

Danniflex 480 CPM
Technical & Service Manual

December 1998



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1.0 General Overview

1.1 Introduction

The Danniflex 480 Continuous Passive Motion (CPM) system is designed for the rehabilitation of the lower limb. The 480 offers changeable thigh and calf components allowing pediatric use. The purpose of this manual is to provide basic maintenance, repair and service instructions for the Danniflex 480 CPM system.

1.2 Safety Precautions

When using your CPM, to reduce the risk of fire, electric shock and injury to persons, basic safety precautions should always be observed, including the following:

1. Read and understand all instructions.
2. Follow all warnings and instructions marked on the product.
3. Use only OrthoLogic parts for repair and/or replacement.
4. Never use parts from other manufacturers' units even though they may seem to fit.
5. Never install the wall transformer in wet locations.
6. Never touch uninsulated transformer wires, or terminals, unless the transformer has been unplugged from the wall.
7. Unplug the 480 product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
8. Do not use this product near water.
9. Do not place this product on an unstable cart, stand, or table. The product may fall causing serious injury to the patient or damage to the CPM.
10. This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supply, consult your OrthoLogic representative or local power company.
11. Do not allow anything to rest on the power cord. Do not locate this product where the cord will become damaged.
12. Do not overload wall outlets or use extension cords as this may result in the risk of fire or electric shock.
13. Never insert objects into the drive unit casing as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock.
14. To reduce the risk of electric shock, do not disassemble this product, but take it to a qualified serviceperson when service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect re-assembly can cause electric shock when the unit is subsequently plugged in.

15. If at any time during therapy the patient experiences extreme pain or discomfort, stop therapy and consult their physician.
16. Unplug the product from the wall outlet and refer servicing to qualified personnel under the following conditions:
 - a. If the power supply cord is damaged or frayed.
 - b. If liquid had been spilled into the product.
 - c. If the product has been exposed to rain or water.
 - d. If the product has been dropped or the unit casing has been damaged.
 - e. If the product exhibits a distinct change in performance.
 - f. If the product does not operate normally by following the operating instructions.
17. Adjust only those controls that are covered by the operating instructions.
18. Patient Safety: Patients must be advised to keep clear of moving parts. The unit is designed to force-reverse if an obstruction is under the cradle; however, a patient could experience pain or be injured by the downward pressure of the cradle if a body part is positioned under the cradle.

1.3 Specifications and Symbols

Weight	Approximately 24 lbs. (11 kg)	
Range of Motion	-5 degrees extension to 110 degrees flexion	
Safety	UL listed, ECE certified where applicable	
Power Supply	Type 2	
Input	120 VAC 60 Hz or 230 VAC 0.06A-50 Hz	
Output	14 VDC 730 MA or 14 VDC 730 MA	
Pause	0-30 seconds at maximum extension/flexion	
NMES	Compatible with various NMES devices	
Speed	1 to 10 minutes per cycle	
Classification	Class 1 medical device	
Electric shock classification	Type B	
Mode of operation	continuous	
Environmental conditions	-10° to 35° temperature, 90% max. humidity ATM pressure 750 kPa to 1040 kPa	
Limb length	30.5 - 42 in. (77 - 107 cm)	19.5 - 34.5 in. (50 - 88 cm)
Calf length	16.5 - 24 in. (43 - 61 cm)	9.5 - 18.5 in. (24 - 47 cm)
Thigh length	14 - 18 in. (36 - 46 cm)	10 - 16 in. (25 - 41 cm)

1.4 Symbols



Power Off



Power On



Model 480 classifications (regulatory classes defined). This unit is classified by IEC standards as Class II, Type "B", Category AP.



Class II Equipment - Equipment in which protection against electric shock does not rely on "basic insulation" only; but, in which additional safety precautions such as "double insulation" or "reinforced insulation" are provided, there being no provision for protective earthing or reliance upon installation conditions.



Type B applied part - Equipment providing a particular degree of protection against electric shock, particularly regarding allowable "leakage current" and/or reliability of the protective earth connection (if present).



Category AP (Danger Explosive) - Equipment or equipment part complying with specified requirements on construction, marking and documentation in order to avoid sources of ignition in a "flammable anesthetic mixture with air".



Danger Electric Shock: Service by a qualified individual only.



Attention, consult accompanying documents

1.5 Suggested Maintenance Schedule

Between Patients

1. Check entire unit for any visible evidence of damage, such as bent sliders, cracked or broken covers, frayed or damaged wires, etc. If any signs of damage are found, the unit must be repaired before use.
2. Ensure that all knobs and/or levers are usable and in place.
3. Ensure that all moving components move freely as required.
4. Check all displays and electronic controls for proper operation.
5. Check all mechanical pivot and linkage points for smooth operation and secure mechanical connection. Make sure all screws, nuts, bolts, rivets, pivot pins, and other fasteners are secure.
6. Gently wipe clean all exposed surfaces with a soft cloth dampened with a mild soap solution or alcohol. Avoid abrasive cleansers. To disinfect, wipe all exposed surfaces with a 1% to 10% solution of bleach and water, or other suitable disinfectants.

7. Ensure that all labels are present.
8. Replace patient softgoods.
9. Verify that the device operates to its set limits over several complete cycles.
10. For devices offering absolute Range of Motion (ROM) settings, verify device calibration by observing the ROM of the device while taking a visual reading using a goniometer at the machine's pivot points. Compare the ROM settings of the device with the goniometer readings. ROM readings should be within +/- 5 degrees of the set parameters. If the readings do not fall within the set parameters, the unit needs to be checked and recalibrated by a properly trained Service Technician.

Every six Months

1. Repeat steps 1 through 10 of "BETWEEN PATIENTS" procedures.
2. Verify ground continuity where applicable from the device frame to ground pin of the power supply, if so equipped, using a Safety Analyzer or appropriate device.

Every Eighteen Months

A full inspection of the device by a properly trained Service Technician is recommended every 18 months. The following points should be covered:

1. Steps 1 and 2 of "EVERY SIX MONTHS" above.
2. Fully inspect all internal and external mechanical and drive components, and repair or replace as necessary.
3. Fully inspect all internal and external electrical components (including wires, connectors and solder joints), and repair or replace as necessary.
4. Perform a complete recalibration and subsequent check of electronic and mechanical safety systems including Reverse-On-Load and Range of Motion.
5. Complete a final check of the device in accordance with OrthoLogic Final Inspection criteria (these are available in the appropriate Technical Service Manual or on request from OrthoLogic).

2.0 Covers

2.1 Bottom Cover

Removal:

Note: Avoid cutting the heads off the plastic fasteners as these can be reused to reattach the covers.

1. Remove the Handle by removing the two Phillips screws located at each end of the Handle attachment.
2. Remove all 11 plastic fasteners from around the cover using the following method:
 - a. With a flat head screwdriver, lift up and remove the male half of the fastener.
 - b. With diagonal cutters, lift the female half of the fastener from each hole.
 - c. Separate the bottom cover from the unit.

Installation:

1. With the unit upside down, carefully place the bottom cover on the exposed frame.
2. With the unit upside down, align the bottom cover's holes with the holes in the top cover.
3. Insert the female halves of the plastic fastener into the holes from which they came and insert the males halves into the females halves.
4. Insert one male half into each of the female halves.
5. With a small hammer gently seat the two sections together.
6. Reinstall the handle. Use one drop of Loctite #425 on each attachment screw.

2.2 Top cover

Removal:

1. Remove bottom cover (refer to section 2.1).
2. Remove cradle (refer to section 3.0).
3. With the bottom cover and cradle removed, the top cover comes free.

Installation:

1. Place the top cover on top of the exposed base frame.
2. Install cradle (refer to section 3.0).
3. Install bottom cover (refer to section 2.1).

3.0 Cradle

Removal:

1. Remove the bottom cover (refer to section 2.1).
2. Remove kneepot cable plug from the connector jack on the main PC board.
3. Using a pair of diagonal cutters, remove the ty-rap that holds the kneepot cable secure to the base.
4. Remove the kneepot cable strain relief from the top cover by removing the underside nut.
5. Pull the kneepot cable gently through the hole in the top cover.
6. Remove both 3/16" cradle pivot Allen bolts from the U-bracket assembly to detach the cradle from the ballscrew. (If you run into difficulty removing the bolt, apply a slight tilt to the Allen wrench and pull the entire bolt, threaded insert, and pivot sleeve straight out. Replace the slider blocks with new ones.)
7. Lift the cradle through the top cover.

Installation:

1. Gently spread apart rubber track seals and slide cradle struts between the track seals through the top cover.
2. Position the cradle strut between the slider blocks and the U-bracket, and re-insert the spacer into the hole in the cradle strut.
3. Place both pivot sleeves into their proper locations.
4. Apply one drop of Loctite #242 on the threads of each cradle pivot Allen bolt and using a 3/16" hex key, install the two Allen bolts into the U-bracket assembly.
5. Slide the kneepot cable through both the top cover and the base.
6. Reinstall the kneepot cable (refer to section 4.2)

4.0 Kneepot

4.1 Kneepot Cover

Note: Plastic rivets may be re-used if not damaged during removal.

Removal:

1. Push the center pins of the plastic rivets through the center of the rivet castings.
2. With a pair of diagonal cutters, carefully lift out the center of the rivet to free the kneepot cover.
3. Remove the kneepot cover.
Important: Remove center of kneepot rivet from casting by moving outer thigh tube so they fall out.

Installation:

1. Install the kneepot cover over the casting, aligning the cable with the small divot in the cover and the holes in the plastic with the holes in the casting.
2. Install the rivets in their appropriate holes and insert the plastic rivet centers.
3. With a small hammer gently tap the centers of the plastic kneepot rivets flush with the rivet casting.

4.2 Kneepot cable

Removal:

1. Remove the bottom cover (refer to section 2.1).
2. Remove kneepot cover (refer to section 4.1).
3. Remove kneepot cable plug from the socket on the main PC board.
4. With diagonal cutters, remove all ty-raps from the kneepot cable.
5. Remove strain relief from top cover by removing the nut on the underside strain relief side of the top cover.
6. Pull cable through cover.
7. De-solder the cable from the terminals on the kneepot.

Installation:

1. Wrap wires one and one-quarter turns around kneepot terminals and solder as follows: pin #1 - white, pin #2 - Red, pin #3 - black
2. Install kneepot cover (refer to section 4.1).
3. Carefully put kneepot cable through top cover. Feed the free end of the cable through the hole in the top cover until the cable strain relief is reached (only tighten the strain relief nut 1/4 turn past finger tight).
4. Put rubber washer on kneepot cable.
5. Install bottom strain relief nut on kneepot cable.
6. Tighten strain relief bottom nut 1/4 turn past finger tight.
7. Install the kneepot cable plug onto the main PC board connector pins 1,2,3.
8. Gather excess cable and secure to the front of the base frame with a ty-rap.
9. Install bottom cover (refer to section 2.1).

5.0 Motor

NOTE: Motor Replacement on IEC units. Transfer both ferrite loops to the new motor and install them in the same location on the cable.

