it may be a requirement that all electronic components be updated at the same time. It is recommended, in order to assure compliance and reliability of the Flexmate K500 Knee CPM, that the following components be upgraded. This upgrade is intended for Flexmate units that have the older model Motor PCB (see Section 5, page 4, for details).

Full Upgrade Package includes

- Motor PCB
- Controller PCB
- Controller Cable
- Potentiometer Assembly (includes cable)

**NOTE:** This section is for the replacement of the complete upgrade, with references made to previous sections of this manual for individual component replacement.



**Tools Required:**

#1 Phillips Screwdriver  
 5/64" Allen Wrench  
 Straight Edge  
 6" Ruler or Tape Measure

#2 Phillips Screwdriver  
 3/32" Allen Wrench  
 Slip Lock Pliers  
 Small Diagonal Cutters

Flathead Screwdriver  
 Needle Nose Pliers  
 Strain Relief Pliers

**8.14.1 Removal of the electronics from the Flexmate K500**

1. Switch unit off and unplug the transformer from the wall.
2. Remove the push rivets from the smaller portion of the upper housing of the unit by lifting the head of the rivet with a small screwdriver. Remove small housing section and set aside with the push rivets for later installation.
3. Open wire clips with the small flathead screwdriver and remove wires from clips.
4. Disconnect the connectors from the headers on the motor PCB:
  - Controller - J1
  - Transformer - J2
  - Motor - J3
  - Potentiometer - J4
  - Optical Sensor - J5

Note: Cut cable tie securing the DC plug to the PCB and any wiring secured to the frame of the CPM unit.
5. Remove the strain relief from the housing sections with strain relief pliers and discard the bushings. Remove the wires that are threaded through the openings (potentiometer and controller) and discard the controller.
 

**Note:** If the cables being removed from the housing have a molded strain relief at the housing, it is an upgraded unit and will not require cable removal from the housing. Reference note above, this section, for further details.
6. Remove the potentiometer from its mounting per Section 8.3 (page 10) of this manual and discard.
7. Unscrew the Motor PCB from its mountings. Discard PCB but set the screws aside for the installation of the new PCB.

**8.14.2 Installation of the Electronics Upgrade Package**

1. Install the new potentiometer per Section 8.3.2; steps 1-3, of this manual (page 11).
2. Carefully feed the cables for both the new potentiometer and controller through the housing as to not damage the wiring if the connectors.
3. Position the new motor PCB to the mounting points within the housing with the J2 power connector pointed away from the motor. Secure with the screws that were removed from the old motor PCB.
4. Carefully pull the controller and potentiometer cables to the motor PCB and connect to the appropriate headers listed below.
  - Controller - J1
  - Potentiometer - J4
5. Connect the remaining wires to the appropriate headers listed below.
  - Transformer - J2

NOTE: If the transformer is of the older configuration and has a black DC power plug where it plugged into the old PCB, an adaptor cable will need to be used to connect the transformer to the new PCB.

  - Motor - J3

6. Secure each of the controller and potentiometer cables into the housing with a Heyco strain relief.
7. Secure the wires into the black wire clips located on either side of the new motor PCB and snap clips closed.
8. Once the PCBs are completely installed, calibration of the Flexmate K500 Knee CPM will be required. Calibrate the CPM unit per the instructions in **Sections 7.1 and 7.2.2** of this manual (page 6 and 7).
9. Once the calibration process has been completed successfully, place the smaller portion of the main housing into place and secure with the push rivets removed at the beginning of this process.

