
medRAD®

**Stellant
CT Injection System**

Service Manual



STELLANT®

Serial numbers and date of installation information must be supplied when ordering replacement parts, or inquiring about servicing. For convenience, record the following information below:

OWNER:

DATE INSTALLED:

INJECTOR HEAD SERIAL NUMBER:

DISPLAY SERIAL NUMBER:

BASE SERIAL NUMBER:

The information and specifications included in this publication were in effect at the time of approval for printing. Medrad, reserves the right, however, to discontinue or otherwise change specifications or design at anytime without notice, and without incurring any obligation whatsoever.

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1 - Introduction

Copyright Notice

Copyright 2006 by MEDRAD, INC.. All rights reserved. No part of this manual may be reproduced in any form without prior written permission of MEDRAD. Printed and assembled in the U.S.A.

Trademarks

MEDRAD Stellant CT®, Qwik-Fit Syringe®, FluiDot®, Quality for Life®, and MEDRAD® are registered trademarks of MEDRAD, INC.

Restricted Sale

Federal (U.S.A.) law restricts the sale of this device on or by the order of a physician.
Disclaimers

MEDRAD makes no warranties on the contents of this manual, and specifically disclaims any implied warranties of merchantability or fitness for any purpose.

MEDRAD reserves the right to change specifications and the contents of this manual without obligation.

Disclaimer

External wiring modification disclaimer: MEDRAD disclaims liability for any modifications or interfaces with other equipment which are not in conformity with the specifications and information contained within this manual. Such unauthorized action could jeopardize injector operation, safety, or reliability.

Accessory equipment connected to the MEDRAD Stellant CT Injector must be certified according to IEC 60601-1 standards. Furthermore, all configurations shall comply with the system standard IEC 60601-1-1. Anyone who connects additional equipment to the signal input or output, configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601-1-1. To obtain on-site consulting or consulting references, contact MEDRAD Service.

All drawings in this manual are for reference purposes only, and may not reflect the construction of units produced prior to the publication of this manual. Reproduction quality of these drawings may have been effected by the level of reduction required. Call MEDRAD Service if assistance in drawing interpretation is required.

The Stellant CT Injector is not for portable use.

Address / Telephone If you experience problems with the MEDRAD Stellant CT System, contact your MEDRAD authorized dealer or:

MEDRAD, INC. One Medrad Drive Indianola, Pa 15051-0780 U.S.A Phone: 412 767-2400 Fax: 412-767-4128	MEDRAD Europe B.V. Postbus 205 6190 AE Beek The Netherlands Phone: +31(0)43-3585601 Fax: +31(0)43-3656598	Nihon MEDRAD KK 9F Central Shin-Osaka Building 4-5-36, Miyahara, Yodogawa-ku Osaka, 532-0003 Japan Phone: +81-6-6350-0680 Fax: +81-6-6398-0670
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Applicability This manual applies to the MEDRAD Stellant CT Injection System.

Purpose The purpose of this manual is intended to provide instructions for servicing the MEDRAD Stellant CT Injection System safely and accurately. It is intended for those qualified to service the injection system, whether they be MEDRAD Service Personnel, Certified Laboratory Service Technicians or MEDRAD authorized international dealers.

Important Safety Notice The information in this manual is intended for people with adequate backgrounds and experience in electronics and electromechanical devices. Any attempt to repair a sophisticated medical device such as the injector may result in personal injury, property damage, or patient injury.

Intended Use Refer to the Stellant CT Injection System operation manual.

Certifications MEDRAD Stellant CT Injection Systems are equipped to operate at 100 - 240 VAC, 50/60 Hz, and designed to be in compliance with EN 60601 -1 (Safety), and EN 60601-1-2 (EMC/ Emissions).

Symbols and Descriptions

The following international symbols are used on the MEDRAD Stellant CT Injector and throughout this manual.



Attention, consult accompanying instructions.



Indicates that this device conforms to the requirements of the European Medical Device Directive 93/42/EEC.



Indicates on/off switch for the Control Room Unit.



Indicates hazardous voltages.



Indicates alternating current.



Identifies a type BF applied part complying with EN 60601-1 standards.

CLASS 1

Indicates the injection system is Class 1 medical equipment as defined by EN 60601-1 standards.

IPX1

Identifies the degree of protection against fluid as drip proof.



Identifies connection of the handswitch.



Forward and Reverse Piston Controls.



Identifies the direction of manual knob rotation relative to plunger movement.



Identifies the ENABLE key.



Indicates the AIR EXPELLED button on the injector head. When illuminated yellow on the touch screen, also indicates that the operator has acknowledged inspecting the fluid path for air.



Identifies the Equipotential connection.



Identifies the Earth Ground point.



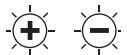
Identifies the Service Connection Port.



Indicates design for indoor use only.



Indicates the presence of no serviceable parts.



Identifies the Control Room Unit brightness controls.



Indicates the Protocol Lock is engaged.



Start / Hold.



Stop.



Reset.



Help.



Setup.

Labels on the system or statements in this manual preceded by any of the following words and/or symbols are of special significance, intended to help you to operate the system in a safe and successful manner:



Protocol is unlocked or unengaged.



Phase View.



Profile Preview.



Pressure Graph View.

ISI Symbols



Indicates scanner hookup.



Indicates DC power.



Indicates injector hookup.

TX

Identifies the CAN Interface TRANSMIT LED.

RX

Identifies the CAN Interface RECEIVE LED.

LK

Identifies the Ethernet LINK LED.

AT

Identifies the Ethernet ACTIVITY LED.



DO NOT dispose of in municipal waste. Wheeled bin symbol indicates separate collection for electrical and electronic equipment. (WEEE Directive 2002/96/EEC).



Symbols on the Power Switch:

I - On

O - Off

The following icons may appear on the injector screen when using ISI 700:



The user is not able to arm the injector. The injector is configured for ISI, and it is communicating to the ISI module. The injector and ISI module are functional, but the scanner signals are in a state that will NOT allow arming the injector.



The injector is configured for ISI and it is communicating to the ISI module. The scanner signals are in a state that will allow arming the injector.



Communication is lost between the injector and the ISI module.

OR

The ISI module is in need of repair. Refer to the ISI System Messages section of this manual.

The following icons may appear on the injector screen when using ISI 800:



(No Highlight) Indicates that communication between the injector and the MEDRAD ISI 800 Module has been established.



(Highlighted in Yellow) Indicates that communication between the Injector and the scanner has been established.



(No Highlight) Indicates that communication has been lost between the injector and the MEDRAD ISI 800 Module. The MEDRAD ISI 800 Module may be in need of repair. Refer to the ISI 800 System Messages section of this manual.

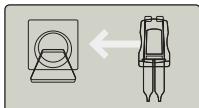


(Highlighted in Yellow) Indicates that the injector is working in conjunction with the scanner ("coupled"). This symbol will only appear on the screen when the system is in Control or Tracking modes.

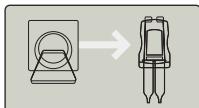


(No Highlight) Indicates whether or not the injection protocol has been locked. When this icon is highlighted in yellow, the protocol has been locked.

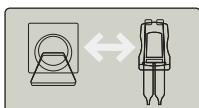
NOTE: The configurations below are determined by the scanner manufacturer. Refer to the scanner manufacturer instructions for further information.



Indicates that the injector will request the initiation of a procedure. When either or both system symbol is gray, that system is not ready and the injection will not proceed. When both symbols are highlighted in yellow, both systems are ready and the injection can proceed.



Indicates that the scanner will request the initiation of a procedure. The Start Button has been locked out on the Injector. When either or both system symbol is gray, that system is not ready and the injection will not proceed. When both symbols are highlighted in yellow, both systems are ready and the injection can proceed.



Indicates that the procedure request can be initiated from EITHER the scanner or the injector. When either or both system symbol is grayed out, that system is not ready and the injection will not proceed. When both symbols are highlighted in yellow, both systems are ready and the injection can proceed.

Additional Information Regarding Compliance to IEC 60601-1-2 / 2001 2nd Edition

This section is intended to reflect conformance to IEC-60601-1-2 / 2001 2nd edition Standards.



CAUTIONS

The following statements are cautions. Cautions advise of circumstances that could result in damage to the device. Read and understand these cautions before operating the injector system.

Injector may disarm or fail to operate when exposed to high magnetic fields. Portable and mobile RF communications equipment can affect the injector.

FOR PROPER OPERATION, use only accessories and options provided by MEDRAD that are designed specifically for the injector system. Other non-MEDRAD approved accessories or options may cause equipment damage or may result in increased emissions or decreased immunity of the injector system. Injector system accessories listed in its operation manual comply with the requirements of electromagnetic emissions and immunity standards IEC-60601-1-2 / 2001 2nd edition.

DO NOT USE INJECTOR ADJACENT TO OR STACKED WITH OTHER EQUIPMENT. If adjacent or stacked use is necessary, the injector should be observed to verify normal operation in the configuration in which it will be used.

Recommended separation distances between portable and mobile RF communications equipment and the injector			
Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 KHz to 80 MHz $d = [3.5/V_1] \sqrt{p}$	80 MHz to 800 MHz $d = [3.5/E_1] \sqrt{p}$	800 MHz to 2.5 GHz $d = [7/E_1] \sqrt{p}$

Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 KHz to 80 MHz $d = [3.5/V_1] \sqrt{p}$	80 MHz to 800 MHz $d = [3.5/E_1] \sqrt{p}$	800 MHz to 2.5 GHz $d = [7/E_1] \sqrt{p}$

The injector is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the injector can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the injector as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 KHz to 80 MHz $d = [3.5/V_1] \sqrt{p}$	80 MHz to 800 MHz $d = [3.5/E_1] \sqrt{p}$	800 MHz to 2.5 GHz $d = [7/E_1] \sqrt{p}$
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.69	3.69	7.38
100	11.67	11.67	23.33

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where p is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

INJECTOR REQUIRES SPECIAL PRECAUTIONS REGARDING EMC. Install and put into service according to the EMC information provided below:

Guidance and manufacturer's declaration - electromagnetic emissions		
Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The injector uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B Stellant	The injector is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class B Stellant	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Guidance and manufacturer's declaration - electromagnetic immunity			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with a synthetic material, the relative humidity should be at least 30%.
Electrical/fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	$<5\%$ U_T $(>95\% \text{ dip in } U_T)$ for 0.5 cycle 40% U_T $(60\% \text{ dip in } U_T)$ for 5 cycles 70% U_T $(30\% \text{ dip in } U_T)$ for 25 cycles $<5\%$ U_T $(>95\% \text{ dip in } U_T)$ for 5 sec	$<5\%$ U_T $(>95\% \text{ dip in } U_T)$ for 0.5 cycle 40% U_T $(60\% \text{ dip in } U_T)$ for 5 cycles 70% U_T $(30\% \text{ dip in } U_T)$ for 25 cycles $<5\%$ U_T $(>95\% \text{ dip in } U_T)$ for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the injector requires continuous operation during power mains interruptions, it is recommended the injector be powered from an uninterruptible power supply or battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE U_T is the a.c. mains voltage prior to application of the test level.			

Guidance and manufacturer's declaration - electromagnetic immunity			
The injector is intended for use in the electromagnetic environment specified below. The customer or user of the injector should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC-61000-4-6	3 V _{rms} 150 kHz to 80 MHz	3 V _{rms}	Portable and mobile RF communications equipment should be used no closer to any part of the injector, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.17 \sqrt{p}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.17 \sqrt{p}$ 80 MHz to 800 MHz $d = 2.33 \sqrt{p}$ 800 MHz to 2.5 GHz Where p is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, ^a should be less than the compliance level in each frequency range. ^b Interference may occur in the vicinity of equipment marked with the following symbol:
 NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the injector is used exceeds the applicable RF compliance level above, the injector should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the injector.			
b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

Introduction to Warnings and Cautions

This manual contains important information about safe servicing of the MEDRAD Stellant CT Injection System.

MEDRAD urges the service technician to read this manual carefully, become familiar with the procedures and system functions that it describes, and follow its recommendations to assure proper servicing of the system.

Warning labels on the MEDRAD Stellant CT system or Warning statements in this manual preceded by any of the following words and/or symbols are of special significance:



WARNING: Indicates a potentially hazardous situation. If not avoided, this could result in death or serious injury.



WARNING: Indicates electrical hazards which could result in death or serious injury.



CAUTION: Indicates potential hazards or unsafe practices which could cause product, system, or property damage.

NOTE: Indicates helpful information is being offered.

WARNINGS



Injury may result from exposure to hazardous voltages existing within the system. The system should be opened and serviced by qualified service personnel only. Disconnect the system from line power before cleaning or attempting to perform any maintenance.



Explosion hazard in the presence of flammables. Do not use the system in the presence of anesthetic gases and equipment.



Patient or operator injury can occur from use of worn power cords or control cables. Examine power cords and cables for cuts, frays, or any other visible damage. Do not use the system if any of the cords or cables show signs of damage. Any damaged or worn connection cables or power cords should be replaced.



Unsafe operation may result from using improper accessories and replacement parts. Use only accessories, options, and parts designed for this system, and provided by MEDRAD.



Fire hazard: to avoid an electrical fire, assure the correct type of fuse is used for replacement. The fuse must be replaced with type T, 250V, 3.15 A fuse by qualified personnel only.

CAUTIONS

Damage may occur as a result of failure to follow electrostatic discharge (ESD) protection practices. ESD protection practices must be followed when servicing any component of this system.



Damage can occur as a result of incorrect voltages. Check the voltage and frequency marked on the back of the Power Supply. Ensure that the outlet providing power to the injector supplies a voltage, frequency, and volt-ampere rating within the range specified on the unit.



Environmental damage may result from improper disposal of system components or accessories. Electronic assemblies contain potentially hazardous materials. Follow all local regulations for the recycling or disposal of electronic assemblies, or contact MEDRAD Service for assistance.



Damage can occur as a result of abrupt interruption or application of supplies. To avoid damage to sensitive circuits on the boards, disconnect the power cord before removing or replacing PC boards.



Allow system temperature to stabilize before use. To avoid damage to sensitive electronic circuits, allow the system to stabilize to room temperature before servicing when exposed to extreme temperature changes.



Perform regular preventive maintenance. To ensure that your MEDRAD Stellant CT System remains properly calibrated, and that all primary and backup circuits are functioning properly, regular preventive maintenance is recommended. An annual preventive maintenance package is not included in the new machine warranty. Contact your local MEDRAD Service Representative for details.



Damage may result from improper or careless cleaning methods. While cleaning any outside portion of the system, avoid allowing any water to seep inside system components.

NOTE: All relevant guidelines for institutional, local, or national safety recommendations related to cable routing and installation should be followed.

2 - Maintenance and Checkout

This section contains recommended procedures for maintenance, and an operational checkout of the MEDRAD Stellant CT Injection System. Routine maintenance and inspection will:

- Ensure continued performance of the injection system
- Reduce the possibility of equipment malfunction

Recommended Maintenance Schedule

Your MEDRAD Stellant CT Injection System must be properly maintained to ensure that it is in peak operating condition. Your individual maintenance system and schedule depends upon how your injection system is used, the type of procedures performed, and frequency of use. The following maintenance schedule is recommended for the system:

Daily:

The piston rod or rods should be thoroughly cleaned after each use. Before use each day, the system should be cleaned and inspected, using the procedures outlined in this section. Ensure that all system safety and warning labels are in place and are legible.

Monthly:

Once a month, the entire system should be thoroughly inspected and cleaned, and an Operational Checkout should be performed.

Annually:

As part of an annual maintenance program performed by a qualified MEDRAD Service Representative or authorized dealer, both Electrical Leakage and Ground Continuity checks should be performed.

NOTE: Local regulations or hospital protocol may require electrical leakage checks at more frequent intervals. If this applies, local regulations for leakage must be followed.

MEDRAD also recommends that a complete system calibration and performance checkout be performed annually. Contact MEDRAD Factory Service, or your local MEDRAD office for complete details.

In the United States, Canada, Japan, and Europe, the MEDRAD Service Department offers Preventive Maintenance Programs. These annual programs greatly assist in maintaining accuracy and reliability, and can also extend the life of the system. Contact MEDRAD for details. In Europe, contact your local MEDRAD office or your local authorized dealer for further information. Refer to the back of the title page of this manual for address, telephone and FAX information.

NOTE: Failures which occur due to lack of proper maintenance will not be covered under warranty.

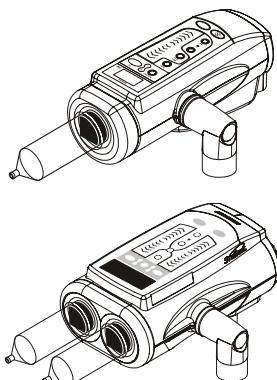
MEDRAD Service

MEDRAD Service will make available upon request:

- Circuit diagrams, component parts lists, or other information that will assist qualified technicians to repair components classified as repairable.
- On site consulting upon request

Inspection Procedures

The following procedures are recommended for daily inspection of all components in the MEDRAD Stellant CT Injection System. If any defects are detected, either repair the system, or call MEDRAD for service. Do not use the system until the problem is corrected.

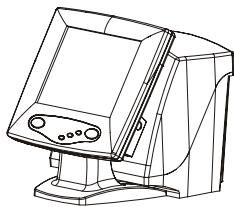
Single and Dual Head

1. Inspect the housing for any damage or cracks that could allow fluid to leak inside, or weaken the structural integrity of the unit.
2. Inspect all cables connected to the unit: Look for cuts, cracks, worn spots or other obvious damage to the cables. Ensure that all connectors are properly seated.
3. Inspect for contrast media build-up in the syringe interface area. Follow the cleaning guidelines outlined in this section.
4. Ensure that all mounting bolts and screws are secure.
5. Inspect the pivot points. The head and support arm must pivot freely.
6. Ensure that the keypad is clean and free of cracks.

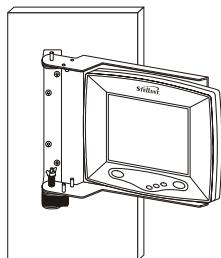
NOTE: All relevant guidelines for institutional, local, or national safety recommendations related to cable routing and installation should be followed.

Syringe Heat Maintainer

1. Ensure that the device is warm to the touch while attached to the head.
2. Ensure that the LED indicator is not illuminated or flashing.
3. Inspect the cable and connector for cracks, worn areas, or other obvious damage.
4. Ensure the heater has extension cable attached P/N 3013737.

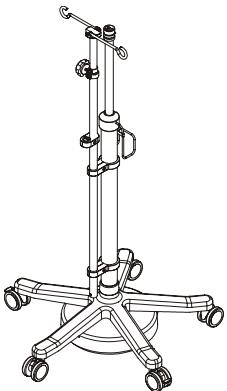
Display and Base

1. Inspect all cables connected to the unit: Look for cuts, cracks, or worn spots, or other obvious damage. Ensure that all connectors are properly seated.
2. Inspect the housing for any damage or cracks that could allow fluid to leak inside, or weaken the structural integrity of the unit.

Wall Bracket

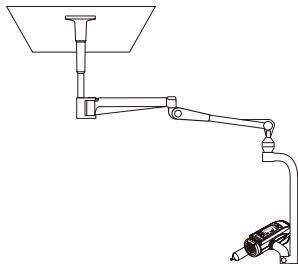
1. Inspect all parts of the bracket for cracks and other defects that would weaken the assembly.
2. Ensure that the bracket is securely attached to the wall.
3. Ensure that all cables are secured to the display control unit and do not interfere with the movement of the mounting bracket.

Adjustable Height Pedestal



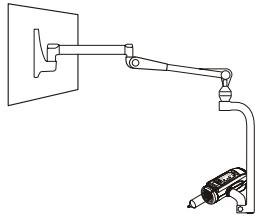
1. Inspect the stand, base and support arm for cracks and other defects that could weaken the structure.
2. Ensure all mounting bolts and screws are secure.
3. Ensure that the casters roll smoothly with no binding or scraping.
4. Ensure all locking mechanisms on the casters are functional.
5. Verify that the vertical height adjustment of the column shaft moves freely without binding or scraping.

CS Mounting Systems



1. Inspect all parts of the arm and mounting system for cracks and other defects that would weaken the system.
2. Ensure that the mounting system is securely assembled, with no loose parts. The area should be stable with the head installed.
3. Ensure that the arm moves smoothly in all directions, with no binding or scraping.
4. Verify that all cabling is tied back and does not interfere with the movement of the supporting parts or the injector head.

NOTE: All relevant guidelines for institutional, local, or national safety recommendations related to cable routing and installation should be followed.



ISI

1. Inspect all parts of the ISI, ensure all cables are secured to the ISI.
2. Ensure ISI cables are free of cuts, cracks or other obvious damage.

Electrical Leakage Check

To ensure safe operation of the MEDRAD Stellant CT Injection System, an electrical leakage check must be part of regular maintenance.

Use a commercial leakage tester such as one of the following:

MANUFACTURER	MODEL
Bio-Tek Instruments, Inc. Electrical Safety Analyzer	Model 601 PRO
Bender	Unimet 1000 ST
Bapco	IEC601L

1. With the AC ground open, power applied, and the line at normal, leakage should be less than 100 micro amps at 110V or 300 micro amps at 220 V.
2. With the AC ground open, power applied and the line reversed, leakage should be less than 100 micro amps at 110V or 300 micro amps at 220 V.
3. Disconnect the leakage test device.

Ground Continuity Check

A ground continuity check must also be part of regular maintenance of the MEDRAD Stellant CT system.

1. Disconnect the system from the power source.
2. Using an ohm meter, measure the resistance between the ground terminal, the power cord and the equipotential connector on the Base and the front casting of the head. The resistance measured must be less than 0.2 ohms.

Cleaning and Operational Checkout

Cleaning Guidelines

Deposits of contrast media can interfere with proper operation of the MEDRAD Stellant CT Injection System. The following guidelines should be followed when removing deposits, or cleaning any portion of the system.



WARNING: Serious injury or death may result from exposure to hazardous voltages existing within the system. Disconnect the system from line power before cleaning or attempting to perform any maintenance. Ensure that the system is completely dry before connecting to the power source and applying power.



CAUTION: Improper or careless cleaning methods may result in equipment damage. Do not soak or immerse any part of the injection system in water. While cleaning any outside portion of the system, avoid allowing any water to leak inside system components.

- If contrast medium has leaked inside any component of the system, the affected subassembly should be disassembled and cleaned. This cleaning procedure can be done in the field by trained MEDRAD Service personnel, or returned to MEDRAD Service.
- Care must be taken not to get water or cleaning solutions inside any system components. Do not use strong industrial cleaning agents or solvents such as acetone. Warm water and a mild disinfectant such as antibacterial hand soap are all that is required.
- To clean the syringe interface area of the injector head, fully retract the piston. Using a paper towel moistened with warm water or a mild disinfectant, gently wipe the inner syringe installation area. Do not insert any sharp instruments into this area during the cleaning process.

Operational Checkout

A basic functional checkout of the MEDRAD Stellant CT Injection System should be included as part of regular maintenance. Verifying proper operation of the injection system will help in detection of any problems that may not be noticed in day to day operation. The following procedure represents a suggested series of activities which encompass typical operation of the system. Read the following procedure carefully before beginning the checkout. If problems are detected, refer to the General Troubleshooting Procedure.



CAUTION: Any problems detected during this or any other procedure should be corrected before using the injection system in patient procedures.

System Labels

Ensure that all system safety and warning labels are in place and legible.

Power Up

1. Apply power to the system.
2. Verify that the Safety screen is displayed after system diagnostics occur.
3. Press Continue to acknowledge the messages on the Safety screen.
4. Verify that audible tones are functioning on the Display Control Unit and injector head.
5. Verify that the following controls are functioning properly.
 - Forward and Reverse
 - Start
 - Stop
 - Fill
6. Verify that the arm lights on the injector head are functioning.

Programming

7. After the Main screen is displayed, verify that the following controls are functioning properly.
8. At the rear of the Display, press the **Display Brightness Up** key until the screen is lightened to its fullest extent. Press the **Display Brightness Down** Key until the screen is darkened to its fullest extent. Adjust the screen appearance to return to a desirable contrast level.
9. Fully advance and reverse the pistons by using the ENABLE key and the forward/reverse controls.
10. Ensure the Auto Dock, Auto Advance, and Auto Retract are enabled.
11. Verify that both pistons respond to the forward and reverse controls.

Enter the following protocol:

Dual Flow Rate

Phase	Syringe	Flow Rate	Volume
Phase 1:	Syringe A:	10 ml/s	70 ml
Phase 2:	Syringe B:	2.5 ml/s	29 ml
Phase 3:	Syringe A:	5.0 ml/s	100 ml
Phase 4:	Syringe B:	0.1 ml/s	1 ml

Single Flow Rate

Phase	Syringe	Flow Rate	Volume
Phase 1:	Syringe A:	10 ml/s	70 ml
Phase 2:	Syringe A:	2.5 ml/s	29 ml
Phase 3:	Syringe A:	5.0 ml/s	100 ml
Phase 4:	Syringe A:	0.1 ml/s	1 ml

12. Install empty syringes(s) and ensure the piston automatically docks with syringe plunger. The plunger(s) should advance to full forward position.
13. Fully reverse the plunger(s).
14. Arm in single mode and inject. In one of the phases, activate the HOLD feature for at least 10 seconds.
15. Press Start/Hold again. Verify the injection completes normally, and the Injection Complete screen values are similar to the protocol values.
16. Advance plunger(s) to the full forward position, remove syringes(s) and ensure the piston(s) automatically retracts.
17. Inspect the heat maintainer. Make sure it is warm and the fault indicator is not illuminated while attached to the head.

3 - Troubleshooting

System Malfunction Codes

Conditions can occur which will prevent the injection system from being armed, or even interrupt an injection that is in progress. These conditions may be operator induced or caused by a system malfunction. Error Codes which inform the user of these conditions are displayed on the control panel.

General Troubleshooting Guidelines

Consider the following guidelines before troubleshooting any condition. These guidelines may help in resolving the condition quickly: Remember, try the simple things first.



CAUTION: Damage may occur as a result of failure to follow electrostatic discharge (ESD) protection practices. ESD protection practices must be followed when servicing any component of this system.



CAUTION: Damage could result from improperly handled components. Before touching any of the circuit cards in the system, discharge yourself to grounded metal. If memory components are to be shipped, place the components in conductive carriers (as supplied through MEDRAD).



CAUTION: Disconnect the power cord before removing or replacing PC boards. Sensitive circuits on the boards can be damaged by abrupt interruption or application of supplies.

- Try removing the power cord from the power source for one minute. Allow the system to reset completely, then reapply power and retry. The condition could be intermittent, or caused by a voltage transient. If the condition persists, continue troubleshooting.
- To verify the existence of a condition, attempt to recreate the problem. Follow the Checkout Procedure outlined in Section 2 of this manual to check for proper (or improper) operation of the system.
- Some faults can be caused by a noisy electrical environment. If these conditions persist, contact MEDRAD Factory Service* for further assistance.

* Indicates contact MEDRAD Factory Service or an Authorized Dealer.

System Messages

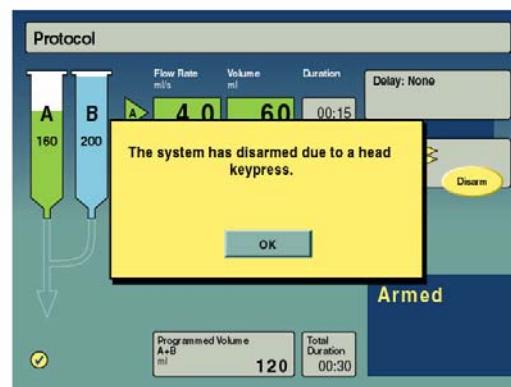
The system will display messages on the screen as conditions or events occur. There are three basic types of messages:

Type 1 Messages

Type 1 messages provide information regarding the current system status, and will clear automatically. These messages typically display in the lower right corner of the screen.

**Type 2 Messages**

Type 2 messages convey information that must be explicitly acknowledged before proceeding. Press the button(s) within the yellow dialog box to dismiss the message.

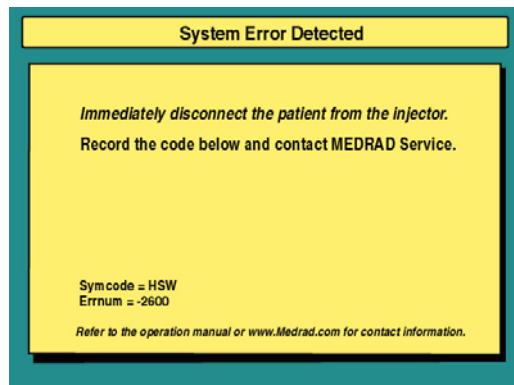


Type 3 Messages

Type 3 messages are system malfunction messages which require power to be removed from the system. Some Type 3 messages provide suggestions to prevent the condition from recurring. If the condition cannot be corrected, record the code and number from the lower left corner of the dialog box, then call MEDRAD Service for assistance.



WARNING: Patient injury may result from a system malfunction. If a system malfunction occurs, immediately remove and disconnect the system from the patient. If a fault message is displayed that cannot be corrected, and/or the system is not operating correctly, do not use the injection system. Call MEDRAD for assistance.



Type 3 errors are divided into categories of function level. Each category is also divided into specific errors. Below is a list of the categories and suggested repair sequences. These are to be tried in order, not to be performed all at once. Before replacing any parts, cycle power to injector. This will initiate a system self-test. If this does not correct the problem, replacement of the Display, Base, or Head as needed is suggested. For further assistance, contact MEDRAD Service or an authorized dealer.

NOTE: Replacement of the Servo/CPU Card requires calibration/verification.

White Screen/System Lock Up Condition	A white screen that displays, "MEDRAD" indicates a communication or software problem. <ul style="list-style-type: none">• Software mismatched between Display and Head. Software update needed.• Faulty Head extension cable. Replace Head extension cable.• Replace the Servo/CPU card
--	---

Listing of Type 3 Errors	CAL - Calibration Errors with a prefix of CAL mean that the system has found an error with the system calibration values missing or corrupt. <ul style="list-style-type: none">• Calibrate system potentiometer, flex ring and pressure.• Replace the Servo/CPU Card.
---------------------------------	--

	DOCK SENSA - Docking Sensor A Errors with a prefix of DOCK SENSA mean that the system has detected that Piston A docking sensor is closed with no syringe attached on side A.
--	---

- Verify syringe is installed correctly.
- Clean syringe interface area.
- Replace size Sensor A.

	DOCK SENS B - Docking Sensor B Errors with a prefix of DOCK SENS B mean that the system has detected that Piston B docking sensor is closed with no syringe attached on side B.
--	---

- Verify syringe is installed correctly.
- Clean syringe interface area.
- Replace size Sensor B.

	ENCA - Encoder A Errors with a prefix of ENCA indicate a problem with the Encoder on motor A or the associated circuitry.
--	---

- Ensure P4 is connected.
- Replace the Power Drive card.
- Replace the motor.

	ENCB - Encoder B (Dual only) Errors with a prefix of ENCB indicate that the system has found a problem with the Encoder on motor B or the associated circuitry.
--	---

- Ensure that P4 is connected correctly.
- Replace the Power Drive card.
- Replace the motor.

FRA - Flex RingA

Errors with a prefix of FR indicate a problem with the Flex Ring on side A.

- Clean housing.
- Replace housing

FRB - Flex RingB

Errors with a prefix of FR indicate a problem with the Flex Ring on side B.

- Clean housing.
- Replace housing

HOVER - Switch Card

Errors with a prefix of HOVER indicate that the system has found a problem with the head, DCU overlay switch card or the associated circuitry.

- Ensure there where no switches pressed during power up diagnostic test.
- Ensure that the head cable is seated properly.
- Replace the switch card of the module posint the error.
- Replace the Servo/CPU card.

HSW - Handswitch

Errors with a prefix of HSW indicate a problem with the Handswitch or associated circuitry.

- Ensure handswitch is is properly seated.
- Replace handswitch.
- Replace CPU card in moduel where handswitch is installed.

HUB - Ethernet Hub

Errors with the prefix HUB, have detected a problem in the Ethernet HUB or the associated circuitry.

- Ensure all cables are fully connected into the HUB (power and communication).
- Replace the HUB.

ICD - Interface/Switch Card In Display

Errors with a prefix of ICD indicate a problem with the Display Interface Card in the Display top section or the associated circuitry.

- Ensure the card has all the connectors fully seated.
- Replace the Display Interface Card.
- Replace the SBC Card.

ICE - Interconnect Card Base

Errors with a prefix of ICE indicate a problem with the Expansion Base Interface Card or the associated circuitry.

- Ensure that the card connectors are fully seated.
- Replace the Base Interface Card.

ICS - Interface Card In Head Unit

Errors with a prefix of ISC indicate a problem with the Head Interface Card(s) or the associated circuitry.

- Ensure that the Head connectors are fully seated.
- Replace the Head Interface Card.
- Replace the Servo/CPU card.

MOTA - Motor A

Errors with a prefix of MOTA indicate a problem with motor A or the associated circuitry during the H Bridge test.

- Ensure that P3 is connected correctly onto the Power Drive card.
- Replace the Power Drive card.
- Replace the motor.

MOTB - Motor B (Dual only)

Errors with a prefix of MOTB indicate a problem with motor B or the associated circuitry during the H Bridge test.

- Ensure that P3 is connected correctly onto the Power Drive card.
- Replace the Power Drive card.
- Replace the motor.

PCMCIA - PCMCIA Card

Errors with a prefix of PCMCIA indicate a problem with the PCMCIA card or the associated circuitry.

- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure that the card is fully seated into the SBC card.
- Replace the PCMCIA card.
- Replace the SBC card.

POTA - Pot A

Errors with a prefix of POTA indicate a problem with the Potentiometer A or the associated circuitry.

- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure the connector is fully seated on the interface card.
- Realign potentiometer A.
- Replace potentiometer A.
- Replace Head Interface Card.
- Replace the Servo/CPU card.

POTB - Pot B (Dual only)

Errors with a prefix of POTB indicate a problem with Potentiometer B or the associated circuitry.

- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure the connector is full seated on the Interface card.
- Realign potentiometer B. Align with gear train and recalibrate.
- Replace Potentiometer B.
- Replace Head Interface Card.
- Replace the Servo/CPU card.

POWR - Power Drive Card

Errors with a prefix of POWR indicate a problem with the power card or the associated circuitry.

- Verify power supply voltages are at the Power Drive card.
- Ensure that connectors are fully seated.
- Replace the Power Drive card.
- Replace the Servo/CPU Card.

PRSSRA - Pressure Transducer A

Errors with a prefix of PRSSRA indicate a problem with Pressure Transducer A or the associated circuitry.

- Verify Power Supply voltages are at the Power Drive Card.
- Ensure the Transducer connector is fully seated on the Interface Card.
- Replace the Interface card.
- Replace the Servo/CPU card.

PRSSRB - Pressure Transducer B (Dual only)

Errors with a prefix of PRSSRB indicate a problem with the Pressure transducers B-side or the associated circuitry.

- Ensure the Transducer connector is fully seated on the Interface Card.
- Replace the Interface card.
- Replace the Servo/CPU card.

RATE - Over Rate Injection

Errors with a prefix of RATE indicate that the system has detected an over rate condition.

- Verify Calibration
- Ensure potentiometers are fully seated into gears.
- Replace potentiometer of the side with the problem.
- Replace the motor of the side with the problem.
- Replace the Servo/CPU card.

SBC - Single Board Computer (SBC)

Errors with a prefix of SBC indicate a problem with the Single Board Computer or the associated circuitry.

- Ensure the card has all the connectors fully seated.
- Replace the SBC card.
- Replace the Display Interface Card.

SER - Servo/CPU Card

Errors with SER typically indicate the Head Card. This may be a condition that must be corrected, or simply an electrical transient that disrupted the system. Try the following:

- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- If the problem continues, replace the Servo/CPU card.
- If the condition persists, call MEDRAD Factory Service.

SSD - Start Switch (Display)

Errors with a prefix of SSD typically indicate a problem with the Start Switch. If a Start Switch is not present, contact MEDRAD Service. If one is present, try the following to return the injector to service:

- Check the Start Switch connection at the Display to assure the connector is fully seated. If the connection is loose, remove and reattach the connector.
- Cycle power to the unit to reset the system.
- Disconnect the patient and perform a trial injection using the Start Switch. If the system performs correctly, return the system to use.
- If the error reappears, remove the Start Switch.
- Cycle power. If the error is resolved, order a replacement Start Switch.
- If the error persists, contact MEDRAD Service.

SSH - Start Switch (Head)

Errors with a prefix of SSH typically indicate a problem with the Start Switch. If a Start Switch is not present, contact MEDRAD Service. If one is present, try the following to return the injector to service:

- Check the start switch connection at the Head to assure the connector is fully seated. If the connection is loose, remove and reattach the connector.
- Cycle power to the unit to reset the system.
- Disconnect the patient and perform a trial injection using the Start Switch. If the system performs correctly, return the system to use.
- If the error reappears, remove the Start Switch.
- Cycle power. If the error is resolved, order a replacement

SW - Software Problem

Errors with SW typically indicate a problem with internal software. This may be a condition that must be corrected, or simply an electrical transient that disrupted the system. Try the following:

- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- If the problem continues, contact MEDRAD to reload software.
- If the problem continues, replace the SBC card.
- If the problem continues, replace the Servo/CPU card.

SWMTCH - Software Mismatch

Errors with SWMTCH typically indicate a problem with internal software not matching between the Head and the Display. This may be a condition that must be corrected, or simply an electrical transient that disrupted the system. Try the following:

- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- If the problem continues, contact MEDRAD to reload software.

SWSBC - CPU software

Errors with a prefix SWSBC typically indicate a problem with internal software on the display CPU card. Try the following:

- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- If the problem continues, contact MEDRAD to reload software.
- If the problem continues, replace the SBC card.

SWSER - Servo software

Errors with a prefix SWSER typically indicate a problem with internal software on the Head CPU card. Try the following:

- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- If the problem continues, contact MEDRAD to reload software.
- If the problem continues, replace the Servo/CPU card.

SYR SENA - Size Sensor A

Errors with a prefix of SSSA indicate a problem with the size sensor on A side or the associated circuitry.

- Ensure no syringes are on during self test.
- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure the connector between the Syringe Size Sensing Module and the Head Interface Card is fully seated.
- Replace the Size Sensing Assembly.
- Replace the Interface Card.

SYR SENB - Size Sensor B (Dual only)

Errors with a prefix of SSSB indicate a problem with the size sensor on B side or the associated circuitry.

- Ensure no syringes are on during self test.
- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure the connector between the Syringe Size Sensing Module and the Head Interface Card is fully seated.
- Replace the Size Sensing Assembly.
- Replace the Interface Card.

TCHSCR - Touch Screen

Errors with a prefix of TCHSCR indicate a problem with the touch screen or the associated circuitry.

- Ensure that nothing is pressing the touch screen during self test.
- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Recalibrate the Touch Screen
- Insure ribbon cable for the Touch Screen to the SBC is fully connected.
- Replace the Touch screen.
- Replace the SBC card.

UOM - Unintended opposite motion

Errors with the prefix UOM indicate that a software routing running the DSP did not report in the allowed time.

- Remove and re-apply power to the unit. This triggers a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Replace the Servo/CPU card.

VOL - Over Volume Injection

Errors with a prefix of VOL indicate that the system has detected an over volume condition.

- Ensure potentiometers are fully seated into gears.
- Replace potentiometer of the side with the problem.
- Replace the motor of the side with the problem.
- Replace the Servo/CPU card.