Removal:

1. Remove bottom cover (refer to section 2.1).
2. Remove motor plug from main PC board and pull connector through the hole in base frame.
3. Remove the four nuts from the rubber mounts inside the bearing bracket assembly.
4. Take the motor out of the assembly, making sure that you do not lose the internal tooth star washers (two per mount).
5. Remove the rubber coupling from either the motor or ball screw assembly.

Installation:

1. Insert the rubber coupling onto the end of the ballscrew bearing bracket assembly.
2. Place the two internal star tooth washers on each of the rubber mounts.

3. Insert the four motor mount bolts through the base and into the mounting bracket and tighten nuts. (Take care not to twist the rubber mounts when tightening nuts.)
4. Reinstall the bottom cover (refer to section 2.1).

6.0 Ballscrew

Removal:

1. Remove bottom cover (refer to section 2.1).
2. Disconnect the motor and remove from the Bearing Bracket and Frame (refer to section 5.9).
3. Loosen the ballscrew nut.
4. Slide the U-bracket assembly to full extension.
5. Being careful to hold the bearing end of the ballscrew in place, lift the bearing bracket and ballscrew out of the thigh end of the unit by guiding it toward the corner of the frame while lifting.

Installation:

1. Check to make sure that the plastic bearing for the ballscrew is located in its proper position. Then carefully place the ballscrew free end into the plastic bearing.
2. Slide the bearing bracket end down into place. The four holes in the assembly should align with the frame holes.
3. Place the rubber mounts into the frame holes and through the bracket assembly, making sure that the washers are on the threaded side of the mounts.
4. Secure the ballscrew in place by screwing the mount nuts on the inside of the bracket assembly on the end of each mount and tightening.
5. Tighten the ballscrew nut (use Locktite #242).
6. Re-install the motor assembly.
7. Reinstall the bottom cover (refer to section 2.1).

7.0 Transformer

Removal:

1. Remove bottom cover (refer to section 2.1).
2. Disconnect transformer cable connection from the power switch and the ground wire from the frame.
3. Carefully pull the transformer wires from the unit.

Installation:

1. Insert the transformer cable through the base frame.
2. Install the strain relief.
3. Re-connect and/or solder wires according to color codes.
4. Install tie-wraps as needed.
5. Reinstall bottom cover (refer to section 2.1).

8.0 Controller Pendant

8.1 Pendant Cable



Caution: The Controller Pendant is a Static Sensitive Device. Repair should be attempted by qualified personnel only. All static device safety precautions must be observed.

NOTE: Pendant Cable replacement on IEC Units. Transfer the ferrite loop to the new cable and install them in the same location. Ensure the cable and loops will not come in contact with any moving parts.

Removal:

1. Remove bottom cover (refer to section 2.1).
2. Cut ty-raps from the entire length of the pendant cable, being careful not to damage the ribbon cable.
3. Pull the cable connector off the board-mounted connector.
4. Remove the strain relief and pull the cord through the base.
5. Remove back cover label from pendant.
6. Using a No. 2 Phillips screwdriver, remove the four screws from the back of the pendant to open the pendant housing.
7. Carefully pull the pendant board straight away from the face of the pendant housing.
8. Cut the ty-rip which holds the cable flat to the board.
9. Carefully slide cable connector from the board-mounted connector pins.

Installation:

1. Carefully slide cable connector onto the main pendant board connector.
2. Position the cable so the shielded cable comes up over the edge of the pendant board. Ty-rip the cable in place flat to the board.
3. Guide the pins from the pendant keypad board into the connector on the main pendant board. Carefully squeeze the two boards together until the connector is well seated.
4. Reinstall the back of the pendant housing.
5. Reinstall the four Phillips screws and tighten.
6. Replace the back cover label.
7. Slide the board end of the cable through the opening in the base of the unit.
8. Re-position the strain relief.
9. Connect the cable to the board-mounted connector.
10. Join the pendant and ribbon cables with ty-raps
11. Reinstall the bottom cover (refer to section 2.1).

8.2 Pendant Keypad

Removal:

1. Remove back cover label from pendant.
2. Using a No. 2 Phillips screwdriver, remove the four screws from the back of the pendant.
3. Remove the back of the pendant housing.
4. Carefully pull the control board straight away from the face of the pendant housing.
5. Lift the board out of the pendant housing.
6. Lift the LCD window out of the front half of the pendant.

7. Using a 1/4" nut driver remove the four locknuts from the inside of the front half.
8. Carefully lift the pendant housing away from the front bezel.
9. Lift out the pendant control board to remove the keypad.

Installation:

1. Gently press keypad into position inside the bezel, checking to be sure that the locator pins have come through the pad.
2. Position the pendant control board so that the locator pins also pass through the appropriate holes in the PC board.
3. Place the front pendant housing on top of the bezel and control board assembly, and secure with four locknuts.
4. Place the LCD window into the opening, being sure that the printing is readable from the front of the pendant.
5. Carefully position the main pendant board in the front half of the pendant housing.
6. Gently push the cable into the appropriate cutout in the housing.
7. Position the back pendant housing making sure that the cable is not pinched between the two halves.
8. Install the four Phillips screws in the holes on the back of the pendant and tighten.
9. Replace back cover label on back side of pendant housing.

8.3 Pendant Printed Circuit Board

Removal:

1. Remove back cover label from pendant.
2. Using a No. 2 Phillips head screwdriver, remove the four screws from the back of the pendant.
3. Remove the back pendant housing.
4. Carefully pull the pendant board straight away from the front half of the pendant housing.
5. Cut the ty-rap which holds the cable flat to the board.
6. Carefully slide cable connector from the board-mounted connector pins.
7. Lift the board out of the pendant housing.

Installation:

1. Slide the cable connector onto the board-mounted connector pins.
2. Carefully insert the board into the front pendant housing.
3. Gently push the cable into place in the cutout of the housing and tie-wrap the cable flat to the board.
4. Reinstall the back of the pendant housing, making sure that the cable is not pinched between the two halves.
5. Reinstall the four Phillips head screws in the holes on the back of the pendant and tighten.
6. Place back cover label on back side of pendant housing.

8.4 LCD Module

Removal:

1. Remove back cover label from pendant.
2. Using a No. 2 Phillips head screwdriver, remove the four screws from the back of the pendant.
3. Remove the back pendant housing.
4. Carefully pull the pendant board straight away from the front pendant housing cover.

5. Carefully de-solder the LCD Module pins.
6. Remove the screws, nuts and standoffs from the board.
7. Lift the module from the main pendant board.

Installation:

1. Place the LCD Module so the board-mounted pins on the main pendant board pass through the holes of the LCD Module board.
2. Re-install the screws, nuts and standoffs on the board.
3. Solder all pins being careful not to create solder bridges between pins.
4. Carefully insert the main pendant board into the front half of the pendant housing.
5. Gently push the cable into the appropriate cutout of the housing.
6. Re-join the front and back pendant housings making sure that the cable is not pinched between the two halves.
7. Insert the four Phillips screws in the holes on the back of the pendant and tighten.
8. Place back cover label on the back side of pendant housing.

9.0 Main Printed Circuit Board (PCB)



Caution: The Printed Circuit Board is a Static Sensitive Device. Repair should be attempted by qualified personnel only. All static device safety precautions must be observed.

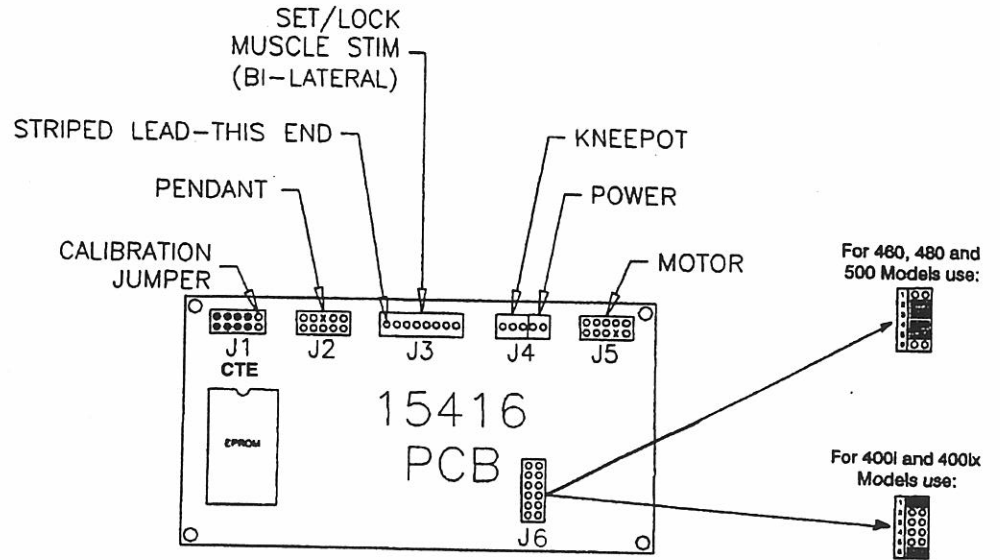
Removal:

1. Remove bottom cover (refer to section 2.1).
2. Remove all connectors from the main PC board.
3. The PC board may be removed by one of three procedures depending on when a particular device was manufactured:
 - a. Gently push the PC board toward the top cover until the nylon standoff is disengaged from the board.
 - b. Or, remove the nylon screws securing the PC board to the nylon standoffs.
 - c. Or, remove the nylon nuts securing the Shield, insulator and PC board to the nylon standoffs. Lift the shield off. Lift the insulator off. Remove the four Spacers. Lift the PC board from the standoffs.

Installation:

1. Place the main PC board above the nylon standoffs.
2. While guiding the nylon standoffs into the mounting holes, place the PC board on them.
3. To reinstall the PC board perform the following procedure (depending on when the device was manufactured):
 - a. Gently push the PC board toward the bare frame until the PC board seats firmly against the stopping pad on the nylon standoff.
 - b. Or, install the nylon screws securing the PC board to the nylon standoff.
 - c. Or, place the PC board on to the four standoffs. Install the four Spacers on the standoffs. Place the insulator into the Shield. Place the Shield on to the standoffs and route the cables through the slots in the Shield. Position the ferrite loops as close to the Shield as possible and secure such that they do not contact any moving parts.
4. Install the connectors into main PC board.
5. **Note:** Cable connectors are installed on the following PCB connectors: Pendant cord -J2, Kneepot Cable -J4-1,2,3, Power switch cord -J4-4,5, Motor cord -J5
6. Reinstall bottom cover (refer to section 2.1)

10.1 Calibration Diagram



10.0 Calibration



Caution:

1. Handle the printed circuit board using Static Safe techniques in a Static Safe environment.
2. The calibration jumper must be in place during initial start-up. After machine calibration is complete, remove the calibration jumper.
3. Do not remove the EEPROM from the printed circuit board. The printed circuit board is designed for use only with the latest revision of firmware loaded into the EEPROM installed by the factory.
4. Thoroughly test all machine functions and test run the machine a minimum of two (2) hours prior to patient use.