### 8.15 Miscellaneous Part List

Bushing, Strain Relief , Right Angle (Heyco)	7.01951
Bushing, Strain Relief, .250" (Heyco)	7.01970
Foam Insert, Box FM K500	2.01030
Housing, Bottom FM K500 (for Heyco strain relief)	7.01810
Housing, Bottom FM K500 (for molded strain relief)	7.01870
Housing, Top K500 (for Heyco strain relief)	7.01780
Housing, Top K500 (for molded strain relief)	7.01875
Label Flexmate K-500	1.07640
Label Scale PSA Flexmate Extension	1.01940
Label, CPM Oiler Location	1.14680
Manual Operation FM K500	1.07080
Manual Service Flexmate K500	1.00060
Measuring Tape, BREG Logo	9.11440

*Component part numbers listed are subject to change without prior notice to the customer*

Part Number	Description
03555	HOSPITAL BED CLAMP
06490	SOFT GOODS, PAD SET
70004	FOOT PLATE HARDWARE KIT
70005	MALE KNOB REPLACEMENT KIT
70006	BELT REPLACEMENT KIT
70007	OLD BELT REPLACEMENT KIT
70016	LARGE PULLEY ASSY
70034	HOSPITAL BED STRAP
70039	CPM OILER LUBRICANT
70077	CABLE, CONTROLLER, K500 UL
70078	CABLE, CONTROLLER, K500 NON UL
71160	TIMING PULLEY / BELT ASSY KIT
71170	BEARING ASSY REPLACEMENT KIT
71180	PUSH RIVET KIT (24 QTY)
71190	POTENTIOMETER ASSY KIT (NON UL)
71200	LEAD SCREW W/NUT ASSY KIT
71205	NUT HOUSING ASSY
71210	BOX W/CUSTOM PACKING FOAM
71220	MEMBRANE SWITCH KIT
71230	ROD END BALL JOINT KIT
71240	BRUSH / ROD ASSY KIT
71250	FLEXMATE HANDLE ASSY KIT
71270	OPTICAL SENSOR ASSY KIT
71280	MOTOR ASSY KIT

<b>71290</b>	<b>TRANSFORMER REPLACEMENT KIT (Heyco)</b>
<b>71300</b>	<b>CONTROLLER ASSY REPL KIT (Heyco)</b>
<b>71310</b>	<b>POWER SWITCH REPLACEMENT KIT</b>
<b>71330</b>	<b>FOOT PLATE ASSY REPLACEMENT KIT</b>
<b>71480</b>	<b>CPM HOUSING REPLACEMENT KIT (Heyco)</b>
<b>73616</b>	<b>ELECTRONICS UPGRADE KIT</b>
<b>76520</b>	<b>TRANSFORMER REPL KIT K500 (Molded)</b>
<b>76521</b>	<b>HOUSING REPL KIT K500 (Molded)</b>
<b>76522</b>	<b>CONTROLLER ASSY REPL KIT K500 (Molded)</b>
<b>76523</b>	<b>MOTOR PCB REPL KIT K500</b>
<b>76524</b>	<b>POTENTIOMETER REPL KIT K500 (Molded)</b>
<b>76525</b>	<b>NON SKID PAD KIT (10 ea.)</b>
<b>78463</b>	<b>POTENTIOMETER CAP W/CLIP QTY. 6</b>
<b>1.07620</b>	<b>SERVICE MANUAL</b>
<b>1.07080</b>	<b>USER MANUAL</b>

### 8.15.1 Electronic Replacement Parts List \*\*

\*\* These components must be installed in a static free environment.  
Failure to do so may render the electronic components inoperable.

\*\*\* When upgrading an older motor board, these components must be installed together at the same time. Failure to install as a set, the PCBs will fail and severely damage the other electronic components within the system.

Controller Chip**	9.28451
Controller PCB***	6.01131
Motor PCB***	6.01130
Cable, Controller (No Molded Strain Relief)	9.00060
Cable, Potentiometer (Molded Strain Relief One End)	0.34545
Cable, Potentiometer (Molded Strain Relief Both Ends)	0.34540

To Verify	Positive TP	Negative TP	Adjustable Y/N@X	VDC
Transformer Voltage	4	3	No	22.0-22.8VDC
Old Board @-10	2	3	Yes @ R6	.425-.450 mVDC
New Board				
Extension Overload @-08 ext	2	3	Yes @ R6	.125±.002 mVDC
Flexion Overload@-08flex	2	3	Yes @ R1	.425±.002 mVDC
Motor Voltage	Red Lead	Black Lead	No	11.4 – 11.8 VDC