4 - Theory of Operation

The Stellant system consists of 3 basic parts:

- Display Unit
- Base Unit
- Head Unit (Single or Dual)

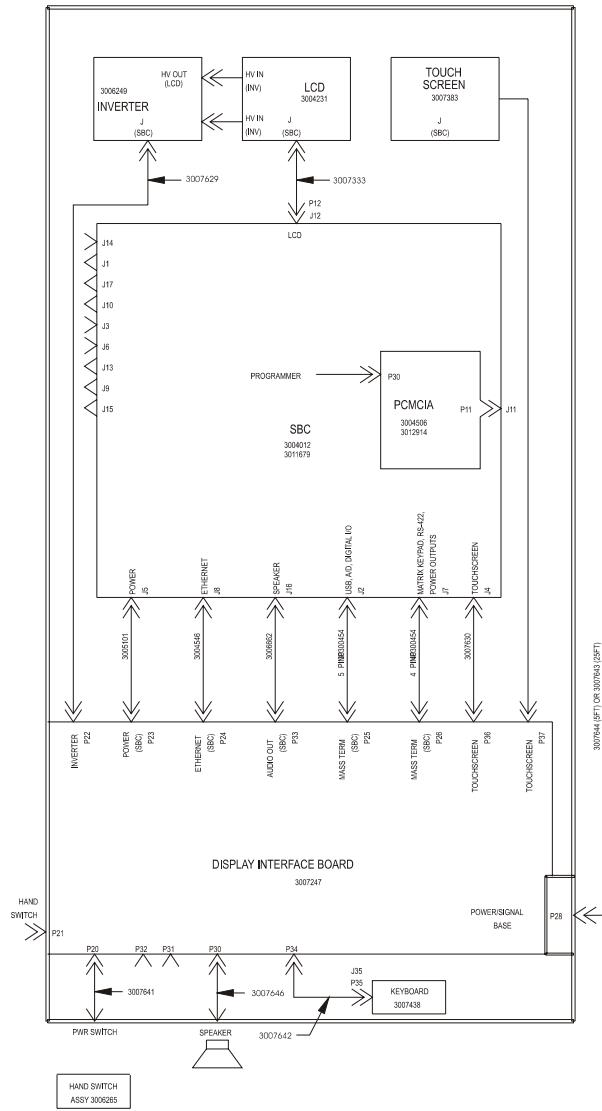
Each component in the system is interconnected with an external cable from the Base Unit, the system center.

In this section, basic circuit block descriptions of each of the sub-systems are explained. A block diagram of each primary component is followed by a functional block description for each of the sub-systems.

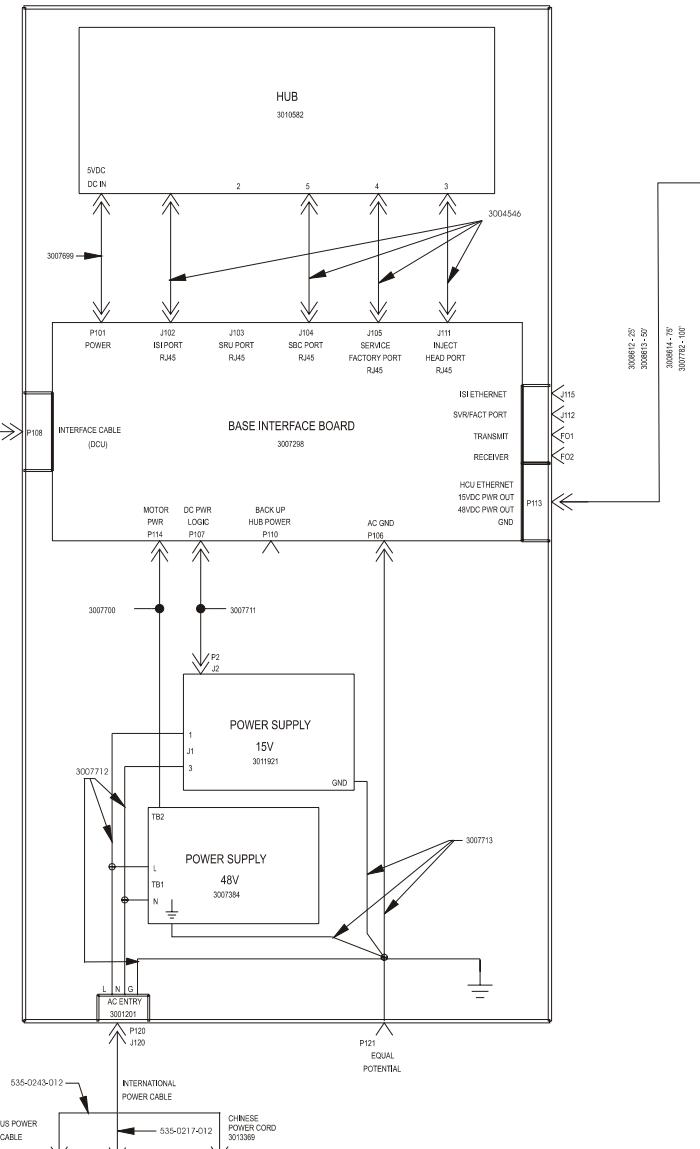
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Single Head Interconnect Drawing

DISPLAY ASSEMBLY (3007032 or 3014227)

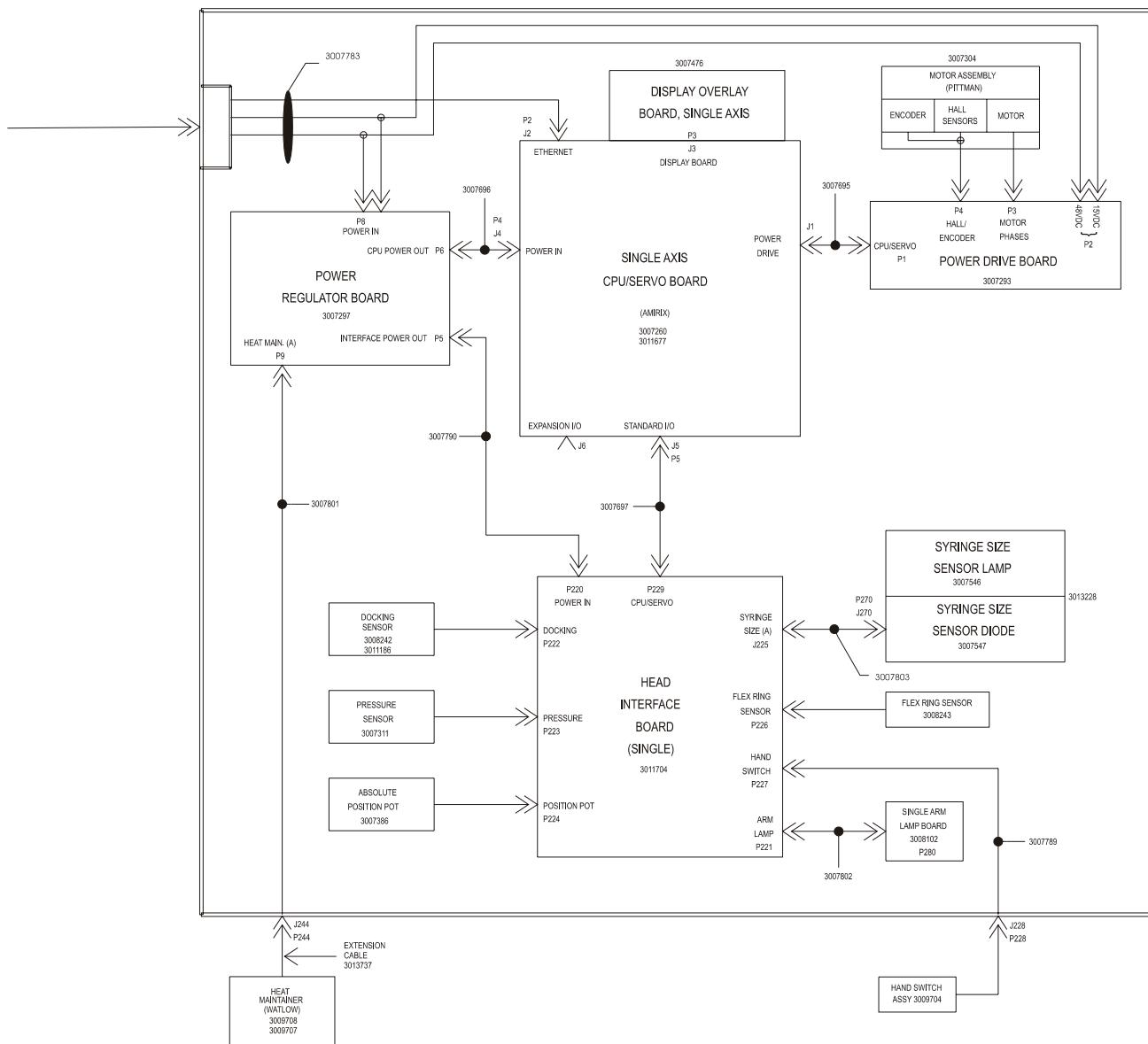


BASE ASSEMBLY (3007039)



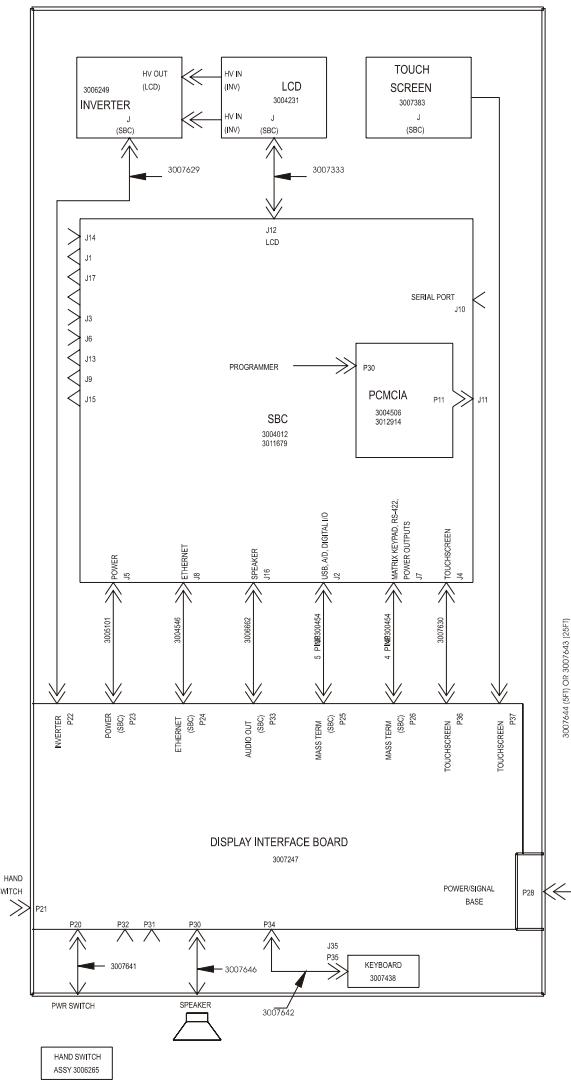
Single Head Interconnect Drawing

SINGLE HEAD ASSEMBLY (3007062, 3007260 or 3014224, 3014225)

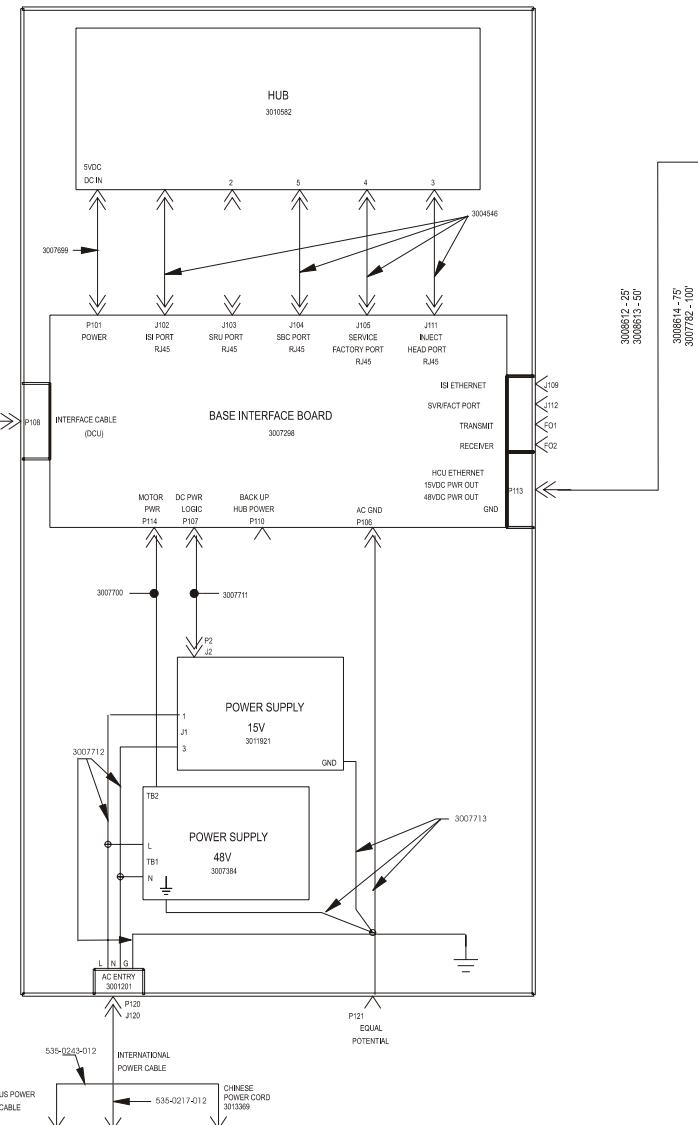


Dual Head Interconnect Drawing

DISPLAY ASSEMBLY (3007032, 3014227)

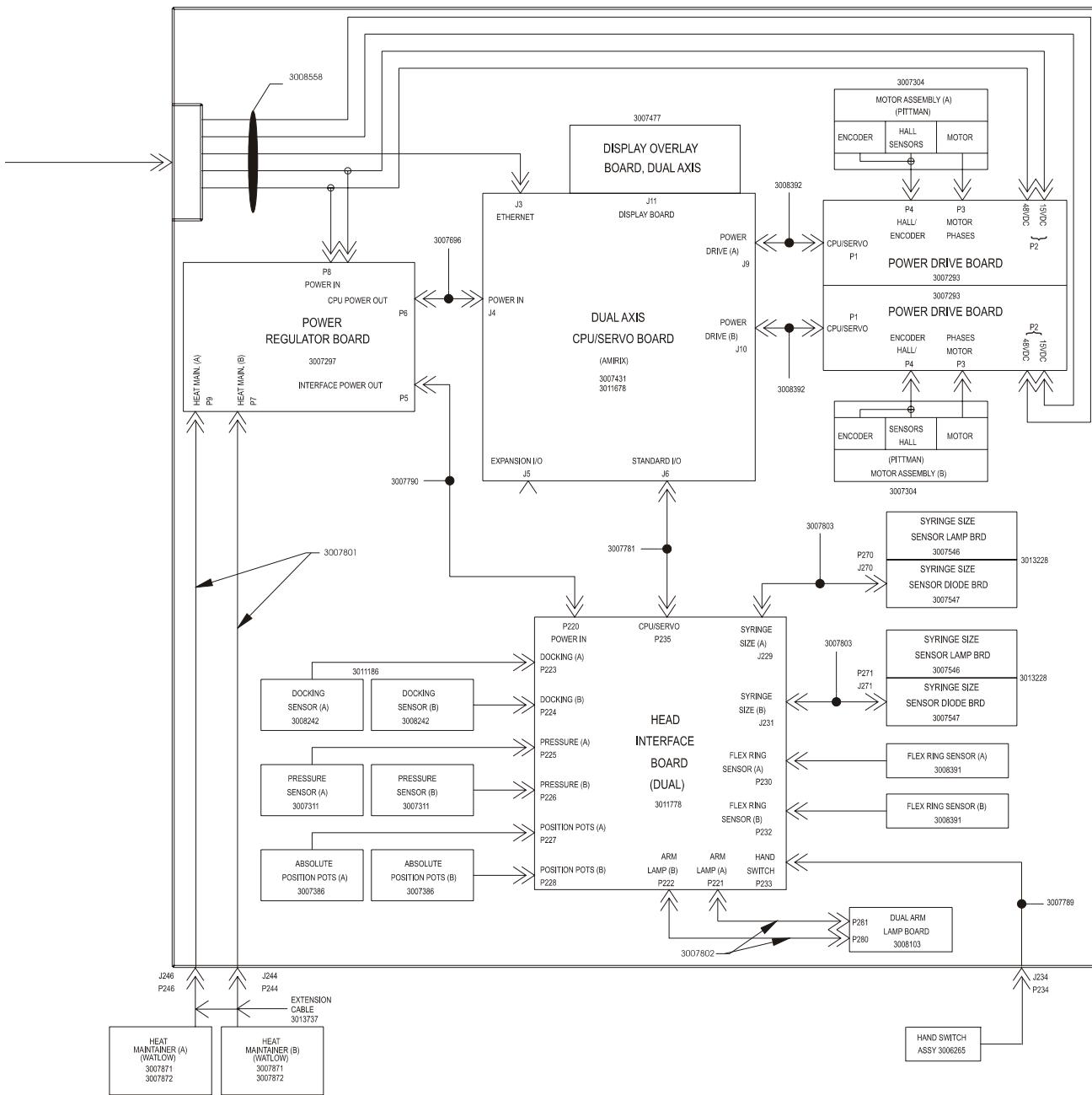


BASE ASSEMBLY (3007039)



Dual Head Interconnect Drawing

DUAL HEAD ASSEMBLY (3007033, 3014226)



Display Unit

The Display interface board is the primary PCB in the Display enclosure. Support circuits are placed on this PCB including the physical support for the SBC. All connectors and switches, such as the start switch and interface cable from the Base are terminated at the Display interface card.

Display - Block Diagram Description**Brightness Control**

Two buttons. One button sends a voltage to the up count of an up-down counter, increasing the count to increase the amount of voltage sent to the inverter card; the other button causes the counter to count down, decreasing the voltage sent to the inverter card. This inverter card output is also sent to the SBC card for monitoring.

CCFT Inverter

The brightness on the LCD is developed by the use of two CCFT (Cold Cathode Filament Tube). The CCFT inverter supplies a regulated, adjustable AC potential across the CCFT to start and maintain fluorescence. The brightness control input of 0-3 VDC is inversely proportional to the intensity of light emitted by the CCFT.

+12VDC Regulator

The +15 VDC power supply feeds power to a regulator providing a +12 VDC power level to the CCFT inverter board required to light the CCFT on the LCD panel and supplies power to the audio amplifier.

+5VDC Regulator

The +15 VDC power supply feeds power to a regulator providing a +5 VDC power level to most logic circuits.

+3.3VDC Regulator

The +15 VDC power supply feeds power to a regulator providing a +3.3 VDC power level to most logic circuits.

+12VDC Audio Regulator

The +15 VDC power supply feeds power to a regulator providing a +12 VDC power level to the CCFT inverter board required to light the CCFT on the LCD panel and supplies power to the speaker amplifier.

Single Board Computer (SBC)

The SBC is the master controller for system functions and system communications.

- Ethernet interface: 10Base T
- PCMCIA Interface*
- Power Management
- LCD Panel Interface

Speaker Amplifier

The amplifier is driven by an audio signal provided by the SBC card the signal is amplified and sent to the speaker located on the rear cover. Volume and pitch are controlled by the SBC card.

PCMCIA Card

This card contains the Real Time Clock for the system, 32 Kbytes of Non-Volatile (NV) ram and 256 Kbytes of Boot Flash.

Start Switch

The start switch signals are buffered by the Display interface card and sent to the SBC card. The signals are fed through a set of normally open and normally closed contacts along with Start Switch Present line.

Arm light drive for Start Switch

The start switch contains an LED driven from a drive circuit on the Display Interface card from the SBC.

Touch Screen

The touch screen is an analog output device that is run directly from the SBC card.

LCD

The primary visual interface to the operator is a 640 x 480 Color Liquid Crystal Display (LCD) panel with a physical dimension of 10.4" diagonally. This is driven directly from the SBC card.

On/Off Switch

The on/off switch provides the means to power down the system. The +15 VDC main power is switched through a single pole, single throw lighted switch. The light is run off +5VDC

DCU Copilot

This signal enables and disables the +5VDC regulator on the Base Interface Card.

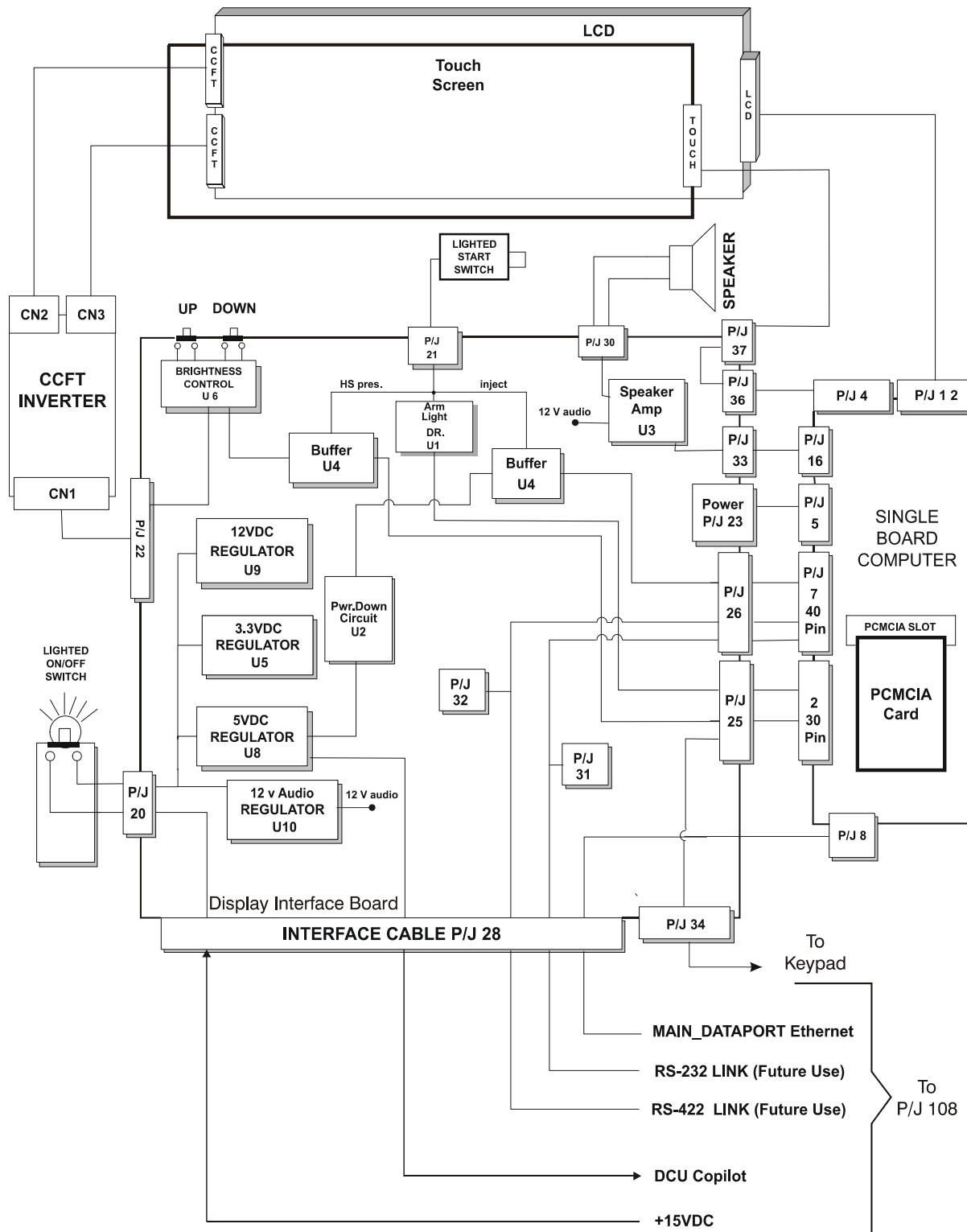
Power Down Indicator

This circuit provides an early warning to the processor when the +15VDC supply rail decays to +12VDC.

*Depending on system configuration, this may not be present.

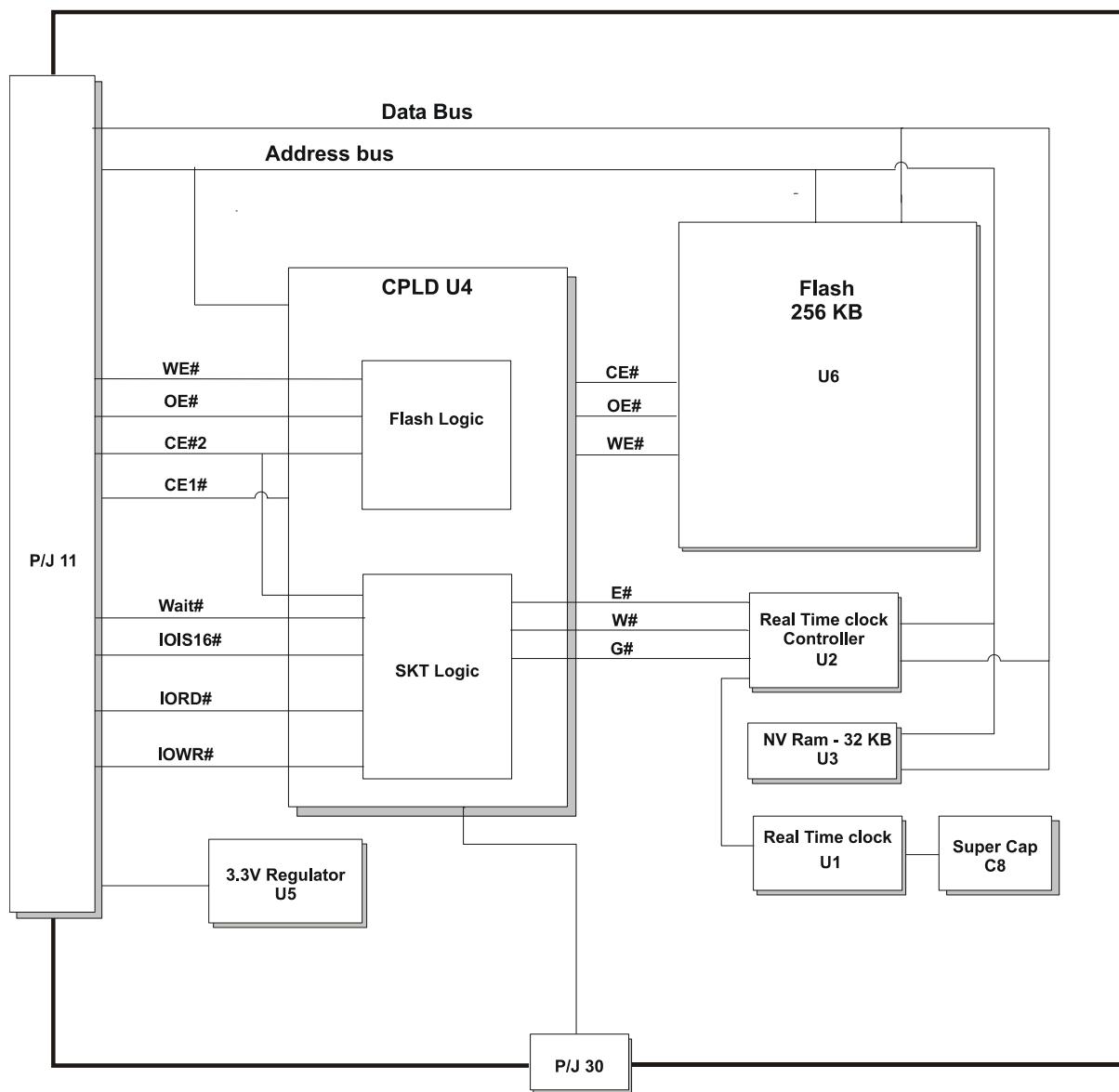
Display Top Block Diagram

DCU TOP BLOCK DIAGRAM



PCMCIA Block Diagram

PCMCIA CARD



Base Unit - Block Diagram Description

This unit supplies and controls DC power for the system. It is a communication interface between the Head and the Display and any external communication inputs.

Ethernet Hub

The Ethernet hub is the connection point for all Ethernet communications. The network is arranged in a star topology with each segment (SBC, FO communications, Service Port, and an external interface) connecting to a port on the hub. Packets received on one port are copied to all other ports, allowing all ports on the network to see all packets. The hub is powered by the 5 volts from the Base interface cards.

Power Sense

The Power sense circuit watches a dedicated digital line (DCU Co pilot) between the Display and Base for an indication that the Display unit has been turned on. The circuit then energizes the 5 VDC power to the Base circuitry and HUB.

48 V Switch Circuitry

From the power supply, 48 volts is fed onto the base interface card. On the base interface card it is filtered and monitored so that it does not fluctuate from 48 volts. If the 48V drops to 42V for more than 2 seconds, the monitoring circuits disable the switching circuit to shut off the 48 volts feeding the head. Normal operation of the 48V switch circuit is controlled by the power sense line via the 5 volt VCC. Without 5 volts VCC, the 48 volts will not be switched to the head.

Three Phase Motor Function Operation

To understand how the Drive Card works, one must have a good understanding of how the entire servo system works, which includes the Servo/CPU Card, the Base Interface card and the BLDC (Stepper) motor. One must also understand BLDC motor principles and commutation techniques. This is a basic explanation on how motor stator excitation is performed, so as to produce rotary motion.

COMMUTATION TABLE CW ROTATION		
POWER AMPLIFIER OUTPUT		
ØA	ØB	ØC
L	H	X
L	X	H
X	L	H
H	L	X
H	X	L
X	H	L

LEGEND:

L - Low Side H - High Side X - OFF

The commutation table shown above shows the switching order that the power amplifier FETs must follow in order to cause clockwise motor shaft movement. The first 60° of rotation is accomplished by setting ABH and AAL high while holding all other signal low. Current is sourced from Phase B of the bridge, and sunk through Phase A as shown in Figure 1.

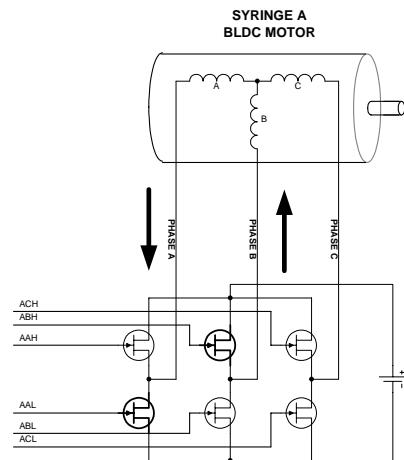


Figure 1

The next 60° of rotation is caused when ABH is shut off, AAL is left on, and ACH is switched on. Current sinking will still occur through the Phase A motor winding, however, current will now be sourced through Phase C as shown in Figure 2.

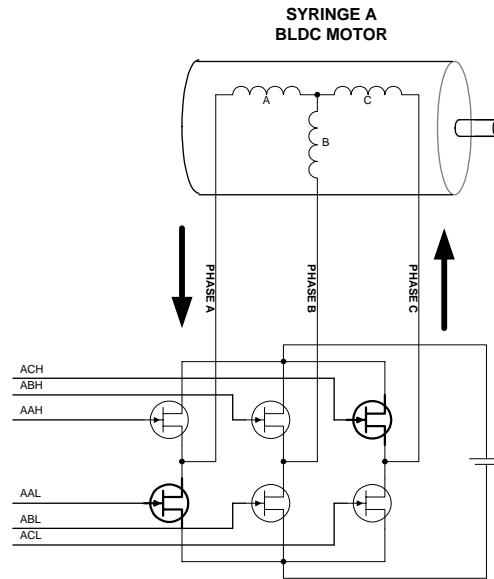


Figure 2

Once complete, then AAL is switched to the off state, and ABL is switched on, while ACH is kept on. The current sinking path is now transferred to Phase B. By following the commutation table, one can see that for a 360° cycle, each switching device is held on for 120° thus allowing current to flow through that particular phase for 120° . Figure 3 is a graphical display of the current flow through the motor windings for the given example.

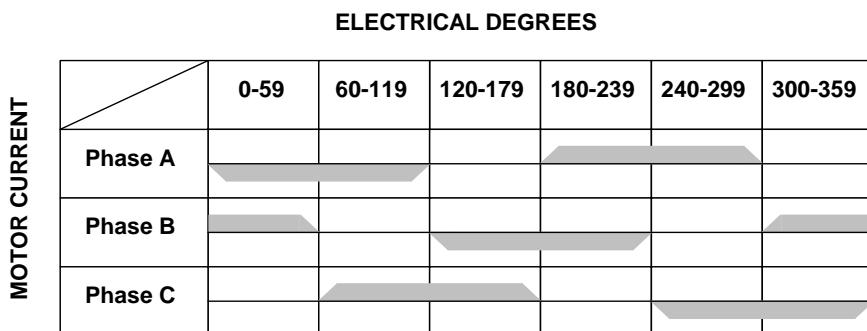
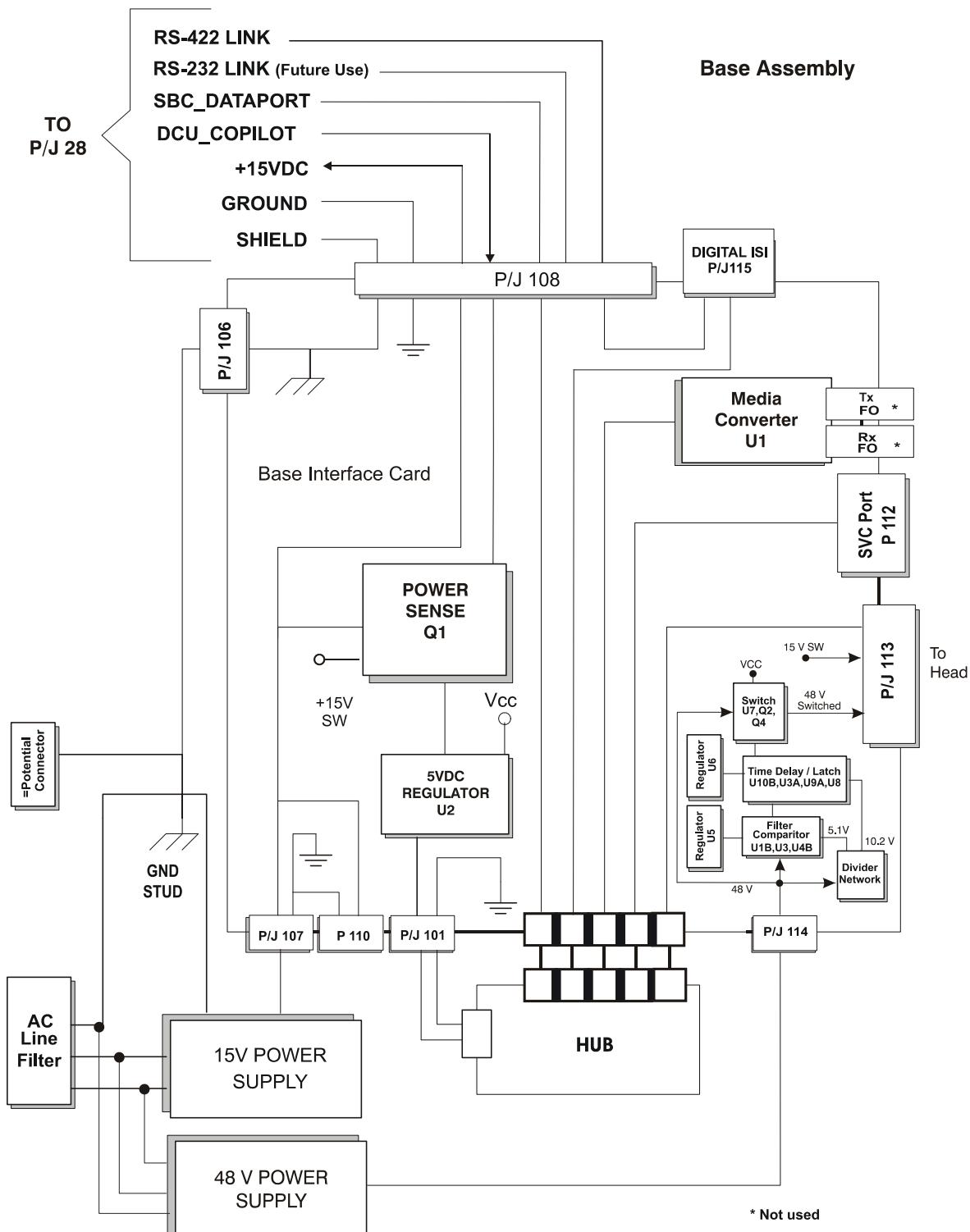


Figure 3

Base Unit Block Diagram



**Single Head Block
Diagram Description**

The head consists of 6 separate cards and the mechanical drive. The cards are:

- Power Regular card
- Servo/CPU card
- Head interface card
- Power Drive card (2 needed for a dual head)
- LED Card
- Syringe size sensing assembly (Two needed for Dual)

Power card

The power card is to regulate power from the base unit and distribute it to the other cards.

Block diagram Descriptions**Heat Maintainers**

The heat maintainer runs on the 48 V supplied from the base units.

5V DC Regulator

This circuit uses a 5V DC switching regulator to produce a +5V supply for the head circuitry. This voltage is derived from the +15V DC from the base.

Servo/CPU Card

The CPU/Servo card contains a microprocessor that performs the following functions in the head:

- Card power management
- Data management I/O - two ports
- Footswitch control
- Network communications in conjunction with the Tower
- Motor Drive control
- JTAG - programming port - not used.

Head Interface Card

The Head card is the electrical interconnect point between the internal electronics of the head to the Servo CPU card.

Block Diagram Descriptions**POT_REF Regulator**

This circuit uses a +4.096 VDC reference to produce the +4.096V at the 0.05 Amps reference voltage for the potentiometers. This voltage is derived from +5 VDC.

Potentiometer Buffers

The Pot signals are routed to the Servo/CPU. This signal is buffered and filtered on the Head interface card before being routed to the Servo/CPU.

Pressure V+ Loopback

This signal monitors a reference voltage from the top of the pressure bridge. The reference is an output from the pressure sensor and is buffered before being sent to the Servo/CPU card where it is monitored as a critical voltage.

Pressure Buffered

The signal from the pressure sensor is sent to the Servo/CPU card. It is buffered and filtered on the Head Interface card.

Pressure A Syringe

This circuit uses a full Wheatstone bridge arrangement to produce a differential signal which corresponds to the force applied to the rear plate due to the pressure in the syringe. This signal is sent to the Servo/CPU card.

Start Switch Interface

Start switch signals are conditioned and routed to the Servo/CPU card through the Head Interface card. The signals pass through a set of normally open and normally closed contacts along with the Hand Switch Present line.

Hand Switch Arm Light Drive

The Hand Switch Arm Light drive signal comes from the Servo/CPU card to a driver on the Head Interface card.

LED Board

LEDs on the board are driven by the A driver on the Head Interface card.

Potentiometer A

The Pot provides an analog signal from 0 to 4.096 VDC indicating the absolute position of the piston during power up. It also serves as a backup to the syringe encoder during a move. This signal is buffered and filtered in the Head Interface card and passed to the Servo/PCPU card.

Flex Ring Sensor

The Flex Ring system is an electro/mechanical design this is used by the Stellant Dual and Single Syringe injector to determine if a syringe or adapter has been inserted or removed from the injector assembly.

Autodocking Sensor

The Autodocking sensor consists of a spring energized mechanical pin whie, when depressed, interrupts an optical path, thereby closing a transistor switch. The sensor is used to determine when the piston has encountered the rear of the syringe, known as the plunger.

Speaker Drive - Head

The speaker on the head is a piezo device (buzzer) that is driven by an external oscillator residing on the Head Interface board. A resistor controls the oscillator frequency.