Procedure:

1. Turn off CPM.
2. Remove bottom cover (refer to section 2.1).
3. Lay the unit on its side.
4. Make sure all connectors are connected.
5. Install calibration jumper on the PC board on J1 at CTE.
6. Turn power on.
7. If the error code screen is displayed record the error codes.
8. Press Start/Stop to clear error codes.
9. Choose machine model using arrow keys.
10. Press Start/Stop.
11. When screen displays motor type, press Start/Stop.
12. Remove cradle from thigh assembly
13. Hold the kneepot side cradle at zero degrees (straight), using calibration fixture.
14. Press EXT.
15. Hold the kneepot side cradle to the following angle using calibration fixture:
 - a. 90 degrees (right angle) for Danniflex 4001, 400ix, 460, 480
 - b. 125 degrees for Danniflex 500
16. Press FLEX.
17. Hold kneepot side cradle at maximum extension.
18. Press EXT.
19. Hold kneepot side cradle at maximum flexion
20. Press FLEX.
21. Reassemble the cradle.
22. Lay unit flat.
23. Press Start/Stop.
24. The machine runs through a complete cycle.
25. When the screen displays "CAL COMPLETE" turn power off.
26. Remove the calibration jumper.
27. Reassemble unit.

11.0 Error Codes

Important: Errors are handled on a case by case basis. Detection of some errors stops the CPM. At that time it will display an error code. It then burns the associated error code into the EE-ERROR byte in EEPROM. For other lesser errors the only action taken is to burn the code into EEPROM. The specific actions of each error are detailed in the following text. The EE-ERROR byte is reset by getting into the calibration mode. Refer to section 10.0 for further instructions.

[E1]: KNEE PIVOT ANGLE CALIBRATION ERROR

Error Action: This error prevents the CPM from entering the run mode.

Display: CALIBRATE [E1]

Cause: An invalid knee pivot angle calibration is indicated by bit 0 of EE_CAL_STATUS being zero.

Corrective Action: Re-calibrate the unit.

[E2]: MECHANICAL LIMIT CHECK OR FORCE CHECK VALIDATION ERROR

Error Action: See Display

Display: CALIBRATE [-<-]

Cause: The extension limit check, the flexion limit check of the force check was not fully executed. This action occurs when the unit is calibrated.

Corrective Action: Re-calibrate the unit.

[E3]: EE EXT CAL OR EE FLEX CAL EEPROM VARIABLE ERROR

Error Action: This error prevents the CPM from entering the run mode.

Display: CALIBRATE [E3]

Cause: On power-up the microcontroller checks the values of EE_EXT_CAL and EE_FLEX_CAL.

Limits are imposed on the value of these variables at calibration. If the values read from EEPROM are not within these limits the variable is assumed to be corrupted and an error is generated.

Corrective action: Re-calibrate the unit.

[E4]: SOFTWARE TIMER ERROR

Error Action: This error causes the microcontroller to burn 4 in the EE_ERROR EEPROM.

Display: *****STOP*****

Cause: A software variable called Timer Overflow Interrupt

Count (T01 Count) is incremented every time the timer overflows. After the value of the T01 Count becomes greater than 2746 the timer value in EEPROM is incremented and the 2746 is subtracted from T01 Count. If for some reason this process fails and T01 Count becomes greater than 32000 Error 4 is generated.

Corrective Action: Contact OrthoLogic Customer Service Department and inform them of the error. The main PCB may need to be replaced.

[E5]: MOTOR SPEED MEASUREMENT ERROR

Error Action: This error causes the microcontroller to burn 5 in the EE_ERROR EEPROM and causes the CPM to stop.

Display: *****STOP*****

Cause: With every revolution of the motor the MC33039 detects when the sensor in the motor makes a transition. That is when the sensor goes from high to low or low to high. It generates a pulse of fixed width. The microcontroller measures the speed of the motor by counting the number of pulses that occur in one timer overflow period. This happens in 131 seconds. When the unit runs too fast (over 230 RPM) the time between sensor transitions becomes less than the pulse width. The microcontroller counts 0 pulses therefore the speed measured=0 even though the motor is revolving.

Corrective Action: Troubleshoot PCB. MC33039 OSC Resistor-Capacitor combination may be out of tolerance. There can be excessive noise on the Hall effect sensor inputs, a bad MC33039, a bad microcontroller, etc. Reset EE_ERROR byte by entering the calibration routine.

[E6]: EEPROM INITIALIZATION ERROR

Error action: This error prevents the CPM from entering the run mode.

Display: EEPROM ERR [E6]

Cause: During initial calibration certain variables in EEPROM are initialized. If there is some problem and one of these variables cannot be written to EEPROM, error 6 is generated.

Corrective Action: If the problem recurs replace the microcontroller or the PCB.

[E7]: CYCLE COUNTER ERROR

Error Action: This error causes the microcontroller to burn 7 in the EE_ERROR EEPROM.

Display: *****STOP*****

Cause: Every time the unit pauses in extension a variable in the software called cycles since save is incremented. Every six minutes of operation the timer is incremented and the total cycle count is increased by the cycles since save, after which cycles since save is zeroed. If this process goes awry and cycles since save becomes greater than 500 error 7 is generated.

Corrective Action: OrthoLogic Medical's Customer Service Department and inform them of the error. The main PCB may need to be replaced.

[E8]: MOTOR SPEED ERROR

Error Action: This error causes the microcontroller to burn 8 in the EE_ERROR EEPROM and causes the CPM to stop.

Display: *****STOP*****

Cause: The maximum CPM rpms is less than 200. If the speed measured is greater than 254 counts in one timer overflow (roughly 500 rpm) then error 8 is generated.

Corrective Action: Troubleshoot PCB. MC33039 OSC Resistor-Capacitor combination may be out of tolerance. There can be excessive noise on the Hall effect sensor inputs, a bad MC33039, a bad microcontroller, etc. Reset EE_ERROR byte by entering the calibration routine.

[E9]: START/STOP ERROR

Error Action: This error causes the microcontroller to burn 9 in the EE_ERROR EEPROM and causes the CPM to stop.

Display: *****WAIT*****

Cause: The microcontroller has detected that the START/STOP key was depressed for more than 16.4 seconds. The START/STOP on the main or auxiliary pendant may have been depressed for that period. The PCC (Patient Control Cord) may have an open circuit. The main pendant may have a short circuit. It is normally open.

Corrective Action: Troubleshoot the pendants and the main PCB. Reset EE_ERROR byte by entering the calibration routine.

[E10]: KNEEPOT WIPER VOLTAGE TOO LOW

Error Action: This error causes the microcontroller to burn 10 in the EE_ERROR EEPROM and causes the CPM to stop.

Display: ANGLE ERROR [E10]

Cause: The kneepot wiper or +8v may have an open. The main PCB may have a problem.

Corrective Action: Examine the kneepot, the kneepot cable and kneepot connector for possible opens and troubleshoot the main PCB. Perform the extension limit check in the calibration mode to assure that the cradle is not traveling outside the kneepot's voltage range. Reset EE_ERROR byte by entering the calibration routine.

[E11]: KNEEPOT WIPER VOLTAGE TOO HIGH

Error Action: This error causes the microcontroller to burn 11 in the EE_ERROR EEPROM and causes the unit to stop.

Display: ANGLE ERROR [E11]

Cause: The problem may be in the main PCB or the kneepot ground may have an open.

Corrective Action: Examine the kneepot, the kneepot cable and kneepot connector for possible opens and troubleshoot the main PCB. Perform the extension limit check in the calibration mode to assure that the cradle is not traveling outside the kneepot's voltage range. Reset EE_ERROR byte by entering the calibration routine (refer to section 10.0).

[E12]: Not used in the Model 480

[E13]: EEPROM VARIABLE ALLOCATION ERROR

Error Action: This causes the microcontroller to burn 13 in the EE_ERROR EEPROM.

Display: *****STOP*****

Cause: Each variable, in software, has a predetermined amount of EEPROM dedicated to it. The reason being that each byte of EEPROM can be written to only a finite number of times. Upon copying a variable to EEPROM the microcontroller checks that the copy matches the original. If it does not match it goes on to the next byte of EEPROM and tries to write it again. Eventually there may come a time when the variable runs out of the EEPROM that was allocated for it. This generates an error 13.

Corrective Action: Contact OrthoLogic Customer Service Department and inform them of the error. The main PCB may need to be replaced. (There is enough EEPROM allocated for each variable to last for more than a decade of constant use.)

[E14]: EEPROM POINTER ALLOCATION ERROR

Error Action: This causes the microcontroller to burn 14 in the EE_ERROR EEPROM.

Display:*****STOP*****

Cause: Each variable, in software, has a predetermined amount of EEPROM dedicated to it. The reason being that each byte of EEPROM can be written to only a finite number of times. Upon copying a variable to EEPROM the microcontroller checks that the copy matches the original. If it does not match an "EEPROM pointer" byte is incremented so the microcontroller is directed to the next byte of EEPROM. It proceeds to write the variable again. However, if the EEPROM pointer, a byte of EEPROM, can not be incremented, an error 14 is generated. The variable cannot be written to the EEPROM correctly.

Corrective Action: Contact OrthoLogic Customer Service Department. The main PCB may need to be replaced.

[E15]: KNEEPTOT WIPER VOLTAGE NOT CHANGING QUICKLY ENOUGH

Error Action: This causes the microcontroller to burn 15 in the EE_ERROR EEPROM and causes the CPM to stop.

Display: *****STOP*****

Cause: If the CPM is in the run mode and the A/D converter reading doesn't change by more than two counts in a short, pre-determined amount of time, an error 15 is generated. The problem could be due to a faulty kneepot or kneepot cable.

Corrective Action: Check for a faulty kneepot or kneepot cable. Reset EE_ERROR byte by entering the calibration routine.

[E16]: CONFIGURATION ERROR

Error Action: This error prevents the CPM from entering the run mode.

Display: EEPROM ERR [E16]

Cause: The CONFIG register is latched on power-up from a CONFIG byte in EEPROM located at the same address. The CONFIG register configures the microcontroller. The EEPROM CONFIG is burned each time the microcontroller is put through calibration. If for some reason the CONFIG is not equal to the correct value, an error 16 is generated.

Corrective Action: Reset EE_ERROR byte by performing the calibration routine. If the problem persists the main PCB may need to be replaced.

[E17]: TOO MANY FORCE REVERSALS

Error Action: This error causes the microcontroller to burn 17 in the EE_ERROR EEPROM and causes the CPM to stop.

Display: *****STOP*****

Cause: If the unit has seven force reversals in a 30 second period an error 17 will be generated. Corrective Action: With the unit traveling, look for binding in the unit. Reset EE_ERROR byte by entering the calibration routine.

[E18]: INVALID EE MOTOR TYPE

Error Action: This error causes the CPM to exit the run mode.