Syringe Size Sensing (SSS)

The SSS Module consists of 2 PCBs containing an LED and an array of photodiodes, as well as various alignment/focus mechanical components. The LED illuminates the Syringe whie, through a series of grooves, disperses the light in a characteristic pattern unique for a particular syringe, or Pre-filled Adapter.

Power Drive Card -
Block Diagram
Description

SYRINGE A PWM ISOLATION

This block provides electrical isolation of the Pulse Width Modulation (PWM) switching signals for Syringe A. These signals are generated on the Servo/CPU Card via DSP A and are used to command and control the power amplifier current delivery to the motor.

SYRINGE A DRIVER

The Syringe Driver stage performs voltage translation and current capacity enhancement to the PWM signals for the Syringe motor. Once the PWM signals have passed through the isolation barriers, they are routed to the Driver circuits. It is the responsibility of the Driver to translate the 0-5V PWM signals to 0-12V on the low channels, and 0-12V plus boost voltage on the high side. The Driver has the capacity of sinking and sourcing high switching currents normally associated with power FETs. The Drive Inhibit signal disables the Driver output signals. When Drive Inhibit is active high, the outputs are disabled. When low, the outputs are enabled. The Driver has built-in shoot-through protection to inhibit high side and low side outputs from being turned on simultaneously.

SYRINGE A POWER AMPLIFIER

The Syringe Power Amplifier is configured in a 3-phase bridge arrangement comprising 6 N-Channel Enhancement mode power FETs. Each bridge leg is configured in a high-low arrangement with a motor phase (A,B, or C) tapped at the junction of the upper and lower power FET. The Syringe Power Amplifier converts the low level PWM signals from DSP on the Servo/CPU to high current motor signals that are used for the excitation of the stator windings of the Syringe BLDC motor. The switching rate for the Power Amplifier is approximately 16 KHz.

DRIVE INHIBIT CONTROL

This block provides shutdown control of the Drivers, which in turn disable the Syringe Power Amplifiers. This signal is generated on the Servo/CPU card and is passed through optical isolation circuitry where it is applied to the Shutdown pins of all drivers. When Drive Inhibit is active high, the outputs of all drivers are disabled.

DRIVE INHIBIT STATUS

This block is a feedback to the Servo/CPU card indicating the status of the Drive Inhibit signal. This signal is optically isolated from the drive section of the board.

SYRINGE BRIDGE CURRENT TEST FEEDBACK

This block is responsible for measuring, isolating and filtering each Syringe Power Amplifier bridge node voltage. The rationale is: During bridge testing, these nodes will provide vital voltage information back to the Servo/CPU Card on the status of the bridge and motor windings. By exploiting the resonant frequency of the motor windings series inductance and distributed capacitance, each phase of the bridge can be excited with a single, short duration pulse. These pulses would be long enough to induce current into the motor windings but not long enough to produce motion. By observing the voltage at each node during excitation, the status of both the bridge and motor windings can be ascertained.

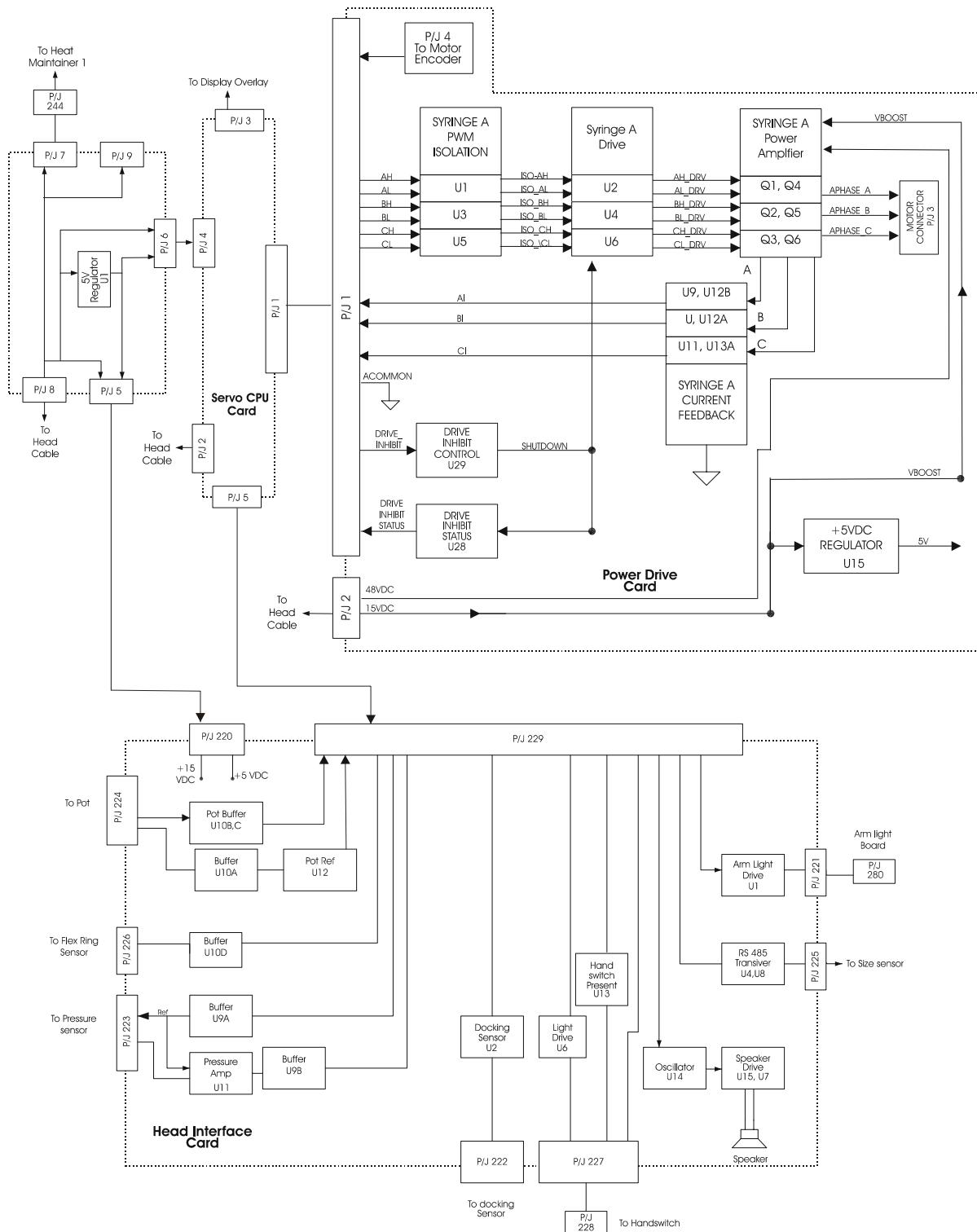
HIGH SIDE BOOST

The HIGH SIDE BOOST block is to generate a floating voltage that is applied to the high-side FET gates at the Driver stage. This voltage (VBOOST) allows the gate voltage of the high side FETs to remain elevated above the source voltage when that particular leg of the bridge is sourcing motor current.

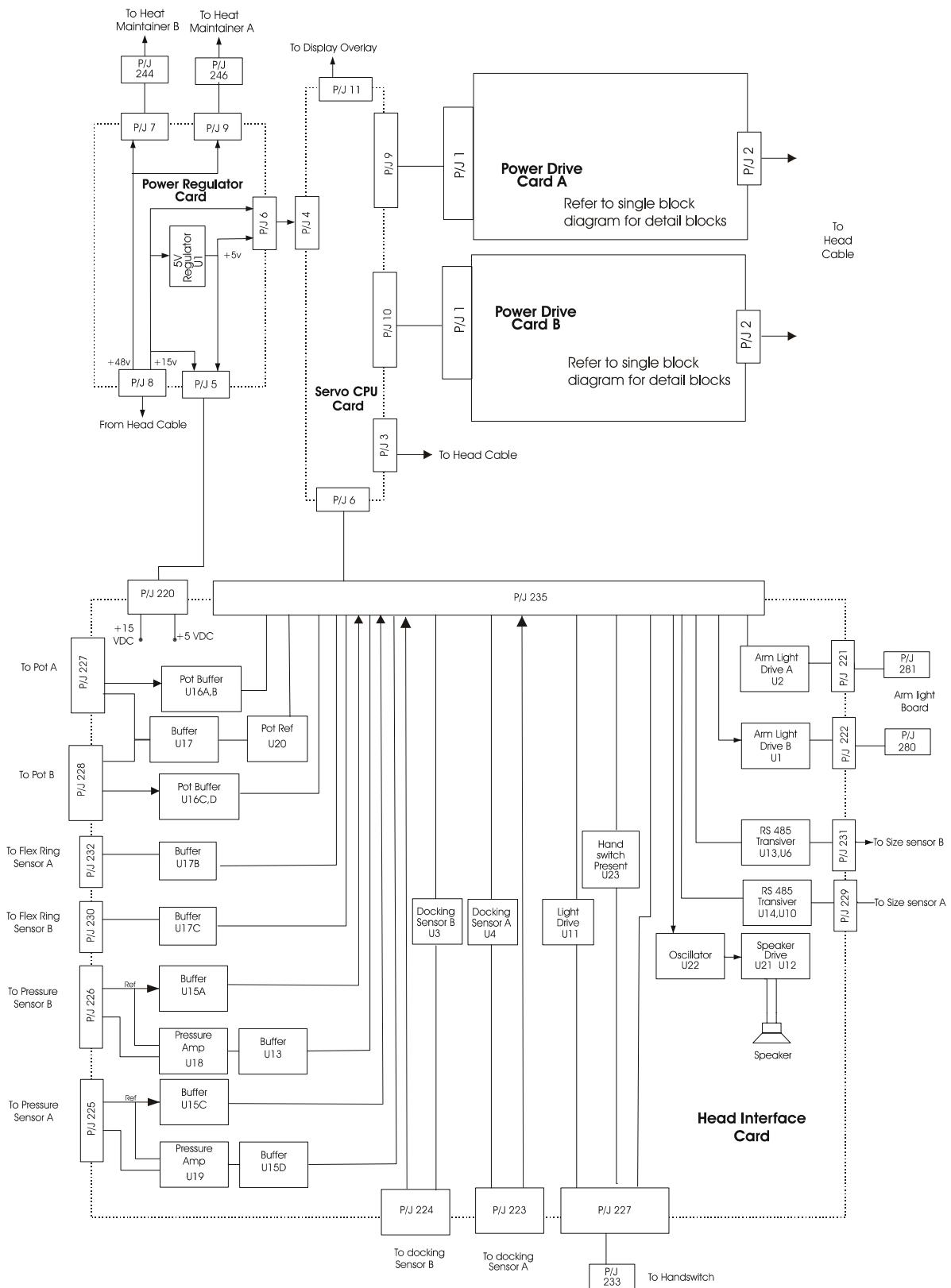
+5VDC REGULATOR

This block provides 5VDC power to the motor side of the following subsystems for both Syringe A and B axes: Bridge Test Current Feedback, PWM Isolation, Drivers.

Single Head Block Diagram



Dual Head Block Diagram



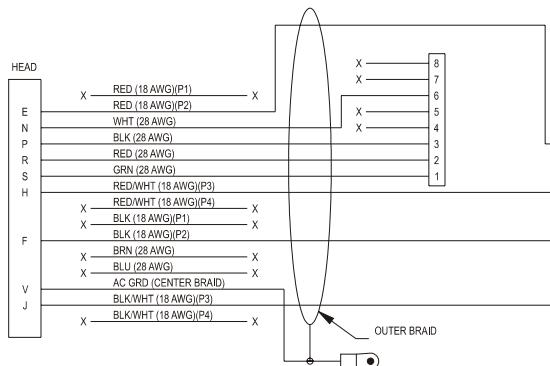
Cable Wiring Pin Out Diagrams

Base to Display Cable

P/N 3007644 3007643		DISPLAY
BASE	1	(28 AWG) YELLOW
	2	(28 AWG) GREEN
	3	(28 AWG) BLUE
	4	(28 AWG) VIOLET
	5	(28 AWG) GRAY
	6	(28 AWG) WHITE
	7	(22 AWG) RED
	8	(22 AWG) ORANGE
	9	(28 AWG) PINK
	10	(28 AWG) TAN
	11	(28 AWG) WHITE/BLUE
	12	(28 AWG) BLUE/WHITE
	13	(28 AWG) WHITE/ORANGE
	14	(28 AWG) ORANGE/WHITE
	15	(28 AWG) WHITE/GREEN
	16	(28 AWG) GREEN/WHITE
	17	(28 AWG) WHITE/BROWN
	18	(28 AWG) BROWN/WHITE
	19	(22 AWG) BLACK
	20	(22 AWG) BROWN
	21	
	22	
	23	
	24	
	25	
	26	

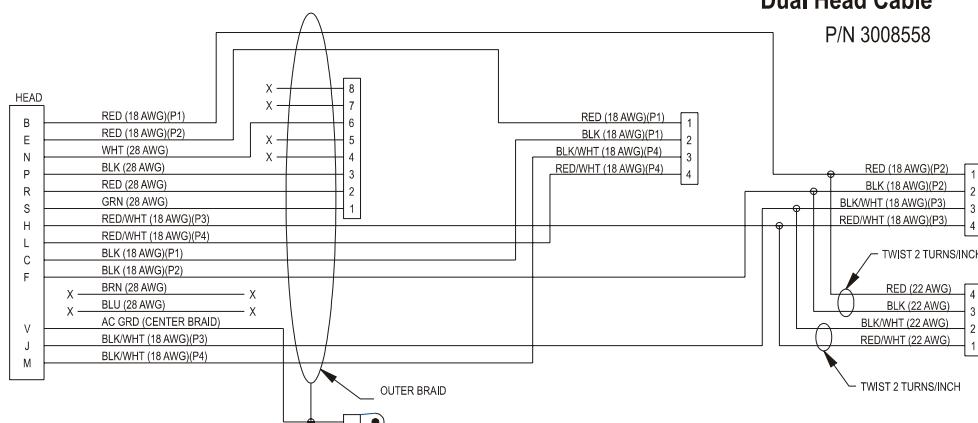
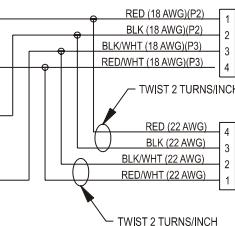
Head Extension Cable

P/N 3008612 3008613 3008614 3007782	
BASE	1 (18 AWG) RED (P1)
	2 (18 AWG) RED (P2)
	3 (28 AWG) WHT
	4 (28 AWG) BLK
	5 (28 AWG) RED
	6 (28 AWG) GREEN
	7 (18 AWG) RED/WHT (P3)
	8 (18 AWG) RED/WHT (P4)
	9 (18 AWG) BLK (P1)
	10 (18 AWG) BLK (P2)
	11 (28 AWG) BROWN
	12 (28 AWG) BLUE
	13 AC GROUND (CENTER BRAID)
	14 (18 AWG) BLK/WHT (P3)
	15 (18 AWG) BLK/WHT (P4)



Single Head Cable

P/N 3007783



Dual Head Cable

P/N 3008558

5 - Disassembly / Assembly & Replacement Parts

When troubleshooting the Stellant Injection System, it may be necessary to order replacement parts for a given assembly. This section contains information regarding individual assemblies of the system. Each primary assembly has a corresponding Parts List and Parts Diagram, specifying components that may require replacement.

When ordering replacement parts, contact Medrad Service, or your authorized Medrad dealer.

Parts Lists and Diagrams are arranged in the following sequence:

Display	5-3	P/N 3007032
Base	5-15	P/N 3007039
Single	5-24	P/N 3007040 or 3007062
Dual	5-46	P/N 3007033 or 3007038
ISI 800	5-117	P/N 3012987
ISI 700	5-119	P/N 3010435
Pedestal	5-121	
Misc.	5-122	

Parts List Components

Each Parts Lists contains the following information:

1. Item Number

This number refers to the labels of all items specified in the parts diagrams.

2. Part Description

This information, useful in part identification, is a brief description of all items specified in the parts diagrams.

3. Part Number

Used specifically for ordering purposes, these numbers are the primary designators of all system components, and should be used when ordering any Medrad replacement parts.

4. Quantity

This number represents the quantity of like pieces that are used in the represented assembly.

NOTE: Replacement of rear plate, pots, single or dual housing, or Servo/CPU PCB will require calibration.

Symbols Guide

The table below is a reference guide for the symbols displayed in the drawings on the following pages.

Cautions & Warnings

WARNING: Hazardous voltages exist within the Stellant Injection System that can shock, burn, or cause death. To avoid injury, the system should be opened and serviced by qualified service personnel only. Disconnect the system from line power before cleaning or attempting to perform any maintenance.



WARNING: Immediately disconnect the patient from the injector if any system malfunction occurs. If a system malfunction message appears, do not attempt to use the system until the source of the condition has been identified and corrected by qualified service personnel. Do not attempt to recreate any fault conditions while the injector is connected to a patient.



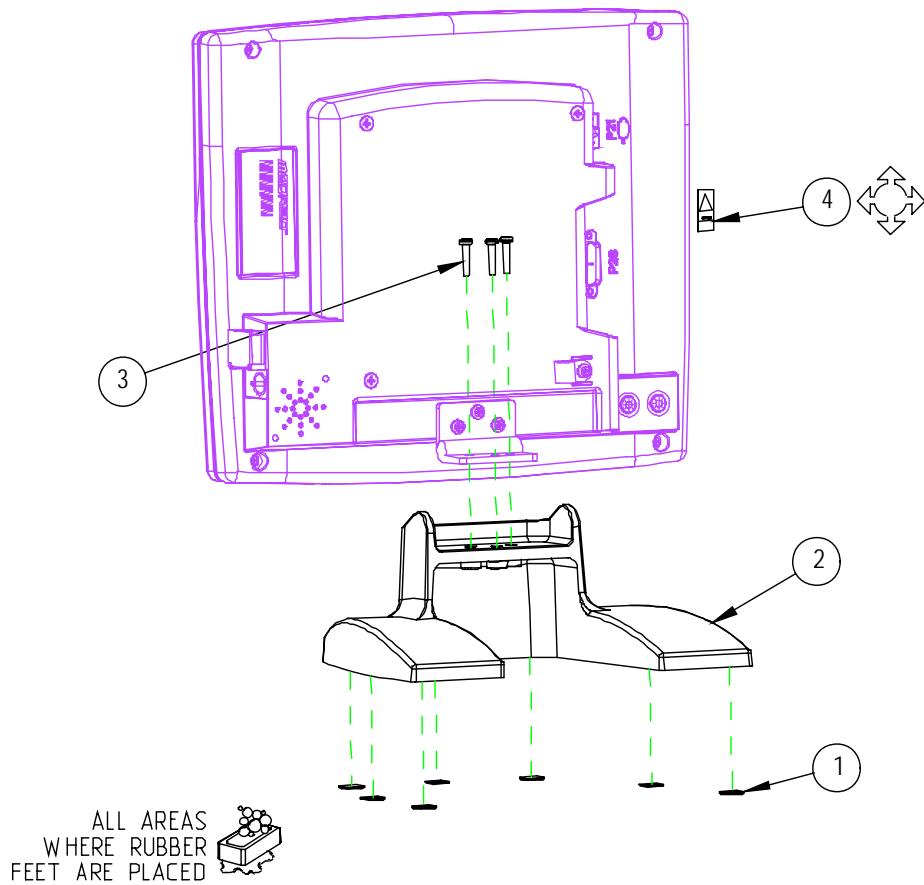
CAUTION: Electrostatic Discharge (ESD). Failure to follow ESD protection practices may result in equipment damage. ESD protection practices must be followed when servicing any component of this system.

Drawings

See the Assembly / Disassembly drawings and Replacement Parts listing below.

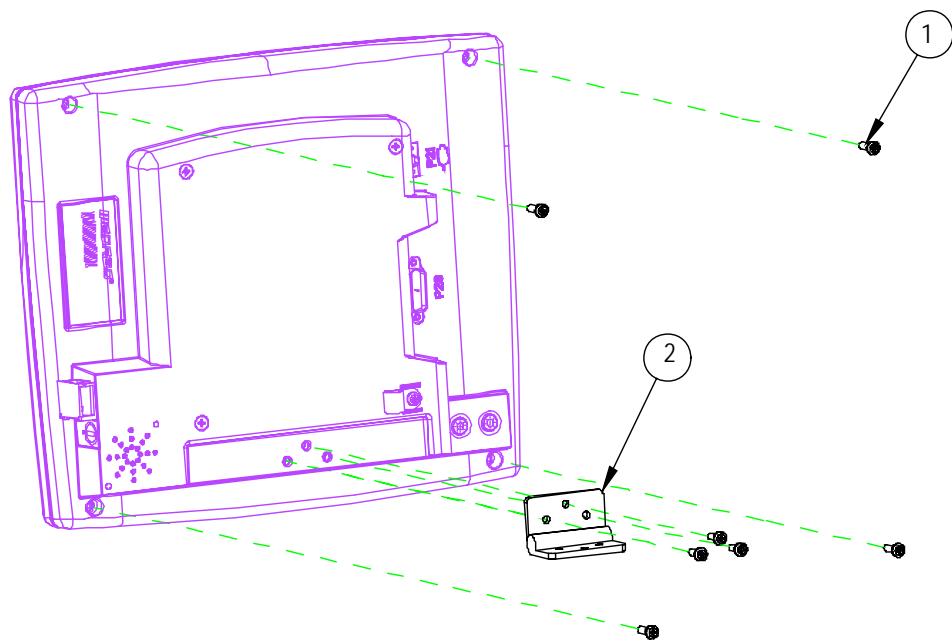
Display

ITEM	PART NUMBER	DESCRIPTION	QTY
1	600-5007-400	Foot	7
2	3007413	Stand Display	1
3		Screw #8 - 32 x 3/4"	3
4	201829	Label, Static Discharge	1

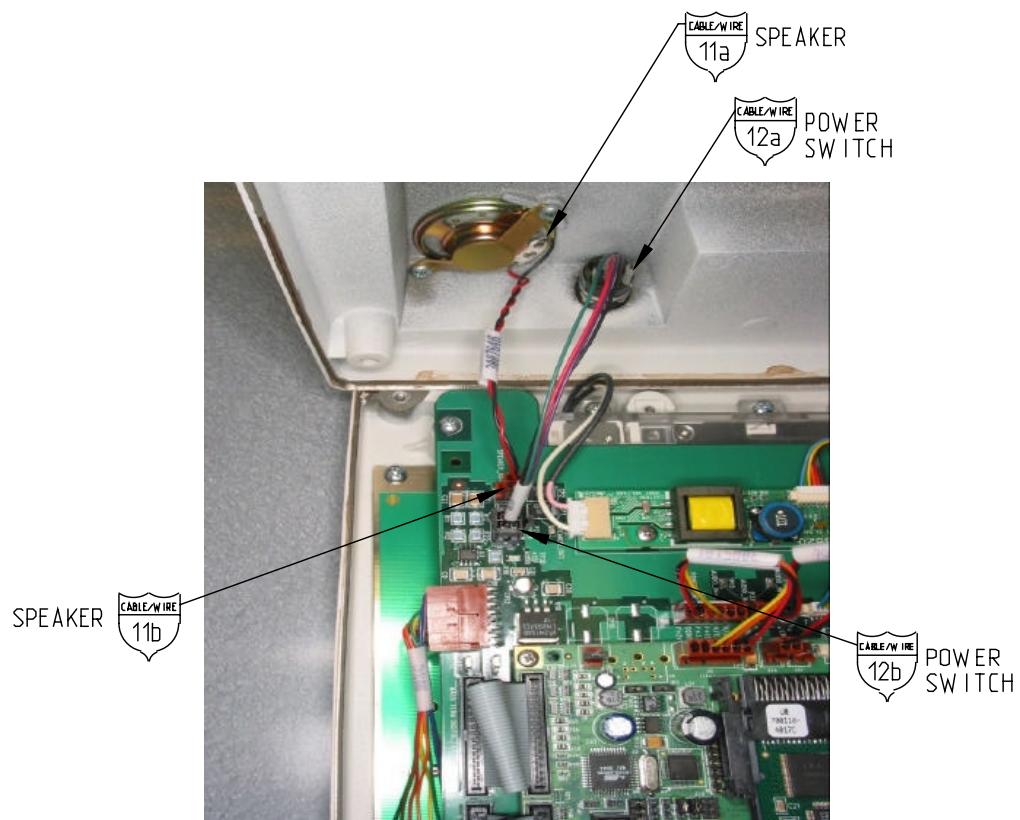


Display

ITEM	PART NUMBER	DESCRIPTION	QTY
1		Screw PH #8 - 32 x 1/2"	7
2	3007412	Hinge	1

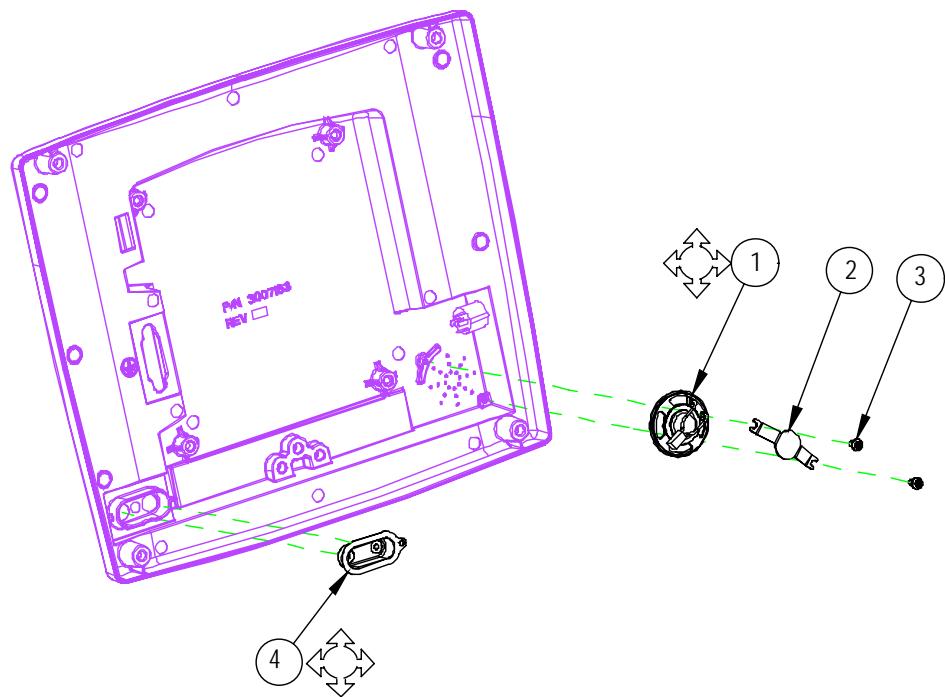


Display



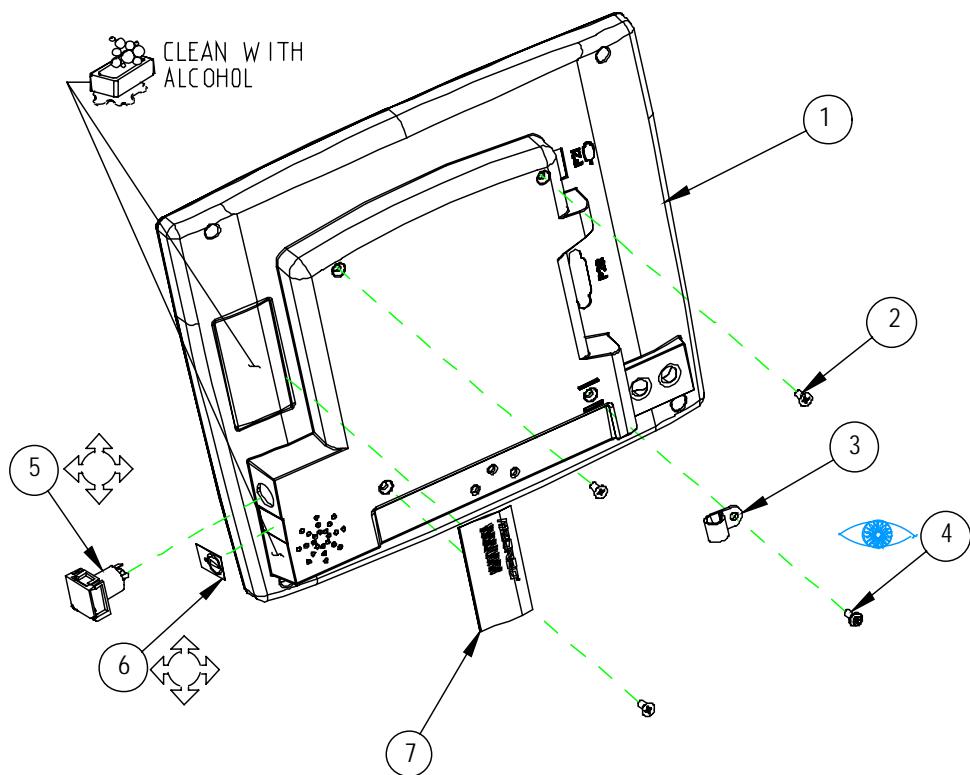
Display

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007646	Speaker	1
2	3008892	Speaker Bracket	1
3		Screw PH #8 - 32 x 1/8"	2
4	3005273	Switch Boot	1



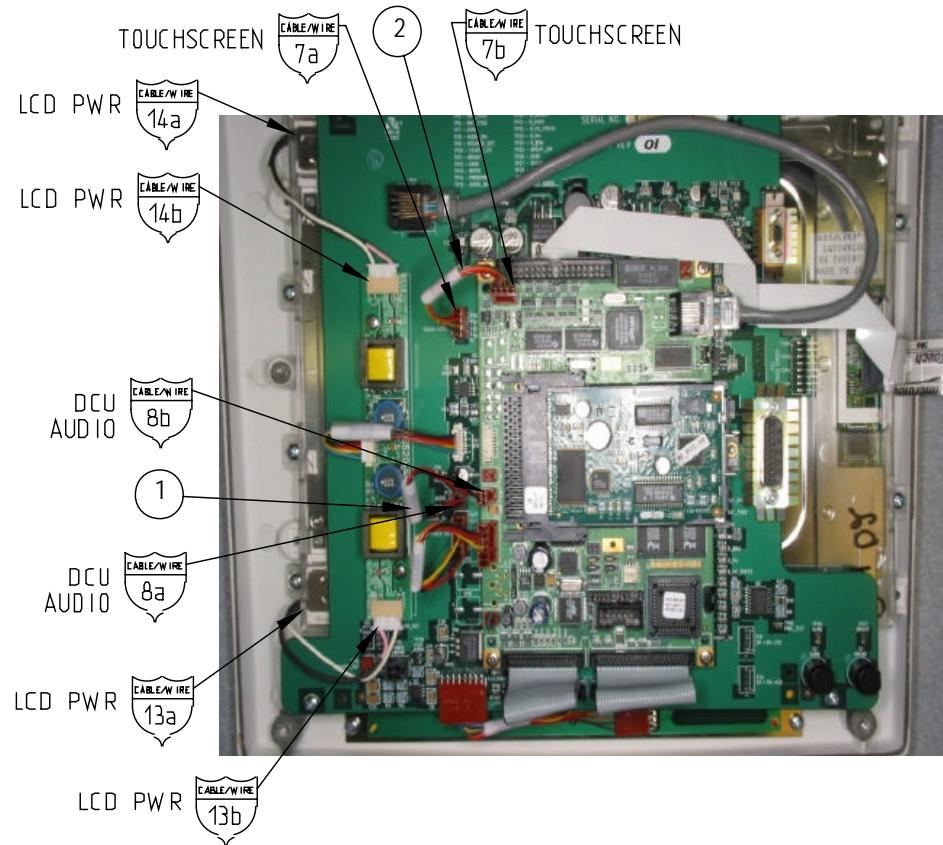
Display

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007163	Enclosure	1
2		Screw PH #8 - 32 x 3/8"	3
3	3008313	Clamp	1
4		Screw PH #8 - 32 x 3/8"	1
5	3007641	PWR Switch	1
6	201459	Label	1
7		Label S/N	1



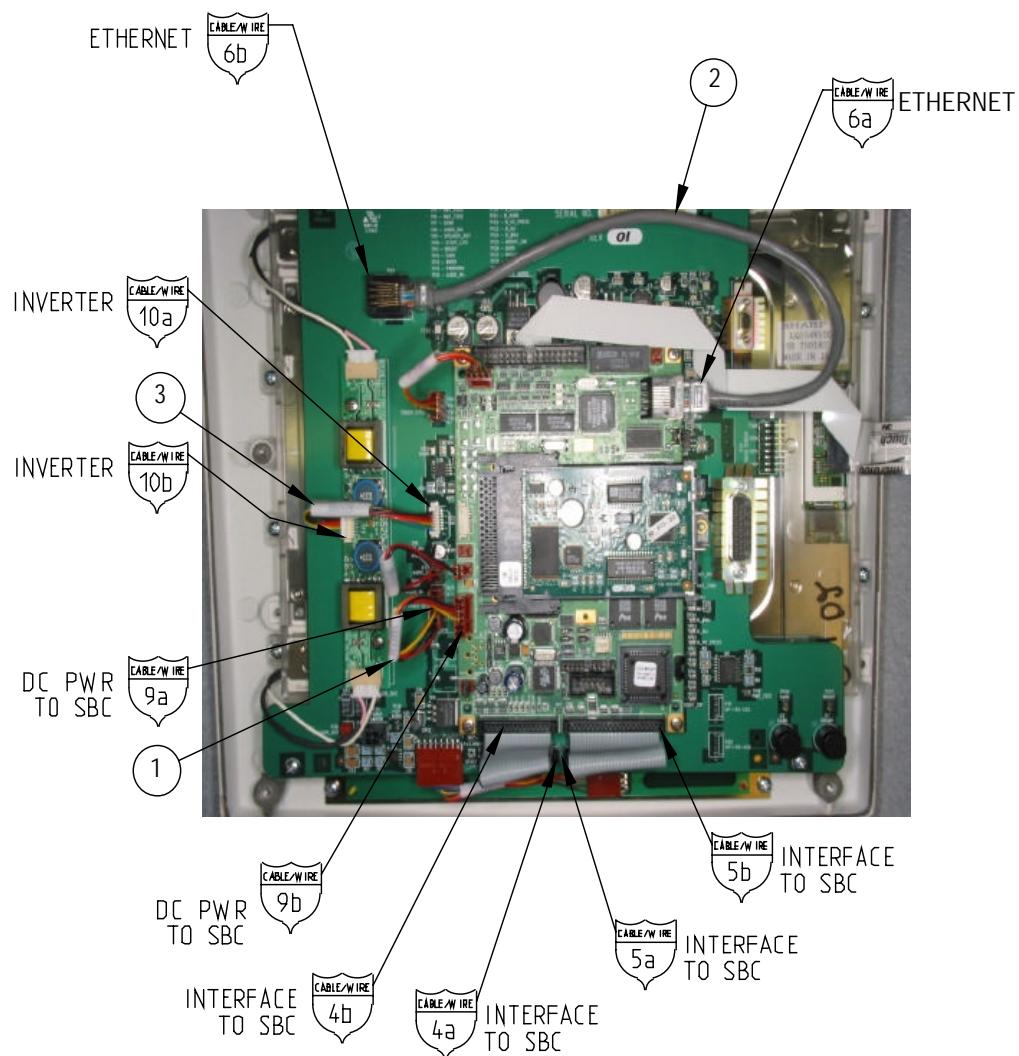
Display

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3006662	DCU Audio Cable	1
2	3007630	Touchscreen cable	1



Display

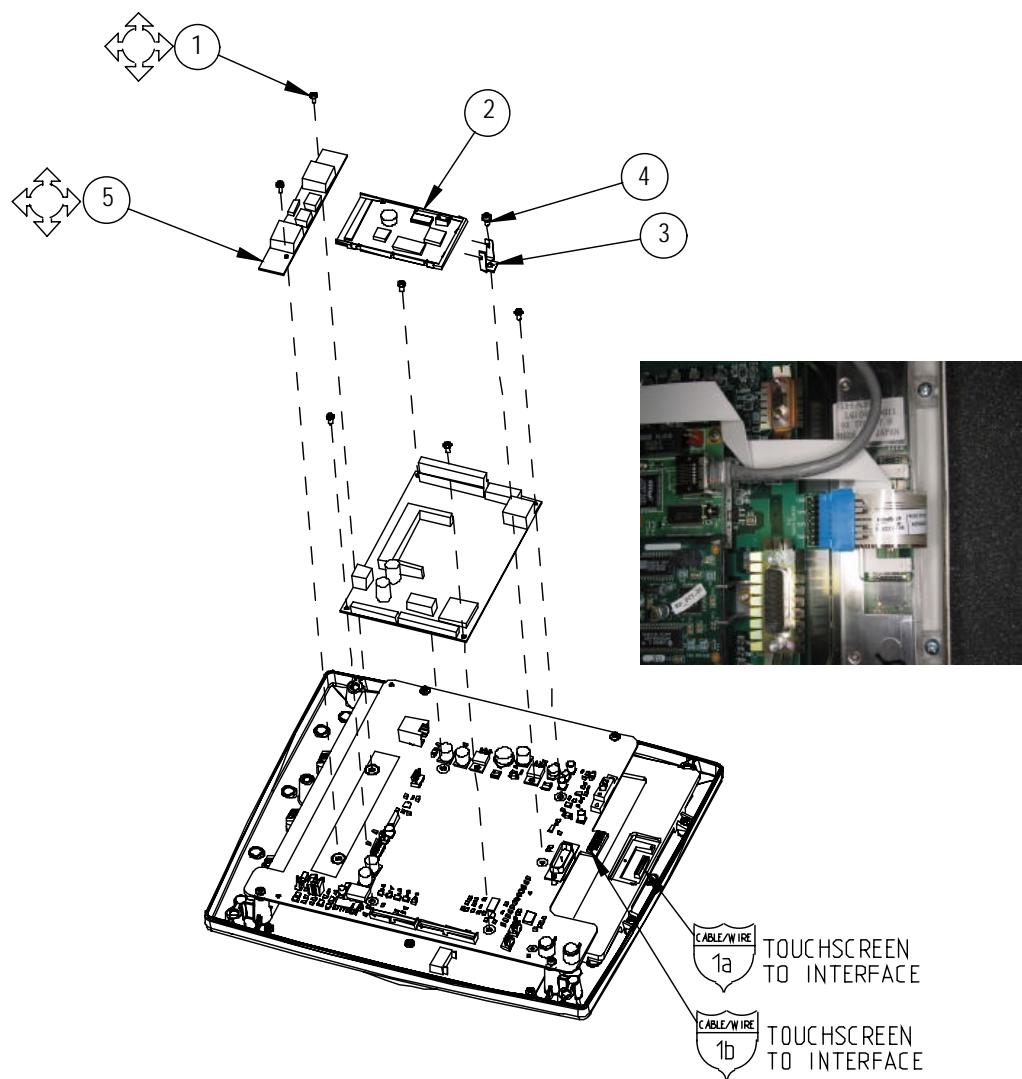
ITEM	PART NUMBER	DESCRIPTION	QTY
1	3005101	Cable DC PWR to SBC	1
2	3004546	Cable Ethernet	1
3	3007629	Inverter Cable	1



Display

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007163	Screw PH #4 - 40 x 3/8"	6
2	3012914	PCB PCMCIA*	1
3	3006351	Retainer Bracket	1
4		Screw PH #4 - 40 x 3/8"	1
5	3006249	Inverter	1

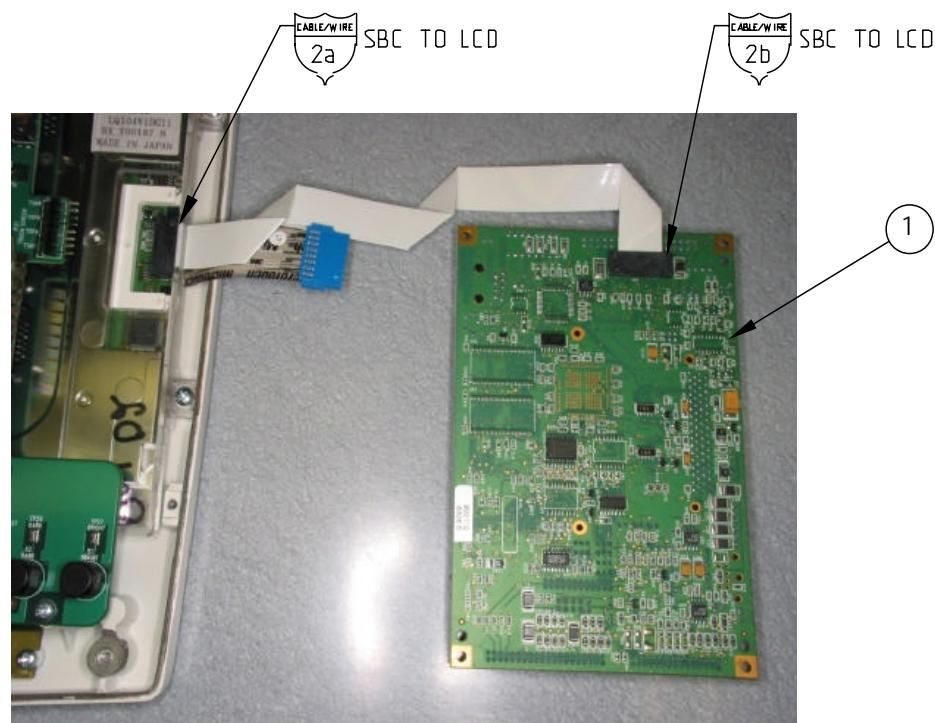
*Not required if SBC cord is P/N 3011679



Display

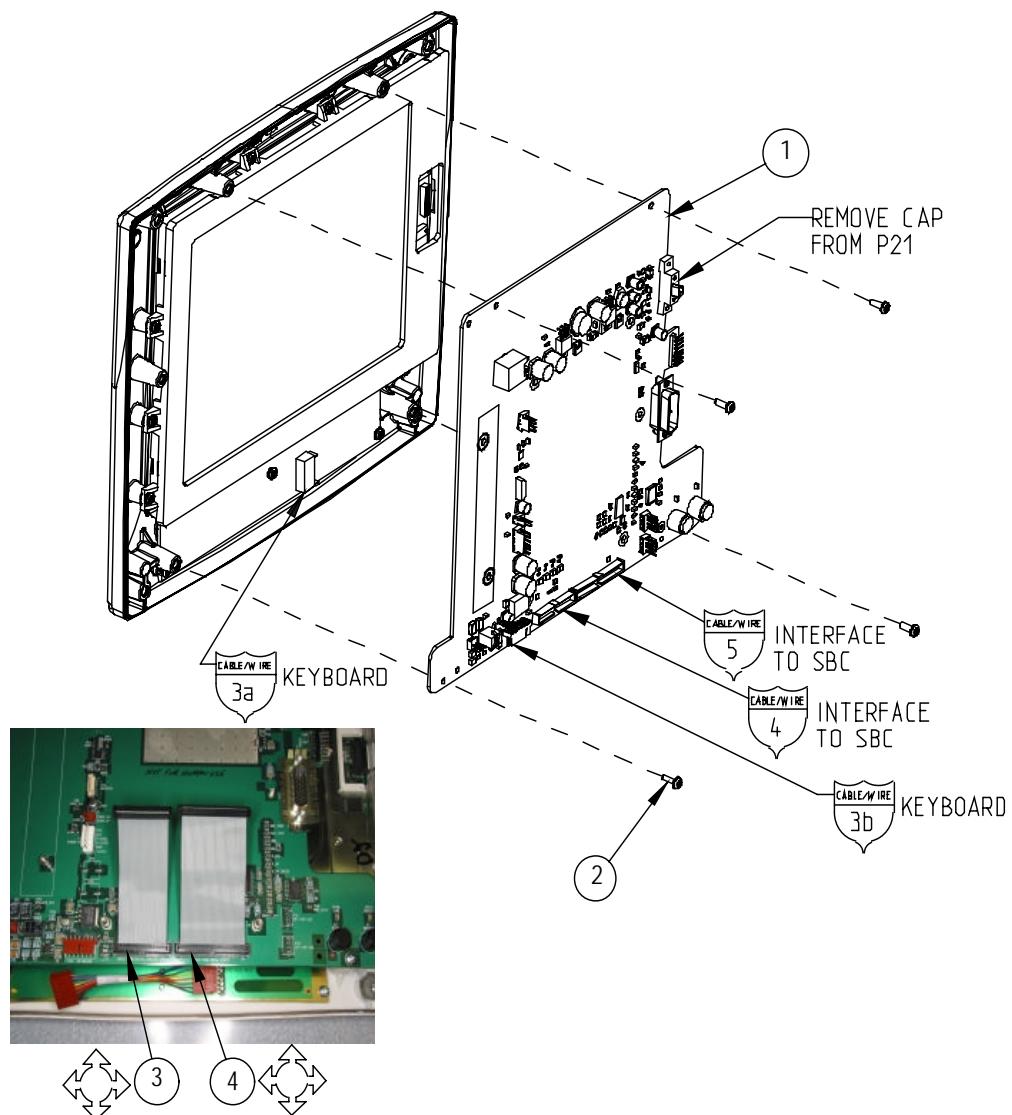
ITEM	PART NUMBER	DESCRIPTION	QTY
1	3004212	Single Board Comp Strong Arm*	1
1	3011679	Single Board Comp Super H*	1

*Order same card cumer as removed.



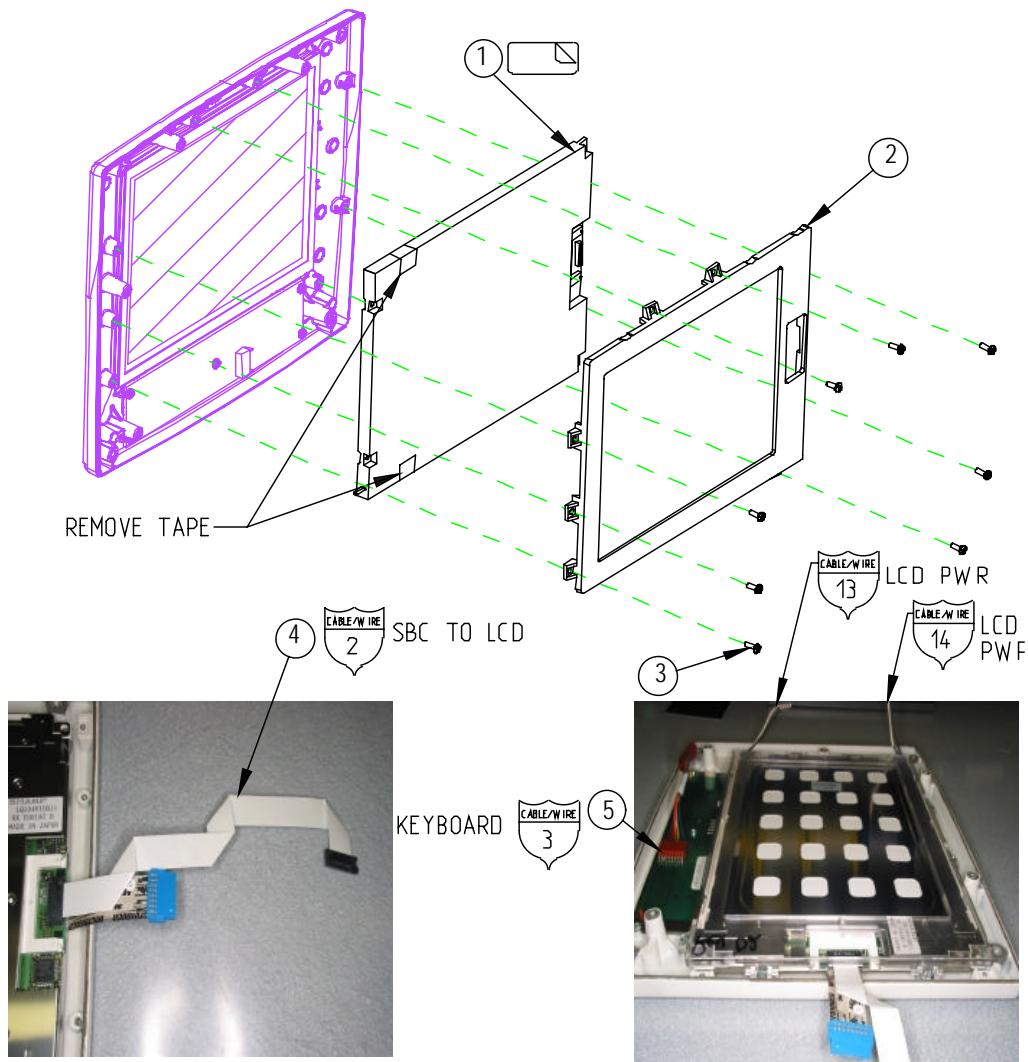
Display

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007247	PCB Interface	1
2		Screw PH #6 - 32 x 1/4"	4
3	3004545	30 Pin RBN Cable	1
4	3004544	40 Pin RBN Cable	1



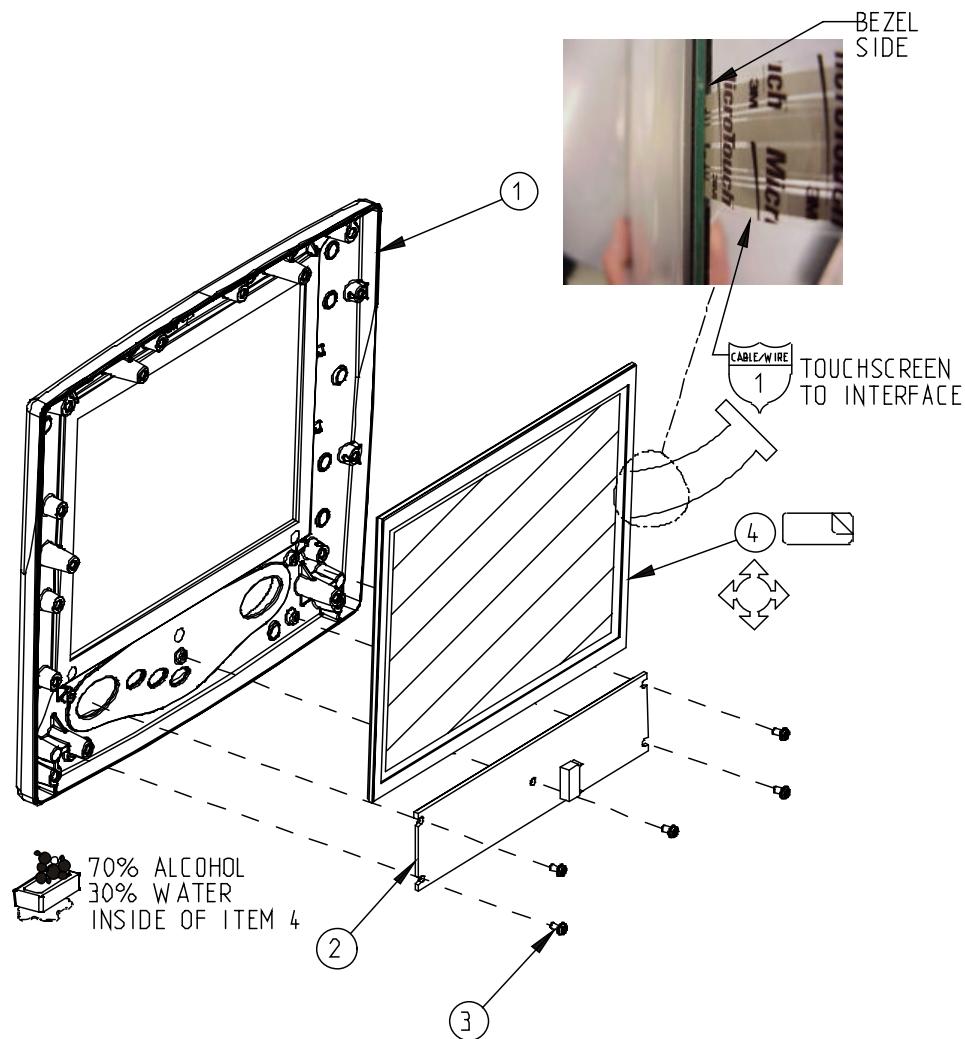
Display

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3004231	LCD Display	1
2	3007411	LCD Bracket	1
3		Screw PH #6 - 32 x 1/4"	8
4	3007333	Cable SBC To LCD	1
5	3007642	Keyboard Cable	1



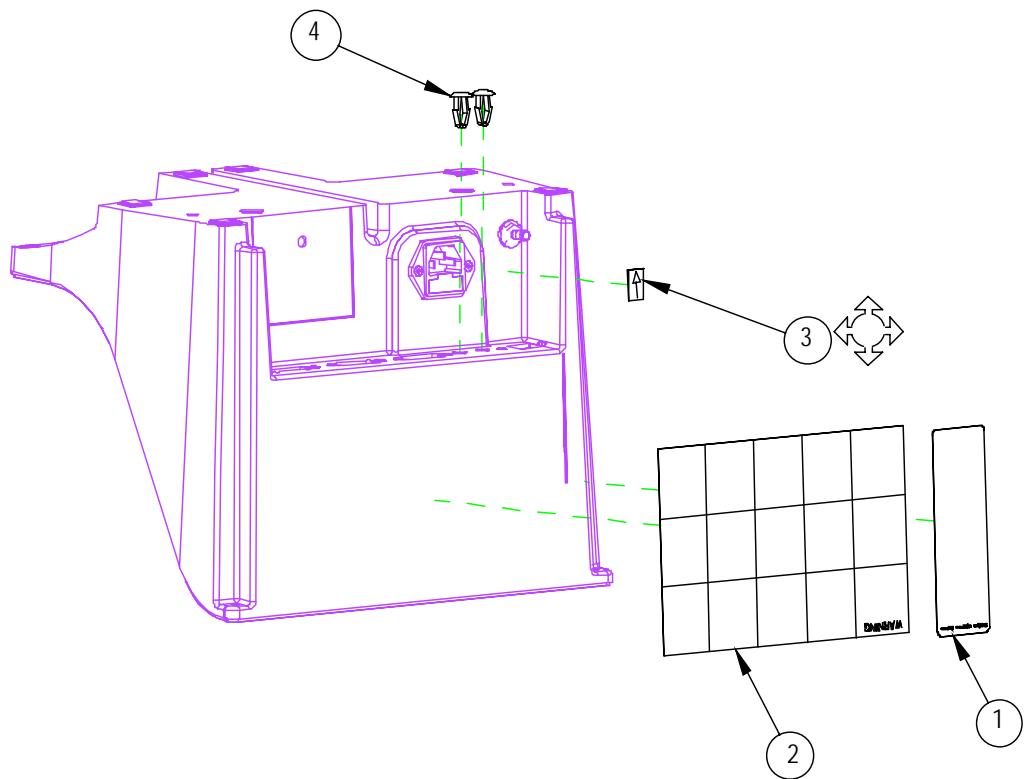
Display

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007164	Display Bezel	1
2	3007438	Rubber Keypad	1
3		Screw PH #6 - 32 x 1/4"	5
4	3007383	Touchscreen	1



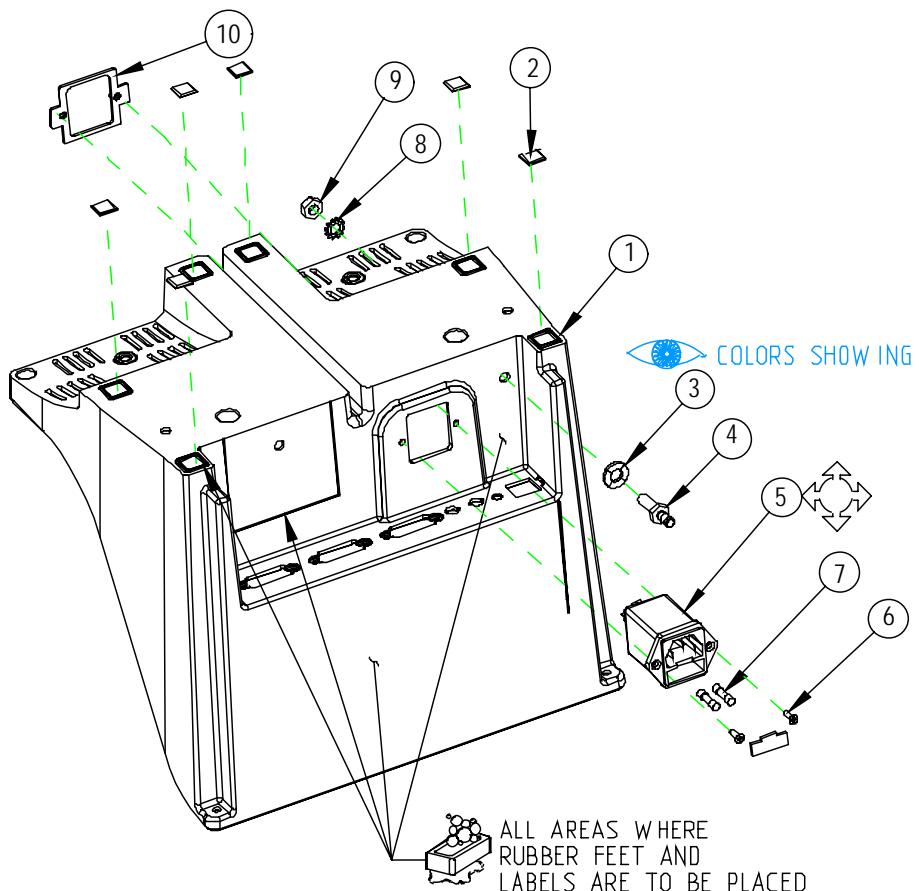
Base

ITEM	PART NUMBER	DESCRIPTION	QTY
1	202036	Patent Label	1
2	201428	Warning Label	1
3	98411-T-148	EQL POT Label	1
4	3008312	FO Plugs	2



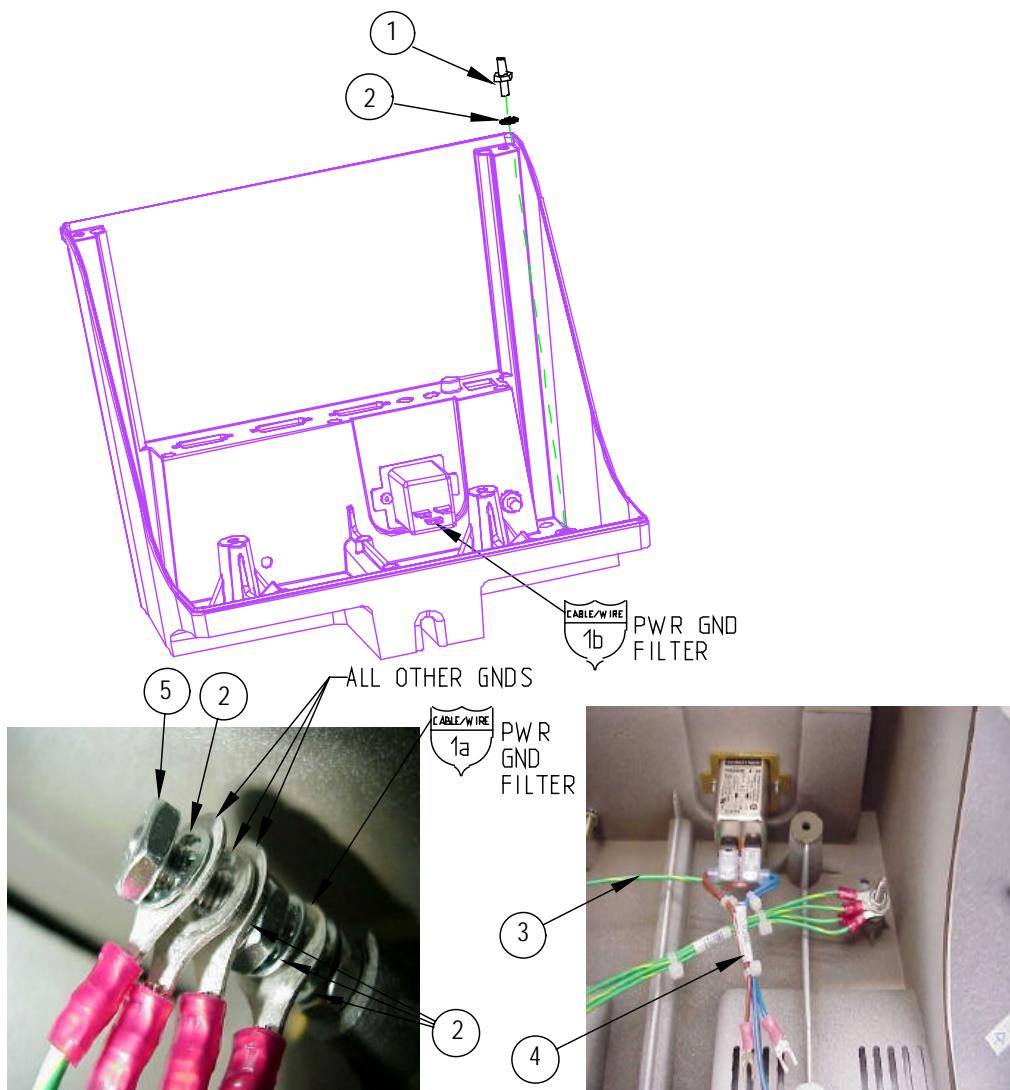
Base

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007204	Base Bottom	1
2	600-5007-400	Rubber Feet	6
3	528-1450-001	YEL/GRN washer	1
4	528-4057-001	Brass Plug	1
5	3009074	Line Pwr Filter	1
6		Screw FH #4 32 x 1/2"	2
7	3009595	Fuse	2
8	528-8704-001	Lock washer 1/4"	1
9	528-8501-001	EQL POT Nut	1
10	3004653	Filter Bracket	1



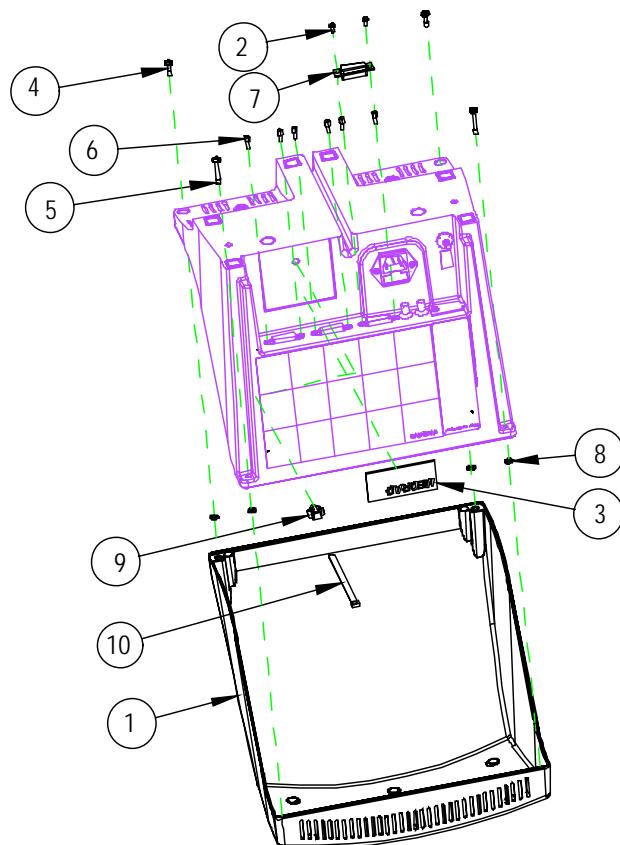
Base

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3008893	GND Stud	1
2	605-0010-000	Star Washer #10	5
3	3007713	Cable GND Kit	1
4	3007712	Pwr Input Kit	1
5	604-1132-380	Nut #10	2



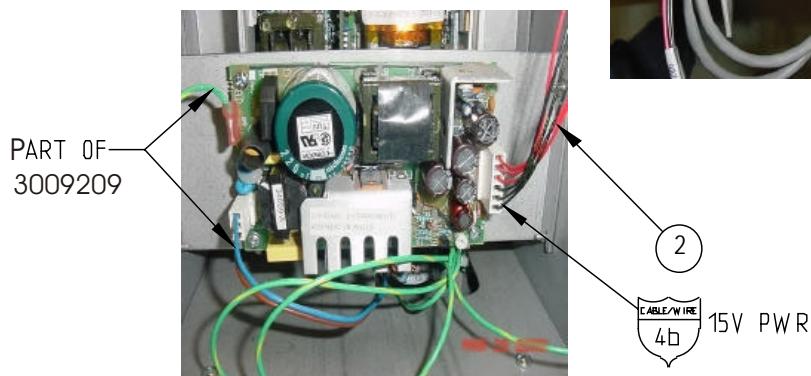
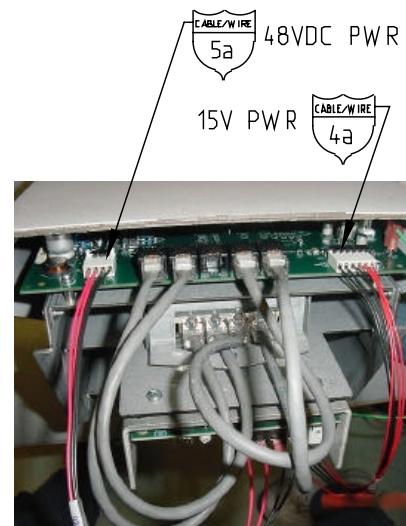
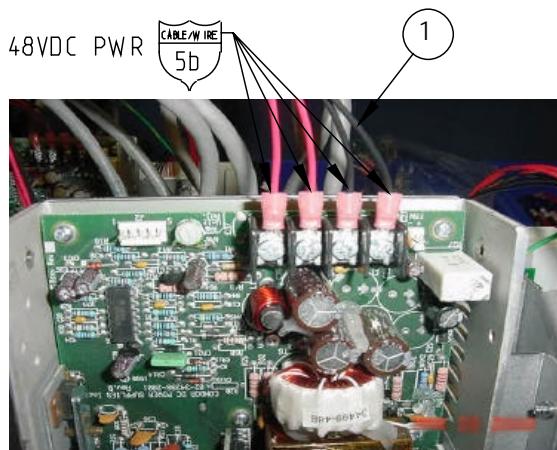
Base

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007203	Cover	1
2	601-0440-180	Ret Screws D-SUB	2
3	528-1450-001	Serial Tag	1
4	618-0832-999	Captive Screw #8	2
5	3008316	Captive Screw #8	2
6	3000221	Standoffs	6
7	3008631	Cover Cap	1
8	3005973	O-ring	4
9	3009553	Retainer	1
10	3009554	Cable Tie Reusable	1



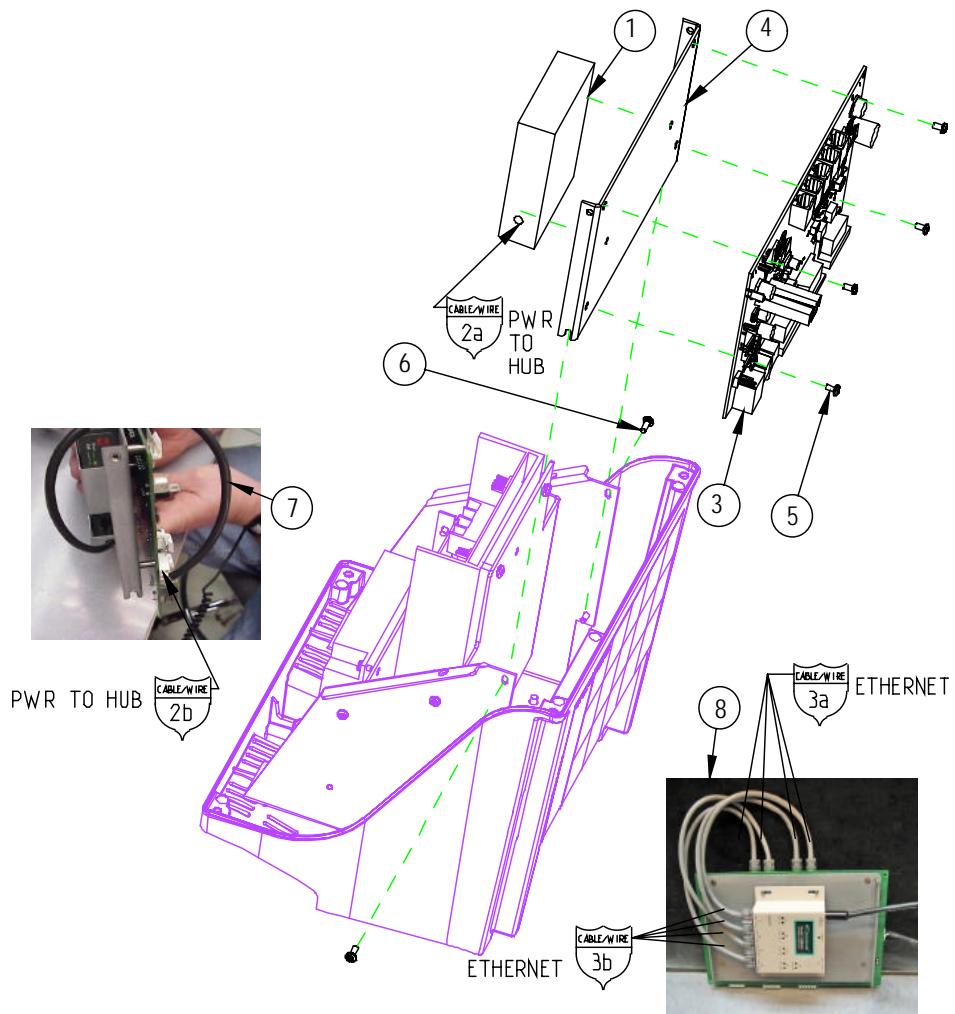
Base

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007700	Cable Pwr 48VDC	1
2	3011929	Cable Pwr 15V	1



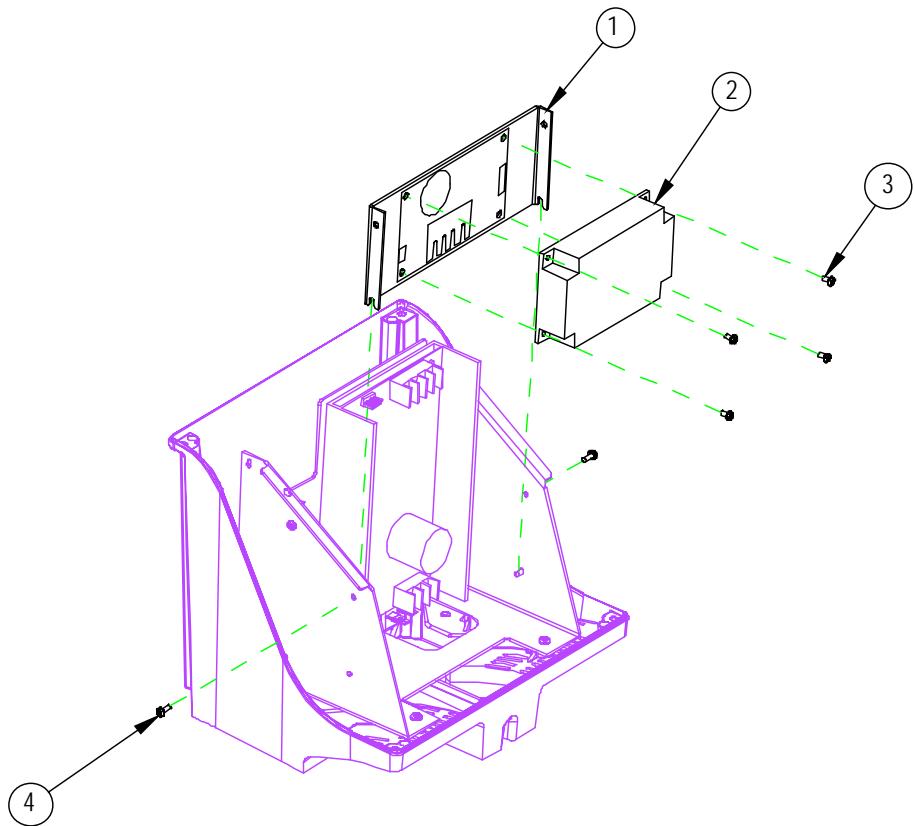
Base

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3010582	HUB	1
3	3007298	Interface PCB	1
4	3010581	Interface Bracket	1
6		Screw PH #6 32 x 3/8"	2
7	3010583	Cable Pwr to HUB	1
8	3004546	Cable Ethernet	4



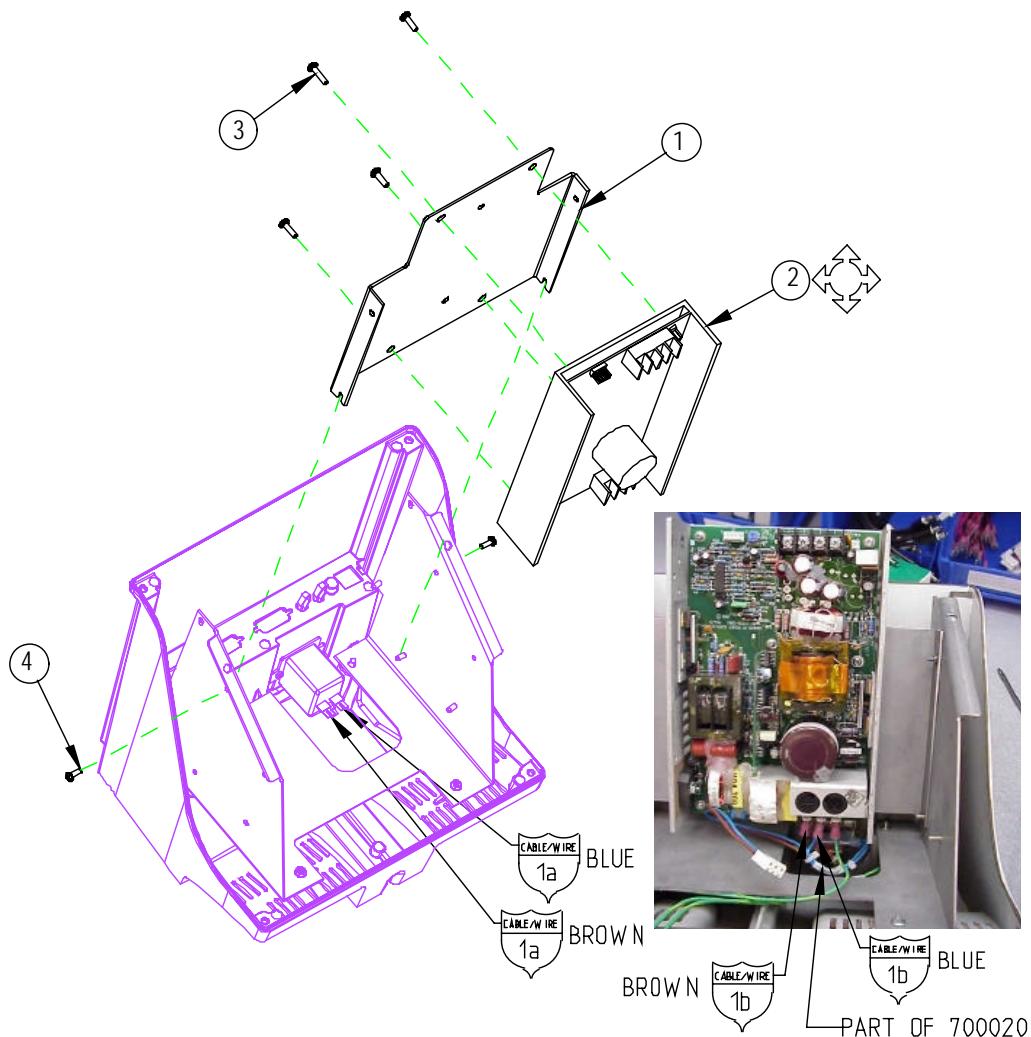
Base

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007471	Pwr Supply Bracket	1
2	3011921	Power Supply	1
3		Screw PH #8 32 x 1/4"	4
4		Screw PH #8 32 x 3/8"	2



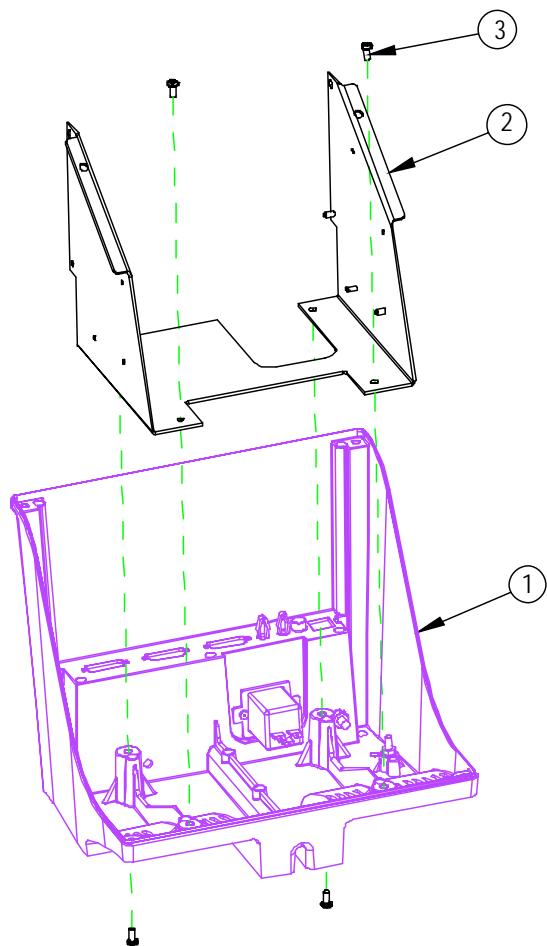
Base

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007480	Pwr Supply Bracket	1
2	3007384	Pwr Supply	1
3	602-0832-120	REC PN HD #8	4
4	602-0632-380	REC PN HD #6	2



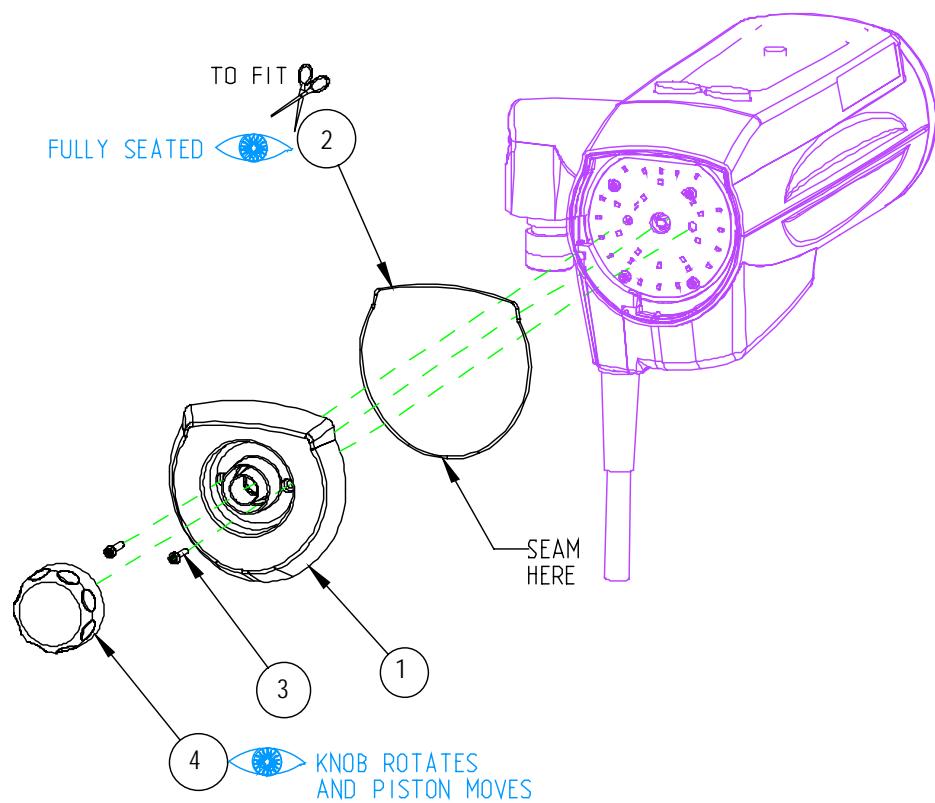
Base

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3009209	Base Bottom Assy	1
2	3007416	Chassis	1
3		Screw PH #8 32 x 1/2"	4