Display: CALIBRATE [E18]

Cause: Calibration includes a motor type selection. If the EE_MOTOR_TYPE is found to contain something other than the correct selection an error 18 is generated.

Corrective Action: In the calibration mode re-select the motor type. If the error persists, contact OrthoLogic Customer Service Department.

[E19]: INVALID EE MODEL TYPE

Error Action: This error causes the CPM to exit the run mode.

Display: CALIBRATE [E19]

Cause: Calibration includes a model type selection. If the EE_MODEL_TYPE is found to contain something other than the correct selection an error 19 is generated.

Corrective Action: In the calibration mode re-select the model type. If the error persists, contact OrthoLogic Medical's Customer Service Department.

[E20]: FIRMWARE CHECKSUM ERROR

Error Action: This error prevents the CPM from entering the run mode.

Display: CHECKSUM ERROR [E20]

Cause: The Firmware in the EEPROM has become corrupted.

Corrective Action: Replace the PCB Assembly and the EEPROM.

[E21]: KNEEPTOT VOLTAGE NOT CHANGING FAST ENOUGH

Error Action: This error causes the CPM to exit the run mode.

Display: ERROR 21

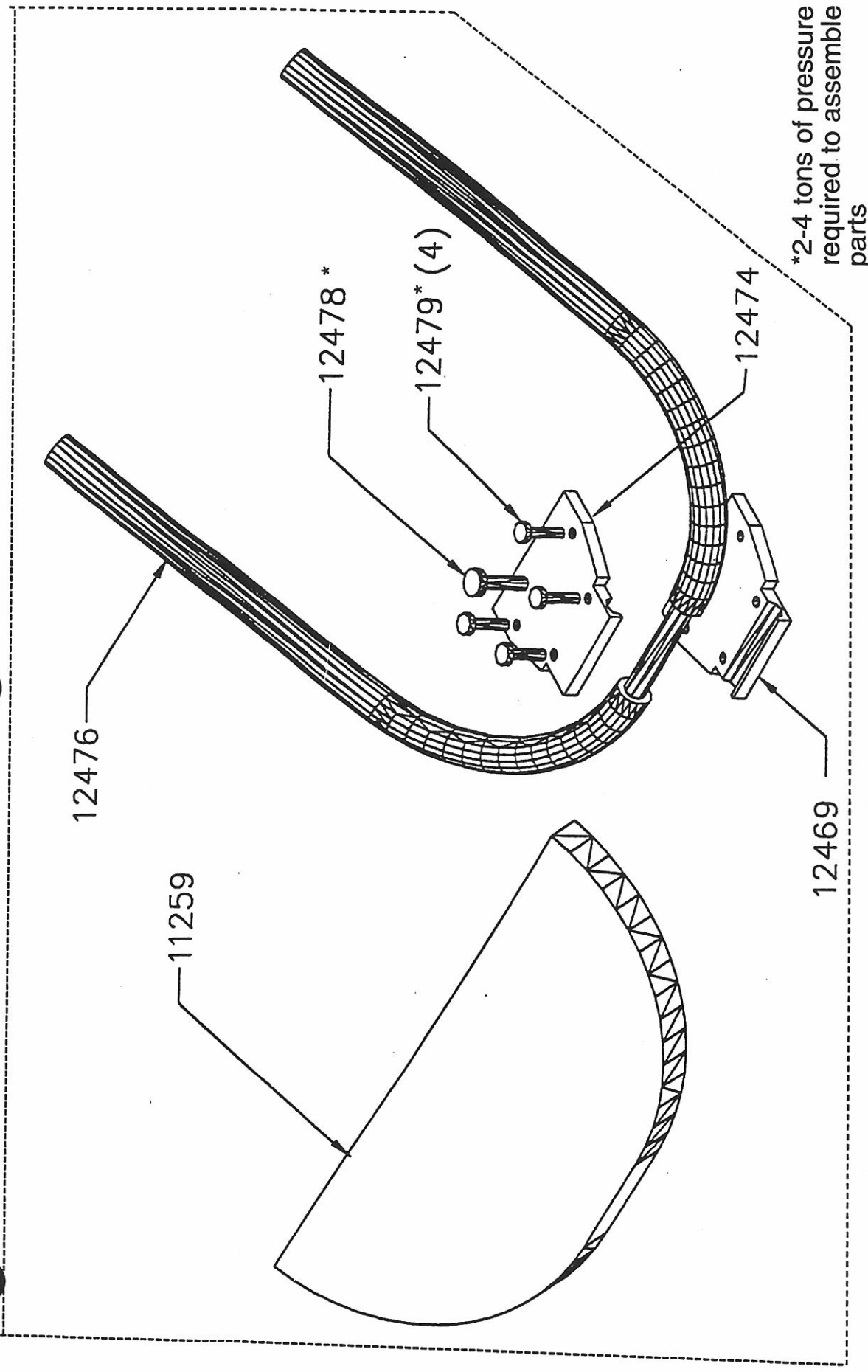
Cause: If the CPM is in the run mode and the A/D converter reading does not change by more than two counts in a short, pre-determined amount of time, an error 21 is generated. The problem could be due to a faulty kneepot or kneepot cable.

Corrective Action: Check for a faulty kneepot or kneepot cable and replace. Re-start the unit by turning the power off and then on. This error code is not burned into the EE_ERROR EEPROM.

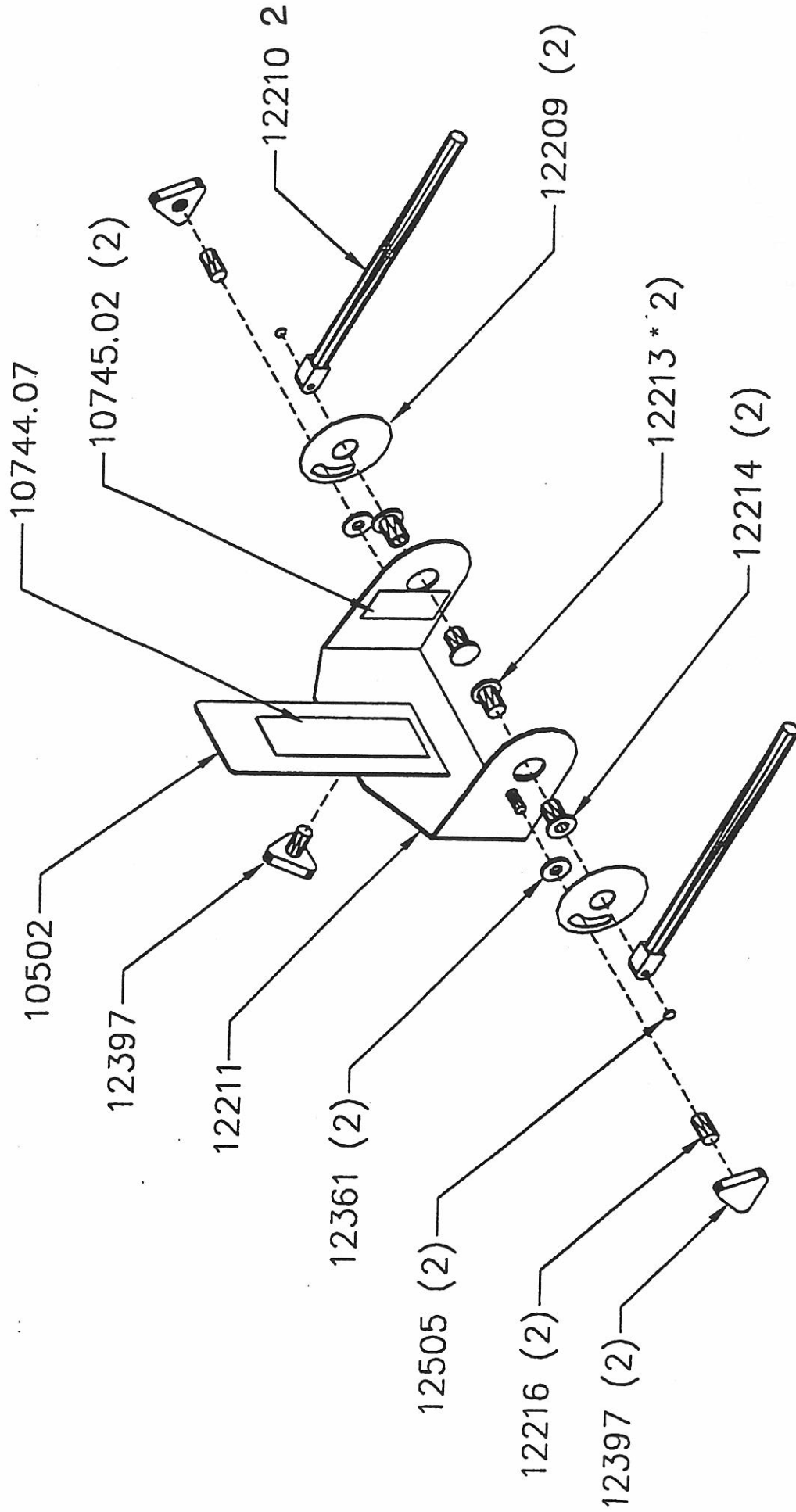
12.0 Troubleshooting

PROBLEM	POSSIBLE CAUSE	FIX
Unit will not power up Unit does not beep	Not receiving 19-21 VDC on secondary side	Replace Transformer Kit
	Not receiving 19-21 VDC on secondary side	Replace Switch
	Main PCB failure	Replace PCB
	Pendant cable disconnected	Check pendant cable connections at both ends
		Return for service