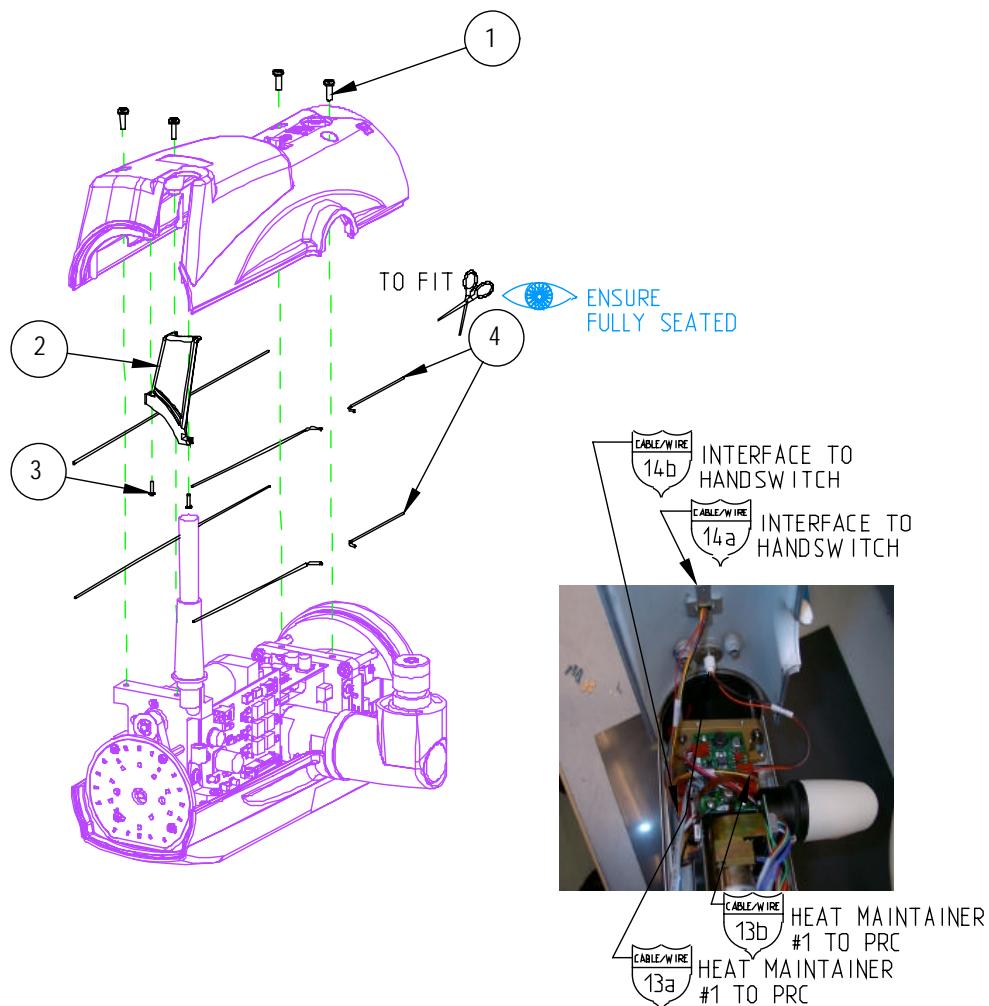
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007652	Lens	1
2	3008786	Lens Gasket	1
3		Screw #6 - 32 x 5/8"	2
4	3007654	Knob	1



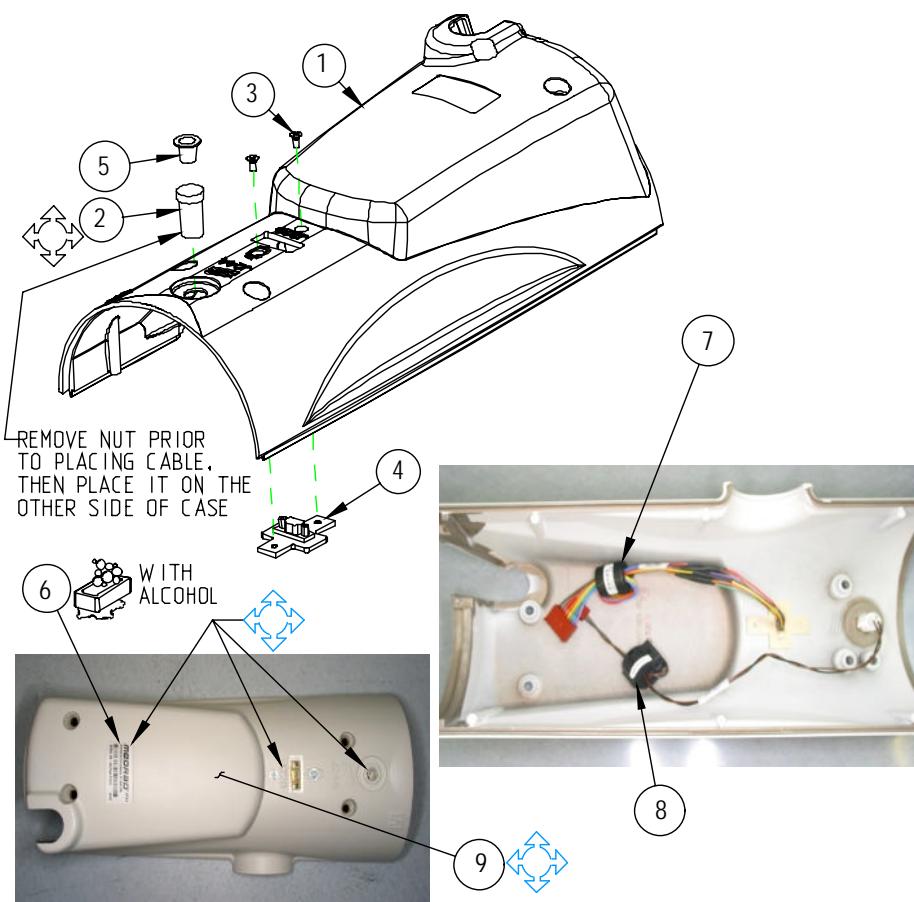
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1		Screw #8 - 32 x 1/2"	4
2	3008351	Cable Retainer	1
3		Screw #2 - 56 x 5/16"	2
4	3007724	Gasket	A/R



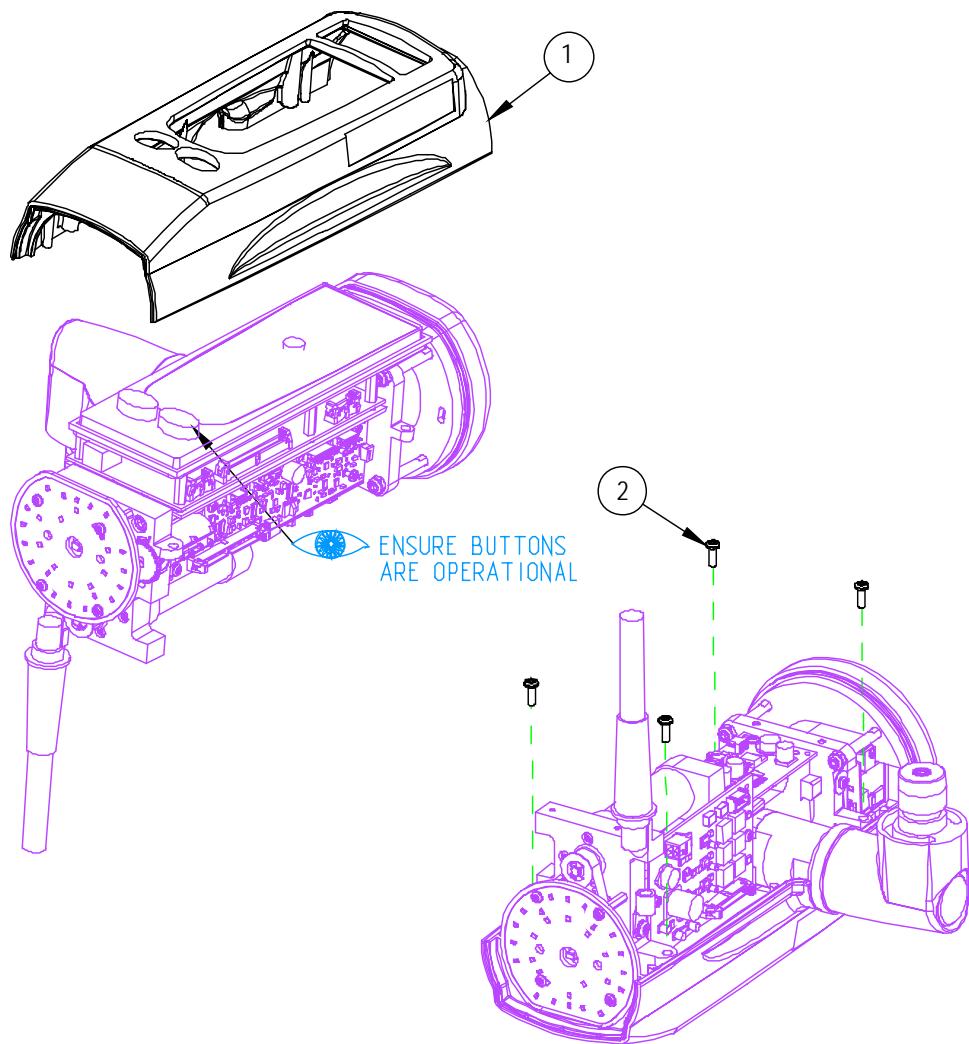
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3010079	Bottom Cover	1
2	3007801	Cable, Heat Maintainer	1
3		Screw #4 - 40 x 1/4"	2
4	3007789	Hand Switch Cable	1
5	3009198	Plug	1
6		Serial Label	1
7	3009649	Ferrite Core128A2432-0A21	1
8	3009662	Ferrite Core (0443665801)	1
9	201966	HS & Heat Maintainer Label	1



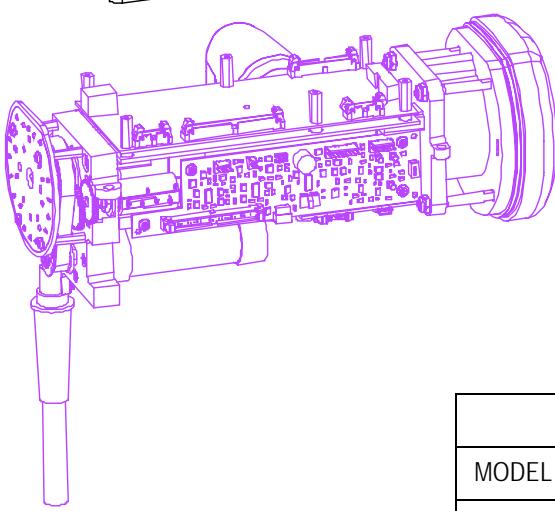
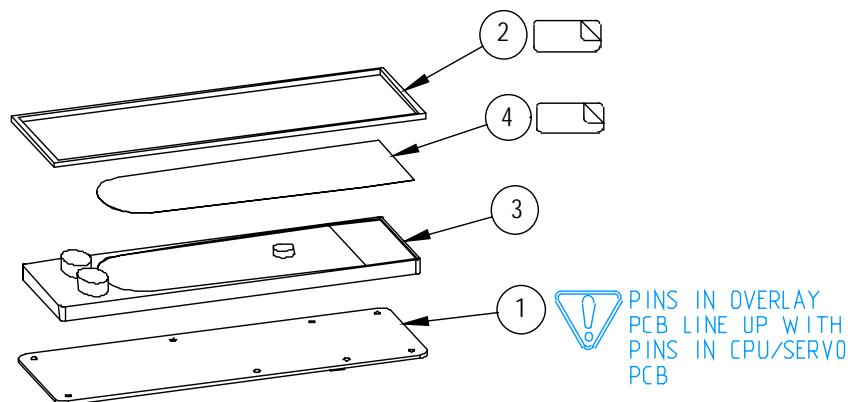
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3009235	Top Cover	1
2		Screw #8 - 32 x 1/2"	4



Single Head

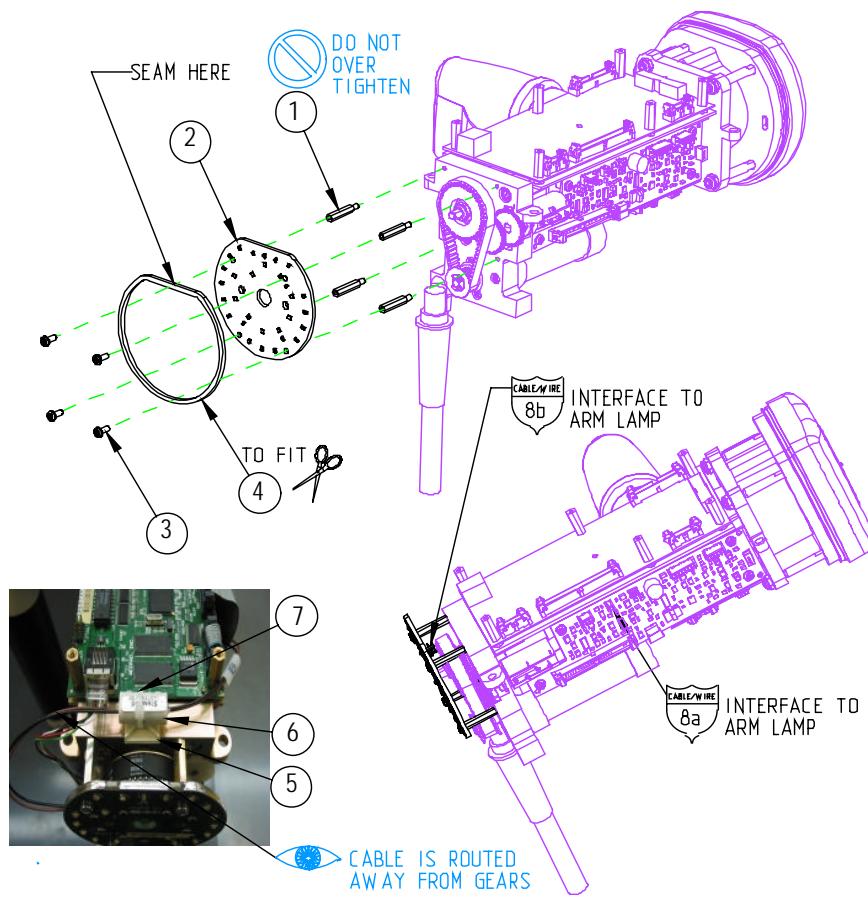
ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007476	Overlay PCB	1
2	3013785	Overlay Gasket	1
3	3008164	Overlay Rubber, S	1
3	3008165	Overlay Rubber, SX	1
4	3008162	Overlay Graphics, S	1
4	3008163	Overlay Graphics, SX	1



OVERLAY		
MODEL	ITEM 3 (RUBBER)	ITEM 4 (GRAPHICS)
3007040	3008165	3008163
3007062	3008164	3008162

Single Head

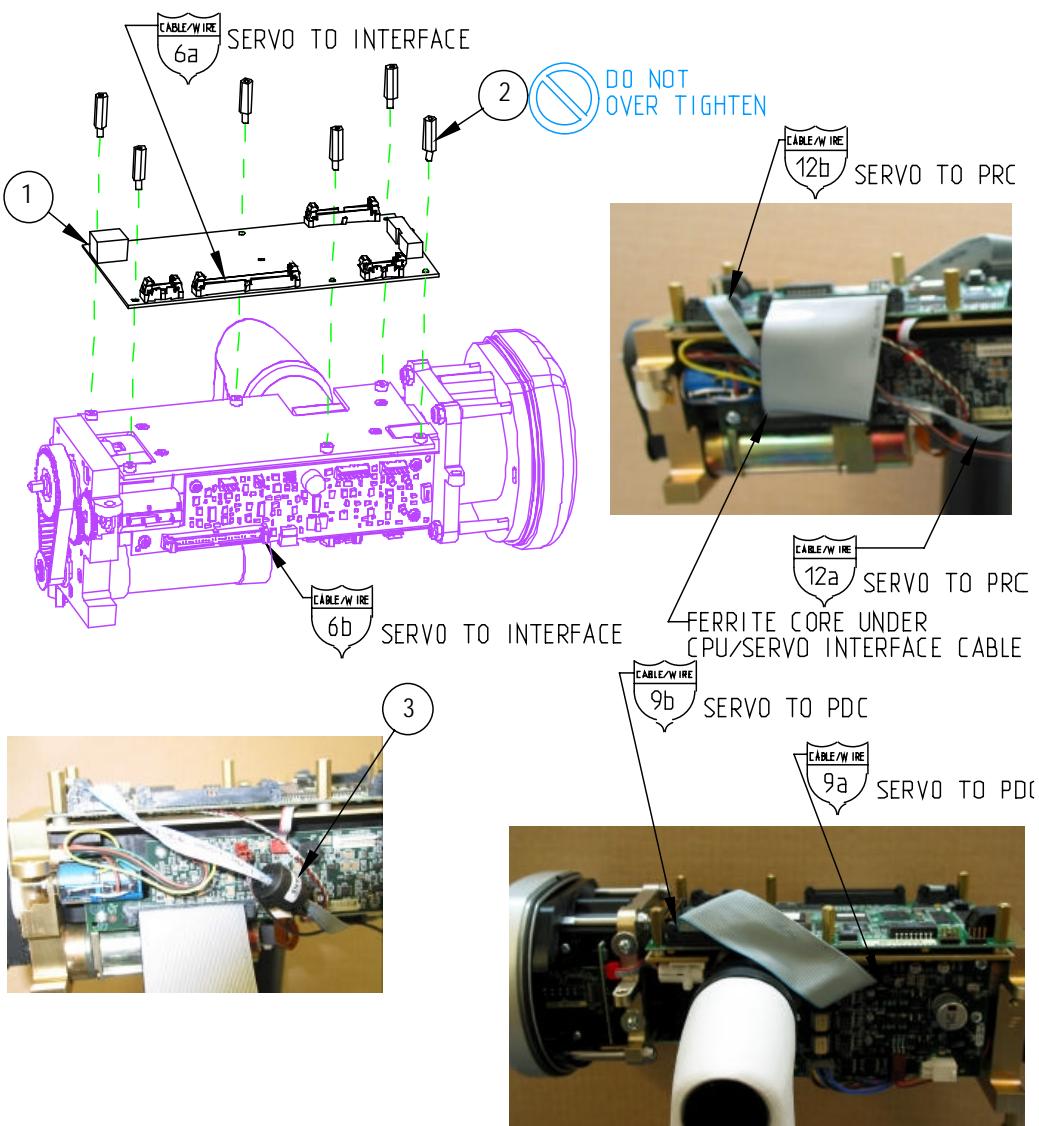
ITEM	PART NUMBER	DESCRIPTION	QTY
1	3008849	Standoff 15/16	4
2	3008102	LED PCB	1
3		Screw #6 - 32 x 3/8"	4
4	3008787	LCD PCB Gasket	1
5	3009701	Cable Tie Mount	1
6	3009648	Ferrite Core	1
7	715-0096 003	Cable Tie	1



Single Head

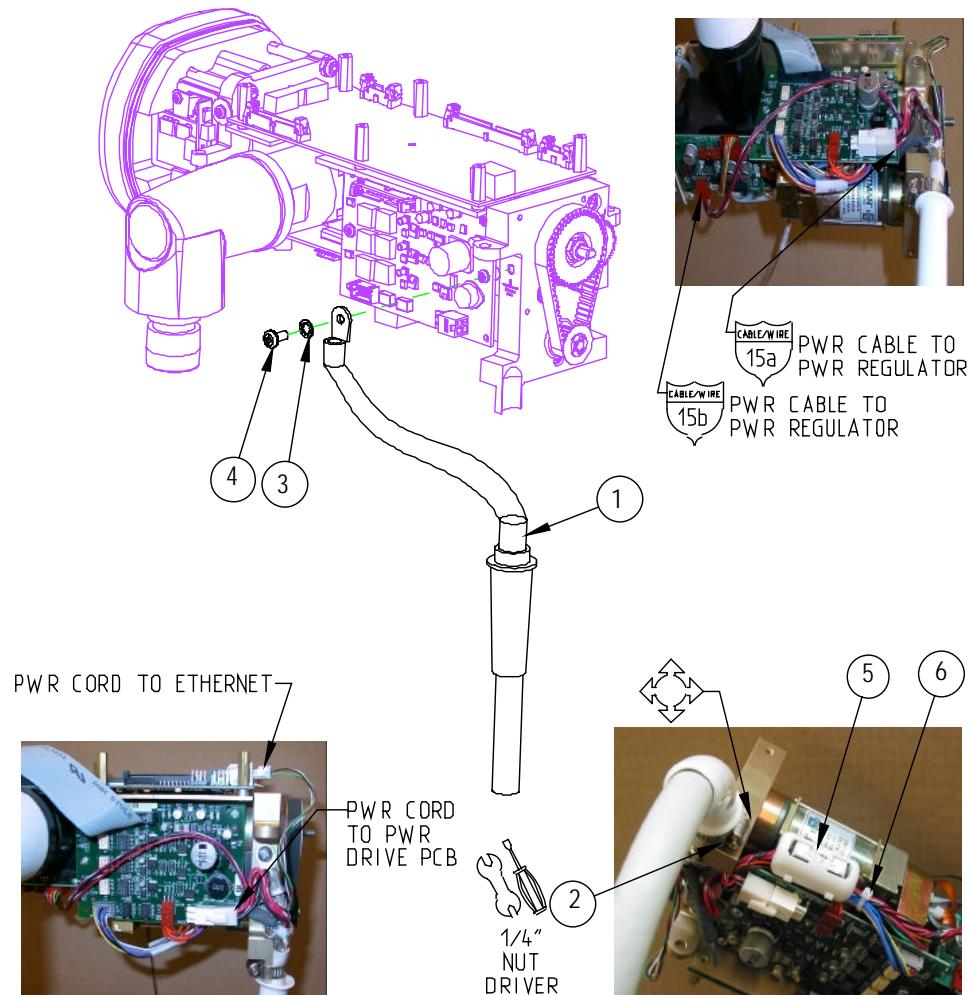
ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007260	CPU / Servo PCB Strong arm*	1
1	3011677	CPU / Servo PCB Super H*	1
2	628-1434-631	Standoff #6 - 32 plastic	6
3	3009649	Ferrite Core	1

* Order same card number as removed.



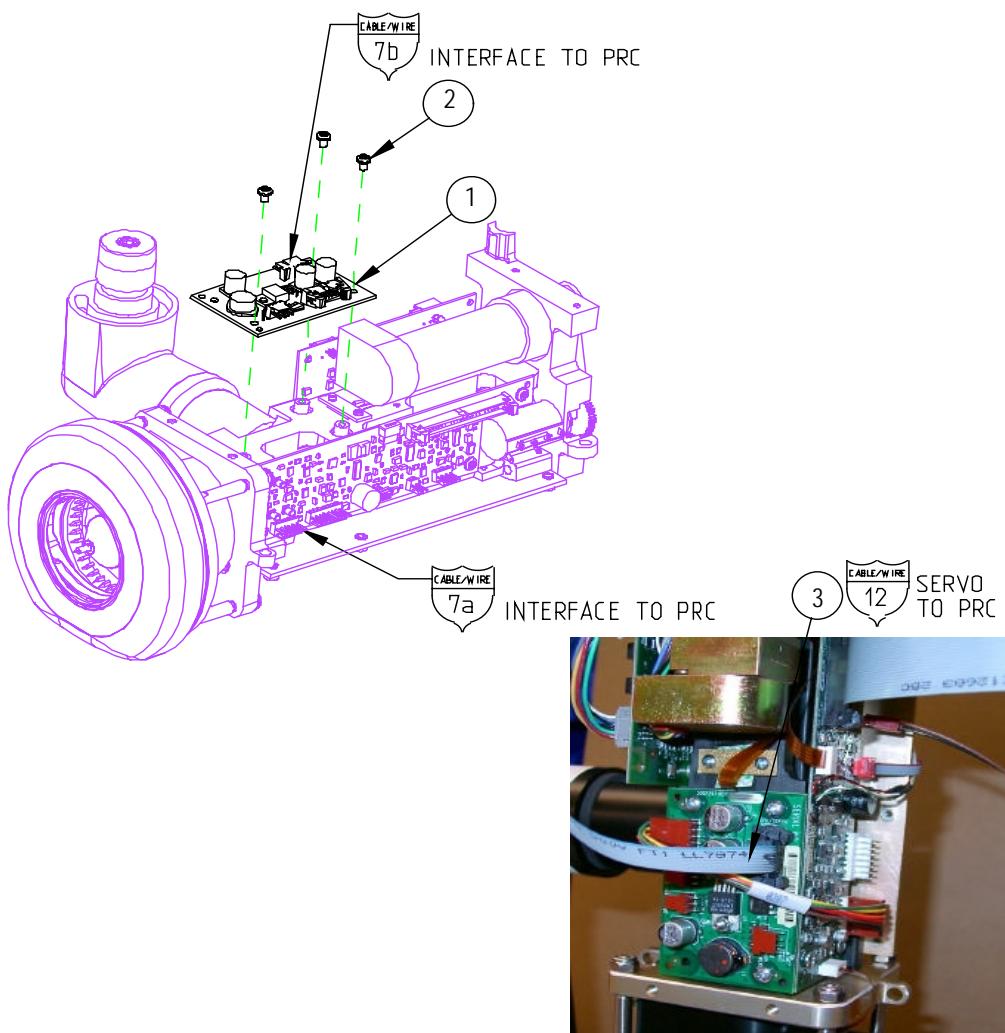
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3012531	Power Cord	1
2	539-0550-000	Hose Clamp	1
3	3003725	Lock Washer #10	1
4	602-1032-380	Screw #10 - 32	1
5	3009650	Ferrite core	1
6	715-0096-003	Cable Tie	1



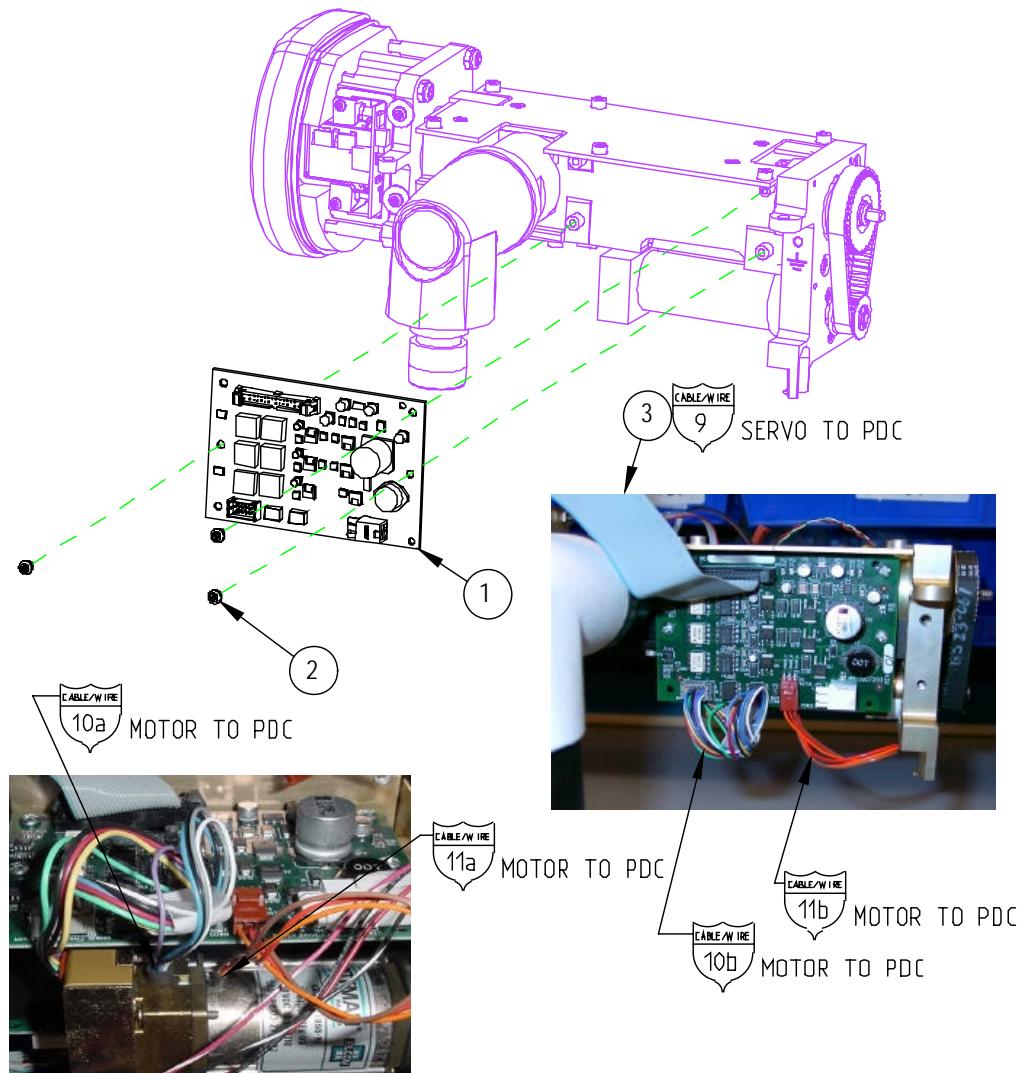
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007297	PWR Regulator PCB	1
2		Screw #6 - 32 x 3/16"	3
3	3010112	Cable, CPU / Servo to PRC	1



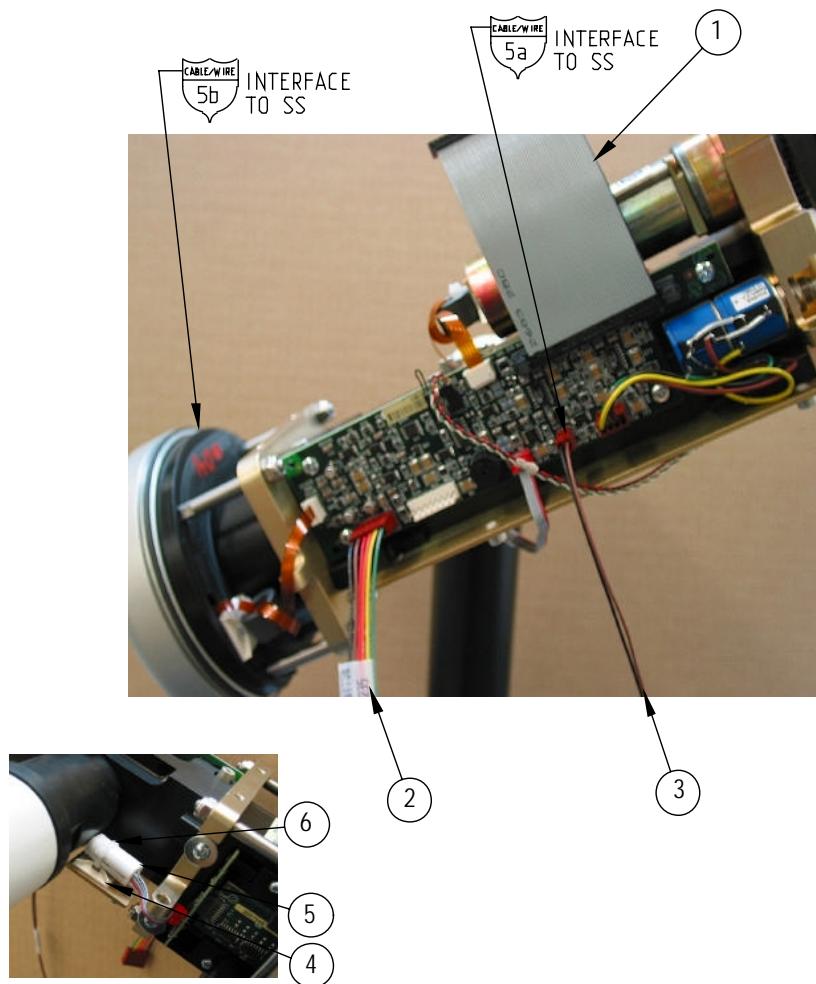
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007293	PWR Drive PCB	1
2		Screw #6 - 32 x 3/16"	3
3	3007695	Cable, CPU / Servo to PDC	1



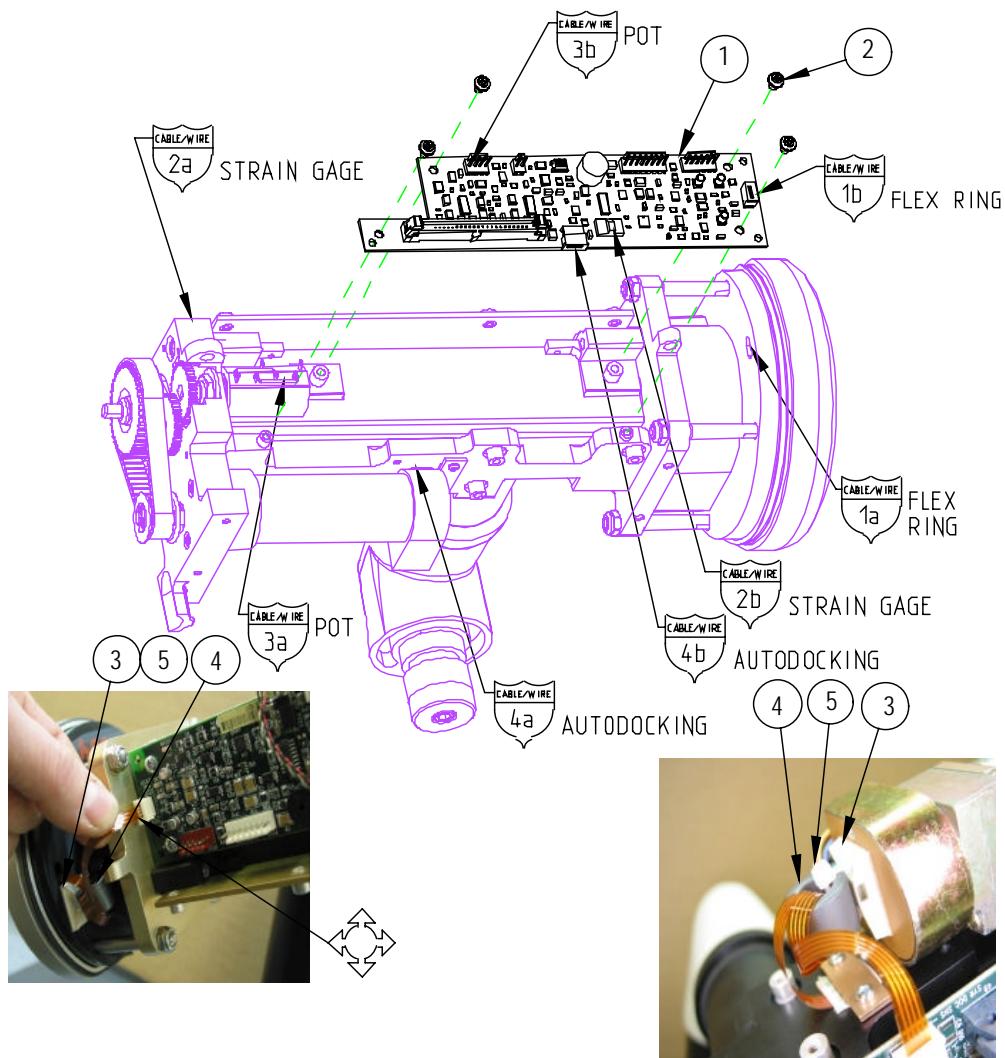
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3010111	Cable, CPU / Servo to Interface	1
2	3007790	Cable, PRC to Interface	1
3	3007802	Cable, Arm Lamp	1
4	3009701	Mount, Cable tie	1
5	3009648	Ferrite Core	1
6	715-0096-003	Cable Tie	1



Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3011704	Interface PCB	1
2		Screw #6 - 32 x 3/16"	4
3	3009701	Cable Tie Mount	2
4	280-2643-665	Ferrite core	2
5	715-0096-003	Cable Tie	2

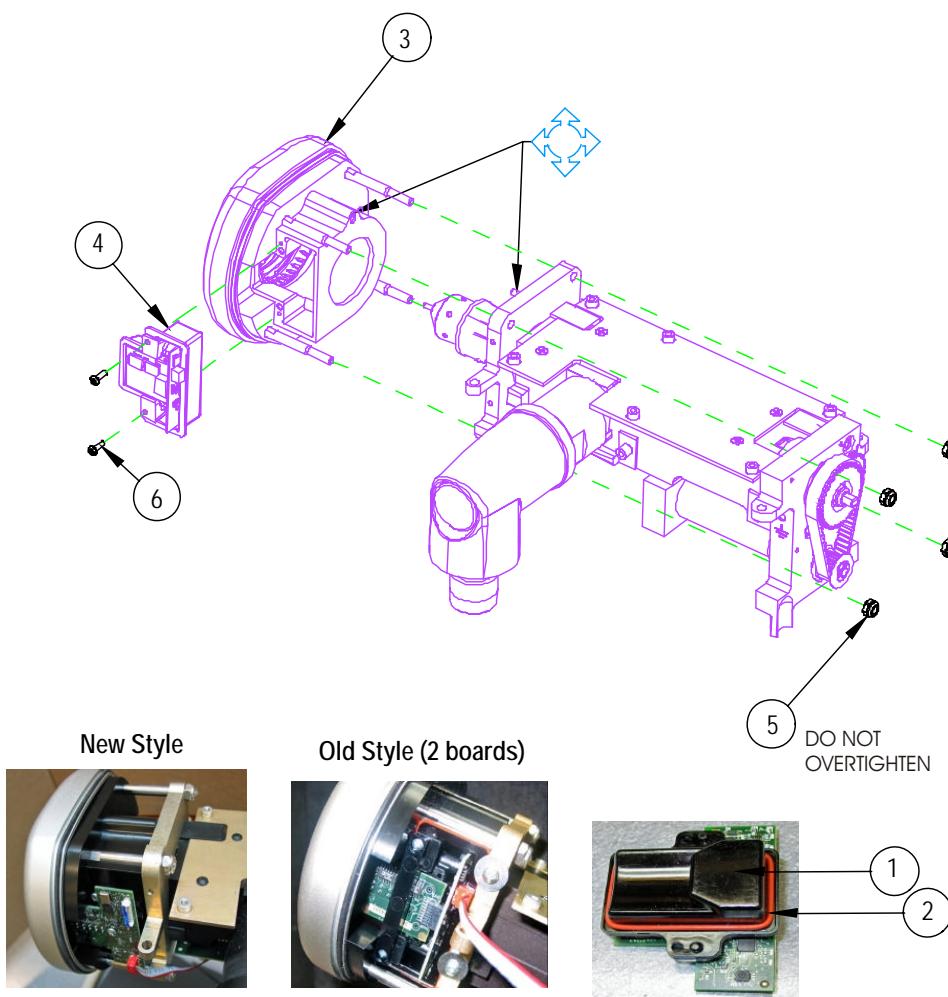


Single Head

ITEM	P/N Old Style	P/N New Style	PART NUMBER	DESCRIPTION	QTY
1	3007094	3013103		Window	
2	3008365	3013101		Gasket	
3			3009210	Single Housing	1
4	3009234	3013368		Size Sensing Kit*	1
5			3009341	Nylock Nut #10	4
6				Screw #4 - 40 x 3/8"	2

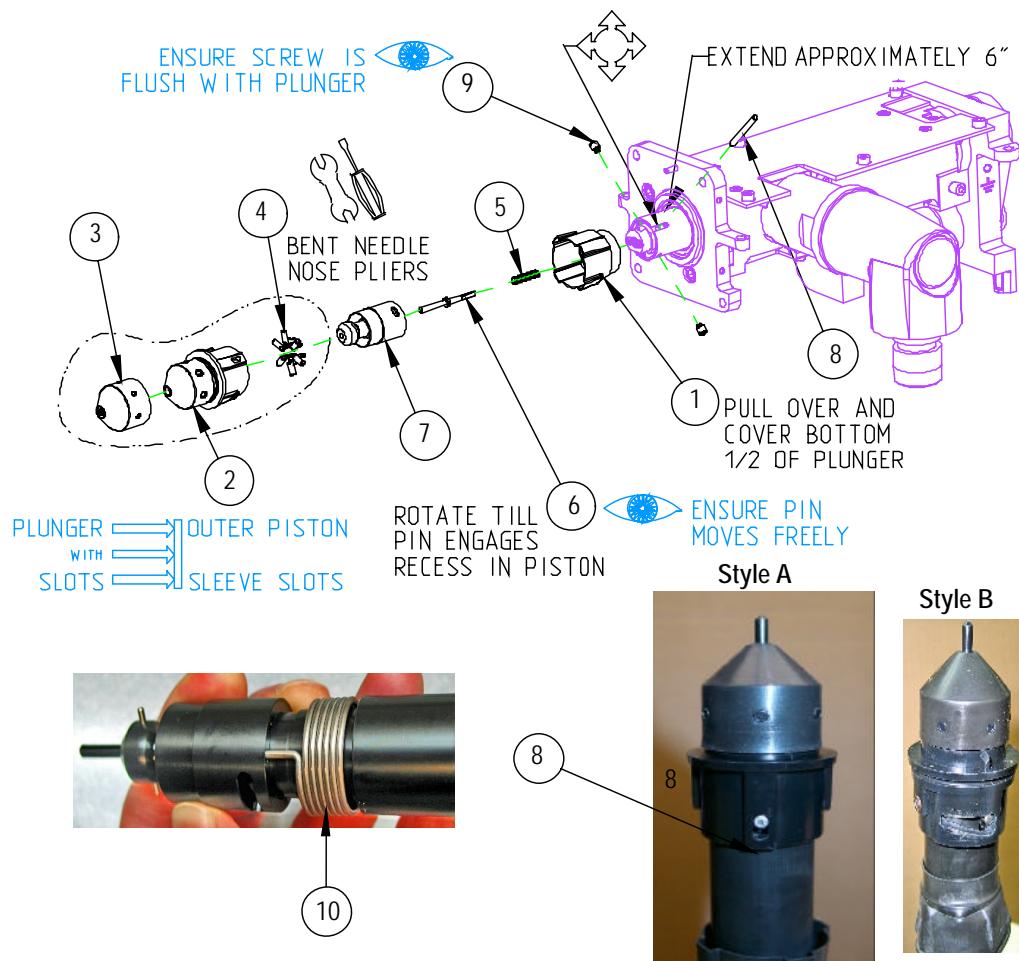
Old Style Size Sensor will only fit in Old Style front housing. If replacing housing (#3), you must order New Style Size Sensor (#4).

*Size Sensing Kit comes with window, board, gasket and screws.



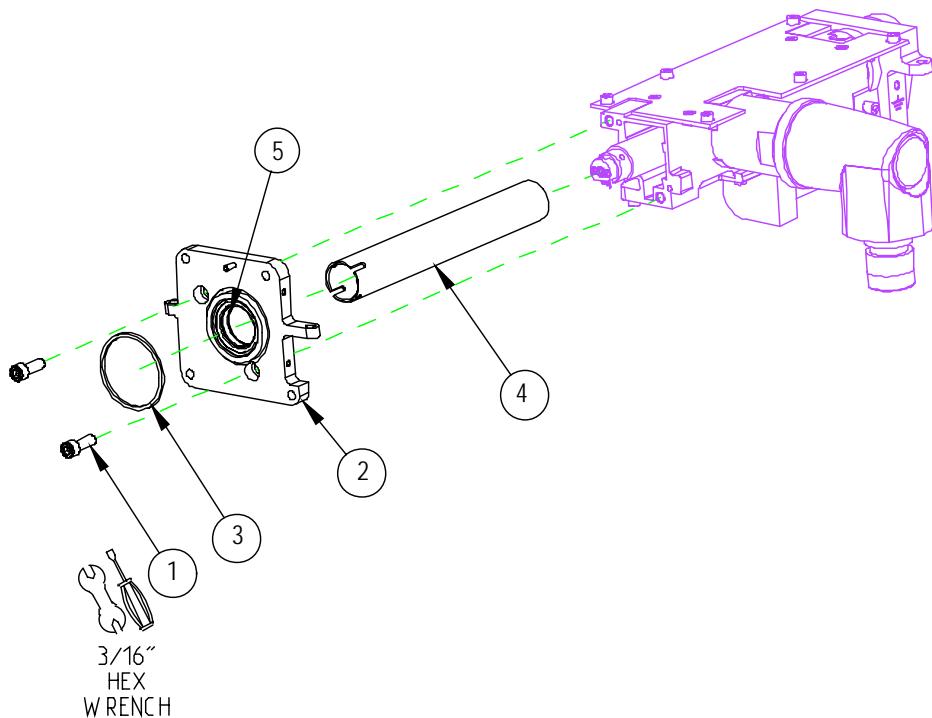
Single Head

ITEM	P/N STYLE A	P/N STYLE B	PART NUMBER	DESCRIPTION	QTY
1	3008704	3010914		Plunger Sleeve	1
2	3007318	3010898		Plunger	1
3	3008615	3010900		Plunger Boot	1
4			3007314	Plunger Pin	6
5			3008336	Spring	1
6			3007313	Sensor Pin	1
7	3007332	3010912		Piston Wedge	1
8			3008334	Dowel Pin	1
9			3008553	Set Screw	2
10	N/A	3008336		Spring	1



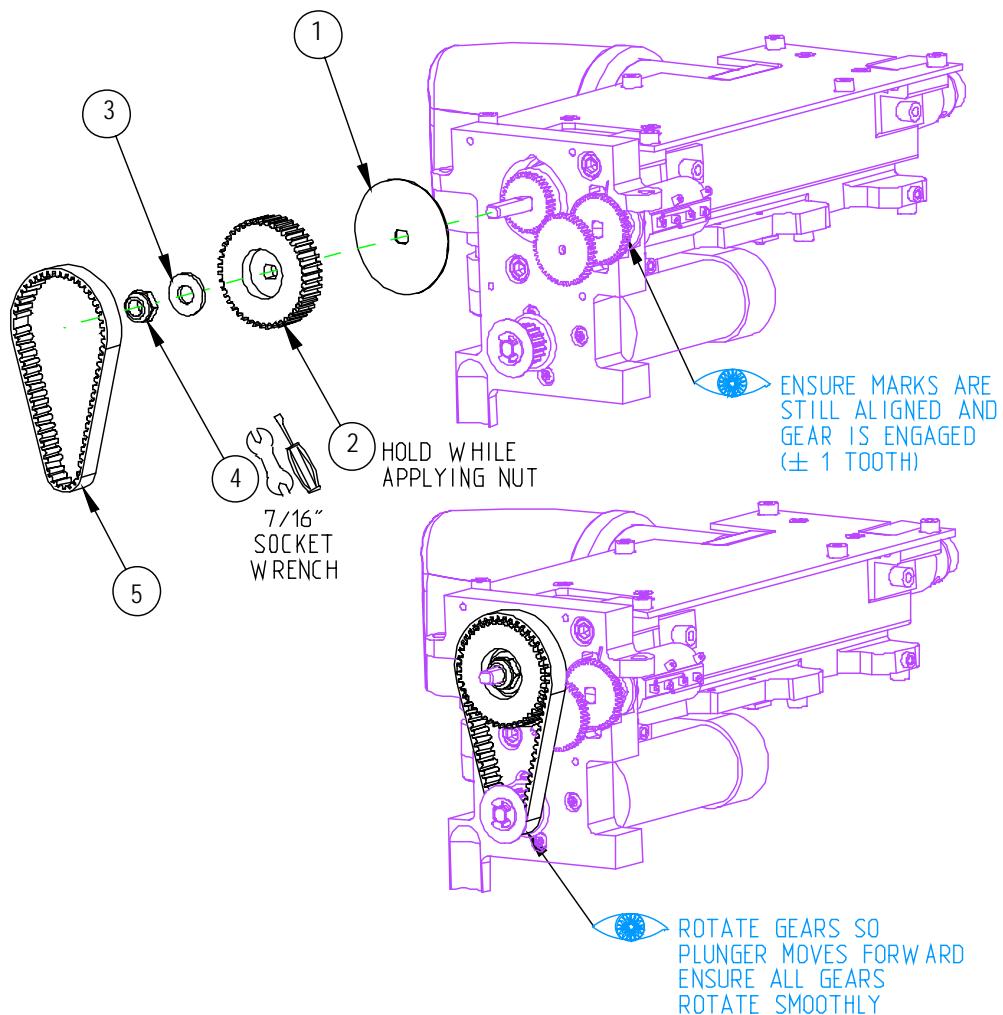
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1		Screw 1/4 - 20 x 3/4"	2
2	3008784	Front Mounting Plate	1
3	3008991	Gasket	1
4	3007331	Outer Piston Sleeve	1
5	3012696	Wiper Seal	1



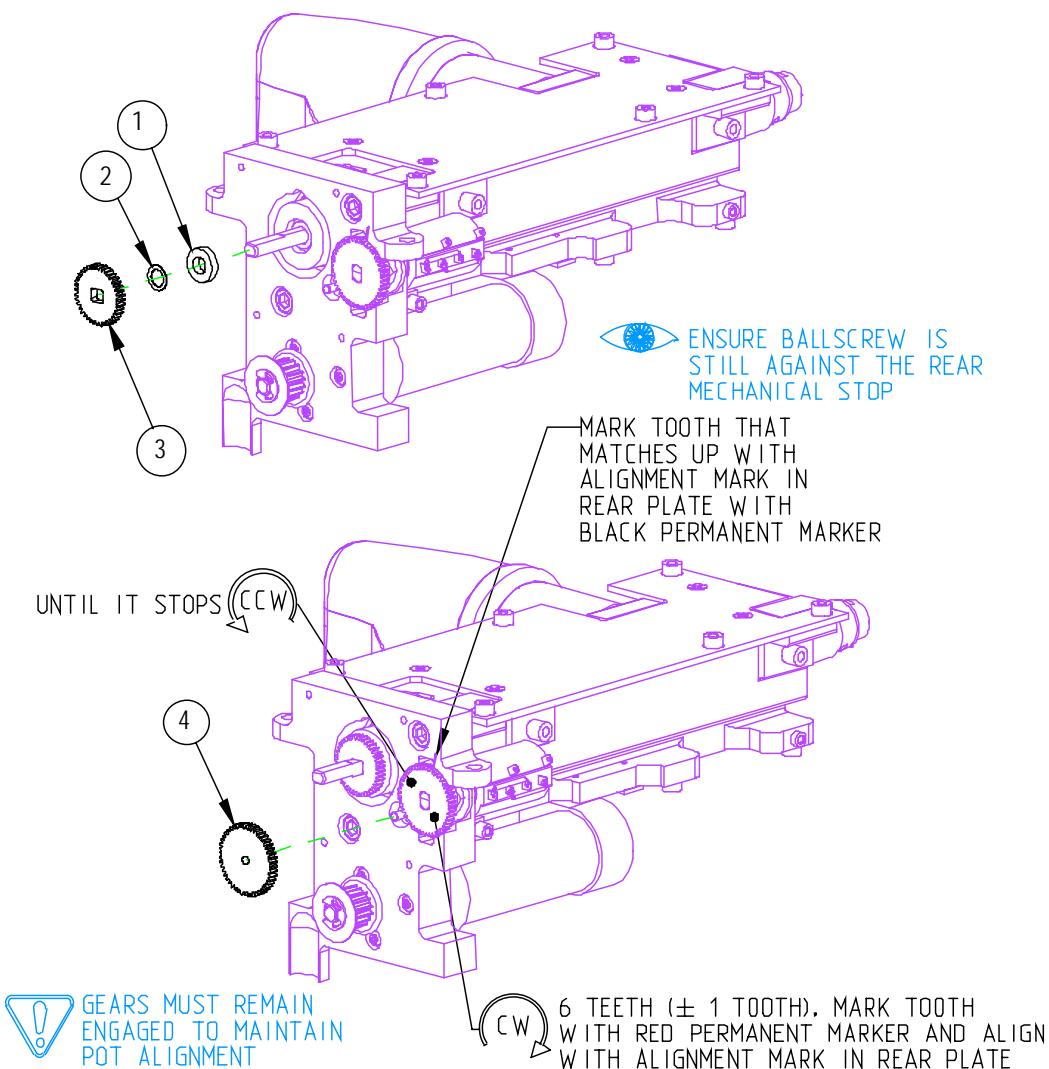
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	403003602	Pully Washer	1
2	401000423	Belt Pulley	1
3	607-0074-580	Washer	1
4	609-1420-999	Nut 1/4-20	1
5	682-7090-306	Timing Belt	1



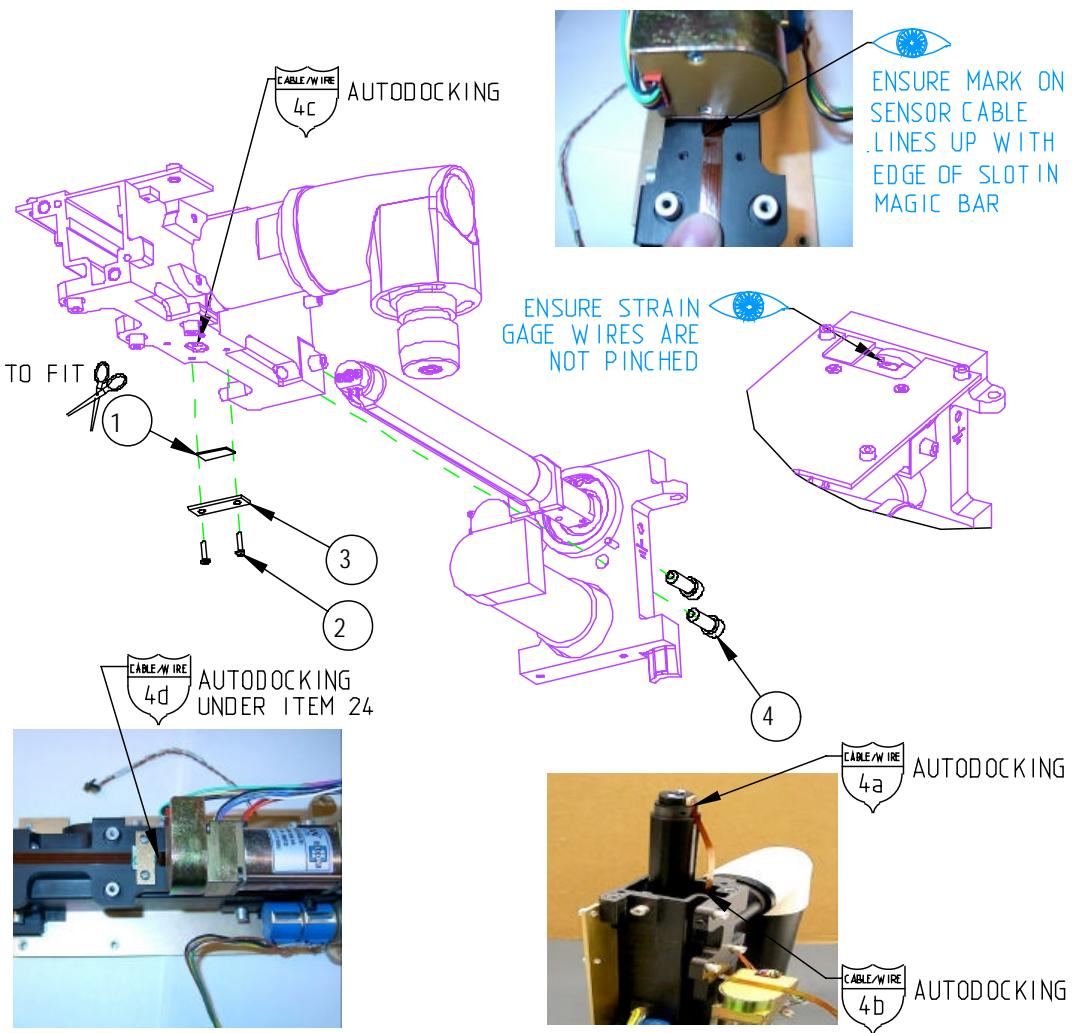
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3009042	Bearing	1
2	3009129	Shim	1
3	401000422	40 Tooth Gear	1
4	682-4812-480	Idler Gear	1



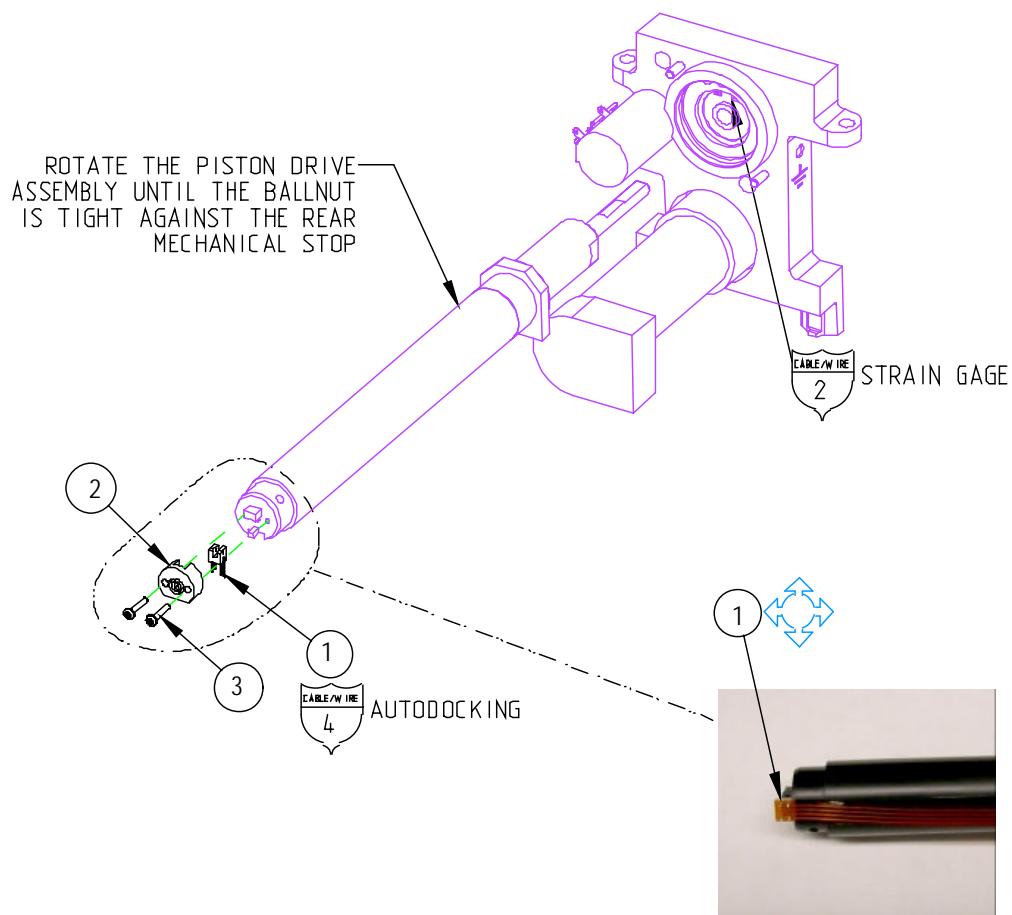
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	717-4016-120	Foam Tape	1
2		Screw #4 - 40 x 3/8"	1
3	3009101	Flex Cable Plate	1
4	3000253	Screw 1/4 - 20	2



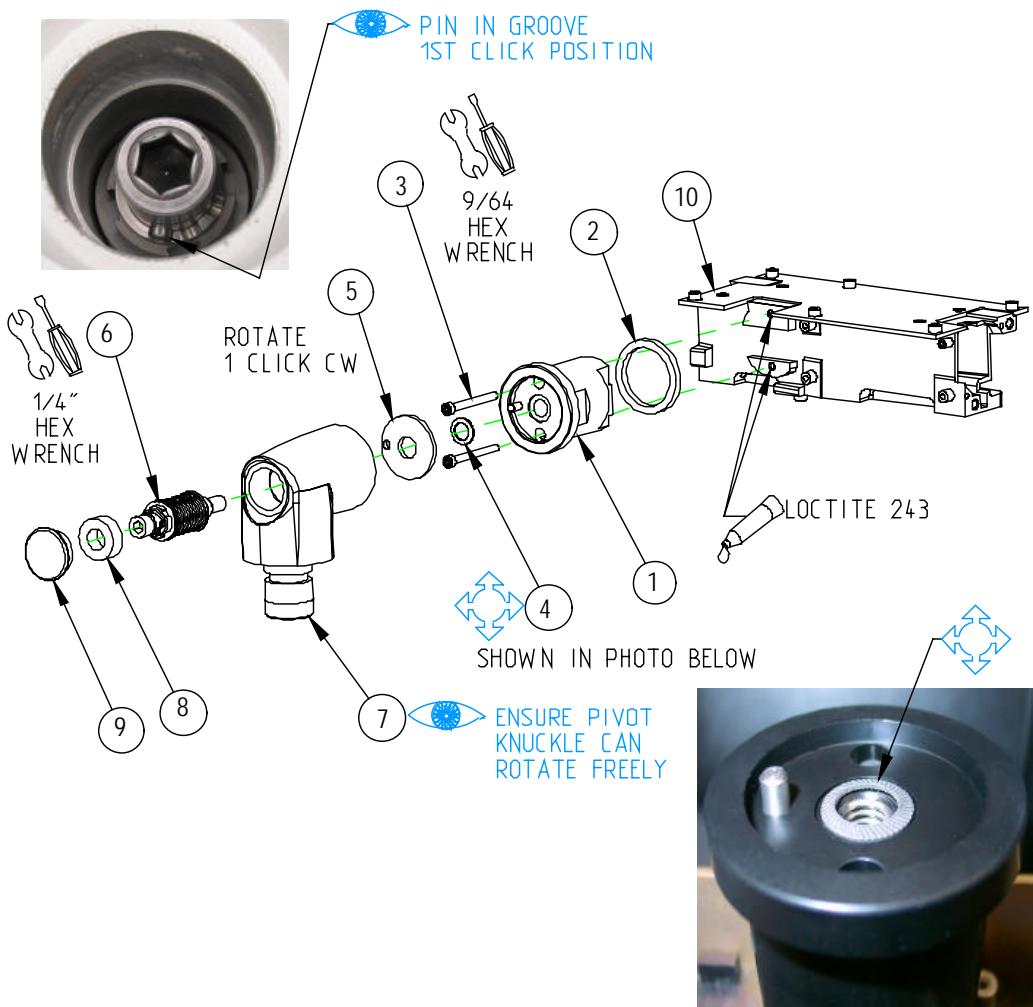
Single Head

ITEM	STYLE	PART NUMBER	DESCRIPTION	QTY
1	A	3008242	Sensor Cable	1
1	B	3011186	Sensor Cable	1
2		3007317	Sensor Retainer	1
3			Screw #2 - 56 x 7/16"	2



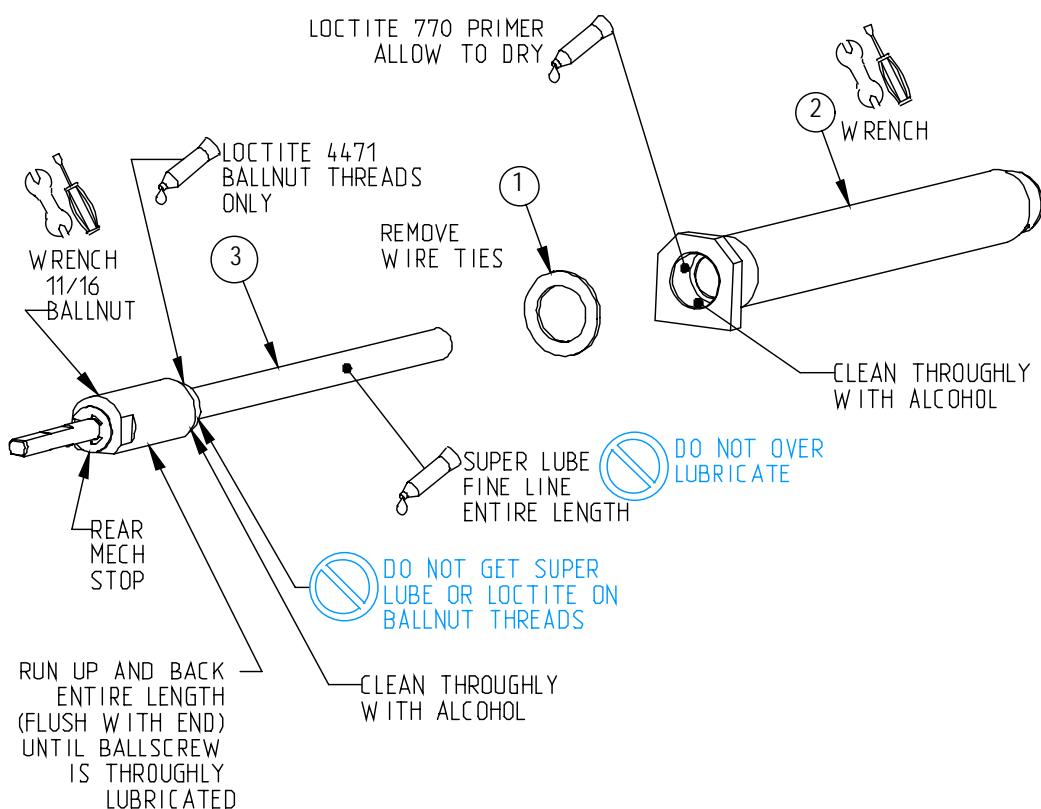
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3008554	Knuckle Stub	1
2	3008362	Gasket	1
3		Screw #8 - 32 x 1 3/4"	2
4	3008850	Bellville Washer	1
5	3007720	Knuckle Washer	1
6	3008338	Knuckle Adjustment	1
7	3008110	Knuckle Assembly	1
8	3008810	Knuckle Bushing	1
9	3007721	Knuckle Plug	1
10	3009103	Magic Bar	1



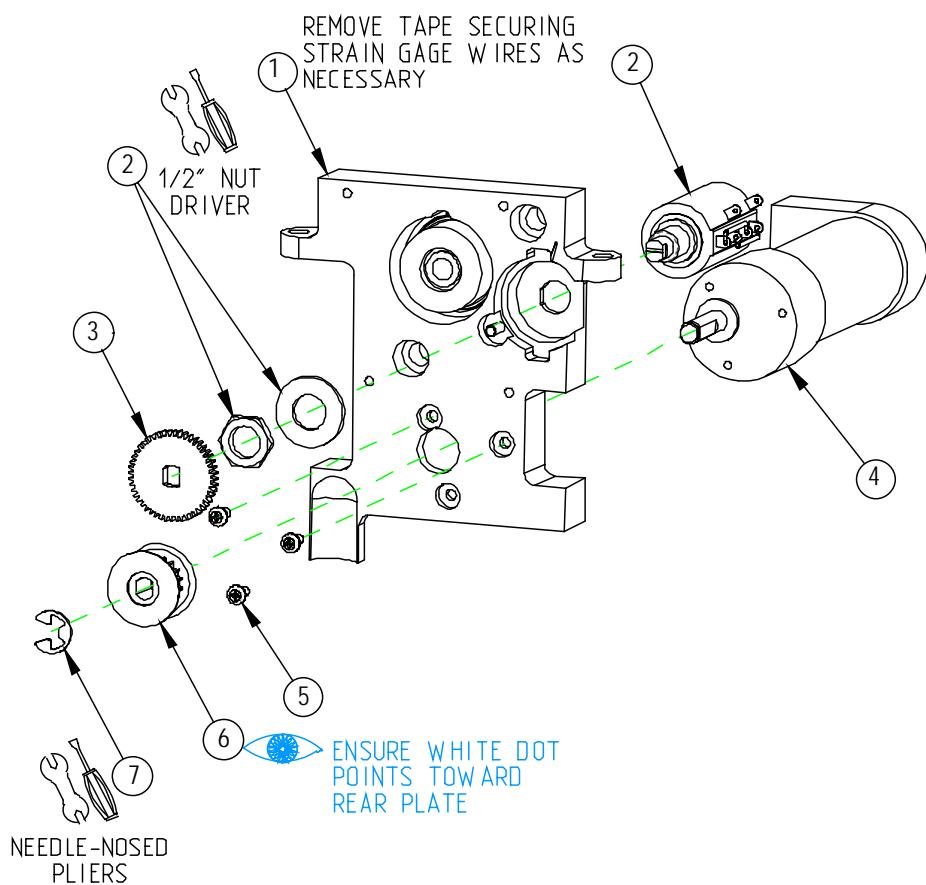
Single Head

ITEM	STYLE	PART NUMBER	DESCRIPTION	QTY
1		401000447	Washer	1
2	A	3007320	Inner Piston	1
2	B	3010899	Inner Piston	1
3		3007694	Ballscrew	1



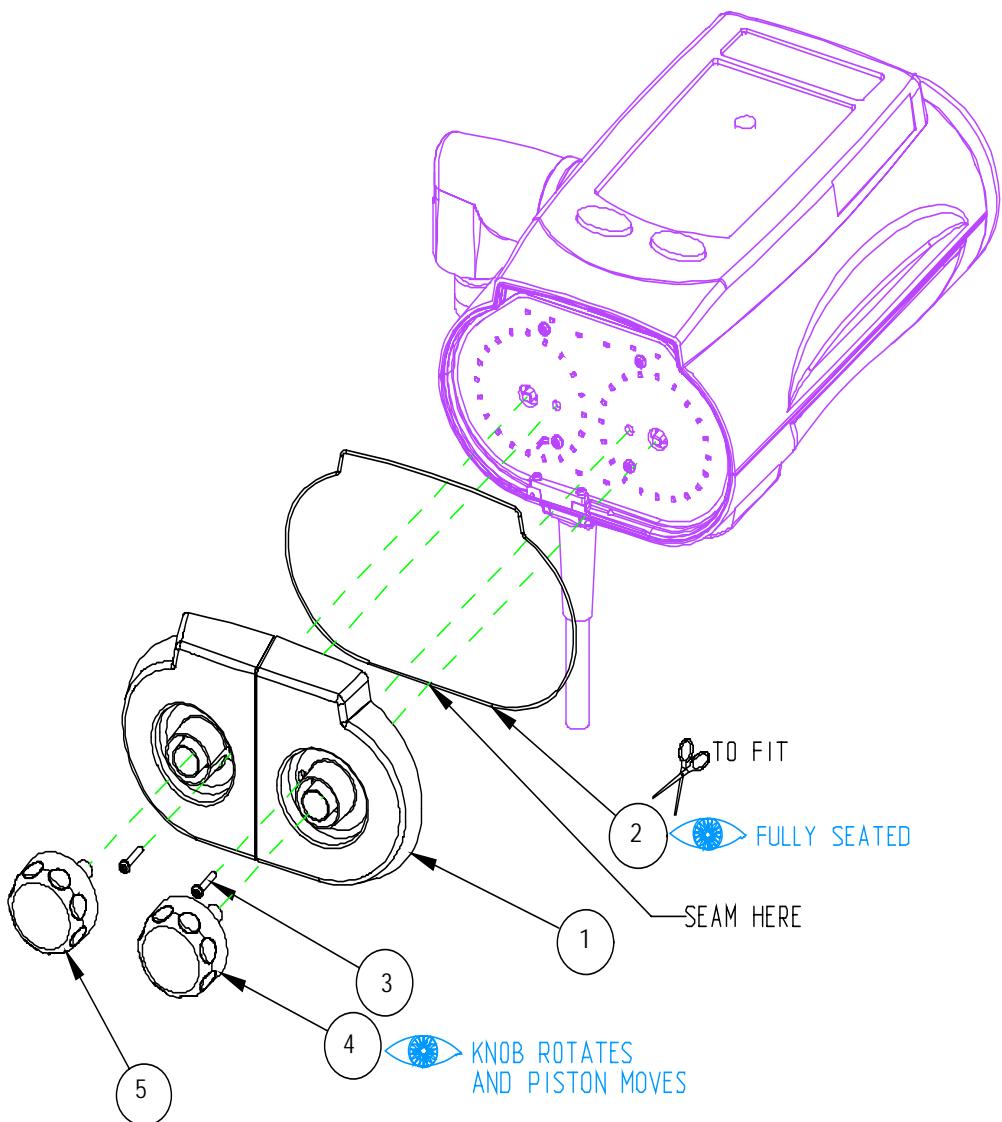
Single Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3009207	Rear Plate	1
2	3009204	POT	1
3	403002877	48 Tooth Gear	1
4	3007304	DC Motor	1
5		Screw #4 - 40 x 1/4"	3
6	401000421	Drive Pulley	1
7	645-5144-210	Retaining Ring	1



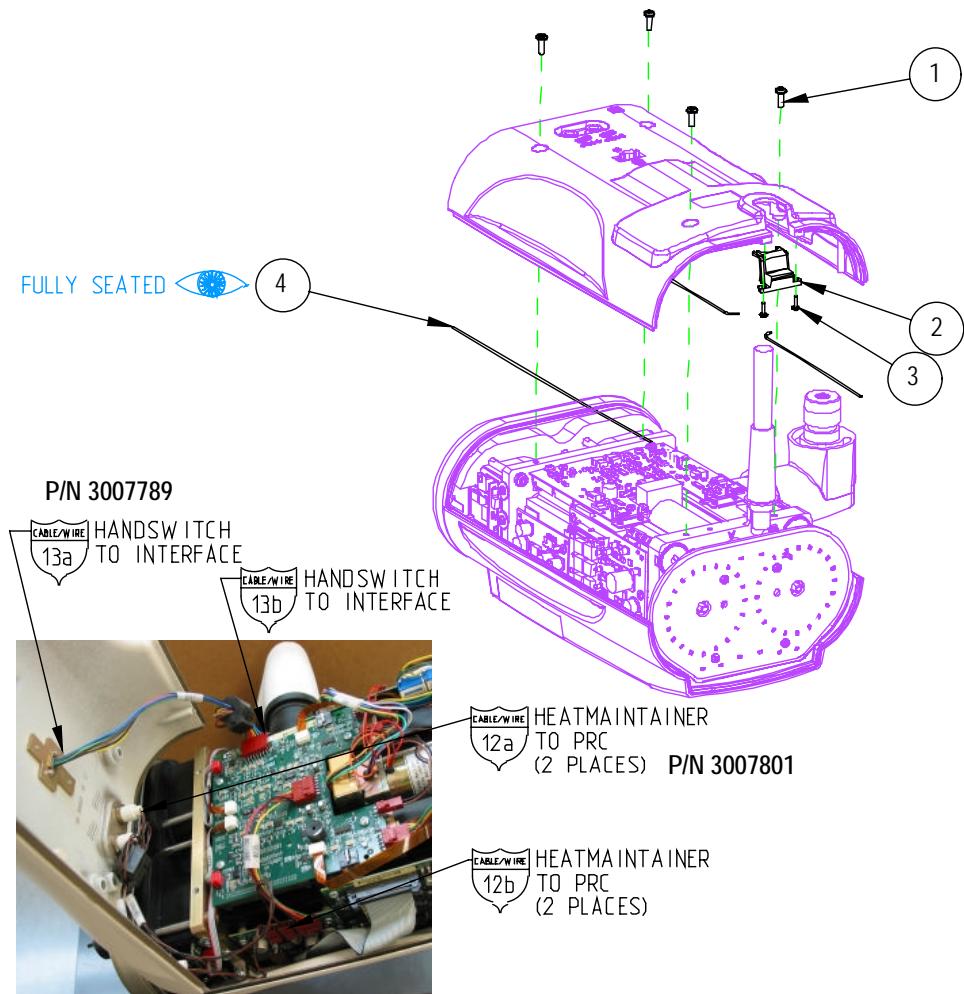
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007653	Lens	1
2	3008786	Lens Gasket	1
3		Screw #6 - 32 x 5/8"	2
4	3007654	Knob, Green	1
5	3009013	Knob, blue	1



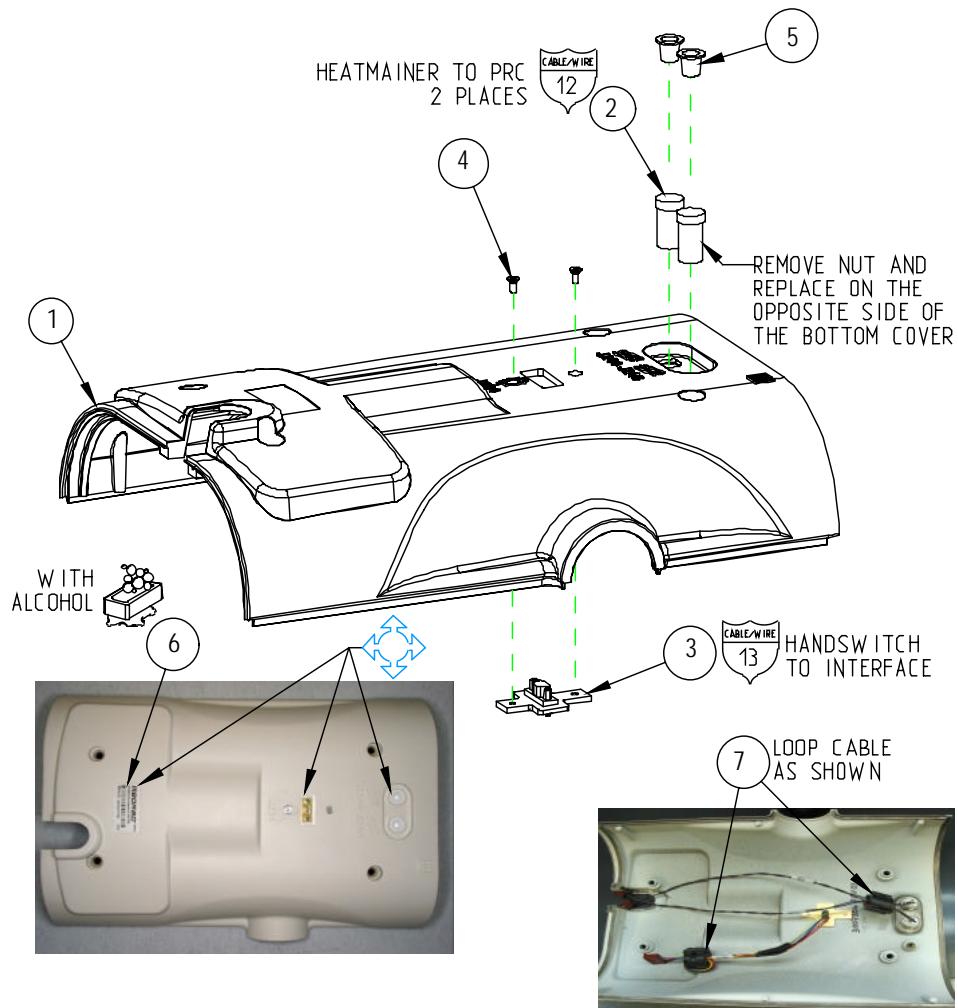
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1		Screw #8 - 32 x 1/2"	4
2	3008340	Cable retainer	1
3		Screw #4 - 40 x 3/8"	2
4	3007724	Gasket	A/R