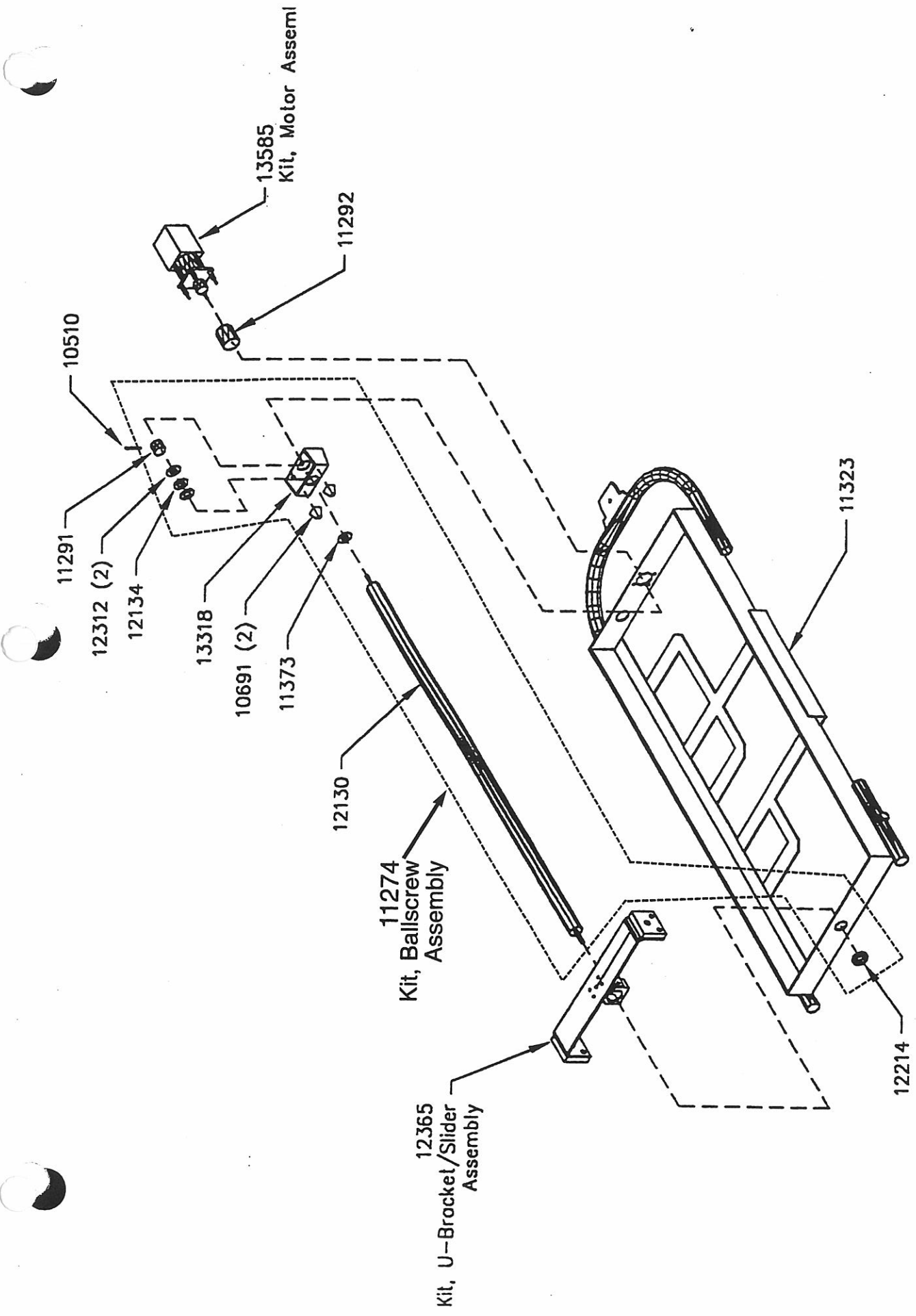
PROBLEM	POSSIBLE CAUSE	FIX
Pendant, erratic display	Pendant cable break	Replace cable
	Pendant PCB failure	
	Main PCB failure	Replace PCB
	Poor connection at ribbon cable	Check for faulty ribbon cable
		Return for service
Error codes: E1,2,3,4,6,7,8,12,13,14,15,16,18	Out of calibration	Re-calibrate unit following calibration procedures
	Main PCB failure	Replace PCB
	Pendant cable break	Replace pendant cable
	Pendant PCB failure	Replace pendant
		Return for service
Error code E9	Calibration error	Re-calibrate following calibration procedures
	Pendant cable break	Replace pendant cable
	Pendant PCB failure	Replace pendant
		Return for service
Error codes E10,11	Knee pot cable break	Replace Knee Pot cable
	Knee pot	Replace Knee Pot
		Return for service
Error code E20	Main PCB failure	Replace PCB
		Return for service
Mechanical binding/jerking	Insufficient lubrication on track, ballscrew, and track seals	Use a Light Lithium based lubricant, Lubriplate #105 on tracks and ballscrews, and a Silicone spray on track seals
	Bearing bracket assembly failure	Replace bearing bracket Assembly
	Ballscrew failure	Replace Ball Screw Assembly
	U-Bracket/Slider Assembly failure	Replace U-bracket/Slider Assembly Bracket Assembly
	Motor failure	Replace Motor
		Return for service
Insufficient lifting power	Motor failure	Replace motor
		Return for service