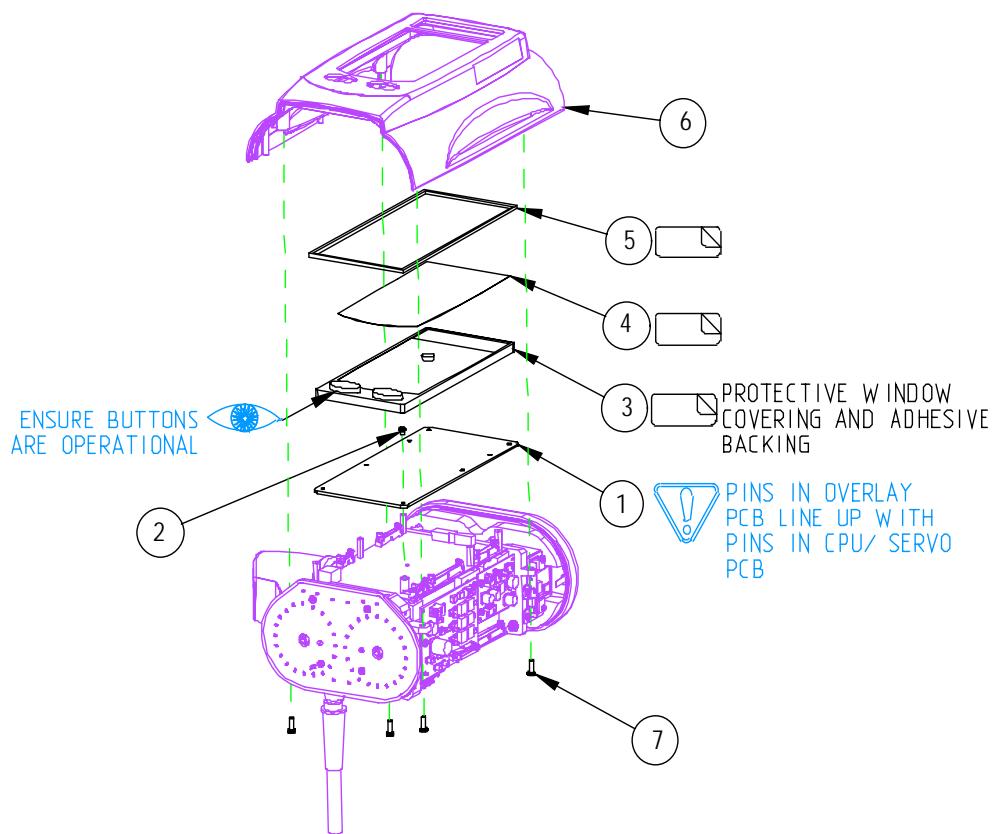
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3010080	Bottom Cover	1
2	3007801	Maintainer Cable	2
3	3007789	Handswitch Cable	1
4		Screw #4 - 40 x 1/4"	2
5	3009198	Plug	2
6	201423	Serial Tag	1
7	3009629	Ferrite Core	2



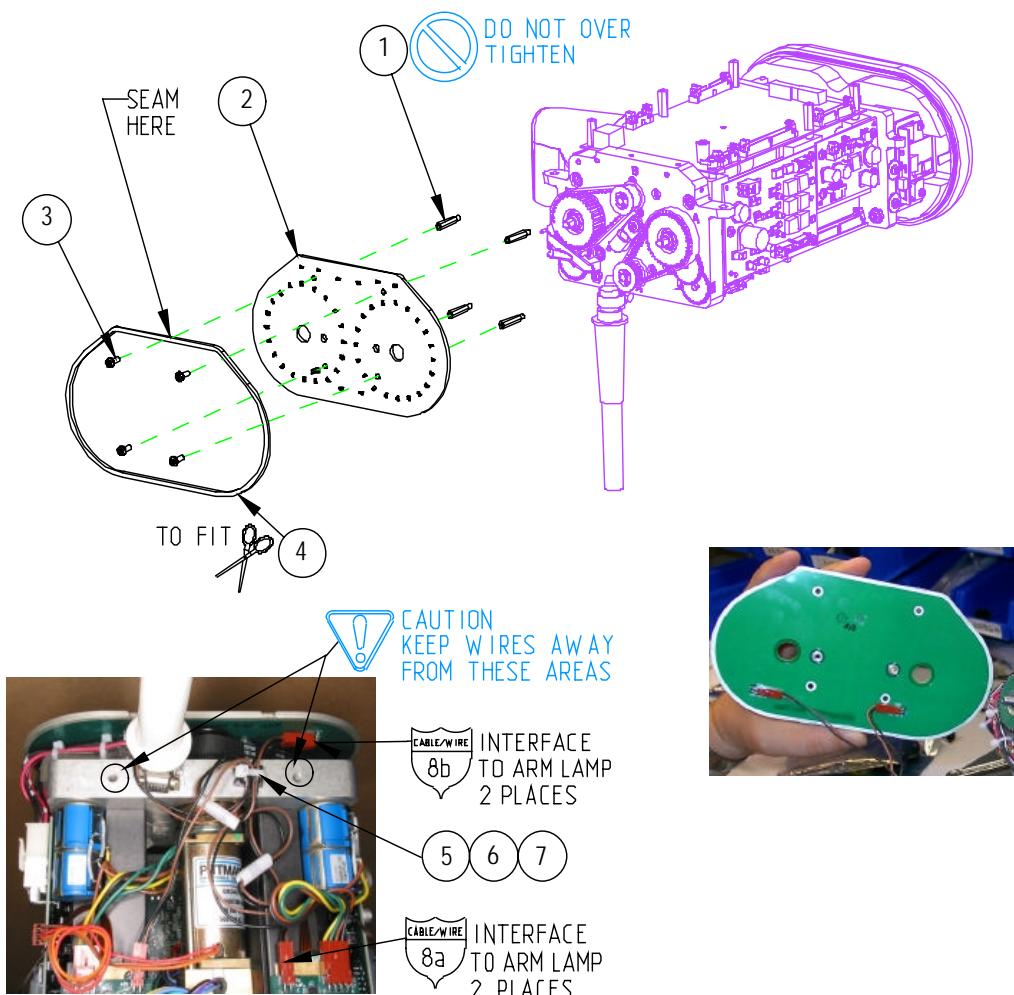
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007477	PCB Overlay	1
2		Screw #6 - 32 x 3/8"	1
3	3008167	Overlay Rubber	1
4	3008166	Overlay Graphics	1
5	3013784	Overlay Gasket	1
6	3009236	Top Cover	1
7		Screw #8 - 32 x 1/4"	4



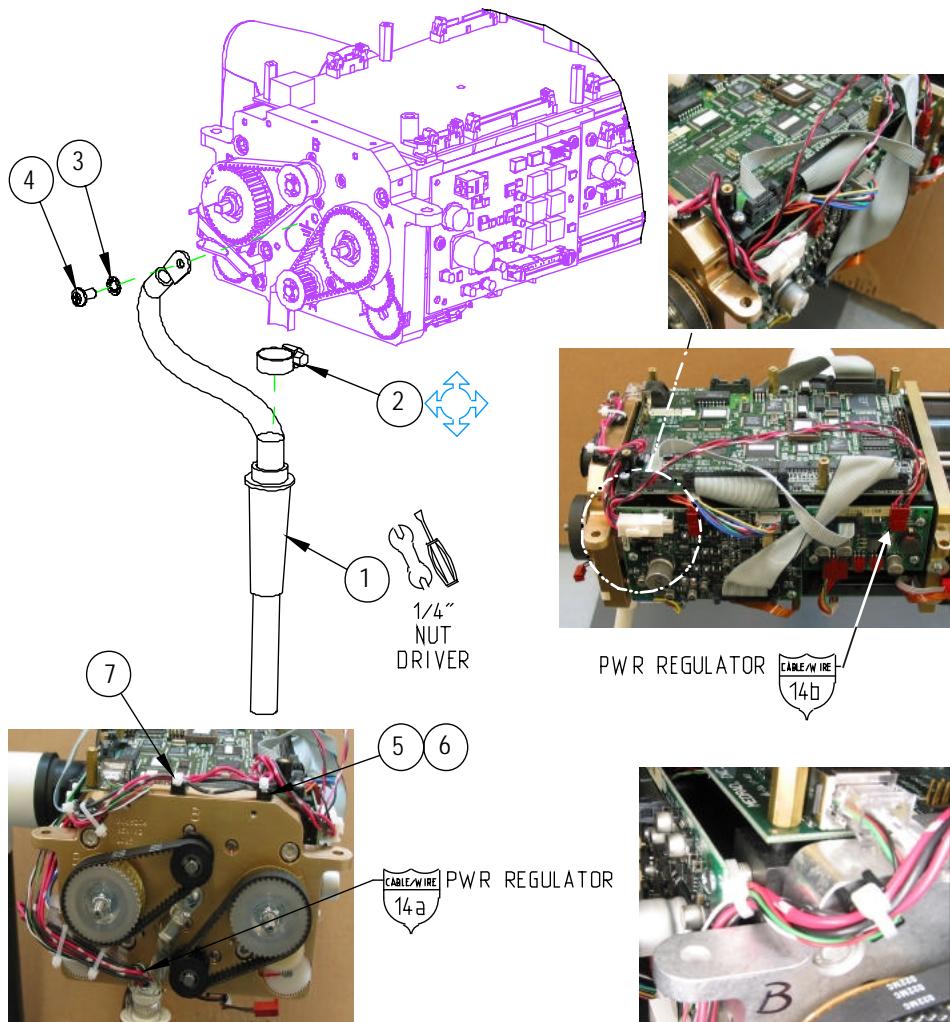
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3009232	Standoff	4
2	3008103	LED PCB	1
3		Screw #6 - 32 x 3/8"	4
4	3008787	Dual PCB Gasket	1
5	3008906	Cable Mount	1
6		Screw #6 - 32 x 3/16"	1
7	715-0096-003	Cable Tie	1



Dual Head

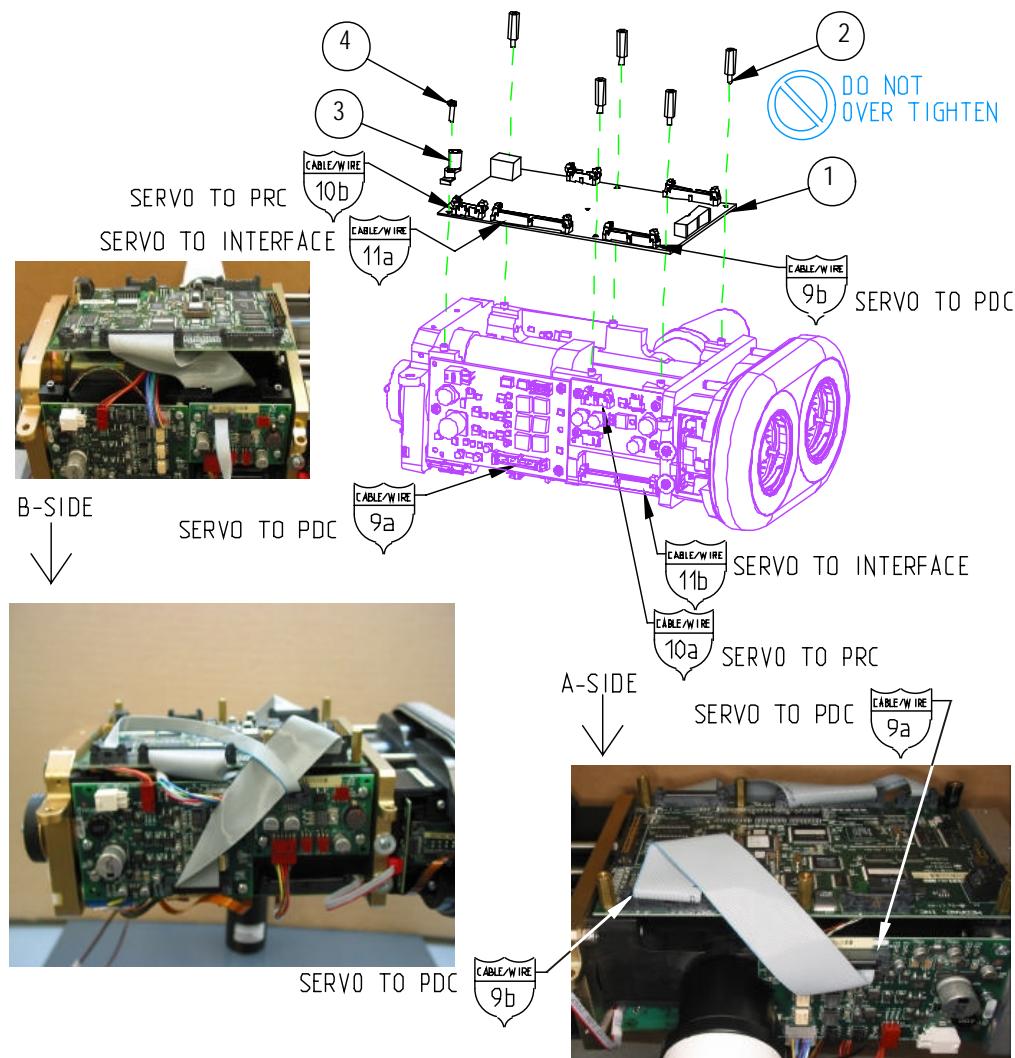
ITEM	PART NUMBER	DESCRIPTION	QTY
1	3012520	Power Cord	1
2	539-0550-000	Hose Clamp	1
3	3003725	Lock Washer #10	1
4		Screw #10 - 32 x 3/8"	1
5	3008906	Cable Mount	3
6		Screw #6 - 32 x 3/16"	3
7	715-0096-003	Cable Tie	6



Dual Head

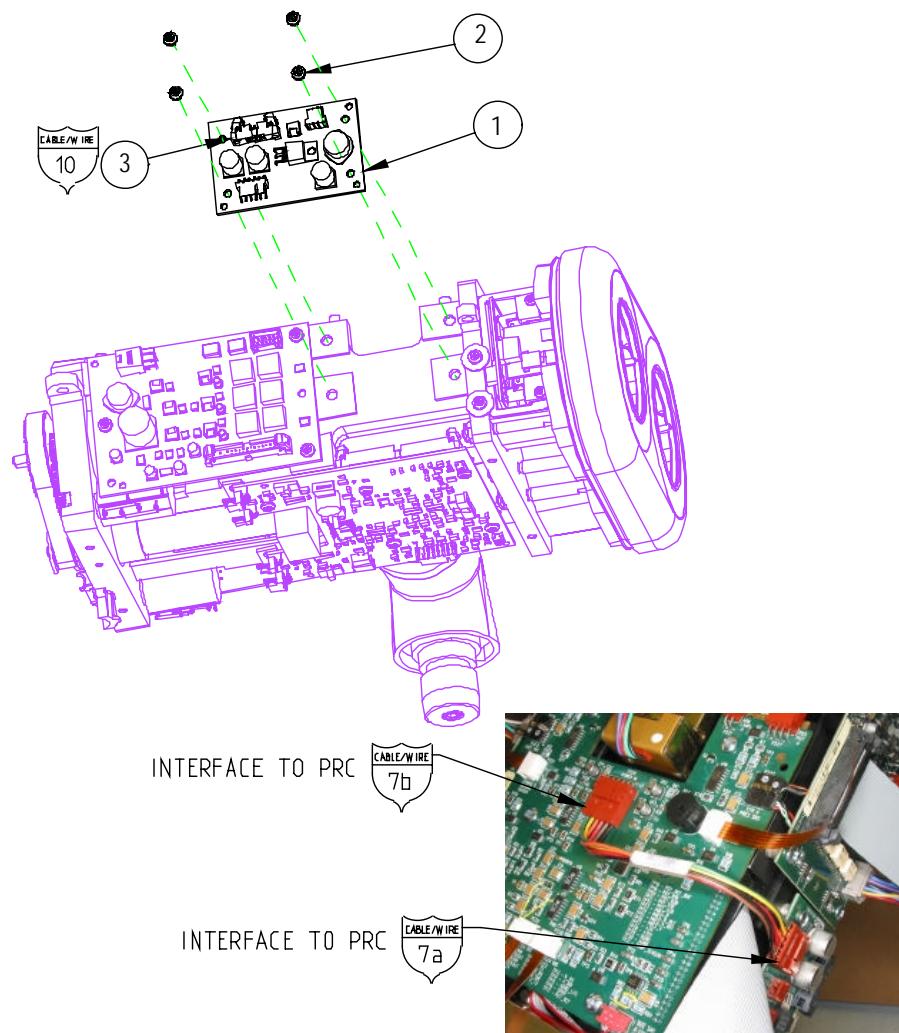
ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007431*	Servo PCB Strong Arm	1
1	3011675*	Servo PCB Super H	1
2	628-1434-631	Standoff	5
3	3008723	Offset Standoff	1
4		Screw #6 - 32 x 1/2"	1

*Order same card number as removed.



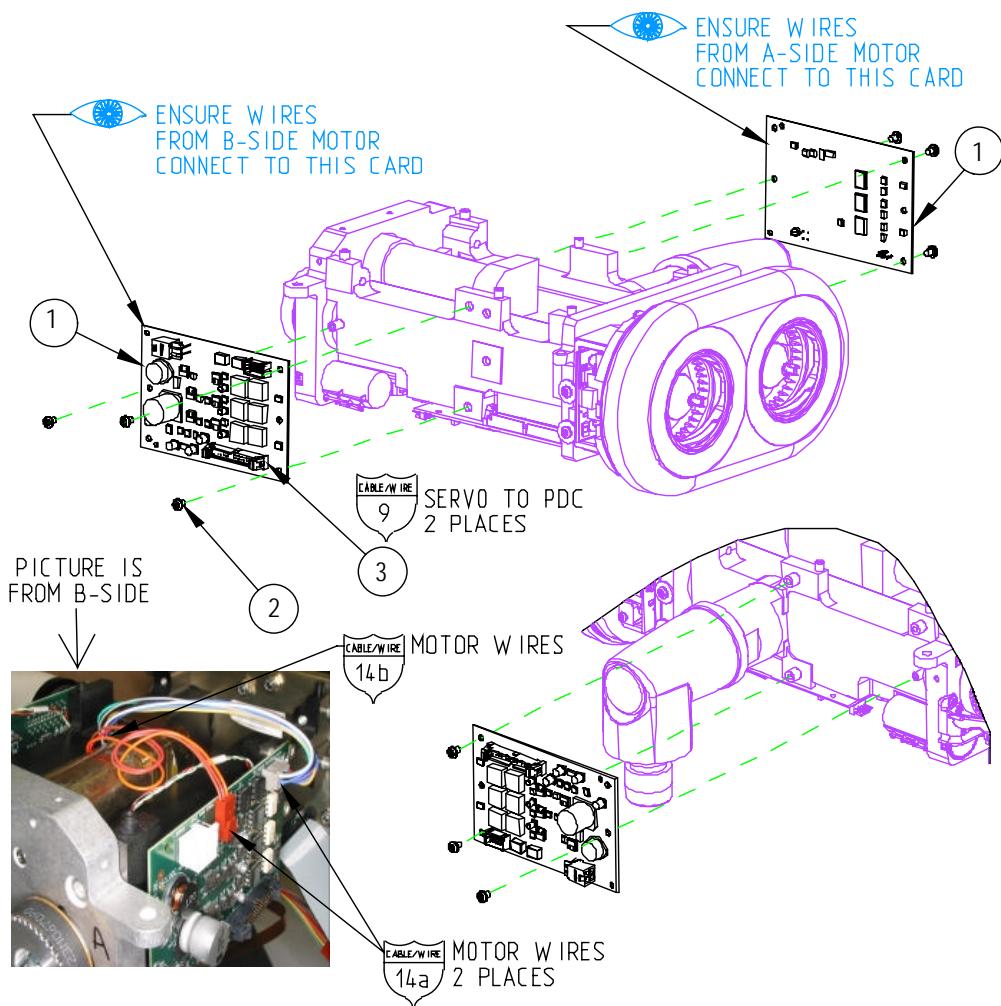
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007297	PWR Regulator PCB	1
2		Screw #6 - 32 x 3/16"	4
3	3010112	Cable, Servo to PRC	1



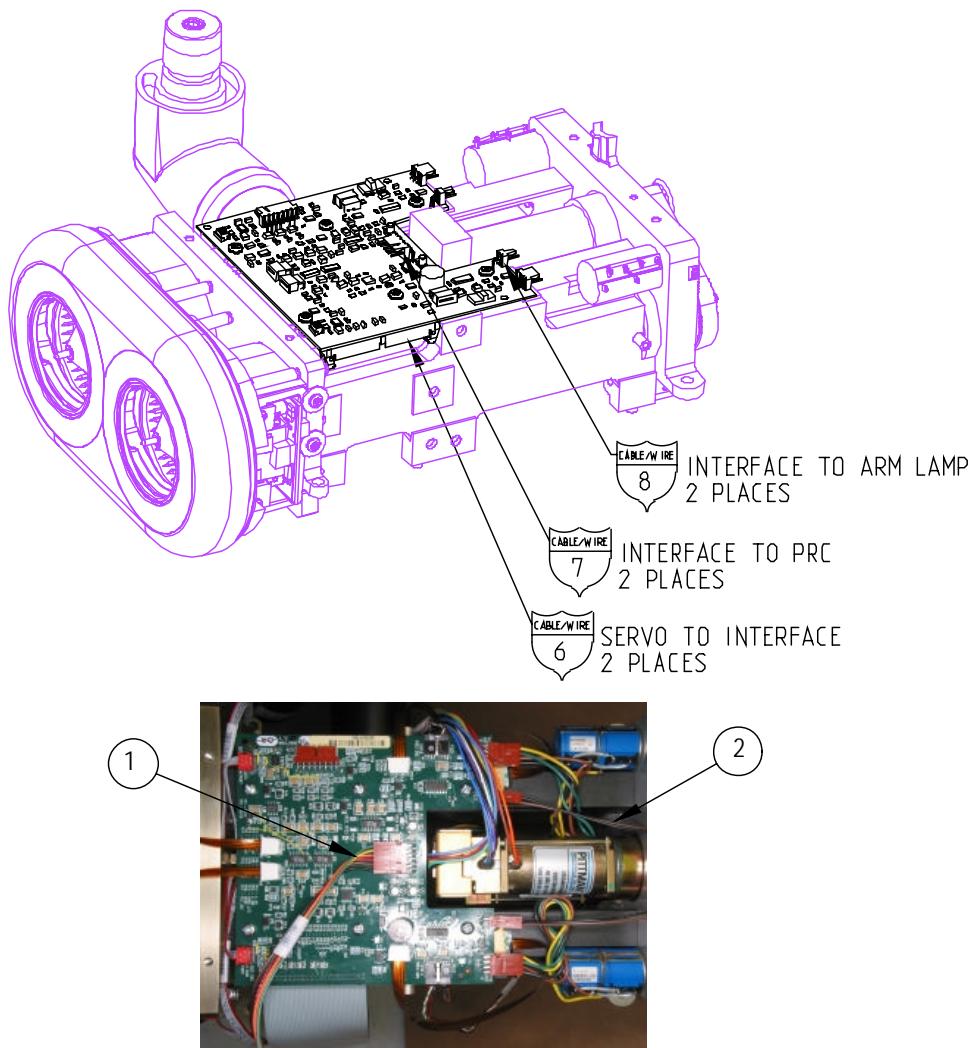
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007293	Power Drive Card	2
2		Screw #6 - 32 x 3/16"	6
3	3008392	Cable, Servo To PDC	2



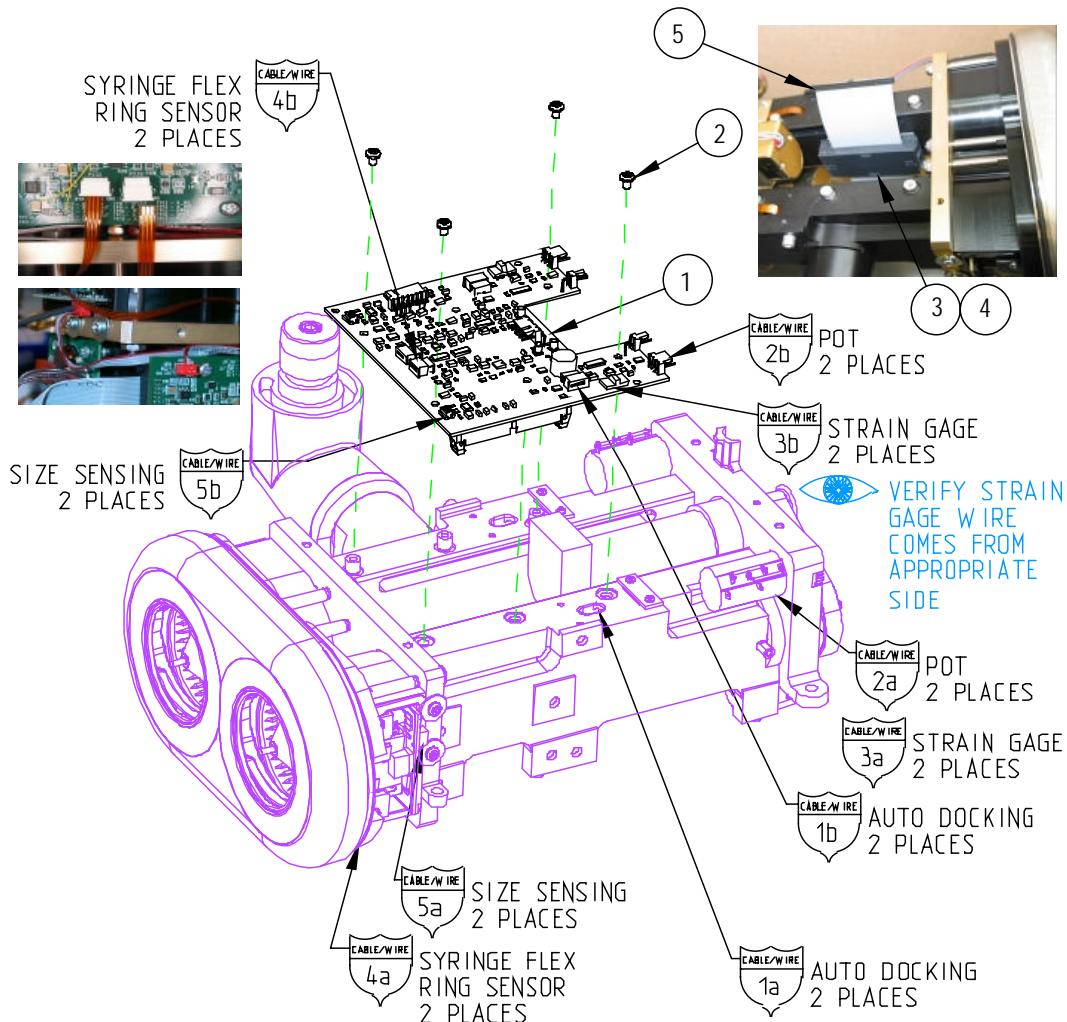
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007790	Cable, Inter To PRC	1
2	3007802	Cable, Inter To Arm Lamp	2



Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3011778	Interface PCB	1
2		Screw #6 - 32 x 3/16"	4
3	280-0443-163	Ferrite	1
4	717-4016-120	Foam Tape	A/R
5	3007781	Cable, Servo To Inter	1

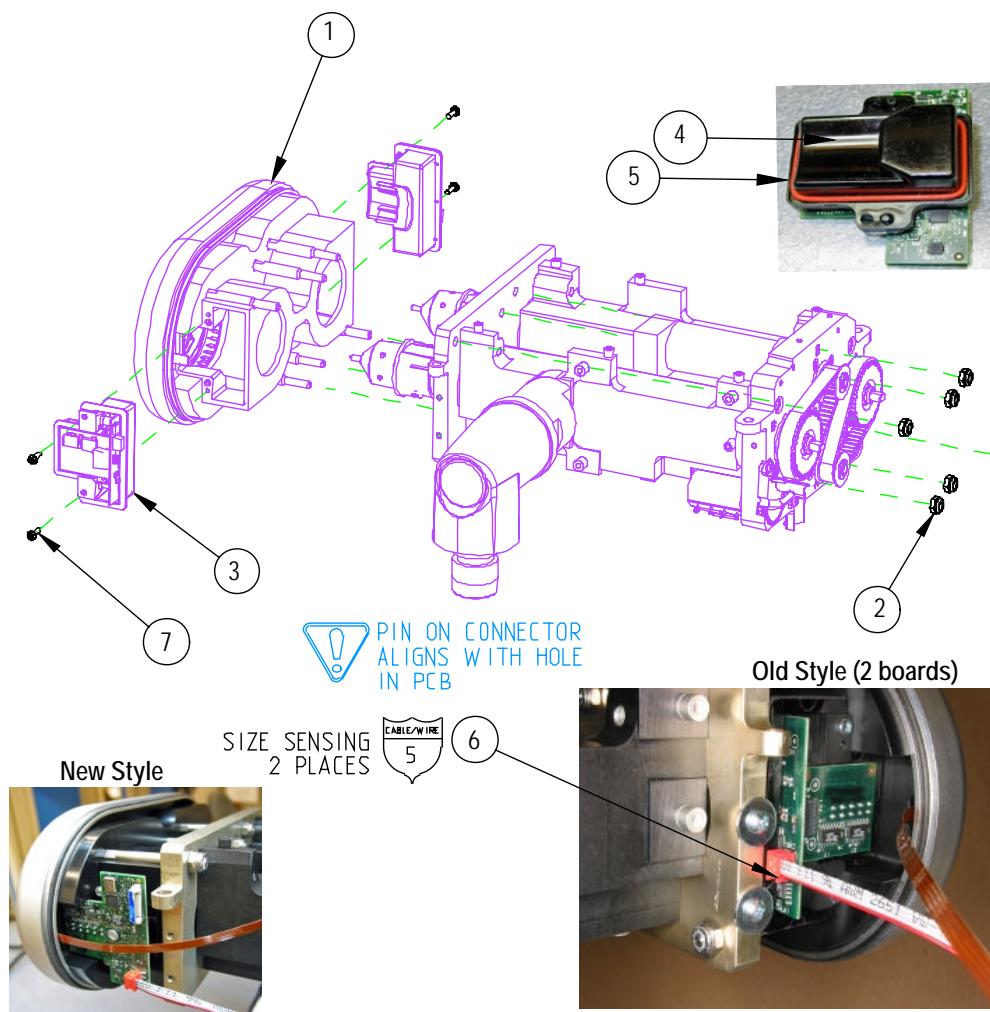


Dual Head

ITEM	P/N Old STYLE	P/N New STYLE	PART NUMBER	DESCRIPTION	QTY
1	3009211			Dual Housing	1
2	3009341			Nylock Nut #10-32	6
3	3009234	3013368		Size Sensor Kit*	2
4	3007094	3013103		Window	1
5	3008365	3013101		Gasket	1
6			3007803	Cable, Size Sensing	2
7				Screw, #4 - 40 x 3/8"	4

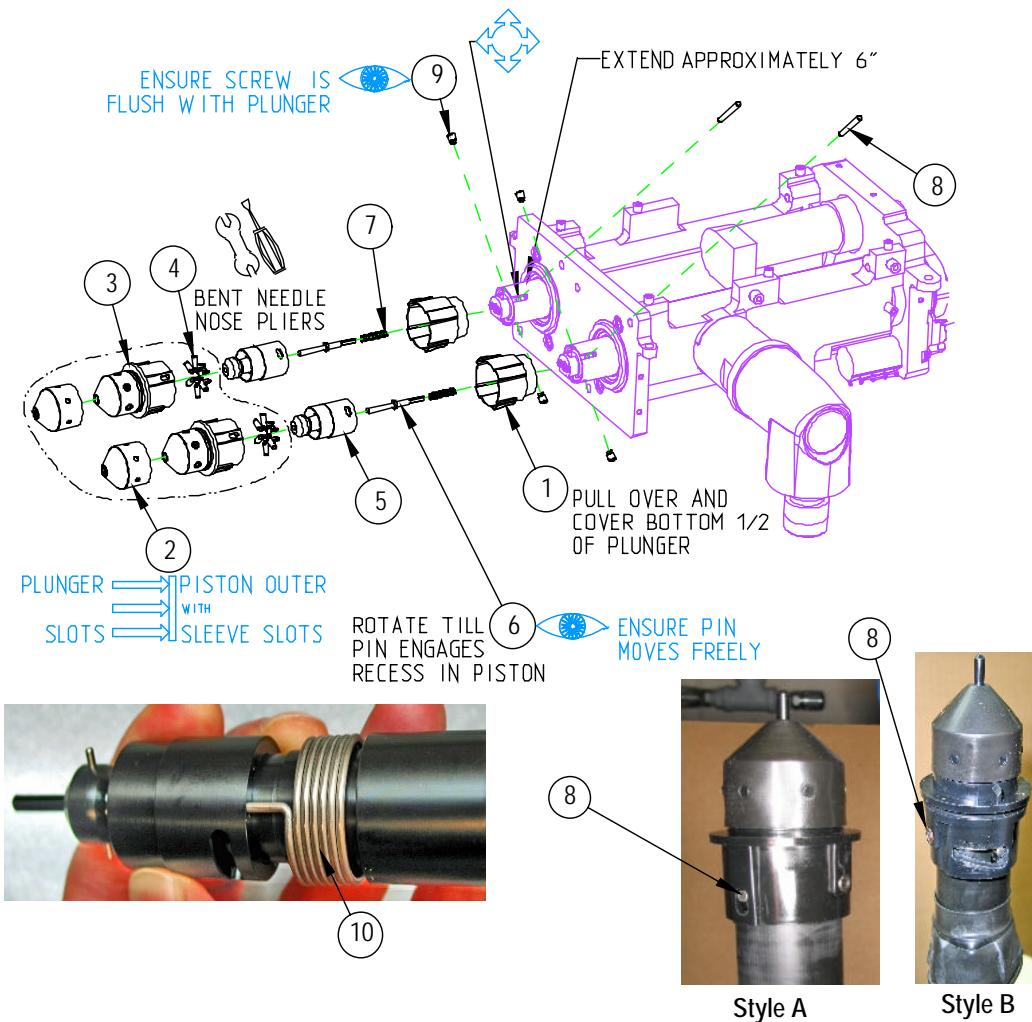
Old Style Size Sensors will only fit on Old Style front housing. If replacing (P/N 1) you must order New Style sensors (P/N 3).

*Size Sensing Kit comes with window, board, gasket and screws.