12605; Kit, Adult Thigh Assembly - 400 Series

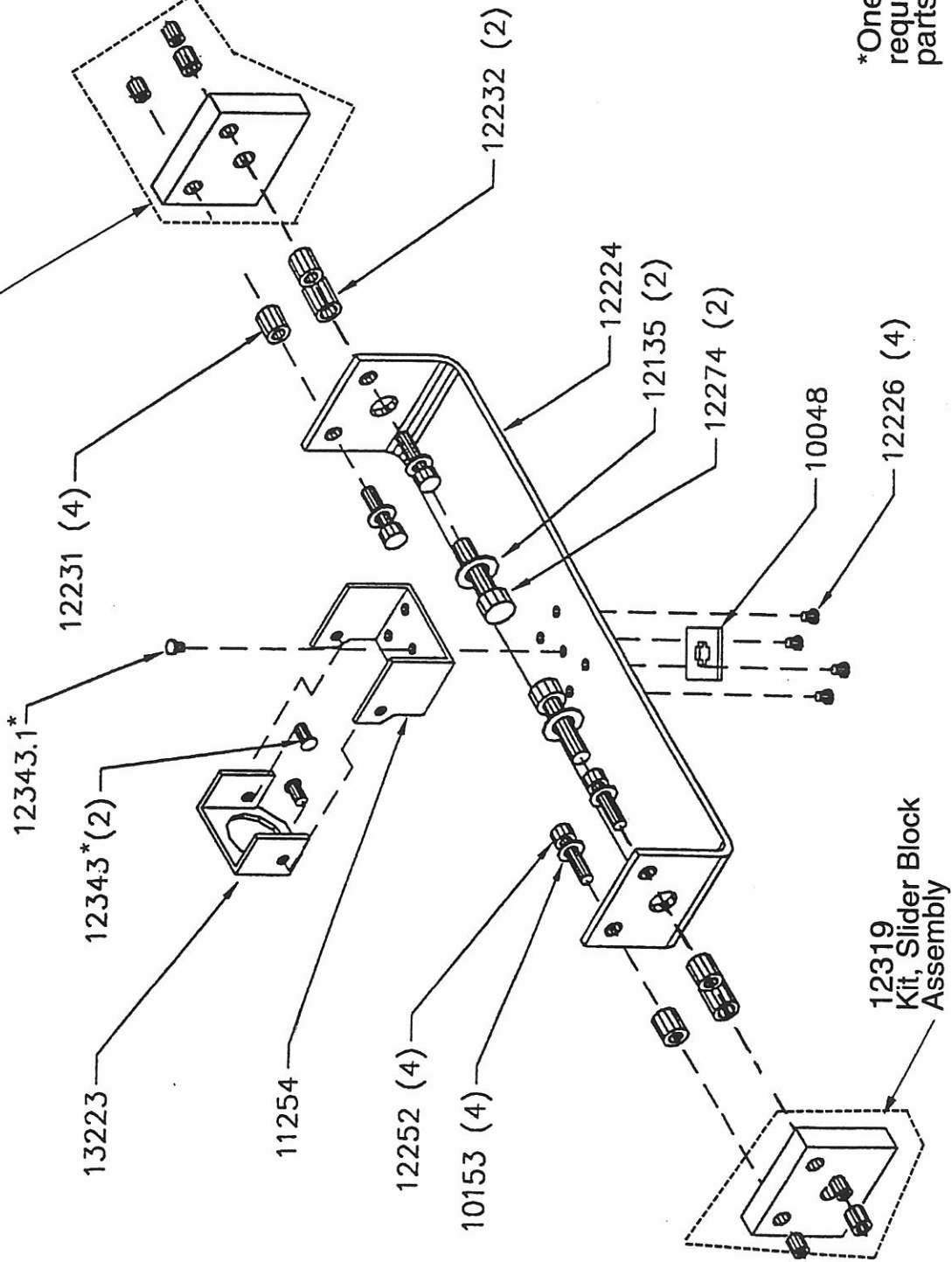


12606; Kit, Adult Foot Assembly – 400 Series



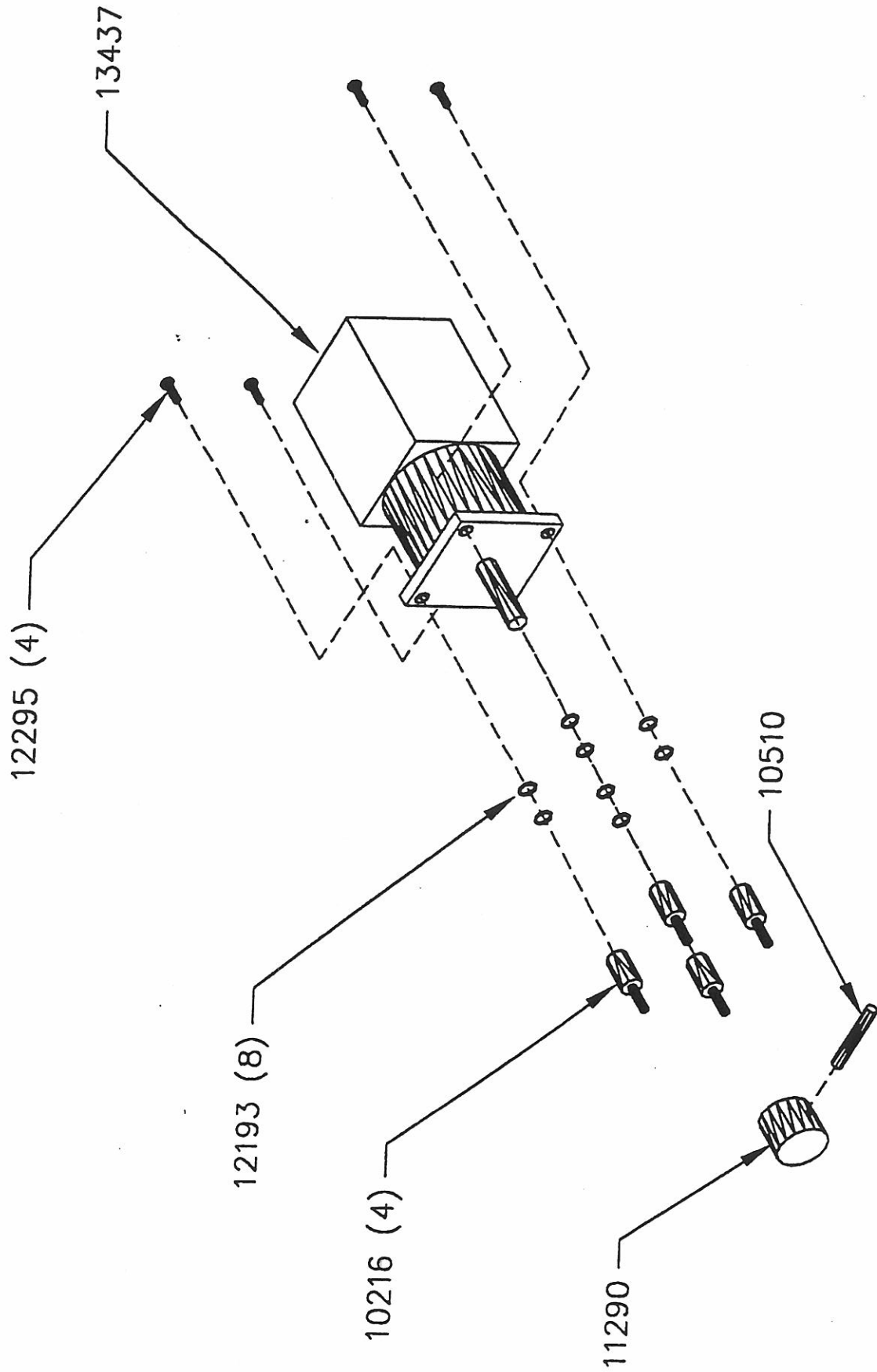
12245; Kit, Ballscrew Assembly

12319
Kit, Slider Block
Assembly

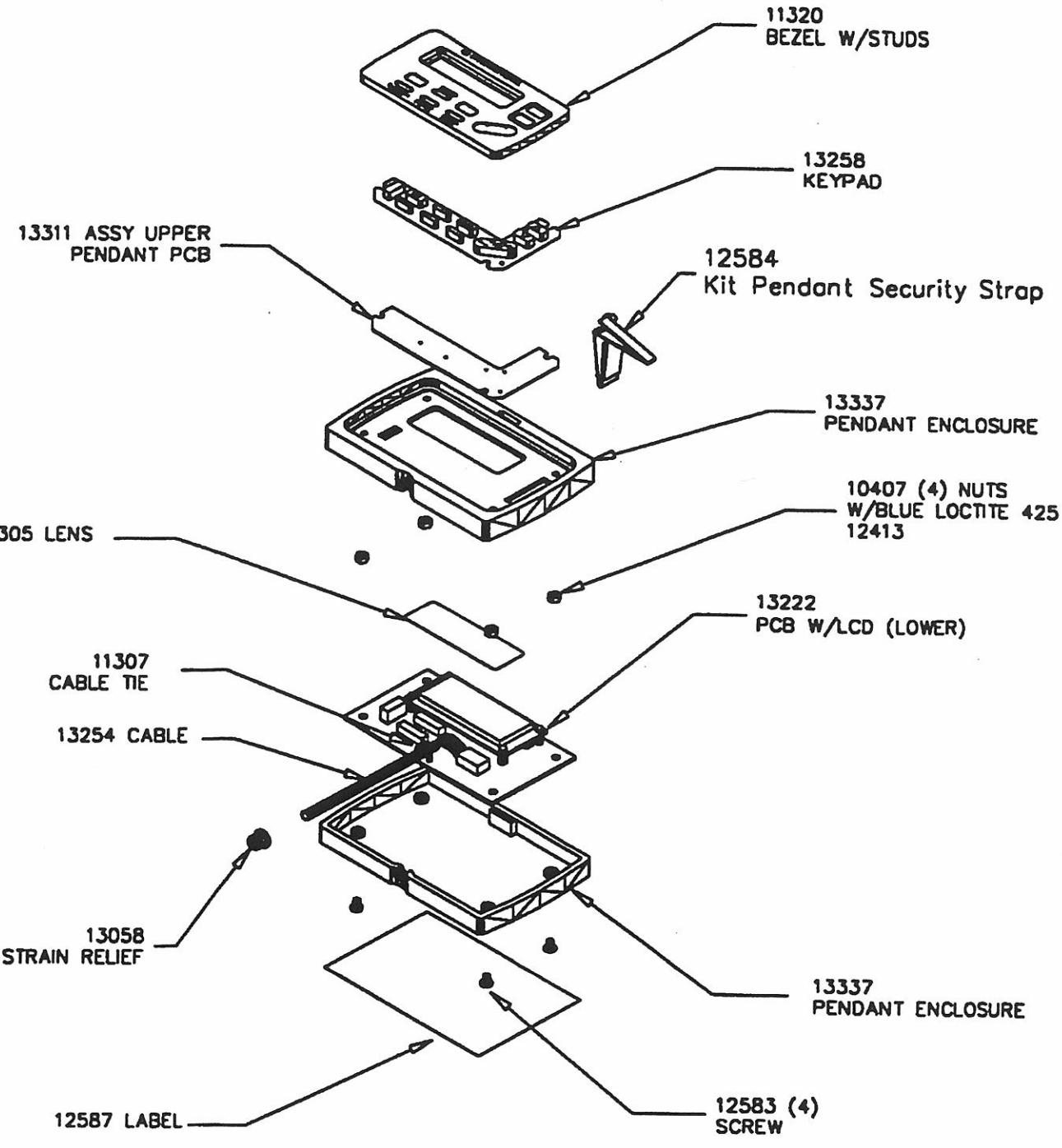


*One ton of pressure
required to assemble
parts

12365; Kit, U-Bracket / Slider Assembly Complete

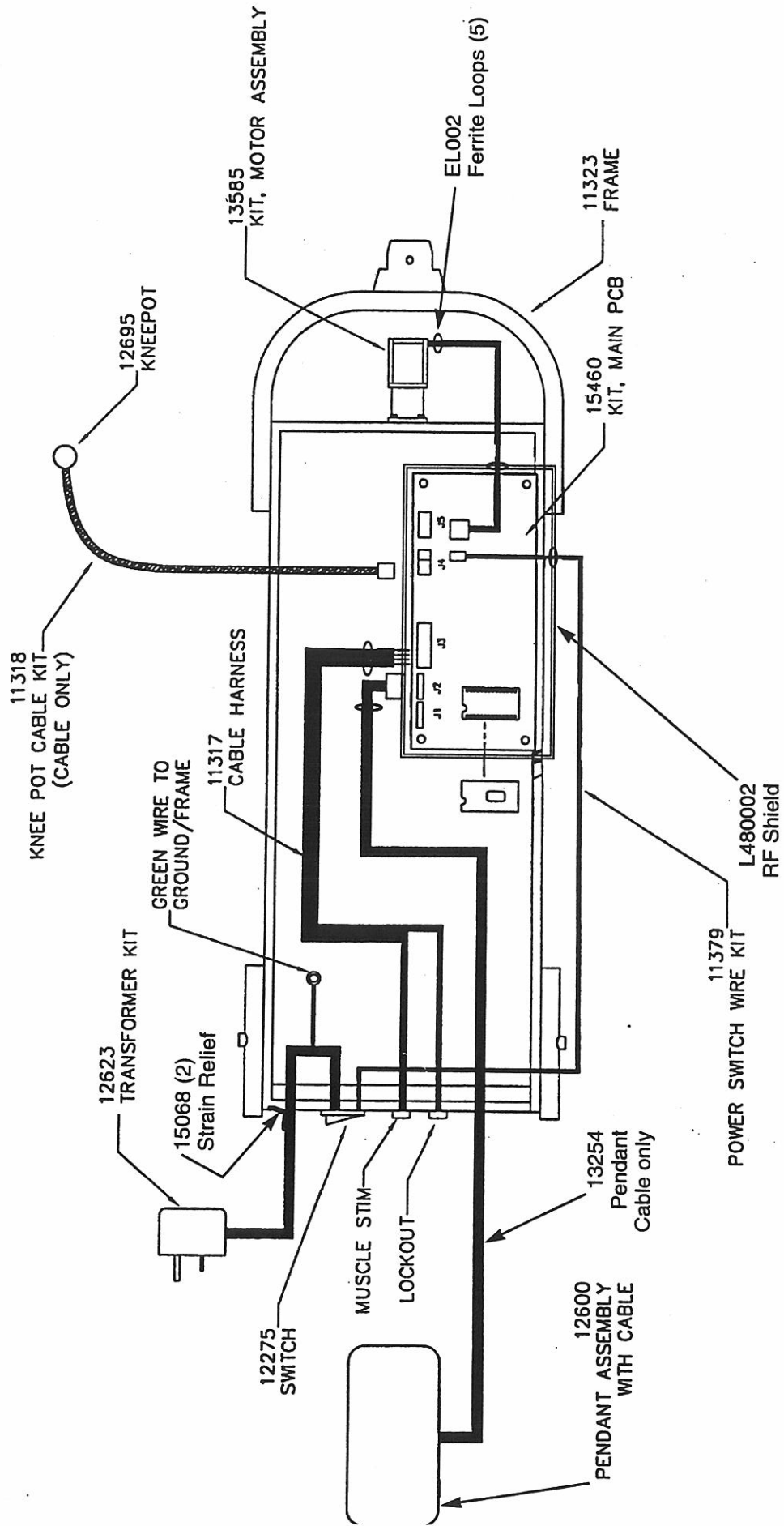


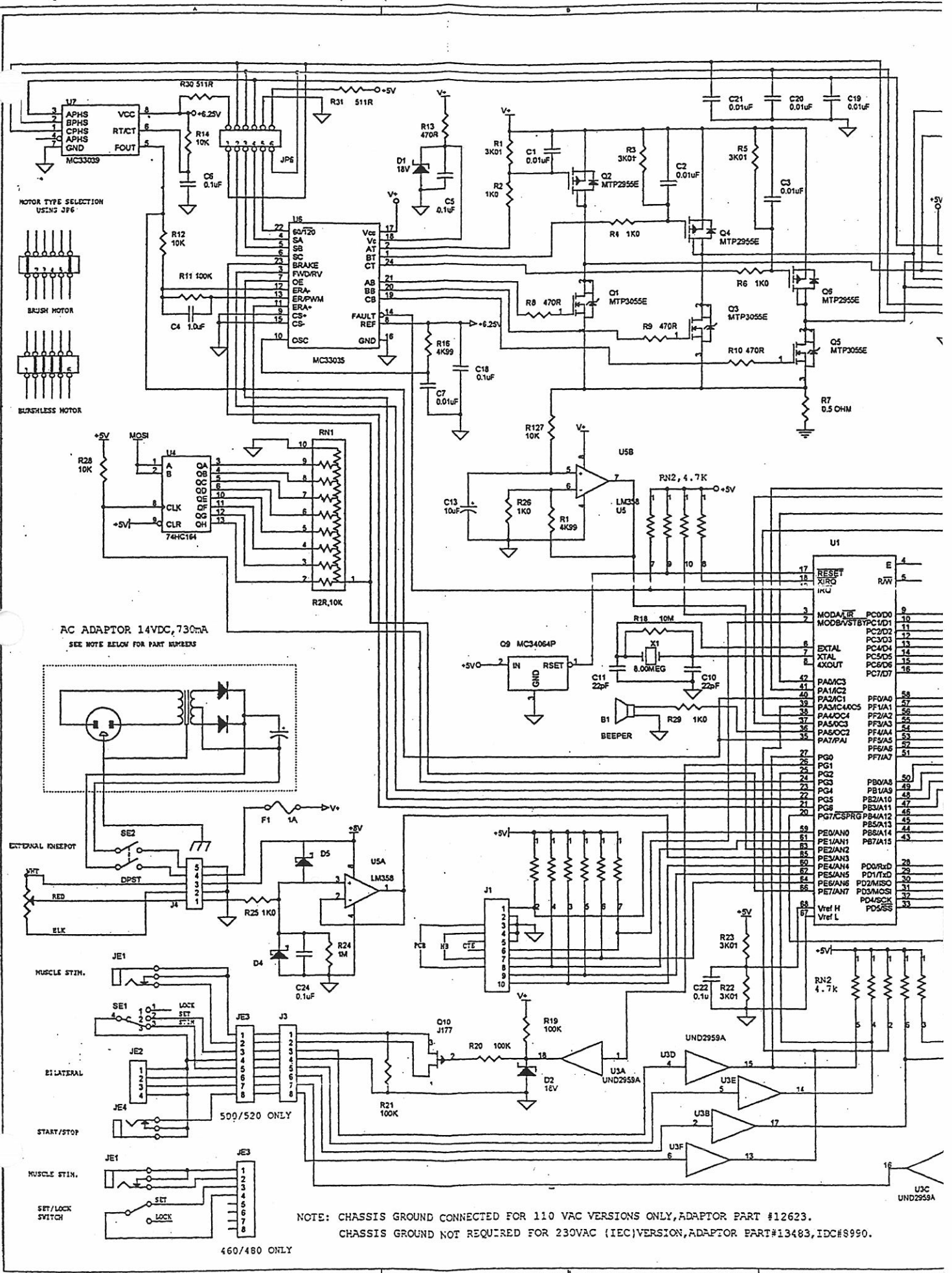
13585; Kit, 460 Motor Assembly



Additional parts required:

- 4 of nylon M/F/ Standoffs FS832AA
- 4 of nylon Flat Washer FW027
- 4 of Nylon Nut FN832E



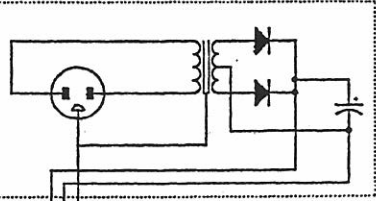


MOTOR TYPE SELECTION USING JPF6

BRUSH MOTOR

BRUSHLESS MOTOR

AC ADAPTOR 14VDC, 730mA
SEE NOTE BELOW FOR PART NUMBERS



EXTERNAL KNEEPOD

MUSCLE STIM.

BILATERAL

START/STOP

MUSCLE STIM.

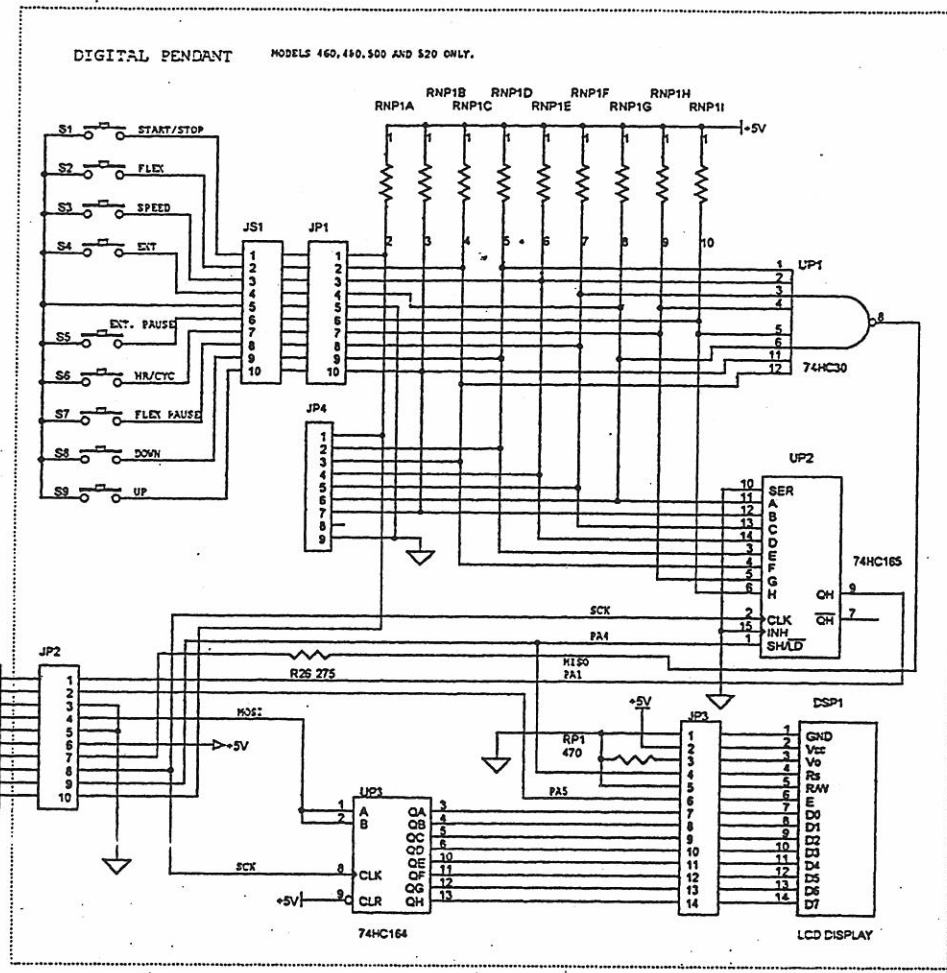
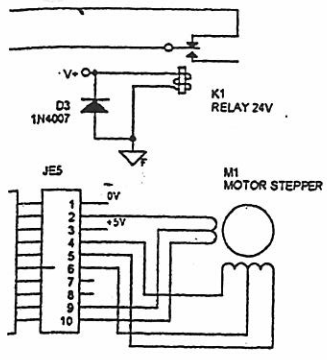
SET/LOCK SWITCH

NOTE: CHASSIS GROUND CONNECTED FOR 110 VAC VERSIONS ONLY, ADAPTOR PART #12623.
CHASSIS GROUND NOT REQUIRED FOR 230VAC (IEC) VERSION, ADAPTOR PART #13483, IDC#8990.

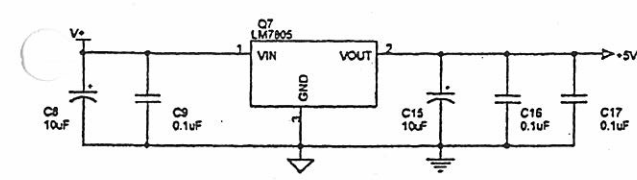
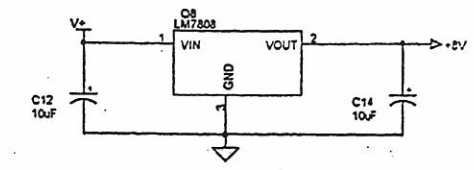
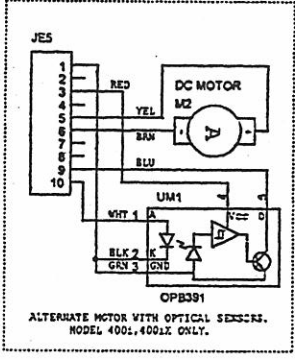
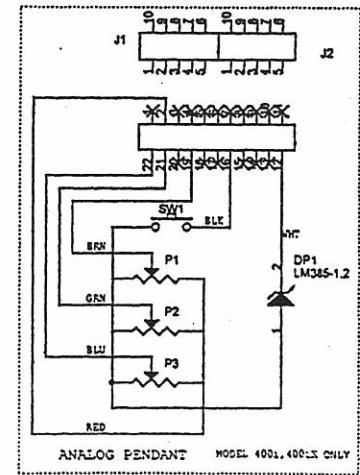
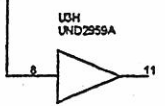
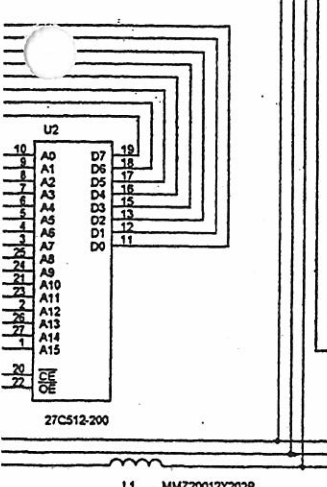
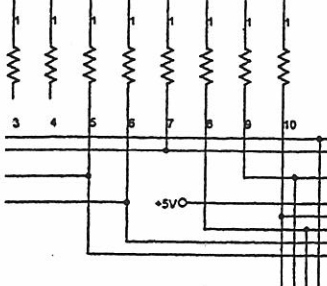
460/480 ONLY

Pin	Signal	Signal
17	RESET	PC0D0
18	XIRQ	PC1D1
19	IRQ	PC2D2
2	MODA/IR	PC3D3
3	MODB/STBY	PC4D4
4		PC5D5
5		PC6D6
6	EXTAL	PC7D7
7	XTAL	
8	4XOUT	
47	PAMC3	
48	PA1AC2	
49	PA2AC1	
50	PA3AC0CS	
51	PA4OC1	
52	PA5OC2	
53	PA6OC3	
54	PA7/PAI	
55	PG0	
56	PG1	
57	PG2	
58	PG3	
59	PG4	
60	PG5	
61	PG6	
62	PG7/CS/PRG	
63	PB0/A0	
64	PB1/A1	
65	PB2/A2	
66	PB3/A3	
67	PB4/A4	
68	PB5/A5	
69	PB6/A6	
70	PB7/A7	
71	PB8/A8	
72	PB9/A9	
73	PB10	
74	PB11	
75	PB12	
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DIGITAL PENDANT MODELS 460, 480, 500 AND 520 ONLY.



INB RN3C RN3D RN3E RN3F RN3G RN3H RN3I



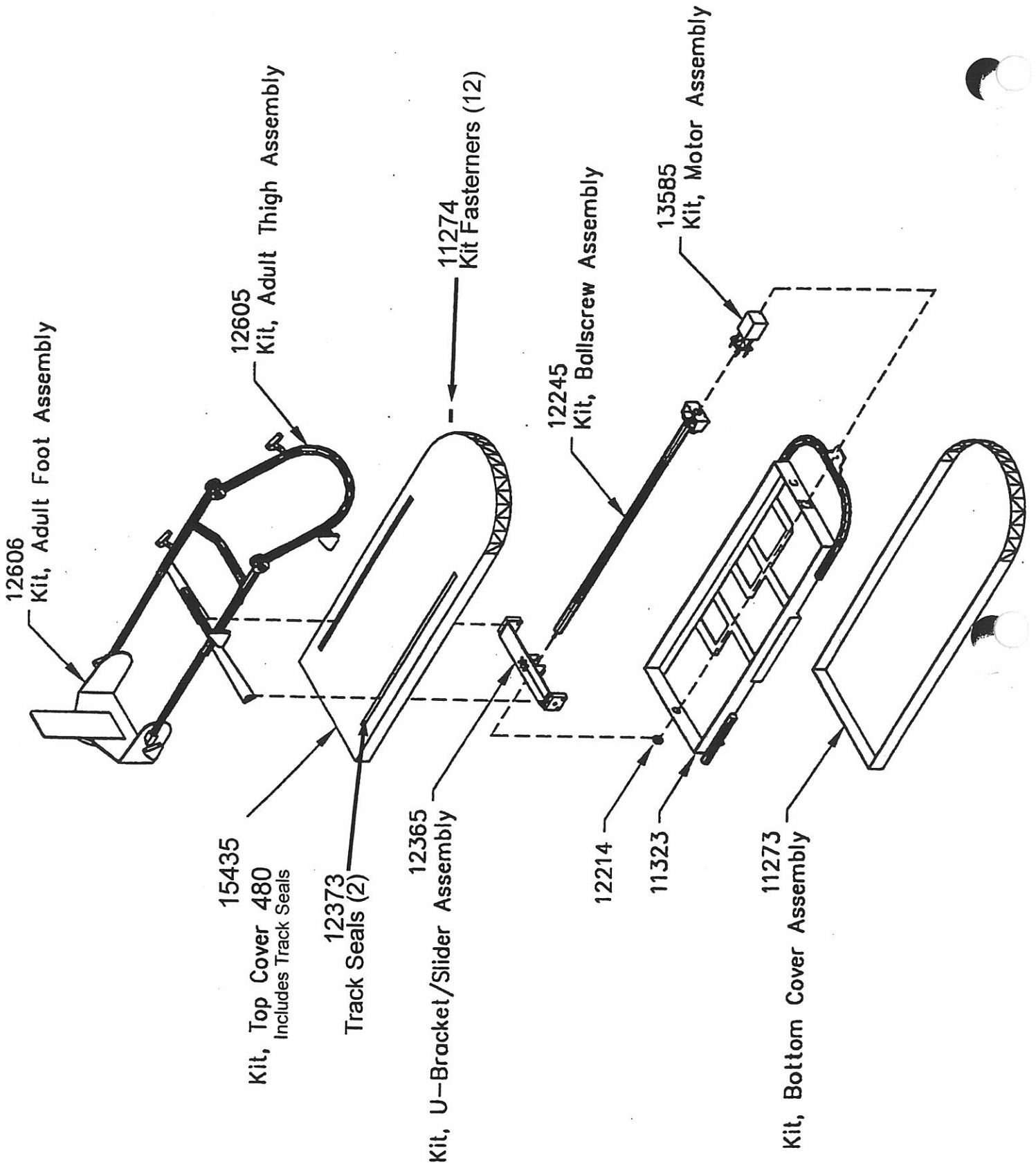
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A	11475	NEW RELEASE	YC
B	11548	REMOVED C13, ADDED NOTES & 520 USAGE	YC
C	1614.0	UPDATED TO INCLUDE BK, DS, R23, C24, KNEEPOD ADDED EMC & ESD PROTECTION REDRAWN ON ORCAD	DC
	12/9/97	INITIAL ISSUE - TRANSFERRED TO NEW FORMAT	

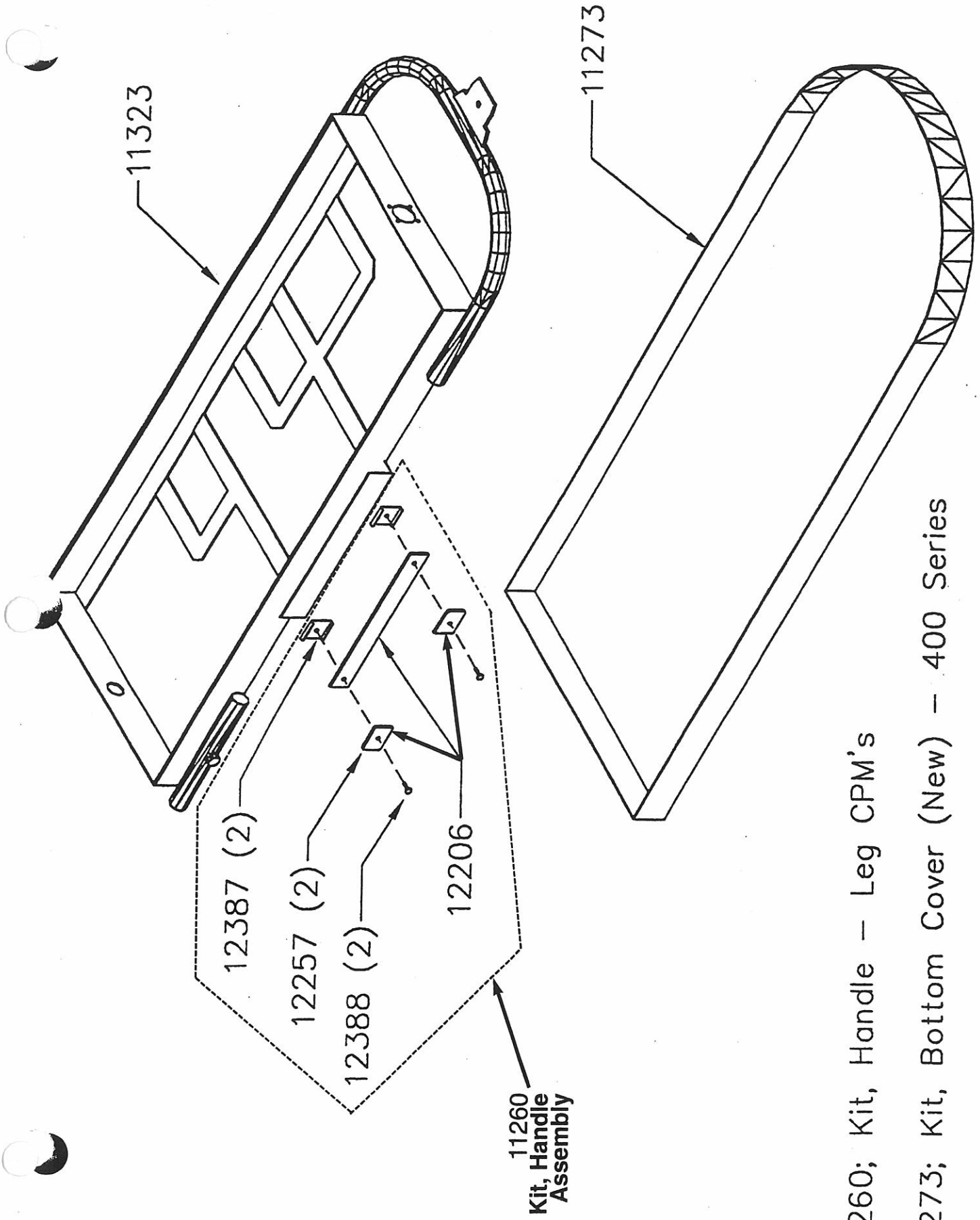
ORTHOLOGIC PICKERING, CANADA			
REV	DATE	DESCRIPTION	ENR

Title: DANNIFLEX 400,460,480,500,520 OVERVIEW SCHEMATIC

Size: Custom Document Number: D4MS0A97 (15427) Rev: C

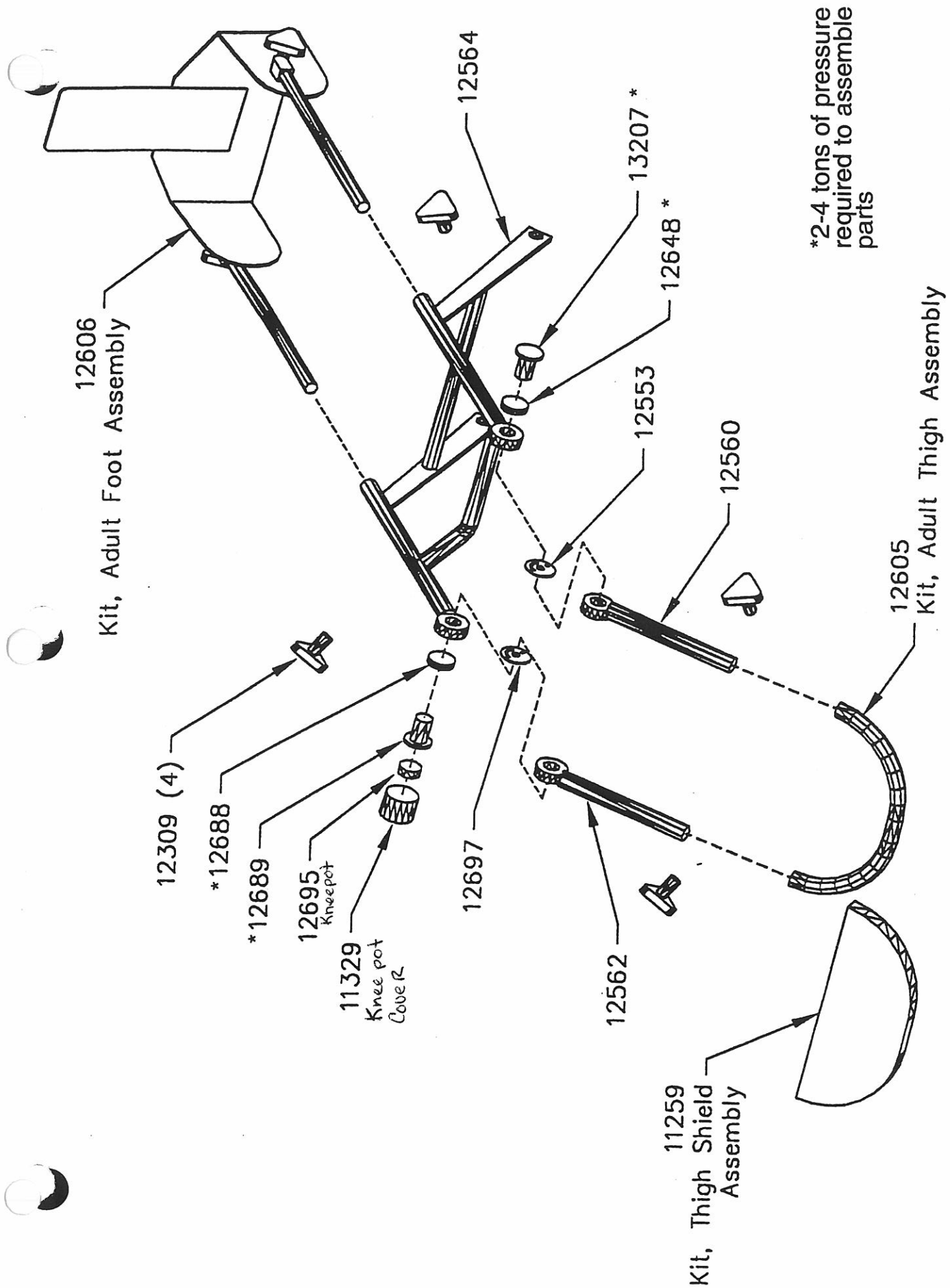
Date: Wednesday, December 16, 1998 Sheet: 1 of 1





11260; Kit, Handle - Leg CPM's

11273; Kit, Bottom Cover (New) - 400 Series



*2-4 tons of pressure
required to assemble
parts