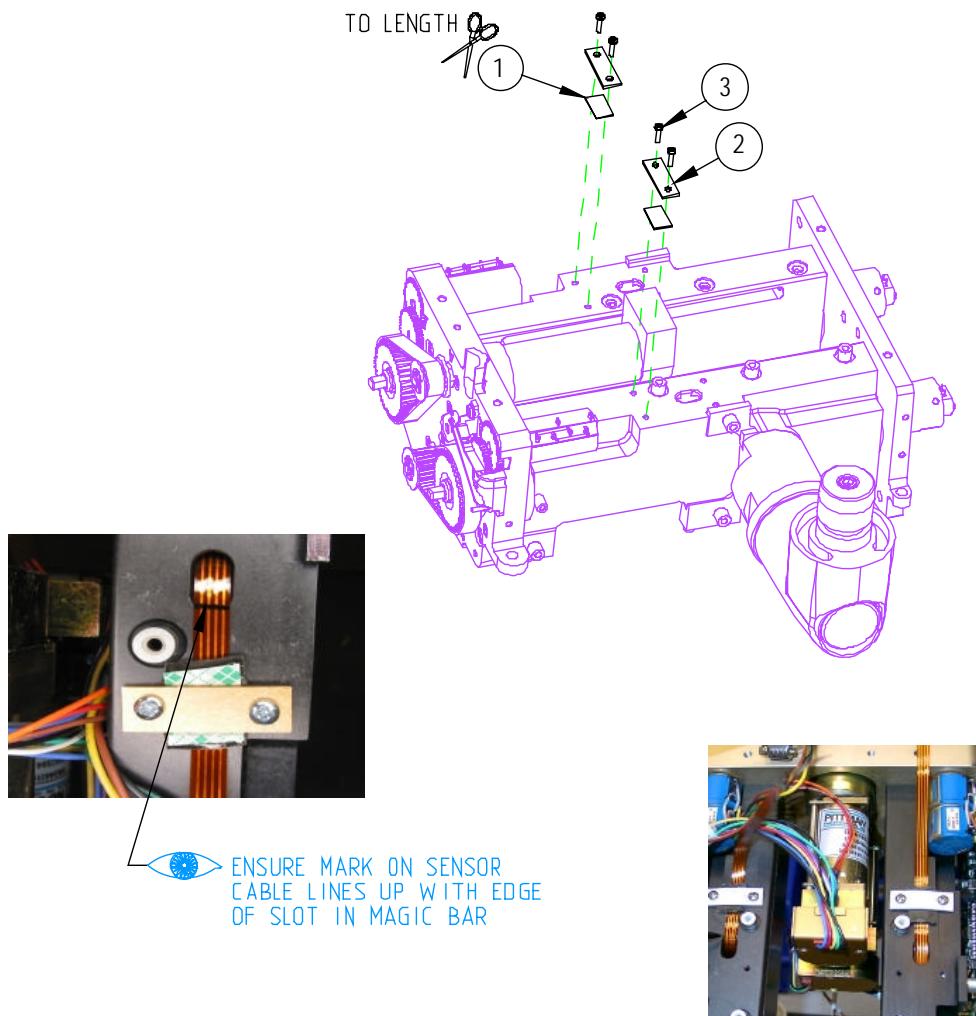
Dual Head

ITEM	P/N STYLE A	P/N STYLE B	PART NUMBER	DESCRIPTION	QTY
1	3008704	3010914		Rubber Sleeve	2
2	3008615	3010900		Plunger Boot	2
3	3007318	3010898		Plunger	2
4			3007314	Plunger Pins	12
5	3007332	3010912		Piston Wedge	2
6			3007313	Sensor Pin	2
7			3008336	Spring	2
8			3008334	Dowel Pin	2
9			3008553	Set Screw	2
10	N/A	3010911		Spring	2



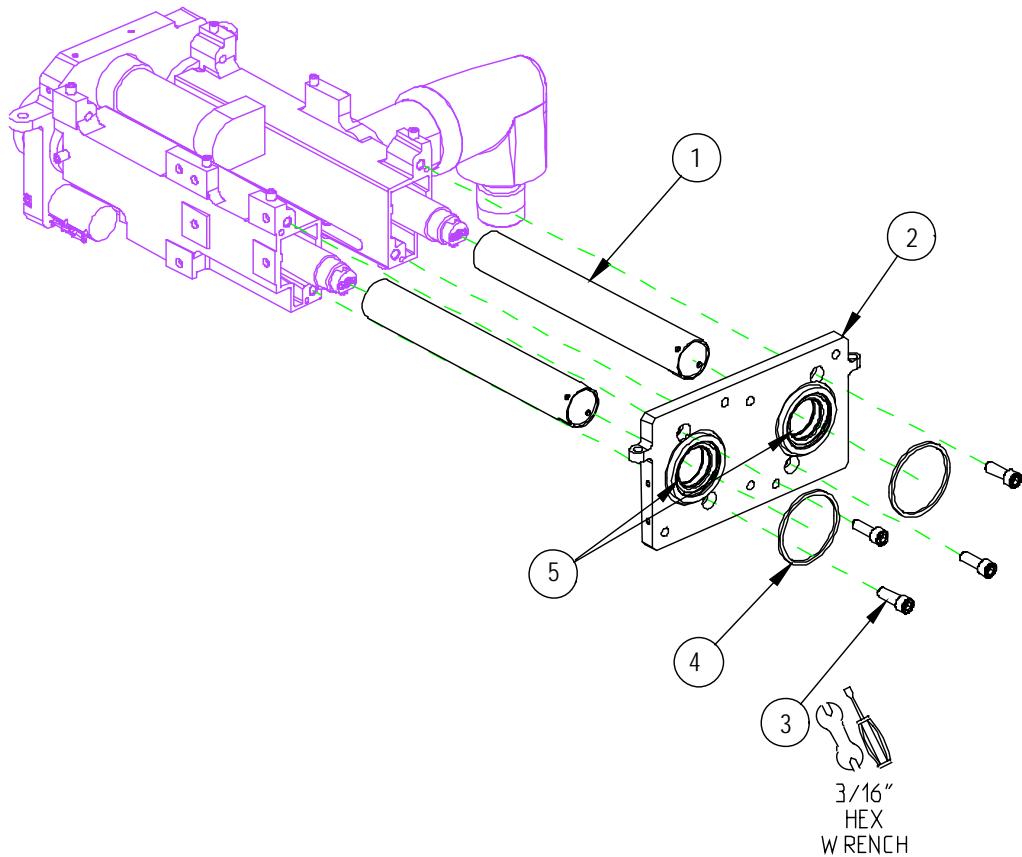
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	717-4016-120	Foam Tape	2
2	3009101	Flex Cable Plate	2
3		Screw #4 - 40 x 3/8"	4



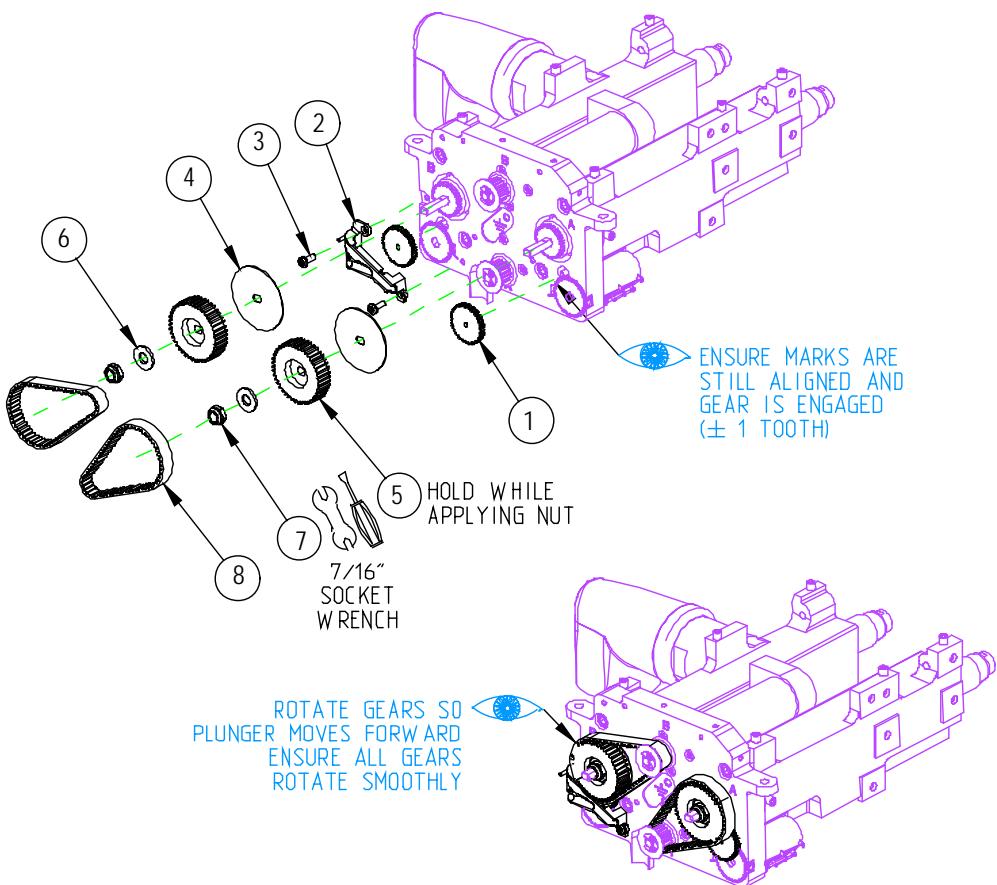
Dual Head

ITEM	STYLE	PART NUMBER	DESCRIPTION	QTY
1	A	300733	Outer Piston Sleeve	2
1	B	3007331	Outer Piston Sleeve	2
2		3008785	FNT Mounting Plate	1
3		3000253	Screw 1/4 - 20 x 3/4"	4
4		3008991	Gasket	2
5		3012696	Wiper Seal	2



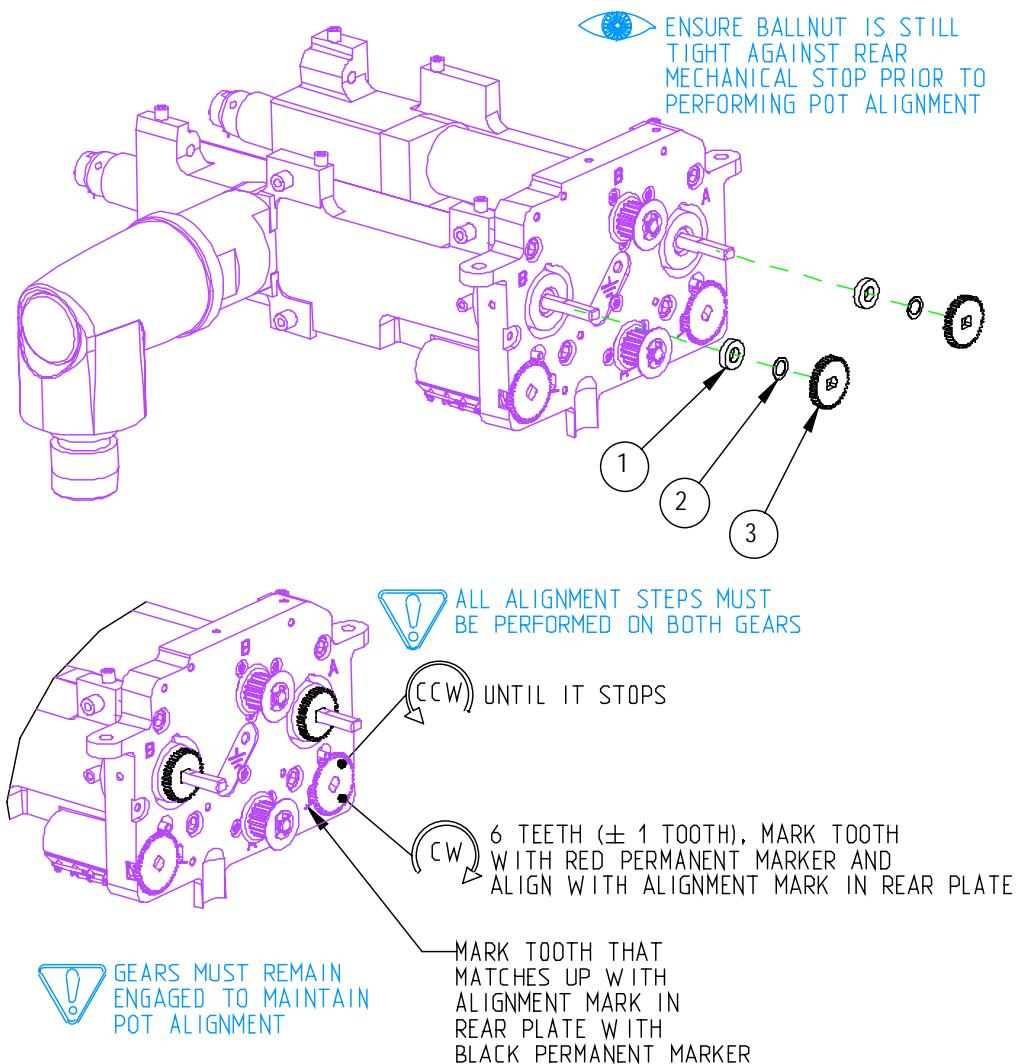
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	682-4812-480	Idler Gear	2
2	3008724	Cable Router	1
3		Screw #6 - 32 x 3/8"	2
4	403003602	Pulley Washer	2
5	401000423	Belt Pulley	2
6	607-0014-580	Washer	2
7	600-1420-919	Lock Nut 1/4 - 20	2
8	682-7090-306	Timing Belt	2



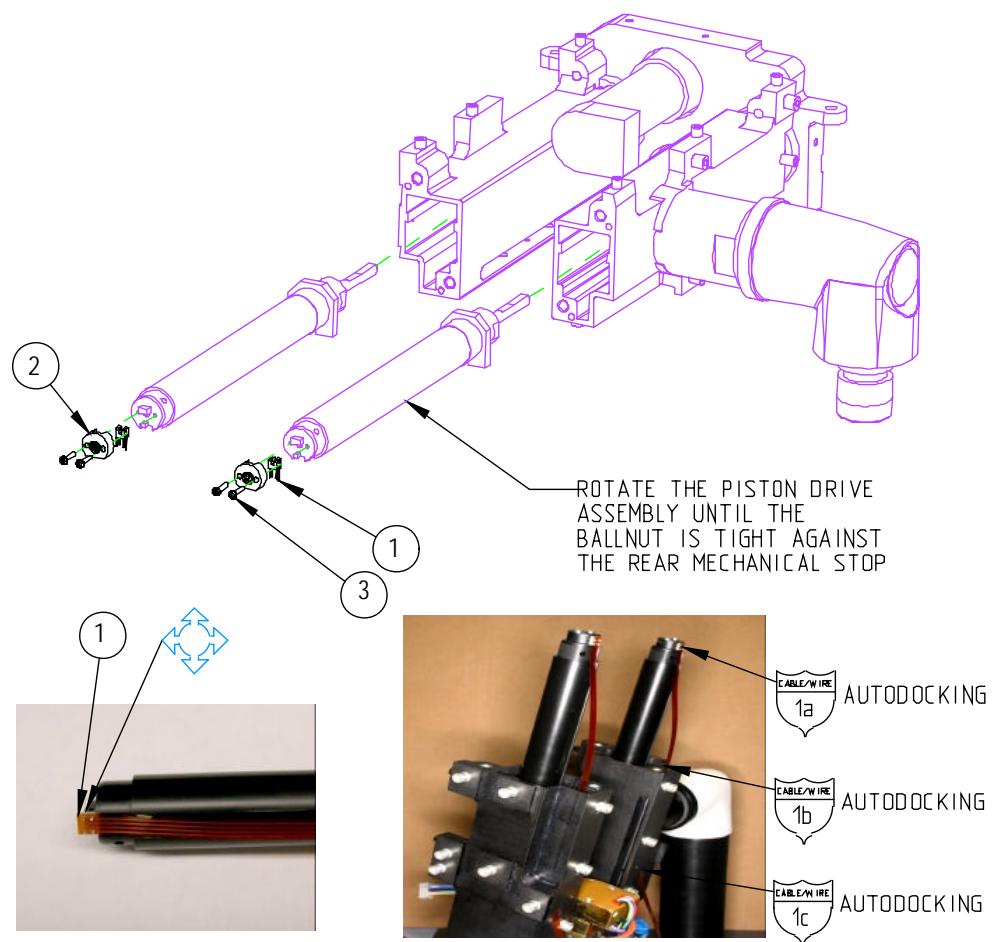
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3009042	Bearing	2
2	3009129	Shim	2
3	401000422	40 Tooth Gear	2



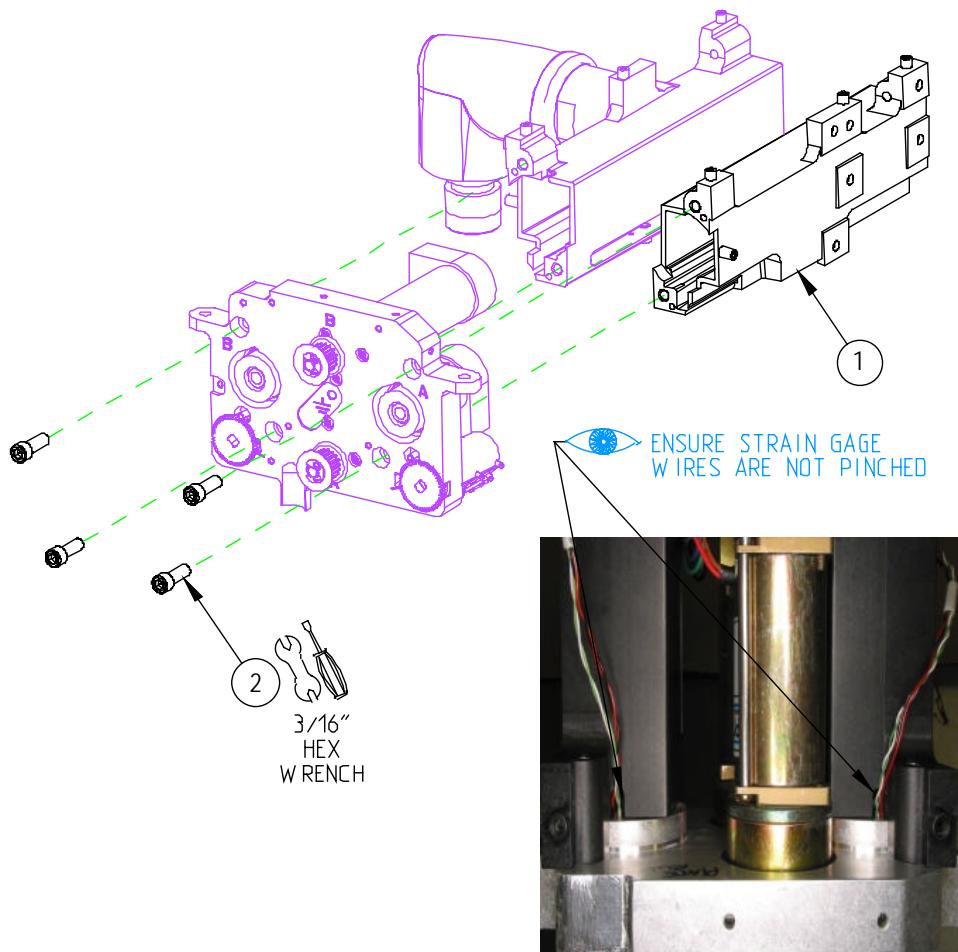
Dual Head

ITEM	STYLE	PART NUMBER	DESCRIPTION	QTY
1	A	3008242	Sensor Cable	2
1	B	3011186	Sensor Cable	2
2		3007317	Sensor Retainer	2
3			Screw #2 - 56 x 7/16"	4



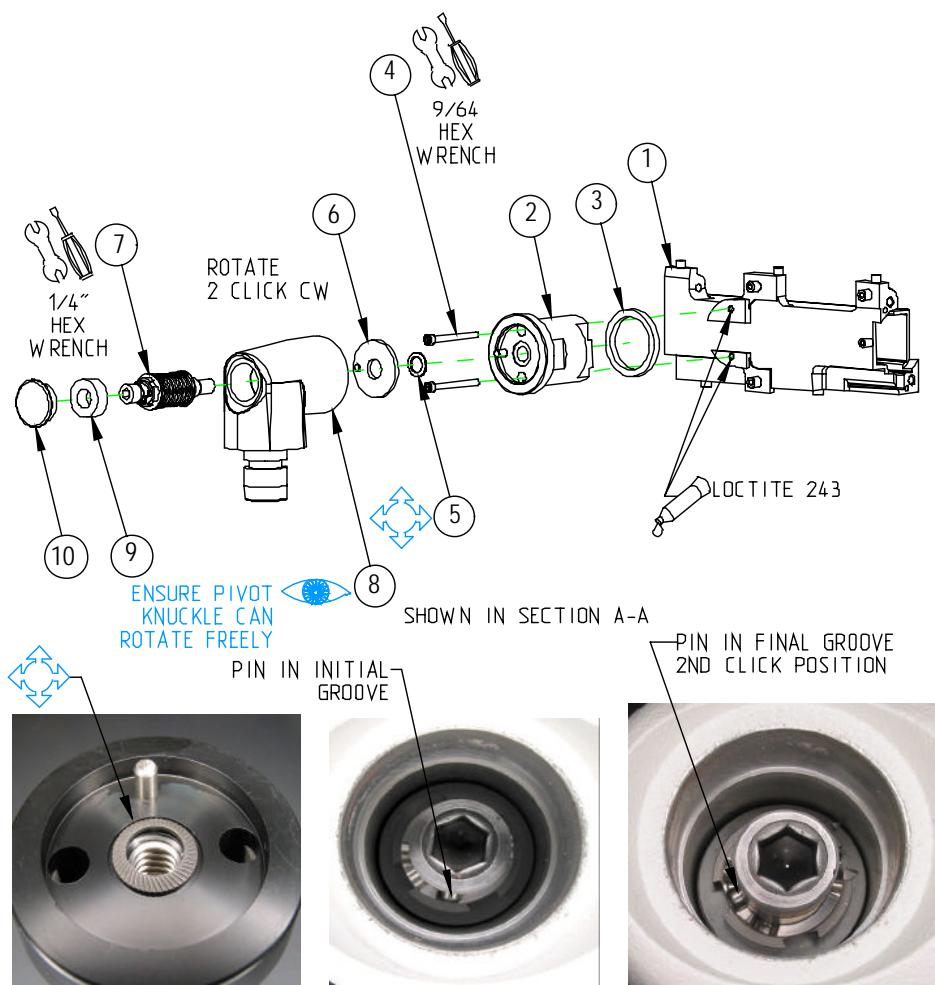
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3008781	Left Magic Bar	1
2		Screw 1/4 20 x 3/4"	4



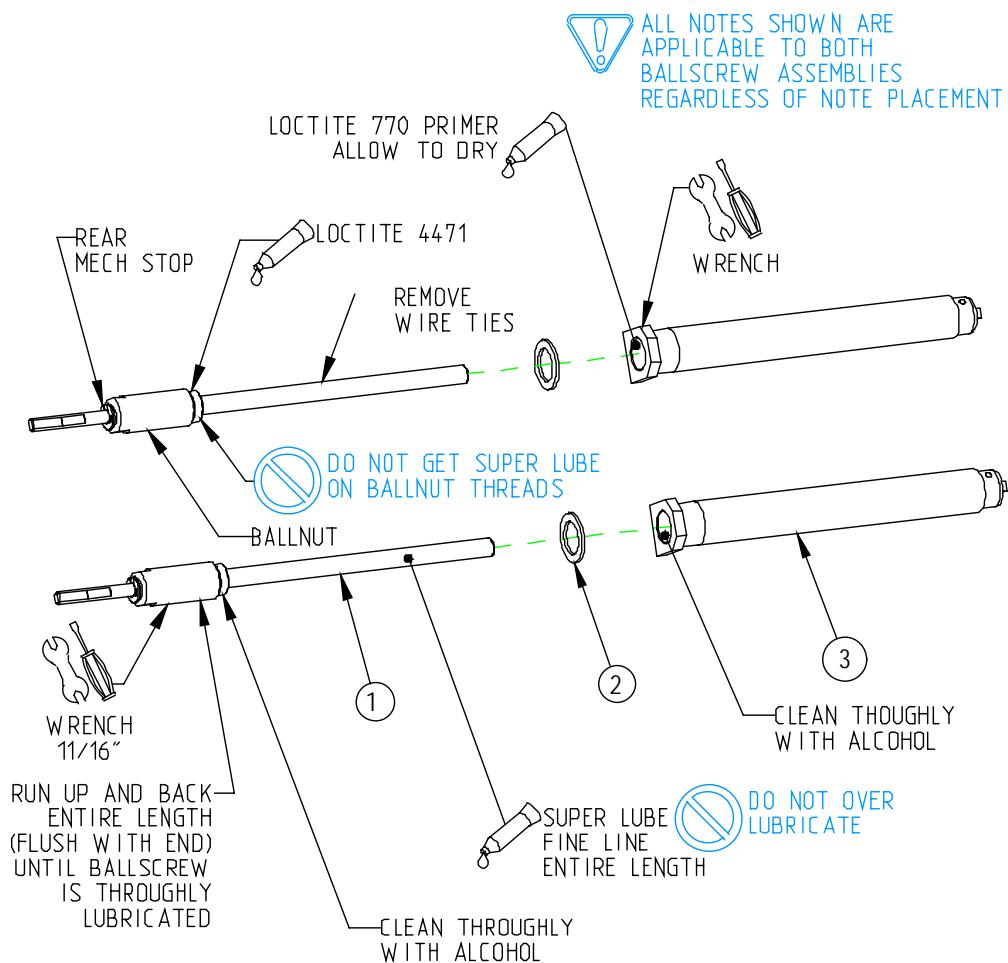
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007308	Right Magic Bar	1
2	3008554	Knuckel Stub	1
3	3008362	Gasket	1
4		Screw #8 - 32 x 1 3/4"	2
5	3008850	Bellville Washer	1
6	3007720	Knuckle Washer	1
7	3008338	Knuckle Adjustment	1
8	3008110	Knuckle Assembly	1
9	3008810	Knuckle Bushing	1
10	3007721	Knuckle Plug	1



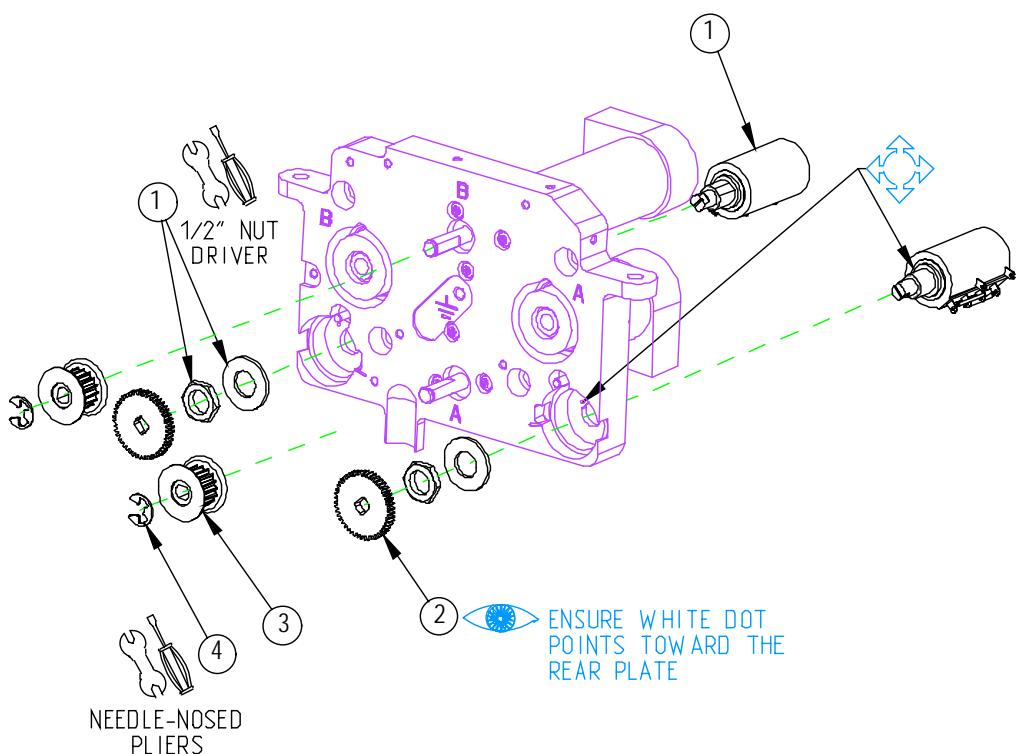
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3007694	Ballscrew	2
2	401000447	Washer	2
3	3007320	Piston	2
3	3010899	Piston	2



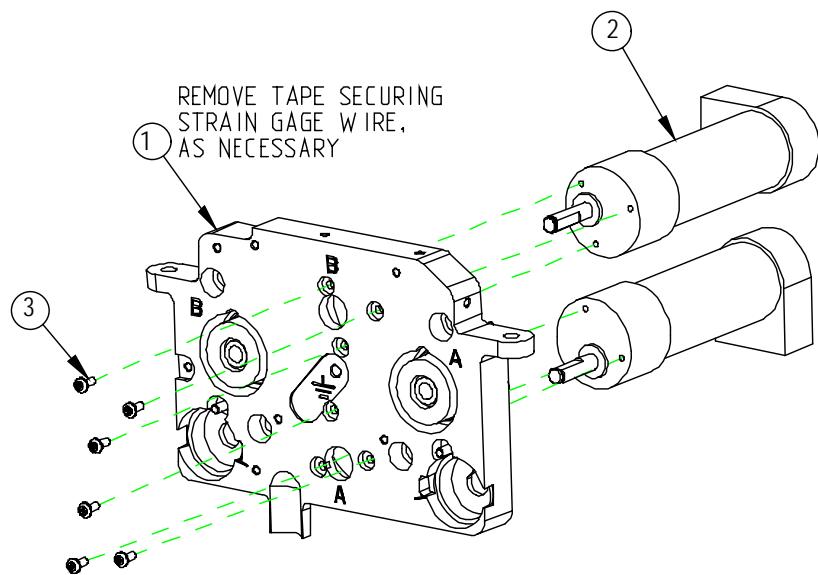
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3009204	POT	2
2	403002877	48 Tooth Gear	2
3	401000421	Drive Pulley	2
4	645-5144-210	Retaining Ring	2



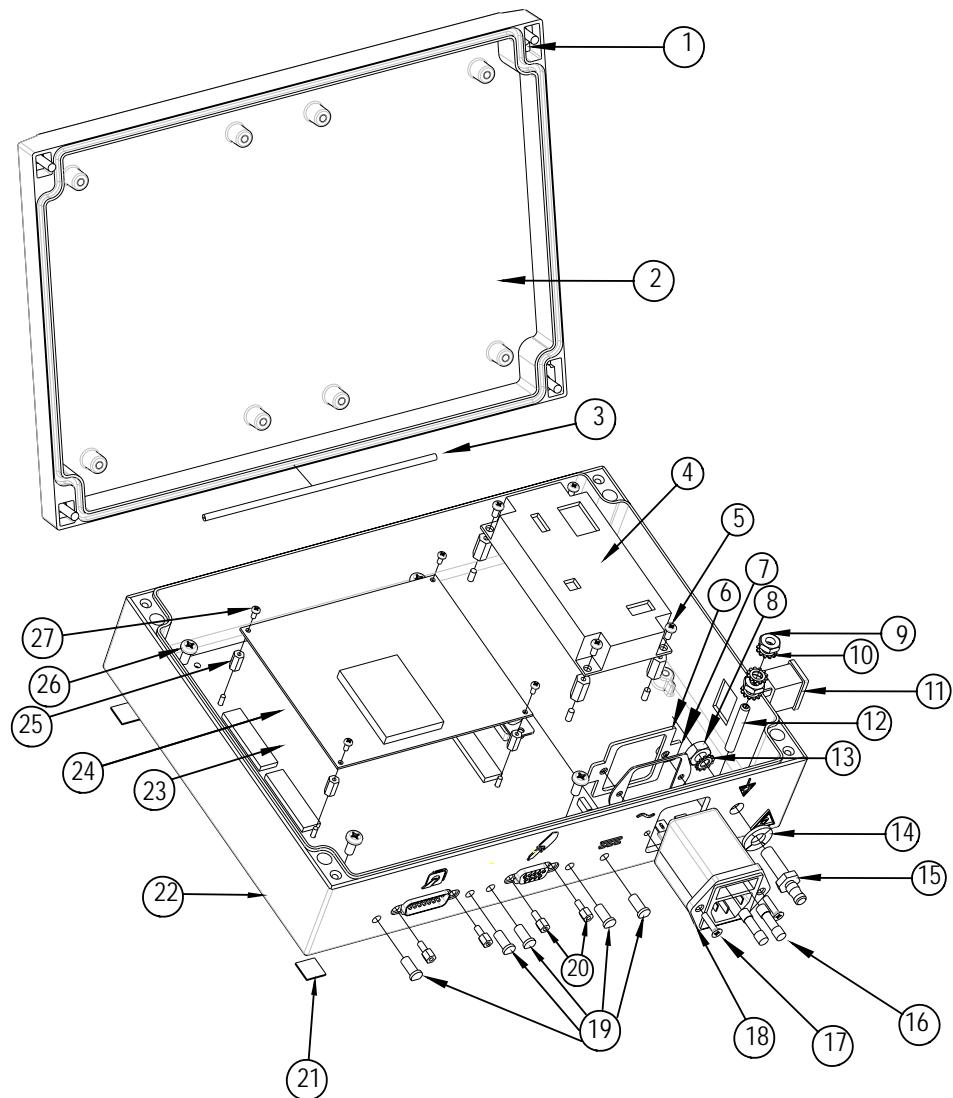
Dual Head

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3009208	Rear Plate	1
2	3007304	DC Motor	2
3		Screw #4 - 40 x 1/4"	6



ISI 800

ISI 800 (3012987) Part numbers and descriptions on next page.



ISI 800

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3011217	Screw, 4M x 20M	4
2	3012984	Top, Enclosure	1
3	3011055	Gasket	1
4	3012979	Supply, Power	1
5	602-0440-140	Screw, 4-40 x 1/4	4
6	3004653	Plate, Backing	1
7	3010164	Gasket, Line Filter	1
8	528-8501-001	Nut, 08-0501	1
9	604-1132-380	Nut, Hex, 10-32	2
10	528-8704-001	Lock Washer, External	3
11	3013141	Switch and wiring	1
12	3013289	Set screw, Socket	1
13	528-8704-001	Lock washer, external	1
14	528-1450-001	Washer, color code	1
15	528-4057-001	Plug, Brass	1
16	3011210	Fuse	2
17	603-0440-120	Screw, 4-40 x 1/2	2
18	3001201	Module, Power	1
19	3010700	Pipe, Light	5
20	3000221	Screw, Jack	4
21	600-5007-400	Foot, Black	4
22	3012983	Enclosure, Bottom	1
23	3013012	Assembly, PCB	1
24	3014626	PCB Assembly	1
25	3013027	Standoff, 2-56 x 3/8	4
26	3011216	Screw, 4M x 5M	4
27	3008881	Screw, 2-56 x 3/16	4

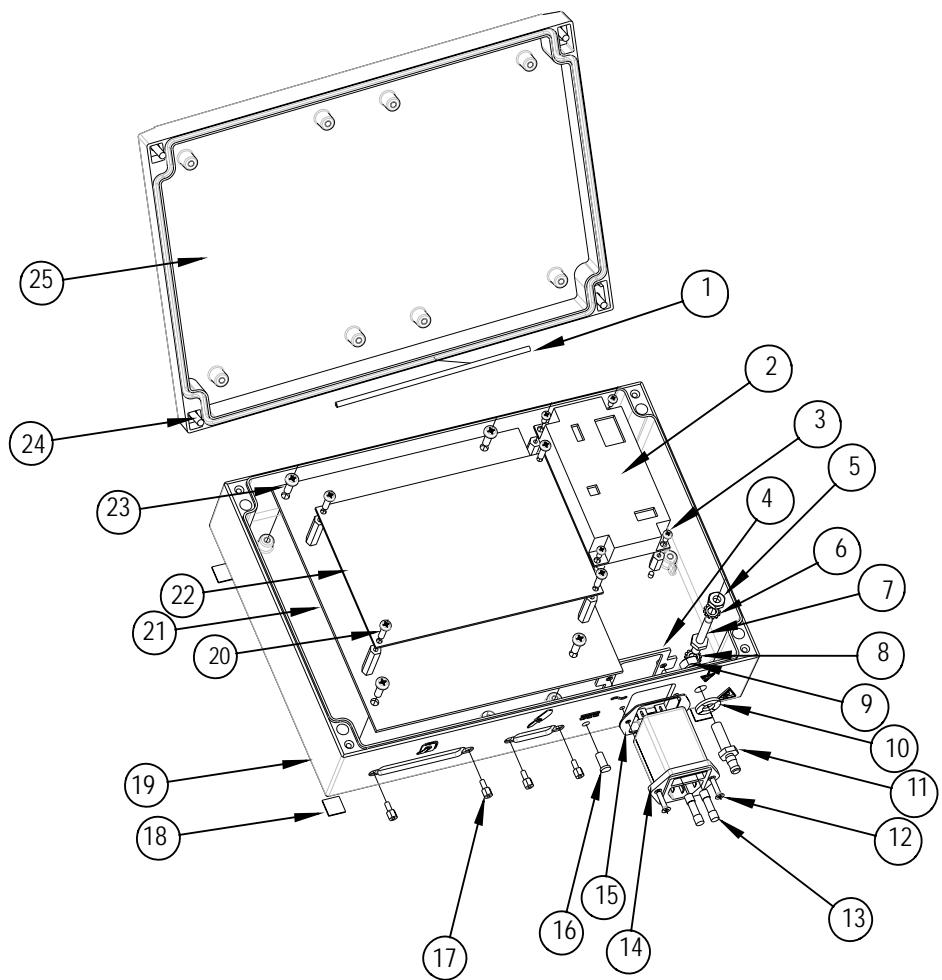
Not Shown:

3013141 AC supply harness

3010698 DC supply harness

ISI 700

ISI 700 (3010435) Part numbers and descriptions on next page.



ISI 700

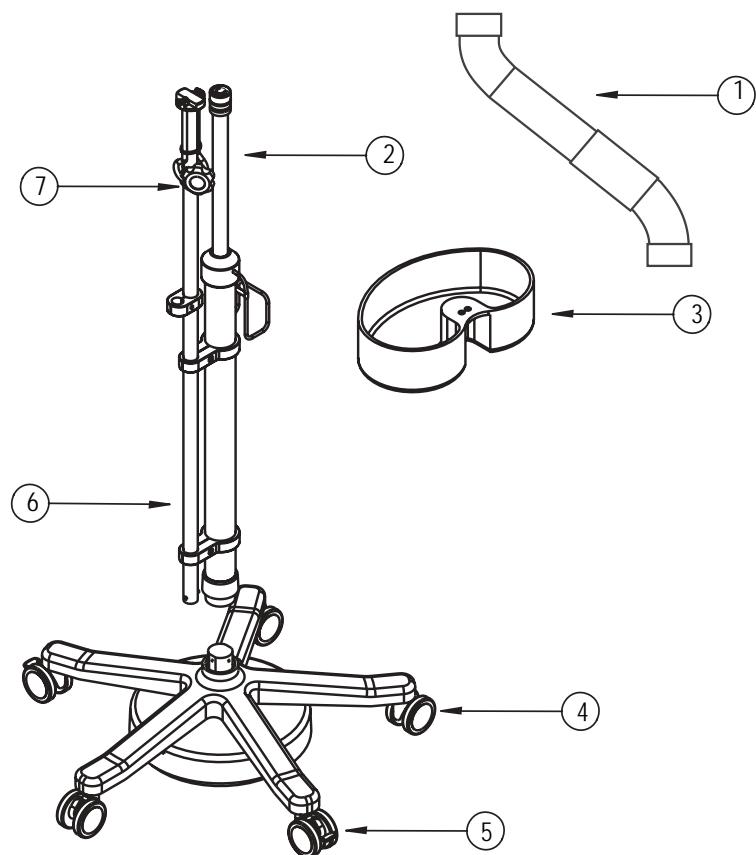
ITEM	PART NUMBER	DESCRIPTION	QTY
1	3011055	Gasket	1
2	3010883	Power Supply	1
3	602-0440-140	Screw 4-40 x 1/4	4
4	3004653	Backing Plate	1
5	604-1132-380	1-32 Hex Nut	1
6	528-8704-001	External Lock Washer	1
7	3008893	Ground Stud	1
8	528-8501-001	08-0501 Nut	1
9	528-8704-001	External Lock Washer	1
10	528-1450-001	Color Code Washer	1
11	528-4057-001	Brass Plug	1
12	603-0440-120	4-40 x 1/2 screw	2
13	3011210	5 x 20 MM fuse	2
14	3001201	Power Module	1
15	3010164	Line Filter Gasket	1
16	3010700	Light Pipe	1
17	3000221	Jack Screw	4
18	600-5007-400	Black Foot	4
19	3011054	Bottom Enclosure	1
20	3005960	6-32 x 1/2 screw	4
21	3010231	PCB Assembly	1
22	3010695	PCB Assembly	1
23	3011216	4M x 5M screw	4
24	3011217	4M x 20M screw	4
25	3011053	Enclusre Top	1

Not shown:

3009929	AC power harness
96406-T-148	GND wire harness
3010698	DC power harness from supply
3004546	Ethernet cable
3005101	DC power harness to SBC
3007333	Flat cable to SBC

Pedestal

ITEM	PART NUMBER	DESCRIPTION	QTY
1	3006942	Support Arm	1
2	3013602	Post	1
3	404003227	Tray	1
4	3013104	Caster (not locking)	1
5	3013105	Caster (locking)	1
6	404002295	Telescoping Pole	1
7	3011608	Knob	1



Miscellaneous Replacement Parts

Part Number	Item
Manuals	
201071	Operation Manual - English
201612	Operation Manual - Chinese
201614	Operation Manual - Danish
201615	Operation Manual - Dutch
201617	Operation Manual - French
201618	Operation Manual - German
201619	Operation Manual - Greek
201620	Operation Manual - Italian
201611	Operation Manual - Japanese
201621	Operation Manual - Norwegian
201623	Operation Manual - Portuguese
201624	Operation Manual - Spanish
201625	Operation Manual - Swedish
201681	Service Manual
201682	Service Schematic Manual
Language Conversion Instructions	
3009261	Language Conversion - English
3009264	Language Conversion - Dutch
3009266	Language Conversion - French
3009267	Language Conversion - German
3009269	Language Conversion - Italian
3009274	Language Conversion - Spanish
3009275	Language Conversion - Swedish
3009270	Language Conversion Japanese
Heat Maintainer	
3009708	Heat Maintainer FLS with Ferrite (Single Head)
3009707	Heat Maintainer PLS with Ferrite (Single Head)
3013737	Heat Maintainer Extension Cable

3007871	Heat Maintainer FLS
3007872	Heat Maintainer PFS
Syringe Adapter	
3009580	Japanese 150PF Syringe Adapter Assembly
3008169	Japanese 100 PF Syringe Adapter Assembly
Cables	
3007644	5 ft. Base to Display Cable
3007643	25 ft. Base to Display Cable
3008612	25 ft. Head Ext. Cable
3008613	50 ft. Head Ext. Cable
3008614	75 ft. Head Ext. Cable
3007782	100 ft. Head Ext. Cable
Power Cords	
535-0127-012	International Power Cord
535-0243-012	N. America and Japan Power Cord
3013369	Chinese Power Cord
Wall Mount	
401000775	Wall Mount System
750001967-2	CS Ceiling Mount System
750001967-3	CS Wall Mount System
3008277	Adjustable Height Pedestal
Hand Switch	
3006265	Hand Switch
3009704	Handswitch with Ferrite (Single Head)